Integrating transportation and land-use management strategies aimed at reducing urban traffic congestion: a dynamic adaptive decision framework

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Abstract

Much has been written about the desperate need to seek alternative solutions to the urban traffic congestion problems we face today. To manage these problems, three main streams of intervention have evolved from supply, demand and land-use management paradigms. Whilst their underlying measures all have the ability to reduce traffic congestion one way or another, little has been done to integrate the measures of each stream using a qualitative decision framework or process enabling the selection of site specific measures appropriate to local traffic and transport conditions.

To this end the study reports the results of an empirical investigation by which a Multi-Criteria Analysis based Dynamic Adaptive Decision Framework (D.A.D.F.) was developed. This screens selected measures identifying those that have the potential to alleviate site specific road based traffic congestion. The product of the screening process is a set of sustainable measures transposed into an integrated strategy tailored to address local traffic congestion issues. Once the D.A.D.F. was developed, its usefulness and workability was tested by applying it to a case study. The case study results demonstrated that the D.A.D.F. is capable of producing integrated strategies with the ability to manage traffic congestion, encourage sustainable development and alleviate some site specific development challenges within the context of the study areas. Going beyond developing the decision framework, the study recommends positioning the D.A.D.F. within the South African planning system as part of a Traffic Congestion Management Plan (T.C.M.P.), setting out its likely components within the local context.

It is concluded that the main innovation of the study is the development of the D.A.D.F., the T.C.M.P., the recommendations to situate both in the planning system and the comprehensive, but still transparent, approach undertaken to create integrated strategies for specific local conditions consisting of elements that work together to produce cumulative short to long term effects that attain a balanced set of environmental, social and economic goals – all imperative for sustainable development.

Glossary of terms

Accessibility

Accessibility is a measure of the ease of reaching opportunities (jobs, shops, leisure activities) or the ease of being reached by contacts.

Access Management

Access Management is a term used by transportation professionals for the co-ordination of road design and land-use in order to improve transportation which involves changing land-use planning and road design practices to limit the number of driveways and intersections on arterials and highways and constructing medians to control turning movements, encourage clustered development, and create more pedestrian-oriented street designs.

Apartheid

Apartheid is the policy and system of laws implemented and continued by "White" governments in South Africa from 1948 to 1990 and, by extension, any legally sanctioned system of racial segregation to maintain separate development of government-demarcated racial groups.

Average Vehicle Occupancy (AVO)

Average Vehicle Occupancy refers to the number of persons divided by the number of vehicles travelling past a selected point over a predetermined time period.

Beslissings Ondersteunend Systeem voor Discrete Alternatieven (BOSDA)

BOSDA (or DEFINITE - decisions on a finite set of alternatives – English version of BOSDA) is a decision support software programme that has been developed to improve the quality of environmental decision-making using Multi-Criteria Analysis.

Bi-Directional Facility

A bi-directional facility is a preferential facility in which two-way traffic flow is provided for during at least a portion of the day.

Capacity

Capacity is the maximum number of vehicles (vehicular capacity) or persons (person capacity) that can pass over a given section of road in one or both directions during a given period of time under prevailing environmental, road and road-user conditions, usually expressed as vehicles per hour or persons per hour.

Carpool

A carpool describes any vehicle (usually a private car) or arrangement in which two or more occupants, including the driver, share the use, cost or both when travelling between fixed points on a regular basis.

Central Business District (CBD)

The central business district is the traditional business core of a community, characterized by a relatively high concentration of business and administrative activity within a relatively small area.

City Development Strategy (CDS)

City Development Strategies are an approach to city-based strategic planning that seeks to promote stronger local economies and to reduce poverty, through the development of strategies for growth and better local governance particularly in respect to financial strategies.

Clustered Land-Use

Clustered Land-Use is a planning measure aimed at locating related activities close together in order to reduce travel distances and improve travel options.

Confidence Interval (CI)

A Confidence Interval quantifies uncertainty in measurement and is usually reported as 95% CI, which is the range of values within which we can be 95% sure that the true value for the whole population lies.

Consolidated Municipal Infrastructure Programme (CMIP)

The Consolidated Municipal Infrastructure Programme (CMIP) is an initiative launched by the South African government to fund the building, upgrading and/or the rehabilitation of internal bulk and connector infrastructure.

Corridor

A corridor is a broad geographical area that defines the general directional flow of traffic that may encompass a mix of streets, highways and public transport alignments.

Cost-Benefit Analysis (CBA)

Cost-Benefit Analysis is an analytical technique that compares the social costs and benefits (measured in monetary terms) of proposed programmes or policy actions. Identified losses and gains experienced by society are included, and the net benefits created by an action are calculated. Actions are compared to allow the selection of those which will yield the greatest net benefits or benefit-cost ratio.

Current Public Transport Record (CPTR)

The CPTR is a document prepared by the staff of a local or metropolitan authority in South Africa providing a record of all operational scheduled and unscheduled public transport services, the number of passengers carried, the facilities used and the utilisation of routes and facilities by passengers and vehicles. The CPTR is a component of a city's Public Transport Plan and its primary purpose is to identify services that are operating over or under passenger capacities.

Dynamic Adaptive Decision Framework (D.A.D.F.)

A Dynamic Adaptive Decision Framework is a Multi-Criteria Analysis based option analysis tool used to select those TDM, TSM, LUM and Smart Growth measures most appropriate for managing specific local traffic congestion more effectively.

Economic informality

Economic informality refers to a range of economic assets and activities that are not conventionally regulated and which are either marginalised from full public scrutiny and/or lack public support. Low wages, seasonality and low levels of unionisation and benefit payments are among the generally inferior conditions experienced by informal workers.

Employment Coefficient

An employment coefficient is an indicator which measures the degree of responsiveness of employment to economic growth.

Endogenous variables

Endogenous variables are variables that describe characteristics associated with the transport system such as travel time, construction and implementation cost, the provision of public transport, environmental and infrastructure characteristics.

Environmental Health Impact Assessment (EHIA)

Environmental Health Impact Assessment is an Environmental Impact Assessment with a health component included in the appraisal process. Often EHIA has a particularly quantitative health assessment, focusing on health issues that can be measured – such as exposure to chemicals and pollution whilst focusing less on qualitative information such as community perceptions of health issues.

Environmental Impact Assessment (EIA)

Environmental Impact Assessment is a detailed and systematic identification and evaluation of the potential environmental impacts of proposed projects at local implementation level.

Environmental Impact Statement (EIS)

An Environmental Impact Statement is a report that documents the information required to evaluate the environmental impact of a project. It informs decision-makers and the public of reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the environment.

Environmental Management Framework (EMF)

An Environmental Management Framework contains a group of Environmental Management Systems that guide and monitor environmental assessment tools and performance whilst encouraging and embracing social responsibility as well as environmental protection at a national and regional level.

Environmental Management Programmes/Plans (EMP)

Environmental Management Programmes/Plans are programmes that set out the elements of environmental impact assessment to be implemented in the management plans of local programmes and projects.

Environmental Management System (EMS)

An Environmental Management System contains procedures and codes of practice in order to implement the requirements of ISO 14000. Operating, emergency, data collection and documentation procedures are set out, along with procedures for training, the transfer of information and all the elements of a complete management and quality control system.

Environmental Risk Assessment (ERA)

Environmental Risk Assessment is a process of gathering data and estimating the probability and severity of the short and long-term harmful effects on human health or the environment from exposure to hazards associated with a particular substance, product or technology.

Exogenous variables

Exogenous variables describe economic, social, demographic, physical and land-use characteristics of a geographical area describing the context or scenario within which integrated strategies will operate.

First order effects

First order effects are those transport effects that occur directly as a result of the altered land-use/transport system manifested in a change in congestion, user costs, reliability of journey time and the quality of the journey.

Grounded theory

A grounded theory is one that is discovered, developed and provisionally verified through systematic data collection and analysis of data pertaining to the subject being studied - it is a theory that arises from data collected, by empirical research and is descriptive in nature.

Growth and Development Strategy (GDS)

A Growth and Development Strategy details the long-term strategic direction a city must take and the future efforts it has to undertake jointly with its social partners, to accelerate its economic growth and enhance its development in a way that benefits all its residents.

Headway

Headway is the time interval between successive passing of vehicles (measured from bumper to bumper), moving along the same lane in the same direction on a road, expressed in seconds or minutes.

HOV lanes

High Occupancy Vehicle lanes are road lanes designated on a public highway which can only be used by high occupancy vehicles or alternatively low occupancy vehicles which have paid a toll.

Impact Assessment (IA)

Impact assessment is a process concerned with identifying, predicting and evaluating foreseeable impacts, both beneficial and adverse, of public and private (development) activities, alternatives and mitigating measures. It aims to eliminate or minimise negative impacts and optimise positive impacts.

Impact criteria

Impact criteria measure the contribution made by an option or measure in meeting an objective.

Informal economy

See: Economic Informality

Integrated Development Plan (IDP)

An Integrated Development Plan is an aggregate plan for an area that provides an overall framework for development that co-ordinates and aligns many sectoral functions within the local municipal landscape from different levels of government.

Integrated Environmental Management (IEM)

Integrated Environmental Management is a philosophy developed in South Africa which prescribes a code of practice ensuring that environmental considerations are fully integrated into the management of all planning activities in order to achieve a desirable balance between conservation and development.

Integrated Support Unit (ISU)

An Integrated Support Unit is envisaged as a well-managed and focused organisational structure to improve the delivery and implementation of the T.C.M.P. by planning and setting out how to manage traffic congestion effectively whilst maintaining sustainable development.

Integrated Transport Plan (ITP)

An Integrated Transport Plan is a document setting out how to integrate transport systems in order to increase accessibility for all people by giving priority to public transport, non-motorised transport and traffic safety.

Intelligent Transportation Systems (ITS)

Intelligent Transportation Systems include the application of a wide range of new technologies, including driver information, vehicle control and tracking systems, public transport improvements and electronic charging to provide a variety of transportation improvements, including driver convenience, reduced congestion, increased safety, more competitive public transport services and support for pricing incentives.

Laissez-faire

Laissez-faire is a policy founded in classical economic theory that encourages free enterprise market capitalism and as little government interference with economic systems as possible. Free trade would result in world resources being utilised most efficiently and would maximise world welfare.

Land-Use Management (LUM)

Land-Use Management is a tool exercising control over the trip-generating characteristics of land-use and is used to influence trip-making patterns, volumes and modal distributions by the effective spatial distribution and use of land, thereby forcing the resulting demand to be consistent with the existing transportation infrastructure and the level of service desired.

Level of Service (LOS)

A Levels of Service describes the different operating conditions which can occur on a road segment or at a junction at different times in terms of speed, safety, drivers' comfort, travel time, travel cost, number of transfers, delay and vehicle operating cost.

Local Agenda 21 (LA 21)

Local Agenda 21 is the local version of Agenda 21 - an international agreement made at the first Earth Summit held in Rio de Janeiro in June 1992, aimed at addressing global environmental concerns.

Mode

Mode refers to a particular form of travel i.e. walking, cycling, travelling by bus, car, carpool or by train.

Mode Shift

Mode Shift refers to the shift of people from one mode to another i.e. from single occupancy vehicles to HOVs or vice versa.

Multi-Criteria Analysis (MCA)

Multi-Criteria Analysis is a tool that guides decision-making on the basis of common criteria. It is mainly designed to facilitate the understanding and resolution of decision-making issues. It is undertaken to make a comparative assessment between projects or heterogeneous measures. It can therefore be appropriate for evaluations and requires the participation of stakeholders (decision-makers, technicians, beneficiaries etc.) and yields operational advice and recommendations.

Multi-modal

Multi-modal refers to facilities serving and / or promoting the opportunity to access more than one transportation mode.

New Realism

New Realism is a paradigm that aims to remove traffic congestion and improve mobility and accessibility through demand management, implementing measures designed to change or modify the capacity of road networks, altering the spatial distribution of land-use attracting an excessive volume of traffic and combating urban sprawl.

Non-recurring congestion

Non-recurring congestion is an infrequent traffic phenomenon characterized by excessive traffic volumes resulting from vehicle density exceeding physical road capacity caused by demographic and market forces or traffic-influencing events such as vehicle accidents, spills, stalls, vehicle breakdowns and traffic signals not being synchronised.

Objective

Objectives are broad statements of the improvements which a city is seeking in its land-use and transport system, specifying the directions for improvement, but not the means of achieving them.

Objective-led approach

Within the objective-led approach to problem identification the decision-maker specifies the broad objectives which need to be achieved and uses the objectives to identify problems by assessing the extent to which current or predicted future conditions, in the absence of new policy measures, fail to meet the objectives.

Operating Licences Strategy (OLS)

An Operating Licences Strategy sets out and considers the parameters and criteria which are used by Planning Authorities to make recommendations to the Operating Licensing Boards which will enable that Board, in disposing of applications regarding operating licences, to achieve a balance between public transport supply and utilisation that is both effective and efficient and which responds to customer needs. The operating licence issued permits the applicant to operate a particular mode of transport on a specific route.

Package Approach

A Package Approach integrates general transport and planning measures into coherent feasible packages in order to achieve transport policy objectives leading to sustainable development.

Park-and-Ride

Park-and-Ride describes a parking facility where people access public transportation as a transfer of mode, usually from the private car to a bus or coach.

Peak Hour

A Peak Hour describes the hour during which the maximum demand occurs for a given transportation corridor / road, generally specified as the morning peak hour or the evening peak hour.

Peak Period

A Peak Period is a portion of the day in which the heaviest demand occurs for a given transportation corridor or road, usually defined as a morning or evening period of two or more hours.

Preliminary Environmental Scan (PES)

The Preliminary Environmental Scan (PES) is a process similar to Prior Environmental Review (PER) introduced in Korea as part of an environmental appraisal to identify and minimise the environmental impacts of projects at an early stage.

Prior Environmental Review (PER)

The Prior Environmental Review (PER) is a process introduced in Korea as part of an environmental appraisal to identify and minimise the environmental impacts of projects at an early stage.

Problem-orientated approach

The problem-oriented approach to problem identification starts by defining types of problems, and uses data on current (or predicted future) conditions to identify when and where these problems occur. It then develops objectives in response to the problems.

Public-Private Partnership (PPP)

A Public-Private Partnership is a variation of privatization in which elements of a service previously run solely by the public sector are provided through a partnership between the government and one or more private sector companies. Unlike a full privatization scheme in which the new venture is expected to function like any other private business, the government continues to participate in some way.

Public Transport Plan (PTP)

Generally, a Public Transport Plan is considered to be the mechanism by which an authority can plan for, develop, manage, integrate and promote public transport and consequently should address the provision of both the public transport services and the associated infrastructure and facilities.

Ramp Metering

Ramp metering is a method which uses a traffic signal to regulate traffic entering a highway according to the current traffic conditions. It aims to reduce congestion on the highway by breaking up platoons of vehicles entering the highway, ensuring that traffic can merge more easily and by ensuring that the total flow on the highway does not exceed capacity at downstream bottlenecks.

Rationalisation Plan (RATPLAN)

The purpose of a rationalisation plan prepared by a planning authority at local government level is to eliminate inefficiencies within the subsidised bus system, to create a framework for the restructuring of tendered bus contracts, (taking cognisance of the total public transport system and its modes), in order to obtain a more efficient and cost effective public transport system and to address the restructuring of all modes forming part of the public transport system in the longer term.

Recurring traffic congestion

Recurring traffic congestion is a frequent traffic phenomenon characterized by excessive traffic volumes resulting from vehicle density exceeding physical road capacity. It tends to be concentrated into short time periods, such as “rush hours”.

Ridesharing

Ridesharing refers to the function of sharing a ride with other passengers in a common vehicle. The term is usually applied to carpools and vanpools.

Scenario

A scenario represents the context or circumstances within which integrated strategies operate.

Second order behavioural responses

Second order behavioural responses are human responses to the effects that occur as a result of an altered land-use/transport system.

Sector Plan

A sector plan is a document outlining the long-term development path and goals of a sector of governance (i.e. transport, housing, environment, health, public safety etc.), setting out medium-term objectives and programmes over a five year period as well as strategic interventions in order to achieve long-term goals.

Single embedded case study

A Single embedded case study is a case study containing more than one sub-unit of analysis providing a means of integrating quantitative and qualitative methods into a single research study.

Smart Growth

Smart Growth is an ideology aimed at reducing urban sprawl through better land-use and transportation planning by focusing on development that serves the economy, enhances communities and protects the environment acting as an antidote for suburban sprawl in an effort to reshape urban and suburban growth.

South African Local Government Association (SALGA)

The South African Local Government Association is an organization mandated by the new South African Constitution to assist in the wholesale transformation of local government in South Africa from the pre-1994 regime to the new dispensation under the country's first democratically elected government.

Spatial Development Framework (SDF)

A Spatial Development Framework broadly sets out the objectives that reflect the desired spatial form of a municipality, contains strategies and policies regarding the manner in which to achieve the objectives, sets out basic guidelines for a Land-Use Management System, sets out a capital Investment Framework for the municipality's development programmes and contains a strategic assessment of the environmental impact of the spatial development framework.

Spatial integration

Spatial integration refers to a policy that addresses the spatial fragmentation legacy of the apartheid spatial planning and land-use management era. It engages issues of urban restructuring, settlement location and property development in order to reduce urban sprawl, integrating different communities (mixed income and mixed tenure), land-use activities (mixed use: commercial, retail, recreational, transport, residential, social services, etc.) and encourages the shift from a single motor car urban design concept to a new urban design concept based on public transport.

Standard Deviation (SD)

Standard Deviation is a measure of the range of variation from an average of a group of measurements.

Standard Error (SE)

In statistics, the standard error of a measurement, value or quantity is the standard deviation of the process by which it was generated.

State Environmental Review (SER)

A State Environmental Review is a form of Environmental Impact Assessment carried out on plans and strategic proposals in former Soviet countries.

Strategic Environmental Assessment (SEA)

Strategic Environmental Assessment is a process which assesses the environmental implications of a proposed strategic decision, policy, programme, piece of legislation or major plan.

Strategy integration

Strategy integration implies the combination of TDM, TSM and LUM policy measures into a package through focused decision-making that allows the synergy between the measures to attain sustainable development and local policy and project objectives.

Street reclaiming

Street reclaiming is a process aimed at increasing the social, cultural, recreational and economic activity in neighbourhood streets by reducing vehicle traffic volumes and speeds, re-allocating road space and creating more attractive pedestrian-friendly street environments.

Sustainable Development

Sustainable Development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

Sustainable Development Indicator Framework (SDIF)

A Sustainable Development Indicator Framework contains indicators from the social, environmental and institutional dimensions of the urban fabric cutting across core indicators, non-core indicators and local or complementary indicators and is designed to measure the achievement of sustainable development objectives.

Third order effects

Third order effects are those transport effects that occur as a result of the altered land-use/transport system, but which lie outside the land-use/transport systems being studied, in the sense that such effects are not assumed to change human behaviour or affect the choices of the users of the system.

Transportation Demand Management (TDM)

Transportation Demand Management in its broadest sense is any action or set of actions intended to influence intensity, timing and spatial distribution of transportation demand for the purpose of reducing the impact of traffic resulting in more efficient use of transportation resources.

Transportation Supply Management (TSM)

Transportation Supply Management entails adding new capacity or making operational changes to the existing infrastructure so as to improve system performance.

Travel Plan

A Travel Plan is a document containing a package of measures produced for businesses or residents setting out the ways in which the use of public transport and other more sustainable means of travel (essentially using alternatives to single-occupancy car-use) can be encouraged amongst employees, customers or residents.

Urban restructuring

Urban restructuring refers to a strategy aiming to increase the quality of urban life and citizenship through integrated transport-led land reform (densification, infill and development of strategically located public brown/greenfield sites) within a demarcated urban edge, and to upgrade (previously) degraded areas and new developments.

Urban sprawl

Urban sprawl is the spreading out of a city and its suburbs over rural land at the fringe of an urban area.

Vanpool

Vanpool refers to a pre-arranged ridesharing function in which a number of people travel together on a regular basis in a van, usually designed to carry six or more persons.

Vehicle Miles Travelled (VMT)

Vehicle Miles Travelled is a measure of the extent of motor vehicle operation, by measuring the total number of vehicle miles travelled within a specific geographic area over a given period of time.

Vehicle operating cost

Vehicle operating costs refer to those travel costs (fuel, tyres, maintenance, repairs, and mileage-dependent depreciation) that vary with vehicle usage and which are based on vehicle-miles travelled.

List of abbreviations

AEE	Assessment of Environmental Effects
AVO	Average Vehicle Occupancy
BOSDA	Beslissings Ondersteunend Systeem voor Discrete Alternatieven
CBA	Cost-Benefit Analysis
CBD	Central Business District
CDS	City Development Strategy
CI	Confidence Interval
CMIP	Consolidated Municipal Infrastructure Programme
CPTR	Current Public Transport Record
DADF	Dynamic Adaptive Decision Framework
EHIA	Environmental Health Impact Assessment
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EISS	Environmental Impact Statement System
EMF	Environmental Management Framework
EMP	Environmental Management Programmes/Plans
EMS	Environmental Management System
ERA	Environmental Risk Assessment
GDS	Growth and Development Strategy
IA	Impact Assessment
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
ISU	Integrated Support Unit
ITP	Integrated Transport Plan
ITS	Intelligent Transportation Systems
LED	Local Economic Development
LUM	Land-Use Management
LOS	Level of Service
LA 21	Local Agenda 21
MCA	Multi-Criteria Analysis
MEC	Member of Executive Council (in a Provincial Administration in South Africa)
OLS	Operating Licences Strategy
MTA	Metropolitan Transport Area
PER	Prior Environmental Review
PES	Preliminary Environmental Scan
PPP	Public-Private Partnership

PTP	Public Transport Plan
RATPLAN	Rationalisation Plan
SALGA	South African Local Government Association
SD	Standard Deviation
SDF	Spatial Development Framework
SDIF	Sustainable Development Indicator Framework
SE	Standard Error
SEA	Strategic Environmental Assessment
SER	State Environmental Review
SOV	Single Occupancy Vehicle
TCMP	Traffic Congestion Management Plan
TDM	Transportation Demand Management
TSM	Transportation Supply Management
VMT	Vehicle Miles Travelled

Summary and key terms

Title

Integrating transportation and land-use management strategies aimed at reducing urban traffic congestion: a dynamic adaptive decision framework

Summary

The traditional transport planning process has given rise to unsustainable transport systems. Higher car ownership levels, more and longer trips and the sub-optimal provision of public transport are direct outcomes of traditional planning – all giving rise to increasing traffic congestion. The lack of effective transport and land-use integration has had adverse effects on the environment we live in, on peoples' welfare and on continued sustainable development. However, despite this negative prognosis the implementation of a wide variety of land-use and transport measures has been proposed in response to the desperate need to seek alternative solutions to the traffic congestion problems we face. Unfortunately it has been found that it is not sustainable to implement a variety of measures on a piecemeal basis when tackling road based traffic problems (as has been the practice in the past). Consequently, the integration of land-use and transport measures has been proposed to force a greater level of synergy where the sum of their total impacts is greater than their individual impacts.

The difficulty lies in identifying the right mix of measures for particular local conditions for inclusion in an integrated package or strategy. In response to this need the study aims to develop a Multi-Criteria Analysis based Dynamic Adaptive Decision Framework (D.A.D.F.) as a qualitative tool to help identify the most appropriate and sustainable measures for inclusion in an integrated strategy to alleviate and manage road based traffic congestion specific to prevailing local conditions. The theme of the study is therefore to identify the considerations and components necessary to develop a D.A.D.F., to test its effectiveness and to establish where and how it could be positioned within the planning process.

The method used to achieve these research aims involves a multi-method strategy in capturing both qualitative and quantitative data - essentially having structured and semi-structured components. The first part of the strategy involves a literature review examining the considerations to be taken into account when planning for sustainability and in identifying the likely components of the D.A.D.F. The review also transposes the dimensions of sustainability into planning components and explores whether and where integrated strategies (within the context of the study) can be connected to them. The process identifies research gaps which necessitates a survey exploring the gaps within an international context. The second part

of the strategy requires a case study exploring and identifying the relevant local conditions, criteria and subject matter to be uploaded into the decision framework so as to test its effectiveness. The results of the case study demonstrates that (i) it is possible to develop integrated strategies aimed at road based traffic congestion reduction using the D.A.D.F. (ii) the D.A.D.F. identifies sustainable measures that are suitable to local conditions (iii) it is possible to produce integrated strategies which are consistent with broad local planning goals and aspirations and (iv) integrated strategies have the ability to support the more specific urban perspectives and provide options capable of alleviating some strategic development challenges. Once the empirical stages are complete, conclusions are drawn positioning the study in order to formulate plausible planning recommendations.

The recommendations detail how and where to position and operationalise the decision framework within the South African planning system by recommending the need for a Traffic Congestion Management Plan (T.C.M.P.) and by setting out its likely components within the local context, how it should operate and which legislative amendments to South African planning should be made to facilitate the proposed Plan. Against this background it is considered that the main innovation and scientific contribution made by the study is the development of the D.A.D.F., the T.C.M.P., the recommendations to situate both in the planning system and the comprehensive, but still transparent, approach undertaken to create integrated strategies for specific local conditions consisting of elements that work together to produce cumulative short to long term effects that attain a balanced set of environmental, social and economic goals which are imperative for sustainable development. In terms of the significance of the study and the wider international application of the D.A.D.F., the recommendations will show that the D.A.D.F. has application value in cities world-wide.

Key terms

- Transportation Demand Management (TDM)
- Transportation Supply Management (TSM)
- Land-Use Management (LUM)
- Strategy integration
- Recurring traffic congestion
- Non-recurring congestion
- New Realism
- Smart Growth
- Sustainable development

Opsomming en sleutelterme

Titel

Die integrasie van vervoer- en grondgebruikbestuurstrategieë wat toegespits is op die vermindering van stedelike verkeerskongestie: 'n dinamies-aanpasbare besluitnemingsraamwerk

Opsomming

Die tradisionele vervoerbeplanningsproses het tot die ontstaan van onvolhoubare vervoerstelsels bygedra. Groeiende motoreienaarskapsvlakke, meer en langer pendelritte en die relatiewe ondervoorsiening van openbare vervoer is direkte uitkomste van tradisionele beplanning en dra alles by tot toenemende verkeerskongestie. Die gebrek aan doeltreffende vervoer- en grondgebruikintegrasie in die beplanningsproses het 'n negatiewe uitwerking op die omgewing waarin ons leef, ons welvaart asook volhoubare ontwikkeling. Ten spyte van hierdie sombere prognose is verskeie beplanningsinstrumente voorgestel in die soeke na oplossings vir padverkeerskongestie. Daar is egter bevind dat dit nie volhoubaar is om beplanningsinstrumente een-een of in isolasie te implementeer nie. Gevolglik is voorgestel dat die afsonderlike vervoer- en grondgebruikinstrumente integreer word sodat hulle gesamentlike uitwerking meer effektief is as die impak van die afsonderlike instrumente.

Die probleem lê egter daarin om die regte kombinasie van instrumente te kies vir insluiting in 'n geïntegreerde pakket of strategie, gegewe die plaaslike omstandighede waarvoor dit bedoel is. Vanaf hierdie vetrekpunt is die doel van die studie om 'n multi-kriteria-analisegebaseerde dinamies-aanpasbare besluitnemingsraamwerk (D.A.B.R.) te ontwikkel. As kwalitatiewe hulpmiddel sal dit help met die identifisering van die mees volhoubare instrumente vir insluiting in 'n geïntegreerde pakket, met inagneming van plaaslike omstandighede. Derhalwe is dit die doel van die studie om die komponente te identifiseer en te ontwikkel wat nodig is vir die D.A.B.R., die doeltreffendheid daarvan te toets en te bepaal waar in die beplanningsproses dit geposisioneer kan word vir implementering.

Ten einde hierdie doelwitte te bereik, word 'n veelfasettige strategie aangewend om relevante data in te samel. Eerstens word 'n literatuurstudie onderneem, sodat 'n geïntegreerde oorsig van die mees relevante teoretiese standpunte en leemtes gevorm kan word. Dit is van besondere belang om die oorwegings te ondersoek waaraan gehoor gegee moet word en om die komponente van die D.A.B.R. te identifiseer, sodat beplanning tot volhoubare ontwikkeling sal aanleiding gee. Na aanleiding van die literatuurstudie word die dimensies van volhoubare ontwikkeling dan omgeskakel in beplanningskomponente en daar word ondersoek ingestel na hoe, waar en of 'n geïntegreerde strategie (binne die konteks van die studie) aan die

beplanningskomponente gekoppel kan word. Na afloop van die literatuurstudie is die volgende stap om die geïdentifiseerde leemtes sowel as nuwe idees rondom die D.A.B.R. empiries te ondersoek deur middel van 'n vraagbriefopname. Hierdie resultate word dan aangewend om die D.A.B.R. te struktureer.

Die tweede komponent van die data-insamelingstrategie behels 'n gevallestudie om plaaslike omstandighede, kriteria en ander elemente te identifiseer wat nodig is om die D.A.B.R saam te stel, sodat die doeltreffendheid en werkbaarheid daarvan getoets kan word. Die resultate van die gevallestudie toon dat (i) dit moontlik is om geïntegreerde strategieë te ontwikkel deur middel van die D.A.B.R. ten einde verkeerskongestie te bestuur en/of te verminder, (ii) die D.A.B.R. wel oor die vermoë beskik om volhoubare instrumente te identifiseer wat geskik is vir plaaslike omstandighede, (iii) dit moontlik is om geïntegreerde strategieë te ontwikkel wat breë plaaslike beplanningsmikpunte en aspirasies ondersteun en dat (iv) geïntegreerde strategieë die vermoë het om meer spesifieke stedelike beplanningsperspektiewe te ondersteun en in staat is om sekere strategiese ontwikkelingsprobleme aan te spreek.

Met hierdie nuwe kennis as agtergrond, word gevolgtrekkings gemaak wat die studie posisioneer om beplanningsaanbevelings te ontwikkel. Die beplanningsaanbevelings dui aan hoe en waar die D.A.B.R. in die Suid Afrikaanse beplanningstelsel geposisioneer moet word, ten einde dit te operasionaliseer. Dit word gedoen deur aan te beveel dat 'n Verkeerskongestie-bestuursplan (V.B.) saamgestel moet word. Die aanbevelings identifiseer gevolglik die komponente daarvan en die wyse waarop dit behoort te funksioneer binne die Suid-Afrikaanse konteks asook die wetgewende beplanningswysigings wat aangebring sal moet word om 'n V.B. te operasionaliseer. Uit die aanbevelings word afgelei dat die belangrikste innovasie en wetenskaplike bydrae van die studie die ontwikkeling van die D.A.B.R. en V.B. is sowel as die insiggewende aanbevelings om beide binne die beplanningstelsel te posisioneer. Op hierdie wyse word 'n deursigtige benadering geskep om volhoubare en geïntegreerde strategieë te ontwikkel wat spesifieke plaaslike verkeerskongestieprobleme kan aanspreek en bestuur op grond van die kumulatiewe uitwerking van die geselekteerde grondgebruik- en vervoerbeplanningsinstrumente. Op grond van die betekenisvolheid van die studie en die wyer, internasionale toepassingsmoontlikhede van die D.A.B.R. word aanbeveel dat dit ook in ander stede regoor die wêreld toepassingswaarde het.

Sleutelterme

- Bestuur van Vervoervraag (Engels: Transportation Demand Management)
- Bestuur van Vervoeraanbod (Engels: Transportation Supply Management)
- Grondgebruikbestuur (Engels: Land Use Management)
- Strategie-integrasie (Engels: Strategy integration)
- Herhalende verkeerskongestie (Engels: Recurring traffic congestion)
- Nie-herhalende verkeerskongestie (Engels: Non-recurring congestion)
- Nuwe Realisme (Engels: New Realism)
- Volhoubare ontwikkeling (Engels: Sustainable development)

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To my wife Lana and my parents

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CHAPTER 1
INTRODUCTION

1.1 Orientation and study limitations

The traditional urban transport planning process has given rise to unsustainable transport systems. Higher car ownership levels, more and longer trips and the provision of less public transport are direct outcomes of traditional planning. This has brought about astronomical community costs in terms of road fatalities and injuries, traffic congestion, costs to the economy, massive capital investment and environmental degradation. The failure to integrate land-use and transport in traditional transport planning in cities has resulted in a declining share of public transport and the ever increasing dominance of the private car closely associated with increased emission levels and environmental degradation. Growing road based traffic congestion is, therefore, recognised as a major problem as road-user demand keeps outstripping the supply of road infrastructure.

The relationship between land-use and transport networks has a fundamental influence on the overall level of demand for travel, patronage of various travel modes, accessibility, travel distances and the cost of travel as well as on the ongoing cost of providing essential infrastructure and services. The lack of transport and land-use integration has indeed had adverse effects on the environment, on people's welfare and on continued sustainable development.

Despite this negative prognosis, the implementation of a wide variety of land-use and transport measures has been proposed in order to force greater co-operation between land-use and transport. Three main streams of intervention have evolved over the past two decades and have been applied with varying degrees of success originating from a supply-side paradigm, a demand-side paradigm and land-use management initiatives - all having the ability to reduce road based traffic congestion one way or another. As decision-makers are increasingly concerned about the environmental impact of planning proposals and as it is considered important to devise approaches to planning that enable joined-up decision making across a variety of sectors, the debates in recent years have focused on policy integration - developing integrated packages to overcome a wide range of transport and spatial planning externalities.

This concept, labelled New Realism, demands that transport and land-use measures and elements of environmental management be integrated in the form of a package approach so as to get the most out of the transport system in accessing spatially dispersed destinations. As it is not sustainable to implement a variety of measures on a piecemeal basis when tackling urban traffic problems, integration of the measures has been proposed which encourages the decision-maker to integrate the many measures at his/her disposal forcing greater synergy where the sum of the total impacts is greater than that of the individual impacts. The difficulty lies in identifying the right mix of measures to be applied to particular local conditions for inclusion in the package or strategy when trying to manage or reduce traffic congestion. Whilst the developed world is increasing, using packages of options to integrate transport and land-use management strategies in a general sense in order to deliver sustainable transport facilities and services as well as spatial development patterns, little has been done to integrate the three streams of intervention using a decision framework when deciding which policy measures are best suited to alleviating site specific traffic congestion.

To this end the study is built on the premise that developing integrated strategies aimed specifically at reducing road based traffic congestion is no longer an option but an essential requirement if traffic congestion reduction and sustainable communities are to be left as the legacy of today's planners. In recent years growing emphasis has been placed on demand management when dealing with congestion problems and planners have found themselves hard-pressed to persuade the public that it should pay for a driving privilege, which until recently, has been virtually free and often viewed as an inviolable right. But with mounting pressure from the environmentally conscious public and with the growing discontent that stems from unconscionably long commute times and growing concerns over simply carrying on "building our way out of congestion", the tide of public opinion seems poised to turn. A robust and defendable mechanism that allows decision-makers to select from a wide variety of measures those most applicable and appropriate to their local conditions and circumstances in managing road based traffic congestion is desperately needed - one which considers all the dimensions of sustainable development.

To this end the theme of this study is to identify the considerations and components necessary to develop a Dynamic Adaptive Decision Framework (D.A.D.F.) or operational process that allows policy-makers to do just that - select the measures most applicable and appropriate to site specific conditions and circumstances in developing integrated strategies to manage exclusively road based traffic congestion. In going beyond merely developing a useful process that integrates transportation and land-use management strategies, the research is poised to test the D.A.D.F.'s effectiveness and/or usefulness and ultimately assess and recommend it to be positioned on merit within the planning system as part of a Traffic Congestion Management Plan.

In demarcating the focus of the study and setting out its limitations it is recognised that whilst traffic congestion may present a much wider context that includes other modes of transport such as pedestrian congestion, cycle congestion, specific vehicle type congestion and congestion caused by trip purpose etc., the study focuses on road based traffic congestion (hereafter referred to only as traffic congestion) caused mainly by the private car. Reducing car related traffic congestion is one of many strategic transport objectives; it is not the intention of the study to elevate the reduction of car related traffic congestion as a strategic transport objective to a level above other strategic transport objectives such as the reduction of travel cost, travel time or the reduction of pollution etc. The integrated strategies produced as output from the D.A.D.F. and indeed the results of the study are not envisaged as all inclusive solutions to traffic congestion problems or as an answer to all strategic transport objectives, rather they form an important component in the search for solutions to the many strategic urban transport problems we face today.

1.2 Previous research and existing shortcomings

The complexities faced by transport professionals, planners, environmentalists and economists in delivering an integrated strategy to alleviate traffic congestion is an enormous challenge when they have to live up to a vision of a transport and land-use system that supports sustainable development, economic prosperity, environmental benefits and social inclusion. The concept of developing integrated strategies as an overarching approach to transport and land-use integration is not a new one - attempts have been made to this end with varying degrees of success and for various purposes. However, less empirical work has been carried out to show whether progress has been made in developing integrated strategies aimed at traffic congestion reduction *per se* (Geerlings, 2003:187).

Previous research on the topic of policy or strategy integration is mainly technical and focuses on policy options, instruments or assessment methods, rather than on decision-making processes and/or implementation issues; little attention has been given to organisational and/or institutional aspects of policy integration and how these relate to theories from organisational, policy or political sciences. Indeed, where such studies have been undertaken they reflect significant international differences in the ways in which countries perceive and respond to traffic problems and subsequently the manner whereby they develop approaches that integrate transport and land-use, suggesting that policy integration has varying degrees of success (Abu-Lebdeh and Benekohal, 2003:110-111; Button, 1994:289). However, apart from the differences in approach, there is widespread acceptance that integrating decisions across land-use planning, transport and environmental policy is crucial for sustainable development - this at least is a shared vision.

Over the last decade the approach to transport and land-use integration as a means of evaluating resulting strategies has been developed and accepted into practice as shown by major UK studies of cities such as London (May and Gardner, 1990:274-275), Birmingham (Wenban-Smith et al, 1990a,b) and Edinburgh (May et al., 1992). These studies have demonstrated that when an integrated approach in which infrastructure provision, management of existing infrastructure and pricing of use of that infrastructure are co-ordinated, the scale of urban transport problems can be significantly reduced.

These developments led indirectly, particularly through the experience in Birmingham, to the introduction of the Package Approach for urban transport funding (May, 1994) and more directly to the development of the Common Appraisal Framework for assessing Package Approach bids, providing a consistent means of evaluating the wide ranging types of measure which might be included in such a package. The Package Approach is aimed at integrating general transport and planning measures into coherent feasible packages in order to achieve transport policy objectives conducive to sustainable development. A shortcoming of the UK Package Approach and the Common Appraisal Framework is that they were not designed to deal specifically with the reduction of traffic congestion *per se,* but rather to provide a consistent means to evaluate the wide ranging types of measures which might be included within a more general package of transport measures, on the basis of predicting their effects. And so the Package Approach does not identify the measures needed to form part of an integrated approach based on site specific conditions which is a requirement if strategies are to deal with site specific traffic problems.

Another difficulty experienced by policy-makers is that of reaching consensus over the right mix of TDM, TSM and LUM policy measures to be included in integrated strategies (Shiftan et al., 2003:323). When promoting greater efficiency and sustainable development the challenge many policy-makers face is that of knowing which measures to apply in particular local conditions and situations (Meyer, 1997:15; Firman, 2004:353) and how to integrate them.

Whilst many researchers accept this prognosis, little progress has been made in providing a decision framework enabling decision-makers to select the optimal measures best suited to site specific conditions and which encourage sustainable development from a menu (Bell, 1995:78). In support of this statement, Litman (2000:2) cites recent research in the UK, USA and Canada, which underlines the need for developing a holistic decision framework enabling optimal integration in the context of the New Realism and Smart Growth ideologies in transport.

A key further shortcoming in producing integrated strategies, both in general and in particular those which can reduce traffic congestion, is the lack of policy co-ordination and integration. Such co-ordination and integration are essential to ensure that packages of complementary policies, rather than single measures, are implemented. The danger lies in the strictly sectoral approach to implementing TDM, TSM and LUM policies (Geerlings, 2003:187) which has been the case in the past. While it is possible to formulate feasible integrated strategies, very few studies have been able to demonstrate that transport or planning policy measures alone will achieve a sustainable situation or indeed reduce traffic congestion.

At the local or regional level, the lack of a co-ordinated planning process for all transport (road and public transport), land-use and environmental considerations results in a segmented approach to policy-making, critically affecting the development and implementation of comprehensive, integrated plans addressing all aspects of urban travel and spatial development. Furthermore, a lack of co-ordination of urban travel and land-use policy among constituent municipalities in a metropolitan area may also result in serious organisational problems and inefficiencies in, for example, the provision of public transport services.

Turning to current practice in developing and perhaps implementing integrated strategies the World Bank reports that cities in the least developed and in developing countries (without singling any out) are unable, for whatever reason, to plan transport systems, manage travel demand, relate land-use and transport and to provide adequate resources for transport. As a result they suffer from transport problems such as (i) increasing traffic congestion (ii) declining attractiveness of road based public transport (iii) increasingly high costs of travel (iv) high levels of (road) accidents and (v) increasing road traffic related emissions and atmospheric pollution (Cracknell, 2000:1). These findings demonstrate that the development of integrated strategies within the context of traffic congestion reduction is not being given enough thought in the least developed and in developing countries.

The developed world has had more success in integrating TDM, TSM and LUM measures as the examples below suggest. Stewart and Pringle (1997:1211) and Lim (1997:1193) report that Toronto and Vancouver in Canada have been able to achieve an enviable level of public transport use as a result of historical success in maintaining an effective public transport system and integrating public transport policies with LUM. Verhetsel (2001:111-112) reports that a number of planning and infrastructure measures taken in Antwerp (Belgium) are aimed at alleviating traffic congestion. The measures implemented are mainly TSM and LUM measures. Halden (2002:313) reports the successful application of access management aimed at integrating land-use and transport policies in Edinburgh and the Lothians in Scotland. There are also indications of LUM successes in Korea in the imposition of development restrictions which have resulted in clustered demand around Seoul, special land assembly in Shanghai and Bombay and new cluster development in Bangkok aimed at reducing congestion (Gakenheimer, 1999:684).

Sim et al. (2001:339) report the successful integration of TDM, LUM and TSM in Singapore and that its success in alleviating severe traffic congestion is due to its comprehensive and highly integrated policy measures. The only other two cities experiencing similar success are Curitiba (Brazil) and the Lao People's Democratic Republic (Rabinovitch, 1996:51; Sawathvong, 2004:553). Their success also lies in comprehensive and highly co-ordinated land transport policies, which combine the integration of land-use and transport planning with demand management measures.

Current practices suggest that integrating transport and land-use strategies to alleviate traffic congestion is a concept that is alien to many policy makers and that it is not occurring on a wide enough scale. And so authors such as Rabinovitch (1996:51), Sawathvong (2004:553) and Badoe (2003:235) acknowledge that rather than applying various congestion reducing instruments on a piecemeal basis an integrated approach is desperately needed. Barredo and Demicheli (2003:297) and Banister (1999:313) go further, suggesting that an integrated strategy will address the real cause of congestion problems rather than their symptoms or consequences. Where strategies are being integrated the problem lies in the lack of a framework to facilitate the selection of those measures most appropriate to site specific conditions.

From this point of view there is indeed a growing consensus for radical change emphasising the need for joined-up action across different areas of TDM, TSM and LUM policy application (Department for Transport, 2004a) as well as a process or tool that guides policy-makers when selecting the appropriate measures suitable for their local conditions. Transport policy must engage increasingly with other sectors to deliver a truly integrated approach and to move towards a New Realism (Goodwin et al., 1991) in transport. The integrated strategies of the future must be cast in a major role that cuts across many policy areas (Hine, 2000:175). Only the development of highly integrated strategies with a clear decision framework has the potential to address the core of the problem (Potter and Skinner, 2000:275).

1.3 Problem statement

Having briefly described the previous research into strategy integration and having identified some of the main shortcomings, the problem to be solved is formulated as follows:

- Urban road based traffic congestion is an unsatisfactory situation in major cities, as road capacity does not increase in the same proportion as the volume of traffic, resulting in a wide variety of adverse consequences and impacts.

- Transport trends and international practices suggest TDM, TSM, LUM and "Smart Growth" measures employed to deal with traffic congestion are not integrated specifically to reduce traffic congestion whilst progressing sustainable development.

- Current literature has not singled out a qualitative methodology or process that provides a logical decision framework allowing co-ordinated decision-making in selecting the TDM, TSM, LUM and "Smart Growth" measures, most appropriate for dealing with local (site specific) traffic congestion conditions whilst considering local spatial development patterns, existing transport infrastructure and policy objectives.

1.4 Research question

The following central research question has been formulated to address the problem statement:

What components have to be built into a dynamic adaptive decision framework to provide a process capable of selecting the most effective and appropriate combination of measures to reduce traffic congestion at specific local conditions whilst encouraging sustainable development?

The research question is more general and not in itself answerable because of its generality. For this reason the study and especially the data-gathering process will be guided by 13 more **specific research questions** presented below.

1. Which TSM, TDM and LUM policy approaches are generally expected to reduce traffic congestion when considering economic, social, infrastructure and transport goals and objectives?
2. Which elements of "Smart Growth" and the New Realism paradigm should be incorporated into the framework?
3. Which policy measures will be acceptable, feasible and sustainable and most conducive to achieving the decision-maker's goals and objectives under prevailing local conditions?
4. What relationship exists between the application of policy measures and the development stage of a country?
5. Which variables and technical considerations, exogenous and endogenous to the transport system should be used to describe the problems, concerns and local conditions?
6. What circumstances or local conditions should prevail, warranting specific types of intervention in deciding between alternative policy options?
7. Which objectives and sub-objectives, criteria and indicators should be applied in measuring the feasibility of formulated strategies when they are a function of the overall predetermined project goals and objectives?
8. Which policy objectives are conducive to integration aimed at congestion reduction and sustainability?
9. Which criteria and indicators should be used to assess the extent to which policy measures contribute to sustainable development?
10. Do the criteria and indicators used to assess the extent to which policy measures contribute to sustainable development differ between the least developed, developing and developed countries?
11. Which performance indicators should be considered in measuring or evaluating the success of an integrated strategy?
12. What barriers exist to implementing policy measures?
13. Will mobility and accessibility increase in urban areas when LUM, TDM and TSM policy measures are integrated?

1.5 Research aims and objectives

In answering the research question the research **aims** to:

(i) develop a Dynamic Adaptive Decision Framework (D.A.D.F.) as a tool to integrate various TDM, TSM, LUM and "Smart Growth" measures to help reduce existing over-saturated road conditions and their future occurrence.

(ii) identify the elements required to be built into a D.A.D.F. by examining the considerations to be taken into account when planning for sustainability as well as the components of the planning system so as to establish whether and where integrated strategies can be connected to it.

(iii) produce a decision framework or process recognising local conditions, constraints and circumstances capable of identifying those measures most appropriate to dealing with local traffic congestion through an integrated strategy.

(iv) apply the decision framework to a case study.

(v) formulate plausible recommendations on ways to position the D.A.D.F. within the planning system.

In achieving these more general aims it is a requirement to work towards the following research **objectives:**

(i) identify TDM, TSM and LUM measures that have a successful track record in reducing traffic congestion.

(ii) identify and critically evaluate the elements of "Smart Growth" and New Realism proving effective in reducing traffic congestion.

(iii) determine which policy measures are most conducive to achieving the decision-maker's goals and objectives under specific conditions.

(iv) determine whether a relationship exists between the development stage of a country and the policy measures deemed most effective and applicable to their conditions.

(v) determine the variables, endogenous and exogenous, to the transport system that should be used to describe the local setting, problems and conditions that would help select the most appropriate measures for a particular local area.

(vi) identify the objectives conducive to integration aimed at congestion reduction and sustainability.

(vii) determine whether the criteria and indicators used to measure the extent to which policy measures contribute to sustainable development differ between the least developed, developing and developed countries.

(viii) identify performance indicators to measure the success of a congestion-reducing integrated strategy.

(ix) identify potential barriers to policy implementation.

(x) assess the purpose and context of ITPs and IDPs to establish whether it is feasible to connect the D.A.D.F. to them and more generally to the planning system.

(xi) structure the decision framework.

(xii) apply the decision framework to a case study.

(xiii) determine the anticipated value of the decision framework by positioning its output within a case study.

(xiv) determine whether the decision framework will increase mobility and accessibility in urban areas.

(xv) solve the research problem and formulate plausible recommendations.

1.6 Method of investigation

Figure 1.1 illustrates the conceptual model of the research process, summarising the method of investigation followed.

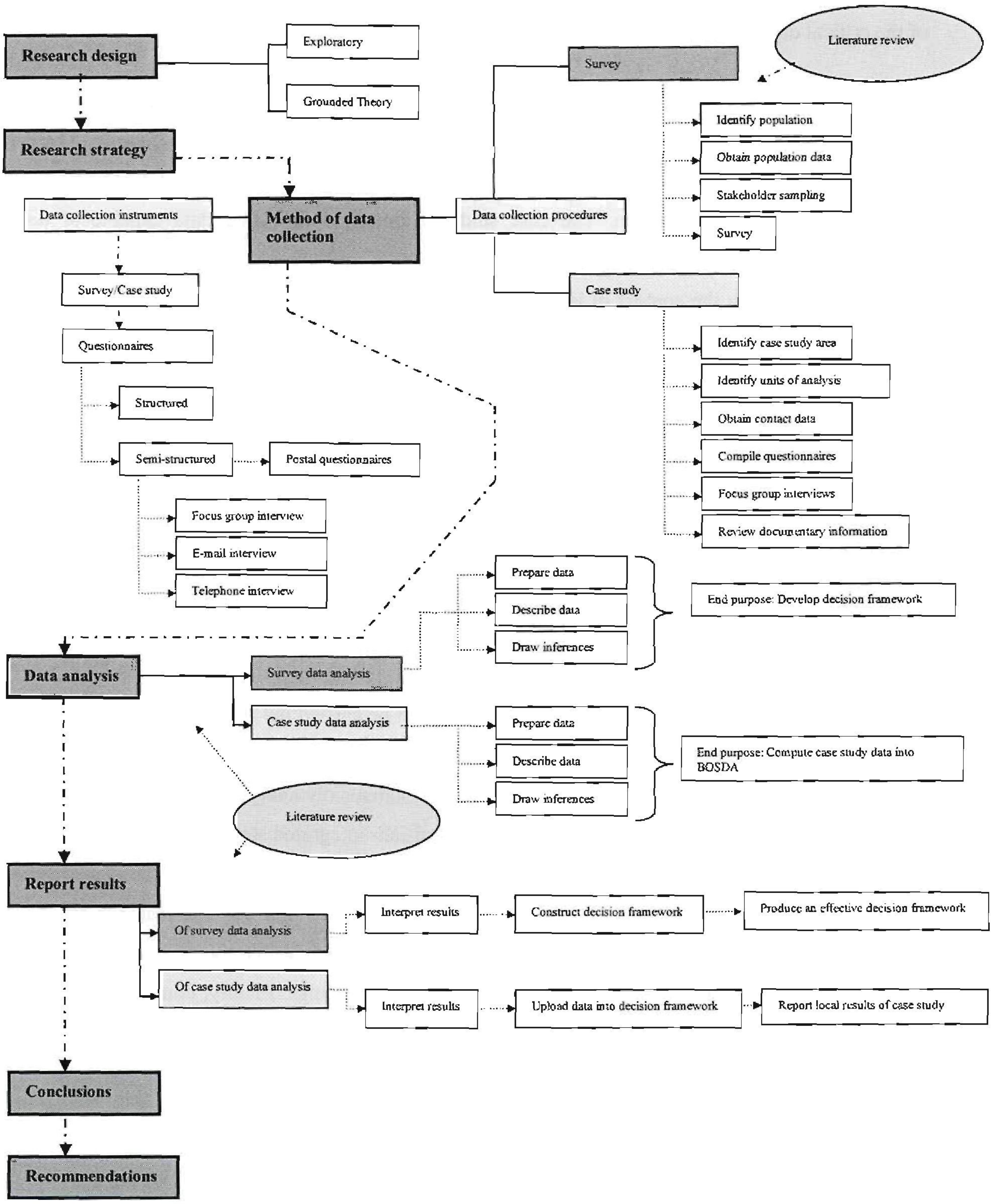


Figure 1.1 Conceptual model of the research process

The study will have a grounded theory and exploratory design representing the overall approach that implements the research strategy. It is initiated by undertaking desk research, whereby a thorough literature review will be undertaken in relation to the research aims, objectives and questions, reporting a well-integrated review of the issues of concern and reporting any gaps. The information, viewpoints and insights obtained from primary sources are used to contribute towards clarifying arguments which are discussed and developed and to confirm or disprove the views and findings of the research and form part of the critical discussion with such authors.

In achieving the research objectives and solving the research problem the main drive behind the study is a two stage empirical investigation where data is collected using a survey and case study. The survey is intended to collect data components relevant to identified gaps in developing a D.A.D.F. and to explain other relevant issues of concern. The case study is aimed at collecting data capable of testing the D.A.D.F.'s ability to produce integrated strategies aimed at traffic congestion reduction suitable to local conditions and within the context of local prevailing development challenges and objectives. Both stages of the empirical investigation will be characterised by the analysis of survey and case study data, reporting and interpreting their results.

Once the survey has been conducted its results will be interpreted and positioned within the literature survey, conclusions will be drawn and inferences made in order to construct the D.A.D.F. In addition, the first stage of the study will also (i) assess planning's administrative and institutional framework in identifying the appropriate level of governance at which integrated strategies should be implemented and (ii) assess the perceived value of linking integrated strategies to either ITPs or IDPs via a D.A.D.F. as part of a Traffic Congestion Management Plan (T.C.M.P.).

During the second stage of the research a case study will be carried out to gather relevant data to test the D.A.D.F.'s ability to produce integrated strategies. Once case study data has been collected it will be analysed, reported and interpreted. This is followed by statistically analysing and uploading the data into the D.A.D.F. The D.A.D.F.'s results will be transposed into integrated strategies for the case study cities. These results will be interpreted against a literature check and positioned within the considerations and development challenges experienced in both case study cities. In this way the research results and the analysed data will be connected to the literature thereby verifying certain arguments, concepts and findings in contributing towards the internal validity of the findings. Finally, conclusions will be drawn and recommendations made, demonstrating how the D.A.D.F. could be positioned within the South African planning system through the introduction of a T.C.M.P.

1.7 Structure of the thesis

Figure 1.2 below sets out the structure of the thesis. Chapter 1 introduces the reader to the topic of discussion, what previous work has already been done, what the problems are and why they are being investigated. Chapter 2 reports the case for strategy integration. Chapter 3 examines the considerations to be taken into account when planning for sustainability and highlights the gaps in the current literature. Chapter 4 transposes the dimensions of sustainability into planning components and explores whether and where integrated strategies can be connected to them and also identifies some existing gaps. Chapter 5 explains the methodology of the research in more detail.

Chapter 6 reports the results of the survey and Chapter 7 discusses and interprets these results. Chapter 8 reports and interprets the case study results in establishing the D.A.D.F.'s scope to produce integrated strategies and how well they can be positioned within the case study cities' context and development considerations. Chapter 9 subsequently provides an overview of the main findings and results, conclusions and insights made. Finally, Chapter 10 outlines the recommendations made by this study.

Structure

Chapter 1	Introduction
Chapter 2	The case for strategy integration
Chapter 3	Planning for sustainability
Chapter 4	Connecting integrated strategies to the components of planning
Chapter 5	Methodology
Chapter 6	Survey results
Chapter 7	Discussion and interpretation of survey results
Chapter 8	Case Study: Cape Town and Johannesburg
Chapter 9	Conclusions
Chapter 10	Recommendations

Figure 1.2 Structure of thesis

CHAPTER 2

THE CASE FOR STRATEGY INTEGRATION

2.1 Introduction

The aim of this chapter is to evaluate, critically discuss and argue the case for Transportation Demand Management (TDM), Transportation Supply Management (TSM), and Land-use Management (LUM) strategy integration. The discussion is structured as illustrated by Figure 2.1.

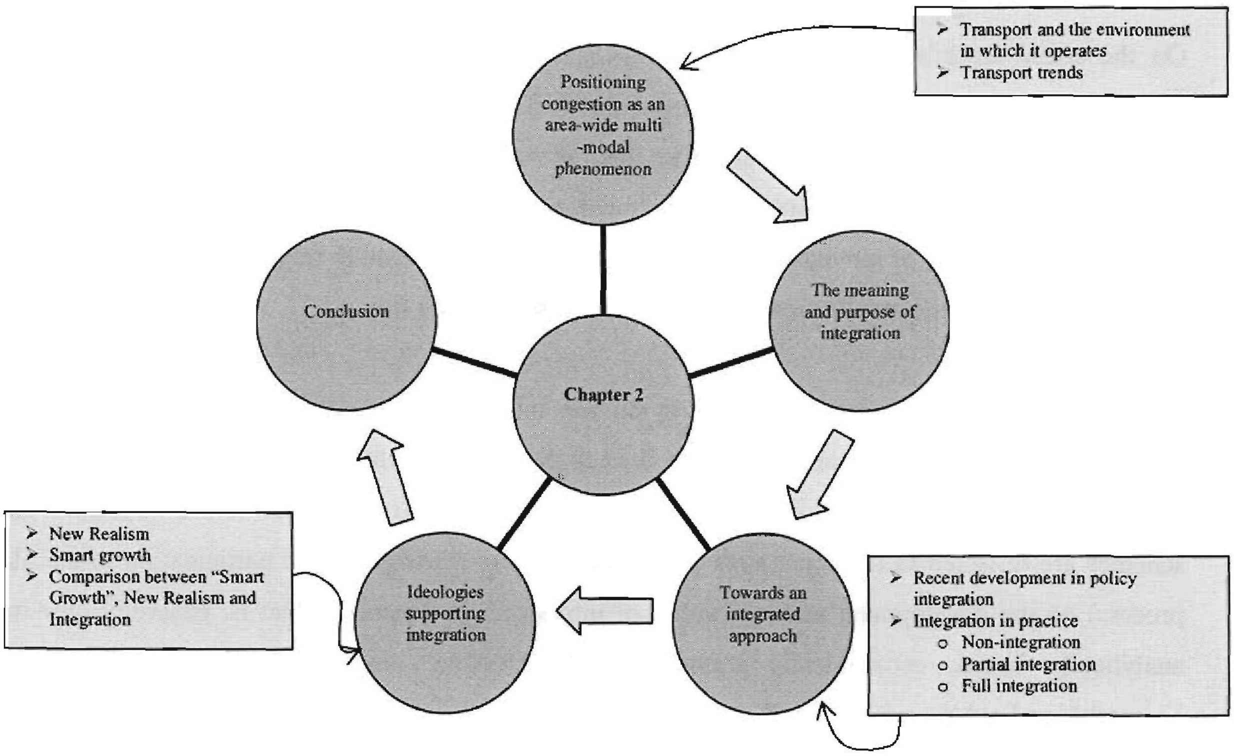


Figure 2.1 Structural components of Chapter 2

2.2 Positioning congestion as an area-wide multi-modal phenomenon

2.2.1 Transport and the environment in which it operates

A fundamental axiom in transport planning is that of transportation being a "derived demand", that is, people rarely "consume" transportation for the pleasure of movement *per se*, but rather travel in order to reach opportunities (social, leisure and economic interaction) available at destinations (Martinez, 1995:457). Indeed, the spatial separation of human activities creates the need for mobility and accessibility and the transportation of goods. Because of its pervasive nature it occupies a key position in the fabric of modern-day urban conurbations. As a result, the provision and use of transport infrastructure affects and interacts with our socio-economical wellbeing, the economy, the environment, politics and the way in which spatial development occurs. Because of the pervasiveness of transport, the provision and solutions to transport problems have a major influence on people's lives (O'Flaherty, 2005:2).

Developing a clear understanding regarding the link between transport, the economy and land-use development is difficult. Asking questions about that relationship, challenges a fundamental and obvious assumption: that economic growth, the need for movement and the need to invest to facilitate that movement go hand in hand. It is therefore necessary to consider the impact of proposals to invest in infrastructure or adopting traffic reduction measures on economic growth.

On the social front a more dispersed society has been facilitated by spatial planning, housing and economic development policies that allow towns and cities to grow encouraging peripheral developments, which are often only accessible by car. More flexible working practices creates a workforce more willing to live further away from its place of employment, resulting in increased average commuting distances. Although the freedom of movement has given society the mechanism to travel greater distances there is a public awareness that communities must develop in a sustainable way.

For this reason society places a premium on the interactions between socio-economical wellbeing, economic growth, the environment and the need to develop land that enhances connectivity, facilitating movement and economic progress. In many instances the public awareness of the effects of transport schemes are reflected in the constraints which they impose (through public participation in the planning process) on the development and evaluation of infrastructure proposals; that is, generally they must be analytically based, economically sound, socially credible, environmentally sensitive, politically acceptable and public inquiry proof.

As Basiago (1999:145) and many other environmentalists will point out, there is widespread public concern about the global and local damage caused to the environment by the transport sector. Environmental degradation, noise pollution, vibration, air pollution, visual intrusion and road accidents leading to loss of life are but a few examples of the way in which transport schemes and the development of land affects the environment. Because of this cause-effect phenomenon the impact on the environment must be considered in the development of all transport improvement or schemes. Any scheme which changes traffic patterns will have an effect on the environment, even if mitigating measures are implemented to alleviate some environmental pressure. Consequently, as Hope and Lekorwe (1999:884) suggests planners have to rely on planning as the guiding mechanism to steer development away from vulnerable ecosystems. Moreover, planning is tasked with striking a balance between increasing travel demand, the need to provide infrastructure that is environmentally acceptable and to sustain accessibility, mobility and economic growth whilst providing and ensuring social integration and livable neighbourhoods.

Of equal relevance is the relationship between transport and politics. There are good reasons why any government as a political facilitator should seek to have a thorough understanding of the nature and importance of the relationship between spatial development and the provision of transport that facilitates movement and interaction. Governments are usually committed to promoting sustainable development whilst embracing environmental, economic and social objectives. As key players in planning and transport strategy formulation they need to be mindful of the interrelationship between transport, the economy, the needs of society and land-use planning considerations when deciding on efficient transport and planning strategies in meeting this commitment. In order to ensure economically efficient and effective decision-making the justification for traffic regulation strategies must in turn be as robust as possible while taking into consideration their impact on other areas.

Because urban systems are extremely complex involving social, economic and environmental dimensions, there is an inherently stable relationship among these dimensions in any urban or rural area which has a direct bearing on the way the system operates and how productive it is. No matter how efficient or inefficient, how equitable or inequitable, or how effective or ineffective the system is, this stability makes it extremely difficult to change. To do so requires planned intervention involving the reassessment of all policy variables - regulatory, pricing and investment - which are able to influence change in the spatial distribution of land-use activities, the performance of the transport system and road user behaviour as well as the interrelationship between them.

Clearly the provision of transport systems connecting a dispersed society, public functions and economic activity are interrelated with spatial development as Geerlings and Stead (2003:187) confirm. As such the aim generally is to devise new ways of planning development which would make it possible to develop sustainable transport systems to serve our future needs and facilitate a healthy economy. And so, it is increasingly urgent to create policy integration across the area of land-use planning, transport and environmental policy and to encourage acceptance that integrating decisions across these sectors is crucial to sustainable development - a notion supported by authors such as Begg and Gray (2004:156), Irving and Moncrieff (2004:47) and other proponents of sustainable development.

2.2.2 Transport trends

This section provides some broad comparisons between transport trends in major industrialised countries. Due to the many constraints in arriving at a level playing field (such as the availability of comparable data, differences in the statistical methods and definitions used and availability of recent data) in measuring and reporting available statistical data, the insights presented here are based on the data extracted from 35 countries predominantly European, but including the USA and Japan over a varying period of time. Tables 2.1 to 2.5 and Figures 2.2 to 2.4 on pages 15 - 19, seek to illustrate how the demand for transport and its growth has changed over time in various countries giving rise to the congestion problem we face today.

Table 2.1 Comparative statistics reflecting real GDP growth rate between 2004 and 2006

Country	Population (millions)	Population Density (people/km²)	Real GDP growth rate		
	2004	2004	2004	2005	2006
Belgium	10.40	343.6	3	1.1	3.2
Bulgaria	7.80	70.1	6.6	6.2	6.1
Czech Republic	10.21	132.2	4.2	6.1	6.1 (f)
Denmark	5.40	125.4	2.1	3.1	3.2
Germany	82.53	231.1	1.2	0.9	2.8
Estonia	1.35	31.1	8.1	10.5	11.4
Ireland	4.03	59.5	4.3	5.5	6.0 (f)
Greece	11.04	84.6	4.7	3.7	4.3
Spain	42.35	79.0	3.2	3.5	3.9
France	62.13	113.0	2.5	1.7	2
Italy	57.89	197.1	1.2	0.1	1.9
Cyprus	0.73	129.9	4.2	3.9	3.8
Latvia	2.32	37.1	8.7	10.6	11.9
Lithuania	3.45	54.8	7.3	7.6	7.5
Luxembourg	0.45	175.2	3.6	4	6.2
Hungary	10.12	108.6	4.8	4.1	3.9
Malta	0.40	1271.5	0.1	3.3	3.3
Netherlands	16.26	481.9	2	1.5	2.9
Austria	8.14	99.1	2.4	2	3.1
Poland	38.19	122.1	5.3	3.5	5.8
Portugal	10.47	114.1	1.3	0.5	1.3
Romania	21.71	94.3	8.5	4.1	7.7
Slovenia	2.00	99.2	4.4	4	5.2
Slovakia	5.38	109.8	5.4	6	8.3
Finland	5.22	17.2	3.7	2.9	5.5
Sweden	8.98	21.9	4.1	2.9	4.2
United Kingdom	59.70	246.9	3.3	1.9	2.8
Croatia	4.44	78.5	3.8	4.3	4.8 (f)
Macedonia	2.03	92.5	4.1	3.8 (f)	3.1 (f)
Turkey	70.69	15.1	8.9	7.4	6.1
Iceland	0.29	184.8	7.6	7.2	2.6
Norway	0.03	12	3.9	2.7	2.9
Switzerland	4.58	182	2.3	1.9	2.7
United States	281.40	31	3.9	3.2	3.3
Japan	127.33	337.1	2.7	1.9	2.2

Source: Authors' own construction from Euroekonom.com (2006)
Forecast (f)

Table 2.2 Average annual distance travelled by mode: 35 country average 1986 to 2003

Mode	Kilometres per person per year					
	1986	**1991**	**1994**	**1997**	**2000**	**2003**
Car	6476	8219	8425	8768	8964	8951
Walk	393	381	372	369	359	307
Bicycle	153	127	113	111	159	109
Bus	478	441	417	417	394	418
Rail/Metro	478	669	560	555	689	671
Other	478	584	528	573	541	573

Source: Authors' own construction from Euroekonom.com (2006)

Table 2.3 Comparative road and rail infrastructure statistics: 1995 and 2003

Countries	Total length of motorways (km)		Total length of railway lines (km)	
	1995	**2003**	**1995**	**2003**
Belgium	*1666*	1729	3368	3521
Bulgaria	314	328	4293	4318
Czech Republic	414	518	9430	9612
Denmark	796	1027	2349	2273
Germany	11190	12044	41718	36054
Estonia	64	96	1021	959
Ireland	72	176	1945	1919
Greece	-	420	2474	2414
Spain	6962	10296	16336	14387
France	8275	10379	31940	29269
Italy	6435	6487	16005	16288
Cyprus	168	268	-	-
Latvia	-	-	2413	2269
Lithuania	394	417	2002	1774
Luxembourg	115	147	275	275
Hungary	335	542	7632	7950
Malta	-	-	-	-
Netherlands	2208	2541	2813	2812
Austria	1596	1670	5672	5661
Poland	246	405	23986	19900
Portugal	687	2002	3065	2818
Romania	113	113	11376	11364
Slovenia	293	477	1201	1229
Slovakia	198	313	3665	3657
Finland	394	653	5859	5851
Sweden	1141	1591	10925	9882
United Kingdom	3307	3609	16999	17052
Croatia	302	554	2726	2726
Turkey	1246	1851	8549	8697
Iceland	-	-	-	-
Liechtenstein	-	-	9	9
Norway	107	173	4023	4077
Switzerland	*1197*	1342	5041	*5159*

Source: Authors' own construction from Euroekonom.com (2006)
Not available -

Table 2.4 Comparison of modal trends in passenger transport: Europe 1992 and 2002

Countries	Distance travelled per person by mode (km)					
	Passenger Cars		Buses		Rail	
	1992	**2002**	**1992**	**2002**	**1992**	**2002**
Belgium	83.8	83.3	10.3	10.4	6.1	6.3
Czech Republic	(-)	80	(-)	11.9	(-)	8.1
Denmark	82.3	80.3	12	12	5.6	7.7
Germany	83.5	85.5	9.4	7.5	6.7	7
Estonia	(-)	(-)	(-)	(-)	(-)	(-)
Greece	71.3	78.2	26.1	20.2	2.8	1.7
Spain	80.4	82.8	13.2	12.3	6	4.8
France	85.1	86.6	5.8	4.8	8.6	8.6
Ireland	78.1	82.3	17	14	4.8	3.6
Italy	80.6	83.2	11.6	11.4	6.1	5.4
Latvia	(-)	66.5	(-)	25.5	(-)	8
Lithuania	(-)	86.3	(-)	11	(-)	2.7
Luxembourg	78.7	80.7	16.5	13.8	4.7	5.5
Hungary	63.5	61.7	22	24.5	12.6	13.8
Netherlands	85.3	86.4	5.8	4.3	9.4	9.3
Austria	79.5	76.3	10.7	14.7	10.8	9.1
Poland	(-)	77	(-)	13.5	(-)	9.5
Portugal	72.5	87.5	20.8	9.1	8.3	3.4
Slovenia	52.2	80	38.2	13.8	4.9	6.2
Slovakia	(-)	69.6	(-)	22.9	(-)	7.5
Finland	81.7	84.1	13	11.1	5	4.8
Sweden	85.8	83	8.5	8.9	5.9	8.1
United Kingdom	88.2	88.1	6.5	6.4	4.8	5.5
Bulgaria	12.2	(-)	66.9	(-)	21.3	(-)
Turkey	27.6	(-)	67.2	(-)	4.8	(-)
Iceland	(-)	88.8	(-)	11.2	(-)	0
Norway	87.5	88.2	8.2	7.4	4.5	4.5

Source: Authors' own construction from Euroekonom.com (2006)
Not available (-)

Table 2.5 Journey distance per person per year by main mode and purpose for 35 countries: 1997

Purpose	Mode and distance (km)									
	Walk	Bicycle	Driver[1]	Passenger[1]	Motorcycle	Buses	Underground	Rail[2]	Taxi	All modes
Commuting	23	23	1429	230	23	95	37	201	6	2108
Business	3	2	882	103	0	5	6	50	5	1146
Education	27	2	42	80	2	80	3	18	5	302
Escort Education	16	0	97	32	0	3	0	0	0	150
Shopping	63	5	616	483	3	122	6	32	6	1345
Other escort	8	0	380	214	0	10	2	5	2	624
Other personal business	24	3	375	2216	3	34	6	32	6	722
Visiting friends at home	27	6	825	785	5	61	6	68	10	1823
Visiting friends elsewhere	13	2	132	156	2	16	3	13	11	359
Social/entertainment	11	5	304	298	3	27	5	23	6	721
Holidays/day trips	3	14	391	647	10	116	2	77	6	1350
Other, inc. just walking	51	0	14	5	0	0	0	5	0	79
All purposes[3]	**272**	**61**	**5488**	**3253**	**50**	**566**	**77**	**523**	**64**	**10726**

Source: Authors' own construction from Euroekonom.com (2006)
1 Note: Drivers and passengers of cars and vans
2 Note: Surface Rail
3 Note: Figures rounded to nearest whole number

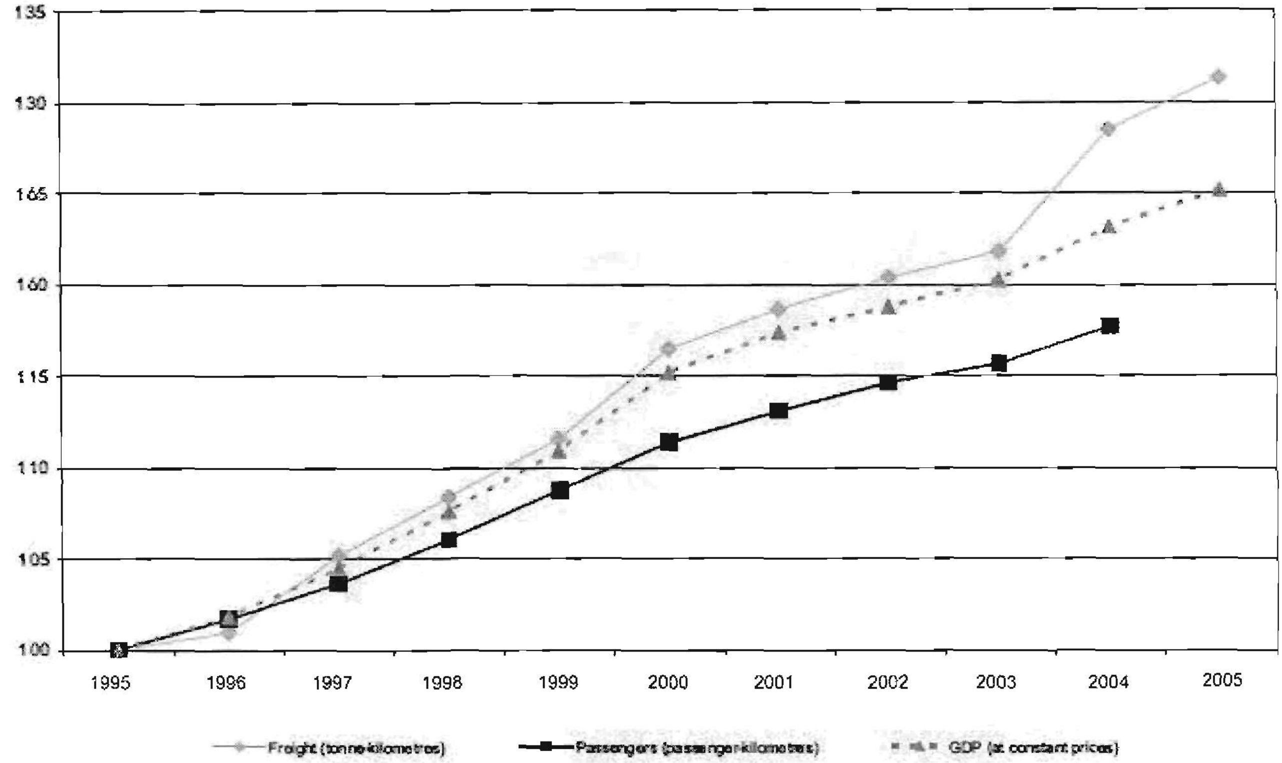


Figure 2.2 Transport trends against GDP: 1995 – 2005

Source: Euroekonom.com (2006)

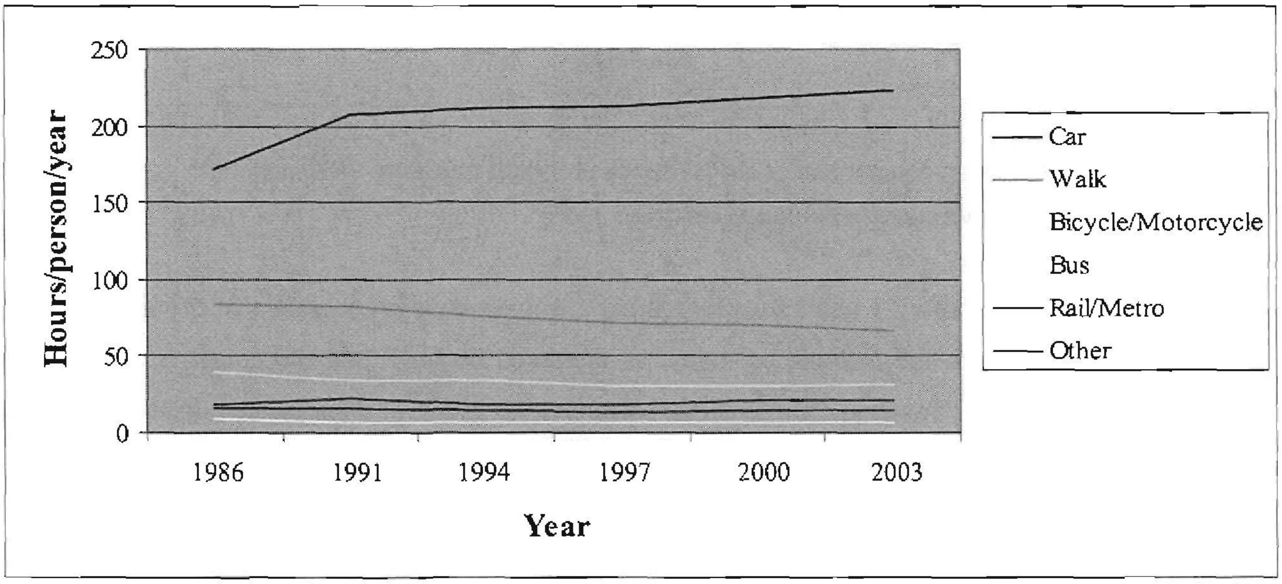


Figure 2.3 Average annual time spent travelling by mode: 35 countries 1986 to 2003

Source: Authors' own construction from Euroekonom.com (2006)

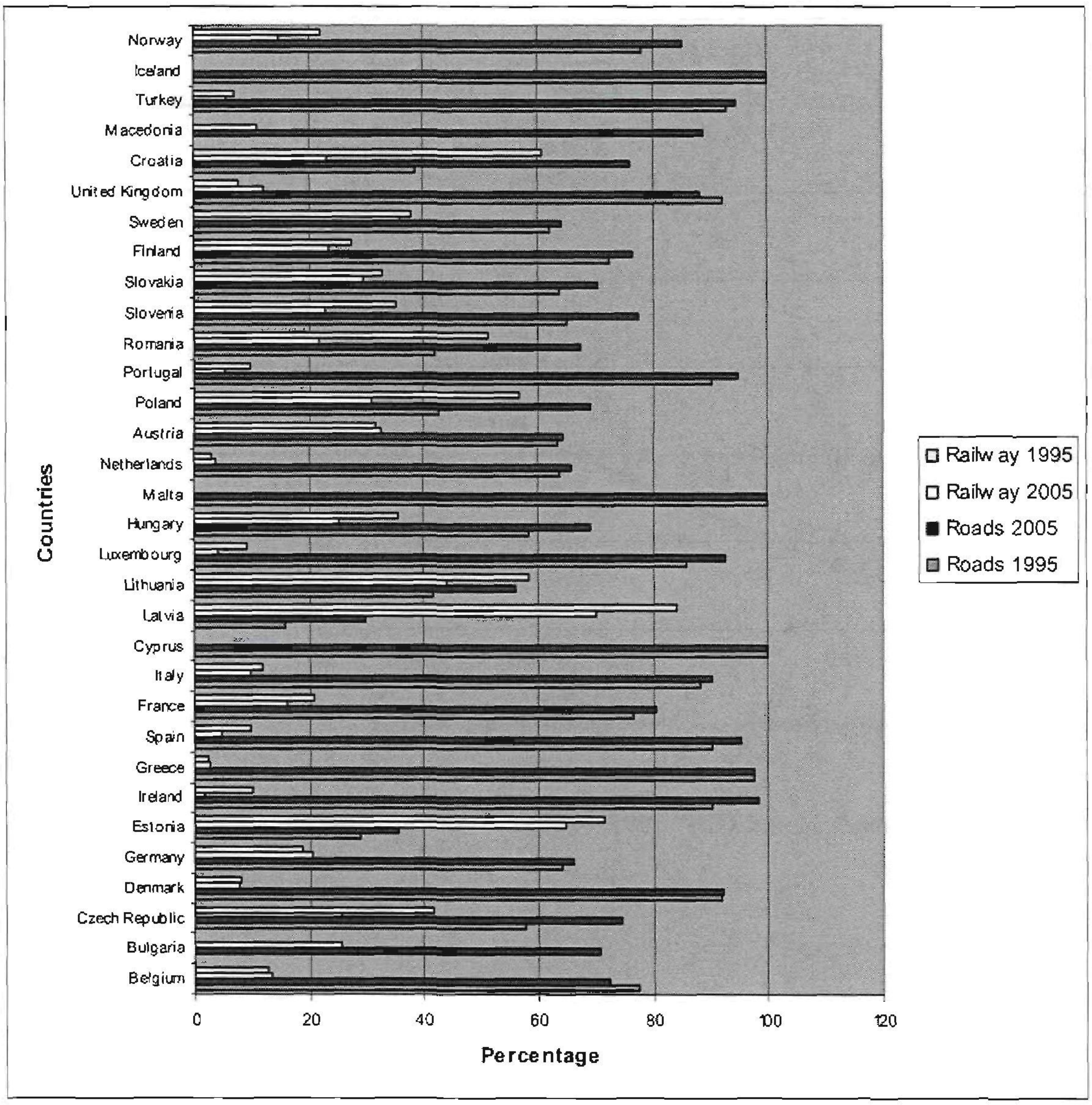


Figure 2.4 European comparison of modal trends in freight transport: 1995 and 2005

Source: Authors' own construction from Euroekonom.com (2006)

When comparing Table 2.1 and 2.3 with Figure 2.2 it is possible to conclude that the last 20 years have seen growth in both the national economy, as measured by GDP and the domestic traffic of the 35 countries concerned. Passenger traffic across all modes has grown at a faster rate than their economies as a whole, while freight traffic has grown at a slightly slower rate. Road and rail capacity expansion (infrastructure capacity) has been outstripped by the growth in road and rail traffic growth - giving rise to congested conditions in both.

Table 2.2 shows that the average annual distance travelled per person (km/person/year) has increased by 6% since 1991 to 11030 kilometres in 2003, owing to an increase in the average distance travelled by car of 9% to 8951 kilometres. Over the same period the average annual distance walked fell by 19%, from 381 to 307 kilometres per year, and the distance travelled by bicycle or motorcycle fell by 14% - from 127 to 109 kilometres per year. The distance travelled by local bus also declined over the whole period, from 441 to 418 kilometres a year (down by 5%). The distance travelled by rail fell in the first part of the period but recovered to 1991 levels in 2003.

The average time spent travelling has remained fairly stable at around 360 hours per person per year as illustrated by Figure 2.3. The average amount of time spent travelling by car has increased by 8% between 1986 and 2003 to 223 hours. The largest decline was in the amount of time spent walking, which decreased by 20% between 1986 and 2003 to 66 hours. Travel by car now accounts for 62% of the time spent travelling, which represents a 10% increase in its share since 1991. Over the same period, the proportion of time spent walking has fallen from 22% to 18%. So of the 60 minutes spent travelling on average each day in 2003, 37 minutes were by car and 11 minutes were by foot. A comparison of the data from Table 2.2 with that of Figure 2.3, reveals that as the average distance travelled by car increased, so did the time spent travelling. While the average time people spend travelling has hardly changed, at around one hour per day, increased car use has allowed them to travel further in the same time. Similarly as the average distance walked decreased so did the time spent walking.

Cars have accounted for an increasing share of passenger kilometres for the period 1992 to 2002 as shown by Table 2.4. While there has been strong growth in passenger kilometres travelled by car in recent years in many developed economies, some countries have also experienced some growth in passenger kilometres travelled on some forms of public transport (e.g. Sweden, Belgium and Austria). However, the general picture emerging is of a decline in public transport passenger kilometres travelled, particularly in Portugal and Poland.

In the case of freight, Figure 2.4 shows that road transport has become the predominant mode of moving goods, apart from in Latvia and Estonia, during the period 1995 - 2005. As with passenger transport, many countries have recently experienced strong growth in road freight traffic, although some countries (e.g. Germany, Netherlands, Austria and the UK) have seen some increases in freight traffic moved by rail. Generally, between 1995 and 2005, there has been a decline in freight movement by rail. Looking at personal travel across all modes the three most significant reasons for travelling are shopping, commuting and visiting friends at home, accounting for 21%, 15% and 13% respectively of journeys per person per year (Table 2.5). The preferred mode of transport from origin to destination is by far driving or being a passenger and/or taking the bus.

These trends and statistics enforce the notion of transport playing a significant role in the social and economic development of not only metropolitan areas but a country as a whole and transport is recognised as a stimulus to socio-economic development across all of the countries cited. It suggests that transport facilitates economic growth and increases mobility, but at the expense of increasing traffic congestion and environmental degradation and this is set to continue if left without intervention. In addition to these analytical observations the effectiveness of the role played by transport is to a large extent dictated by the soundness of transport policy, the efficiency of infrastructure usage and the strategies employed in implementing the policy. Even with the best intentions, current transport policies have no solution to increasing traffic congestion levels.

2.3 The meaning and purpose of integrated strategies

Given the expected increase in car ownership and an increase in the percentage heavy goods vehicles forecast for the next 10-15 years, the situation is likely to become more serious, providing the thrust for the identification of optimal and efficient mechanisms to deal with traffic congestion. To this end a coherent integrated approach or integrated strategy to managing traffic congestion is desperately sought as May and Gardner (1990:274) argue. This begs the question of what exactly is understood when the term "integrated strategies" or "approaches" are used in the context of this research.

To explain what is meant by an integrated strategy it is necessary to refer to the terms 'integrated', 'balanced' and 'package' as the debate over urban transport policy has generated these terms, which in strategic terms are largely synonymous (Department for Transport 2004b). Each implies the combination or integration of policy measures into a package, which is balanced in its treatment of modes and areas or groups of users. Although there is no widely accepted definition of integration in the context of the research, the term integration used here describes the interaction and synergy between TDM, TSM and LUM as vital components of a management and decision framework aimed at reducing traffic congestion whilst encouraging sustainability. Fundamentally, integration should yield collective benefits, opposed to the less effective and inefficient piecemeal implementation of individual measures as has been the case in the past (Barredo and Demicheli, 2003:297; Banister, 1999:313). To be effective, TDM cannot be just an add-on to conventional supply-side highway capacity strategies, but must be incorporated into a framework for integrated transport and spatial development planning where TDM, TSM and LUM work together to achieve efficient goal-directed management of transportation systems.

The purpose of integration and integrated strategies must be to achieve a higher performance against the local policy objectives of the strategy than could otherwise be achieved by the individual measures on their own. Whatever the local policy objectives, the synergy achieved between the integrated or packaged measures is the key to success and the identification of measures which might achieve synergy the principal skill in policy development. Whilst individual TDM, TSM and LUM measures all have the ability to reduce traffic congestion one way or another, little has been done in the way of producing a mechanism or decision framework that allows decision-makers to select and integrate those measures best suited to their specific local traffic and transport conditions whilst encouraging sustainable development (Geerlings, 2003:187). The challenge here is to develop the necessary skill and a decision framework to achieve such a level of synergy through an integrated strategy.

With such a (dynamic adaptive) decision framework in place decision-makers will be able to include in their Integrated Development Plans, Local Transport Plans, Regional Transport Plans etc. a balanced package of integrated strategies tailored to dealing with a variety of transport issues for a specific location, tackling congestion based on sound transport and land-use planning principles and guidelines. In analyzing the comments made by May and Roberts (1995:97), having such a tool allows an Authority (i) to bid confidently for both road and public transport investment proposals (ii) the opportunity to outline the alternative methods it has considered for alleviating traffic problems (iii) to demonstrate that it has developed an overall plan for dealing with the transport requirements of a particular urban area in the context of broader strategic land-use and economic and environmental policy objectives.

2.4 Towards an integrated approach

The complexities faced by transport professionals, planners, environmentalists and economists in delivering an integrated strategy alleviating congestion is an enormous challenge. They must live up to a vision of a transport and land-use system that supports sustainable development, economic prosperity, environmental benefits and social inclusion. However, research suggests that the concept of developing integrated strategies is not a new one. There have been attempts to this end with varying degrees of success and for various purposes. And so the sub-sections which follow evaluate the progress that has been made to this end, identifying existing shortcomings in the development of integrated strategies specifically aimed at congestion reduction and providing some examples of current integration practice.

2.4.1 Recent developments in policy integration

The development of integrated transport strategies has been based on the identification of the synergy between transport policy instruments. Similarly, the development of integrated TDM, TSM and LUM strategies are based on the synergy between transport planning, land-use planning and demand management principles. The interaction between spatial planning and transport demand and supply management policies on the one hand and the conception, operation and management of transport systems on the other is well known and accepted in both scientific and professional circles (May, 1991; May and Roberts, 1995:274). The danger lies in the strictly sectoral approach to implementing TDM, TSM and LUM policies (Geerlings, 2003:187) as has been the case in the past. While it is possible to formulate feasible integrated strategies, very few studies have been able to demonstrate that transport or planning policy measures alone will achieve a sustainable situation or indeed reduce traffic congestion.

In recognizing the problem there has been growing interest in the UK in recent years in the development of integrated transport strategies (May, 1991). The UK Transport White Paper “A New Deal for Transport” and subsequent “daughter documents” have signalled the need for an overhaul of transport policy in the UK (May et al., 1995:68; May and Gardner, 1990:257). The European Commission (1998), Ministry of Transport, Public Works and Water Management (1998) and the US Department of Transportation (2000) report parallel developments in Europe, the United States and elsewhere having signalled the urgency and need for more sustainable and integrated transport systems against the background of 5 common themes emerging in the international debate over the way forward in reducing congestion.

These are:

- Better planning of transport infrastructure
- Making more efficient use of existing infrastructure
- Reducing dependence on the car, especially in towns; empowering local decision-making
- Switching emphasis in spending from roads to public transport
- Reducing the impacts of road freight

Over the last decade the concept of integrated strategies for urban areas and the means of evaluating them have been developed and accepted into practice by major UK studies of cities such as London (May and Gardner, 1990:274-275), Birmingham (Wenban-Smith et al, 1990a) and Edinburgh (May et al., 1992). These studies have demonstrated that when an integrated approach in which infrastructure provision, management of existing infrastructure and the pricing of the use of that infrastructure are co-ordinated, the scale of urban transport problems can be significantly reduced.

These developments led indirectly, particularly through experience in Birmingham, to the introduction by the Package Approach for urban transport funding (May, 1994) and more directly to the development of the Common Appraisal Framework for assessing Package Approach bids, providing a consistent means of evaluating the wide ranging types of measure which might be included in such a package. The Package Approach is aimed at integrating general transport and planning measures into coherent feasible packages to achieve transport policy objectives leading to sustainable development. The resulting packages have not been specifically aimed at the reduction of traffic congestion *per se,* but rather at a multitude of objectives. The Package Approach enables local authorities to seek financial support for a set of transport schemes and measures designed to work together to achieve certain objectives. They are then given flexibility to use the finance allocated in the most appropriate way to meet the objectives of the Package.

It is now generally accepted that transport strategies designed to meet the objectives of economic efficiency and sustainability will require a combination of measures to manage the existing infrastructure more effectively, to provide selective enhancements to that infrastructure and to impose appropriate pricing mechanisms on both public and private transport. It follows that the number of potentially worthwhile combinations of the options available is extremely large. Currently no obvious basis for qualitatively optimizing the choices into a package exists and the selection task is made more complex because the resulting strategies have to be justified against a number of potentially conflicting objectives (May et al., 1995:68). It follows that a Pareto optimal solution to such a multi-objective optimization problem means that an improvement in one objective can only be achieved at the expense of at least one of the other objectives – a notion supported by Gabriel et al. (2006:212).

Whilst the UK experiments and developments in Europe and the USA are considered to be making favourable progress toward the common goal of integrating transport, land-use and spatial planning in developing sustainable transport systems and other industrial reforms aimed at emission reduction, the Sustainable Communities Network (2004), Geerlings (2003:187) and Litman (2000:2) highlight two components still lacking in the approach described above if a holistic approach is to be developed to deal effectively with traffic congestion and provide an instrument for policy makers when deciding between alternative measures. The first being advice on how to design such integrated transport strategies or packages so that the most appropriate measures are included and specified in an optimal way to deal with traffic problems on a site-by-site basis. The second component that needs to be built into the approach is specifying and incorporating appropriate elements of LUM.

In balancing these arguments Still (1996) warns that the impact of transport on land-use is perceived as a serious gap in policy understanding and as a result of this there is a danger that impacts of strategy integration might have counter-productive effects. For example, road pricing, which may be a key element in a sustainable transport strategy, may reduce accessibility by private car, and hence lead to out-migration of business, thus producing a less sustainable land-use pattern. Conversely it could enhance the city centre environment, and hence encourage certain firms to relocate to the centre. These twin impacts of transport policy on accessibility and on environmental quality are key elements in predicting the resulting location decisions of individuals and firms, and need to be better understood if sustainable integrated strategies are to be developed.

There is indeed a growing consensus for radical change emphasising the need for joined-up action across different areas of TDM, TSM and LUM policy application (Department for Transport, 2004a). Transport policy must engage increasingly with other sectors to deliver a truly integrated approach and move towards a New Realism (Goodwin et al., 1991) in transport. The integrated strategies of the future must be cast in a major role that cuts across many policy areas (Hine, 2000:175). Only the development of highly integrated strategies with a clear decision framework has the potential to address the core of the problem (Potter and Skinner, 2000:275).

Whilst many researchers accept this prognosis, little progress has been made in providing a decision framework enabling decision-makers to select optimal measures from a menu, which is best suited to site specific conditions and encourages sustainable development (Bell, 1995:78). This statement is also supported by Litman (2000:2) citing recent research in the UK, USA and Canada, which underlines the need for developing a holistic decision framework enabling optimal integration in the context of the New Realism and "Smart Growth" ideologies in transport.

2.4.2 Integration in practice

This section shows how various policy measures and initiatives have been considered and implemented in the past in addressing traffic congestion which reflect significant international differences in the ways countries perceive and respond to congestion problems. It will demonstrate the types of integration implemented and how they have been implemented with varying degrees of success. Fundamentally, it highlights the sectoral approach to implementing TDM, TSM and LUM measures, referencing typical examples forming the argument for the desperate need to integrate TDM, TSM and LUM measures into a package approach (Bell, 1997; Hine, 1998; Alfa, 1986; Badoe and Miller, 2000; Abu-Lebdeh and Benekohal, 2003:110-111; Button, 1994:289).

2.4.2.1 Non-integration

The World Bank has reported cities in the least developed countries and in developing countries (without singling any out) have an inability, for whatever reason, to plan transport systems, to manage travel demand, to relate land-use and transport and to provide adequate resources for transport. This results in common transport problems such as (i) increasing traffic congestion (ii) declining attractiveness of road based public transport (iii) increasingly high costs of travel (iv) high levels of (road) accidents and (v) increasing road traffic related emissions and atmospheric pollution (Cracknell, 2000:1).

Barredo and Demicheli (2003:298-299) add that the transport management practices in the cities of less developed countries and developing countries, which are becoming the engines of economic development, are woefully inadequate, with functional or modal integration and transport and planning integration not occurring on a wide enough scale. Many believe that improvements in the operation and performance of the transport system per se will provide the necessary thrust to combat traffic problems and they attach no benefit to the implementation or consideration of full integration with TSM, TDM and LUM measures or they find it difficult to fund such undertakings.

2.4.2.2 Partial integration

The developed world has had more success in integrating TDM, TSM and LUM measures as the examples below suggest. Stewart and Pringle (1997:1211) and Lim (1997:1193) reports that Toronto and Vancouver in Canada have been able to achieve an enviable level of public transport use as a result of historical success in maintaining an effective public transport system and in integrating public transport policies with LUM. Verhetsel (2001:111-112) reports that a number of planning and infrastructure measures have been implemented in Antwerp (Belgium) aimed at alleviating traffic congestion. The measures implemented are predominantly TSM and LUM measures within the functional or modal integration and transport and planning integration context.

Recent work for the European Commission, studying optimal transport strategies in nine cities, has demonstrated the importance of an integrated package of measures, including fiscal controls on car use, changes in public transport frequency and fares, vertical integration, horizontal integration and low cost improvements in infrastructure (May et al., 2000). It has also demonstrated that, in six of these nine cities, the revenue stream from the fiscal controls on car use would be more than sufficient to finance the remaining elements of the strategy. Again, the vital ingredient to complete full strategy integration namely, LUM is absent.

