2-2 Mode-wise Framework of Investment

The investment in Transport Sector in Pakistan can be divided into three categories, i.e., public, semi-public and private sectors. The federal development budget allocated to the public organizations and corporations is known by the name of ADP. The development budget of semi-public corporations is compiled outside the ADP. The above two combined fall under the name of the Public Sector Development Programme (PSDP).

So far as Transport is concerned private sector is at present virtually limited to Road Transport.

(1) Modal Allocation of ADP Budget

As is already mentioned, in assigning the inland traffic to Road and Railway the study team assumes two cases, namely Case A and Case B. Besides, the team considers two alternatives regarding the overall framework of ADP budget, i.e., Standard and 25% Increase. As a result four combinations are given rise to, for each of which mode-wise investment frameworks are to be determined. When the two future periods are treated separately the number of combinations reaches eight.

In allocating ADP budget to respective modes the study team employed the following methodology.

Firstly, the allocations to Road Transport, Port and Aviation were determined by calculating the traffic to be newly generated during a given period in accordance with demand forecast, converting it into facility requirement (replacement need is also considered) and finally rendering it into investment.

Secondly, what remained after they were subtracted were divided between Road and Railway.

In Case A the division was done in conformity to the historical pattern of forty to Road and thirty to Railway. In Case B where a higher priority is accorded to the development of Railway the comparative weight of thirty five was given to it, the weight of Road being left unchanged.

Eventually in Case A - 1 (1) (Case A, Standard, Sixth Plan Period) 12,623 MRs (million rupees) (40.6%) have been allocated to Road, 2,937 MRs (9.4%) to Road Transport, 9,467 MRs (30.4%) to

Railway, 3,426 MRs (11.0%) to Port and 2,677 MRs (8.6%) to Aviation. (Refer to Table 2-2-1.) In Case A - 1 (2) (Case A, Standard, Period up to 1999-2000) the allocation resulted in 62,288 MRs (47.3%) for Road, 9,840 MRs (7.5%) for Road Transport, 46,716 MRs (35.5%) for Railway, 6,431 MRs (4.9%) for Port and 6,448 MRs (4.9%) for Aviation. (Refer to Table 2-2-2.)

As regard the cases of 25% Increase in connection with the above, see Table 2-2-3 and Table 2-2-4.

In Case B - 1 (1) (Case B, Standard, Sixth Plan Period) ADP has been divided in such a way that 11,877 MRs (38.1%) is given to Road, 2,758 MRs (8.9%) to Road Transport, 10,393 MRs (33.4%) to Railway, 3,426 MRs (11.0%) to Port and 2,677 MRs (8.6%) to Aviation. (Refer to Table 2-2-5.) And in Case B - 1 (2) (Case B, Standard, Period up to 1999-2000) 58,610 MRs (44.5%), 8,951 MRs (6.8%), 51,284 MRs (38.9%), 6,431 MRs (4.9%) and 6,448 MRs (4.9%) have been respectively allotted to Road, Road Transport, Railway, Port and Aviation. (Refer to Table 2-2-6.)

As for the cases of 25% Increase in connection with the above see Table 2-2-7 and Table 2-2-8.

It is to be remembered that the extent of road networks subjected to this study is limited, comprising 41 percent of the entire systems. In addition, the road projects costing more than ten million rupees are taken up, the rest being excluded from the study. It has been found that upon the above premise the amount of the expenditure on Road coming under the study constitutes about 50.7 percent of the entire allocation to Road.

Thus, in Case A - 1 (1) 6,400 MRs have been earmarked for the relevant road projects, and in Case A - 1 (2) 31,583 MRs are assigned to them. Likewise, in Case B - 1 (1) the related allocation is calculated at 6,022 MRs, and in Case B - 1 (2) it comes to 29,718 MRs.

As regard the cases of 25% Increase you simply multiply the above figures by 1.25.

It is to be noted that the above modal allocations are of a tentative nature and will be revised more or less when socio-economically optimal intra/inter modal splittings are arrived at.

(2) Development Expenditure on Semi-Public Sector

At present KPT, PNSC and PIA belong under the semi-public sector.

The investment requirements for the respective corporations in future were determined by calculating the traffic to be newly generated in a planned period in accordance with demand forecast, converting it into facility requirement (replacement need is also considered) and finally rendering it into financial terms.

The result is that in KPT 1,282 MRs and 2,734 MRs will be needed in the sixth plan period and the period up to 1999-2000 respectively excluding the expenditure on container berths. As for PNSC 5,152 MRs and 11,907 MRs will be required in the two periods respectively if it is to follow the future growth of sea trade. In PIA the investments amounting to 10,291 MRs and 29,557 MRs will be necessary for the respective periods if it is to catch up with the growth of aviation demand. (Refer to Table 2-2-1 and Table 2-2-2.)

In case of the expenditure on semi-public sector the alternative of 25% Increase is not assumed because it is outside ADP.

It is to be noted that the above estimation is of a tentative nature and will be revised more or less at the final stage.

It seems that the investment plan for the Sixth Plan period is conservative in some of the corporations. Under the circumstances the possibility that a certain difference will be created between the growth of corporations and that of demand may not be dismissed even if the raising of managerial and operational efficiencies is to be duly considered.

(3) Investment in Private Sector

The amount of private investment in Road Transport has been determined by subtracting the public portion from the entire investment requirement for the sub-sector.

Obviously between Case A and Case B it takes a different value. In the former case it is calculated at 25, 194 MRs for the sixth plan period and 88,778 MRs for the period up to 1999-2000. And in the latter (where Railway is given a higher priority) it is reduced to 22,345 MRs and 75,058 MRs for the respective periods. (Refer to Table 2-2-1, 2-2-2, 2-2-5 and 2-2-6.)

As regards the cases of 25% Increase see Table 2-2-3, 2-2-4, 2-2-7 and 2-2-8.

(4) Summary

The mode-wise investments incorporating both the public and private sectors are in Case A - 1 (1) (Case A, Standard, Sixth Plan Period) summarized as 12,623 MRs (17.1%) for Road, 28,133 MRs (38.5%) for Road Transport, 9,467 MRs (13.0%) for Railway, 4,708 MRs (6.4%) for Port, 5,152 MRs (7.1%) for Shipping and 12,968 MRs (17.8%) for Aviation. (Refer to Table 2-2-1.) In Case A - 1 (2) (Case A, Standard, Succeeding Period) they are 62,288 MRs (23.5%), 98,618 MRs (37.3%), 46,716 MRs (17.6%), 9,165 MRs (3.5%), 11,907 MRs (4.5%) and 36,005 MRs (13.6%) in the above order. (Refer to Table 2-2-2.)

