Economic & Financial Evaluation of Transportation Projects

by

Prof. S. L. Dhingra

Transportation Systems Engineering

Department of Civil Engineering

IIT Bombay

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Purpose of Economic Evaluation

- Preparation of highway plans at the national regional and local level.
- To rank schemes within highway sector plan competing for scarce resources in order of priority
- To compare mutually exclusive schemes and select the most attractive one
- To determine whether a scheme under consideration is worth investment at all

- **To evaluate alternative strategies stage construction or full construction; alternative specification such as flexible pavement or rigid pavement; alternative policies such as increased outlay of maintenance or rehabilitation; alternative design standard and alternative policy options on axle loads.**

Basic Concepts of Economic Analysis

- National view point
- Difference between economic analysis and financial analysis
- Analysis is a study of future
- All possible alternatives should be considered
- Cost and benefit components of equal magnitude

- **Marginal differences**
- **All consequences should be considered**
- **Analysis period should not extend beyond the period of reliable forecasts**
- **All future cash flows to be brought to a common time datum**

Aspects of Project Appraisal

- Engineering Aspects
- Managerial Aspects
- Financial Aspects
- Economic Aspects

Engineering Aspects

- **Deal primarily with the technical construction process and the operating of the project after it is completed, as well as with the estimates of capital and operating costs.**

Managerial Aspects

- **Deal with the multitude of management and staffing problems involved in constructing and operating the project.**

Financial Aspects

- **Deal with the cost and revenue of the enterprise responsible for the project**

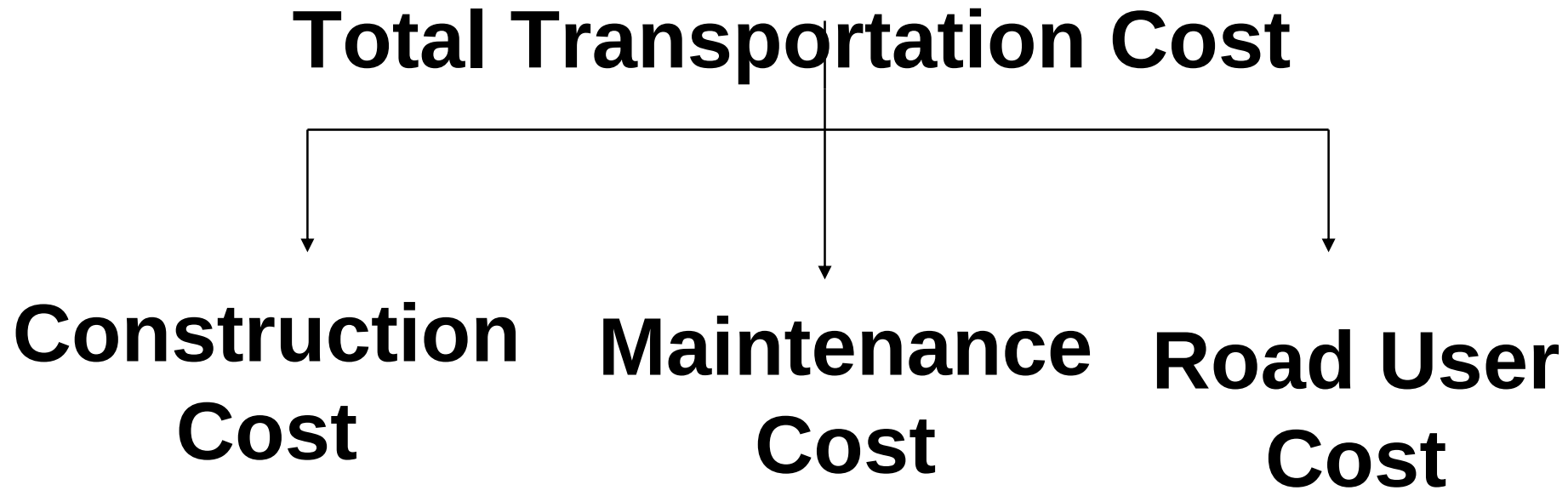
Economic Aspects

Deal with the economic costs and benefits from the point of view of the country as a whole

To estimate the economic cost two adjustments are necessary

- **Taxes and customs duty must be deducted.**
- **The foreign exchange component must be shadow-priced**

Total Transportation Cost



Construction Cost

- Survey, Investigation And Design Cost
- Land Acquisition Cost
- Construction Costs
- Physical Contingencies
- Supervision, quality Control And Administration Charges

Maintenance Cost

- Ordinary repairs
- Periodic repairs
- Operation expenses
- Supervision and operational charges

Road User Cost

Vehicle operating cost	Time cost	Accident cost
1.Fuel And Lubricants Costs 2.Spare Part Cost 3.Tyre Cost 4.Maintenance Labour Cost 5.Fixed Cost 6.Crew Cost 7.Depreciation Cost 8.Commodity Cost	1.Value Of Occupation Time 2.Value Of Goods In Transit 3.Value Of Time Of Commercial Vehicle	1.Cost Of Human Fatal Accident 2.Loss Due To Injury 3.Cost Of Hospitalization 4.Damage To Property Vehicle

Benefits from Highway Improvements

Road user benefits

- Vehicle operating cost saving
- Value of travel time savings
- Value of savings in accident cost
- Savings in maintenance cost

Social benefits

- Improvement in administration. Law and order and defense
- Improvements in health and education
- Improvements in agriculture, industry, trade, mining and environmental standards
- Appreciation in value of land adjacent to roads.

Factors Affecting the Road User Cost

Roadway factors

- Pavement width
- Surface type and riding quality
- Vertical profile
- Horizontal geometry
- Number of junctions per Km

Vehicle factors

- Type
- Age
- Make
- Engine horse power
- Power weight ratio

Traffic factors

- Traffic volume
- Traffic composition
- Speed
- Congestion

Environmental factors

- Weather, rainfall, temperature
- Altitude of the place

Stages Involved In Economic Evaluation

- Identification and definition of project
- Collection of economic based data
- Traffic surveys in existing facilities
- Selection of policy variable for analysis and decision
- Inventory of existing roads
- Traffic projections

- Engineering design of proposed alternative schemes
- Estimation of cost of new facility as per all alternatives considered
- Traffic analysis of existing road and new facility
- Estimation of user benefits
- Economic analysis

EFFICACY AND EFFICIENCY

- For many years, efforts have been dedicated to high-quality clinical research on the relative efficacy of treatment options for various diseases, illnesses, and disabilities
- The environment has changed dramatically in the last decade, and clinical efficacy must now be combined with economic efficiency

BASIC ECONOMIC EVALUATION

PURPOSE: To compare the relative value of different interventions in creating better health and/or longer life in order to maximize benefits conferred

DEFINITION: Economic evaluation in health is a method designed to assess the comparative impacts of expenditures on different health interventions

EVALUATION APPROACHES

- BENEFIT-COST RATIO APPROACH: Projects are compared on the basis of the average benefit per unit cost; the project with the greatest ratio of benefits to costs is selected (benefits / costs) -- impacted by classification of an event as a cost or a benefit
- NET BENEFIT APPROACH: Projects are compared on the basis of the excess of benefits over costs; total costs are subtracted from total benefits to determine highest difference (benefits - costs) -- ignores relative magnitude of projects with use of an absolute value

PRINCIPLES OF ANALYSIS

- Define problem
- State objectives
- Identify alternatives
- Construct decision tree
- Analyze benefits or effects
- Analyze costs
- Differentiate perspective of analysis
- Perform discounting
- Analyze uncertainties
- Address ethical issues
- Discuss results
- Monitor and re-evaluate decisions

Compound Interest Equations

The terms used in these equations has the following meaning,

P = Present sum of money

i = Interest rate (compound) per annum

N = Number of years

F = Sum of money at a future date

A = End of year equal annual payments for n years

Derivation of Compound Interest Equation

Equation 1

$F_1 = P_0 + P_{0i} = P_0(1+i)$

End of the second year the sum F_2

$F_2 = P_0(1+i) + P_0(1+i)I = P_0(1+i)^2$

F_n for any specific number of periods n will be

$F = P(1+i)^n$

Equation 3

The equation is of a geometric series. The accumulation sum form a geometric series ranging from $A((1+i)^0$ to $A((1+i)^5$ for n=5, the series compound ed sum is as follows