Halden (2002:313) reports the successful application of access management aimed at integrating land-use and transport policies in Edinburgh and the Lothians in Scotland as an example of partial integration. There are also indications of LUM successes in Korea in imposing development restrictions that have resulted in clustered demand around Seoul, special land assembly in Shanghai and Bombay and new cluster development in Bangkok aimed at reducing congestion (Gakenheimer, 1999:684).

2.4.2.3 Full integration

Sim et al. (2001:339) reports the successful integration of TDM, LUM and TSM in Singapore and how it has alleviated severe traffic congestion thanks to its comprehensive and highly integrated policy measures. The only other two cities experiencing similar success are Curitiba (Brazil) and the Lao People's Democratic Republic (Rabinovitch, 1996:51; Sawathvong, 2004:553). Their success lies in comprehensive and highly co-ordinated land transport policies combining the integration of land-use and transport planning with demand management measures. Essentially, they have managed to implement the four types of integration described above within the four dimensions identified in a holistic way. This has the effect of maximising the benefits from the transport system, providing the best opportunity for more sustainable transport and a better environment, creating a fairer and more inclusive society.

2.5 Ideologies supporting integration

Apart from assessing the recent developments in integration, it is also important to consider the ideologies supporting it. With the need to shift from policies that "predict and provide", to demand-management orientated policies such as "predict and prevent" as urged by Owens (1995:43), Goodwin et al. (1991) the term New Realism has been coined capturing an emerging consensus over how to approach transport problems. The principal elements of New Realism is that of less reliance on road construction, the adoption of a package of solutions to given problems, and in general terms *managing* travel demand rather than providing for it.

Although no formal definition of New Realism exists, Walton and Shaw (2003:2) suggests the concept can be described against its primary objectives namely: (i) removing traffic congestion and improving mobility and accessibility through demand management (ii) implementing measures designed to change or modify the capacity of road networks (iii) altering the spatial distribution of land-use attracting an excessive volume of traffic (iv) combating urban sprawl. Fundamentally, New Realism suggests that the best approach to solving traffic congestion problems is through a coherent package approach providing the scope and mechanism to couple TDM, TSM and LUM.

This prescription was based on the consideration that it is no longer possible to solve local problems by adding to network capacity following a *supply-side* paradigm, causing congestion to migrate to other sites increasing traffic pressures there. The message is clear – building a way out of the problem will most certainly not address the causes of congestion. Investment in the construction and maintenance of new roads may well increase capacity, but the induced traffic arising from the latent demand may simply neutralise its impact. Critics suggest the underlying solutions that New Realism brings to the fore are not new – however they do provide a set of mechanisms for tackling transport problems in a more integrated way which could be translated as a new paradigm for transport planning - an argument supported by Masser et al. (1992a:4) and Marvin and Guy (2001).

Another ideology that supports the notions of integrated strategies is that of "Smart Growth". Table 2.6 below illustrates some "Smart Growth" strategies.

Table 2.6 "Smart Growth" strategies

Strategy	Description
Parking management	Encourage shared parking and other parking management strategies.
Create a network of interconnected streets	Keep streets as narrow as possible, particularly in residential areas and commercial centres. Use traffic calming to reduce excess traffic speeds.
Site design and building orientation	Encourage buildings to be orientated toward city streets, rather than set back behind large parking areas.
Improve non-motorised travel conditions	Encourage walking and cycling by improving pavements and footpaths.
Strategic planning	Establish a comprehensive community vision that individual land-use and transportation decisions should support.
Create more self-contained communities	Locate a variety of land-uses within proximity of each other.
Encourage quality, higher density development	Eliminate unnecessary restrictions on density. Demand high quality designs that address problems associated with higher density.
Encourage cluster development	Keep clusters small and well-defined, such as "urban villages" with distinct names and characters. Co-ordinate development to facilitate accessibility.
Encourage infill development	Encourage redevelopment of existing facilities and neighbourhoods.
Concentrate activities	Concentrate commercial activities in "nodes" of high-density, mixed development linked by freight service.
Flexible zoning	Reduce excessive and inflexible parking and road capacity requirements.
Encourage public transport orientated development	Increase development density around public transport hubs and high-capacity public transport corridors. Provide good walking and cycling facilities in those areas.
TDM	Use transportation demand management to reduce total vehicle traffic and encourage the use of efficient modes.
Preserve green space	Preserve open space, particularly areas with high ecological and recreational value. Channel development into built-up areas.
Encourage a mix of housing types and prices	Develop affordable housing near employment, commercial and transport centres.
Stormwater management	Encourage on-site stormwater drainage and water conservation.

Source: Litman (2000), Victoria Transport Policy Institute (2005)

Proponents of "Smart Growth" discourage urban sprawl, advocating the use of smart techniques in integrating LUM and TDM thereby creating a more sustainable urban environment. Although no single definition of "Smart Growth" exists, several common themes are noted. Proponents believe "Smart Growth" should reduce urban sprawl through better land-use and transportation planning. Miller and Hoel (2002:1) suggest it focuses on development that serves the economy, enhances communities, and protects the environment as an antidote to suburban sprawl in an effort to reshape urban and suburban growth. Along the same strand of thought, "Smart Growth" is described by Litman (2000:5) as a set of complementary TDM and LUM strategies that vary depending on the needs of a specific situation.

In comparing "Smart Growth", New Realism and Integrated Strategies Table 2.7 below demonstrates how the underlying goals of a D.A.D.F. will be supported by the collective structure and underlying principles of New Realism and "Smart Growth" and how it supports the integration of TDM, TSM and LUM strategies in reducing traffic congestion.

Table 2.7 Comparing the goals, objectives and principles of "Smart Growth", New Realism and Integration

Intervention	"Smart Growth"	New Realism	Integration
Goal			
Sustainable development	*	*	*
Economic prosperity	*	*	*
Community enhancement	*		*
Co-ordinated planning	*	*	*
Broad Objectives			
Efficiency in the use of resources			*
Safety in design of infrastructure	*	*	*
Improved accessibility and mobility		*	*
Environmental protection	*	*	*
Integrating transport and planning measures	*	*	*
Financial feasibility		*	*
Foster economic growth	*	*	*
Congestion reduction	*	*	*
Combating sprawl	*		*
Raising revenue			*
Fundamental Principles			
Create range of housing opportunities and choices	*		
Encourage community and stakeholder collaboration	*		*
Foster distinctive, attractive communities with a strong sense of place	*		
Make development decisions predictable, fair and cost effective	*		*
Mix land-uses	*		*
Preserve open space, natural beauty and critical environmental areas	*		*
Social progress which recognises the needs of everyone	*		*
Effective protection of the environment, limiting global effects	*	*	*
Prudent use of natural resources	*		
Maintenance of high and stable levels of economic growth and employment		*	*
Predict and manage		*	*
Provide a variety of transportation choices	*	*	*
Strengthen and direct development towards existing communities	*		
Compact building design	*		
Create walkable neighbourhoods	*	*	*

Source: Authors' own construction

The Table shows that New Realism and "Smart Growth" support the common goal of a decision framework enabling strategy integration because it shares to a large extent the same general policy goals and because it is compatible with the broad objectives and principles of integration. It is therefore possible to infer that New Realism and "Smart Growth" support the common goal of a decision framework enabling strategy integration and that its elements are also compatible with the policy objectives of such an approach.

2.6 Conclusion

The arguments that have been discussed show a trend towards traffic growth exceeding existing road capacity at peak periods especially in urban conurbations thereby intensifying traffic congestion. Congestion and its associated impact of journey time unreliability impose major and growing costs on urban communities. While it is unrealistic to expect the cost to be avoided entirely by policy integration, the benefits from reduced congestion are potentially very large.

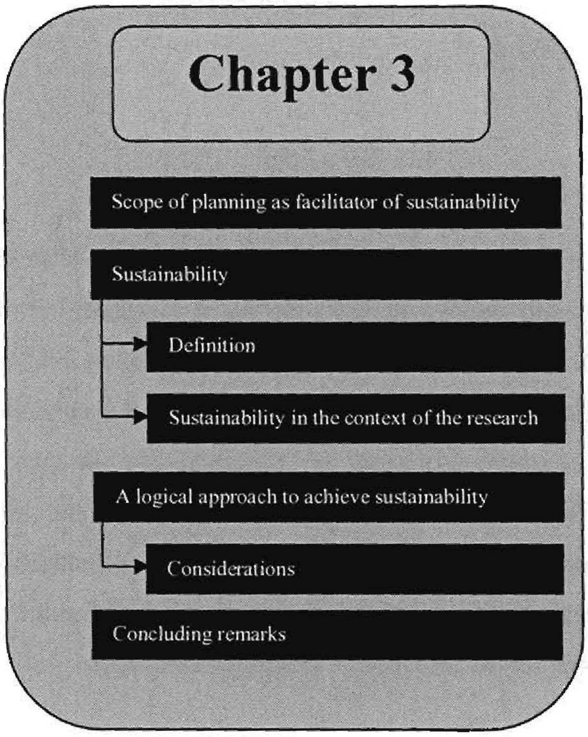
In reviewing the progress made in delivering integrated approaches to deal effectively with congestion and by evaluating recent ideological developments, it emerged that integrated strategies, or packages, combining appropriate TDM, TSM and LUM measures, can significantly reduce the scale of urban transport problems. Although the UK Package Approach and a Common Appraisal Framework have been developed providing a consistent means of evaluating the wide ranging types of measure which might be included in such a package, they do so on the basis of predicting the effects of measures but do not take into consideration the behavioural impacts or factors outside the transport system in determining which measures are best suited to local circumstances and conditions.

It was also found that transport policy must engage increasingly with other sectors to deliver a truly integrated approach and move towards a New Realism in transport employing "Smart Growth" principles in the formulation of such strategies. **It was therefore deemed appropriate to determine which elements of "Smart Growth" will have a positive impact in delivering the New Realism.** Only the development of highly integrated strategies through a clear decision framework has the potential to address the core of the problem. While tools are now available for the systematic quantitative appraisal of such measures, there are few sources of guidance on the major challenge of designing a package, co-ordinating, identifying and specifying the measures tailored to local conditions to be included in such an approach at a more qualitative level – identifying a need for a dynamic adaptive decision framework.

CHAPTER 3

PLANNING FOR SUSTAINABILITY

3.1 Introduction



When designing optimal integrated strategies, sustainability is a key issue in the approach to and considerations of planning (Minken et al., 2002). Whilst current approaches to planning provide significant input to managing planning processes toward sustainability, they do not always consider the interface between transport and development planning and environmental management and fail to make decision-makers aware of the synergistic and potentially contradictory effects of their decisions. Against this background, the purpose of this chapter is to examine the considerations to be taken into account when planning for sustainability within the context of the research.

Figure 3.1 Components of Chapter 3

It argues that the considerations identified are fundamentally responsible for shaping and guiding the development of sustainable integrated strategies aimed at traffic congestion reduction. The structure of Chapter 3 is presented by Figure 3.1.

3.2 The scope of planning

In describing the scope of planning as a vehicle to achieve sustainable development, it is important to specify what functions and purposes, planning is expected to perform (Davidson, 1996:457). If this is not clear, any discussion about planning is likely to be meaningless. In considering the function of planning it should be asked how?, where?, when? and by whom? urban planning should take place. In drawing on the purpose of planning O'Flaherty (2005:26) defines planning in the broad sense as a formalised procedure regulating the development and use of land in the public interest producing an articulated result in the form of an integrated system of decisions aimed at sustainable urban development. By (i) determining future land-uses (ii) improving the properties of areas (iii) organising the management of new situations, land-use planning contributes to sustainable development through physical planning, land (re) development and land-use management (Van Lier, 2002:194). In this sense it distributes the often scarce space between several potential users with a main objective of optimising land-use.

Planning for sustainable transport and urban development focuses on improvements in all of these facets of the functioning of cities and as a result of the multi-disciplinary and interrelated nature of these facets it has the ability to increase sustainable land-use and transport policy development through an integrated approach – an argument supported by Nijkamp et al. (1997:693).

3.3 Sustainability

With sustainability as a generally accepted vision for any type of land development (Alshuwaikhat, 2005:310) and the integration of transport and land-use planning a widely recognized essential, but often neglected, precondition (Wegener and Furst, 1999; Priemus et al., 2001:167; Meyer and Miller, 2001), the concern is about how to achieve such a result and what is meant by the concept. Without it sustainability will only be a catchword. There are, so to speak, as many definitions of "sustainability" as there are authors publishing on the topic (Franks, 1996:53; Baeten, 2000:70; Basiago, 1995:109; Naess, 1995). Moreover, in spite of the vast sustainability literature, the main academic disciplines which contribute to the theorization of "sustainable transport" actually fall back upon pre-existing conceptual frameworks which, in general, do not require transport analyses to be revisited - perhaps pointing to the poor theoretical elaboration of the concept.

3.3.1 Defining sustainability

There are no algorithmic answers to the question of "what is sustainable?" What sustainability means may be dependent on one's political and ethical commitments, not some scientific standard (Beatley, 1995:339; Bowersox & Gillroy, 2002; Owens & Cowell, 2002; Poon, 1999:83). Sustainability is an ambiguous inheritance because as a desirable objective it has also served to obscure the growth and contradictions that transport and urban development imply (Redclift, 1987).

None the less the term "sustainable development" was coined in 1980 by the International Union for the Conservation of Nature in its report "World Conservation Strategy". The standard definition of sustainability is of course due to the Brundtland Commission (Bond and Brooks, 1997:306), under the tutelage of the United Nations, who defined sustainable development as:

> *"development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs."*

A necessary condition for securing the ability of future generations to meet their own needs is that each generation provides the next generation with the opportunity to do so, even if they too make provisions for the generation after them. Taking into account the fact that the consumption of each generation depends on the stock of man-made and natural capital, and that the returns on this capital are uncertain, Asheim and Brekke (1997) arrive at the following shrewd definition:

> "*A generation's management of its stocks of man-made and natural capital is sustainable if its level of consumption can be shared by the next generation (in the sense of certainty equivalents) even if the latter abides by the requirement of sustainability.*"

Subsequent to their definition the debate then turned to the issue of whether sustainability requires the natural capital to be maintained (strong sustainability), or if some substitution of man-made capital for natural capital may take place (weak sustainability). Adopting the strong sustainability view, Daly (1991) states that:

> "*Development is sustainable if the rates of use of renewable resources do not exceed their rate of regeneration, the rates of use of non-renewable resources do not exceed the rate at which sustainable renewable substitutes are developed, and pollution rates do not exceed environment's assimilative capacity.*"

It is evident that Asheim and Brekke's as well as Daly's criterion may be fulfilled by many different development paths, some of which may be judged more efficient than others. To be able to rank all development paths, an intergenerational welfare function incorporating the concerns for sustainability must be applied. This is what Chichilnisky (1996:231) and Heal (2000) did. They require that a sustainability welfare function places a positive value in the very long run by treating the present and the long-term future "symmetrically", and that it recognises explicitly the intrinsic value of environmental assets.

A definition of urban sustainability which broadly accords with these requirements is due to Breheny (1990). He defines urban sustainability as:

> "*the achievement of urban development aspirations, subject to the condition that the natural and man-made stock of resources are not so depleted that the long term future is jeopardised.*"

Chichilnisky (1996:231), Heal (2000) and Minken et al. (2002) define sustainability in terms of its two fundamental characteristics. According to them, one of the two defining characteristics of sustainability as an objective is that it includes both the welfare of the present society and the society of the very distant future. The second defining characteristic of sustainability is that it implies conservation of natural resources. Put in other words: natural resources should be valued not only as something that may be consumed (in production or consumption), but also as stocks that benefit us even when not being consumed. The fundamental reason for this is that we are dependent on some basic qualities of our surrounding ecosystems for our quality of life and indeed our ability to continue to exist.

If the welfare of the present society and the society of the future is an objective of sustainability, Benson (2003:263) argues that there is probably universal agreement that stakeholder participation (along with integration) is a necessary feature of all sustainable endeavours. The justification may be based on arguments for human rights (Pezzoli, 1997:549) or perhaps more pragmatic concerns about co-operation and lifestyle changes.

When it comes to the implementation of sustainable policies, Brugmann (1996:364) reports on the role of local government as facilitator of sustainable planning. He argues that it is possible to encourage sustainable development at local government level through the diversification of decision-making towards a situation where decisions are made democratically on the back of thorough and open preparation. In his view decision-making should aim to provide sustainability and be supported by social and cultural justice and equality. Decisions made should, therefore, be based on examination over a sufficiently long time span which also takes into account future generations.

Against the background of these intertwining arguments it is possible to suggest that to achieve sustainability, not only the transport, social, economic and environmental concerns of cities should be addressed, but also the vitality of citizens as Basiago (1999:145) suggests in producing liveable and self-sustaining cities.

3.3.2 The meaning of sustainability in the context of the research

Sustainability is an overarching concept with many layers (Ravetz, 2000:35), which makes benchmarking of sustainable transport and urban development difficult so that it can not be handled in an entirely detached way. Within this context the interfaces between Integrated Environmental Management (IEM), Integrated Development Planning (IDP), TDM, TSM and LUM is particularly important from a sustainability perspective. Moreover, if integrated strategies are to be effective and of economic, social and environmental benefit they have to be sustainable. If transport and land-use strategies developed now have negligible long-run effects, sustainability would not be an issue. The concerns about sustainability arise precisely because our actions now may constrain the opportunities (or the problematic concept of needs as defined by the Brundtland definition) of future generations and diminish their maximum attainable welfare. So when the decision-maker is tasked to develop integrated strategies that ameliorates traffic congestion a clear understanding is required of the meaning of sustainability (the higher order goal being pursued) within the context of the research. For this purpose the author defines sustainability as follows:

Sustainability is an end product achieved by the interaction between transport and spatial development measures and environmental management that:

- *provides access to goods and services in an efficient way for all inhabitants of the urban are*
- *protects the environment, cultural heritage and ecosystems for the present generation*
- *does not endanger the opportunities for future generations to reach at least the same welfare level as those living now, including the welfare they derive from their natural environment and cultural heritage*
- *enables participative planning that builds up understanding and co-operation between multiple stakeholders*
- *provides a mechanism allowing strategic decision-making, and looks beyond individual short-term interests to the common good of a future generation*
- *integrates LUM, TDM and TSM to ensure efficient use of scarce resources*
- *provides legal backing and the institutional basis for effective implementation and enforcement*

This definition in essence sets out what decision-maker needs to achieve to secure the development of integrated strategies. The decision-maker is therefore expected to strike a balance between the unique demands of maintaining economic, social/community, transport and ecological systems in local development decisions to ensure that the system does not destroy the preconditions of its own existence. As Brugmann (1996:364) and Banister (1997:437) cite, the long-term sustainability of development choices must be balanced with today's imperative to serve the local population equitably.

3.4 A logical approach to achieve sustainability

As the author's definition of sustainability suggests - sustainability should be the end product of interacting components within the planning process and in developing integrated strategies, therefore it is essential to be clear about what the strategy is designed to achieve. Within the vision of suggesting solutions to address traffic congestion and achieve sustainability, there are, not surprisingly, a wide range of suggested solutions to the problem. There is however also a danger that politicians and in some cases, professionals immediately assume that a particular solution is needed without truly understanding the magnitude of the problem. It is essential that decision-makers are clear about the reasons for such solutions: that is, that the objectives which are to be achieved can be specified and measured against an overall predetermined vision. That is precisely why Himanen et al. (2005:25) argue that decision-makers have to take account of specific considerations and must have a clear vision of what their proposed integrated strategies are to achieve.

Once a clear vision of the problem has been formed and the general idea of solving it has been conceptualized, the decision-maker is interested in a further fundamental question - that is "when are the integrated strategies sustainable?" The answer and connection may lie in the assessment made by Banister (1999:331) suggesting that the measurement of sustainability be used as a mechanism connecting the sustainability objective with the derivation of sound planning considerations. Conversely, within the context of the study a mechanism or process is required to measure or evaluate the level of sustainability achieved by the integrated strategy in reducing traffic congestion. From this point of view the following sub-sections provide an outline of:

- the considerations to be included in a logical approach to ensure integrated strategies contribute to sustainable development.
- how to measure or evaluate the level of sustainability achieved by integrated strategies developed to reduce traffic congestion.

3.4.1 Problem identification

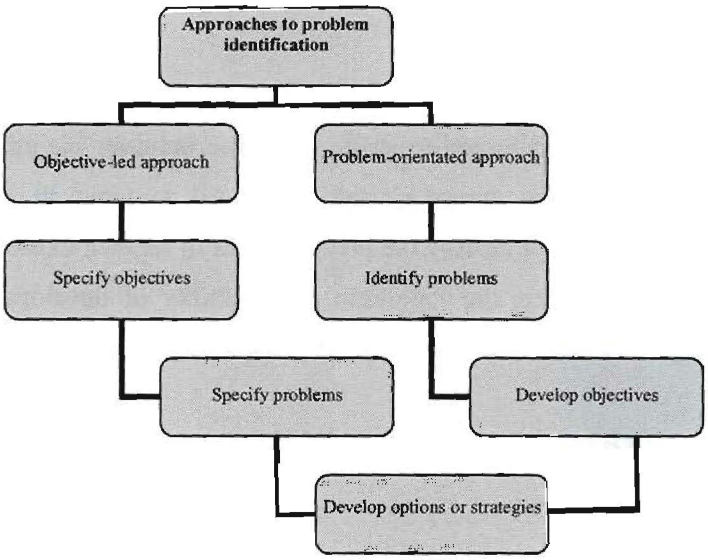


Figure 3.2 Approaches to problem identification
Source: Author's own construction

The first consideration according May et al. (1992) is that of identifying the problems. There are in practice two different types of approach which can be adopted to identify problems and indeed also objectives. The first is the true objective-led approach and the second is the problem-orientated approach illustrated by Figure 3.2. With the objective-led approach detailed objectives are first specified - being a range of specific objectives that will help contribute to the main strategic objective of reducing traffic congestion. These are then used to identify problems by assessing the extent to which current, or predicted future conditions, in the absence of new policy measures fail to meet the objectives. This approach has been adopted in many "so-called" integrated transport studies (Wenban-Smith et al., 1990b).

Having specified a set of objectives, these studies have then predicted future conditions if nothing new were done, and have compared these conditions with the objectives to identify future problems. In some cases this list of problems has then formed the basis for discussions with elected members or the public to establish whether they have different perceptions of the problems. If they do, these are then used to re-define the objectives to match their concerns. The main drawback with this approach is that many elected members and members of the public are less familiar with the abstract concept of objectives (such as improving accessibility) than they are with concrete problems (such as the nearest recruitment centre being 50 minutes away).

The alternative problem-orientated approach starts by defining types of problems, and uses data on current (or predicted future) conditions to identify when and where these problems occur - then developing objectives in response to the problems. This approach has been used in a number of recent studies of smaller conurbations (Coombe et al., 1990; Ramsden et al., 1992). It is the approach advocated by the UK Department of Transport in its package approach guidance (Department for Transport, 2004b) and has the merit of being easily understood. However, it is critically dependent on developing a full list of potential problems at the outset. If particular types of problem (like access to recruitement centres) are not identified because the underlying objective (accessibility) has not been considered, the resulting strategy will be partial in its impact. It is thus probably still wise to check with elected members and the public that the full set of problems has been identified.

Both methods (objective-led and problem-orientated) converge at the stage of option development using these as a basis for identifying solutions and strategies. In either case it is essential to be comprehensive in the list of types of problem. This may be difficult to achieve with the problem-orientated planning approach in which there is no pre-defined set of objectives to prompt the question "how do we know that we have a problem?" With the objective-led approach the situation is simpler, for objectives are first identified and problems identified around them. Neither of these approaches is necessarily preferable to the other. Both require checks to ensure that the problems and objectives identified are comprehensive. In the author's view the choice between the approaches to objective development should be determined by whether the decision-maker feels more at ease with the concepts of objectives or problems – preferably an approach combining both methods will be adopted.

3.4.2 Specifying objectives

Regardless of which approach is used, the objectives specified are broad statements of the improvements which a city is seeking in its land-use and transport system, specifying the directions for improvement, but not the means of achieving them. In being clear about what the integrated strategy is designed to achieve, clear policy objectives are required (Jones and Lucas, 2000:185; Gudmundsson and Höjer, 1996:273). The formulation and development of such objectives must incorporate the characteristics or components of our understanding of what it is believed sustainability will achieve and to incorporate those into the decision-making processes (Jones and Lucas, 2000:186). Such objectives will allow the decision-maker to measure the extent to which his/her integrated strategies will contribute to transport and development sustainability in serving the following key functions:

- identify problems to overcome, both now and in the future
- provide guidance on the appropriate types of solution and the locations in which they are needed
- act also as constraints, in clarifying what should be avoided in pursuing any particular solution
- provide the basis for appraisal and monitoring progress of alternative solutions

By reformulating the author's definition of sustainability it is possible to identify seven objectives to be used as a guide when measuring the extent to which integrated strategies contribute to sustainable development, whilst discouraging traffic congestion as main strategic objective (May and Roberts, 1995:97; May 1991:223). Figure 3.3 illustrates the objectives which will be described in more detail below.

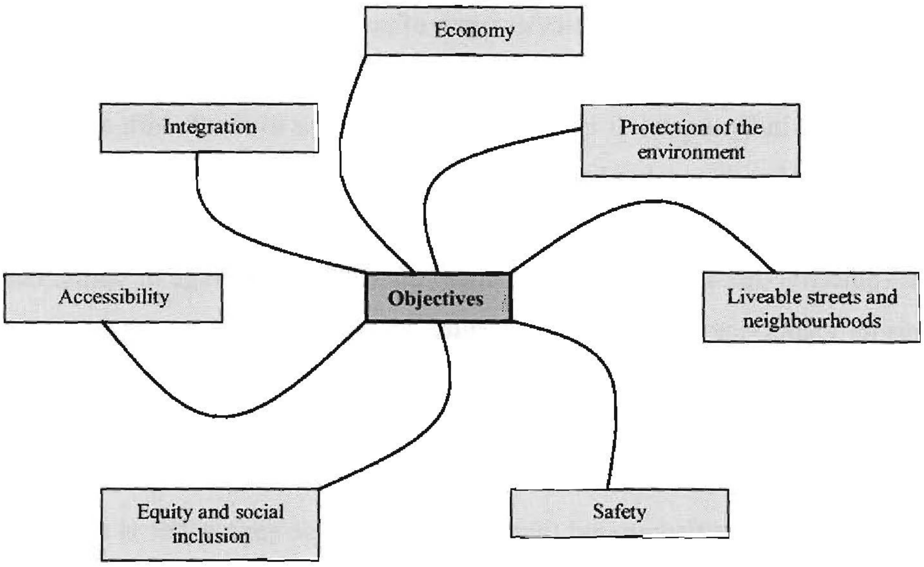


Figure 3.3 Objectives measuring the achievement of sustainability

3.4.2.1 Economy

The economy objective is concerned with improving (a) the economic efficiency of transport and development and (b) the efficiency of economic activities enabling growth. Economic efficiency is achieved when it is impossible to make one person or group in society better off without making another group or person worse off by the same amount. To this end, it is virtually impossible to find any land-use or transport measures for which the gainers would be able to compensate the losers and still be better off themselves (Hyman, 1999:53; Schotter, 2001:132). In other words, seeking economic efficiency means taking all measures for which the "willingness to pay" of the beneficiaries exceeds the "required compensation" of the losers by an acceptable margin.

The second element of this objective is the efficiency of economic activities. According to Litman (2000) it has often been argued that the benefits to transport users and operators captured in a cost/benefit analysis are a satisfactory measure of the wider benefits to the economy, that is, the efficiency with which economic activities are undertaken in so far as they are affected by transport. Thereby, economic efficiency involves maximising the benefits that users gain from the transport system, after taking account of the resource costs of provision and operation of the transport system. However, as Litman (2001) argues it might be difficult to measure goal achievement with respect to the economy objective as a city is part of wider systems and it is difficult to detect whether the transport and land-use measures introduced have been the cause of economic efficiency gains or whether other factors were at work. The extent to which strategy integration contributes to sustainability and helps to achieve the objective of economy is therefore predominantly unclear.

3.4.2.2 Protection of the environment

The environmental protection objective involves reducing the direct and indirect impacts of transport facilities and their use on the environment of both users and non-users (Alshuwaikhat, 2005:307; Arnott et al., 1998:79; Barker and Fischer, 2003:697; Begg and Gray, 2004:155). Notably, environmental impacts of concern include noise, atmospheric pollution of differing kinds, vibration, formal intrusion, community severance, and impacts on intrinsically valuable flora and fauna, ancient monuments and historic buildings et cetera. While some of these can be readily quantified, others such as community severance are much more difficult to define and analyse. More recently, as Gudmundsson and Höjer (1996:277) report, the environmental protection objective has been defined more widely to include reduction of the impact of transport on the global environment, particularly through the emission of carbon dioxide, but also by consumption of scarce and non-renewable resources.

3.4.2.3 Liveable streets and neighbourhoods

This objective is focused more on development planning than transport planning being aimed at quantifying streets and outdoor conditions in residential areas. It includes the positive external effects on social, cultural and recreational activity in neighbourhoods, increased freedom of movement on foot and bicycle, and a reduced sense of danger for these modes when planning to achieve this objective. This objective is also supported by the "Smart Growth" ideology in that it aims to foster distinct, attractive communities with a strong sense of place, preserving open space and natural beauty (Sustainable Communities Network, 2004).

3.4.2.4 Safety

The Department for Transport (2004c) states the safety objective is concerned with reducing the loss of life, injuries and damage to property resulting from transport accidents and crime. This objective straightforwardly involves reducing the numbers of accidents for all modes, and reducing the severity of those which occur. It has been common practice for some time in the UK and USA to place money values on casualties and accidents of differing severity and to include these within a cost/benefit analysis.

The safety objective can be achieved by improving the personal security of travellers and their property. Also, the security of public transport passengers increases with the provision of surveillance, design features which reduce the opportunities for attackers to surprise travellers and facilities for making emergency calls. The security of car users increases when the distances they are required to stop or travel very slowly are reduced, when vehicles can be parked in safety and facilities for making emergency calls are increased. Having a well-maintained infrastructure is also a benefit adding to user safety.

3.4.2.5 Equity and social inclusion

Reference to "all inhabitants" in the definition of sustainability points to objectives of fair distribution, equity and social inclusion. Under equity, the principal concerns are the need for reasonably equal opportunities to travel, equity in terms of the costs of travel and the environmental and safety impacts of travel. True equality of opportunity to travel will never be feasible as Gudmundsson and Höjer (1996:279) report, but consideration needs to be given to compensating those with the fewest opportunities or facing the greatest costs, especially the mobility impaired.

3.4.2.6 Accessibility

Strategies aimed at sustainability must aim to increase accessibility. Accessibility as an objective is loosely defined by Bertolini et al. (2005:207) as "the ease of reaching opportunities (jobs, shops, leisure activities) or the ease of being reached by contacts (such as clients, customers, workers)" providing a useful framework for strategy integration. The term accessibility has in the past been used in several different, often overlapping and conflicting ways as Bruinsma & Rietveld (1998:499), Geurs & Van Wee (2004:127), Halden (2002:313), Hansen (1959:73), Ingram (1971:105), Koenig (1980:145) and Seah (1980:55) suggest, covering the following:

- measurement of ease of access to the transport system itself in terms of, for example, the proportion of homes within x minutes of a bus stop or the proportion of buses which may be boarded by a wheel-chair user
- measurement of ease of access to facilities with the emphasis being on the provision of the facilities necessary to meet people's needs within certain minimum travel times, distances or costs
- measurement of the value which people place on having an option available which they might use only under unusual circumstances (such as when the car breaks down) – "option value" - or even the value people place simply on the existence of an alternative which they have no real intention of using – "existence value"
- measurement of ease of participation in activities (for personal travel) or delivery of goods to their final destination (for goods travel), provided by the interaction of the transport system, the geographical pattern of economic activities, and the pattern of land-use as a whole

Planners of public transport systems often focus on the first view, while land-use planners often concentrate on the second. It is possible to argue that the first three views of accessibility are particular views within the general framework provided by the fourth. Thus, the fourth view may be regarded as the all-embracing measure of accessibility. **Integrating TDM, TSM and LUM must then aim at providing accessibility within the context of these views and it would therefore be useful to explore empirically whether integrating TDM, TSM and LUM measures will indeed increase accessibility and mobility.**

3.4.2.7 Integration

The integration of transport and land-use planning as an objective is widely recognized as an essential, but often neglected, precondition of sustainable development (Wegener and Fürst, 1999; Priemus et al., 2001:171; Meyer and Miller, 2001). The general presumption is that integrated strategies should increase integration between transport and land-use policies, ensuring that decisions are taken across all strategic government sectors. More specifically, this means:

- integration within and between different types of transport, so that each contributes its full potential and people can move easily between them
- integration with the environment, so that the transport choices available support a better environment
- integration with land-use planning, at national, regional and local level, so that transport and planning work together to support more sustainable travel choices and reduce the need for travel
- integration with policies for education, health and wealth creation, so that transport helps make a fairer, more inclusive society

3.4.2.8 Industry implemented objectives

The obvious research question is how comprehensive and representative are these objectives in terms of measuring goal achievement in relation to strategy integration? By comparing practices in five different countries/continents it provides a flavour of the variance and similarities in approach.

1. Experience from Singapore (Taiwan) – regarded as a city with a world class demand and land-use management system – reveals many of the objectives identified above aimed at sustainability are built into the city's transport and urban development strategy. Evidence by May (2004:83) suggests the following objectives, broadly parallel to those identified above:

- To deliver an effective land and transport network that is integrated, efficient, cost-effective and sustainable to meet the nation's needs.
- To plan, develop and manage Singapore's land transport system to support a quality environment while making optimal use of their transport, whilst safe-guarding the travelling public.
- To develop and implement policies to encourage commuters to choose the most appropriate transportation mode.

Between them, these statements cover the widely accepted objectives of transport policy (May and Roberts, 1995:97) - efficiency, environmental sustainability, safety, economic growth and implicitly, accessibility. One omission in their strategy is the issue of equity, although the Singaporean authority has actions in place to improve conditions for public transport users and pedestrians helping those with the least choice of travel mode and those with disabilities.

2. Experience from Australia (Department of Infrastructure, Energy and Resources, 2005) underlines eight intrinsically linked objectives in their approach to integrated transport and land-use management. They are:

- providing a cost-effective and efficient transport system for moving people, goods and resources
- providing the necessary infrastructure enabling communities and industries to meet their transport needs
- to enhance economic development and social and environmental wellbeing
- enhancing safety for users and the community
- promote integration across transport modes, geographic regions and economic sectors
- economic efficiency
- enhance accessibility contributing to equity of access to opportunities, goods and services between regions
- achieve sustainability – maintaining or enhancing the ability of future generations to meet their needs

These objectives share similarities with the aspects of sustainability.

3. Experience from the UK suggests 5 key policy objectives are used in the appraisal of any form of transport investment and land-use developments. The UK's new approach to appraisal is set out in "A New Deal for Trunk Roads in England" and "A New Deal for Transport" (Department for Transport, 2004a). The UK applies five objectives in its approach to integrated transport and land-use management:

- to protect and enhance the built and natural environment
- to improve safety for all travellers
- to contribute to an efficient economy and to support sustainable economic growth in appropriate locations
- to promote accessibility to everyday facilities for all, especially those without a car
- to promote the integration of all forms of transport and land-use planning, leading to a better, more efficient transport system.

As with the other developed countries, the UK objectives contain elements largely very similar to those contained in the author's more comprehensive definition of strategies aimed at transport and urban development sustainability.

4. In **South Africa**, the White Paper on National Transport Policy (Department of Transport, 1996) states:

> *"The broad goal of transport is the smooth and efficient interaction that allows society and the economy to assume their preferred form. To play this role, policies in the transport sector must be outward looking, shaped by the needs of society in general, of the users or customers of transport, and of the economy that transport has to support."*

In progressing towards this broad goal the South African National government has identified 6 more specific objectives:

- To support the goals of the RDP for meeting basic needs, growing the economy, developing human resources, and democratising decision-making
- To enable customers requiring transport for people or goods to access the transport system in ways which best satisfy their chosen criteria
- To improve the safety, security, reliability, quality and speed of transporting goods and people

- To improve South Africa's competitiveness and that of its transport infrastructure and operations through greater effectiveness and efficiency to better meet the needs of different customer groups, both locally and globally
- To invest in infrastructure or transport systems in ways which satisfy social, economic, or strategic investment criteria
- To achieve the above objectives in a manner which is economically and environmentally sustainable and minimises negative side effects.

Although these objectives go a long way to encapsulate the aspects of sustainability no mention is made of environmental protection and the pursuance of transport and land-use integration, but fundamentally stresses the issue of formulating objectives best suited and desired for location-specific conditions and consideration and being in line with other national policies.

5. Finally, the **experience from Curitiba** (Brazil) has been recognised by international experts and development institutions as a successful example of urban management (Rabinovitch, 1996:51-54). The city was planned as an integrated structure for living and working activities to affect social, environmental and economic aspects so as to benefit as many people as possible, especially the most vulnerable groups - which, in the context of most developing countries, constitute a large proportion of the population. Land-use policies were combined with transport policies and other dynamic elements existing within the urban fabric, such as the mobility of the population, so as to benefit as many people as possible. Although Curitiba's policies were not specifically aimed at promoting sustainability, its objectives reflect some comparison with those identified above. Curitiba has six policy objectives:

- encourage economic development by reducing the costs of mobility, trade and exchange within the city
- reduce the indirect costs of other infrastructure improvements such as water, sewage, electricity and communication
- create an effective transport system
- preserve historic buildings and areas within the city centre
- promote direct urban growth out of the central city and into arterial growth corridors
- integrate transport and land-use controls to redirect growth out of the central city and into corridors

In sum, industry practices suggest some consistency between the objectives although they are broad and reflect their specific regional and sub-regional circumstances. It must be recognised that transport policies and objectives will vary in different urban areas (Institution of Highways and Transportation, 1997:19), reflecting both the wide range of factors which affect transportation needs and the inclination of relevant decision-makers. In empirical terms there is tension between objectives, such that proposals may contribute to the achievement of one objective, but work against the achievement of others (Jones and Lucas, 2000:193). Thus, the decision-maker must determine the appropriate balance between the selected objectives. Most often sustainability will never be the only and often not even the dominating policy goal, but will rather be weighed against other goals, such as economic competitiveness or social equity. This means that strategies that succeed in serving more goals at the same time will invariably be the ones with the greatest chance of success. **In terms of the research objectives it is a requirement to identify the specific objectives conducive to strategy integration and long-term sustainability.**

3.4.3 Selecting criteria

Because the sustainability objectives described in the previous section are abstract concepts, it is difficult to measure performance against them or the contribution made by every measure (TDM, TSM and LUM) in meeting them. It is not possible to satisfy all the objectives which may be desirable to achieve a given strategy as Jones and Lucas (2000:193) cites. For example it is often difficult to improve accessibility without intruding upon the environment. It will consequently be useful to trade off performance against different objectives, so that these conflicts can be more easily resolved. To do this, *impact* criteria are required to measure the various options/measures' contribution to meeting the sustainability or policy objectives. In other words such impact criteria are required to measure the extent to which integrated strategies contribute to sustainable development. The development of a D.A.D.F. will require such impact criteria for its option analysis functions and so, since the purpose of the D.A.D.F. is not to monitor a system as it evolves in the real world, but to plan for the future, only data that can be derived from the planning process itself can be used to construct the criteria. Each criterion must be measurable, in the sense that it will be possible to assess, at least in a qualitative sense, how well a particular option/measure is expected to perform in relation to the criteria (and associated indicators).

Table 3.1 List of objectives and associated criteria

Objectives	Criteria
Economy	Implementation cost
	Vehicle operating cost
	Journey time reliability
	Economic efficiency
	Economic growth
Liveable streets and neighbourhoods	Safe and secure neighbourhood
	Freedom of movement
Protection of the environment	Emission level
	Urban sprawl
	Visual intrusion
Equity and social inclusion	Contribution to investment in transport
	Access to public transport
	Community cohesion
Safety	Accidents
	Danger
	Intimidation
Integration	Transport interchange
	Impact on traffic congestion
Accessibility	Ease of reaching opportunities
	Community severance
	Access to the transport system

Source: Author's own construction

Given these considerations, Table 3.1 provides a list of commonly used criteria when assessing objective achievement. Although they present commonly used industry criteria in land-use development and transport planning, the question posed by authors such as Bertolini et al. (2005:220), Bond and Brooks (1997:305), Brugmann (1996:363), Davidson (1996:445), Geerling and Stead (2003:188-191), Himanen et al. (2005:23) Jones and Lucas (2000:193), May and Roberts (1995:97) and Sawathvong (2004:553) which remains unanswered is, **which of these should be applied in assessing the achievement of objectives in relation to traffic congestion reduction?** Because of different planning approaches, objectives and national and regional policies implemented in the least developed, developing and developed countries, the potential exists for the criteria to differ significantly and it will therefore be useful to **determine empirically whether the criteria differ between the least developed, developing and developed countries** as it will clarify the basis upon which objectives are chosen and help to develop a comprehensive list of criteria enabling objective measurement.

3.4.4 Selecting indicators

Objectives and criteria generally indicate the desired general direction of change, for example, to reduce the environmental nuisance caused by traffic. Indicators are required to inform the decision-maker about the extent to which selected measures contribute to meeting the sustainability objectives and their use is a very effective way of encouraging action and monitoring performance. With the increasing demand for joined-up policy assessment, it is important for decision-makers to have a set of core indicators, both at the national and local level that can be used in different situations assessing the contribution made by differing strategies in achieving predetermined objectives (Jones and Lucas, 2000:185).

Within the context of environmental management and sustainable urban development, the purpose of indicators is threefold. They either evaluate the effectiveness of objectives at the outset of a program or project, or monitor progress of implemented policies towards policy goals and objectives or they assess the outcome of policies in terms of these objectives (Commission of European Communities, 2005:3). It follows that indicators can subsequently be classified as input indicators, process indicators and output indicators (Gudmundsson, 2001). Crucially though, indicators provide guidance for decision-making in a variety of ways as they translate physical and social science knowledge into manageable units of information that can be easily understood and interpreted.

For the purpose of the study output indicators are required to measure the outcome or impact of proposed integrated TDM, TSM and LUM measures as opposed to process indicators which evaluate and monitor the actual progress and processes that lead to the end results. **The obvious question that follows this statement is which indicators are appropriate within the context of the study.** In answering this question the next section evaluates what has been done internationally to progress the issue of sustainable development indicator formulation.

3.4.4.1 Sustainable development indicator framework

The 1992 Earth Summit recognized the important role that indicators can play in helping countries to make informed decisions concerning sustainable development. Chapter 8 of Agenda 21 calls on countries to adopt National Strategies for Sustainable Development (NSDS) that "should build upon and harmonize the various sectoral economic, social and environmental policies and plans that are operating in the country." This recognition is articulated in Chapter 40 of Agenda 21 which calls on countries at the national level, as well as international, governmental and non-governmental organizations to develop and identify indicators of sustainable development that can provide a solid basis for decision- making at all levels.

In response to this call, a Sustainable Development Indicator (SDI) task force from the Commission on Sustainable Development approved the Programme of Work on Indicators of Sustainable Development in 1995 and called upon the organizations of the UN system, intergovernmental and non-governmental organizations with the co-ordination of its Secretariat to implement the key elements of the work programme. In 2000 the Millennium Summit and in 2002, the World Summit for Sustainable Development (WSSD), urged participating states not only to take immediate steps to make progress in the formulation and elaboration of national strategies for sustainable development but also to begin their implementation by 2005.

A large number of indicators are needed to properly assess the multi-dimensional nature of sustainable development as the framework of indicators must contain indicators for respective categories, whether they are for project phases, environmental or sustainable development themes or other dimensions. Based on voluntary national testing and expert group consultations the SDI task force developed an indicator framework of 58 indicators and methodology sheets for all countries to use which is suited to country-specific conditions and makes indicators of sustainable development accessible to decision-makers at the national level (United Nations, 2005).

This core set was derived from a working list of 134 indicators, improved and tested as part of the implementation of the Work Programme on Indicators of Sustainable Development (ISD) adopted by the Commission on Sustainable Development (CSD) at its Third Session in April 1995 and presented to the CSD in 2001. The WSSD, JPOI, CSD11 and most recently CSD13 encouraged further work on indicators for sustainable development by countries in line with national conditions and priorities. CSD13 furthermore invited the international community to support the efforts of developing countries in this regard.

In order to facilitate communication about the SDI, the indicator set is built as a three-level hierarchical pyramid as shown by Figure 3.4 below.

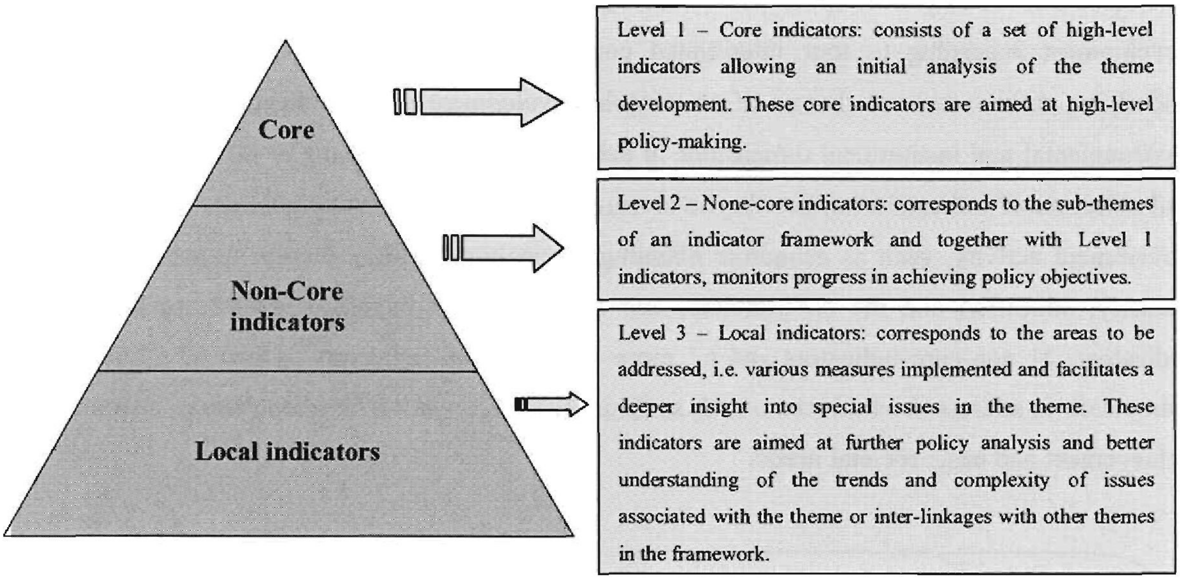


Figure 3.4 Three-level hierarchical indicator pyramid

Source: Author's own construction

Another important question is how indicators are selected. The UN SDI task force together with the Commission of European Communities have much experience in the selection of indicators for sustainable development. In general for indicators to be included in the SDI framework they must meet the following criteria:

- An indicator should capture the essence of the problem and have a clear and accepted normative interpretation and have direct relevance to the objective
- An indicator should be robust and statistically validated in clear design
- An indicator should be responsive to policy interventions but not subject to manipulation
- An indicator should be measurable in a sufficiently comparable way and comparable as far as practicable with the standards applied internationally by the UN and the OECD
- An indicator should be timely and susceptible to revision
- An indicator should be transparent and accessible to scrutiny by the public

Indeed the identification of appropriate indicators measuring sustainable development is an iterative process. It must be recognized that any framework, by itself, is an imperfect tool for organizing and expressing the complexities and interrelationships encompassed by sustainable development (UN, 2002). There is no universal set of indicators that is equally applicable in all cases. Ultimately, the choice of a framework and a core set of indicators must meet the needs and priorities of users, civil society groups and decision-makers responsible for the development and use of indicators to monitor progress towards sustainable development.

The current set of indicators developed by the SDI task force allows integrated evaluation of sustainable development according to four interrelated components as illustrated by Figure 3.5. Because the underlying themes and sub-themes of sustainable development are the integration of economic, social environmental and institutional dimensions in decision and policy-making at all levels – the integration and selection of indicators implies the involvement of virtually all traditional sectors of economic and government activity, such as economic planning, agriculture, health, energy, water, natural resources, industry, education and the environment, and so forth. It is therefore possible to identify 16 core indicators, 21 non-core indicators and 67 more specific local indicators as part of a themed indicator framework to address considerations such as future risks, correlation between themes, sustainability goal achievement and basic societal needs.

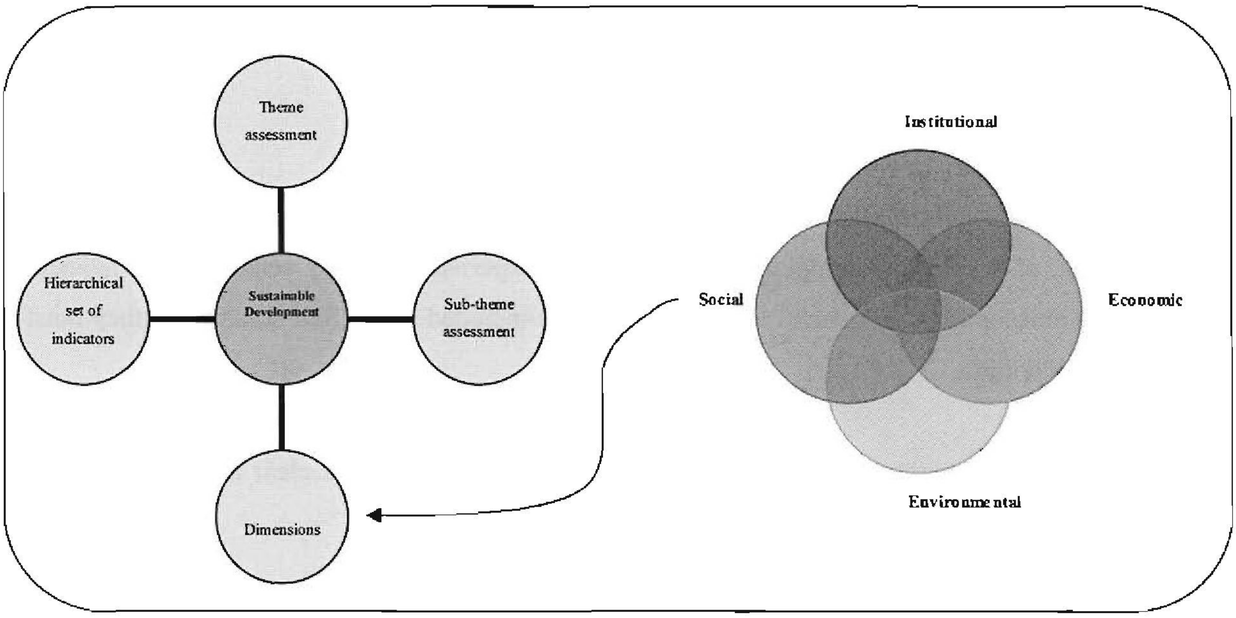


Figure 3.5 Components of sustainable development

Source: Author's own construction

Having extracted the relevant indicator data from the work carried out by the SDI task force and the Commission of European Communities, the framework summarized by Table 3.2 below, represents a culmination of the individual components (and their individual parts) illustrated in Figure 3.5 providing a set of sustainable development indicators.

Table 3.2 Sustainable development indicator framework

	Theme	Sub-theme	Core Indicator	Non-Core Indicator	Local/Complementary Indicator
Social	Equity	Poverty	At-risk-of poverty rate after social transfers	At-persistent-risk-of-poverty rate	Percent of population living below poverty line
				Total long-term unemployment rate	Gini index of income inequality

				Early school leavers	Unemployment rate
		Gender Equality			Ratio of average female wage to male wage
	Health	Nutritional Status			Nutritional status of children
		Mortality	Healthy life years at birth by gender		Mortality rate under 5 years old
					Life expectancy at birth
		Sanitation			Percent of population with adequate sewage disposal
		Drinking Water			Population with access to safe drinking water
		Healthcare Delivery		Percentage of overweight people, by age group	Percent of population with access to primary health care facilities
				Deaths due to infectious foodborne diseases	Immunization against infectious childhood diseases
				Index of apparent consumption of chemicals, by toxicity class	Contraceptive prevalence rate
				Population exposure to air pollution by particulate matter	
	Education	Education Level			Children Reaching Grade 5 of Primary Education
					Adult Secondary Education Achievement Level
		Literacy			Adult Literacy Rate
	Housing	Living Conditions			Floor Area per Person
	Security	Crime			Number of Recorded Crimes per 100,000 population
	Population	Population Change	Current and projected old age dependency ratio	Projected theoretical replacement ratio (ratio between income after and prior to retirement)	Population Growth Rate
				Life expectancy at age 65 by gender	Population of Urban Formal and Informal settlements
				General government consolidated gross debt as % of GDP	
Environmental Dimension	**Atmosphere**	Climate Change	Total greenhouse gas emissions	GHG emissions by sector	Emissions of Greenhouse Gases
			Gross inland energy consumption by fuel		Consumption of Ozone Depleting Substances
		Ozone Layer Depletion			
		Air Quality			Ambient Concentration of Air Pollutants in Urban Areas
		Agriculture			Arable and Permanent Crop Land Area
					Use of Fertilizers
					Use of Agricultural Pesticides
		Forests			Forest Area as a Percent of Land Area
					Wood Harvesting Intensity
		Desertification			Land Affected by Desertification
		Urbanization			Area of Urban Formal and Informal Settlements
	Oceans, Seas and Coasts	Coastal Zone			Algae Concentration in Coastal Waters

Percent of Total Population

					Living in Coastal Areas
		Fisheries	Fish catches outside safe biological limits		Annual Catch by Major Species
		Water Quantity		Groundwater abstraction as % of available groundwater resources	Annual Withdrawal of Ground and Surface Water as a Percent of Total Available Water
		Water Quality			BOD in Water Bodies
					Concentration of Faecal Coliform in Freshwater
		Ecosystem	Biodiversity Index		Area of Selected Key Ecosystems
					Protected Area as a % of Total Area
		Species			Abundance of Selected Key Species
	Land-use	Change by category	Built-up area as a % of total land area	Exceedance of critical loads of acidifying substances and nitrogen in sensitive natural areas	Percentage of forest trees damaged by defoliation
				Percentage of total land area at risk of soil erosion	Fragmentation of habitats due to transport
Economic Dimension	**Economic Structure**	Economic Performance	GDP per Capita		Real GDP growth rate
					Investment Share in GDP
		Trade			Balance of Trade in Goods and Services
		Financial Status			Debt to GNP Ratio
					Total ODA Given or Received as a Percent of GNP
	Consumption and Production Patterns	Material consumption	Total material consumption and GDP at constant prices		Intensity of Material Use
			Domestic Material Consumption and GDP at Constant prices		
		Energy Use	Gross inland energy consumption by fuel		Annual Energy Consumption per Capita
					Share of Consumption of Renewable Energy Resources
					Intensity of Energy Use
		Waste Generation and Management			Generation of Industrial and Municipal Solid Waste
					Generation of Hazardous Waste
					Generation of Radioactive Waste
					Waste Recycling and Reuse
		Transporta-tion	Vehicle-km and GDP at constant price	Car share of inland passenger transport	Distance Travelled per Capita by Mode of transport
				Road share of inland freight transport	Modal split of passenger and freight transport
					Access to public transport
				External costs of transport activities	Freight transport prices by mode
					Investment in transport infrastructure by mode
			Energy consumption by	Emissions of air pollutants (particulate matter and ozone	Energy consumption by transport mode

			transport and GDP at constant price	precursors) from transport activities	
				Greenhouse gas emissions by transport activities, by mode	
			Social and environmental impact of transport		People killed in road accidents, by age group
				Emissions of air pollutants (particulate matter and ozone precursors) from transport activities	Emissions of NOx from road vehicles (petrol and diesel)
Institutional Dimension	**Institutional Framework**	Strategic implementa-tion of SD	Level of citizens' confidence in EU institutions	Effectiveness of administrative and legal support system	National Sustainable Development Strategy
		International Co-operation			Implementation of Ratified Global Agreements
	Institutional Capacity	International Co-operation			Number of Internet Subscribers per 1000 Inhabitants
		Information Access			Main Telephone Lines per 1000 Inhabitants
		Communica-tion Infrastructure			Expenditure on Research and Development as a Percent of GDP
		Science and Technology			Economic and Human Loss Due to Natural Disasters
		Disaster Preparedness and Response			

Source: Reconstruction of United Nations (2005) and Commission of European Communities (2005:3)

By developing a sustainable development indicator framework (SDIF) it is then possible to measure progress effectively and the impact of measures introduced - put differently, measuring the extent to which options or measures contribute to meeting objectives and the extent to which policy measures contribute to sustainable development. As the purpose of the study is to develop a D.A.D.F. that assists decision-makers in selecting the most appropriate measures for inclusion into an integrated strategy to deal with traffic congestion, it is necessary to relate only those indicators which can be directly related to the objectives set out in section 3.4.2, in such a way that each objective is assigned its own indicator or set of indicators.

To this end, when the SDIF illustrated in Table 3.2 is compared and related to commonly used industry indicators in land-use development and transport planning, by referring to citations by Bertolini et al. (2005:220), Bond and Brooks (1997:305), Brugmann (1996:363), Davidson (1996:445), Geerling and Stead (2003:188-191), Himanen et al. (2005:23) Jones and Lucas (2000:193), May and Roberts (1995:97) and Sawathvong (2004:553) it is possible to decompose the SDIF dimensions and its associated indicators and transpose them into 24 elements or concerns as illustrated by Table 3.3 below. Each element reflects a key concern of sustainable transport and spatial development.

Table 3.3 Decomposing dimensions, elements and concerns

Environmental dimension	Societal dimension	Economic dimension	Institutional dimension
Limiting emissions	Meeting access needs of individuals	Affordability	Effective institutional framework
Limiting waste	Meeting access needs of society	Efficient operation	Institutional capacity
Minimizing consumption of non-renewable resources	Access needs are met consistent with ecosystem health	Choice of transport mode	Need for a national sustainability strategy
Limiting consumption of renewable resources	Access needs are met consistent with human health	Support for a vibrant economy	
Reusing and recycling of components	Access needs are met safely	Distance travelled by mode	
Minimizing land-use	Access needs are met with equity within this generation	Journey time	
Minimizing noise	Access needs are met with equity across generations	Journey cost	

Source: Author's own construction

It follows then that it is possible for each concern or element to be reflected in output indicators measuring the extent to which selected measures contribute to meeting the sustainability objectives. The argument for using this approach is based on the definition of sustainability as defined by the author. The elements of the definition have straightforwardly been transposed to objectives allowing indicators to be developed within the set formulated by the SDI task force and the European Commission of Communities. The output indicators can be straightforwardly related to specific criteria associated with each objective such as those conceptualised in Table 3.4 below.

Table 3.4 Objectives, criteria and output indicators

Objectives	Criteria	Indicators
Economy	Implementation cost	High
	Vehicle operating cost	Medium
	Journey time reliability	Low
	Economic efficiency	CBA
	Economic growth	
Liveable streets and neighbourhoods	Safe and secure neighbourhood	Freedom of movement
		Number of accidents involving pedestrians/cyclists and cars
		Accidents by location, mode and victim
Protection of the environment	Emission level	Reduction in emission levels
	Urban sprawl	Visual intrusion
	Visual intrusion	Noise
		Land take
Equity and social inclusion	Contribution to investment in transport	Increased accessibility to public transport services
	Provision of public transport	Losers and winners by income and category

	Community cohesion	Close proximity of demand driven land-use functions reducing travel time and distance
Safety	Accidents	Less traffic accidents
	Danger	Residential design that makes people feel safe
	Intimidation	
Integration	Transport interchange	Increased land-use mix and clustering
	Impact on traffic congestion	Reduced Total vehicle miles of travel (VMT) on congested roads
		Reduced Total vehicle hours of travel (VHT) on congested roads
		Reduction in distance travelled to leisure, work, shopping and education destinations
		Mode shift
Accessibility	Ease of reaching opportunities	Reduced average time and cost to all activities of a given type from a specified origin by a specified mode
	Community severance	Increased access to the transport system
	Access to the transport system	

Source: Reconstruction of United Nations (2005), Commission of European Communities (2005:3) and O'Flaherty (2005:56)

Because of different planning approaches, objectives and national and regional policies implemented in the least developed, developing and developed countries, the potential exists for the output indicators to differ significantly (Gakenheimer, 1999:671). **It will therefore be meaningful to determine empirically whether the indicators measuring objective achievement and sustainable development differs from those used to measure objective achievement against traffic congestion reduction between the least developed, developing and developed countries.**

3.4.4.2 Determining baselines, thresholds and targets

For any indicator to be meaningful, baselines, thresholds and/or targets for the indicators need to be established. Their roles are summarised in Table 3.5 below.

Table 3.5 Baselines, thresholds and targets

Analytical tool	For which activity	When to use...	How to establish...
Baseline	For any activity whose impacts one wishes to identify.	To monitor changes (positive or negative) due to an activity.	When used for monitoring environmental change: establish baseline at initiation of activity. When used to illustrate total environmental change: set baseline as zero.
Thresholds	To control an activity that may have a negative impact.	To monitor negative impacts which should not exceed a pre-determined threshold.	Establishment depends on the objective of the activity.
Targets	For activities which aim to improve the state of sustainable development.	To monitor the positive impacts of an activity that is sufficiently large.	Establishment depends on the objective of the activity.

Source: Author's own construction

A *baseline* is a value that is determined before an indicator is due to measure an objective in order to show a positive or negative change. Without a baseline, the indicator values detected as the monitoring continues can not be compared to anything meaningful; it is not possible to say whether things have improved or become worse. For some monitoring systems the establishment of *thresholds* may be of even greater importance than that of baselines as a tool for analysis. However, thresholds are generally useful in strategies that do not necessarily have environmental improvements, or sustainable development, as their main objective.

The use of *targets* is very similar to the use of thresholds, but differs with respect to its outcome. In short, targets are useful for strategies that have environmental or sustainable development improvement as one of their objectives. Because output indicators are used to measure the extent to which strategy objectives have been achieved, they serve an important role in facilitating indicator analysis within the research context. For many of the most common indicators at the national, regional and international levels, targets already exist in the form of international commitments or consensus. It is not the intention of the research to prescribe specific targets for indicators, nor is it the intention to prescribe specific thresholds as they critically depend on the local conditions and circumstances and the expectations of stakeholders, the public and decision-makers.

3.4.5 Defining scenarios

Once objectives and indicators have been identified as tools assessing the extent to which integrated strategies contribute to sustainability and achieve the policy objectives, it is necessary to establish the context or circumstances within which the strategies will operate – that is the scenario (Minken et al., 2002). In other words, a scenario defines and describes both urban and transportation systems performance trends, local conditions and potential limitations – the context of a scenario. In further defining the term "context", Geurs et al. (1997) suggest the context of a scenario refers to general "macro trends or developments", e.g. assumptions about economic, social and demographic trends and current and future land-use planning features. When developing a scenario, the key issue become the formulation of the context using exogenous and endogenous variables describing the economic, social, demographic, physical and land-use characteristics of a geographical area planned for providing a coherent picture of the settlement.

Despite some potential difficulties in constructing a scenario using exogenous and endogenous variables, the research demands the identification of those variables both exogenous and endogenous to the transport system describing urban land-use and transportation system performance. The purpose of this exercise is threefold. First, the variables will serve as a medium by which the context within which formulated strategies will operate are described. Secondly, because the variables can be seeded with quantitative and qualitative data, it is possible to quantify the scenario (or location) being planned for. Finally, quantified variables will help determine specific circumstances warranting specific types of measures being implemented.

Several promising approaches to scenario construction or design have been documented in the past (Nijkamp et al., 1997:696). Of these, two notable approaches have been recorded by Grubler and Nakicenovic (1991) and Masser et al. (1992b) being (i) a compound transport-land-use package approach and (ii) a compound behavioural framing approach. Both these approaches provide the scope to describe a scenario's economic, social, demographic and physical features and characteristics combining contextual land-use and transport system factors. Within this context, it is possible to identify exogenous and endogenous variables in developing a scenario for proposed TDM, TSM and LUM strategy integration. Table 3.6 below lists a summary of exogenous and endogenous variables, having been assimilated from the least developed through to developed countries cutting across wide differences in national policy and strategy objectives and variables applied.

Table 3.6 List of exogenous and endogenous variables

Exogenous variables		**Endogenous variables**	
Economic	**Land-use**	**Environment**	**Infrastructure**
Economic growth	Land availability	Noise	Carriageway capacity
Employment	Land-use patterns	Air Quality	Road class
Price stability	Parking provision	Biodiversity	Speed limit
Balance of payment stability	Housing	Journey Ambience	Lane throughput
Income distribution	Retail development	Accidents	Width
Funding available	Leisure	Security	Parking and Loading
	Accessibility		Pedestrian crossing
Demographic		**Public transport**	Bus stops
Population size		Access to public transport	Accessibility
Annual urban population growth		Transport interchange facilities	Traffic effects
Population density per km^2		Hub integration	Travel time saving
			Vehicle operating cost
Social		**Construction and implementation cost**	Capital renewal cost
Human Development Index			Negotiation and Development cost
Cars per household		**Economic development effects**	
		Travel time	

Sources: Banister (1999:316-319), Sim et al. (2001:239), Rabinovitch (1996:51), Sawathvong (2004:553), Sustainable Communities Network (2004), May (2004:81), May and Roberts, (1995:97), Department of Infrastructure, Energy and Resources (2005), Department of Transport (1996), Department for Transport (2004c), Jones and Lucas (2000:193) and Minken et al. (2002)

Because an exhaustive set of generic variables do not exist, but only variables relating to describing the contexts of land-use and transport planning integration in a more general sense (Sustainable Communities Network, 2004) **the empirical phase of the research will aim to find such variables for inclusion in a dynamic adaptive decision framework aimed at identifying measures best suited for a specific scenario thereby overcoming this specific research gap.**

3.4.6 Measures to be included in integrated strategies

Land-use and transport planners have available to them, at least in principle, a wide range of instruments to influence development and transport policy. These are the means by which policy objectives can be achieved and problems overcome forming an integral part of strategy integration. Fundamentally the selected policy instruments affect the performance of the transport system by changing (i) the demand for travel (ii) the supply of transport facilities and (iii) the cost of provision and operation of the transport system (Department for Transport, 2004d).

Although the instruments are categories in several ways, this research considers them under the headings of TDM, TSM and LUM identifying a range of instruments supporting infrastructure, land-use and transportation needs. The instruments, intended to improve sustainability, will provide the decision-maker with choices that enables him to improve:

- urban design to promote travel on foot and by bicycle
- public transport options
- vehicle and traffic management technologies to reduce the impact of car journeys
- alternatives to travelling

An evaluation of the instruments available for inclusion to decision-makers follows in Chapter 4 forming part of the components required to operationalise integrated strategies.

3.4.7 Barriers to implementation

A further element to be considered in planning for sustainability is the barriers to its implementation. Research by Goodwin (1990:6-7), Lindsey and Verhoef (2000:22), Santos (2000:7) and May (2005:2,7) to name but a few suggest the barriers to introducing integrated strategies are complex and a result of the interdependencies between the legal and institutional, financial, political, practical and decision-making frameworks in which they operate and the links between TDM, TSM and LUM measure. If effective strategies are to be developed the decision-maker has to consider the types of barriers so as to formulate mechanisms that control the barriers. In assessing these authors' views the following 5 barriers are deemed the key ones to overcome if strategies aimed at congestion reduction are to be successful, these being (i) legal and institutional barriers (ii) financial barriers (iii) political and cultural barriers (iv) practical and technological barrier and (v) decision-making.

It is fairly easy to derive an extensive list of barriers affecting strategy integration. By reviewing the work of the Commission for Integrated Transport (2002), May (2005:2,7), Banister (1998, 2002:1-2), Banister and Pucher (2003:1), Niskanen et al. (2003:10), Vigar (2000:22-28) and Wenben-Smith and Coombe (2004:60-62) it is possible to illustrate using Figure 3.6 some of the most common barriers. As most of these barriers are complex and often conflate legal, financial and cultural issues sometimes presenting insurmountable obstacles, it is essential to have mechanisms to deal with them effectively.

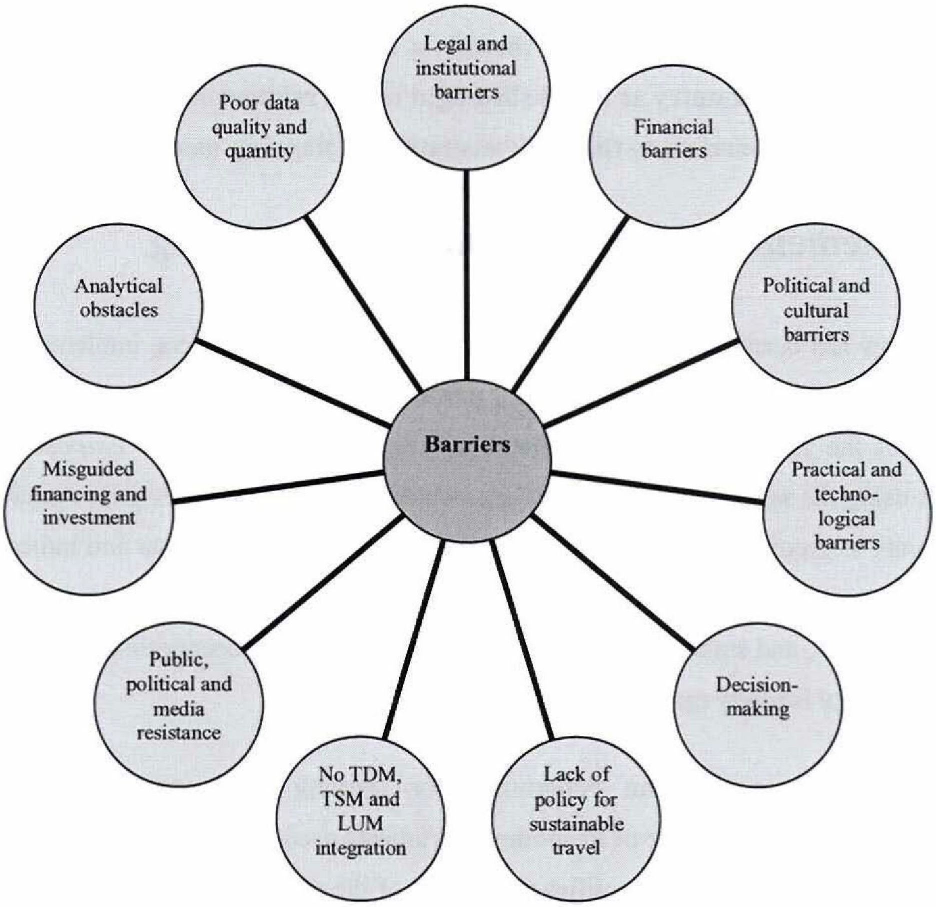


Figure 3.6 Barriers to strategy integration
Source: Author's own construction

The removal of barriers therefore implies identifying factors which hinder the implementation of an otherwise desirable policy instrument and an instrument to overcome them. In this respect TDM, TSM and LUM integration can serve a useful purpose in the removal or amelioration of barriers in three ways as Jones (1998) suggests:

- It can involve measures which make other elements of the strategy financially feasible
- Integration can package measures which are less palatable on their own such as demand management measures with ones which demonstrate a clear benefit to those affected
- Integration can involve measures which compensate losers

Seen against this background, achieving successful integration is no easy task and requires leadership and a commitment to change. This statement is particularly important where there are so many potentially conflicting interests, and where there is extreme complexity together with uncertain outcomes. Quite often approaches include good practice in consultation and presentation of strategies, design of effective institutional structures, and more effective decision-making processes. However, it may prove difficult to overcome barriers in this way without to some extent reducing the performance of the overall strategy – there will inevitably be trade-offs between policy measures. The pursuit of synergy and the resolution of barriers are thus to some extent in conflict with the design of integrated strategies. **It will be useful to establish at an empirical level whether there is a link between the barriers encountered and the development stage of a country as it will shed light on the relationship between countries in the way in which they address barriers to the implementation of planning measures.**

3.4.8 Implementation, evaluation and monitoring

Once a strategy has been formulated with mechanisms controlling barriers, implemented and operational for some time, evaluation of the strategy forms part of the specific application of appraisal to the *post hoc* assessment of the implemented or completed strategy (Cracknell, 2000). *Ex-post* evaluation may be carried out using the same appraisal framework as before. But of course, *ex-post* evaluation also provides an opportunity to reconsider the objectives and the usefulness of the criteria and indicators providing the mechanism to assess the success of the implemented strategy. Even when a thorough study of the options has been conducted, and stakeholders' views have been taken into account throughout, implementation of the chosen strategy is rarely easy.

Every new scheme provides an opportunity for learning from experience, and improving our understanding of the performance of the policy instruments used. One way of doing this is by undertaking a before and after survey which identifies the effects of the strategy on the key performance criteria and against the strategy objectives (Office of Land Information Services, 2001; Department for Transport, 2004a&b; Department of Infrastructure, 2005). Alternatively, the regular monitoring of conditions will help assess whether barriers and problems are being overcome, or whether new problems are emerging. It also allows for a second round of consultation to present the results of strategy tests and to obtain stakeholder views on the preliminary composition of the preferred strategy. Evaluation and monitoring therefore provide the context for the next review of the strategy (Rabinovitch, 1996:54); considering agreed performance criteria and indicators, and are therefore an essential part of an approach aimed at encouraging sustainable development and planning.

3.4.9 A logical approach

Having explored the considerations to be taken into account when planning for greater sustainability it is possible to suggest a logical approach or sequence of events enabling the decision-maker to shape and develop integrated strategies in a convincing and defensible way. The structure illustrated by Figure 3.7 below summarises the preceding discussion although it permits considerable flexibility in the decisions taken at each stage.

Although the process may seem somewhat idealised, it has several virtues. It provides a structure within which participation can be encouraged at all the key stages in decision-making. It offers a logical basis for proposing solutions, connecting and shaping the components of a strategy and also for assessing any proposals suggested by others. By considering relevant planning considerations during the strategy formulation period justifiable outcomes are attainable. Additionally, it forces the appraisal of alternative solutions to be conducted in a logical, consistent and comprehensive way against a full set of objectives. It therefore provides a means of assessing whether implemented strategies have performed as predicted, and enables the models used for prediction to be improved. Finally, regular monitoring also provides a means of checking not just the scale of current problems, but also, through attitude surveys, the perception of those problems and the extent to which they have been ameliorated.

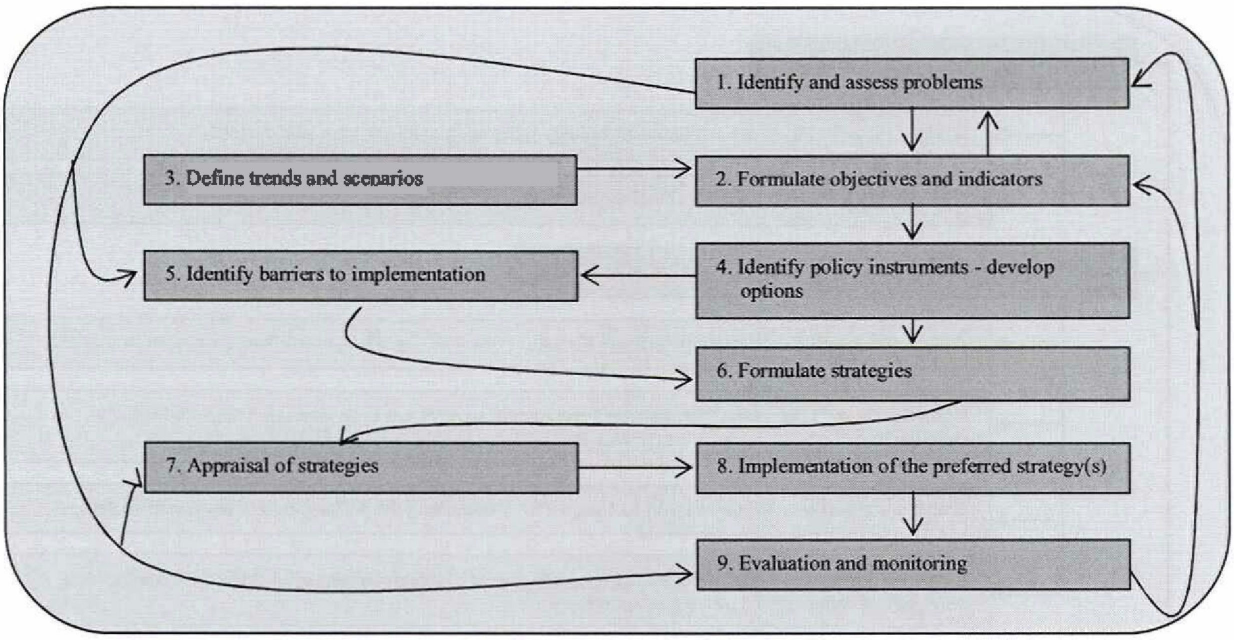


Figure 3.7 The logical structure

Source: Author's own construction

The real planning process is likely to be more complex than the neat structure of Figure 3.7. Results at one stage may throw new light on decisions made at an earlier stage and call for revisions. Since time and resources are limited, it is important to avoid too many such surprises. From the planner's point of view, then, Figure 3.7 is not to be understood as a linear process, but as a process that needs to be performed at least *twice*; first as preparations and planning for the planning process and then as the actual execution of it.

3.5 Conclusion

This chapter has demonstrated that planning has the scope to facilitate sustainable development in all the functioning facets of the city as a result of its multi-disciplinary and interrelated nature. It positioned the sustainability concept within the context of the research by evaluating its meaning, functioning and ultimately its goals. Because sustainability is an overarching concept with many layers, the decision-maker is expected to balance the unique demands of sustaining local economic, community, transport and environmental systems in local development decisions. To achieve development sustainability, the decision-maker has to take into account several key considerations thereby providing a logical approach and tool to shape and formulate integrated strategies. Throughout examining the considerations, some important research gaps, uncertainties, concepts and ideas which have not yet been explored fully in current research attempts, have been identified. Figure 3.8 below illustrates the gaps this study aims to address, progressing the formulation of a Dynamic Adaptive Decision Framework.

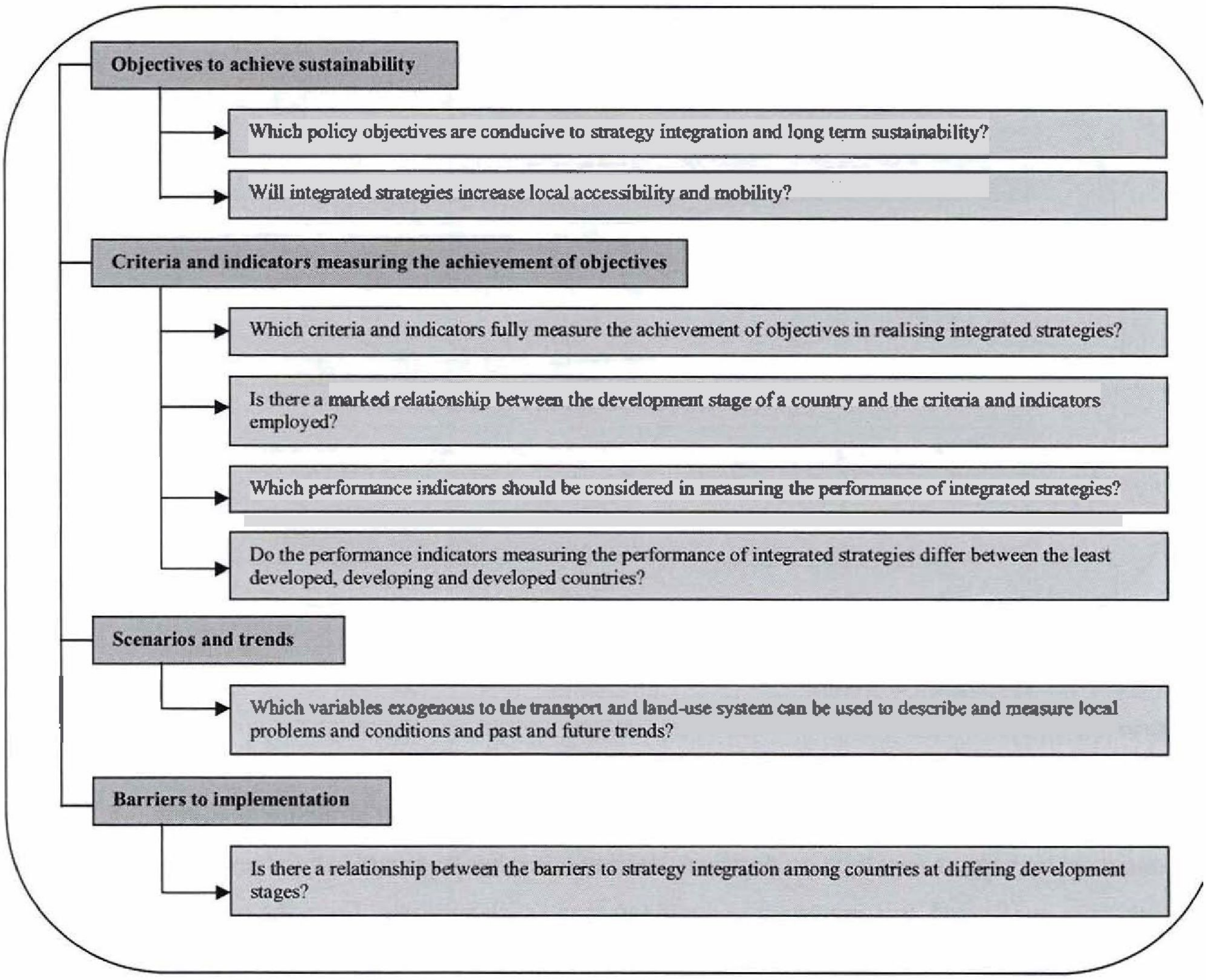


Figure 3.8 Issues to be investigated

CHAPTER 4

CONNECTING INTEGRATED STRATEGIES TO THE COMPONENTS OF PLANNING

4.1 Introduction

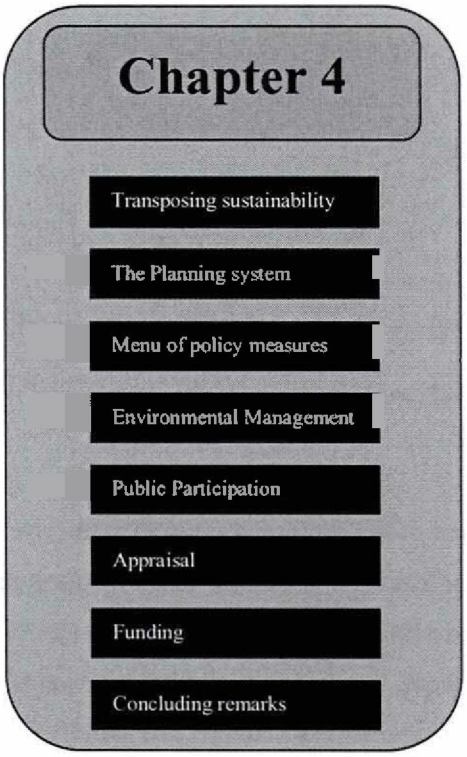


Figure 4.1 Components of Chapter 4

As a policy outcome, the integration of economic, political, environmental, social and cultural objectives (as dimensions of sustainability) within the land-use planning process is considered desirable and essential to ensure the attainment of sustainable and balanced urban development patterns. Having assessed the considerations to be taken into account when planning for sustainable development, and how to measure the achievement of sustainability and the dimensions that stem from the sustainability concept – it is now possible to reformulate these main stream discourses (dimensions) into more transformative ends – the interrelated components of the planning system. It is these components this chapter aims to assess and to assert whether and where integrated strategies can be connected to the planning system in operationalising strategy integration within the planning system. Figure 4.1 sets out the components covered by this chapter.

4.2 Transposing sustainability dimensions into components relevant to planning

To ensure that the Brundtland Commission's definition of sustainable development finds widespread acceptance it is both vague and simple enough to include a variety of divergent interest groups. Sustainable development is ascribed to by just about every single nation-state, irrespective of its democratic credentials, economic strength or political system. More fundamentally, sustainability has become the raison d'être and ideal of spatial development.

The source of this almost universal appeal can be found in the highly elastic core ideas that flow from the Brundtland definition. Underlying this definition is the assumption that balancing the three pillars of sustainable development – economic development, environmental integrity and social well-being is attainable and that sustainable development arises when economic, social and environmental objectives are realised simultaneously. This is not always possible and trade-offs become necessary primarily through political or institutional debate thereby adding a fourth component to the achievement of sustainability. Subsequently societies formulate development objectives and strategies that move the dimensions in the direction of partial or full overlap (integration) as illustrated in Figure 4.2 below.

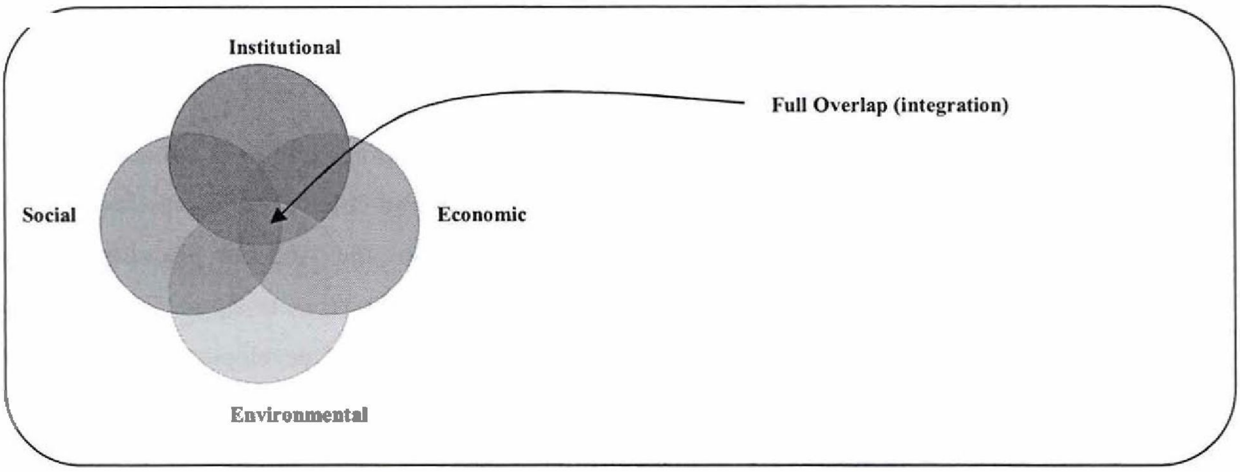


Figure 4.2 Dimensions of sustainable development achieving full overlap
Source: Author's own construction

Integrated strategies must encourage and facilitate the movement of the dimensions towards full overlap. By weaving together the dimensions, a consistent and concise decision framework can be formulated enabling sustainable development decisions to be made. To understand how these dimensions are related within the planning system it is necessary to reformulate them into more transformative ends. By transposing the dimensions the following interrelated components relevant to planning are identified:

- The planning system supported by an institutional framework that considers and promotes economic growth and social well-being
- The menu of policy instruments that helps attain sustainability and forms the underlying components of strategy integration
- The environmental management framework within which planning decisions are made
- The requirement of effective public participation reflecting the public mood and the sentiments of other stakeholders in the development process
- A funding framework
- An appraisal framework assessing the impact of proposed planning policies

By analysing each component and its contribution towards greater sustainability it is possible to assert an interface between the planning system, integrated strategies and the D.A.D.F. as a facilitating mechanism, thereby linking the integrated strategy concept (and D.A.D.F.) to the components of the planning system as a factor that helps decision-makers arrive at consistent and concise decisions about traffic congestion reduction.

4.3 The planning system

Planning systems, their procedures, the nature and the objective of sustainable development are inextricably linked and supported by institutional or administrative frameworks. They determine the location and form of development, the spatial distribution and intensity of activities as well as accessibility and connectivity between spatially dispersed land-uses. To understand the underlying links it is necessary to assess the role played by the administrative and institutional framework supporting planning systems and how it differs between developed and developing countries since ultimately it is responsible for the way in which different planning systems operate. The section also delves deeper to find a link between the local level implementation of spatial planning policies and plans and the implementation of Integrated Development Plans and Integrated Transport Plans as local level interventions, ultimately suggesting a plausible connection between IDP as a facilitator of integrated strategies in relieving traffic congestion. The sub-sections which follow assess these issues.

4.3.1 The institutional levels of planning

The administrative and institutional framework within which decision-makers and planners at all levels of governance operate is central to achieving and arriving at sustainable integrated planning. The administrative structure is typically characterised by a three-tier system of government (Banister, 1999:334). As illustrated in Figure 4.3 they are: (i) the national level (ii) state/regional/sub-regional/provincial/county level and (iii) the local level.

Administrative structure		**← Supporting mechanisms (Institutional tools)**			
Level of government	**Components relevant to planning and transport system**	**Legislation**	**Policy/Vision**	**Guidelines**	**Plans**
National	* Transport sector * Environment * Spatial Planning	National Transport/ Planning Act	White paper	National guideline	Strategic plans
Regional	* Development planning (LUM)	Ordinance	Regional policy	Structure planning	Regional spatial development framework
Local	* Economy * Housing and other sectors	Regulation	Local policy	Development planning	Integrated development plans Integrated Transport Plans

Vertical integration

Horizontal integration

Figure 4.3 A generalised administrative and institutional structure supporting planning

Source: Author's own construction

Policy and legislative frameworks (as horizontal dimensions of the planning system) are the support systems that allow the administrative structure to function, directing land-use, spatial and transport planning and other sectoral functions. They comprise elements such as:

- Acts that legislate planning
- Policies that provide direction to the planning process
- Guidance to the planning process and decision-making process
- Plans that embody and manage/direct spatial and land-use planning

The increased role of the private sector in dealing with transportation and land-use issues have often introduced added complexity into the institutional structure for decision-making, stressing the importance of having an effective institutional framework to co-ordinate and facilitate decisions being made. Because the cascading nature of policy-making often results in dispersed decision-making it is important that the institutional framework need to address and set out clearly arrangements for the relationships between various levels of government, as well as the structure for non-government, or statutory transport bodies (Bickerstaff et al., 2002:61,70-72).

Generally, co-ordination and policy integration is made easier within governments where development planning and transport planning are combined into a single department (May, 2003) as it helps to focus planning and aligns priorities. In practice however, the creation of transport authorities as autonomous bodies at arms length from municipal government has the disadvantage that it may make it more difficult to reconcile its own planning with development or spatial planning performed by the municipality. It would appear therefore as Brugmann (1996:373) suggests, that the success of strategy integration depends crucially on the success of maintaining strategic control over local development processes, co-ordination between the vertical levels of governance and the horizontal support systems associated with each level of the administrative structure.

More difficult to achieve is vertical cross-sectoral integration and co-ordination (May, 2003; May and Roberts, 1995:97; Hine, 2000; Hull, 2005 and Potter and Skinner, 2000:275). For plans, proposals and projects to further the objectives of sustainability - effective co-ordination, integration and decision-making is required:

- Within and between different types of transport
- Between transport and spatial planning
- Between transport and development planning
- Between environmental, economic and transport authorities and sectors

Integration between these levels of decision-making poses a challenge to many developing countries. The problem according to Baeten (2000) and Stead (2003) is the failure to elaborate precisely what role integration might play within a spatial planning and transport vision at local policy level and the absence of policy guidance. Hull (2005) argues that at the local or regional level, where the lack of a co-ordinated planning process for all transport (road and public transport), land-use, and environmental considerations are prevalent a segmented approach to policy-making may occur, preventing the development and implementation of comprehensive, integrated plans addressing all related aspects of urban travel. Against this background the next section assesses and compares the institutional structures in developed and developing countries.

4.3.2 Comparing institutional structures in developed and developing countries

Appendix 1 (see CD) illustrates key institutional and administrative structure features of 23 randomly selected developed and developing countries which are used to compare and identify interfaces, relationships, similarities and mutual problems and differences experienced in their respective structures.

The principle or theory of vertical consistency and its importance in urban development planning are well documented in the collaborative works of Burby and May (1997). They believe that vertical planning consistency and integration refers to the drafting of municipal plans and the implementing of local policies that are conceptually compatible with the goals and policies set forth in the plans and regulations of superior government levels. Experience from Denmark where larger scale plans bind smaller scale plans, vertical top-down planning system facilitates **vertical integration** and is a powerful and common instrument for integrating plans and planning activity. Another prime example of vertically integrated development planning and its role in strengthening the economic base of its cities is found in Japan (Jacobs, 2002:182).

It is important to emphasise that a central mechanism and requirement for promoting co-ordination and vertical integration is that all levels of government engage in development planning processes. International precedents such as the Netherlands, New Zealand, Australia and Japan show that successful co-ordination and integration of clearly allocated functions across the vertical levels of government is a key success factor in achieving positive planning outcomes. Co-operation and integration is required both between and within different levels of government. In Australia, Germany, the Netherlands and Ghana higher levels of administrative governance must approve plans produced at lower levels of administrative governance. The advantage of these planning systems is that they achieve "buy-in" and give the plan status. Another aspect of vertical integration is the power to "call-in" plans as necessary. This power, which allows higher levels of government to initiate reviews of plans and decisions adopted at lower levels exists, for example, in Denmark, Australia and New Zealand.

The review indicated that there are currently considerable problems in terms of vertical integration in many developing countries such as Ghana, Argentina, Indonesia and South Africa. The planning systems of India, Zimbabwe and the Philippines are examples of where smaller scale plans feed into larger plans, involving some type of consultation or participation and are designed to function from the bottom up. However the success of this approach in practice is not yet proven.

In terms of **horizontal integration** across different institutional tools and the promotion of horizontally consistent growth management planning, Japan is a pioneer (Jacobs, 2002:185). Effective horizontal integration ensures that cross and inter-sectoral integration also takes place. The analysis also suggests a good level of horizontal integration exists in all of the cited developed countries and in some developing countries such as Brazil, Canada, Poland and Malaysia.

In terms of **cross-sectoral integration** governments commonly divide levels of governance into units (departments) which have responsibilities over different sectors – housing, education, transport, land-use etc. One reason for this division is that the management of different sectors frequently requires specialist knowledge. While sectoral divisions are perhaps inevitable in order to deal with ongoing operational issues, the danger, particularly in relation to planning, is that different sectoral divisions pursue their own agendas without fully understanding the role of that sectoral element in the greater scheme of sectors and in the operation of the settlement as a whole.

From Appendix 1 it is seen that cross-sectoral integration characterised by multi-layered planning systems exists and initiatives have been applied to promote greater co-operation and integration as in New Zealand, Australia, Germany and the USA. Very little cross-sectoral integration is prevelant in the developing countries illustrated in Appendix 1, although there are some exceptions such as Canada and Poland. The development of a common definition of a problem and a vision about the way forward is essential in order to achieve integration. The emphasis should thus be on developing inter-disciplinary, as opposed to multi-disciplinary, approaches and inter-sectoral planning processes. (Inter-disciplinary approaches bring different sectoral knowledge to bear on a shared objective; multi-disciplinary approaches pursue their own sectoral objectives.)

In the state of New Jersey in the United States, neither lower nor higher levels of government can adopt cross sectoral plans until statutory procedures to ensure the mutual compatibility of both have been followed. This is perhaps the most advanced institutionalisation of the co-operation between state (or regional/provincial) planning on one side, and local planning on the other. The New Zealand Resource and Management Act of 1994 is one of the best known examples of legislation underpinning an integrated planning system. The Act creates a single planning process for a wide range of activities that in most countries are governed by separate, often contradictory, legislation and procedures. These include coastal management, hazardous substances, transport planning, soil conservation, water quality, natural hazards, historical places and many more. While having enormous and obvious advantages, it does not remove all the problems. One major difficulty in New Zealand, for example, is that the system prioritises environmental protection to the virtual exclusion of other vital settlement concerns.

In terms of the existence and application of **land-use and transport planning legislation, plans and guidelines,** legislation sets out the format of plans and procedures for decision-making. France, China, India and Ghana provide examples of this. The reverse is represented by countries such as Zimbabwe, Indonesia and Japan, which specify neither the form nor content of plans (Jacobs, 2002). There is a middle ground (for example, New Zealand and the UK) where legislation broadly outlines the processes and issues to be covered in different types of planning and plans, but leaves the plan structure to be determined by local agencies and authorities. Also, overriding national planning goals have an important role to play in directing planning procedures. The New Zealand Resource and Management Act is one example facilitating such directions. Similarly, Section 1 of the German Federal Building Code sets out a set of principles to guide spatial planning.

