applying rating and weighting method. The second approach is economic evaluation known as Cost-Benefit Analysis. This approach regards a transport plan as a public investment program and try to measure its cost and benefit to the society in monetary terms. The value of plan is calculated by comparing the cost and benefit. The third type is 'financial analysis'. This analysis is used to evaluate feasibility of projects which will bring revenue to depreciate the capital expenditure and to make profit.

In a long term comprehensive land use and transport planning process, the first method is most widely used. The economic evaluation is carried out when there is strong concern over the effectiveness of public expenditure, financial analysis is important in project appraisal but less relevant in the preparation of general plans. For this, the remaining sections are devoted to elaborate only the first and second methods.[1]

8.2 Comprehensive Evaluation

8.2.1 Evaluation Criteria

Evaluation criteria should be drawn from the general objectives of comprehensive planning. A sample list of criteria and measurement methods is shown in Table 8-1, which covers three broad areas of network performance, and environmental impacts.

Some of the above mentioned criteria can be measured by using network simulation results.

Average vehicular trip length

Average vehicular trip length may be calculated by

$$\bar{d} = \frac{\sum_{ij} l_{ij} T_{ij}}{\sum_{ij} T_{ij}}$$

where, $\bar{d}$ = average vehicular trip length
l_{ij} = length of link
T_{ij} = assigned traffic volume on link ij

Average trip duration

Similarly, average trip duration can be calculated by replacing l_{ij} in (1) by t_{ij}, where, t_{ij} is the average travel time on line ij, which is determined by using the average traffic speed of that link.

[1] Interested readers should be referred to, for example, Adler, Hans A. (1987), Economic Apprisal of Transport Projects - A Manual with Case Studies, Baltimore : Johns Hopking University Press for World Bank.

Table 8-1 Example Evaluation Criteria for Comprehensive Transport Plans

Evaluation Criteria	Measures (Example Unit)
Network Performance:	
Transport Cost	Total Vehicle-Kms (000/day) Total Vehicle-Hrs (000/day) Average Trip Length (km/trip) Average Trip Duration (hrs/trip) Vehicle Operating Cost (Baht/year) Time Cost (Baht/year)
Transport Capacity	Road Capacity (vehicle-kms/hr) Bus Capacity (passenger-kms/hr)
Traffic Flow	Average Volume/Capacity Ratio Total Length of Road with v/c Ratio 0.9 or More (km)
Energy Consumption	Total Fuel Consumption (litres/day)
Environmental Impacts:	
Air Pollutant Emission	Carbon Monoxides (CO) (tons/day) Hydrocarbons (HC) (tons/day) Oxides of Nitrogen (NOX)(tons/day) Number of Residents Seriously Affected by Noise
Traffic Accidents	Number of Deaths (persons/year) Number of Casualties (persons/year)
Social Impacts:	
Community Disruption	Number of Buildings or People Displaced (persons)

Level of services

Planned transport network should provide reasonable level of service. If a quantitative approach is incorporated in the planning process, level of service indices are calculated by comparing the assigned traffic volume and the expected capacity of each link. An example of such levels are shown in Table 8-2.

Table 8-2 V/C Ratio and Level of Service

Level of Service	Example V/C Ratio Categories
A	Less than 0.5
B	0.5 ~ 0.75
C	0.75 ~ 0.85
D	0.85 ~ 0.9
E	more than and equal to 0.9

Average travel speed for each link should be examined to secure minimum travel speed on highway network. Travel speed has close correlation with the level-of-service indice mentioned above.

Fuel consumption rate

Claffey (1971) conducted a comprehensive study on the factors affecting automobile fuel consumption. Two of the most relevant factors in this application are identified to be the average cruising speed of the vehicle and the gradient of the road. The effects of these factors to the fuel consumption rates are summarized in Table 8-3.

Table 8-3 Automobile Fuel Consumption as Affected by Speed and Gradient

(litres/km)

Average vehicle cruising speed	Fuel consumption rates on gradient of		
	level	+ 5%	- 5%
16.1 km/h	.169	.236	.094
32.2	.118	.221	.049
48.3	.103	.205	.031
64.4	.108	.205	.028
80.5	.122	.219	.042
96.6	.136	.240	.064
112.7	.158	.261	.085

[1]

[1] Based on : Claffey, P.J. (1971), Running Costs of Motor Vehicles as Affected by Road Design and Traffic, National Cooperative Highway Research Program Report No. 111, Washington, D.C. : Highway Research Board, P 17, Table 6.

This relation may be stored within the computer in a tabular form and linear interpolations may be made to determine the consumption rates between the listed speeds. Once the fuel consumption rate e_{ij} is determined for all the links, the total fuel consumption (in litres) becomes,

$$\sum_{ij\varepsilon\zeta} e_{ij} d_{ij} q_{ij} \qquad (2)$$

Air pollutant emission

For light duty gasoline vehicles, the emission factors in the Sydney Area Transportation Study[1] were used in this application. The emission factors (in grams per vehicle kilometre) as a function of vehicle cruising speed are obtained by the following equations.

Carbon Monoxides	(CO)	= $1010.3V_{ij}^{-0.85}$	grams	
Hydrocarbons	(HC)	= $52.9V_{ij}^{-0.66}$	"	(3)
Oxides of Nitrogen	(NOX)	= 2.1	"	

where, v_{ij} is the average vehicle cruising speed (km/h) on transport link $ij\varepsilon\zeta$ The air pollutants on each link are obtained by multiplying the factors by the vehicle kilometres of that link, and the results are aggregated in order to obtain area wide pollutant emission.

Vehicular traffic accidents

The accident rates are assumed to vary among different road types. Table 8-4 shows an example from the Sydney Area Transportation Study (1974, Vol. 2).

Table 8-4 Traffic Accident Rates Based on Sydney Area Transportation Study (1974)

(per million v.km)

Category	Road type	Accident Type		
		Persons killed	Persons injured	Property damage only
1	6-lane freeway	0.014	0.454	0.951
2	4-lane freeway	0.014	0.454	0.951
3	6-lane expressway	0.034	1.609	4.896
4	4-lane expressway	0.034	1.609	4.896
5	4-lane arterial	0.042	1.758	3.764
6	2-lane arterial	0.042	1.758	3.764

[2]

8.2.2 Selection Method

Selection of alternative plan is essentially a decision making problem involving value judgment. In a comprehensive evaluation process,

[1] Sydney Area Transportation Study (1974), New South Wales, Ministry of Transport, Vol. 2, P V-3

[2] ibid, Vol. 2, Table 5.5, P V-11

'value' of a plan is expressed by evaluation criteria. These criteria are often difficult to measure in single unit, therefore, special treatment is required to make overall judgment under the existence of multiple criteria. The key problem addressed here is the treatment of mutually exclusive criteria and their trade-offs, or weighting. Most widely used approach is simple rating and weighting approach. Rating and weighting values are determined based on the empirical assessment of relative importance of each values and criteria. Goals Achievement Matrix[1] is an approach to this rating and weighting method. A variety of other approaches are available which treat the problem of value trade-offs more rigorously : they are, for example, Condordance Analysis[2], Planning Balance Sheet[3] and Utility Theory Approach[4].

Practical approaches suited for evaluation of comprehensive transport plans are also available[5]. They have a common ground in using scaling and weighting method. These approaches may be called 'linear-additive value-function' method that recognizes the subjective feature of value systems and internal trade-offs or changing nature of marginal utilities.

The process of applying this approach is as follows:-

1. Choose a Set of Evaluation Criteria: Set of criteria are selected to cover all the important aspects of plan implications. Double counting of similar criterion should be avoided.

2. Construct Plan Impact Table: For every alternatives, calculate impact values of all the criteria. The impact are measured either by subjective scaling or quantitative assessment.

3. Assess Value Functions to Evaluation Criteria: For each criterion, set the worst impact as 0 and the best impact as 1 and draw a line to define the internal trade-off relation from the worst to the best. Different types of value function are shown in Figure 8-2.

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[1] Hill, M. (1973), Planning for Multiple Objectives: An Approach to the Evaluation of Transport Plans, Philadelphia: Regional Science Research Institute.

[2] Nijkamp, P. (1975), 'A multicriteria analysis for project evaluation: economic-ecological evaluation of a land reclamation project', Papers of the Regional Science Association, 35, pp. 87-111.

[3] Lichfield, N., P. Kettle, and M. Whitbread (1975), Evaluation in the Planning Process, Oxford: Pergamon Press.

[4] Keeney, R.L., and H. Raiffa (1976), Decisions with Multiple Objectives: Preferences and Value Tradeoffs, New York: John Wiley & Sons.

[5] For Example : Thomson, J. Michael (1983) Toward Better Urban Transport Planning in Developing Countries, World Bank Staff Working Paper, No. 600, Washington D.C.: The World Bank.

4. Assign Weights

Evaluation criteria usually possess hierarchical structure. Figure 8-3 shows an example of 10-criteria case and their relation importance within sub-sets defined by the hiearchical structure.

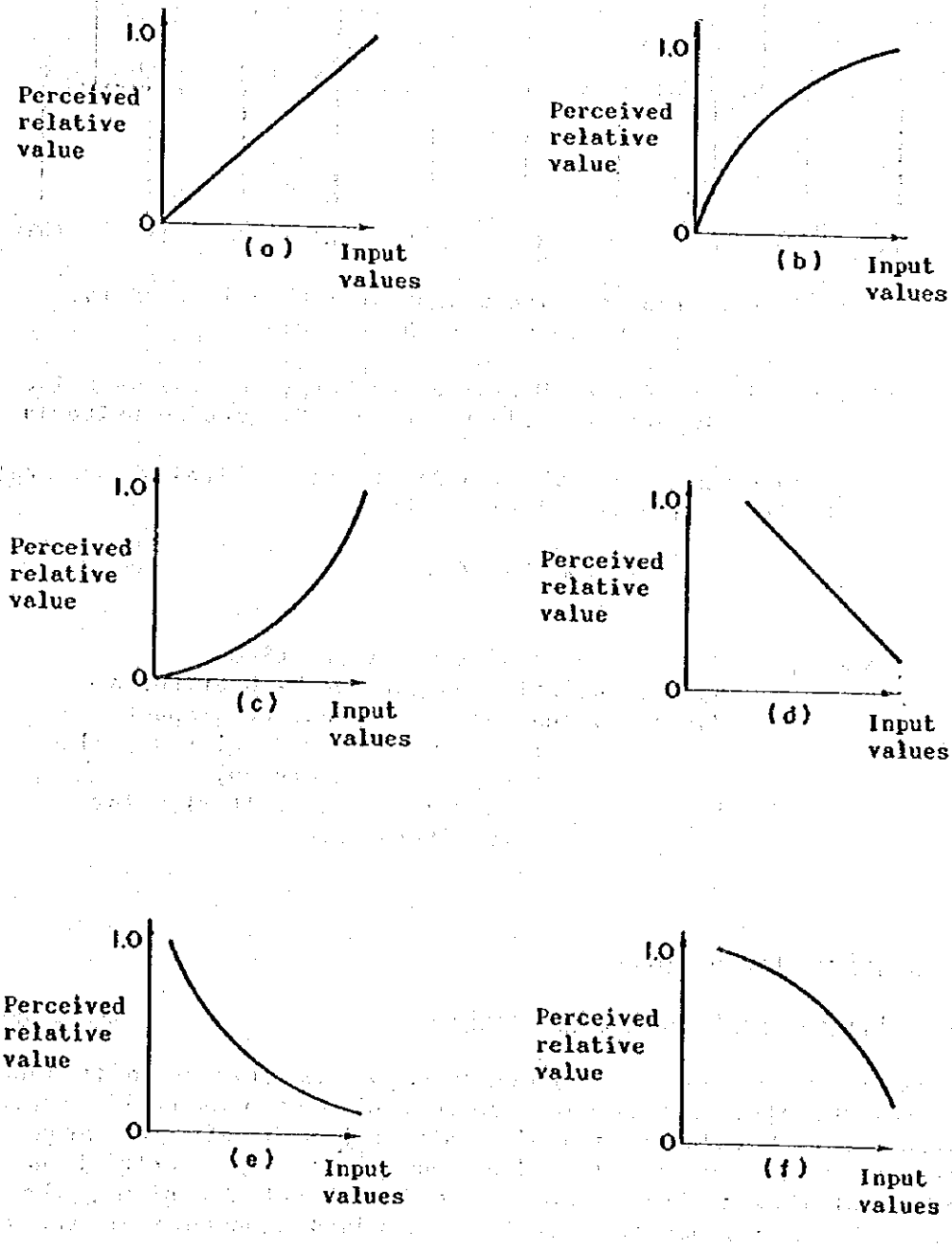
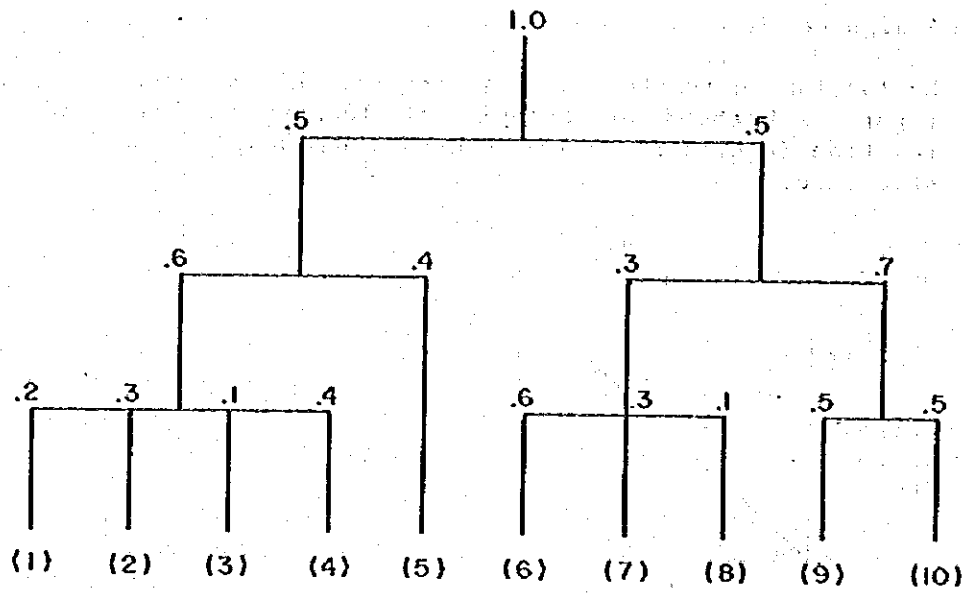


Figure 8-2 Type of Value Function



EXAMPLE : The relative weight of 7-th criterion is,
$w_7 = .3 \times .3 \times .5 = .045$

Figure 8-3 The Use of Hierarchy to Determine the Relative Importance Weights between Evaluation Criteria

5. Calculate the Value of Each Alternative: Finally, the value of each alternative is calculated by:

$$U_i = \sum_r W_r V_R (X_{iR})$$

where, U_i : Value of i-th alternative
W_R : Relative weight for k-th criteria
$V_R( )$: Value function to convert impact index to perceived relative value (graphical conversion)
X_{iR} : Impact index of k-th criterion for i-th alternative

8.3 Economic Evaluation

8.3.1 Purpose of Economic Evaluation

Economic evaluation, or commonly known as cost-benefit analysis, concerns the effectiveness of transport plan seen as public expenditure programme. It calculates both costs and a benefit of programme in monetary unit. Though, there have been long argued criticisms against the use of this technique to public investment decisions, the use of this analysis has become a part of standard procedure in the area of transport project appraisal.

