TransPlan®

The ultimate software system for Traffic Analysis and Transport Planning

[Operating Systems: Microsoft Windows 10/11 with 32 / 64 Bit, Minimum 4 GB RAM, 100 GB HDD space]

TransPlan is powerful software system for Traffic Analysis and Transport Planning. TransPlan features for signalized intersection capacity analysis as per Highway Capacity Manual (HCM) by Transportation Research Board, Traffic Analysis to obtain Peak Hour Factor, Seasonal Variation Factor, Traffic Homogeneous Sections, Tollable Traffic, ADT, AADT, Transport Demand Elasticity, Traffic Projections, Capacity and Level of Service (LOS), Equivalent Standard Axle Load (ESAL/MSA), Economic Analysis and Financial Analysis for a highway project.

Cloud based Process / Storage / Sharing facilities are available as optional. On procuring multiple licenses, say, four licenses, and installing at four different locations anywhere in the country/world, the project name, user name and password may be shared with those four license locations. They all can access cloud server to view the design and drawings, modify, re-process, download, upload the work at the cloud storage 'Techsoft Drive'.

TechSOFT Engineering Services

Website: www.techsoftglobal.com
Email: techsoftinfra@gmail.com, techsoft@consultant.com , info@techsoftglobal.com
Tel: +91 9331 9330 39, +91 33 4603 6129, +91 33 4008 3349

Signalized Intersection

The analysis contains a methodology for analyzing the capacity and level of service (LOS) of signalized intersections. The analysis must consider a wide variety of prevailing conditions, including the amount and distribution of traffic movements, traffic composition, geometric characteristics, and details of intersection signalization. The methodology focuses on the determination of LOS for known or projected conditions.

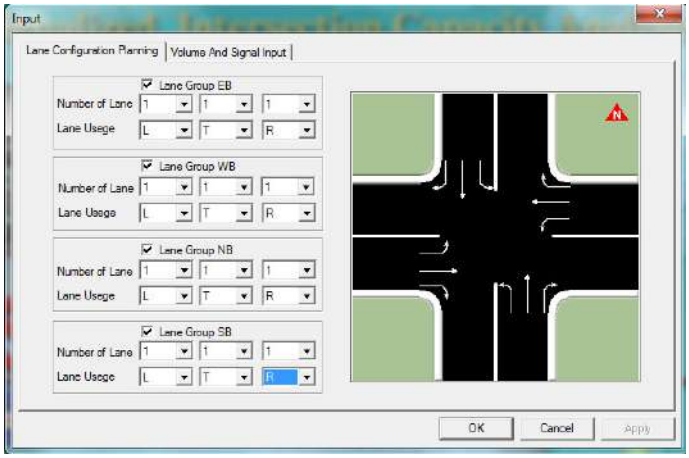
The methodology addresses the capacity, LOS, and other performance measures for lane groups and intersection approaches and the LOS for the intersection as a whole. Capacity is evaluated in terms of the ratio of demand flow rate to capacity (volume/capacity ratio), whereas LOS is evaluated on the basis of control delay per vehicle (in seconds per vehicle). Control delay is the portion of the total delay attributed to traffic signal operation for signalized intersections. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Each lane group is analyzed separately. The capacity of the intersection as a whole is not addressed because both the design and the signalization of intersections focus on the accommodation of traffic movement on approaches to the intersection.

The capacity analysis methodology for signalized intersections is based on known or projected signalization plans. Two procedures are available to assist the analyst in establishing signalization plans. The first is the quick estimation method requires minimal field data and relies instead on default values for the required traffic and control parameters.

A detailed procedure is provided for estimating the timing plan at both pretimed and traffic-actuated signals. The procedure for pretimed signals provides the basis for the design of signal timing plans that equalize the degree of saturation on the critical approaches for each phase of the signal sequence. This procedure does not, however, provide for optimal operation.

The methodology is based in part on the results of a National Cooperative Highway Research Program (NCHRP) study. Critical movement capacity analysis techniques have been developed in the United States, Australia, Great Britain, and Sweden. Background for delay estimation procedures was developed in Great Britain, Australia, and the United State.



Traffic Analysis

Roads form the spine of any emerging economy. The economic benefits of a newly constructed/ improved road, both in terms of direct and indirect benefits, are immense. An accurate estimate of the traffic that is likely to use the project road is very important as it forms the basic input in planning, design, operation and financing. A thorough knowledge of the travel characteristics of the traffic likely to use the project road as well as other major roads in the influence area of the study corridor is essential for future traffic estimation. The estimation of revenue through toll collection is important to assess the financial viability of the project and to finalize the financial covenants for the concession agreement. Thus an accurate assessment of the existing traffic and forecasting attains utmost importance for the road projects.

