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New Delhi-110011, Dated the 200

No.K-14011/9/2007-UT  
Dated, the 7<sup>th</sup> May, 2007.

Dear Ms. Lakshmi,

Subject: Preparation of Comprehensive Traffic & Transportation Plan (CTTP) for six cities/Municipal Corporations (excluding Bangalore).

Kindly refer to your DO letter no. KUIDFC/PPD/TC-CTTP-6CC/2006-07/2889 dated 6.1.07 addressed to Shri S.M. Acharya, Additional Secretary, Ministry of Urban Development.

2. At the out set, my apologies for a bit of delay in conveying, in principle, approval for taking up CTTP in Mysore, Mangalore, Dharwad, Gulbarga, Belgaum and Bellary at a total cost of Rs. 260 lakhs. The delay was intentional as we wanted to build upon the work done by Government of Karnataka regarding the typical Terms of Reference (TOR) prepared for Mangalore, so as to make it a model TOR for similar sized cities. The TOR submitted by Government of Karnataka has been reviewed by number of experts and has been modified to make it more NUTP 2006 compliant. A copy of the approved TOR duly highlighting the major changes is enclosed.

3. While, most of the proposed terms of reference have been retained, certain additions/alterations have been made regarding the development of comprehensive mobility plan, integration of land use and transport plan, development of pedestrian and cycle network, stake holder consultations at various stages of the report preparation, review of the consultant work by the monitoring-cum- appraisal committee etc. The soft copy is also being e-mailed highlighting the changes which have been made with respect to draft

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TOR. The final TOR as approved is also being posted on the website of MoUD as a model TOR for similar sized cities.


4. In principle, approval of Ministry of Urban Development, Government of India is hereby conveyed to the proposal of Government of Karnataka for taking up CTTT for the above mentioned six cities at a total cost of Rs. 260 lakhs with funding from Government of India as per the existing scheme subject to State Government following the detailed guidelines issued vide MoUD letter no. K-14011/36/99-UT dated 4.8.2006 (available on MoUD website - www.urbanindia.nic.in).

5. The posting of the draft report and working papers at various stages on MoUD website as well as Institute of Urban Transport website for inviting the comments shall be coordinated by IUT.

With regards,

Yours sincerely,

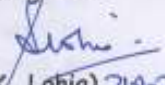
Encl : As above

  
(S.K. Lohia)

Ms. Lakshmi Venkatachalam,  
Principal Secretary to Government  
Department of Urban Development  
436, 4<sup>th</sup> Floor, Vikasa Soudha  
Dr. B.R. Ambedkar Veedhi  
BANGALORE 560001.

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CC: DO(UT) - to put the TOR on website under Head "Model TOR for Comprehensive Traffic and Transportation Study for developing comprehensive mobility plan for medium size cities - Mangalore example.

  
(S.K. Lohia) 7/9/07

**COMPREHENSIVE TRAFFIC & TRANSPORTATION STUDY  
FOR THE  
MANGALORE URBAN AGGLOMERATION AREA**

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## 1. INTRODUCTION

Economic growth and spatial developments are quite often governed by the quality and quantity of transport infrastructure provided. While inadequate transport facilities create problems of congestion, delays and hazards causing significant socio-economic costs to the society, an over-supply, apart from being uneconomical, often acts counter to the long term spatial development strategies of settlements and regions. Supplying and maintaining an optimal level of infrastructure is the key to planned development. Under this overall guiding principle, this study aims to prepare an investment program for augmenting and upgrading transport infrastructure in select urban settlements within the coastal districts of South Canara, Udupi and North Canara in Karnataka State.

Multiple demands for the limited financial resources at the disposal of all the Urban Local Bodies (ULBs) has restrained them from undertaking major development programs. This over-riding constraint to development has not only made the ULBs adopt reactive incremental planning process, it has also restricted their capacity to handle larger projects and has relegated strategic planning into the background. In the absence of a short term (5 year) or medium term (10year) urban transport infrastructure development plan, there is no ready list of projects which can be considered to have undergone some preliminary evaluation by the stake holders and beneficiaries.

During the last two decades Mangalore City has grown rapidly and its present population (2001) is about 4.22 lakhs. The population of the city is expected to be 6.75 lakhs by 2016 AD.

The details of main arterial roads in and around Mangalore is given in Attachment 1. It may be noted that 3 National Highways nos. 13, 17 & 48 and State Highway 67 pass through Mangalore. The total length of main arterial corridors, sub-arterial corridors, radial road and transverse corridor are 22, 8, 16 & 4 km respectively.

Out of the total land use, residential area covers 49.58%, Commercial area covers 4.92%, Industrial area constitutes 12.25%, Public utilities area covers 0.31%, Parks and playground and open spaces cover 2.96%, Traffic and Transportation covered under roads is 20.82% and Public and Semi Public

areas covers 9.16 % of total Built up area. The city has been divided into thirty eight planning districts as per the revised CDP (1991)

Traffic Volume count reveals that a number of corridors are handling traffic, which is more than their recommended capacity. Intersections have become bottlenecks resulting in excessive delays.

Vehicle registration data for Mangalore has been obtained from the Road Transport department. Regression analysis has been carried out to obtain the growth trends. Average annual growth of about 7.5% was registered. The annual growth for buses, trucks, cars, two wheelers Autoriksha and LCV's have been 14.4%, 4.9%, 5.87%, 8%, 3.65%, and 3.4% respectively.