Implementation of a transport plan usually involves a substantial amount of public expenditure. Highway construction, for example, requires the acquisition of land, construction costs and compensation for those who

are to be displaced. These capital expenditure is spent over time and 'social benefit' is also accrued over time. This involves the introduction of discount rate, which will be explain in detail in later sections. For these reasons, it requires precise definition of projects to be evaluated in terms of the extent of transport network development and implementation programme as well as operation and maintenance policy over entire project life.

8.3.2 Calculation of Cost and Benefit

The cost of project is the cost for providing transport infrastructure and the benefit is usually calculated in the saving made in vehicle operating cost and value of time, by comparing the 'do nothing' and 'planned' situations.

Estimation of the Capital Cost

Development of transport system involves capital to be invested. Acquisition of land for right of way and construction of road, are the major investment cost for most of the municipalities.

The financial cost is then adjusted by considering tax, subsidies and opportunity cost of labour etc. to obtain closer figures to true costs to the society. The cost described in this manner is called 'social cost'.

Vehicle Operating Costs

Vehicle operating costs are usually calculated by considering the following items:

- fuel
- oil
- tyres
- maintenance (parts)
- maintenance (labour)
- overhead
- capital costs (depreciation and interest)

The JICA feasibility study on New Krungthep Bridge Construction and Thonburi Road Extension[1] estimated the vehicle operating cost by eight repeat vehicle types for average speed of 5 Km/h to 90 Km/h at 5 Km/h interval. Table 8-5 shows the figure used in this study.

The assumptions made to the calculation are summarized below:

1. Prices are fixed at Spring 1986 levels.

2. Capital costs were depreciated by equal-interval method. Basic interest rate was set at 12%, but the rate for motorcycles and passenger cars was set at 6% p.a. and for pickups 8% because a large portion of these vehicles are not business related. The basic assumptions made for each vehicle type are shown in Table 8-6.

[1] JICA (1986), Progress Report (II), Japan International Cooperation Agency.

Table 8-5 Vehicle Operating Cost by Vehicle Type

(Baht/000 Km)

Average Speed	Vehicle Type							
	Cycle	Car	Pick-Up		Bus	Bus	Truck	Truck
5	860	3495	2453	2518	4611	10505	5645	7363
10	791	3095	2167	2552	3778	8374	4608	5968
15	686	2721	1910	1938	3226	7076	4045	5221
20	617	2471	1762	1753	2885	6327	3704	4774
25	568	2282	1656	1621	2654	5834	3512	4521
30	522	2142	1585	1525	2479	5482	3350	4310
35	513	2040	1541	1473	2375	5261	3259	4188
40	495	1955	1505	1433	2288	5090	3186	4092
45	482	1892	1481	1404	2242	4988	3166	4071
50	475	1849	1475	1390	2210	4906	3139	4035
55	470	1811	1469	1374	2210	4905	3135	4030
60	465	1814	1468	1364	2210	4910	3141	4085
65	468	1824	1474	1364	2248	4919	3175	4136
70	468	1827	1474	1362	2305	5050	3211	4235
75	472	1840	1487	1372	2369	5145	3283	4398
80	480	1859	1505	1392	2477	5291	3405	4398
85	486	1880	1525	1418				4398
90	496	1910	1553	1451	2477	5291	3405	4398

3. The effect of slow speed on congested roads is considered significant in the calculation of annual operating costs. The assumed annual distances by journey speeds are shown in Table 8-9.

4. Fuel and oil consumption rates based on experiments undertaken in Japan were used. The producer costs of fuel and oil were set at spring 1986 prices.

[1] Ibid, Appendix 7.1

Table 8-6 Assumptions Made for Each Vehicle Type in VOC Calculation

Cost Item	Motorcycle	Car	Taxi	Pick-Up	Medium Bus	Heavy Bus	Medium Truck	Heavy Truck
Manufacturer	Suzuki	Corolla	Corolla	Nissan	Isuzu	Hino	FE 172	IL 176
Engine C.C.	100	1300	1300	1600	3300	5900	6500	6500
Market price (000 Baht)	25.5	273.0	259.0	158.0	290.0	1055.0	445.0	610.0
Economic cost (000 Baht)	17.1	155.7	144.9	118.8	243.0	924.4	370.9	520.4
Excluding tyres (000 Baht)	16.5	152.5	141.7	115.6	234.0	908.4	366.9	490.4
Use depreciation %	80	65	100	100	100	100	100	100
Use life (000 kms)	80	160	200	225	360	480	400	500
Use depreciation/000 kms	165	619	709	462	669	1893	892	981
Benchmark speed (k/h)	30	30	30	30	25	20	30	26
Annual use at benchmark (000 kms)	10	12	100	25	75	80	56	51
Age depreciation/00 kms at benchmark (Baht)	41	333	-	-	-	-	-	-
Annual economic interest (Baht)	516	4677	8690	4810	14470	55630	22130	30408
Interest/000 kms at benchmark (Baht)	52	390	87	192	193	694	402	596
Life at benchmark (years)	8	13.3	2	9	4.7	6	7.3	9.8

Table 8-7 Assumed Annual Distances by Journey Speed (000 kms)

Average Speed (k/h)	Motor-cycle	Car	Taxi	Pick-Up	Medium Bus	Heavy Bus	Trucks
5	5.0	6.0	24.1	10.0	17.4	23.7	16.5
10	6.0	7.2	43.9	14.1	33.6	42.2	28.6
15	7.0	8.4	61.0	17.5	48.9	61.8	37.8
20	8.0	9.6	75.6	20.0	63.0	80.0	45.1
25	9.0	10.8	88.0	22.5	75.0	97.3	50.9
30	10.0	12.0	100.0	25.0	88.8	113.9	55.0
35	11.0	13.2	108.6	26.5	101.1	129.6	60.0
40	12.0	14.4	117.5	28.0	111.9	144.6	63.3
45	13.0	15.6	126.1	29.5	123.0	158.6	66.0
50	14.0	16.8	132.0	31.0	123.6	172.2	68.6
55	15.0	18.0	138.3	32.5	123.6	172.2	71.0
60	16.0	18.0	143.9	34.0	123.6	172.2	73.1
65	16.0	18.0	149.2	35.5	123.6	172.2	75.0
70	16.0	18.0	154.1	37.0	123.6	172.2	76.4
75	16.0	18.0	158.4	38.5	123.6	172.2	78.0
80	16.0	18.0	162.4	40.0	123.6	172.2	79.2
85	16.0	18.0	162.4	40.0	-	-	-
90	16.0	18.0	162.4	40.0	-	-	-

Value of Time

The factors considered in the calculation of value of time usually include the income level of drivers and passengers.

The JICA Study mentioned before also calculates value of time for business trips and all other purposes separately. The assumption and the results are summarized below.

1. Value of time being lost while travelling, has been estimated for trips of business purposes and trips of all other purposes separately. For the former, average wage of crew and passengers differentiated by vehicle type, were used but for the latter the same value was used for all vehicle types. The former could be considered reflecting the economic productivity of different types of person, but the value of non-productive time of a high wage earner should not be considered any more valuable than a low wage earner.

2. Wages of drivers and assistants were estimated from the results of labor force survey carried out in 1984 by NSO and are shown in Table 8-8. Percentages of business trips were assumed for each vehicle type based on the JICA Second Stage Expressway Study.[1] Business trips by cars were assumed to be performed with professional drivers, and business trips by pickups with 50% professional drivers. The equity value of time was assumed to be 25% of average wage (Baht 5.25 per hour). Estimates and assumptions used are summarized in Table 8-9.

Table 8-8 Wages of Vehicle Drivers

Vehicle Type	Monthly Wage Cost Bt.	Hours/ Month	Cost/ Vehicle Hour Bt.
Motorcycles	3000	240	12.5
Cars	3000	185	16.2
Taxis	6350	280	22.7
Pick-Ups	4000	250	16.0
Buses	7500	200	37.5
Trucks	6000	220	27.3

Note : Hours include non-driving time [1]

[1] ibid, Appendix 7.2

Table 8-9 Time Value for Business Trips

Vehicle Type	Vehicle Occupancy	Business Trip %	Business Pass. Wage (Baht/Hr)	Time Value Per Veh. Hour (Baht/Hr)
Motorcycle	1.2	15	12.5	7.6
Cars	2.0 driver + business pass.	15	48.0	18.6
Taxis	driver + 1.1 passengers	15	48.0	35.5
Pickups	driver + 1.5 passengers	see note	48.0	34.4
Buses	crew + 37.7 passengers	4	48.0	259.3
Trucks	crew	100	21.0	-

Note: Pickup drivers 50% business, 50% non-business, Pickup passenger 10% assistant, 40% business, 50% non-business

Calculation of Total Benefit of a Project

The calculation of total benefit for a project can be calculated as follows:

1. Calculate the vehicle Km spent on existing network, Denote this by Lj for vehicle type j.

2. Calculate the vehicle Km spent on planned (improved) network L'j.

3. Calculate the vehicle-hours spent on existing network Tj.

4. for planned network
   T'j

5. The benefit is calculated by

$$B = \sum_j C_j(L_j - L'_j) + \Sigma t_j (T_j - T'_j)$$

where, lj VOC type j
tj volume of time type j

Discount Rate

Investment cost and benefit arise over time (Table 8-10), and the future cost and benefit are discounted to Net Present Value (NPV).

Discount rate should reflect the opportunity cost of investment capital. The interest rate of financial market is most widely used as discount rate. Different projects have different NPV's and the ratio of NPV to capital cost is often used to evaluate the priority of implementation.

Alternative approach to measure the present worth of the project is to calculate 'Internal Rate of Return (IRR)' which is defined as the discount rate that makes the NPV = 0. It is regarded that the higher the IRR the better the investment.

Table 8-10 The Notion of Cost and Benefit and Project Life

Cost and Benefit	Year (Project Life)					
	1	2	.....	i	.....	n
Cost	C1	C2	.....	C1	.....	Cn
Benefit	B1	B2	.....	B2	.....	Bn

Present Value $\sum_i \frac{B_i - C_i}{(1+r)^i}$

Internal Rate of Pattern

$$r_o : \sum_i \frac{B_i - C_i}{(1+r_o)^i} = 0$$

PART 9:

Note on Plan Revision

PART 9

NOTE ON PLAN REVISION

9.1 Introduction

Under the current Town Planning Act (1975), a General Plan is valid only for 5 years after its proclamation of enforcement. This allows certain changes to be made to the previous plan so that revised plan can adapt to the changing trend of urban development.

The revision of the plan has to consider the following two major aspects.

1) Change of boundaries
2) Change of planning framework

Change of Boundaries

Planning boundaries could change in the revision of the General Plan. In the past experiences, new planning area of Muang Chiang Mai has been more than doubled compared to the planning area of the old plan. For the case of Muang Rayong, however, the new boundary was nearly the same. Plan revision process surely becomes different between the above two cases.

Change of Planning Framework

Urban development trend could change and the modification may be necessary to the future scenario depicted in the demographic forecasts and the transport demand forecasts. Accordingly, the new General Plan may have to be modified to correspond to the changing scenario.

This Part discusses the implication of plan revision and technical procedures with which the transport systems plan in General Plan may be modified.

9.2 Implication of Plan Revision

When a General Plan is enforced the local government has the right to permit or reject building applications so as to secure public-right-of-way specified in the plan. If a modification is made to transport network various confusing cases may arise. The confusing cases are, for example:

- Once permitted building sites becomes within the public-right-of-way in the new plan; and

- Once rejected applications becomes acceptable under the new plan.

This unfairness cannot be avoided in certain cases, but it is better to avoid them as much as possible by adopting the strategies such as:

1) Increase the accuracy of planning in the first General Plan therefore to minimize the modification required in the successive plan.

2) Change of transport proposal should pay careful consideration to the injustice to the land owners affected by the change. The change includes:

   - Cancelling of road improvements or constructions; and

   - Newly proposed improvements and constructions within the old planning area.

9.3 Technical Aspects of Plan Revision

The technical process of plan revision differs slightly depending on the state of boundary changes. The following two cases may be considered:

1) Minor change or no change of planning boundary; and

2) Major change of planning boundary.

The process of plan revision for each case will be explained below:-

Case for Minor Change or No Change in Planning Boundary

The work process of this case is shown in the Fig. 9-1.

Data collection stage of this case mainly concerns the updating of the previous data set. The following guideline may be applied:

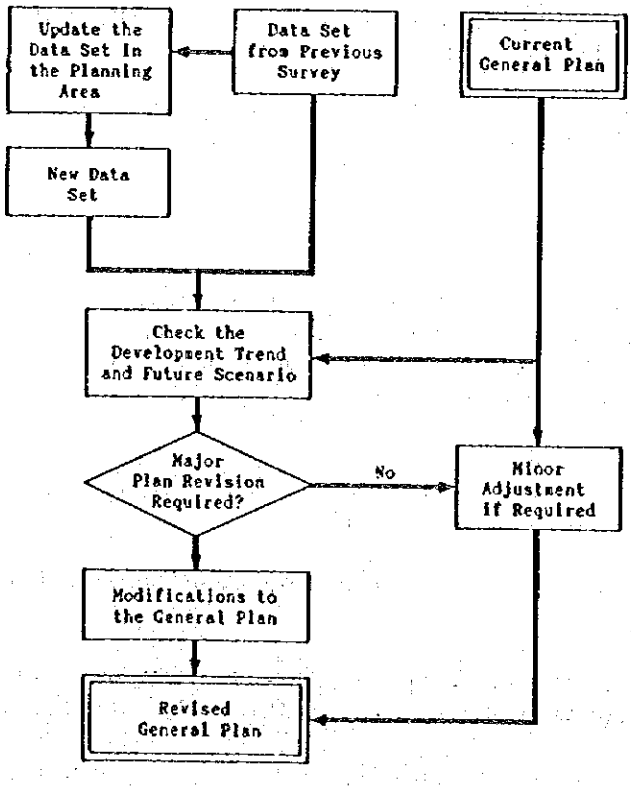


Fig. 9-1 Process of plan revision
(Minor or no Change in Planning Boundary)

. Transport system data	- Survey only for changed part - Conduct more detailed survey than the previous survey
. Traffic data	- Re-survey most of the data items to accumulate time series data
. O-D surveys	- Re-survey if it is possible, otherwise use new traffic courts to update O-D matrix.

