

Sample Terms of Reference

Terms of Reference for Traffic Forecasting on a Toll Road in the Philippines

Note: These terms of reference are very comprehensive and include significantly more detail than is typical.

1 Project background:

The project consists in contracting into a concession system approximately 170 km of motorway in the Northern vicinity of Manila.

The project includes several motorway sections (a map was included)

- Improving and widening an existing section of the toll motorway linking Manila to Sania Ines (North of San Fernando) named the Northern Luzon Expressway (NLE). Length of this section is approximately 80 km.
- Extending the motorway in the North up to the Clark Economic Zone (4 km) and to the West up to the Subic Economic Zone (approximately 60 km).
- Creating a peripheral section inside the Manila conurbation from the University of Philippines to Letre. Length of this section is approximately 22 km.

The delivery of each section will be phased and would occur from 1996 to 1999.

The motorway sections will be submitted to a new toll system and new rates with the following indicative rates for the sections to be improved:

- 1.5 PhP/km for Light Vehicles (LH)
- 3.75 PhP/km for Heavy Vehicle (HV)

and for the new sections:

- 2.5 PhP/km for Light Vehicles (LH)
- 6.25 PhP/km for Heavy Vehicles (HV)

The toll system would be either a closed or an open system.

The concession period is expected to be 30 years.

2 Traffic study objective:

The objective of the traffic study is to forecast the expected traffic attracted to the toll motorway and estimate the expected revenue over the whole concession period. So it requires to address three major concerns:

2.1 A detailed demand segmentation:

Experience shows that urban and suburban toll motorway revenues are very sensitive to specific parameters such as:

- trip purpose,
- hourly variations,
- weekly variations,
- seasonally variations.

At a given time of a given day, the number of drivers from a given user category that will choose the toll motorway will depend on:

- the levels of traffic on the main roads competing with the toll motorway, which determine the potential time savings on the motorway,
- the time value for this user category compared with the toll tariff

This type of study requires a proper segmentation of the different periods of time and categories of users, and from experience it is known that insufficient segmentation would conceal large variations in revenue levels. This is one of the main aspects for the study trustworthiness.

-since attractively of the toll infrastructure is unevenly distributed among the user categories, the study shall identify and address each main category of users and vehicles, and determine the economic parameters monitoring their behaviour.

-and since traffic is unevenly distributed during the day, the week and the year, the study shall identify and analyse typical time segments, and associate demand database to each time segment:

2.2 A traffic assignment tool:

Technically the problem is to compare the new infrastructure to the existing road network. The traffic conditions are specifically urban for the South part of the project and more inter-city like for the North part

However all along the alignment, traffic congestion may occur which means that hourly situations must be considered including at least peak hours.

This type of study requires sophisticated computer means for modelling the road network and the traffic demand. The assignment method must operate under both road capacity and toll restraints, and the modelling tool will be sufficiently integrated in order to provide an automatic and quick answer to a series of varied parameters.

2.3 Quantified trends of the expected economic regional development:

The traffic forecasts should include the whole concession period. In fact uncertainty rapidly increases with time and economic forecasts are practically meaningless beyond 20 years from now:

Generally three main horizons are sufficient to described the revenue trends

- the opening years (say from 88 to 99),
- the end of the stabilisation period (say 2005),
- the economic long term (say 2010 or 2015),

While the first horizon may be possibly dealt with in extending the currently observed trends, it is clear that the second and third horizons require a wider analysis based on both regional development strategies and macro-economic national policies, and their reasonably expectable results.

3 Scope of work:

3.3 Data collection

- Review of existing studies:
- Reviewing existing traffic studies in order to:
 - obtain traffic data and observed traffic growth rates
 - criticise user behavioural analysis towards the toll system
 - evaluate previous traffic and revenue forecasts
- Reviewing existing economic studies in order to:
 - assess distribution of socio-economic parameters over the studied zone, with such indicators as GDP or income per dwelling, number of cars per dwelling, population, employment, etc.
 - analyse the planned sectoral development and regional strategies, in order to estimate possible low and high growth rate.
- Meeting local authorities:
 - including at least Department of Public Works and Highways, and Motorway operators for traffic data collection and road construction programme.
 - and all concerned demographic and economic actors for demographic and –economic data collation (including new industrial zone authorities SMBA and BCDA).

Site surveys:

Site surveys will be proposed in order to improve existing data in the following fields:

- classification of traffic by type of vehicles (bicycles, motorcycles, private cars, taxis, light good vehicles (LGV) including pick-ups, vans, medium and heavy good vehicles (MGV and HGV) including 2 axle trucks, trailers with 4 axles and over, jeeps and buses etc.

- daily and weekly traffic variations at places where existing data are insufficient¹
- origin, destination and purpose of motorised trips in the studied zone
- categorisation of users based on subjective Value of Time (VoT) and Vehicle Operation Cost (VOC)
- road network description including all access roads and comparison between competing routes

Site surveys would therefore indicatively:

- automatic counts with counting devices operated and maintained for 2 weeks at one spot (with separated traffic directions)
- manual classified counts in plain straight section or at cross-roads
- road side interviews for Origin/Destination/Purpose of trips, trip frequency
- road side interviews for Stated Preference Survey (VoT and VOC)
- road network survey and description of main parameters (free speed, max. capacity)
- trip duration along selected routes at selected times

The proposal will include an estimate of the required quantities for each survey category.