A development strategy for fixing the implementation priority is being proposed. For the entire Mangalore City nine radial corridors and eight transverse corridors were selected, analysed and prioritised.

Industrial activity in and around Mangalore City, continues to grow and attracts a large number of people to the city. The rapid urban population growth with relatively small investments in transport (roads and buses) has resulted in an increasing gap between the transport demand and supply.

The Mangalore Urban Development Authority (MUDA) has plan for development of the city. It does not cover the urban transportation needs of the city fully. It is, therefore, quintessential to conduct a Comprehensive Traffic and Transportation Study (CTTS) of the city and accordingly propose urban transportation network and a comprehensive mobility plan. Such a study would identify various kinds of traffic corridors and suggest appropriate strategy and modes of transport to service them. It should also provide for proper inter-modal transport integration, if any.

It is appropriate to prepare a comprehensive mobility plan that reflects the land use and its changes as well as the buoyant changes in economy and industrialization that is part of Mangalore. This proposal is to prepare a comprehensive metropolitan mobility plan for the period 2007-27 in line with National Urban Transport Policy, 2006, which focuses on the mobility of people and not vehicles. NUTP, 2006 stresses, upon the need of promoting

safe pedestrian movement, bicycle movement and public transport, integration of land use and transport planning. The comprehensive mobility plan should, therefore, address these requirements.

## 2. EXISTING SITUATION

Presently the main modes of transport in the city are - two wheelers, three wheelers, cars and public transport (buses).

Rapid growth both in human and vehicular population with relatively small investments in public transport and related infrastructure, has been widening the gap between the transport demand and supply.

The public transport system (bus) is also limited. Congested streets and longer route lengths have only served to reduce bus frequencies further.

Traffic Management study has been carried out in the city to improve its transportation facilities. As short term measures, road widening, junction improvements, one way systems, parking restrictions were suggested and some of them have since been implemented to ease the congested street network. However impact of these strategies on pedestrians, bicycles and public transport has not been evaluated.

The result is a low average speed on the network. Traffic Management measures such as one-way systems are very much evident, but they too are facing capacity problems. The sprawl of the city further loads the radial routes since there have been a spate of new layouts developed by MUDA as well as private.

The transport problems can be classified under two major headings:

1. The conflict of environment and the accessibility demands of a growing population and vehicle ownership. This problem manifests in many ways
  - Slow travel speeds, delays, road congestion and inconvenience to road users
  - Road accidents and fear of danger

- Problems in public transport operations (traffic delays restricting vehicle mileage, bus overcrowding, roadway capacity, capacity of bus system, etc.)
  - Parking, loading and unloading difficulties
  - Environmental disturbances due to noise, visual intrusion and emission of vehicles
  - Pedestrian - vulnerability, facilities required and the frequent difficulty of crossing roads on foot.
  - Inappropriate location of bus stops, IPT stands, etc.
2. Problems of implementation of transport network improvements which have beset improvement projects.
- cost of projects
  - availability of land
  - disruption during construction and alternative routes for diverting the traffic.

### 3. SCOPE OF WORK; PRINCIPAL AREAS OF ACTIVITY

The study goals will include:

- i) Development of transportation network and comprehensive mobility plan for all modes including pedestrians, cyclists and IPT to achieve convenient and cost effective accessibility to places of employment and education;
- ii) Optimal utilization of funds and human resources.

The specific objectives of the study are :

- i) Study of existing and proposed landuse pattern, transport network pattern.
- ii) Identify travel pattern of residents of the local planning area / urban agglomeration of Mangalore
- iii) Develop landuse-transport model to evolve a long term strategy for urban structure and road network pattern.
- iv) select, develop and operationalise an Urban Transport Planning (UTP) model using state of the art modeling techniques and software package, appropriate to the conditions and planning needs of the study area;
- v) assess the relevance of the existing strategy, identify the consequences of pursuing alternative transportation strategies and recommend / update a short term, medium term and long - term comprehensive

- transportation strategy for the study area up to 2027 (2017 & 2027); based on cost benefit analysis of alternatives.
- vi) Strategize transport policy and parking policy as an integrated part of urban planning.
  - vii) Identify for all modes, a phased program of appropriate and affordable investments and policy proposals; and also integration of various modes of mass transits as well as public transport with IPT
  - viii) Assess existing infrastructure requirements and forecast short term and long term requirements.
  - ix) Recommend institutional mechanism for inter agency co-ordination
  - x) Help strengthen transport planning skills, and transfer all data, planning model / tools and knowledge obtained through the study to agencies such as MCC, MUDA, KSRTC, Local Bus Transit, Traffic Police, etc.
  - xi) Operationalise LUT Model, Transport Model and Transport Circulation model as decision tools for use by city planners, traffic police and public transport operations planners.

In line with the specific objectives of the study described in above, the consultant work is expected to divide roughly into five areas of activity, which will be discussed in turn:

- i) Collection of household, land use, and travel demand data
- ii) Development and operation of Landuse- Transport Model (LUT) and urban transport model
- iii) Define a Vision, mobility policy and formulation of transport strategy and institutional mechanism;
- iv) Identification of a phased program of transport investments and management proposals; and
- v) Training and knowledge transfer to the concerned agencies

#### **Activity 1. Collect Household, Land use and Transport Data**

The data to be collected are those usually required for the purpose of metropolitan transport strategic planning. These would include both historical and spatial data. Spatial data are needed for the calibration of the LUT & UTP models. An elaborate traffic zonal system needs to be determined for the purpose of spatial data collection, traffic forecasts and sub area analysis.