Change of development trend and future scenario is examined by comparing old data set and new data set. Traffic demand forecast should be made by using new scenario, the adequacy of current General Plan is checked against the newly projected demand.

Necessary modifications are made to produce a revised General Plan.

Case for Major Change in Planning Boundary

The planning activities for Fig. 9-2 show the plan revision process for the case where major change in planning boundary exists.

The current planning area follows almost the same process as the above case except that the modifications, if any, should be considered in relation to the additional planning area.

Complete set of new data should be collected for the additional planning area, and the update of the old data is performed for the old planning area. Two data sets are conbined to form a new database to the planning area within the new boundary.

Preparation of the revised land use plan and transport plan requires the modification within the current planning area and the preparation within the additional areas.

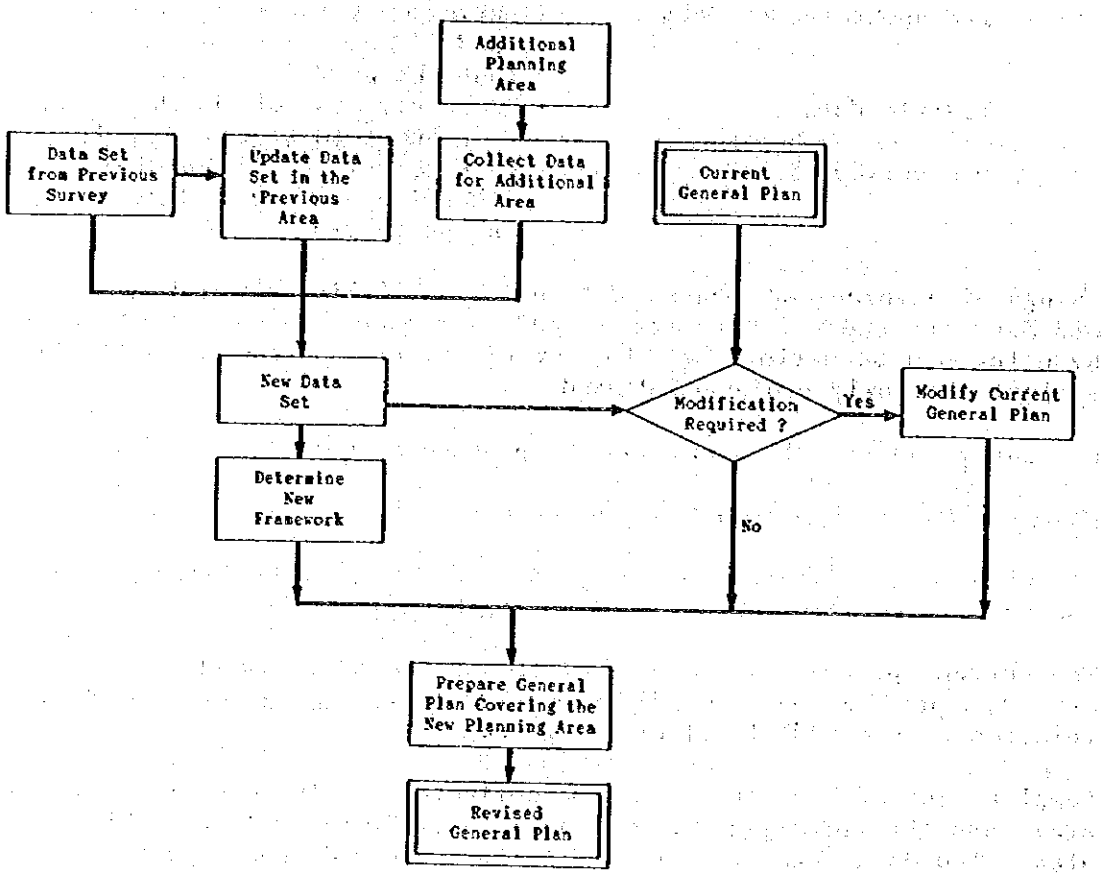


Fig. 9-2 Process of Plan Revision
(Major Change in Planning Boundary)

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APPENDICES

APPENDIX 1

FUNCTIONS AND AGENCY RESPONSIBILITIES IN BMA

SECTOR	FUNCTION	AGENCIES RESPONSIBLE
LAND USE & TRANSPORT POLICIES	Formulation	NESDB,DTCP,CPD,DLT(LTPC),OCMRT,ETA
	Evaluation	-
	Decision	CAB,MOI,MOC,MOF,BDETA,CMRT,LTPC
	Control	BB,NESDB,OCMRT,OFP,TD
TRANSPORT INFRASTRUCTURE	Roads - planning	DTCP,ETA,DOH,CPD,PWD,DPW,NESDB
	- design	DOH,ETA,DD,TED,OCMRT
	- construction	DOH,CCSD,CMD,ETA
	- maintenance	DOH,CMD,ETA
	Major Bridges - planning	DTCP,CPD,DPW,ETA,PWD,NESDB
	- design	DPW,ETA,PWD
	- construction	DPW,ETA,PWD
	- maintenance	DPW,ETA,PWD
	Railway - planning	DTCP,CPD,SRT,ETA,NESDB
	- design	SRT,ETA
	- construction	SRT,ETA
	- maintenance	SRT,ETA
	Truck Terminal	DLT
	Control	BB,OFP,TD,NESDB
PUBLIC TRANSPORT	Planning	DLT,BMTA,OCMRT,NESDB
	Operation	BMTA,SRT
	Regulation	DLT(LTCD), TPD
PRIVATE VEHICLE TRAFFIC	Traffic Management	OCMRT,TED,TPD,PWD,ETA
	Parking	PWD,TPD,OCMRT
	Vehicle Licensing	PD,DLT
	Regulations	TPD,DLT,ETA
	Traffic Safety	TPD,NSC
	Enforcement	TPD

(Source: STTR Working Paper No. 1)

AGENCIES WITH URBAN TRANSPORT RELATED RESPONSIBILITIES IN BMA

ABBREVIATION	AGENCY	REPORTING TO
BB	Budget Bureau	OPM
BCD	Building Control Division	BMA
BMA	Bangkok Metropolitan Administration	MOI
BMTA	Bangkok Mass Transit Authority	MOC
CAB	Cabinet	-
CCSD	Construction Control & Supervision Division	BMA
CMD	Construction & Maintenance Division	BMA
CPD	City Planning Division	BMA
DD	Design Division	BMA
DOH	Department of Highways	MOC
DLT	Department of Land Transport	MOC
DPP	Department of Policy and Planning	BMA
DPW	Department of Public Works	MOI
DTCP	Department of Town and Country Planning	MOI
ETA	Expressway and Rapid Transit Authority of Thailand	MOI
ETO	Express Transportation Organization of Thailand	MOC
HD	Harbour Department	MOC
MOC	Ministry of Communications	CAB
MOF	Ministry of Finance	CAB
MOI	Ministry of Interior	CAB
MPB	Metropolitan Police Bureau	MOI
MSTE	Ministry of Science, Technology and Energy	CAB
NESDB	National Economic and Social Development Board	OPM
NSC	National Safety Council	OPM
OCMRT	Office of the Committee for the Management of Road Traffic	MOI
OFP	Office of Fiscal Policy	MOF
ONEB	Office of the National Environmental Board	MSTE
OPM	Office of the Prime Minister	CAB
OPP	Office of Policy and Planning	MOI
OPS	Office of Permanent Secretary (BMA)	BMA
PD	Police Department	MOI
PWD	Public Works Department	BMA
RWLD	Right of Way and Land Division	BMA
SRT	State Railway of Thailand	MOC
TD	Treasury Department	MOF
TED	Traffic Engineering Division	BMA
TPD	Traffic Police Division	MOI

(Source: STTR Working Paper No. 1)

APPENDIX 2

LIST OF CITIES AND THEIR CHARACTERISTIC OF GENERAL PLANS

(1)

NO.	Province	Base Year	Area of Municipality	Area of General Plan	Present Population	Growth Rate	Target Year	Future Population
1	Chiang Rai	(25)	11.22	47.42	52,140	1.5	(45)	103,600
2	Phayao	(21)	9	60	45,242	2.08	(47)	68,580
3	Mae Hong Son	(28)	6	4.7	8,105	2.7	(48)	13,800
4	Chiang Mai	(23)	19.5	129.89	165,330	2.21	(40)	264,420
5	Lamphon	(27)	4.92	58	40,618	1.46	(47)	54,400
6	Lampang	(25)	19.6	45	37,440	0.63	(45)	110,000
7	Tak	(28)	7.2	27.35	33,291	2.12	(48)	50,700
8	Mae Sot, Tak	(29)		72	39,381	2.34	(49)	62,800
9	Kamphaeng Phet	(25)		48.6	36,799	2.63	(45)	58,700
10	Nakhon Sawan	(26)		31.5	104,054	2.81	(46)	191,439
11	Chumsaeng, Nakhon Sawan	(25)		24.48	21,232	1.57	(50)	29,520
	Pakhli, Nakhon Sawan	(30)		60	48,416	2.31	(50)	76,400
12	Uthai Thani	(27)		21.466	21,031	1.17	(48)	26,900
13	Chai Nat	(29)		56.49	32,273	1.57	(49)	44,100
14	Sing Buri	(28)		29.84	28,922	2.03	(48)	44,160
15	Ang Thong	(28)		23.97	24,083	1.89	(48)	35,150
16	Phra Nakhon Si Ayuthaya	(25)	13.24	39	69,240	2.37	(45)	110,610
17	Pathum Thani	(26)		42	28,231	3.09	(44)	50,000
18	Pachatipus Community, Pathum Thani	(28)		126.08	80,684	4.38	(44)	162,400
19	Nonthaburi	(25)	2.5	245.75	356,648	3.88	(44)	700,000
20	Suphan Buri	(27)		31.8	36,835	1.43	(47)	49,000
21	Samut Prakan	(26)			611,272	2.7	(44)	1,193,522
22	Samut Sakhon	(22)		16.95	61,351	1.85	(44)	90,088
23	Samut Songkhram	(25)		23.75	35,191	2.05	(45)	52,810
24	Chachoengsao	(25)		22	38,697	2.63	(44)	71,905
25	Bang Khla, Chachoengsao	(30)		50.74	16,593	1.64	(50)	23,030
26	Chon Buri	(24)	4.6	130.3	150,246	1.93	(44)	220,854
27	Pattaya, Chon Buri	(30)		52.8	73,671	3.53	(50)	145,600
28	Pranat Nikhom, Chon Buri	(29)		57	27,056	2.3	(47)	42,900
29	Laem Chabung Coma., Chon Buri			165		-		
30	Rayong	(30)		41.7	48,269	3.91	(50)	105,490
31	Kaeng, Rayong	(29)		31.4	15,210	3.38	(50)	30,900
32	Ban Pae, Rayong	(26)		29.7	10,313	3.49	(45)	20,500
33	Industial Coma., Rayong	(23)		223.7	46,154	5.8	(33)	117,800
34	Chanthaburi	(28)		58.315	67,278	3.35	(48)	131,410
35	Trat	(26)		43.3	26,099	2.82	(48)	45,800
36	Prachin Buri	(28)		27.6	29,263	1.85	(48)	42,400
37	Aranyaprathet, Prachin-Buri	(29)		37.6	23,677	1.35	(48)	30,500
38	Nakhon Nayok	(27)		67	28,088	2.19	(47)	43,500
39	Saraburi	(28)		39.27	54,213	2.24	(48)	85,000
40	Nakhon Ratchasima	(23)		41	162,740	2.44	(39)	239,300
41	Non Sung, Nakhon Ratchasima	(30)		24.85	10,232	1.35	(50)	13,400
42	Bua Yai, Nakhon Ratchasima	(30)		37	18,432	2.55	(50)	30,740
	Pak Chong, Nakhon Ratchasima	(30)		38.66	47,033	1.85	(50)	69,100
43	Chaiyaphum	(28)		41.33	35,222	2.9	(48)	62,400
44	Khon Kaen	(23)		46	94,019	5.55	(43)	292,300
45	Ban Phai, Khon Kaen	(30)		58	42,369	3.38	(50)	82,700
46	Phon, Khon Kaen	(30)		31.5	19,546	1.74	(50)	27,700
47	Chum Phae, Khon Kaen	(29)		35	35,055	3.65	(50)	69,500
48	Udon Thani	(24)		48.3	138,909	2.61	(46)	238,300
49	Nong Khai	(28)		27.92	40,991	2.48	(48)	67,300
50	Sakon Nakhon	(28)		115.69	48,908	1.78	(48)	71,200
51	Nakhon Phanom	(28)		24	30,770	1.48	(48)	41,450
52	Maha Sarakham	(27)		42	41,946	3.59	(47)	86,000
53	Roi Et	(26)		47.9	55,187	2.54	(46)	81,140
54	Buri Ram	(28)		26.49	37,578	2.13	(48)	58,463
55	Surin	(27)		27	45,900	2.45	(47)	74,500