Likewise, in Case B - 1 (1) (Case B, Standard, Sixth Plan Period) they are 11,871 MRs (16.9%) for Road, 25,103 MRs (35.8%) for Road Transport, 10,393 MRs (14.8%) for Railway, 4,708 MRs (6.7%) for Port, 5,152 MRs (7.3%) for Shipping and 12,968 MRs (18.5%) for Aviation. (Refer to Table 2-2-5.) And in Case B - 1 (2) (Case B, Standard, Period up to 1999-2000) they are 58,610 MRs (23.4%), 84,009 MRs (33.5%), 51,284 MRs (20.4%), 9,165 MRs (3.7%), 11,907 MRs (4.7%) and 36,005 MRs (14.3%) in the above order. (Refer to Table 2-2-6.) As regards the cases of 25% Increase see Table 2-2-3, 2-2-4, 2-2-7 and 2-2-8.

Table 2-2-1 SUMMARY TABLE 1-1(1)

< CASE A-1 (1) >
[BASIC], [STANDARD]
[PERIOD 1983-84 TO 1987-88]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC.	1010	0	1010	0	1010	0	1010
THE REST	5302	0	5302	0	5302	0	5302
PRVNCIAL	0	6311	6311	0	6311	0	6311
ROAD T'P	2045	892	2937	0	2937	25196	28133
ROAD TTL	8357	7203	15560	0	15560	25196	40756
RAILWAY	9467	0	9467	0	9467	0	9467
CT.BRTH	1995	0	1995	0	1995	0	1995
THE REST	1431	0	1431	0	1431	0	1431
PORT TTL	3426	0	3426	1282	4708	0	4708
SHIPPING	0	0	0	5152	5152	0	5152
AVIATION	2677	0	2677	10291	12968	0	12968
G.TOTAL	23927	7203	31130	16725	47855	25196	73051

NOTES:

BASIC = EXTENSION OF HISTORICAL TRENDS
STANDARD = STANDARD FRAMEWORK OF ADP BUDGET

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-2 SUMMARY TABLE 1-1<2>

< CASE A-1 (2) >
[BASIC], [STANDARD]
[PERIOD 1988-89 TO 1999-00]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	4983	0	4983	0	4983	0	4983
THE REST	26161	0	26161	0	26161	0	26161
PRVNCIAL	0	31144	31144	0	31144	0	31144
ROAD T'P	7038	2802	9840	0	9840	88778	98618
ROAD TTL	38182	33946	72128	0	72128	88778	160906
RAILWAY	46716	0	46716	0	46716	0	46716
CT.BRTH	3561	0	3561	0	3561	0	3561
THE REST	2870	0	2870	0	2870	0	2870
PORT TTL	6431	0	6431	2734	9165	0	9165
SHIPPING	0	0	0	11907	11907	0	11907
AVIATION	6448	0	6448	29557	36005	0	36005
G.TOTAL	97777	33946	131723	44198	175921	88778	264699

NOTES:

BASIC = EXTENSION OF HISTORICAL TRENDS
STANDARD = STANDARD FRAMEWORK OF ADP BUDGET

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-3 SUMMARY TABLE 1-2(1)

< CASE A-2 (1) >
[BASIC], [25 % INCREASE]
[PERIOD 1983-84 TO 1987-88]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	1262	0	1262	0	1262	0	1262
THE REST	6627	0	6627	0	6627	0	6627
PRVNCIAL	0	7889	7889	0	7889	0	7889
ROAD T'P	2556	1115	3671	0	3671	24461	28132
ROAD TTL	10445	9004	19449	0	19449	24461	43910
RAILWAY	11834	0	11834	0	11834	0	11834
CT.BRTH	1995	0	1995	0	1995	0	1995
THE REST	2288	0	2288	0	2288	0	2288
PORT TTL	4283	0	4283	1282	5565	0	5565
SHIPPING	0	0	0	5152	5152	0	5152
AVIATION	3346	0	3346	10291	13637	0	13637
G.TOTAL	29908	9004	38912	16725	55637	24461	80098

NOTES:

BASIC = EXTENSION OF HISTORICAL TRENDS
25 % INCREASE = ENLARGING ADP FRAMEWORK BY 25 %

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-4 SUMMARY TABLE 1-2(2)

< CASE A-2 (2) >
[BASIC], [25 % INCREASE]
[PERIOD 1988-89 TO 1999-00]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	6229	0	6229	0	6229	0	6229
THE REST	32701	0	32701	0	32701	0	32701
PRVNCIAL	0	38930	38930	0	38930	0	38930
ROAD T'P	8798	3503	12301	0	12301	86318	98619
ROAD TTL	47728	42433	90161	0	90161	86318	176479
RAILWAY	58395	0	58395	0	58395	0	58395
CT.BRTH	3561	0	3561	0	3561	0	3561
THE REST	4478	0	4478	0	4478	0	4478
PORT TTL	8039	0	8039	2734	10773	0	10773
SHIPPING	0	0	0	11907	11907	0	11907
AVIATION	8060	0	8060	29557	37617	0	37617
G.TOTAL	122222	42433	164655	44198	208853	86318	295171

NOTES:

BASIC = EXTENSION OF HISTORICAL TRENDS
25 % INCREASE = ENLARGING ADP FRAMEWORK BY 25 %

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-5

SUMMARY TABLE 2-1(1)

< CASE B-1(1) >
[SIMULATION], [STANDARD]
[PERIOD 1983-84 TO 1987-88]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	950	0	950	0	950	0	950
THE REST	4988	0	4988	0	4988	0	4988
PRVNCIAL	0	5939	5939	0	5939	0	5939
ROAD T'P	1864	894	2758	0	2758	22345	25103
ROAD TTL	7802	6833	14635	0	14635	22345	36980
RAILWAY	10393	0	10393	0	10393	0	10393
CT.BRTH	1995	0	1995	0	1995	0	1995
THE REST	1431	0	1431	0	1431	0	1431
PORT TTL	3426	0	3426	1282	4708	0	4708
SHIPPING	0	0	0	5152	5152	0	5152
AVIATION	2677	0	2677	10291	12968	0	12968
G.TOTAL	24298	6833	31131	16725	47856	22345	70201

NOTES:

SIMULATION = GIVING HIGHER PRIORITY TO RAILWAY
STANDARD = STANDARD FRAMEWORK OF ADP BUDGET

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-6 SUMMARY TABLE 2-1(2)