The primary objectives of the traffic studies are:

- To determine characteristics of traffic movement and to establish base year traffic demand
- To identify the zone of influence for the project roads and extent of influence based on O-D Survey
- To determine the travel pattern of goods and passenger vehicles
- To determine the percentage of right turning traffic at road intersections as a guide to the intensity of vehicle – vehicle conflict and geometric design
- To determine Vehicle Damage Factor (VDF) as an aid to pavement design
- To determine traffic growth rates; and
- To perform Capacity and Level of Service (LOS) analysis

The data collected from primary and secondary sources are recorded in Excel sheets, compiled, checked and corrected before further proceeding for analysis. Traffic data analysis is carried out, to understand traffic characteristics and travel pattern in the study area and to provide basic input for traffic capacity assessment.

The traffic flow is measured in terms of number of vehicles per unit time. Since traffic in developing countries is heterogeneous in nature, it is common practice to convert the traffic in terms of Passenger Car Units (PCUs). The traffic data (in vehicles) collected during field surveys have been compiled and converted into equivalent Passenger Car Units (PCU) to determine the Average Daily Traffic (ADT) in vehicles and their equivalent PCUs of vehicles. the adopted equivalent PCU Factors for different vehicle type are based on either IRC: 64-1990 or other relevant standard of the country.

Traffic fluctuates by the hour, by the day and by the month. Hence, it is essential to estimate a factor which provides a relationship between Annual Average Daily Traffic (AADT) and Average Daily Traffic (ADT) for the month corresponding to the traffic surveys. While hourly and daily fluctuations have been accounted for by conducting surveys for continuous 168 hours (24 hours x 7days), the Seasonal Variation Factor (SVF) is used to estimate AADT from ADT data.

The seasonal variation factor is estimated using the past fuel sales data collected from the existing petrol bunks (as the Project roads are non-tolled stretches and hence the toll revenue details of existing toll plazas, if any, not considered) along the project roads. The petrol (MS) and diesel (HSD) sales data in liters consumption has been collected for the past 1 year at various traffic volume count stations in the project highway and are analyzed for the monthly variation in the sales of fuel as per either IRC: 108 – 2015 or other relevant standard of the country. The analysis to assess the seasonal variation factor and detailed calculations are given in MS-Excel Worksheet.

Classified Traffic Volume Count

The analysis has been carried out to derive:

- Average Daily Traffic (ADT) for fast and slow moving vehicles
- Average Daily Variation and average Hourly Variation
- Annual Average Daily Traffic (AADT) after seasonal correction
- Traffic composition pattern for passenger, goods and non-motorized vehicles
- Peak hour traffic variation for passenger and commercial vehicles

Average Daily Traffic (ADT)

The classified traffic volume count data collected is analyzed to assess the traffic intensity along the project corridors. The summary of Average Daily Traffic (ADT in number of vehicles) at various survey locations along project sections is presented with salient findings. Detailed calculations are presented in MS-Excel Worksheet as **Annexure – 1**.

Annual Average Daily Traffic (AADT)

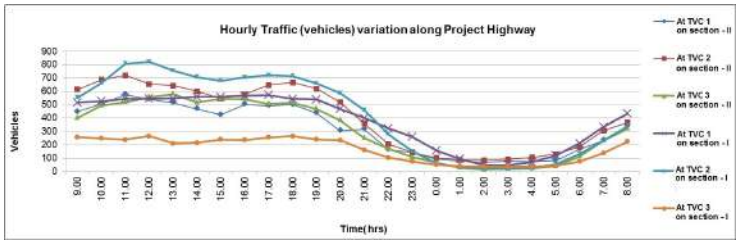
The Annual Average Daily Traffic (AADT in no of vehicles) at the survey locations is obtained by multiplying the Average Daily Traffic (ADT) with the seasonal correction factor. The AADT of vehicles for the base year at the various survey locations along the project highway sections is to be presented in the report by user.

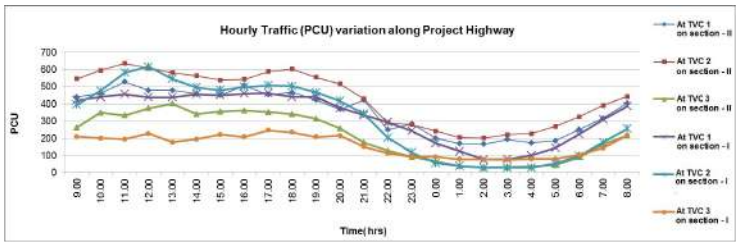
Peak Hour Factor

The peak hour factor is defined as the traffic volume during peak hour expressed as a percentage of AADT. The day time (04:00 AM to 16:00 PM) and night time (16:00 PM to 04:00 AM) peak factors are calculated separately at the traffic count locations indicate fairly uniform distribution of the traffic volume during the day and night. Peak hour factors indicate slightly higher traffic volumes during the peak hour at night time. Full day wise (24 hours) peak hour factor calculation is to be presented in the report by user.