Fifth and last payment = $A((1+i)^0$

Fourth payment = $A((1+i)^1$

Third payment = $A((1+i)^2$

Second payment = A((1+i)3

First payment = A((1+i)4

The sum of the series may be written as

$F = A((1+i)^0 + A((1+i)^1 + A((1+i)^2 + A((1+i)^3 + A((1+i)^4$

Multiplying the above by ((1+i) and subtractin the above equation we get

$$F = \frac{((1+i)n-1)A}{i}$$

Equation 5

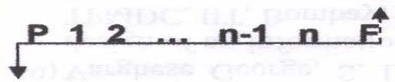
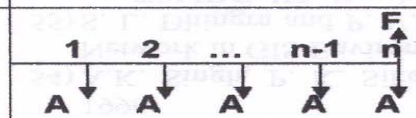
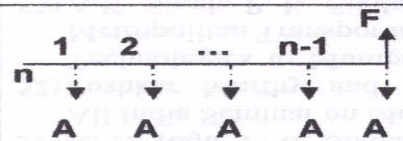
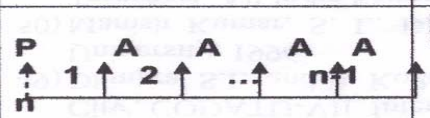
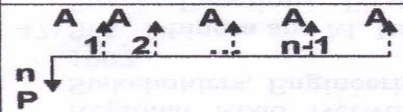
In the equation 3 the accumulated amount f, a single sum, may be converted into the present worth by multiplying the present worth single sum factor, thus

$$p = \frac{((1+i)^n-1)A}{i} \quad \frac{(1)}{(1+i)^n}$$

$$p = A\,\frac{((1+i)^n-1)}{i\,(1+i)^n}$$

Other equation will get by taking the reciprocal of these equations

Compound Interest Equations

S. no	Diagram	Equation	Factor
1		$F=P(1+i)^n$	$(1+i)^n$ Is known as compound amount factor (CA)
2		$P=F/(1+i)^n$	$1/(1+i)^n$ Is known as Present worth factor of single sum(PW)
3		$F=\frac{((1+i)^n-1)A}{i}$	$\frac{((1+i)^n-1)}{i}$ is known compound amount factor of uniform series (SCA)
4		$A=\frac{i\ F}{((1+i)^n-1)}$	$\frac{i}{((1+i)^n-1)}$ known as sinking fund factor (SF)
5		$P=\frac{((1+i)^n-1)A}{i(1+i)^n}$	$\frac{((1+i)^n-1)}{i(1+i)^n}$ is known present worth factor of uniform series(SPW)
6		$A=\frac{i(1+i)^n\ P}{((1+i)^n-1)}$	$i(1+i)^n$ is known as $((1+i)^n-1)$ capital recovery factor

Examples for Compound Interest Equations

- The future worth of Rest 1,00,000 at the end of 20 years invested at a compound rate of interest of 12% per annum

  CA(12%, 20 years) = 9.6463

  Future worth = 100000 * 9.6463

  = 964630.

- Present worth of a sum of Rs. 75,000 at the end of 10 years when the discount rate is 10 percent per annum

  PW(10%, 10 years) = 0.3855

  Present worth = 75000*0.3855 =28,912.50

- Annual cost of maintenance of a new road thrown open to traffic is Rs. 15,00,000. What is the future worth of this expenditure at the end of 10 years when the rate of interest is 15% per annum

SCA(15%, 10 years) = 20.3037

Future worth at the end of 10 years = 15,00,000 * 20.3037

= 304,55,550

- A major rehabilitation of a pavement will be done 10 years from hence at a cost of Rs. 100 lakhs. What should be the series of uniform annual payments that must be set apart to accumulate this amount, if the interest rate is 9% per annum

SF(9%, 10 years) = 0.0658

Amount of uniform annual payment = 0.0658 * 100 lakhs

= 6.58 lakhs

- Annual maintenance cost of a major bridge is Rs. 10,000. what is the present worth of this cost incurred for 10 years after the opening of the bridge? The discount rate may be taken as 12% per annum

  SPW(12%, 10 years) = 5.6502

  Present worth = 10,000* 5.6502

  = 56,502

- The cost of construction of a new facility is Rs.100 crores at current price, and is met with by raising a loan. What is the annual payment of equal amount for 20 years to repay the loan, if the rate of interest is 10% per annum?

CR(10%,20) = 0.1175

Equal annual payment to repay the loan

= 0.1175 * 100 crores

= 11.75 crores

Methods of Economic Evaluation

- Equivalent Uniform Annual Cost Method (EUAC)
- Present Worth Of Cost Method (PWOC)
- Equivalent Uniform Annual Net Return Method (EUANR)
- Net Present Value Method (NPV)
- Benefit / Cost Ratio Method (B/C)
- Internal Rate Of Return Method

Equivalent Uniform Annual Cost Method (EUAC)

- The equivalent uniform annual cost method combines all investment costs and all annual expenses into one single annual sum that is equivalent to all disbursements during the analysis period if spread uniformly over the period.
- When more than one alternative is being examined the one with the lowest EUAC is most economical.
- The present worth of this equivalent annual cost will give the same answer as obtained by the present worth of costs method.

- $EUAC = -I(CR\text{-}i\text{-}n) + T(SF\text{-}i\text{-}n) - K - U$
- $EUAC = -I(CR\text{-}i\text{-}n) + T(SF\text{-}i\text{-}n) - K - G_k(GUS\text{-}i\text{-}n) - U_E$

Present Worth Of Cost Method (PWOC)

- **Present worth of cost method combines all investment cost and all annual expenses into a single present-worth sum, which represent the sum necessary at the time zero to finance the total disbursement over the analysis period.**

- **This present sum when multiplied by capital recovery factor will give the equivalent uniform annual cost obtained by EUAC**

- **PWOC = -I + T(PW-i-n) - K(SPW-i-n) - U(SPW-i-n)**
- **PWOC = -I +T (PW-i-n) - K(EPW-i-n) - U(EPW-i-n)**

Equivalent Uniform Annual Net Return Method (EUANR)

- This method is EUAC plus inclusion of an income factor or benefit factor.
- The answer indicates the amount by which equivalent uniform annual income exceed the EUAC.
- The alternative having the greatest equivalent uniform cost net return of the one of greatest economy.

- $EUANR = -I(CR\text{-}i\text{-}n) + T(SF\text{-}i\text{-}n) - K + R$
- $EUAC = -I(CR\text{-}i\text{-}n) + T(SF\text{-}i\text{-}n) - K - G_k(GUS\text{-}i\text{-}n) + R_G$

Net Present Value Method (NPV)

- In this method the stream of costs/ benefits associated with the project over an extended period of time is calculated and is discounted at a selected discount rate to give the present value.
- Benefits are treated as positive and cost as negative and the summation gives the net present value (NPV).
- Any project with positive NPV is treated as acceptable.
- In comparing more than one project, a project with higher NPV should be accepted.

- **NPV= -I + T(PW-i-n) - K(SPW-i-n) + R(SPW-i-n)**
- **NPV = -I + T(PW-i-n) - K(SPW-i-n) - Gk(GUS-i-n)+R(EPW-i-n)**

	Project			
	I	II	III	IV
NPB (#1000)	22759	25390	25856	26606
NPC (#1000)	20643	21958	21958	21958
NPV (#1000)	2117	3432	3899	4649
Ranking	4	3	2	1

1. **Project IV will have the greatest excess of benefits over costs**
2. **Project II has a greater excess than I, since the benefits last longer**
3. **Project IV's excess is more than project III's because the benefits come earlier in time.**

- **If the NPV of a project turns out negative, this would mean that discounted costs exceeded benefits, and thus the project should not be undertaken.**

Benefit / Cost Ratio Method (B/C)

- In this method all costs and benefits are discounted to their present worth and the ratio of benefit to cost is calculated.
- Negative flows are considered as costs and positive flows are benefits.
- If the B/C ratio is more than one the project is worth undertaking.

$$B/C = \frac{-(U_{GP}-U_{GB})-(K_{GP}-K_{GB})}{-(I_P-I_B)\,(CR-i-n)+(T_P-T_B)(SF-i-n)}$$

$$B/C = \frac{-(U_{GP}-U_{GB}) - (K_{GP}-K_{GB})}{-(I_P-I_B) + (T_P-T_B)\,(PW-i-n)}$$

	Project			
	I	II	III	IV
BCR	1.10	1.16	1.18	1.21
Ranking	4	3	2	1

Internal Rate Of Return Method

- **The internal rate of return is the discount rate, which makes the discounted future benefits, is equal to the initial outlay.**
- **The higher the rate of return the greater the economy.**

- $0=-(I_P-I_B)\ (CR-i-n)+\ (T_P-T_B\ (SF-i-n)-(UP-UB))$

  $-(KP-KB)$

- $0=\ -(I_P-I_B)+((T_P-T_B\ )(PW-i-n)-(UP-\ UB)$

  $(SPW-i-n)-\ (KP-KB)(SPW-i-n)$

	Project			
	I	II	III	IV
IRR(%)	50	65	47	78
Ranking	3	2	4	1

COMPARISON OF CRITERIA

- **The NPV shows the discounted gain to the national or regional product, which is the most desirable objective.**
- **If the returns on added components are even the slightest bit positive, more expenditures bring even more benefits and a greater NPV. If asked to use the NPV criterion, then, a clever advocate will combine as many small projects as possible into one “super” project.**

- **The BCR approach takes into account "efficiency" by comparing the benefits obtained *per unit of cost.***
- **Larger projects thus are not almost automatically better if added components are marginal.**
- **Ironically, small projects with very little NPV can look comparatively attractive with the BCR.**

- **The IRR criteria shares the advantage that it does not require direct knowledge of the discount rate.**
- **IRR bears a rough similarity to a long-term profit margin for a firm, so that many business people can attach a personal meaning to it.**

Some problems of IRR

1. There is not necessarily a unique IRR for a given situation. If there are several “reasonable” values, which should be selected?
2. Low investment, short-term alternatives (like maintenance projects) almost always give relatively high IRRs.
3. The alternative with the highest IRR may not have the greatest NPV at the proper discount rate. See the Figure below.