Considering the vast study area, the population and its distribution over the area, the sample size for the survey should be determined based on the size and spread of the geographical sections. However, it is desirable to adopt an average sample size of at least 5% for Household survey for the entire region (stratified random samples representing the entire population may be considered).

A statistically valid basis for expansion of the sample adequate to represent the total population of the study area and the geographical distribution of trips to be adopted. Analysis of recent electoral rolls and census details may provide a basis for selection of the sample.

The following tasks are to be conducted under this activity.

- ◆ Baseline Data Collection
- ◆ Surveys / studies
  - Design, Supervision and Implementation of Household Travel Origin-Destination survey including a stated preference survey & opinion survey on all necessary issues including mass rapid transit system, integrated system and type of integration.
  - Screenline Traffic Counts
  - Survey of floating population
  - Suburban Commuter Rail Passenger Survey
  - Bus Passenger Survey
  - Roadside Motor Vehicle O-D Survey (including Goods Vehicles) Roadside interview & public transport surveys of a conventional kind shall be done for 24 hours at the external cordon (sample survey). For inner cordons and screen line, such surveys shall be done for continuous 16 hours.
  - Estimating Speed Flow Functions
  - Taxi, autorickshaw and other surveys (IPT Surveys- trip lengths, costs, maintenance cost, ownership etc)
  - Speed and delay surveys
  - Workplace surveys
  - Goods focal point survey
  - Parking survey
  - Non-Motorised Traffic survey

- **Pedestrian Surveys**

- Opinion survey regarding willingness to pay, willingness to charge and capacity to pay for various services.
- The commercial vehicle surveys should be done on trucks and LCV trips within the study area. Data on O-D time period and goods carried shall be collected for a full 24 hours period. As in the household survey O-D data shall be recorded as accurately as possible to facilitate zone coding. The consultant must collect accurate information on the total number of goods vehicles based in the study area. A scientific basis of sampling for commercial vehicles must be proposed.
- The interview shall be carefully structured to secure all data required for the model analysis. It should necessarily include:
  - Sample surveys relating to trip data should also take into account the residents of hotels, educational institutions including universities and other residential establishments.
  - For proper estimation of trip making and trip length over a geographical area, household surveys and roadside interviews would be utilized. In the event of roadside interviews not found reliable, some additional households may have to be surveyed.
  - Factual data on the household location, size and employment details of members, students and vehicle ownership including cycles;
  - Details of all trips (trip diary including access mode, time, distance, cost etc.) made on the day preceding the interview by the residents who are more than 5 years old. These details shall include Origin & Destination (O&D), purpose, and mode time. For trips performed by rail/bus - name of rail/bus station of boarding/alighting shall be recorded.
  - Income of each member of the household - salary, pension, investment income etc.
  - The household interview forms shall be pre-coded as far as practicable. For each household, the measured walking time to the nearest railway station and appropriate bus stop shall be coded irrespective of whether any public transport trips are made.
  - O & D data shall be recorded with full addresses and the addresses should be coded. This must be specifically ensured for Central Business District (CBD) and other business areas.

- Journey purpose data at origin as well as destination shall be recorded to enable allocation of trips -home to their relevant motivation, e.g. returning from work, education.
- Classified traffic counts on the screen lines and long term counts on the cordon lines.
- Speed and journey time surveys.
- Inventory surveys (roads, footpaths, drains, lights, signs, markings etc.)
- Study of the mass transportation systems.
- Land-use, populations and employment data. Care has to be taken to collect and estimate trip attraction variables (employment by type, schooling opportunities, shopping opportunities, entertainment facilities etc.)
- The consultants will break these data down into the CTTS zones.
- ◆ Survey Data Processing and Analysis
- ◆ Study of the revised CDP and spatial data
- ◆ Study the physical roadway characteristics (including functional condition of pavement and pedestrian pathways etc in detail).
- ◆ Study the present trend of growth, desired development and actions for inducing desired development from land use, land development and traffic point of view.
- ◆ Study the effect of various alternative development strategies.

#### **Review of existing transport scenario**

Analyze the data collected to identify and quantify the existing transport problems. Also assess the operational characteristics and deficiencies of the existing transport systems.

- i) Concentrating the growth (work & education places) in the city centres and catering to the traffic needs (including park and ride, feeder bus services, prohibition of freight vehicles along certain roads / areas / city etc.) or
- ii) Dispersing the development (work & educational places) and catering to the different pattern of traffic.
- iii) Analyze existing road network and its adequacy for pedestrian, NMV and public transport improvement.
- iv) Integrating main mass rapid transit system and various modes of feeder transit system (bus, IPT, NMT, Pedestrians etc).

v) **Carry out Road Safety Analysis and Air Quality Analysis**

The Inter-Modal Mass Transit System (IMMTS) shall be developed so as to optimally meet the expected public transport demand in the horizon year (2027)

Various alternatives (Permutation and Combination) of Met rail, Mono rail, Electrical Trolley Bus System, Sky Bus System, High Capacity Bus System, regular Bus System, etc should be examined with reference to cost benefit analysis and from main, sub-main and feeder service requirements along with their integration. Integrated mass rapid transit system should be dealt in detail as a separate chapter. Subsequently upgrading the same to Metro, ELRTS, Circular Railway (Commuter Rail Service), may also be examined.