Traffic homogeneous sections

With a view to capture section-wise traffic flow characteristics, project stretches has been segmented into several traffic-homogeneous sections, based upon the locations of major intersections/ urban settlements that act as main collectors or distributors of traffic along the project corridors; i.e., sections of more or less similar traffic characteristics would form one homogeneous section. The traffic homogeneous sections identified are to be presented in the report by user.

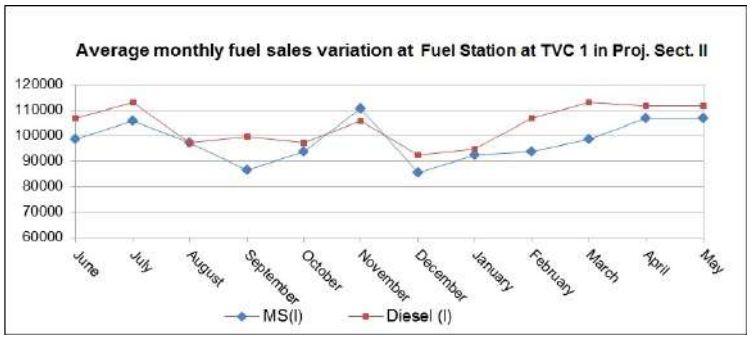




Seasonal variation factor

Traffic fluctuates by the hour, by the day and by the month. Hence, it is essential to estimate a factor which provides a relationship between Annual Average Daily Traffic (AADT) and Average Daily Traffic (ADT) for the month corresponding to the traffic surveys. While hourly and daily fluctuations are accounted for by conducting surveys for continuous 168 hours (24 hours x 7days), the Seasonal Variation Factor (SVF) will be required to estimate AADT from ADT data.

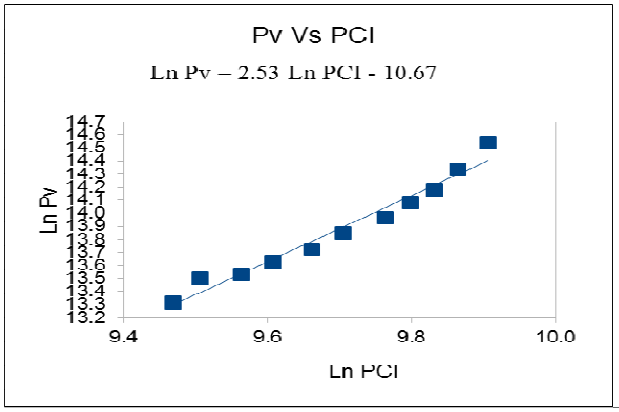
The seasonal variation factor is estimated using the past fuel sales data collected from the existing petrol bunks (as the project roads are commonly non-tolled stretches and hence the toll revenue details of existing toll plazas, may not be considered) along the project roads. The petrol (MS) and diesel (HSD) sales data in liters consumption are collected for the past 1 year at identified locations in the project section and are analyzed for the monthly variation in the sales of fuel as per either IRC: 108 – 2015 or other relevant standard of the country. The analysis to assess the seasonal variation factor and detailed calculations are given in MS-Excel Worksheet as **Annexure – 2**.

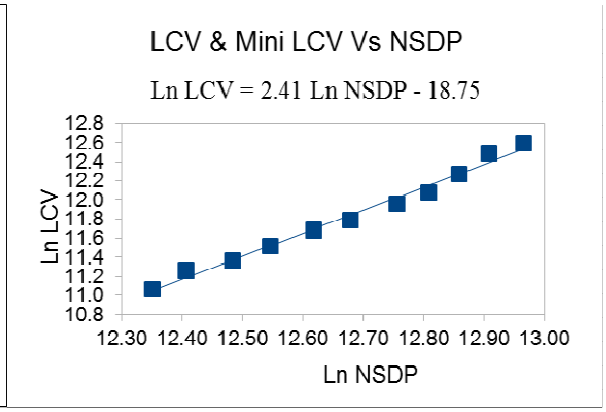


Transport Demand Elasticity

The most important parameter, on which the future forecast of traffic depends, is the 'Growth Rate'. However, for small stretches where most of the traffic neither originates nor ends within the stretch, growth potential of the origin and destination (Zone of Influence) need to be assessed to arrive at the growth potential of the stretch. It is ideal to identify future growth potential of each zone for goods and passenger movements and for each category of vehicles separately.

