
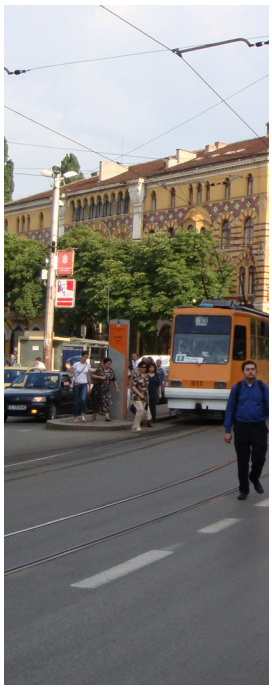


MPTM Monitoring and Indicators

Developing a Monitoring Framework for the Sofia Masterplan for Traffic Management

October 2010

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Content

1. Developing a Monitoring Framework

1.1 Introduction

Although the majority of data need to design an urban traffic scheme will be derived from specific sample surveys, the need for continuous monitoring is important. To assess whether the MPTM is achieving its objectives, it is essential to set targets and monitor progress towards them. Monitoring of the MPTM programme is a vital and integral part of the plan, and will assess how successful measures are performing against the objectives and targets that have been set. It will also allow corrective action to be taken at appropriate milestones during the plan period if performance is not as good as expected.

In this document we propose an outline for a monitoring framework which will help assess the impact of the MPTM programme. Adopting a comprehensive monitoring process will ensure there is a focus on delivery and that this is managed and maintained over the life of the plan.

The Stage 1 analysis phase of the project revealed the lack of reliable data in Sofia from which regular monitoring can be undertaken and therefore new programmes of data collection will need to be set. However, setting actual targets and detailed survey programmes is not possible until details of the Plan are finalised in terms of specific programmes of schemes and also the level of investment proposed to implement these (.for example, setting a target for increasing park & ride patronage is only possible once a programme of park & ride schemes has been confirmed.) Therefore, the targets presented in this document are provisional until details of the MPTM are confirmed.

1.2 The Importance of Monitoring

Regular monitoring of conditions will help assess whether problems are being overcome or whether new problems are being seen to emerge. Monitoring should be based on an agreed set of performance indicators and consequently it is important that these can be readily measured and easily interpreted. It is recommended that the municipality carry out annual monitoring of the core indicators to review progress against objectives and targets.

Monitoring has several basic purposes:

- To support planning, the process of figuring out where we want to go and how we can get there;
- To improve decision-making by giving us a clearer understanding of current conditions and trends;
- To enable benchmarking of conditions and performances; and
- To ensure accountability for actions and results.

Monitoring can be used to answer key questions such as:-

- Is the Plan contributing towards the desired objectives and targets?
- Is the Plan performing as well as expected?
- Are (mitigating) measures performing as well as expected?
- Are there any undesirable effects? Are these within acceptable limits or is remedial action required?
- Are the impact predictions of the assessment correct?

Effective monitoring contributes towards:

- Managing uncertainty:
  - Checking and adjusting Plan Implementation;
  - Identifying and managing unanticipated impacts; and

  - Testing the accuracy of impact predictions.
- Improving Knowledge:
  - Improving impact prediction methods and the quality of future reports;
  - Updating or filling gaps in existing baseline information; and
  - Keeping track of changes in the environment.
- Enhancing transparency and accessibility:
  - Assisting in strengthening public involvement.
- Managing Information:
  - Structuring information from various monitoring and evaluation activities; and
  - Presenting monitoring information in a format appropriate for its purpose.

1.3 Challenges of Effective Monitoring

There are a number of major challenges facing monitoring efforts in support of sustainable urban transportation goals:

- **Complexity of urban transportation systems**. Urban transport systems are complicated by a great number of influences, including unpredictable nature of human behaviour. It is often difficult to say with confidence where transportation patterns are heading, what the driving factors are, and what the implications might be;
- **Financial and staff resource limitations**: Collecting, analysing and reporting on monitoring data frequently require more time than authorities can often provide. Even before monitoring activity begins, the identification of relevant baseline conditions forms an essential step which in itself can be a resource-intensive task; and
- **Inconsistent data collection procedures, data formats and reporting practices**: Monitoring can help benchmark results, question differences and draw conclusions but this requires a means for meaningful comparison. In the absence of any national monitoring guidelines or frameworks to follow, such comparisons can often be difficult. There is a need for capacity-building to raise the awareness and skill of municipal employees related to sustainable transportation monitoring, and to improve the comparability of monitoring frameworks.

Without monitoring, the entire “knowledge foundation” of a plan becomes gradually less relevant, and responsible decisions about future changes to policies or programmes will become more difficult.

In the years immediately following approval of a new transport plan, the enthusiasm for implementation can lead to a neglect of monitoring — and when the time comes to review the plan after a few years, there could be a lack of credible information that would enable an intelligent and thorough update.

Regular monitoring, and the publication of results, also helps to keep the plan relevant by demonstrating its’ effectiveness and reinforcing the key objectives.

1.4 Establishing a Monitoring Strategy

An ideal monitoring framework should reflect a comprehensive hierarchy of transport goals and objectives, and should explicitly define the relationships among them. To be useful, objectives should be measurable and reflect a desired change in baseline conditions over a specific timeframe. Even then, the dynamic cause-and-effect relationships among goals, objectives and indicators may not always be explicitly understood or defined, and judgement and intuitive understanding may be needed to interpret monitoring results.

A wide variety of tools and activities can play a role within an effective monitoring programme. Some of the simplest will be part of basic management processes (e.g. annual spending summaries etc.). Others

require ongoing or recurring efforts that have multiple applications (e.g. annual collision summaries, intersection traffic counts, infrastructure condition surveys, public opinion polls). Still others represent special or infrequent efforts that fulfill purposes that are either broad and strategic (e.g. regional origin-destination surveys) or narrow and tactical (e.g. cycle parking.

In developing the monitoring framework it is proposed that a rolling programme of monitoring of key indicators is undertaken based on the strategy objectives including modal split, levels of public transport usage, safety and security and environmental conditions. It is also proposed that Scheme Impact Reports (see below) be developed which provide more in-depth analysis of success factors associated with a range of scheme types.

Throughout the design process from the initial identification of a problem through to the final selection of the most appropriate scheme to remedy it, data are required to assist the judgements being made at every stage in the process. This process will require:-

- Information about the current state of the traffic system and how it has (and is) changing over time (for problem identification);
- Specification of any alternative design standards and their implications for the application to scheme proposals;
- Forecasts of the effects that each proposed scheme is likely to have, considered against its objectives as well as any side effects that are foreseen); and
- The values (and any priorities or weightings) to be used in assessing the overall impact of schemes on different sections of the community.

A range of survey types and possible sources of data for different purposes include those relating to:-

- Traffic characteristics and manoeuvres, including pedestrians and cyclists (ie. the composition of traffic);
- Demands for movement, journey times and costs, including accidents (ie. the demand for the service offered by the transport network); and
- The various impacts of traffic on the users of the system and on the environment (ie. the consumers' response to prevailing traffic conditions.)

1.5 Developing a Monitoring Strategy for Sofia

Monitoring is an essential element of Sofia Municipality's pursuit of sustainable urban transportation. It provides vital support to planning, decision-making, benchmarking, and the ensuring of accountability. In the future, as urban transportation plans continue to more fully integrate the various dimensions of sustainability, monitoring will become even more important. However, it is apparent that many current plans do not have an integral monitoring strategy as part of an overall approach to performance measurement.

Monitoring efforts should consider outputs (actions taken), outcomes (the results of actions) and external conditions (the circumstances of actions) using three different lenses (broad focus, medium focus, narrow focus) that respond to varying purposes and interests.

The development of an effective monitoring framework should consider the strategic goals and objectives used to develop transportation plans and manage their implementation. Ideally, the relationships among goals, objectives and indicators would be defined explicitly. However, in practice this may be extremely difficult to accomplish. Monitoring programs can include many tools and activities, some of which may be "business as usual" and some of which may require special, intensive efforts.

Major challenges to successful monitoring of urban transport systems include the complexity of the systems themselves, municipal staff and budget constraints, and inconsistencies of practice among urban areas. This document sets out a outline monitoring framework for the Traffic Masterplan, including a clear process for the collection and reporting of datasets linked to the Masterplan's objectives.

It is important for the Municipality to establish a programme of SMTP monitoring and reviewing to ensure that the policies, strategies and interventions outlined in the Plan continue to reflect the overarching priorities for the city. In the development of programmes a critical balance is necessary between the level of

ambition in the targets that are set and the required level of investment in the areas included in the funding programme. This balance is important if the required outcomes are to be delivered.

The proposed strategy and programme of measures are designed to make progress towards meeting a set of objectives. It is important to identify the expected outcomes for each objective and to keep the strategy under review as the action plans and implementation plans progress. This process involves:

- Establishing a set of performance indicators (PI) which authorities can relate to objectives (some might be assigned target values);
- Collecting sufficiently robust PI data that will allow conclusions to be made about the direction and speed of change; and
- Assessing strategy performance and adjusting parts of the strategy if necessary.