3.4 Data treatment:

A first analysis of the collected data will allow to define the demand segmentation for instance:

- 4 categories of vehicles (LV, LGV, HGV, bus),
- 4 categories of LV users (work commuters, business, tourism, others).
- 4 time segments for off-summer working days (morning peak hour, average day period, evening peak hour, average night period)
- 4 time segments for weekends and holiday periods (average period for weekends, average night period for weekends, average day period for holidays, average night period for holidays).

The above segmentation that is totally indicative would lead to $7 \times 6 = 56$ combined segments.

The data will be treated accordingly in particular, the O/D surveys will be treated with an appropriate zoning matching the available socio-economic zoning.

O/D matrices will be established. They will directly or indirectly reflect the existing hourly, weekly and seasonally variations.

3.3 Seating appropriate modelling tool:

¹ For seasonal variations it is supposed that sufficient data will be available in existing toll motorway traffic coins and daily revenues.

The traffic assignment software that will be used for the analysis of the existing situation and prospective study should have the main following features:

-complete description of the road network including:

per road sections -- section category, free flow speed, maximum capacity speed/flow curve , toll value (where required)

per node numbering and co ordinates, type of intersection, permitted and penalised and forbidden directional movements,

possibly per zone wealth indicator (based on GDP or household incomes)

-assignment algorithm:

the assignment software will look for the Wardrop equilibrium under road capacity and toll restraints:

it will optimise the generalised travel cost (including trip duration and toll value)

it will accept several matrices (one per user category) to be assigned jointly

in order to reflect human behaviour vis-à-vis the toll system, VoT inside each used category should be properly distributed (in stead of an “all-or-nothing” condition)

to a given user and his O/D couple, attractivity of the toll motorway might involve the wealth indicators of both origin and destination zones

Other features:

- Traffic values corresponding to hourly coons will be filed and automatically cornered to calculated traffic volumes provided by the model in order to check calibration validity,
- Automatic calibration modules giving priority to matrix / network adjustment are welcome,
- due to the high number of traffic assignments required for estimating one year revenues (one per time segment), the software should be operated under a batch system.

3.5 Modellion existing conditions:

The road network will be described in the study zone:

-the study zone will include the whole project and all possible competing routes; the road network will be more densely described in Manila (where the study zone will include part of the Metro Manila).

-the number of zones will be adapted to the available socio-economic zoning

The number of road sections should not be lesser than 500 and the number of zones no lesser than 50.

The method of cross-checking the network description will be described.

The demand matrices of each time segment will result from

- the O/D matrices provided by the O/D surveys,
- conventional O/D matrices corresponding to generation and distribution process based on home-to-work trips (and identified big generators).

The method for combining both approaches will be described

The calibration process will be described as well

3.5 Prospective conditions:

Modelling the future road network:

- description of the toll motorway project and its planned phasing
- identification of all other planned projects on the road network (new roads, widening) status (planned, approved, initiated...) construction phasing,

Preparing the future demand matrices:

- analysis of the different parameters influencing the demand growth (population and employment per zone, economic trend in terms of GDP or income growth, numbers of cars per household, number of persons per car, specific generators,)
- Coherence with national and regional development strategies,
- Coherence with current traffic growth rates,
- Generation of demand marches for the proposed horizons.

3.6 Basic prospective tests:

Defining a basic solution:

- selecting a complete toll system
- selecting a tariff structure
- selecting a basic network for each horizon.

Estimating basic traffic and revenues:

- traffic assignments for each time segment of each horizon
- combining traffic and revenue forecasts at the level of the whole horizon year
- estimating revenues over the concession period

Optimising toll levels:

-selecting various toll levels for the basic traffic structure

testing tariffication for each horizon

comparing yearly revenues.

3.7 Sensitivity tests:

Sensitivity of the revenues to toll system:

selecting one specific reference configuration and horizon

comparing revenues for open or closed systems

comparing revenues for various configurations of toll stations

-Sensitivity of the revenues to tariff structure:

selecting one specific reference configuration and horizon

testing tariff modulation for night period for peak hours

testing various tariff distributions into the different toll stations

-Sensitivity of the revenues to possible alternatives regarding the competing infrastructures:

selecting one specific reference configuration and horizon

testing the influence of delayed or anticipated construction works of strategic competing infrastructures (including public transport ones)

-Sensitivity of the revenues to possible alternatives regarding the project construction works:

- selecting one specific reference configuration and horizon

- testing the influence of alternative construction works phasing

Sensitivity of the revenues to uncertain values of socio-economic parameters:

selecting one specific reference configuration and horizon

testing the influences of expected traffic growth

testing the influence of average time values

testing the influence of expected GDP growth

recollecting above results for a preliminary risk analysis

4 Presentation of the proposals:

The proposal will include the following sections:

a methodology statement addressing all the above listed items and detailing:

- the proposed site surveys (quantities, personnel, local support etc.)
- the modelling tool (principle, references etc.)
- the model construction and calibration
- the prospective traffic and revenue estimates,

a detailed bar chart showing sequence and duration of the tasks

a presentation of the study team and organisation

a financial proposal including:

- the detailed quantities and unit rates for the proposed site surveys,
- the man months and unit rates for:
 - data collection (site surveys excluded)
 - data treatment
 - modelling and calibrating
 - preparing prospective conditions,
 - testing basic solution and forecasting revenue over the concession period,
 - carrying-out sensitivity test and risk analysis
 - participating to co-ordination meetings,
 - commenting on the results to financial experts

the out-of-pocket expenditures for air tickets, accommodation, report printing etc.

The proposal will also include a clear definition of the computer tests and the number of tests included in the proposal to achieve above listed results.
Unit rates will be proposed for additional tests requested by the Owner.

brief presentation of the consultant firm

main references for similar studies

bio data of the team members.