**Activity 2. Development and Operation of Landuse- Transport Model (LUT) and an urban Transport Planning (UTP) Model**

**Development of an appropriate LUT model for evolving future urban and transport network strategies.** For transport Model the consultant is expected to recommend a model package that would be suitable for the planning needs. The purpose of the travel demand model will be to provide good policy-related and future travel forecasts, and therefore, should be simple. That is, the models should represent the travel decisions made by individuals (and households) and should incorporate important demographic and policy-sensitive explanatory variables. The model should, therefore, develop a disaggregate (individual / household level) modeling paradigm. The disaggregate procedures should be reflected even at trip distribution level and take account of the characteristics of households and trip makers and the way in which those characteristics interact with the attributes of alternative destinations.

In addition, the model should integrate household activities, land use patterns, traffic flow, and regional demographics. The core of the proposed model system should be a household activity simulator that determines the locations and travel patterns of household members & daily trips by purpose. The model should estimate travel behavior with regard to longer term choices of residential and employment location, and land use and adaptive behavior in response to transportation system changes, including fare and pricing policy.

It should be noted that given the high volume of passengers that travel in the bus network, the model should pay particular attention to mode split between bus and two wheeler as well as private car and two wheeler and conduct sensitivity analysis of demand with regard to bus fare, quality of buses and bus stations. Attention should be paid to the issue of how travel time (walk and wait time), comfort, and mobility or access to transport is treated in the model and how improving these parameters could affect modal split in favour of the mass transit network. Similarly attention should be paid to these issues for travel on the bus network, as well as the impact of traffic congestion on bus speeds. The behavior pattern of the commuters / trip makers and preference needs to be considered.

As the client has procured "SATURN" software, the consultants should utilize the same for the development of the requisite model. While utilizing the software, the following have to be carried out:

- ◆ The zoning system of the study shall be carefully designed as a hierarchical system of fine zones and larger districts to achieve the multiple objectives of the study. The zones shall relate to the road and railway networks. The population of a zone at the end of the horizon period should be preferably 15,000 and not exceed 25,000, so as to have realistic forecast of intra-zonal trips and to avoid overloading of the network. The number of zones should be minimal so that the model does not become cumbersome and time consuming. However, reasonable number of zones would be required for a detailed operational transport model.
- ◆ In the model, the road and public transport networks shall be described accurately; travel time should be calculated from link-speeds and speed/flow relationships. The link-speeds must be derived from previous data and / or fresh surveys. Provision must be made for the cost of travel by different private / public modes of transport. In the public transport networks, appropriate times for access walk, waiting and transfer links shall be coded as increased dependence on modal transfer may arise in future.
- ◆ Modeling mode split, including walk, public transport and para transit modes (auto rickshaws, taxi, bus, BRT and rail as well as the metro,

circular railway, mono rail / metro rail etc **as relevant**) and private transport (motorcycle and car), goods vehicles, etc

- ◆ Assigning trips to bus networks, variations in bus speeds and frequency due to changes in overall traffic volume, and fares
- ◆ Reflecting the impact of new land use developments and / or control policies, including freight terminals, truck parking lots, inter city bus terminal etc. Plying of private buses, boarding and alighting of passengers from private buses within city, etc & its effect on congestion. ( for evaluating short term management measures ).
- ◆ Responding to traffic demand management measures such as parking fees, road user charges and congestion pricing as well as the staggering of working hours, flexi hours and multiple shift work.
- ◆ Working out alternative scenario and its effect on the traffic situation.
- ◆ Infrastructure development (developed, being developed & proposed) and its impact analysis.
- ◆ Type of road network - main / arterial roads and in residential areas / layouts with particular emphasis on hierarchy of roads & improper utilization resulting in unsafe conditions.

#### **Task 2.1 Transport Network Coding**

Consultants shall compile a transport network inventory with sufficient details with a view to ensuring traffic assignments to network at link level. The consultants will have to compile attribute data for the network (link and node characteristics). The consultant will prepare input files including network coding based on the inventory collected as a part of Task 1 to code the network. Hierarchy of roads will be addressed in detail. Also the road networks will be studied in detail and model road network for new layout will be suggested along with improvement to major road network. In addition, the consultant will also develop traffic origin and destination matrix by mode and time (day / peak / off peak). The consultant will review current speed volume function and assess the adequacy of this function for the purpose of planning

and update speed / volume if necessary specially for the new road facilities (flyovers, bypass, ring road, etc).

The consultants in consultation shall identify the committed schemes, proposed schemes and accordingly prepare do-nothing, do-minimum, do-something & do all networks to assess the impact. Examine strategies for making all corridors pedestrian and NMV friendly by adopting different strategies, possibility of providing dedicated lanes for public transport and also study one way system, prohibition of entry to certain type of vehicles complete pedestrianisation of selected areas and dedicated lanes for cycling along certain roads & certain periods of time, etc. (for evaluating short term traffic management measures).

#### **Task 2.2 Model Calibration**

The model should reflect the travel behavior of different income and social groups in a disaggregate fashion and should be sufficiently sensitive to test policy measures and physical improvements to the transportation network and services. The model should be calibrated for travel costs, speed and other factors.