Econometric models





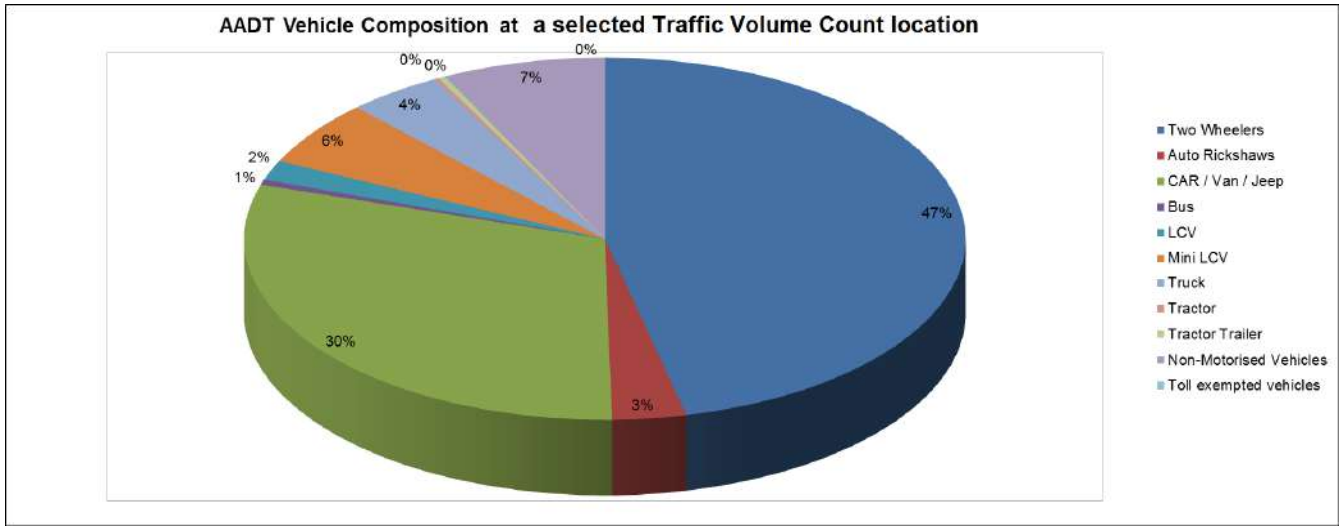
The following steps are adopted to derive the elasticity and growth factors

- Growth rate of registered vehicles in zone of influence is to be found out.
- Growth rates of NSDP/GSDP, Per Capita Income and population are to be obtained.
- For passenger vehicles and buses, number of registered vehicles is regressed with population data of the state.
- For trucks, number of registered trucks is regressed with NSDP.
- Mean value of average growth rate of registered vehicles and the growth rate obtained by regression analysis for all categories are found out at state level.

The elasticity analysis in terms of econometric models is to be presented for the State by the user. Detai calculations are given in MS-Excel Worksheet as **Annexure – 3**.