< CASE B-1 (2) >
[SIMULATION], [STANDARD]
[PERIOD 1988-89 TO 1999-00]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	4689	0	4689	0	4689	0	4689
THE REST	24616	0	24616	0	24616	0	24616
PRVNCIAL	0	29305	29305	0	29305	0	29305
ROAD T'P	6158	2793	8951	0	8951	75058	84009
ROAD TTL	35463	32098	67561	0	67561	75058	142619
RAILWAY	51284	0	51284	0	51284	0	51284
CT.BRTH	3561	0	3561	0	3561	0	3561
THE REST	2870	0	2870	0	2870	0	2870
PORT TTL	6431	0	6431	2734	9165	0	9165
SHIPPING	0	0	0	11907	11907	0	11907
AVIATION	6448	0	6448	29557	36005	0	36005
G.TOTAL	99626	32098	131724	44198	175922	75058	250980

NOTES:

SIMULATION = GIVING HIGHER PRIORITY TO RAILWAY
STANDARD = STANDARD FRAMEWORK OF ADP BUDGET

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-7 SUMMARY TABLE 2-2(1)

< CASE B-2 (1) >
[SIMULATION], [25 % INCREASE]
[PERIOD 1983-84 TO 1987-88]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	1188	0	1188	0	1188	0	1188
THE REST	6236	0	6236	0	6236	0	6236
PRVNCIAL	0	7423	7423	0	7423	0	7423
ROAD T'P	2330	1117	3447	0	3447	21655	25102
ROAD TTL	9754	8540	18294	0	18294	21655	39949
RAILWAY	12991	0	12991	0	12991	0	12991
CT.BRTH	1995	0	1995	0	1995	0	1995
THE REST	2288	0	2288	0	2288	0	2288
PORT TTL	4283	0	4283	1282	5565	0	5565
SHIPPING	0	0	0	5152	5152	0	5152
AVIATION	3346	0	3346	10291	13637	0	13637
G.TOTAL	30374	8540	38914	16725	55639	21655	77294

NOTES:

SIMULATION = GIVING HIGHER PRIORITY TO RAILWAY
25 % INCREASE = ENLARGING ADP FRAMEWORK BY 25 %

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

Table 2-2-8

SUMMARY TABLE 2-2(2)

< CASE B-2 (2) >
[SIMULATION], [25 % INCREASE]
[PERIOD 1988-89 TO 1999-00]

(UNIT: RS. MILLION)

MODE	FEDERAL	PRVNCIAL	ADP TTL	NON ADP	PSDP	PRIVATE	G.TOTAL
AK ETC	5861	0	5861	0	5861	0	5861
THE REST	30770	0	30770	0	30770	0	30770
PRVNCIAL	0	36631	36631	0	36631	0	36631
ROAD T'P	7697	3491	11188	0	11188	72821	84009
ROAD TTL	44328	40122	84450	0	84450	72821	157271
RAILWAY	64105	0	64105	0	64105	0	64105
CT.BRTH	3561	0	3561	0	3561	0	3561
THE REST	4478	0	4478	0	4478	0	4478
PORT TTL	8039	0	8039	2734	10773	0	10773
SHIPPING	0	0	0	11907	11907	0	11907
AVIATION	8060	0	8060	29557	37617	0	37617
G.TOTAL	124532	40122	164654	44198	208852	72821	281673

NOTES:

SIMULATION = GIVING HIGHER PRIORITY TO RAILWAY
25 % INCREASE = ENLARGING ADP FRAMEWORK BY 25 %

AK ETC = AZAD KASHMIR, NORTHERN AREAS AND FATA
PRVNCIAL = PROVINCIAL
ROAD T'P = ROAD TRANSPORT
CT.BRTH = CONTAINER BERTHS

3. Transport System Development Policy and Strategy for Masterplan

The formulation of policy and strategy for Masterplan upto year 2000 was attempted by means of analysis of each mode, reviews of the policies adapted in the previous 5 Year Plans, trend of the national and regional development and the analysis of traffic demand forecasting by each mode. Forecasted traffic volume shall be the basis to follow policy options.

As for the modal split of road and railway which are the most essential modes of inland transportation, forecasting of the traffic volumes of the two modes were tried in two cases, and in consideration of the aforesaid factors, the policy formulation was attempted. In compliance with the policies for the two cases, two Masterplan Alternatives were formulated.

Policy and strategy in this study was conserved and refined through discussion with each counterpart and with related organizations of the Government of Pakistan.

3-1 Policy and Strategy for Total Transport System

The structure of economy in Pakistan is still dominated by agriculture whose major products are wheat, rice, cotton and fruit/vegetables.

However, the manufacturing industry in Pakistan is inclined to change from the traditional spinning industry and food processing industry to the more technology oriented industry like production of chemical fertilizer and cement, the basic metals and machinery. Consequently, the demand of transport by commodity has been changing from consumption goods to the industrial material and products.

Keeping with the progress of industry, concentration of population to the cities is being accelerated and not only the international passenger movement like emigrants to the Middle and Near East, but also the domestic passenger movement by bus, railways and aircraft has expanded, too.

Despite Government of Pakistan has devoted their efforts to improvement of transport and traffic hitherto with such increase of transport demand, their efforts have not been fruitful and transport capacity is insufficient situation on account of restriction in various resources.

Taking the environmental socio-economic situation and existing transport system into consideration, establishing the policy and strategy for the comprehensive transport Masterplan upto year 2000, the important factors are described below.

(1) The consistency of traffic volume among each mode should be secured and transport capacity shall be matched with the traffic volumes. These are, for example, the linkage of ports and the inland transport, modal split of road, railway and aviation as inland transport means, the linkage of railway and road as its feeder, and investment balance between infrastructure and equipments of each mode.

(2) Under the restraint of financial resources, it is taken for granted that the priority of investment should be given to projects having high and quick economic return. On the other hand, the transport investment to backward or isolated areas shall be made from the view point of basic human needs and national integration.

(3) The situation of railways in Pakistan is one of the essential issues in the comprehensive transport plan. Due to locational characteristics of socio-economic structure, it is reasonable that the railways shall have major responsibility to the freight transport of long distance, connecting up-country with down-country. It is to be pointed out that railways transport is a set of the system that a certain equipment should be harmonized with the matching infrastructural facility and operational method for its effective operation. Therefore, it is in not only the problem of investment in facility and equipments, but also that of operational system and its management.