The implementation programme can be modified based on how the strategy performs. Indeed, the strategy's performance may ultimately require the authority to review and amend it). Monitoring plan performance will also allow authorities to demonstrate successes to their local partners, their regional peers and the funding agencies. This may help to attract other (non-capital support) sources of finance.

Developing a set of indicators requires a number of issues to be considered:

- The need to collect enough data to understand how the strategy is performing against all the important objectives;
- The cost of a robust monitoring regime and the need to make maximum use of existing data;
- The need for readily understandable indicators; and
- The need for indicators to reflect investment (separating, as far as possible, changes due to factors outside the influence of the plan).

1.6 Monitoring Strategy Components

The proposed monitoring strategy for the MPTM is built on the following key principles:

- A carefully selected indicator set that is fully aligned with the priorities set out in the Plan's strategy and objectives;
- Comprehensive documentation of performance indicator assimilation and target setting; and
- Ownership of the MPTM indicators by those responsible for overseeing the reporting and delivery of their performance indicator(s) with a process that provides clear lines of reporting for the indicators, and a chain of responsibility for reviewing delivery to re-prioritise resources.

These elements are described in more detail below:

1.6.1 Performance Indicator Selection and Function

The indicators are designed to provide evidence of "real and measurable improvements in the quality of transport services" for Sofia. They have been selected to monitor the important outcomes that demonstrate real achievement of the visions and objectives that this plan outlines.

Figure 1.1 shows how the selected performance indicators are integral to the overall MPTM process. Targets and trajectories for each performance indicator are put in place to quantify the achievements and improvements that the plan will deliver, year on year. These reflect the strategy and objectives of the plan. The programme of spending provides delivery, subject to resource constraints, and the outcomes and outputs are monitored by the indicators. Performance monitoring/performance management is the process by which these outcomes are monitored and reviewed in the context of the targets that were set to reflect the strategy and objectives.

1.6.2 Performance Documentation

In order to monitor performance robustly, effective monitoring systems must be put in place. These processes are managed by full documentation of the methodology and calculation of data for each performance indicator.

1.6.3 Indicator Owners

Central to the performance management process are the designated “indicator owners” who take responsibility for the overall collection, reporting and target setting process for that indicator. Indicator owners provide a central point of responsibility for documentation, data collection, monitoring and review of progress for each performance indicator.

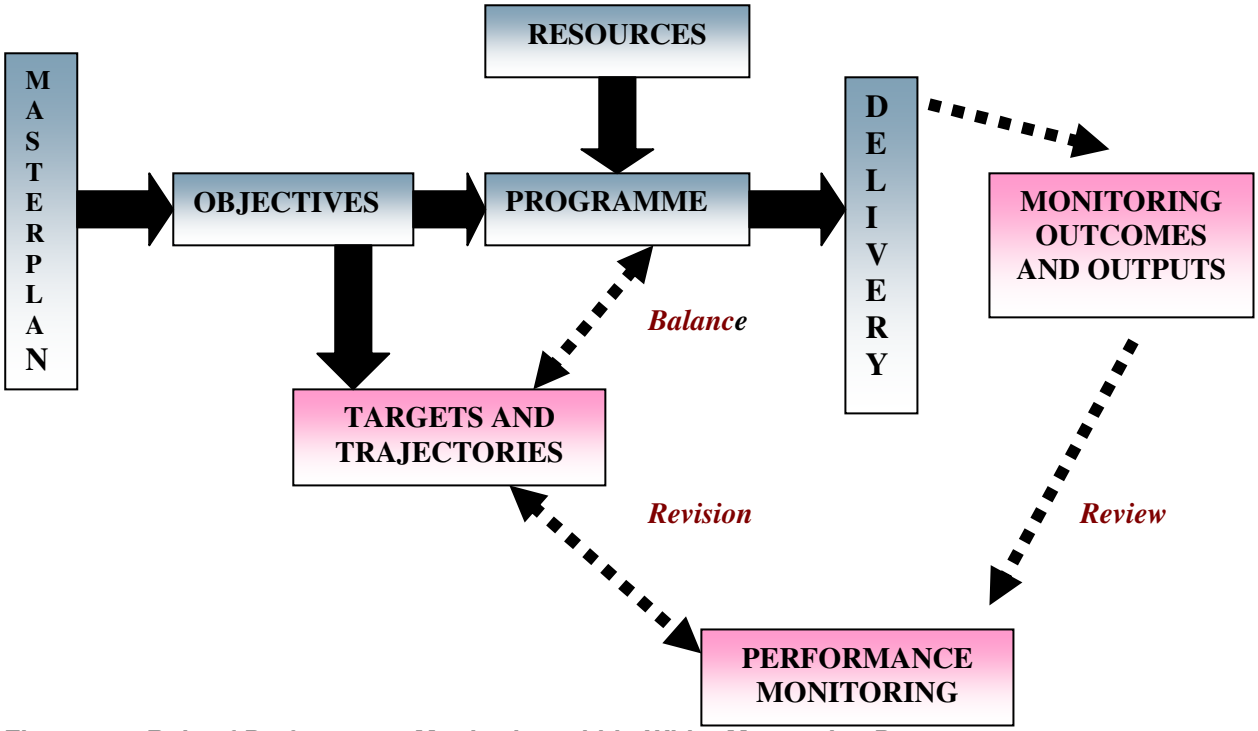

Figure 1.1: Role of Performance Monitoring within Wider Masterplan Process

1.6.4 Monitoring Framework

Effective and efficient monitoring programmes must reflect a simple process of aggregating readily available data sets. In the development of the plan and its targets, a crucial balance is necessary between the level of ambition in the targets being set and the necessary investment in these areas reflected in the financial programme. This balance must be correctly set and maintained, if the plan is to deliver the desired outcomes. The refinement of this balance between programmes and targets was subject to substantial iteration in the development of the final plan, and will be a crucial point for review in future progress reviews. One option for the ongoing monitoring process is highlighted in Figure 1.2 which summarises how the monitoring of the MPTM could operate.

Figure 1.2 sets out the framework for review, with the process examining the evidence (programme spend, performance indicator outturn) as well as the performance against each indicator. This scrutiny and review process helps with corrective actions being used to amend programmes, or if appropriate adjustments to MPTM targets. The approach requires close involvement of indicator owners and programme managers who in the first instance need to work together to make any day to day adjustments to the programme that are necessary.

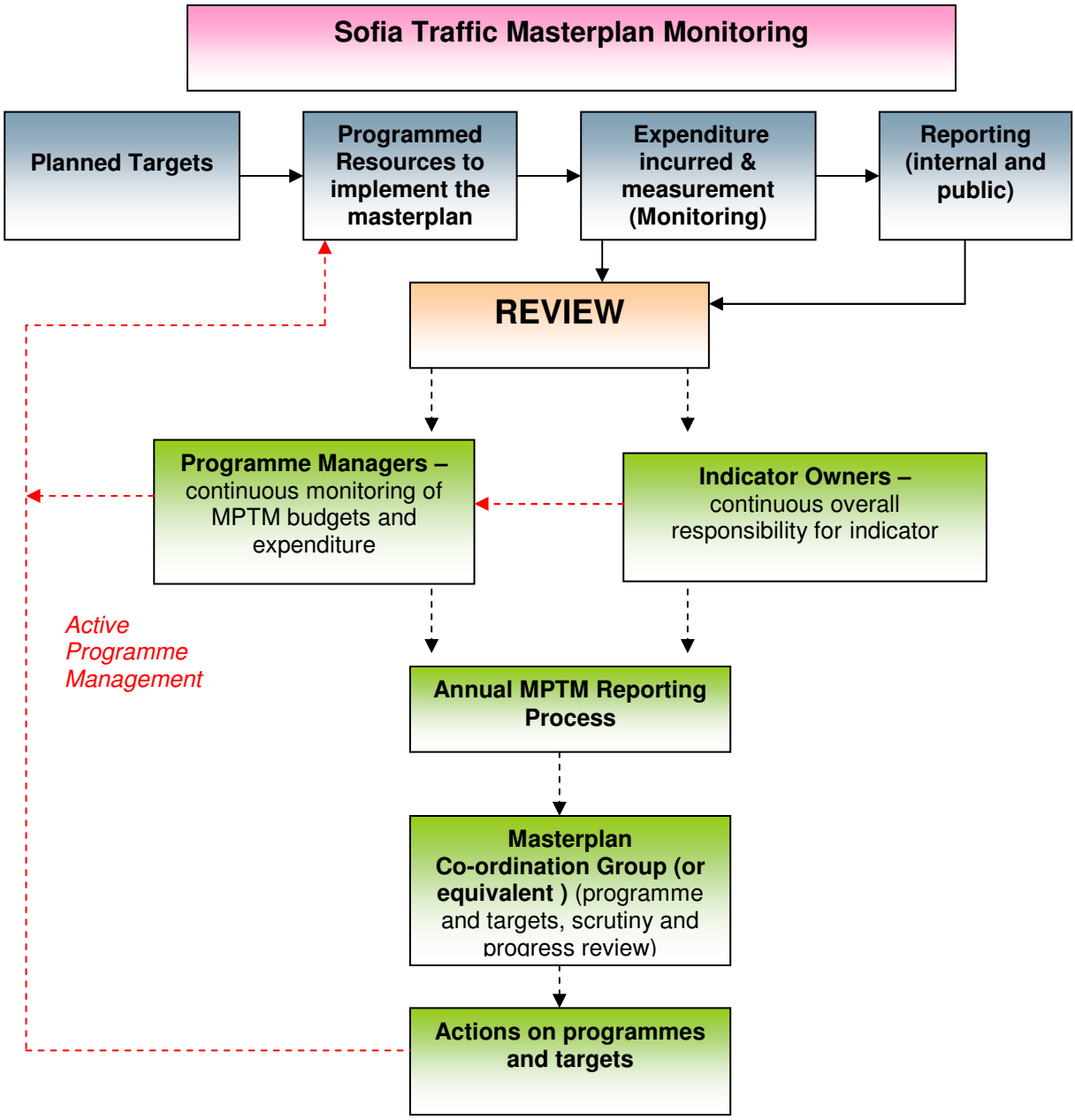

Figure 1.2: Proposed Sofia Traffic Masterplan Monitoring Framework

2. Performance Indicators & Targets

2.1 Introduction

Performance indicators need to provide a measure of the success of the Plan in delivering against the vision and desired outcomes. Typical indicators are usually quantitative:

INDICATORS	MEASUREMENT
• Input indicators - which document the main resource inputs to the project at each stage	• Input indicators should: o Cover all the primary types of resource inputs to the project with units matching the action plan o Be collected on a regular basis, taking account of key timing points and project milestones
• Process indicators - which monitor on-going project activities and may include qualitative indicators	• Process indicators should: o Address all aspects and stages of the transport decision making process o Cover project management and public engagement activities o Provide key data for project managers
• Output indicators document the products and services delivered through the strategy/plan	• Output indicators measure what projects achieve in terms of delivery at the end and also key stages during delivery
• Outcome indicators measure the impacts, benefits and changes that are experienced before or after implementation	• Outcome indicators measures what impact the project has had in terms of meeting underlying policy objectives

Transportation monitoring programmes generally focus on three kinds of elements — outputs, outcomes and external conditions.

- ***Outputs:*** These are actions taken or resources applied (e.g. funds, staff time etc.). They can include an organisation's adherence to its own plans and policies, facilities it has built, services it has provided, or promotions or events it has undertaken;
- ***Outcomes:*** These are impacts of actions taken, hopefully representing progress toward key objectives. They can include transportation behaviours, public attitudes, transportation activity levels, or measurements of congestion, emissions and air quality. In the complex world of urban transportation, it is difficult to find outcomes that arise solely and directly from actions by one party — there are typically many factors that might influence any given outcome. Further details on outcome indicators are set out in paragraph 2.2.1 below; and
- ***External Conditions:*** These represent changes in the circumstances that have informed current plans, such as economic growth, land use, socio-demographics, public attitudes, transportation costs, government legislation, international events etc.

2.2 Choosing Performance Indicators

Objectives are in effect abstract concepts and therefore it is often difficult to measure performance against them. The use of performance indicators provides a way of quantifying objectives or sub-objectives.

2.2.1 Outcome Indicators

Outcome indicators actually measure what impact the project has had in terms of meeting objectives. (for example, the number of people that cycle; the level of reduction in car use; have overall traffic safety levels improved (numbers of casualties decreased) etc.) The key issues that need to be considered when selecting the appropriate indicators include understanding:

- The need to compare results with those from other projects or to meet particular reporting formats (such as national requirements for major transport infrastructure projects);
- Over what time period the outcome indicators need to be measured;
- How impacts of projects will be determined (e.g. through collecting before and after data, conducting stakeholder interviews to assess their views on the projects' impact(s);
- The level of detail and accuracy that is required from the outcome indicators and evaluation process; and
- The level of data that already exists that might be used as part of the post-implementation evaluation.

Key questions to be considered when selecting/identifying indicators includes:

- Is the indicator measuring a priority area of the strategy?
- Is sufficient data going to be available to report/monitor the indicator?
- What would be the cost of additional data collection?
- Is a SMART (Specific, Measurable, Achievable, Relevant and Time-based) target possible with the indicator?
- Is the indicator cross-cutting (i.e. supports more than one priority/policy area)?

2.3 Setting Performance Targets

Objectives and indicators desired general direction of change. It is often difficult to specify targets which are appropriate and internally consistent. However, targets are an effective way of encouraging action and monitoring overall performance. The level of political priority afforded to investment decisions and the level of investment in scheme outputs has a major influence on whether targets can be met.

2.4 Supporting the MPTM Objectives

The MPTM performance indicators need to provide a measure of the success of the Plan in delivering against the objectives that have been set.

In September 2009 a draft vision statement was developed as the basis of the MPTM which we believe brings together the ambitions underlying the Project Terms of Reference:

'To develop and maintain an integrated (co-ordinated) transport network which promotes safety and sustainability and contributes to creating a better quality of life for people living, working or visiting Sofia'.

In support of this vision statement a draft set of strategic objectives against which the success of the Masterplan can be measured in the future were also developed including:

- To manage the transport network effectively to provide network efficiency, reduce unnecessary delays and traffic congestion;
- To maintain and improve the transport infrastructure;
- To maintain and improve accessibility to facilities and services for all – including pedestrians, cyclists and bus users, and particularly for disadvantaged people;
- To reduce road accident casualties, particularly for vulnerable road users;
- To maintain and improve transport and community safety and security, including reducing perceived danger;
- To improve environmental conditions for communities in Sofia by reducing the adverse effects of transport on the city's environment; and
- To promote and encourage healthier and more sustainable travel choices and improved quality of life

In developing the list/selection of indicators for the SMPT we have considered the following principles

- **Acceptability:** Reflecting the need for acceptance by those who will apply them;
- **Availability:** The need to easily obtain the data is important.
- **Clarity:** Indicators should be simple and unambiguous;
- **Limit in number:** Greater focus on indicators linked to a few headline measures; and
- **Comparability:** Important to adopt definitions/methods which are sound, practically feasible and consistent across measures.

Table 2.1: List of Proposed MPTM Indicators

Element	Ref. No.	Indicator Name	Contribution Towards Masterplan Objectives				
			Network Efficiency	Accessibility	Safety	Environment	Quality of Life
Transport System	1	Road Traffic Kilometres	✓			✓	
	2	Road Traffic Flows into the City Centre and Level of Transit Traffic	✓		✓	✓	
	3	Proportion of journeys to work by public transport		✓			
	4	Increase in Total Number of Public Transport Trips		✓			
Travel Times	5	Average journey time per kilometre in the morning peak	✓			✓	
	6	Public transport services running on time and public transport services suffering from congestion	✓			✓	✓

Road Safety	**7**	Road Traffic Casualties (Fatalities and Injuries) and Fatalities per capita (100,000 population)			✓		✓
	8	Road Traffic Accidents involving Pedestrians and Cyclists			✓		✓
	9	Speed Monitoring Relative to Legal Limit			✓		✓
Accessibility & mobility	**10**	Cycling Monitoring: Modal split (proportion of trips by bicycle) and local cycling levels		✓		✓	✓
	11	Pedestrian Monitoring: Modal split (proportion of trips by foot) and local walking levels		✓		✓	✓
Parking	**12**	Parking Space Occupancy Rate	✓	✓			
	13	Parking Behaviour (According to Regulations)	✓		✓		
	14	Parking Behaviour According to Regulations	✓			✓	
	15	Number of people using park & ride (when new/formal scheme introduced)	✓	✓			
Environment	**16**	Air Quality Monitoring: Concentration of Nitrogen Dioxide (NO2) and PM10				✓	✓
	17	Outdoor traffic related daytime noise levels				✓	✓
Social	**18**	Level of Public Satisfaction with Public Transport Services					✓
	19	Car ownership		✓			✓
	20	Satisfaction with the Quality of Pedestrian and Cycle Environment		✓		✓	✓

2.5 Existing City Transport Indicators

The Municipal Development Plan (2007 – 2013) contains a number of transport indicators in support of the objective to 'develop and modernise transport and water infrastructure, creating conditions for sustainable growth and better living style' (Prioritisation 2):

- Length in km. of railway lines (reconstructed and new);
- Length in km. road network (reconstructed and new);
- Length in km. underground network (reconstructed and new);
- Number of projects related to development and modernization of transport and engineering infrastructure;
- % Increase in traffic of people and goods; and
- % decrease of journey time.

Whilst the majority of these indicators relate to outputs rather than outcomes, they are useful indicators nonetheless in terms of overall transport performance in the city. It is not intended to duplicate these within the MPTM, and the indicators that have been selected are more focused on outcomes rather than outputs.

3. Sofia MPTM Indicators and Targets

3.1 Introduction

This section sets out the proposed indicators for the MPTM which reflect different MPTM objectives, including definitions of each indicator and method of measurement, as well as background information and provisional targets that have been proposed.

3.2 Transport System Indicators

Indicator 1: Road Traffic Kilometres

Definition:

- This indicator compares the overall road traffic kilometres monitored annually during the MPTM period.