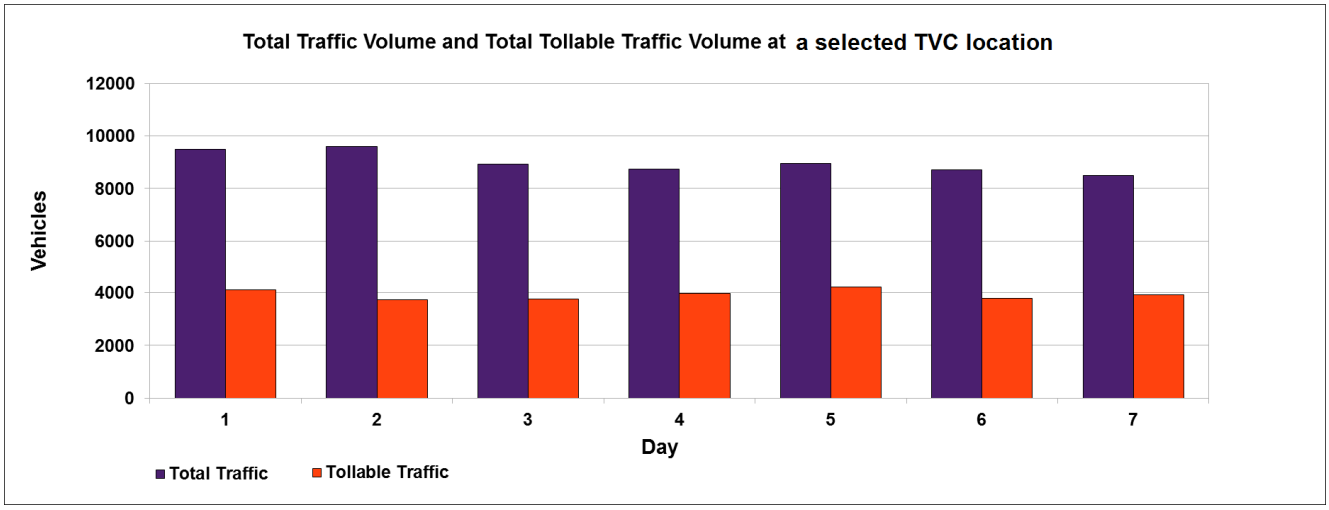
TRAFFIC PROJECTIONS

Based on the estimated traffic growth rates and the Annual Average Daily Traffic (AADT) observed at the TVC locations and traffic homogenous sections, the traffic on to the Project corridors for the horizon years is estimated as given in MS-Excel Worksheet as **Annexure – 4**.



CAPACITY AND LEVEL OF SERVICE (LOS) ANALYSIS

The Capacity of a facility is defined as the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of the lane or roadway during a given time period under prevailing roadway, traffic and control conditions. By comparing the present traffic volume with the capacity of existing highways, their adequacy or deficiency can be assessed. Improvements and changes in the geometric features, junction features, traffic control devices and traffic management measures can be planned if capacity studies are considered.



Computation of ESAL / MSA

The Equivalent Standard Axle Load (sometimes expressed in millions as Million Standard Axle, MSA), is computed from axle load survey data, as given in MS-Excel Worksheet as **Annexure – 5**.

Traffic Analysis - Annexure 5 Equivalent Standard Axle Load MSA Computation [Read-Only] - Microsoft Excel

Standard Reference: (May be mentioned by the user)

Equivalence Factors

Gross Axle Weight (T)		Load Equivalency Factors	
		Ainge Axle	Tandem Axle
900	0.900	0.0002	0.0000
1810	1.810	0.002	0.0002
2720	2.720	0.009	0.001
3630	3.630	0.031	0.003
4540	4.540	0.08	0.006
5440	5.440	0.176	0.013
6350	6.350	0.35	0.024
7260	7.260	0.61	0.043
8160	8.160	1.00	0.07
9070	9.070	1.55	0.11
9980	9.980	2.3	0.166
10890	10.890	3.27	0.242
11790	11.790	4.48	0.342
12700	12.700	5.98	0.47
13610	13.610	7.8	0.633
14520	14.520	10	0.834
15420	15.420	12.5	1.08
16320	16.320	15.5	1.38
17230	17.230	19	1.73
18140	18.140	23	2.14

Axle Load Spectrum

Axle Load Category	
0	0.900
0.900	1.810
1.810	2.720
2.720	3.630
3.630	4.540
4.540	5.440
5.440	6.350
6.350	7.260
7.260	8.160
8.160	9.070
9.070	9.980
9.980	10.890
10.890	11.790
11.790	12.700
12.700	13.610
13.610	14.520
14.520	15.420
15.420	16.320
16.320	17.230
17.230	18.140

Data Entry | Vehicle Type Coding | Raw Data | LCV | 2A | 3A | BUS | MAV

The Vehicle Damage Factor (VDF) is also computed, for the design of pavement design,

Traffic Analysis - Annexure 5 Equivalent Standard Axle Load MSA Computation [Read-Only] - Microsoft Excel

Values in Red color are user input data

Analysis Period = YR (Years) 15

Vehicle Damage Factors at Toll Plaza

Vehicle Type	VDF from Origin to Destination	VDF from Destination to Origin	Average VDF	Average Daily Traffic (ADT)	Growth Rate (GR) %	nGR	dGR	Equivalent Standard Axle (ESA)
LCV	0.34	0.40	0.366303	4000	6	1.06	0.06	12448032.59
2-Axle Truck	1.94	1.16	1.550260	3000	6	1.06	0.06	39511771.76
3-Axle Truck	4.75	4.31	4.530497	2000	4	1.04	0.04	66223271.81
MAV	8.91	7.16	8.036321	2000	4	1.04	0.04	117468662.2
Bus	0.53	0.74	0.634450	1000	5	1.05	0.05	4997039.679
						Total ESA=		240648778.1
						Total MSA=		240.6487781

Total Number of Vehicle Types = 1 to i
Analysis Period = YR (Years)
nGR = 1.0+GR[i]/100.0;
dGR = GR[i]/100.0;
ESA = 365.0 * ADT[i] * VDF[i]*(pow(nGR,YR)-1.0) / dGR;

MSA = ESA/1000000

LCV Summary | 2-Axle Summary | 3-Axle Summary | MAV Summary | BU

Economic Analysis

After having assessed the project cost in the most reasonable manner, the next step is to quantify the various benefits to be accrued to the project due to improvement of a selected section of road. Through this study, the benefit component of the project can be quantified over a specified time horizon and measured by a common yardstick.