NO.	Province	Local Street		Distributor Street		Major Road		Total Length - m	Total Area - m^2
		Total - m Length	(Total - m^2 Area)	Total - m Length	(Total - m^2 Area)	Total - m Length	(Total - m^2 Area)		
1	Chiang Rai								2,398,400
2	Phayao								1,672,000
3	Mae Hong Son	225	(1,600)	3,185	(55,890)	6,475	(129,500)	9,885	187,190
4	Chiang Mai								
5	Lamphun	23,730	(415,220)	28,840	(553,760)	14,090	(467,950)	66,610	1,536,960
6	Lampang								
7	Tak								8,558,800
8	Mae Sot, Tak								1,860,688
9	Kamphaeng Phet								2,523,040
10	Nakhon Sawan								
11	Chumsaeng, Nakhon Sawan								786,800
	Takhli, Nakhon Sawan								
12	Uthai Thani								1,066,800
13	Chai Nat	22,042	(323,590)	2,700	(54,000)	5,650	(188,000)	30,392	574,590
14	Sing Buri	8,200	(114,400)	4,100	(82,000)	17,100	(613,500)	29,400	809,900
15	Ang Thong	12,970	(61,920)	9,100	(142,000)	15,400	(881,100)	35,478	1,085,020
16	Phra Nakhon Si Ayuthaya	26,750	(398,640)	24,700	(494,000)	22,420	(813,700)	71,910	1,702,340
17	Pathum Thani	18,530	(35,560)	9,810	(16,022)	19,208	(476,249)	47,548	527,829
18	Pachatipus Community, Pathum Thani	2,500	(40,000)	34,200	(694,000)	20,200	(693,600)	56,900	1,617,600
19	Nonthaburi	51,800	(1,036,000)	15,750	(472,500)	47,750	(2,620,000)	115,300	4,128,500
20	Suphan Buri	8,700	(174,000)	10,400	(312,000)	4,800	(384,000)	23,900	870,000
21	Samut Prakan								
22	Samut Sakhon								1,851,536
23	Samut Songkhram	3,580	(392,450)	2,810	(43,300)	8,110	(226,020)	35,160	661,800
25	Bang Khla, Chachoengsao								881,120
26	Chon Buri								890,060
27	Pattaya, Chon Buri								6,650,000
28	Pranat Nikhom, Chon Buri								8,668,180
29	Laem Chabung Comm., Chon Buri								1,040,000
30	Rayong	32,670	(202,720)	37,435	(748,760)	80,775	(3,883,250)	130,928	4,834,730
31	Kaeng, Rayong	31,010	(496,150)	27,830	(556,600)	11,800	(439,000)	70,640	1,491,750
32	Ban Pae, Rayong	18,380	(212,040)	7,000	(98,000)	7,450	(202,900)	24,840	612,940
34	Chanthaburi	6,950	(106,860)	35,300	(706,000)	9,880	(395,200)	52,030	1,208,060
35	Trat								
36	Prachin Buri	16,570	(265,120)	33,950	(675,000)	37,980	(1,253,400)	88,300	2,193,520
37	Arunyaprathet, Prachin-Buri	15,750	(252,000)	13,940	(312,060)	7,370	(320,900)	37,060	884,960
38	Nakhon Nayok	900	(10,800)	18,150	(405,480)	10,360	(310,800)	30,450	727,060
39	Saraburi								
40	Nakhon Ratchasima	6,630	(73,680)	7,180	(143,600)	62,150	(2,105,900)	78,810	2,323,180
41	Non Sung, Nakhon Ratchasima	4,390	(61,710)	17,690	(352,440)	18,530	(1,038,400)	40,810	1,452,550
42	Bua Yai, Nakhon Ratchasima								2,426,992
	Pak Chong, Nakhon Ratchasima	18,178	(265,132)	3,810	(76,200)	2,300	(78,600)	24,288	422,332
43	Chaiyaphum	17,200	(280,200)	1,200	(24,000)	15,750	(501,750)	34,150	805,950
44	Khon Kaen								
45	Ban Phai, Khon Kaen	24,450	(383,000)	1,400	(42,000)	9,870	(385,800)	35,720	770,800
46	Phon, Khon Kaen								
47	Chum Phae, Khon Kaen								
48	Udon Thani								
49	Kong Khai	11,150	(181,500)	11,320	(238,650)	11,650	(628,000)	34,520	1,049,180
50	Sakon Nakhon	20,190	(245,250)	2,970	(59,400)	8,520	(453,300)	31,680	759,460
51	Nakhon Phanom								
52	Maha Sarakham	8,050	(151,590)	15,600	(312,000)	24,790	(1,069,700)	49,470	1,533,289
53	Roi Et								
54	Buri Ram								
55	Surin								1,494,000

NO.	Province	Base Year	Area of Municipality	Area of General Plan	Present Population	Growth Rate	Target Year	Future Population
56	Si Sa Ket	(29)		52.33	9,518	1.17	(49)	13,300
57	Kalasin	(29)		28.02	33,366	2.45	(69)	54,430
58	Yasothon	(25)		18.14	19,489	2.44	(45)	31,000
59	Warin Chasrap, Ubon Ratchathani	(28)		65.7	119,767	2.67	(65)	197,600
		(26)			44,299	1.77	(45)	61,600
60	Phibun Mangsahan, Ubon Ratchathani	(29)		18.2	18,456	2.22	(49)	28,800
61	Mukdahan	(28)		39.3	26,350	2.85	(45)	46,300
62	Loei	(28)		42.23	38,068	2.62	(68)	57,800
63	Lop Buri	(27)		53.64	35,000	2.52	(46)	120,400
64	Sukhothai	(29)		29.058	32,931	2.06	(49)	49,500
65	Uttaradit	(27)		45.46	45,115	2.66	(47)	76,800
66	Phrae	(28)	5.54	31.07	38,340	2.31	(48)	49,800
67	Nan	(28)		40.7	35,735	2.72	(45)	50,300
68	Phichit	(27)		36.13	30,997	2.95	(47)	56,000
69	Phitsanulok	(27)		54.78	88,129	2.67	(47)	149,300
70	Phetchabun	(28)		35.28	26,772	3.6	(48)	58,300
71	Nakhon Pathom	(24)		36.72	123,319	2.85	(44)	217,600
72	Aom Yai, Nakhon Pathom	(25)		78.36	37,777	3.08	(45)	69,000
73	Krathumbaen	(29)		66	53,700	5.27	(49)	150,000
74	Kanchanaburi	(25)		35.9	36,310	3.9	(45)	78,000
75	Tharua-Phrathaen	(29)		17.8	19,557	2.46	(49)	31,860
76	Ratchaburi	(22)		47.3	62,573	2.71	(48)	132,100
	Potharam, Ratchaburi	(30)		12.509	18,360	1.16	(50)	26,300
77	Phetchaburi	(26)		27.78	43,549	0.8	(46)	51,100
78	Cha-am, Phetchaburi	(29)		118	19,709	2.75	(49)	34,160
79	Hua-Hin Comm., Prachuap Khiri Khan	(28)		43	32,910	2.05	(49)	50,620
80	Prachuap-Kiri-Khan	(29)		56.56	21,672	2.07	(49)	33,000
81	Chumphon	(28)	2.0	74	52,447	1.6	(48)	72,390
82	Ranong	(29)	2.084	19.87	27,037	3.94	(49)	59,530
83	Surat Thani	(25)	4.92	87.06	56,356	3.19	(44)	100,500
						0.67	(39)	32,530
84	Ko Samui, Surat Thani	(29)	346.02	346.02	27,076	1.43	(49)	37,450
85	Phangnga	(26)	6.75	16.23	11,356	1.95	(46)	16,700
86	Phuket	(23)	12	25.15	58,760	2.29	(40)	86,347
87	Phartong-Kraron, Phuket	(26)		11.57	4,090	2.12	(45)	6,090
		(26)			2,457	1.87	(45)	3,490
88	Wichit Comm. Harbour, Phuket	(28)		24.33	9,787	4.77	(48)	35,000
89	Chalong-Kavai Comm., Phuket	(28)		31.31	12,203	2.09	(48)	20,000
90	Cheng Trle-Kum Aala Comm., Phuket	(28)		53.18	12,393	1.78	(48)	16,000
91	Mai Khoa-Saku Comm., Phuket	(28)		31.33	10,323	2.12	(45)	16,000
92	Ko Kaev-Ratchada-Kratou Comm., Phuket	(20)		84.23	23,405	3.53	(50)	48,500
93	Krabi	(24)		28.21	17,860	3.61	(40)	41,500
94	Nakhon Si Thammarat	(27)		100	105,340	2	(47)	156,500
95	Pak Phanang, Nakhon Si	(30)		43.48	35,411	2.09	(50)	53,780
96	Trang	(28)	14.7	52.8	63,356	2.21	(45)	98,100
97	Phatthalung	(26)	13.342	42.63	41,971	2.24	(46)	72,256
98	Songkhla	(24)		82.44	84,814	4.51	(44)	196,100
99	Hat Yai, Song Khla	(23)		33.5	127,948	3.92	(45)	276,100
100	Sadao, Song Khla	(28)		43.5	13,017	2.25	(45)	20,300
101	Deep Sea Port Comm., Song Khla	(25)		82.44	26,299	2.38	(45)	56,950
102	Sutun	(21)	8.2	28.2	27,295	3.24	(60)	47,388
103	Pattani	(26)		32.78	60,331	2.75	(46)	96,670
104	Yala	(28)	19	55	48,800	3.9	(48)	148,000
105	Betong, Yala	(29)		45.5	20,068	1.31	(49)	25,060
106	Narathivat	(24)		27.2	40,653	2.39	(45)	66,800
107	Phikultong Comm., Narathivat	(29)		65.42	14,157	2.13	(49)	17,100
108	Sungai Kolok, Narathivat	(29)		25.63	30,350	3	(49)	54,800

No.	Province	Local Street		Distributor Street		Major Road		Total Length - m	Total Area - m^2
		Total - m Length	(Total - m^2 Area	Total - m Length	(Total - m^2 Area	Total - m Length	(Total - m^2 Area		
56	Si Sa Ket								
57	Kalasin								821,680
58	Yasothon	14,584	(220,808)	15,872	(317,440)	14,744	(531,600)	45,200	1,072,848
59	Warin Chamrap, Ubon Ratchathani	14,510	(225,760)	13,240	(376,900)	26,810	(1,038,400)	68,460	1,641,060
60	Phibun Mangsahan, Ubon Ratchathani	6,930	(101,250)	1,020	(20,400)	7,960	(212,050)	15,910	333,730
61	Mukdahan	10,035	(159,760)	20,590	(411,800)	30,345	(1,018,950)	60,970	1,589,510
62	Loei								1,019,021
63	Lop Buri	14,320	(214,800)	7,150	(143,000)	12,455	(372,350)	33,925	730,150
64	Sukhothai	9,845	(119,340)	14,630	(234,080)	16,020	(656,500)	40,555	1,049,920
65	Uttaradit								1,965,340
66	Phrae								696,203
67	Nan	30,700	(490,699)	4,490	(89,800)	21,240	(737,900)	56,420	1,318,389
68	Phichit								850,600
69	Phitsanulok	43,069	(706,523)	24,615	(535,260)	23,200	(739,680)	84,884	1,981,263
70	Phetchabun	19,950	(295,450)	28,510	(602,800)	8,190	(421,300)	56,670	1,319,586
71	Nakhon Pathom								2,641,600
72	Amphawa, Nakhon Pathom	15,900	(235,200)	10,810	(216,200)	8,620	(215,502)	35,330	666,900
73	Krathumbaen	15,115	(226,725)	30,670	(701,750)	7,920	(396,003)	53,705	1,324,475
74	Kanchanaburi								2,565,040
75	Tharua-Phrathaen								
76	Ratchaburi	6,180	(50,160)	23,130	(462,600)	21,010	(855,700)	49,350	1,388,650
	Potharam, Ratchaburi								
77	Phetchaburi								
78	Cha-am, Phetchaburi								
79	Hua-Hin Comm., Prachuap Khiri Khan	23,100	(378,400)	22,300	(492,000)	26,750	(996,500)	72,150	1,867,900
80	Prachuap-Kiri-Khan	24,130	(380,640)	11,230	(258,240)	5,200	(312,000)	41,160	960,880
81	Chumphon	8,900	(124,600)	12,700	(253,400)	10,500	(403,000)	32,100	781,000
82	Ranong	3,610	(66,850)	15,420	(308,400)	16,440	(768,700)	35,470	1,143,850
83	Surat Thani	28,800	(447,568)	27,456	(536,240)	23,040	(811,200)	84,296	1,845,008
84	Ko Samui, Surat Thani								
85	Phangnga	63,900	(1,102,400)	41,800	(956,000)	-	-	116,700	2,058,400
86	Phuket								
87	Thalang-Kraron, Phuket								1,877,760
88	Wichit Comm. Harbour, Phuket	8,590	(173,800)	6,360	(169,000)	21,220	(725,600)	36,570	1,066,400
89	Chalong-Rawai Comm., Phuket								1,247,840
90	Cheng Trle-Kus Asla Comm., Phuket								2,303,952
91	Mai Khao-Saku Comm., Phuket								1,714,050
92	Ko Kaev-Natchada-Kratou Comm., Phuket	14,730	(226,620)	11,925	(350,500)	2,550	(76,500)	35,205	661,620
93	Krabi	10,130	(161,080)	16,800	(336,000)	27,030	(873,200)	53,950	1,376,280
94	Nakhon Si Thammarat	35,880	(559,920)	28,500	(490,009)	21,400	(357,000)	81,780	1,806,920
95	Pak Phanang, Nakhon Si								1,819,280
96	Trang								
97	Phatthalung								
98	Songkhla								
99	Hat Yai, Song Khla								2,882,400
100	Sadao, Song Khla								
101	Deep Sea Port Comm., Song Khla								
102	Satun								
103	Pattani								
104	Yala								
105	Betong, Yala								
106	Narathiwat	23,648	(418,456)	10,888	(481,650)	7,280	(247,520)	69,816	1,149,656
107	Phikultong Comm., Narathiwat								
108	Sungai Kolok, Narathiwat	23,800	(355,500)	8,360	(187,200)	11,618	(357,800)	43,778	920,550

Included Access Rd.	* 33 cities	31%
Excluded Access Rd.	* 48 cities	44%
Lacking data of Rd.	* 27 cities	25%
Total	* 108 cities	

APPENDIX 3

TRANSPORT PLANNING TASKS IN THE PREPARATION OF GENERAL PLAN[1]

1. Reconnaissance to define general plan area. Coordinate with the officers of Comprehensive Planning Div., Mapping Div. and Research & Analysis Div.

2. Advisory Board meeting asking for suggestions, opinions and defining the planning area (which probably have to be declared as the Royal decree of survey area).

3. Survey and collection of engineering data.

4. Conduct analysis on collected data and start the preparation of the Engineering Report, and distribute Engineering Reports to the concerned divisions in DTCP

5. Advisory Committee meeting (I).

6. Public hearing (I).

7. Analysis of field data. Obtain future land use plan from Comprehensive Planning Div.

8. After receiving the future land use plan, prepare the first draft transport plan and system design by coordinating with Comprehensive Planning Div.