(4) The situation of ports in Pakistan is one of the important subjects for working out the comprehensive transport plan. Especially, full utilization of new Port of Qasim including the hinterland would be a essential key in advancing the future development of industry and trade of this country.

From the above point of view, policy and strategy in comprehensive transport Masterplan upto year 2000 was established as follows.

1. The modal distribution of future traffic shall be made on the basis of suitability of various commodities for transport by various mode and the relative costs .

2. Integrated development of different modes of transport should be ensured to minimize the total transport costs taking in view their alternatives and complements.

3. Encouraging and increasing production and commercial activities and to contribute to economic development of the country should be one of the primary aims of the transport system.

4. Opening-up of backward areas and isolated areas should also be one of the aims of the transport system development for basic human needs and national unity.

5. The transport capacity of existing facilities and equipments should be fully utilized by elimination of their bottlenecks and optimization of their performance efficiency.

6. Private sector investment should be more introduced into transport sector to reduce the restriction of public resources and to stimulate the transport activities.

7. Railways should be more strengthened on the long haul freight traffic along the main lines by operation of through trains between major stations for more effective utilization of existing railway system.

8. The balanced national highway network should be established by rationalizing the existing network including the roads of national importance such as route N-5, Indus Highway, RCD Highway, route N-50, a route of Makran Coast and so on.

9. Comprehensive policies in road transport sector should be introduced to promote the sector as an industry through the grasp of actual conditions of this sector.

10. Port capacity should be increased by close coordination between KPT and PQA and by construction of new ports on Baluchistan Coast.

11. Comprehensive measures to containerization should be developed in effective coordination among shipping, ports, railways and road transport.

12. Serious bottlenecks on capacity and safety at major airports must be removed on the highest priority to secure a smooth international and domestic air traffic flow.

3-2 Policy for Modal Split between Road and Railway

In the study, as for the policy for modal split between road and railway being the major modes in Pakistan, from the viewpoint of the geographic condition and utilization of capital stock hitherto, it is suggested that the sufficient utilization of the mass and long haul railways transport should be advanced.

There explains a comparsion of transport costs between the both modes and an idea of break-even distance which leads to the policy applied in the Masterplan Alternative Case B.

(1) Generally users of transport means choose a certain mode comparing with all costs between the modes which consist of actual cost like fare and the value of transport time evaluated by each user. This is called sacrificed value.

Sacrificed Value = Fare + Time Cost
where Time Cost = Time Value x Transport Time

(2) However, in this study the choice of transport means is not based on sacrificed value from the viewpoint of users and it should be in comparison with all costs between modes from the viewpoint of national economy, therefore transport cost of each mode (Economic cost other than fare) is used. This is called General Transport Cost (GTC).

GTC = Transport Cost + Time Cost

(3) In many cases of the studies on transport with time factor, cost of railways is used the transport cost between stations. For proper comparison with the road between origin and destination it should be compared adding feeder cost from each terminal station (local transport cost by road).

(4) On the other hand, as to roads, only vehicle operating cost is considered as transport cost of roads. For proper comparison with railways, it should be added investment cost and maintenance cost of road being its infrastructure.

Being based on these consideration, general transport cost of road and railway per a unit volume is formulated respectively as here under:

1. General Transport Cost of Roads and Road Transport (GDTC)

$$GDTC = (VOC + RDC) \cdot D + \alpha \cdot Td$$

where VOC = Vehicle Operating Cost

RDC = Road Cost

D = Distance between Origin and Destination

α = Time Value

Td = Transport Time between Origin and Destination

= D/Average Speed of Vehicles

2. General Transport Cost of Railways (GRTC)

$$GRTC = (TMC + KMC \cdot D) + \alpha \cdot (Tm + Tr) + (VOC + RDC) \cdot L + \alpha \cdot Tl$$

TMC = Terminal Cost

KMC = Kilometric Cost (Running Cost between Stations)

Tm = Terminal Time

Tr = Running Time

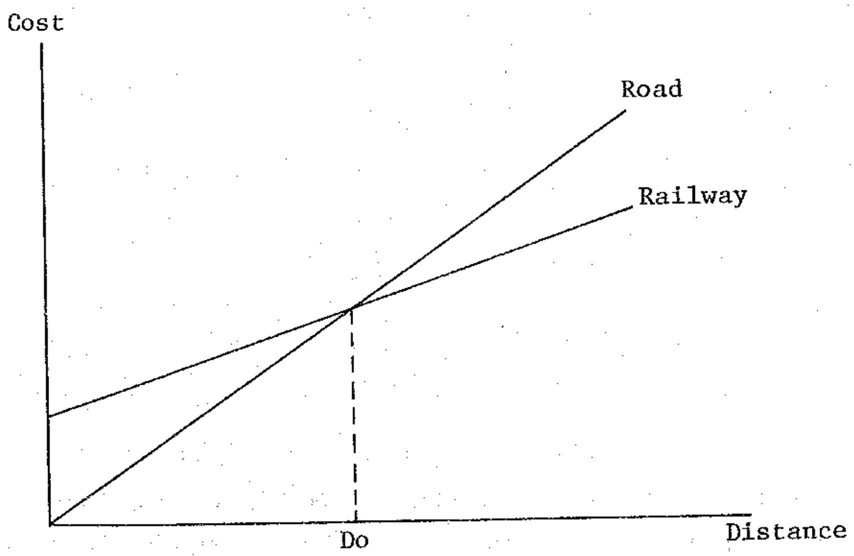
Tl = Local Transport Time by Road

= L/Average Speed of Road Transport

L = Local Transport Distance by Road

The proper formulas to compare the transport cost between road and railway are like above. Those formulas are shown in a graph like Fig. 3-2-1.

Fig. 3-2-1 Transport Costs of Road and Railway



(Break-even distance)

Two cost curves cross at a point of break-even distance showing railways cost per unit volume over break-even point is lower than that of road. On the other hand, it is larger than road cost in distance less than break-even distance.

Break-even distance as to passenger transport and cargo transport is shown in the Table 3-2-1.

In the study, two plans are prepared as the alternatives of Masterplan for comprehensive transport plan according to the policy of railway long distance directivity.

Plan A is one to let the share of railway kept under present situation in each O-D zone and plan B is one to intensify the long distance derectivity of railways applying the above-mentioned Break-Even Theory and concentrate existing cargo stations to several major stations (refer to Chapter IV as to the result of traffic demand on above consideration and Chapter VII as to the Masterplan).