Co-ordination of legislation and co-ordination of physical planning with environmental planning is a problem in the Netherlands because attention to environmental aspects is limited by the rule that problems such as pollution and degradation should primarily be dealt with by powers created specifically for environmental policy, not spatial policy (Bouwer, 1994:108). In the United Kingdom and Germany there is a traditionally less strict distinction made between these two sectors. In the UK, the central concept of development in the Town and Country Planning Act also incorporates environmental aspects such as pollution. In the German planning system, environmental effects have to be taken into consideration in provincial and local land-use plans. A single law which incorporates all dimensions of spatial planning and which, particularly, integrates spatial planning, land-use planning, the environment and transportation, is an ideal situation. However co-ordination and integration of legislation remains inadequate in most developing countries and is problematic in some developed countries. Consolidation or integration between existing laws must be sought if a viable single law does not exist.

In terms of **control within the administration** Japan can best be characterized as a plan-rational, Unitary Developmental State, where authority is hierarchical and development decisions are made under the direction of the national government. Although Japan's central bureaucracy considers capitalism to be the best economic system, it does not feel comfortable leaving primary control of the development process to local governments and to the private sector. This is because it believes that a firm's quest to maximize profits and a municipality's desire to raise tax revenues can sometimes conflict with national development objectives. As a result, the national government guides corporate and local government decisions in a direction which they perceive will be in the best interest of workers, communities, and the nation as a whole (Hill & Fujita, 1995).

An essential element of effective planning is co-operative governance and integration between and within different levels of government and, where appropriate, legislative co-ordination and alignment of plans. Although attempts are being made in South Africa to align and integrate plans, policies and strategies across sectors dealing with planning and transport, this is still a problematic area which once remedied will pay a significant dividend, economically, socially and environmentally. Co-operative decision-making and co-ordination between levels of government is arguably the most powerful mechanism to promote co-operative governance. Decisions incorporated into regional and national plans should be made in conjunction with local authorities and provinces affected by those decisions. Local plans should in turn be informed by provincial and national priorities. There is clearly a lack of integration between public agencies and clarity about decision-making responsibilities in developing countries as suggested by Appendix 1.

In terms of **responsibility for local transport and traffic problems** Appendix 1 suggests that the planning roles and relationships between the levels of government in developing countries requires clarification. Most local transport and land-use regulatory and planning functions are executed at relevant Departments of Transport and Planning and private sector participation in some instances, as is the practice in developed countries. A major problem in developing countries is the lack of clarity about decision-making responsibilities between the levels of government.

In terms of **the mechanisms and level at which traffic congestion is actively tackled,** Appendix 1 suggests that dealing with traffic congestion and implementing preventative measures (if any) becomes the responsibility of local and regional transport and land-use planning authorities in both developed and developing countries. It is also apparent that plans and policies executed at local level deal specifically with, and are aimed at addressing local transport problems although regional and national plans and strategies inform and provide direction to local plans. Integrated Transport Plans (ITPs) provide direction when dealing with local and regional transport matters by setting out general transport strategies and proposals with due regard to Integrated Development Planning.

Where IDPs have been employed in both developing and developed countries, a balance of environmental, economic and social concerns and greater integration has been achieved between transport and land-use activities at local levels. In this sense it could be argued that IDPs have the potential of being coupled to congestion reduction proposals or plans as both have a local planning focus. In countries where stronger inter-sectoral co-operation and integration is of good quality and is effective such as in New Zealand, Australia, Japan and Germany, IDPs have a better chance of succeeding.

Although there is an obvious interface between IDPs (as an aggregate plan) and sectoral plans, no specific provisions are made within either IDPs or ITPs to tackle traffic congestion via "Traffic Congestion Management Plans" *per se* or to integrate TDM, TSM and LUM specifically for this purpose. To this end the following sections evaluate IDPs and ITPs in the South African context more closely in order to identify which should be linked to integrated strategies aimed at traffic congestion reduction and which is more appropriate to position the T.C.M.P. within.

4.3.3 The Integrated Development Plan

4.3.3.1 History and early origins of IDP

The IDP concept has been developed over a long period of time, involving the recycling and combination of old and new concepts and fragments of concepts, within an ever changing social and political context. The origins of IDP (although the terminology differs between countries) can be traced back to the early 1950s when cities across the developing and developed world experienced rapid growth resulting from the migration of people and the demand for regeneration of economies following the Second World War. This presented circumstances that demanded effective city planning in areas ranging from social services, housing and sanitation, to the environment and transport. Internationally, planning was shifting away from the ad hoc project based or strictly sectoral approaches associated with the 1980s towards more strategic and integrated forms aimed at enhanced sustainability.

Across the nations including South Africa, IDPs share striking similarities across a range of international ideas and practices, as well as some of the recent planning ideas such as the new realism in transport that have emerged from the UK government; the concept of integrated planning and performance monitoring promoted in New Zealand (McKinlay Douglas Ltd, 2000); the integrated regional policy of Switzerland (Thierstein and Egger, 1998); integrated area planning in Europe (Moulaert, 1999) and the multi-sectoral investment planning promoted by the United Nations Development Programme (UNDP) (Singh et al., 1996).

In Brazil, Curitiba is a world class example of a city which benefits from integrated development planning, today boasting a transportation system having its origin in the late 1960s and early 1970s (Rabinovitch, 1996). A key to Curitiba's success is found in its approach to planning. Instead of succumbing to the demands of the growing population and addressing transportation as a service that caters to such an ever prevalent and pressing demand, they essentially planned their transport system with the intention of dictating spatial planning and the growth of the city thereby influencing effective accessibility and controlling sprawl much like the implementation of Smart Growth principles at local level in the USA. In this way transport planning leads spatial planning.

The most obvious agents influencing planning in South Africa (post Apartheid) include the German Agency for Technical Co-operation (GTZ), the World Bank's Urban Sector Missions to South Africa, foreign consultants and international tours undertaken by senior officials and politicians in South Africa's new government to countries including Zimbabwe, Brazil, Malaysia, Poland, Canada and the Philippines.

Of the multiple ideas and practices underpinning the South African IDP, the most important include (1) new public management practices (2) historical and contemporary ideas and influences from the UK and USA about integration within South African planning processes and (3) the assimilation of ideas associated with development and development planning from its allies in the developed and developing world.

Following the 1994 election in South Africa, the government set up the RDP (Reconstruction and Development Programme) Office to co-ordinate the actions of the various sectoral and provincial ministries involved with the delivery of the RDP programme. The RDP Office was instrumental in setting up an intergovernmental committee known as the Forum for Effective Planning and Development, which worked towards the conceptualisation of a national system of IDP that would align different planning and development processes from different levels of government in a single co-ordinated framework.

South Africa's 1996 Constitution cleared the way for a fundamental transformation and reconstruction of Local Government and identified the need to address the high level of fragmentation in governance caused by Apartheid, and the problems associated with status, finance, capacity and legitimacy. In an attempt to facilitate restructuring, the Integrated Development Plan (IDP) was introduced in 1996 by the amendment to the LGTA and was intended as an instrument to assist Local Authorities in the transformation and in fulfilment of the objectives of the RDP. The alignment and transformation of national provincial plans and programmes and their citing within the IDP were carefully negotiated although little clarity existed about what the IDP should contain or how it should be prepared. There was also continued confusion about the relationships between the IDP and Land Development Objectives (LDO) and between the IDP and sectoral planning processes (Pycroft, 1998:152).

Finally the Municipal Structures Act of 2000 clarified the misconceptions and perhaps confusion in the form of guidance and a framework for integrated development plans for all local municipalities and district municipalities with the responsibility for integrated development planning. The guidance is meant to cover all aspects of the IDP, including its methodology, institutional organisation, the form of public participation and the way cross-cutting issues can be incorporated into planning.

4.3.3.2 The purpose and context of an IDP

According to the Education and Training Unit (2006) an Integrated Development Plan is "a super plan for an area that gives an overall framework for development". It aims to co-ordinate the work of local and other levels of government in a coherent plan to improve the quality of life for all the people living in an area. It also takes into account the existing conditions and problems and resources available for development and assesses economic and social development options for the area as a whole. It must set a framework for how land should be used, what infrastructure and services are needed and how the environment should be protected. The IDP as envisaged by South Africa is a strategic managerial tool with direct local application that co-ordinates and aligns many sectoral functions within the local municipal landscape.

Sowman (2002:844) suggests that IDPs aim to achieve integrated territorial development as a resurgence of 'bottom-up' regional planning from the 1980s, coupled with initiatives towards decentralization. Hardy & Lloyd (1994) and Clement & Hansen (2001) have also highlighted the potential of an IDP in regional planning, with its emphasis on contextually specific development strategies that bring together economic, social and ecological concerns and promote sustainable development. An IDP has a strategic position within regional planning since it encapsulates environmental, social and economic factors as cross-cutting concerns in policy.

It is therefore possible within the IDP to formulate a single programme that brings together "various sectoral actions into a sustainable integrated spatial development process" as Roberts & Colwell (2001:435) and Todes (2004) argue. Clearly IDPs have a number of key functions as summarised in the text box below:

- Provides long-term vision for the development of a locality
- IDP promotes "a local, informed and participatory process, which seeks a balance between economic, ecological and social sustainability"
- Territorial integrated development planning is seen as a way of addressing poverty, environmental issues, economic and social development (Dabholkar, 2001)
- IDPs are key tools for developmental local government and a central function for the decision-making process of municipal and district councils, rather than a sectoral function of spatial planning departments
- IDPs are intended to be holistic multi-sectoral plans, which guide the future development of the locality, giving direction to both the municipality and other spheres of government operating in the area
- IDPs set out the basic guidelines for land-use management systems and contain expenditure priorities
- Both legislation and guide material on IDPs suggest that they should contribute to sustainable development (Coetzee, 2002)
- Link and coordinate the various sectorally-based plans, strategies and projects relating to the locality

South Africa's IDPs reflect an interest in multi-sectoral, integrated, bottom-up approaches to local and regional development, associated with new forms of governance based on participatory approaches and high levels of decentralization (Todes, 2004:849). The South African IDP is a five-year strategic development plan for a municipality and district municipality that involves the entire municipality and its citizens in finding the best solutions in order to achieve good long-term development. It is legislated by the Municipal Systems Act 2000 (MSA) and supersedes all other plans that guide development at a local level. In line with the National Department of Provincial and Local Government (DPLG) and the MSA (Municipal Systems Act 2000), the IDP approach has to conform to specific methodological principles. It has to reflect the priority needs of the municipality and its residents and ensure that available resources are used in an objective manner.

In this way the IDP seeks to position local authorities at the centre of a complex matrix of organisations operating within its area of jurisdiction, where they will take responsibility for managing both horizontal and vertical dimensions of integration. IDP has become one of the key tools used by the local or regional government across several developing and developed countries to tackle developmental objectives. In Curitiba (Brazil), The British Virgin Islands, India, New Zealand, Tibet, Malaysia, South Australia and Poland integrated plans such as those being developed in South Africa are seen as an integral part of the business plan of the municipality and its statutory functions and they aim to integrate the different sectors of service provision within the municipality. Integrated planning is no longer a sole plan of the planning department; it is designed to deal with environmental issues, together with social and economic issues, in an integrated manner across all relevant sectors of governance and decision-making.

4.3.3.3 IDPs relationship and alignment to other plans in South Africa

Next, the question arises as to how to link TDM, TSM and LUM measures to IDP. Assessing the South African IDP as an example of a developing country IDP, it is possible to infer that it provides alignment instruments that connect strategic plans to separate sectorally based plans such as Transport, Environmental Mangement and other planning processes. At face value the role of the IDP seems relatively uncomplicated, but there are ambiguities in the conceptualisation of the IDP that relate to the politics of its creation and to the more general ambiguities surrounding the role of Local Government in South Africa. Figure 4.4 illustrates general components of the South African planning system and where the IDP is positioned.

It illustrates that a profoundly complex aspect of urban integration in South Africa is the fact that both sectoral and multi-sectoral interventions must occur simultaneously at various scales in the city. Furthermore, the interventions at these various levels and dimensions must also be consistent and enhance greater synergy across the whole urban system while accommodating the requirements of national government departments. This requires immensely sophisticated institutional systems to ensure information flows and organisational alignment between municipal departments, between local and other spheres of government, between government and civil society organisations, and of course, between government and private sector initiatives.

Spatial development frameworks can potentially ease this task by providing an accessible and graphic 'language' to talk about sequencing, co-ordination and integration of disparate efforts. The imperative that sectoral, multi-sectoral and spatial plans hang together in the IDP is crucial. In this sense, the IDP can also be seen as an aggregate framework that provides a consistent and politically situated rationale for the way in which numerous development efforts hang together moving the city towards less fragmentation and more integration. However, for the IDP to succeed in this way, what is needed is a razor-sharp understanding of politics, political accountability frameworks and the underlying issue of institutional effectiveness.

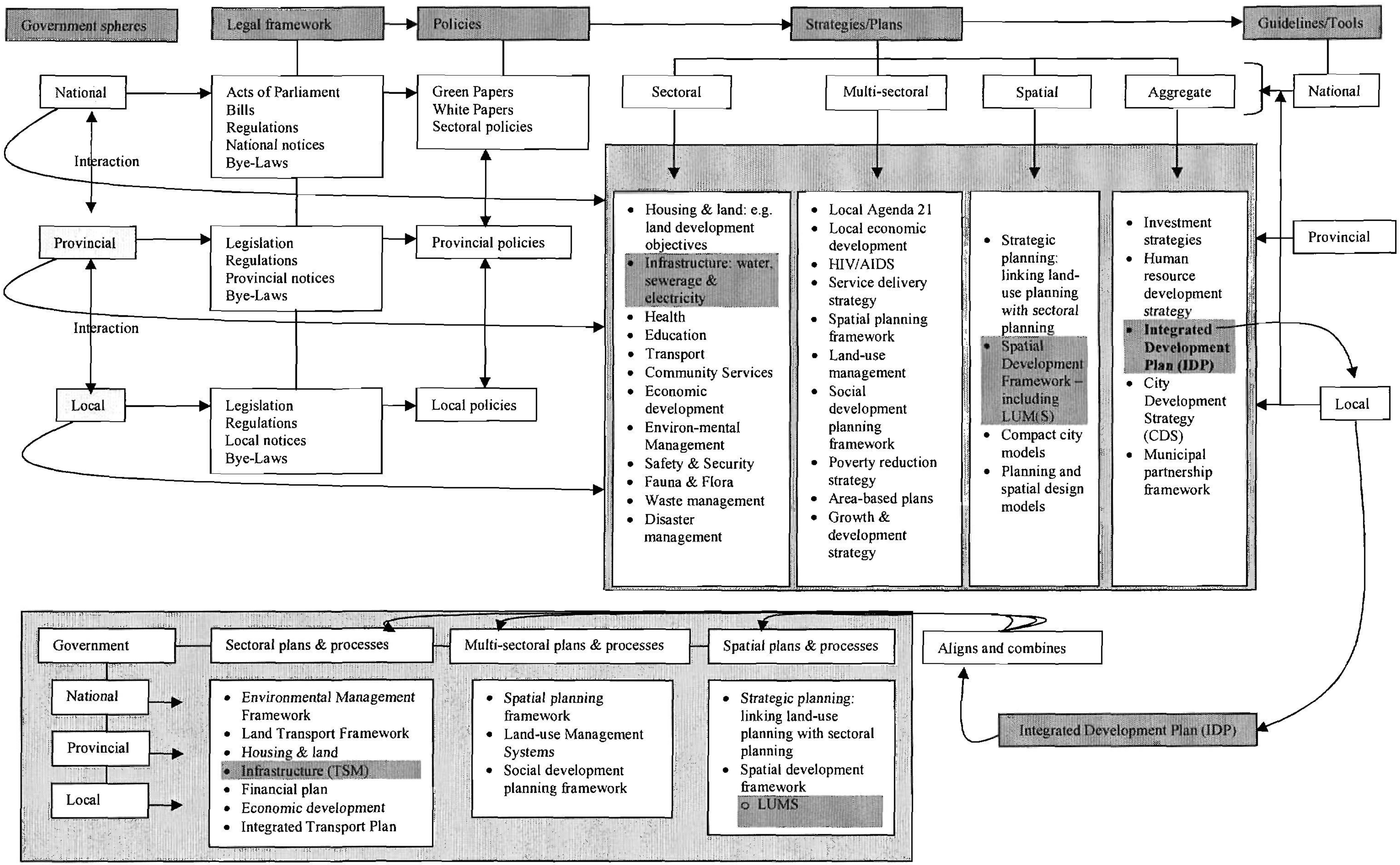


Figure 4.4 General components of the South African planning system

Source: Author's own construction

Currently the South African IDP includes Environmental Management, Sectoral plans, Spatial Planning and Land-Use Management elements and it is possible to identify a direct connection between sectoral plans and TSM and TDM, and between Spatial Planning and LUM as illustrated by Figure 4.5. And so it possible to assert that integrated strategies aimed at traffic congestion reduction has the scope to be assimilated into the IDP process thereby forcing an interface between TSM (an Infrastructure sector provided function), LUM (implemented within Spatial Development Frameworks) and TDM (to be facilitated by the Transport sector) in the form of a "Traffic Congestion Management Plan" proposed by the author.

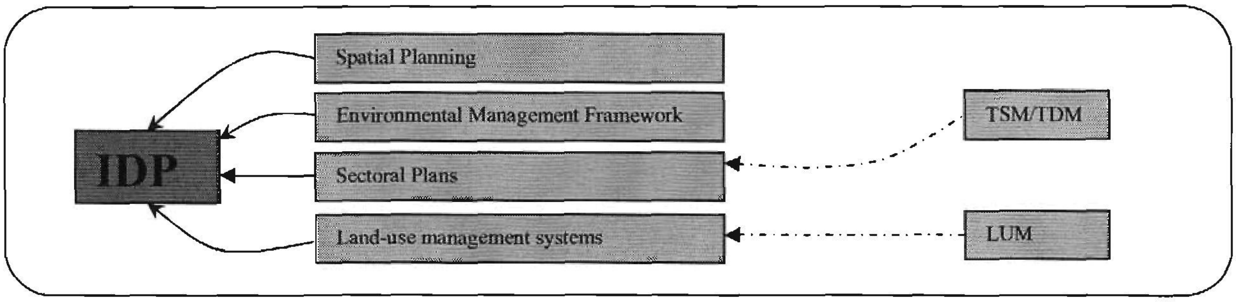


Figure 4.5 Components of IDP relevant to traffic congestion reduction and its link to TDM, TSM and LUM **Source**: Author's own construction

For the purpose of promoting greater integration between the different components of the IDP whilst focusing on traffic congestion reduction it is necessary to weave together elements of the various components illustrated in Figure 4.6 to produce a Traffic Congestion Management Plan that facilitates or operationalises as a product, integrated strategies once they have been developed through the proposed D.A.D.F. In this way the IDP not only pulls together all sectors of government involved in development, but has a direct tool to be used at local level when addressing traffic congestion at source.

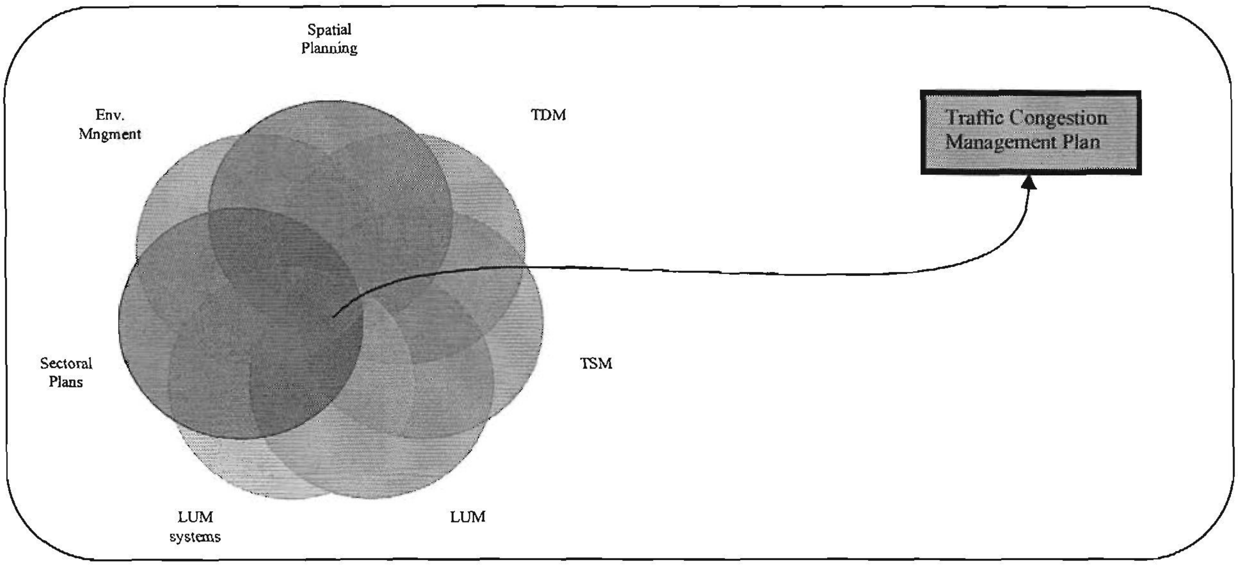


Figure 4.6 Weaving together the components of IDP, TDM, TSM and LUM forging a Traffic Congestion Management Plan **Source**: Author's own construction

When such a Traffic Congestion Management Plan is assimilated into an IDP, the components of the planning process aimed at traffic congestion reduction may greatly benefit from increased interaction across all levels of governance and tiers of planning. The resulting IDP process may then, simplistically, comprise the elements illustrated in Figure 4.7 below. **This potential interface and connection must be verified at empirical level in assessing its merits as well as the relevant levels of governance within which identified strategies aimed at congestion reduction must be positioned.**

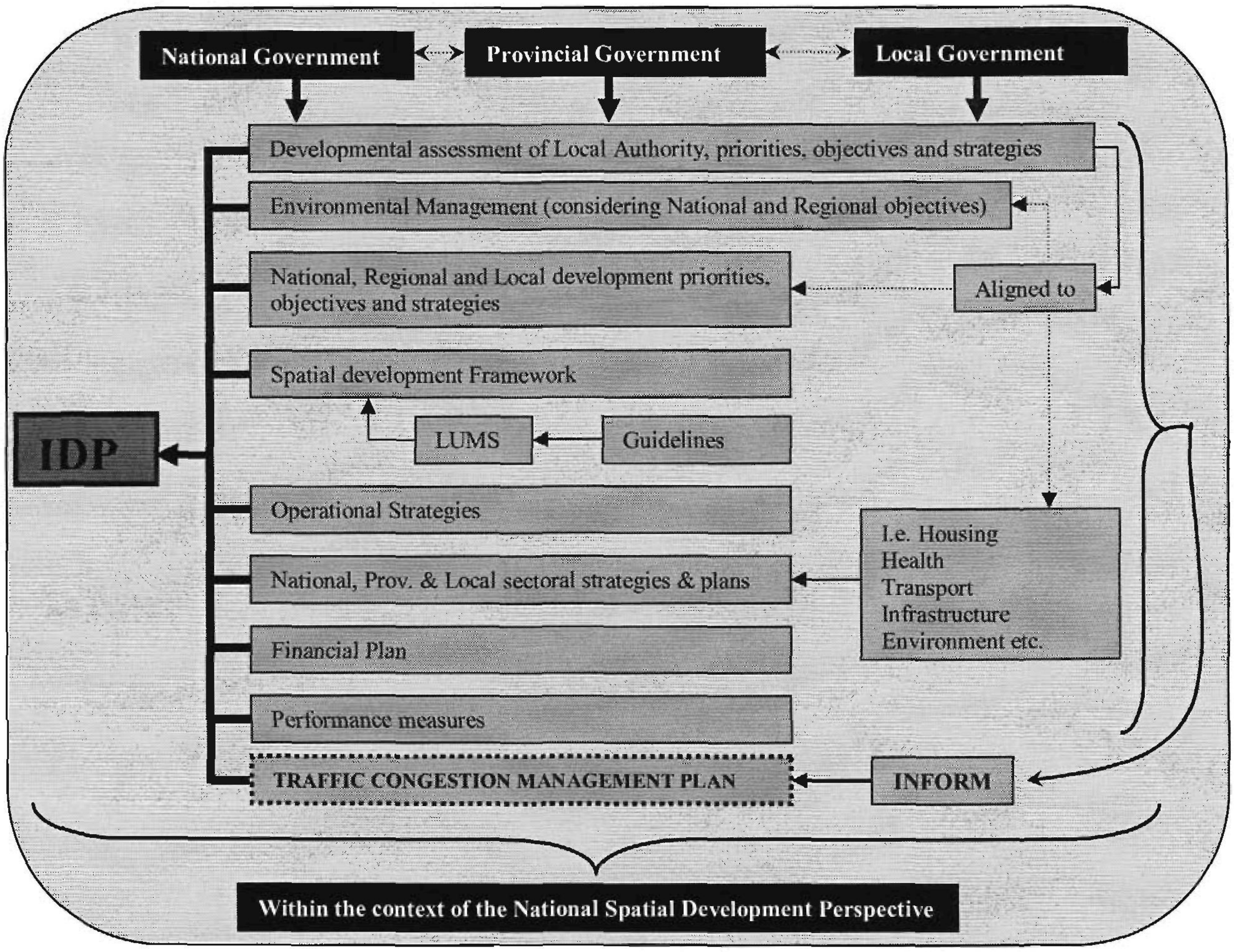


Figure 4.7 Positioning a Traffic Congestion Management Plan within the IDP process

Source: Author's own construction

4.3.4 The Integrated Transport Plan

4.3.4.1 Purpose and relationship to other plans in South Africa

In South Africa the requirement for an Integrated Transport Plan (ITP) is legislated by the National Land Transport Transition Act 2000 (Act 22 of 2000). As a 5 year plan the ITP details the land transport planning authority's vision, policy objectives, principles, transport needs, strategies and proposals which must be consistent with national and provincial policies. Its purpose is to provide an efficient transportation system with due regard to relevant Integrated Development Planning and land development objectives. The ITPs' relationship to other plans in South African planning is illustrated by Figure 4.4. It shows that an ITP is a sectoral plan situated within the Transport Sector.

4.3.4.2 Approach

The National Land Transport Transition Act 2000 requires the preparation of three types of ITP depending on the category of planning authority as agreed by the MEC and / or Minister, being a Comprehensive Integrated Transport Plan (CITP), a District Integrated Transport Plan (DITP) and a Local Integrated Transport Plan (LITP). CITPs and DITPs must contain a long term component, which identifies the long term vision and objectives for the transport system in the region and the strategy for developing the transport system over time to achieve the set objectives. The long term strategy can, however, only be achieved over the long run and in an incremental fashion and therefore CITPs and DITPs include annual action plans specifying the projects to be implemented. Local planning authorities may prepare Comprehensive Integrated Transport Plans if they so wish, provided that the costs are justified by the transport situation in the area. There is however no requirement to set out long term strategies.

The primary focus of ITPs is on developing strategies aimed at non-motorised transport and the enhancement of the public transport infrastructure and services to connect people and places in a sustainable and cost effective manner. This is to be achieved by balancing transport needs, managing transport demand and supply and meeting spatial development objectives.

4.3.4.3 ITP framework

Given the approach of the ITP as outlined above, the Department of Transport (2007) has set out the minimum requirements for the content / framework of the ITP and its preparation and specifies that it must include the following elements:

- the changes to the planning authority's land transport policies and strategies since the previous year's five-year plan
- the projects and project segments to be carried out in that five-year period, and the cost of each project
- consideration to relevant IDPs and land development objectives set in terms of section 27 of the Development Facilitation Act 1995 (Act No. 67 of 1995) or, where applicable, in terms of a law of the province
- all modes and infrastructure, including new or amended roads and commercial developments having an impact on the land transport system, and land transport aspects of airports and harbours
- the planning authority's detailed budget, including funding sources, with regard to land transport for the relevant financial year in the format prescribed by the MEC

- the planning authority's public transport plan
- a general strategy for travel demand management
- a road and transport infrastructure provision, improvement and maintenance strategy
- a general strategy or plan for the movement of hazardous substances contemplated in section 2(1) of the Hazardous Substances Act 1973 (Act No. 15 of 1973) by road along designated routes, in accordance with the strategy or plan in the provincial transport framework contemplated in section 22(3)(l)

Figure 4.8 illustrates the minimum contents of a CITP.

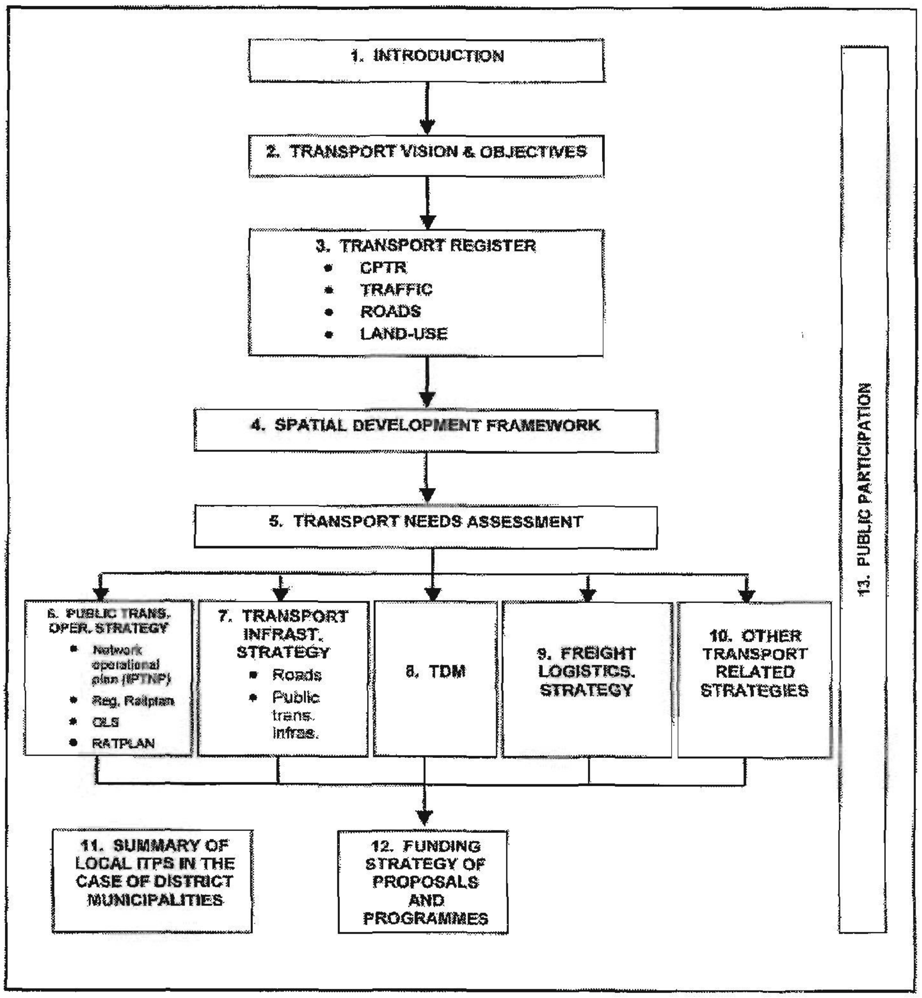


Figure 4.8 Minimum contents of a CITP

Source: Department of Transport (2007)

Figure 4.8 shows how a CITP is structured to integrate various transport components to deliver strategies, proposals and programmes that will deliver integrated transport planning across all modes of transport. By nature of its underlying components it is possible to link ITPs to integrated strategies aimed at traffic congestion reduction. However as seen from section 4.3.3, IDPs clearly have different functions than ITPs, comprise a wider range of components and focus at a higher / strategic level of integration. ITPs do not cover the full spectrum of strategic input as IDPs, do not consider economic growth and development strategies, environmental management strategies and housing strategies to the same extent as IDPs and neither plan sets a requirement to implement a T.C.M.P.

Against this background and for the purpose of promoting greater strategy integration in the context of a T.C.M.P. the author considers it more appropriate to position the T.C.M.P. within an IDP as aggregate plan than an ITP as sectoral plan. This is because the development of integrated strategies using the D.A.D.F. spans across a wider and more inclusive horizon of inputs than that offered by an ITP. The potential interface and appropriateness of positioning the T.C.M.P. within an ITP will therefore not be verified at empirical level. Given the underling elements of an ITP the proposed D.A.D.F. and T.C.M.P. will however play an important role in informing and supporting the ITP process.

4.4 Menu of policy instruments

Policy instruments are the tools used to overcome problems and achieve objectives as the mechanisms which policy makers and planners use in order to further an overall policy. Whether they follow a plan-led, vision-led or consensus-led approach to decision-making, policy-makers and planners have a large number of policy measures available to them to assist in the pursuit of their overall transport and land-use strategy. This can be advantageous in that it provides a high degree of choice and flexibility, although the sheer scale of choice and flexibility might be overwhelming.

However, cities will rarely consider that they require the full range of policy measures available to them. As Geerlings and Stead (2003:187) suggest this is the fundamental problem – having preconceived ideas of what instruments may or may not work before considering the full range. It is difficult in the absence of clear guidance on the issue of policy integration to select instruments appropriate to prevailing circumstances which are best suited to specific local traffic and transport conditions.

In developing an integrated strategy, the decision-maker has various sources available to him/her. For simplicity the sources are categorised into 3 groups as follows (i) **policy instruments** selected from TDM, TSM and LUM measures (ii) **the public**, if consulted at an early stage, will provide useful local knowledge and ideas and (iii) **ideas** considered previously may be reviewed to check whether any of the proposals discarded in the past may now be worth considering. With this in mind, section 4.4 aims to:

- Identify the full range of TDM, TSM and LUM measures available and their likely effects, and provide references to particular sources of such evidence
- Explore the circumstances that should prevail in an urban area experiencing traffic congestion, warranting specific types of intervention in deciding between alternative instruments
- Determine the relationship between the development stage of a country and the most effective and applicable intervention instruments

Implemented policy measures will impact on the urban area in which they have been put to use and it is quite possible that there will be a unique reaction to them (Robert et al., 2002:197). It is important to consider the effects of every measure as part of the decision-making process, as in essence it is the effects of each measure that influences driver behaviour, generalised cost, trip characteristics and ultimately congestion levels. Appendix 2 (see CD) explains the types of effects associated with the implementation of TDM, TSM and LUM measures. In recognising these effects it is important to identify the TDM, TSM and LUM measures with a successful track record in reducing traffic congestion.

4.4.1 The Full Range of Policy Measures

4.4.1.1 Land-use measures

O'Flaherty (2005:255) notes that trip-making patterns, volumes and modal distributions are largely a function of the spatial distribution and use of land. Thus, at individual development sites, exercising control over the trip generating characteristics of the land-use function (e.g. development density) can be used to make the resulting demand consistent with existing transportation infrastructure and the level of service desired. To this end, Table 4.1 shows the land-use measures that have been considered in several metropolitan areas to manage and direct urban growth. In alleviating future congestion it is therefore essential that these measures be considered when developing integrated strategies influencing spatial planning in conjunction with strategic planning of transportation services to help determine where development occurs.

Table 4.1 Land-use measures

LUM Measures
Development densities - involving an increase in density of development throughout an area to reduce the need to travel
Development patterns - including transport corridor-based developments designed to encourage provision and use of public transport
Development mix - in which homes, jobs and shops are placed close together, thus reducing the need to travel
Development conditions - such as parking standards for new development
Commuted payments, whereby developers can provide less parking but pay for public space
Developer contributions to the financing of transport infrastructure for new developments
Value capture taxes, designed to reflect the windfall benefits to existing developments from improved accessibility
Land-use taxes - including property taxes.
Company travel plans
Changes in business taxes
Location relative to public transport
Infilling and control of peripheral development
Smart Growth
Street reclaiming
Clustered land-use
Location efficient development – such as development that maximizes multi-modal accessibility
Car-free planning
Taxation policy

Sources: Meyer (1997), Victoria transport policy institute (2005), Department for Transport (2004b & d), May et al. (1995) and Potter and Skinner (2000)

4.4.1.2 Transportation supply measures

Supply managing the transportation system by adding new capacity or making operational changes to improve system performance has been the most common response to transport and congestion related problems for many years (O'Flaherty, 2005:57; Gakenheimer, 1999:672; Cracknell, 2000). Table 4.2 illustrates TSM measures categorised by target group. Inevitably, where new capacity is continually added to accommodate increasing demand to reduce congestion levels, a continued reliance on the private car will be fostered, which in turn gives rise to induced traffic, sometimes nullifying the increased capacity and having serious implications on the urban mobility options available in a region (Cervero, 2003:145). However, on the positive side, additional capacity improvements to accommodate public transport facilities may help alleviate the congestion problem, but the construction of these actions can be very costly and may be met with strong public opposition if funded through the public purse.

Table 4.2 Transportation supply measures

TSM Measures to get the most out of existing infrastructure	**TSM Measures to influence public transport use**
Incident detection and management systems	Upgrades to existing fixed infrastructure
Ramp metering	New rail or bus stations, terminals and interchanges
Highway Information Systems	New rail or light rail lines
Providing additional lanes without widening the freeway	New rail services on existing lines Fixed route and express bus services
HOV facilities	Provision of guide busses
Park and Ride facilities	Park and ride
Street design – (i) super street arterials (ii) intersection improvements (iii) one way streets (iv) reversible traffic lanes (v) arterial access management (vi) streets space management (vii) traffic calming and (viii) alteration of geometrical features	Terminals and interchanges
Traffic engineering – (i) Traffic signal improvements (ii) Interconnected and adaptive signal systems (iii) Arterial surveillance (iv) Turn prohibitions and (v) Improved traffic control devices	Light rail systems
	Bus priorities
	High occupancy vehicle (HOV) lanes
TSM Measures to influence car use	Timetabling strategies, such as regular "clock-face" departure times and simple (e.g. 10 minute headways)
	Bus service management measures designed to improve reliability
New road construction (grade separation, geometric design)	Access management
New off-street parking	Shuttle services
New car parks	
Parking controls, including controls on duration, entry times and designated users	**TSM Measures for cyclists and pedestrians**
Road maintenance and improvements	
Road space re-allocation	Cycle lanes and priorities
Conventional traffic management	Cycle parking provision
Conventional speed controls and restrictions	Cycle facilities
Urban traffic control (UTC) systems	Pedestrian crossing facilities
Intelligent Transport Systems (ITS), which use new technology to improve the performance of the road network	Pedestrian areas
Accident remedial measures	Safe routes to school
Traffic calming measures – relates to design features such as	

roundabouts instead of stop signs	
Traffic restraint measures – such as segregation and integration	**TSM Provision for freight**
Access control or management	
Multi-modal transport stops and interchanges	Lorry parks
Smart Growth	Transhipment facilities
Reversible lanes	
Physical restrictions	

Sources: Meyer (1997), Victoria Transport Policy Institute (2005), Department for Transport (2004b & d), May et al. (1995) and Potter and Skinner (2000)

4.4.1.3 Demand management measures

Another element to be assimilated into a congestion reduction strategy is that of including TDM measures such as those illustrated in Table 4.3 below.

Table 4.3 Demand management measures

TDM Measures to influence car use	**TDM Measures to influence public transport use**
Regulatory restrictions	Fare levels
Car sharing	Fare structures, such as flat fares, zonal fares and monthly passes
Parking charges	High occupancy vehicle (HOV) lanes
Charges for ownership of private parking space	Integrated ticketing systems
Urban road charging, including area licensing and road pricing	Concessionary fares, which are lower for identified groups of users such as elderly people
Fuel taxes	Changes in bus and rail frequencies
Vehicle ownership taxes	Targeted assistance for specific income groups
Company car taxation	General subsidies for specific income groups
Public car park management	
Workplace parking charges	**TDM Measures for cyclists and pedestrians**
Commute trip reduction programs	
Car restriction zones	Cycle lane regulations
Toll roads	Bicycle and public transport integration
TDM Information provision	**TDM Provision for freight**
Conventional direction signing	Lorry routes and lane bans
Variable message signs	Lorry parking and loading restrictions
Real-time driver information systems and route guidance	
Parking guidance and information systems.	
Public transport timetable information	
Trip planning systems which provide information on alternatives before the start of the journey	

Sources: Meyer (1997), Victoria transport policy institute (2005), Department for Transport (2004b & d), May et al. (1995), Potter and Skinner (2000), Bell (1995:2), Seik (1997, 1998, 2000), Goh (2002:29) and Dahlgren (1998:99)

Managing transportation demand in its broadest sense suggests implementing any action or set of actions intended to influence intensity, timing and spatial distribution of transportation demand for the purpose of reducing the impact of traffic- resulting in more efficient use of transportation resources (Victoria Transport Policy Institute, 2005).

Research by May (2004:79) and Seik (1998:27) suggests that well-conceived and aggressively promoted demand reduction programmes can indeed decrease peak period traffic in many cities by as much as 10 – 15%. One should be careful to understand the limitations of this technique though. Demand reduction efforts, unless undertaken on a truly massive scale, can have only a local impact in relieving spot congestion and subsequently they will not appreciably reduce traffic on highways and major arterials. The major barrier to the success of demand management strategies is that they require an adjustment in the lifestyles of travellers and the requirements of employers (Meyer, 1997:13). Flexible scheduling is simply not possible for a large number of workers, which limits the effectiveness of TDM strategies. In formulating integrated strategies it will be imperative to undertake thorough public consultation when TDM measures are considered for implementation.

Having identified various TDM, TSM and LUM measures as components to be considered in integrated strategies it is necessary to empirically verify which of the measures are most commonly associated with implementation aimed at traffic congestion reduction.

4.4.2 Identifying location specific measures

A key research objective is that of exploring the circumstances that should prevail in an urban area experiencing traffic congestion, warranting specific types of intervention in deciding between alternative measures. This is critical to developing integrated strategies that have the ability to manage traffic congestion at specific locations, whilst encouraging sustainable development. The obvious question that follows is "how is this to be achieved?" Work carried out by Grubler and Nakicenovic (1991) and Masser et al. (1992b) provides some insight into how such a problem may be approached. They suggest applying a compound behavioural framing approach to structuring the context of the area planned for. The analogy that follows is that the context, described by a scenario (using exogenous variables) will provide the premise for assessing the suitability of various measures. Unfortunately, Grubler and Nakicenovic (1991) and Masser et al. (1992b) have not identified the means, indicators, standards or guidelines required to asses the effectiveness and suitability of each measure. In fact very little theory exists in identifying or agreeing on these key components. As Jones and Lucas (2000:185) note, the principal obstacle in exploring the prevailing circumstances, warranting specific types of intervention is exactly the many location specific circumstances and human behavioural related movements that are customarily found at each and every individual settlement.

There is no "quick fix solution" when it comes to identifying the right mix of measures in this regard. In order to identify the policy instruments, which may positively or negatively influence the achievement of different transport policy objectives in specific locations, Jones (2004) suggests employing a "measures-objective tool". Developing such a tool will allow the decision-maker to score and weigh each measure, using MCA (Multi-Criteria Analysis) in order to decide between the measures and rank them in terms of locality specific suitability. The principle behind this argument is that a "measures-objective tool" is capable of relating the three broad categories of LUM, TSM and TDM measures to a set of transport and land-use policy objectives aimed at sustainability and strategy integration whilst considering their impacts, as simplified by the illustration presented in Figure 4.9.

According to Jones (2004) the objectives are grouped into categories and sets of criteria and indicators measure the extent (or performance) to which the measures will contribute to the achievement of the specific objectives by asking 5 specific underlying questions (shown in the figure). Once performance scores have been calculated they will show which measures achieve the desired policy objectives more effectively than others.

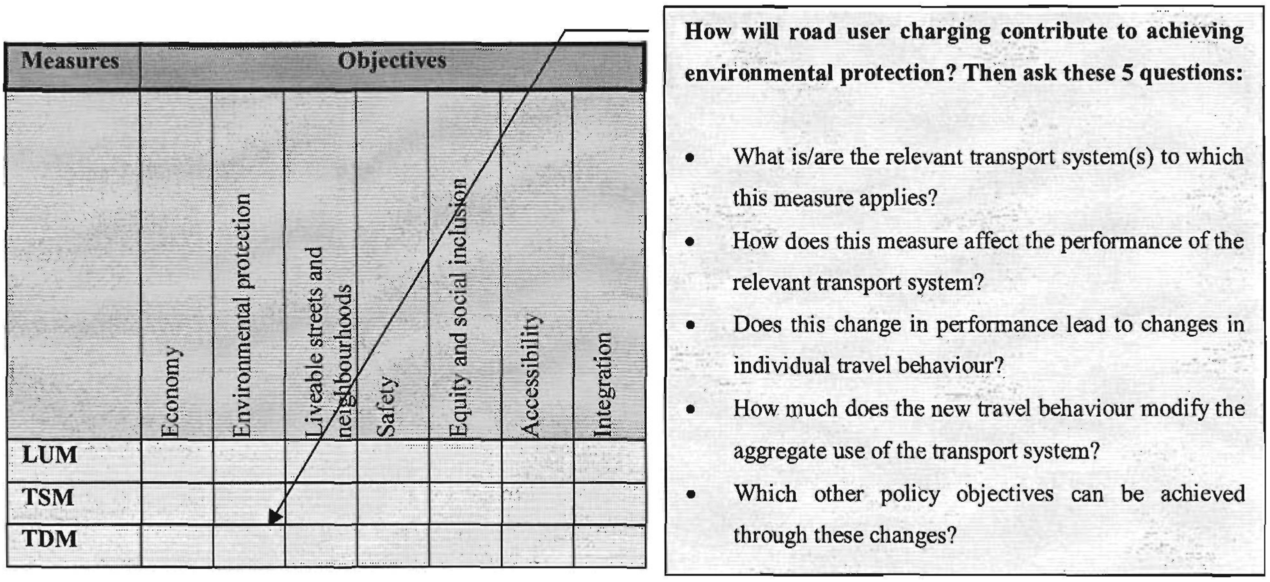


Figure 4.9 Measures-objective tool
Source: Author's own construction

The argument presented by Jones (2004) provides further scope for refinement as it does not allow the decision-maker to select a range of measures tailor made or suitable to specific locations and circumstances. In order to further the critical evaluation of the concepts and views regarding the issue, one has to take a few steps back and revisit Chapter 3, where paragraph 3.4.5 discussed the role of scenarios in describing the context or circumstances within which strategies are likely to operate. It reported that amongst others, variables exogenous to the transport system have the ability to describe the "context" or scenario much like Grubler and Nakicenovic (1991) and Masser et al. (1992b) in their argument about compound behavioural framing. Paragraph 3.4.5 went on to list such variables, but warned that it should not be regarded as exhaustive and that it requires empirical testing to ascertain whether those listed may indeed describe any scenario satisfactorily. Not withstanding this warning, a certain type of logic has to be established or adopted in making the connection between identifying sustainable TDM, TSM and LUM measures for prevailing conditions and employing exogenous and endogenous variables describing the context within which the measures will operate. Following rational induction from what has been gathered above it is possible to assume that:

- Variables exogenous and also those endogenous to the transport system have the ability to describe and reflect local circumstances and conditions
- Exogenous and endogenous variables may be employed to assess the extent to which policy measures meet sustainability objectives using Multi-Criteria Analysis (MCA) methods (Department of the Environment, Transport and the Regions, 2003b:22) because the exogenous and endogenous variables describe local conditions
- Measurement can be facilitated using guidelines and technical considerations which assess the extent to which policy measures contribute to achieving sustainability objectives much like the criteria and indicators used in MCA assessing the extent to which policy measures contribute to achieving predetermined objectives. To this end Table 4.4 below lists exogenous and endogenous variables being qualified and/or quantified by relevant cited guidelines and technical considerations enabling their use for measurement purposes
- MCA methods also indicate that by assigning weights to guidelines and technical considerations (following a process similar to assigning weights to criteria and indicators) and by further dividing them into categories, the selection of the appropriate weighted guideline and technical consideration category best describing the local conditions enables the decision-maker to assess the extent to which the measures contribute to the sustainability objectives based on local conditions
- Thus, measures are chosen based on the circumstances for which they are suitable

Table 4.4 Exogenous and endogenous variables and their respective guidelines and technical considerations

Exogenous variables	**Guideline/Technical considerations**	**Endogenous variables**	**Guideline/Technical considerations**
Economic		**Environment**	
Economic growth	GDP per capita high > 6.1%	Noise	Reduction
	GDP per capita medium 2.1-6%		No change
	GDP per capita high low 0-2%		Increase
Employment	Employment coefficient 0.7-1.0	Air Quality	Reduction
	Employment coefficient 0.3-0.69		No change
	Employment coefficient 0.0-2.99		Increase
	Employment rate 90-100%		
	Employment rate 80-89.9%	Biodiversity	Reduction
	Employment rate 70-79.9%		No change
	Employment rate 60-69.9%		Increase
	Employment rate < 59.9%		
		Journey Ambience	Reduced stress level
Price stability	CPI high		No change in stress level

	CPI medium		Increased stress level
	CPI low		
	PPI high	Accidents	Reduction
	PPI medium		No change
	PPI low		Increase
Balance of payment stability	Highly stable	Security	Reduction
	Stable		No change
	Volatile		Increase
Income distribution	Highly inequitable Gini Coefficient < 0.3	**Public transport**	
	Medium equitable Gini Coefficient 0.3-0.7	Access to public transport	Reduction
	Highly equitable Gini Coefficient > 0.7		No change
			Increase
Funding available	High		
	Medium		
	Low	Transport interchange facilities	Reduction
			No change
Demographic			Increase
Population size	>10.1mil		
	6.1-10mil	Hub integration	Reduction
	2.1-6.0mil		No change
	0.0-2.0mil		Increase
Annual urban population growth	High: >3%	**Infrastructure**	
	Medium: 1.1-2.9%	Carriageway capacity	>4 lanes
	Low: <1%		4 lanes
			3 lanes
Population density per sq Km	High: >60		2 lanes
	Medium: 30-60		1 lane
	Low: <30		
		Road class	Motorway
Social			Trunk Road
Human Development Index	>0.8		Classified Road (Distributor)
	0.5-0.8		Primary Route (Collector)
	<0.5		Special Route
			Residential Street
Cars per household	High: >3		
	Medium: 1-3	Speed limit	60 mph
	Low: 0-1		40-60 mph
			40 mph
Land-use			30-34 mph
Land availability	High		30 mph
	Medium		
	Low	Lane throughput	High
			Ave
Land-use patterns	Mixed		Low
	Clustered		
	Unified Zoning	Width	High
	Density		Ave
	Central location		Low
	Choice of access by different modes		
		Parking and Loading	No on street
Parking provision	High		On street
	Medium		
	Low	Pedestrian crossing	None
			At grade
Housing	High density		
	Medium density	Bus stops	None

	Low density		In lay byes
			At kerbside
Retail development	Central location		
	Peripheral location	Accessibility	Increased accessibility through mode shift
	Mixed use		Decreased accessibility through mode shift
	Coherent parking strategy		Unchanged accessibility through mode shift
	High density		Increased accessibility through mode split
	Medium density		Decreased accessibility through mode split
	Low density		Unchanged accessibility through mode split
Leisure	Central location	Traffic effects	Reduced speed
	Peripheral location		Speed unchanged
	Coherent parking strategy		Increased speed
	Mixed use		Reduce traffic congestion
			Increase traffic congestion
Accessibility	Increased		
	Decreased	Travel time saving	Positive saving
	Unchanged		No saving
			Negative saving
		Vehicle operating cost	Reduction
			No change
			Increase
		Capital renewal cost	High
			Ave
			Low
		Negotiation and Development cost	High
			Ave
			Low
		Construction and implementation cost	High
			Medium
			Low
		Economic development effects	Positive change to employment
			Negative change to employment
			Reduction in economic activity
			Increase in economic activity
			Long term increase in income
			Long term decrease in income
		Travel time	Reduction
			No change
			Increase

Sources: Author's own reconstruction from Banister (1999:316-319), Sim et al. (2001:239), Rabinovitch (1996:51), Sawathvong (2004:553), Sustainable Communities Network (2004), May (2004:81), May and Roberts, (1995:97), Department of Infrastructure, Energy and Resources (2005), Department of Transport (1996), Department for Transport (2004c), Jones and Lucas (2000:193), Dornbusch and Fischer (1994:317), Gillis et al. (1996:196-202), Todaro (2000:72-75), Institution of Highways and Transportation (1997: 116,149) and Mohr (2000: 45-57, 86, 143-153, 204, 210)

By using exogenous and endogenous variables to measure objective achievement under specific conditions, the decision-maker is freed from having to achieve all predetermined policy objectives and from using rigid criteria only, as is the case with the "measures-objective tool" reported by Jones (2004). As the IHT (1999:16) suggests, guidelines (describing exogenous variables) attempt to indicate the desirable provision of policy measures and also alternative approaches that may prove satisfactory in certain circumstances.

Fundamentally, the argument presented here is that the decision-maker requires a mechanism which enables him/her to "weigh" local conditions (using variables, guidelines and technical considerations) and that these selected weighted conditions may then successfully assess the extent to which the measures achieve and contribute to the sustainability objectives. Conversely, the "weighted local conditions" establish which specific measures warrant or are more suitable and (cost) effective when implemented under prevailing local conditions. Currently such a mechanism does not exist, but it is the undertaking of this research to spearhead and test the argument above and construct a D.A.D.F. which may or may not provide further assistance to the decision-maker. **To this end the argument presented here as well as the exogenous and endogenous variables and their respective guidelines and technical consideration will be put forward at an empirical level in assessing its merits and use in practical application.**

4.4.3 Relationship between measures and country development stage

It goes without saying that the choice of measure implemented in any country will vary and depend strongly on existing infrastructure, settlement patterns, demographic characteristics, industrial and commercial activity, cultural differences, economic growth, institutional and policy frameworks and the social complexities of that society. Due to fundamentally different approaches to planning, existing planning legislation and policies, circumstances and the approaches to decision-making in every country it is not possible or at all desirable to simply transpose and apply measures with an effective track record in the developed world to developing countries and vice versa. It is more useful to determine whether a relationship exists between the development stage of a country and its implementation of measures associated with congestion reduction as it will identify the measures to be considered for inclusion in an integrated strategy more appropriately.

In delineating the development stage of countries it will suffice for the purpose of this section to classify implicitly all countries on a continuum based on their degree of economic development used by the World Bank and the International Monetary Fund (IMF). These institutions divide countries into two main categories: (i) developed or industrialised countries and (ii) developing countries. Developing countries are further divided into high income countries, middle income countries, upper middle income countries and the least developed countries. An analytical review of the development stages of countries follows more appropriately in Chapter 5. Appendix 3 (see CD) illustrates the differences in measures implemented or being proposed for implementation in 18 developing and 10 developed countries in an attempt to establish whether a relationship exists between the development stage of a country and the measures associated with congestion reduction.

4.4.3.1 Developing countries

Quite often difficulties associated or experienced in developing countries when successfully implementing a wide range of measures arise because of a number of well defined characteristics distinguishing the developing city from those with more advanced economies in developed countries in relation to its (i) rapid pace of motorization (ii) travel demand that far exceeds the supply of facilities (iii) provision of public transport (iv) limited agreement on planning approaches and (v) capital being scarce and operating subsidies difficult to sustain. However in recognising the inevitable increase in urban traffic congestion, developing countries have implemented various techniques to combat congestion as the following sub-sections explain.

(i) TDM measures

Demand management and restraint in traffic volumes in high income and upper middle income developing countries such as Poland, Canada, Brazil, Thailand, Japan, Mexico and South Africa are realised by a range of measures, which have been successfully implemented in the past and may be divided into the following categories:

- Parking control and pricing of public car parking and of other parking such as private non residential parking
- Control of use of vehicles by regulation
- Pricing measures

The implementation of TDM measures has been less successful in the Least Developed Countries (LDCs) such as Malawi and Niger as seen in Appendix 3. It is not uncommon for developing countries to implement TDM measures more appropriately as tax instruments rather than applying them to rationalise the use of private transport. This is mainly because taxes are used as "blunt instruments" on vehicle ownership and are an important source of revenue for public finance. These taxes have a high yield and can be argued to have a re-distributive effect (higher income households have more cars, more expensive cars, drive more and consume more fuel and thus pay more tax than lower income households). Clearly if taxes are high enough, there will be some effect on use, but in principle, such charges do not address wider congestion creating issues nor specific congested time periods.

(ii) TSM measures

The traditional strategy in developing countries for coping with growing road traffic is to build more and larger roads. This measure has been implemented with varying degrees of success in Canada, South Africa, Botswana, Brazil, Mexico, Bulgaria, Poland, Papua New Guinea, Bolivia, Thailand, Philippines, Nigeria, Zambia, China, Pakistan and India as illustrated by Appendix 3. However, it has failed to solve congestion in urban areas and instead has aggravated the situation by encouraging more car use and car-dependent urban structures. In other countries such Nigeria, Zambia, China, Botswana Papua New Guinea, Bolivia, Thailand and the Philippines the rate of road building declined in the 1980s due to economic problems, scarcity of public funds and policy deficiencies, thereby seriously eroding their capacity to undertake maintenance or new build projects, subsequently accelerating the deterioration of the road quality giving rise to increased congestion and fuel consumption.

Techniques using physical measures to manage traffic by making the use of motor vehicles less attractive through street design, traffic calming, access control and HOV lanes (Cracknell, 2000:86-87) is often applied in all of the developing countries listed in Appendix 3 apart form Malawi and Niger. In addition very few developing countries implement ramp metering, access control and reversible lanes as forms of congestion management.

(iii) LUM measures

As travel demand is dependent on land-use disposition, it should theoretically be possible to reduce overall demand for travel through control of land-use. Indeed, it can be argued that much of the increase in the use of cars is a direct result of policies which have permitted, even encouraged, the dispersion of major activity centres to the fringes of urban areas and beyond. The emphasis in developing countries has been on increased accessibility and mobility in facilitating economic growth and prosperity rather than being aimed at integrating land-use planning with transport as shown above. Spatial planning decisions are often made without explicit consideration of their impact on travel behaviour or on the overall efficiency of the transportation system. And so land-use mix, travel plans, smart growth strategies, clustered land-use and car free planning is very seldom applied in the developing countries named in Appendix 3 as measures which will reduce traffic congestion. Transportation and land-use planning integration has a chequered history with limited success in developing countries as a number of fundamental problems in their planning frameworks inhibit sustainable development being linked effectively to transport planning (Gakenheimer, 1999:684; Mattingley, 1993:113; Olima, 1997:319 and Sivam, 2002:523).

Many of the developing countries listed in Appendix 3 such as Malawi, Niger, Botswana, Bolivia, the Philippines, China and Zambia have not at all implemented LUM in a way that reduces traffic congestion. Transport planners in developing countries are faced with major challenges in providing affordable, efficient and reliable transport services for the majority of their citizens while minimising negative environmental impacts. Clearly more comprehensive integration of LUM with TSM and TDM can help decision-makers in developing countries address appropriate priorities and assumptions. However, it is difficult to make generalisations regarding the relationship between the development stage and the measures applied.

4.4.3.2 Developed countries

The mechanisms for reducing congestion in developed countries are several and vary enormously. In the main, as Appendix 3 suggests, various TDM, TSM and LUM measures are implemented from the pool of available measures, but sometimes in an isolated fashion not necessarily integrated in a comprehensive package (with few a exceptions). The possible success achieved by the developed world is perhaps a result of direct political will, public support, substantial financial resources and commitment to facilitate integrated planning methods and the co-ordination and implementation of sustainable development practices (Vold, 2005:548; Toh, 1992:289). At an institutional and administrative level, developed countries have demonstrated their capability to manage and plan effective vehicle and land-use management strategies, often learned through decades of trial and error.

Although it is difficult to establish a clear relationship between the development stage of countries and the measures they employ to combat traffic congestion, it would appear (from Appendix 3) that both developing and developed countries have responded to increasing congestion by increasing capacity. However, developed countries (such as the UK, USA, Sweden, Finland, the Netherlands and Germany) have gone further and attempted to manage the demand for capacity by using TDM measures (Cracknell, 2000) and LUM measures on a much wider scale. Appendix 3 provides some indication of the relationship, albeit in a general sense confined across 28 countries. **It will therefore be useful to establish whether these observed trends can be generalised to more countries without trying to set general rules of direction – an issue that will be put forward during the empirical phase of the research.**

4.5 Environmental management

Development policies, programmes, plans, projects and strategies in all sectors of government that do not address environmental concern cannot claim to be sustainable. Indeed, the key objectives of environmental management are to provide for a high level of environmental protection, to contribute to the integration of environmental considerations in the preparation and adoption of plans and programmes and to encourage increased community involvement in land-use and spatial planning with a view to promoting sustainable development in line with Local Agenda 21 objectives.

The challenge to decision-makers is, as summarised by Retief and Sandham (2001:76), is to integrate environmental management in its broadest sense into mainstream developmental processes to support decision-making and to ensure sustainable long-term development (which does not deplete the resource base it depends on, but sustains it over time) in line with the objectives of LA 21. To arrive at this stage of sound planning, environmental management in its broadest context has to ensure that the environmental consequences of development proposals are understood and adequately considered in the planning, implementation and management of all developments. Ultimately the purpose of integrated environmental management (IEM) is to resolve or lessen any negative environmental impacts and to enhance the positive aspects of development proposals.

Indeed a number of decision support tools exist within environmental management to aid the decision-maker in this respect. Common decision support tools as illustrated below in Figure 4.10 are divided into two groups, those informing decision-making and those facilitating management (relating to operational planning). Environmental Assessment and Impact Assessment involve the systematic identification and evaluation of the potential impacts of a proposal on the environment. At the project level, "Environmental Assessment is generally known as Environmental Impact Assessment (EIA) while at the level of policies, plans and programmes it is commonly referred to as Strategic Environmental Assessment (SEA)" (Eales et al., 2003:38-41).

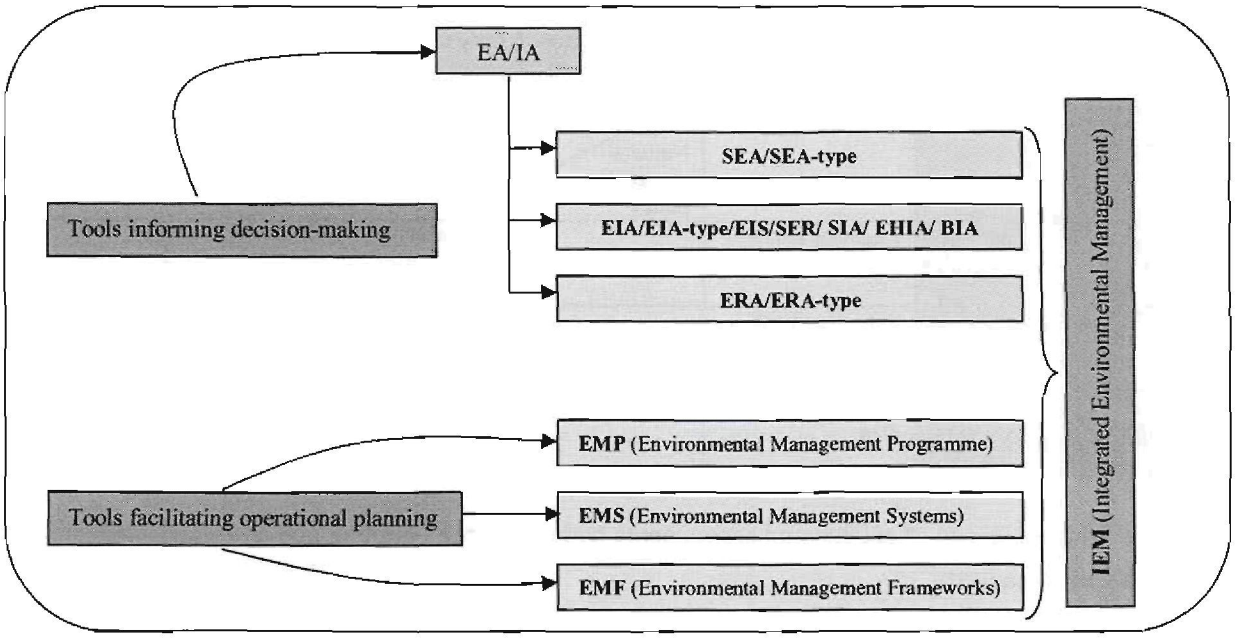


Figure 4.10 Environmental management decision support tools

Source: Author's own construction

A variety of environmental decision support tools exists. Dalal-Clayton and Sadler (2004) and Petts (1999) provide an excellent review of such tools and techniques. The origins, nature and methodology employed by each tool and technique and its relative location within strategic planning is well documented and is illustrated by Figure 4.11 and Figure 4.12.

Instrument	Affected at which phase of development	Scope and level of detail	Time span	Resource requirement
SEA	Policy vision Development framework Goals Strategies	Broad scope with a low level of detail	Usually completed within six months	Low human and financial resources required to complete
EIA	Project or local level	Narrow scope with a high level of detail	Varies	Low human and financial resources required to complete
ERA	Project or local level	Narrow scope with a high level of detail	Varies	Low human and financial resources required to complete

Figure 4.11 Instruments according to relative location within strategic planning

Source: Author's own construction

Level of government	Land-use plans (SEA)	Sectoral and multi-sectoral action			
		Policies (SEA)	Plans (SEA)	Programs (SEA)	Projects (EIA)
International	Trans-boundary agreement on resource management	Multi-country policy framework		Multi-country investment programme	Trans-boundary projects
National/Federal	National Land-use plan	National sector (e.g. transport) policy National economic policy	Long term sector (e.g. national roads) plan	5-year sector (e.g. road building) programme	Construction project (e.g. motorway section)
Regional/Provincial/State	Regional Land-use		Regional strategic plan		
Sub Regional	Sub - Regional Land-use plan			Sub - Regional Investment Programme	
Local	Local Land-use plan				Local infrastructure project

Figure 4.12 Sequence of actions and assessments within a tiered planning and assessment system

Source: Lee and Walsh (1992)

Figure 4.11 and Figure 4.12 illustrate that SEA/SEA-type is a strategic tool generally affected at national level with a broad scope considering a limited level of detail and is performed at regional and local levels. EIA and ERA are tools with local or project based impacts and have a narrow scope considering a high level of detail. An ideal SEA process is such that it influences the making of a policy, plan or programme from the earliest stage of development. EIA is applied to specific projects that may be freestanding or within a programme.

SEA and EIA should be related to each other within the same policy and planning process, and are intended to be complementary to each other. This is often illustrated in a somewhat simplified way through the concept of "tiering" (Lee and Walsh, 1992) illustrated in Figure 4.12. It is a simplified representation of what, in reality, could be a more complex set of relationships. The higher the tier level (e.g. national policies) the broader and less detailed the SEA is likely to be and the lower the tier level the more emphasis is placed on local project implementation and assessment through EIA.

Indeed different countries and, therefore cities are likely to use different tools and techniques appropriate to their local conditions. To this end the following sub-sections compare the implementation of SEA (and SEA-type) and EIA (and EIA-type) as primary assessment tools employed among developing and developed countries. In this way it will be possible to identify suitable techniques assessing the environmental impact produced by integrated strategies thereby coupling environmental management with the integrated strategy concept.

4.5.1 Strategic Environmental Assessment (SEA)

Appendix 4 (see CD) provides a basis for comparative analysis of the different SEA frameworks and institutional arrangements that are in force and attempts to delineate the main elements of their anatomy and approach. Indeed differing forms of SEA have been in place since EIA was first introduced in 1969 and, arguably, for an even longer time in land and resource planning practice (World Bank, 2002). SEA-type approaches reflect an extension of EIA trends, beginning in the late 1970s and 1980s which include area-wide and regional assessments, and landscape-level or synoptic methodologies for cumulative effects assessment. Since, the 1990s, SEA was introduced as a separate process from EIA in a number of countries mainly addressing policies, plans and programmes, not projects.

A good-quality SEA process informs planners, decision-makers and affected public on the sustainability of strategic decisions, facilitates the search for the best alternative, and ensures a democratic decision-making process. This enhances the credibility of decisions and leads to more time-effective EIA at the project level. For this purpose, a good-quality SEA process is (i) integrated (ii) sustainability-led (iii) focused (iv) accountable (v) participative and (vi) iterative. However, SEA has shortcomings – predominantly in its lack of methodological definition and robustness. Several countries and institutions have grappled with these shortcomings over the last decade or so, and have come up with different responses, hence the origin of para-SEA and SEA-type assessments. As a result the SEA methodology, institutional context and processes of assessment vary considerably between countries. Appendix 4 provides an overview of SEA implementation in 63 developing and developed countries in terms of:

- Institutional provision
- Scope and relationship to decision-making

- Elements of process and procedure
- Public participation
- Constraints/shortcomings
- Alternatives to SEA

From Appendix 4 it is possible to identify some key differences and similarities in approach. All developed countries illustrated in Appendix 4 provide institutionally for the implementation of SEA, except the Netherlands, Finland, New Zealand, Germany and Portugal. The majority of developing countries do not have any institutional requirement for formal SEA. Notable exceptions are South Africa, Canada, Estonia, Poland, and Slovakia.

In terms of scope and relationship to decision-making those developed countries providing institutionally for the implementation of SEA have very specific application to plans, programmes and policies applicable at national and regional level and guidance as to its implementation. Developing countries with no formal requirement of SEA, implement a "SEA-type" assessment which is quite often combined with elements of EIA and does not conform to international SEA principles and standards. In addition developing countries with no formal requirement of SEA seldom provide for or encourage public participation as part of the assessment procedure – at worse China keeps the assessments secret as the policies and programmes assessed are not to be openly and publicly debated.

There is also a great level of variance between what is actually assessed. In developed countries generally, policies, programmes and plans are assessed and they are driven from national policies through to local level. Within developing countries it is the exception rather than the rule for all levels of policies, programmes and plans to be assessed, the exceptions being South Africa, Canada and other high income developing countries. In Burkina Faso, Côte d'Ivoire (Ivory Coast), Cameroon, Djibouti, Guinea – Conakry, Mali, Morocco, Niger, Tunisia, Togo, Sénégal, the custom is to assess either plans or projects, primarily because the assessment culture there has its origin in EIA practice and not SEA.

The elements of process and procedure followed in assessment developed countries conform to a structured and formal approach whereas developing countries predominantly follow an adapted SEA-type of approach with principles of EIA. Public participation is generally a requirement in developed countries but not in developing countries. There are some exceptions although it is widely accepted that consultation and participation in decisions relating to development hinge on adequate communication and understanding (Lohani et al., 1997:2-23).

Even within developed countries some constraints and/or shortcomings in the strict application of their SEA procedures exists. For example in Australia not all measures recommended as part of the assessment have been implemented, which raises concerns over its effectiveness. In Germany insufficient consideration is given to alternative options as part of the SEA process and public participation and transparency into the process is not effective. In developing countries the constraints and/or shortcomings in environmental assessment are more acute. The newly independent countries from the former Soviet Union, in particular, implement old-fashioned, out-of-date and inappropriate Soviet State Environmental Reviews or SERs. The assessment methods lack transparency, public consultation and are not applied to all strategic plans, policies and programmes. They overlap with EIA where practised and lack adequate integration into the planning system.

Alternative approaches to SEA have therefore originated either by formal EIA or SEA being adapted to local conditions and circumstances or because SEA has not been given adequate thought in terms of international best practice requirements. The application of SEA in developing countries appears extremely limited, however growing experience in national-level strategic planning and more local, integrated, land-use and resource management planning in the broader sense might offer a platform for an SEA approach suited to planning and decision-systems in the region that works. African countries especially reflect totally different approaches to standard SEA because their approaches are aligned to the actual dynamics of decision-making in the country concerned. Of the African countries South Africa has the most experience with the implementation of SEA (Dalal-Clayton and Sadler, 2004).

4.5.2. Environmental Impact Assessment (EIA)

Environmental Impact Assessment is one of several techniques within Impact Assessment that is used to improve the way in which the trade-offs between potentially conflicting objectives within the broad scope of sustainability are made and it is increasingly being viewed as a key mechanism for involving different stakeholder groups in the development process. The challenge is therefore to optimise the trade-offs within the four dimensions of sustainable development – the institutional system, the environment, the economy and the social dimension (Barbier, 1987; Holmberg et al., 1991). The comprehensive EIA process will typically include elements for consideration contained in Figure 4.13.

The textbook version of EIA rarely takes place, albeit parts of the comprehensive process are implemented and others ignored, subject to legislation enforcing its use. Environmental Impact Assessment (EIA) dates back to the mid-1970s and since then its application has varied significantly from country to country (Momtaz, 2002:163). There is a danger that the advances in environmental protection and enhancement achieved through the use of EIA in developed nations will prove inadequate on a global scale unless a similar level of attention is given to the application of EIA in developing countries. It is crucial that this performance be improved in order to help to protect the environment of three quarters of the world's land area.

Just as there are huge differences in EIA systems in the developed world, so is there between EIA systems in developing countries. Appendix 5 (see CD) contains data comparing 60 countries's approach to EIA reflecting enormous variations between the developed and the developing world. The comparison was carried out using the same headings as were used for the SEA analysis.

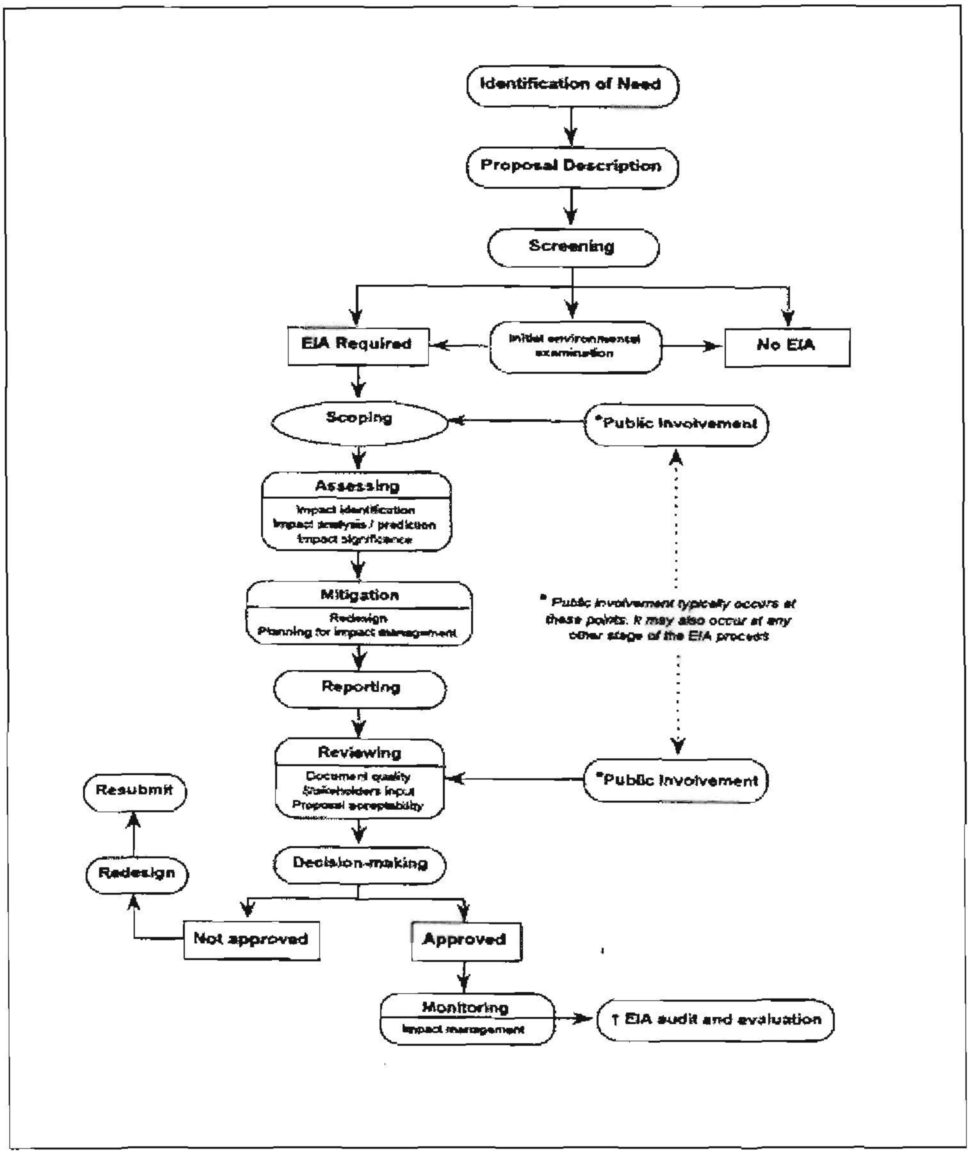


Figure 4.13 Stages in the EIA Process
Source: Donelly et al. (1998)

Appendix 5 suggests that it is now well established that legislation is the essential precursor to an effective EIA system, in developing countries just as it is in developed countries (Wood, 2002). However, the legal basis of EIA systems in many developing countries may be weak, non-mandatory or non-existent. For example, EIA is not mandatory in many African countries (such as Botswana, Namibia, Tanzania, Mali and Senegal) and the enactment of appropriate legislation there is now almost universally regarded as a crucial first step (Kakonge, 1999). While many developing countries have enacted some form of EIA legislation, this usually forms one part of a general environmental law rather than being EIA-specific (Sadler, 1996).

A common weakness of legal provisions for EIA in developing countries is that they are often expected, unrealistically, to resolve environmental problems resulting from the absence of, or shortcomings in, environmental planning and pollution control systems. In addition, Petts (1999:172) notes a number of fundamental reasons why EIA has not been adequately insitutionalised especially in Africa. The reasons included (i) the reluctance by politicians to encourage EIA as it is believed to discourage investors (ii) incorrect application – African countries have replicated the American style EIA without regard to, their local conditions (iii) cost (iv) lack of qualified and experienced human resources (v) EIA is carried out towards the end of the project instead of during the screening phase (vi) lack of enforcement of environmental policy and (vii) lack of understanding the value and use of IEA.

Making decisions about projects may be the task of both development assistance agencies and governments. It is frequently closed to external scrutiny, and may be influenced not only by economic and social factors but also by corruption (Boyle, 1998; Donnelly et al., 1998). Lee (2000) emphasised that the effectiveness of the EIA process is dependent on the "degree of success in integrating assessment findings into decision-making in the planning and project cycle" and that this is frequently low in developing countries, starting too late and resulting in poor links with project implementation.

In terms of the elements of process and procedure in EIA, Kennedy (1988:262) concludes that "...EIA works best when ... there is a specific legal requirement for its application, where an environmental impact statement is prepared, and where authorities are accountable for taking its results into consideration in decision-making". He emphasised that, for EIA to be successfully integrated in the project planning process, "...procedures for screening, scoping, external review and public participation need to be a part of it". To this end the consideration of alternatives in developing country EIAs is frequently weak as illustrated in Appendix 5. The no-action alternative is often not a viable choice in circumstances where the alleviation of poverty and starvation may be the predominant goal and, in practice, the environmentally preferable alternative may not be considered either. Also the screening of actions for the applicability of EIA is not undertaken satisfactorily in many developing countries.

It is generally agreed that scoping is as important a step in EIA systems in developing countries as it is in developed countries (Ahmad and Sammy, 1985; Biswas and Agarwala, 1992; Organisation for Economic Co-operation and Development, 1992; Jones, 1999). It is, however, frequently missing in the former, at least in so far as public consultation is concerned. EIA reports in developing countries are often confidential as is the case in China (Bisset, 1992). In particular, EIA reports are not user-friendly and are weak on alternatives, scoping, prediction, the attribution of significance, and the justification of proposals (Lee and George, 2000).

As in the developed world, monitoring has been a missing step in EIA in developing countries. For example, Lohani et al. (1997) identified the lack of attention and commitment to follow up as a serious shortcoming in Asian EIA practice (such as Korea and China). EIA monitoring practice in Tunisia is almost non-existent (Ahmad and Wood, 2002). Mitigation of the impacts of some projects in developing countries is generally considered during the EIA process but is not always implemented. Too often, there is little opportunity for changes to be made to previously designed projects: mitigation is frequently an after-thought. This is certainly the case in, for example, Tanzania (Mwalyosi and Hughes, 1997). EIA is often integrated within the statutory planning system in developed countries but not in developing countries.

Although it is widely accepted in developed countries that the benefits of public participation and stakeholder involvement in EIA include development that delivers more environmental and social benefits and avoids conflict (Donnelly et al., 1998, 21; Wood, 2002:275), there is no tradition or requirement for consultation and participation in many developing countries (Lee, 2000). Indeed the notion of public participation in decision-making is revolutionary in many developing countries (Wilbanks et al., 1993). As Boyle (1998:95) confirms "the public is effectively excluded from project planning and decision-making" in South East Asia. The same is effectively true in the Philippines (Lohani et al., 1997:2-23).

4.5.3 Coupling Environmental Management to integrated strategies

The preceding analysis suggests that numerous obstacles and difficulties in applying SEA and EIA as primary assessment tools exist especially in developing countries. Despite the existence of EA and IA such as SEA and EIA, guidelines for effective environmental management and the institutional framework in many cases is not effective, especially in developing countries due to a lack of efficient and enforceable legislation, organizational capacity, training, environmental information, participation, diffusion of experience and political will. Environmental Assessment relies on different techniques, appropriate to the consideration of environmental and social impacts at the plan/programme level. It is clearly important that methods of environmental assessment in terms of the environmental impact of integrated strategies are chosen which are appropriate to the scale of the study being undertaken or to the project being implemented, the nature of the area and the kind of solutions likely to be appraised (Noble, 2000:224).

Within the context of the research, integrated strategies should be assessed in terms of SEA, driven by effective IEM and EMPs as the integrated strategies produced by the D.A.D.F will be aligned and positioned within the context of the IDP. This may be difficult to achieve in some developing countries as their SEA or SEA-type assessments do not even consider plans or strategies within the formal transport and land-use framework nor do they possess the institutional framework for its facilitation.

4.6 Public participation

The development of optimal and comprehensive integrated strategies requires knowledge of who the customers and stakeholders for the land-use and transportation system are and as Meyer (1997:343-344) suggests, it depends on a comprehensive programme of providing opportunities for involvement in the planning process. A wide body of literature has been developed over the last few decades on the process of public participation in land-use and transport planning (Halla, 2005:137; Hunsberger et al., 2005:609; Savathvong, 2004:18; Minken et al., 2002:85; May et al., 2001:20-21). Effective public participation is a complex and arguably, demanding process, which can take place at a number of different levels and in a variety of ways. Although participation is central to the consensus-led approach to decision-making bringing together bottom up and top down planning processes (Minken et al., 2002:86) it can also increase the success of vision-led and plan-led approaches.

Essentially public participation is the act of stakeholders actively taking part, or sharing in the actual planning process, including the identification of needs and solutions, influence upon the choices being made and the prioritisation of projects as defined by Bickerstaff et al. (2002:61). This definition is consistent with the well-known ladder of citizen participation conceptualised by Arnstein (1969:216) and illustrated by Figure 4.14, which goes from non-participation at the bottom to real citizen power at the top.

Figure 4.14 Arnstein's Ladder of Participation
Source: Reconstruction from Arnstein (1969)

Traditionally, participation in transport planning has taken place at the lower levels of Arnstein's ladder and has involved "informing" and "consultation" rather than a significant degree of delegated power associated with the top of the ladder (Bickerstaff et al., 2002:66). Indeed, there are different approaches to public participation in planning with varying degrees of conformation to Arnstein's Ladder or participation. To this end this section aims to review the nature or broad direction of and the processes involved in public participation in the planning process. By assessing the approach to public participation in terms of (i) the broad theoretical elements of the process, stances and stages involved (ii) requirements for effective public participation and (iii) participation techniques it will be possible to compare the approaches in the developing and developed countries thereby measuring their effectiveness and identifying certain shortcomings and similarities that should be taken into account when developing an integrated strategy.

4.6.1 The nature and processes of public participation

As starting point for involving the public in planning decisions, it is necessary to have an **institutional framework** enabling, supporting and/or prescribing the procedures to be followed in the process to allow effective and meaningful public engagement. The institutional framework enacts public participation, provides guidelines ensuring efficient and effective public participation, states the goals of public participation, the process or approach to be followed and who should be involved. It also sets out requirements for the public participation process in terms of national, regional and local government requirements.

Comprehensive public participation ensures that the full range of project, strategy or proposal objectives at all levels of governance are considered, and that it is consistent with those in other sectors such as health and education (Hunsberger et al., 2005:609). In the context of the research, public participation can provide a better understanding of transport problems, help generate innovative solutions and be a key factor in gaining public support and acceptability for the final mix of measures to deliver a strategy capable of addressing traffic congestion. It also improves the relationship with the targeted audience and enhances the effectiveness of collective decision-making within the group context. Involving the community can indeed precipitate fruitful results for both the government and the community as Sanoff (1991), Smith (1993) and Towers (1995) agree.

Public participation in effect enhances the capacity of citizens to cultivate a stronger sense of commitment, increasing user satisfaction, creating realistic expectations of outcomes, and building trust. The sense of commitment and the achievement of expectations can be better realised if the following 5 stances in communicating information to engage the public in decision-making is adopted in the public participation process (Wilcox, 1994). The stances are (i) information (ii) consultation (iii) deciding together (iv) acting together and (v) supporting independent community interests.

No one stance is intrinsically "better" and different stances are appropriate for different situations. In this framework, only the latter three stances involve substantial participation in relation to Arnstein's ladder cultivating a degree of tokenism and progressing a stronger degree of citizen power. None the less, the nature of the public participation process varies significantly between developing and developed countries. Each planning, highway or transport Authority designs its own public participation process to address its specific needs.

For stakeholders to participate in any public participation process and to have the opportunity to develop an understanding of the issues at stake the process has a number of **requirements** with regard to the transport planning process typically involving the following:

- A workplan for each public participation and consultation exercise identifying the objectives of the public participation process, the target audience and the methodology in detail
- A detailed budget and programme
- Monitoring and reporting on the progress of the participation process
- Official publication of draft and final plans
- Transparent consultation offering the full opportunity to comment on the planning process

A compelling question often raised is whether the process of involving the public has been effective because of the potential of tremendous variation in circumstances, stakeholders and processes. To this end NEPA (the National Environmental Policy Act implemented federally in the USA) and the International Association for Public Participation has formulated the following **requirements for effective public participation** and these have become a good standard in operational planning (US Department of Energy Environment, Safety and Health, 1998):

- Decide on the scope of planning needed, including information required, timing, resources, responsibilities and techniques before participation is initiated
- Initiate participation by a variety of techniques involving stakeholders – advise of the need for participation and why the stakeholders' view is important
- Initiate a process that involves initial stakeholder analysis of the proposals that is open to discussion and amendment, builds credibility, ensures that the level and kind of public participation efforts meet the needs of various affected segments of the population and is carried out by the initiator
- Identify problem issues and enhance mutual understanding
- Acceptance of the need to use independent facilitators or mediators as relevant
- A full, clear and agreed record of all discussions being made available to the public, along with all key documentation – deciding and acting together
- A final document that lists the relevant areas of agreement and disagreement arrived at during the process and that it is agreed by the representative forum
- A final independent review that measures the satisfaction of participants with the outcome of the participation/consultation process

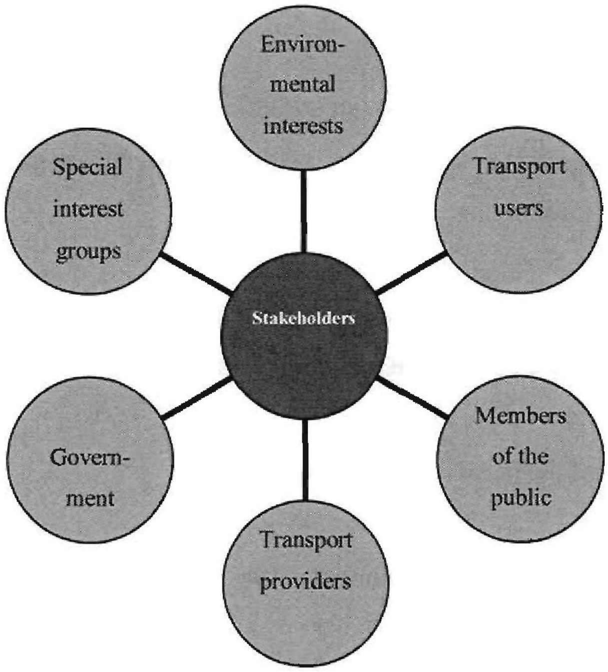


Figure 4.15 Stakeholders to be involved in public participation

In terms of **who should be involved** - public participation involves people and the term "public" in public participation is very broad and usually includes any and all interested or affected parties or stakeholders in decision-making. This presumption is aligned to the definition of Bickerstaff et al. (2002:61) provided above. In terms of whom to involve, the IHT (1997:124) identifies a host of stakeholders or groups of people who would be included at some stage and to varying degrees as illustrated in Figure 4.15.

As a rule those involved should include role players who are affected by the strategy; organisations which are directly involved and affected; those who help or hinder the public participation process or have skills or other resources they might be able to devote to the development of the strategy or the public participation process, and those who are likely to influence it. In addition, at least as far as land-use and transport related decision-making are concerned, there is also the consideration of the level of strategies, policies, plans, programmes, projects being considered and the appropriate stakeholders who should be involved at different levels. Table 4.5 below illustrates a typical situation regarding the level of stakeholder involvement in national, regional and local considerations.

Table 4.5 Stakeholder involvement and the level of governance

Initiating Authority	**Stakeholders**					**Considerations**
	Non-government & statutory bodies	**Regulating and advisory bodies**	**Members of Parliament, Government officials**	**Public**	**Stakeholders with local vested interest**	
National						**National strategies**
						National policies
						National plans
Regional/State/Province						**Regional strategies**
						Regional policies
						Regional plans
Local						**Local strategies**
						Local policies
						Local plans
						Local projects

Source: Author's own construction

The question of who is involved in public participation is dependant on the scope of the strategies, policies, plans, programmes and projects being planned, considered or developed and there is often (in the developed world) a legal requirement for facilitating public participation as part of statutory consultation. As Table 4.5 shows strategic decision-making will not cover detailed public involvement in the same way as projects or proposals of local significance (such as an environmental impact assessment) and will avoid detailed discussion of specific impacts to avoid diverting attention from the consideration of a strategic direction although the overall strategic direction is still capable of being influenced. It is important to remember that consultation might not always be appropriate; it is perfectly legitimate for decisions to be taken by elected representatives (Minken et al. 2002:86).

Finally, the techniques used to encourage public involvement in development proposals and the methods used to facilitate the desired level of communication will depend on local circumstances and preference in decision-making and the specific stakeholders interested in the strategy being formulated. The IHT (1997:132-136), Minken et al. (2002:85) and O'Flaherty (2005:39-41) provide some examples of techniques which are particularly suited to the different stances as illustrated below in Table 4.6.

Table 4.6 Techniques to encourage public involvement

Techniques	
Information	**Consultation**
o Posters, leaflets and information sheets	o public meeting
o telephone hotline	o staffed exhibition
o website	o mailback leaflet or surveys
o media coverage	o focus groups
o unstaffed exhibition	o website
Deciding	o public inquiry
o planning for reliability	**Supporting independent community interests**
o citizens' forums	o citizens' planning
o interactive participation	o advice
Acting together	o support
o the development of partnerships bodies	o funding
o co-working	

Sources: Author's reconstruction of IHT (1997:132-136), Minken et al. (2002:85) and O'Flaherty (2005:39-41)

Public participation methodology should spell out from the outset the aims and limits of this involvement, so that suitable techniques can be identified and confusion over the role of different groups can be avoided (Scottish Executive, 1996:14-15). In practice, most successful public participation programmes result from careful planning, a supportive governmental climate, simple techniques, and the basic skills and common sense of practitioners who are sensitive to people. There are no formulae guaranteed to work in every instance; however, openness and honesty, flexibility and a willingness to deal with people in a constructive non-defensive way are key attributes.

4.6.2 Experience of public participation in selected developing and developed countries

Having assessed the general nature of and processes involved in public participation and having identified techniques normally employed to facilitate that process this section compares and relates public participation practice in 21 countries (8 developed and 13 developing) as summarised in Appendix 6 (see CD). The comparison is made based upon the considerations below allowing the identification of the shortcomings, similarities and differences in approach among the different countries enabling comments to be made on the effectiveness of their public participation processes.

- Institutional provision
- Procedural content
- Extent to which effective public participation is achieved
- Scope of techniques employed to encourage participation

From the review of the **institutional provisions** made by developing and developed countries, all have provisions for public participations in the context of orderly and progressive development of land by means of ordinances, regulations or Acts.

With respect to **procedural content** only half of the developed countries listed in Appendix 6 have specific requirements relating to (i) the initiation of public participation (ii) setting up a work plan (iii) monitoring and reporting of the participation process and (iv) keeping the process transparent. For developing countries the situation is very different. Only 4 countries like their developing country counterparts have specific requirements – Poland, South Africa, Zambia and Pakistan. In terms of prescribing participative guidelines in developed countries, none are prescribed institutionally in Finland, the Netherlands, Germany, Sweden, and Portugal and participation is reactively facilitated, i.e. involves the public in decision-making following plan formulation. Hence, the public is not involved from the outset in developing and making decisions on key issues of the plan. Seven developing countries have prescriptive participative guidelines. Papua New Guinea, Mali, Brazil, Niger and China do not have institutional requirements to provide guidelines. In both developed and developing countries, monitoring and evaluation of participation is the exception rather than the rule, especially in rural areas.

The participation process in Finland, the Netherlands, Germany, Sweden, and Portugal does not provide the opportunity for the initial sharing of information, consultation, deciding together, acting together or supporting independent community interests during the conceptualisation of plans or proposals, whilst the remaining developed countries do. This suggests the selected developed countries take into consideration the five stances identified by Wilcox (1994) in communicating information and engaging the public in the decision-making process. It also suggests these countries are progressing towards the top of Arnstein's ladder of public participation. This phenomenon occurs in a only few developing countries namely, South Africa, Canada, Poland, Zambia and Pakistan, suggesting the majority of developing countries in Appendix 6 facilitate participation as a small degree of tokenism or not at all effectively.

In terms of **effective public participation** being achieved, no country in Appendix 6 has a fully effective participative process that involves the public in decision-making measured against NEPA and the International Association for Public Participation criteria. At best the developed countries achieve partial effectiveness with Australia out performing the rest of the group. Of the developing countries, more effective participation is achieved by Canada, Pakistan, South Africa and Zambia.

A variety of **techniques** is employed in both the developed and developing countries including public notices, public meetings, focus groups, public inquiries, posters, leaflets and information sheets, radio television and newspapers. Appendix 6 suggests that developed countries are prepared to engage the public using more expensive and comprehensive techniques than developing countries and the most basic techniques are more often used in the latter and in rural areas.

In assessing potential shortcomings in public participation of the countries identified in Appendix 6, some similarities and differences can be identified. In terms of similarities, both developing and developed countries lack the identification of appropriate evaluation tools that measure the effectiveness of public participation programmes and reactive participation often occurs. In some cases an initiation process that involves initial stakeholder analysis of alternative proposals during policy formulation stages are absent. Public participation can also slow down the decision-making process in both cases and in both developing and developed countries rural public participation has a low up take.

4.7 Appraisal

An important component of planning is appraising transport and land-use proposals or options. When formulating integrated strategies aimed at traffic congestion reduction the measures included in the strategy have to be assessed in terms of policy or strategy objective achievement and the extent to which they contribute to sustainable development. It is therefore fundamental to develop a D.A.D.F. that incorporates a suitable form of appraisal. To this end this section sets out to identify (i) the purpose of appraisal (ii) the use and requirement of an appraisal framework (iii) the general approach to appraisal (iv) forms of appraisal and (v) the choice of a suitable approach within the context of the study.

4.7.1 Purpose of appraisal

The main purpose of appraisal according to Eales et al. (2005:114) is to provide participants in the decision-making process with the information they need to optimise and rank strategies (options), to select a single best strategy or a set of preferred strategies, or to retain a set of core strategies to be processed and discussed further by eliminating useless, unacceptable or dominated strategies. In general the appraisal process involves deciding on the performance of a scheme or strategy and is associated with the question: "How well does this proposed scheme or strategy meet the policy objectives which have been set?" Consequently, appraisal has to provide information about the level of goal achievement with respect to predetermined strategy objectives.