9. Propose the plan for consideration and approval in the Engineering Division meeting.

10. Send the draft transport plan, which has been approved by Div.'s Conference, to the Comprehensive Planning Div.

11. Complete the Technical Report as an accompaniment to the draft transport plan.

12. Submit the Technical Report and 40 sets of map to Comprehensive Planning Div.

13. Department meeting for plan approval.

14. Revise the plan according to the opinions from the meeting, if any, in the draft plan and the document.

15. Submit the revised Technical Report and the 35 sets of revised plan to Comprehensive Planning Div.

16. Meeting for coordinating with other external agencies such as DOH, PWD, DLT etc.

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[1] Based on the material provided by the Engineering Div. of DTCP.

17. Color 12 sets of transport system plan (Scale 1:10,000~1:20,000), signed by Director-General and 10 sets to be sent to Public Relation Div. for posting for not less than 15 days for Public Hearing.

18. Advisory Committee (II).

19. Public Hearing (II) to consider public views.

20. Make revisions and modifications if necessary.

21. Send the Technical Report of plan concerned in 45 sets (revised) to Comprehensive Planning Div.

22. Planning Board's Conference.

23. Revise the plan if necessary.

24. Color 14 sets of the transport system plan, signed by Director-General and 12 set have been sent to Public Relation Div. for posting for not less than 90 days for the inspection by affected parties.

25. Collect and consider public's complaint to use as documents for arrangement of the Conference. (if any)

26. Submit the complaint to Planning Board (if any)

27. Revise and modify the plan according to the board's decision (if any)

28. Prepare statutory drawing to accompany the plan and making Ministerial Regulation's plan.

29. Send Ministerial Regulation's plan attachment without road names given; A, B, etc. and Title in Radex in one sheet and the blueprint with road names given including Title in one sheet to Comprehensive Planning Div.

30. Send Ministerial Regulation's plan attachment including the first draft of accompanying plan's description to Legal Div. in one set for approval.

31. Coordinate with Legal Div. to rectify the accompanying plan.

32. Send Ministerial Regulation's plan attachment to Director of Div. and Director-General to sign, arrange documents to accompany plan and Ministerial Regulation's map attachment to be sent to Legal Div. in 30 sets.

33. Advisory Committee on Ministerial Regulation's Conference.

34. Coordinate and revise description accompanying the plan by law and send the map to Legal Division in 70 sets for Ministry of Interior's Conference.

35. Ministry of Interior's Conference.

36. Send 100 sets of the plan attachment of Ministerial Regulation Legal Div. for the Juridical Council's approval.

37. The Juridical Council's Conference.

38. Revise the documents, and send 6 sets to Legal Div. to present to the Juridical Council.

39. Send 70 sets of Ministerial Regulation's plan attachment that have been approved by the Juridical Council to Legal Div. for the Juridical Council's Conference once again.

40. Prepare the original Ministerial Regulation's map attachment (color separated) for the Office of Secretary to send to printing house.

41. Examine the printing of Ministerial Regulation's Map attachment by coordinating with printing house.

42. Check the printing of Ministerial Regulation's Map attachment received in 10,000 sheets.

43. Prepare documents for local exhibition and seminar.

44. Hold a planning seminar at the planning area or at the province of the planning area.

APPENDIX 4

FUNCTIONS AND CAPABILITY OF TRAFICOM 241 CLASSIFICATION RECORDER[1]

The TrafiCOM 241 is a microprocessor based traffic classifier with extensive capability for traffic surveillance. It is completely self contained and includes all display and keyboard facilities for configuring, program setup and adjustment, loop detector tuning, operation and monitoring, and for outputting to a printer or computer at the site or elsewhere. In addition, it has facilities for accepting a plug-in data module that can be used to collect the data for later processing at the central station.

The recorder has built-in facilities for traffic counting and classification by lane, speed, length, vehicle type, headway, and gap, any three at a time. It has a very unique system for arranging this data for storage and printout which is based on assigning the different classification types to columns, rows and sections in the printout. Data memory capacity is 32K, expandable to 64K, which along with a 10 ampere hour battery provide extensive memory storage, both quantity-wise and time-wise.

The 241 recorder includes the following input capability:
2 air switches standard - 4 on special order
4 to 8 internal loop detectors, optional
1 to 8 external loop detectors, optional
8 piezo cable amplifiers, optional

The loop detectors are serviced by two separate connectors on the side of the housing. When piezo sensors are used, one or two additional connectors are used, mounted above the others. The latter connectors are also used for the external loop detector outputs. Two air switch tubes are permanently mounted next to the connectors. Space is available for mounting two more immediately above. See drawings at the back of this manual.

The 241 has one connector for serial outputs for driving an Oki or Epson type printer or a computer. The same connector receives serial inputs and outputs for telemetry and other applications.

With all of the above capabilities, the 241 can perform the following:

- Count traffic in up to eight lanes with loops or piezos
- Monitor speed in up to four lanes with loops or piezos
- Monitor vehicle type in up to four lanes with loops and piezos or piezos alone
- Monitor headway and gap in up to eight lanes with loops or piezos
- Count traffic in two to four directions with tubes, or monitor speed in one to two lanes with tubes
- Output all collected data in operator controllable format to a printer or other output device
- Monitor any three of speed, type, length, gap, headway, or lane count simultaneously.

[1] Based on TrafficCOMP 241 Classification Recorder Operating Manual

Major Specification of TrafiCOMP 241

Item	Features
Size & Weight	6.5x9.5x10 inches (16.5x24.1x25.4 cm) 15 lbs. (6.8kg)including batteries and detectors
Functions	Volume counting and speed, length, vehicle type, headway, or gap classification. Any three classifications may be related and recorded simultaneously or any two related to lane or direction and recorded.
Power Source	one 10 ampere hour 6 volt battery
Temperature	-40 F to 158 F (-40 C to 70 C)
Maximum Count Rate	20 counts per second, 150 vehicles per minute, 9,999 vehicles per count period
Memory Storage	32K bytes standard, 64K optional
Recorder Connectors (some optional)	connector for printer or computer connector for 4 and 8 loop detectors connectors for up to 8 external detectors or up to 8 piezo sensors 2 - air switch nipples for roadtubes (4 on special order)
Controls and Displays	1-16 key keyboard 1-32 character alpha numeric LCD display
Output	Baud rate user selectable 300 to 9600

[1]

[1] TrafiCOMP 241 Operating Manual

APPENDIX 5

BRIEF EXPLANATION ON 'MOTORS' TRANSPORTATION PLANNING SOFTWARE

'MOTORS' is an integrated suite of computer programs for transport planning. It is suitable for a wide range of transport modelling applications. It has been developed by Steer Davies & Gleave as part of their transport modelling capability and has been used by them and other consultancies and governments, on projects both in the UK and around the world. In Thailand, PADECO, the authorized sole distributor/developer, has developed a version of MOTORS with considerable modifications to suit local conditions and has applied to a number of projects in Thailand. MOTORS includes a matrix estimation module which can be used to update trip matrices using traffic counts or public transport passenger counts.

FEATURES

- o Comprehensive - programs cover all phases of highway and public transport analysis including trip generation, distribution, modal split, assignment, and network evaluation.
- o Easy to Use - interactive operation using English language commands; no specialised programming or systems knowledge is required; comprehensive, easy-to-read documentation.
- o Compatible - With spreadsheets and other packages eg Lotus 123 and dBase III.
- o Large Study Capabilities - up to 400 zones, 2000 nodes and 6000 links and 295 public transport routes.
- o Tried and Tested - the MOTORS package has been used successfully on numerous studies in the UK, Europe, North and South America, India and the Far East.
- o Hardware Requirements - runs on IBM PC XT/AT and all compatible microcomputers.
- o Low Price - Basic MOTORS is 1,500 (excluding VAT)

SOFTWARE

For convenience, the programs in the MOTORS package are grouped into five categories:

Demand Models

Category Analysis I	:	calculates trip rates from survey data
Category Analysis II	:	produces total zonal trip productions and attractions
Trip End Calculator	:	merges files of trip productions and attractions
Gravity Model	:	distributes trips between pairs of zones based on a gravity model
Furness/Fratar Model	:	applies growth factors to a trip matrix
Trip Length Table	:	produces a trip "impedance" distribution table
Modal Split	:	diversion curve modal split for trip matrices

Highway Models

Network Building	:	checks records and builds a network from link data
Matrix Estimation	:	estimates the most likely trip matrix from network traffic counts
Tree Building	:	finds minimum cost trees through a network
Tree Skim Matrix Building	:	Skims from the trees
Assignment I	:	loads trips using an all-or-nothing assignment
Assignment II	:	loads trips using Burrell assignment
Assignment III	:	loads trips using an incremental capacity restrained technique
Assignment IV	:	loads trips using an equilibrium assignment technique
Network Evaluation	:	produces statistics summarizing a trip assignment

Public Transport Models

Network Building	:	builds a public transport network from line and route data
Public Transport Matrix Estimation	:	estimates most likely public transport trip matrix from passenger counts

Path Building	:	finds minimum cost paths through a public transport network
Path Skim	:	skims an inter zonal "time" matrix from the paths
Route Assignment	:	loads trips to public transport paths
Link Assignment	:	loads trips to public transport links

Matrix Programs

Matrix Building	:	reads trip survey records and builds a trip matrix
Matrix Manipulation	:	adds together several matrices
Matrix Formatter	:	prints stored matrices
Zone Compressor	:	compresses zonal trip matrices to district level
Zone Splitter	:	expands a trip matrix from district level to zone level

Utility Programs

Read Headers	:	displays header information from program produced files
Print Network Files	:	prints network files (including loaded network)

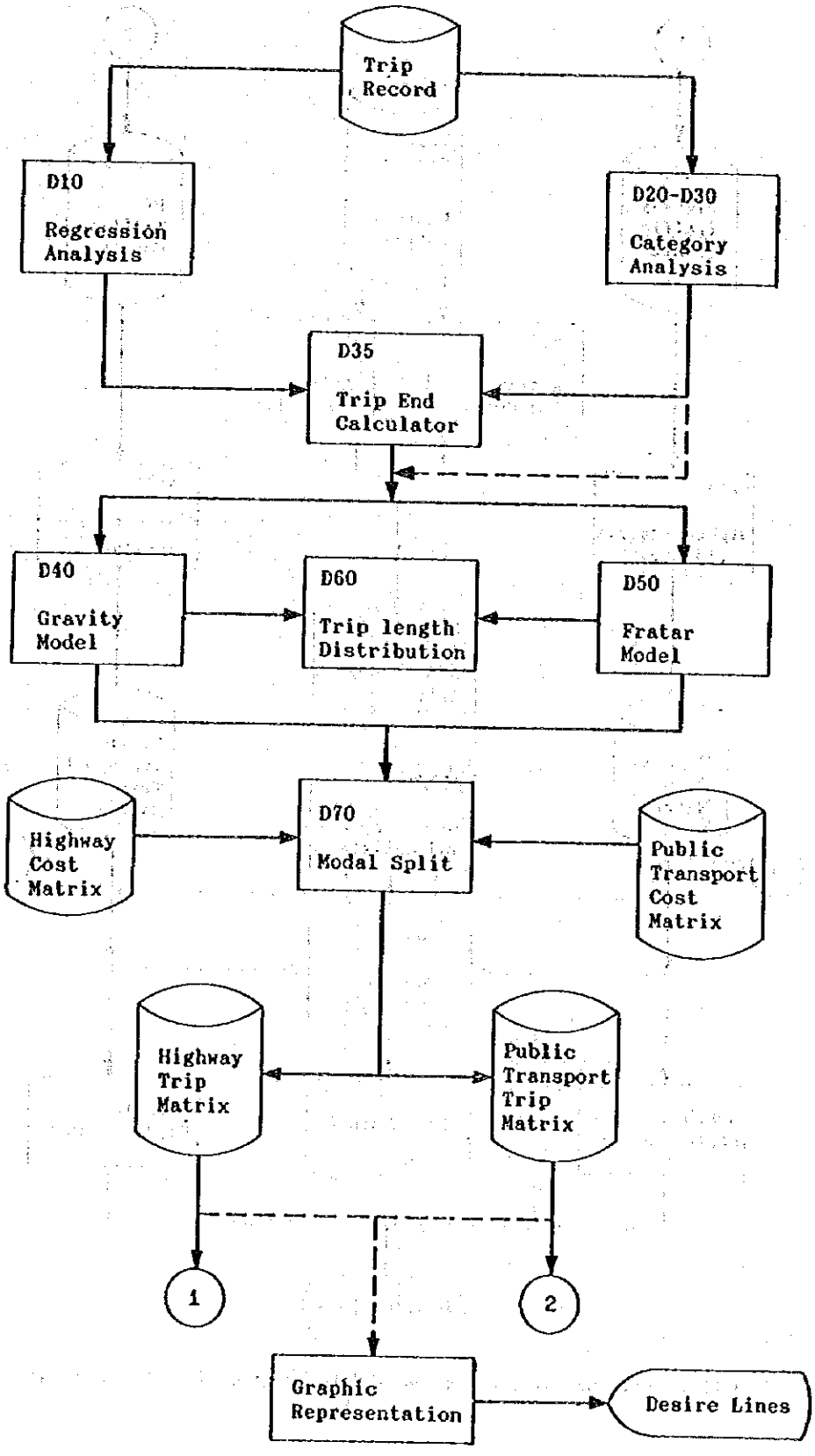
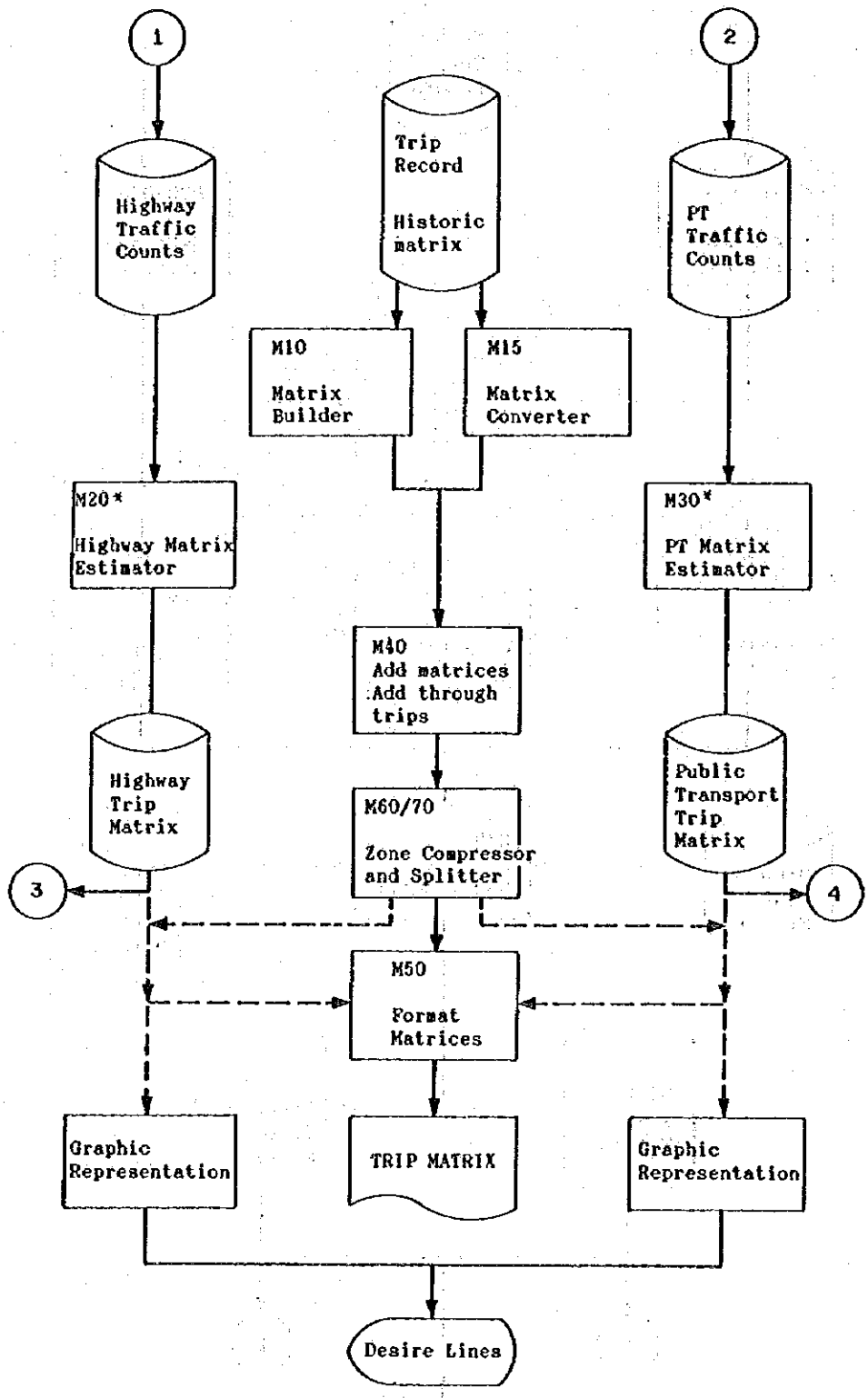