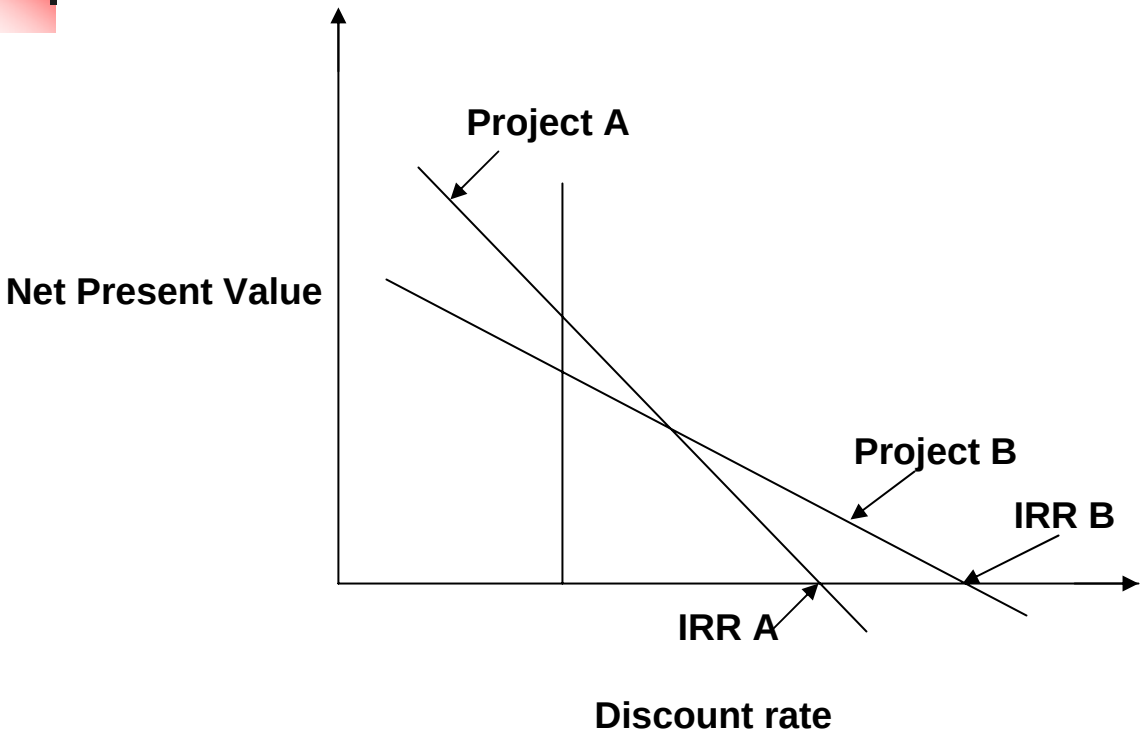


Fig. Net present values as a function of discount rate for two projects

- **Project A has lower IRR than project B, but the latter has a lower NPV at the point of the “true” discount rate.**
- **Generally the kind of discrepancy occurs for large capital projects.**
- **Should the decision between the two alternatives be made at an NPV of zero or at the NPV associated with the “true” discount rate?**

Notation Scheme

EUAC	=	Equivalent uniform annual cost
PWOC	=	Present worth of cost and expenses
EUANR	=	Equivalent uniform annual net return
NPV	=	Net present value
B/C	=	Benefit/Cost ratio
ROR	=	Rate of return
MARR	=	Minimum attractive rate of return
I	=	Original or initial investment, or equivalent investment at time zero including discounted investments subsequent to time zero
T	=	Terminal value at the end of analysis period
K	=	Total uniform annual expenses for of and ministration A, traffic services and highway operation J, and highway maintenance

KG	=	Equivalent uniform annual K when K grows as a uniform gradient
KE	=	Equivalent uniform annual K when K grows exponentially.
U	=	Annual road-user costs, exclusive of road user taxes, but inclusive of travel time value, and accident cost when designated
UD	=	Equivalent uniform annual road user benefits, being the difference in road-user costs between a pair of alternatives
UG	=	Equivalent uniform annual road user costs under a gradient growth of traffic volume.
UE	=	Equivalent uniform annual road user costs under an exponential growth of traffic volume.
UT	=	Equivalent uniform annual road user tax payment, or tax revenue from road users.

R	=	Uniform annual gross income from sales revenue, receipt of their equivalent, or gross benefits. R is inclusive of return of investment (depreciation and d net profit)
RD	=	Difference in the equivalent uniform annual receipts of a pair of alternatives.
B and P the	=	Indicate the base alternative and proposed alternative
RG and RE	=	Equivalent uniform annual R either a gradient or exponential increase is present

- Improvement cost of an existing road, 25 Km long is Rs. 4 lakhs per Km. Road user costs, with and without improvements, accident costs, with and without improvements and maintenance costs, with and without improvements are given in the table for a 10 year period after completion of the improvements. Assuming a discount rate of 10%, find out whether the project is economically feasible. (NPV Method)

Year (t)	Road User Costs		Accident Costs		Maintenance costs		Benefits (3)+(5)+(7)-(2)-(4)-(6)	B - C	(B-C)/(1+0.1)^t
(1)	With Imp (2)	Without Imp(3).	With Imp(4)	Without Imp(5)	With Imp(6)	Without Imp(7)			
0							-100	-100	-100
1	105.5	126.5	1.1	3.1	3.5	2.5	22	22	20
2	110.3	132.2	1.1	3.1	3.5	2.5	23.1	23.1	19.1
3	115.8	138.9	1.2	3.5	3.5	2.5	24.4	24.4	18.4
4	121.6	145.8	1.2	3.7	3.5	2.5	25.7	25.7	17.6
5	127.6	153	1.3	3.8	3.5	2.5	26.9	26.9	16.7
6	134	161	1.3	4	3.5	2.5	28.7	28.7	16.2
7	140.7	168.9	1.4	4.2	3.5	2.5	30	30	15.4
8	147.8	177	1.5	4.4	3.5	2.5	31.1	31.1	14.5
9	155.1	186.2	1.6	4.7	3.5	2.5	33.2	33.2	14.1
10	162.9	195.2	1.6	4.9	3.5	2.5	34.6	34.6	13.4
									165.4
									-100
									65.4

- Cost of improvements = 25 * 4 = 100 lakhs

  NPV = (165.4 – 100) = 65.4 lakhs

NPV is +ve, project is economically feasible

Consumer Surplus

A consumer willing to pay the price for a commodity up to its marginal utility compared with the marginal utility of the money which he has to pay. if the marginal utility of the commodity is high while its actual market price is low, the consumer derives actual satisfaction. ie consumer surplus.