4.7.2 The appraisal framework

Before options are appraised for inclusion in a package of measures, an appraisal framework is required (Department for Transport 2004b:11; Bond and Brooks, 1997:310). An appraisal framework typically takes the form of a matrix, with one row for each objective, indicator or criterion that is in some way relevant to the appraisal of a number of columns each representing the options or alternatives being considered. In essence, the framework is simply a presentational device. Its main purpose is to overcome man's limited capacity as an intuitive processor of complex and unusual information, by ensuring that all data considered relevant to appraisal is explicitly set down and available. In doing so, it also ensures that all alternatives are assessed consistently and against the same set of objectives, indicators and criteria - something that cannot be guaranteed in the absence of some type of formalisation.

4.7.3 Approach to appraisal

Once the decision framework has been identified and a pool of measures has been structured, it is important to have a clear approach to the selection of a number of measures from the pool for subsequent appraisal in formulating a strategy and ultimately a package of measures comprising the components described in section 4.4 above. To do this Bond and Brooks (1997:305) suggest the appraisal process must be well-defined, transparent, easily understood and communicated with a clear and open framework to:

(i) be aware of the objectives that the strategies must meet or attain to ensure sustainable development
(ii) appraise the impact of a wide range of policy options or proposed measures
(iii) prioritise between strategies

The key principle underlying the approach to appraisal is that the measures should be set out simply and concisely aimed at achieving specific objectives and being assessed against the same set of objectives. Because there is tension between objectives, for example, some proposals may contribute to the achievement of one objective but work against the achievement of others, the approach to appraisal must enable the decision-maker to determine the appropriate balance between identified objectives. To achieve this balance requires the insertion of indicators and criteria in the appraisal process which is intended to provide sufficient information to pass judgement on the sustainability of proposed strategies (options) as Black et al. (2002:186-188), Koenig (1980:145) and Zander and Hachele (1999:313) suggest.

By employing a broad set of indicators which is not overly judgemental or impressionistic, recognising the diverse and unique role that transport plays and ensuring that each indicator is related to a particular objective, consistency between appraisal and the hierarchy of objectives can be achieved (Jones and Lucas, 2000:185; Koenig, 1980:140). This provides decision-makers with a clear and reliable basis for justifying their decisions, without giving prominence to any one type of measure or impact or to benefits expressed in monetary terms compared to those which cannot be monetized (Eales et al., 2005:114). However, because there is invariably an element of uncertainty involved in appraisal, the approach should also allow for sensitivity analysis and robustness testing.

4.7.4 Forms of appraisal

Throughout the years, a great deal of research has been conducted by academic and other relevant public and private institutions into the appraisal of transportation and land-use systems and newer and better methods have been sought (Caliskan, 2006:8). Many methods have been used but few have been adequate in making cross-cutting decisions. The most common forms of appraisal in transport in use in developed and developing countries are Cost-Benefit Analysis (CBA) and to a lesser extent in the developing world Multi-Criteria Analysis (MCA) or a combination of the two as Bristow et al. (1998) suggest. The sub sections below consider both.

4.7.4.1 Cost Benefit Analysis (CBA)

Cost Benefit Analysis represents a practical technique for determining the relative merits of alternative government projects over time. Use of CBA can contribute to efficiency by making sure that new projects for which marginal social cost exceeds marginal social benefit are not considered for approval. Essentially three steps are involved in CBA being:

- Enumerate all costs and benefits of the proposed project
- Evaluate all costs and benefits in monetary terms
- Discount future net benefits

CBA is well established in transport as a means of aggregating the impacts of competing transport proposals so as to get an overall ranking in terms of contribution to net social well-being. There are numerous texts and manuals outlining its theory and practice, see, for example, Pearce and Nash (1981), Sugden and Williams (1978).

Closely linked to CBA is the use of discounting procedures to allow costs and benefits that occur at different points in time to be aggregated into a single measure. This has a strong foundation in individual behaviour. Individuals will prefer to consume now rather than later and would require compensation in the form of interest to postpone consumption. Also, financial markets set the price of obtaining money now rather than later. However, when we appraise strategies with respect to sustainability, the issue is not just how individuals value benefits now compared to later. Sustainability involves very long-term considerations, reaching well beyond single individuals' lives, and there is an important equity issue (intergenerational equity) involved. This may call for other approaches to discounting. In fact, faced with irreversible long-term impacts of strategies, CBA in its traditional form will be inadequate and needs to be modified (Bristow and Nellthorp, 2000:53). Since CBA concentrates solely on efficiency, it goes without saying that the distribution of impacts, socially and spatially, is not covered by CBA appraisal. It might be possible to derive the distribution of impacts from a CBA, but distributional aspects are certainly not appraised by the CBA. Thus in the context of the objectives to sustainability identified in Chapter 3, CBA can be used to compute an overall indicator of economic efficiency, but the equity objectives must be tackled by other means.

Furthermore, CBA has difficulty in establishing money values for a number of crucial environmental and social impacts, either because the impacts are difficult to quantify or because the value per quantity varies considerably according to circumstances and across individuals. Even if accidents, air pollution and noise seem to be amenable to monetary valuation, the loss of natural habitats and cultural sites, the level of security and freedom of movement, the creation of liveable streets and neighbourhoods etc. pose much greater problems. For the impacts that can be quantified but not valued, separate non-monetised indicators need to be established. Since these indicators (and the indicators relating to equity) cannot be included in the CBA objective function, it will not perform a complete ranking of strategies. It may however perform a complete ranking of strategies that meet targets with respect to these indicators. This provides a way of incorporating environmental and social sustainability issues in a CBA setting, or conversely of taking care of economic efficiency issues in an Environmental Impact Assessment setting.

4.7.4.2 Multi-Criteria Analysis (MCA)

According to Olsen (1995) there are many distinct MCA approaches, responding to a number of different types of potential application. As Yoon and Hwang (1995) suggest MCA provides an alternative to pure monetary methods that fail to capture the qualitative features of the decision-making process in that:

- it is open and explicit
- the choice of objectives and criteria is open to analysis and to change if they are felt to be inappropriate

- scores and weights, when used, are also explicit, are developed according to established techniques and can be cross-referenced to other sources of information on relative values, if necessary
- performance measurement can be left to experts, so need not necessarily be left in the hands of the decision-making body itself
- it provides a means of communication, within the decision-making body and between that body and the wider community
- it enables sensitivity and robustness tests
- it provides an audit trail

There is no single approach to MCA that is without its critics. However, a central reference is the work of Keeney and Raiffa (1993) who developed a set of procedures, consistent with normative foundations, which would allow decision makers to appraise multi-criteria options in practice. Keeney and Raiffa formally take uncertainty into account and allow attributes to interact with each other in other than a simple, additive fashion bringing unnecessary complexities to its application. In certain circumstances, it can be important to build into the analysis one or both of these factors, but often in practice it may be better to ignore them in order to allow a simpler decision process. Such a model is a simple linear one, created by multiplying the value score on each criterion by the weight of that criterion, and then adding all those weighted scores together.

Models of this type have a well-established record of providing robust and effective support to decision-makers working on a range of problems and in various environments (Sayers et al., 2003:95). They have an adequate theoretical foundation and an ability to diminish the cognitive limitations of unaided decision makers. They also allow the appraisal of environmental and socio-economic impacts in more depth providing more flexibility to the decision-maker. Models or processes of this nature are often referred to as MADA (Multi-Attribute Decision Analysis) models (Department of the Environment, Transport and the Regions, 2003b) and are sufficiently simple and transparent for use as part of a process of consultation with stakeholders. The process is not a simple linear one to be worked through once, or sequentially, with an answer emerging at the conclusion. Rather, a good MADA process is likely to involve substantial iteration, with feedbacks to earlier steps. A full description of a MADA process is beyond the scope of the section, however Dodgson et al. (2000) provides a comprehensive overview of the steps involved.

4.7.5 The choice of approach

Cities have different approaches to appraisal. It is not the purpose of this study to prescribe which method is best. In general countries have different traditions with respect to which appraisal method they are accustomed to use. Also, different users have different needs. Where there is a multiplicity of users and different emphases, flexibility within a formal structure is an important feature. However for the purpose of the research and the development of the D.A.D.F. MCA is deemed an appropriate appraisal mechanism as it enables simultaneous assessment of both quantitative and qualitative data (where CBA is mostly concerned with assessing quantitative data). This argument is supported by the DETR which also provides guidance for undertaking and making the best use of MCA in order to evaluate alternative options for policy and decision-making in the transport and planning industry and it is therefore compatible with the purpose and needs of this study. The approach advocated by the DETR involves procedures using quantitative and qualitative data inputs. Although the DETR (2003b:22) takes the view that reliable and transparent decision-making is more effectively achieved by using quantitative data, it also acknowledges an alternative approach, largely developed in the Netherlands whereby MCA allows for the input of "imprecise" qualitative data (referring to the use of BOSDA).

The DETR feels BOSDA is most applicable in the area of transport and urban and regional planning. BOSDA (Beslissings Ondersteunend Systeem voor Discrete Alternatieven) or DEFINITE (decisions on a finite set of alternatives - Dutch acronym for BOSDA) is a decision support software package that has been developed at the Institute for Environmental Studies of the Free University of Amsterdam, Netherlands to improve the quality of decision-making. BOSDA comprises a whole tool kit of methods that helps, amongst others, to assess and rank alternative solutions from a set of options by weighing up the alternatives and by identifying the most reasonable alternative. Because the results obtained in the survey comprise both quantitative and qualitative data, BOSDA is a suitable software package for undertaking the option analysis and examination of alternative options.

4.8 Funding

Adequate funding is an important component within the planning system and of any congestion reduction program (Litman, 2000). Given that not much can be achieved without funding, managing the process of obtaining the required resources and then effectively managing the operating and capital budgets that result is likely to be the most critical aspect of a comprehensive integrated congestion reduction strategy. Its success depends crucially on the funding capability of the instigating authority (Meyer, 1997:305). Without an adequate capital budget, the ability of the decision-maker to ensure the preservation and enhancement of the land-use and transportation system will be severely constrained.

In the past, the focus of investment has been on building new roads at the expense of maintenance and the appraisal and provision of new infrastructure and the exploration of alternative options to deal with growing traffic demands. Funding of such projects has been supported primarily by government and local funds and revenues from fares and other forms of taxation (Ubbels & Nijkamp, 2002:317). The reason why governments fund these activities is because the provision of infrastructure especially (TSM) is an unprofitable business or service having a non-exclusive public good characteristic (Hyman, 1999:135;

Schotter, 2001:653). When public investment is under tight treasury control, macro-economic circumstances are the main determinants of the infrastructure investment programme in roads and rail (Newbery, 1994:258).

With mounting pressure on the public purse, it makes sense to formulate strategies comprising TDM, TSM and LUM measures enabling a greater degree of self-finance as the revenue generating characteristic of demand management measures is well known (Lim, 1997:1193; Matas, 2004:195; McFadden, 1974:328; Schlag & Schade, 2000:318; Seik, 1997:164). Subsequent to these pressures and the emergence of the New Realism during the 1980s and 1990s the case for developing a comprehensive or integrated strategy was strengthened even more (Bell, 1995:81) with the aim of providing a package which is cost effective, enhances mobility and accessibility, encourages sustainable development, reduces traffic congestions and is value for money while being consistent with community and policy objectives.

Therefore, as Matas (2004:195) notes, successful strategy implementation will be mainly due to the success that project proponents have in managing the institutional characteristics of decision-making. This means formulating transport policies which will be sustainable and stable over time and which help to secure funding to achieve policy objectives which in turn ensure that demand is reconciled with the transport resources and services which can be afforded (Meyer, 1997:14). As a result the main thrust to secure funding requires consideration concerning (i) targeting spending effectively (ii) providing value for money and (iii) identifying sources of funding as Seik (1997:155; 1998:27) reports.

Crucial to the funding process is the ability to demonstrate that the implementation of integrated strategies will provide value for money. Assessing the value for money component is crucial during the tendering, bidding, monitoring and evaluation cycle. The assessments should therefore consider several criteria and indicators similar to those reported by Ubbels and Nijkamp (2002:323) which are likely to have a positive impact on the level or direction of the success of the strategies. In addition, it is important to recognise that the degree of success in securing funding is not only dependent on the transferability and principles behind the schemes, but on broader considerations such as the convenience, specific features and public support of the scheme concerned (Hine, 1998:158).

4.9 Conclusion

By transposing the sustainability dimensions found in the highly elastic core of ideas that flow from the Brundtland definition, into interrelated components relevant to planning it was possible to assess the components in terms of their potential links to integrated strategies. From the assessment several key findings were made as well as a number of issues for empirical investigation.

A connection between integrated strategies and planning systems is possible by means of positioning integrated strategies within IDPs. The local level focus of an IDP makes it potentially a very effective tool to be coupled with strategies aimed at traffic congestion reduction as both are formulated from a strategic objective perspective, with a bottom up approach, and implemented at local level. This similarity provides a link between the strategic provision of integrated strategies and IDPs. When a D.A.D.F. facilitates or operationalises such a strategy it has the scope to be assimilated into the IDP process as part of a Traffic Congestion Management Plan. Having identified a wide range of measures to be included in an integrated strategy and their likely effects, a fundamental question was asked with regard to discovering which policy measures will be feasible and have the greatest success under particular local conditions and circumstances. It was found that little empirical research has been carried in answering this question, although some scope for development has been identified.

In terms of the role played by environmental management in planning the analysis suggests that numerous obstacles and difficulties in applying SEA and EIA exist as primary assessment techniques especially in developing countries. It was also identified that within the context of the research - the proposed D.A.D.F. should be initiated with a strategic focus and therefore strategies developed to reduce traffic congestion have to be assessed in terms of SEA and driven by effective Environmental Management Plans (EMPs) so that it serves as a basis for subsequent detailed project planning at local level associated with EIA and ERA. Comprehensive public participation ensures that the full range of project, strategy or proposal objectives at all levels of governance are considered, and is consistent with those in other sectors such as health and education. In the context of the research, public participation can provide a better understanding of transport problems, help generate innovative solutions and be a key factor in gaining public support and acceptability for the final mix of policies needed to deliver a strategy capable of addressing traffic congestion.

The role appraisal plays as a component in integrated strategies has also been explored and found to be essential in providing clear guidance on the systematic, normative and procedural assessment of options to be considered in strategy formulation and the choice of approach which is dependent upon the policy objectives identified. MCA was identified as an appropriate appraisal type within the context of the study. In terms of funding, different strategies will require different combinations of financing sponsors (central, regional and local government, public/private and private) and sources as different combinations of financing sources are appropriate to provide the best fit for a specific package of measures and for the specific sponsor involved. Obviously funding requirements will differ between strategies, will be location specific and each has specific advantages and disadvantages associated with its use.

Having explored the interrelated components and identified potential areas where the proposed D.A.D.F. could be connected to existing planning systems, some important ideas, concepts and themes, which have not yet been explored fully in current research attempts, have been highlighted. These are further gaps this study aims to address and are indicated in Figure 4.16 below.

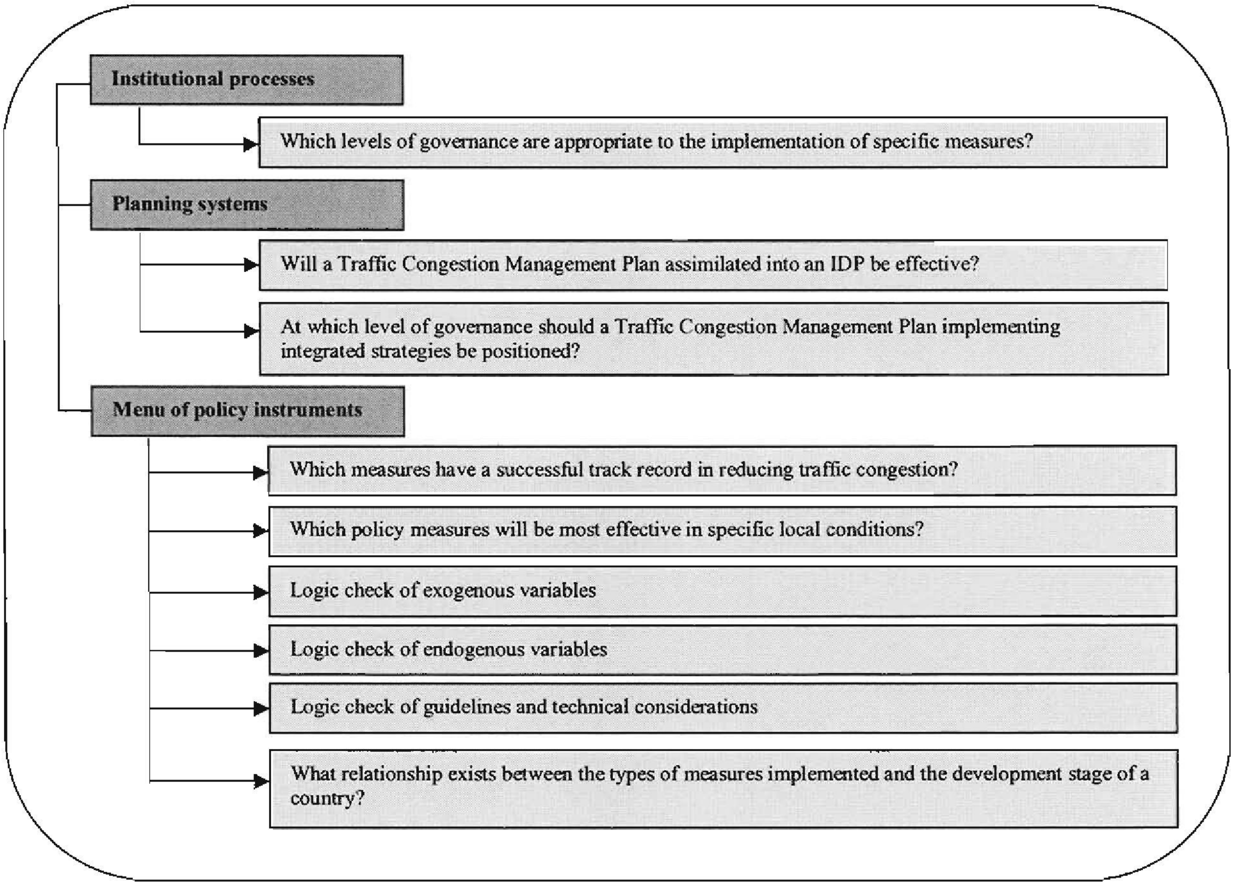


Figure 4.16 Issues to be investigated

CHAPTER 5
METHODOLOGY

5.1 Introduction

The previous chapters have shown that planning has the scope to facilitate sustainable development and that it forces the decision-maker to take into account several key considerations, ultimately providing a logical approach relevant to operationalising integrated strategies. Having transposed the sustainability dimensions into components of the planning system it was possible to assess them and assert whether and where integrated strategies can be connected to these components. The process highlighted and identified specific inconsistencies, concepts, issues, themes and unanswered questions which are the gaps this study aims to address. This chapter will describe and explain how these gaps will be investigated.

5.2 Overall methodological approach

5.2.1 Research design

The empirical investigation will have a **grounded theory and exploratory** design representing the overall approach that implements the strategy. Grounded theory is a pragmatic research method offering a comprehensive and systematic framework for building theory (White, 2002:110-111). A grounded theory is one that is discovered, developed and provisionally verified through systematic data collection and analysis of data pertaining to the subject being studied. It is a theory that arises from data collected, by empirical research and is descriptive in nature. The research will not simply describe the data, but look for interpretations, analysing concepts and searching for possible generalisation or theories to emerge or be "grounded" in the empirical research. Hence, the term "grounded theory".

The goal of grounded theory is to formulate conceptual ideas that others may try to verify (Glaser & Strauss 1967). They are generated by comparing conceptualized data on different levels of abstraction, and these comparisons contain deductive steps. Grounded theory aims to conceptualize "what's going on" using empirical data and is a systematic generation of theory from data that contains both inductive and deductive thinking. In a way grounded theory resembles what many researchers do when retrospectively formulating new hypotheses to fit data. However, in grounded theory the researcher does not pretend to have formulated hypotheses in advance since preformed hypotheses are prohibited (Glaser, 1978; Glaser, 1998).

An exploratory research design is essentially investigatory, creative and driven step-by-step in an evaluative way to inform the full research strategy (Punch, 2002:38). It often relies on secondary research such as reviewing available literature and/or data, or qualitative approaches such as informal discussions with consumers, employees, management or competitors, and more formal approaches through in-depth interviews, focus groups, projective methods, case studies or pilot studies. It is ideally suited to describe market and social characteristics, to pick up on perceptions and to determine possible cause and effect relationships (Trochim, 2002). The results of exploratory research *per se* are not usually useful for decision-making by themselves, but they can provide significant insight into a given situation when coupled with grounded theory to become a powerful ally in generating and verifying new ideas.

5.2.2 Research strategy

The research strategy illustrated by Figure 5.1 represents the reasoning, or the set of ideas, by which the study intends to proceed in order to answer the research questions, to solve the research problem, to attain the research aims and to realise the purpose of the research. In achieving this goal the gaps identified need to be explored first of all, necessitating an empirical investigation – principally identifying and collecting new data and verifying existing theories, ideas and concepts so as to develop a Dynamic Adaptive Decision Framework. Once this data has been collected, analyzed, reported and interpreted the D.A.D.F. will be developed providing a process to develop sustainable and locally acceptable integrated strategies alleviating traffic congestion for local conditions. Once the D.A.D.F. has been constructed its workability will be tested as part of a case study, forming part of the study's evaluation and internal validation process.

The data collected as part of the case study will then be computed into the D.A.D.F enabling its practical application and determination of the most suitable options for specific local conditions. These options can then be transposed into an integrated strategy. Once the results and conclusions from the case study have been reported the research is in a position to draw conclusions and formulate recommendations as to (i) the potential use and application of the D.A.D.F. (ii) its use within a Traffic Congestion Management Plan (iii) how to position the Traffic Congestion Management Plan within South African planning and particularly the IDP process and (iv) the institutional changes that the South African planning system may have to undergo in operationalising a D.A.D.F.

Such a strategy requires a multi-method approach in capturing both qualitative and quantitative data - essentially having structured and semi-structured components. The **first part** of the strategy requires a **survey** exploring international practice pertaining to the relevant themes, issues and gaps identified enabling the decision framework to be developed, whereas the **second part** of the strategy requires a **case**

study exploring and identifying the relevant local conditions, criteria and subject matter to be uploaded into the decision framework so as to test the effectiveness of the D.A.D.F.

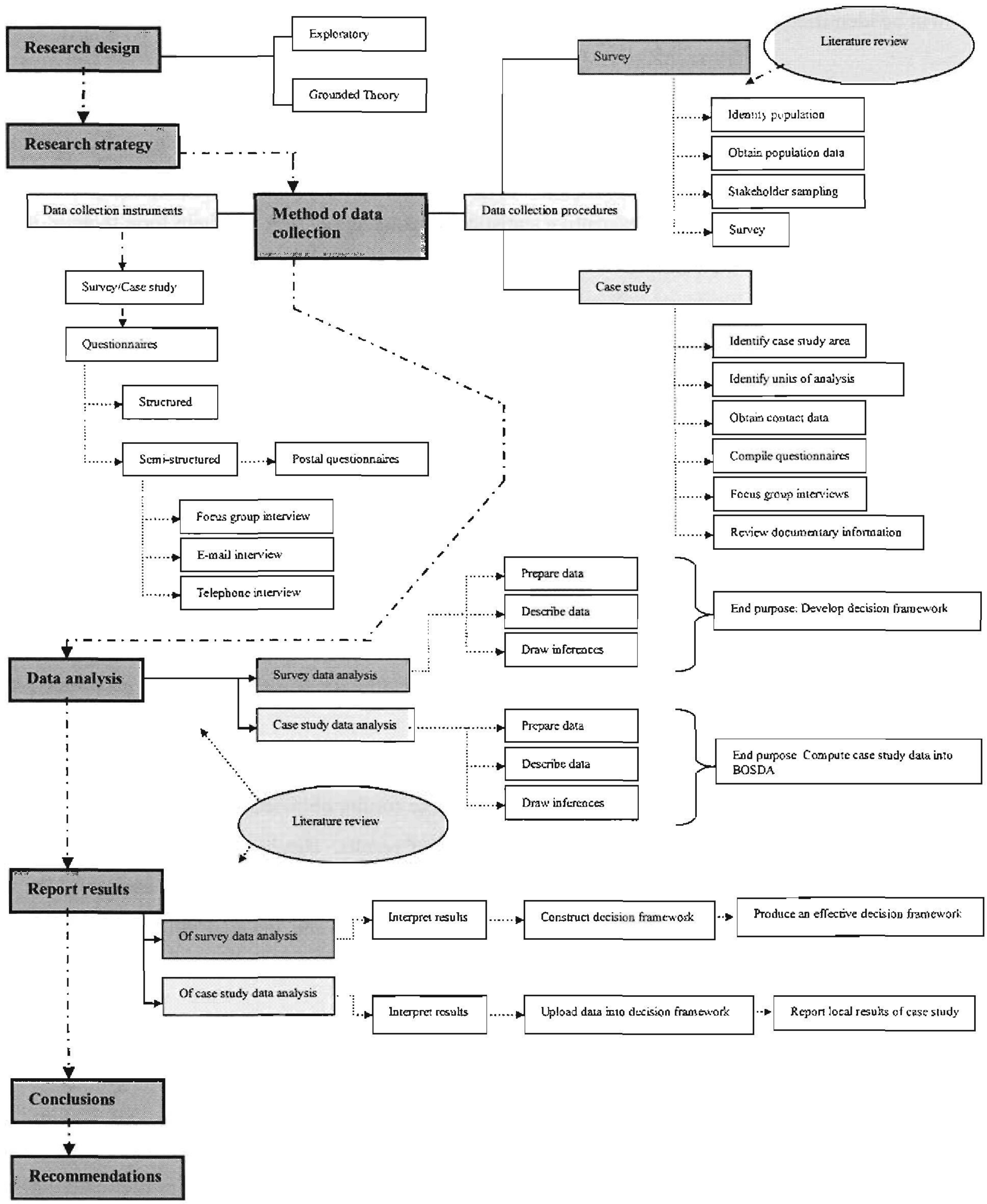


Figure 5.1 Research strategy

In both cases the data collection procedures will be initiated by identifying the population or units of analysis from which data is to be extracted and about whom or what generalisations are made. Once the population has been identified a sample will be drawn (where appropriate) and the survey will be carried out in both a structured and semi-structured form, enabling the collection of both quantitative and qualitative data using questionnaires. For the purpose of the case study, units of analysis and data units will be identified so as to extract relevant data through focus group interviews.

Because the strategy is characterised by an initial comprehensive survey followed by a case study it necessitates two stages of data analysis. Both will involve the cleaning, coding and enumeration of quantitative data into nominal and ordinal data using quantitative analytical techniques. Qualitative data will be reported with the aid of descriptive statistical instruments as they will help form themes, ideas and concepts and identify similarities. Analyse-it, the software program, will be applied as a quantitative data analysis instrument producing descriptive and inferential statistical data using various analytical techniques.

5.2.3 Dealing with data validity

Throughout the investigation the research design will promote internal validity; this is the approximate truth about inferences regarding cause and effect or relationships. The careful and precise application of the research methodology will ensure reliable and consistent data, results and conclusions which will meet the criteria of good science, reproducibility, precision and verification. The validity of the research will also be emphasised by the research design fully addressing the research questions and objectives.

External validity can be achieved by drawing a representative and random sample from the population. Because the sample should represent the population the results obtained can be generalised back to the population, strengthening the external validity of the results. Hence external validity refers to the approximate truth of the conclusions reached that involves generalisation. By analysing the results statistically, the validity of the relationship between dependent and independent variables will also be strengthened and the validity of conclusions and interpretations made in the research enhanced.

5.2.4 Handling confidentiality and anonymity

As ethical issues are involved in research participants will be informed about the purpose of the research so they can make an informed decision as to whether to take part or not. The data collected will remain the property of the researcher and will not be used for any other purpose except for this study. Data gathered will be treated in a way that protects the confidentiality and anonymity of participants by quantifying and coding collected data. The questionnaires will also briefly explain how and why participants have been chosen and how their information will be treated.

5.2.5 Literature review

In the previous chapters the purpose of the literature review was to identify initially the main concepts in strategy integration recording a need for joined-up decision-making and guidance across different areas of TDM, TSM and LUM policy integration as instruments to this end. It also identified several key considerations and strategic components relevant to operationalising integrated strategies - ultimately providing a logical approach which shapes and formulates integrated strategies. In addition the literature review set out to detect the issues, problems, gaps, concerns and shortcomings in this area of research through a thorough literature analysis in getting to grips with and setting out the problem.

Following the survey and during the case study, primary sources are used as a literature check contributing towards verifying arguments, viewpoints and insights to confirm or disprove the views and findings of the research as it progresses as part of the critical evaluation process. The intention is to connect the literature with the research results and analysed data verifying certain concepts and findings in contributing towards the internal validity of the findings.

5.3 Survey

5.3.1 Survey data collection methods

The method of data collection refers to the instruments and procedures used to obtain raw data in providing a comprehensive approach to detect and document stakeholder perceptions, addressing the research questions and gaps. As a first step in this direction the issues identified in Figures 3.8 and 4.16 will be investigated to enable the development of a D.A.D.F. and to identify other relevant data requirements. To this end the following subsections explain how the survey data will be collected.

5.3.1.1 Survey data collection instruments

The survey forms the basic design for collecting data. The survey will have structured and semi-structured components and will be administered by 3 unique questionnaires and cover letters tailored to each stakeholder. Appendix 7-9 (see CD) illustrates the questionnaires used and Appendix 14 and 15 (see CD) the cover letters. The questionnaires together with a cover letter will be sent by post or e-mail in a structured form to participating stakeholders following sampling. The questionnaires will also be used in a semi-structured form where the relevant stakeholder will give his/her input into the research through telephone interviews and discussions and/or by e-mail interviews and discussions. In these cases, data will be recorded by taking notes and writing them up after the interview, e-mail and/or telephone interview or discussion.

5.3.1.2 Survey data collection procedures

The data collection procedures refer to the actual process of data collection and how the instruments are administered. In addressing the research questions and the more specific gaps identified three stakeholder groups or role players have been identified from which information is required. They are (i) National planning and engineering departments (ii) Land-use and transport planning consultants and (iii) Environmental interest groups. Because generalisation is sought between the participants, it is necessary to have a large enough sample enabling statistical generalisation to be made back to the general population, validating the research methodology and providing credible results. For this reason each stakeholder has a unique sampling procedure as explained below.

5.3.1.2.1 National planning and engineering department sampling procedure

Because the intention is to generalise the research findings, a representative sample has to be drawn from the identified population. Furthermore, because the research aims to identify the relationship between the development stage of a country and the most effective intervention measures it employs and the extent to which its preferred sustainability objectives, criteria and indicators differ (or correspond), it is necessary to draw a representative sample from developed, developing and the least developed countries.

For this purpose it is essential to consider how the development stages of countries are defined and delineated. The starkest distinction is between backward and advanced economies, or between traditional and modern ones. The more popular classifications used by the World Bank implicitly put all countries on a continuum from developed to the least developed countries based on their degree of development reflecting a four-part classification that is useful for many analytical purposes (Todaro, 2000:30). The developing countries are divided by income into low-income economies and middle-income economies. The latter group is further divided into lower-middle-income economies, and upper-middle-income economies. (A subset of upper-middle-income countries, mostly Asian and occasionally Latin American economies whose industrial output has been growing rapidly, is sometimes called the newly industrializing countries or economies.) The World Bank's classification is completed by the high-income economies (also called the industrial countries), mostly members of the Organization for Economic Co-operation and Development (OECD), with incomes over $10066 per capita.

However, no classification system can capture all the important dimensions of development and provide a perfectly consistent, manageable framework. To this end Ghatak (1995:1), Todaro (2000:30) and Gilis et al. (1996:6-7) cite that organizations such as the World Bank, the International Monetary Fund (IMF) and the Central Intelligence Agency, generally agree on categorising the 194 countries in the world primarily by stage of development (including the human development index) and income level as illustrated in Table 5.1 and shown by Figure 5.2.

Table 5.1 Country classification

Degree of development	Income level	Country		
Developed countries	**High Income/ Industrialised/ OPEC (per capita > $10066)**	Andorra	Hong Kong	Norway
		Australia	Iceland	Portugal
		Austria	Ireland	Qatar
		Bahrain	Israel	San Marino
		Belgium	Italy	Saudi Arabia
		Bermuda	Japan	Singapore
		Denmark	Kuwait	Spain
		Finland	Liechtenstein	Sweden
		France	Luxembourg	Switzerland
		Germany	Malta	United Kingdom
		Greece	Netherlands	United States of America
		Greenland	New Zealand	Vatican City
Developing countries	**Low income (per capita between $650 and $825)**	Albania	India	Sierra Leone
		Angola	Kenya	Slovakia (Slovak Republic)
		Antigua and Bermuda	Lebanon	Slovenia
		Bosnia and Herzegovina	Liberia	Solomon Islands
		Burundi	Madagascar	Somalia
		Cambodia	Mauritania	Sri Lanka
		China	Mongolia	Surinam
		Djibouti	Mozambique	Togo
		Dominica	Nauru	Tonga
		East Timor	Nicaragua	Tuvalu
		Egypt	Nigeria	Vanuatu
		Eritrea	Pakistan	Vietnam
		French Guiana	Palau	Zaire
		Ghana	Palestine	Zambia
		Grenada	Sao Tome and Principe	Zimbabwe
		Honduras		
	Middle income (per capita between $826 and $3225)	Aruba	El Salvador	Papua New Guinea
		Algeria	Fiji	Paraguay
		Armenia	Georgia	Peru
		Azerbaijan	Guatemala	Philippines
		Bahamas, The	Guyana	Poland
		Barbados	Iran	Romania
		Belize	Ivory Coast (Cote d'Ivoire)	Saint Kitts and Nevis
		Bolivia	Jamaica	Saint Lucia
		Brunei	Jordan	Saint Vincent and the Grenadines
		Bulgaria	Kazakhstan	Samoa
		Cameroon	Kiribati	Senegal
		Cayman Islands	Kyrgyz Republic (Kyrgyzstan)	Seychelles
		Chile	Macedonia	Syria
		Colombia	Malaysia	Tajikistan
		Congo, The Republic of	Marshall Islands	Thailand
		Costa Rica	Mauritius	Tunisia
		Croatia	Micronesia, Federated States of	Turkey

		Cuba	Moldova	Turkmenistan
		Cyprus	Monaco	Ukraine
		Czech Republic	Morocco	Uzbekistan
		Dominican Republic	Namibia	
		Ecuador	Panama	
	Upper middle income/ Newly industrialised (per capita between $3256 and $3225)	Argentina	Iraq	South Africa
		Botswana	Korea, Dem Rep.	Taiwan
		Brazil	Latvia	Trinidad and Tobago
		Canada	Libya	United Arab Emirates
		Estonia	Lithuania	Uruguay
		Gabon	Mexico	Venezuela
		Hungary	Oman	Yugoslavia (Serbia and Montenegro)
		Indonesia	Russia	
Least developed countries	**Low income (per capita < $650)**	Afghanistan	Ethiopia	Maldives
		Bangladesh	Gambia	Mali
		Benin	Guinea	Nepal
		Bhutan	Guinea-Bissau	Niger
		Burkina Faso	Haiti	Rwanda
		Cape Verde	Kosovo	Sudan
		Central African Republic	Lao PDR	Tanzania
		Chad	Lesotho	
		Comoros	Malawi	

Sources: Ghatak (1995:1), Todaro, (2000) & Gilis et al. (1996)

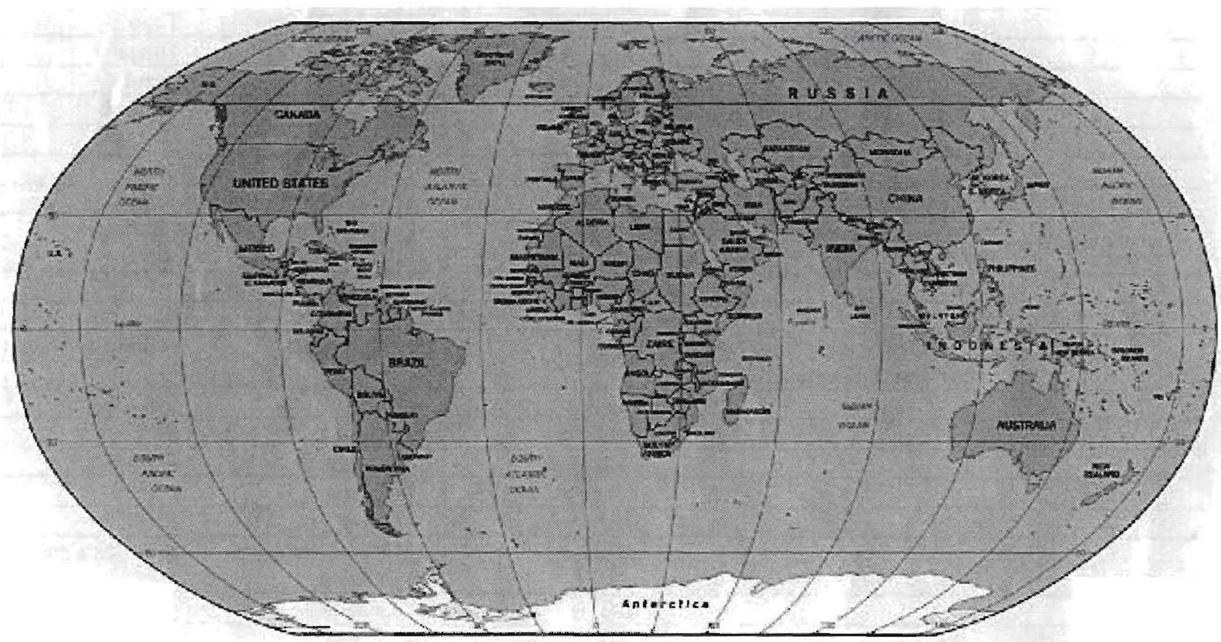


Figure 5.2 World map

Source: Wikipedia (2006)

Against this background the accessible or study population comprises every country in the world with their respective National planning and engineering departments equating to 194 countries as illustrated by Table 5.1. Because the population is grouped by development and income level it is possible to divide the population into clusters, where each unit in the cluster is similar in profile. For the purpose of sampling, Wegener (2002:173) and Easton and McColl (2004) cite that cluster random sampling is well suited for such groupings within the population.

Once the population has been arranged alphabetically within each of the 5 clusters, namely (i) high income countries,(ii) low income developing countries (iii) middle income countries (iv) upper middle income countries and (v) low income least developed countries; an 80% sample will be drawn from each cluster to provide a representative sample of the population. An 80% sample will also ensure a high level of statistical confidence in the generalisation of the sample and the sample being representative of the population. For example, in a cluster containing a sample frame of 36 high income countries, with a required 80% sample, sampling begins by randomly selecting 20% of the sample units once the first sampling unit has been randomly selected. Thus every 5th sample unit in the cluster will be selected once the starting point has been randomly selected. This will leave a sample size of 7 units. Thereafter, three subsequent 20% samples will be drawn at a uniform interval relative to the first observation to end up with an 80% sample. Therefore, if the initial starting point was sampling unit 23, subsequent samples are selected systematically at every 5th unit from the 23rd unit. This means that the 2nd 20% sample will be drawn starting at sample unit 28, the 3rd 20% sample will be drawn starting at sample unit 33 and the final 20% sample will be drawn starting at sample unit 4. This process will leave a sample size of 28. By repeating the process for every other cluster 156 sample units will be randomly selected as illustrated in Table 5.2.

Table 5.2 National planning and engineering department sample

Degree of development	Income level	Country		
Developed countries	**High Income/ Industrialised/ OPEC (per capita > $10066)**	Australia	Iceland	Norway
		Austria	Ireland	Portugal
		Belgium	Israel	Qatar
		Bermuda	Italy	Singapore
		Denmark	Japan	Spain
		Finland	Kuwait	Sweden
		France	Luxembourg	Switzerland
		Germany	Netherlands	United Kingdom
		Greece	New Zealand	United States of America
		Hong Kong		
Developing countries	**Low income (per capita between $650 and $825)**	Angola	India	Sierra Leone
		Antigua and Bermuda	Kenya	Slovenia
		Bosnia and Herzegovina	Lebanon	Solomon Islands
		Cambodia	Liberia	Somalia
		China	Mauritania	Sri Lanka
		Djibouti	Mongolia	Surinam
		Dominica	Mozambique	Togo

		East Timor	Nicaragua	Tonga
		Egypt	Nigeria	Vanuatu
		Eritrea	Pakistan	Vietnam
		Ghana	Palestine	Zaire
		Grenada	Sao Tome and Principe	Zambia
		Honduras		
	Middle income (per capita between $826 and $3225)	Algeria	El Salvador	Panama
		Armenia	Fiji	Papua New Guinea
		Azerbaijan	Georgia	Peru
		Babamas, The	Guyana	Philippines
		Belize	Iran	Poland
		Bolivia	Ivory Coast (Cote d'Ivoire)	Romania
		Brunei	Jamaica	Saint Lucia
		Bulgaria	Kazakhstan	Saint Vincent and the Grenadines
		Cayman Islands	Kiribati	Samoa
		Chile	Kyrgyz Republic (Kyrgyzstan)	Senegal
		Colombia	Macedonia	Seychelles
		Congo, Republic of The	Marshall Islands	Tajikistan
		Croatia	Mauritius	Thailand
		Cuba	Micronesia, Federated States of	Tunisia
		Cyprus	Moldova	Turkey
		Czech Republic	Morocco	Ukraine
		Ecuador	Namibia	Uzbekistan
	Upper middle income/ Newly industrialised (per capita between $3256 and $3225)	Botswana	Iraq	South Africa
		Brazil	Korea, Dem Rep.	Taiwan
		Canada	Libya	Trinidad and Tobago
		Estonia	Lithuania	United Arab Emirates
		Hungary	Mexico	Venezuela
		Indonesia	Oman	Yugoslavia (Serbia and Montenegro)
Least developed countries	**Low income (per capita < $650)**	Bangladesh	Guinea	Mali
		Benin	Haiti	Nepal
		Burkina Faso	Kosovo	Rwanda
		Cape Verde	Lao PDR	Sudan
		Chad	Lesotho	Tanzania
		Comoros	Malawi	Uganda
		Gambia	Maldives	Yemen

Source: Author's own construction

As it is possible to compile a fairly accurate listing of each country's national planning and engineering departments from their respective websites, it is possible to record and approach every department represented by each selected sample unit. To this end, the selected countries' national planning and engineering departments will receive a questionnaire by mail or e-mail as appropriate opposed to taking part in personal or focus group interviews because the sample of interest is dispersed over to a wide geographical area for the study to be feasible with personal or focus group interviews. The questionnaire will include a cover letter explaining the purpose of the research, how and why participants have been selected, seek informed consent and provide some background information as to the purpose of developing a D.A.D.F. The cover letter will also include information about how the participant's confidentiality and anonymity will be preserved, how the information will be safeguarded and how his identity will be protected. Participants will also be told who owns the data and the conclusions drawn from the survey, how it will be reported and disseminated and will be assured that the data will not be abused or used for any purpose other than the research.

5.3.1.2.2 Land-use and transport planning consultant sampling procedure

When sampling, the production of the sampling frame (population) of consultants is a key element to ensure that bias is reduced and that it truly represents the population from which it is taken, enhancing its generalisability (White, 2002:60). For the purpose of the research it is necessary to identify a population of consultants from developed, developing and the least developed countries which meets a number of criteria in demonstrating their working experience, expertise and suitability to form part of the population. Such criteria are:

- Having experience in integrating transport and land-use development projects

- Experience of development or formulation of TDM, TSM and LUM policy strategies aimed at integration

- Being multi-disciplinary –
    - providing professional, technologically-based support services
    - at the local, strategic and inter-regional levels
    - working with public and private sector clients and the regulated industry
    - having markets in at least the rail and road sectors of the economy

- Provide services including –
    - demand forecasting
    - development / masterplanning
    - intelligent transport systems
    - micro-simulation
    - policy evaluation and research
    - public transport policy development
    - transport economics
    - traffic engineering
    - major scheme business case development

Table 5.3 Pool of countries for consultant selection

Countries		
Australia	Germany	Poland
Austria	Greece	Portugal
Belgium	Hong Kong	Singapore
Brazil	Hungary	Spain
Bulgaria	India	Sweden
Canada	Ireland	Switzerland
China	Italy	Taiwan
Czech Republic	Korea	UK
Denmark	Lao Peoples Republic	United Arab Emirates
Estonia	Mexico	USA
Finland	Netherlands	
France	Norway	

As it would be a very difficult and time-consuming task to identify comprehensively every practising transport planning consultancy across every country in the world (to form the theoretical population), this research will focus only on identifying the relevant consultants from those countries and cities where known success in TDM, TSM and LUM policy integration has been achieved (as recorded in the literature review) and those meeting at least one of the criteria above (the accessible population). As a result 34 countries have been identified as illustrated in Table 5.3 that have engaged in TDM, TSM and LUM policy integration or are actively researching the issue by commissioning consultants. These are the countries from which a population of consultants will be extracted.

The method used to identify and compile such an ambitious list of consultants involves accessing a number of World Wide Web sites and other published sources so as to identify a comprehensive and representative population. In producing the population, the European Commission, the World Bank, the New Civil Engineer and Yellow Pages provide online access to consultants engaged in the transport planning and land-use planning activities. Once every listed consultant has been identified by country, it will be amalgamated into one set of data serving as a population. Having accessed this data, a sampling frame or population of 6217 consultants have been identified. For sampling purposes the population of consultants will be arranged alphabetically and a 30% sample drawn. For example, in a population of 6217 consultants with a required 30% sample, 1865 consultants will be selected once the starting point has been randomly selected. Each selected consultant will then receive a questionnaire and a cover letter by mail and or e-mail. This method of stakeholder involvement is chosen above personal or focus group interviews because the sample of interest is dispersed over to a wide geographical area in order for the study to be feasible.

5.3.1.2.3 Environmental interest group sampling procedure

Table 5.4 below illustrates the schedule of Environmental interest groups to be approached as part of the survey, inclusive of address details. The population size is a function of the purpose of the study, the need for qualitative data, the benefit and value it will add to the research and practical constraints to the research. The environmental interest group population consists of 3 stakeholders with an international presence. A sample will not be drawn from this population. The complete population will be approached by e-mail or telephone in seeking their co-operation in participating in the survey. A date and time will initially be arranged to meet and discuss the questionnaire. The telephone call or e-mail will be followed by sending a covering letter and questionnaire, for the stakeholder to become familiar with the content before the meeting.

Table 5.4 Environmental interest group interview schedule

Stakeholder	Address
Friends of the Earth	26-28 Underwood Street
	London
	N1 7JQ
Greenpeace	Canonbury Villas
	London
	N1 2PN
Environment Agency	Swift House
	Camberley
	Surrey
	GU16 5SQ

This will also serve as a method by which the participant could become acquainted with the questionnaire, reflect on the issues raised and consult other staff in relation to the questions. The focus group meetings will then be held at the stakeholder's office. At the interview the questionnaire will be administered by the author in the presence of the participant(s) by taking notes. Once the notes have been completed the participant(s) will be given the opportunity to discuss the issues raised in the questionnaire in more detail and to raise any concerns. They will then be asked to check the notes and whether they believe they are a true reflection of their statements, ideas and perception. The data will then be reconstructed following the interview.

5.3.1.3 Non-response

No matter how well the sampling design is planned, a poor response rate to the survey can have a detrimental impact on the study. By non-response it is meant that the required data are not obtained for all the elements, selected for observation (Durrant, 2005:5). Hence, those participants not returning questionnaires directly affect the generalizability of the findings and conclusions. If one considers that a 75% response rate is highly desirable if generalizability of the findings are to be maintained, it makes all the more sense to reduce non-response as far as practicable. Non-response normally occurs as a result of one or more of the following reasons (Yamamoto & Kirsch, 1995:293):

(i) Participants are away (e.g. for holiday or occupational commitments) at the time of the survey

(ii) Participants refuse to answer and/or return the questionnaire

(iii) Some participants may have moved and left no forwarding address or are not contacted due to an unforeseen error in the survey procedures.

(iv) E-mail sent to an address where the user account has been closed

Non-response presents two problems for the interpretation of research results. First it reduces the sample size and thus decreases the precision with which results can be stated. Secondly non-response increases the potential for a biased sample. Hence the obtained responses may no longer be representative of the larger population and render the conclusions much weaker. Burkell (2003:244-250) recommends several strategies to deal with non-response - the following will be used should the need arise.

Firstly a cover letter will be included with the postal questionnaire briefly introducing the concept of integrated strategies to the uninformed participant. It also presents the opportunity to build a certain degree of rapport with the participant by personalizing the questionnaire and removing an unwanted businesslike appearance. Secondly, a self-addressed, stamped or franked envelope will be included with the questionnaire to increase the response rate. Thirdly, the questionnaire and cover letter will also be e-mailed to participants where e-mail addresses are available. Finally a reminder letter will be sent two weeks after sending the questionnaires to prompt the early return of questionnaires.

In the event of having a very poor return i.e. 10%, it is essential to have a reserve sample to boost the response rate and increase the desired level of confidence and precision. In producing a reserve sample, the National planning and engineering Departments sampling procedure will be repeated, by randomly selecting 30% of the population as a sample, thereby producing a reserve sample size of 58 participants. Similarly, the land-use and transport planning consultants sampling procedure will be repeated, by randomly selecting 10% of the population as a sample, thereby producing a reserve sample size of 621 participants.

5.3.2 Survey data analysis

Following the survey, the collected data will be analysed in three phases, as shown by Figure 5.3. These phases form the platform for unlocking the required information to fill the gaps in previous research and to develop a D.A.D.F.

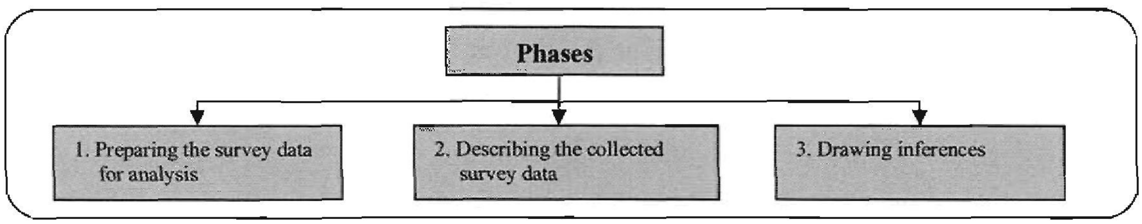


Figure 5.3 Three phases of survey data analysis

5.3.2.1 Preparing the survey data for analysis

This will involve checking and logging the data, checking the data for accuracy and entering the data into a personal computer. Qualitative data will undergo a content reduction to reduce the amount of data, reduce the volume of information, identify significant patterns and construct a framework for communicating the essence of what the data reveals. The identification of significant patterns in the data will be facilitated by a procedure whereby a relatively small number of coding schemes or categories are developed and assigned to similar concepts and/or ideas. Because quantitative data is analysed using quantitative data analysis which requires the data to be in the form of numbers, the data will be transformed by coding or enumeration. For example, a closed question from the questionnaire may read as follows:

The response "Yes" is given the numerical value of 0 and "No" is given the numerical value of 1. Once all qualitative replies have been coded into quantitative data it is possible to be statistically analysed. Hence by working through the interview transcripts and questionnaires, each separate concept or idea is allocated with a numerical code. The answers to open questions will be coded by coding similar patterns, concepts and ideas in the same way.

5.3.2.2 Describing the collected survey data

Descriptive statistics will be used to provide simple summaries about both quantitative and qualitative data in describing the basic features of the data. This will be carried out by presenting the data with the aid of tables, figures, graphs etc.

5.3.2.3 Drawing inferences

Analyse-it will be used to obtain inferential statistics, which extend sample findings to the population and serve as an additional technique investigating the research question and more specific research questions. The use of inferential statistics makes it possible to measure the relationship between independent and dependent variables and to establish whether the relationships truly exist, if they are significant or whether they occurred by change (Trochim, 2002).

5.3.3 Reporting the survey results

Following the first stage data analysis the survey results will be reported with descriptive statistical instruments and report writing. The results will help form a holistic view of the fundamental elements required in developing a D.A.D.F and throw some light on overcoming the gaps identified.

5.3.4 Discussion and interpretation of the survey results

Once the results have been reported it is equally important to interpret and explain and evaluate what has been found, how it fits in with what is already known about the subject and to identify remaining problem areas. This positions the research to structure the D.A.D.F to evaluate or appraise alternative TDM, TSM and LUM measures under differing local conditions using Multi-Criteria Analysis (MCA) based software

BOSDA. The interpretation of the results will also shed some light on the appropriate levels of government at which integrated strategies should be implemented, the use of the D.A.D.F. and whether it is feasible to incorporate the D.A.D.F. into a Traffic Congestion Management Plan.

5.3.5 Structuring the Dynamic Adaptive Decision Framework

Once the survey results have interpreted and the data to develop the D.A.D.F. is available, the study is in a position to structure the D.A.D.F. The central idea is that the reported data from the survey and those key concepts identified through the literature review such as policy objectives, criteria, indicators, measures, effects, guidelines and technical considerations etc. will be computed into the MCA software program BOSDA. The data will effectively be shaped and grouped as a flexible or dynamic adaptive screening mechanism or framework enabling the establishment of preferences between alternative policy options and to determine the most suitable measures for specific local conditions. The product will provide the blue print for developing and ranking sustainable and locally acceptable measures to alleviate traffic congestion in particular local conditions.

5.4 Case study protocol

The case study protocol sets out how data will be collected for uploading into the D.A.D.F. referring to the methods employed, the instruments used, and the procedures for data collection and data analysis.

5.4.1 Case study strategy

To apply the D.A.D.F. the study requires a second stage of data collection, collecting relevant data for upload into the framework thereby testing its workability and effectiveness. Figure 5.4 illustrates the broad case study strategy which is aimed at obtaining the following type of qualitative and quantitative data:

- raw data about local demographic, economic, infrastructural conditions and planning policy
- comparing local policy objectives to the research derived sustainable development objectives
- development planning concerns and constraints as well as strengths
- planning criteria and indicators and assigning weights to them
- performing a logic check on variables exogenous and endogenous to the transport system and assigning weights to them
- weights to be assigned to empirically determined guidelines and technical considerations
- empirical rating of 1st, 2nd and 3rd order effects

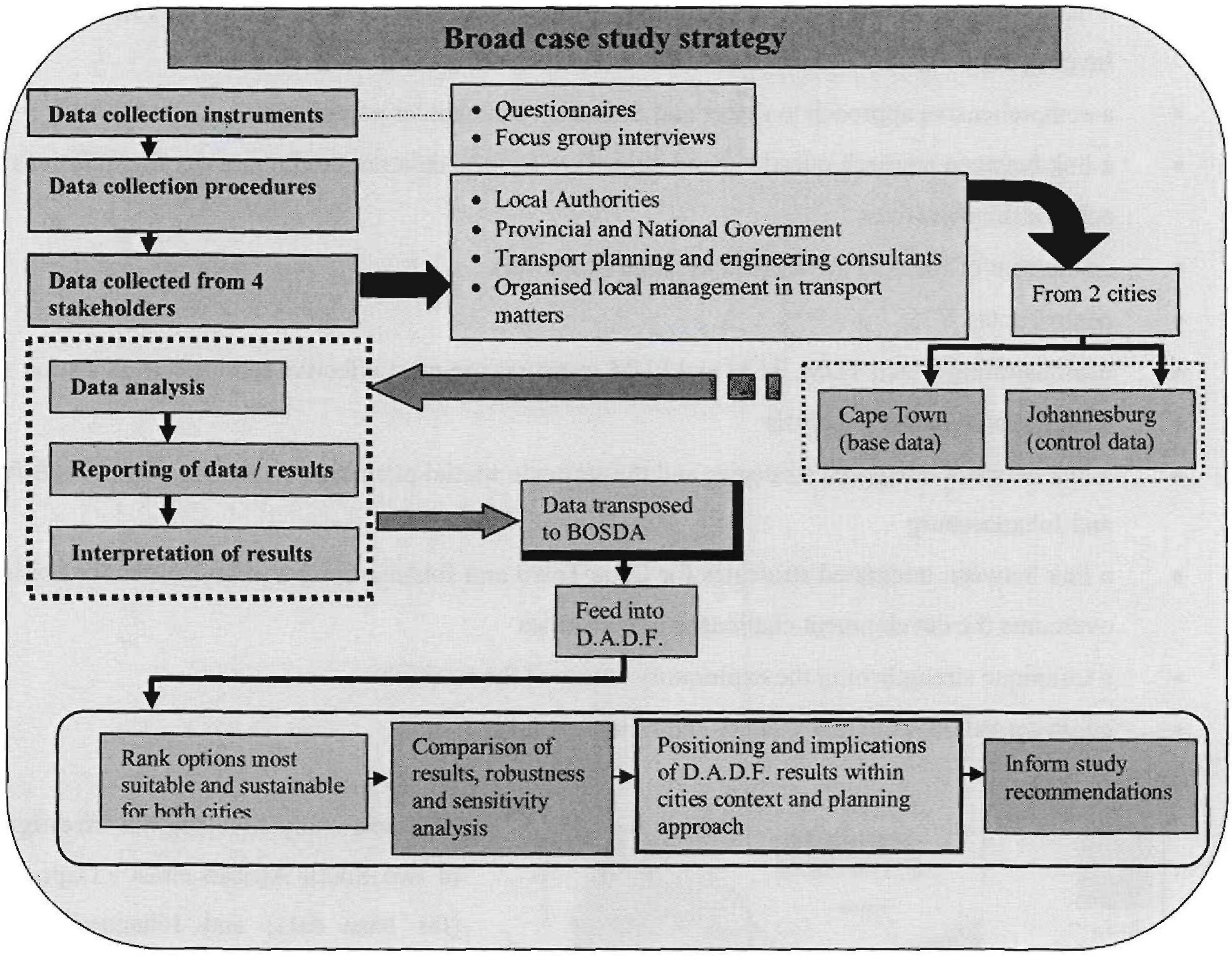


Figure 5.4 The broad case study strategy

Because the research questions involved are predominantly "what", "how", "which" and "where" questions, they are suitable for focus group interviews, and survey and desk research as data collection instruments within the context of a case study (Frechtling & Westat, 1997). Due to the type of data required (qualitative and quantitative) and the type of research questions and objectives, this stage of the research warrants a *single embedded case study*, because the objectives concerned captures the circumstances and conditions of an everyday or commonplace situation (Scholz & Tietje, 2001).

A case study is not a single qualitative technique, since a number of methods are used such as the logic of design, data collection techniques and specific approaches to data analysis. In this sense the case study is neither a data collection tactic nor merely a design feature alone (Stoecker, 1991:89) but a comprehensive research strategy. It investigates a contemporary phenomenon within its real life context when the boundaries between phenomenon and context are not clearly evident." Most fundamentally, case studies in general aim to explain the presumed causal links in real life interventions that are too complex for a single survey or experiment to identify. Against this background, the case study will serve a number of purposes by providing:

- a natural setting giving the study a "reality" which is often absent from surveys and similar types of investigation
- a comprehensive approach to detect and document stakeholder perceptions
- a link between research questions and objectives and the data required to answer the questions and achieve the objectives
- an element of focus to the derived decision framework
- control data
- demonstrating which TDM, TSM and LUM measures are most effective for a specific location
- enabling comparative analysis
- a link between integrated strategies and the strategic spatial planning perspectives from Cape Town and Johannesburg
- a link between integrated strategies for Cape Town and Johannesburg and how it has the ability to overcome the development challenges in both cities
- a technique strengthening the exploratory nature of the research
- construct validity, internal validity and reliable results

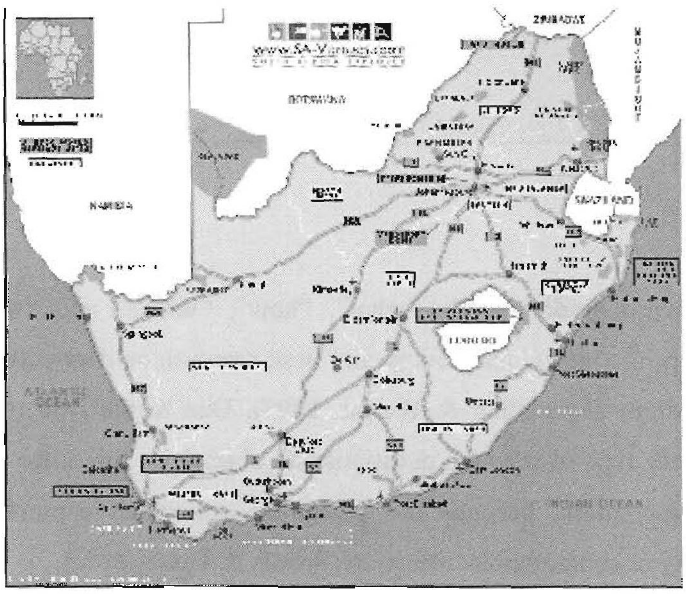


Figure 5.5 Geographical location of Cape Town and Johannesburg within South Africa

Source: SA-venues (2006)

The case study involves the investigation of two South African cities - Cape Town (for base data) and Johannesburg (for control data) as shown by Figure 5.5. The choice of cities is based on population size, geographical coverage and similarities in traffic and development problems experienced. Their background will be described and explained in Chapter 8 in order to provide a full picture of the situation under investigation, thereby "setting the scene" for the reader. This gives the research more credibility and renders it academically more valid.

The contextual features to be considered are amongst others:

- the history and location of the city: how it has developed over time to its current situation
- an account of its traffic, transport and strategic location within the wider national picture
- the role and influence of government and other institutions in its development

- transport and spatial development perspectives for Cape Town and Johannesburg
- development challenges experienced in both cities
- the application of land-use techniques
- researching the data required to enumerate the exogenous variables

5.4.2 Methods of data collection

The following sub-sections set out to explain how the relevant case study data will be collected with reference to the procedures and instruments employed.

5.4.2.1 Case study data collection instruments

A characteristic feature of case studies is that they employ a variety of different data collection instruments or techniques (Smith, 1999:2). The primary instruments for collecting data in this stage of the research include questionnaires, focus group interviews, reviewing documentary information, a literature review and general overt field observations. By using multiple instruments of data collection it is possible to detect a broader range of historical, attitudinal and behavioural issues and they help develop convergent lines of argument through triangulation (Trochim, 2002). The case study will have structured and semi-structured components and will be administered by 4 unique questionnaires and cover letters tailored for each unit of analysis. Appendix 10 – 13 (see CD) illustrates the questionnaires used and Appendix 16 and 17 (see CD) the cover letters. The questionnaires together with cover letters will be sent by post or e-mail in a structured form to respondents following sampling. The questionnaires will also be used in a semi-structured form (i) at open ended focus group interviews, where the relevant respondent will give his/her input into the research (ii) telephone interviews and discussions and (iii) by e-mail interviews and discussions. In these cases, data will be recorded by taking notes and writing them up after the interview, e-mail and/or telephone interview or discussion.

5.4.2.2 Case study data collection procedures

The data collection procedures refer to the actual process of data collection and how the instruments or techniques are used or administered. They are described in more detail in the sub-sections which follow.

5.4.2.2.1 Identifying units of analysis

The identification of the units of analysis is a key element to ensure reduced bias and to enhance generalisability. Theory development does not only facilitate the data collection phase of the ensuing case study. The appropriately developed theory, delivered results and subsequent recommendations are also at the level at which the generalisation of the case study will occur. When case studies are applied to develop theory or test perception, analytical generalisation (opposed to statistical generalisation) is used to generalise the results of the case study. Sarens & De Beelde (2004:14) assert that a fatal flaw in doing case studies is to conceive of statistical generalisation as method of generalising the results of the case study. This is primarily due to the *case* not consisting of "sampling units", but instead of units of analysis. Under these circumstances, the mode of generalisation is analytical generalisation, in which previously developed theory is used to compare the empirical results of the case study.

The number of units of analysis involved in the case study is a function of the purpose of the study, the need for qualitative and quantitative data, the benefit and value it will add to the research and practical constraints to the research. Four role player groups as units of analysis from which information is required to achieve the research objectives have been selected, based upon the following considerations:

- the type of research questions and objectives inherently hint at the sources from which data is to be collected
- the geographical location in which the case study is carried out
- national and provincial government institutions responsible to facilitate transport and land-use planning and highway infrastructure provision
- national and local consultants involved in transport projects in both cities
- the involvement of organised local management in transport matters

With these considerations in mind the following units of analysis have been identified: (i) the City of Cape Town Metropolitan Municipality and the City of Johannesburg Metro (ii) the Provincial Government of the Western Cape, the Gauteng Provincial Government and the National Department of Transport (iii) local and national land-use and transport planning and engineering consultants involved in development planning and transport projects in both Cape Town, Johannesburg and nationally and (iv) SALGA (South African Local Government Association). Both cities provide an online service at their websites http://www.capegateway.gov.za and http://www.joburg.org.za when searching for national, provincial and local government services provided within each.

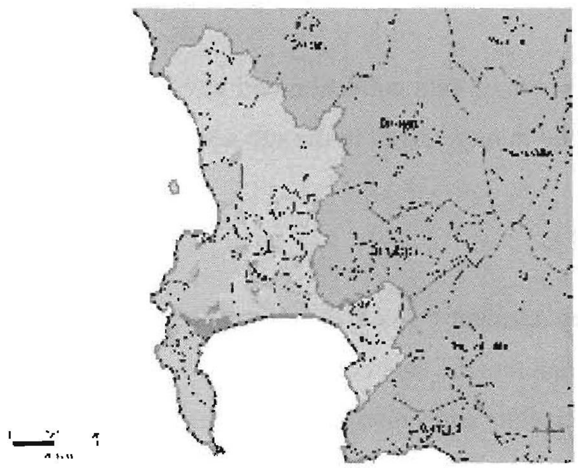


Figure 5.6 Locality map of Cape Town and its bordering municipalities

Source: Cape Town (2005)

In browsing the Cape Gateway website 2 units of analysis and further units of data were identified for Cape Town. That is (i) the **planning and highway engineering departments of the City of Cape Town Metropolitan Municipality** being further defined into relevant units of data. Figure 5.6 illustrates the metropolitan area covered. Similarly, the service was also used to identify the (ii) **Provincial government of the Western Cape as well as the National Department of Transport** (national government) as units of analysis in determining the relevant planning and highway engineering authorities responsible for delivering these services at Provincial and National level in Cape Town.

Figure 5.7 *Locality map of Johannesburg and its bordering municipalities*
Source: Wikipedia (2006)

The units of analysis relevant to Johannesburg were identified using the Johannesburg Metro website http://www.joburg.org.za. That is: (i) the **Development Planning and Facilitation and Transportation Planning and Management Departments of the city of Johannesburg** being further defined into relevant units of data. Figure 5.7 illustrates the metropolitan area covered. Similarly, the service was also used to identify (ii) the **Gauteng Provincial government** as a unit of analysis in determining the relevant planning and highway engineering authorities responsible for delivering these services at Provincial level in Johannesburg. In identifying the (iii) **local and national land-use and transport planning and engineering consultants** (units of analysis) operating in both cities the Yellow Pages provide an online service at their website http://www.yellowpages.co.za when searching for a specific listed business and provide the option of searching by business name, city or location and province within 11 classifications.

A population of units of analysis will be identified from both cities' geographic area by searching the Yellow Pages website. The search has identified 210 consultants as the population of units of analysis. Following their identification and alphabetical arrangement a 20% sample will be drawn serving as units of analysis to the case study. For example, in a population of 210 consultants with a required 20% sample, every fifth sample unit on the list will be selected once the starting point has been randomly selected. This will leave a sample size of 21 local and national land-use and transport planning and engineering consultants as data units.

In terms of organised local management in transport matters, SALGA has been identified as a unit of analysis. SALGA has offices in both cities, is involved in local transport matters and will be approached for input into the case study.

5.4.2.2.2 Collecting data from the units of analysis

In preparation for collecting data from the units of analysis and units of data, the organisations involved will be approached by e-mail or telephone seeking their co-operation in participating in the case study.

The purpose of the study will be explained to them and key contact information assembled. The telephone call or e-mail will be followed by sending a covering letter and questionnaire so the units can become familiar with the content before the meeting and reflect on the issues raised and consult other staff in relation to the questions. A date and time will initially be arranged to formally meet and discuss the questionnaire by means of a focus group interview. Table 5.5, 5.6, 5.7 and 5.8 below show the units of analysis and units of data.

Table 5.5 City of Cape Town and City of Johannesburg Metropolitan Municipality: Planning and Highway Authority focus group interview schedule

Units of analysis	Units of data
City of Cape Town Metropolitan Municipality	Directorates: Transport, roads and planning
	Directorate: Environmental Planning, Environmental Management Department (Metro Office)
	Directorate Planning and Development
	Spatial Planning Department
City of Johannesburg	Development planning and facilitation
	Transportation planning and management

Table 5.6 Provincial planning Authority and National and Provincial highway Authority focus group interview schedule

Units of analysis	Units of data
Provincial government of the Western Cape	Department of Environmental Affairs and Development Planning
	Department of Environmental Affairs and Development Planning: Western Cape Provincial Development Council
	Department of Transport and Public Works
	Department of Transport and Public Works: Roads and Infrastructure Branch
Guateng Provincial Government	Department of Public Transport, Roads and Works
South African Department for Transport	SA National Roads Agency

Table 5.7 Land-use and transport planning consultant focus group interview schedule

Units of analysis	
Kwezi V3 Engineers	Larry Aberman Town Planning
Africon	Pro-Consort Town Planners
HHO Africa	CSIR
ARUP	Plan Africa Consulting CC
WSP International Management consultancy	M.L.H. Architects & Planners
Murrey and Roberts Limited	Macroplan CC
UWP Consulting	Holtmann Jonathan & Associates
Information and Consulting Engineering	Urban Dynamics Gauteng Inc.
Arcus Gibb	Megaplan Town and Regional Planners & Construction
Pendulum transportation planning and engineering consultants	A M I Town & Regional Planners
B C D	METROPLAN
Planning Partners (PTY) LTD	

Table 5.8 Organised local management in transport matters

Units of analysis	Units of data
SALGA	SALGA Western Cape
	SALGA Gauteng

Once a date and time to meet the participants have been agreed between all parties involved, focus group interviews will be held at selected participants' offices. At the interview the questionnaire will be administered by the author in the presence of the respondents by taking notes. This provides the opportunity to follow the line of inquiry set out by the case study protocol and to ask actual and conversational questions in an unbiased manner. It will also help corroborate facts thought to have been established in the earlier parts of the research. Another useful data collection instrument according to Gonzalez (1983:11) is the use of "table shells". When this is used the questions include empty "tables". These are the outlines of a table, defining precisely the "rows" and "columns" of the data array, but in the absence of having the actual data. In this sense, the table indicates the data to be collected by the author as part of the question.

Once the questions have been asked and the notes have been completed, the respondents will be given the opportunity to discuss the issues raised in the questionnaire in more detail and to raise any other concerns. They will then be asked to check the notes and questionnaire and whether they believe they are a true reflection of their statements. The data will then be reconstructed following the interview. For the purpose of collecting quantitative and or statistical data required to enumerate the exogenous variables under consideration, documentary information received from the stakeholders as well as data from desk research will be used in gathering the data sought. These sources of data are essential to corroborate and augment evidence from other literature sources, help make inferences and strengthen or disprove the data collected from the focus group interviews.

5.4.2.2.3 Considering principles of data collection

Throughout the data collection procedures three principles of data collection will be implemented. They are (i) using multiple sources of evidence (ii) creating a case study database and (iii) maintaining a chain of evidence.

5.4.3 Case study data analysis

Following the data collection process, the data will be analysed in three phases similar to the process followed in the first stage survey data analysis, but with some additional analytical techniques as appropriate to case study analysis. This process (which is explained in more detail below) will unlock the required information to be uploaded into the D.A.D.F, consisting of examining, categorising, tabulating and otherwise combining both quantitative and qualitative findings. It will also identify qualitative data relevant to considering the strategic spatial perspectives held of Cape Town and Johannesburg and the development challenges faced by both cities.

5.4.3.1 Preparing the case study data for analysis

The data collected for analysis from both cities will be prepared separately by checking the data for accuracy, logging it and entering it into a personal computer. Qualitative data will undergo a content reduction to reduce the amount of data and the volume of information, identify significant patterns and construct a framework for communicating the essence of what the data reveals. The identification of significant patterns in qualitative data will be achieved by introducing procedures such as those suggested by Yin (2003:111) specifically aimed at effectively analysing case study data. They include:

- Putting information into different arrays
- Preparing a matrix of categories and placing the evidence within such categories
- Creating data displays such as flow charts and other graphs for examining the data
- Tabulating the data
- Examining the complexities of such tabulations and their relationships by calculating second order numbers such as means and variances
- Putting information in chronological order
- Coding and categorising data into groups and assigning similar concepts and/or ideas to appropriate groups

The cleaning and coding of quantitative data will be carried out following the same procedure as described in paragraph 5.3.2.1 pertaining to the survey data.

5.4.3.2 Describing the collected data

Descriptive statistics will be used to provide simple summaries about both quantitative and qualitative data in describing the basic features of the data for both cities. This will be carried out by presenting the data with the aid of tables, figures, graphs etc.

5.4.3.3 Drawing inferences from the collected data

During the analysis, case study data from Cape Town and Johannesburg will be analysed comparatively. Because the case study will generate large amounts of qualitative data, pattern matching and cross data unit analysis will be carried out to help draw inferences about the data collected at both locations. Pattern matching involves comparing similar groups of empirically collected data to identifying significant patterns and/or similarities in the data. It presents an opportunity to assess written documents, survey results and other documentary information received from respondents in further identifying unique patterns within the data across several similar groups. If the patterns coincide, the results will help the case study strengthen its internal validity.

Cross data unit analysis involves examining pairs of data units (stakeholders involved in the focus group interviews), categorising the similarities and differences in each pair. As patterns begin to emerge, certain evidence and pertinent results may stand out either being in conflict with the patterns under examination or supporting each other, to tie the evidence to the findings and the inter-dependent relationships in answer to the research questions.

Some case study data will be quantitative and it follows that it will be analysed using quantitative data analysis. Because this data type has been transformed by coding during the cleaning and preparation of the case study data, inferential statistics will serve as an additional technique exploring the research question and more specific research questions. Analyse-it will be used for this purpose.

5.4.4 Reporting and interpreting the case study results

Following the second stage case study data analysis the results will be reported and interpreted with descriptive statistical instruments and report writing.

5.4.5 Upload of case study data into the D.A.D.F.

Once Cape Town's results have been reported and interpreted they are uploaded into the D.A.D.F., screening a host of TDM, TSM and LUM measures sequentially to establish the most appropriate measures for Cape Town thereby producing measures to be assimilated into an integrated strategy. This process is followed by uploading the results from Johannesburg into the D.A.D.F. again screening TDM, TSM and LUM measures to establish the most appropriate measures for Johannesburg enabling an assessment and comparison of the results from both cities in testing the D.AD.F.'s robustness and consistency in terms of forecasting. The measures identified will also be transposed into an integrated strategy for Johannesburg. The D.A.D.F. results will then be positioned within both cities' context in identifying its implication.

5.5 Drawing conclusions

Following the upload of the case study data into the D.A.D.F. and positioning its results within the cities' context, conclusions will be drawn from the study, including:

1. a summary of its principal components
2. an outline of the main findings
3. the implications of the research
4. the achievement of objectives
5. the main results of the research
6. directions for future research

5.6 Recommendations

This is the final stage of the research and will be used to formulate recommendations and practical suggestions as to the potential application of the D.A.D.F. Particular emphasis will be placed on positioning the role of the D.A.D.F. within the (transport and land-use) institutional framework of South Africa as a developing country with reference to:

- its position and use within a proposed Traffic Congestion Management Plan
- its position/role in the vertical and horizontal dimensions of decision-making, planning and integration across the relevant institutional tiers
- identifying the appropriate levels of governance to provide guidance on congestion reduction (to implement a D.A.D.F.) and at which level the process must be implemented
- determining whether institutional changes are required for the way in which traffic congestion is being dealt with in the South African planning framework and providing recommendations

5.7 Conclusion

This chapter has set out the methodology for investigating the gaps identified by the study. The method involves a grounded theory and exploratory investigation whereby data is collected using a survey and a case study as data collection methods. It has also shown how the study will deal with data validity, confidentiality and anonymity and the use of current literature. It explained how the collected data will be analysed and evaluated through to the practical application of a D.A.D.F. finally drawing conclusions about positioning the research to formulate plausible recommends on the use of such a process. First however, the results obtained from the survey will be reported in the next chapter.

CHAPTER 6

SURVEY RESULTS

6.1 Introduction

The survey was used as a tool to ascertain various stakeholder views and to gather information about the gaps being investigated. The results reported here are as far as possible descriptive, inferential and comparative in nature. Figure 6.1 below highlights the components covered by this chapter.

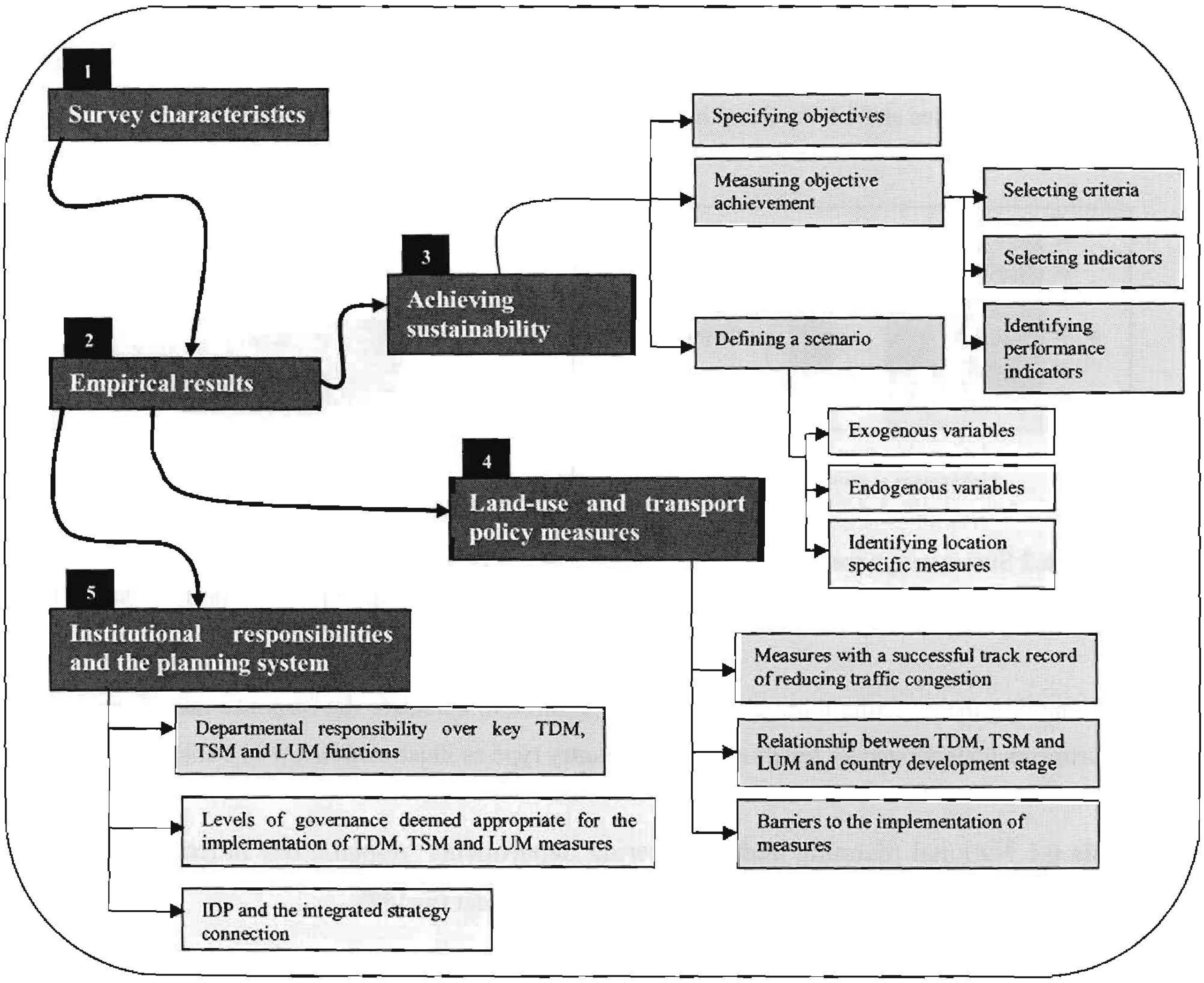


Figure 6.1 Components of Chapter 6

6.2 Survey Characteristics

The survey which was carried out in April 2006 was the driving force behind obtaining relevant and meaningful results and the subsequent survey characteristics reported here. It would take too long to discuss the questionnaires themselves in great detail here Appendices 7 - 9 (see CD) give an impression of the questions asked. Before reporting the empirical findings in section 6.3 this section reports the characteristics of the respondents, comprising three stakeholder groups - (i) National planning and engineering departments (ii) Land-use and transport planning consultants and (iii) the Environmental interest group.

Figure 6.2 below illustrates the response rate of these stakeholders. It shows that the highest response rate was yielded by the National planning and engineering departments with 43.38%, followed by the Land-use and transport planning consultants with 38.87% and the Environmental interest group with a 100% response rate.

Of 468 randomly selected **National planning and engineering departments,** 187 (43.38%) responded by post or e-mail. Of the 187 questionnaires returned, 64.1% were from developed countries, 21.3% from developing countries and 14.4% from the least developed countries as shown by Figure 6.3.

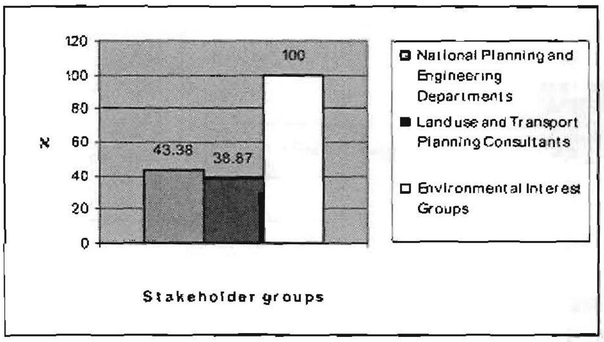


Figure 6.2 Survey response rate

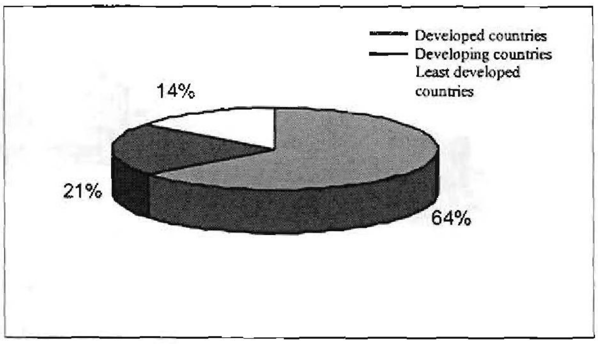


Figure 6.3 National planning and engineering departments' response in terms of country development stage

In examining these results more closely it was possible to calculate the response rates from 5 different departments (categorised by function) and by country type as illustrated below in Table 6.1.

Table 6.1 National planning and engineering departments' response rate in terms of departmental responsibilities and stage of country development (n=187)

Departmental Function	Origin			
	Developed countries	Developing countries	Least dev. countries	Total
Land-use and Transport Planning	19.5%	12.3%	9.2%	41.0%
Road Building and Infrastructure	14.3%	5.1%	2.6%	22.0%
Public Transport Infrastructure	9.2%	1.0%	0.8%	11.0%
Traffic Management	4.2%	0.7%	0.3%	5.0%
Bus and Rail operation	1.1%	0.7%	0.2%	2.0%
Demand Management/Strategic Policies	15.8%	1.5%	1.3%	19.0%

It was found that 41% of the National planning and engineering departments responding were responsible for land-use and spatial planning, 22% for road building and infrastructure, 11% for public transport infrastructure, 5% for traffic management, 2% for bus and rail operations and finally 19% for Demand Management and strategic policy making. These results indicate that the majority of responses were from land-use and spatial planning and road building and infrastructure departments followed by those responsible for Demand Management and strategic policy making. It also reveals that developed countries across all departments had the highest response rate followed by developing countries and the least developed countries.

Respondents were also classified according to the extent to which they had sole responsibility over their main functions, whether it was a joint responsibility with another department or whether it was the responsibility of another organisation altogether. Table 6.2 illustrates that Road building and Infrastructure departments (78%) have the highest level of sole responsibility over their departmental functions and 85% of the land-use and spatial planning departments indicated they have some form of joint responsibility over their functions. It follows that road building and infrastructure departments are associated with less sharing of functions whereas the opposite is true for land-use and spatial planning departments. When respondents were asked whether they agreed to the notion that integrating TDM, TSM and LUM will increase accessibility and mobility, 87% responded positively. Similarly, when asked whether any obvious and proven drawbacks may exist, only 3% voiced their concern in this regard.

Table 6.2 Type of responsibility over departmental functions

Departmental Functions	Own responsibility %	Joint responsibility %	Other %
Land-use and Transport Planning	7	85	8
Road Building and Infrastructure	78	21	1
Public Transport Infrastructure	68	27	5
Traffic Management	41	49	10
Bus and Rail operation	57	40	3
Demand Management/Strategic Policies	28	69	3

Of 1865 randomly selected **Land-use and transport planning consultants,** 725 (38.87%) responded by post or e-mail. Of the 725 questionnaires returned, 66.8% were from developed countries, 22.6% from developing countries and 10.4% from the least developed countries as shown by Figure 6.4.

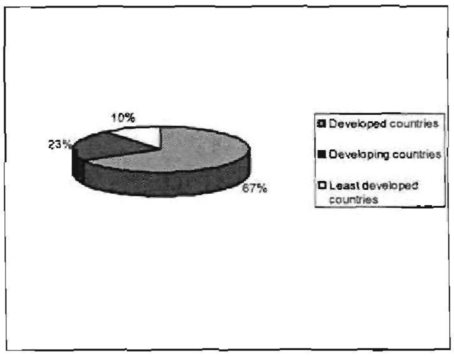


Figure 6.4 Land-use and Transport Planning Consultants' response rate in terms of country type

In comparing the results of the consultants with those of the national departments it is seen that more consultants than national departments responded to the questionnaires from developed and developing countries, but not in terms of their least developed country counterparts who have a more even response rate. In further assessing the consultants' response rate it was possible to disaggregate the response into 3 dominant groups of consultants by country type as illustrated by Table 6.3.

Table 6.3 Consultants' response rate by discipline and country type (n = 725).

Discipline	Developed countries	Developing countries	Least developed countries	TOTAL RESPONSE RATE
Land-use Planning	22 %	9 %	3 %	34 %
Transport Planning	34 %	19 %	5 %	58 %
Traffic and Transport Engineering	4 %	2.5 %	1.5 %	8 %

Table 6.3 shows that 34% of the total number of consultants who responded are involved with land-use and spatial planning, 58% with transport planning (the highest response rate) and 8% with engineering services. It also indicates that developed countries across all departments yielded the highest response rate followed by developing countries and the least developed countries.

The consultants were also asked how much their decision-making and professional judgement about land-use planning, transport planning and their engineering services were influenced by three levels of government – (i) Local Authorities (ii) Regional Authorities and (iii) National Government. Table 6.4 below shows that their decisions about land-use planning are mostly influenced at the Local authority level with some influence from regional level.

Table 6.4 Extent to which consultants decision-making is influenced by different levels of government

Discipline	Local government	Regional government	National government
Land-use Planning	High	Medium	Low
Transport Planning	Low	High	Low
Traffic and Transport Engineering	Low	Low	Low

Decisions about transport planning and engineering were influenced to a lesser extent at Local Authority level. It was also indicated that transport planning are influenced to a greater extent at regional level rather than at the national level. When the consultants were asked whether they agreed to the notion that integrating TDM, TSM and LUM would increase accessibility and mobility, 88% responded positively suggesting optimism about the prospect of integration. Similarly, when asked whether any obvious and proven drawbacks may exist, only 6% voiced their concern in this regard.

The **Environmental Interest group** yielded a 100% response rate. From their responses it was apparent that they have an important role as "consultation bodies/consultees" in the spatial and transport planning processes. The consultation process provides them with an opportunity to influence planning and development decisions in order to minimise the impact of transport on air quality and human health and to make a contribution to sustainable development. When asked whether they agreed to the notion that integrating TDM, TSM and LUM would increase accessibility and mobility, all responded positively again suggesting optimism about the prospect of integration. The group also commented strongly on the need for integration stating that a general aim of planning should be the integration of transport policy with planning policy at all levels to achieve sustainable development and to design out the need for transport solutions that harm the environment.

6.3 Empirical results

By carefully sifting through and analysing collected data, the following sub-sections report and describe the findings of the gaps identified for investigation, thereby forming a holistic view of the key elements required in developing a D.A.D.F. This is done firstly by reporting on the concepts relevant to achieving sustainability, followed by reporting the importance, relevance and preference that exist in terms of land-use and transport planning measures aimed at alleviating traffic congestion. Finally the section reports stakeholder views about (i) the institutional responsibilities in the planning system and (ii) the perceived value of employing a D.A.D.F. to select measures suitable to local conditions and (iii) transposing them into integrated strategies aimed at traffic congestion reduction.

6.3.1 Achieving sustainability

The study has identified that the decision-maker is interested in knowing "when are policies, plans, proposals and strategies designed to alleviate traffic congestion sustainable and effective?" Consequently, the questionnaire was designed to ask about the underlying "method of measuring" sustainability so as to assess the transposibility of general sustainability objectives, indicators, criteria and the scenario in which they occur in measuring the extent to which integrated strategies contribute to sustainable development within the context of traffic congestion reduction. The following sub-sections report the findings in this respect.

6.3.1.1 Specifying policy objectives that will contribute to sustainability

When developing integrated strategies it is essential to be clear about what the strategy aims to achieve within the context of a higher order policy goal – sustainability. In specifying or agreeing on the objectives that will contribute to sustainable development two issues have to be addressed: (i) how important is each of the 7 objectives in achieving sustainability through integrated strategies and (ii) does a relationship exist between objective preference/importance and the stage of a country's development.

6.3.1.1.1 Perception of objective importance to achieving sustainability

Using revealed preference questionnaire techniques the issue of objective importance was put to the stakeholders by asking, in their view how important is each of the 7 objectives in achieving sustainability through integrated strategies. Table 6.5 below reports the response of the three stakeholders collectively and Figure 6.5 illustrates it graphically.

Table 6.5 Overall stakeholder perception of objective importance to achieving sustainability

Objectives		**Importance (%)**		**(n= 915)**
	Not important	Quite important	Important	Very Important
Economic efficiency	0	17.6	35.3	47
Protection of the environment	0	5.8	35.3	58.7
Liveable streets and neighbourhoods	0	11.7	41.1	52.9
Safety	0	17.6	23.5	58.8
Equity and social inclusion	0	17.6	23.5	52.9
Accessibility	0	0	47	51.6
Integration land-use/ transport	0	5.8	23.5	64.7

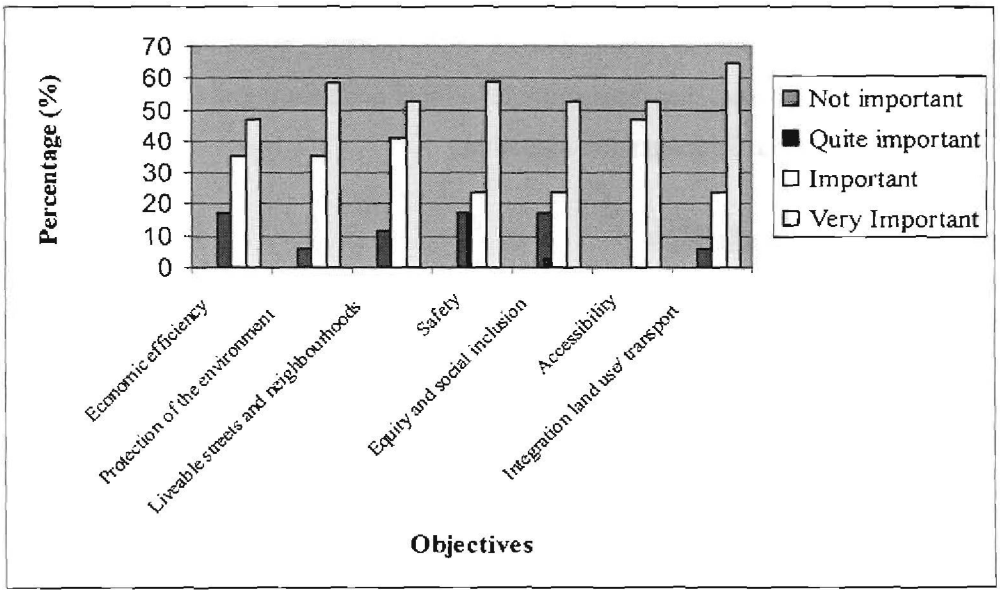


Figure 6.5 Overall stakeholder perception of objectives importance to achieving sustainability

The collective or overall results suggest that economic efficiency (47%) is regarded as the least important objective to be achieved in achieving sustainability and subsequently the objective most likely to stand to lose in a trade-off if measured against the other objectives. Integrating transport and land-use is regarded by most respondents (64%) as the most important objective to be achieved in realising integration and sustainable development.

Stakeholders were also asked to indicate any additional objectives they considered appropriate to measuring the achievement of sustainable urban development and integrated strategies. The responses were clustered in four additional objectives groups. They are: (i) effective public transport (ii) affordable public transportation (iii) minimum levels of service provided across all modes of transport and (iv) protection of human health. It is possible to group the first three additional objectives within the economy objective as they describe and attach an attribute to the achievement of the economy objective. The fourth additional objective relates to the preservation and protection of human health, which forms part of the environmental protection objective. Protection of health is encouraged through design features, regulations and policies of especially TSM. LUM also provides guidance in this respect, but to a lesser extent so does TDM, unless the TDM measure involves newly built and infrastructural changes to the existing infrastructure.

6.3.1.1.2 Assessing whether a relationship exists between objective preference/importance and the stage of a country's development.

In further assessing Table 6.5 it is possible to assert whether a relationship exists between the objectives deemed most appropriate in measuring the extent to which sustainability has been achieved and the level of a country's development. If the objectives and the country's levels of development are defined as variables, correlation analysis can be used to quantify and describe the possible relationship between the objectives from developed, developing and the least developed countries. Once the data in Table 6.5 has been manipulated into ratio scaled data it is possible to calculate statistically the strength of the relationship using a Pearson's correlation coefficient using Analize-it as the software programme.

The results suggest that the objectives deemed important or appropriate to **developed and developing countries** have a weak negative correlation as shown by a relatively low correlation coefficient r value of -0.238. Testing the significance of the correlation determines the probability that the correlation is a real one and not a chance occurrence therefore testing the mutually exclusive hypotheses:

Null Hypothesis: Chance is a reasonable explanation for correlation	**r = 0**
Alternative Hypothesis: Correlation due to factors other than chance	**r < > 0**

In testing the significance of the correlation it was concluded that it was a chance finding and that the correlation was not statistically significant (given the parameters of the correlation test). This implies that there is **not a statistically significant relationship** between the objectives deemed most important in measuring the achievement of sustainability in developed and developing countries. The null hypothesis can therefore be accepted. Table 6.6 below illustrates some of the most critical descriptive comparative statistics in assessing the relationship between revealed objective importance and developed and developing countries.

Table 6.6 Statistics assessing the relationship between revealed objective importance and developed and developing countries.