Methodology and input data collection:

- Traffic data should be obtained from traffic surveys, with survey sites covering all types of roads in the city - including classified principal roads, classified non-principal roads and unclassified roads all around the city;
- Ideally the use of Automatic Traffic Counters (ATCs) should be used for this purpose. ATCs are placed at particular locations ensuring that they can detect and count passing vehicles. They capture information on the direction of passing traffic, the speed at which a vehicle is travelling, the number of vehicles and their classification (cars, lorries, buses or coaches) based on their axle length;
- It is necessary to conduct surveys for a period of several days duration each year. This data, combined with road length data (the traffic flows are multiplied by length of the appropriate links) is then used to produce an estimate of the total vehicle kilometres for each vehicle type and by road type which can then be monitored annual over the life of the Plan;
- As part of the Stage 1 Analysis work a programme of extensive traffic count surveys was undertaken to obtain a good understanding of traffic movement and intensity at junctions across the city. The selection of junctions was based on the city's major street network classification and local knowledge of traffic movements; and
- It is recommended that installing ATC equipment (or a selection of) will enable traffic data to be more easily obtained in future.

Background Information:

- Baseline data to be produced in terms of total vehicle kilometres for each vehicle type and by road type for this indicator.

Target: To maintain the level of traffic kilometres at current levels.

Indicator 2: Road Traffic Flows into the City Centre and level of transit traffic

Definition:

- The indicator shows how number of vehicles entering the city centre changes in a period of time.

Methodology and input data collection:

- A large cordon survey is necessary to be conducted to obtain the basic data for this type of indicator calculation. The total number of traffic flows entering the city centre for all observed years is calculated.

Background Information:

- During 2009 AECOM (formerly Faber Maunsell) undertook roadside interview surveys at seven locations on the approaches to Sofia outside of the Ring Road at the following locations:
  - A1 / E80 Trakia Motorway between SRR and first junction;
  - II-82 between Iskar Lake and Samokov;
  - I1 / E79 between SRR and first section of Struma Motorway;
  - I8 / E80 between SRR and Bozhurishte;
  - II81 approx 15km north of SRR;
  - II16 approx 20km north of SRR; and
  - I1 / I6 / E79 between SRR and first section of Hemus Motorway.
- These surveys have captured origins and destinations of traffic by mode, therefore it should also be possible to identify traffic passing through Sofia (transit traffic) and trips that have one end of their journey stopping or starting within the City. The information was collected for the period 07.00 – 19.00 on an average weekday; and
- Baseline data for the MPTM for these indicators needs to be set.

Target: To maintain level of traffic entering the city and transit traffic at current levels.

Indicator 3: Proportion of journeys to work by public transport (modal split)

Definition:

- Assessment of change in AM Peak public transport mode split for journeys to work. Household Travel Surveys (HTS) provide information travel behaviour information from residents within Sofia. (Also relates to Indicators TM12 and TM13 to). It will be the primary source of information concerning the current travel patterns of residents of, collecting data on household composition and the number of trips made by those living within the sampled households.

Methodology and input data collection:

- Modal split surveys provide information on journey purpose during peak periods and provide a measure of the level of success in terms of the Municipality's transport policies;
- During 1999/2000 in the process of preparation of the 2004 Masterplan of Sofia a large mobility survey was carried out to obtain information to feed into the development of a traffic model for the city. In support of the MPTM last year a new household travel survey was constructed in such a way to enable a

comparison to be made between the two surveys. This focused on journey to work trips undertaken during the morning peak period;

- The surveys were undertaken using a market research company in July/August last year, with the survey structured to obtain information on the following:
  - Mode of transport used during the morning peak period;
  - Time of departure from home and time of arrival at destination of trip;
  - Public perception of solutions to traffic problems in Sofia; and
  - Public perception of public transport and cycling.
- The survey was representative of the city's population within the internal perimeter of the Sofia Ring Road, with interviews proportionally allocated to municipalities and districts according to the proportion of the population of the municipality to the population of the city as a whole. Households were also randomly selected within the district / region and the set quota; and
- In order to satisfy this indicator it is recommended that similar surveys are undertaken in Years 3 and 5 of the Plan (every 2 years).

Background Information:

- In relation to the results from the 2009 survey:
  - The primary mode of travel for trips undertaken during the morning period is public transport which accounts for just over 49% of all trips, higher than car use which accounts for 38% of trips;
  - Use of non-motorised modes is relatively low across Sofia with trips undertaken on foot or by bike representing only 11% and 1% respectively; and
  - Use of taxis is very low accounting for less than 1% of all trips undertaken.
- Comparing results of the modal split between 2009 and 2000:
  - There are significant changes in the mode of travel used during morning peak period. The proportion of trips undertaken by public transport fell from 65% of all trips in the morning period in 1999 to 49% in 2009;
  - The modal share of car trips has increased from just over 17% to just under 32% of all trips in the morning period; and
  - The share of people walking to work has a marginal increase with the proportion remaining relatively unchanged – remaining at approximately 11% in both surveys.
- Given the downward trend in proportion of trips made public transport a key challenge is likely to be to maintain current levels.

Target: To maintain the proportion of journeys to work by public transport at 50% of all trips in the AM peak period.

Indicator 4: Increase in Total Number of Public Transport Trips

Definition:

- Assessment of change in public transport trips.

Methodology and input data collection:

- Public transport patronage figures are held by the Centre for Urban Mobility who are responsible for surveys concerning public transport and travel demands

- Data should be obtained each year over the life of the MPTM.

Background Information:

- Data obtained during the Stage 1 Analysis revealed that between 2004 and 2008 total annual public transport patronage increased by 6.7% (across all public transport modes – comprising electrical transport, tram, trolleybus, bus and metro services);
  - Over 50% of trips undertaken in Sofia are by bus, with electric modes accounting for 41% of all trips (of which 25% are undertaken by tram); and
  - In 2000 just over 3% of people travelled by Metro, whereas the current proportion of trips by Metro has since increased to just under 11% of all public transport trips. However, this is still some way short of the figure forecast in the 2004 City Masterplan, which predicts a level of 24% by 2020.
- In the absence of more recent data the 2008 patronage figures provide the baseline for the MPTM.

Target: To increase the total number of public transport trips (all) by 10%.

3.3 Travel Times

Urban areas with high dense population suffer from congestions very often. In these cases traffic both public and private becomes inefficient. Therefore policies and measures are applied to improve the transport systems in terms of travel times. Travel time monitoring is an important tool to assess the success of implemented measures. The following indicators are appropriate:

Indicator 5: Average journey time per kilometre during the morning peak

Definition:

Travel time and delay surveys measure average travel and running times along sections of a route while at the same time collecting information on location, duration, routing and causes of delays. This indicator calculates vehicle journey time per kilometre during the morning peak hour on major inbound routes in the larger urban centres.

Methodology and input data collection:

- The first step in the production of the indicator is the identification of the target routes. It is necessary to collect vehicle flow information for these routes. The collection should be done through a roadside survey. It can be done by Automatic Number Plate Recognition (ANPR) cameras, traffic cameras or automatic traffic counters as well. These will be used to weight the journey time data to make it representative of traffic flows in the area. This means that the busiest of the selected routes counts the most towards the indicator;
- The next stage selects the journey time data relevant to the morning peak and the routes which need to be surveyed. This data is then used to calculate average journey times for each of your routes;
- The final stage is to use the vehicle flow information to weight the route journey time information to produce your annual indicator figure; and
- This approach can provide useful data about morning peak congestion.

Background Information:

As part of the Stage 1 Traffic Analysis surveys were undertaken to assess car journey times on the main corridors to provide information on average journey speed and to help identify locations where congestion occur. The measurements were conducted on the following directions which provide the target routes for ongoing monitoring over the life of the Plan:

- Border of Zone I Madrid Boulevard – Acad. Ivan Geshov – Slivnitsa Boulevard;
- Bozhurishte – Dolni Bogrov;
- Russki Pametnik – Knyazhevo;
- Nadezhda Overpass – Mirovyane; and
- Entrance Sofia – Orlov Most.

The baseline data will need to be obtained for the above 'target routes' in terms of journey times per kilometre against which the target will be measured over the life of the MPTM.

Target: To increase average journey time on target routes by 15% by 2015.

Indicator 6: Public transport services running on time and public transport services suffering from congestion

Definition:

- Public transport punctuality – defined as keeping public transport vehicles to their scheduled departure times. This indicator can express quality of public transport system in terms of time punctuality and its progress in time; and
- Public Transport Congestion – defined as the number of minutes in excess of the free flow operational speed as measured at 5am on a Sunday morning.

Methodology and input data collection:

- The existing data and collection of information needs to be improved to collect and record data that will enable accurate punctuality measurements to be taken;
- The punctuality measurements enable the live situation to be shown in order that controllers can deal with developing problems as well as historic measurements;
- The measurement of punctuality should not be adjusted by the continual adjustment of scheduled time to show no late running. This will not enable the identification of problem areas that need addressing;
- Punctuality is measured by the identification and geo-coding of a number of stopping points called timing points. These can range from every station on the metro to key locations on bus and tram routes with about 5 minutes running time in-between. Each vehicle is fitted with an Automated Vehicle Location device using GPS which allows the actual time at timing points to be measured against scheduled time;
- All city surface public transport vehicles will be regarded as on-time if they are measured as departing from a defined timing point within a window of 2 minute 0 seconds early to 1 minutes 59 seconds late. All metro trains will be regarded as on-time if they are measured as departing from a metro station within a window of 0 seconds early to 30 seconds late. Vehicles that fail to run should be treated as "late" and not ignored in the calculations;

- It is expected that all journeys would be measured; and
- A measurement of the actual timings against best case timings, i.e. an operational run at an un-congested time of day such as 5am, enables the authority to establish which journeys suffer from the worst congestion and where this is.