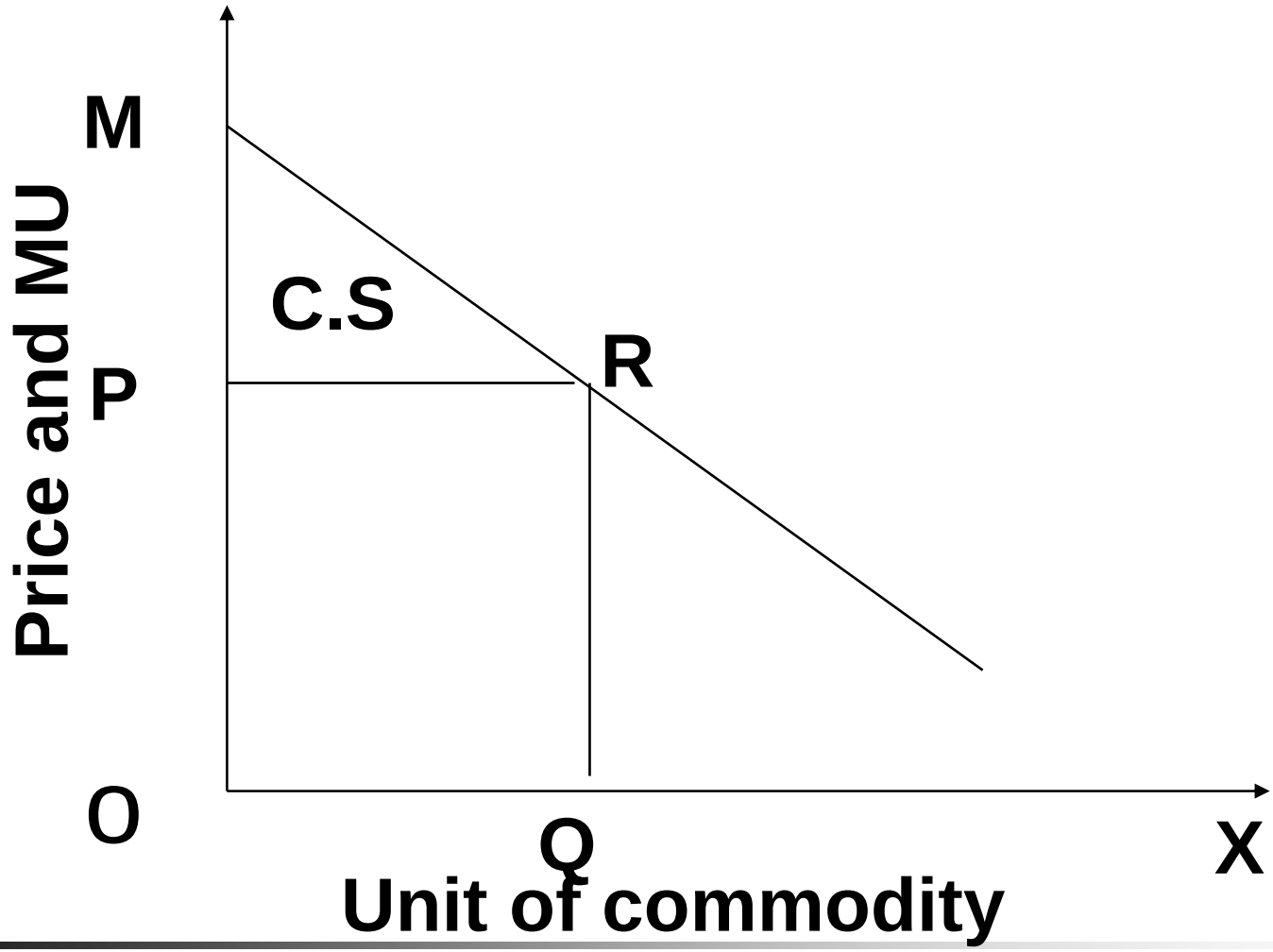
CS = TU-(price*quantity)

CS = Price prepared to pay-

Actual price

Measurement Of Consumer Surplus

Units of commodity	Marginal Utility	Market Price	Consumer Surplus
1	35	10	35-10 = 25
2	30	10	30-10 = 20
3	22	10	22-10 = 12
4	10	10	12-10 = 0
Total 4 units	TU = 97	40	= 57


M
Price and MU
C.S
R
P
O
Q
X
Unit of commodity

Economic Evaluation Model

- **Economic Evaluation Models for Highway Projects**
- **Economic Evaluation Models For Urban Transportation Projects**

Highway Projects

Different models like

- **HDM- 3**
- **RTIM-3, and**
- **RIDM**

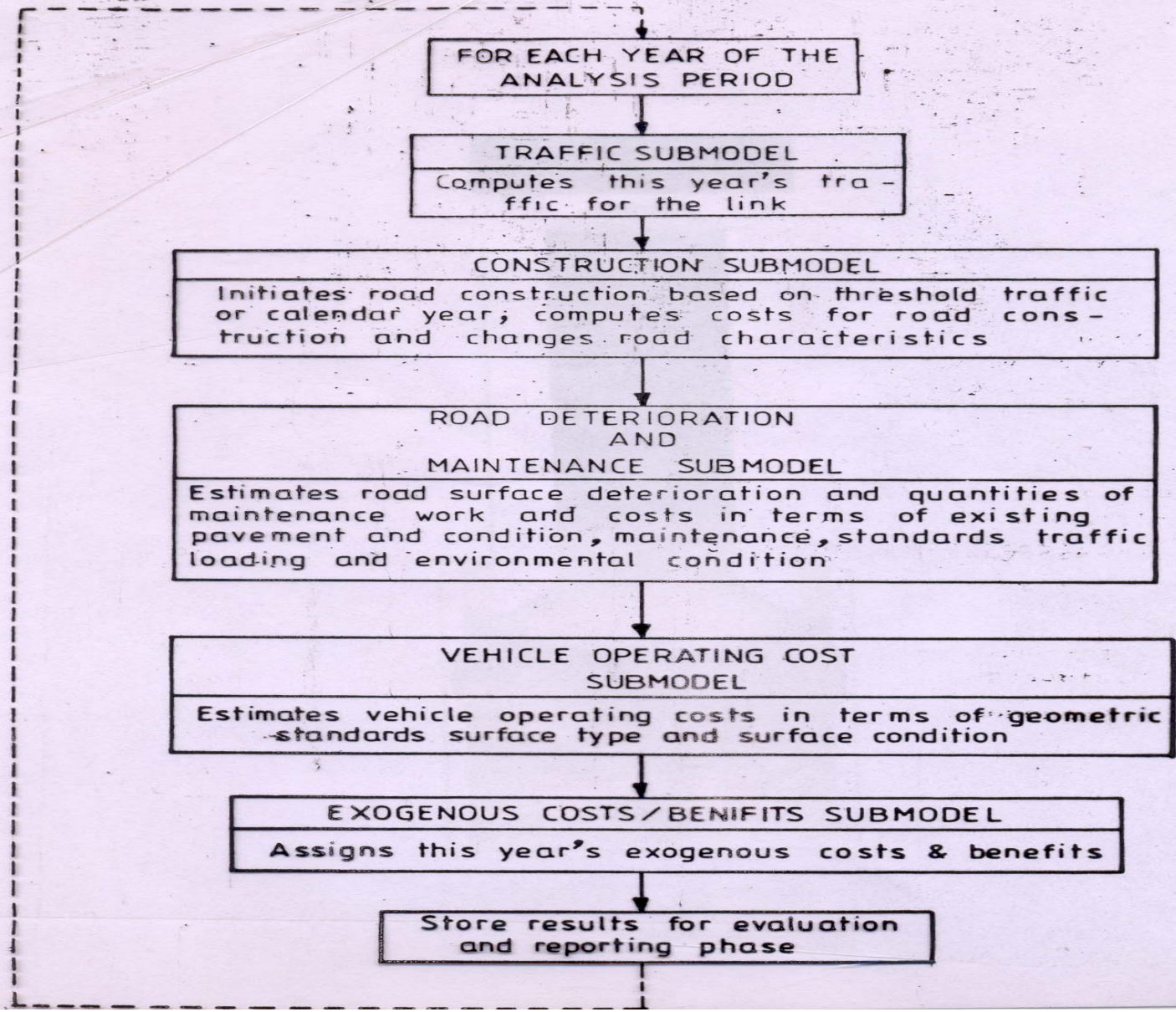
are used for economic analysis of highway projects.

HDM-3

- **The Highway Design and Maintenance Standards Model is a computer program for analyzing the total transport cost of alternative road improvement and maintenance strategies.**