Country Type	Economic efficiency	Protection of the environment	Liveable streets and neighbourhoods	Safety	Equity and social inclusion	Accessibility	Integration
Developed country	44	55	55	66	55	33	66
Developing country	50	63	65	36	50	61	64

Variables	Mean	SD	SE	95% CI of Mean		Median
Economic efficiency	47.000	4.2426	3.0000	8.881	to 85.119	47.000
Protection of the environment	59.250	6.0104	4.2500	5.249	to 113.251	59.250
Liveable streets and neighbourhoods	60.250	7.4246	5.2500	-6.458	to 126.958	60.250
Safety	51.000	21.2132	15.0000	-139.593	to 241.593	51.000
Accessibility	47.250	20.1525	14.2500	-133.813	to 228.313	47.250
Equity and social inclusion	52.500	3.5355	2.5000	20.735	to 84.265	52.500
Integration land-use/ transport	65.250	1.0607	0.7500	55.720	to 74.780	65.250

From Table 6.6 it is possible to assert that there is a probability of 0.95 that the actual mean of all variables are statistically significant for both developed and developing countries. This is because the actual mean lies between the upper and lower identified confidence limits, suggesting the mean of all variables for both developed and developing countries lies within the 1.96% (for a 95% confidence interval) standard errors of the sample.

Next, the **objectives deemed most important by developed countries are compared with those of the least developed countries** when assessing whether a relationship exists. Importing the data into Analyse-it, and performing correlation analysis the result produced a Pearson's correlation coefficient of $r = 0.851$ suggesting that the importance attached to objectives by developed and developing countries has a strong positive correlation as shown by the relatively high correlation coefficient r value of 0.851. A significance test of this correlation concluded that the relationship is not a chance finding and that the correlation is statistically significant. The null hypothesis can therefore be rejected and the alternative accepted.

Comparing the **objectives deemed most important by developing countries with those of the least developed countries,** correlation analysis produced a Pearson's correlation coefficient of $r = -0.317$ suggesting that the importance attached to objectives by developing and the least developed countries has a moderate negative correlation. A significance test of the correlation found that no relationship of **statistical significance** exists between the objectives deemed most important in measuring the achievement of sustainability by both types of countries. The null hypothesis can therefore be accepted.

6.3.1.2 Measuring the achievement of objectives

The study questioned the appropriateness, applicability and transposibility of the Local Agenda 21 sustainable development indicator framework and criteria in terms of its capacity to assess the extent to which integrated strategies aimed at traffic congestion reduction contribute to the overall sustainability objectives. Subsequently the research questions were designed to identify criteria, indicators and performance indicators from the development indicator framework appropriate to measuring the contribution made by TDM, TSM and LUM measures in achieving the sustainability objectives. The results are reported in the sub sections which follow.

6.3.1.2.1 Selecting criteria

As a starting point, all stakeholders were asked how appropriate they deem 7 sets of criteria that relate directly to the 7 sustainability objectives in measuring the contribution made by TDM, TSM and LUM measures in achieving the 7 sustainability objectives. Respondents had to indicate their choice by answering "Yes" or "No" to the questions asked. For example, respondents were asked: "Which of the following criteria best measure the extent to which the **economy objective** has been achieved?" In this way respondents commented on the appropriateness of a set of criteria per sustainability objective. The overall results (from all respondents, n = 915) in terms of the support and appropriateness of criteria measuring the extent to which the sustainability objectives have been achieved are illustrated in Figures 6.6 – 6.12 below.

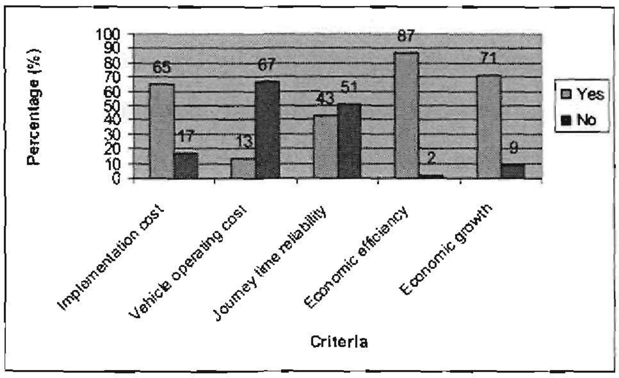


Figure 6.6 Overall support and appropriateness of criteria measuring the extent to which the economy objective has been achieved

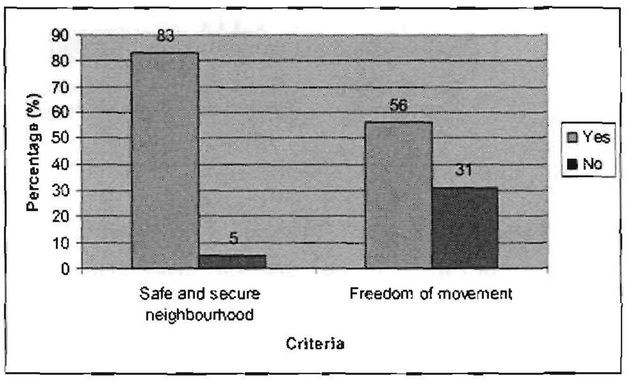


Figure 6.7 Overall support and appropriateness of criteria measuring the extent to which the liveable streets and neighbourhoods objective has been achieved

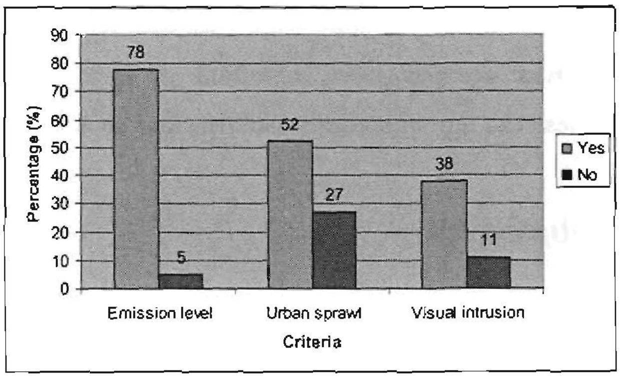


Figure 6.8 Overall support and appropriateness of criteria measuring the extent to which the protection of the environment objective has been achieved

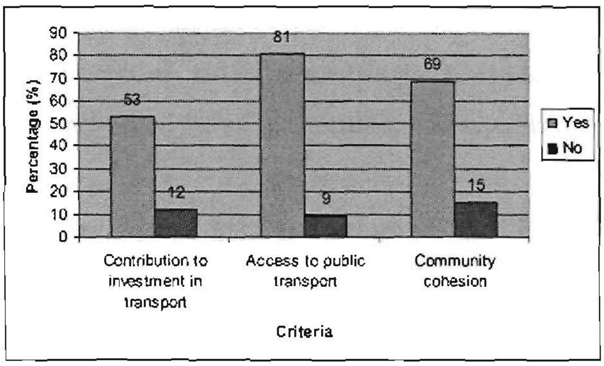


Figure 6.9 Overall support and appropriateness of criteria measuring the extent to which the equity and social inclusion objective has been achieved

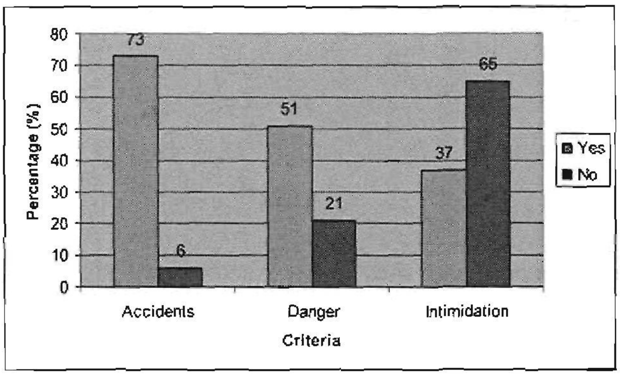


Figure 6.10 Overall support and appropriateness of criteria measuring the extent to which the safety objective has been achieved

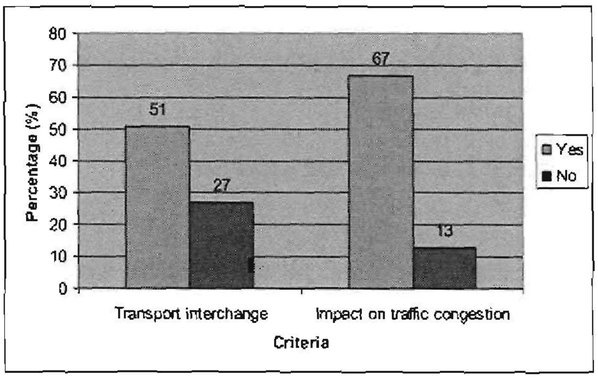


Figure 6.11 Overall support and appropriateness of criteria measuring the extent to which the integration objective has been achieved

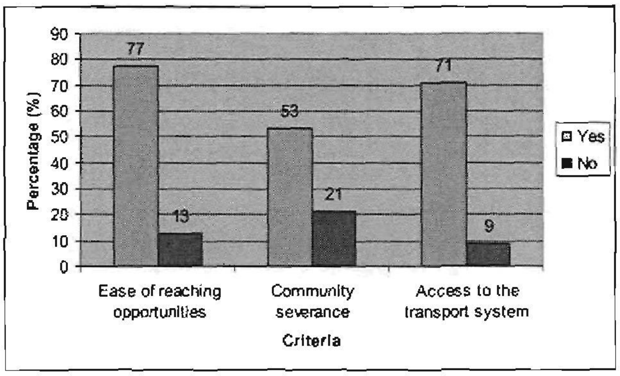


Figure 6.12 Overall support and appropriateness of criteria measuring the extent to which the accessibility objective has been achieved

In terms of the criteria most commonly used and /or deemed appropriate in measuring the extent to which the **economy** objective has been achieved, the results illustrated by Figure 6.6 suggest a high level of support for the economic efficiency criteria (87%) followed by the economic growth criteria (71%) with the implementation cost criteria (65%) as the third most appropriate criteria. In terms of the criteria deemed appropriate in measuring the extent to which the **liveable streets and neighbourhoods** objective has been achieved, the results illustrated by Figure 6.7 suggest a high level of support for the safe and secure neighbourhood criteria (83%) followed by the freedom of movement criteria (56%). When asked about the criteria most commonly used and/or deemed appropriate in measuring the extent to which the **protection of the environment** objective has been achieved Figure 6.8 suggests a high level of usage of the emission level criteria (78%) followed by the urban sprawl criteria (52%) and the visual intrusion criteria (38%) as the third most appropriate criteria. In terms of the criteria deemed appropriate in measuring the extent to which the **equity and social inclusion** objective has been achieved, Figure 6.9 suggests a high level of support for the access to public transport criteria (82%) followed by the community cohesion criteria (69%) and the contribution to investment in transport criteria (53%). In terms of the criteria deemed appropriate in measuring the extent to which the **safety** objective has been achieved Figure 6.10 suggests a high level of support for the accidents criteria (73%) followed by the danger criteria (51%) then the intimidation criteria (53%).

When respondents were asked about the criteria most commonly used and/or deemed appropriate in measuring the extent to which the **integration** objective has been achieved Figure 6.11 suggests a moderately high level of support for the impact on traffic congestion criteria (67 %) followed by the transport interchange criteria (51%). In terms of the criteria deemed appropriate in measuring the extent to which the **accessibility** objective has been achieved Figure 6.12 suggests a high level of support for the ease of reaching opportunities criteria (77%) followed by the access to the transport system criteria (71%) and the community severance criteria (53%).

Next, the analysis assessed whether a relationship exists between the preference for criteria used or deemed appropriate and the development stage of a country. By first **comparing the criteria deemed most appropriate by developed countries with those of developing countries**, correlation analysis produced a very strong negative correlation with a correlation coefficient of r = -1.00. In testing the significance of this correlation, it was found to be **a statistically significant relationship.** The null hypothesis can therefore be rejected and the alternative accepted.

Comparing the criteria deemed most appropriate by developed countries with those of the least developed countries correlation analysis produced a very strong negative correlation as reflected by the high correlation coefficient *r* value of -1.00. In testing the significance of this correlation it was found to be **statistically significant.** The null hypothesis can therefore be rejected and the alternative accepted. Finally **comparing the criteria deemed most appropriate by developing countries with those of the least developed countries**, correlation analysis produced a very strong and statistically significant negative correlation as shown by the high correlation coefficient *r* value of -1.00. From these results it is possible to summarise that there is in general terms a correlation and relationship between the preference for criteria or their appropriateness between developed, developing and the least developed countries in measuring the achievement of objectives and that the relationship is statistically significant, although negative.

6.3.1.2.2 Selecting indicators

Now the discussion turns to identifying and selecting indicators that assess the contribution of various measures to achieving sustainable development objectives. Respondents were asked how appropriate they consider seven sets of indicators to be in qualifying criteria that measure the extent to which policy options contribute to achieving the seven sustainability objectives. The overall results (n = 915) are illustrated in Figure 6.13 – 6.19.

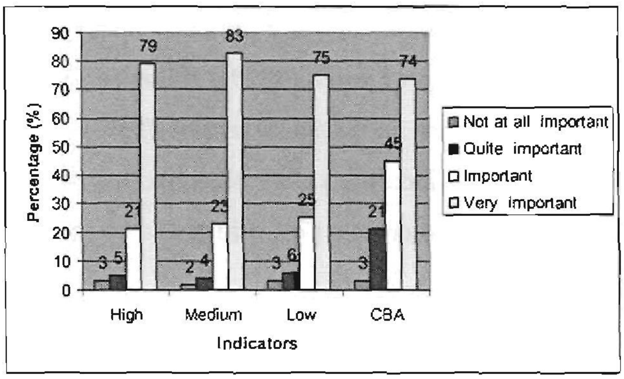


Figure 6.13 Support and appropriateness of indicators measuring the extent to which the economy objective has been achieved

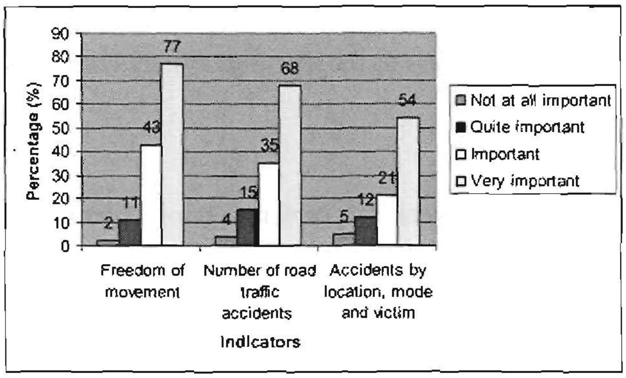


Figure 6.14 Support and appropriateness of indicators measuring the extent to which the liveable streets and neighbourhoods objective has been achieved

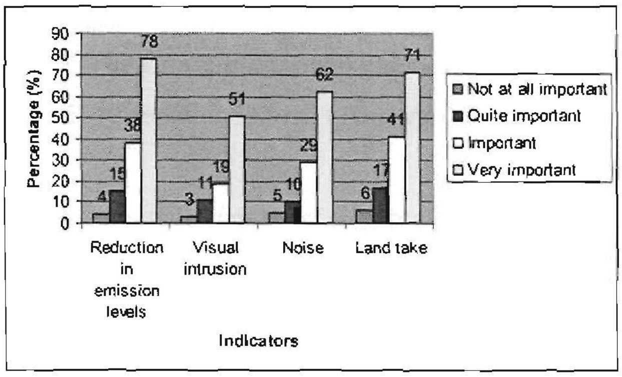


Figure 6.15 Support and appropriateness of indicators measuring the extent to which the protection of the environment objective has been achieved

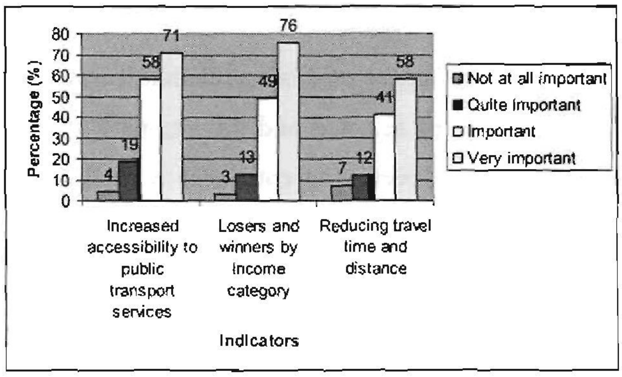


Figure 6.16 Support and appropriateness of indicators measuring the extent to which the equity and social inclusion objective has been achieved

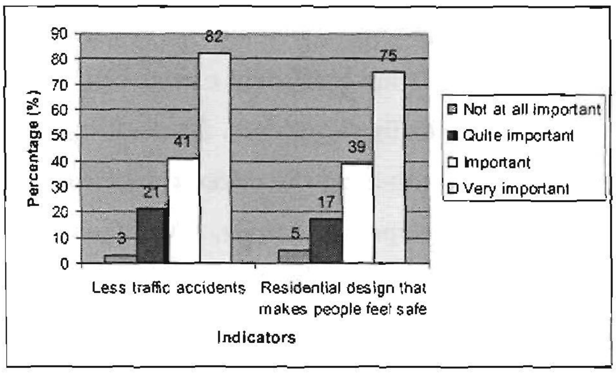


Figure 6.17 Support and appropriateness of indicators measuring the extent to which the safety objective has been achieved

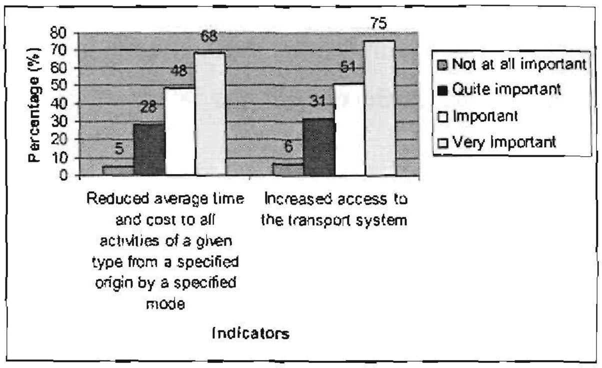


Figure 6.18 Support and appropriateness of indicators measuring the extent to which the accessibility objective has been achieved

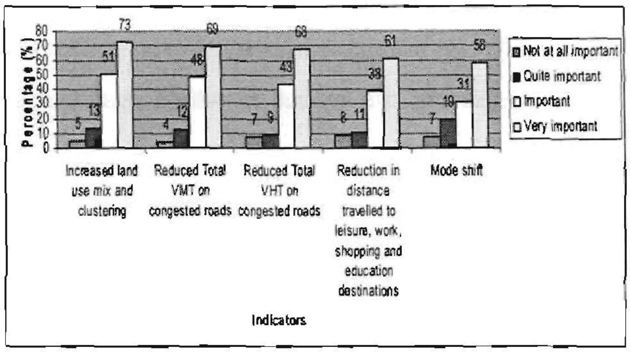


Figure 6.19 Support and appropriateness of indicators measuring the extent to which the integration objective has been achieved

In terms of indicators most commonly used or deemed appropriate in measuring the extent to which the **economy** objective has been achieved Figure 6.13 suggests a high level of usage of the high, medium and low level system of indicators as well as CBA (74%). In terms of the indicators deemed appropriate in measuring the extent to which the **liveable streets and neighbourhoods** objective has been achieved Figure 6.14 suggests a high level of support for the freedom of movement indicator (77%) followed by the number of road traffic accidents indicator (68%).

When respondents were asked about the indicators most commonly used and or deemed appropriate in measuring the extent to which the **protection of the environment** objective has been achieved Figure 6.15 suggests a high level of support for the reduction in emission levels indicator (78%) followed by the land take indicator (71%) with the noise indicator (62%) as the third most appropriate indicator. In terms of the indicators deemed appropriate in measuring the extent to which the **equity and social inclusion** objective has been achieved Figure 6.16 suggests a high level of support for the losers and winners by income category indicator (76%) followed by the increased accessibility to public transport services indicator (71%) and the close proximity of demand driven land-use functions reducing travel time and distance indicator (58%). In terms of the indicators deemed appropriate in measuring the extent to which the **safety** objective has been achieved Figure 6.17 suggests a high level of support for the less traffic accidents indicator (82%) followed by the residential design that makes people feel safe indicator (75%).

In terms of the indicators deemed appropriate in measuring the extent to which the **accessibility** objective has been achieved Figure 6.18 suggests a high level of support for the ease of increased access to the transport system indicator (75%) followed by the access to the reduced average time and cost to all activities of a given type from a specified origin by a specified mode indicator (68%). When asked about the indicators most commonly used and/or deemed appropriate in measuring the extent to which the **integration** objective has been achieved Figure 6.19 suggests a moderately high level of support for the increased land-use mix and clustering indicator (73%) followed by the reduced total VMT on congested roads indicator (69%).

It is possible to further explain these findings with correlation analysis as the research also demands identifying whether a relationship exists between the preference for indicators deemed most appropriate in measuring the extent to which sustainability objectives are achieved and the levels of countries' development.

In comparing the **indicators deemed most appropriate (with highest level of preference) by developed countries with those of developing countries** Analyse-it was used to perform correlation analysis. The result produced a Pearson's correlation of r = -1.00 suggesting that the appropriateness or preference attached to indicators by developed and developing countries has a very strong negative correlation. In testing the significance of this correlation it was also found to be statistically significant. The null hypothesis can therefore be rejected and the alternative accepted.

Comparing the **indicators deemed most appropriate by developed countries with those of the least developed countries** correlation analysis produced a Pearson's correlation of r = -1.00 suggesting that the appropriateness attached to indicators by developed and the least developed countries has a very strong negative correlation. In testing the significance of this correlation it was also found to be statistically significant. The null hypothesis can therefore be rejected and the alternative accepted. Finally by comparing the **indicators deemed most appropriate by developing countries with those of the least developed countries**, correlation analysis produced a Pearson's correlation of r = -1.00 suggesting that the appropriateness attached to indicators by developing and the least developed countries has a very strong negative correlation. A significance test of this correlation also found it to be statistically significant. The null hypothesis can therefore be rejected and the alternative accepted.

From these results it is possible to infer that a good correlation and relationship exists between the preferences for indicators between developed, developing and the least developed countries in measuring the achievement of objectives and that the relationship is statistically significant.

6.3.1.2.3 Identifying performance indicators

The study is also concerned with those indicators capable of measuring the performance of a strategy once it has been implemented referred to as output indicators, enabling the decision-maker to assess how well the strategy is performing and whether it is contributing to sustainable development. To this end the national planning and engineering departments and land-use and transport planning consultants were asked which performance (output) indicators they consider best assess the performance of integrated strategies, by classifying the indicators in three groups: (i) indicators quantified with money values (ii) indicators quantified without money values and (iii) qualitative indicators. In addition, both stakeholders were then asked: "If these indicators are applied to assess the performance of integrated transport and land-use strategies, once implemented, which of the following indicators in each category do you consider assesses the performance of such strategies best?" Respondents were then presented with a wide choice of output indicators to choose from and allowed to select up to three output indicators in each category. The overall results of their choices (n = 912) are reported in Figure 6.20, 6.21 and 6.22 below.

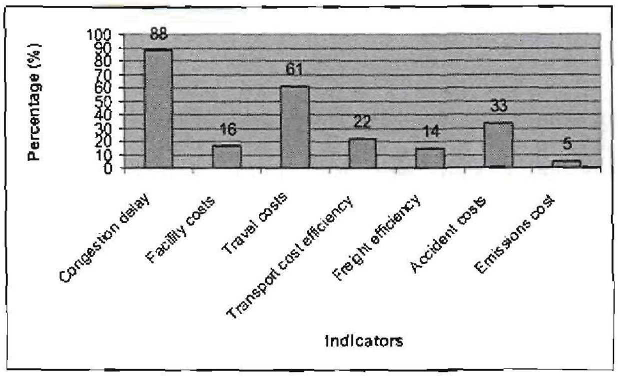


Figure 6.20 Preferred indicators quantified with money values

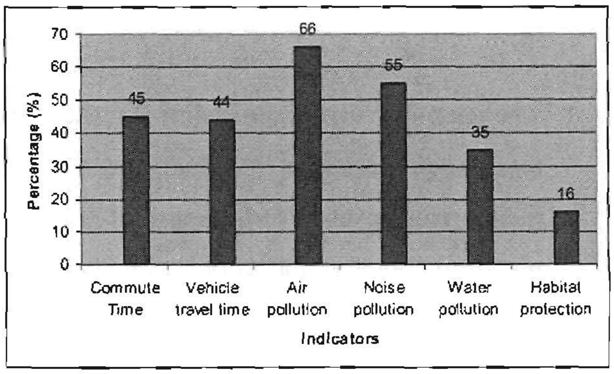


Figure 6.21 Preferred indicators quantified without money values

The results suggest that in terms of **indicators quantified with money values**, congestion delay (88%), travel costs (61%) and accident costs (33%) were the most preferred indicators measuring the performance of integrated strategies once they have been implemented. In terms of **indicators quantified without money values**, air pollution (66%), noise pollution (55%) and commute time (45%) were the most preferred indicators measuring performance.

In terms of **qualitative indicators**, safety (64%), affordability (50%) and transport diversity (47%) were the most preferred indicators measuring the performance. The overall picture emerging from Figures 6.20-22 is that a reduction in congestion delay and air pollution and an increase in safety are the most preferred or most likely to be used indicators when assessing the performance of implemented strategies.

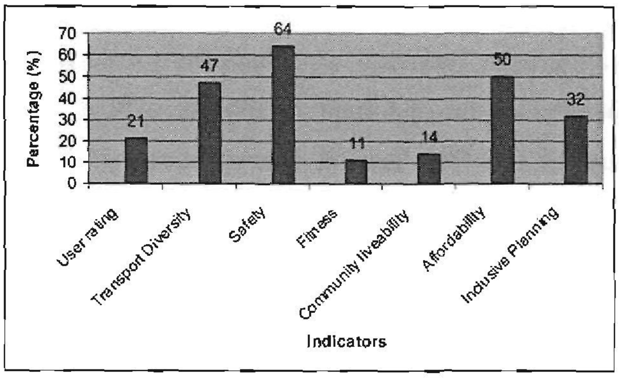


Figure 6.22 Preferred qualitative indicators

Finally by disaggregating the overall results above it is possible to establish whether the preferred performance indicators differ significantly or whether they are comparable between developed, developing and the least developed countries. To this end **developed countries** indicated that the congestion delay (81%) indicator within the "indicators quantified with money values" category was their preferred choice. In terms of the "indicators quantified without money values" category their preferred choice of indicator is air pollution (71%). In terms of the "qualitative indicators" category their preferred choice of indicator was the safety indicator (69%).

Developing countries also indicated that the congestion delay (79%) indicator within the "indicators quantified with money values" category was their preferred choice, although with a smaller margin than their developed countries counterpart. In terms of the "indicators quantified without money values" category their preferred choice of indicator was air pollution (71%). In terms of the "qualitative indicators" category their preferred choice of indicator was affordability (61%).

The least developed countries, like their developed and developing country counterparts, indicated that the congestion delay (73%) indicator within the "indicators quantified with money values" category was their preferred choice. In terms of the "indicators quantified without money values" category their preferred choice of indicator was commute time (65%). In terms of the "qualitative indicators" category their preferred choice of indicator was affordability (67%) which was similar to the developing countries.

These results reflect a good level of correspondence in preference for performance indicators. All stakeholders favoured the use of congestion delay as a primary performance indicator. At face value it does appear that developing and the least developed countries prefer indicators that will measure value for money coupled with a direct journey time improvement. On the other hand, developed countries prefer performance indicators that measure environmental and safety concerns as well as those that enhance transport cost efficiency.

6.3.1.3 Defining the scenario

Having reported the objectives, criteria and indicators deemed appropriate as tools to assess the extent to which integrated strategies contribute to sustainable development, it is necessary to establish the context or circumstances within which the strategy will operate. The context describes the economic, social, demographic, physical and land-use characteristics of an area being planned for – the scenario. These contextual features describe the scenario with the aid of variables exogenous and endogenous to the transport systems. And so the exogenous and endogenous variables form the basis for describing the context within which strategies are planned and they are an important component of the D.A.D.F.'s screening process. They also form a key element in selecting location specific measures. The study identified a number of exogenous and endogenous variables which were put to the stakeholders in agreeing those that adequately describe the transportation and land-use system and are easily measurable.

Subsequently the national planning and engineering departments and land-use and transport planning consultants were presented with two sets of variables, one exogenous and the other endogenous. Respondents were asked "How important do you consider each of the following exogenous variables in describing a scenario being planned for?" Each variable had to be assigned with a degree of "importance or preference" ranging between not at all important to very important. Following the analysis of the responses it was possible to identify which exogenous variables, in the respondents' view best described a scenario in the study context. Table 6.7 illustrates the results.

Table 6.7 Importance and or preference assigned to each exogenous variable (n= 912)

Exogenous variables	Not at all important (%)	Quite important (%)	Important (%)	Very important (%)
Economic growth	0	20	20	53
Employment rate	20	0	26	46
Price stability	20	26	20	20
Balance of payment stability	46	25	26	0
Income distribution	26	25	26	6
Funding available	6	20	13	46
Population size	0	6	53	33
Annual urban pop. growth	0	13	53	26
Population density per sq km	0	13	66	20
Human Development Index	26	20	33	6
Cars per household	6	0	66	13
Land availability	6	26	26	33
Land-use patterns	6	0	33	53
Parking provision	0	13	73	13
Housing	0	0	53	33
Retail development	0	20	53	20
Leisure	6	53	33	6
Accessibility	0	13	46	33

Based on these results Table 6.7 illustrates that respondents viewed the following exogenous variables as relevant and/or appropriate in describing the context or scenario of the settlement being planned for. They are:

1. Parking provision	6. Housing
2. Population density per km^2	7. Retail development
3. Cars per household	8. Economic growth
4. Population size	9. Land-use patterns
5. Annual urban population growth	10. Employment rate

Similarly the stakeholders were also presented with a list of endogenous variables and then asked "How important is each of the following endogenous variables in describing planned for local conditions?". Again each variable had to be assigned with a degree of "importance or preference" ranging between "not at all important" to "very important". Once responses were analysed it was possible to identify which endogenous variables, in the respondents' view best described a planned scenario. Table 6.8 illustrates the results.

Table 6.8 Importance and/or preference assigned to each endogenous variable

Endogenous variables	Not at all important (%)	Quite important (%)	Important (%)	Very important (%)
Air Quality	0	6	60	26
Emission cost	13	33	33	13
Traffic accidents	6	13	20	53
Access to public transport	0	0	20	71
Transport interchange facilities	13	26	26	26
Hub integration	20	33	26	13
Road class	20	6	26	6
Parking and Loading facilities	13	20	60	13
Travel time	0	20	46	53
Vehicle operating cost	0	26	20	40
Capital renewal cost	13	26	26	13
Construction & implementation cost	6	20	40	46
Ease of accessing leisure facilities	6	46	20	0

Based on the results contained in Table 6.8 it can be seen that respondents view the following endogenous variables as very important in describing the local conditions being planned for. They are:

1. Access to public transport	6. Vehicle operating cost
2. Air Quality	7. Construction and implementation cost
3. Parking and Loading facilities	8. Emission cost
4. Traffic accidents	9. Transport interchange facilities
5. Travel time	10. Hub integration

For the endogenous and exogenous variables to play an effective part in the D.A.D.F. screening process they have to be quantifiable and/or measurable which requires the use of technical guidelines and considerations, which is a key component when exploring a mechanism that can be used to identify successfully which circumstances should prevail thereby warranting specific types of intervention in deciding between alternative measures (in other words what scenario is associated with specific measures).

Once guidelines and technical considerations have been established it will be possible to assign, in a qualitative sense, weights to guidelines and technical considerations (following a process similar to assigning weights to criteria and indicators) and by further dividing them into categories, the selection of the appropriate weighted guideline and technical consideration categories best describing the local conditions. In essence this approach provides the decision-maker with a mechanism which enables him to "weigh" local conditions at local or area wide level (using variables, guidelines and technical considerations) and that these selected weighted conditions may then successfully assess the extent to which the measures achieve and contribute to the sustainability objectives.

In establishing a robust set of guidelines and technical considerations stakeholders were asked how appropriate they considered a number of technical considerations to be in measuring a set of exogenous and endogenous variables and whether they are deemed practical and useful in terms of good science. Table 6.9 illustrates their responses.

Table 6.9 Responses on effectiveness, appropriateness and good science of guidelines and technical considerations assessing exogenous and endogenous variables

Exogenous variables	Guidelines/Technical considerations	Not appropriate %	Not very well %	Fairly good %	Well %	Very well %
Economic growth	GGP per capita	3.2	5.1	18.2	73.2	13.4
Employment	Employment rate	4.5	7.6	16.7	44.8	23.4
Price stability	CPI/PPI	7.3	12.3	28.5	56.1	15.2
Balance of payment stability	Stability/Volatility	14.4	15.7	32.5	37.2	16.3
Income distribution	Gini Coefficient	11.4	14.2	23.1	49.3	17.1
Funding available	Level	7.8	12.1	28.3	43.5	46.3
Population size	Actual size (millions)	6.1	9.5	38.7	23.4	63.1
Annual urban pop. growth	Rate in %	3.5	6.9	13.5	45.9	41.7
Population density per km^2	Persons per sq km	5.8	6.3	23.7	57.1	23.7
Human Development Index	HDI	19.5	12.3	19.2	52.3	28.4
Cars per household	Number	6.4	5.4	22.7	57.1	53
Land availability	Ha	12.6	4.5	9.2	36.2	42.8
Land-use patterns	Efficiency of use	13.2	7.4	38.7	33.6	15.6
Parking provision	Vehicles/m^2	9.7	8.2	19.2	48.2	43.4
Housing	Density	5.6	9.4	23.5	68.5	11.7
Retail development	Location	8.3	7.3	35.5	65.7	51.7
Leisure	Location	13.6	17.1	23.4	62.3	43.6
Accessibility	Travel time saving	4.8	9.7	37.2	41.5	13.9

Endogenous variables	Guidelines/Technical considerations	Not appropriate %	Not very well %	Fairly good %	Well %	Very well %
Air Quality	Reduction or increase	3.8	16.9	71.9	68.1	11.9
Biodiversity	Reduction or increase	6.3	15.4	43.5	22.1	3.2
Journey Ambience	Reduction or increase	11	27.2	23.7	13.9	6
Accidents	Reduction or increase	14.4	31.2	65.9	64.9	13.1
Security	Reduction or increase	12.9	21.8	48	15.8	10.1
Access to public transport	Reduction or increase	10.8	27	59.2	45	6.5
Transport interchange facilities	Reduction or increase	8.2	37.4	22.1	34.8	4.8
Hub integration	Reduction or increase	5.6	12.2	44.6	40.4	2.2
Carriageway capacity	Number of lanes	5	22.4	53.8	22.4	4.5
Road class	Type	11	17.9	51	27.1	18.2
Speed limit	Regulated speed limit	4.1	21.4	43.8	43.7	5.1
Lane throughput	Max carrying capacity	3.2	7.9	34.9	41.5	11.3
Width	High, Ave, Low	6.1	37.4	32.3	14.3	11.9
Parking and Loading	On street/off street	6.9	17.9	46.9	42.1	8.4
Pedestrian crossing	None/At grade	8.1	22.2	45.2	10.4	4.3
Bus stops	None/ In lay bys/ kerbside	6	34.2	42.4	38.4	7
Accessibility	Increase/decrease	15.8	22.1	41	42.3	12.3
Traffic effects	Reduction or increase	8.4	35.9	40.2	12.6	3.5
Travel time saving	Reduction or increase	3.8	16.9	68.9	42.1	1.9
Vehicle operating cost	Reduction or increase	4.7	11.3	32.7	39.5	1.3
Capital renewal cost	Reduction or increase	4.1	21.5	36.9	21.5	3.6

It shows that in terms of **exogenous variables** 73.2% of respondents felt that economic growth, 68.5% that housing and 65.7% that retail development are very effective technical considerations in describing endogenous variables. However, population size, leisure, income and population density per square kilometre is also of importance. In terms of **endogenous variables** 71.9% of respondents felt that air quality, 68.9% that travel time saving and 65.9% that accidents are very effective technical considerations in describing these types of variables. Additionally, access to public transport, hub integration and carriageway capacity are also deemed important. Overall the results suggest that respondents appear positive in terms of employing the set of technical considerations above as responses in the "not appropriate" category have reasonably low values. Respondents also favoured marking answers in the "well" category rather than in the "very well" category perhaps erring on the side of caution.

6.3.2 Land-use and transport policy measures

The TDM, TSM, and LUM measures described in Chapter 4 are the tools or options used to overcome traffic problems and achieve the sustainability objectives. Cities will rarely consider the full range of policy measures available to them because of preconceived ideas based on past experience and ever changing public, political, environmental and developmental pressures. And so within this continuum of measures the sub sections which follow report on the following research questions - aimed to assess and establish:

- the menu of measures having a successful track record in reducing traffic congestion within an operational background
- the elements of "Smart Growth" and New Realism proving effective in reducing traffic congestion.
- whether a relationship exists between the types of measures implemented and the development stage of a country
- common barriers experienced to the implementation of measures

6.3.2.1 Measures having a successful track record in reducing traffic congestion

Because the context within which measures are introduced differs from one settlement to another, it is quite acceptable to hypothesise that solutions at one location are not straightforwardly transferable to another. This may be so, but within the cosmos of choices made across many countries, all with different circumstances, it is possible to perceive that a degree of similarity in either approach or mechanism to alleviate traffic congestion has been introduced. It is clear from an operational planning point of view that overlap in international practice will occur, even if to a very small extent. This statement then begs some justifications, within the context of international practice and the question: "Are there any policy measures that have a successful track record in reducing traffic congestion?"

In finding an answer to this question, all stakeholders were asked how important and effective a selected number of TDM, TSM and LUM measures are to them in contributing to traffic congestion reduction. They were also asked how important a number of key "Smart Growth" measures are in their experience. Although not all respondents were familiar with the "Smart Growth" concept, the questionnaire explained its meaning and purpose and as a result the use of this perhaps unfamiliar term did not contribute to non-response to the question. The "Smart Growth" measures the respondents were asked about were easily recognisable as many are applied as TDM, TSM and LUM measures under another name.

Starting with LUM, stakeholders were asked how important and effective they feel a selection of measures is in alleviating traffic congestion based on their operational experience. Responses were classified into four groups, "Not at all important", "Quite important", "Important" and "Very important". The stakeholders' responses are reported in Table 6.10 below.

Table 6.10 Revealed preference of important and effective land-use management measures (n = 915)

LUM measures	Not at all Important %	Quite Important %	Important %	Very Important %
High development density aimed at travel reduction	14.2	21.4	36.7	36.2
Development encouraging use of public transport	2.3	14.5	28.9	43.1
Development mix	7.2	13.6	51.6	65
Development conditions	1.3	42.8	50.7	43.9
Development of travel plans	6.7	35.7	57	29.3
"Smart Growth" strategies	1.7	28.5	64	28.7
Clustered land-use	2.3	21.2	67.5	21.3
Car-free planning	14.3	39.6	43.7	5.8
Taxation policy	7.8	26.3	42.6	27.6

These results suggest that 67.5% of respondents felt that clustered land-use is the most preferred and effective in reducing traffic congestion. 65% felt that development mix is the second most preferred and effective and 64% felt that "Smart Growth" measures are the third most preferred and effective. Of all the LUM measures put to the respondents, car-free planning was reported as the least preferred and effective in contributing towards congestion reduction.

Turning to TSM measures, stakeholders were asked the same question as was asked about LUM measures. Responses were classified into the same four groups as with LUM measures. Responses are illustrated in Table 6.11 below.

Table 6.11 Revealed preference of important and effective transportation supply management measures (n = 915)

TSM measures	Not at all Important %	Quite Important %	Important %	Very Important %
Ramp metering	42.7	21.6	21.9	26.4
HOV facilities	28.7	35.7	29.7	15.7
Park and Ride facilities	21.3	27.8	22.8	45.8
Street design	6.7	35.9	58.3	16.7
Effective and reliable public transport	1.3	14.3	31.2	73.5
New roads or additional lanes	2.1	36.7	37.4	28.5
Parking controls	2.6	37.8	67.9	38.7
Urban traffic control (UTC) systems	15	9.6	36.7	36.3
Intelligent Transport Systems (ITS)	14.2	22.5	29.5	26.7
Traffic calming or restraint measures	7.4	16.2	36.1	16.8
Access control or management	8.6	78.5	13.4	13.8
Multimodal transport interchanges	5.6	20.9	53.4	29.7
Reversible lanes	51.3	23.6	21.8	15.3

In terms of the TSM measures the results suggest that 73% of respondents felt that effective and reliable public transport is the most preferred and effective measure in reducing traffic congestion, 67.9% felt that parking controls is the second most preferred and effective measure and 58.3% felt that street design is the third most preferred and effective measure. Of all the TSM measures put to the respondents, reversible lanes were reported as the least preferred and effective in contributing towards congestion reduction.

Stakeholders were also asked about the importance and effectiveness of a set of TDM measures in achieving success in reducing traffic congestion. Again they were asked the same questions as were asked regarding LUM and TSM measures, but now were presented with a list of TDM measures. Again their responses were classified into four groups as before. The stakeholders' responses are illustrated in Table 6.12 below.

Table 6.12 Revealed preference of important and effective transportation demand management measures (n = 915)

TDM measures	Not at all important %	Quite important %	Important %	Very important %
Regulatory restrictions	3.2	4.7	67.4	24.6
Urban road charging	19.7	38.9	4.2	43.8
Vehicle ownership taxes	19.7	23.4	17.4	42.6
Fuel taxes	17.5	8.9	29.8	38.5
Public car park management	13.2	31.7	53.5	15.6
Workplace parking charges	7.6	46.2	31.2	7.9
Car restriction zones	24.7	38.3	19.8	33.4
Variable message signs	15.4	22.1	45.8	7.8
Driver information systems	13.5	61.2	23.7	8.5

In terms of the TDM measures the results suggest that 43.8% and 53.5% of respondents felt that urban road charging and public car park management are the most preferred and effective measures in reducing traffic congestion. 42.6% felt that vehicle ownership taxes is the second most preferred and effective measure and 38.5% felt that fuel taxes is the third most preferred and effective. Of all the TDM measures put to the respondents, car restriction zones was reported to be the least preferred and effective measure in contributing towards congestion reduction.

Finally, respondents were also asked about how important and effective a set of "Smart Growth" measures were in their experience in successfully reducing traffic congestion. Responses were again classified into four groups and are illustrated in Table 6.13 below.

Table 6.13 Revealed preference of important and effective "Smart Growth" measures (n = 915)

"Smart Growth" measures	Not at all important %	Quite important %	Important %	Very important %
Strategic planning	2.1	4.6	43.8	65.8
Self-contained communities	21.6	21.4	59.7	5.7
Higher density development	15.8	20.5	61.5	23.5
Cluster and infill development	14.3	13.9	64.6	5.2
Concentrate activities	23.4	23.5	52.4	15.6
Flexible zoning	15.7	29.7	28.6	28.7
Public transport orientated development	5.6	7.1	35.7	51.6
Parking management	1.3	22.8	51.5	31.4
Creating interconnected streets	2.7	39.8	42.3	24.8
Improve non-motorised travel conditions	14.3	6.8	44.5	36.3
Implement TDM	19.7	32	44.8	8.3
Preserve green space	37.8	19.4	23.1	19.8

In terms of the "Smart Growth" measures the results suggest that 65.8% of respondents felt that strategic planning is the most preferred and effective measure in reducing traffic congestion. 64.6% felt that cluster and infill development is the second most preferred and effective measure and 61.5% felt that higher density development is the third most preferred and effective measure. Of all the measures put to the respondents the preservation of green space was reported as the least preferred and effective in contributing towards congestion reduction.

Having assessed the measures available to tackle traffic congestion it is possible to identify and rank 10 measures with the most successful track record in reducing traffic congestion within the experience of 915 respondents. The measures are in decreasing order of importance and effectiveness:

1. providing effective and reliable public transport (73%)	6. cluster and infill development (64.6%)
2. parking controls (67.9%)	7. "Smart Growth" strategies (64%)
3. clustered land-use (67.5%)	8. higher density development (61.5%)
4. strategic planning (65.8%)	9. street design (58.3%)
5. development mix (65%)	10. urban road charging (53.5%)

6.3.2.2 The relationship between TDM, TSM, LUM and "Smart Growth" measures and the development stage of a country

The research identified a need to investigate whether a relationship exists between the types of TDM, TSM, LUM and "Smart Growth" measures implemented and the development stage of a country. By further assessing the responses reported in the previous section it is possible to analyse whether such a relationship exists. By disaggregating the overall response data (n = 915) by country development stage and measures implemented or considered for implementation, it was possible to perform correlation analysis in assessing the relationship.

Tables 6.14, 6.15 and 6.16 below illustrate the revealed importance and effectiveness of a set of TDM, TSM, LUM and "Smart Growth" measures by country development stage.

Table 6.14 Revealed preference of importance and effectiveness of TDM, TSM, LUM and "Smart Growth" measures in developed countries

Measures	Not at all important%	Quite important %	Important %	Very important %
LUM				
High development density aimed at travel reduction	7.1	19.1	36.3	38.3
Development encouraging use of public transport	5.4	21.1	30.2	59.9
Development mix	3.4	11.5	67.6	57.2
Development conditions	7.9	45.4	58.5	49.5
Development of travel plans	9.1	23.1	39.3	38.9
"Smart Growth" strategies	6.4	37.3	59.5	37.1
Clustered land-use	3.2	20.1	64.1	21.3
Car-free planning	14.1	18.7	55.1	37.8
Taxation policy	15.4	16.3	57.8	45.7
TSM				
Ramp metering	43.7	56.5	10.1	5.7
HOV facilities	23.8	66.2	19.3	41.2
Park and Ride facilities	9.1	32.1	43.7	23.4
Street design	10.3	65.6	25.3	21.1
Effective and reliable public transport	9.4	38.9	56.7	54.5
New roads or additional lanes	7.8	62.9	29.2	44.7
Parking controls	3.5	23.1	67.9	39.7
Urban traffic control (UTC) systems	6.5	21.6	64.1	23.9
Intelligent Transport Systems (ITS)	5.2	53.7	38.5	37.3
Traffic calming or restraint measures	8.7	20.2	63.1	43.1
Access control or management	3.6	90.9	43.8	52.1
Multimodal transport interchanges	12.5	25.3	52.8	27.1
Reversible lanes	54.5	38.7	23.1	13.1
TDM				
Regulatory restrictions	3.4	17.1	65.7	41.8
Urban road charging	12.5	47.3	51.9	61.5
Vehicle ownership taxes	13.1	24.5	48.5	35.6
Fuel taxes	22.7	26.6	41.2	38.5
Public car park management	4.1	32.4	31.6	39.1
Workplace parking charges	21.3	37.2	42.3	29.1

Car restriction zones	7.2	33.7	41.9	23.1
Variable message signs	13.1	29.9	53.5	37.8
Driver information systems	3.1	81.8	62.1	45.7
"Smart Growth"				
Strategic planning	3.5	34.8	48.8	84.1
Self-contained communities	23.7	56.6	34.2	23.1
Higher density development	5.1	43.6	62.1	34.5
Cluster and infill development	4.6	47.2	75.7	39.6
Concentrate activities	6.1	54.7	71.2	54.2
Flexible zoning	5.8	62.7	36.8	23.2
Public transport orientated development	7.3	39.6	54.5	31.7
Parking management	5.2	37.1	55.1	24.2
Creating interconnected streets	6.9	36.2	50.1	21.9
Improve non-motorised travel conditions	10.3	29.1	53.1	36.2
Implement TDM	9.5	35.6	54.7	21.4
Preserve green space	17.5	33.8	52.6	25.1

Table 6.15 Revealed preference of importance and effectiveness of TDM, TSM, LUM and "Smart Growth" measures in developing countries

Measures	**Not at all important%**	**Quite important %**	**Important %**	**Very important %**
LUM				
High development density aimed at travel reduction	14.2	17.4	45.1	30.5
Development encouraging use of public transport	7.8	8.6	14.2	85.6
Development mix	15.4	28.5	44.8	45.8
Development conditions	5.7	27.4	29.5	30.8
Development of travel plans	15.6	13.3	27.8	43.8
"Smart Growth strategies"	12.1	17.3	41.8	29.5
Clustered land-use	15.2	13.2	57.1	17.5
Car-free planning	11.6	42.8	29.5	13.7
Taxation policy	12.7	12.7	13.7	59.1
TSM				
Ramp metering	26.5	10.5	42.8	29.5
HOV facilities	12.2	11.3	58.1	31.9
Park and Ride facilities	28.9	12.4	12.4	42.1
Street design	14.7	24.2	42.8	13.2
Effective and reliable public transport	4.6	31.5	8.9	88.3
New roads or additional lanes	5.8	19.2	44.9	17.2
Parking controls	9.2	30.5	64.1	48.4
Urban traffic control (UTC) systems	27.8	19.2	17.2	46.7
Intelligent Transport Systems (ITS)	29.5	17.2	29.5	38.2
Traffic calming or restraint measures	13.2	35.5	46.8	43.5
Access control or management	13.2	46.8	31.5	11.9
Multimodal transport interchanges	12.2	14.3	43.8	42.8
Reversible lanes	15.2	15.7	39.8	25.5
TDM				
Regulatory restrictions	16.2	19.4	75.4	17.2
Urban road charging	13.7	47.6	57.2	38.5
Vehicle ownership taxes	12.3	29.5	48.9	57.9
Fuel taxes	7.8	12.5	43.3	43.8
Public car park management	5.4	11.7	58.1	36.5
Workplace parking charges	18.2	43.8	35.5	23.6
Car restriction zones	34.8	28.5	12.6	30.9
Variable message signs	29.4	18.2	41.8	15.6

Driver information systems	19.2	26.5	39.6	27.2
"Smart Growth"				
Strategic planning	10.6	18.9	76.4	29.7
Self-contained communities	17.8	16.4	72.1	17.2
Higher density development	21.2	21.9	42.8	37.5
Cluster and infill development	23.9	12.7	79.5	78.8
Concentrate activities	27.3	18.7	59.2	24.2
Flexible zoning	12.7	19.6	61.1	21.7
Public transport orientated development	16.8	29.9	15.6	63.1
Parking management	12.5	27.2	47.8	42.2
Creating interconnected streets	17.2	63.1	45.2	39.7
Improve non-motorised travel conditions	28.8	34.5	54.3	41.3
Implement TDM	22.1	27.8	55.1	17.8
Preserve green space	17.2	28.5	28.5	28.9

Table 6.16 Revealed preference of importance and effectiveness of TDM, TSM, LUM and "Smart Growth" measures in least developed countries

Measures	Not at all important%	Quite important %	Important %	Very important %
LUM				
High development density aimed at travel reduction	12.4	15.6	43.3	28.7
Development encouraging use of public transport	6	6.8	12.4	83.8
Development mix	13.6	26.7	43	54.6
Development conditions	3.9	25.6	27.7	29
Development of travel plans	13.8	11.5	26	42
"Smart Growth" strategies	10.3	15.5	40	38.2
Clustered land-use	13.4	11.4	55.3	74.7
Car-free planning	9.8	41	27.7	11.9
Taxation policy	10.9	10.9	11.9	57.3
TSM				
Ramp metering	24.7	8.7	41	27.7
HOV facilities	10.4	9.5	56.3	30.1
Park and Ride facilities	27.1	10.6	10.6	40.3
Street design	12.9	22.4	41	11.4
Effective and reliable public transport	2.8	29.7	7.1	83.1
New roads or additional lanes	4	17.4	43.1	63.2
Parking controls	7.4	28.7	61.3	46.6
Urban traffic control (UTC) systems	26	17.4	15.4	47.4
Intelligent Transport Systems (ITS)	27.7	15.4	27.7	36.4
Traffic calming or restraint measures	11.4	33.7	45	41.7
Access control or management	11.4	45	29.7	10.1
Multimodal transport interchanges	10.4	12.5	42	41
Reversible lanes	13.4	13.9	38	23.7
TDM				
Regulatory restrictions	14.4	17.6	51.6	15.4
Urban road charging	11.9	45.8	65.4	36.7
Vehicle ownership taxes	10.5	27.7	47.1	61.1
Fuel taxes	6	10.7	41.5	42
Public car park management	3.6	9.9	56.3	74.7
Workplace parking charges	16.4	42	33.7	21.8
Car restriction zones	33	26.7	10.8	29.1
Variable message signs	27.6	16.4	40	13.8
Driver information systems	17.4	24.7	37.8	25.4

"Smart Growth"				
Strategic planning	8.8	17.1	74.6	27.9
Self-contained communities	16	14.6	70.3	15.4
Higher density development	19.4	20.1	41	73.7
Cluster and infill development	22.1	10.9	43.7	47.8
Concentrate activities	25.5	16.9	57.4	22.4
Flexible zoning	10.9	17.8	59.3	19.9
Public transport orientated development	15	28.1	53.8	63.3
Parking management	10.7	25.4	46	41.4
Creating interconnected streets	15.4	61.3	43.4	37.9
Improve non-motorised travel conditions	27	32.7	52.5	39.5
Implement TDM	20.3	26	53.3	16
Preserve green space	15.4	26.7	26.7	27.1

In summarising the results of these tables the text box illustration below sets out their key characteristics.

Country	Most preferred and/or effective LUM measure	Most preferred and/or effective TSM measure	Most preferred and/or effective TDM measure	Most preferred and or effective "Smart Growth" measure
Developed	Development mix	Access control	Driver info systems	Strategic planning
Developing	Encouraging the public transport development	Effective & reliable public transport	Regulatory restrictions	Cluster and infill development
Least developed	Encouraging the public transport development	Effective & reliable public transport	Public car park management	Higher density development
Country	**Least preferred and/or effective LUM measure**	**Least preferred and/or effective TSM measure**	**Least preferred and/or effective TDM measure**	**Least preferred and or effective "Smart Growth" measure**
Developed	Taxation policy	Reversible lanes	Fuel Taxes	Encouraging self- contained communities
Developing	Travel Plans	Park & Ride facilities	Car restriction zones	Improving non-motorised vehicles travel
Least developed	Travel Plans	ITS	Variable message signs	Concentrating specific activities

It is possible to further explain these findings by carrying out correlation analysis in identifying whether a relationship exist between the preference for measures and the country's development stage. To this end if the measures in the columns marked "very important" in Table 6.14, 6.15 and 6.16 are defined as variables, correlation analysis can be used to quantify and describe the likely relationship.

By comparing the measures deemed most important (with highest level of preference) by **developed countries** with those of **developing countries** correlation analysis produced a Pearson's correlation of r = -1.00. This result suggests that the importance or preference attached to measures by developed and developing countries has a very strong negative correlation as shown by the high correlation coefficient r value of -1.00. In testing the significance of this correlation it was found that it is not a chance finding and that the correlation is "statistically significant" (given the parameters of the test). The null hypothesis can therefore be rejected and the alternative accepted.

Next, comparing the measures deemed most important by **developed countries** with those of the **least developed countries** correlation analysis revealed a Pearson's correlation coefficient of $r = -1.00$ suggesting that the importance attached to measures by developed and the least developed countries has a very strong negative correlation. In testing the significance of this correlation it was also found to be statistically significant implying there **is a statistically significant relationship** between the importance or preference attached to measures by both types of countries. The null hypothesis can therefore be rejected and the alternative accepted.

Finally, comparing the measures deemed most important by **developing countries** with those of the **least developed countries**, correlation analysis produced a Pearson's correlation of $r = -1.00$. This result suggests that the importance attached to measures by developing and the least developed countries has a very strong negative correlation as shown by the high correlation coefficient r value of -1.00. In testing the significance of this correlation it was found to be statistically significant. Again the null hypothesis can be rejected and the alternative accepted.

These statistical findings suggest a strong, negative, statistically significant relationship exists between the preference for measures between developed, developing and the least developed countries in measuring the achievement of objectives.

6.3.2.3 Barriers to the implementation of measures

A key issue underlying the implementation of successful and sustainable integrated strategies is that of overcoming the barriers to effective implementation these being legal and institutional, financial, political, practical barriers and those barriers relating to decision-making. The literature review acknowledged that obstacles within this context may very well vary between countries at different development stages and the resulting research question postulated is aimed at identifying whether a relationship exists between the barriers experienced and the level of the country's development. This is important because sustainable and effective strategies aimed at dealing with traffic congestion are largely constrained by overcoming obstacles relevant at local, regional or even national level and they subsequently require interactive and participatory processes that foster a greater understanding of how to overcome such barriers. Once such relationships have been explored it will be possible to develop integrated strategies that focus political and institutional intentions and help policy interventions coincide with sustainable transport objectives. In pursuit of establishing such a relationship the results are divided into two categories, those reporting descriptive statistics and those reporting inferential statistics.

6.3.2.3.1 Descriptive statistics

The national planning and engineering departments and land-use and transport planning consultants were presented with 7 common measures of TDM, TSM and LUM and were then asked which of the five barriers as noted above impacts most on their ability to implement or modify the measures listed. Table 6.17 below reports their response. Then Tables 6.18 – 6.20 disaggregate the responses by country development stage.

Table 6.17 The extent to which barriers impact on the ability to implement or modify measures

Measure	Barriers				
	Legal %	Financial %	Political %	Technological %	Decision-making %
Land-use	21.3	5.1	58.6	1	58.4
Road building	7.1	76.9	23.1	3	20.3
Public transport infrastructure	2.1	72.4	18.5	3	45.1
Traffic management	5.3	36.1	52.7	15.1	31.3
Bus and rail operations	6.4	53.7	26.3	7.3	19.3
Information provision	9.3	21.3	13.2	39.5	38.4
Pricing measures	12.8	14.2	68.9	34.1	18.2

Table 6.18 The extent to which barriers impact on the ability to implement or modify measures in developed countries

Measure	Barriers				
	Legal %	Financial %	Political %	Technological %	Decision-making %
Land-use	11.6	1.9	65.4	0.6	55.2
Road building	3.9	78.7	49.9	1.4	17.1
Public transport infrastructure	2.1	64.2	15.3	1.3	41.9
Traffic management	2.1	32.9	59.5	11.9	28.1
Bus and rail operations	3.2	48.5	33.1	4.1	16.1
Information provision	6.1	38.1	15.2	36.3	35.2
Pricing measures	9.6	11	75.7	30.3	15

Table 6.19 The extent to which barriers impact on the ability to implement or modify measures in developing countries

Measure	Barriers				
	Legal %	Financial %	Political %	Technological %	Decision-making %
Land-use	9.2	12.4	36.6	3.3	65.1
Road building	5	84.2	28.5	5.3	27
Public transport infrastructure	2	79.7	23.9	5.3	51.8
Traffic management	3.2	43.4	58.1	22.9	38
Bus and rail operations	4.3	61	31.7	15.1	26
Information provision	12.2	28.6	18.6	47.3	45.1
Pricing measures	10.7	21.5	74.3	41.9	24.9

Table 6.20 The extent to which barriers impact on the ability to implement or modify measures in the least developed countries

Measure	Barriers				
	Legal %	Financial %	Political %	Technological %	Decision-making %
Land-use	13.4	19.4	70	13.8	75.1
Road building	15.2	91.2	34.5	15.8	37
Public transport infrastructure	10.2	86.7	29.9	15.8	61.8
Traffic management	29.4	50.4	64.1	27.9	48
Bus and rail operations	13.5	68	37.7	20.1	36
Information provision	16.4	35.6	24.6	52.3	55.1
Pricing measures	20.9	28.5	80.3	46.9	34.9

In terms of the **overall** results illustrated by Table 6.17, **legal barriers** present the greatest obstacles to implementing land-use measures aimed at traffic congestion reduction (11.6%). **Financial barriers** present the greatest obstacles to road building (76.9%) and public transport infrastructure measures (72.4%). The results also suggest that **political barriers** present the greatest obstacle to pricing measures being implemented (68.9%). **Technological barriers** present the greatest obstacles to information provision (34.1%) and pricing measures (39.5%). The results also suggest that **decision-making barriers** present the greatest obstacles to implementing land-use (58.4%) and public transport infrastructure measures (45.1%). Disaggregating these results by the type of measure, TDM measures are strongly constrained by legal and political obstacles, TSM measures are strongly constrained by financial obstacles and LUM measures are constrained by political and decision-making constraints.

Next, responses are disaggregated by a country's development stage. By assessing the results of **developed countries**, Table 6.18 suggests that **legal barriers** present the greatest obstacles to the implementation of land-use (21.3%) and pricing measures (12.8%). **Financial barriers** present the greatest obstacles to road building (78.7%) and public transport infrastructure (64.2%). The results also suggest that **political barriers** present the greatest obstacles to land-use (65.4%) and pricing measures (75.7%). **Technological barriers** present the greatest obstacles to information provision (30.3%) and pricing measures (36.3%). **Decision-making barriers** present the greatest obstacles to implementing land-use (55.2%) and public transport infrastructure (41.9%). By further disaggregating the results by the type of measure, TDM measures are strongly constrained by political obstacles, TSM measures are strongly constrained by financial obstacles and LUM measures are constrained by political and decision-making constraints.

Turning to **developing countries**, Table 6.19 illustrates that **legal barriers** present the greatest obstacles to information provision (12.2%) and pricing measures being implemented (10.7%). **Financial barriers** present the greatest obstacles to road building (84.2%) and public transport infrastructure (79.7%). **Political barriers** present the greatest obstacles to traffic management (58.1%) and pricing measures

(74.3%). **Technological barriers** present the greatest obstacles to information provision (47.3%) and pricing measures (41.9%). The results also suggest that **decision-making barriers** present the greatest obstacles to land-use (65.1%) and public transport infrastructure (51.8%). Disaggregating the results by the type of measure, TDM measures are strongly constrained by technological and political obstacles, TSM measures are strongly constrained by financial obstacles and LUM measures are constrained by decision-making constraints.

In assessing the results of the **least developed countries** as illustrated in Table 6.20, the results are very similar to those of developing countries and show that **legal barriers** present the greatest obstacle to the implementation of traffic management (29.4%) and pricing measures (20.9%). **Financial barriers** present the greatest obstacles to road building (91.2%) and public transport infrastructure (86.7%). **Political barriers** present the greatest obstacles to pricing measures (80.3%) and land-use (70%). **Technological barriers** present the greatest obstacles to information provision (52.3%) and pricing measures (46.9%). The results also suggest that **decision-making barriers** present the greatest obstacles to land-use (75.1%) and public transport infrastructure (61.8%). Disaggregating the results by the type of measure, TDM measures are strongly constrained by legal, political and technological obstacles, TSM measures are strongly constrained by financial obstacles and LUM measures are constrained by political and decision-making constraints.

In sum, the greatest barriers to the implementation of TDM, TSM and LUM measures reported above are financial and political barriers and they have the greatest obstructive impact on road building and the provision of public transport infrastructure - recognised as TSM measures. In terms of TDM measures, political obstacles have the greatest impact on the introduction of such measures in all countries, but in developing and in the least developed countries the problem is more acute resulting from a lack of TDM related technology. LUM measures are largely constrained by political processes which makes reaching amicable solutions through decision-making difficult. Finally, the obstacles experienced in developing and in the least developed countries share a large degree of similarity. In the least developed countries, however, the extent of the obstacles is more severe.

6.3.2.3.2 Inferential statistics

It is possible to further explain the descriptive findings above with the help of correlation analysis in identifying whether a relationship exists between the barriers influencing measure implementation among countries at differing developmental stages. When the barriers illustrated in Tables 6.18, 6.19 and 6.20 are defined as variables, correlation analysis is used to quantify and describe the possible relationship by comparing each country's type of barriers with the others. Importing the data contained in Tables 6.18, 6.19 and 6.20 into Analyse-it, and performing correlation analysis Table 6.21 below illustrates the results.

Table 6.21 Pair-wise correlation between barriers impacting on the ability to implement or modify measures and the development stage of a country

Correlation pair	Barriers (r - value)				
	Legal	Financial	Political	Technological	Decision-making
Developed country & Developing Country	0.787	0.957	0.825	0.987	1
Developed country & Least Developed Country	-0.100	0.957	0.923	0.998	1
Developing country & Least Developed Country	0.022	0.022	0.884	0.994	1

In terms of the **legal** barriers influencing the ability to implement or modify measures, Table 6.21 shows a moderate positive correlation between developed and developing countries reflected by a Pearson's correlation coefficient of r = 0.787. This result suggests that legal barriers are an impediment to implementing measures in both country types. However a weak relationship exists between the developed and the least developed country's legal barriers as well as between the developing and the least developed country's legal barriers. This suggests that legal barriers are not an impediment to implementing measures in developing countries and in the least developed countries but in only one of them. By inspecting Tables 6.19 and 6.20 it is revealed that the least developed countries reported that legal barriers have more influence on their ability to implement or modify measures than they do on that of developing countries, thereby confirming the correlation results.

In assessing the **financial** barriers which influence the ability to implement or modify measures, Table 6.21 illustrates a strong positive correlation between developed and developing countries and the developed and least developed countries reflected by a Pearson's correlation of r = 0.957 respectively suggesting that financial barriers are an impediment to all country types. However a weak relationship exists between the developing and the least developed country's financial barriers. The result does not suggest that financial barriers are not an impediment to either country's, it suggests that there is not a significant relationship.

In terms of **political, technological and decision-making** barriers impacting on the ability to implement or modify measures, Table 6.21 reports a strong positive correlation between all types of countries reflected by high value Pearson's correlation coefficients. This suggests that political, technological and decision-making barriers are an impediment to implementing measures in all country types.

In terms of testing the significance of the correlations reported in Table 6.21, Table 6.22 below show which correlations are of statistical and non-statistical significance. It shows that the majority of the correlation values are significant, only those for legal and financial barriers between developed countries and the least developed countries and developing countries and the least developed countries are statistically insignificant (given the parameters of the test).

Table 6.22 Statistical significance of correlation between barriers impacting on the ability to implement or modify measures and the development stage of a country

Correlation pair	Barriers (r - value)				
	Legal	Financial	Political	Technological	Decision-making
Developed country & Developing Country	Significant	Significant	Significant	Significant	Significant
Developed country & Least Developed Country	*Insignificant*	Significant	Significant	Significant	Significant
Developing country & Least Developed Country	*Insignificant*	*Insignificant*	Significant	Significant	Significant

6.3.3 Institutional responsibilities and the planning system

The administrative and institutional framework within which decision-makers and planners at all levels of governance operate is central to achieving sustainable planning. The complexity of institutional structures makes the achievement of sound decision-making more compelling, stressing the importance of having an effective institutional framework that co-ordinates and facilitates the decisions being made. Generally, co-ordination and policy integration is made easier within governments where development planning and transport planning are combined into a single department. This helps to focus planning and to align priorities. In practice however, the creation of transport authorities as autonomous bodies at arms' length from municipal government results in difficulties when reconciling its own planning with development or spatial planning performed by municipal or local government.

The literature review highlighted that the success of strategy integration depends crucially on the success of maintaining strategic control over local development processes, co-ordination between the vertical levels of governance and the horizontal support systems associated with each level of the administrative structure. In assessing the extent to which such strategic control exists, the empirical questions were designed to identify departmental responsibility over the implementation of measures and to identify which measures is the responsibility of one department managed together rather than in separate departments. This is anticipated to provide some direction as to which levels of governance are considered most appropriate to the implementation of TDM, TSM and LUM measures and in identifying the extent to which horizontal and vertical integration occurs.

To this end national planning and transport departments were given a set of measures and asked to indicate, which were their department's responsibility, which were a joint responsibility and which were the responsibility of another department. Table 6.23 below illustrates the results.

Table 6.23 Departmental responsibility over key TDM, TSM and LUM measures (n = 187)

Measure	Your Responsibility %	Joint Responsibility %	Others' Responsibility %
Land-use	16	23	74
Road building	31	56	23
Public transport infrastructure	32	63	15
Traffic management	47	34	31
Bus and rail operation	37	32	42
Information provision	42	27	37
Demand management	63	41	16

The results suggest traffic management and demand management are the measures most likely to be implemented from within one department. Land-use management measures are unlikely to be facilitated from one department but rather to be implemented following consultation with other sectoral departments suggesting vertical and horizontal integration. In terms of joint responsibility for the implementation of measures, the provision of public transport infrastructure and roads are most likely to be given joint responsibility with other sectoral departments suggesting vertical integration and/or decision-making takes place when implementing TSM measures. Bus and rail operations and their management are most likely to be a departmental function with the responsibility over its control and management being divided between that of one department and/or joint responsibility with other private or regulatory transport authorities and/or operators.

The national planning and transport departments were also asked which levels of governance they deem most appropriate to the implementation of TDM, TSM and LUM measures. Table 6.24 below reports the results.

Table 6.24 Levels of governance deemed most appropriate for the implementation of TDM, TSM and LUM measures (n = 187)

Measure	Local government %	Regional government %	National government %
Land-use management	64.2	28.5	16.4
Transportation supply management	35.7	38.7	47.8
Transportation demand management	54.1	23.4	35.7

The Table shows that 64.2% of respondents felt that LUM and the implementation of its associated measures are best implemented at local government level. In terms of TSM measures, 47.8% of respondents felt that national government should initiate polices and initiatives under this umbrella whereas with TDM measures 54.1% of respondents felt that their implementation is best at local level.

Turning to the planning system and its connection to IDP, the author conceptualised the idea that integrated strategies have the scope to be assimilated into the IDP process through a Traffic Congestion Management Plan, forcing an interface between TSM (an Infrastructure sector provided function), LUM (implemented within Spatial Development Frameworks) and TDM (to be facilitated through Transport Planning). Following this argument the empirical questions postulated were whether the stakeholders perceived a Traffic Congestion Management Plan assimilated into an IDP to be effective or feasible and at which level of governance such a Traffic Congestion Management Plan should be positioned?

In response, 76.1% supported to the notion of a Traffic Congestion Management Plan and its assimilation into an IDP being feasible. When respondents were asked at which level of governance a Traffic Congestion Management Plan should be positioned, 67.3% reported that it should benefit most when implemented at Local Government level, 18.4% said at regional level and 14.3% said at National level.

6.4 Conclusion

The results reported in this chapter are based on a reasonable response rate from the National Planning and Transport Departments and Land-use and Transport Planning Consultants, 43.38% and 38.87% respectively. The Environmental Interest group yielded a response rate of 100% and served an equally useful purpose in highlighting their perceptions, preferences and concerns.

It has been shown that the extent to which integrated strategies achieve sustainability is measurable using sustainability objectives, criteria and indicators transposed from the SDI framework. More specifically, the findings reported stakeholder perceptions, preferences between alternatives and quantified the importance attached to (i) objectives that help measure the extent to which policy measures contributes to sustainability and (ii) criteria and indicators measuring the achievement of objectives.

By transposing qualitative data into quantitative data the results were statistically measurable and so it was possible to establish the existence of statistical relationships between developed, developing and the least developed countries and their preferred sustainability objectives, criteria, indicators and performance measuring indicators.

In terms of exogenous and endogenous variables postulated by the author, the results suggested a significant level of support for those put to the stakeholders. In terms of common barriers experienced in the implementation of policy measures, correlation analysis illustrated a positive and strong relationship between the barriers experienced by developed, developing and the least developed countries. In sum the greatest barriers to the implementation of TDM, TSM and LUM measures are reported to be financial and political barriers and they have the greatest obstructive impact on road building and the provision of public transport infrastructure - recognised as TSM measures.

In terms of TDM, TSM and LUM measures deemed to have a successful track record in alleviating traffic congestion the results suggest that: providing effective and reliable public transport, adequate parking and the use of clustered land-use planning are among the most preferred measures in dealing with traffic congestion. A strong statistical relationship exists between the preference for measures between developed, developing and the least developed countries in this regard.

In exploring a mechanism that can be used to identify location specific measures that will contribute to alleviating site specific traffic congestion using scenario defining variables the stakeholders suggested and agreed to a number promising exogenous and endogenous variables in this respect. Stakeholders stated their preference for appropriate and effective guidelines and technical considerations so as to assess which policy measures contribute to achieving sustainability objectives much like the criteria and indicators used to assess the extent to which policy measures contribute to achieving predetermined objectives. Having established these guidelines and technical considerations it is possible to assign, in a qualitative sense, weights to guidelines and technical considerations in describing local conditions.

Finally, the administrative and institutional framework within which decision-makers and planners at all levels of governance operate were assessed in terms of establishing the extent to which strategic control over development processes exist. It was reported that co-ordination and policy integration is perceived to be made easier within governments where development planning and transport planning are combined into a single department as it helps to focus planning and align priorities. The success of strategy integration depends crucially on the success of maintaining strategic control of local development processes, co-ordination between the vertical levels of governance and the horizontal support systems associated with each level of the administrative structure. The results confirmed these sentiments – horizontal and vertical integration is perceived to enhance the effectiveness of TDM, TSM and LUM strategy integration. This finding then paves the way to force an interface between an IDP and a proposed "Traffic Congestion Management Plan" at the local government level because an IDP's inherent characteristics facilitates cross sectoral and vertical integration.

Next, Chapter 7 attempts to explain the results and relate them to published work in identifying their meaning, whether they address the aims and objectives of the research and how well they position the research into developing the D.A.D.F when producing integrated strategies.

CHAPTER 7

DISCUSSION AND INTERPRETATION OF SURVEY RESULTS

7.1 Introduction

This chapter considers the survey results using emerging data to fill identified gaps as far as possible, explains what the results mean and establishes whether it agrees with and progresses the aims and objectives of the research. Information is assessed, interpreted and discussed not only in the context of the results but also in the context of the literature review establishing how it fits in with published work in the subject field.

To reflect the relationship between the results and the purpose and objectives of the research, Figure 7.1 below briefly summarises the purpose and objectives of the research, serving as a quick reference when interpreting the results.

Purpose

The purpose of this study is to develop a D.A.D.F. as a tool capable of integrating various TDM, TSM and LUM measures to help reduce traffic congestion and to assimilate the framework/process into a Traffic Congestion Management Plan supporting IDPs.

Objectives

- Identify TDM, TSM and LUM measures that have a successful track record in reducing traffic congestion.
- Identify and critically evaluate the elements of "Smart Growth" and New Realism proving effective in reducing traffic congestion.
- Determine which policy measures are most conducive to achieving the decision-makers' goals and objectives under specific conditions.
- Determine the relationship between the development stage of a country and the most effective and applicable policy measures.
- Determine the variables endogenous and exogenous to the transport system that should be used to describe the local setting, problems and conditions that would help select the most appropriate measures for a particular local area.
- Identify the objectives conducive to integration aimed at congestion reduction and sustainability.
- Determine whether the criteria and indicators used to measure the extent to which policy measures have contributed to sustainable development differ between the least developed, developing and developed countries.
- Identify the performance indicators and methodology in measuring the success of a congestion-reducing integrated strategy.
- Identify potential barriers to policy implementation.
- Structure the decision framework.
- Apply the decision framework to a case study.
- Determine the anticipated value of the decision framework by positioning its output within the case study.
- Determine whether the decision framework will increase mobility and accessibility in urban areas.
- Solve the research problem and formulate plausible recommendations.

Figure 7.1 Research reference: purpose and objectives of research

7.2 Interpreting the survey results

When interpreting the results the process recognises and reflects the following:

(i) the interdependency between the components of planning, sustainable development and the relationships and interfaces that exist between them

(ii) the relationship between the results, the purpose and objectives of the research

(iii) the relationship between the results and the current literature - providing balanced for and against arguments

To this end the discussion first considers those concepts relevant to achieving sustainability ranging from specifying objectives to defining scenarios that help determine location specific measures. This is followed by discussing the importance, relevance and preference that has been assigned to land-use and transport planning measures aimed at traffic congestion reduction and the relationship that exists between TDM, TSM and LUM measures and the development stage of countries. The discussion then turns to assessing planning's administrative and institutional framework in selecting appropriate levels of governance to implement integrated strategies and the perceived value of linking integrated strategies into an IDP via the D.A.D.F. as part of a Traffic Congestion Management Plan.

7.3 Achieving sustainability

For integrated strategies to contribute to sustainable development a variety of elements have to be considered and built into the decision-making process. The survey results identified the key components relevant to the study and so this section aims to interpret these findings within the current literature. Figure 7.2 summarises the components to be discussed in the following sub sections.

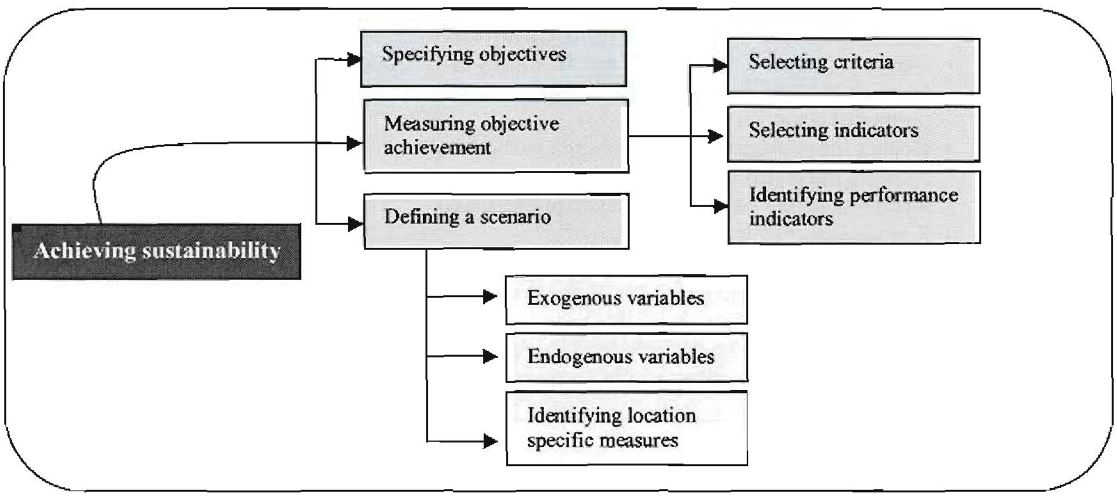


Figure 7.2 Components covered by section 7.3

7.3.1 Specifying policy objectives that will contribute to sustainability

In exploring the policy objectives that will contribute to sustainability within the study context, respondents were asked about the appropriateness of 7 objectives in measuring the extent to which measures will contribute to sustainable development. To this end the results have shown that two-thirds (64.7%) of respondents consider the integration of the land-use and transport objective as the most important objective to be achieved by integrated strategies closely followed by that which contributes to safety and environmental protection. By implication these findings support the arguments of Geerlings and Stead (2003:187) suggesting that policies and measures aimed at traffic congestion reduction must focus on a greater level of land-use and transport integration coupled with environmental protection and safety. It follows that transport policy must engage increasingly with other sectors to deliver a truly integrated approach or New Realism as Hine (2000:175) argues.

A surprising finding was that economic efficiency (47%) is regarded as an objective of lesser importance in terms of contributing to sustainable development. This may be ascribed to the difficulties involved in measuring efficiency gains from transport and land-use improvements as economic changes takes place within the context of the wider regional and national economy and because it is difficult to detect whether the transport and land-use measures introduced have been the cause of economic efficiency gains or whether other factors were at work as Litman (2001) suggests. The extent to which strategy integration contributes to sustainability and helps to achieve the objective of economy is therefore predominantly unclear, but is fundamentally an objective not to be ignored in any strategy assessment or appraisal. Even if respondents perceive economic efficiency as an objective of lesser importance it is not prudent to discount it straight away because it is a fundamental element underpinning the wellbeing and socio-economic balance in society. There is an inherent link between transport and the economy as Martinez (1995:457) noted and it will be an error for integrated strategies not to incorporate an element that enhances or strengthens economic growth or efficiency.

Respondents were also given the opportunity to indicate additional objectives they consider appropriate to measuring the achievement of sustainable urban development. Having clustered their responses into four groups no "new" or additional objectives were identified. However it was reported that great importance was attached to the achievement of the economy objective. This is an interesting finding as it contradicts the statistical results reported in Chapter 6 that only (47%) of respondents feel that economic efficiency is regarded as an important objective contributing to sustainable development. This result should, in the opinion of the author, be interpreted as respondents favouring economic growth as an objective rather than economic efficiency. This suggests that respondents are less familiar with the economic efficiency objective and/or how it is achieved and or interpreted. The fourth additional objective identified relates to the preservation and protection of human health, which slots in with the safety and equity and social inclusion objectives.

Disaggregating the overall results suggested that for developed countries it is most important for integrated strategies to achieve the integration of transport and land-use and safety objectives (66%) and the least important objective is the accessibility objective (33%). For developing countries the liveable streets and neighbourhoods objective (65%) is the most important and the safety objective (36%) the least. For the least developed countries the safety objective is the most important, with the accessibility objective (36%) the least important. In this respect different countries attach different levels of importance to the 7 sustainability objectives reflecting national and regional preferences.

It is interesting that at a disaggregated level both the developed and the least developed countries attach the lowest level of importance to the accessibility objective through integrated strategies although section 6.2 reported that 87% of respondent felt that integrated strategies might contribute to increasing accessibility and mobility. If the achievement of improving developmental accessibility is so important then why do respondents from the developed and the least developed countries feel that the accessibility objective (in achieving sustainable development) is not that important?

The reason for the contradiction may lie in the fact that when transport as a component of land-use and spatial planning is integrated it produces a greater level of mobility and accessibility without the accessibility objective being prescribed as a policy objective *per se* as Stead and Banister (2001:317-319) suggest. By integrating various TDM, TSM and LUM measures accessibility becomes a by-product of integration. So although the polices of decision-makers may not necessarily be aimed at attaining greater accessibility per se, it may be achieved by default as a result of the synergy between the various measures included in the package and in that way provide an effective outcome whereby accessibility and mobility are increased and congestion reduced.

By further assessing the results in establishing whether a relationship exists between the stage of a country's development and the objectives it deems important to measuring objective achievement, pair-wise comparison and correlation analysis revealed that in general a weak to moderate negative correlation exists between the objectives deemed important/appropriate between countries at differing development levels. In addition, the correlation reported is not statistically significant for the possible combinations of correlation. There is however a strong positive and statistically significant correlation between the developing and the least developed countries in terms of the objectives they deem important when measuring the achievement of sustainable development. It is therefore possible to conclude that the importance attached to sustainability objectives may very well differ from country to country according to national objectives and other principles although all agree to the identified 7 sustainability objectives as being representative of common policy goals in development and transport planning.

When comparing the survey results with industry implemented objectives as explored in section 3.4.2.8 of Chapter 3 it is possible to identify how comprehensive and representative they are in terms of measuring goal achievement in relation to strategy integration. Table 7.1 illustrates a simple comparison in this regard and suggests acceptable consistency between the sustainability objectives and the industry objectives although it is broad based and reflects specific regional and sub-regional circumstances of perhaps individual urban areas worldwide.

Table 7.1 Comparing selected industry implemented objectives to identified sustainability objectives

Objectives	Countries vs Sustainability					
	Taiwan	Australia	UK	South Africa	Brazil	Sustainability
Economic efficiency	√	√	√	√	√	√
Protection of the environment	√	√	√		√	√
Liveable streets and neighbourhoods		√		√		√
Safety	√	√	√	√		√
Equity and social inclusion		√		√		√
Accessibility		√	√	√		√
Integrating land-use/transport	√	√	√		√	√

Source: Author's own construction

Although the research has achieved consensus on 7 sustainability objectives, it must be recognised that transport policies and objectives will vary in different urban areas (Institution of Highways and Transportation, 1997:19), reflecting both the wide range of factors which affect transportation needs and the inclination of relevant decision-makers. Moreover, the urban environment is continually changing and decision-makers should be prepared to be flexible and to adapt to changing urban conditions and demands and alter objectives to local needs. Most often sustainability will never be the only, and often not even the dominating policy goal, but will rather be weighed against other goals, such as economic competitiveness or social equity. This means that strategies that succeed in serving more goals at the same time will invariably be the ones with the greatest chance of success.

7.3.2 Measuring the achievement of objectives

In exploring the elements required to measure the extent to which policy measures may contribute to achieving sustainability objectives, the survey focused on identifying criteria and indicators for this purpose. Stakeholders were presented with 7 sets of impact criteria each relating to an alternative sustainability objective and were asked how appropriate they deem each criterion to be in measuring its associated objective. In this way it is possible to rationalise and reduce the number of criteria to those of specific importance within the research context. A number of criteria were reported to be less important or appropriate for measurement purposes than others and have therefore been discounted from the larger pool of criteria thereby leaving a set of criteria to be used in developing the D.A.D.F. as shown by Table 7.2.

Table 7.2 Criteria to be uploaded into the D.A.D.F.

Objectives	Criteria
Economy	Implementation cost
	Economic efficiency
	Economic growth
Environmental protection	Emission level
	Urban sprawl
Liveable streets and neighbourhoods	Safe and secure neighbourhood
Equity and social inclusion	Contribution to investment in transport
	Access to public transport
	Community cohesion
Safety	Accidents
	Danger
Integration	Impact on traffic congestion
Accessibility	Ease of reaching opportunities
	Community severance
	Access to the transport system

Having disaggregated the overall results of preference and appropriateness of criteria between countries at differing levels of economic development as reported in section 6.3.1.2.1 of Chapter 6, a surprising correspondence in criteria deemed appropriate for measurement was established. Statistical analysis confirmed this finding in that correlation analysis suggested a statistically significant relationship between countries at differing development levels and the criteria they deem important.

A further requirement for measuring the achievement of sustainability objectives is that of selecting appropriate output indicators from the SDIF discussed in section 3.4.4.1 of Chapter 3. This required identifying those indicators relevant to the purpose of the study without detracting from the sustainability goal. By having respondents rank the output indicators the survey reported a mixture of indicators deemed effective or appropriate to measurement as well as indicators which will be of less use or inappropriate. Subsequently it was possible to discount those deemed inappropriate. Following a process of elimination Table 7.3 illustrates the remaining indicators deemed most appropriate to measuring objective achievement.

Table 7.3 Indicators to be used in structuring the D.A.D.F.

Objective	Criteria	Indicator
Economy	Implementation cost	High
		Medium
		Low
	Economic efficiency	High
		Medium
		Low
	Economic growth	High
		Medium
		Low
Liveable streets and neighbourhoods	Safe and secure neighbourhood	Freedom of movement
		Number of road traffic accidents
Environmental protection	Emission level	Reduction in emission
		Noise
	Urban sprawl	Land take
		Visual intrusion

Equity and social inclusion	Contribution to investment in transport	Increased accessibility to public transport services
		Reducing travel time and distance
	Access to public transport	Increased accessibility to public transport services
		Reducing travel time and distance
	Community cohesion	Increased accessibility to public transport services
		Reducing travel time and distance
Safety	Accidents	Less traffic accidents
		Residential design that makes people feel safe
	Danger	Less traffic accidents
		Residential design that makes people feel safe
Integration	Impact on traffic congestion	Mode shift
		Reduced total VHT on congested roads
		Reduction in distance travelled to destinations
Accessibility	Ease of reaching opportunities	Reduced average time and cost to all activities
		Increased access to the transport system
	Community severance	Reduced average time and cost to all activities
		Increased access to the transport system
	Access to the transport system	Reduced average time and cost to all activities
		Increased access to the transport system

Indeed the identification of appropriate indicators measuring sustainable development is an iterative process. It must also be recognized that there is no universal set of indicators that is equally applicable in all cases, any set, by itself, is an imperfect tool for organizing and expressing the complexities and interrelationships encompassed by sustainable development (United Nations, 2005). Ultimately, the choice of a set of indicators must meet the needs and priorities of users, civil society groups and decision-makers responsible for the development and use of indicators to monitor progress towards sustainable development.

Because the set of indicators illustrated by Table 7.3 allows for integrated evaluation of sustainable development according to the four interrelated components of sustainability (economic, social, environmental and institutional) as identified in section 3.4.4.1 of Chapter 3 it provides for measurement of virtually all traditional sectors of economic and government activity and compares well to the UN established SDIF. For this reason, the indicators contained in Table 7.3 will be used as part of the D.A.D.F.

Having disaggregated the indicators to further establish whether a relationship exists between the indicators selected by country type, the results suggested a significant correlation in this respect which can be ascribed to many countries having signed up to Local Agenda 21. Also, following the Millennium Summit and in 2002, the World Summit for Sustainable Development (WSSD), countries were urged not only to take immediate steps to make progress in the formulation and elaboration of national strategies for sustainable development but also to begin their implementation by 2005. Because one of the targets contained in the United Nations Millennium Declaration is for countries to reach the goal of environmental sustainability by integrating the principles of sustainable development into their countries' policies and programmes it is to be expected that respondents were more familiar with the concepts of sustainability indicators and the questions asked about in this respect.

Finally, a key element in policy formulation is that of measuring the performance of strategies post implementation. And so decision-makers require a set of performance indicators measuring how well the implemented strategy or policy is performing and how much it is contributing towards sustainable development. By classifying performance indicators into those quantified financially, those not quantified financially and qualitative indicators, respondents ranked the indicators in terms of their appropriateness to measuring strategy performance. The results reported in section 6.3.1.2.3 of Chapter 6 identified indicators favoured or deemed more appropriate for measuring to varying degrees.

By discounting the performance indicators deemed less important or inappropriate Table 7.4 illustrates the remaining indicators that will be used to assess the performance of integrated strategies. From the Table it is seen that for integrated strategies to be successful and contribute to sustainability, they must reduce traffic congestion, travel cost and accidents, while it is also important for them to reduce air and noise pollution and average commute times.

Table 7.4 Performance indicators to assess integrated strategies

Method of quantification	Performance indicators
Indicators quantified financially	Congestion delay (81%)
	Travel cost (61%)
	Accident cost (33%)
Indicators not quantified financially	Air pollution (66%)
	Noise pollution (55%)
	Commute time (45%)
Qualitative quantification	Safety (64%)
	Affordability (50%)
	Transport Diversity (47%)

Successful integrated strategies must also ensure safety from a transport user perspective as well providing affordable and accessible transport systems. Disaggregating these results by a country's development stage again identified resemblances in preferred output indicators. Across all types of countries stakeholders suggested the success of integrated strategies is best measured in their opinion in terms of (i) a reduction of traffic congestion (ii) a reduction in air pollution and (iii) induced affordable travel. It is also interesting to note that both the developing and the least developed countries prefer indicators that will measure value for money coupled to a direct journey time improvement, whereas developed countries prefer performance indicators that especially measure the environmental and safety implications of the overall implemented strategy.

7.3.3 Defining the scenario

Having discussed and identified the objectives, criteria and indicators deemed appropriate as tools for assessing the extent to which integrated strategies contribute to sustainable development, it is also necessary to establish the variables describing the context within which the strategies will operate as they form part of the process determining those measures which are suitable to specific local conditions.

For this purpose it is necessary to agree on exogenous and endogenous variables that describe the context. The results reported in Table 6.7 and 6.8 of section 6.3.1.3 of Chapter 6 illustrate the usefulness and appropriateness of the variables for this purpose. A number of variables were reported as not being appropriate (by virtue of their ranked position) and have subsequently been excluded from the final group of variables to be used in developing the D.A.D.F. After discounting the inappropriate variables Table 7.5 shows the exogenous and endogenous variables to be used in the D.A.D.F.

Table 7.5 Exogenous and endogenous variables to be used in structuring the D.A.D.F.

Exogenous variables		Endogenous variables	
1	Parking provision	1	Access to public transport
2	Population density per sq km	2	Air Quality
3	Cars per household	3	Parking and Loading facilities
4	Population size	4	Traffic accidents
5	Annual urban population growth	5	Travel time
6	Housing	6	Vehicle operating cost
7	Retail development	7	Construction and implementation cost
8	Economic growth	8	Emission cost
9	Land-use patterns	9	Transport interchange facilities
10	Employment rate	10	Hub integration

This Table shows that among the exogenous variables describing economic circumstances (recognised as traditional macro-economic indicators) those such as price stability, balance of payment stability and income distribution are not felt to be appropriate in describing the context or scenario being planned for and as a result they have been excluded from the Table.

Their exclusion reflects the fact that from the respondents' point of view it will be difficult to quantify and/or gather such data for computation. Also this data is less appropriate for describing their local circumstances and is not easily transposable to meaningful transport characteristic descriptors. In terms of endogenous variables, road classes and the ease of accessing leisure facilities have been discounted as stakeholders did not view these variables to be a standard yard stick when describing a scenario.

In order for the selected endogenous an exogenous variables to play and effective part in the screening process they have to be quantifiable and/or measurable which requires the use of technical guidelines and considerations. This is a key mechanism that can be used to identify which circumstances should prevail warranting specific types of intervention in deciding between alternative measures (in other words what scenario is associated with specific measures). The results suggested that some guidelines and technical considerations used to qualify both endogenous and exogenous variables had been deemed inappropriate. Following a discounting process of those considerations deemed inappropriate, Table 7.6 below illustrates the remaining endogenous and exogenous variables and their associated guidelines and technical considerations to be used for developing the D.A.D.F.

Table 7.6 List of final endogenous and exogenous variables and associated guidelines and technical considerations to be used in structuring the D.A.D.F.

Exogenous variables	Guidelines and technical considerations	Endogenous variables	Guidelines and technical considerations
1 Parking provision	Vehicles/m^2	1 Access to public transport	Reduction or increase
2 Population density per sq km	Persons per sq km	2 Air Quality	Reduction or increase
3 Cars per household	Number	3 Parking and Loading facilities	On street/off street
4 Population size	Actual size (millions)	4 Traffic accidents	Reduction or increase
5 Annual urban pop. growth	Rate in %	5 Travel time	Reduction or increase
6 Housing	Density	6 Construction and implementation cost	Reduction or increase
7 Retail development	Location	7 Emission cost	Reduction or increase
8 Economic growth	GGP per capita	8 Transport interchange facilities	Reduction or increase
9 Employment	Employment rate	9 Hub integration	Reduction or increase

Comparing Table 7.5 to Table 7.6 it is seen that the land-use patterns (exogenous) variable and the vehicle operating cost (endogenous) variable have been removed from the group. In this rationalised format the endogenous and exogenous variables and associated guidelines and technical considerations form a useful set of measurement instruments to help identify measures most appropriate to specific local conditions and/or circumstances. These variables and associated technical considerations go further than the "measures-objective tool" reported by Jones (2004) as the decision-maker is free from having to achieve all predetermined policy/sustainability objectives and from using rigid criteria only.

However it has to be recognised that as the Institution of Highways and Transportation (1999:16) argue, technical considerations or guidelines (describing exogenous variables) that indicate the desirable provision of policy measures and also alternative approaches that may prove satisfactory in certain circumstances may differ when considered within different political, national, regional or local agendas. What this means is that although good support exists for using the endogenous and exogenous variables and associated guidelines and technical considerations illustrated in Table 7.6, it should not be regarded as an exhaustive and prescriptive list, but rather one which gives direction and is in itself adaptive or flexible and may be adjusted to reflect local conditions.

7.4 Land-use and transport policy measures

This section aims to establish a list of land-use and transport policy measures that may prove effective and appropriate in reducing traffic congestion following the interpretation of the survey results. To this end Figure 7.3 below illustrates the elements covered in this section.

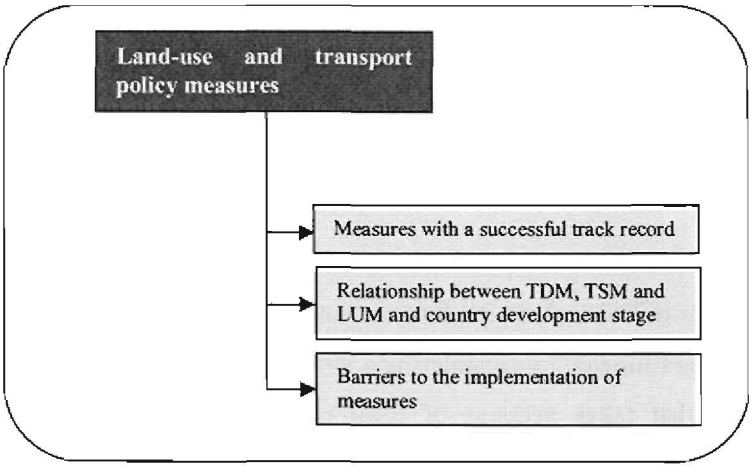


Figure 7.3 Land-use and transport policy measures

By assessing the survey results and relating and comparing them to the literature review it will be possible to identify:

- the menu of measures having a successful track record in reducing traffic congestion within an operational background
- the elements of "Smart Growth" and New Realism proving effective in reducing traffic congestion
- whether a relationship exists between the types of measures implemented and the development stage of a country
- barriers to the implementation of measures

Once these aspects and their interaction have been identified and explained yet more components to form part of the D.A.D.F. will have been identified.