Background Information:

- As part of the Stage 1 analysis work, using public transport data supplied by SKGT it was possible to assess the performance of the three surface public transport modes (tram, trolleybus and bus) against their timetable plans;
- The timetable derived data included the timetabled runtime, the actual run time and the frequency of the actual runtime. (However, there was no means to break the data down by time period, for examples to distinguish AM peak, PM peak or working weekday performance which would have provided a more detailed view of the public transport performance in the context of demand for road space from car drivers in the peak travel periods); and
- The existing methodology incorporates scheduled timings that include congestion. It is important that in order to identify problem locations, the existing schedule is compared against free flow timings. This is a different indicator to that of punctuality.

Target: To improve the percentage of public transport services running to schedule. The proportion of public transport services running to time shall be - metro and tramway 100%, trolleybus 97% and bus 95%.

3.4 Safety

Road safety is a serious issue in Bulgaria, with nearly 1,000 people killed each year and around 10,000 injured in road accidents. Safety monitoring is therefore an important issue which should identify if the policy and measures work. Given the need to consider the safety conditions for vulnerable road users we are proposing collecting and evaluating data on casualty rates for the following indicators.

Indicator 7: Road Traffic Casualties (Fatalities and Injuries) and fatalities per capita (100,000 population)

Definition:

- Road traffic casualties: A person killed or injured in an accident. One accident may give rise to several casualties therefore the total number of casualties may be higher than the total number of accidents; and
- The annual number of road fatalities per capita per year.

Methodology and input data collection:

- One source of information which is necessary is road accident statistics. Accidents in Bulgaria are categorised by severity as either a) fatal accidents, b) accidents involving injury to people or c) accidents involving only damage to vehicles;
- The national road accident database contains 2 main folders with general accident data (total of 36 variables and also persons involved and vehicles (total of 20 variables);

- In order to give a broader overview of the city's accident trend a 5-year rolling average method should be considered. This uses an average of the preceding 5 calendar years (including latest year) figures to give average number at the current year. This method provides a more robust data set to provide an overview of the overall casualty trend, which negates any casualty "peaks" and "troughs" which individual years may contain;
- In the UK most authorities use a GIS database system to record, validate and analyse accidents, enabling data to be viewed and interrogated on a map background;
- It is recommended that a database to be collected and processed in digital format. Traffic police is moving toward this practice. The current paper format makes it difficult and time-consuming to interrogate data sets and to examine specific variables;
- In addition, the recording of additional variables, for example, vehicle direction of travel, would greatly improve the interpretation of the accident data, and allow improvement schemes to be developed to tackle specific accident problems at specific locations;
- The frequency of accidents at a particular location (i.e. number of injury accidents per year) is not necessarily an appropriate indicator of risk, as it takes no account of the level of exposure to risk. (For example, a large number of accidents may simply reflect a large volume of traffic); and
- Accidents and casualties are often expressed in terms of a rate. Rates are normally expressed in accidents (or casualties) per 100 million vehicle kilometers). Total vehicle kilometer statistics and vehicle proportions are necessary to calculate this indicator. However, data on vehicle kilometres travelled for each city is not always readily available. In this case, the best alternative data available reports all accidents (and fatalities) across all urban transport modes, per capita (per 100,000 population).

Background Information:

- A knowledge of the number of accidents and casualties occurring allows for:
  - Benchmarking of safety in Sofia against other cities in other countries;
  - Identification of locations with high accident records, as a basis for prioritising where action should be taken to reduce accident occurrence; and
  - A baseline so that the future accident rate can be monitored, as a check that the actions taken are indeed successful.
- The National Road Safety Plan 2006-2010 includes a target to reduce the number of fatalities by 50% by 2010 (compared to the average between 1991 and 2004), while additionally the National Strategy for Protection of Children's Life and Health in the Road Traffic 2006-2010 aims to halve the number of child accident victims by 2010 (compared to the average between 1990-2001);
- Sofia Traffic Police collate and evaluate accident records, with the accident records held being split into three categories: a) fatal accidents, b) accidents involving injury to people and c) accidents involving only damage to vehicles. We understand that it used to be a requirement within Sofia that the Police are called to all traffic accidents but that Police are now also called to damage-only accidents;
- It is understood that the accident records are not entered into a computer database that allows searching of the accident data automatically, for example the sites with the largest number of accidents cannot be automatically identified;
- Information on traffic accidents has been provided for a five year period (2004 – 2008). There is a national system of recording road traffic accidents in Bulgaria; this allows up to 40 variables to be recorded for each accident; and
- A baseline needs to be set for the casualty level based on an annual average of the preceding 5-year casualty totals ion Sofia. This information should be obtained from the Police to establish this baseline.

Target: To reduce the number of casualties by one third.

Indicator 8: Road Traffic Accidents involving Pedestrians and Cyclists

Definition:

- Number of recorded pedestrian and cyclist accidents.

Methodology and input data collection:

- Numbers of accidents involving pedestrians / cyclists (divided into fatalities and injured) is recorded by the Police every year. The data for particular years are compared afterwards and trends analysed;
- The national system of recording road traffic accidents in Bulgaria allows up to 40 variables to be recorded for each accident, included in an accident schedule. It is understood that within Sofia, 14 of the variables are reported including Item 17 which records accident type (including pedestrian / cyclist); and
- Specific details of pedestrian / cycle accidents should be monitored in a similar fashion to that described under Indicator TM9 (using 5-year rolling average).

Background Information:

- Same as "Indicator TM9: Road Traffic Accidents (Fatal, Injuries, Vehicle-Damage accidents); and
- In line with the Municipality's aspirations to see greater use of sustainable modes for trips, compared to use of the car it is important to monitor the level of casualties involving 'vulnerable road users' to ensure that improving conditions for pedestrians and cyclists is not having an adverse impact in terms of increasing casualty rates for these modes.

Target: To reduce the level of accidents involving pedestrian / cycle (fatal and injured) by one third.

Indicator 9: Speed Monitoring Relative to Legal Limit

Definition:

- Speed monitoring is useful to obtain an overview of speed limits adhering on a scale of different class of roads with different speed limits.

Methodology and input data collection:

- The speed monitoring should be done annually at similar time of year. It is necessary to decide which speed limits we want to monitor and to choose a set of road sections for each of speed limit we want to observe;
- Speed of the vehicles is necessary to be monitored during off-peak period when we can observe vehicles moving in free flow;
- Speed monitoring can be very useful tool to analyse the efficiency of specific measures like for instance traffic calming; and

- The measurement is usually done using a speed radar guns which collect free flow speeds at discreet points along road lengths. Out of the observed data we can obtain a set of statistical figures which describe the traffic behavior of drivers in terms of speeding. Useful data are for example average speed on the road sections with a certain speed limit, percentage of compliance of the speed limit or 85th percentile spot speed (i.e. speed up to which 85% of vehicles travel in free flow conditions).

Background Information:

- A programme of speed surveys to be undertaken which will establish a baseline for this indicator.

Target: To reduce the level of speeding activity relative to legal limits.

3.5 City Mobility and Accessibility

Accessibility is one of the major conditions for sustainable cities. The municipality should ensure the accessibility of social centres for all inhabitants through the transport policy.

Indicator 10: Cycling Monitoring: Modal split (proportion of trips by bicycle) and local cycling levels

Definition:

- Cycling monitoring is carried out usually to get basic information about this transport mode and trends in cycling transport. The data we can obtain from this are modal share, flows of cyclists or their origins and destinations.

Methodology and input data collection:

- **Modal split**: Data is collected together with other transport modes in extensive household surveys.
- The surveys were undertaken using a market research company in July/August last year, with the survey structured to obtain information on the following:
  - Mode of transport used during the morning peak period;
  - Time of departure from home and time of arrival at destination of trip;
  - Public perception of solutions to traffic problems in Sofia; and
  - Public perception of public transport and cycling.
- The survey was representative of the city's population within the internal perimeter of the Sofia Ring Road, with interviews proportionally allocated to municipalities and districts according to the proportion of the population of the municipality to the population of the city as a whole. Households were also randomly selected within the district / region and the set quota. In order to satisfy this indicator it is recommended that similar surveys are undertaken in Years 3 and 5 of the Plan (every 2 years);
- **Cycling levels**: Local data about cycling are usually counted manually or automatically. Automatic systems are used for long-term data collection where manual data collection would be too expensive;
- It is recommended to choose the representative locations on the core cycling network (existing or planned) and undertake regular counts in selected periods of the year (spring, summer holidays, autumn). The results provide the quantitative outputs, compiled into a time series to show the increase / decrease of the cycling activity in the local context. These counts can help to prioritize investment in middle-term planning; and
- Origin-destination cycling surveys are meaningful in the district size, where especially data about daily commuting are helpful for future network improvements. The most common example are the cordon

surveys in certain destination (local district centre, university campus, schools, shopping malls).