FIGURE - I

SIMULATION OF A LINK-ALTERNATIVE (HDM) 8

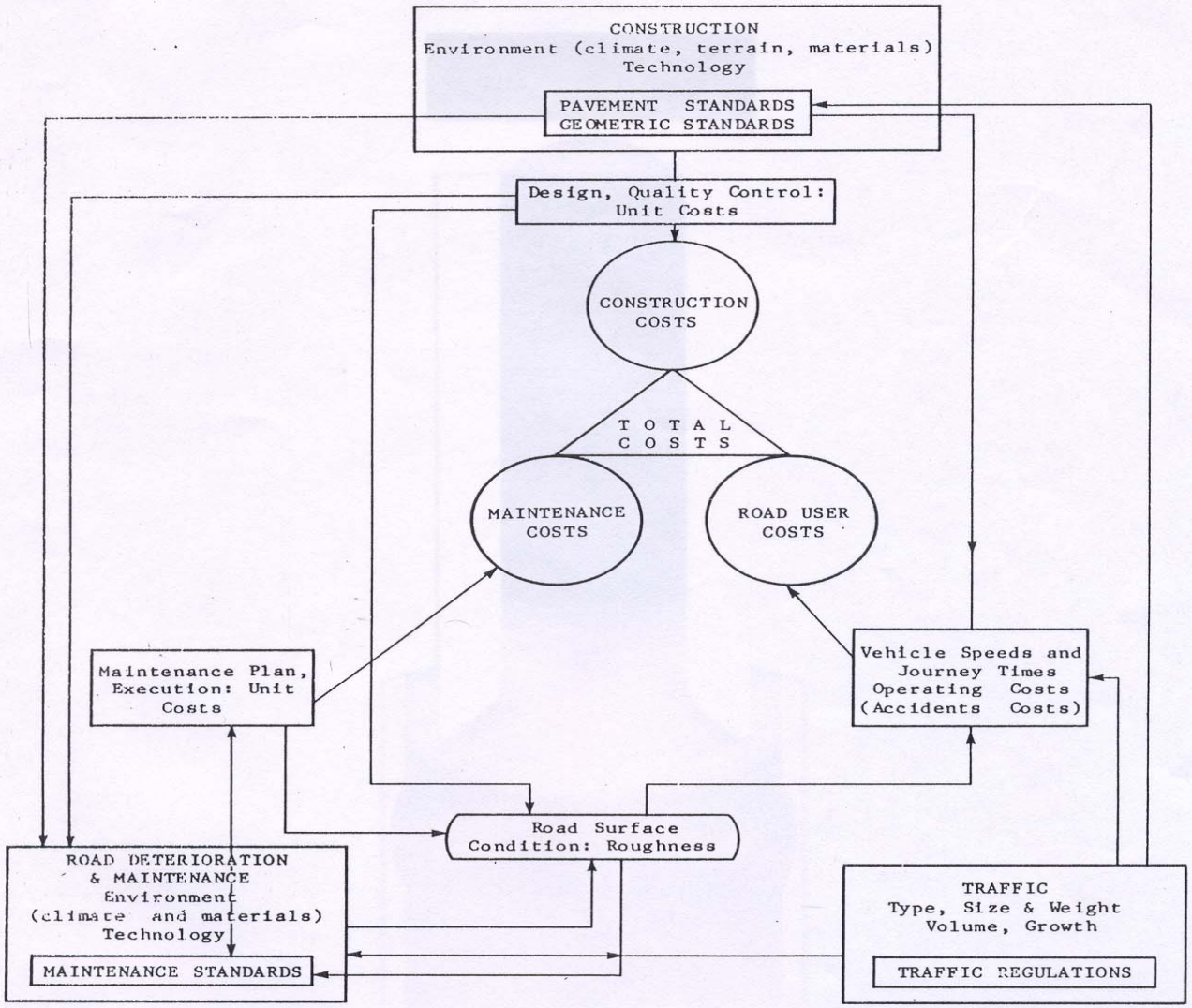


Limitations of the Model

- The sub model for the vehicle operating costs does not include the effects of congested traffic conditions, but the congestion costs may be entered as an exogenous input in the model.
- The road deterioration sub model does not include freezing climates but facility to adjust the sub model for most effects of freezing conditions is provided and has been validated.

- **The model does not explicitly account for the account of varying base routine maintenance on pavement performance, but this can be handled indirectly by adjusting pavement strength parameter.**
- **The model endogenously predicts neither road accidents nor their costs, nor the indirect costs incurred during road construction or maintenance. Facility is provided however, to incorporate accident costs, delays and environmental impacts where exogenous estimates are available.**

Figure 1.1: The HDM Model: Interaction of Costs of Road Construction Maintenance and Use



Pavement Deterioration Models

- Cracking models
- Patching Models
- Ravelling Models
- Pothole Models
- Rutting models
- Roughness Models

Cracking Model

- **Cracking Initiation Models**
- **The initiation of cracking is defined as the stage when a crack is observed on the pavement surface.**
- **It is mainly caused due to traffic repetition and the bituminous mix properties.**
- **The age of cracking initiation has been taken as the time between the pavement age since the last renewal or strengthening and the appearance of the cracks up to 2 percent of the pavement age.**

- **MSN :Modified structural number**
- **CSALYR :Cumulative standard axles per year (msa)-million standard axles**
- **AGECRIN :Age of pavement at the time of cracking initiation (years)**
- **PC :Premix carpet surfacing**
- **SDC :Semi-dense carpet (Semi-dense bituminous concrete) surfacing**
- **AC : Asphaltic concrete (Bituminous concrete) surfacing**
- **CRi :Initial cracking (%)**

Crack Initiation Models

Eqn No.	Surface type	Model form
Eqn. 1	PC	AGECRIN = 2.74*EXP*- 2.57(CSALYR/MSN^2)
Eqn. 2	SDC	AGECRIN = 3.29*EXP*-2.40(CSALYR/ MSN^2)
Eqn. 3	AC	AGECRIN = 4.00*EXP*-1.09(CSALYR/ MSN^2)

Cracking Progression Models:

Eq No.	Surface type	Model form
Eqn. 4	PC	$(CR_t/ti) = 5.41(CSALYR/MSN)* 0.54*SCR_i^{0.28}$
Eqn. 5	SDC	$(CR_t/ti) = 5.67(CSALYR/MSN)*0.34*SCR_i^{0.20}$
Eqn. 6	AC	$(CR_t/ti) = 4.26(CSALYR/MSN)*0.56*SCR_i^{0.32}$

Ravelling Models

- Raveling occurs either due to loss of fines or stone particles from the surfacing and due to the loss of adhesion or bonding between binder and aggregates.
- It affects both the structural and functional performance of the pavement. Thin binder film tends to oxidize rapidly, and thus the affect of aging on raveling is much higher on thin films than on thick films.
- Raveling when developed beyond a certain extent, leads to potholing

- **AGERVIN = Age of pavement at the time of ravelling initiation**
- **AXLEYR = No. of vehicle axle per year (million)**
- **CQ = Construction quality**

- **Ravelling Initiation Models:**

$$AGERVIN = 3.18\ AXLEYR^{-0.138*}(CQ+1)^{-0.38}$$

Ravelling Progression Models:

- $(RVt/ti) = 3.94\ AXLEYR^{0.32*}SRVi^{0.46}$

Pothole Models

- Potholes are the cavities in the raod surface and are generally bowl-shaped. Potholes are the most severe form of pavement distress which is caused due to spalling of wide cracks and disintegration of surfacing and subsequently the base material.
- THBM = Thickness of bituminous layer (mm)

Pothole Initiation Models

Eqn. No.	Surface type	Model form
Eqn. 9	PC	$AGEPHIN = 0.21THBM^{0.23}EXP[-0.18AXLEYR]$
Eqn. 10	SDC	$AGEPHIN = 0.29THBM^{0.35}EXP[-0.22AXLEYR]$
Eqn. 11	AC	$AGEPHIN = 0.13THBM^{0.47}EXP[-0.12AXLEYR]$

Pothole Progression Models

Eqn. No.	Surface type	Model form
Eqn. 12	PC	$(PH_t/ti) = 1.49CR_i * \frac{AXLEYR(1+CQ)}{THBM*MSN} + 3.60Ph_i * \frac{AXLEYR(1+CQ)}{THBM*MSN} + 3.47\ RV_i * \frac{AXLEYR(1+CQ)}{THBM*MSN}$
Eqn. 13	SDC	$(PHt/ti) = 5.24CRi * \frac{AXLEYR(1+CQ)}{THBM*MSN} + 0.78Phi * \frac{AXLEYR(1+CQ)}{THBM*MSN} + 0.84\ RV_i * \frac{AXLEYR(1+CQ)}{THBM*MSN}$
Eqn. 14	AC	$(PH_t/ti) = 1.23CR_i * \frac{AXLEYR(1+CQ)}{THBM*MSN} + 2.50Ph_i * \frac{AXLEYR(1+CQ)}{THBM*MSN}$

Roughness Progression Models

- **Roughness is distortion in the road profile. The rate of distortion is accelerated, on weakening of the pavement due to surface defects like cracking, ravelling, potholing etc. roughness affects the dynamics of moving vehicles, vehicles wear and tear, and therefore, has an appreciable influence on vehicle operating costs.**
- **It also imposes dynamic loading on the road surface, thus accelerating the deterioration process further. Empirical statistical models of incremental form have been developed for prediction of roughness progression.**

- $RG_t = a_1(CSAL/SNCK)*e^{mPAGE} + a_2\ m.RG_t*ti + a_3\ CR_t + a_4\ PH_t + a_5\ PT_t + a_6\ RV_t$

- Where,
- SNCK = Modified pavement strength = (1+MSNR)
- MSNR = Reduced modified structural number due to cracking
- m = Environmental factor
- MSNR = MSR – (0.0000758*THBM*CRi)
- CR_j =Initial cracking (%)
- RV_j =Initial ravelling (%)
- PH_j =Initial pothole (%)

Modified structural no.

$$SN = \sum_{i=1}^{N} a_i D_i + 3.51 \log_{10} CBR - 0.85 (\log_{10} CBR)^2 - 1.43$$

Where a_i = the strength coefficient of layer i

D_i = the thickness of layer i in inches

CBR = California Bearing Ratio of the subgrade.