7.4.1 Measures having a successful track record in reducing traffic congestion

To achieve the policy objectives it is necessary to choose from a wide variety of measures those which are most appropriate to dealing with the problem. In finding those measures perceived to have a successful track record in reducing traffic congestion it is important to consider the impacts of the identified measures as their impact, through 1st, 2nd and 3rd order effects may have unique consequences and ways of influencing travel behaviour. In considering these impacts respondents ranked 43 measures in terms of effectiveness in reducing traffic congestion based on their operational experience. To this end respondents suggested 10 measures as the most effective from the pool of 43 as reported in section 6.3.2.1 of Chapter 6.

1. Providing effective and reliable public transport (73%)	6. Cluster and infill development (64.6%)
2. Parking controls (67.9%)	7. "Smart Growth" strategies (64%)
3. Clustered land-use (67.5%)	8. Higher density development (61.5%)
4. Strategic planning (65.8%)	9. Street design (58.3%)
5. Development mix (65%)	10. Urban road charging (53.5%)

The ranking suggests that providing effective and reliable public transport is perceived as the most useful measure (73%) followed by parking controls (67%) and the implementation of clustered land-use (65.8%) when dealing with traffic congestion. This is followed by considering a strategic planning approach (65% of respondents supports this argument) that takes account of local circumstances, constraints and concerns. This will necessitate the implementation of planning principles in a much smarter way. By mixing land-use and clustering, associated and mutually inclusive land-use functions, higher development densities can be achieved which in turn require careful street design and the provision of infrastructural services that can cope with such density. But with increased urban development density as a result of mixed development comes greater population density and indeed a demand for greater mobility. If traditional physical measures do not constrain demand enough the decision-maker may have to resort to managing the transport demand artificially using economic principles of taxation.

The ranking and perhaps choice of measures may be explained by referring to their effects. By definition **first order effects** are those effects that occur directly as a result of the altered land-use/transport system. To bring about first order effects it is necessary to implement or introduce measures that (i) changes transport capacity (ii) affect user cost (iii) influences journey reliability (iv) influence the quality of journeys (v) and provide information to the moving public as suggested by Meyer (1997), Victoria Transport Policy Institute (2005), Department for Transport (2004b & d), Potter and Skinner (2000) and Goh (2002:33). To facilitate these effects a physical measure has been identified (referring to the 10-measure short list) and selected to set the chain of events in motion – i.e. providing effective and reliable public transport. In other words a TSM measure has been selected to bring about the 5 first order effects above.

As Mogridge (1997:5) and Giuliano (1995:330) argue, TSM measures clearly have direct effects upon capacity (and hence congestion) and upon user costs (in terms of money and average travel time), and it is these effects that have a second order effect in that they influence user behaviour. These effects in turn will lead directly to changes in journey reliability, quality and the way in which road users are provided with travel information.

The second measure identified by the respondents to bring about first order effects was that of implementing stringent parking controls – a TDM measure that directly effects user costs forcing the road user to alter his travel behaviour. Most land-use measures are unlikely to have a first order and/or direct effect on transport capacity, although once users have responded to implemented land-use measures there are likely to be changes in system congestion (road, public transport and in car parks) as Marshall (2000:69) reports. The obvious exception to this general observation is that parking measures (for both passenger and freight traffic) will have a direct effect on parking capacity with a potential subsequent effect on parking congestion.

The shortlist of 10 measures also includes five LUM measures (i) clustered land-use (ii) strategic planning (iii) development mix (iv) cluster and infill development and (v) higher development density. These have been identified as capable of bringing about **second order behavioural effects** through (i) strategic location responses (ii) strategic transport responses (iii) day-to-day transport responses and (iv) within day transport responses. By changing the location of people's homes, work and other activities they will have a direct effect on user costs as Pendall (1999:555) suggests. For example, if land-use measures locate workplaces and shops close to each other, it is likely that the reliability of work journeys and shopping journeys will improve.

Introducing the five LUM measures above are likely to lead to strategic location responses, with subsequent effects on both passenger and freight traffic. Such measures are likely to have an important effect on car-buying behaviour and the possibility of car pooling and car sharing as Cervero and Kockelman (1997:216) suggest. Of particular interest are those land-use measures which bring homes, workplaces and shops closer to one another, thus making "normal everyday" journeys much shorter, thereby reducing the need or reliance on private transport.

It is possible that the shortening of "normal" journeys might lead to an increase in one-off journeys such as leisure journeys. This would occur, for example, under the behavioural hypothesis of a "fixed (individual) travel time budget". However, if there is no overall reduction in journeys made, the land-use measures (by themselves) will clearly not produce improvements in overall environmental sustainability as Schwanen et al. (2004:579) report. Additionally, the make up of the household has a significant effect on the behavioural responses to land-use measures, especially if there is more than one adult in the household who needs to travel regularly to work. If the workplaces are geographically distant, the concept of "workplaces closer to homes" becomes diluted. This issue leads directly to the question about the flexibility of workplace location and to the possibility of using telecommunications in order to be less physically bound to (distant) workplaces.

Compact, mixed use, pedestrian friendly designs reduce vehicle trips, vehicle miles travelled per capita (VMT) and encourage non-motorised travel. In terms of transport response, Badoe and Miller (2000:237), Handy (1996:161-162) and Sim et al. (2001:399) note land-use measures create higher density, residential and employment developments which affect travel behaviour to the extent of reducing the number of trips undertaken by car, subsequently shifting car trips to public transport trips. In terms of the effect land-use planning has on the strategic location and resulting transport responses, Marshall (2000:69) notes that spatial planning policies can structure settlements in such a way as to promote more environmentally favourable modes and travel patterns. The sensitive design of the environment will also support sensitive modes such as walking and cycling. Furthermore, planning regulations can directly influence the use of public transport modes, e.g. through the prohibition of car use in specific locations (i.e. pedestrianisation).

The penultimate measure identified as capable of bringing about second order effects was that of street design – a TSM measure that directly affects road user behaviour. For example traffic calming measures forces drivers to reduce speed at certain points along a road link.

The final measure identified as being able to bring about second and perhaps third order effects was that of urban congestion charging – a TDM measure that directly affects road user cost and behaviour. TDM measures are capable of initiating a large number of behavioural responses in terms of location choice, strategic transport choice and day-to-day transport choice. Of particular interest here are the responses to well-focused urban road charging measures although where they have been implemented, congestion levels have decreased. Since such measures have not yet been implemented on a widespread scale, a certain amount of speculation is currently required concerning the likely level of response of people to such measures. Many third order effects only emerge as the end result of the total behavioural changes in the land-use and transport system. The **third order effects** depend crucially on the finer details of land-use and transport planning and the whole package of measures it has been grouped with for implementation, and can only be assessed in a very broad way at the strategic level.

The ranking order of the 10 measures suggests that TSM measures are at the top of the priority list, followed by LUM which is indicative of the supply side paradigm being strongly embedded in the transport industry in response to increasing congestion. Comparing these measures to the "Smart Growth" strategies illustrated by Table 2.6 it is observed that a good level of overlap exists and indeed that they form an integral part of the measures that help secure sustainable development, which will most certainly have a positive impact on delivering the New Realism. However it is also possible to read into this interpretation that transport measures, or indeed needs, drive land-use planning. The analogy is that integrated strategies led by LUM measures may then have in principle a limited impact. In this context the integration process may be more likely to succeed if the general urban outcomes or needs are understood, transport is then planned and land-use is filled around that need. It is most important that greater benefits will be achieved through the synergy between the two types of measures.

People will always travel and there will always be a demand for private transport as existing spatial land-use patterns in nearly every city dictate that it is not always possible or desirable to co-locate work and home land-use functions even within the best intended mixed or clustered land-use patterns on a big enough scale to make a significant impact. Also in most cases the infrastructure that connects land-uses will not change over a short period of time to alleviate "spot" traffic pressures by more "effective usage" where they are desperately needed (unless the authorities have infinite financial resources). So the focus of integration must therefore lie with getting the land-use/transport provision balance right from the outset at new developments – by determining the realistic carrying capacity of the infrastructure and associated traffic engineering requirements associated with the trip generation and attraction characteristics at the proposed site. To the contrary, market forces (i.e. what people want) may produce an even better optimum outcome, so these should be acknowledged and harnessed, then adjusted through appropriate, reasonable and realistic regulation, rather than ignored or controlled.

This section has shown that TSM is still a very powerful measure capable of reducing traffic congestion and that LUM is regarded as a strong regulatory tool to creatively plan land-use patterns and should provide the mechanism that facilitates the provision of transport between activities. TDM measures are positioned at the bottom of the list of 10 measures deemed as having a successful track record in reducing traffic congestion. This is due to a large proportion of respondents favouring TSM and LUM measures as their preferred first and second choice measures, some scepticism and public and political opposition confirming the notion of Cracknell (2000) that especially in developing and the least developed countries the response to traffic congestion is to "build your way out of it" rather than manage the demand for road space more effectively or consider the contribution to be made by spatial planning and traffic management measures. In this respect demand management measures' placing at the bottom of the list may be indicative of respondents' perception that it is a "last resort" mechanism and that it enforces an aggressive economic efficiency argument in order to produce a sustainable and efficient outcome.

Nonetheless the key finding is that whichever measures are used to tackle congestion, they must consist of at least 3 types and be implemented in an integrated manner so as to draw on each others' strengths and their associated impacts and so ameliorate barriers and concerns. The provision of effective, reliable and safe public transport is central to addressing traffic congestion problems. This confirms the notion of Goodwin et al. (1991), Hine (2000:175), Potter and Skinner (2000:275) and Litman (2000:2) that integrated strategies within the New Realism and "Smart Growth" context are powerful tools and more effective than the stand-alone components implemented on their own.

7.4.2 The relationship between TDM, TSM, LUM and "Smart Growth" measures and the development stage of a country

Moving on to the more general measures employed to deal with traffic problems the survey assessed whether a relationship exists between the TDM, TSM, LUM and "Smart Growth" measures employed and the development stage of a country, thereby highlighting the preference and effectiveness of measures between developed, developing and the least developed countries. The results illustrated that different measures are deemed appropriate at different levels of a country's development. Table 7.7 shows a summary of disaggregated revealed preference for a set of TDM, TSM, LUM and "Smart Growth" measures deemed important and effective to each country type in dealing with traffic congestion.

Table 7.7 Revealed preference of the most effective and appropriate measures implemented to deal with traffic congestion disaggregated by country type

Development stage	Type of measures			
	LUM	TSM	TDM	"Smart Growth"
Developed countries	Development mix (67.6%)	Access control or management (90.9%)	Driver information systems (81.8%)	Strategic planning (84.1%)
	Clustered land-use (64.1%)	Parking controls (67.9%)	Regulatory restrictions (65.7%)	Cluster and infill development (75.7%)
	Development encouraging the provision of public transport (59.9%)	Urban Traffic Control (UTC) systems (64.1%)	Urban road charging (61.5%)	Concentrating activities (71.2%)
Developing countries	Development encouraging use of public transport (85.6%)	Effective and reliable public transport (88.3%)	Regulatory restrictions (75.4%)	Cluster and infill development (79.5%)
	Taxation policy (59.1%)	Parking controls (64.1%)	Public car park management (58.1%)	Strategic planning (76.4%)
	Clustered land-use (57.1%)	HOV facilities (58.1%)	Vehicle ownership taxes (57.9%)	Creating self-contained communities (72.1%)
Least developed countries	Development encouraging use of public transport (83.8%)	Effective and reliable public transport (83.1%)	Public car park management (74.7%)	Density development (73.7%)
	Clustered land-use (74.7%)	New roads or additional lanes (63.2%)	Urban road charging (65.4%)	Public transport orientated development (63.3%)
	Development mix (54.6%)	Parking controls (61.3%)	Vehicle ownership taxes (61.1%)	Parking management (41%)

Although it is difficult to establish from Table 7.7 a clear relationship between the development stage of countries and the measures they employ to combat traffic congestion, it shows that both developing and developed countries respond to increasing congestion by focusing on development that encourages the provision of public transport and clustered land-use as LUM measures - supporting the data in Appendix 3 (see CD). Both country types have reported implementing parking control and regulatory restrictions as TSM and TDM measures and share similarities in terms of "Smart Growth" strategies perceived to be appropriate when dealing with traffic congestion. Developed countries are prepared to go further in that they deem the implementation of TDM measures to manage the demand for capacity as important. In sum, the mechanisms deemed appropriate for reducing congestion in developing and developed countries are several, vary greatly and are implemented in an isolated fashion and not necessarily integrated in a comprehensive package (with few exceptions).

The measures identified as appropriate when dealing with traffic congestion - the provision of public transport and infrastructure, regulatory measures and planning which promotes cluster or higher development density – are acknowledged as important in both developing and the least developed countries. Two explanations can be considered in support of this outcome from Appendix 3. One possibility is that increased public transport provision and in general greater emphasis on balanced transportation options is justified in the developing and the least developed countries as a greater portion of the population do not have access to a private vehicle. Providing public transport options will therefore improve transportation equity significantly.

Alternatively it can be argued that is economically inefficient and inequitable to favour transportation by car if it is only used by a small proportion of the population, and as a result authorities will rather focus on providing public transport in some form or another as a means of enhancing transportation equity and employ regulatory measures to reduce traffic congestion caused by other road users. Another possible explanation for the measures identified as appropriate in dealing with traffic congestion is that the provision of infrastructure (building new roads) is still important in developing countries (Ubbels & Nijkamp, 2002:317). Both country types also recognise that regulatory measures and planning which promotes cluster or higher development density is very important in the achievement of sustainable development, an argument supported by Banister (1999:335), Meyer (1997) and the Victoria Transport Policy Institute (2005).

The LUM measures reported by respondents as appropriate when dealing with traffic congestion between the developing and the least developed countries does not support the literature review, as land-use mix, travel plans, "Smart growth" strategies, clustered land-use and car free planning are very seldom applied in the developing and the least developed countries as Appendix 3 suggests. Transportation and land-use planning integration has a chequered history and their achievements in the developing and the least developed countries have been limited. Perhaps the respondents of these countries reported measures they deemed appropriate in dealing with traffic congestion subject to favourable political, economical and other decision-influencing conditions – perhaps a stated preference rather than a revealed preference.

Although general trends are observed and others have been discounted outright, correlation analysis has identified that a relationship does not exist between the country types and the measures they deem appropriate in dealing with traffic congestion. This is quite possibly due to the choice of a variety of measures which may also depend greatly on existing infrastructure, settlement patterns, demographic characteristics, industrial and commercial activity, cultural differences, economic growth, availability of funding, institutional and policy frameworks and the social complexities of a society. Additionally different approaches to planning, planning legislation, policies, circumstances and the approaches to decision-making makes it hard to comprehend that it is possible, or at all desirable, to simply transpose and apply measures that work in one part of the world to another and vice versa.

7.4.3 Barriers to the implementation of measures

The survey results have shown that the greatest barriers to the implementation of TDM, TSM and LUM measures are financial and political barriers and of the three the implementation of TSM measures is affected the most especially road building and the provision of public transport infrastructure. Without adequate capital or funding, the ability of any proposed strategy to preserve and enhance the transportation systems and their sustainability will be severely constrained. To add credibility to this finding Goodwin (1989:495-496) reports that infrastructure measures are widely accepted as having the widest ranging rigid financial constraints, largely because of their high costs, but in some cases also because of constraints in the ability to use finances flexibly across a range of different types of project.

With respect to politics being a barrier to the implementation of TDM, TSM and LUM measures, Giuliano (1992:355) lends further support to this finding by stating that without the support of politicians as key decision-makers, the introduction of any traffic congestion reduction measure is impossible and as such the politicians' opinions and acceptance of proposed strategies are of great importance for successful implementation – a notion also supported by Schade (2003:2). If politicians are sceptical about the projected outcome of strategies they will not risk pursuing their implementation for fear of losing votes.

The survey revealed that LUM measures especially are largely constrained by political and institutional processes and as a result difficulties arise in reaching amicable solutions through decision-making. Difficulties in this regard are in a large part ascribed to unstable administrations and/or unqualified personnel not having the capacity or perhaps experience to implement measures together as Smith (1973) reports. Although the results must be interpreted carefully, it is possible to assert that the developing and the least developed countries especially have noted grave frustration with political and institutional processes constraining effective decision-making although needless to say, it would be unwise to speculate whether this is due unstable administrations and/or poorly or unqualified personnel.

Correlation analysis has also shown a statistically significant relationship exists between countries at different development levels and the barriers they experience. The relationship is especially strong between the developing and the least developed countries. However above all, decision-making as an obstacle to implement or modify measures has the strongest correlation among the three types of countries suggesting a real problem lies at the heart of the planning process. Making sound and informed decisions and having the legal, financial, political and technical support system to implement them is of fundamental importance if joined-up strategy integration is to be achieved.

In discovering the barriers to the implementation of measures it is then possible to derive policy options that use integrated strategies to control or overcome barriers. Within the New Realism paradigm TDM, TSM and LUM integration can therefore be a useful tool to the removal or amelioration of barriers in several ways. In positioning the findings within the literature review it is possible to suggest a number of mechanisms that have been posited in the past with the view of overcoming these specific barriers. They are:

1. Selecting measures which make other elements of a strategy/policy financially feasible
2. Employing strategy integration to package measures which are less palatable on their own such as demand management measures with ones which demonstrate a clear benefit to those affected (Jones, 1998)
3. Establishing a national policy framework on spatial development and sustainable transport which takes a long-term perspective providing consistency within which individual decisions can be placed
4. Devolving powers and responsibilities for land-use, spatial planning and transport to the most appropriate level of governance for implementation, together with the necessary resources or revenue-raising powers (Banister, 2002:5-6)
5. Negotiating with and gaining environmentalist support so as to develop strategies that treat congestion and environmental externalities in an integrated manner (Oberholzer-Gee and Weck-Hannemann, 2002:366-367) and (Jakobsson et al., 2000:157)
6. Motivating politicians and interest groups in an attempt to win support for strategies (Small and Gomez-Ibanez, 1998:213-214; Flowerdew, 1993; Oberholzer-Gee and Weck Hannemann, 2002:364 and Jones, 1998:263-264)
7. Identifying the complementary roles between the private and public sectors in terms of financing, administration and long-terms goals to overcome concerns and scepticism (Schlag and Schade, 2000:1-2; Jakobsson et al.; 2000:156-157; Goodwin, 1989:495-496, 1990:6-7 and Truelove, 1998:15-17)
8. Building administrative capacity

It must therefore be recognised that it is vital to play on the strengths of each TDM, TSM, LUM and "Smart Growth" measure in order to provide a sustainable yet feasible policy outcome. If, for example, financing a specific project is a problem it would be sensible to build into that project options that include TDM measures as part of an integrated strategy, because of their inherent revenue raising characteristic. However, of equal importance is the administrative competence and associated decision-making ability to identify projects or options that will ensure a balance between political, environmental and socio-economic objectives so as to produce a sustainable outcome. This is where the application of the D.A.D.F. comes to the for because integrating TDM, TSM, LUM and "Smart Growth" measures into a package using the D.A.D.F. will allow the decision-maker an opportunity to control most of the barriers by selecting measures appropriate to the policy objective. In this way it allows, in effect the decision-maker more power over the measures required to guarantee the desired results in an optimum solution – one which also controls barriers.

7.5 Planning's administrative and institutional framework: selecting appropriate levels to implement integrated strategies

The administrative and institutional framework within which decision-makers and planners at all levels of governance operate is central to achieving sustainable integrated planning. Generally, co-ordination and policy integration is made easier within governments where development planning and transport planning functions and responsibilities are combined into a single department. This helps focus planning and to align priorities. In assessing where integrated strategies fit into the administrative and institutional framework this section begins by assessing the reported dimensions of *status quo* integration achieved at different Government Departments engaged in planning and transport then assessing the levels of government reported or deemed appropriate in implementing integrated strategies.

Once these aspects have been dealt with it will be possible to position the implementation of integrated strategies at an appropriate institutional level and show how it interacts within the sectoral environment. The section then goes on to explore whether integrated strategies as part of a Traffic Congestion Management Plan should be assimilated into an IDP and if so which levels of government will be most suitable for this purpose. Figure 7.4 below illustrates the main components to be covered in the discussion.

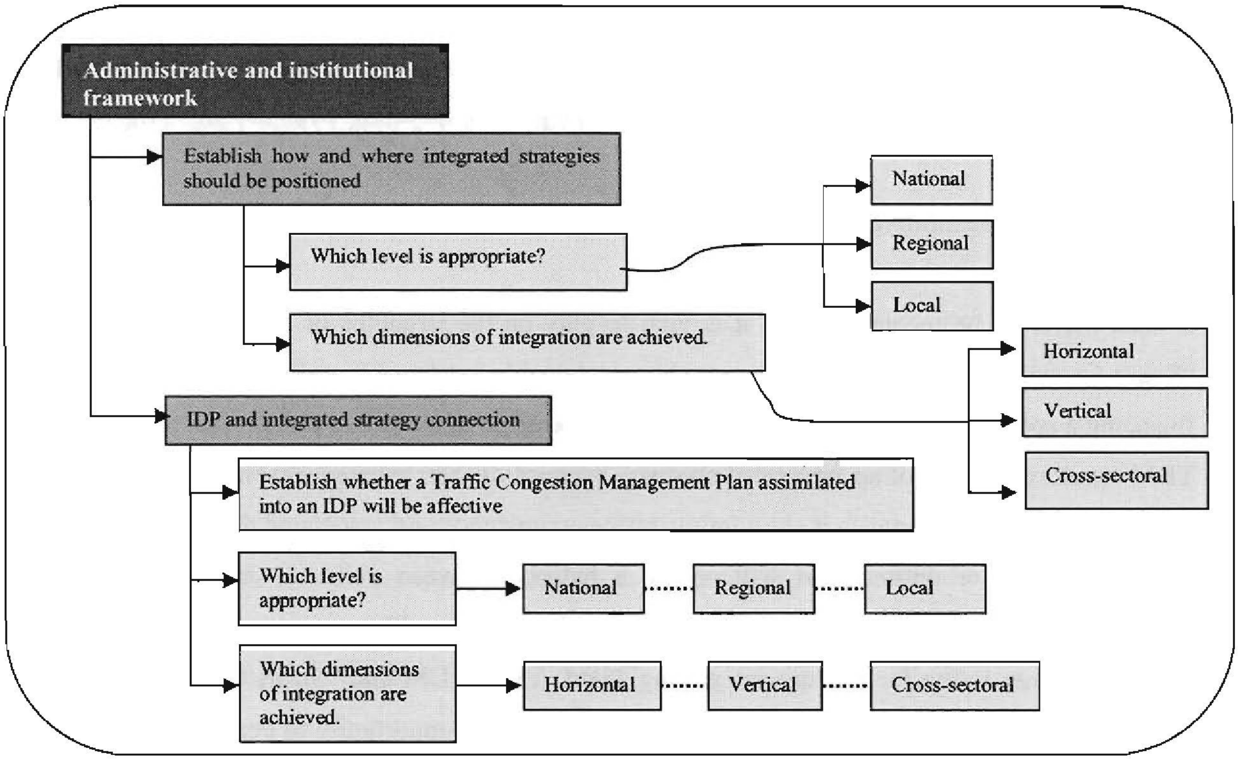


Figure 7.4 Components covered by section 7.5

Having reported the type of responsibility Departments have over their statutory functions it is possible to establish whether an element of integration exists among Departments and also the nature and dimension of integration. The results reported in Chapter 6 have shown that departmental functions such as traffic management and demand management are likely to be implemented within one department (being an example of sole responsibility) and that land-use management functions are likely to be implemented following consultation with other sectoral departments (being an example of joint responsibility). This suggests that the implementation of land-use management measures comprise vertical and horizontal integration.

The provision of public transport and highway infrastructure as functions is most likely to be in joint responsibility with other sectoral departments suggesting horizontal integration associated with the implementation of TSM measures. Bus and rail operations and their management are most likely to be a departmental function with the responsibility over their control and management being divided between that of one department and/or joint responsibility with other private or regulatory transport authorities and/or operators.

What this means is that land-use management, infrastructure provision and the provision and management of public transport, although operating from within separate sectors (horizontally), between them facilitate strategic control of local development processes and co-ordination across the vertical levels of governance and the horizontal support systems associated at each level of the administrative structure - an argument supported by Brugmann (1996:373). This inference is illustrated by Figure 7.5A below.

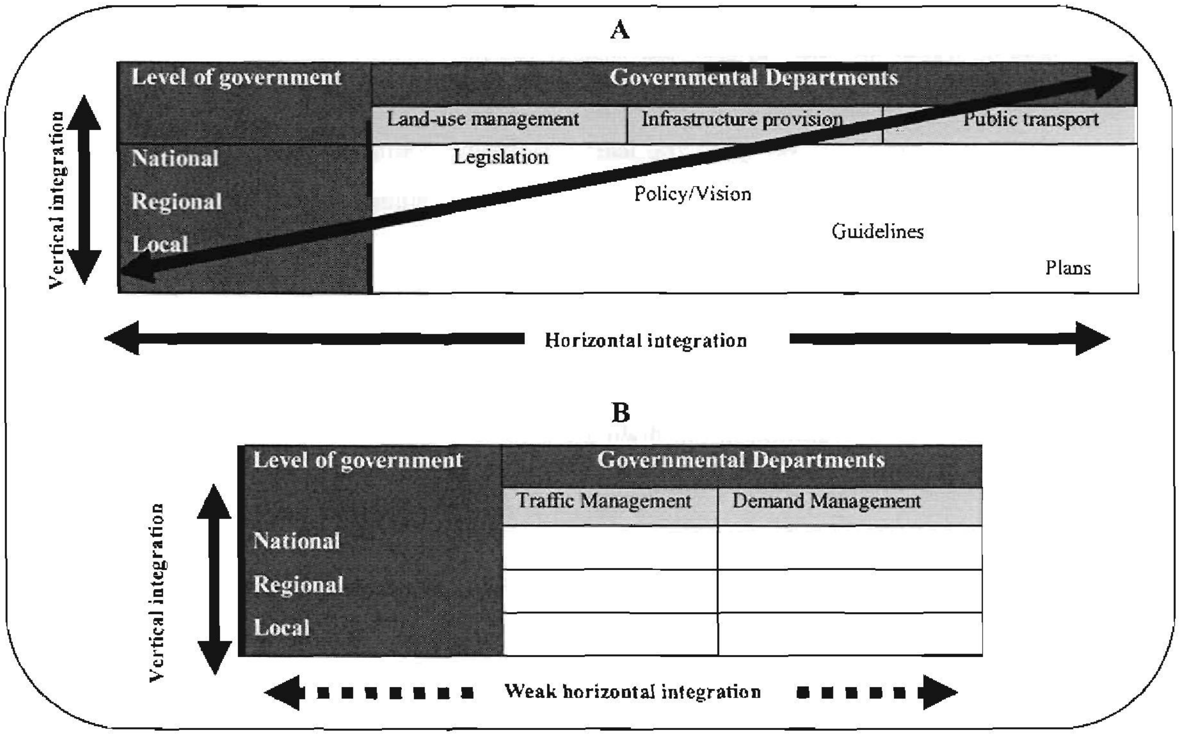


Figure 7.5 Stated vertical, horizontal and cross-sectoral integration among Governmental Departments

Traffic Management and Demand Management as specialized functions are operated autonomously within or from one department with less emphasis placed on horizontal integration, whilst vertical integration is strongly maintained as higher levels of government inform those ranking lower. These conclusions are illustrated by Figure 7.5B.

Moving on to the levels of government deemed appropriate in implementing integrated strategies the results have shown that 64.2% of respondents felt that LUM measures are best implemented at local government level. 47.8% of respondents felt that TSM measures, polices and initiatives are to be driven from national government but initiated at local government level where there is a greater understanding of local needs so projects and schemes can be directly related around their aspirations. 54.1% of respondents felt that the implementation and formulation of TDM measures are best suited at local level. These findings again support the arguments of Brugmann (1996:373) that for integrated strategies to play an effective part in the planning system they are best placed at local government level. However, the effective operation and administrative capabilities of local and regional government in the developing and the least developing countries have been questioned by authors such as Baeten (2000) and Stead (2003).

The main concern is that a lack of co-ordinated planning between road and public transport, land-use, and environmental considerations at local level can lead to a segmented approach to policy-making, preventing the development and implementation of comprehensive, integrated plans thereby jeopardizing effective and sustainable urban development. Sections 4.3.2 and 4.3.3 of Chapter 4 have shown that there are currently considerable problems in terms of cross-sectoral integration in many developing countries such as Ghana, Argentina, Indonesia and South Africa to name but a few. The problem is partly due to inefficient cross-sectoral alignment and departments following multi-disciplinary approaches in dealing with development issues as they pursue their own sectoral objectives. Although respondents have suggested that integrated strategies are best suited to implementation at local government level and perhaps they are - some of the developing and least developing countries have a long way to go in terms of establishing and building basic capacity to deal with their implementation effectively.

In advance of developing and implementing integrated strategies decision-makers therefore require:

- Organizational capability
- Land-use, transport planning and environmental management legislation, plans and guidance
- Commitment to sustainable development
- Cross-sectoral co-ordination of legislation
- Deciding which levels of government control which functions within the administrative structure
- Clearly delineating responsibilities in terms of taking ownership over the regulation, facilitation and enforcement of planning legislations, plans and guidelines and then align as appropriate
- Developing a mechanism (such as an IDP or equivalent) to engage traffic congestion and to implement preventative measures

Plans and policies executed at local level, more so than regional and national plans, deal specifically and are aimed at addressing local transport problems although national plans and strategies inform and provide direction to local plans. This is where an IDP comes to the fore – presenting a mechanism that integrates sectoral functions and promotes vertical and horizontal integration and communication as Edgington & Fernandez (2001) suggests. It can therefore be argued that scope exists for IDPs to be coupled to congestion reduction proposals or plans as both have a local planning focus aimed at the integration of a diverse set of functions supporting the arguments of Todes (2004). In countries where IDPs have been employed balancing environmental, economic and social concerns, greater integration has been achieved between transport and land-use activities at local levels. Also, where strong inter-sectoral co-operation and integration is of good quality and effective such as in New Zealand, Australia, Japan and Germany for example, section 4.3.3 has shown that IDPs have a better chance of succeeding.

Because IDPs is seen as (i) a multi-sectoral and multi-level activity (Edgington & Fernandez, 2001) incorporating local government and other actors (ii) a process integrating various dimensions of development and (iii) the action of sectoral agencies driven by regional goals and aspirations - space rather than sectors becomes significant, and the role of spatial planning comes to the fore. With a "Traffic Congestion Management Plan" greater emphasis is placed on identifying the right mix of measures suitable to a specific location, through the D.A.D.F., to deal effectively with traffic congestion. For that purpose a "Traffic Congestion Management Plan" weaves together elements of TDM, TSM, LUM, land-use management systems, sectoral plans, environmental management and spatial planning and forces interfaces and alignment with an IDP. Although there is an "obvious" interface between IDPs and sectoral plans, no specific provisions are made within IDP's to tackle traffic congestion via a "Traffic Congestion Management Plan", to integrate TDM, TSM and LUM measures or to use some other tool that focus efforts on dealing with the growing problem *per se*.

To this end the author hypothesised the idea that integrated strategies (developed using the D.A.D.F.) aimed at traffic congestion reduction have the scope to be assimilated into the IDP process thereby forcing an interface between TSM (an Infrastructure sector provided function), LUM (implemented within Spatial Development Frameworks) and TDM (to be facilitated by the Transport sector) in the form of a "Traffic Congestion Management Plan". In this way the IDP not only pulls together all sectors of government involved in development as illustrated by Figure 7.6, but contains a direct tool to be affected at local level addressing traffic congestion at source. Further still, within the IDP it is possible to formulate a single programme that brings together "various sectoral actions into a sustainable integrated spatial development process" as Roberts and Colwell (2001:435) argue.

The author's hypothesis received strong support (76% of all respondents) and respondents indicated that such a plan would be best suited to implementation at local level being driven from a regional or strategic perspective. Consequently this inference further supports the survey findings that TDM, TSM and LUM measures are deemed more appropriate for implementation at local government level as reported above. It is also a favourable finding in terms of the author's hypothesised idea, for, in order to deal with local traffic congestion, it is necessary to involve the public, environmental concerns, politicians, local business management and other relevant statutory and non-statutory stakeholders with an immediate local concern. Local traffic problems require locally derived solutions driven by regional and national strategy plans.

The stakeholders did not deem it appropriate to devise an integrated strategy at national level as its main drawback is the complexity of the package of measures at that level not to mention phasing its implementation. By having a local focus the "people" decide which measures they prefer, which will provide a democratically representative outcome and not a perceived top down solution. The implication is however that for a "Traffic Congestion Management Plan" to be assimilated into IDPs or adopted into equivalent development Plans many of the developing and least developed countries will have to build the necessary capacity and support structure to maintain and operationalise such an approach to alleviating traffic congestion first of all.

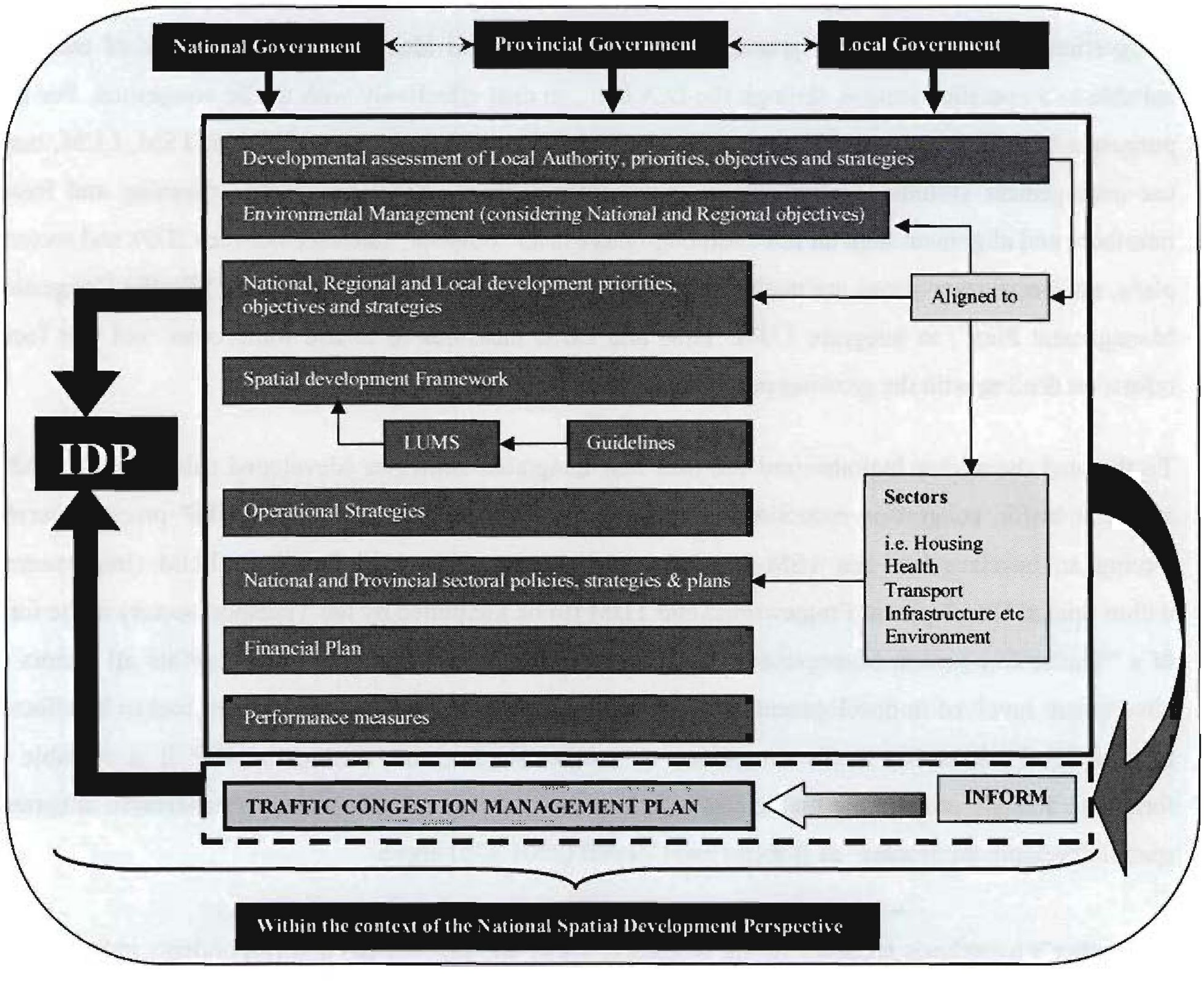


Figure 7.6 A Traffic Congestion Management Plan within the IDP process

7.6 Summary of key findings

Having discussed and interpreted the results it is possible to identify key findings as Tables 7.8, 7.9 and 7.10 illustrate and to relate them to the research purpose and objectives. In this way the findings are positioned within the study and will form the basis for structuring the D.A.D.F.

Table 7.8 Key findings about achieving sustainability

Summary of discussion
• 7 Objectives were identified as conducive to strategy integration and long term sustainability.
• There is a statistically significant relationship between the development stage of a country and the objectives deemed appropriate to measure and qualify sustainable development.
• Integrated strategies are perceived to increase local accessibility and mobility.
• A robust set of criteria and indicators that measure the achievement of objectives in realising integrated strategies have been identified.
• There is a statistically significant relationship between the development stage of a country and the criteria and indicators employed.
• A robust set of performance indicators were identified to measure the performance of integrated strategies.
• A significant relationship exists between performance indicators and the development stage of a country.
• A set of exogenous and endogenous variables have been identified to describe and measure local conditions.

Table 7.9 Key findings about land-use and transport policy measures

Summary of discussion
• 10 measures were identified by respondents as having a successful track record in reducing traffic congestion including Smart Growth measures.
• No relationship exists between the different levels of countries' development and the measures they deem appropriate in dealing with traffic congestion reduction.
• The measures deemed appropriate for reducing congestion in developing and developed countries are several, vary strongly and are implemented in an isolated fashion not necessarily integrated in a comprehensive package (with few exceptions).
• Integrated strategies can help to control or overcome barriers to the implementation of measures.
• TSM measures are still perceived as a very powerful measure capable of reducing traffic congestion and LUM is regarded as a strong regulatory tool to creatively plan land-use patterns.
• TDM measures are perceived especially in the developing and least developed countries as a "last resort" mechanism - the first choice in dealing with traffic congestion is to "build your way out of it" rather than manage the demand for road space.
• Correlation analysis has shown a statistically significant relationship between countries at different development levels and the barriers they experience.

Table 7.10 Key findings about administrative and institutional frameworks

Summary of discussion
• Integrated strategies are suitable for implementation at Local Government level.
• Joint Departmental responsibility of individually managed departments such as land-use management, environmental management, infrastructure provision and the provision and management of public transport facilitates horizontal and vertical integration.
• Individual (opposed to joint) Departmental responsibility for Traffic Management and Demand Management functions facilitates weak horizontal integration and strong vertical integration.
• Integrated Development Plans present a mechanism that integrates sectoral functions and promotes vertical and horizontal integration and communication.
• A Traffic Congestion Management Plan (T.C.M.P.) has the scope to be assimilated into an IDP.
• A T.C.M.P. must preferably be implemented at local government level and coupled to an IDP or IDP-equivalent plans where it has the opportunity to encourage horizontal and vertical integration.
• For integrated strategies to be successfully implemented at Local Government level, the developing and least developed countries have to build sufficient capacity to enable implementation effectively and develop the institutional support system that will facilitate such strategies through a D.A.D.F.

Comparing these findings with the research objectives cited at the introduction of this chapter it is possible to conclude that the objectives relevant to the survey have been achieved, thereby providing the **primary building blocks** to develop the D.A.D.F. as illustrated by Figure 7.7.

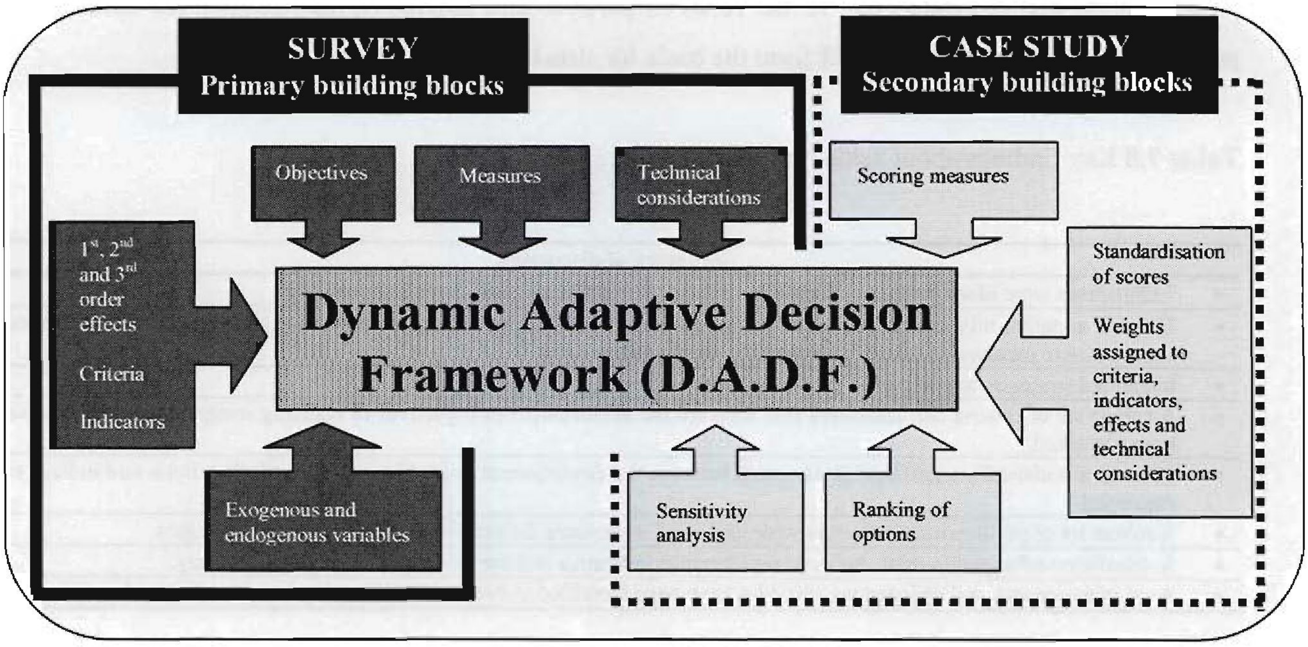


Figure 7.7 Primary building blocks for the construction of the D.A.D.F. and secondary building blocks for the testing of the D.A.D.F.

Once the case study has been completed, it will provide the **secondary building blocks** (input data) to test the D.A.D.F.'s functionality and determine its anticipated value as a decision-making tool.

7.7 The MCA based D.A.D.F. explained

The findings of this chapter have identified the **primary building blocks** required to develop the D.A.D.F. as illustrated by Figure 7.7. The development of the D.A.D.F. is a key and fundamental part of the research where new knowledge gained through an empirical process is unlocked and assimilated into a central idea shaping a process that serves as a tool to discriminate between TDM, TSM and LUM measures best suited for individual local conditions in managing traffic congestion. To this end Figure 7.8 illustrates the logic or structure of the D.A.D.F. It illustrates the stages involved in the MCA based process, how it has been adapted to reflect the mechanics of the D.A.D.F. and how it incorporates three screening processes to establish options suitable to local conditions.

7.7.1 The operation of the D.A.D.F.

Figure 7.8 below illustrates the operation of the D.A.D.F.

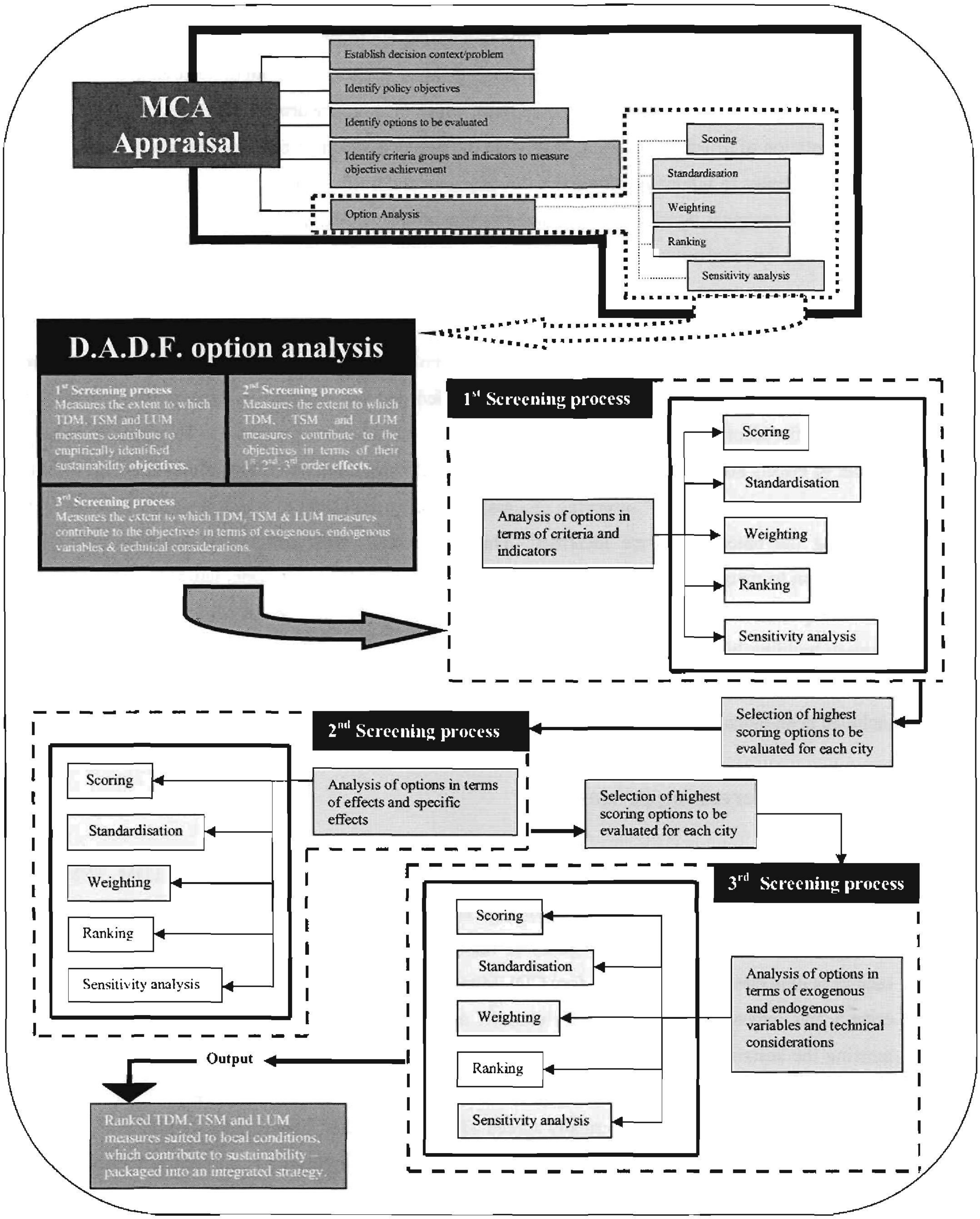


Figure 7.8 The operation of the D.A.D.F.

As Figure 7.8 shows, the option analysis stage of standard MCA has been adapted to reflect the mechanics of the D.A.D.F. and how it incorporates three screening processes. The MCA process is initiated by establishing a decision context. This means that a clear context for the topic being investigated is required. For the purpose of the study, the context is deciding which measures (options) are the most suitable, effective and sustainable in contributing towards traffic congestion reduction. Final decisions and the examination of results will be made against the background of achieving the policy goal (higher order goal and its sub-ordinate objectives), which is to reduce urban traffic congestion through the implementation of selected measures. To enable the decision-maker to measure the extent to which each option contributes to achieving sustainable development and traffic congestion reduction it is necessary to provide an assessment framework. By computing the primary building blocks into BOSDA the D.A.D.F. is created as an assessment framework enabling analysis and trade-offs to be made between policy options.

To this end section 7.3.1, page 177, reported the stakeholder agreed policy objectives to be computed into BOSDA. Policy measures/options have been identified and are reported in section 6.3.2.1, page 158. Following the identification of policy options, criteria and indicators (relevant to 1st screening process), classes of effects and more specific effects (relevant to 2nd screening process) and variables and technical considerations (relevant to 3rd screening process) measuring the extent to which the options contribute to achieving the objectives, were identified. This is essential when comparing the different options' contribution to meeting the policy objectives. These measurement instruments have also been identified and are reported in section 7.3.2, page 179, section 4.4.2, page 81 and section 7.3.3, page 183. Once these primary building blocks have been uploaded into BOSDA it provides the mechanism that screens out undesirable options. In essence the D.A.D.F. is an option analysis tool establishing measures to be included in an integrated strategy.

7.7.2 First screening process

The first screening process measures the extent to which all of the empirically agreed TDM, TSM, LUM and "Smart Growth" measures contribute to achieving the empirically identified sustainability objectives. It is possible to illustrate the functionality of this process by way of a matrix (assessment framework) such as is illustrated in Appendix 18 (see CD). Measurement is performed by using the empirically agreed criteria and indicators reported in this chapter, assessing the contribution made by the measures in meeting the sustainability objectives, higher order goal of traffic congestion reduction and appropriate sub-ordinate objectives. Collectively these components form the first screening framework which is constructed by computing all empirically agreed TDM, TSM and LUM measures into BOSDA as well as all empirically agreed criteria and indicators. The structure and screening is only set in motion once the case study results are computed into BOSDA. The structure then "screens" the measures in terms of their case study derived scoring results, the standardising and the weighting of the criteria and indicators and ranks the measures in terms of objective achievement. Once the measures have been screened the 30 highest ranked measures (from a total of 38) are transferred to the second screening process.

7.7.3 Second screening process

The second screening process measures the extent to which the remaining 30 empirically agreed TDM, TSM, LUM and "Smart Growth" measures contribute to achieving the empirically identified sustainability objectives. During this process the extent to which the measures contribute to the sustainability objectives and higher order goal and sub-ordinate objectives are measured against the first, second and third order effects and more specific effects associated with implementing the measures. As with the first screening process, these components collectively form the second screening process which is constructed by computing the remaining 30 empirically agreed TDM, TSM, LUM and "Smart Growth" measures into BOSDA as well as the first, second and third order effects and more specific effects. BOSDA performs the measurement by using the first, second and third order effects and their more specific effects to assess the performance or contribution made by the various measures in achieving the sustainability objectives. In this way undesirable measures are eliminated based on their inability to contribute to sustainable development in terms of their effects or impacts. It is possible to illustrate the functionality of this process by way of a matrix such as is illustrated in Appendix 19 (see CD).

Once again the structure and screening process is only set in motion once the case study results have been computed into the framework. BOSDA then "screens" the measures in terms of their case study derived scoring results, the standardising and the weighting of the first, second and third order effects and more specific effects and ranks the measures in terms of objective achievement. Once the measures have been screened the 25 highest ranked measures (from a total of 30) are transferred to the third screening process.

7.7.4 Third screening process

The third screening process is designed to identify the most suitable measures to be implemented under specific local conditions from the remaining 25 measures. For the screening process to be dynamic and adaptive it measures the extent to which the remaining 25 empirically agreed TDM, TSM, LUM and "Smart Growth" measures contribute to achieving the empirically identified sustainability objectives and higher order goal and sub-ordinate objectives. During this process the extent to which the remaining measures contribute to the sustainability objectives are measured using the empirically agreed exogenous and endogenous variables, guidelines and technical considerations (as reported earlier in this chapter) that describe the prevailing conditions. It is again possible to illustrate the functionality of this process by way of a matrix such as is illustrated in Appendix 20 (see CD).

Once again the third screening process is only set in motion once the case study results have been computed into BOSDA. Following the case study data analysis the guidelines and technical considerations which describe the local conditions best are reported. Depending on the study areas local transport, economic and land-use characteristics and conditions, the decision-maker will have scored the contribution made by the measures to the sustainability objectives in terms of the exogenous and endogenous variables, guidelines and technical considerations differently and will have assigned a higher or lower value weight to his choice of exogenous and endogenous variables and guidelines and technical considerations. The collective assignment of the differing weights to the variables and technical considerations will influence the extent to which the measures contribute to the objectives, ultimately identifying only those measures likely to be effective and appropriate to local conditions and capable of progressing sustainable development. The results of the third screening process then leaves the remaining measures ranked from the highest to the lowest scores and based on the scores it is possible to identify and assimilate those scoring highest into an integrated strategy that comprises a balanced mix of measures.

7.8 Appropriateness of the survey methodology and data collection methods

As part of the research strategy the survey involved an exploratory, descriptive and inferential investigation as a means of obtaining the desired data to fill identified gaps. In hindsight, the strategy followed proved quite useful in terms of accessing data from identified stakeholders. The identification of the population and obtaining of the required statistical data enabling random selection went ahead without encountering any difficulties or obstacles which would suggest it was possibly the most efficient data collection procedure to set the stage for the survey. Having selected stakeholders within an international audience it was envisaged that a large volume of data would be obtained and it would be a demanding task to report and analyse the data. Fortunately Analyze-it made this task less difficult and provided efficient and accurate results.

Although a reasonable response rate was attained enabling generalisation, a higher response rate may have been achieved if the questionnaires had been shorter. This may have been possible provided the different sections contained in each questionnaire were programmed over some months and then each section of the current questionnaires sent as a separate questionnaire. Alternatively a shorter version of the current questionnaires may have been used, which may have resulted in less detailed questions being asked and consequently precious data being lost. However, in order to meet deadlines in relation to the study program and to avoid a compromise in the quality and quantity of data collected, the alternative approach was not followed. In general, both structured and semi-structured instruments served their purposes adequately. In as far as the survey is concerned, the research design promoted the internal and external validity of the findings, strengthening the case for generalising the findings from the respondents.

7.9 Conclusion

The discussion and interpretation has demonstrated with a good degree of certainty that some relationships do exist between countries at differing development stages and the building blocks they deem important for achieving sustainability. A significant variance was observed in terms of measures being deemed appropriate for dealing with traffic congestion, although broadly speaking the developing and least developed countries share more similarities in this respect than comparing them to developed countries. Even in terms of the barriers experienced to introducing traffic congestion reduction measures, all types of countries showed remarkable similarities in that they all experience financial and political barriers.

The discussion has also shown how the survey results helped to achieve the research objectives relevant to the survey and provided the primary building blocks of the D.A.D.F. The integrated strategy concept was supported by the majority of respondents who viewed its benefits as far exceeding the individual implementation of measures. It was also found that integrated strategies are perceived to be best suited to implementation at Local Government level because they need to be informed from a local perspective but partly driven from a regional point of view, much like IDPs. Because integrated strategies will be the product of the D.A.D.F. they need to be inserted somehow into the decision-making process. As such the D.A.D.F. needs to be coupled to existing planning appraisal systems that are capable of providing the scope for its implementation.

This requires the formulation of a "Traffic Congestion Management Plan" (T.C.M.P.) that can be assimilated into local level governance as a supporting tool. In this regard the findings have shown support for the T.C.M.P.'s implementation at Local Government level because of its envisaged local level impact and because of its scope to be assimilated into, or as part of, an IDP or IDP-equivalent plan where it has the opportunity to encourage horizontal and vertical sectoral integration. However, for successful implementation of the D.A.D.F. and integrated strategies, the developing and least developed countries will have to build sufficient capacity to enable effective implementation and development of the institutional support system that will facilitate a D.A.D.F.

Having discussed and interpreted the survey results the scene was set to demonstrate how the D.A.D.F. is developed and how the processes it uses as part of MCA operate. Finally, in considering the appropriateness of the research strategy, it was deemed quite useful and appropriate in terms of accessing data from identified stakeholders.

CHAPTER 8

CASE STUDY: CAPE TOWN & JOHANNESBURG

8. 1 Introduction

Following the interpretation of the survey results it was possible to construct and explain the working of the D.A.D.F. It is now possible to apply it as part of a case study. To this end Chapter 8 reports and interprets the case study results within the current planning policies and objectives of the Cape Town Metropolitan Municipality and the City of Johannesburg Metro. This means positioning the case study results within a city context and identifying its implications with due regard to historic development, strategic perspectives, development concerns and planning challenges. Figure 8.1 outlines the sub-sections to follow.

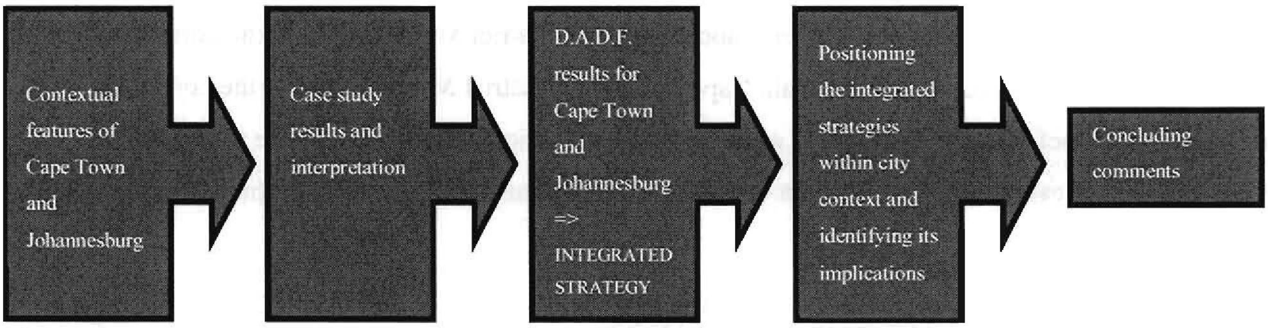


Figure 8.1 Structural content of Chapter 8

8.2 Contextual features of Cape Town and Johannesburg

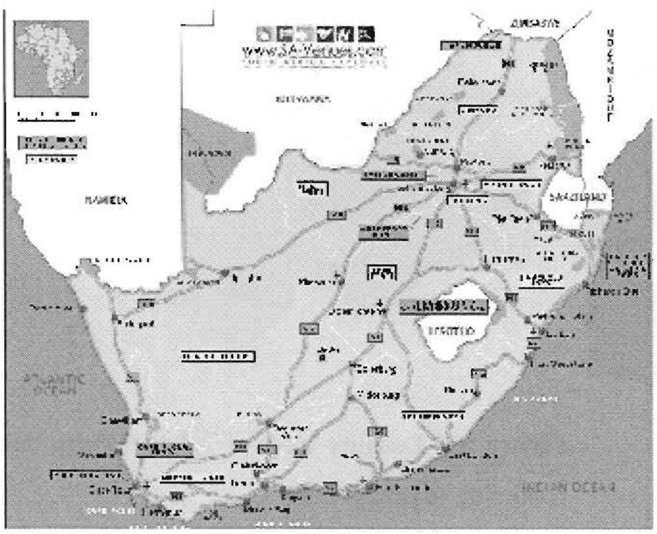


Figure 8.2 Locality of Cape Town and Johannesburg within South Africa
Source: SA venues.com (2006)

Cape Town and Johannesburg as shown in Figure 8.2 have been selected as case study cities, with data collected from Cape Town serving as base data and data collected from Johannesburg as control data thereby allowing comparative analysis. Of the many cities and/or metropolitan areas in South Africa, Cape Town and Johannesburg have been selected largely because of the serious and growing traffic congestion experienced by both as highlighted amongst others by Heyningen (2006) and Chakwizira (2007). Johannesburg closely followed by Cape Town have the worst levels of traffic congestion in the country at peak hours along distributory routes, trunk routes and motorways (City of Johannesburg, 2006; Cape Town, 2006a). Both share similar development challenges and concerns at a strategic level as will transpire in the sub-sections to follow. Moreover, similarities are also observed in terms of urban growth rates and demographic characteristics. However, before reporting and interpreting the case study results this section describes the key contextual features of both cities.

8.2.1 Location and demarcation of the study areas

The city of Cape Town (covering approximately 2474 km^2) is located in the Western Province on the south-western corner of South Africa. For the purpose of the case study the boundary of Cape Town as a study area is delineated by the following bordering municipalities as shown in Figure 8.3:

- Swartland Local Municipality (within West Coast District Municipality) to the north
- Drakenstein Local Municipality (within Cape Winelands District Municipality) to the northeast
- Stellenbosch Local Municipality (within Cape Winelands District Municipality) to the northeast
- Theewaterskloof Local Municipality (within Overberg District Municipality) to the southeast
- Overstrand Local Municipality (within Overberg District Municipality) to the southeast

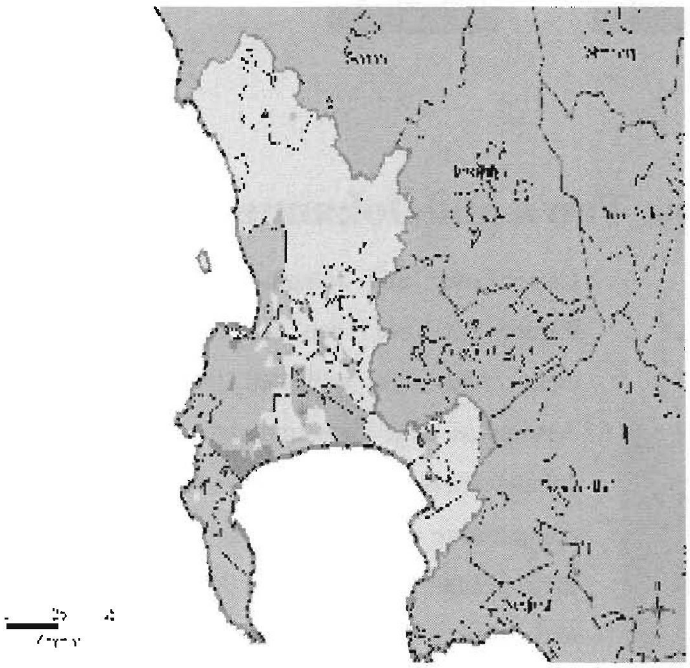


Figure 8.3 Locality map of Cape Town and its bordering municipalities
Source: Cape Town (2005)

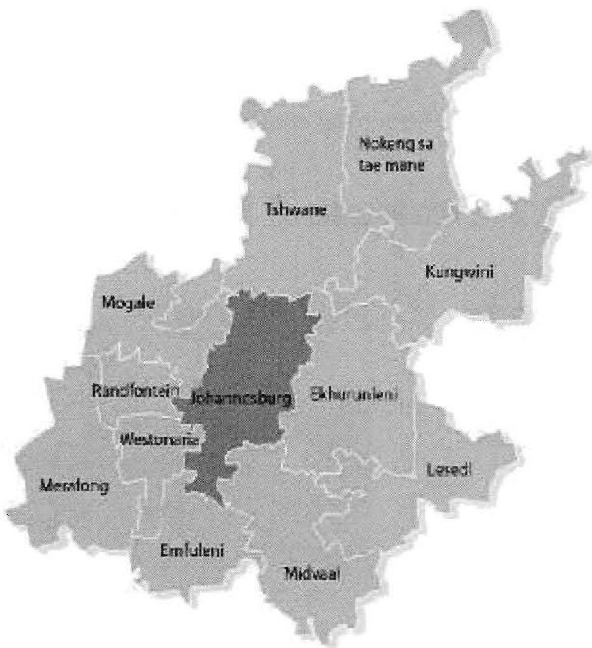


Figure 8.4 Locality map of Johannesburg and its bordering municipalities
Source: Wikipedia (2006)

Johannesburg, the provincial capital of Gauteng Province (covering approximately 1,644 km^2) is situated to the north of the country and has borders with the following 7 municipalities (2 metropolitan and 5 local municipalities) as shown by Figure 8.4:

• City of Tshwane Metropolitan Municipality	• Westonaria Local Municipality
• Ekurhuleni Metropolitan Municipality (East Rand)	• Randfontein Local Municipality
• Midvaal Local Municipality	• Mogale City Local Municipality
• Emfuleni Local Municipality	

8.2.2 Historic development and implications

Cape Town, the oldest city in South Africa, was founded in 1652 as a supply depot and temporary refreshment station by the Dutch East India Company (Vereenigde Oost-Indische Compagnie; VOC) for its ships trading with the Far East (Western, 2002:711). The VOC totally transformed the countryside by promoting colonial-style expansion both in the city's layout and architecture. In 1834, the formation of Bo-Kaap, or 'upper city', marked the first separation of the town. Muslims, forming their own community after being freed from slavery, caused this separation. This separation is fundamental, because it was one of the first that really began to separate the Europeans (whites) from the indigenous and slave sectors of society.

The discovery of gold at the Witwatersrand Reef in 1886 led to the establishment of modern day Johannesburg setting off a mass migration of fortune seekers to Johannesburg to try their luck at finding gold. After the discovery the population of the city exploded and Johannesburg became the largest city in South Africa. Within 10 years, Johannesburg was the largest town in South Africa, outstripping the growth of Cape Town, which was more than 200 years older. The gold rush saw massive expansion and the development of Johannesburg and the Witwatersrand - inducing growth at Cape Town with the construction of a rail line to the interior of the country which was extended to reach Johannesburg by 1892.

The development of Cape Town and Johannesburg were strongly influenced by the political and ideological perceptions of the early 19th century in South Africa and it is impossible to fully appreciate the spatial historical development of South African cities without reference to it. For about 60 years from 1900 onwards racial segregation was engineered (Jenkins and Wilkinson, 2002:37) across the country. In 1927, the first City Planning Act came into force, when the first Town Planning Ordinance was passed by the Cape Town City Council (later also by Johannesburg) thereby implicitly creating an institutional planning tool to segregate the inhabitants of towns and cities in South Africa by race. This aspect of colonial town planning which encouraged segregation became the theme for all the urban development that followed across South Africa and had a formative impact on urban economic, social and political form (SA History, 2006). In 1948, the National Party introduced its policy of apartheid and formalised residential/racial segregation that gave South African cities their distinctive character (Oldfield 2004:190).

With the deliberate neglect of the non-white sectors of society and the worsening of their social and economical conditions, townships and squatter settlements became a part of the urban morphology through the years to come. The living conditions and state of affairs were not sustainable. Instead of creating a sustainable socially and economically balanced society, politicians of the 1970s and 1980s enforced apartheid stringently until 1994 when majority rule was achieved by a free election to bring to an end this unsettling period in South African history.

Today, more than a decade on, Cape Town and Johannesburg present a mixed picture - apartheid has left an "awful legacy" - the witting creation of deeply divided communities characterised by social and economical inequality, segregative land-use patterns, great disparities in levels of education, the inadequate and the inefficient provision of transport infrastructure to serve the needs of all its people and inequitable access to labour and economic markets. This section can not possibly describe all aspects of the historical development of Cape Town and Johannesburg. Interested readers who wish to delve into the chronological evolution of the development of these cities can refer to the papers written by Oldfield (2004:189), Western (2002:711), Wilkinson (2000:195) and Lemanski (2006:415).

8.2.3 Aspects of Cape Town and Johannesburg's spatial development

South African cities are characterised by sprawl and low urban densities and Cape Town and Johannesburg are no exceptions to the rule with Cape Town having a population density of 1207 persons/km^2 and Johannesburg a density of 2003 persons/km^2. Both cities have a low urban density compared to other world cities having their origins in colonial land utilisation patterns, apartheid segregation and the impact of decentralisation, which has been a key feature of urban development in most South African cities. Despite extensive urban growth during the last four decades, the basic structure of Cape Town and Johannesburg continues to reflect the patterns of its development during the nineteenth and early twentieth centuries. The low urban densities experienced in both cities are one of the critical factors inhibiting the creation of sustainable settlements.

New housing developments built since 1994 have perpetuated these low-density urban patterns. Housing schemes, generally using project-linked housing subsidies, have promoted the familiar one house per plot housing typology – often on the urban periphery reinforcing the sprawling, fragmented, racially divided character of South African cities (Harrison et al., 1997). Corridors of more intense commercial, retail and office activity and mixed land-use associated with major arterial roads and suburban rail lines is very common in South African spatial development. The significant decentralisation of office and retail activity, from the CBD (Central Business District) as well as manufacturing and services have given rise to the growth of important urban sub-nodes at Claremont, Bellville and Somerset-West (in Cape Town) and at Randburg, Sandton, Randfontein and Westonaria (in Johannesburg). The emergence of regional shopping centres during the last 30 years, located near major interchanges on the city's motorway system in order (to increase private vehicle accessibility), has also fundamentally reshaped the city's retail geography.

The fragmented, dispersed and low-density form of urban settlement built by planners of the apartheid (and post-apartheid) era has meant that most residential areas are a long way from work opportunities, public and commercial facilities and leisure activities, which are generally concentrated near the "core" of the city. This has imposed a major burden on the inhabitants of poorer areas, who are required to bear the high financial and time costs associated with lengthy journeys to reach work and urban facilities. The low density and fragmented nature of these poorer areas has also made it difficult to provide an affordable and efficient public transport system: the bus and rail services are expensive and inadequate, and most families have little option but to rely on the decidedly unsafe combi-taxi / minibus taxi system. In addition, the low density has meant a high cost to municipalities in delivering and maintaining essential services.

Since the late 1980s the planning authorities of both cities came under mounting social and political pressure to map out their future spatial development to alleviate these development concerns. They responded by producing Metropolitan Spatial Development Frameworks (MSDFs) in the late 1990s. Unfortunately the plans were static and had a blueprint planning approach (Haferburg, 2002:35) in that they presented a spatial vision of a future but did not suggest how to achieve it and had a fundamental misunderstanding of space economy. To make matters worse, departments of national and provincial government were producing policies inconsistent with the goal of spatial integration (or even horizontal and vertical integration).

What was desperately needed was spatial planning policy guidelines which encouraged integrated urban development and the provision of more efficient transport links. This need saw the formulation of the Municipal Systems Act 2000 (MSA) that facilitated the introduction of Integrated Development Plans (IDPs) as five year strategic development plans for every municipality superseding all other plans that guide development at a local level. Cape Town and Johannesburg's IDPs are comprehensive documents setting out how the municipalities intend to tackle their development challenges. These documents are supported by their respective Land-Use Management Systems (LUMS), sector plans and the latest 2006 version of their SDFs and their City Budgets.

8.2.4 Transport systems in Cape Town and Johannesburg

The efficiency of a road network and especially public transport is a useful indicator of urban sustainability - good public transport makes cities more accessible and reduces the need for private transport. In measuring the extent to which Cape Town and Johannesburg's transport systems achieve some degree of sustainability it is necessary to describe their transport systems in the context of their highway networks and public transport systems.

8.2.4.1 Highway systems

Cape Town is the meeting point of three South African national roads as shown by Figure 8.5: (i) the N1 connecting Cape Town with Johannesburg and Pretoria and ultimately the Zimbabwean border (ii) the N2 to Durban and further north towards Mozambique and (iii) the N7 to Namibia. In addition to these national roads which are also used for local traffic, the city is served by the M3, M5, M7, R300 motorways and an extensive network of dual carriageways and main roads. Johannesburg is heavily dependent upon 10 traffic links for transportation in and around the city as illustrated by Figure 8.6 - the N1, N3, N12, N14, N17, R21, R24, R59, M1 and the M2. In addition, the City of Johannesburg (2006) reports that three new motorways are being planned: the G5, G9 and G14.

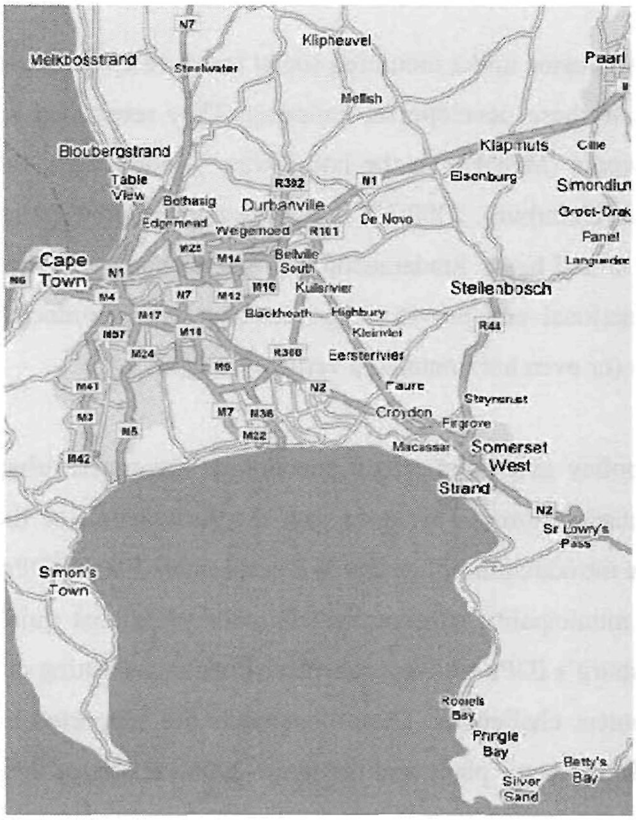


Figure 8.5 Cape Town motorway system
Source: Google Maps (2006)

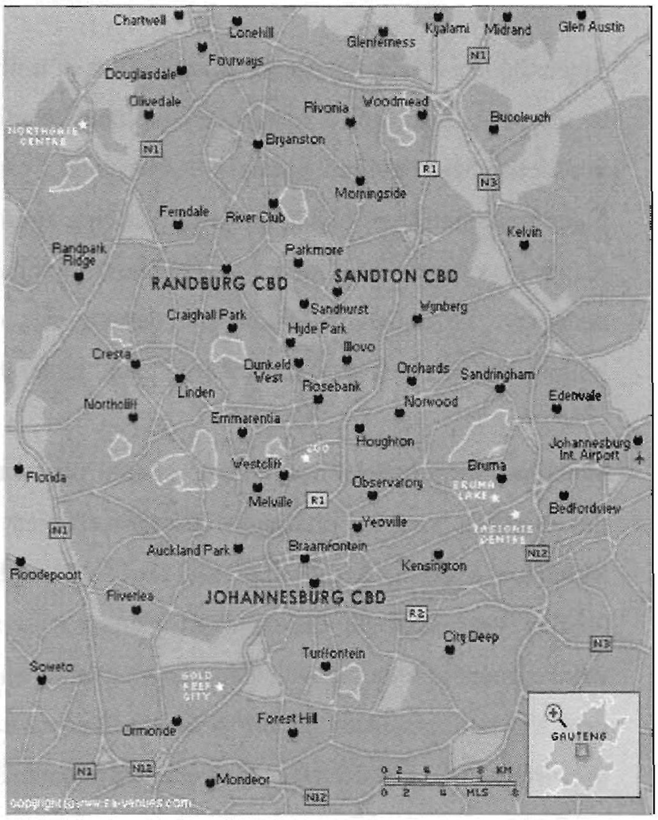


Figure 8.6 Johannesburg motorway system
Source: Sa-Venues (2006)

Cape Town and Johannesburg's road layout range between the typical colonial grid pattern to conventional neighbourhood unit designs with trunk roads and motorway systems connecting suburban nodes to a lesser or greater extent depending on the wealth of the suburb. Both cities are experiencing several similar problems such as (i) too many road intersections running at capacity or over capacity (ii) congestion due to poor route continuity (iii) poor operating conditions at motorway and trunk road interchanges and (iv) peak hour traffic congestion.

8.2.4.2 Public transport

Cape Town's commuter rail network (Metrorail) operates a large suburban rail network consisting of 93 passenger stations over 164 km of track. Many of the stations act as nodal interchanges with buses and minibus taxis. Johannesburg's metro railway system connects central Johannesburg to Soweto, Pretoria, and most of the satellite towns along the Witwatersrand. The metro railway system transports a very large number of commuters across south Johannesburg with very poor connections to the new residential developments to the north of the city primarily because the railway infrastructure dates back to, and was built in, Johannesburg's infancy and covers only the older areas in the city's south.

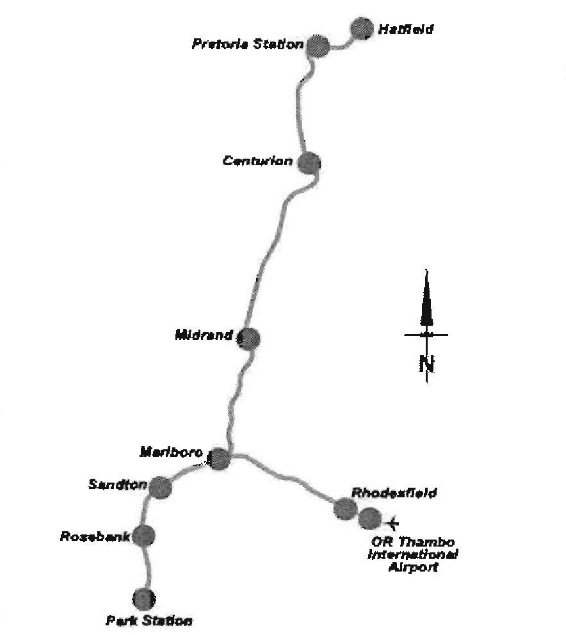


Figure 8.7 Gautrain rapid rail link
Source: Gautrain (2006)

In making some provision for this gap the Gautrain rapid rail link is currently under construction and follows the routing shown by Figure 8.7. The link will comprise a number of underground stations (in built-up areas) as well as some above ground and will run north to south, from Johannesburg's Park Station, through Rosebank, Sandton, Midrand and into Pretoria, and east-west between Sandton and the OR Tambo International Airport (formally Johannesburg International Airport).

In terms of bus commuters, Cape Town's metropolitan commuter bus fleet services about 700 routes which use the primary road network and an expanding system of bus priority lanes. Johannesburg is serviced by 84 bus routes in the city. In addition there are a number of private bus operators, though most focus on the inter-city routes, or on bus charters for touring groups. Taking the bus is not the preferred mode of public transport in Cape Town and Johannesburg, primarily due to cost and service routing.

Johannesburg and Cape Town have two types of taxis - metered taxis and minibus taxis. Unlike many cities, metered taxis are not allowed to roam around the city waiting to be flagged down by passengers and instead must be called and ordered to a destination. Metered taxis are rare in comparison with many other world cities. The minibus "taxi" is the *de facto* standard, most preferred and essential form of public transport for the majority of the population in both cities. Minibus taxis are not subsidised and are also the most expensive form of public transport for distances greater than approximately 5 km. Sadly inhabitants of both Cape Town and Johannesburg are heavily reliant on minibus - taxis as a primary form of public transport, representing a trend away from high occupancy vehicles, like buses, to vehicles carrying fewer passengers. Like taxis and cars, minibus - taxis have negative implications for urban sustainability, resulting in increased traffic congestion, increased levels of emissions and greater use of fossil fuels. However, without subsidies from the Government and with a lack of other feasible public transport options, minibus - taxis will at present remain an essential form of transport for their users.

8.2.4.3 Implications of the existing transport and road system

Interpreting Cape Town and Johannesburg's transport systems has to be done against their spatial historic development. As a result of the fragmented, dispersed and low-density form of urban development, commuters have to travel great distances to and from their normal place of work or for recreational, business or other purposes. Both cities are grappling with the pressure of growing demand for access and mobility due to a growing and dispersed population, low population density and increasing levels of tourism.

The increase in demand is also not met by investment in transport, especially investment in public transport resulting in the worsening of traffic congestion and the deterioration of the already at capacity operating public transport services. Inadequate infrastructure, low capacity and poor traffic control and enforcement are further contributors to the growth of traffic congestion resulting in high commuting costs, long journey times and distances and increasing energy consumption which aggravate pollution. Poor access and mobility have a serious impact on Cape Town's economy, with areas of job opportunities, economic development and housing developments located outside the established radial rail and road transport corridors (Cape Town, 2005). Johannesburg suffers from poor public transport connectivity to the north of the city by formal transport modes (City of Johannesburg, 2006).

In a 2003 a national transport survey, Statistics SA (2005), reported that low-income and informal households identified inaccessible public transport services as a key issue. This suggests that public transport is failing those who rely on it the most, namely the poor. High taxi fares also emerged as a key concern for informal households in a Johannesburg survey. While statistics are unreliable and hard to come by, car ownership appears to be increasing rapidly in both cities, compounding congestion problems. The overall result of the current transport situation is one of increasing congestion, longer travel times, soaring fuel bills and less access for the poor. All point to lower levels of urban sustainability.

8.3 Case study results and interpretation

This section characterizes the respondents who took part in the case study, outlines the case study results and reports and interprets the quantitative and qualitative data collected.

8.3.1 Respondent characteristics

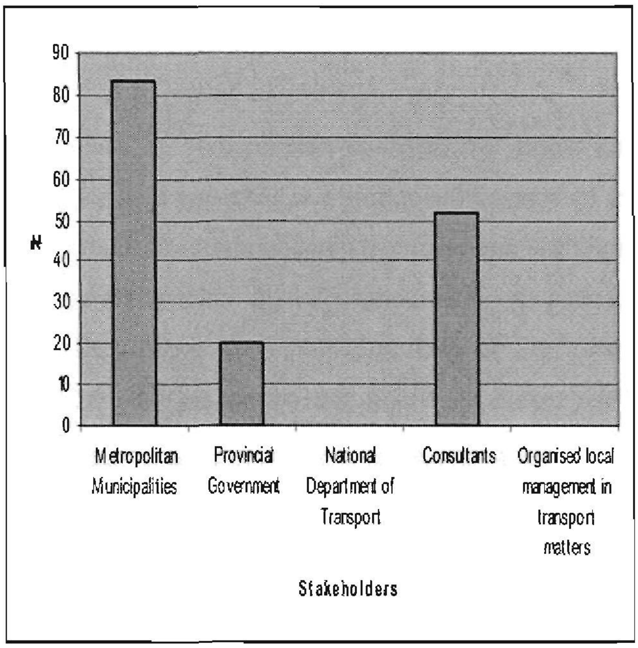


Figure 8.8 Stakeholder participation rate

The case study which was carried out in mid-October 2006 was used to obtain relevant and meaningful results about the local planning situation in Cape Town and Johannesburg. The case study followed a structured format through focus group interviews where questionnaires were administered to obtain required data - Appendices 10 - 13 give an impression of the questions asked. Figure 8.8 shows the actual rate of participation of the stakeholders approached as well as the stakeholders who elected not to participate such as SALGA, the Gauteng Provincial Government, the National Department of Transport and the Directorate Planning and Development at Cape Town. Although it would have been extremely extremely valuable to have had these stakeholders involved in the focus group interviews, their absence meant that a thorough desk research exercise via their respective websites had to be undertaken as an alternative to supplement the data sought at the focus group interviews. Figure 8.8 also shows that the Metropolitan Municipalities, consultants and, to a lesser extent, the Provincial Government returned a satisfactory participation rate.

8.3.2 Quantitative results

Respondents were asked to score each LUM, TSM, TDM and "Smart Growth" measure's contribution to achieving sustainable development in terms of the measurement instruments and also weigh each measurement instrument – a process that created an enormous amount of quantitative data. This section reports the key results to this end in order to identify whether significant relationships, differences and/or similarities exist between the option scores and weights assigned for Cape Town and Johannesburg.

8.3.2.1 Scoring results

The case study questionnaires illustrated in Appendices 10 - 13 (see CD) asked respondents to score the LUM, TSM, TDM and "Smart Growth" measures' contribution to achieving sustainable development and reducing traffic congestion in terms of:

- Criteria and indicators (1st screening process)
- The effects of the measures and their specific effects (2nd screening process)
- Exogenous and endogenous variables and their associated technical considerations (3rd screening process)

By asking this question respondents were required to assess the expected performance of each option (measure) against the identified measurement instrument by scoring the options i.e. assessing their value. For the purpose of data input some indicators, more specific effects and technical considerations are identified as "costs" and others as "assets". The expected consequences or performance of each option is assigned a numerical score on a preference scale extending from 0 to 100, for each indicator, more specific effect and technical consideration. The value assigned reflects the extent to which the option may contribute to achieving sustainable development and the reduction of traffic congestion. Cost indicators have negative values and asset indicators have positive values. This will result in more preferred options scoring higher on the scale and less preferred options scoring lower. Hence, all options considered in the MCA would then fall between 0 and 100 in terms of assigned value. Qualitative data on the other hand is dealt with by categorising the performance of each option into three or four categories (++++, +++, ++ and +) in descending order of quality.

Following cleaning, coding and analysis of the results Appendix 21 (see CD) presents the collective average option scores assigned by stakeholders from Cape Town and Appendix 22 (see CD) the average option scores assigned by stakeholders from Johannesburg. Where a zero value has been assigned against an option, it means the indicator, more specific effect and technical consideration has no relation to the option. The complete scoring results illustrated in Appendices 21 and 22 will be used in the BOSDA option analysis as part of the three screening processes of the D.A.D.F. In extracting the highest scores assigned by the stakeholders to the measures, Table 8.1 below suggests that both cities have scored very similar options highest in terms of importance.

In terms of the 1st screening process it is observed that the 5 highest scored options represent a combination of LUM, TSM and TDM measures, which is an encouraging result because it means the stakeholders have recognised (knowingly or unknowingly) that an integrated strategy should comprise a balanced mix of all types of measures. With respect to the 2nd screening process the results suggest that the 6 highest scored options represent a combination of LUM, TSM and TDM measures, again showing that stakeholders have recognised that an integrated strategy should comprise a balanced mix of all types of measures. In terms of the highest scored options for the 3rd screening process it is seen that four of the 6 options are LUM measures, one a TSM and one a "Smart Growth" measure which implies that respondents favour LUM measures in reducing traffic congestion above TDM and, to a lesser extent, TSM and "Smart Growth" measures.

Table 8.1 Cape Town and Johannesburg comparison: highest scores achieved.

Cape Town		**Johannesburg**	
Options	**Score (%)**	**Options**	**Score (%)**
1st Screening process		**1st Screening process**	
Effective and reliable public transport	60.28	Effective and reliable public transport	59.97
Development encouraging use of public transport	56.31	Development encouraging use of public transport	57.82
Park and Ride facilities	46.94	Park and Ride facilities	46.82
Multimodal transport interchanges	46.6	Urban road charging	46.20
Urban road charging	45.62	Multimodal transport interchanges	46.05
2nd Screening process		**2nd Screening process**	
Car-free planning	50.0	Car-free planning	52.01
Effective and reliable public transport	33.10	Effective and reliable public transport	33.89
Car restriction zones	31.0	Car restriction zones	30.75
Development of travel plans	25.62	Development encouraging use of public transport	27.62
Strategic planning	25.60	Development of travel plans	27.48
Development encouraging use of public transport	25.33	Strategic planning	25.67
3rd Screening process		**3rd Screening process**	
Car-free planning	20.65	Car-free planning	21.07
High development density aimed at travel reduction	18.38	Development encouraging use of public transport	19.65
Development encouraging use of public transport	18.26	High development density aimed at travel reduction	19.38
Development of travel plans	15.80	Development of travel plans	16.84
Public transport orientated development	15.5	Effective and reliable public transport	16.0
Effective and reliable public transport	15.26	Public transport orientated development	15.84

In comparing the assigned option scores it is apparent that the provision of public transport is deemed an important measure throughout in dealing with traffic congestion. The role of LUM measures has also been recognised in dealing with traffic congestion, notably in the form of higher density development and the development of travel plans. Urban road charging as a TDM measure and car-free planning also featured among those given high priority in Johannesburg.

8.3.2.2 Weighting results

To reflect the relative importance of each measurement instrument in the decision-making process respondents were also asked to assign a weight to each (i) criteria (ii) indicator (iii) effect (iv) specific effect, (v) exogenous and endogenous variable and (vi) associated technical considerations. As part of the focus group interview numerical weights were manually assigned to each of these instruments using a combination of rating methods, ranking methods and pairwise comparisons, defining each measurement instrument and the relative valuations of a shift between the top and bottom of the chosen scale to reflect their relative importance in the decision-making process.

Because the D.A.D.F. has three screening processes, assessments were made for each screening process. Hence, for the first screening process respondents had to assess criterion importance and indicator importance. Criterion assessments are qualitative and the separate weights assigned to the criteria combined equates to 1. Depending on the difference in assessed performance, each rating, ranking or comparison might be at one extreme a major positive difference, assigned a weight, coded as 0.8. At the other extreme, where a compared criterion is of negligible importance it may be coded 0.01 for example. Similarly indicators are assessed qualitatively so that separate weights assigned to each indicator combined equates to 1. Qualitative indicators on the other hand are dealt with by assessing performance in terms of ++++, +++, ++ and + categories in descending order of performance contribution. In the same way respondents were asked to assign weights to effects and specific effects reflecting the relative importance of each relating to the second screening process. In addition the relative importance of each exogenous and endogenous variable and technical consideration were also assessed in readiness for the third screening process.

Appendices 23 and 24 (see CD) report the weights assigned to each of these measurement instruments for Cape Town and Johannesburg respectively. Weights assigned to criteria, effects and exogenous and endogenous variables are illustrated in column Weight Niveau 1 for each of the screening processes whereas the weights assigned to the indicators, specific effects and technical considerations are illustrated in column Weight Niveau 2. Table 8.2 shows which variables have been deemed most important for Cape Town and Johannebsurg.

Table 8.2 Cape Town and Johannesburg comparison: highest weights assigned to variables

Cape Town	Weight	Johannesburg	Weight
• Economic growth	0.1	• Economic growth	0.07
• Employment	0.1	• Housing	0.07
• Air quality	0.1	• Accidents	0.07
• Access to public transport	0.1	• Access to public transport	0.07
• Transport interchange facilities	0.1	• Transport interchange facilities	0.07
• Travel time	0.1	• Travel time	0.07

The comparison demonstrates that measures introduced to reduce traffic congestion must take into account the economic growth rate of the city and the economic viability of the measures under consideration. Cape Town also placed emphasis on the employment variable as a further prerequisite determining the applicability of the measures being considered for implementation whereas Johannesburg suggested that the measures selected must look closely at the current and local housing situation. Both cities selected three similar endogenous variables as important in describing the direction in which the measures introduced must steer traffic and transport outcomes (access to public transport, the provision of transport interchange facilities and the reduction of travel time).

Comparing the weights assigned to the indicators for both cities as illustrated in column Weight Niveau 2 in Appendices 23 and 24 the weights assigned for Cape Town show no indicators of outstanding importance while for Johannesburg the reduction of land take weighted at 0.036, is the most important indicator. In terms of the more specific effects associated with each class as reported in Appendices 23 and 24 column Weight Niveau 2, the most notable trend observed for both cities is that there is a good relationship between classes of effects being weighted higher and their associated or supporting specific effects also being weighted higher.

The focus group interviews served a very useful purpose in assigning weights to measurement instruments although some respondents did not fully understand why specific measures will work better under different prevailing conditions and how the variables and weights are used to arrive at such solutions. It had to be explained that the variables are used to inform the decision-maker about the local circumstances – the scenario being planned for and then about technical considerations and deciding which measures will be optimal for their cities under the conditions indicated. Once this concept was explained respondents reacted favourably to the method proposed by the author. Technical considerations were then ranked according to what respondents deemed to be the desired direction (i.e. increase or decrease) of change that should be brought about when implementing the measures under consideration. Typically, for both cities a positive outcome (such as a reduction in travel time or increasing the accessibility to public transport) was weighted proportionately heavier than those with a negative outcome (such as an increase in travel time or reducing the accessibility to public transport). This is indicative of respondents understanding the questions they have been asked and also the logic of the operation of the 3rd screening process.

8.3.3 Qualitative results

Spatial development and transport planning in Cape Town and Johannesburg are situated in the context of a number of inextricably linked documents, most notably National Strategic Plans, their respective Regional Spatial Development Frameworks, their Integrated Development Plans 2006/7 (IDP), their Spatial Development Framework (that includes Land-use Management Plans), the Johannesburg Growth and Development Strategy, the Cape Town Draft Growth and Development Strategy and a host of Sector Plans. And so in assessing the development context of Cape Town and Johannesburg at a strategic level the sub-sections that follow report the strategic perspectives held by participating stakeholders as well as positioning key transport and development challenges within the context of the aforementioned strategic documents.

8.3.3.1 Strategic perspectives

The focus group interviews included discussions about the strategic development perspectives of both cities within the context of these direction-giving documents and how the current emerging circumstances may evolve to shape the progress of future development. And so the outlook and prospects are based on assumptions and projections made by the stakeholders within the policy context reporting on how key perceptions, trends and dynamics will play out over the lifecycle of the city and the future challenges and opportunities likely to emerge from these.

Stakeholders suggested that **economic growth** is one of the primary prerequisites for boosting job creation and achieving better quality human settlements and improved human well-being. However, the quality of growth must foster environmental sustainability and social benefit in the long term. Growth must provide the basis for a more equitable distribution of assets and opportunities as well as protecting their economies and the environment. The apartheid legacy of deliberately planned and implemented unsustainable and inequitable social and economic development in Cape Town and Johannesburg has been further entrenched by contemporary market-driven trends of spatial marginalisation from economic opportunity. Until 2005 patterns of human settlement formation and spatial planning practice have consistently failed to locate the poor and low income communities in proximity with economic opportunity. A fundamental aim of the spatial development in Cape Town and Johannesburg is to prevent market driven perpetuation of the apartheid spatial economy and to guide investment choices and public developmental spend.

As the economy of South Africa is characterised by a formal and informal economic sector so are both cities entangled in the provision of employment in these sectors and both experience problems in terms of labour absorption. The unique confluence of circumstances presents both cities with economic challenges more complex and pressing than those faced in many cities around the world. Stakeholders suggested aggressive promotion of economic opportunities for new market entrants in the small enterprise, informal and community sectors in both Cape Town and Johannesburg. However, fostering entrepreneurship and supporting the sustainability of these emerging industries – in effect trying to grow the economy from below – will not equal economic restructuring by itself. Large businesses across the entire spectrum of economic sectors need to come to the party.

The shared growth and integrated development approach that Johannesburg and Cape Town wish to pursue sets the strategy apart from other development strategies in that equity, empowerment and environmental concerns are not just given equal weight to economic imperatives, but are seen as a necessary part of the economic imperative; as it is the nature in which these intersecting principles are manifested to ensure spatial integration. In this context shared growth and integrated development must address poverty reduction, a decline in levels of inequality, environmental integrity and economic growth as four interdependent elements of its development strategy in the medium to long term.

In terms of the current provision of service **infrastructure** such as water, waste, electricity and highway infrastructure both Cape Town and Johannesburg still face a steep uphill challenge in order to meet national government commitments to eradicating key service backlogs for the poor. As a result both cities are committed, at a strategic level, to invest in bulk infrastructure over the medium to long term including expenditure on (i) strategic roads and corridor developments (ii) energy, water and sanitation provision and (iii) asset management.

In terms of **environmental** concerns a current pressing challenge for Johannesburg is storm water management, as Johannesburg's built form has grown and densified over the last few decades, without adequate attention having been paid to the need to design and maintain adequate drainage and attenuation systems. To this end a complete overhaul of the city's storm water management system is currently being planned. With the economic base of the Western Cape and indeed Cape Town lying in tourism, agriculture and coast-based economic activities, development constraints on the natural resource base and sensitive ecological systems will play a definitive role in its future economic growth path. Protecting, growing and managing the ecological system therefore have to be integrated into any future vision of growth and development.

On the topic of **spatial development** Johannesburg, much like Cape Town, is suffering from urban sprawl despite years of national and local policy commitment towards a compact city. The spatial distribution is characterised by (a) low income residential development around existing disadvantaged areas and (b) high income residential development concentrated around nodes of urban growth scattered across the greater urban conurbation. There is a clear trend that indicates that significant spatial expansions all occur on more peripheral areas disconnected from growth nodes, strongly reinforcing the existing pattern of spatial marginalisation or sprawl associated with patterns of locating the poor in the city's periphery, in poorly integrated, unsustainable residential neighbourhoods far from urban amenity and opportunities. This in turn raises the aggregate cost of servicing the city as a whole. For this reason both cities have placed a great deal of emphasis on encouraging urban compaction policies through their IDPs, Growth and Development Strategies and Spatial Development Frameworks which raise extremely challenging policy questions.

The traffic congestion experienced in Cape Town and Johannesburg reaches impossible proportions at peak hours with major arterial and national roads being affected most. A key concern highlighted by both cities was the lack of safe, reliable and frequent public **transport** connecting the peripheral areas of Johannesburg to the city nodes and similarly in Cape Town where there is no viable public transport system (notably rail) connecting the Cape Flats and suburbs to its urban nodes. If a viable public transport system was in place it might dramatically relieve the congestion problem. The political pressure is therefore mounting on the transport sector to implement new innovative measures to manage increasing traffic growth in the absence of an integrated transport system and thereby to respond to increasing public commute demands.