Traffic assignment w.r.t. creation of new facilities, imposition of certain management actions, etc needs to be studied for various alternative scenarios.

Traffic assignment should be done on both peak and off-peak hour. The model result should be sufficiently detailed for the identification of project benefits among different income groups and users by different modes. The consultants, upon calibration, must demonstrate to the client how reliable the model is in replicating the current modal splits and traffic flows at screen lines and cordons. If the model is to be used for evaluating micro-investments including inter alia major land use changes (commercial development exceeding 10000 sq.m. of built up area), development of new roads, grade separators at junctions, widening of ROW / carriage ways, considering introduction of transfer of development rights on a corridor basis, providing exclusive bus lanes, introduction of ATC system, various mass rapid transit proposed, integration of mass transit system etc., the consultants should show how reliable the calibrated model is for more detailed flows than at screens / cordons.

### **Task 2.3 Establish Economic Evaluation Procedures**

Consultants are expected to establish the framework for economic evaluation that would be used in the formulation of a long-term master transport strategy and the identification of a phased investment program. The framework should allow the economic feasibility to be expressed in terms of expected Net Present Value (NPV), Financial Internal Rate of Return (FIRR) and **Economic Internal Rate of Return (EIRR)**. Special attention should be given to the following major areas:

- Identify major items of economic benefits;
- Evaluate appropriate Vehicle Operating Costs (VOC), **health costs (pollution and accidents)** and Value of Travel Time (VTT); and value of comfort
- Develop appropriate economic evaluation procedures to make full use of UTP model outputs including link traffic volumes and speeds by vehicle type for existing and planned networks

Present trend of growth, desired development trends and actions for inducing desired development from land use, land development and traffic facilities issues, shall be detailed. Development priorities like

- Concentrating the growth (work & education places) in the city centers and catering to the traffic needs (including integrated rapid mass transit system, park and ride facility, feeder bus services, prohibition of freight vehicles along certain road / areas, etc.) or
- Dispersing the development (work & educational places) and catering to the multidirectional pattern of traffic.
- Economic incentives/disincentives critical to public transport management, road use, parking, **pedestrianisation, NMT etc** to be examined.

Phase wise development and phase wise accrual of benefits needs to be estimated.

### **Activity 3. Propose the Long-Term Transport Strategy**

### **Task 3.1 Review of earlier reports**

The consultants should review the Traffic Management Plan developed for Mangalore by M/s.Dalal Mott McDonald under Asian Development Bank assisted Karnataka Urban Development & Coastal Environmental Management Project.

The consultant should review the strategy, assess its relevance to the current and future transport needs of study area, identify major changes in socioeconomic conditions, land use, and transport and suggest strategic areas that need to be considered, improved and strengthened.

### **Task 3.2 Review of Institutional Arrangement of Transport**

The purpose of this task is to clarify current arrangements for formulating, monitoring and implementing transport policy and for identifying, appraising, authorizing, sanctioning, financing and implementing traffic and transport schemes and operational policies. The study is required to identify the role and responsibilities of the various agencies concerned with transport policy, financing, investment and regulation of operations. The main issues to be addressed include the following:

- the current lack of a clear institutional structure with regard to urban transport planning, management and investment coordination;
- institutional and policy barriers to positive change in the delivery of transport services to the people and businesses;
- the requirement of number of staff qualified in traffic engineering, transport planning and management;
- the relative roles of public and private passenger transport operations, and the means of regulating them;
- the relative roles of central, state and municipal governments in transport planning, investment and management

The study should advise on the needs and possible scope of (i) institutional and policy reform; and (ii) post-study professional development and training in transport planning and management, common programme (MCC, MUDA), Intra & Intercity transport, short term and long term plans, land management etc.

### **Task 3.3      Review of Transport Financing**

The study should pay careful regard to the financial resources available for transport investments, maintenance and operations, both in total and by agency, on the basis of an assessment of the level of funding available annually during the past 5 years, current changes in the fiscal framework and economic trends. The outcomes of this work should be estimates, on the basis of a number of assumptions and scenarios, of resources likely to be available for transport investments, maintenance and operations during the coming years, with distinction between tied resources and untied resources. Potential sources of private sector finance needs to be identified. Likely candidates for private sector financing / PPP based on feasibility of levying tolls or user fees should be identified & presented.

### **Task 3.4      Traffic Demand Analysis and Forecast**

They shall review the latest development plan and may consider alternate land use scenarios (minimum 3) for future development. Forecasts of population and employment distribution for the years 2012, 2017, 2021 and 2027 to be considered. The consultants are required to forecast travel demand by mode using the calibrated UTP model for the years 2012, 2017, 2021 and 2027 on the existing transport network plus all committed transport investments, under the assumed alternative income, population, and land use growth scenarios along with sensitivity analysis. These exercises will give indications on the likely traffic problems in the future years, thus providing a basis for strategy formulation.

### **Task 3.5      Alternative Long-Term Transport Strategies**

The long-term transport development and management strategy should be a combination of policies (e.g. demand management, user charges etc.) and physical improvements (landuse strategies, network strategies, modal mix strategies etc.). The consultants should define the specific objectives, principles, and criteria required to guide the formulation of the long-term strategy.