Fig. A5-1 Demand Models



* these programs also use network data as given from the P modules

Fig. A5-2 Matrix Models

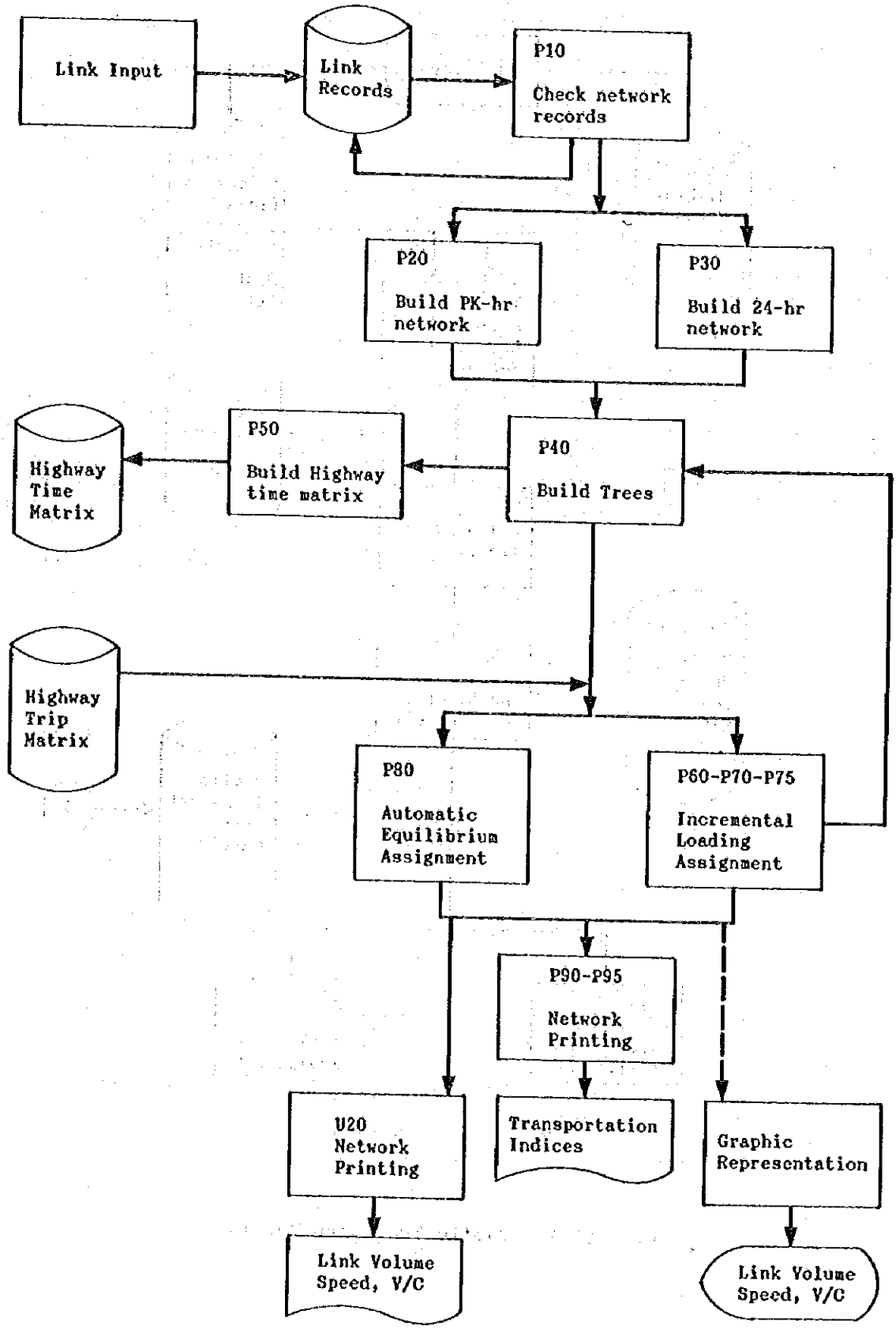


Fig. A5-3 Private Transport Models

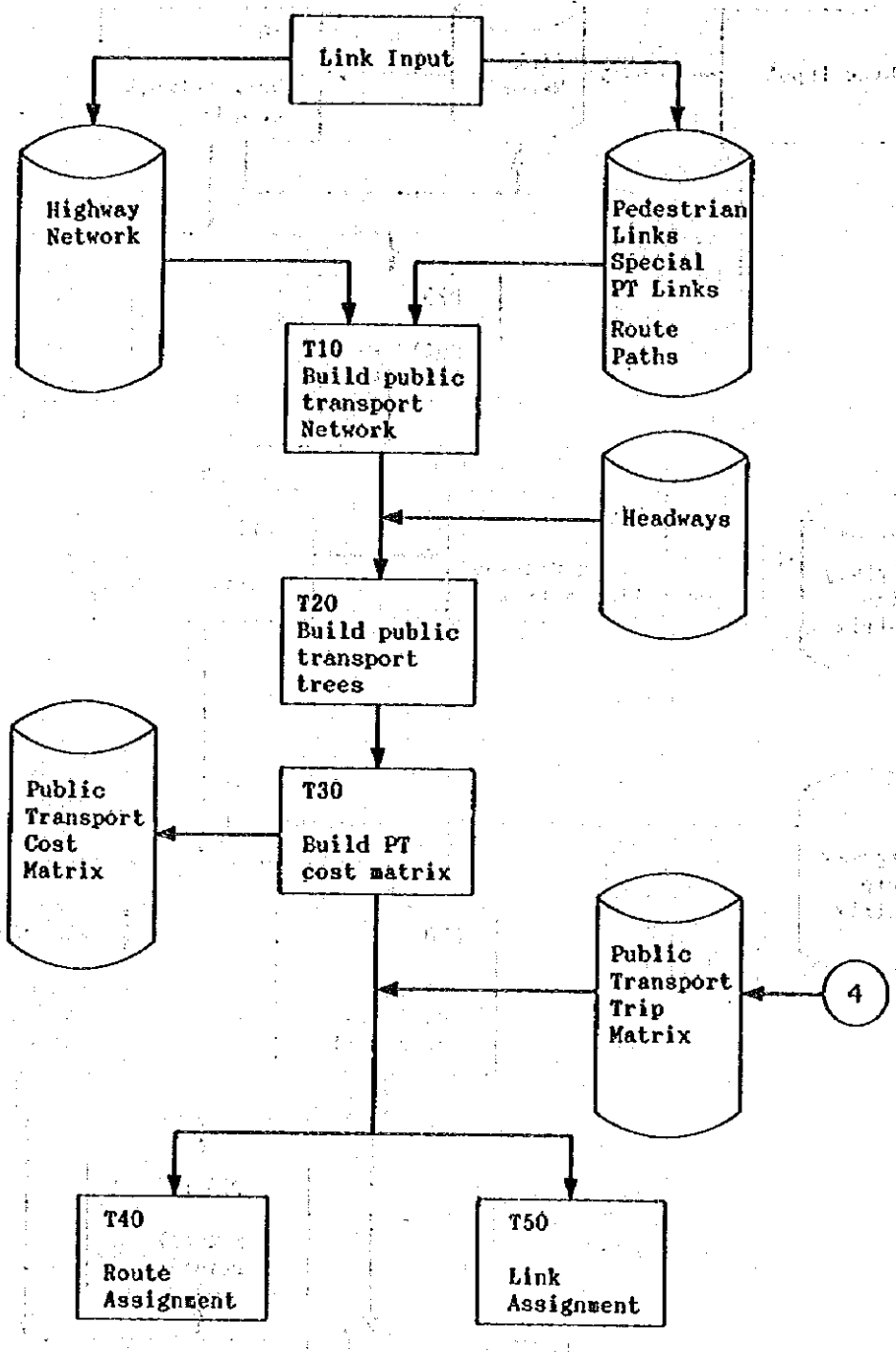


Fig. A5-4 Public Transport Models

APPENDIX 6

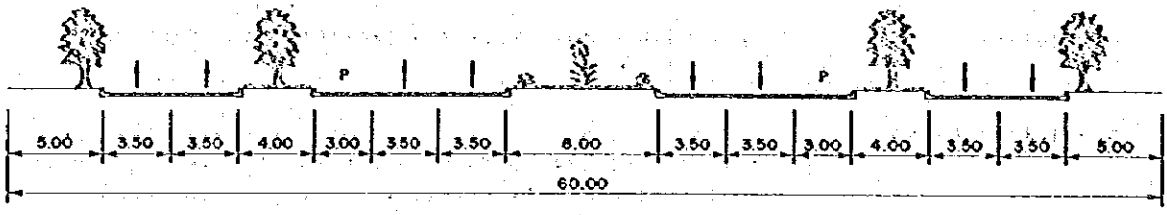
GENERAL CLASSIFICATION OF ROAD TYPE IN THAILAND

CATEGORIES	RESPONSIBLE AUTHORITY AND CHARACTERISTICS OR ROADS
Special Highways	DOH - These are the roads with especially high standards of design, particularly with respect to access to the carriage way and control of roadside activity and development. At present, there are 2 highways in this category : 1. Highway no. 35 : Thonburi - Pak Thoa 2. Highway no. 338 : Bangkok Noi - Nakhonchaisri
National Highways	DOH - Roads which are of primary importance to the economic development, administration and defence of the Kingdom are designated as National Highways.
Provincial Highways	DOH - Roads in this category are of secondary importance for national development but essential to efficient provincial administration, linking Amphoes (Districts) and other important centers of areas to provincial capitals.
Rural Roads	Changwat (provincial authority) Administrative Organizations - These are minor roads of local significance only.
Municipal Roads	Municipality - All major road in areas governed by a municipal authority such as cities, and towns.
Road in Small Municipal Areas	Municipality - Roads in small municipal areas governed by municipal authorities such as districts, and sub-districts.
Concession Highways	DOH - A special category of road, little used, in which a developper contracts with the Government to provide a road for public use on which he has, for a specified period, sole transportation concession of agreed rates. At the expiration of the contract the facility becomes public property.

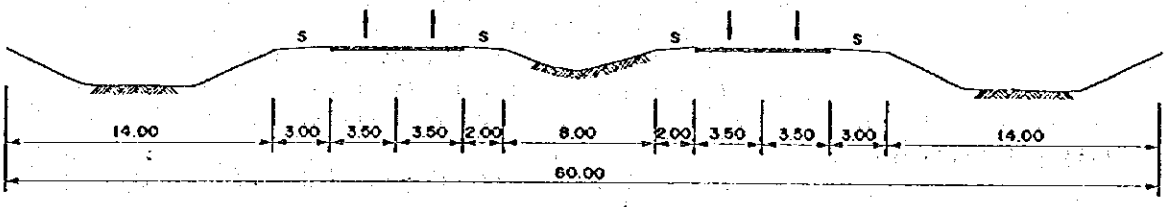
APPENDIX 7

STANDARD CROSS SECTIONS USED IN GENERAL PLAN

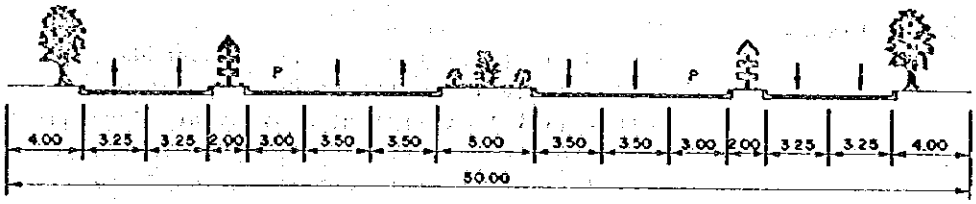
1. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 60.00 M.)



2. BY-PASS (WIDTH OF RIGHT OF WAY 60.00 M.)

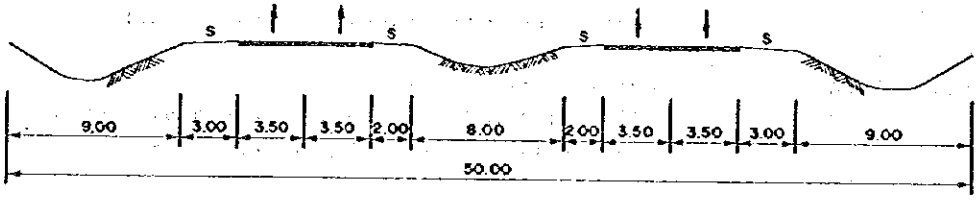


3. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 50.00 M.)