In response to this pressure a key aspiration of Cape Town is the potential construction of a high-speed airport rail link connecting the CBD with Cape Town International airport which requires the upgrade of an existing rail line along the N2, consequently providing improved access to passengers commuting between these points. The city is also considering building an elevated light rail system along the N1 and has plans for an integrated public transport system that includes rail, road and taxi interchanges.

The key long-term opportunity in Johannesburg is the implementation of the Gautrain project. This infrastructure will have a profound impact on the patterns of mobility in the city, and very likely also on the spatial configuration of the Guateng city region as a whole. A key challenge, however, is to ensure that the city's existing transport infrastructures and operations interface adequately with the Gautrain, particularly to ensure that this massive investment does not end up being inaccessible to the poor. Over the long term, a number of other large transport infrastructure developments are planned for the city, including a number of new rail connections, highways, and highway-based development corridors. Only some of these are planned by the City of Johannesburg, and not all of them correspond with the current spatial vision expressed in the city's Spatial Development Framework, or indeed the Growth and Development Strategy, again highlighting the fragmented nature of planning in South Africa.

From these perspectives it is possible to derive a number of strategic objectives by integrating stakeholder discussions and objectives derived from both cities' IDPs, their Spatial Development Frameworks, their Growth and Development Strategies and cross-cutting Sector Plans. Although these documents cover the objectives in far greater detail as well as the interventions deemed appropriate to achieve the objectives, Tables 8.3 and 8.4 below summarise this integrated result.

Table 8.3 Cape Town's strategic objectives

	Strategic objectives					
	Economic development and job creation	**Creating liveable communities**	**Service delivery and infrastructure that creates connectivity**	**Environmental protection**	**Building integrated human settlements**	**Meeting integrated access and mobility challenges**
Interventions	Targeted skills development	Nurture the well-being of all residents consistent with the ideals of sustainable human settlements	Improve safety, affordability, convenience and comfort on public transport	Protection of biodiversity and environmental heritage	Protect and develop public places and the natural resource base	Develop mechanisms to provide integrated transport
	Increase rates of human, infrastructural and financial investment	Protecting and resource management to long-term socio-economic development	Stimulate transport and energy infrastructure provision	Protection of river ecosystems and ecological reserves	Overcoming apartheid spatial legacies	Improved access via strategic transport infrastructure to assure access to the marginalised

	Development of local economic base	Improve social solidarity	Provide effective public services		Engage strategic land-use management	Increased public transport accessibility levels
	Improvement in business environment	Increase overall sustainable livelihoods	Public transport investments		Effective use of strategic planning tools	Public transport interchanges(rail, road, bus, taxi)
	Tackle barriers to employment	Address blockages to rapid housing delivery	Investment in ports and airports		Increase in high-density and mixed- use developments	Non-motorised transport network (bicycle and pedestrian)
	Investment in human development	Reduce the crime rate and the segregation index	Strategic roads and corridor developments		Spatial development and spatial integration	Effective multi-modal transport system
			Bulk infrastructure investment			

Source: Author's own construction from Cape Town's IDP, SDF, GDS and cross-cutting Sector Plans and stakeholder discussions

Table 8.4 Johannesburg's strategic objectives

	Strategic objectives					
	Economic development	**Housing**	**Infrastructure and services**	**Environmental sustainability**	**Spatial development and urban management**	**Transportation**
Interventions	Diversification of the local economy	Provide to all affordable, safe and decent accommodation	Provide infrastructure and services in accordance with national policy commitments	Waste Management	Develop a city with an urban form that is efficient, sustainable and accessible	Road and public transport user education
	Develop a local economy with strong links to the national, regional and global economy	Accelerated supply of housing	Extension and maintenance of reliable and competitively priced services	Protection of river ecosystems and ecological reserves	A quality built environment, providing for integrated and sustainable settlements	Improved access through strategic transport infrastructure
	A robust and growing domestic market for locally produced goods and services.	A fully functional secondary housing/property market	Effective service delivery of well-designed, well-integrated and well- maintained distribution networks	Protection of biodiversity and environmental heritage	An efficient land-use management system	Development and maintenance of a world-class road, traffic-signalling and storm water infrastructure network
	Equitable sharing of the value gains from economic growth and geographic spread of economic activities	Enhance and Maintain existing and future housing stock	A regime of effective service delivery regulation and stakeholder interaction	Diversification of the energy sources	Effective urban management to maintain appropriate standards of safety	Improved safety, affordability, convenience and comfort on all transport infrastructure and services
	Continuous improvement in the general business environment	Increased livability and sustainability of all residential communities		Reduction in land, air, water, noise and light pollution	An efficient and effective spatial information service	Greater user preference for sustainable public transport and non-motorised transport choices
						World-class freight-transport and logistics infrastructure

Source: Author's own construction from Johannesburg's IDP, SDF, GDS and cross-cutting Sector Plans and stakeholder discussions

Tables 8.3 and 8.4 show that both cities share very similar strategic objectives and that they compare very well to the authors' defined sustainability objectives. Johannesburg, however, lacks the strategic objective of integrating spatial development and urban management and transportation, whereas Cape Town has documented this objective very well. This finding supports earlier literature review findings in that policies in South Africa are often made in isolation within sectors instead of sectors coming together and working out a mutual framework that will integrate all concerns, challenges, proposed interventions and aspirations. However, the sentiments of the stakeholders suggested that some attempts are being made to address this issue, but the practice is not driven cross-sectorally or indeed in an integrated manner.

8.3.3.2 Transport and development challenges

The stakeholders identified several development challenges within the context of their city's IDPs, Spatial Development Frameworks and Transport Plans and some instruments in response to these challenges. Once these challenges have been identified it was possible to formulate some development strategies that may help alleviate some deep-rooted problems such as residential segmentation. The following challenges facing both cities were identified as illustrated by Table 8.5.

Table 8.5 Cape Town and Johannesburg's transport and development challenges

Cape Town's challenges	Johannesburg's challenges
Urban restructuring	Inefficient urban configuration
Improving access to strategic developmental information	Inequality and disparities
Provision of water, transport, housing and core urban infrastructure	Urban restructuring
Institutional challenges	Sustainable and environmentally conscientious development
	Institutional challenges

The **configuration of South Africa's human settlements**, both across the country and in particular urban areas such as Cape Town and Johannesburg, is severely distorted by the apartheid policies of the past and so the resulting spatial disposition observed in South Africa presents a major challenge to planners in developing sustainable communities. Coupled with the challenges above is the deep **inequality and disparities** in circumstances, living conditions, quality of life and future prospects. Society under apartheid supported the nature of the urban economy, and in turn was supported by it. Cities were planned to function in the same way as they do in most parts of the developed world – but not for the marginalised, creating sweeping inequalities.

In its commitment to keep people of different races separate, apartheid spread the city out, laying the foundations for a low density residential and retail-strip sprawl. This encouraged private vehicle based transport in the wealthier suburban developments on the outskirts, and an irrationally designed public transport system that could never reach viability because of the lack of population density (and in turn usage) on any routes. Dormitory townships were created with limited functionality except to house (hopefully temporarily) a labour force and were deliberately located far from any real opportunities for shopping or entertainment. As a result apartheid was the driver of urban sprawl and like other cities in South Africa both Cape Town and Johannesburg now suffer from similar problems and face the challenge of major **urban/settlement restructuring**.

Through systematic under-development of housing, transport and household service infrastructure, Johannesburg and Cape Town's sprawling dormitory townships have gradually degenerated into over-crowded, dirty and smoky ghettoes. Because of poorly located, designed and managed settlements these symptoms negatively impact on the cities' natural resources and the challenge is to guide future development in a **sustainable and environmentally conscientious** manner that recognises the integrated nature of environmental and socio-economic challenges and spatial needs.

In terms of **institutional challenges** facing not only Cape Town and Johannesburg but also the country as a whole, the stakeholders identified that the key priority of government should be to ensure appropriate horizontal and vertical alignment between different spheres of government to help achieve common development objectives and outcomes. Their key message was that spatial development and transport plans, policies and strategies must be driven from an integrated perspective. In this regard stakeholders were asked whether the South African institutional planning framework has the capability to implement integrated strategies. In answering the question the discussion turned to reviewing appropriate legislation. It was established that the National Land Transport Transition Act (Act 22 of 2000) requires all transport authorities and municipalities to prepare a series of plans in accordance with the requirements of the Act and regulations issued by the Department of Transport. All of these plans need to be prepared within the national and provincial policy frameworks as set out in the relevant White Papers on Transport Policy and the ensuing land transport frameworks. The National Land Transport Transition Act (NLTTA) requires planning authorities to prepare five statutory plans:

- Current Public Transport Record (CPTR)
- Operating Licences Strategy (OLS)
- Rationalisation Plan (RATPLAN)
- Public Transport Plan (PTP)
- Integrated Transport Plan (ITP)

The Municipal Systems Act (No. 32 of 2000) requires all municipalities to prepare an IDP as a primary and overriding management tool and the Public Transport Plan and the Integrated Transport Plan must form part of the Integrated Development Plan (IDP) for the area concerned. These two plans need to be developed within the overall policy and development framework of the IDP. As an integral part of the IDP the Spatial

Development Framework (SDF) must also adhere to the Local Government Municipal Planning and performance Management Regulations, 2001. These regulations state that a SDF must consider the Chapter 1 principles of the Development Facilitation Act 67 of 1995 in achieving a number of key development outcomes.

In view of developing a T.C.M.P. facilitating the D.A.D.F. and integrated strategies aimed at traffic congestion reduction the stakeholders suggested and/or identified the scope of the National Land Transport Transition Act (Act 22 of 2000) to accommodate a sixth plan that deals specifically with traffic congestion – a T.C.M.P., as IDPs, SDFs and other sector plans and guidelines do not specifically provide plans to deal with the issue. This implies that for the D.A.D.F. to be operationalised and a T.C.M.P. to be implemented amendments have to made to the South African institutional planning process in that it would be necessary to amend (at the very least) the National Land Transport Transition Act (No. 22 of 2000), the Local Government Municipal Systems Act (No. 32 of 2000), the Development Facilitation Act 67 of 1995 and national and provincial policy frameworks. The necessary amendments inherently imply that local government is favoured as the primary vehicle for the implementation of the T.C.M.P. subject to appropriate national, regional and legislative direction.

Improving access to strategic developmental information is a key challenge in Cape Town. The information resources (structured information that is housed in databases) of the city are widely dispersed throughout the organisation. This makes the retrieval of information difficult, especially where a series of information items across multiple departments is required. The sustainable and effective **provision of water, transport, housing and core urban infrastructure** is another key challenge pointed out by Cape Town's stakeholders.

Collectively these challenges have significantly undermined both the productivity (and hence competitiveness) of the urban system as well as its capacity to ensure social inclusion of the poor and marginal. Cape Town faces major challenges, but many are outside the constitutional responsibility of local government and will require intergovernmental partnerships to address them. Sadly, or quite ironically, traffic congestion was not identified as a specific challenge by the stakeholders (although recognising its urgency) and neither is it documented as such in both cities IDPs and SDFs as warranting a unique mechanism or strategy to deal with it.

Against the background of these challenges the stakeholders suggested some opportunities, strategies or programmes illustrated in Table 8.6 below for getting to grips with some of the challenges. The suggested strategies are in line with their current 2006 SDFs, IDPs, Sector Plans and Growth and Development Strategies.

Table 8.6 Strategies to overcome some of the challenges facing Cape Town and Johannesburg

Corrective strategies	
Cape Town	**Johannesburg**
Plan Cape Town as part of the Western Cape region – it does not function in isolation	Supporting an efficient movement system that focuses on public transport and non-motorised transport
Optimise environmental resources and improve access to natural assets	Ensuring strong viable nodes coupled to strong economic development
Identify areas for redevelopment and growth in the next 20 years by (i) consolidating a redefined urban core (ii) defining and planning city growth (iii) Urban Renewal that encourages integrated development, (iv) strategic infrastructure provision	Sustainable human settlements coupled with community development that creates liveable neighbourhoods that foster safety, prosperity and pride.
Make areas of opportunity more productive and accessible by (i) establishing an equitable pattern of access and by (ii) prioritising critical mobility linkages	Initiating and implementing corridor development
2010 Football World Cup	Increased densification of strategic locations
High speed airport rail-link	Managing urban growth delineating urban development boundary
City light rail system	Facilitating sustainable housing environments in appropriate locations
Integrated public transport system	2010 Football World Cup
	Gautrain
	Supporting sustainable environmental management

Source: Author's own construction

8.4 D.A.D.F. results for Cape Town and Johannesburg

This section reports the results of the option analysis in which the quantitative data reported in the previous section have been uploaded and run through the D.A.D.F. The D.A.D.F. option results are then transposed into an integrated strategy for both cities consisting of the selected measures.

8.4.1 Option analysis

The analysis of the options followed a three part screening process that occurs within BOSDA following the steps set out in Figure 7.8. Having scored and weighted the options as shown in Appendices 21, 22, 23 and 24 the data is uploaded into BOSDA which then standardised the scores of both cities from quantitative and qualitative scores to standardised scores ranging between 1 and 0. Interval standardisation was chosen to standardise the scores for simplicity. The final steps is for BOSDA to rank the options through the three screening processes and eliminate undesirable options followed by sensitivity analysis of the option ranking ensuring that the results are robust and reliable. The results of the option analysis are discussed in more detail below.

8.4.1.1 Ranking Cape Town's options to produce an integrated strategy

The results and option ranking of the first, second and third screening processes for Cape Town is illustrated in Appendix 25 (see CD) and graphically illustrated in Appendices 26, 27 and 28 (see CD). The measures collectively form an integrated strategy (or a package of measures) for Cape Town. The horizontal axis (x-axis) in Appendices 26, 27 and 28 represents the options, whereas the vertical axis (y-axis) shows the ranking. The height of each bar reflects the option's contribution to sustainability, traffic congestion reduction and objective achievement, hence, the higher the bar, the more preferred the option is. The following 6 policy options (contained in the integrated strategy) have been ranked highest in the integrated strategy and are considered most likely to achieve sustainable development whilst reducing traffic congestion in Cape Town's context:

- Cape Town -

- Car-free planning (0.69)
- Development encouraging use of public transport (0.68)
- High development density aimed at travel reduction (0.63)
- Development of travel plans (0.62)
- Effective and reliable public transport (0.62)
- Public transport orientated development (0.61)

When comparing the option ranking results between the three screening processes it is noted that the provision of effective and reliable public transport and development encouraging its use ranked very strongly throughout. Urban road charging featured among the highest scored options throughout the first and second screening process, but dropped back to the eight position in the final screening process reflecting its appropriateness given local conditions. The results presented here very much reflect the mood and aspirations of the stakeholders and it is encouraging that the options contained within the integrated strategy agree with their sentiments being tailored to local conditions.

Although the screening process has eliminated 13 options and the 6 highest ranked options have been identified, it is important to recognize that a package of 25 measures (an integrated strategy) has been identified. Looking more closely at the final 25 measures it is seen that their make up consists of LUM, TDM, TSM and "Smart Growth" measures. This result is therefore consistent with, and supports the notion, that integrated strategies have the potential to deliver a sustainable outcome and that the combination of measures is representative of the four types of measures. It is significant that the four highest ranked measures are LUM measures suggesting that land-use management and spatial planning are of fundamental importance in providing direction to other types of planning in dealing with traffic congestion in the context of Cape Town.

A natural question arising during and following analysis usually relates to the reliability of the option ranking. It is important to consider that the reliability of the ranking depends highly on the certainty of the weights and scores assigned. By performing a sensitivity analysis it was possible to examine the extent to which vagueness and uncertainty about the inputs could be overcome and the influence of each Weight Niveau 1 could be assessed. By electronically varying the weights and scores of each measurement instrument it was possible to assess the extent to which the expected performance and ranking of each option would change as a result. It was found that by varying the weights assigned to each measurement instrument by 5%, 10%, 15%, 20% and 25% during sensitivity analysis at the end of each screening process the results suggested little significant variance in the ranking results which means that the final 25 options identified present a reliable and valid outcome.

8.4.1.2 Ranking Johannesburg's options to produce an integrated strategy

Appendix 29 (see CD) shows the results and option ranking of the first, second and third screening processes for Johannesburg. The option ranking is graphically illustrated in Appendices 30, 31 and 32 (see CD). The measures collectively form an integrated strategy (or a package of measures) for Johannesburg. The following 6 policy options (from the integrated strategy) have been ranked highest in the integrated strategy and are considered most likely to achieve sustainable development whilst reducing traffic congestion in Johannesburg's context:

- Johannesburg -

- Car-free planning (0.69)
- Development encouraging use of public transport (0.69)
- Development of travel plans (0.67)
- Effective and reliable public transport (0.66)
- Public transport orientated development (0.65)
- High development density aimed at travel reduction (0.65)

When comparing the option ranking results between the three screening processes as contained in Appendix 29 it is seen that the provision of effective and reliable public transport and development encouraging its use ranked very strongly throughout. Urban road charging featured among the highest scored options throughout the first screening process, but dropped back to the eighth and ninth position in the final screening processes. The options ranked highest summarise the aspirations of the Johannesburg stakeholders very well in that they uphold their aspiration to develop an effective and reliable public transport system supported by densification of urban Johannesburg. It is also important to observe that the options contained within the integrated strategy agree with their sentiments being tailored to local conditions.

Similarly to the 25 options ranked appropriate to Cape Town, the 25 options ranked most appropriate to contributing to sustainable development in Johannesburg also consist of a balanced mix of measures with no single type of measure dominating within the group. This result is therefore consistent with, and supports the notion, that integrated strategies have the potential to deliver a sustainable outcome and that the combination of measures is representative of the four types of measures. However, the combination of the highest ranked options differs from Cape Town in that the four highest ranked measures for Cape Town are LUM measures, whereas the highest ranked options for Johannesburg comprise a balanced mix of the four types of measures.

In testing the reliability of the ranked options the weights assigned to each criterion, to indicators, class of effects, more specific effects, variables and technical considerations was varied by 5%, 10%, 15%, 20% and 25% as part of a process of sensitivity analysis. The results suggested the initial ranking results (illustrated in Appendix 29) are reliable and valid because, when varying the weights, insignificant variances were identified.

8.5 Positioning the derived integrated strategies within a city context and identifying its implications

This section aims to explain how and whether the integrated strategies (package of measures) identified for Cape Town and Johannesburg support or enhance their strategic perspectives and help to overcome some of the development challenges they face.

8.5.1 Positioning the integrated strategies within the strategic perspectives held of Cape Town and Johannesburg

The option ranking was a fundamental instrument in predicting which options will contribute to traffic congestion reduction in both cities whilst encouraging sustainable development. The question is whether the D.A.D.F. output (integrated strategies) is useful and whether it has practical application in supporting the strategic perspective and views of the cities or whether it proposes a new direction altogether. By relating the D.A.D.F. output or integrated strategies to the case study results it is possible to explore this question.

Cape Town and Johannesburg stressed the importance of fostering and enhancing **economic growth** as it is a prerequisite for boosting job creation, a better quality human settlement and improved human well-being. What is required is to employ smart strategic and spatial planning and the development of effective and reliable public transport to prevent the market driven perpetuation of the apartheid spatial economy and to guide investment choices and public developmental spend.

The D.A.D.F. option ranking supports this perspective in that it ranked the introduction of safe, reliable and effective public transport as a top priority in both cities. Closely related to strategic planning as an option is land-use development practices that support the integration of neighbourhoods and the provision of well connected infrastructure systems in providing a mechanism for people to access economic opportunities, setting the tone of the challenges lying ahead for both cities. The option ranking supports, and will foster, a growing economy in that, once an effective and well-oiled transport system is in place, it provides a mechanism by which every member of society can take part in accessing the economic opportunities Cape Town and Johannesburg present as a starting point.

Key to the provision of public services is the provision of **infrastructure** such as transport systems, water, waste, electricity and highway infrastructure. Whilst grappling with the provision of these services both cities are committed at a strategic level to invest in bulk infrastructure over the medium to long term. These strategic aspirations are supported by the D.A.D.F. option ranking in that Cape Town and Johannesburg will benefit from a host of TSM measures as part of their integrated strategies. Table 8.7 illustrates the options identified for Cape Town and Johannesburg in support of their strategic aspirations whilst being driven by the need to reduce traffic congestion.

Table 8.7 Cape Town and Johannesburg: TSM measures supporting infrastructure aspirations

Cape Town TSM measures	Johannesburg TSM measures
• New roads or additional lanes	• HOV facilities
• Street design	• Street design
• Creating interconnected streets	• New roads or additional lanes
• HOV facilities	• Creating interconnected streets
• Park and Ride facilities	• Traffic calming or restraint measures
• Traffic calming or restraint measures	• Multimodal transport interchanges
	• Park and Ride facilities
	• Ramp metering

Source: Author's own construction

Within both cities **Environmental Management** plays an important role setting out visions, objectives, challenges and strategies to ensure viable and sustainable open space systems and the interaction between transport planning and the use and development of land together with other institutional sectors. Protecting, growing and managing both cities' sensitive ecological systems will therefore have to be integrated into any future vision of their growth and development paths. Whilst the final group of options did not produce any direct measures that may contribute to the cities' aspirations in terms of environmental management, the group of options collectively, if managed and implemented as a package staged over the long term has the ability to foster environmental protection. As developments are subject to SEA and EIA the likely environmental impact of the proposed options will be identified at an early stage allowing the identification of mitigation measures to reduce their potential negative impact.

On the topic of **spatial development,** Johannesburg much like Cape Town is suffering from urban sprawl despite years of national and local policy commitment towards a compact city. The D.A.D.F. has identified options that will help combat the significant spatial expansions especially occurring in more peripheral areas, which encourage unsustainable residential neighbourhoods far from urban amenity and viable public transport. They are: (i) strategic planning (including retail, housing and transport policy) (ii) the use of development mix (iii) clustered land-use planning (iv) using development conditions smartly and (v) developing and planning integrated self-contained neighbourhoods.

In terms of dealing with traffic congestion in Cape Town and Johannesburg the key perspectives identified were that of congestion being periodic and confined to particular local areas at peak and inter peak periods and the lack of safe, reliable and frequent public **transport** that could serve as a viable alternative if traffic congestion was to be tackled using demand management. To this end both cities' Transport Plans have identified the need for effective, reliable and safe public transport as a prerequisite, recognising that before any blunt demand management measure (such as urban congestion charging) can even be considered a viable alternative must be in place before motorists are charged off the roads. In positioning the D.A.D.F. output the following options which were identified will have particular practical value for both Cape Town and Johannesburg:

- Car-free planning
- Development encouraging use of public transport
- High development density aimed at travel reduction
- Development of travel plans
- Effective and reliable public transport
- Public transport orientated development

When the strategic perspectives are transposed into a number of strategic objectives as detailed in section 8.3.3.1 the question that was posed at the introduction of that section was whether the D.A.D.F. selected options that support the derived strategic objectives and the interventions set out by Cape Town and Johannesburg's IDPs, Spatial Development Frameworks and other Sector Plans. By comparing the identified options of Cape Town and Johannesburg (as illustrated by Appendices 25 and 29) with their strategic objectives and their associated interventions (as illustrated by Tables 8.3 and 8.4), Table 8.8 below shows that the D.A.D.F. options do, in fact, support the structure of strategic objectives for both cities.

Table 8.8 Aligning the strategic objectives of Cape Town and Johannesburg with their selected options.

Cape Town strategic objectives	D.A.D.F. corresponding options	Johannesburg strategic objectives	D.A.D.F. corresponding options
Economic development and job creation	▪ Development encouraging use of public transport ▪ HOV facilities ▪ Park and Ride facilities	**Economic development**	▪ Development encouraging use of public transport ▪ HOV facilities ▪ Park and Ride facilities
Creating liveable communities	▪ Self-contained communities ▪ Car restriction zones ▪ Creating interconnected streets ▪ Car-free planning ▪ Effective and reliable public transport ▪ Public transport orientated	**Housing**	▪ High development density aimed at travel reduction ▪ Development mix ▪ Improve non-motorised travel conditions ▪ Flexible zoning ▪ Concentrate activities

	development ▪ Street design		▪ Self-contained communities
Effective service delivery and infrastructure that creates connectivity	▪ Effective and reliable public transport ▪ Public transport orientated development ▪ New roads or additional lanes ▪ Street design ▪ Creating interconnected streets ▪ Improve non-motorised travel conditions ▪ Traffic calming or restraint measures ▪ Car restriction zones	**Infrastructure and services**	▪ Traffic calming or restraint measures ▪ Car restriction zones ▪ Effective and reliable public transport ▪ Public transport orientated development ▪ New roads or additional lanes ▪ Street design ▪ Creating interconnected streets ▪ Improve non-motorised travel conditions
Environmental protection	▪ Car-free planning ▪ Improve non-motorised travel conditions ▪ Self contained communities ▪ Urban road charging	**Environmental sustainability**	▪ Self-contained communities ▪ Car-free planning ▪ Improve non-motorised travel conditions
Building integrated human settlements	▪ Self-contained communities ▪ Concentrate activities ▪ Clustered land-use ▪ Development mix	**Spatial development and urban management**	▪ Concentrate activities ▪ Clustered land-use ▪ Development mix ▪ Strategic planning ▪ Regulatory restrictions
Meeting integrated access and mobility challenges	▪ Multimodal transport interchanges ▪ Access control or management ▪ Park and Ride facilities ▪ Creating interconnected streets ▪ Clustered land-use ▪ Street design ▪ Public transport orientated development	**Transportation**	▪ Development of travel plans ▪ Effective and reliable public transport ▪ Public transport orientated development ▪ High development density aimed at travel reduction ▪ HOV facilities ▪ Street design ▪ New roads or additional lanes ▪ Multimodal transport interchanges ▪ Traffic calming or restraint measures ▪ Park and Ride facilities ▪ Ramp metering

8.5.2 Positioning the integrated strategies within the development challenges of Cape Town and Johannesburg

Cape Town and Johannesburg face unique, albeit similar strategic transport and development challenges as section 8.3.3.2 reported and perhaps require tailor-made solutions. Traffic congestion is but one of the many problems or challenges faced by them. The difficulty in dealing with traffic congestion is that it is inextricably linked to these development challenges and so key to driving down traffic congestion is addressing the identified development challenges.

Within this context this section attempts to explain (i) which options within the integrated strategies may address the development challenges (ii) whether they support decision-makers in overcoming the development challenges and (iii) whether the options will complement the stakeholder proposed corrective strategies. When policy measures are implemented they will impact on the urban area in which they have been introduced as Robert et al. (2002:197) suggest. It is, therefore, expected that any option will have unique first, second and third order effects. And so, to position Cape Town and Johannesburg's integrated strategies within their respective development challenges it is necessary to identify those options that may be useful to help overcome some of the challenges in terms of their first, second and third order effects.

8.5.2.1 Setting out possible options to alleviate the challenges in Cape Town and Johannesburg

A major feature of all South African settlements is residential segregation associated with severely distorted spatial and infrastructural **configurations**. Coupled to this is the deep rooted challenge of addressing **inequality and disparities** in circumstances, living conditions and the quality of life the residents of Cape Town and Johannesburg are experiencing and the future prospects they may experience. The question is how the integrated strategy can help to ameliorate these challenges. Looking more closely at the options identified for both cities, Table 8.9 shows which options have the ability to reduce traffic congestion, address configuration issues and restore some equality and parity.

Table 8.9 Options to address distorted spatial and infrastructural configurations and inequality and disparities

Options to address configuration issues	Options to address inequality and disparities
• Public transport orientated development	• Effective and reliable public transport
• Creating interconnected streets	• Public transport orientated development
• Creating self-contained communities	• Strategic planning aimed at increasing development density
• Clustered land-use	• Creating interconnected streets
• Strategic planning aimed at increasing the density of development	• Self-contained communities
• Park and Ride facilities	
• New roads or additional lanes	

Source: Author's own construction

Closely related to the problem of inequality and disparity is the challenge of major **urban/settlement restructuring** affecting Cape Town and Johannesburg. The integrated strategies have identified LUM options to deal with this aspect in support of a strategy aimed at urban densification, thereby encouraging a viable population density to sustain the demands of a cost effective public transport system. Even if population density and Cost Benefit Analysis requirements do not warrant the implementation of an integrated public transport system at this stage that operates through the provision of bus, train and mini-taxi services, there is a strong argument for its implementation in that nearly 30% of the population has no means of private transport and subsequently limited means of accessing work, business and leisure opportunities. The provision of public transport and indeed the management of existing road infrastructure have a tremendous opportunity to play an economic and socio-economic part in bringing together separated communities and in restructuring affected urban areas in both cities.

Whilst the D.A.D.F. does not specify options that specifically address environmental challenges it goes without saying that strategies aimed at traffic congestion reduction will operate more efficiently within a well developed and maintained community or housing development that has sufficient capacity and access onto the urban road transport system. Of the proposed options SEA and EIA will ensure that future development takes environmental needs into consideration and balances them with spatial needs.

Another challenge facing Cape Town especially is that of **institutional governance.** Sectoral plans and policies are often implemented with little regard to their impacts on other Plans, Policies and Strategies with the problem being that of non-vertical or horizontal alignment. The D.A.D.F. does not specify options for this problem. However, a T.C.M.P. that incorporates a D.A.D.F. will have the ability to cut across sectoral Plans, Policies and Strategies serving as a vertical or horizontal alignment platform. In essence the T.C.M.P. will force the effective vertical and horizontal alignment of Plans, Policies and Strategies, but it requires institutional tools to be successful. Finally, Cape Town and Johannesburg's integrated strategies contain a range of LUM and TSM measures capable of supporting the **transport, housing and urban highway infrastructure** challenges faced by both cities.

8.5.2.2 Explaining how the options may overcome some of the challenges

The previous section has shown that the options identified in order to address the challenges are a combination of LUM, TSM, TDM and "Smart Growth" measures. Although the measures were first and foremost identified to reduce traffic congestion they obviously have other functions by virtue of their effects. And so having apportioned plausible options to challenges the next step is to explain how they may ameliorate the challenges collectively in terms of their first, second and third order effects in bringing about a more sustainable socio-economic, spatial distribution and traffic level outcome. The assessment can be made simple by using Appendix 2 (see CD) which provides matrices enabling the measurement of the predicted intensity of each type of effect resulting from the introduction of the selected LUM, TSM and TDM measures. When reading Appendix 2 in conjunction with the measures-objective tool as illustrated in Figure 4.9 it becomes possible to predict the effects of each measure in terms of the literature review in a systematic and consistent way. Following such an assessment the following paragraphs report the predicted outcomes or effects of the options contained in Cape Town and Johannesburg's integrated strategies in relation to their development challenges.

Starting with the likely impacts of the following **LUM and "Smart Growth" measures** - (i) strategic planning aimed at increasing the density of development (ii) clustered land-use as examples (iii) creating interconnected streets and (iv) creating self-contained communities, it is possible to predict how they may ameliorate the challenges.

The **first order effects** of these measures are expected to impact on people's attitudes, their travel behaviour and on user cost (such as direct location cost of businesses, households, freight companies, travellers and passengers) (Meyer, 1997; Victoria Transport Policy Institute, 2005; Department for Transport, 2004b & d; May, 1995; Potter and Skinner, 2000 and Goh, 2002:33). Most land-use measures are unlikely to have a direct effect on transport capacity, although once users have responded to land-use measures there are likely to be changes in system congestion (road, public transport and in car parks) (Marshall, 2000:69). By changing people's locations of home, work and other activities, land-use measures will have a direct effect on user costs (Pendall, 1999:555). Furthermore, if land-use measures lead to homes, workplaces and shops being located close to each other through clustering and or increased density, it is likely that the reliability of work journeys and shopping journeys will improve. Restructuring is possible by linking new development to existing development densification, thereby providing the necessary connecting infrastructure and consequently creating self-contained communities.

With respect to the **second order effects** - they will impact mostly on the strategic location responses of road users as well as strategic transport responses. In other words if a strong spatial development policy is followed aimed at densification and traffic congestion reduction it may cause businesses and residents to move to an area that is now more attractive and/or it may influence people to look at alternative modes of transport to get from one place to another. Some day-to-day responses may also be observed where typically the number of trips or departure times will be altered. LUM measures aimed at compact, mixed use and pedestrian friendly designs reduce vehicle trips, vehicle miles travelled (VMT) per capita and encourage non-motorised travel. Settlements can also be structured in such a way as to promote more environmentally favourable modes and travel patterns (Marshall, 2000:69). In terms of transport response, Badoe and Miller (2000:237), Handy (1996:161-162) and Sim et al. (2001:399) note land-use measures creating higher density residential and employment developments affect travel behaviour by reducing the number of trips undertaken by car, by shifting car trips to public transport trips (should it be available).

Third order effects are those effects which occur outside the land-use/transport systems being studied, in the sense that such effects are not assumed to change the behaviour or affect the choices of the users of the system and so the third order effects only emerge as the end result of the total behavioural changes in the land-use and transport system. Third order effects of the identified measures can only be fully appraised once the measures have been implemented and traffic patterns have "normalised" following a period of 5 years.

Looking more closely at the impacts of **TSM measures** once implemented, it is possible to predict how they may ameliorate the challenges with reference to the following examples – (i) new roads or additional lanes (ii) street design (iii) traffic calming and restraint measures (iv) Park and Ride facilities (v) improve non-motorised travel conditions (vi) effective and reliable public transport (vii) public transport orientated development (viii) HOV facilities and (ix) ramp-metering. TSM measures have a favourable chance of influencing both Cape Town and Johannesburg's infrastructural and configurational distortions thereby addressing some inequality problems of access to the transport system. They also have the ability to encourage sustainable and environmentally conscientious development and will play an important part in restructuring Cape Town and Johannesburg as urban settlements.

The **first order effects of TSM measures** will have direct impacts on capacity and congestion through the anticipated changes in bus capacity, bus crowding, parking capacity changes, road capacity changes, traffic congestion and direct costs to public transport users (Meyer, 1997; Victoria transport policy institute, 2005; Department for Transport, 2004b & d; May and Roberts, 1995 and Potter and Skinner, 2000). The effects of infrastructure provision upon quality and reliability are also important, especially concerning public transport infrastructure, since the behavioural responses of users are liable to be highly dependent upon such effects. TSM measures will also directly influence car use as well as public transport usage. It is therefore expected that by introducing these options it will be possible to increase the connectivity between neighbourhoods as well as providing an alternative means of accessing opportunities which may not only ensure a reduction in traffic congestion but also the strategic objective providing liveable communities, effective infrastructure, integrated settlements, urban restructuring opportunities and public transport as an alternative mode of transport.

The provision of public transport is a key option for both cities and one which may potentially contribute a great deal in terms of opening up access and mobility to all of its residents. In this respect transport has the opportunity and ability to serve as a mechanism that puts the majority of residents on the same footing in terms of mobility and accessibility as well as reducing the large equality gaps in both cities. Once public transport is a key component of the city it will demolish some very real movement barriers and open up markets to the marginalised population of Cape Town and Johannesburg. This goal will, however, not be achieved if it is not driven from a strategic planning perspective. In other words a strategy that cuts across various sectoral policies and plans and that influences the spatial allocation and proximity between land-use functions and the provision of infrastructure to facilitate effective movement between them. By considering the role of interconnected streets and the creation of self-contained communities characterised by clustered and mixed land-use and servicing it with reliable and safe public transport it is clear that much is to be gained by reducing urban disparities.

The **second order effects of TSM measures** will impact mostly on the strategic location responses of road users as well as strategic transport responses. In other words if effective street design, traffic calming and restraint measures, Park and Ride facilities and reliable and safe public transport are implemented, they may induce businesses and residents to move to an area that is now more attractive and accessible and/or they may induce mode shift. Some day-to-day responses may also be observed where typically the number of trips or departure times will be altered.

TSM measures are also likely to give rise to a number of location responses. Whilst these responses might not be immediate, they are significant when considered over a long term time horizon. On the other hand, strategic transport responses are liable to be more immediate, especially responses such as buying a public transport season ticket (in response to new public transport infrastructure). All TSM measures are liable to change trip length distributions for drivers, passengers and freight, generally increasing the length of trips and the quantity of travel. Infrastructure measures may also encourage a large number of changes in different types of day-to-day transport responses, but will not usually lead to within-day transport responses.

Many **third order TSM effects** only emerge as an end result of the total behavioural changes to TSM measures. It will then be possible to identify the environmental impacts of the options, the resultant changes in traffic levels and the extent to which the measures have contributed to liveable streets and neighbourhood status, equity and economic growth. They will also indicate over the long run how emission levels have been influenced, whether traffic accidents have been reduced and if people's health has improved.

Assessing the impacts of **TDM measures** once implemented, it is possible to predict how they may ameliorate the challenges with reference to the following examples – (i) urban road charging (ii) car restriction zones and (iii) variable message signs. The most direct **first order effects of TDM measures** are upon user costs. The immediate response to increased user cost is usually associated with pricing users off the road system, although this may depend on the users' elasticity in terms of value of time and user cost. This may prove a very powerful option especially in Johannesburg, albeit a publicly unpopular option, with a very good chance of reducing traffic congestion along severely trafficked corridors. However the proviso is having an efficient, reliable and safe public transport system in place first of all.

The **second order effects of TDM measures** are likely to induce a large number of behavioural responses in terms of location choice, strategic transport choice and day-to-day transport choice. Of particular interest here are the responses to well-focused urban road charging measures. Since such measures have not yet been implemented widely, a certain amount of speculation is currently involved concerning the likely level of driver response to such measures. However, when urban road pricing schemes have been implemented, it will be important to quantify their behavioural effects. The **third order effects of TDM measures** are likely to encourage directly changes in public finance, equity and economic growth and change to other second order supply effects indirectly through behavioural changes in the transport and land-use systems. These will be beneficial to sustainable and environmentally conscientious development.

The discussion has shown that the integrated strategies identified for both cities have the scope to support and aid the correction of some of the challenging situations experienced in Cape Town and Johannesburg although they have primarily been selected to deal with traffic congestion reduction. Both cities have identified in section 8.3.3.2 some opportunities, strategies or programmes to deal with these challenges.

Figure 8.9 below shows the extent to which the integrated strategies of both cities support the common goal of overcoming these challenges.

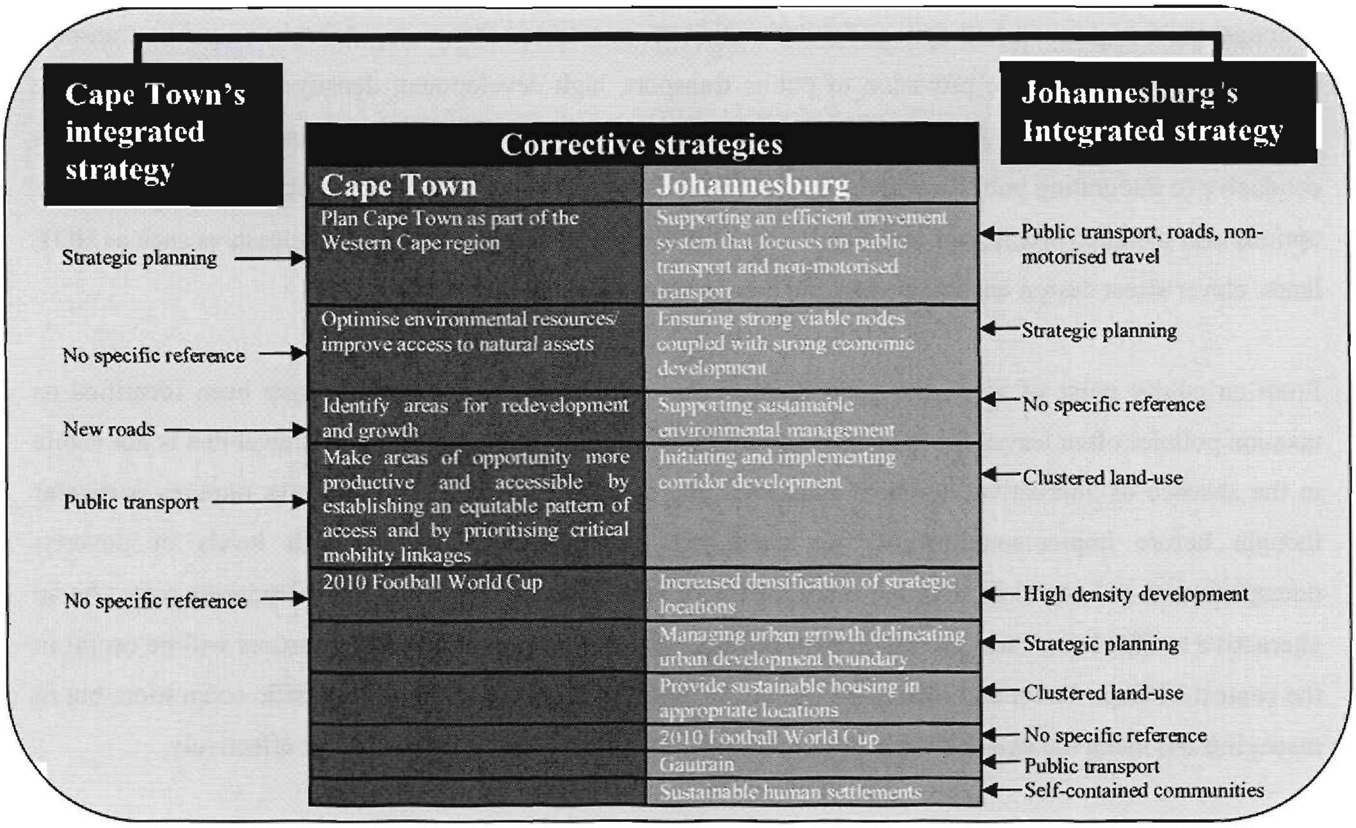


Figure 8.9 Aligning the integrated strategies of Cape Town and Johannesburg to stakeholder identified corrective measures

It shows that some of the options contained in Cape Town and Johannesburg's integrated strategy support and are aligned to the identified corrective measures. Although the options do not specifically address environmental concerns or economic growth, a central idea of the integrated strategy is that, having selected a wide range of measures they will have a collective ability to enhance environmental conditions and foster economic growth through the synergy between the measures and so address these concerns at a strategic level.

8.6 Conclusion

The case study results of Cape Town and Johannesburg provided the input data required for computation into the D.A.D.F. The screening process reduced the number of options in both cities from 38 to 25, identifying those deemed most effective in dealing with traffic congestion in their local settings, yet contributing to sustainable development. These options were then transposed into an integrated strategy for Cape Town and

Johannesburg and it was shown that their strategies identified a balanced mix of measures tailored to local conditions.

Amongst the 6 highest ranked options for both cities, those selected focus very strongly on public transport orientated development, the provision of public transport, high development density that creates effective public transport threshold levels and soft measures such as travel plans. Combining these options is conducive to integrating public transport with highway infrastructure at key nodes or hubs. The mixed bag of options also included urban road charging for both cities (ranked 8th) as well as TSM measures such as HOV lanes, clever street design encouraging traffic calming and ramp metering.

From an equity point of view, the good news is that not many TDM measures have been identified as taxation policies often leaves the poor less well off by increasing the cost of travel to a level that is not viable in the absence of alternative modes of transport. The consideration of TDM measures requires particular thought before implementation as both cities are characterised relatively high levels of poverty, unemployment and social deprivation associated with very great inelasticity towards transport costs. As an alternative to TDM measures the assessment of the options has shown that TSM measures will be useful in the context of Cape Town and Johannesburg, not in terms of building a way out of traffic congestion, but in managing and using the existing capacity provided by the highway infrastructure more effectively.

Having reported the development context, challenges and proposed strategies to overcome the challenges facing Cape Town and Johannesburg, the assessment has shown that the package of options or integrated strategy selected by both cities will contribute to some, not all, development challenges and that these options are aligned with and supports both cities' proposed strategies for overcoming the development challenges. Integrating transportation and land-use management strategies aimed at reducing urban traffic congestion is therefore possible through the D.A.D.F. Amongst the challenges that can be ameliorated through the package of options (integrated strategy) are (i) the spatial and infrastructural configuration of Cape Town and Johannesburg (ii) inequality and disparities (iii) urban settlement restructuring (iv) sustainable and environmentally conscientious development and (v) ineffective transport, housing and urban infrastructure.

It was found that a real gap exists in South African planning in dealing directly with growing traffic congestion levels and that the existing institutional arrangements do not offer a mechanism to address growing congestion levels directly. In bridging this gap it will be necessary to amend planning legislation allowing the D.A.D.F. to be incorporated into a T.C.M.P. as a mechanism to deal with traffic congestion thereby forcing greater alignment and intergovernmental co-operation producing all-round positive implications.

CHAPTER 9
CONCLUSIONS

9.1 Introduction

This chapter presents a summary of the findings, conclusions, viewpoints and insights which have been made - it reports the essence of the empirical investigation.

In considering and summarising these elements, this chapter is structured as follows. Section 9.2 provides a summary of the principal components of the study. Section 9.3 outlines the main findings and conclusions. Section 9.4 reports the extent to which the research objectives have been achieved. Section 9.5 summarises the main results of the research. Section 9.6 suggests some further work that may be considered as a basis for future research. Finally, section 9.7 provides some concluding remarks positioning the study for the final stage where plausible planning recommendations will be made.

9.2 Principal components of the study

Finding innovative methods to deal with and manage traffic congestion involves a broad understanding of the interrelationships between transport, spatial development, economic growth, social imperatives, environmental management, the role of public participation, financial management, appraisal and the dimensions of sustainable development. The complexity of the research aims and objectives has forced the research into several directions in an attempt to capture the essence of the interrelated components involved in integrating transport and land-use management strategies. Several components were built into the study to obtain scientific results, reflecting not only the case for integrated strategies and the means of achieving this end, but also the author's ideas and empirically derived perceptions about positioning and connecting integrated strategies to the planning system. The following principal components of the study have emanated as a result:

- **The case for integrated strategies** - To focus the research in the right direction it was necessary to identify background theory in:
    - Positioning congestion as an area-wide multi-modal phenomenon, identifying the close relationship between transport and the environment in which it operates.
    - Identifying recent developments in policy integration at an academic and industry level
    - Identifying the ideologies supporting the integrated strategy concept.

- **Defining the meaning of sustainability in the context of the research** - If integrated strategies are to be effective and of economic, social and environmental benefit they have to be sustainable. The author provided a comprehensive definition of sustainability in the context of the research, which in broad terms summarised sustainability as an end product achieved by the interaction between transport and spatial development measures and environmental management.

- **Examining the considerations to be taken into account when planning for sustainability** – In developing integrated strategies, it is essential to be clear about what the strategy is designed to achieve and so it is essential to take account of specific considerations (as part of a logical approach) rendering integrated strategies sustainable. Whilst examining the considerations, gaps in the current literature were identified and those to be explored, highlighted.

- **Transposing the dimensions of sustainability into the interrelated components of the planning system** – From the Brundtland Commission and the author's definition of sustainable development it was possible to derive four underlying dimensions. Integrated strategies must encourage and facilitate the movement of the dimensions towards full overlap. By weaving together the dimensions, a concise decision framework enabling sustainable development decisions to be made is presented. To understand how the dimensions are related within the planning system, they were transposed into the interrelated components of the planning system. This was followed by assessing the components so as to establish whether and where integrated strategies can be connected to them - the process again highlighted the gaps in the literature and those to be explored in this context. This positioned the study to explore the relevant components and considerations that help connect integrated strategy to the planning system and identify the elements to be built into a D.A.D.F. necessitating an empirical investigation.

- **Conducting a two stage empirical investigation** – Once the gaps and issues to be investigated were identified, a grounded theory and an exploratory investigation was undertaken through a:

  - **survey** intended to collect data components relevant to the identified gaps in developing a D.A.D.F. and to explain other relevant issues of concern and,
  - **case study** of Cape Town and Johannesburg aimed at collecting data capable of testing the D.A.D.F.'s ability to produce an integrated strategy aimed at traffic congestion reduction for each city, suitable to their local conditions and within the context of their development challenges and objectives.

- **Analysis of survey data and reporting the results** – The survey results were statistically analysed and the results reported in a structured form.

- **Interpreting the survey results** – The survey results were subsequently interpreted, positioned within the literature survey, conclusions were drawn, inferences made were reported and the D.A.D.F was constructed. This part of the study also:

  - assessed planning's administrative and institutional framework in identifying the appropriate level of governance at which integrated strategies should be implemented;
  - discussed the perceived value of linking integrated strategies to IDPs via the D.A.D.F. as part of a T.C.M.P.

- **Analysis of case study data and reporting the results** – The case study results were statistically analysed and uploaded into the D.A.D.F. where the results of its option analysis were transposed into an integrated strategy for both Cape Town and Johannesburg.

- **Interpreting the case study results** – The case study results were interpreted, conclusions were drawn, inferences made were reported and the integrated strategies were interpreted against a literature check. In this way the research results and analysed data was connected to the literature verifying certain arguments, concepts and findings in contributing towards the internal validity of the findings.

- **Conclusions and recommendations** – The case study results positioned the study to formulate plausible recommendations.

9.3 Main findings and conclusions

The basis of the findings reported in the study rests on a good survey response and representative stakeholder participation as part of the case study. Both data collection procedures served a very useful purpose in terms of identifying perceptions, views, concerns and problem areas in an attempt to fill the gaps identified. The main findings are presented below, also illustrating that the gaps identified in the research have been addressed to a large degree.

9.3.1 **Integrated strategies will enhance sustainable development outcomes when the following seven key policy objectives are built into the decision-making process and fundamentally the D.A.D.F.:** (i) economic efficiency (ii) protection of the environment (iii) liveable streets and neighbourhoods (iv) safety (v) equity and social inclusion, (vi) accessibility and (vii) the integration of land-use/ transport. Policies aimed at traffic congestion reduction must focus on a greater level of land-use and transport integration coupled to environmental protection and safety whilst harnessing economic efficiency and creating liveable streets and neighbourhoods. It follows that transport policy must engage increasingly with other sectors to deliver a truly integrated approach or New Realism.

9.3.2 **A set of criteria and indicators that measure the extent to which policy measures contained in an integrated strategy contribute to achieving the sustainability policy objectives have been identified.** It must however be recognized that there is no universal set of criteria or indicators which are equally applicable in all cases. Any set, by itself, is an imperfect tool for organizing and expressing the complexities and interrelationships encompassed by sustainable development. Ultimately, the choice of a set of indicators must meet the needs and priorities of the users, civil society groups and decision-makers responsible for the development and use of the indicators to monitor progress towards sustainable development.

9.3.3 **A set of performance indicators was identified to measure the performance of integrated strategies post implementation.** It was found that for integrated strategies to be successful and contribute to sustainability they must reduce traffic congestion, travel cost and accidents, while it is also important to reduce air and noise pollution, average commute times, ensure the safety of transport users and provide affordable and accessible public transport. Another interesting finding was that both the developing and the least developed countries prefer indicators that will measure value for money coupled to a direct journey time improvement, whereas developed countries prefer performance indicators that especially measure the environmental and safety implications of the overall implemented strategy.

9.3.4 **A group of variables exogenous and endogenous to the transport and land-use system (with associated technical considerations) have been identified to describe local conditions.** These variables define or explain the context or scenario being planned for within which the strategies will operate and form part of the process determining measures suitable to specific local conditions. Again it is important to recognise that the variables identified are by no means an exhaustive prescribed set, but rather one which gives direction and is in itself adaptive or flexible and may be adjusted to reflect local conditions.

9.3.5 **A key group of measures were identified as having a successful track record in reducing traffic congestion.** The measures identified by respondents consider the 1st, 2nd and 3rd order effects of the identified measures as they may have unique consequences and ways of influencing travel behaviour and indeed traffic congestion. The findings have shown that the supply side paradigm is still very strongly embedded in the transport industry in response to increasing congestion. LUM is regarded as a strong regulatory tool to plan land-use patterns creatively providing the mechanism that facilitates the provision of transport between activities. TDM measures are interestingly of lesser importance especially to the least and developing countries in being deemed as having a successful track record in reducing traffic congestion and are most commonly applied as a "last resort" instrument. Nonetheless the key finding is that whichever measures are used to tackle congestion, they must consist of at least 3 types of measures and be implemented in an integrated manner so as to draw on each other's strengths and ameliorate barriers and concerns – an underpinning of the New Realism and "Smart Growth" arguments.

9.3.6 **The greatest barriers to the implementation of TDM, TSM and LUM measures as part of integrated strategies are financial and political barriers.** TSM measures are constrained most severely especially with respect to road building, maintenance and the provision of public transport infrastructure as being capital intensive measures. TDM measures are mostly constrained by political drivers and to a lesser extent financial limitations as these measures have a "self-financing" ability through their revenue raising characteristic. It is possible to overcome the barriers by implementing integrated strategies (selected through the D.A.D.F.) as it allows the decision-maker more power over selecting the measures required to control the barriers.

9.3.7 **Environmental management must be coupled with integrated strategies.** In terms of the environmental appraisal of integrated strategies the findings suggest that they should be assessed in terms of SEA, driven by effective IEM and EMPs as the integrated strategies produced by the D.A.D.F will be aligned and positioned within the context of the IDP – a strategic tool.

9.3.8 **Public participation must play a key part in developing integrated strategies.** The development of optimal and comprehensive integrated strategies requires a good sense of who the customer and stakeholders are for the land-use and transportation system and depends on a comprehensive programme of providing opportunities for involvement in the planning process.

9.3.9 **The process of developing integrated strategies must be mindful of funding requirements and early consultation should point out the need to incorporate measures that have a self-financing characteristic.** Given that not much can be achieved without funding, managing the process of obtaining the required resources and then effectively managing the operating and capital budgets that result is a very critical aspect of a comprehensive integrated congestion reduction strategy. Its success depends crucially on the funding capability of the instigating authority. Within a funding framework the aim should be to provide a package which is most cost effective, enhances mobility and accessibility, encourages sustainable development, reduces traffic congestion and is consistent with community and policy objectives while being value for money.

9.3.10 **Integrated strategies are perceived to increase local accessibility and mobility.** By integrating various TDM, TSM and LUM measures, accessibility and mobility become a by-product of integration. Although the polices of decision-makers may not necessarily be aimed at attaining greater accessibility per se, it may be achieved by default as a result of the synergy between the various measures included as a package and in that way provide an effective outcome whereby accessibility and mobility are increased and congestion reduced.

9.3.11 Key statistical findings have shown that:

- There is a statistically significant relationship between the development stage of a country and the policy objectives deemed appropriate to measure and qualify sustainable development.
- There is a statistically significant relationship between the development stage of a country and the criteria and indicators employed to measure the extent to which policy measures contribute towards policy objectives.
- A significant relationship exists between performance indicators and the development stage of a country.
- No relationship was found between the different levels of countries development and the measures they deem appropriate in dealing with traffic congestion reduction.
- The measures deemed appropriate for reducing congestion in developing and developed countries are several, vary greatly and are implemented in an isolated fashion not necessarily integrated in a comprehensive package (with few exceptions).
- Correlation analysis has shown a statistically significant relationship between countries at different development levels and the barriers they experience.

9.3.12 Joint departmental responsibility of individually managed departments such as land-use management, environmental management, infrastructure provision and the provision and management of public transport facilitates stronger horizontal and vertical integration. Greater horizontal interaction and synergy between different departmental functions and outputs can assure more efficient, co-ordinated and streamlined decision-making. Centralising decisions horizontally within the land-use and transport disciplines from within one "super department" will ensure greater integration of public services as well a focused and visible effort to achieve sustainable development outcomes. However, is it also recognized that vertical integration between different spheres of government (National, Provincial and Local) must provide an operational framework of appropriate legislation, policies, visions, guidelines and plans to force a greater level of interface between these spheres of government. In this way a segmented approach to policy-making, which prevents the development and implementation of comprehensive, integrated plans jeopardizing effective and sustainable urban development is avoided.

9.3.13 **Integrated strategies should be implemented at Local Government level.** Although policies, plans and initiatives are driven, directed and informed by national, provincial and regional government legislation, policies and plans, integrated strategies should be initiated at local government level where there is a greater understanding of local needs and so projects and schemes can be directly related around local level aspirations, strengths, opportunities, needs, challenges and concerns. Plans and policies executed at local level, rather than at regional and national level deal specifically, and are aimed at addressing local transport problems although national plans and strategies inform and provide direction to local plans.

9.3.14 **Integrated Development Plans present a mechanism that aligns sectoral functions and promotes vertical and horizontal integration and communication.** Because IDPs are seen as (i) a multi-sectoral and multi-level activity incorporating local government and other agents and (ii) a process integrating various dimensions of development and (iii) the actions of sectoral agencies driven by regional goals and aspirations, they are well positioned to operationalise a plan aimed at local traffic congestion management.

9.3.15 **A T.C.M.P. has the scope to be assimilated into an IDP.** South African planning does not offer a mechanism to address growing congestion levels directly. The findings have shown support to the notion of connecting the D.A.D.F. to a T.C.M.P. to deal with traffic congestion and force greater alignment and intergovernmental co-operation. With a T.C.M.P. greater emphasis is placed on identifying the right mix of measures suitable to specific local conditions through the D.A.D.F. The parallel between a proposed T.C.M.P. and an IDP is found in their local approach in dealing with spatial development issues. To this end a T.C.M.P. will weave together elements of TDM, TSM, LUM, sectoral plans, environmental management and spatial planning and force an interface and alignment with an IDP.

9.3.16 **A T.C.M.P. must preferably be implemented at local government level and be coupled with an IDP or IDP-equivalent plans where it has the opportunity to encourage horizontal and vertical integration.** Within the IDP it is possible to formulate a single programme that brings together various sectoral actions into a sustainable integrated spatial development process. However for integrated strategies to be successfully implemented at Local Government level, the developing and the least developed countries have to build sufficient capacity to enable effective implementation and to develop the institutional support system that will facilitate such strategies through a D.A.D.F.

9.3.17 **The primary building blocks required to develop the D.A.D.F. were successfully identified.** In essence the D.A.D.F. is a MCA based option analysis tool and process, where the option analysis stage of a standard MCA has been adapted to reflect the three screening mechanisms of the process. It is the values of the exogenous and endogenous variables, guidelines and technical considerations that give the screening process a dynamic and adaptive characteristic as the values and weights assigned to the variables are site specific. As an appraisal method it is therefore flexible in that the components of the structure such as the criteria and indicators, the classes of effects and more specific effects and the exogenous and endogenous variables, guidelines and technical considerations can be varied to meet local requirements therefore allowing the selection of measures suitable to a particular location.

9.3.18 The D.A.D.F. option analysis produced integrated strategies for Cape Town and Johannesburg tailored to their local conditions. The identified measures were shown to be representative of the four types of measures in that the integrated strategies of both cities consist of a well balanced mix of LUM, TDM, TSM and "Smart Growth" measures. This result is therefore consistent with and supports the notion that integrated strategies have the potential to deliver a sustainable outcome when strategies draw on the synergy between their individual components. Significantly though, the four highest ranked measures of Cape Town's integrated strategy are LUM measures suggesting that land-use management and spatial planning are of fundamental importance in providing direction to other types of planning in dealing with traffic congestion in the context of Cape Town. However, the combination of the highest ranked options in Johannesburg's integrated strategy comprises a balanced mix of the four types of measures suggesting a different focus. This outcome demonstrated that developing integrating strategies aimed at reducing urban traffic congestion is possible through the D.A.D.F. and further supports the argument that it is capable of identifying measures that are suitable to local conditions.

9.3.19 The integrated strategies of Cape Town and Johannesburg support their strategic development perspectives. Having positioned the integrated strategies within the strategic context and development challenges experienced in both cities in identifying their implications, the findings have demonstrated that the integrated strategies support the perspectives of:

(i) enhancing economic growth
(ii) providing key public infrastructure services
(iii) environmental management
(iv) combating urban sprawl and or trends of increasing spatial expansion and
(v) providing safe, reliable and frequent public transport in areas where it is most needed, notably socially deprived areas

9.3.20 The integrated strategies of Cape Town and Johannesburg provide options capable of alleviating some of their development challenges. In positioning Cape Town and Johannesburg's integrated strategies within the development challenges they face, it was possible to identify options that may be useful to help overcome some of the challenges in terms of their first, second and third order effects. The following development challenges could potentially be overcome by implementing the integrated strategies:

(i) distorted spatial and infrastructural configuration

(ii) inequality and disparities in circumstances, living conditions, quality of life and the future prospects of residents

(iii) urban/settlement restructuring

(iv) inconsistent sustainable and environmentally conscientious development that recognises the integrated nature of environmental and socio-economic challenges and spatial needs

(v) institutional governance problems - although the D.A.D.F. did not specify options for this problem per se a T.C.M.P. that incorporates a D.A.D.F. will have the ability to cut across sectoral Plans, Policies and Strategies serving as a vertical or horizontal alignment platform. In essence the T.C.M.P. will force the effective vertical and horizontal alignment of Plans, Policies and Strategies but it requires institutional tools to be successful

(vi) transport, housing and urban highway infrastructure challenges

By having these positive impacts, the integrated strategies produced by the D.A.D.F. become more than just a tool to alleviate traffic congestion, but also a mechanism that contributes to sustainable transport and spatial development.

9.4 Achievement of objectives

A number of objectives were identified at the outset of the study to identify the components of a D.A.D.F. providing a process that selects the most effective combination of measures to deal with traffic congestion under specific local conditions and to connect the D.A.D.F. to the Planning system. In this way the research was positioned to arrive at informed decisions in recommending, considering and developing a T.C.M.P. that has the ability to relieve traffic congestion. The paragraphs below report the success achieved.

9.4.1 Identifying TDM, TSM and LUM measures that have a successful track record in reducing traffic congestion. The survey results identified a key set of measures comprising a mix of TDM, TSM and LUM measures having a successful track record in reducing traffic congestion. If implemented within an integrated strategy the synergy between the measures strengthens the overall strategy - an underpinning principle of the New Realism and "Smart Growth" arguments.

9.4.2 To identify and critically evaluate the elements of "Smart Growth" and New Realism proving effective in reducing traffic congestion. Having assessed the elements and purpose of

"Smart Growth" and New Realism it were possible to compare the measures that have a successful track record in reducing traffic congestion to "Smart Growth" strategies. It was found that a good level of overlap exists and indeed that "Smart Growth" measures form an integral part of a strategy that helps secure sustainable development ensuring the delivery of the New Realism.

9.4.3 **Determine which policy measures are most conducive to achieving the decision-maker's goals and objectives under specific conditions.** A D.A.D.F. was developed to help the decision-maker select measures appropriate to specific local conditions from a survey identified group of 38 TDM, TSM, LUM and "Smart Growth" measures.

9.4.4 **Determine the relationship between the development stage of a country and the most effective and applicable policy measures.** The survey results suggest that no relationship exists between the different levels of countries development and the measures they deem appropriate in dealing with traffic congestion reduction.

9.4.5 **Determine the variables endogenous and exogenous to the transport system that should be used to describe the local setting, problems and conditions that would help select the most appropriate measures for a particular local area.** The survey results identified variables that help to describe the context or scenario being planned for. However it was noted that the variables identified are by no means exhaustive and may be adapted to better reflect local decision-making requirements.

9.4.6 **Identify the objectives conducive to integration aimed at congestion reduction and sustainability.** Seven key policy objectives were identified as conducive to congestion reduction and sustainability and were built into the D.A.D.F.

9.4.7 **Determine whether the criteria and indicators used to measure the extent to which policy measures have contributed to sustainable development differ between the least developed, developing and developed countries.** The survey results have shown that a statistically significant relationship exists between the development stage of a country and the criteria and indicators employed to measure the extent to which policy measures contribute towards sustainable development.

9.4.8 **Identify the performance indicators measuring the success of a congestion-reducing integrated strategy.** A set of performance indicators was identified to measure the performance of integrated strategies post implementation. Performance indicators are classified as those quantified financially, those not quantified financially and qualitative indicators.

9.4.9 Identify potential barriers to policy implementation. The survey results have shown the greatest barriers to the implementation of TDM, TSM and LUM measures are financial and political barriers. It is possible to overcome the barriers by implementing integrated strategies as they allow the decision-maker more power over selecting the measures required to control the barriers.

9.4.10 Structure the decision framework. The survey was a useful tool in identifying the primary building blocks required to structure the D.A.D.F. successfully.

9.4.11 Apply the decision framework to a case study. In testing the effectiveness and workability of the D.A.D.F. it was applied to a case study comprising two South African cities, Cape Town and Johannesburg. It was found that the D.A.D.F. option analysis produced integrated strategies for Cape Town and Johannesburg tailored to their location conditions.

9.4.12 Determine the anticipated value of the decision framework by positioning its output within the case study. In positioning the integrated strategies (output of the D.A.D.F.) of Cape Town and Johannesburg within their respective strategic perspectives and development challenges the findings demonstrated that the integrated strategies are capable of selecting measures most appropriate to local conditions, dealing with the challenges experienced and enhancing their strengths.

9.4.13 Determine whether the decision framework will increase mobility and accessibility in urban areas. The findings have shown that integrated strategies are perceived to increase local accessibility and mobility. By integrating various measures accessibility and mobility become a by-product of integration as a result of the synergy between the various measures included as a package.

9.4.14 To solve the research problem and formulate plausible recommendations. The findings have demonstrated that it is possible to develop a process that allows the selection and integration of the most appropriate combination of policy measures to deal specifically with traffic congestion under prevailing local conditions whilst encouraging sustainable development. In transforming the D.A.D.F. from theory to practice it is necessary to formulate plausible recommendations for the positioning of the integrated strategy concept and the D.A.D.F. within the planning system.

9.5 Main results of the research

The research has gained a fair amount of ground in theory formation in more general terms as part of its grounded and exploratory design. A range of gaps identified in the study pertained to a lack of empirical evidence about the development of a process that helps the decision-maker decide qualitatively between various measures best suited to his/her needs in dealing with traffic congestion at a local level. The empirical stages of the study have filled these gaps and helped to structure the D.A.D.F. It is however quite possible for another researcher to obtain different results and conclusions should a different approach to the research be followed.

The study has demonstrated that it is possible to select and integrate TDM, TSM, LUM and "Smart Growth" measures based upon specifying local objectives, conditions, needs, constraints and circumstances using a D.A.D.F. As the product of the D.A.D.F. is an integrated strategy aimed at traffic congestion reduction and sustainable development, it is possible to reduce traffic congestion in a balanced way, encouraging economic growth, social wellbeing, environmental protection, overcoming public and political opposition to demand management measures and recycling any revenue raised. In addition to developing a useful process it also endeavoured to position the D.A.D.F. in a practical situation establishing its credibility and ability to produce sensible, sustainable integrated strategies of practical value.

To this end the case study has shown that in positioning integrated strategies within Cape Town and Johannesburg's strategic perspectives, ambitions, policy objectives and development challenges they have significant potential for supporting local ambitions in reducing traffic congestion and have in general application potential within the planning system. In operationalising the D.A.D.F. the links between integrated strategies and the components of the planning system were assessed and it was found that a Traffic Congestion Management Plan will be an appropriate mechanism to integrate the various components and assimilate the D.A.D.F. as a key process within such a plan.

The recommendations must set out the structure of a Traffic Congestion Management Plan that has a clear link to IDPs within South Africa's context. It should explain the relationship between the T.C.M.P. and its links to the planning system, its institutional requirements, its components, relevant consultation procedures, how environmental management will be dealt with and, in general, the changes that have to be made in the South African planning system to accommodate a T.C.M.P.

9.6 Recommendations for future research

There is a number of sensible suggestions to be made in recommending some directions for future research. These include the following:

9.6.1 One of the main difficulties in employing a robust set of thresholds as part of the D.A.D.F. is that they are generally useful in strategies that do not necessarily have environmental improvements, or sustainable development, as their main objective – unlike the integrated strategies in the study context. For this reason specific thresholds were not built into the D.A.D.F. as they critically depend on local circumstances and the expectations of stakeholders, the public and decision-makers. It would however be very useful to research the qualitative and quantitative thresholds relating to the three screening process of the D.A.D.F. as a further element describing scenarios being planned for or considering building thresholds into a fourth screening process.

9.6.2 Optimal settlement size as a precursor for sustainable development. Once it has been established which spatial components should be included in a settlement rendering it sustainable and optimal in size it will be possible to draw parallels between these components and the development of integrated strategies. Bringing the two concepts together may shed more light on the interaction between optimal settlement size, integrated strategies and sustainable development. It may prove valuable in that, if settlements are developed to an optimal size, the pressure on developing integrated strategies to deal with some of the externalities associated with unsustainable urban conditions may be reduced.

9.6.3 The study has shown that a number of different approaches to, and contexts for, decision-making exists and has demonstrated the considerable variety which exists both within and between countries at different development stages. The relative merits of these approaches have not been assessed in more detail. Research is needed on this issue and is particularly relevant for developing countries in identifying the ways in which they come to decisions on spatial development, transport and sustainable development.

9.6.4 Although recent studies have contributed to a better understanding of the contribution of different policy instruments to sustainable development a greater understanding is also needed about the transferability of results from one context or country to another. This may be a reason why the understanding of how to integrate policy measures effectively is still in its infancy, particularly in the area of transport, land-use and environment policy. This is an area in which further research is particularly important and could significantly enhance the performance of integrated strategies.

9.6.5 Barriers to the effective implementation of policy measures exist although initiatives are set in place to control or limit them as far as possible within an integrated strategy. Key areas of concern are public acceptability and finance. In the latter area, more research is needed into the success of different measures' or approaches' ability to financing investment and operations that seek to integrate land-use and transport policy.

9.6.6 Research to date has focused much more on what to implement than on how to implement it. There is still only a limited understanding of what has made some places more successful than others in implementing effective strategies, and very little work on ways of transferring this experience of best practice. The development of the D.A.D.F. is a step in this direction. As a recommendation for future research further refinement of the D.A.D.F.'s screening processes is recommended to further enhance its capability and perhaps operational acceptability.

9.6.7 Consider alternative forms of appraisal to the MCA based D.A.D.F. – consider alternative qualitative and quantitative methods.

9.6.8 Test the D.A.D.F. in another location and part of the world and assess the extent to which it is capable of producing strategies capable of reducing traffic congestion, contributing to sustainable development and helping to overcome the local development challenges.

9.6.9 Research the potential of centralising horizontal decision-making across different spheres of government as it enhances strategic control over local development processes, decision-making and co-ordination between vertical levels of government co-operation and understanding within local government. If it can be shown that centralising horizontal decision-making across these spheres is possible and effective, from an operational point of view it will greatly enhance the process of measure selection or option development and short listing because a mutual understanding of policy goals will exist.

9.6.10 Explore the value of positioning traffic management associated with road and street works within an integrated strategy.

9.7 Conclusion

There is widespread acceptance that integrating decisions concerning spatial development is crucial to achieving sustainable development. It is also common knowledge that increasing traffic congestion is a growing problem. TDM, TSM, LUM and "Smart Growth" measures are vital role players in achieving sustainable development and they also have the potential to reduce traffic congestion. The difficulty lies in identifying which measures to apply in particular local conditions and situations. The literature review suggests that some decision-makers are increasingly concerned about the environmental impacts of planning proposals and it is considered important to devise approaches to planning that enables joined up decision-making across a variety of sectors. And so the debates in recent years have focused on policy integration, developing integrated packages – the New Realism. A fundamental principle of New Realism is that because implementing a variety of measures on a piecemeal basis in tackling urban problems is unsustainable, the integration of the measures should be sought. It urges integration of the many measures the planner has at his/her disposal forcing greater synergy where the sum of the total impacts is greater than the individual impacts.

And so this study built on the premise that developing integrated strategies is no longer an option but an essential requirement if traffic congestion reduction and sustainable communities are to be left as the legacy of the planners present. The thorny issue (transposed into the research problem) that has been identified is, of course, having a robust and defendable mechanism that allows decision-makers to select from a wide variety of measures those most applicable and appropriate to their local conditions and circumstances in managing traffic congestion. Against this background, the theme of the investigation was to detect empirically the considerations and components necessary to develop a D.A.D.F. or process that allows policy-makers to discriminate between the merits and drawbacks of different measures, formulating integrated strategies based upon their specific local policy objectives, conditions, needs, constraints and circumstances in dealing specifically with traffic congestion reduction.

The study made connections between integrated strategies aimed at traffic congestion reduction and the various elements of the planning system in an attempt to position them within operational planning. It was found that the implementation of integrated strategies can be facilitated by connecting the D.A.D.F. to the planning system by assimilating it into IDPs. The fact that IDPs are primarily a strategic tool focused at local level development and that the D.A.D.F. is capable of producing solutions to urban traffic congestion within a local focus, presented common ground for an interface.

To position the D.A.D.F. within the planning system it was envisaged that it should be positioned within a T.C.M.P. that should form part of the formal IDP process – a notion supported by stakeholders participating in the case study. However, before such a bold recommendation can be further explored it was necessary to test the effectiveness and/or usefulness of the D.A.D.F. It was found that it has the ability to develop integrated strategies tailored to local conditions in Cape Town and Johannesburg and that it also has the ability, to some extent, to address development challenges experienced through the synergy or collective impact of the measures. In the light of these findings the study is positioned to set out the recommendation that will see a D.A.D.F. positioned in a T.C.M.P. (which in turn will be assimilated into an IDP) and finally suggest whether scope exists to extrapolate the recommendations to a wider international context.

CHAPTER 10

RECOMMENDATIONS

10.1 Introduction

This chapter formulates recommendations to implement and position the Dynamic Adaptive Decision Framework within the South African planning system. It argues that the introduction of a Traffic Congestion Management Plan will facilitate such a framework and that potential exists to extrapolate it to the wider international context.

10.2 Contextual framework

The recommendations are made within the context of South Africa's planning system in setting out (i) how to connect the T.C.M.P. to the South African planning system (ii) the requirement for an integrated T.C.M.P. support unit (iii) the structure and components of a T.C.M.P. (iv) where the D.A.D.F. fits into the T.C.M.P. in operationalising integrated strategies and (v) whether the recommendations can be extrapolated to a wider international context.

As a "plan" the T.C.M.P. sets out where intervention should occur, where priority areas lie, what kinds of action should occur there, and what processes and tools should be used to achieve the desired outcomes. As a five year plan and policy instrument the T.C.M.P. aims to identify and monitor traffic congestion within the boundaries of the authority and suggests how to deal with congestion using the D.A.D.F. In this way the T.C.M.P. and D.A.D.F. become key planning tools to address and manage traffic congestion by developing sensible, feasible and defendable integrated strategies that recognise and balance the relationship between sustainable development, transport systems, spatial planning, infrastructure investment, environmental management, socio-economic activity and the needs of sectoral agencies.

10.3 Creating an institutional environment for the T.C.M.P.

The empirical phase of the study suggested that to implement and to operationalise a T.C.M.P and D.A.D.F. they are best located within an IDP. To this end this section is divided into three sub-sections. The first recommends how to connect the T.C.M.P. to the planning system in general, the second explains more specifically how to position the T.C.M.P. within an IDP and the third sets out the requirement for an integrated T.C.M.P. support unit (ISU).

10.3.1 Connecting the T.C.M.P. to South African planning legislation

In unravelling the legislation that supports the policies, plans, strategies and guidelines (components) of the South African planning system as shown by Figure 4.4 page 72, Appendix 33 (see CD) sets out the legislative framework that supports these components at national level giving direction to provincial and municipal/metropolitan authorities. The Appendix also provides an overview of the key instruments, interventions and legislation as well as their purpose and functions that support the IDP in particular and the integration it seeks across sectoral, multi-sectoral, spatial and aggregate agencies appropriate to spatial and transport planning, land-use management, environmental management, infrastructure provision and sustainable development. From the Appendix it is possible to narrow down the legislation and interventions most closely associated with the implementation of IDPs and the integration it seeks to those shown in Table 10.1 below.

Table 10.1 Interventions most closely associated with the implementation of IDPs in support of strategy integration

Acts	Policies, Plans and Strategies
Housing Act No. 107, Section 9(1)(f) (1997)	Land-use Management Systems
National Land Transport Transition Act (2000)	Integrated Development Plan
Municipal Systems Act (2000)	Spatial Development Framework
Land-use Management Bill (9-1A 230603) (2003)	Environmental Management Framework
Municipal Planning and Performance Management Regulations (2001)	Land Transport Framework
National Environmental Management Act (1998)	Urban Development Framework (1997)
Development Facilitation Act 67 (1995)	Strategic Plan for Housing (2002-2005)
	Public Works Strategic Plan (2006 – 2010)
	Density policies
	Integrated Transport Plans
	Housing Master Plans
	Human Development Strategies
	Growth and Development Strategies
	National Spatial Development Perspective
	White Paper on National Transport Policy (1996)
	Moving South Africa: the Action Agenda (1999)
	Town Planning Schemes
	2010 Transport Action Plan
	National Land Transport Strategic Framework (2006-2011)
	National Transport Planning Guidelines & Requirements for the implementation of the national Land Transport Transition Act 2001

What is of great importance is, of course, how suitable these components are in their existing format to connect to and/or enact the T.C.M.P. in the South African Planning system. To this end Table 10.2 has been compiled as a result of the research undertaken in this study. It shows the extent to which the legislation and interventions identified above contribute to achieving integrated strategies in terms of:

- Creating balanced packages of measures conducive to integration
- Supporting the objectives of integrated strategies
- The use of methods measuring the extent to which the objectives of integrated strategies are being achieved
- Containing the underlying components of integrated strategies

Table 10.2 Assessing the extent to which the key components of the South African planning system contribute to achieving integrated strategies

Legislation, Policies, Plans and Strategies	Balanced packages	Achieves the objectives of integrated strategies								Methods measuring objectives achievement				Components of integrated strategies								
		Sustainable development	Economic development	Environmental protection	Liveable streets	Safety	Equity /social inclusion	Accessibility	Integration	Criteria	Indicators	Thresholds	Targets	Institutional framework	TDM measures	TSM measures	LUM measures	"Smart Growth" measures	Environmental Mgmt	Public participation	Appraisal	Funding
Housing Act, No. 107, Section 9(1)(f) 1997		✓	✓		✓	✓	✓		✓		✓	✓	✓	✓			✓			✓	✓	✓
National Land Transport Transition Act (No. 22 of 2000)		✓	✓	✓		✓	✓	✓	✓					✓	✓	✓	✓		✓	✓		✓
Municipal Systems Act, 2000		✓	✓	✓		✓	✓		✓		✓		✓	✓						✓	✓	✓
Land-use Management Bill (9-1A 230603), 2003		✓	✓	✓			✓		✓		✓		✓	✓			✓		✓	✓		✓
Municipal Planning and Performance Mgmt. Regulations, 2001		✓		✓			✓		✓		✓			✓			✓		✓	✓	✓	✓
National Environmental Mgmt. Act No. 107, 1998		✓	✓				✓							✓					✓			
Development Facilitation Act 67 (1995)		✓	✓	✓	✓	✓	✓							✓			✓		✓	✓		
Land-use Mgmt. Systems		✓	✓	✓			✓	✓	✓					✓			✓		✓	✓	✓	✓
Integrated Development Plan	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spatial Development Framework	✓	✓	✓	✓			✓	✓	✓		✓		✓	✓		✓	✓		✓	✓	✓	✓
Environmental Mgmt. Framework		✓	✓	✓			✓	✓			✓		✓	✓					✓	✓		✓
Land Transport Framework	✓	✓		✓			✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Urban Development Framework, 1997		✓	✓	✓	✓	✓	✓✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	✓
Strategic Plan for Housing, 2002-2005		✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓			✓		✓
Public Works Strategic Plan 2006 - 2010		✓	✓			✓		✓			✓		✓	✓		✓					✓	✓
Density Policy		✓	✓	✓			✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓		
Integrated Transport Plans		✓	✓	✓			✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Housing Master Plans		✓	✓	✓			✓	✓	✓				✓	✓			✓	✓	✓	✓		
Human Development Strategies		✓					✓	✓	✓				✓	✓				✓	✓	✓		
Growth and Development Strategies		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
National Spatial Development Perspective		✓	✓	✓			✓		✓		✓			✓		✓			✓	✓		
White Paper on National Transport Policy 1996		✓	✓	✓			✓		✓		✓			✓		✓			✓	✓		
Moving South Africa: the Action Agenda, 1999		✓	✓	✓					✓		✓			✓		✓			✓	✓		
Town Planning Schemes		✓	✓	✓					✓		✓		✓	✓		✓			✓	✓		✓
2010 Transport Action Plan		✓	✓	✓					✓		✓			✓		✓			✓	✓		
National Land Transport Strategic Framework 2006-2011		✓	✓	✓					✓		✓			✓		✓			✓	✓		
National Transport Planning Guidelines & Requirements for the Implementation of the National Land Transport Transition Act 2001		✓	✓	✓					✓		✓			✓		✓			✓	✓		

Sources: Author's own construction

Table 10.2 demonstrates that the legislation identified as supporting an IDP goes some way to contributing to strategy integration but stops short of encouraging full strategy integration. Fundamentally though, it shows that the (i) National Land Transport Transition Act (No. 22 of 2000) (ii) Municipal Systems Act (2000) (iii) Land-use Management Bill (2003) (iv) Municipal Planning and Performance Management Regulations (2001) (v) National Environmental Management Act No. 107 (1998) and (vi) Development Facilitation Act 67 (1995) have the potential to be enhanced to facilitate the connection between the T.C.M.P. and the South African planning system. The following sub-sections recommend how these legislative components are to be enhanced.

10.3.1.1 National Land Transport Transition Act (No. 22 of 2000)

The National Land Transport Transition Act prescribes the plans, policies, principles, requirements, guidelines, frameworks, norms and standards that must be the same for all the provinces of South Africa, introducing and establishing the land transport system for the country as a whole. Part 7 of the Act identifies the requirements for land transport planning to be integrated with the land development process and the transport plans required for that purpose, designed to give structure to the function of "municipal planning" mentioned in Part B of Schedule 4 of the Constitution.

Part 7, Section 3 requires that transport plans must be developed and form part of the integrated development plans, with due regard to Section 84(1)*(a)*, 84(2) and 84(3) of the Local Government: Municipal Structures Act (1998) to enhance the effective functioning of cities, towns and rural areas through integrated planning of transport infrastructure and facilities and public transport services within the context of IDPs and land development objectives as required by Section 27 of the Development Facilitation Act (1995).

To ensure that all plans prescribed by the Act address the integration of transport and land-use planning within the context of the Development Facilitation Act (1995), the National Land Transport Transition Act Part 7 Section 19 paragraph 1 requires 7 specific plans and/or strategies in support of this aim and sets out clear priority issues to this end. As the Act does not specify dealing with traffic congestion as a priority or require a plan that will manage traffic demand management and congestion within the context of integrated transport and spatial planning as contemplated under Part B of Schedule 4 of the Constitution, it is recommended that a T.C.M.P. be introduced as a provision of the Act to fill this gap and create integrated strategies.

The recommendation is therefore that the Act be amended to include a requirement specifying that a T.C.M.P. as an additional sectoral plan is required under the provision of Section 27 of the Act. Figure 10.1 below illustrates the position of the T.C.M.P. within the context of the other national strategies required by the Act.

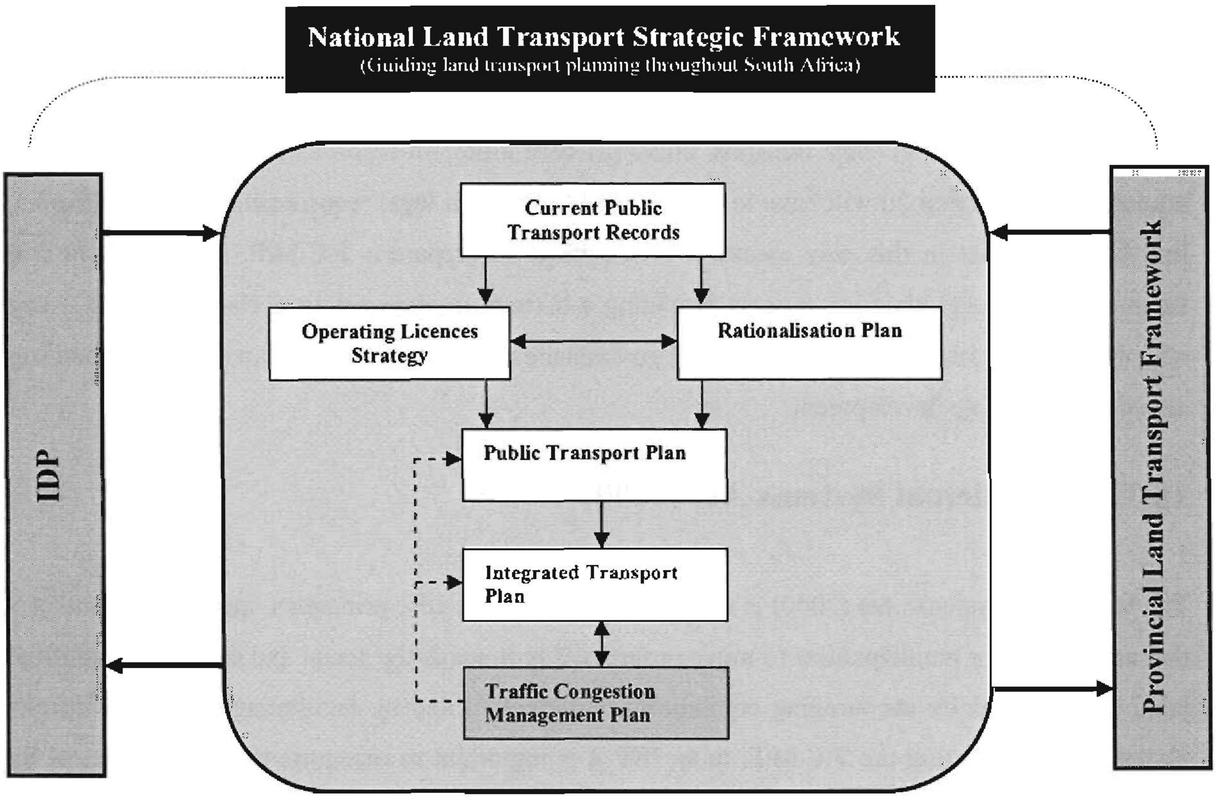


Figure 10.1 Positioning the T.C.M.P. along with the existing 7 plans required by the National Land Transport Transition Act

As part of the amendment to the Act it is also recommended that Part 7 Section 19 paragraph 7 of the Act be amended to specify the following elements of content and requirements of the T.C.M.P. as a 5 year plan:

a) A description of the T.C.M.P.'s vision, policy and objectives, consistent with national and provincial policies with due regard to relevant integrated development planning or land development objectives, the objectives and proposed development strategies of other relevant sector plans.
b) An overview of transport system demand and spatial development needs.
c) An assessment of the operational performance of the highway network and its interaction with land-use.
d) A requirement to identify traffic problem areas and congested corridors and to illustrate them with corridor plans.
e) A requirement to identify suitable measures for alleviating traffic congestion using stakeholder consultation and the D.A.D.F.
f) An implementation plan setting out in order of preference and priority, the projects (integrated strategies transposed to projects) and project segments (part of the integrated strategy) to be carried out in that five year period, and the cost of each project.
g) An investment strategy and detailed budget, including funding sources for the relevant financial year.

h) A requirement to monitor and evaluate integrated strategies using performance indicators.

Finally, as Part 7 Section 20 of the Act requires the plans it proposes to be prepared by (i) Transport authorities, in respect of their transport areas (ii) core cities, in respect of their MTAs and (iii) other municipalities, Section 20 will have to be amended to reflect a legal requirement to prepare the T.C.M.P. Enhancing the Act in this way creates a requirement to prepare a T.C.M.P. as part of the National, Provincial and Local planning process providing a bottom up approach to decision-making, a degree of autonomy to the lowest level of institutional governance and a mechanism to develop integrated strategies aimed at sustainable development.

10.3.1.2 Municipal Systems Act (2000)

The Municipal Systems Act (2000) is designed to provide the core principles, mechanisms and processes that are needed for municipalities to move progressively towards the social and economic "upliftment" of local communities by encouraging community participation and by facilitating integrated development planning. In connecting the T.C.M.P. to an IDP it is important to recognise that the Municipal Systems Act, 2000 sets out the contents of IDPs, their core components and the processes or phases to be followed for planning, drafting, adopting and reviewing them at Municipal and District level. Chapter 5 Part 1 section 23 of the Act forces municipal planning to be developmentally oriented and requires municipalities to adopt IDPs as an inclusive and strategic plan for the development of the municipality which links, integrates and co-ordinates plans and takes into account proposals for the development of the municipality.

In that the Municipal Systems Act seeks greater integration and the D.A.D.F via the T.C.M.P. can provide integrated strategies – the D.A.D.F provides the missing link to the IDP that forces greater policy integration within a traffic congestion management context. The T.C.M.P. and the integrated strategy it proposes through the D.A.D.F. will greatly benefit if developed in collaboration with the output from the various sectoral plans supporting the IDP and the project proposals brought about by the IDP process contemplated by Chapter 5 of the Municipal Systems Act (2000) as it cuts across and weaves together the dimensions of sustainable development. The weaving or integration produces inputs into the T.C.M.P. and reiterates alignment to the sectoral plans that support an IDP. By implication this reiterates the T.C.M.P.'s status as a sectoral plan (positioned within the transport sector) facilitating overlap between sectoral plans and strategies because it is aligned to the strategies, objectives, the vision and the outputs of the various sectoral plans that support an IDP. As a result the T.C.M.P. as a process logically slots in under the umbrella of an aggregate plan such as an IDP which co-ordinates and implements the various sectoral and multi-sectoral plans as illustrated by Figure 10.2 below.

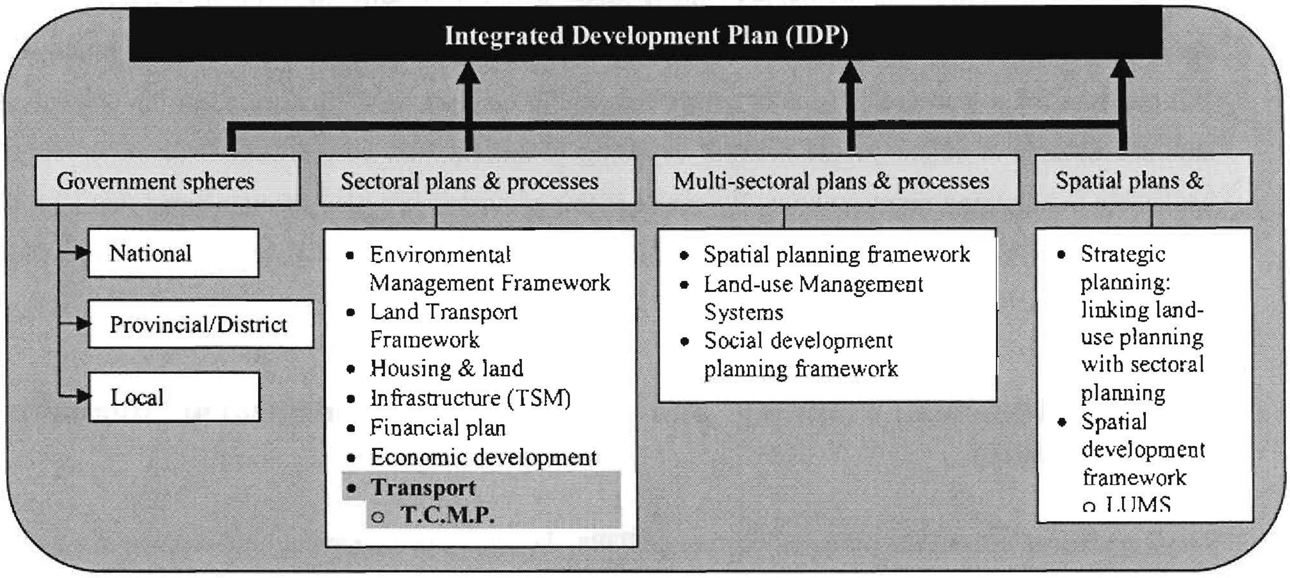


Figure 10.2 Positioning the T.C.M.P. within South African planning in the context of an IDP

Sources: Author's reconstruction from the IDP Nerve Centre (2006)

As Chapter 5 Part 1 section (26) of the Act sets out the core components of IDPs and in particular the requirement that the municipality's development strategies must be aligned to any national or provincial sectoral plans and planning requirements, it is recommended that Chapter 5 Part 1 section 26 of the Act be amended specifying that a T.C.M.P. must form part of a municipal IDP as an additional component as illustrated by Figure 10.2. It will also be necessary to align an IDP that incorporates a T.C.M.P. to the objectives of the District IDP framework to avoid potential conflicts by considering each other's visions, objectives and core outputs.

It is not recommended that the T.C.M.P. is positioned within a District IDP framework because of the different levels of focus. However, as the municipality forms part of a much larger socio-economical regional entity that has very real connections with the District and Provincial jurisdictions, T.C.M.P. decisions can not simply be made at Local Government level without considering their wider implications.

10.3.1.3 Land-use Management Bill (9-1A 230603) (2003)

The Land-use Management Bill provides for the uniform regulation of land-use management in South Africa setting out the principles for spatial planning, land development and land-use management and provide for development of SDFs. Chapter 3 Section 17 (1) of the Bill requires the development of SDFs as part of an IDP as well as Section 26(e) of the Municipal Systems Act and Section 24 of the National Environmental Management Act, 1998 (Act 107 of 1998). For the Bill to facilitate LUM through the D.A.D.F. it is recommended that Chapter 3 Section 17 (2) of the Bill is amended in that it enacts the need for land-use management and spatial planning in South Africa to consider the principles and objectives of the T.C.M.P. in developing integrated strategies. Chapter 4 Section (21) of the Land-Use Management Bill provides for a land-use scheme to give effect to IDP and the SDF. In setting out the contents of a land-use scheme it refers to the scheme as being consistent and co-ordinated with other schemes applicable to adjoining municipalities. By virtue of this provision it is also recommended that Chapter 4 Section (21) of the Bill be amended to recognise the objectives of the T.C.M.P. described in section 10.4.1.

10.3.1.4 Municipal Planning and Performance Management Regulations (2001)

The Regulations set out the planning content of IDPs, the nature of municipal performance management systems and how to encourage community participation in respect of integrated development planning and performance management. In essence it also provides a framework measuring the extent to which the IDP achieves its objectives and assesses the performance of local authorities in achieving the delivery of key civic services. By implication, when positioning the T.C.M.P. within the IDP the performance management-system enacted by Chapter 3 of the Municipal Planning and Performance Management Regulations (2001) must reflect a requirement to measure the performance of the T.C.M.P. and so it is recommended that Chapter 3 is amended to reflect this requirement.

10.3.1.5 National Environmental Management Act No. 107 (1998)

Chapter 5 Section 23 of the National Environmental Management Act (1998) sets out to promote the application of appropriate environmental management tools in order to ensure the integrated environmental management of development activities. The key objectives of the Act are to (i) promote the integration of the principles of environmental management set out in Section 2 of the Act regarding the making of all decisions which may have a significant effect on the environment (ii) identify, predict and evaluate the actual and potential impact of development on the environment, socio-economic conditions and cultural heritage and the risks, consequences, alternatives and options for mitigation of development activities and (iii) identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in Section 2 of the Act. The Act applies to National, Provincial/District and Municipal authorities.

Because the DA.D.F. through the T.C.M.P. considers the environmental impact of the measures it appraises as part of the integrated strategy it supports the environmental management objectives set out by the Act. In terms of operationalising the T.C.M.P. and appraising the resulting integrated strategies, the appropriate mode of environmental management has been identified as Strategic Environmental

Assessment at the empirical stage of the study. Once integrated strategies have been developed (whilst considering environmental concerns), and transposed into smaller projects as part of a package of works, they must be assessed using Environmental Impact Assessment. Because the National Environmental Management Act provides for Integrated Environmental Management of plans at National, Provincial/District and Municipal levels it will also cover a T.C.M.P. once enacted as part of an IDP and so requires no specific amendments. Similarly no specific amendment is required to the National Environmental Management Act to appraise projects produced by the T.C.M.P. as all spatial and infrastructure projects are currently subject to EIA. However, this section has shown that the process of developing sustainable and environmentally considerate integrated strategies is subject to and supports the National Environmental Management legislation and that the Act promotes and supports packages of measures (such as integrated strategies) that are in line with its environmental management principles.

10.3.1.6 Development Facilitation Act 67 (1995)

The Development Facilitation Act is a key legislative component in South African Planning closely associated with the National Land Transport Transition Act (No. 22 of 2000) and the Municipal Systems Act (2000) in giving direction to land development and integrated development planning. It sets out the principles for land development in South Africa and the aspects land development objectives must relate to. Although the Act sets out key principles in promoting efficient and integrated land development that applies to all land development in South Africa, the principles do not extend far enough in acknowledging integrated strategies as a prerequisite to the T.C.M.P.