Table 3-2-1 Break-even Distance between Road Transport and Railway (based on Economic Cost)

(km)

Category	Break-even Distance
Passenger	
Upper class	428
Lower class	203
Average	276
Goods	
Wheat	426
Rice	426
Cotton	456
Edible Oil	434
Sugar	410
Cement	250
Fertilizer	208
Iron/Steel	386
Mining	354
Coal/Coke	312
Petroleum	428
Other Commodities	436
Average	344

Note: As for cement and fertilizer, Break-even distances are calculated as an one end, as these commodities will be directly loaded in the factory or unloaded at the destination point by railway.

Source: JICA Study Team

VI. MASTERPLAN ALTERNATIVES WITH PROJECT IDENTIFICATION AND EVALUATION

VI. MASTERPLAN ALTERNATIVES WITH PROJECT IDENTIFICATION AND EVALUATION

1. Frame of Masterplan Alternatives

General understanding of Masterplan in transport sector is to formulate the comprehensive transport system for 10-20 years span.

Construction of new transport facilities and up grading/improvement of existing facilities are the main objectives which are required to establish effective linkage between the different modes.

It is also suggested that the overall transport system has to be established, not by the project base independently but by bringing it in line with the proposed Masterplan.

After realization of the total Masterplan, the transport system of the country should offer the ideal service level in capacity and in quality which would adequately contribute to the economic activity of the country.

Location, timing and form are the important items to be identified in the Masterplan making. Other necessary factors to be considered are as follows.

(i) Harmonizing with the future land use plan.

(ii) Comparison with the alternatives, based on the differnt forecasts fundamentally initiated by the land use plans.

(iii) The impact of on-going short and medium term projects.

It should be pointed out that the Masterplan in this report is to formulate the conceivable optimum plan for comprehensive transport system by 2000 as the target year for Pakistan taking into consideration the constraints given by the situation.

(1) General

It is anticipated that with the estimated GDP growth rates to be 6.5-7.2%, Pakistan in 2000 would be developed fairly well economically and socially. Therefore, it would be necessary to establish appropriately matching comprehensive transport system so as to provide a reasonable service level not only to cater for expanding commodity and passenger flows as shown in traffic demand forecast, but also to meet the requirements of a better standard of living.

Though road and railway are the main transports modes, the existing road and bridge network, their standards, and maintenance system are not adequate to offer the appropriate service level, and are not fit for the large-size vehicles.

On the other hand, in case of railway, the development effort has been confined to minor rehabilitation and maintenance since Independence, and no real technological change has occurred, e.g. intensive electrification or increasing the system capacity.

Therefore, the railways in Pakistan have not played its role as a mass rapid transport mode.

Transport infrastructure should therefore be developed, not only for meeting the demand of ambitious economic growth till 2000, but also to offer an efficient service to the people of the country.

(2) Future Framework

In order to formulate the Masterplan, macroscopic and microscopic traffic demand forecasts considering the character of zones, projected production targets for various commodities producted in consumption centres and gravity relationship, based on development potentials of macro and regional economics and population, have been considered for each mode and route for future traffic assignment.

As for the microscopic traffic demand forecast, extention of present pattern and a new pattern with shift to the railway by some extent have been determined for formulation of the Masterplan.

Traffic demand forecast with a shift to the railway has been processed as follows.

(i) calculation of break-even distance of major commodities with modal split by present pattern, (ii) shifting some percentage of traffic more than the break-even distance to railway and (iii) shifting some percentage of traffic less than the break-even distance to road.

Shifted pattern to railway has been assessed with the idea to seek the ideal economic transport system for the national economy as also to achieve the optimal utilization of the capital investment on railway, economized energy consumption in the railway, and to countercheck the time restraint, which has resulted to identify the necessary road inventry to meet with the traffic assigned to the road.

Masterplan Alternatives have been formulated on the basis of the above two approaches for modal split in land transport.

(3) Project Identification

Candidate projects are identified fundamentally, based on the gap between present inventory of the transport infrastructure and future traffic demand and with relation to the network analysis of each mode.

The basic standpoint for this Masterplan proposal is to consider the equilibrium of demand and supply by market mechanism. Therefore, the identification of candidate projects has been based on an analysis for economization of Vehicle Operating Cost (VOC), shortening of travel distance and economizing the travel time.

However, those projects have also been included in the Masterplan Alternatives which (i) are considered to have high economic impact by the intended investment and (ii) are selected by the civil minimum standard and (iii) are aiming at national integration.

(4) Financial Framework

The financial framework, according to preliminary estimates considering the growth rate for Pakistan's GDP, amounts to Rs. 162,855 million in ADP category and, Rs. 60,923 million for the Non-ADP category for the period from 1983 till 2000.

Preliminary allocation of financial resource for each mode is estimated to follow the past trends, but final allocation might deffer, depending upon project grouping in Masterplan Alternatives. After selection of the Materplan, the financial frame for the next Five Year Plan is expected to cater for the proposed Plan of Action so as to meet the need to strengthen transport infrastructure. This will constitute a positive attitude toward transport sector, with an allocation of about 16% to 20% of total development resources in ADP category.

(5) Masterplan Formulation

Following the estimates for the financial framework as given in preceding paragraph, it is necessary to proceed with the project grouping. Here, project grouping is worked out by selecting the projects necessary to cope with the projected traffic demands in line with the policy and strategy.

It is also essential that an effective coordination and integrated planning of overall and specific transport system, which also keeps in line with national and regional economic development policies, is achieved. The plan should also cope with the basic social needs which is one of the policies set in Masterplan, and therefore some portion of fund is allocated for this purpose, although such projects do not seem to be economically feasible.

Projects constituent to Masterplan Alternatives differ according to difference in traffic demand forecasts on road and railway. As the traffic demand forecasts for port/shipping and airport/aviation being the same in both the Masterplan Alternatives A and B, projects constituent to both Masterplan Alternatives are the same.

(6) Selection of Optimum Masterplan

Evaluation of Masterplan Alternatives has been processed as follows.

(i) Quantitative Evaluation

Comparative economics in terms of general transport costs, including time cost between Masterplan Alternatives A and B, assuming completion of all the projects constituent to each Masterplan Alternative with the expected service level, have been applied to evaluate the Masterplan Alternatives shedding the forecasted traffic volume in the year 2000.

As for the slight difference of total fund between Masterplan Alternatives A and B, the differencial is to be analyzed considering the opportunity cost of capital in Pakistan.

(ii) Comprehensive Evaluation

After the quantitative evaluation, Masterplan Alternatives have been evaluated with the qualitative elements, such as efficiency of energy utilization and pollution etc.