Roughness is computed as

$$R \doteq R_o + mN$$

Where,

R_o = Initial Roughness

N = No. of millions of standard axles.

$m = 1250/\text{anti}\log_{10} (a^{1/3} - b^{1/3} - 1.3841)$

$a = 0.20209 + 23.1318\, C^2 - 4.809\, C$

$b = 0.20209 + 23.1318\, C^2 + 4.809\, C$

$C = 2.1989 - SN$

RIDM

The model was developed using Lotus 1-2-3 software and its advanced features. It has been tested and applied on number of national highway projects pertaining to widening, construction of bypass etc

Limitations of the Model

- **Only one pair of the alternatives can be compared in each run.**
- **It is suitable for analysis at project level only. Besides, a road section having subsections of different design standards/traffic volume can not be evaluated as a single link alternative.**

- In the absence of pavement deterioration models for Indian conditions, the model makes use of the deterioration rates specified by the user.
- Only four types of vehicles are considered cars, buses, trucks, and two wheelers.
- Compilation of the program is not possible and as such there remains the risk of effecting unauthorized modification in the program

RTIM-3

- The Road Transport Investment Model-3 (RTIM-3) was developed in 1993 by Overseas Center, Transport Research Laboratory, and U.K.
- The RTIM-3 program consists of a series of interlinked spreadsheets which carry out economic assessment.
- Each spreadsheet calculates the result of information given to them and present findings in the form of table and graphs (Cundil, 1993).

Limitations of the Model

- Diverted traffic is not considered.
- Road construction costs are not calculated.
- Wet season and dry season are not considered separately.
- Travel time saving passengers are not considered.

Comparison of Models

	EVALUATION CRITERIA	HDM-III	RIDM	RTIM-3
1	Operating System	DOS, UNIX, Mainframe	Only DOS	Only DOS
2	Packages Needed	Lotus 1-2-3	Lotus 1-2-3	None
3	No. of Alternatives Compared at a Time	50 Alternatives	Only One Pair	Only One Pair
4	Hardware Memory	15-30 MB	0.5 to 0.75 MB	1.0 MB
5	Math CO-Processor	Compulsory	Not Needed	Optional
6	Cost of Construction	Can be Calculated	Given as a Input	Given as a Input
7	Congestion Effect	Not Considered	Considered	Not Considered
8	Accident Cost	Not Considered	Considered	Not Considered
9	Types of Vehicles	8 Types	7 Types	5 Types
10	2 Wheelers	Not Considered	Considered	Not Considered
11	Time for Running the Model	With M.C. 8-10 min Without M.C. 30-40 min	3-4 min	5-7 min

Urban Transportation Projects

- Traffic System Evaluation
- Transport System Evaluation
- Transport Subsystem Evaluation

Traffic System Evaluation

- **This evaluation procedure concentrates on the benefits to road user likely to accrue from potential road investments.**
- **The principal component of the these road user benefits is the savings in travel time of road users.**
- **With this method the road system is viewed as a relatively independent entity, having little interaction with the transportation system and no non user impacts.**

Transport System Evaluation

The transport systems evaluation is used to refer to evaluation method that also concentrate on user benefits but that attempt to isolate the optimum combination of two or more modes of transport.

Transport Subsystem Evaluation

Transport subsystem evaluation procedures view transport systems as having significant non user impacts on the community as well as use impacts.

Generation of Solution at the Metropolitan Level

The goal of the generation phase can be stated as the creation of alternative plans that satisfy as best possible the goals of the project

Special Requirement For Solution Generation

- Clear definition of project goals, including some solution of conflicts
- A strategy to balance the conflicting demands for a) consideration for broad range of relevant factors within (b) the constraints of time, staff, and money
- An information system of all relevant and available information, including the necessary analyses and forecasts

- **Organisation and presentation of this information in a form meaningful and instantly available for the planning task**
- **Design of alternative relative to the goals. Documentation of design decisions.**
- **An effective feed back relationship between the plan synthesis phase and the plan testing and evaluation phase.**

Non Transformational Solutions for Transportation Problem

- Changing Pricing Mechanism
- Staggering of Traveling Hours
- Substitution With Communication

Methods for Raising Funds for Urban Transportation Projects.

- Enhancing the revenue from existing sources where relevant.
- Naval strategies of raising funds

Naval strategies of raising funds

- Fiscal Measure
- Road User Charges: Direct And Indirect
- Development Of Government Land
- Private Funds

Fiscal Measure

Fiscal measures means taxes or cess not directly related to the use of or benefit from any specified transport facility by the payer Useful only if earmarked for transport sector use

1. **Union government taxes and funds**
   - **CRF from excise and import duties on motor spirit is earmarked for highway development, 80% is shared by state government**
2. **State government taxes**
   - **Motor vehicle tax**
   - **Payroll tax**
   - **Passenger cess**
   - **Terminal tax or surcharge**

3 Municipal taxes

- Possible source of new revenue in municipal taxes are
  - Development charges
  - Transport development levy
  - Property sales levy
  - Development cess on private vehicle in Mumbai

- **Private vehicle tax**
- **Development charges**
- **Transport development levy**
- **Property sales levy**

User charges

- Road user charges
- Toll
- Supplementary licenses
- Car parking charges
- Public transport passengers
- Rail fares

- **Development of government land**
  - **Vertical space utilization**
- **Private Funds**
  - **BOT**
  - **BOOT**
  - **BOLT**

Critical Issues In Funding Of Transportation System

- **Financial issues**
- **Administrative issues**
- **Legal issues**

Financial Issues

- Problem of assessing the value of the assets to be solved to the large private monopolies
- Selling state transport undertaking which are vital economic and social infrastructure services to private sector is against the national objective
- The private party may not be in a position to buy such a big assets like APSRTC,MSRTC,MPSRTC etc

- Commuters may be effected by the changes in level and structure of fares imposed by newly privatized operators
- How a “fair” amount to be paid by the private party is to be decided which also benefit to the general public
- How large should a development be before its operator is required to fund for further improvement?

- How can existing business be required (or motivated) to pay for their traffic mitigation, since new developments may be responsible for only a small share of the traffic generated in the area
- How much is cost of housing affected by transportation fees passed on by developers and property owners?
- How long should a private party's obligation extend

Administrative Issues

- If small scale private operators, operating in competition with STU's are allowed to operate on any road, the private operator may choose the most profitable one and neglect the routes which are liable to be incur loses
- The wage level and other amenities provided to the STU employees are better than the private operators. This will cause inefficient employees to work under private operator.

- Infirmity of the present system, its lack of professionalism, absence of accountability and hierarchical nature of decision making contribute infeasibility of private sector participation
- The public sector does not posses right to remove an employee from service due to inefficiency as he is in a government service

Legal Issues

- How much the private party can required to provide or contribute
- Whether fees are to be considered as tax or an impact fee
- The legality of contact or conditional zoning

REFORMS AND CONTRACTING FRAMEWORKS FOR GREATER PRIVATE PARTICIPATION IN THE ROADS SECTOR

VARIOUS WAYS TO MOBILIZE ADDITIONAL FUNDS

1. ENHANCING REVENUE FROM EXISTING SOURCES WHERE RELEVANT
2. NOVEL STRATEGIES

FISCAL MEASURES	USER CHARGES	DEVELOP-METNT OF GOVT. LAND	PRIVATE FUNDS
1. Union Govt. Taxes & Funds 2. State Govt. Taxes Paybill Passenger Cess Terminal Cess Terminal tax Or Surcharge 3. Municipal Taxes Pvt. Veh Taxes Development Charge Wheel Tax Transport Development levy Property Sales Levy	1 Road user charges Direct & Indirect 2 Tolls 3 Suppl. Licenses 4 Car parking charges 5 Parking 6 Public Transport passenger 7 Rail fares 8 Surcharge		Examples and 1 to 6 Incentives

Summary of Novel Urban Transportation Infrastructure Funding Strategies for Mumbai

Source	Potential Revenue Cr ($)	Regularity	Remarks
1 . Vehicle Taxes Revised rate of MVT.	73 (1.54) *45(0.95)	annual	Required revision of first Schedule BMVT Act.
2. Transport Development levy on vehicle tax	15(0.31) * 9(1.9)	annual	
3. Passenger terminal tax	117 (2.47) * 72(1.51)	annual	Required Ministry of Railway action and collection
4. Payroll tax	106 (2.23) * 65(1.37)	annual	Requires amendment of BMVT Act and revision of BMC Act Schedule G Collection by MVD
5. Capitation employment tax	106 (2.23) * 65(1.37)	annual	Alternative to 4 above Requires State Government Legislation may require GOI ratification