Having regard to various policy options and transport strategies and systems, alternative feasible scenarios for horizon years should be developed in consultation with Employer, MCC & MUDA. Test the effects of various combinations of schemes / networks and management policies using the model. Use the results to evaluate the project and policies for economic viability. Also finalize the transport operation plan for the next ten years. Identify the phasing and timing of investment in various schemes relating to the transport operation plan and prepare an annual programme of investment for the planned period. It is likely that the scope to manage transport demand by control of land use development will be limited but that the implications of transport developments on land use developments will be great. It is likely, for example, that restricted space in the CBD, combined with demand management measures and improvement of rail and road links will lead to faster development of less developed areas in peri-urban areas. The study should seek to identify the scale of such development pressures.

The LUTP model linking land use pattern, travel demand and modal split, should be used to test the impact of major modifications of strategy and will be used mainly for the 20-25 year horizon along with sensitivity analysis. Alternative transport strategies and their evaluation should focus on agreed land use strategy and show whether any significant easing of future transport problems could follow from revision of the land use strategy. If the consultants recommend an integrated land use transport model, employer expects to confirm the form of land use strategy to be assumed by the consultants for the development of a long-term transport strategy.

### **Task 3.6 Evaluation of Alternative Strategies and Selection of Preferred Strategy**

A comprehensive evaluation system should be developed in consultation with the employer and stakeholders, taking into account all relevant factors such as capital and operational costs and environmental, social and political factors, services to the poor and vulnerable. In principle, the evaluation should be comprehensive, on the basis of four major criteria: (i) economically viable; (ii) socially acceptable; (iii) environmentally sustainable; and (iv) financially sustainable. At the strategic planning level, a preliminary assessment of economic and financial feasibility and social and environmental impacts is expected for each proposed alternative strategy. In defining the alternative

strategies, the consultants are expected to pay special attention to the services to poor and the vulnerable.

The comprehensive evaluation should result in the recommendation of a preferred long term transport strategy. The consultants in collaboration with employer and transport agencies should explain the basis for its recommendations. Strategies will be evaluated with regards to NUTP compliance.

### **Task 3.7 Prepare a Draft Transport Strategy Document**

The outline strategy should amount to a directional plan indicating the main imperatives of transport policy during the foreseeable future, having regard to need, desirability (with regard to factors such as land use development and environmental and social impacts), affordability and uncertainty. This strategy should take account of economic growth, current initiatives, the need to conserve and enhance the urban environment, land use plans and likely land use development patterns.

The strategy document should cover the following patterns:

- i) **Current Situation.** Clarification in broad but objective terms of the current situation and trends; the quantity of personal movement by sub-urban rail, bus, car, auto rickshaws, NMT, two-wheelers, taxis, and on foot; the amount of goods vehicle movement; Intercity traffic both (passenger & goods and by Govt. and Pvt. Modes), long distance Bus / Railway passenger movement; origin-destination patterns; current problems.
- ii) **Traffic Growth.** Clarification of current growth rates, potential growth rates (with reference to experience elsewhere), potential problems.
- iii) **Current Constraints.** Clarification of current constraints with regard to government policies on vehicle licensing, vehicle and fuel prices and trends, land use policies and the resources available for transport investment and the scope of cost recovery through direct user charges such as tolls, etc.
- iv) **Long Term Trends and Prospects.** Review of implications for transport (supply and demand) of economic growth and land use

- developments; and of the implications for transport planning of uncertainty.
- v) **Transport Investment Options.** Review of the main means of providing additional transport capacity with regard to their effectiveness, magnitude of orders of cost (including both capital and recurrent costs), economic and financial viability, etc.
  - vi) **Demand Management.** The need for and means of achieving the management of the potentially high growth in the use of motor vehicles (including motorcycles). Alternative of various mass rapid transit system including integration of the same needs to be considered.
  - vii) **Environmental Measures.** Review the need for measures to ameliorate adverse environmental impacts, either existing or resulting from proposed projects or increased development.
  - viii) **Land Use Strategy.** Review of the scope and limitations of reducing / controlling traffic demands through land use policy and of the scope for using transport policy to influence land use development. Also examine legal framework - KTCP Act / zoning & Traffic rules (police), Densification of major transport corridors, using land as a resource.
  - ix) **Institutional Arrangement.** A diagnostic assessment of the current institutional arrangements for administering and planning transport activities, including policy formulation, regulation of transport operations, financing, and investments, and recommendations for improving the arrangement.
  - x) **Conclusions and Recommendations on Transport Strategy.**  
Broad conclusions and priorities for development of commuter rail, bus transit, highway construction, goods transport and inter regional bus / rail transport, rapid mass transit, integration of various modes of mass transit and IPTs, traffic management and demand management in short, medium, and long terms; observations on land use strategies, connection of new townships by mass transit systems.