Table 1-1-1 Summary of Traffic Forecasting

Category	Unit	1971/72	1980/81	1982/83	1987/88	1999/2000	71/72-80/81	82/83-87/88	87/88-99/2000
GDP	M.Rs (1980/81 Price)	154,120	249,038	279,830	395,794	844,847	5.5	7.2	6.5
GDP per Capita	Rs.(1980/81 Price)		2,972	3,133	3,856	6,223	(72/73-80/81)	4.2	4.1
Population	000P	(1972/73) 65,309	83,782	89,327	102,635	135,756	3.2	2.8	2.4
Sind	"	14,156	18,966	20,550	24,177	32,697	3.7	3.3	2.5
Punjab	"	37,845	47,451	50,396	57,383	74,809	2.9	2.6	2.2
NWFP	"	10,879	13,060	13,621	15,078	19,092	2.3	2.1	2.0
Baluchistan	"	2,429	4,305	4,787	5,997	9,158	7.4	4.6	3.6
Inland(Passenger)	MPK	46,335	83,507	95,218	130,388	234,771	6.8	6.5	5.0
Road	"	36,520	65,991	74,945	101,784 101,897	182,052 181,338	6.8	6.3 6.3	5.0 4.9
Railway	"	9,515	16,311	18,789	26,442 26,329	48,868 49,582	6.2	7.1 7.0	5.3 5.4
Air	"	300	1,205	1,484	2,162	3,851	16.7	7.8	4.9
Inland(Goods)	MTK	15,808	26,141	30,067	43,574 44,053	95,880 97,092	5.7	7.7 7.9	6.8 6.8
Road	"	8,047	18,207	20,403	31,401 27,745	70,039 55,081	9.5	9.0 6.3	6.9 5.9
Railway	"	7,756	7,918	8,019	9,581 13,716	20,188 36,357	0.2	3.6 11.3	6.4 8.5
Pipeline	"	0	0	1,626	2,566	5,610	0	9.6	6.7
Air	"	5	16	19	26	44	13.6	6.5	4.4
Port(Import & Export)	000T	9,036	14,941	16,572	24,625	44,689	5.7	8.2	5.1
General Cargo	"	2,026	2,725	2,835	3,670	6,042	3.3	5.3	4.2
Dry Bulk Cargo	"	2,609	4,751	5,317	9,506	14,852	6.9	12.3	3.8
Liquid Cargo	"	4,401	7,465	8,420	11,449	23,795	6.0	6.3	6.3
Port(Passenger)	000P	57	37	35	29	42	-4.7	-3.7	3.1
Air(International)		(1972/73)					(72/73-80/81)		
Passenger(Total)	000P	368	2,344	2,785	3,917	6,764	26.0	7.1	4.7
Passenger(PIA)	"	188	1,422	1,707	2,410	4,179	28.8	7.1	4.7
Cargo	000T	12	64	79	130	313	23.3	10.5	7.6

Note: In the figures of road and railway, the upper is one of Case A and the lower is one of Case B.

2. Modal Development Plan

2-1 Road Plan

Long-range Planning means determination of the needs for as far ahead as can reasonably be foreseen.

2-1-1 Basic Objectives of Road Planning

Road is a most general and basic transportation facility which is indispensable for daily life and for production and marketing activities, and which also plays an important role in forming comfortable living environment and in providing public space for disaster prevention.

Among the surface transportation means, motor vehicle transportation plays an important role because of its mobility, door to door servicibility and reliability.

The main objectives of the formulation of the future road network are as follows;

- The minimization of the total transport costs taking account of other modes and multimodal transportation.
- The interconnection of important centres.

2-1-2 Planning Process

The future traffic demands assigned to the future highway network are compared with the future highway capacity resulting from the standards adopted , and the future deficiencies which result from retaining the present network are calculated for the two alternatives, in the following.

- Determine the deficiencies on the basis of desire lines for trial traffic assignment to existing network (Desire lines in the year 1987/88 and 1999/2000 are shown in Fig. 2-1-1 and Fig. 2-1-2).
- Develop tentative networks to eliminate the deficiencies on the basis of 1st traffic assignment. (capacity requirements for future network).
- Test the most promising tentative plans by 2nd traffic assignment.
- Develop the balanced road network with due regard to the future traffic flow and the road construction standard.

2-1-3 Classification of Highway System and Construction Standards

The highway system as proposed along with the construction standards will rationalize the basis and procedure for the proper growth and development of balanced road network.

(1) Highway Classification

Prior to determination of the needs and an orderly solution of the multitude of problems on highways, classification of highways is necessary. Classification is the tool by which the complex network of highways can be allocated into groups or systems of routes having similar characteristics.

There are two types of classifications in highway system;

i) Administrative classification
ii) Functional classification

The administrative classification existing in Pakistan such as National Highway and Provincial Highway are identified from their administrative point of view.

The functional classification does not exist in Pakistan officially and the emphasis is primarily laid on the function and relative importance of the highway in the network.

The latter is more important because it is required for the road users to utilize highway efficiently and in an economical manner.

Actual assigned traffic volume in the year 1987/88 and 1999/2000 on each link has been considered as one of the most reliable parameter for determining the service required.

Road Network System for National Transport Plan is classified into three categories as follows;

i) Primary Highways
ii) Secondary Highways
iii) Feeder Roads

Definitions are as follows;

<u>Primary Highways</u>

Primary highways mean the main highways which form a part of international routes and link up all federal and provincial capitals.

These road also pass through two or more provinces. Primary highways selected for this study on the basis of above criteria and policy mentioned before are shown in Fig. 2-1-3.

Secondary Highways

Secondary highways mean those highways which connect divisional or district centers with each other and also link up divisional or district centers to primary highways. Those highways other than the primary highways on the road networks for national transport plan will be defined as secondary highways.

Feeder Road

The feeder roads are all the other roads which feed into the primary and secondary systems. This class of road is not dealt with in this report.

Although the functional classification is not directly settled by analysis of the traffic on existing roads, it is important, through Origin-Destination analysis, to obtain a proper picture of the links actually used for commuting between different centres.

Functional Classification of the road network should not be regarded as a one-time process. A short-cut reducing the distance between two centres may imply a downward reclassification of the previous main route.

Sections of primary and secondary highways will be dealt with for improvement or reconstruction depending on the assigned volume of traffic into any of the five construction standards described below.