Background Information:

- The modal share of cycling in Sofia is 11% according to the latest household survey;
- Cycling has been monitored during the pedestrian surveys, but the level of cycling was low (mostly about 10 cyclists per hour). For more accurate surveys, the locations need to be chosen on the cyclist network; and
- There have been no specific origin-destination surveys yet and so no baseline has been set.

Target: To increase the proportion of journeys to work by bicycle by an additional 4% (total of 5%).

To achieve a increase in the absolute levels of peak cycle movement at survey sites in the city centre. *(Target to be set when baseline condition established).*

Indicator 11: Pedestrian Monitoring: Modal split (proportion of trips by foot) and local walking levels

Definition:

- Walking monitoring is carried out usually for general transport planning purpose (modal share) or specific data collection, where investment for walking improvements occurs.

Methodology and input data collection:

- **Modal split**: Data is collected together with other transport modes in extensive household surveys.
- **Walking levels**: Manual counts are the basic method of surveying pedestrian movement. As pedestrian journeys are usually very short in nature, the choice of any screen line or cordon is more critical that it would be for surveys of motor vehicles; and
- Pedestrian flows at any one location are likely to show more variety from day-to-day than flows of motor vehicles. One day counts provide a useful impression but are unlikely to forma statistically reliable basis for regular monitoring.

Background Information:

- Pedestrian surveys were undertaken in Sofia at city centre locations, chosen carefully to reflect the following:
  - High intensity of pedestrian flows (to focus on the majority of users);
  - Position of important walking attractors (to assess the accessibility); and
  - Proximity of other modes of transport, especially public transport (to encourage cooperation as well as to solve the negative interaction between pedestrians and motorised traffic).
- A number of locations in the city centre were surveyed, when deciding about the most important locations for walking in Sofia. The surveys involved undertaking pedestrian and cycle counts. In total, 13 busy junctions and 12 profiles were included, in two periods (October 2009, May to June 2010);
- The surveys were undertaken during the peak hour between 4 pm and 8 pm during weekdays. The data collection itself was carried out by people who observed the dedicated profile or crossing movement at the junction. The total number of pedestrians/cyclists were collected in 15 minute intervals; and

- Walking survey Conclusions:
  - The peak hour for walking: 17:30 – 18:30 is prevailing in the city centre;
  - There is a low level of cycling (typically at most of locations have been observed not more than 10 cyclists per hour);
  - Pedestrianised streets show a relatively high level of pedestrian movement and level of use (Vitosha up to 3800 pedestrians per hour in the street profile, Graf Ignatiev up to 3600 pedestrians); and
  - There is a high level of people crossing motorised traffic on the ground.

Target: To increase the proportion of journeys to work on foot by an additional 4% (total of 15%)

To achieve a 10% increase in the absolute levels of PM peak pedestrian movement at survey sites in the city centre.

3.6 Parking

Parking policy and specific measures for parking policy are becoming more and more important in urban areas over the world. As the number of registered vehicles is constantly increasing the cars tend to occupy more space. Urban car parking can cause major congestion in urban areas during the peak hours. The demand of parking stock and the origins to which people drive from are needed to form an accurate base model, and to run future scenario testing to measure a propensity to change modes. Before any measures for better control are introduced, basic data pertaining to the availability of parking space, extent of its usage and parking demand are essential.

Indicator 12: Parking Space Occupancy Rate

Definition:

- This indicator measures occupancy rate of parking spaces on particular car parks.

Methodology and input data collection:

- The data should be obtained from a survey at the car parks. The number of parking spaces available during the day should be recorded, it is usually done by observers on foot. Video recording techniques are also feasible. As data is obtained it is possible to compare particular parking places, days of the week etc. The main objective of this type of monitoring is to get data describing how the parking situation improves after applying some measures.

Background Information:

- One important aspect is to ensure that the city's parking stock is used as efficiently as possible. It is important for the Municipality to maximise the overall capacity of public off-street (and on-street) car parking provision as much as possible;
- Key issues (and deficiencies) relating to parking in Sofia city centre include:
  - the blue zone is not always used as intended (i.e. for short-term parking), with the majority parking for long periods; and
  - in the majority of areas in the city centre parking capacity is insufficient to satisfy demand, (particularly within Area 10).
- Parking wardens are equipped with PDA's to monitor SMS paid parking as well as the validity of parking

tickets displayed on vehicles and there is a central control system within the Centre for Urban Mobility which is able to recognise and verify the purchase of ticket sales through assessment of registration plates against the level of payment made – this offers a means to monitor the occupancy level of public car parks/on-street parking zones on daily/monthly basis and assess trends over the Plan period.

Target: To increase the occupancy rate of public car park provision within the 'Blue Zone' area over the Plan period.

Indicator 13: Car Parking Duration

Definition:

- The indicator shows the length of stay of individual vehicles within a defined area.

Methodology and input data collection:

- The parking areas should be divided into a number of patrols. The frequency of the patrol should depend on the land use characteristics of the surrounding area. Using this indicator we can find out how efficiently the applied measures work.

Background Information:

- The municipality is keen to restrict long stay parking for commuters in the urban centre, whilst making reasonable provision for visitors, especially shoppers, to support the continued economic viability of the city centre. The provision of short stay parking is considered essential for the economic vitality of the city centre;
- Key issues (and deficiencies) relating to parking in Sofia city centre include:
  - the blue zone is not always used as intended (i.e. for short-term parking), with the majority parking for long periods; and
  - in the majority of areas in the city centre parking capacity is insufficient to satisfy demand, (particularly within Area 10).
- Parking wardens are equipped with PDA's to monitor SMS paid parking as well as the validity of parking tickets displayed on vehicles and there is a central control system within the Centre for Urban Mobility which is able to recognise and verify the purchase of ticket sales through assessment of registration plates against the level of payment made – this offers a means to monitor the overall parking duration of vehicles in public parking spaces on a daily/monthly basis and assess trends over the Plan period.

Target: To reduce the level of long stay parking activity in the city centre in favour of short term parking.

Indicator 14: Parking Behaviour (According to Regulations)

Definition:

- This indicator measures what percentage of all vehicles park according to the given rules/regulations.

Methodology and input data collection:

- The proposed measures should increase the percentage of vehicles parking in accordance to the given rules as much as possible. The vehicles parked not according to the rules are for example these ones: when the driver did not pay the compulsory parking fee, the vehicles parked at restricted areas, the vehicles parked in parking places reserved for disabled persons and so on; and
- The data for this indicator should be obtained by observers before as well as after the application of the measures.

Background Information:

- Key issues (and deficiencies) relating to parking in the Sofia city centre include:
  - Illegal parking activity seriously deteriorates the quality of open public spaces, especially with regard to pedestrians (with only one in six cars parked in accordance with established rules);
  - Excessive parking on secondary streets, where parking is free is often observed, which has an adverse impact on the numbers of drivers using parking lots; and
  - Implementation and compliance with the rules is insufficient, which results in a large loss of potential revenue from parking.
- Strict control and enforcement measures are being implemented to comprising both on-street measures to restrict parking as well as regular monitoring of city centre parking activity through the city's 40 policemen and 280 parking wardens help control and enforce parking activity in the 'Blue Zone';
- Parking wardens are equipped with PDA's to monitor SMS paid parking as well as the validity of parking tickets displayed on vehicles and there is a central control system within the Centre for Urban Mobility which is able to recognise and verify the purchase of ticket sales through assessment of registration plates against the level of payment made; and
- It is recommended that this central system be used to monitor overall levels of illegal parking activity to gauge the level of effectiveness of enforcement activities overt he duration of the MPTM.

Target: To reduce the level of illegal parking activity in the city centre (Blue Zone).

Indicator 15: Number of people using park & ride *(when new/formal scheme introduced)*

Definition:

- The estimated total number of passengers using dedicated park & ride facilities (specifically people, not the number of cars) on a daily basis.

Methodology and input data collection:

- An initial survey on all significant park & ride facilities should be carried out to get a data baseline. Consequently biannual surveys should be designed and carried out. These surveys should not be focused just on number of cars but on the number of passengers as well. The surveys should be done from 6 am till 7 pm to get the overall number of passengers using park & ride facilities and identify peak and inter-peak periods and their characteristics as well;
- Broad indicators of passenger demand may be derived from ticketing data, which is particularly useful for

the analysis of time trends (for example, when most people are using the service); and

- One limitation is that the data rarely provides a full representation of demand (excluding off bus sales such as season tickets) and does not lend itself to a more disaggregate analysis of patronage (for example, by trip purpose and ultimate origins and destinations. However, information on counts and analysis based on fares and ticketing will provide an indication on the overall trend in usage and assess whether any park & ride schemes are achieving their objectives or not.

Background Information:

- There are no purpose-built park & ride sites yet in Sofia and so this indicator will only become 'live' once facilities are provided and services are operated; and
- It is known that some residents in the western suburbs and satellite towns drive to Metro stations and use 'unofficial' park & ride, which supports the demand for establishing formal park and ride facilities in the city.