#### **Activity 4. Develop a Medium-Term Investment Program**

The product required for this Activity is a rolling program of investments and management proposals sufficient and appropriate for the period to 2017. The emphasis of the work will depend upon the conclusions reached on the

transport strategy. The Medium-Term Investment Program will probably comprise the following parts:

- i) **Mass Rapid Transit Development Program.** Identification of a staged programme of mass rapid transit development, and its cost implications, etc.
- ii) **Pedestrianisation, NMT network development Program.** Identification of present deficiencies/hindrances in pedestrian & NMT movement and phased investment for developing vast network, facilitating pedestrian movement so as to make it convenience and safe.
- iii) **Road Network Development Program.** Identification of staged program of road investments, having regard to traffic demands, economic benefits, system effects, etc.
- iv) **Bus System Development Program, Route identification based on network approach.** Identification of proposals for investment in buses and civil works (depots, workshops, terminals, segregated bus lanes, exclusive bus ways, introduction of state of the art buses with ITS, modern bus stations etc.) and operational management, taking account of bus transport policy recommendations outlined in the transport strategy. Also to examine high capacity bus system introduction.
- v) **Traffic Management.** Identification of low-cost physical and regulatory measures to improve the efficiency and safety of traffic circulation with and without ITS. Particular attention should be given to the management of NMT, pedestrians, bus priority measures, etc.
- vi) Immediate solution to negotiate choking along high-density corridors & junctions.

#### **Task 4.1 Identification and Costing of Investment Options**

The identification of a phased program of transport investments proposals will first involve a sifting of options and pre-feasibility studies. The consultants are also expected to take consideration of the candidate projects already proposed by the transport agencies. For each investment project, the consultants are expected to define a base option and one or more alternative options. For each option, the consultants are expected to propose preliminary alignment, conceptual design option, technology choice, and timing of construction and start of operations. The consultants should also provide

preliminary (or pre-feasibility study level) estimates of the associated capital and operating costs, traffic, revenues if applicable, and operating characteristics.

#### **Task 4.2 Evaluation of Options**

The consultants are expected to evaluate these options using the comprehensive criteria specified in task 3.6 but at a more detailed level. The evaluation should consist of two parts. The first, which may be partially quantitative and largely qualitative, will consist of categories such as operational feasibility, integration with existing systems and physical environment, ease of response to changing conditions, land use effects, travel generation potential, environmental quality, requirement for involuntary resettlement, and other. The second part will consist of simplified economic and financial evaluation, based on capital and operating costs and revenues, passenger costs and financial costs of each option.

It is provisionally envisaged that evaluation of investment options will be based upon the network assignment of traffic demand matrices derived from the results of the transport surveys.

#### **Task 4.3 Prioritize the Investment Projects and Formulate an Investment Program for Years 2017, 2021 and 2027**

On the basis of comprehensive evaluation of the above options, the consultants are expected to prioritize the identified investment projects and formulate a Medium-Term Investment Program. The program should focus on identification of capital investments to be made in the 10-year period 2007-2017. The medium-term program will include background assumptions, rail, road, road based PT and mass transit system investment proposals. When proposing the program, the consultants should assess the impact / implication of various scenarios / strategies / fiscal policies on transport network.

The background assumptions are to include a summary of the transport strategy emerging from the outline long-term study, the form of land use distribution assumed to apply in the medium term, assumptions about institutional changes or developments and assumptions about investment

levels. It is envisaged, unless good reason emerges to the contrary, that one land use disposition should be defined for the medium term.

#### **Activity 5 Skill and Knowledge Transfer**

The study should advise on the needs and possible scope of professional development and training in transport planning and management.

The new CTS model should be installed in employers' office and MCC, MUDA & any other office suggested. The key personnel with technical background in the sector, in these institutions should be provided necessary training in its use. It is also expected that a two-week workshop will be conducted for senior officers on the usage of model.

The consultant will train core staff on model update and calibration so that they could use the model proficiently as a planning tool with only minimal assistance from consultants on the need basis after the study is completed.

The study shall make provision for two trainings for the concerned staff of GoK, and its organizations dealing with city's traffic & transportation management. CTTS team too will undergo these trainings. The trainings shall be organized through:

- Seminars
- On the job training

At least three seminars connected with the study processes and evaluation techniques shall be held during the study. These seminars shall be organized by the consultant and presented by the team with senior staff from MCC, MUDA, KSRTC, Traffic Police and other relevant local academics & practitioners in the city planning and transport field. The seminars may focus on the following.

- Transport issues brought out in the development plan and criteria & techniques appropriate for evaluating them.
- Objectives and techniques of the operational transport analysis and modeling process.
- Evaluation of transport programmes, policies and projects.

All data, in the form of both raw data and structured database in soft as well as hard copy, should be fully transferred to KUIDFC with copy rights employer / his representative.

#### 4. STUDY OUTPUTS

The study shall be completed within a span of 12 months from the date of work order. The time allocation for main mile stones identified be as follows:

Task Details	No. of Copies	Completion / Submission time
Inception Report including approach & methodology and proposal regarding software / development of model	25	at the end of 1st month - presentation required
Field Surveys (HIS and other surveys)	25	at the end of 4 months
Data compilation and statistical analysis	25	at the end of 6 months
Revalidation or development of CTS model	25	at the end of 8 months
Development scenarios and Travel demand forecasts	25	at the end of 10 months
Draft final report & Executive summary	100	at the end of 11 months
Final report & Executive summary	100	at the end of 12 months

The consultants shall from time to time submit the reports and working papers to employer. The Monitoring Cum Appraisal Committee will review the same and convey its modifications / amendments and suggestions which shall be reported and incorporated in subsequent reports. In addition the various reports and working papers shall also be posted on the website of Institute of Urban Transport (IUT), KUIDFC, MoUD (GOI) as well as the State Government website for inviting comments from public intelligientia interested groups etc. KUIDFC shall compile all such comments and place the relevant ones before the monitoring cum appraisal committee for deliberation. The study outputs expected from consultants are as follows:

- (i) Inception report by the end of 1st month which will essentially review data and confirm / amend the work plan while bringing out the direction of the study and proposed study methodology, time schedules

etc. Proposals for this process and the validation criteria to be adopted shall be included in the Inception Report.