(2) Construction Standards

One of the aspects of the functional classification of roads is to demonstrate the importance of establishing and maintaining a certain level of accessibility between and among the various parts and centres in the country.

There is a clear difference between functional and technical classification. The above mentioned two categories of roads (primary and secondary) adopted into the highway system will be constructed according to different standard on the basis of the traffic volume.

For roads with a traffic too low to justify an acceptable level of construction, minimum construction standard should be established.

On the other hand, the introduction of possibly higher standards shall be applied for improvement of the roads with higher traffic volumes with justification of benefit-cost analysis for the additional investments and user benefits that such improvement entail.

In view of the level of national economy and scarce resources, the construction standards for road planning are determined through making comparison of several standards adopted for road planning in Pakistan and other countries.

Standards studied are as follows;

i) Suggested Design Standard for Two-Lane Highway by IBRD

ii) Tolerable Standards for 2-Lane Highways by U.S. Department of Transportation Federal Highway Administration

iii) Pakistan Rural Highway-Computed Highway Capacity by Techno-Consult for "Master Plan for Highways" in 1978

iv) Construction Standards Recommended in "Classification of Highway System and Design Criteria June 1972 " by Directorate of Planning and Design Highway Department, Lahore,

v) Design Characteristics for Roads in Different Type of Terrain by Central Road Organization., MOC, Government of Pakistan

Basically, the construction standards recommended by the "Classification Highway System and Design Criteria in June 1972" is adopted for this highway planning. The Construction Standards for this highway planning is shown in Table 2-1-1 and typical cross sections are shown in Fig. 2-1-4.

Design Speed & Capacity

It will not be economical to design all roads for very high speed. A road has, therefore, to be designed for specific speed known as 'Design Speed'. The design speed is defined as the maximum approximately uniform speed. This is the safe uniform speed which depends on the following factors.

i) Type and condition of surface

ii) Type of terrain

iii) Width of roadway

In order to set up the Q-V curves for traffic assignment , Table 2-1-2 gives the speed recommended speeds.

-On the basis of above mentioned design speed, traffic capacity in terms of mixed traffic by type of terrain and road width is calculated as in Table 2-1-3 so as to set up the Q-V curves for traffic assignment purposes.

Level of Service in Terms of V/C Ratio

The quality of highway services is measured by two reasonably reliable indicators;

i) Operating Speed

ii) The "volume/capacity ratio" that is, the ratio of the volume of traffic assigned to the maximum volume given in Q-V curve.

These indicators have been used to define six levels of service shown in Table 2-1-4.

The selected standard as the residual level of service will not fall a level is to be acceptable to the users of the highway.

The level of service concept does not apply to class I, but for all other classes level of service analysis is a tool for selecting standards for candidate projects.

2-1-4 Traffic Assignment

Traffic assignment is the technical term used in the process of determing the distribution over the road network of the traffic demand between different zones.

The determination of the anticipated amount of traffic on a new network must be made before the size of the facility can be determined.

Such an estimation can be made only after an evaluation of the type of traffic which will use the new facility and an estimation of their volume. Studies have indicated that the distribution of traffic between alternative routes in the network depends on various characteristics of the routes involved. When these characteristics are known for a new route, it is possible to estimate the traffic volume which can be expected on that route.

Balanced network in the year 1987/88 and 1999/2000 for two alternatives are shown in Fig. 2-1-5 and 2-1-6.

2-1-5 List of Candidate Project

Balanced network with type of improvement in terms of construction standard by the year 1987/88 and 1999/2000 for the two alternatives are recommended as shown in Table 2-1-6 and Table 2-1-7. List of links is shown in Table 2-1-5.

In order to set up the Candidate Projects the improvement criteria for primary and secondary highways are recommended as follows:

Improvement Criteria for Primary Highway

1. The highway shall be a two-lane highway at least in the year 2000.
2. Volume/capacity ratio must be less than 0.70 (level of service, "C") in the year 1999/2000 and 0.85 (level of service "D") in the year 1987/88.
3. Main railway crossings on primary highway must be eliminated by the year 2000.
4. In case of dual carriageways, all junction should preferably be grade separated.
5. The entire carriageway width of pavement plus paved shoulder shall be carried across all structures.

Improvement Criteria for Secondary Highway

1. Volume/capacity ratio must be less than 0.85.(level of service "D")
2. In case of dual carriageways, railway crossings and junctions shall preferably be grade separated , as far as possible.
3. At least pavement width shall be carried across all structures.

2-1-6 Cost Estimation

For the projects identified, and to be initiated during the 6th Plan period, the preliminary cost estimates for the proposed balanced networks in the year 1987 and 2000 have been prepared on the basis of 5 road construction standards. The cost estimates are calculated on the basis of information from implemented road contracts and development studies in Pakistan.

Required road improvement cost by alternative for the next Five Year Plan and beyond next 5-year programme 1988/1989-1999/2000 are summarized as follows;

(Unit; Rs. Million)

	1st Stage 1983/84-1987/88	2nd Stage 1988/1989-1999-2000	total (Master Plan)
Alternative A;	35,206	12,361	47,567
Alternative B;	34,038	12,447	46,295