Target: To increase park & ride patronage by 2015. *(Target to be set for site(s) when decision to take these forward is confirmed).*

3.7 Environment

Environment in urban areas is usually closely observed issue. Emissions which originate from transport are the most significant part of all. More ecological vehicles, tolls, parking policies and other are efficient tools to reach this goal.

Indicator 16: Air quality assessment (concentrations of Nitrogen Dioxide (NO2) and particulate matter (PM10)

Definition:

- The objective of this indicator is to monitor progress on reducing air pollution to meet EC and relevant national air quality standards. This includes No.

Methodology and input data collection:

- Pollution monitors should be installed at strategic locations which will monitor pollutants in near real time. The data should be collected continually and the sets of data will be analysed consequently to assess the impact of particular traffic management measures; and
- Passive diffusion tubes are not as accurate as real time monitoring due to the long averaging time employed by this method. A nitrogen dioxide passive diffusion tube is a clear plastic tube open at one end and at the closed end a mesh is impregnated with a pollutant absorbing chemical. The diffusion tube collects the pollutant during the exposure period and then is resealed and returned to a laboratory for analysis. Each tube is exposed for a month period. The laboratory then assesses the quantity of the pollutant absorbed by calculating the average ambient NO2 concentration over the exposure period.

Background Information:

- Poor air quality resulting from high volumes of congested traffic can have a detrimental impact on the

health of people living in close proximity to busy roads;

- Directive 2008/50/EC of the European Parliament and Council sets out the legal requirements for ambient air quality and cleaner air in Europe. It also sets out the criteria for determining minimum numbers of sampling points for fixed measurement of concentrations for the different pollutants which should be followed in any air quality assessment in Sofia. The targets for nitrogen dioxide in EC countries are for one-hour average of 200 µg/m3, not to be exceeded more than 18 times a calendar year; and the calendar year of 40 µg/m3;
- In addition, the Bulgarian government have asked for an extension for PM10/Particulate Matter by which the limit value should be met. The PM10 (which focuses on particles measuring 10Âµm or less) standard was designed to identify those particles likely to be inhaled by humans, the main sources of which include road transport. All road transport emits PM10, but diesel vehicles emit a greater mass of particulate per vehicle kilometre;
- The relevant targets include achieving the one average for PM10 of 50 µg/m3 which should not to be exceeded more than 35 times a calendar year, as well as average level per calendar year of 40 µg/m3; and
- It is uncertain at this stage how the Municipality is addressing the overall issue of air quality in line with EC requirements. It is recommended that real-time nitrogen dioxide analysers be installed at selected sites in the city, at busy roadside locations. These should be capable of giving accurate hour by hour readings.

Target: To meet EC directive targets on NO2 and PM10.

Indicator 17: Outdoor traffic related daytime noise levels

Definition:

- Noise caused by traffic can be measured using sound level meter. In areas which are affected with traffic noise it is useful to calculate the percentage of the disturbed households.

Methodology and input data collection:

- Sound level meter measurement should be applied before as well as after the application of the measures. The percentage of households affected by the noise can then be calculated. The aim is to reduce the noise which could be reached by reducing speed or volume, by changing the traffic composition, gradient and condition of the road surface etc;
- The best noise index for describing road traffic noise disturbance is the L10 (18 hour) dB(A). This index represents the arithmetic mean of hourly noise levels which are exceeded for 10% of the time, over an 18 hour period between 06:00 - 24:00hrs. The noise level is measured as an ‘A’ weighted decibel. Traffic noise levels approaching an L10 (18 hour) 68 dB(A) are likely to cause some degree of disturbance for 50% of the occupants inside a dwelling; and
- A selection of the traffic site counts should be chosen as representative samples of locations for a noise survey. The noise surveys should be carried our at the same time as the traffic counts but should extend over 18 hours to allow the 18-hour L10 level to be measured. By using the 18-hour measurement period the noise climate between 6am and midnight will be accounted for, which will enable any changes from year to year to be identified.

Background Information:

- Noise from road traffic affects the quality of life for people who live, work or spend leisure time near busy and fast roads. Night time noise can also be a problem. Traffic noise alone is harming the health of almost every third person in the WHO European Region. One in five Europeans is regularly exposed to sound levels at night that could significantly damage health;
- Environmental noise policy is driven by European legislation. The EU 6th Action Programme Environment 2010: Our Future, Our Choice explains the aim for the noise climate of Europe "to achieve reduction of the number of people regularly affected by long-term high noise levels from an estimated 100 million people in the year 2000, by around 10% in 2010 and by 20% in 2020." (Environmental Protection UK, 2009);
- Directive 2002/49/EC, known as the Environmental Noise Directive requests that member states determine noise exposure through noise mapping followed by Action Plans with "a view to preventing and reducing environmental noise where necessary and particularly where exposure levels can induce harmful effects on human health and to preserving environmental noise quality where it is good". To date no clear guidance has been issued with respect to absolute noise levels, although guidance is available from the World Health Organisation on noise levels and health effects;
- SILENCE is a three year research project co-funded by the EC aimed at providing a methodology for control of surface transport noise in urban areas and as such provides a methodology for implementing the philosophy behind Directive 2002/49/EC. It is recommended that guidance within the SILENCE practitioner handbook accordingly be used as a basis for developing traffic plans in Sofia; and
- It is uncertain at this stage how the Municipality is addressing the overall issue of noise assessment in line with EC Directive2002/49/EC (END). However it is recommended to link any monitoring programme of noise assessment to the traffic survey work undertaken in Stage 1 analysis to provide a measure of overall noise levels attributable to traffic noise which can then be subsequently be monitored over the life of the Plan.

Target: To reduce noise levels associated with traffic in line with WHO and SILENCE guidelines.

3.8 Social

Quality views on transport performance is improved in the context of understanding poor performance and what measures are likely to influence mode of travel.

Indicator 18: Level of Public Satisfaction with Public Transport Services

Definition:

- Percentage of people who are satisfied with Public Transport Services.

Method of Data Collection:

- This data should be obtained on yearly basis. Consequently the data from particular years should be compared to each other. The way to collect the data is to carry out a household survey or a survey on public transport stops.

Background Information:

- 2002 Eurostat information reveals that there has been a low level of public satisfaction with public transport (at just under 24%) compared with two-thirds who were dissatisfied with public transport services. (Eurostat is the statistical office of the European Union situated in Luxembourg Its task is to provide the European Union with statistics at European level that enable comparisons between countries and regions. The precise nature of the source of this dataset/survey format is unknown, nor if more recent data is available);
- It is recommended that programme of annual surveys be undertaken across all public transport modes to regularly benchmark satisfaction levels amongst users. This should use the same structure/format of survey and sample size to ensure consistency and a means to compare results on an annual basis;
- Ideally the survey format would encompass a number of questions aimed at obtaining the following information:
  - Feedback on overall accessibility to and use of public transport services;
  - Overall ratings of services in terms of satisfaction;
  - Users' expectations and experiences including opinions on specific aspects: frequency and availability of service, vehicle quality/comfort, information, reliability/punctuality, fares, etc. ease of transfer between modes etc.; and
  - Views on what improvements would encourage greater usage of services.
- The City mobility survey undertaken to inform the MPTM included specific questions on attitudes towards public transport and should be repeated every 2 years to see the change in overall perception.

Target: To achieve a 60% level of passenger satisfaction ion with the city's public transport services.

Indicator 19: Car Ownership

Definition:

- This indicator measures how many cars are registered per 1000 inhabitants.

Methodology and input data collection:

- The basic data to calculate and observe progress of the indicator in time should be obtained from the local authorities. Number of cars registered in particular districts and number of inhabitants of these districts is needed and can be monitored over time (annually).

Background Information:

- The Police hold records of registered vehicles in the City. The car ownership rate has been growing steadily between 1988 and 1998. In March 2006 all cars were re-registered. This process required time and money and led to a number of owners of old cars not re-register them; and
- In 2009 the car ownership level was just under 600 vehicles per 1000 population – which provides a good baseline level for the MPTM.

Target: No target to be set *(this is a contextual indicator).*

Indicator 20: Satisfaction with the Quality of Pedestrian and Cycle Environment

Definition:

- The percentage of people who are satisfied with the walking and cycling environment in the city

Methodology and input data collection:

- An interview survey should be carried out to find out how many people were satisfied with the walking and cycling environment before the measures were applied. The same type of survey should be carried out after the application to find out if the percentage of population who are satisfied increased; and
- An appropriate sample size of the population should be involved in the survey to obtain representative and statistically robust data out of the survey.

Background Information:

- As part of the household travel surveys respondents were asked their views on cycling in the city, more specifically on the types of improvements that would encourage people to cycle more;
- Assessment of the travel to work patterns reveals that the level of walking and cycling is relatively low with only 2.5% and 1% of the proportion of morning period trips;
- In addition, as part of the MPTM city mobility survey (household travel survey) residents were also asked for their views on cycling in the city, and whether they would cycle more if improvements were made:
  - More than 60% would not cycle even if improvements were made to improve cycling conditions in the city;
  - Nearly 20% stated that they would cycle more if segregated cycle lanes were introduced; and
  - Over 15% of respondents were supportive of on-street cycle lanes.
- This information provides good baseline data with which to compare future surveys over the life of the Plan. However, the survey only obtained limited information on cycle trips and it is recommended that a more detailed information on attitudes towards walking and cycling which will inform suitable baselines and a means to set future targets for the MPTM. Sample pedestrian and cycle survey formats are attached in Appendix A.