The economic cost is primarily computed by multiplying a factor with the financial cost. This generally excludes prices, taxes, duties and royalties. It may be important to mention that the cost of construction and maintenance of Toll Plaza are not included in the economic analysis as these are incurred for the specific purpose of toll collection. While conducting project feasibility exercise, the economic benefits to be accrued from investment in road works can be measured in terms of reduction in vehicular delays and vehicle operation costs (VOC). It may be mentioned that the benefits derived from the investment of Toll Plaza are only financial returns.

In order to work out 'Economic Internal Rate of Return (EIRR)', an attempt can be made to carry out an analysis based on with and without project condition, so that the comparison of cost and benefit, in economic terms, can be made in a realistic manner.

This kind of analysis generally demonstrates the expected return to the society from the proposed investment during the project life. Usually this return, known as EIRR, is compared with the breakeven point of the Government's EIRR and other international funding agencies, such as World Bank, and ADB (Asian Development Bank), so as to take an appropriate decision for investment.

There are a number of components associated with carrying out this study of economic feasibility as presented under.

(i) Estimation of design year traffic

(ii) Estimation of capital and maintenance cost at economic prices along with capital cost phasing

(iii) Estimation of economic benefits

(iv) Composition of annual stream of cost as against benefit

(v) Estimation of EPRR

(vi) Conduct of sensitivity analysis by assessing the effects of adverse changes in major variables on EIRR