- (ii) Technical notes on the following topics ;
- Sampling techniques and sample generation
  - OD matrices and Desire line diagrams
  - Road inventory, Traffic surveys and analysis
  - Review of available software packages and application for CTS under mixed traffic situation; details of proposed software package for forecasting with appropriate presentation graphics including traffic assignments on GIS based road network.
  - Development scenarios and network options for different horizons
  - Vehicle Operating Cost and Value of Time
  - CTS model development, calibration and validation
  - Travel demand forecasts & traffic assignment
  - Environment issues including air & noise pollution, abatement of the same, etc.
  - Requirement of MRTS, feeder systems, pedestrianisation and cycle network and role of BMTC etc. Integrated mass rapid transit system
  - Institutional Arrangement of Transport
  - Financial Assessment and Funding Analysis
  - Economics and Operation Assessment of Network Improvements
- (iii) Reports on following topics should be submitted (25 copies):
- Data compilation and statistical analysis of HH survey
  - Methodology for CTS model development, calibration and validation
  - Alternatives Analysis for Short and Medium Term investment strategy
  - Report on Long Term Strategy for the Transport Sector
- (iv) Regarding provision of public transit systems following needs to be studied:
- Institutional issue - regulated; deregulated & organized competition models, advantages & disadvantages, applicability / suitability,
  - Study of various rapid mass transit systems and their suitability w.r.t demand and viability.
  - Integration of multimodal mass transit system, para station, park & ride, etc fare integration, inter modal / multi modal station, inter

- modal transit, integrated multi modal system to perform as single unit (aggregate) and not multiple units (disaggregate units).
- (v) Monthly progress reports – format is to be discussed with employer– 10 copies
  - (vi) Draft final reports should also include key tables, development scenarios, network options travel demand forecasts traffic assignment etc. (100 copies)
  - (vii) Final report (100 copies)
  - (viii) Executive Summary (100 copies)
  - (ix) CDs with raw and processed data in a formatted database and tables and report in database format.
  - (x) Proper documentation for operation of the model
  - (xi) Delineation of Traffic zones and base year planning parameters, base year transport network (road / rail) including maps to appropriate scale in consultation with employer.
  - (xii) All documents, reports databases etc should be submitted to KUIDFC & MoUD, GOI both in soft and hard formats with all copy rights. There should be no objection to put the same in public domain.

## 5. STUDY ADMINISTRATION AND STAFFING

### The Consultant Team

It is also envisaged that the study will be undertaken by Indian consultants having expertise and experience in taking up home interview surveys and preparing Comprehensive Transportation Plans through travel demand modeling techniques for the cities of similar magnitude. Given the scale of the study, it is also envisaged that the consultants will work in partnership with a team of transport planning professionals from MCC and MUDA.

### Composition of the Consultants Team

The consultants should propose appropriate team for this study. Experts in the following disciplines are desirable on the study team:

- Transportation Planner / modeler
- Suburban rail / Metro specialist
- Urban planner

- Statistician
- Transport Economist
- Financial analyst
- Environmental specialist
- Institutional expert

The team shall be led by an experienced and qualified Transportation planner.

#### **Selection of Consultants**

In the selection of consultants much importance will be attached to the experience and quality of key members of the proposed consulting team and in particular, of the person proposed to lead it in the field. The proposal should identify the team leader, who is to be available to the project full time, and other key members of the team, indicating the length of time for which each is intended to be assigned to the study.

The team leader, in addition to being technically authoritative, must be fully able to fulfill the responsibility of managing all the staff working on the study. Responsibility for study findings will rest with the consultants.

**Study duration:** The study is to be conducted within an overall period of 12 months.

#### **Responsibility for Study Findings and Products**

Responsibility for study findings will rest with the consultants. The consultant study team leader will be responsible for managing all the staff working on the study.

All data accomplished by the consultants during the Study shall be the property of the client. The data collected, computer software purchased for and / or modified, during the course of the consultancy assignment should be handed over to employer / MCC / MUDA by the consultant free of cost. Similarly the consultant shall hand over raw data, analyzed data on CDs used by them for data storage in a suitable database format. Every copy of the report will be submitted in soft copies also.

All the study reports shall be prepared in English and shall use SI units in mathematical, engineering and statistical data analysis. The consultants will operate principally from Mangalore.

**Employer Support.** Consultants will be provided essential background documents, available (base maps / DP). Necessary information for identification and delineating of various areas / zones and rail / road network in the study area will be made available for the consultants. The designated officer will liaison with other organizations in the Mangalore to facilitate surveys and data from secondary sources. Assistance shall be provided in establishing contact with respective agencies in Mangalore city.

**Study Task Manager.** An officer will be designated, who will act as a Liaison Officer between the consultant and various agencies and organizations. The consultants shall closely liaise with him at all stages and all matters pertaining to this consultancy assignment.

**Public consultation :** Public consultation workshops need to be held at least thrice during the preparation and finalization of the report. Public opinion survey needs to be carried out during these workshops through questionnaire and also while carrying out house hold surveys by the consultants.

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