Target: To increase the level of satisfaction with pedestrian and cycle facilities *(Target to be set once baseline condition established).*

4. Before and After Scheme Monitoring

4.1 Introduction

Every new scheme provides an opportunity for learning from experience and improving the level of understanding of the performance of policy instruments that have been used. This can only be achieved if there is an effective before and after survey which identified the impact of the scheme on the key performance indicators and against the primary strategic objectives.

It is recommend that within the monitoring strategy representative scheme monitoring is included to review the effectiveness of the proposed interventions in delivering the objectives of the strategy. This should include a representative sample of measures for which detailed monitoring information is available.

4.2 Post Scheme Evaluation

Post-scheme evaluation assesses the consequences of implementing a strategy or a scheme, and how these relate to the intended consequences that provided the justification for proceeding with the scheme. Outcome indicators provide crucial information about the performance of the project and in conjunction with data on resource inputs enable factors such as cost effectiveness to be assessed. Outcome indicators may need to be provided in the short, medium or longer term.

The timing of post-scheme evaluation (and the collection of outcome indicators) is important to consider, because if it is carried out too soon, the full impacts resulting from a project may not be evident (for example, build up of patronage on new tram route). Conversely, if it undertaken too late, resources will be wasted and similar projects will not benefit from the lessons learnt.

The monitoring framework has been adopted which includes post-scheme evaluation to examine the consequences of implementing a strategy or a scheme. This will be used to review the effectiveness of the interventions introduced as part of the MPTM, as outlined in Figure 4.1 below.

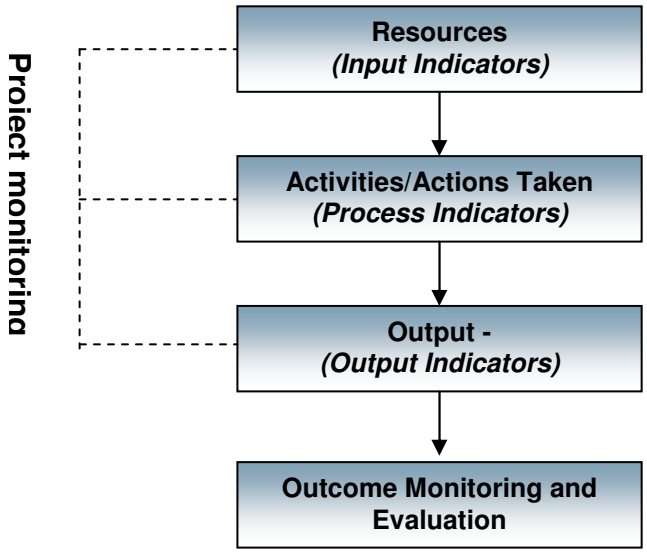

Figure 4.1: Scheme/Project Monitoring Feedback Loop

Post-implementation evaluation is the final stage in the completion of a transport project, and focuses on examining how well the project has performed against a range of objectives, drawing on both project and outcome indicators. It is the most important point at which to review the project planning and

implementation stages and the overall results of the project decision-making. There are numerous benefits of this approach including:

- Identifying any constraints or 'bottlenecks' that have impeded the project;
- Assessing the actual benefits and the number of people who have benefited;
- Providing guidance on the strengths and weaknesses of the project, for future replication; and
- Identifying the extent to which the intended objectives of the project has been realised.

The evaluation process usually involves the assessment of a project's performance, efficiency and effectiveness (including both expected and unexpected) in terms of the stated objectives.

The evaluation process can provide tangible evidence that the resources that have been put into the project has benefited residents and other stakeholder groups. More importantly, it can also help to direct future resources to support the types of projects that deliver clear outcomes. It can also be useful in demonstrating benefits to funding sources and to local communities which can help gain political support for future implementation.

Scheme monitoring provides essential feedback to the proposed programme, allowing successful schemes to be identified (as shown in Figure 4.1) Post scheme evaluation (in the form of Scheme Impact Reports) can also help improve future processes, with findings used to improve future transport decision-making processes and procedures.

A Scheme Impact Report should contain detailed monitoring of a representative sample of schemes, showing how they have contributed to the strategy objectives through the use of "causal chain" diagrams. A typical example of such report is set out in Figure 4.2 below, for a Public Transport Corridor Scheme.

The detailed monitoring also provides essential feedback to the MPTM strategy development, and allows the most effective scheme to be chosen for particular circumstances.

It is recommended that additional 'causal chain' diagrams are produced to clearly understand the intended outcomes and links with MPTM objectives for other types of measures including:-

- Area-wide traffic management schemes;
- Road safety schemes;
- Interchange improvements; and
- Walking and cycling network improvement schemes.

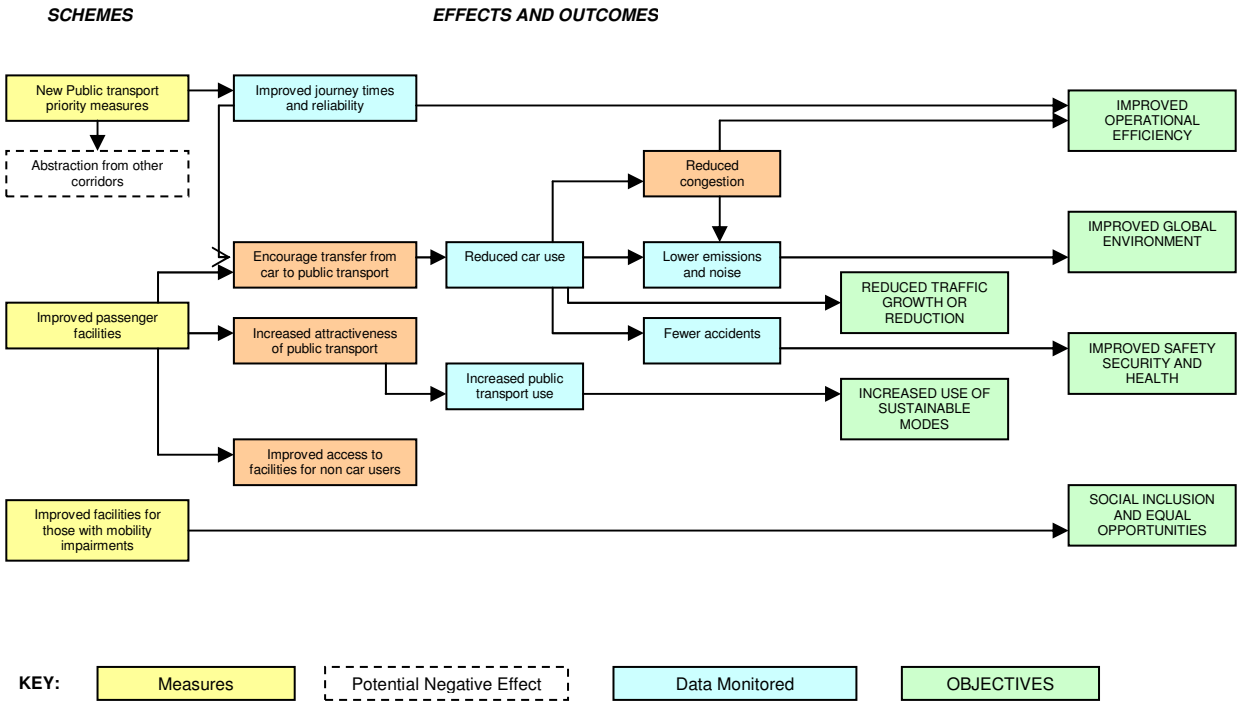

Figure 4.2: Example Public Transport Corridor – Causal Chain of Inputs and Outcomes

5. Summary

This document has set out an outline monitoring framework for reviewing and assessing the success in delivery of the MPTM. In doing so it seeks to provide a comprehensive set of indicator types to cover traffic issues in Sofia, which are also clearly linked to the plan's objectives.

Given the inextricable link between the investment in initiatives and schemes and their contribution towards objectives and targets, it is important that the final monitoring strategy takes full account of both political priorities/aspirations as well as level of investment allocated to enable the targets to be realised. Therefore, only provisional targets have been proposed until the details of the MPTM programme and investment are confirmed,

It is recommended that the monitoring strategy for the SMPTM is built on the following key principles:

- A carefully selected indicator set that is fully aligned with the priorities set out in the Plan's strategy and objectives;
- Comprehensive documentation of performance indicator assimilation and target setting; and
- Ownership of the MPTM indicators by those responsible for overseeing the reporting and delivery of their performance indicator(s) with a process that provides clear lines of reporting for the indicators, and a chain of responsibility for reviewing delivery to re-prioritise resources.

A critical element in the framework is ownership of the indicators and targets which will subsequently be set, and a regular mechanism to review, discuss and challenge progress being made towards meeting the objectives and targets with the focus less on outputs but more on outcomes as a measure of the Plan's success.

Targets for each of the indicators have been presented, including quantified ones against which the success of the MPTM can be measured. However, several of the indicators require further survey work to establish baseline conditions, which can then be used to set appropriate targets.