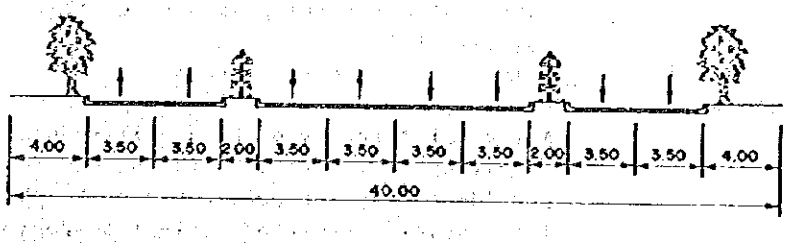


NOTE: P = EMERGENCY PARKING LANE
S = SHOULDER

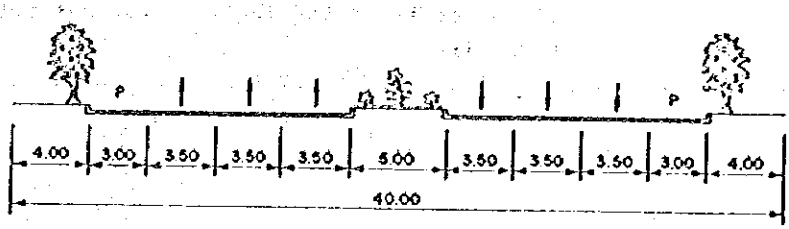
4. BY-PASS (WIDTH OF RIGHT OF WAY 50.00 M.)



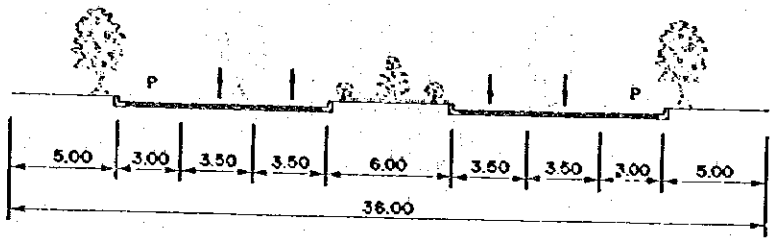
5. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 40.00 M.)



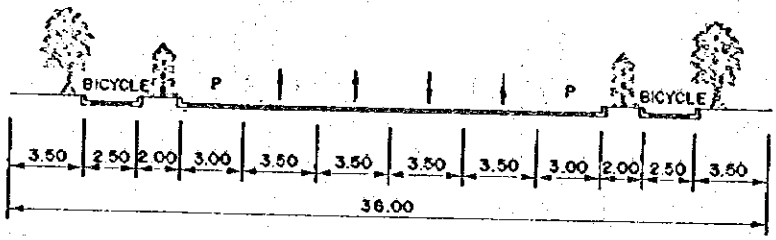
6. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 40.00 M.)



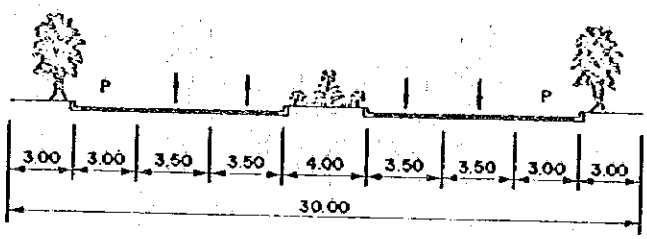
7. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 36.00 M.)



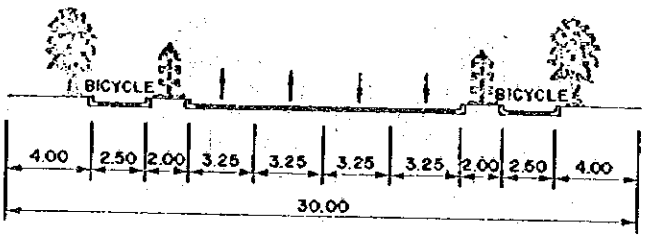
8. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 36.00 M.)



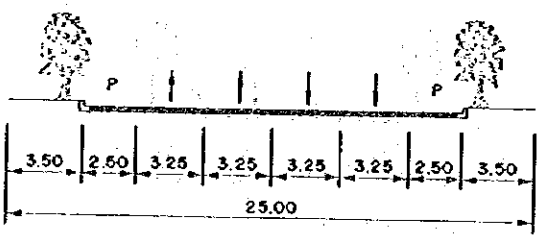
9. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 30.00 M.)



10. ARTERIAL STREET (WIDTH OF RIGHT OF WAY 30.00 M.)



11. MAJOR ROADS (WIDTH OF RIGHT OF WAY 25.00 M.)



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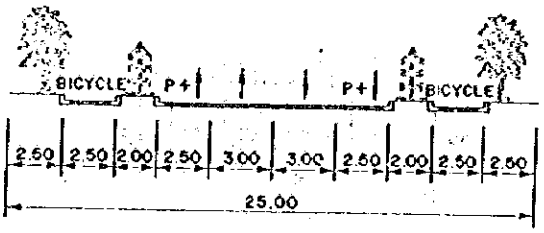
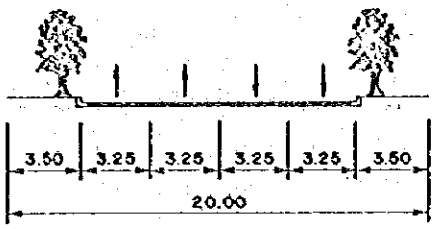


13. MAJOR ROADS (WIDTH OF RIGHT OF WAY 20.00 M.)



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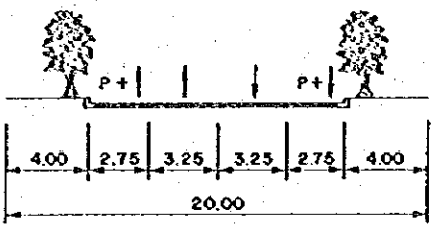
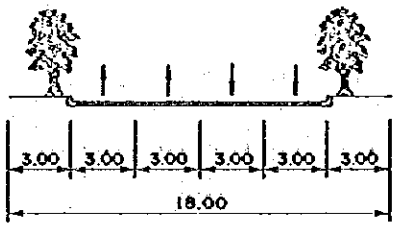
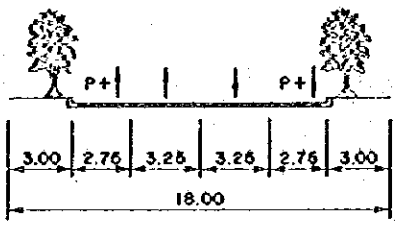


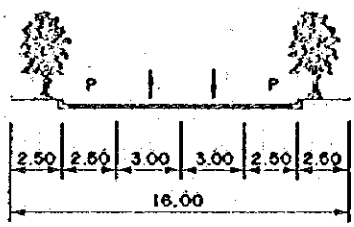
15. MAJOR ROADS (WIDTH OF RIGHT OF WAY 18.00 M.)



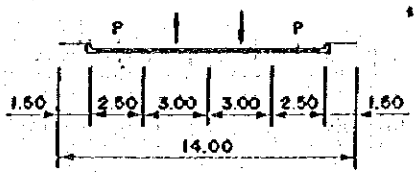
16. MAJOR ROADS (WIDTH OF RIGHT OF WAY 18.00 M.)



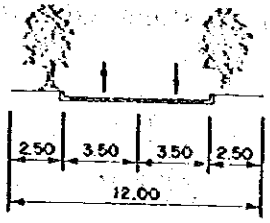
17. MINOR STREET DISTRIBUTIVE (WIDTH OF RIGHT OF WAY 16.00 M.)



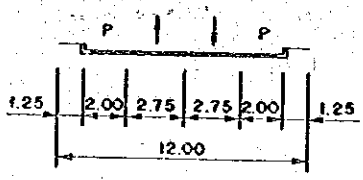
18. MINOR STREET DISTRIBUTIVE (WIDTH OF RIGHT OF WAY 14.00 M.)



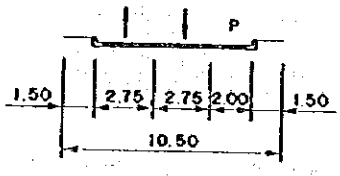
19. ACCESS ROADS (WIDTH OF RIGHT OF WAY 12.00 M.)



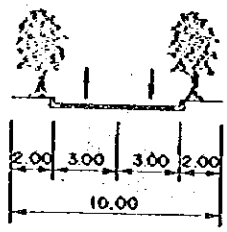
20. ACCESS ROADS (WIDTH OF RIGHT OF WAY 12.00 M.)



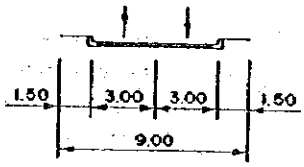
21. SOI (RESIDENTIAL ROADS) WIDTH OF RIGHT OF WAY 10.50 M.



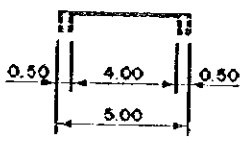
22. SOI (RESIDENTIAL ROADS) WIDTH OF RIGHT OF WAY 10.00 M.



23. SOI (RESIDENTIAL ROADS) WIDTH OF RIGHT OF WAY 9.00 M.

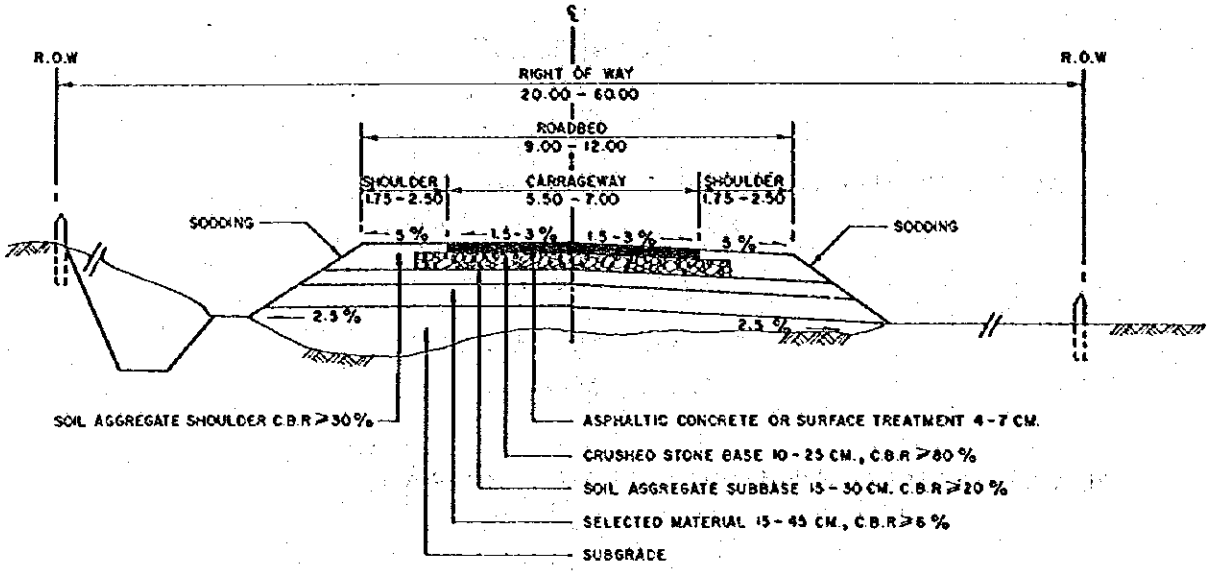


24. SOI (ALLEY ROADS) WIDTH OF RIGHT OF WAY 5.00 M.



APPENDIX 8

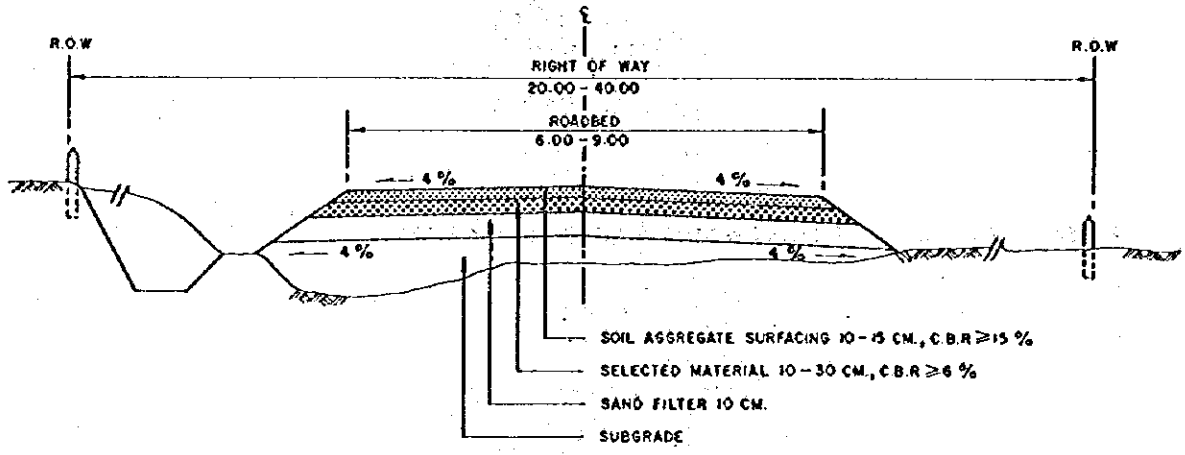
DOH ROAD STANDARD CROSS-SECTION



REMARKS THE ROADBED MAY BE CONSTRUCTED ALONG THE CENTER LINE OF THE RIGHT OF WAY OR ALONG THE EITHER SIDE, PROVIDING TWO MORE LANES CONSTRUCTION IN THE FUTURE.