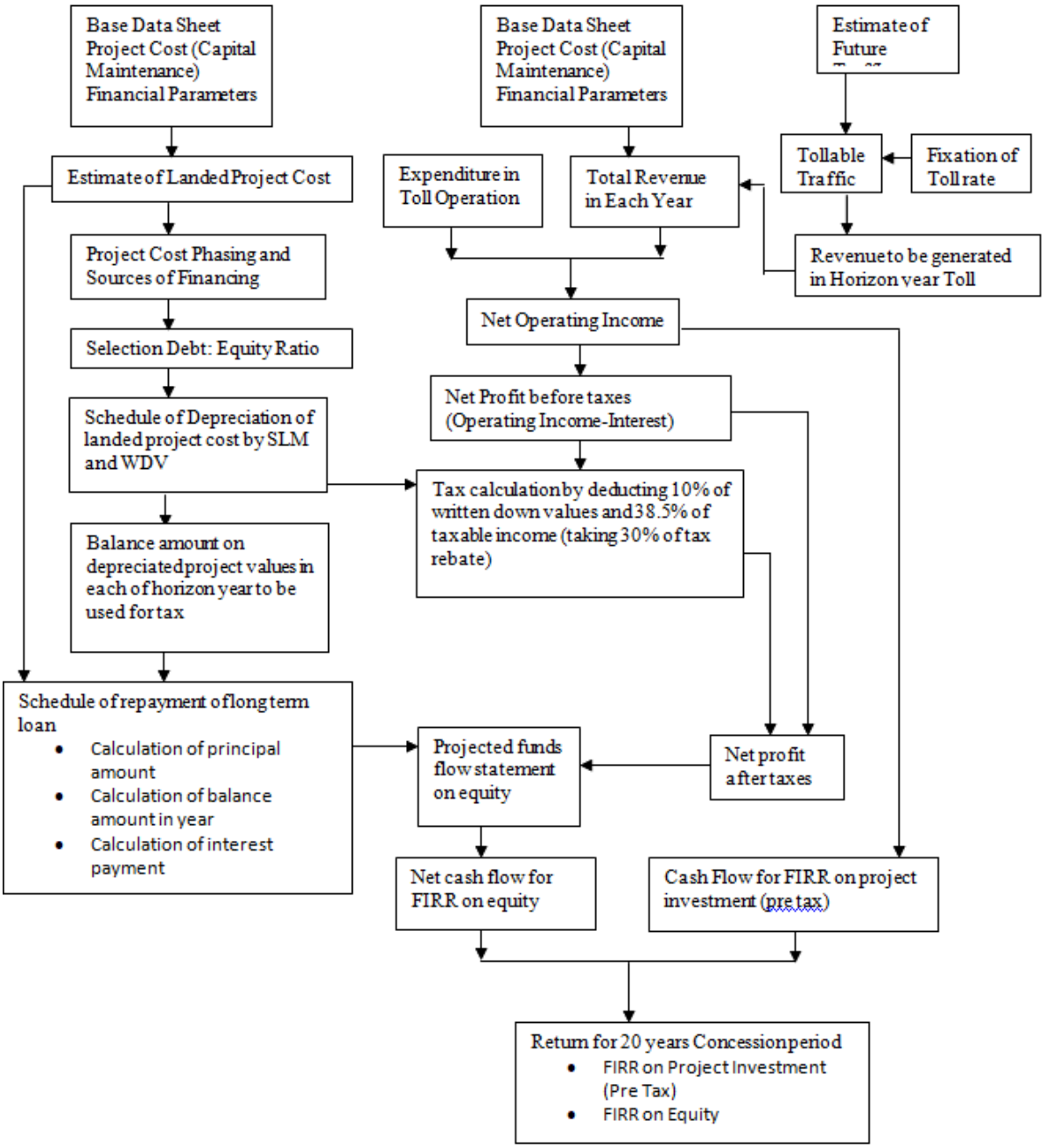
Financial Analysis

In order to carry out the financial analysis, it is extremely important to assess the revenue to be generated from the project after levying the toll on various types of traffic. The primary intension in carrying out the study is to determine the recovery of investment. It is therefore necessary to understand the analysis mechanism of financial viability through a number of financial models such a BOLT (Built Operate Lease and Transfer) and BOT (Built Operate and Transfer). For this analysis, BOT model is used. Hence, the participation of the private entrepreneur for such a project that can be built and operated by them and then be transferred to the government after some period, as decided by the government is very important. These basically help to reduce the financial burden on the government, wherein private participation is encouraged in developing these kinds of projects. In view of the above, a detailed financial analysis is presented to arrive at commercial viability. The financial mechanism through which the viability of the project is determined is explained in subsequent sections.

Approach of Financial Analysis

This is to assess the extent to which the investment can be recovered through the toll revenue mechanism. Financial analysis includes finances to be made available through debt and equity loan repayment, servicing, taxation and depreciation. The commercial viability of the project is examined by working out the 'Financial Internal Rate of Return (FIRR)' on equity investment and FIRR on total investment. The details of calculation of FIRR are presented in subsequent analysis. The flow diagram of the Financial Analysis is as shown below,

Flow Chart for Financial Analysis



Computation of Toll Rates

TransPlan features for Computation of Toll Rates as per Whole Sale Price Index (WPI), Computation Guidelines and Toll Notification to be published in Newspapers and Web Sites of the Project Authorities.

1	**Project Name:** Four laning of Federal Highway FH-4 from km.115.00 to km.193.00 on DBFOT (Annuity) Basis						
2	User Fee Applicable at TP Km 141+000						
3							
4	SINGLE TRIP						
5							
6	WPI A (Whole Sale Price Index of the Week ending on or subsequent Month immediately preceding date of revision under these rule 5)	2017 DEC	355.6	WPI after convertion to 1993-94 base year (115.7*1.873*1.641) **Web link:** eaindustry.nic.in/download_data_3394.asp and eaindustry.nic.in/linking_factor3394.asp			
7	WPI B (Whole Sale Price Index of the Week ending on particular month of revision under these rule 5)	2007 JAN	208.7	Base year 1993-94			
8	For road Section of 76.36 kms						
9	Type of Vehicle	**Base rate of fee per KM (in Dollars/Rupees) for base year**	**Base rate of Fee per KM (in Dollars/Rupees) for Year 2018-**	**Applicable Fee per KMS (in Dollars/Rupees) for Year 2018-**		**Applicable Fee for the section (in Dollars/Rupees) for Year 2018-19**	**Rounded to Nearest $/Rs. 5/-**
10	CAR, JEEP, VAN OR LMV	0.65	**0.8645**	1.1079	1.1079	84.5992	85
11	LCV, LGV or Mini Bus	1.05	**1.3965**	1.7897	1.7897	136.6615	135
12	Bus / Trucks	2.20	**2.9260**	3.7498	3.7498	286.3347	285
13	HCM or EME or MAV (3 to 6 Axles)	3.45	**4.5885**	5.8804	5.8804	449.0273	450
14	Oversized Vehicle (7 or more axles)	4.20	**5.5860**	7.1588	7.1588	546.6460	545
15							
16							
17	Daily Pass (2 single trips in day)						
18	For road Section of 76.360 kms						
19							
20	Type of Vehicle	**Applocable Fee per KMS (in Dollars/Rupees) for Year 2018-19**		**Applicable Fee for the section (in Dollars/Rupees) for Year 2018-19**			**Rounded to Nearest $/Rs. 5/-**
21							
22	CAR, JEEP, VAN OR LMV	1.6619		126.8989			125
23	LCV, LGV or Mini Bus	2.6846		204.9922			205
24	Bus / Trucks	5.6247		429.5021			430
25	HCM or EME or MAV (3 to 6 Axles)	8.8206		673.5410			675
26	Oversized Vehicle (7 or more axles)	10.7382		819.9690			820
27							
28							
29	Monthly Pass (50 single trips in Month)						
30	For road Section of 76.360 kms						
31							
32	Type of Vehicle	**Applocable Fee per KMS (in Dollars/Rupees) for Year 2018-19**		**Applicable Fee for the section (inDollars/ Rupees) for Year 2018-19**			**Rounded to Nearest $/Rs. 5/-**
33							
34	CAR, JEEP, VAN OR LMV	36.9300		2819.9748			2820
35	LCV, LGV or Mini Bus	59.6567		4555.3831			4555
36	Bus / Trucks	124.9933		9544.4909			9545
37	HCM or EME or MAV (3 to 6 Axles)	196.0133		14967.5781			14970
38	Oversized Vehicle (7 or more axles)	238.6267		18221.5323			18220