Summary of Novel Urban Transportation Infrastructure Funding Strategies

Source	Potential Revenue	Regularity	Remark
6. Property based tax	26 (0.55) * 16(0.34)	annual	Requires state legislation may be objected
7. Transport Development levy		annual	Alternative to 6 to be based on capital value of property Requires state Government Legislation may require amendment to constitution
8. Property sale levy		annual	May require State legislation
9. Parking Charge	31 (0.65) * 19(0.4)	annual	Action by BMC
10. Suburban Passenger Surcharge	73(1.54) * 45(0.95)	annual	Precedent set by CIDCO Requires State Government Ministry of Railways Cooperation

Summary of Novel Urban Transportation Infrastructure Funding Strategies

Source	Potential Revenue	Regularity	Remark
12. Land development a) Railways	a. 1141(24.02) as sale * 700(14.7)	Annual	Ministry of Railways are looking at the possibilities at Bandra Station as a test case Possible J. V. leasing
	b. 137 (2.88) * 84(1.77)	annual	Arrangements with property developers could support larger capital investment than outright sale
b)BPT			Not explored so far
13 BOT	Private investment capital could be large	Project by project basis	Required changes to tax schedules appended/related to the constitution. Requires amendment to BMVT Act. Requires major government project management effort

* Indicates the rate for the year 1993

ALTERNATIVE FUNDING SOURCES

- **To reduce borrowing costs, innovative public financing technique includes**
  - **Revenue bonding**
  - **Variable rate bonds**
  - **Grant anticipation financing**
- **To increase charges on properties that benefit from transport**
  - **Special benefit assessment**
  - **Tax-increment financing**
- **Joint venture with the private sector for using tax advantages for public transport**
  - **Sharing benefit to private party and local residents**

- Fare adjustment
- Property development levy
- Levy on business establishment
- Floating of bonds
- External resource mobilization

FINANCING : PRIVATE PARTICIPATION

- **Privatisation**
  - Private sector financing
  - Private sector operation
  - Private sector maintenance
- **Projects suitable for Privatisation**
  - Project for public service
  - Operable
  - Requiring man power and Equipment
  - New Construction Work
  - Development of older one
  - No Track Record Technology
- **Responsibility, Economies of Scale, Capital Transfer**

PRIVATE SECTOR PARTICIPATION

- **Private sector participation in highway sector will prove to be**
  - **Economic**
  - **Efficient**
  - **Productive**
  - **Flexible**
  - **Innovative**
  - **Bankable**

PRIVATE SECTOR PARTICIPATION

- **Financing only**
- **Financing and Operating/Constructing and Maintenance of the Project**
  - **BOT**
  - **BOOT**
  - **BOO**
  - **BOOST**
- **Joint Financing**

Comparative Features of BOT Projects

Country	Australia	U.K.	U.K./France	Malaysia	Thailand	India
Project	Sydney Harbour Tunnel	Dartford Bridge	Channel Tunnel	North – South Expressway	Bangkok 2nd stage Expressway	Rau Pithampura Bypass Indore
Cost	$550 M	$310 M	$10.3 B	$1.8 B	$880 M	Rs. 7 Cro.
Concession Period	30 Yr. (1992 – 2022)	20 yr. (1988 – 2008)	55yr. (1987 – 2042)	30 yr. (1988 - 2018)	30 yr. (1988 - 2020)	10 -12 years
Equity (sponsors)	$11 M	Nominal (1800)	$ 80 M	$9 M	$17 M Total equity	Rs 7 Cror Full amt
Equity (share Holder)	$18 M	Nil	$ 1.72 B	$280 M	Above	Nil
Equity Debt	5:95	0:100	20:80	10:90	20:80	Nil
Rate of Return	6%	Not available	10 to 20%	12% - 17%	10% - 20%	FRR 15% EIRR 30%

Comparative Features of BOT Projects (India)

Project	Western freeway sea link	Bandra Worli Sea link	MRTS thane	Multimodal international passenger and cargo hub airport at Nagpur	Mumbai-Pune expressway Mumbai trans harbour link
Cost (million)	20228	4616	8515	25810	16000
EIRR(%)	21.18	25.64	21.63	15.8	19.35
B/C	1.74	1.79	2.53	1.61	1.43
FRR (%)	11.15	14.26	14	14	12.7

PUBLIC SECTOR OPERATION HAS TO BE

- **Subsidized**
- **Lower fares**
- **Proper wages**
- **Social costs**

CRITERIA TO SELECT A FINANCING TOOL

- **Equity**
  - fees in accordance with benefits received or cost occasioned
  - ability to pay- distributional consequences
- **Economic Efficiency**
  - Short run best utilization of existing transport facilities.
  - Long run- optimizing investments
- **Administrative Case**
  - Governmental collection costs
  - Evasion potential
  - Compliance cost
  - Legal issues.

- **Revenue Potential**
  - absolute
  - Stability over time
- **Political or Public Acceptability**
  - Voter approval
  - Ease of dedication to highways
- **Applicability**
  - Overall system vs project financing
  - State source vs country vs municipal
  - Ability to use with bonding
  - High growth area vs low growth area.

RISKS

- Delay in commencement of project execution
- Environmental clearance delay
- Cost & time over – run during execution
- Traffic Risk
- Risks against changes in tax laws legislation
- Political and administrative risk

FINANCIAL ADVISORY ROLE FOR PROJECT STRATEGY AND FUND RAISING

- Risk assessment and mitigation strategy.
- Financial modelling project structuring.
- Development of efficient financial structures.
- Assess appetite of financial market & terms.
- Developing financial plan.
- Identification, evaluation and selection of member of lending consortium.
- Negotiation of financing terms.
- Negotiation of financing documents.

Financial advisors in a multi disciplinary consortium (ADB)-development of investment program to facilitate inter modal transport

- Examining the legal and institutional set up
- Analyse social and economic costs and benefits
- Priorities investments
- Assess economic and financial scenarios associated with alternate sort of development
- Prepare adequate details for at least one high priority public sector investment project for potential ADB funding.

Financial Advisors (For Annuity Based Road Projects)

- Risk assessment and mitigation strategy.
- Review of bid package
- Financial market sounding the appetite for risk and indicative financing terms
- Development of efficient financial structure
- Financial modelling to support annuity bid price assessments
- Post bid negotiation support through commercial close
- Developing financial plan and identification, evaluation and selection of members of lending consortium
- Negotiation of financing terms
- Negotiation of financing documents

Financial Advisors in a Multi Disciplinary Consortium (ADB)-Development Strategy for Various Roads.

- Development of medium term strategy for the corridor development through public and private sector financing
- Review of existing private participation policy framework
- PPP option analysis for projects in the corridor
- Detailed financial analysis for the pilot project
- Project finance details for the private toll way
- Project finance details for private toll way concession and recommendations for the reminders of the corridor
- Preparation of pre-qualification and detailed bid documents

An Overview of Present Acts and Rules

- National highways are regulated in accordance with national highways act 1956.
- Stage construction will be allowed and collection of toll for the constructed portion will be permitted.
- Roads/Highways have been declared an industry to facilitate loans for financing projects (1989)
- Highways to be considered under the infrastructure sector to permit floating highway bonds (1989)
- Granting advertising rights and permission to establish petrol pumps, hotels, motels etc by roadside to generate revenue.
- Chief engineer will be empowered to clear projects amounting up to Rs. 15 crores to avoid delays as a result of bureaucratic process.

- Environmental clearance for the highway project will be obtained by the government.
- To increase the role of private sector, the state government of Maharashtra issued some guidelines (1989)that indicate:
  - Land for the project to be acquired by government and made available to the private party
  - Maximum return on investment to be 14%
  - Initial tariff and subsequent revisions to be decided by a commission to be set up by the government.
- Foreign companies may invest in projects by applying to Foreign Investment Promotion Board (FIPB)

- Foreign direct investments in the investing company, set at 49%. Also, the management should rest with the Indian owners.
- Exit policy – can an investor wind up his business in the event of running into losses.
- The central government has also issues the Environment (Protection) Rules, 1986, which contain standards for noise, pollution, emission, smoke, etc
- According to the Forest Conservation Act, 1980, deforestation, leasing any part of forest to private organizations, felling of trees, using forest land for non-forest purpose is punishable under the law. Similar is the Wildlife Protection Act, 1972, which describes specific areas as sanctuaries, reserves, etc.
- The Maharashtra land revenue code, 1966, regulates the conversion of agricultural land for non-agricultural purpose.