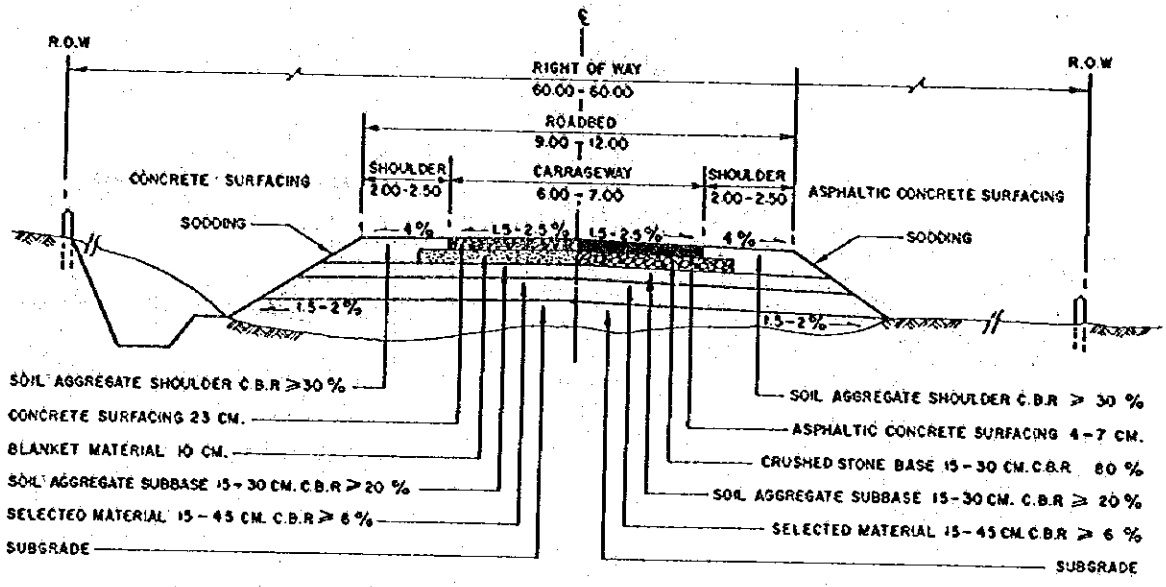
TYPICAL PAVEMENT STRUCTURE FOR FEEDER ROADS OR PROVINCIAL ROADS (RURAL)

DIMENSION IN METRE



TYPICAL PAVEMENT STRUCTURE FOR FEEDER ROADS OR PROVINCIAL ROADS WITH SOIL AGGREGATE SURFACING

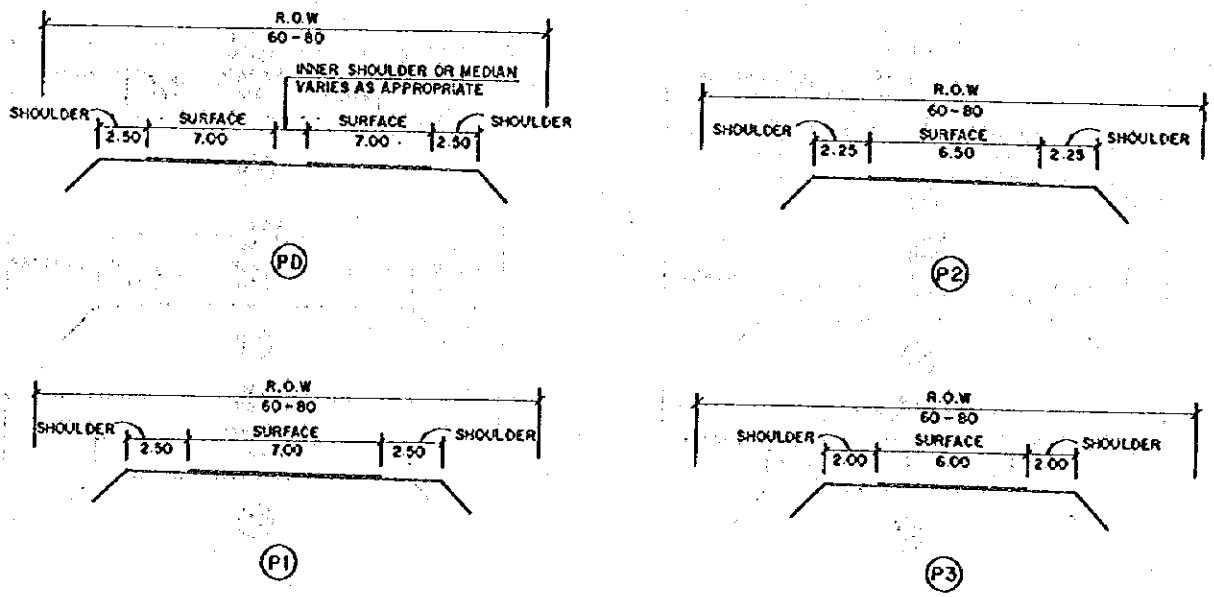
DIMENSION IN METRE



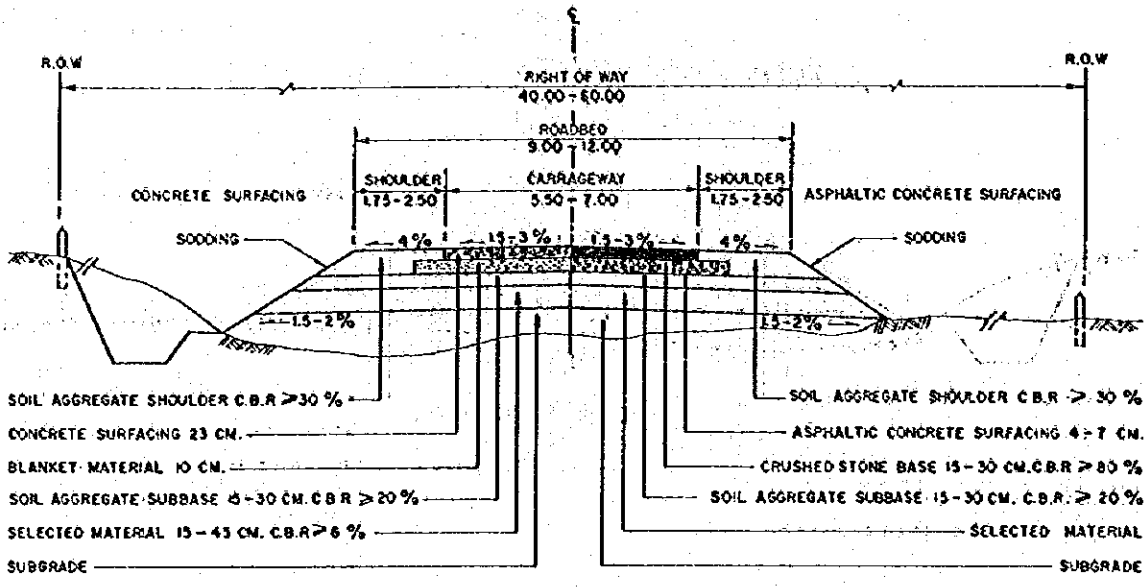
REMARKS : THE ROADBED MAY BE CONSTRUCTED ALONG THE CENTER LINE OF THE RIGHT OF WAY OR ALONG THE EITHER SIDE, PROVIDING TWO MORE LANES CONSTRUCTION IN THE FUTURE.

TYPICAL PAVEMENT STRUCTURE FOR PRIMARY HIGHWAYS (RURAL)

DIMENSION IN METRE



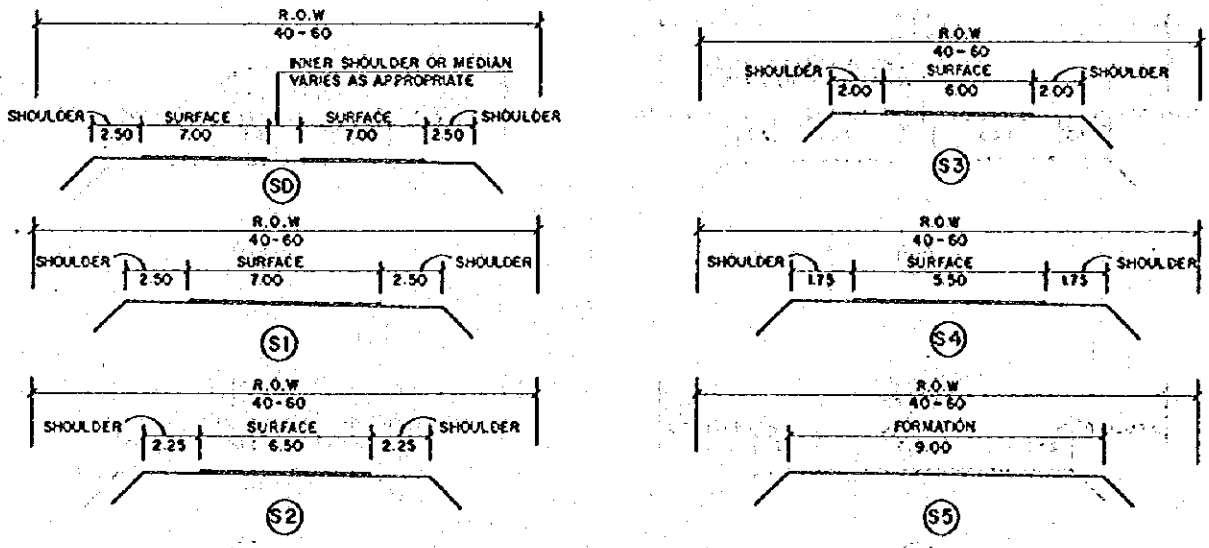
TYPICAL CROSS - SECTIONS FOR PRIMARY HIGHWAYS (RURAL)



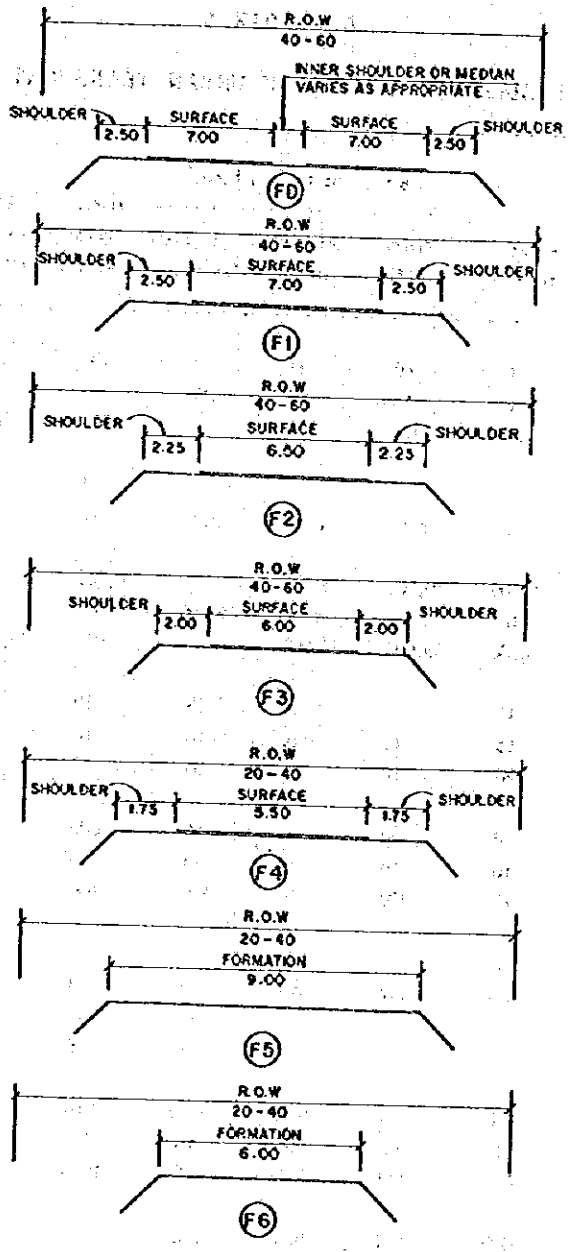
REMARKS : THE ROADBED MAY BE CONSTRUCTED ALONG THE CENTER LINE OF THE RIGHT OF WAY OR ALONG THE EITHER SIDE, PROVIDING TWO MORE LANES CONSTRUCTION IN THE FUTURE.

TYPICAL PAVEMENT STRUCTURE FOR SECONDARY HIGHWAYS (RURAL)

DIMENSION IN METRE



TYPICAL CROSS - SECTIONS FOR SECONDARY HIGHWAYS (RURAL)



TYPICAL CROSS - SECTIONS FOR PROVINCIAL ROADS (RURAL)

APPENDIX 9

SYSTEM CHARACTERISTICS OF URBAN TRANSPORT MODES

Characteristic	Private cars	Para-transit	Buses and trolley buses[a]: Mixed traffic	Buses and trolley buses[a]: Bus-only lanes	Buses and trolley buses[a]: Segregated busways	Trams (mixed traffic)	LRT (surface exclusive)	Rapid rail: Surface	Rapid rail: Elevated	Rapid rail: Underground
Vehicle capacity	4 to 5 (occupancy 1 to 2)	4 to 20	80 to 120	80 to 120	120	100 to 200	200 to 300	300 to 375	300 to 375	300 to 375
Vehicles per train	n.a.	n.a.	n.a.	n.a.	n.a.	1 to 2	3 to 6	4 to 10	4 to 10	4 to 10
Lane/track capacity (passengers per hour)[b]	500 to 800	1,000 to 4,000	10,000 to 15,000	15,000 to 20,000	30,000	6,000 to 12,000	20,000 to 36,000	50,000	70,000	70,000
Journey speed with stops (km per hour)[c]	15 to 25	12 to 20	10 to 12	15 to 18	15 to 30	10 to 12	15 to 25	30 to 35	30 to 35	30 to 35
Capital cost (US$1,000 per vehicle)	5 to 10	2 to 25	50 to 100	50 to 100	50 to 130	300 to 600	800	1,000	1,000	1,000
Cost of complete system minus vehicles (US$ million per km)	n.a.	n.a.	n.a.	n.a.	2 to 7	3 to 5	6 to 10	20 to 25	45 to 55	85 to 105
Total cost including interest (US$ per passenger km)	0.12 to 0.24	0.02 to 0.10	0.02 to 0.05	0.02 to 0.05	0.05 to 0.08	0.03 to 0.10	0.10 to 0.15	0.10 to 0.15	0.12 to 0.20	0.15 to 0.25
Cost recovery: fare for 5 km (US$)	0.60 to 1.20	0.10 to 0.50	0.10 to 0.25	0.10 to 0.25	0.25 to 0.40	0.15 to 0.50	0.50 to 0.75	0.50 to 0.75	0.60 to 1.00	0.75 to 1.25

n.a. Not applicable.

Note: Cost and performance figures assume high levels of utilization and patronage and efficient operation.

a. For trolley buses add approximately 20 percent to the bus costs.

b. Lane/track capacity is the maximum number of passengers that can be carried on a single lane or track past a point during one hour.

c. Journey speed is the average overall speed, with loading and unloading time at stops and stations taken into account; journey speed in mixed traffic may be substantially less in congested conditions.

(Source: World Bank (1986), Urban Transport, A World Bank Policy Study, The International Bank for Reconstruction and Development/The World Bank, Washington: World Bank.)

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