Toolkit Workbook and Guide for Road Asset Management

Sample Consequence Table - ROADS

Category	1	2	3	4	Weight	Notes
Operational Impacts	Requires semi annual monitoring or repair	Requires monthly monitoring or repair	Requires weekly monitoring or repair	Unable to maintain or operate OR repair requires greater than one week	0.6	Reactive operational effort ab what is routine
Environment	Short term irritant (i.e. Dust)	Prolonged irritant (i.e. Dust) OR Aesthetic impact	Release of deleterious substances to environment (i.e. Hydraulic fluid, diesel fuel, etc.)	Release of deleterious substances to environment that result in a fine	0.8	O&G, fines to waterway, etc. Dust control Noise
Safety	Near miss	Minor injuries that do not require medical consultation	Injuries require medical consultation	Many people with major injuries OR fatality	1	Consider all road users - pedestrians, bikes, vehicular. R lights, signs, etc.
Travel Time	Travel time is increased for a period of < 48 hours	Travel time is increased for a period of 48 hours - one month	Travel time is increased for period of one month four months	Travel time is increased for period of > four months	0.6	

TransPlan Release 10 Package:

Each package contains the following items:

1. Installation Setup, Users are to download from web site www.techsoftglobal.com

2. Tutorials containing the Users' Manual, Design Manual, Tutorials, Tutorial Videos and various Tutorials on real project data, Users are to download from web site www.techsoftglobal.com

License Types for Each Product:

License Option1: The single user "Professional License" is made on individual user's name.

License Option2: The single user "Enterprise License" is made on company's name, for one year free email based technical support.

All the Licenses have same Features content of the software.

Purchase and Licensing for Each Product:

Each software License is Web based. Purchase Order/Request is to be sent to Techsoft with complete address, Post Code and Telephone number. Next, we shall send the Invoice with our Bank Account details for making the payment. Customers may make the payments by Cards by using menu 'Purchase' at web site www.techsoftglobal.com, or by Online Transfer to the account of Techsoft as mentioned in the Invoice. No payment should be done without Invoice and after making payment customer has to inform Techsoft about mode of payment.

After making the payment customer has to run the installed software and select menu item 'File >> Enter License Activation Key'. The 'Computer ID is detected, user has to click on 'Send Mail' in internet connected condition. Next, we shall send the License 'Activation Key' within next two working days to the customer by mail. The user has to copy the 'License Key' and paste in the box in software menu item 'File >> Enter License Activation Key'. The license will be activated in the PC/Laptop. During the validity of the license it can not be shifted to another PC/Laptop. The License is for one year, for renewal, after each year user has to pay the annual subscription within 15 days from expiry of the license.

TechSOFT Engineering Services (I) P. Ltd.
(An ISO 9001:2015 Company)
Mobile/Whatsapp: +91 9331 9330 39
Tel: +91 33 4008 3349, +91 33 4603 6129
Web site: **www.techsoftglobal.com**
Email: **techsoftinfra@gmail.com**, **techsoft@consultant.com**