In positioning the T.C.M.P. within the IDP the principles of the Act need to be enhanced for the IDP to fully implement land-use development guidelines and regulations in line with land development objectives and to fully support and align the T.C.M.P. objectives to those of the IDP. The Development Facilitation Act sets out a number of very strong principles for land development to adhere to, but in practice not all are designed for, or built into, the plans they were envisaged for. A critical flaw of the Act from the T.C.M.P.'s point of view, is that Section 3, paragraph (iv) of Chapter 1 suggests that the use of existing roads and transportation must be "optimised" without suggesting how to achieve this objective in terms of creating new roads, nor does it set out principles that encourage land development which is integrated with the provision of transport facilities or the management of such facilities as required by the National Land Transport Transition Act (2000) or its principles that will provide a "convenient " connection between the T.C.M.P. and IDP.

To this end it is recommended that the following additional principles be included in Section 3, Chapter 1 of the Act:

- Promote the integration of land development and the provision of transport infrastructure and its use

- Encourage land-use management aimed at traffic congestion reduction
- Encourage the use of land development instruments conducive to creating densely populated residential areas
- Promote the integration and alignment of land development objectives and transport in encouraging traffic congestion reduction

In developing land development objectives as specified in Section 28, Chapter 4 of the Act it is recommended that the following aspects be included for the purpose of positioning the T.C.M.P. within the IDP:

1) Recognise the positioning of the T.C.M.P. within the IDP
2) The integration of land-use and transport
3) The planning of transport demand management
4) Traffic congestion management
5) Traffic management
6) Spatial densification
7) Safety and reliability of the surface transport system
8) The provision of highly connected and accessible urban nodes

Once these amendments have been made to the Act, it will ensure that the T.C.M.P. through the IDP is aligned to the principles of the Act and vice versa. In effect the amendments enhance the compatibility and alignment between the Act, the IDP and the T.C.M.P. This results in the T.C.M.P. being more effective. To this end the land development principles and the Act will have a useful tool through the T.C.M.P. and the D.A.D.F. in arriving at due environmental management, social care, institutional diligence and economic growth in developing sustainable communities.

10.3.1.7 Policies, Plans and Strategies (interventions)

Table 10.2 showed that a number of selected interventions are conducive to the objectives of the general direction of TDM, TSM and LUM integration and will play an important part in positioning the T.C.M.P. within an IDP. These interventions are: (i) IDPs (ii) Land-use Management Systems (iii) Spatial Development Frameworks (iv) Environmental Management Frameworks (v) Land Transport Frameworks (vi) Urban Development Frameworks (vii) Strategic Plans for Housing (viii) Integrated Transport Plans (ix) Growth and Development Strategies and (x) Public Works Strategic Plans. It is anticipated that once the legislative amendments have been made to National planning legislation as recommended by section 10.3.1.1 to 10.3.1.6 it will be possible to align and better integrate their objectives to that of the T.C.M.P. at Municipal level. To this end the interventions of the future need to consider and acknowledge the objectives of the T.C.M.P.

10.3.2 Positioning the T.C.M.P. within an IDP

The previous section recommended how to connect and enact the T.C.M.P. within the South African planning system in general by suggesting legislative amendments be made to existing planning law. This section goes a step further in explaining how to position the T.C.M.P. within the IDP planning process. For the T.C.M.P. to form part of the 5 planning phases of the IDP planning process: (i) analysis (ii) strategies (iii) projects (iv) integration and (v) approval, it requires enhancement in line with the recommendations of section 10.3.1.2. The following subsections set out these recommendations.

10.3.2.1 Phase 1 - analysis

To encourage strategic and implementation-oriented decisions about how to make best use of scarce resources, the Municipal Systems Act states that the IDP requires an assessment of the existing level of development. Consequently Phase 1 involves assessment and participatory issue identification - the focus of the planning process being at the local level. The analysis carried out by municipal staff covers an economic analysis, environmental analysis, institutional analysis, spatial analysis and a socio-economic analysis. However what is missing from the current analysis process is a strategic/holistic transport or traffic (congestion) assessment or analysis of traffic problems and how it relates to the various planning sectors. For Phase 1 to do the IDP integration process justice and to connect the IDP to the T.C.M.P. it needs to be enhanced as shown by the yellow boxes in Figure 10.3 to (i) consider and review the local transport system demands and spatial development needs (ii) assess the operational performance of the highway network and its interaction with spatial planning and the environment and (iii) identify traffic congestion problem areas and congested corridors.

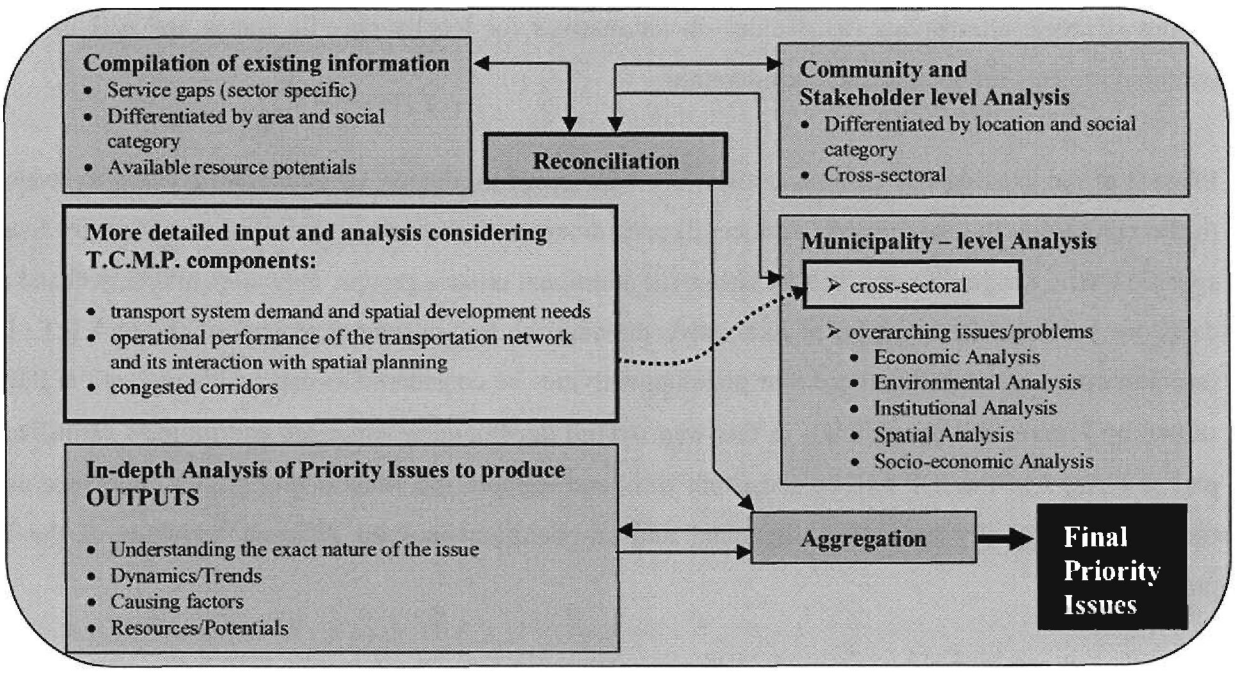


Figure 10.3 Amending Phase 1 of the IDP to accommodate the T.C.M.P.

Sources: Author's reconstruction from the IDP Nerve Centre (2006)

That is why the Municipal Systems Act needs to be amended so that Phase 1 of the IDP coincides with the strategic content analysis and assessment of the operational performance of the highway stages of the T.C.M.P., described in Section 10.4.3 and graphically illustrated by Figure 10.8. So, in essence, for the T.C.M.P. to be fully operationalised within the IDP, the IDP requires a wider scope of data to be collected in addressing not only spatial, environmental and socio-economic priorities but also those relating to traffic congestion - achieved with the help of aligning Phase 1 of the IDP to the strategic content analysis and operational performance of the highway assessment stages of the T.C.M.P. The end product, and also a major challenge of Phase 1, is therefore to join all the pieces of analysis performed at different levels, sectors and places into a consolidated list of **priority issues** which does justice to all stakeholders involved and to all information sources. By adapting Phase 1 of the IDP in this way it is possible to position the T.C.M.P. within the framework of Phase 1 as shown by Figure 10.3.

10.3.2.2 Phase 2 - strategies

During **Phase 2** of the IDP process, as shown by Figure 10.4 a multitude of stakeholders is brought together to determine (i) a **vision** for long-term development (ii) development **objectives** for the elected term of the council and (iii) development **strategies** which must be aligned to national or provincial sector plans and planning requirements.

Once a vision for long term development has been identified, development objectives are formulated from the priority issues identified in Phase 1. This process must occur cross-sectorally to increase sector alignment. By engaging stakeholders and the public at different local and district levels in debate and by formulating objectives it sets the stage for formulating development strategies through a process that (i) creates strategic alternatives (ii) decides on alternatives for locally specific issues and (iii) identifies potential projects for costing and consideration.

Phase 2 of the existing IDP process is therefore well suited to identify (i) objectives relating to reducing traffic congestion in a sustainable manner (ii) preliminary and alternative measures or options for locally specific traffic congestion and priority issues (ii) additional criteria groups, indicators and targets and (iv) decisions between the selection of alternative measures to be considered as part of the D.A.D.F. It is therefore recommended that these four planning activities be considered as part of Phase 2 of the IDP as shown by Figure 10.4 (in yellow). In this way overall development strategies and projects identified as part of Phase 2 of the IDP will be consistent with, and support, the integrated strategies developed using the T.C.M.P. thereby increasing alignment and co-operation between different activities of the IDP process.

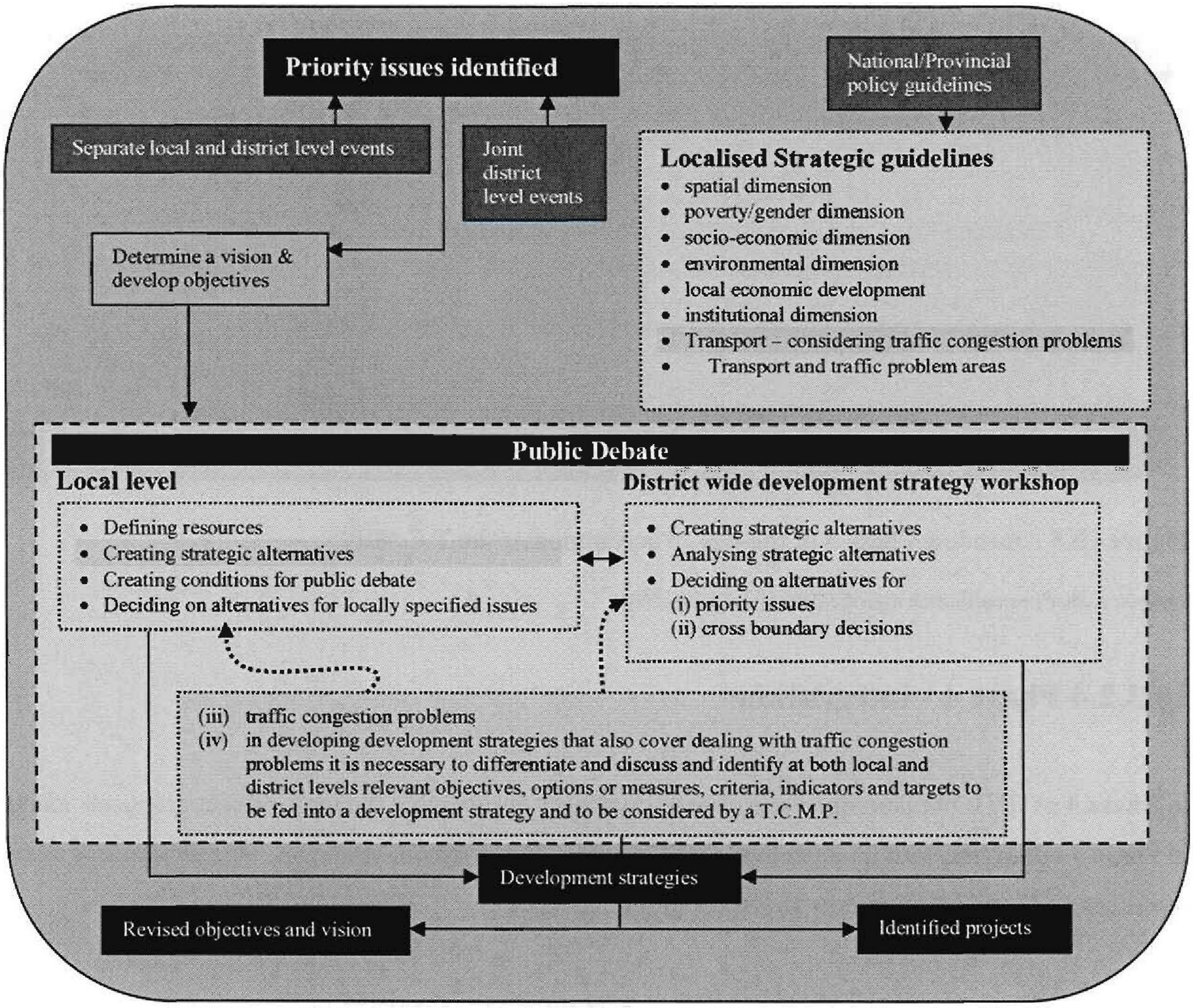


Figure 10.4 Amending Phase 2 of the IDP to accommodate the T.C.M.P.

Sources: Author's reconstruction from the IDP Nerve Centre (2006)

10.3.2.3 Phase 3 - projects

During **Phase 3** of the IDP the municipality specifies **project proposals** for implementation based on the strategies and potential projects identified in Phase 2. One of its key outputs is designing draft project proposals.

Figure 10.5 shows how the existing IDP Phase 3 operates and the yellow boxes illustrate how it needs to be enhanced to accommodate integrated strategies transposed into draft projects. The purpose of enhancing phase 3 is that the integrated strategies developed by the T.C.M.P., transposed into draft project proposals are integrated, aligned and assimilated into the IDP process. In this way the outputs of phase 3 will be the development of draft projects that incorporate the T.C.M.P. draft projects. It also very much means the IDP phases up to this point must be synchronised to the T.C.M.P. planning process.

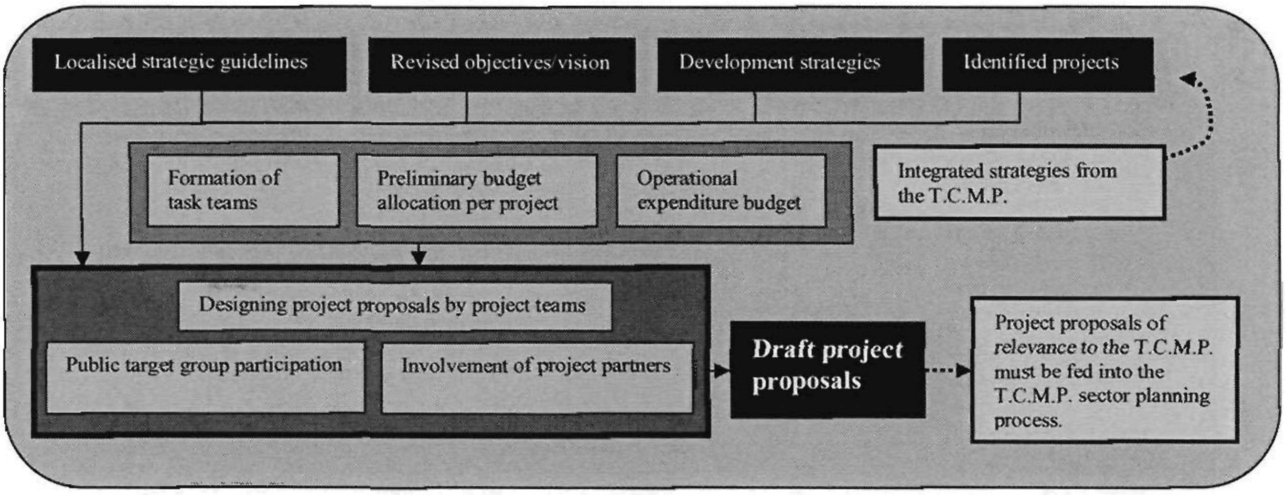


Figure 10.5 Amending Phase 3 of the IDP to accommodate the T.C.M.P.

Sources: Author's reconstruction from the IDP Nerve Centre (2006)

10.3.2.4 Phase 4 - integration

In **Phase 4** of the IDP planning process the municipality ensures that the draft project proposals identified in Phase 3 are in line with its objectives and the agreed development strategies, both in terms of available resources and legal requirements as shown by Figure 10.6.

Critical to this stage is that individual draft project proposals identified in Phase 3 must be harmonised with those contained in the sectoral plans of the sector agencies at National, Provincial and Municipal level in terms of contents, location and timing to arrive at consolidated and integrated programmes for the municipalities and for the sector agencies involved in the provision of services within a municipality. This phase is crucial for arriving at an Integrated Development Plan.

And so it is recommended that the draft project proposals produced by the T.C.M.P. be incorporated into Phase 4 of the IDP to be integrated with the draft project proposals and various other sectoral programmes. An enhanced Phase 4 will lead to greater acceptance of the T.C.M.P. in that a bottom up approach has been followed to problem identification but also because the cross-cutting nature of the IDP process will come to the fore. Phase 4 is therefore about integrating (horizontally and vertically) the ideas, concerns, strategies and potential projects developed through phase 1-3 into relevant sectoral plans from a bottom up perspective resulting in an operational strategy (required by the Municipal Systems Act) as shown by Figure 10.6.

The operational strategy is a consolidation of sectoral programmes and/or sector plans for each sector agency compiled from IDP sector-specific projects, sector components of multi-sectoral IDP projects and from other non-IDP related sectoral activities. As part of the study recommendations, Figure 10.6 also shows a T.C.M.P. as part of the operational strategy demonstrating alignment to and support for the SDF, Integrated Transport Plan, Growth and Development Plan, Integrated Environmental Management Programme and an Integrated Poverty Reduction and a Gender Equity Programme. In this way the IDPs operational strategy co-ordinates spatial needs, environmental concerns, economic growth, development needs, manages traffic congestion and encourages social wellbeing. Once such as an alignment and integration process has been undertaken a draft IDP is produced as an end product of Phase 4.

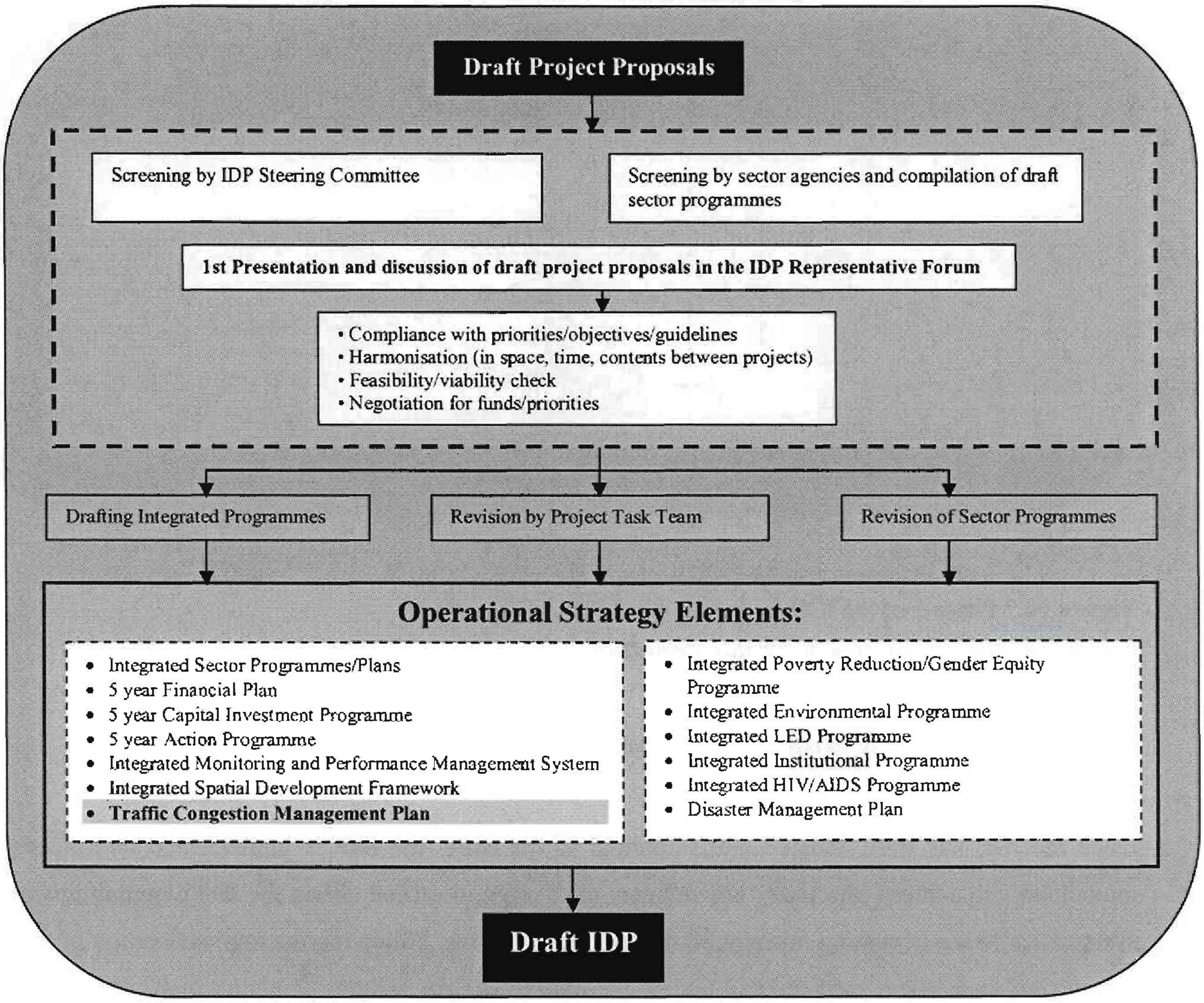


Figure 10.6 Amending Phase 4 of the IDP to accommodate the T.C.M.P.

Sources: Author's reconstruction from the IDP Nerve Centre (2006)

10.3.2.5 Phase 5 - approval

The purpose of **Phase 5** of the IDP as shown by Figure 10.7 is the adoption of the IDP by the municipal council. Phase 5 does not specifically have to be amended in terms of positioning the T.C.M.P. within the IDP as amending phases 1-4 have been instrumental in achieving this objective. Once the IDP has been adopted, it becomes a very useful planning tool in delivering outputs to deal with the problem areas at a local level. The T.C.M.P. is also positioned within an aggregate plan with a very real chance of bringing about meaningful change to managing traffic congestion levels.

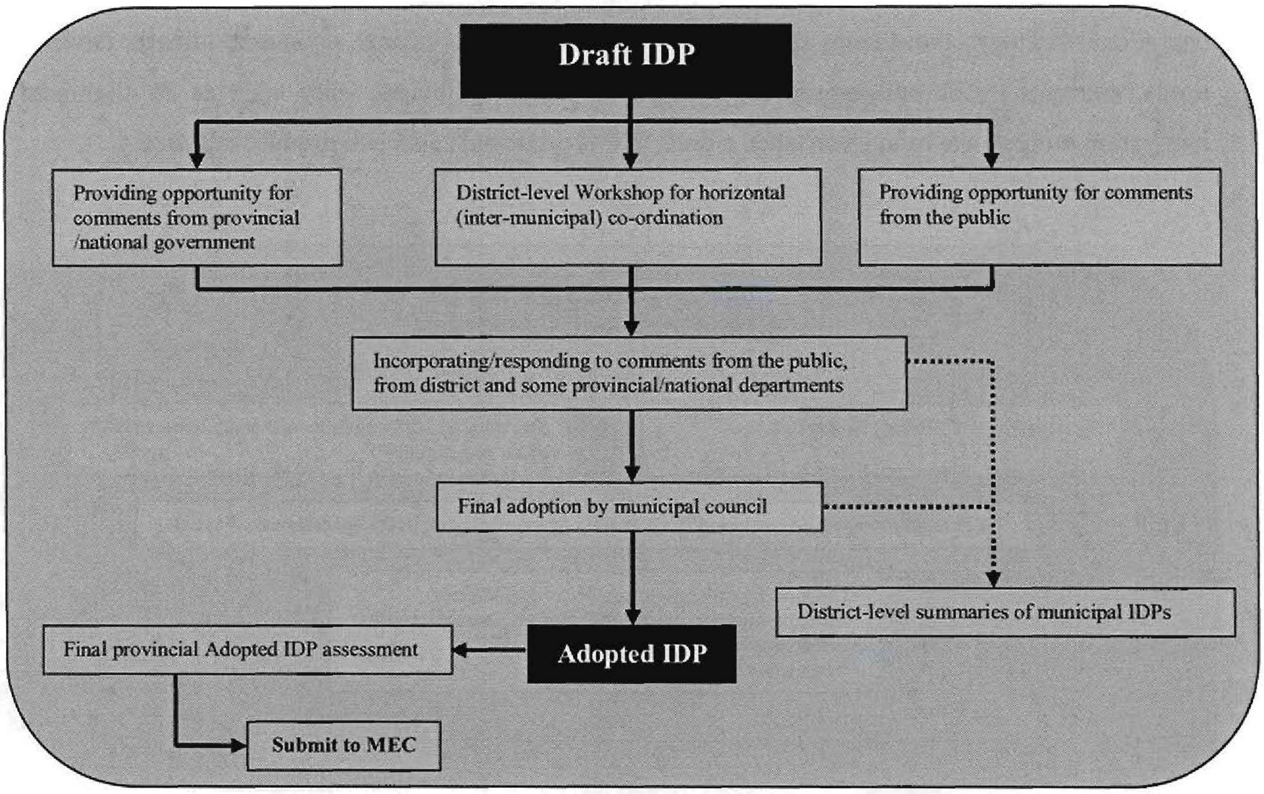


Figure 10.7 Phase 5 of the IDP
Sources: Author's reconstruction from the IDP Nerve Centre (2006)

10.3.2.6 Implementation, monitoring, evaluation and review of the IDP

Once the IDP has been adopted and submitted to the MEC the IDP is implemented and allows the municipality to address effectively key delivery challenges identified during the IDP planning process by systematically implementing meaningful and realistic projects. Following the implementation of the IDP it is critical to monitor, evaluate and review the Plan to use the insights gained through monitoring and evaluation to redraft the relevant sections of the IDP document as necessary. Integrated Development Planning is therefore a cycle of planning, implementation, monitoring and review.

10.3.3 The requirement for an integrated T.C.M.P. support unit (ISU)

To ensure the attainment of the goals and objectives and implementation of the T.C.M.P., it is recommended that an ISU is established within each local and metropolitan municipality to bring together expertise from within the municipality or externally (as appropriate) to deal with the complex consultative and strategic implementation processes. The following sub-sections explain the requirement and purpose of the recommendation.

10.3.3.1 Why an ISU?

The South African planning system is fragmented with similar functions being duplicated and carried out at various horizontal and vertical levels of governance. Even within local and metropolitan municipalities communication, interaction and integration of functions required by the IDP and more specifically the Municipal Systems Act do not occur efficiently. In moving towards a situation that provides the T.C.M.P. with the best chance of succeeding, an ISU is recommended as a unit run by (or on behalf of) a local or metropolitan authority that helps secure the alignment of the T.C.M.P.'s vision, objectives, activities and output to that of the local or metropolitan municipality's policy objectives, spatial development and sectorally identified needs. In this way the ISU brings together all planning related activities, procurement, monitoring, and collating and management functions across a range of municipal, metropolitan and non-governmental service areas. Having an ISU as a "super department", as suggested by section 9.3.12 of Chapter 9, within a single organisational unit rather than in a number of separate teams may also result in efficiency gains over disconnected organisational options. Such advantages will become increasingly important with the growing demands on the public purse.

10.3.3.2 The aims of an ISU

An ISU as a well-managed and focused organisational structure is envisaged in order to improve the delivery and implementation of the T.C.M.P. by planning and setting out how to manage traffic congestion effectively whilst maintaining sustainable development. To this end the ISU must aim to:

(i) reduce traffic congestion whilst considering the aims and objectives of other council departments
(ii) develop the T.C.M.P. objectives, vision, policies and strategies
(iii) ensure the co-ordination, implementation and the management of the T.C.M.P.'s projects and operations
(iv) perform financial planning
(v) facilitate public consultation
(vi) ensure strategic planning and integration of all dimensions of sustainable development
(vii) ensure the objectives of infrastructure management are aligned and considered in the D.A.D.F.
(viii) ensure the objectives of environmental management is adequately considered in the D.A.D.F.
(ix) encourage economic growth and development
(x) ensure socio-economic aspects of planning are given sufficient attention
(xi) ensure transport demand and supply management, safety, security and law enforcement is considered in developing integrated strategies

(xii) encourage horizontal and vertical departmental co-operation and communication especially in terms of data sharing

In this way no single department is dominant in terms of implementing the T.C.M.P. – all are equal and provide input into the T.C.M.P. on a level playing field. This ensures that the overall aims and objectives of the T.C.M.P. and developmental local governance are institutionalised and maintained. An ISU will therefore encourage greater understanding of the work being done by each municipal department resulting in a more effective and efficient T.C.M.P.

10.3.3.3 Potential benefits and costs of implementing an ISU

In moving towards the implementation of an ISU it is important to consider the benefits and costs associated with establishing and operating such a unit as illustrated by Table 10.3. Clearly, the benefits and costs will vary significantly in magnitude depending on the existing situation and the local circumstances of the local authority. Although it is the author's view that the operational benefits of implementing an ISU outweigh the costs on efficiency grounds, the following benefits and costs will have to be considered by each instigating authority in deciding between suitable organisational variants and operational arrangements (discussed in more detail in paragraph 10.3.3.5).

Table 10.3 The benefits and costs to be considered in establishing and operating an ISU

Benefits	Costs
• Implementing an ISU presents the opportunity to assemble a team of professionals with the skills and experience to successfully implement a T.C.M.P.	Changing management support from external consultants may be required to support the achievement of tight project timescales and budgets
• More efficient staff utilisation	Potential staff and office re-location costs
• Enhanced and integrated planning	Staff training costs
• The potential to maximise the potential and talent of in-house human resources	Staff package costs – costs associated with any staff redundancies or early retirements where staff numbers are reduced
• Greater flexibility to meet new policy challenges	Contingency plan costs
• Integrates, mitigates and considers different sectoral perspectives, needs and concerns	Re-siting of IT systems

Sources: Author's own construction

10.3.3.4 Considering implementation issues

In implementing an ISU the following issues need to be considered to encourage efficiency benefits from an early stage:

- Consider staff (institutional) issues associated with the organisational changes and implementation of an ISU to overcome uncertainty engendered by the prospect of change
- Consider training and education requirements of staff who are responsible for producing and implementing the T.C.M.P.

- Develop a new cultural or a common understanding and ethos among ISU staff members in terms of the purpose of the unit and its activities
- Consider an integrated and high quality IT system that can underpin the whole process of integrated planning, procurement, monitoring and review as key components of an efficient and effective ISU
- Develop a business process that considers and meets the needs of the new operating environment at an early stage
- Develop a process of performance monitoring measuring the output of the T.C.M.P. and the extent to which it serves its vision and achieves its objectives

10.3.3.5 Organisational variants and operational arrangements

In operationalising the ISU the local and/or metropolitan municipality should consider which organisational structure is most appropriate to its circumstances. To this end it is recommended that the local and/or metropolitan municipality consider the following organisational variants:

1. Ensure technical compliance in preparing and implementing the T.C.M.P. It may be necessary for the ISU to be set up as an **internal technical advisory committee or working group** from existing staff.
2. Where the internal (human resource) technical skill does not exist, to form a technical advisory committee or working group. It will be necessary to **commission consultants to undertake the first few rounds of the T.C.M.P.** alongside the members of the ISU to encourage skill transfer and technical know-how to enable the formation of an internal technical advisory committee or working group at a later date.
3. Alternatively the municipal or metropolitan municipality must consider the cost effectiveness of commissioning a technical advisory committee or working group that consists of consultants and/or external specialists, in other words **outsourcing the ISU** altogether. A key question the local or metropolitan authority will have to ask when deciding whether outsourcing is the right solution for their needs is:

   "Will additional efficiency benefits accrue from an outsourcing arrangement (over and above those from an in-house ISU) that is greater in value than the additional costs that would be incurred in paying a profit-bearing fee to an external organisation?"

In terms of operational arrangements, the local and/or metropolitan municipality should consider where the ISU must sit within the local authority structure in exercising its functions and activities effectively. Historically "transport authorities" are typically located within the Highways, Planning and Transportation, or Environmental departments. This is often largely because that department is responsible for transport or spatial planning strategy implementation and/or transport service delivery. Although the T.C.M.P. is a sectoral plan within the Transport sector it is the author's view that it should not be driven solely from departments usually tasked with transport planning or spatial development so as to reduce (ii) bias (ii) one-sided input and influence on steering the T.C.M.P. in a transport or land development driven direction and (iii) fragmented service delivery.

It is recommended that the ISU is formed as a separate organisational department or entity within the local or metropolitan authority when considering the organisational variants described above. In this way it becomes a focus point that ensures the relevant impetus into the T.C.M.P. takes place by co-ordinating and liaising with relevant municipal departments tasked with spatial development, land development, environmental management, financial planning, growth and development and the development and implementation of sectoral plans and IDPs.

10.4 The structure and components of a T.C.M.P.

Congestion Management is envisaged as a systematic process with the principal goal of alleviating existing, or preventing future, traffic congestion, thereby enhancing the mobility of persons and goods whilst encouraging sustainable development. This section spells out the structure and components of a Traffic Congestion Management Plan as a 5 year plan as well as the considerations and issues to be taken into account in its preparation. Figure 10.8 illustrates the structure and components of a T.C.M.P. planning process and shows how the phases of the IDP are related to it. The sub-sections that follow explain the components and their interrelationship in more detail.

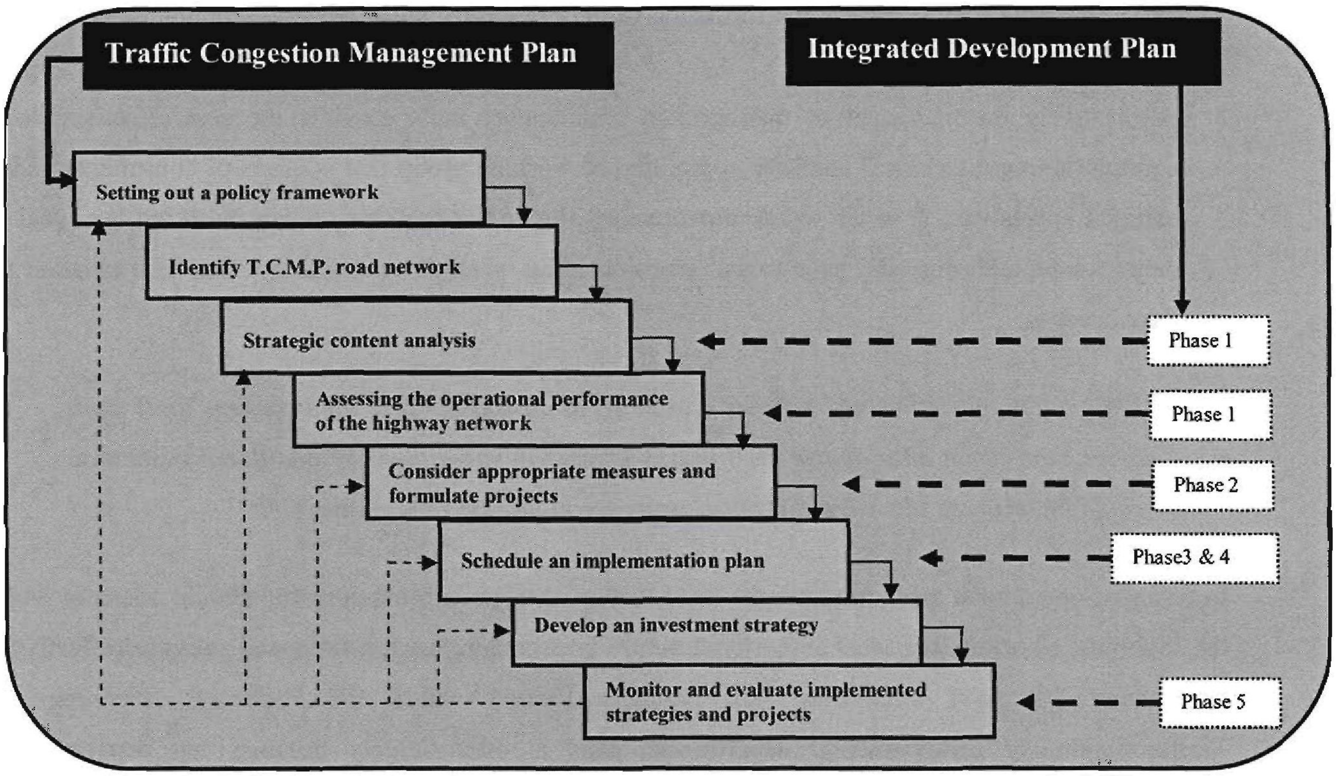


Figure 10.8 Structure and components of a T.C.M.P. planning process and its alignment to IDP phases

Sources: Author's own construction

10.4.1 Setting out a policy framework

In prescribing a policy framework within which a T.C.M.P. will operate, it is necessary to set out its vision, goals and objectives against the "enhanced" legal requirements of the National Land Transport Transition Act 2000 described in section 10.3.3.1. The policy framework must consider national, provincial and local spheres of government in terms of approved spatial, local economic, environmental and development frameworks. Against this background it is recommended that the **vision** of a T.C.M.P. should be to:

> *"Provide a safe, efficient and sustainable urban transportation system that ensures businesses, people and places are connected in a sustainable and cost effective manner with emphasis placed on the provision of public transport and urban densification whilst providing an acceptable standard of living and quality of life without detriment to its competitiveness and growth potential."*

In realising the vision of the T.C.M.P. its intent and **goal** is to link spatial planning, transportation, traffic engineering, economic development and environmental management more directly. It can thereby prompt reasonable "Smart Growth" that will alleviate local traffic congestion, promote effective utilization of available financial resources and minimise the environmental, economic, social and other detrimental impacts it may cause. In fully realizing the goal of the T.C.M.P. it must aim to achieve the following **objectives**:

(i) Promote decision-making that integrates spatial development, land-use management, transportation and infrastructure provision, environmental management, economic growth, housing and financial management

(ii) Consider sectoral objectives and policies across horizontal and vertical levels of government and stakeholders when developing integrated strategies

(iii) Set out guidelines to measure the operational performance of the highway network

(iv) Formulate integrated strategies and transpose them into projects for implementation

(v) Improve the safety and reliability of surface transportation system

(vi) Increase the operational capacity of the existing highway system

(vii) Reduce emissions and environmental costs associated with traffic congestion

(viii) Promote spatial densification of settlements without decreasing accessibility and mobility

(ix) Enhance and/or provide both inter-modal and multi-modal interchange facilities

(x) Reduce Single Occupancy Vehicle (SOV) travel by encouraging the use of more sustainable modes including public transport, walking, cycling and carpooling

To achieve the goals and objectives of the T.C.M.P. the following **procedures** that are transposed into the components of a T.C.M.P. must be included as Figure 10.8 illustrated:

(i) A strategic content analysis to review the plans, programmes, strategies, guidelines and policies (sectoral interventions) relevant to the T.C.M.P. to encourage horizontal and vertical integration and alignment to other sectoral policy objectives
(ii) An assessment of the operational performance of the highway network
(iii) Develop cost-effective integrated strategies to alleviate local traffic congestion
(iv) Implement congestion management (integrated) strategies once transposed into projects
(v) An investment and/or financial plan to aid with funding needs
(vi) Evaluate and monitor the effectiveness of implemented projects

10.4.2 Identifying the T.C.M.P. road network

At the outset of the development of a T.C.M.P. it is necessary to identify the designated highway system to be assessed. The Municipal or Metropolitan Authority must decide and set out the designated road network – the T.C.M.P. Road Network. The network must be created at a level at which transport impacts can be identified, connections can be made between proposed projects and their specific impacts on the network and spatial form can be identified. In identifying the T.C.M.P. road network the following considerations should be taken into account:

- The purpose and function of the road (referring to road classification)
- Known intersections with historic congestion problems
- Land-uses that generate or attract an excessive volume of traffic (in terms of local thresholds)
- The locally acceptable levels of Average Annual Daily Traffic (AADT) volume of the road
- The level of connectivity, accessibility and mobility the road provides for urban facilities

10.4.3 Strategic content analysis

Once the T.C.M.P. Road Network and a policy framework have been identified, the next step in preparing a T.C.M.P. is to review the plans, programmes, strategies, guidelines and policies (sectoral interventions) relevant to the T.C.M.P. - a strategic content analysis. This stage of the T.C.M.P. coincides with phase 1 of the IDP process as illustrated by Figure 10.8. The purpose of the strategic content analysis is to:

(i) Review the structural components of each intervention – the textual make-up of the documents
(ii) Identify priority issues, problems and concerns raised in each intervention
(iii) Review each intervention's proposed strategies or outputs
(iv) Identify the data required to populate the third screening process of the D.A.D.F.

(v) Review the extent to which the interventions involve stakeholder participation

(vi) Review the intervention's funding requirements

(vii) Form a strategic view of the integration potential between the interventions and the T.C.M.P., the level of alignment that exists between the interventions and the alignment potential between the interventions and the T.C.M.P.

By reformulating the purpose of the strategic content analysis it is recommended that the following four **review clusters** are used as a platform to realise the purpose described above:

- A review of the local transport system demands
- A review of the local spatial needs
- A review of development needs
- A review of interventions (sector plans, programmes, strategies and guidelines) relevant to the Local or Metropolitan Authority

The following sub-sections recommend the elements and considerations to be covered by each cluster as a guideline to allow sensible conclusions and inferences to be made.

10.4.3.1 Review of local transport system demands

In providing a picture of the demands on the local transport system it is important to obtain a key set of transport statistics specifically relevant to trip generation, trip distribution, modal spilt and traffic assignment. Accessing such data will inform the decision-maker about trip-making behaviour, movement patterns, the mode by which destinations are accessed and also the demands on the local transport system. Traffic surveys, traffic models, household interview surveys and current Integrated Transport Plans will provide the most accurate sets of data (although they are not the only sources) and should be consulted where available and as appropriate. Traffic data should not be merely collected and collated but compared to earlier survey year data so as to derive trends. In estimating the demands on the local transport system it is recommended that the data types shown by Table 10.4 are collected.

The table shows the minimum data categories and types of data to be reviewed in terms of local transport system demand. Trip purpose and mode data are extremely important in indicating where trips are being made to, the proportions of trips made and in identifying the dominant mode used. In assessing the modal split over a number of years it will be possible to identify the differences in usage between private transport, public transport and the slow modes (walking and cycling). Car ownership as data category will provide information about trip distribution. Of further relevance is household income data as it can be linked to car ownership.

Table 10.4 also shows the types of transport system data required to assess income segment specific trips. For example by assessing a population segment in terms of household income, location and mode of transport it is possible to identify not only public transport infrastructure needs and where demand management may be appropriate, but it will also provide information about travel time, travel costs, trip frequency and trip duration between origins and destinations. Assessing the average walking times between home and accessing public transport modes during the AM and PM peak periods is important for South Africa in establishing whether the public transport network needs to be upgraded to provide more accessible, connective and non-radial services.

Table 10.4 Transport system data considerations

	Data categories								
	Trip Purpose	**Mode**	**Car ownership**	**Segment specific trips**	**Transportation system overview**	**Private transport demand**	**Freight network demand**	**Transportation Demand Management**	**Public transport system**
Data types	Education	Car	Cars per household	Population group	Accessibility of rail network	Road network classification and condition	Trip distribution	Demand management initiatives	Public transport infrastructure status report
	To Work	Walking	Household income	Household income	Capacity of rail network	Private transport demand	Routing	Demand management projects	Metered taxis
	To Home	Cycling		Travel time	Accessibility of road network		Route length		Bus and rail services
	Shopping	Minibus -taxi		Travel costs	Capacity of road network		Freight initiatives		Bus operators
	Social/ Leisure	Bus		Trip frequency	Accessibility of cycle network		Mode of transport		Minibus-taxis operators
	Business	Motor-cycle		Trip duration	Capacity of cycle network		Vehicle kilometres		Travel time and cost
	Recreational	Train		Average walking times from home	Accessibility of walking network				Transfer times
	Collect/ Deliver goods	Other			Capacity of walking network				Fares
					Accessibility of bus network				Levels of dissatisfaction
					Capacity of bus network				Safety of using public transport

Sources: Author's own construction

Another data category of particular importance is a general transportation systems accessibility and capacity review. Having transportation system accessibility and capacity data enables the decision-maker to balance this with the operational performance of the highway network (referred to in section 10.4.4) and to decide where system improvements have to be made if assessed in conjunction with system usage. The Table shows the types of transport system data required to provide an overview of the demand for private transport. In an effort to provide greater insight into the distribution of car trips during the critical peak commuting hours, transport surveys and traffic models will provide valuable data identifying congestion hotspots, locations where unacceptable delays occur and help identify key routing patterns. For this purpose it will be necessary to examine car movements across different urban screenlines / cordons as part of a transport modelling exercise.

In terms of freight network demand it is necessary to obtain data relating to the highway network and rail network demand in terms of their trip distribution, routing, route length and vehicle kilometres travelled and also whether freight-related initiatives have been considered by the Authority. Once heavy goods vehicle movement patterns have been established it will be possible to identify appropriate measures to manage their impact on the highway network. It is also a requirement to identify whether TDM initiatives have been considered in order to reduce traffic congestion at key locations and whether demand management projects have been implemented or considered. A transportation demand management review will provide an opportunity to assess at a more strategic level the level of alignment and importance attached to proposed TDM, TSM and LUM projects and proposals between transport, spatial and development planning and environmental management departments of the authority.

Finally, Table 10.4 shows the types of data to be collected in reviewing key aspects of the public transport system. It suggests a requirement to review the number of minibus-taxi, bus and rail operators in the urban area as well as the percentage of AM and PM peak period trips made involving each mode. It will also be necessary to determine the extent of modal share, intra-modalism and inter-modalism as characteristics of commute journeys. In addition travel time and cost, transfer times and fare data will also be relevant in forming a representative picture of movement patterns associated with travel cost and income groups by geographical or ward area.

10.4.3.2 Review of local spatial needs

In reviewing local spatial needs, it is recommended that the Spatial Development Framework (SDF), Land-Use Management System (LUMS), Integrated Development Plan (IDP) and density policy of the Authority are assessed at a strategic level. In reviewing the local spatial needs it is important to consider the link between spatial planning and LUM. It must be recognised that the SDF is a process contained within an IDP and to be implemented effectively, the SDF requires a LUMS to be in place. In other words, the IDP identifies the need for development. In order for that need to be realized, the SDF guides development processes, i.e. deciding on where the development should take place having considered environmental issues. For the development to actually occur, a LUMS has to be in place in conjunction with a land-use scheme (Town Planning Scheme) that manages, facilitates and controls development to ensure that land-use is planned and implemented in an orderly manner. This understanding will then have to be balanced with the objectives of the T.C.M.P. and Integrated Transport Plan (ITP) in arriving at sustainable spatial development patterns supported by LUMS that encourages a reduction in the need to travel by private vehicles. Table 10.5 shows the elements to be considered in this review cluster.

The first component to be considered is the SDF which outlines developmental principles, policies and goals providing a broad indication of where different types of development should take place within the municipal area. The SDF is the structure, which allows the development of a co-co-ordinated and integrated economic development strategy to harness and exploit opportunities on a large scale throughout the local or metropolitan authority. Because the SDF is one of several plans that forms part of the IDP it is necessary to review its content and the development directions it proposes in assessing whether it has comparative goals and objectives to those of the T.C.M.P. It will also be useful to establish clear linkages between transportation and land-use planning highlighted in the SDF. To arrive at a position where inferences can be made Table 10.5 has identified a number of data types that should be considered as part of the SDF review.

Table 10.5 Elements to be considered in reviewing local spatial needs

	Spatial Development Framework	Land-use Management System	Density policy
Data types	Identifying delineated movement systems	Common and simplified use zones	Residential densification policy
	Identifying nodal development strategies	Designation of special development zones	Density parameters
	Environmental management policies	Mixed use policy and densification	Public transport integration
	Urban boundary identification	Alignment of LUMS to SDF and ITP	CBD densification
	Development of appropriate housing types		Zoning land-uses patterns to encourage less need for travel by SOV
	Location and accessibility		Areas designated for clustered development
	Elements of corridor development		Areas identified for infilling
	The state of existing infrastructure		Infrastructure investment plans that support spatial densification
	Population concentrations		
	Availability and condition of all urban/ civic services		
	Economic opportunities		
	Consideration of areas of conservation		
	Areas that are of historical importance		
	Development strategies		
	Regeneration initiatives		
	The spatial profile of the municipal area		
	Design guidelines		

Sources: Author's own construction

In reviewing the authority's Land-Use Management Systems emphasis should be placed on understanding the use of zoning and the designation of special development zones. The review should also highlight the extent to which the Land-Use Management System supports mixed use policy and the authority's densification policy in general and in particular the alignment between LUMS, the SDF, IDP and the ITP of the authority. This enables the T.C.M.P. to better align inputs into the D.A.D.F. in particular, encouraging synergy between the evolving sectoral plans and strategies.

The third component to be reviewed is the authority's density policy which provides the parameters within which residential, industrial, retail and commercial densification should be encouraged. Once the policy content has been reviewed it will be possible to align the density policy's objectives to that of the outputs of the D.A.D.F. and the IDP as a whole. In this way the T.C.M.P. will support the authority's density policy in encouraging densification along with traffic congestion management proposals in a managed and structured way that further encourages horizontal sectoral integration.

10.4.3.3 Review of development needs

The Local or Metropolitan Authority employs two key documents in addressing development needs in its jurisdiction. They are the IDP and the Town Planning Scheme. For the purpose of reviewing the authority's development needs all elements of the IDP as described by the Municipal Systems Act (2000) and the Planning and Performance Management Regulations (2001) must be evaluated in forming a holistic picture of how the authority proposes to address its needs. It is of the utmost importance that the underlying components of the IDP are reviewed so as to align its proposed outputs and objectives to that of the T.C.M.P., and in developing a T.C.M.P. that supports the IDP, its sector plans, strategies and programmes. In addition to reviewing the IDP it is also necessary to review the technical content of the Town Planning Scheme. The general purpose of the Town Planning Scheme is to spatially organize and arrange development in a pattern that would link the various scheme areas (LUMS) both economically and socially and eliminate their independent way of operation. By reviewing the content of the Town Planning Scheme the T.C.M.P. is able to recognise its principles and objectives and will ensure that LUM measures identified as part of the integrated strategy are aligned to the principles and objectives of the Town Planning Scheme ensuring greater synergy and horizontal integration is achieved.

10.4.3.4 Review of interventions relevant to the Local or Metropolitan Authority

The final review cluster is the interventions (sector plans, programmes, strategies and guidelines) relevant to the Local or Metropolitan Authority in realising the purpose of the strategic content analysis described in section 10.4.3. Table 10.6 below illustrates the interventions to be reviewed as part of the analysis.

Table 10.6 Interventions relevant to the Local or Metropolitan Authority to be reviewed as part of the strategic content analysis

	Sectoral Plans	Local, Provincial and National Plans	Programmes	Strategies	Guidelines
Data Type	Housing	Public Transport Plan	Municipal Infrastructure Grant (MIG)	Housing Strategy	Housing
	Community Development	Provincial and Local Government Strategic Plans	Environmental Management Programme	Growth and Development Strategy	Consolidated Municipal Infrastructure Programme Guidelines
	Economic Development	Integrated Development Plan	Public Works Programme	Human Development Strategy	Environment
	Infrastructure and Services	Environmental Management Plan	Local Economic Development Fund	National Land Transport Strategic Framework (2006-2011)	Provincial Growth and Development Strategy Guidelines
	Environment	2010 Transport Action Plan	Consolidated Municipal	Moving South Africa: the Action Agenda (1999)	Performance Management

			Infrastructure Programme		
	Spatial Form and Urban Management	Growth and Development Plan			Integrated Development Planning
	Transportation	Integrated Transport Plans			Public Private Partnership
	Health				Budgeting
	Public Safety				
	Financial Sustainability				
	Governance				
	Corporate and Shared Services				

Sources: Author's own construction

The Intergovernmental Relations Framework Act of 2005 seeks to ensure horizontal and vertical integration of the interventions considered and developed at each level of government to ensure that they capture the demands, objectives and strategies at a cross-cutting governmental and sectoral level. In this way all interventions are meant to be developed whilst considering other interventions. For the T.C.M.P. to support this legislation the review of the interventions relevant to the Local or Metropolitan Authority is essential as it informs the T.C.M.P. This ensures further horizontal and vertical alignment and ensures that the outputs derived from the T.C.M.P. consider, support and are aligned to various cross-cutting interventions.

10.4.4 Assessing the operational performance of the highway network

Once the strategic content analysis has been completed the next step in preparing a T.C.M.P. is to establish where on the T.C.M.P. Road Network traffic congestion is at its ideal "level of service" and to assess the traffic congestion generating ability of new or regenerated development (requiring a TA or TIA) on the highway network. This stage of the T.C.M.P. roughly coincides with phase 1 of the IDP process as illustrated by Figure 10.8 in identifying priority issues.

Figure 10.9 below recommends an approach to such a methodology paving the way to consider measures which will mitigate existing or potential congestion and to identify areas such as Transport Management Areas. The sub-sections that follow explain the approach set out by Figure 10.9 in further detail.

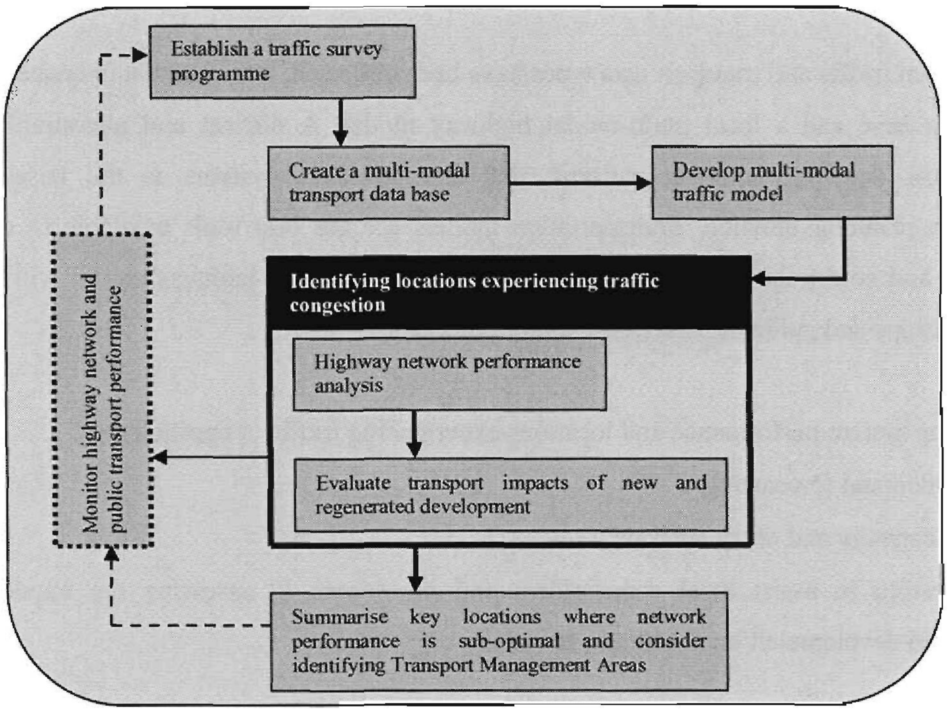


Figure 10.9 Approach to identifying where traffic congestion occurs

Sources: Author's own construction

10.4.4.1 Establish a traffic survey programme

In assessing where traffic congestion occurs and where transport problems are, and in identifying traffic trends and public perception it is recommended that an annual traffic survey programme is established to collect up-to-date and locally relevant traffic and transport data. The survey programme has the following purposes:

1. To collect data for the development of a **multi-modal highway model** as an essential tool assessing the occurrence of traffic congestion and saturation flows on road segments or links.
2. To enable the **monitoring of highway performance** throughout the life span of the 5 year T.C.M.P. so that it will be used to identify:
   - Traffic congestion patterns and trends
   - Fluctuations in road network performance
   - Identification of the causes of congestion
3. To assess **how well the integrated strategies implemented have achieved the alleviation of traffic congestion** either at a strategic or micro level.

The choice of data collected must be consistent with the purpose of the ensuing traffic analysis and the availability of financial resources.

10.4.4.2 Create a multi-modal transport data base and highway model

Once the chosen traffic and transport data types have been collected, it is essential to create a multi-modal transport data base and a local multi-modal highway model. A distinct and measurable relationship between travel demand, land-use patterns, and transportation systems is the basis for modern transportation planning practice. Transportation models are the best tools available to quantify these relationships and so for the purpose of the T.C.M.P. a multi-modal highway model will help quantify these relationships and guide the decision-making process in:

- identifying system performance and locations experiencing traffic congestion
- allowing demand forecasting
- allowing capacity and delay analysis
- option testing to assist local stakeholders and developers in assessing the impact of new or regenerated development on the transport system

10.4.4.3 Identifying locations experiencing traffic congestion

To improve core highway performance and identify where recurrent traffic congestion occurs, an appreciation of the current level of congestion experienced is required. To this end it is necessary to quantify traffic congestion (i) at intersections or junctions (ii) along road segments and corridors (iii) as a result of spatial interaction between land-use and transport infrastructure and (iv) in terms of congestion experienced by public transport.

10.4.4.3.1 Measuring highway performance at junctions and along road segments and corridors

The multi-modal transport data, multi-modal highway model and standard industry software (such as OSCADY, PICADY, ARCADY, LYNSIG and TRANSYT) can be used to quantify existing operational characteristics of the highway network. Every junction, road segment and corridor possesses its own ability to accommodate traffic effectively and has a maximum (ideal) capacity for a given lane or intersection to carry traffic (subject to speed and geometrical variables). It is recommended that the performance of key junctions, road segments and corridors throughout the T.C.M.P. Road Network are measured using the following indicative indicators:

1. Average travel speed on road segments
2. Average travel time on road segments
3. Average travel rate on road segments
4. Accident Rates on road segments
5. Traffic and person throughput

6. Vehicle Miles Travelled (VMT) on congested highway
7. Degree of saturation
8. Operational efficiency

Evaluating the operational efficiency of junctions, road segments and corridors comprise the following three major components:

- **Capacity analysis**
- **Vehicular delay**
- **Queuing**

Capacity analysis measures the ability of a road segment or junction to accommodate traffic effectively and determines the quality of traffic flow, referred to as Level of Service (LOS). Levels of Service (LOS) describes the different operating conditions which can occur on a road segment or at a junction at different times in terms of speed, safety, drivers' comfort, delay and vehicle operating cost. The LOS technique will help with the measurement of traffic growth trends through volumes, capacity, and measures of delay. The Highway Capacity Manual developed by the Transport Research Board identified six levels of service that are assigned the letters A through to F. Although the LOS was developed for conditions in the United States it is widely used throughout the world and is adapted to suit local conditions in most countries (O'Flaherty, 2005), including some South African cities. And so the output of capacity analysis is a servicing pattern (LOS), a qualitative rating of the effectiveness of a road in serving traffic, in terms of operating conditions i.e. the ability of a junction or road segment to cater for the movements made, in that the demand for movement does not exceed the supply within its designed engineering capacity. LOS A represents the best conditions, LOS F represents the worst. A general explanation of the different grades of LOS is as follows:

- LOS A - represents free flow conditions
- LOS B - represents stable flow conditions
- LOS C - represents stable flow conditions with more restrictions on manoeuvrability
- LOS D - represents high density and marginally unstable flow conditions
- LOS E - represents operating conditions at or near capacity
- LOS F - represents conditions beyond capacity with limited mobility and congestion

In **measuring the LOS of road segments or corridors,** congestion is expressed as a Volume to Capacity Ratio (v/c). The **v/c ratio** is an indicator of a road's traffic volume versus its capacity, on a numerical scale, where a v/c ratio equal to 1.0 or greater indicates that the demand volume is exceeding the available capacity of the road segment and forced flow conditions will inevitably result opposed to a zero ratio where there is no demand (and hence no congestion). In this way the v/c ratio provides a good indication of whether the road segment is congested by relating whether there is "excess" capacity available or saturated conditions exist. Once a multi-modal traffic model has been developed it will enable the calculation of the v/c ratios for all road segments in the network in present and future years. The various v/c ratios are then coupled to a specific Highway Capacity Manual defined LOS. In general the Highway Capacity Manual suggests the following v/c ratios to the following corresponding LOS:

- v/c < 0.65 = LOS A,B,C (Not Congested)
- 0.65 < v/c < 0.85 = LOS D (Marginal Congestion)
- 0.85 < v/c < 1.00 = LOS E (Moderate Congestion)
- v/c > 1.00 = LOS F (Serious Congestion)

A road segment with a v/c ratio equal to 1.0 or greater indicates that the demand volume is exceeding the available capacity of the segment and forced flow conditions will inevitably result. This means the operational performance of the road segment is classified as LOS F suggesting serious congestion. In the USA when a road segment has a v/c ratio above 0.8 it is considered congested and serves as a threshold indicating when to introduce traffic congestion management measures. By implication this suggests that every road segment with a v/c ratio above 0.8 is classified as LOS E or F and requires intervention – some transport measure to reduce the level of traffic congestion on that particular road segment. In terms of the T.C.M.P. it is suggested that road segments and intersections falling within LOS E and F are flagged for intervention and identification as a priority issue to be dealt with through the D.A.D.F.

It is recommended that the Highway Capacity Manual LOS relating to v/c ratios of road segments be reformulated to recognise and reflect local conditions for motorised vehicles. The following LOS is **recommended for urban areas in South Africa** with respect to v/c ratios of road segments as a general direction:

LOS	**2 Lane Road**	**4 Lane Road**	**Description**
A	v/c < 0.25	v/c < 0.28	Not Congested
B	0.25 < v/c < 0.4	0.28 < v/c < 0.47	Some Congestion
C	0.4 < v/c < 0.6	0.47 < v/c < 0.66	Marginal Congestion
D	0.6 < v/c < 0.85	0.66 < v/c < 0.79	Moderate Congestion
E	0.85 < v/c < 1.0	0.79 < v/c < 1.0	Heavy Congestion
F	v/c > 1.00	v/c > 1.00	Serious Congestion

The local or metropolitan authority however needs to identify the v/c ratios most appropriate to their conditions in consultation with stakeholders.

When **measuring the LOS at junctions** their capacity is calculated by capacity analysis using techniques defined in the Highway Capacity Manual. At junctions the LOS depends on the junction delay and so the calculated LOS (A through to F) for each junction represents an average delay for all vehicles travelling through the intersection during a peak travel period of the day. Table 10.7 below defines the LOS for signalized and unsignalized intersections (specified by the Highway Capacity Manual) based on the calculated average **delay** in seconds per vehicle (used in the United States).

Table 10.7 Level of Service expressed as delay per vehicle at intersections

LOS	Signalised intersection delay per vehicle (sec/veh)	Unsignalised intersection delay per vehicle (sec/veh)
A	$\leq$ 5.00	< 5.1
B	5.1-15.0	5.1 and 10
C	15.1-25.0	10.1 and 20
D	25.1-40.0	20.1 and 30
E	40.1-60.0	30.1 and 45
F	$\geq$ 60.0	> 45

Source: Transportation Research Board (2000)

It is recommended that the Highway Capacity Manual LOS relating to **delay** at junctions be reformulated to recognise and reflect local conditions for motorised vehicles. The following LOS with respect to delay at junctions is **recommended for urban areas in South Africa** as a general direction:

LOS	**Signalised junction delay per vehicle (sec/veh)**	**Unsignalised junction delay per vehicle (sec/veh)**	**Description**
A	$\leq$ 10	< 5.1	Very Low Delay
B	> 10 and 20	5.1 and 15	Minimal Delays
C	> 20 and 35	15.1 and 25	Acceptable Delay
D	> 35 and 55	25.1 and 35	Approaching Unstable/Tolerable Delays
E	> 55 and 80	35.1 and 55	Unstable Operation/Significant Delays
F	> 80	> 55	Excessive Delays

The local or metropolitan authority, however, needs to identify the amount of delay most appropriate to their conditions in consultation with stakeholders.

Because the output of capacity analysis is a servicing pattern (LOS) - the ability of a junction or road segment to cater for the movements made means that when heavy congestion and unacceptable delays at junctions occur queuing will also occur. And so queue length is another indicator for assessing the occurrence of traffic congestion. Queue length is, in general, the least favoured indicator of performance because approaches with large flows and capacity can have quite long, but fast moving queues with a low average delay per vehicle. Conversely very short queue lengths can occur at low flows and capacity but result in quite long delays because the queue is very slow to disperse. As a result no specific recommendation in terms of LOS is made here. The local or metropolitan authority needs to specify acceptable queue lengths at junctions appropriate to their conditions in consultation with stakeholders.

10.4.4.3.2 Measuring highway performance in terms of the spatial distribution of land

When measuring highway performance in terms of the spatial distribution of land the jobs/housing balance is a useful indicator. This indicator is used to estimate the balance between projected employed residents and projected jobs within different planning areas of the local or metropolitan authority using a simple gravity model or a complex LUTI model. Achieving a balance between jobs and housing within a community can help the transportation system by reducing the length of trips and traffic congestion. If it is found that an imbalance exists, ensuring that liveable streets and neighbourhoods are created with acceptable levels of public transport connectivity should be given priority in the D.A.D.F.

10.4.4.3.3 Measuring Public Transport performance

Measuring **public transport (Bus) performance** is another method by which to identify road segments suffering from traffic congestion. By evaluating the performance of each bus route in terms of the measures described below it is possible to identify locations along the route suffering from traffic congestion. It follows that underperforming routes or segments of the routes then require intervention to mitigate the cause of the problem. The following closely associated indicators are recommended:

1. Aggregate peak hour travel time
2. Bus Headway
3. Multi-modal hub integration
4. Bus on-time performance or reliability

10.4.4.4 Assess the level of traffic congestion created by new and regenerated development

In evaluating the extent to which new and/or regenerated development impacts on highway network performance, the planning system provides for Traffic Impact Assessments (TIAs) and or Transport Assessments (TAs) to be performed when local thresholds are satisfied. The purpose of these assessments is:

- to improve the integration between local land-use decisions and transport planning decisions and activities
- to better assess the transport impacts of development
- to encourage sustainable development
- to identify measures to deal with anticipated transport impacts of proposed development schemes and
- to improve accessibility and safety for all modes of travel, particularly for alternatives to the car such as walking, cycling and public transport in accessing the site

In going one step further, it is recommended that new developments and those being redeveloped requiring a TA or TIA must be subject to the T.C.M.P. traffic congestion assessment as described in Section 10.4.4.3 in measuring the traffic congestion impact of the development proposal. In this way the assessment will consider the impact of the new and or regenerated development in:

- Identifying the extent to which proposed developments or developments undergoing a change in use will contribute to traffic congestion
- Identifying and recording intersections and road segments where the LOS will deteriorate to levels E and F
- Identifying the need to develop integrated strategies to mitigate adverse impacts and increase the LOS to an acceptable level
- Bringing about consistency between the objectives of the T.C.M.P. and spatial and transport planning and land-use management

In connecting a TIA or TA directly to the indicators measuring road network performance in this way the traffic congestion assessment output can be fed into the D.A.D.F process to identify suitable mitigation measures or integrated strategies for inclusion in the TAs and TIAs. This can be explained by the following simple example. A planning application has been lodged with the local authority to approve a development scheme consisting of 600 proposed mixed use units. Based upon the TA or TIA data made available to the T.C.M.P., a run of the multi-modal highway model and the use of industry software calculating capacity and delay at junctions or along road segments, the results indicate that the proposal will reduce the level of service of the T.C.M.P. Road Network from LOS C to LOS E. This triggers a requirement for intervention in that the developer will need to consider measures that will increase the LOS to at least level D – identifying the need and practical use of the D.A.D.F. The D.A.D.F. can therefore directly be used as a tool informing TAs or TIAs as part of the spatial planning process.

10.4.5 Considering measures to manage traffic congestion

To ensure that underperforming road segments, junctions or other locations where traffic congestion has been identified or may potentially occur is dealt with, it is necessary to identify appropriate measures to mitigate their occurrence. In considering appropriate measures to manage traffic congestion, this part of the T.C.M.P. plays a key part in connecting the 2nd, 3rd and 4th phase of the IDP to the T.C.M.P. And so the ISU is charged with developing integrated strategies in response to priority issues identified as part of the strategic content analysis, to improve the operational performance of the highway network and to identify measures alleviating the impacts of new or regenerated development on the transport system. This requires a 3 step integrated and co-ordinated approach: **Step 1** – selecting appropriate measures from a wide pool of measures **Step 2** – applying the D.A.D.F. to select measures contributing to sustainable development and congestion reduction and **Step 3** – carrying out a control check to ensure all integrated strategies are aligned and integrated with other sectoral plan objectives and identified projects. The following sub-sections describe these steps in more detail.

10.4.5.1 Step 1: Selecting measures from a pool of measures

As a variety of measures may have the potential to alleviate the identified problems and priority issues, it is important to have the widest possible range of choices or pool of measures to choose from. To provide the decision-maker with a variety of measures to choose from, Appendix 34 (see CD) contains the measures recommended for consideration as part of the selection process. Although the measures listed reflect those identified by the empirical investigation, the decision-maker is free to add to the list to reflect local innovative measures.

Step 1 should broadly coincide with phase 2 of the IDP to encourage cross-cutting stakeholder and public consultation in identifying a short-list of acceptable measures to address priority issues. By way of amending the National Land Transport Transition Act and the Municipal Systems Act as described previously in this chapter, they also provide for public and stakeholder consultation as part of the T.C.M.P. process. The consultation process is perhaps also one of the most difficult and demanding stages of the T.C.M.P. and IDP where all affected parties have to come to the fore and express ideas and concerns and work towards a common set of initially acceptable measures that are fundamentally aimed at traffic congestion reduction whilst also considering localised strategic guidelines, sectoral plans and their objectives as specified by the Municipal Systems Act.

To this end the purpose of public and stakeholder consultation as part of Step 1 is as follows:

- It provides an opportunity to formulate and discuss general goals and objectives to achieve sustainable development within the context of traffic congestion reduction
- It provides the public and stakeholders with a better understanding of transport issues and problems and is a key factor in gaining public support and acceptability for the final mix of measures to deliver a strategy capable of addressing traffic congestion
- It provides the opportunity to identify problems and refine or review priority issues based on the output produced by the content analysis
- Since the public and stakeholders are consulted, a degree of partnership is established and in essence that helps to achieve level 3 of Arnstein's Ladder of Participation as a degree of citizen power is afforded to those participating
- It is a requirement in generating innovative solutions and identifying a shortlist of measures to be included in the D.A.D.F.

- Once integrated strategies have been formulated it also helps in prioritising draft projects for Council approval
- It is instrumental in aligning phase 1 and 2 of the IDP process to the T.C.M.P. process

10.4.5.2 Step 2: Applying the D.A.D.F.

In applying and connecting the D.A.D.F. to the IDP, Figure 10.8 shows that the development of integrated strategies coincides with phase 2 of the IDP where priority issues are transposed into "development strategies" (in terms of IDP terminology) or integrated strategies for the purpose of the D.A.D.F. For the purpose of the D.A.D.F. option analysis, the outputs derived from the content analysis and highway performance assessment are transposed into higher order sub-ordinate objectives (the higher order objective being traffic congestion reduction) as shown by Figure 10.10.

The decision-maker applies the D.A.D.F. by assessing the extent to which the measures short-listed by the public and stakeholders in Step 1 contribute to achieving the sustainability objectives, the higher order policy objective and its sub-ordinate objectives in terms of (i) the D.A.D.F. criteria and indicators (ii) the effects of the measures (iii) the endogenous and exogenous variables and technical considerations. The operation and screening of the D.A.D.F. is explained in section 7.7 of Chapter 7.

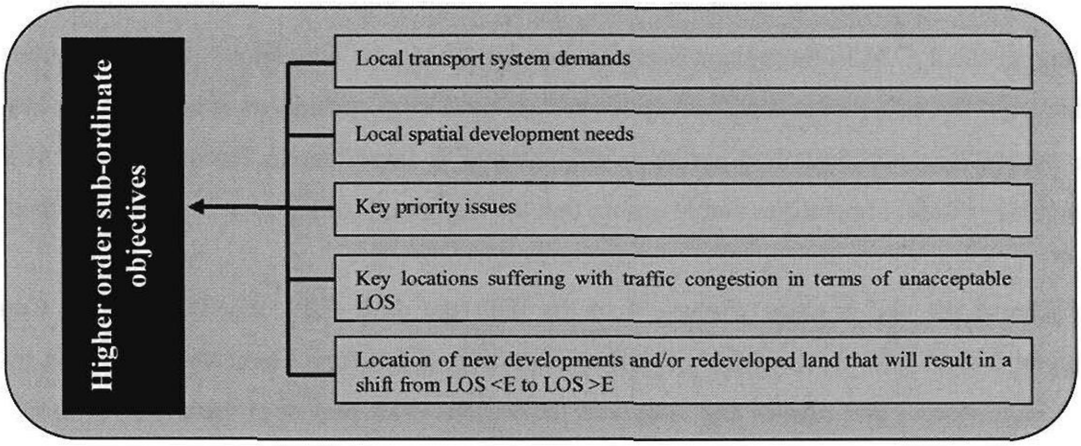


Figure 10.10 Transposing T.C.M.P. process outputs into D.A.D.F. equivalent higher order sub-ordinate objectives

Because it is very likely that the list of sub-ordinate objectives is extensive, it is recommended that those similar in nature are clustered and each appraised separately as appraising all simultaneously will prove to be a very demanding task. By appraising clusters individually, integrated strategies tailored to specific sites at a micro level can be derived alleviating, for example, the adverse transport impacts of a new proposed development and they can be fed into a TIA or TA process.

On the other hand, appraising a close group of clusters can produce integrated strategies at a macro level that set out the direction for local authority-wide traffic congestion management within the context of integrated spatial development, the planning and provision of transport, environmental management and the recognition of other sectoral imperatives. The D.A.D.F. is therefore a strategic 5 year tool identifying integrated strategies as a one-off exercise at a macro level as part of the T.C.M.P. planning cycle, as well as a micro level tool to identify solutions as and when required on an ad hoc basis in providing project input. With respect to macro level integrated strategies, once these are identified the ISU must reformulate them into draft project proposals for members of the Local Authority to consider for implementation. By reformulating the integrated strategies into draft project proposals as part of the T.C.M.P. process, the T.C.M.P. is aligned to phase 3 of the IDP as Figure 10.8 suggest.

10.4.5.3 Step 3: Ensure alignment and integration of integrated strategies with other sectoral plan identified projects

The final step in considering sustainable measures to manage traffic congestion is that of ensuring that the draft project proposals produced by the T.C.M.P. are aligned to and support the draft project proposals of the various sectoral programmes as prescribed by the Municipal Systems Act and phase 4 of the IDP. In this way a maximum level of integration can be achieved. This "final check" of alignment and "project proposal fit" is the last opportunity to harmonise the T.C.M.P. draft project proposals to other sectoral draft project proposals in terms of time, space, cost, objectives, feasibility, viability and priority. Although the T.C.M.P. throughout seeks to develop integrated strategies – full integration can only be achieved if the issues of concern to various sectors have been considered in its development. That is why the content analysis described earlier in this chapter is important in forcing the T.C.M.P. process to recognise sectoral imperatives and to ensure that the integrated strategies at least support their objectives.

To achieve the end product of phase 4 of the IDP (the draft IDP), the IDP Steering Committee will compile a draft IDP that consists of various Operational Strategy Elements as outlined in Figure 10.6 through a process that revises and integrates the various draft project proposal and sectoral programmes (including those of the T.C.M.P.) until the draft IDP truly reflects integrated development. The review by the IDP Steering Committee will necessarily mean an iterative process for the D.A.D.F so as to reflect greater integration between the sectors. Once the draft project proposals and sectoral programmes have been accepted - to coincide with Phase 5 of the IDP - the T.C.M.P. project proposals are accepted in principle as well as the projects it seeks to implement.

10.4.6 Scheduling a project co-ordination and implementation plan

The ISU will be responsible for the prioritisation, co-ordination and implementation of the T.C.M.P. projects in line with the proposed amendments to the National Land Transport Transition Act (2000).

Because of the cross-cutting nature of the projects (projects contain TSM, LUM, TDM and "Smart Growth" measures) they have a direct relationship with the implementation of the various sectoral programmes and projects. Although the ISU is charged with co-ordinating the implementation of the T.C.M.P. projects, it will be the various sectoral departments of the local or metropolitan authority that will be tasked to implement the projects. This, by implication, also means the ISU is responsible for T.C.M.P. project funding requirements explained in more detail in section 10.4.7. Any project planning and programme planning performed by the ISU must consider the implementation programmes of the various sectors and requires effective levels of communication enabling the sectoral departments to programme-in the T.C.M.P. projects assigned.

Before projects can be assigned to relevant sectoral departments though, the ISU must classify projects into two broad groups (i) Capital improvement projects and (ii) Spatial planning projects. These help to identify "who does what". The ISU will then have to establish appropriate phasing of the projects with realistic time tables to achieve results as early as possible. Typical time lines recommended for use are:

- Short term (1 - 2 years)
- Short to medium term (2 - 3 years)
- Medium term (1 - 5 years)
- Medium to long term (5 - 8 years)
- Long term (5 - 15 years)

Figure 10.11 illustrates a simplistic T.C.M.P. project programme with reasonable time scales attached to each element and the Departments that will be responsible for the implementation of each element.

It demonstrates that short term phasing will achieve "quick win" results such as the implementation of traffic calming measures. "Quick win" projects will predominantly be associated with TSM measures although larger projects may run into the medium term and beyond the life cycle of one T.C.M.P. Medium term projects are those that require 5 years to provide the desired highway operational performance or the desired outcomes. Long term projects are those that require and/or build on the implementation of previous projects such as the provision of public transport that has to be implemented before road-user charging or toll roads can be implemented.

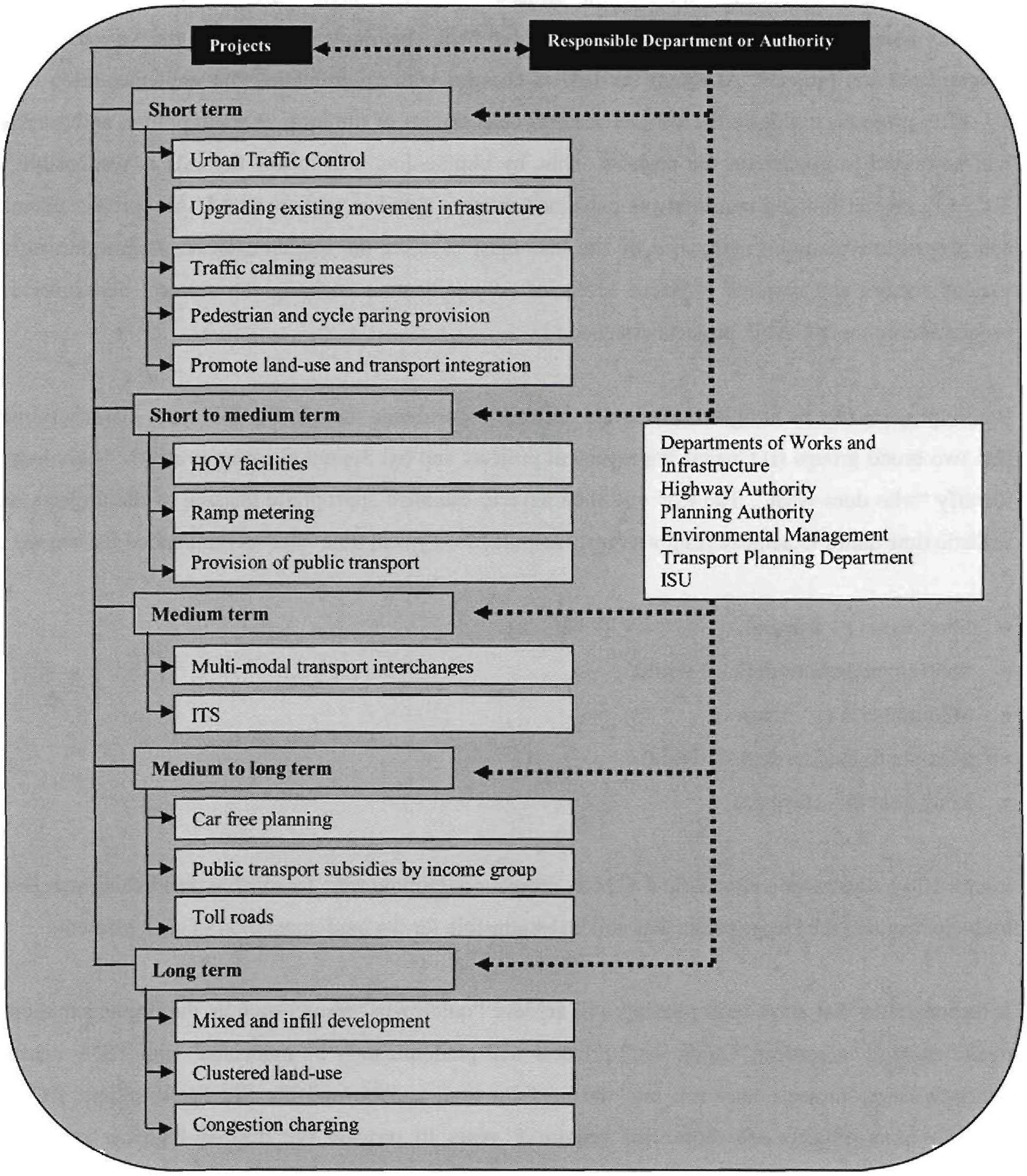


Figure 10.11 A simplistic T.C.M.P. project programme

Sources: Author's own construction

In deciding the phasing of projects, decision-makers should consider:

(i) the priority attached to each project in terms of cost effectiveness and its potential to alleviate traffic congestion on infrastructure experiencing unacceptable high levels of congestion

(ii) the speed with which delivered projects will produce the desired effect

(iii) the operational characteristics of the project - if the project would result in shifting a capacity problem to another location, the effects of the downstream bottleneck must be considered when setting priority to the project in terms of cost and cost effectiveness

(iv) the effects of the projects in terms of first order effects, second order behavioural responses by system-users and third order effects which occur outside the land-use/transport system not necessarily occurring directly as a result of the implementation of the project

(v) Projects that would eliminate existing problem areas are prioritized above those that would eliminate future problems

(vi) Projects that reduce traffic congestion to acceptable levels for most modes of transport

10.4.7 Develop an investment strategy

Funding of the T.C.M.P. projects will be the responsibility of the ISU although the implementation of strategies is carried out by various departments of the local or metropolitan Authority. This means the ISU will require a proportion of the local or metropolitan authority's budget to ensure it maintains its functions or alternatively finds innovative finance options.

Funds for the TSM and TDM components of the T.C.M.P. projects can be obtained in two ways by receiving an increased funding allocation from the national or provincial government or by introducing a new funding mechanism which can be dedicated to the T.C.M.P. and ISU. In order to receive increased funding allocation from the national or provincial government, current national initiatives to obtain additional funding via Consolidated Municipal Infrastructure Programmes (CMIPs), Municipal Infrastructure Grants (MIG) and/or via the National Department of Transport are favourable mechanisms and need to be pursued vigorously. But in view of the existing financial constraints the mammoth task of getting, at least, a much needed public transport system up and running as part of a T.C.M.P. project seems daunting. It is the view of the author that the ISU will have to consider alternative funding mechanisms to realise the full potential of the T.C.M.P. To this end the following recommendations are made with respect to securing additional funding.

As a first additional funding option, decision-makers will have to seriously consider and vigorously defend the use and value of including TDM measures as part of integrated strategies and later T.C.M.P. projects. TDM measures have a "capital generating" characteristic not shared by LUM and TSM measures. When TDM, TSM and LUM measures are integrated in a strategy of measures TDM measures can help finance the implementation of TSM measures. By implementing TDM measures in conjunction with TSM measures the integrated strategy becomes a sustainable self-financing unit over the long term. Of course initial capital outlays may be significant, but this has to be built into the project business plan in terms of producing quick revenue so as to repay initial capital debt. This may have definitive advantages for implementing public transport systems as they are historically heavily subsidised and non-profitable.

By including TDM measures in the strategy the local or metropolitan authority it will be relieved of its financial burden in terms of public transport subsidies.

However it is over optimistic to suggest that by including only TDM measures in a T.C.M.P. project integrated strategy will finance the other measures included. To achieve such a level of investment will mean the strategy will be almost completely dominated by TDM measures. This leads to the second additional funding option Public Private Partnerships (PPPs). These may prove useful in terms of the financing and operating components of the T.C.M.P. project as the private sector will want to maximise returns from the project and may even introduce efficiency gains in transport provision (public transport and over-land rail services).

A third additional funding option to be considered is that of creating a transport innovation fund similar to that introduced in the UK. The UK Department for Transport (national level authority) has established a transport innovation fund to give its delivery partners (i.e. local councils) financial incentives to develop and deploy smarter, innovative, local or regional transport strategies. For authorities to access the fund they must provide evidence of their strategies, meeting at least one of the following criteria:

- support the costs of smarter, innovative local transport packages that combine demand management measures such as road pricing with modal shift and better bus services
- support innovative mechanisms which raise new funds
- support the funding of regional, inter-regional and local schemes that are beneficial to national productivity.

All authorities seeking funds from such a transport innovation fund will then be subject to an assessment regarding decisions about funding allocations, alongside other considerations such as deliverability. It is the author's view that creating such an innovation fund in South Africa can lead to fruitful results as in principle such a fund will share in the objectives and principles of the T.C.M.P. Clearly funding is important, but it is also important that instigating authorities realise that by cleverly implementing T.C.M.P. projects containing "capital generating" measures or by encouraging PPPs much will be gained in terms of self sustainability or even a level of financial autonomy.

10.4.8 Monitoring and improvement evaluation of projects

Once the T.C.M.P. projects have been implemented, the ISU must take active steps, at least biannually, to ensure that implemented projects enhance system performance as the proposed amendments to the National Land Transport Transition Act 2000 specify. Monitoring and evaluation of projects form part of the *ex-post* assessment, providing an opportunity to reconsider the objectives of the projects, the extent to which they have been achieved and the extent to which they have contributed to reducing traffic congestion. In this way every project provides an opportunity for learning from experience and improving the performance of the policy instruments used. Monitoring, and especially evaluation, of land-use projects are particularly challenging, since the land-use effects are slow to show up in full. If to much time passes before an after study or ex-post assessment is carried out, the effects of the project may get mixed up with other non-T.C.M.P. project-related developments while, if it is carried out too early, the full impacts will not have materialised.

Regular monitoring will also identify barriers and problems experienced as a result of implementation or if new problems are emerging. It allows for a second round of consultation to present the results of projects, to refine integrated strategy composition and to combine, perhaps, alternative measures to achieve as much synergy as possible. Evaluation and monitoring primarily provide the context for the next review or T.C.M.P. cycle and are therefore an essential part of an approach aimed at encouraging sustainable development and planning. Key to monitoring and evaluation is measuring the performance of the projects. To this end Figure 10.12 illustrates the recommended performance indicators to be used to monitor changes in traffic congestion levels throughout the local or metropolitan authority.

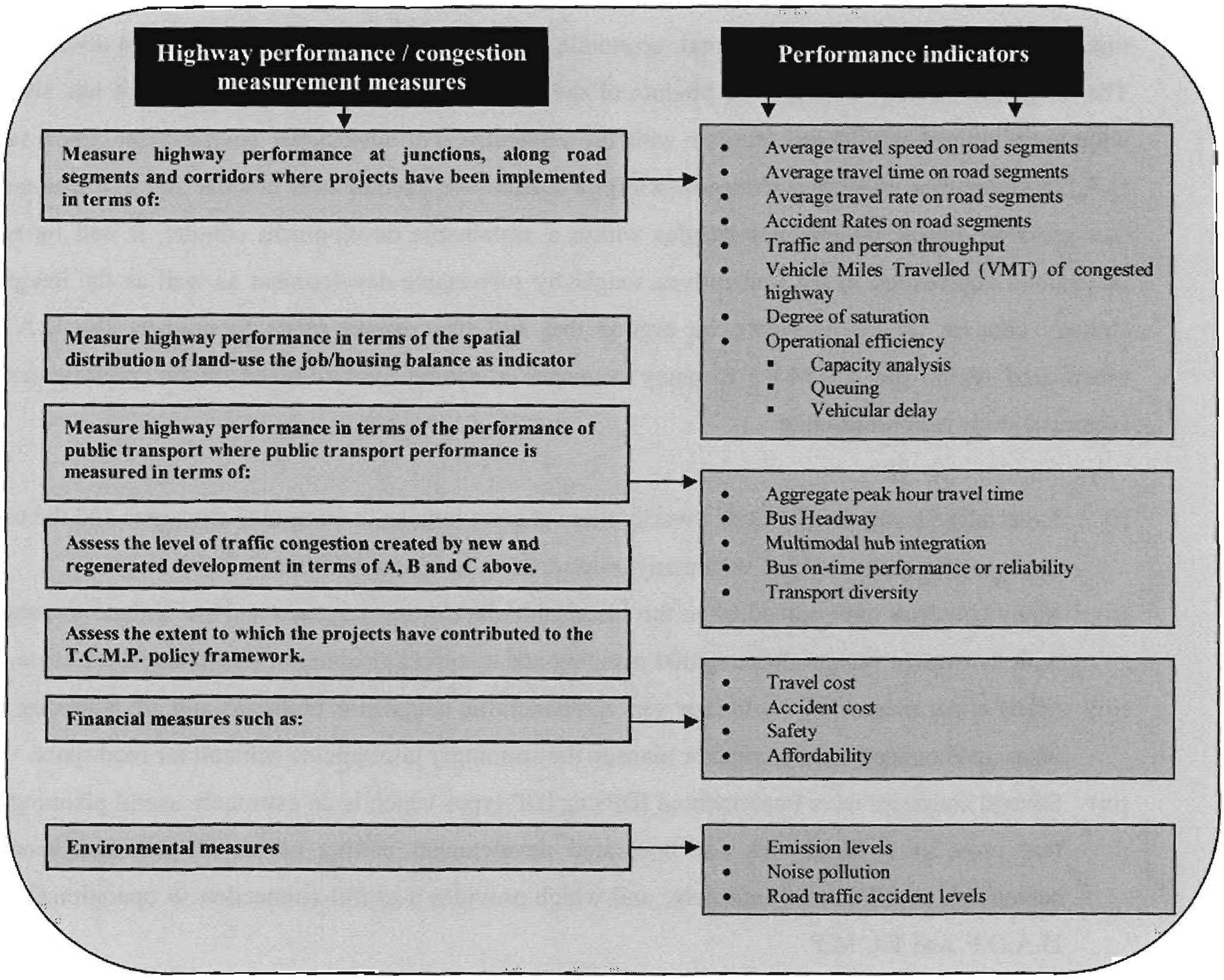


Figure 10.12 Recommended performance indicators measuring traffic congestion levels

Sources: Author's own construction

Because traffic congestion management projects may attract opposition, it is important to report monitoring results in the form of a comprehensive summary biannually so as to instill confidence in the projects. Stakeholders will undoubtedly be interested in the output and effects of the program. It is therefore important to make project reports/findings public to provide a picture of its likely effects, its achievements and failures. By demonstrating the achievements of the programme, public and stakeholder acceptability may be increased. By a continuous reassessment of the choices made in the past, decision-makers may learn lessons to serve as feedback into the D.A.D.F., again influencing future decisions.

10.5 Extrapolating the recommendations to the wider international context

In terms of the international application of the D.A.D.F. it can be argued that many nations have signed up to the sustainability agenda with various applications and objectives as shown by the empirical investigation carried out in this study. Sustainability has become a key objective to many in weaving together the institutional, environmental, economic and social dimensions associated with development. The integrated strategy concept – a product of the pursuance of sustainable development has also had widespread appeal with those familiar with the imperatives of sustainable development. Because the D.A.D.F. embodies integrated strategies within a sustainable development context and is a mechanism that seeks to deliver integrated strategies within a sustainable development context, it will be easily understood and related to the imperatives sought by sustainable development as well as the integrated strategy concept. It can therefore be argued that sufficient scope exists to connect the D.A.D.F. (positioned within the T.C.M.P.) to many countries' planning system based on the premise (as the empirical study has shown) that:

(i) Especially among the developed world, there is great interest in integrated strategies and the use of package approaches to deal with many transport and development issues.

(ii) Many countries have signed up to the sustainable development agenda and are obliged to come up with innovative ways to force spatial planning and transport planning in a sustainable direction.

(iii) Many cities around the world face very similar traffic congestion problems and are grappling with ideas and concepts to overcome or manage the seemingly unstoppable demand for road space.

(iv) Several countries have implemented IDPs or IDP-types which is an extremely useful planning tool that provides a framework for integrated development cutting across all the dimensions of sustainable development and more, and which provides a useful connection to operationalise the D.A.D.F. and T.C.M.P.

(v) The D.A.D.F. positioned within the T.C.M.P. provides a direct framework to tackle traffic congestion in a cross-cutting and integrating way.

As the D.A.D.F. is developed as a tool capable of identifying measures suitable and specific to local conditions in managing traffic congestion and transposing the measures into an integrated strategy it has application value in nearly every town and city world-wide. It is therefore considered that both the D.A.D.F. and the T.C.M.P. have real international application potential.

10.6 Conclusion

The research presented in this study has shown that whilst the developed world is increasingly using packages of options to integrate transport, land-use and environmental management strategies in a general sense to deliver sustainable solutions to transport problems, little has been done to develop a decision framework that integrates TDM, TSM, LUM and "Smart Growth" measures in deciding between alternative policy measures best suited to alleviate local traffic congestion. Within the international context the study identified that such a robust and defendable mechanism will add value in finding innovative ways of combating traffic congestion. In response to this need the study developed a decision framework – the D.A.D.F. that allows policy-makers to select the measures that are the most applicable and appropriate to local traffic congestion conditions in managing traffic congestion.

In going beyond merely developing and demonstrating the usefulness of the decision framework that integrates transportation and land-use management to ensure sustainable development - the recommendations have shown that for the D.A.D.F. and its resulting integrated strategies to come into their own right and to bear any fruit in the planning system, they must be assimilated into a T.C.M.P. And so the recommendations made have demonstrated within a South African planning context, the requirements to create a T.C.M.P. and by subsequently setting out its components, how it should operate and how legislative amendments to South African planning will have to be made to facilitate its operation. In effect the D.A.D.F. becomes a servant of the T.C.M.P. allowing both macro and micro level assessments in managing or ameliorating traffic congestion with international application potential.

Developing world-class integrated transport and land-use systems will not come about easily, but achieving it is not impossible if bold and imaginative solutions are identified, tried and tested. It is important to succeed because a high level of integration stands to enhance the quality of life, is good for economic growth and helps maintain the competitive advantage cities experience. Whatever the individual preferences of road-users and the various transport choices cities offer, the D.A.D.F. and T.C.M.P. must encourage spatial densification, enhanced accessibility, development that fosters economic growth and social wellbeing, provide high quality public transport services which are reliable, convenient and safe to use and development that recognizes the need for environmental protection. Highly balanced and integrated strategies developed by the D.A.D.F. will enhance cities' ability to succeed in this respect and implementing the T.C.M.P. will be instrumental to realizing its potential.

And so in conclusion the main innovation of the study is the development of the D.A.D.F., the T.C.M.P., the recommendations to situate both in the planning system and the comprehensive but still transparent approach undertaken to create integrated strategies for specific local conditions consisting of elements that work together to produce cumulative short to long term effects that attain a balanced set of environmental, social and economic goals – imperative to sustainable development.

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Appendices*

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* **All appendices are contained on a CD placed in a CD sleeve following this page.**