Legal Barriers

- There are innumerable possibilities in the road sector but the major hurdle is the ownership of the facility.
- The earlier version allowed the tolls to be collected by the Govt. Only, and then to transfer to the private party.

Income Tax Act

- Income tax act recognize roads as depreciable asset only and consequently its value decreases in the long run. Hence it is suggested to incorporate the following amendments to this act
- The land that is acquired by the Govt could be provided to the company on a long term lease.
- The road is the constitute part of the gross block of the company and to susceptible to depreciation in accordance with the depreciation in the income tax act.
- The Govt is also seriously thinking of making provision in the act for deduction in computing taxable profits for the entire profit paid.
- The act itself has been amended innumerable times with diverse practice stipulated for various states.

Opinion of Legal Advisor and Law and Judiciary Department Regarding Various Sources of Raising Finance (typically for city highway projects)

	LEGAL ADVISOR OPINION	LAW AND JUDICIARY DEPT
pay roll tax	This falls under entry 60 of the state list read with article 246. There is a pecuniary limitation of Rs 1000 per year. If the limit is to be extended President of India's assent is necessary.	This falls under entry 97 of list 1 of the seventh schedule. Expenditure tax act, 1987 does not include the tax on expenditure on wage bill.
Transport development levy	Such a levy is likely to be declared confiscatory.	No opinion given
property development levy	Not levy able by state legislature. Parliament only is competent to levy such taxes.	No opinion given
commercial exploitation of air and land spaces	The money raised can be spent locally through an agreement	Central government would be competent

Changes Needed to Encourage Private Sector Participation in Investments

- Entrepreneurs should be given access to financial institutions or market borrowings at concessional rates.
- Lease of land should be permitted during the concession period so that resources can be raised.
- Since maximum return has been fixed, minimum return on investment should also be fixed by the government.
- Entrepreneurs should be permitted to collect toll, fix rates and retain the amount to recover the capital.
- In case of a project not being financially viable, commercia exploitation of adjoining land should be permitted.
- Tax holiday may be spread over the entire concession.

- Section 88 of the income tax act may be widened in scope for individual investment tax benefit in these projects.
- No other levies such as sales tax, turnover tax, octori etc. should be levied on tolls/fees.
- Because of long gestation periods, carry back of depreciation to earlier years may be allowed in road projects.
- Reduction of procedural delays in the import of equipment

Incentives under Consideration /likely to be approved by the GOI

The rates of toll will be decided by the entrepreneurs in consultation with the government.

- **For a start, all private companies entering the highway sector here after will be allowed a debt equity ratio of 4:1. They will be permitted to rise up to a minimum of 20 per cent of the total outlay through public issues.**
- **Promoter's contribution should be at least 11 per cent of the total outlay. Not more than 40 per cent of the total outlay can come from Indian public financial institutions. To ensure that private entrepreneurs bring in additional resources, they must find 60 per cent of the outlay from sources other than public financial institutions.**
- **Up to 100 per cent foreign equity participation to be permitted for projects taken up by foreign private investors.**

- **Possibility of co-financing with external financial institutions like Asian development bank, world bank and international finance cooperation could also be explored.**
- **Private parties would be allowed to develop service and rest areas along the road entrusting to them.**
- **Scheme where the total outlay does not exceed Rs 500 million (US$ 50 million) excluding cost of land are proposed to be exempted from CCEA clearance.**
- **If the project is does not viable, the government will participate in it either by buying equity or giving land for road building.**

Some major labour laws applicable to establishments engaged in building and other construction works

- Workmen compensation act 1923
- Payment gratuity act 1972
- Employees P>F and Miscellaneous provision act 1952
- Maternity benefit act 1951
- Contract labour (regulation and abolition) act 1970
- Minimum wages act 1948
- Payment of wages act 1936
- Equal remuneration act 1979
- Payment of bonus act 1965
- Industrial dispute act 1947

- Industrial employment act 1946
- Trade union act 1926
- Child labour act 1986
- Inter-state migrants workmen’s act 1979
- The building and other construction workers act 1996 and Cess act 1996
- Factories act 1948

Problems faced by the road sector in many developing countries

- Lack of maintenance funds and rapid expansion of the road network.
- Extremely bureaucratic setup of the administrative structures, not responsive to user needs.
- Lack of clearly defined responsibilities of the central and local governments for managing the road network.
- Shortage of qualified technical staff, low salaries and few incentives to perform better.
- Poor management information system

The roles of the public sector in the establishment and implementation successful transport infrastructure concession

- Monitoring contract conditions.
- Controlling prices where a concession confers some long term monopoly power on the concessionaire.
- Maintaining quality, safety and environmental standards, either by law or within contracts.
- Defining access rule where there are more extensive economies of scale or scope in infrastructure provision than in provision of services on the infrastructure.

Important institutional requirements for a successful concession arrangement

- **Expert concession design team.**
- **Independent regulatory agency.**
- **Effective legal basis**

The roles of the public sector in the establishment and implementation of a competitively tendered franchising system

- Establishment of a competitive structure in the industry.
- Selecting the form of franchising arrangement to be employed and designing the contracts appropriately.
- Procuring services, and monitoring contract performance.
- Enforcing contracts,
- Policy coordination, especially where there are significant interaction between modes or other external effects.

The critical institutional requirements for service franchising

- Operations and franchise management must be completely separated.
- Industrial restructuring.
- Putting managing agency at arms length from local government
- Separate technical regulation from economic regulation
- Liberalized Transport Markets

Institutional requirements for a liberalized, but managed transport market.

- **Local level technical inspectorate**
- **Control of predatory and restrictive practice.**
- **Monopolization and merger control.**

Institutional reforms for commercialization

- **Establishing *responsibility* for managing roads by clearly assigning roles.**
- **Creating *ownership* of roads by involving users of roads in their management to encourage better management and to win public support for more road funding, while constraining road spending to what is affordable.**
- **Stabilizing road *finance* by securing an adequate, continual flow of funds.**
- **Strengthening *management* of roads by introducing sound business practices and enforcing managerial accountability.**

Reform In The Road Maintenance And Management System

- **Commercialization of road maintenance and financing, i.e., use of market concepts and introduction of fee-for-service element.**
  - **Establishment of the role of the government and creation of organizational structures for managing different parts of a network.**
  - **Creating ownership by involving stakeholders.**
  - **Persuading road users to pay additional charges that will be dedicated to road maintenance.**
  - **Setting up commercially oriented road agencies to promote sound business practices.**

Improved institutional structures

- Compatibility with the functional classification of roads
- Consistency with the administrative structures of the country
- Ensuring that the authorities have the financial and technical capacity to manage the network.

- Dividing the road agency into separate client and producer organizations clarifies roles, increases focus and specificity of actions, which, in turn, increases the operational performance of the client function and the supplier function
- clear division of responsibilities between the government and the road authority
- The role of government should be to formulate policies while the road authority should manage the road network and take decisions within the framework of those policies.

- promote better use of resources, some form of market discipline can be applied to the supplier function
  - bringing outside competition
  - contracting the supplier function to public sector contractor
  - contracting the supplier function to private sector contractor
- clear division of responsibilities between the government and the road authority
- The role of government should be to formulate policies while the road authority should manage the road network and take decisions within the framework of those policies.
- Better performance can also be attained by contracting out the client function, through a conventional contract or through an agreement
- Promote involvement of road users in management
- Development of computerized road management information systems and financial management systems along with other systems for management of personnel records, equipments, etc.,

Conclusions

- The various assessment criteria used to select a financing tool is to be quantified in a better way
- The government has to either shake hands with the competent private sector for construction and operation of infrastructure or to enter into real estate for construction and then resort to fiscal measures and /or charges for operation of highway/rural road infrastructure projects.
- Though private sector participation in transport infrastructure was a new a concept in our country and is catching up, there is a tremendous latent potential available for execution of such projects in this country with their participation.

- The government can even generate additional resources by commercial exploitation of the facilities created in association with such transportation facilities. Of course, any such positive development shall require some constructive amendments of the relevant acts and a rapprochement from all concerned.
- Project prioritization and programming tool are to be developed that take into account public and private costs and public and private sources of revenue.
- Several developed and developing countries have or are in the process of implementing institutional reforms in the road sector with the primary goal of improving efficiency and effectiveness in the utilization of limited resources. Such reforms have been shown to improve cost-effectiveness by over 25% in many countries.

- **An attempt is made in to raise different issues with respect to institutional reforms financial bankability of highway sector projects and suggest measures to bridge the funding gaps for this purpose for the life of the projects.**
- **The reforms have been suggested for special purpose vehicle/authority which should be assured of receiving the committed funds on a perennial basis during construction and for maintenance period.**

Thank You

Transportation Systems Engineering
Department of Civil Engineering
IIT Bombay