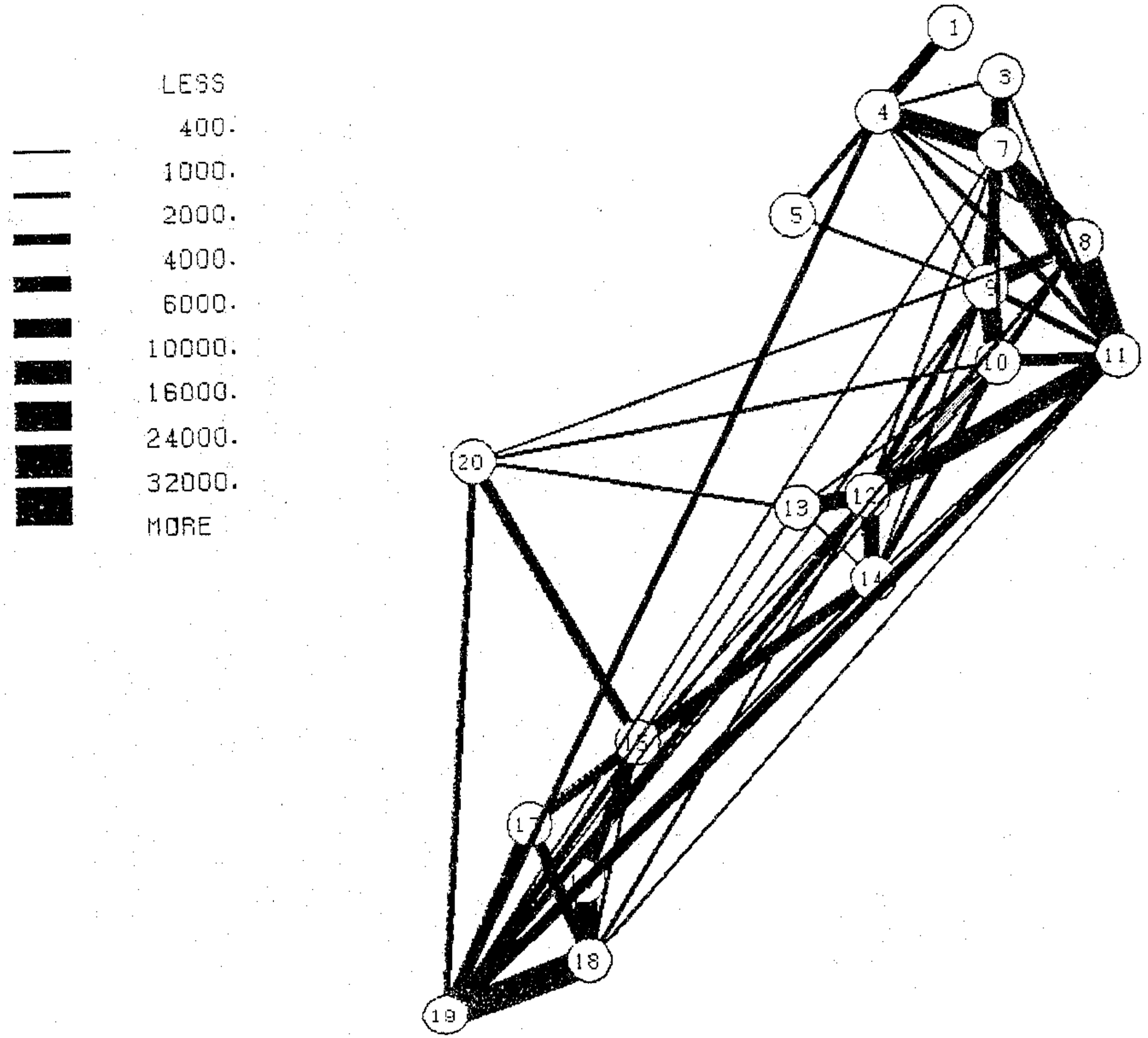


Fig. 2-1-1(1) Desire Line in the Year 1987/88 (Case A)

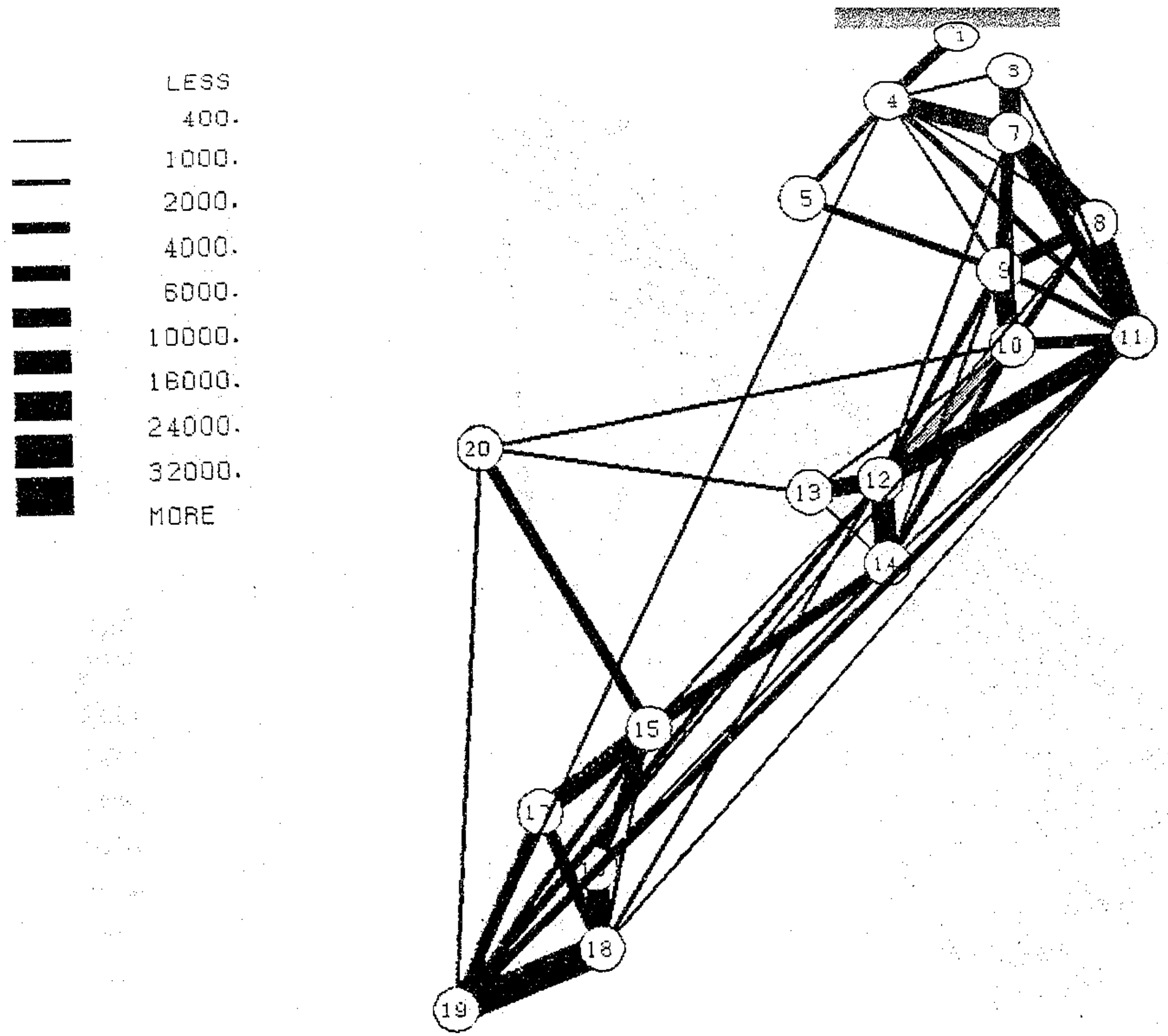


Fig. 2-1-1(2) Desire Line in the Year 1987/88 (Case B)

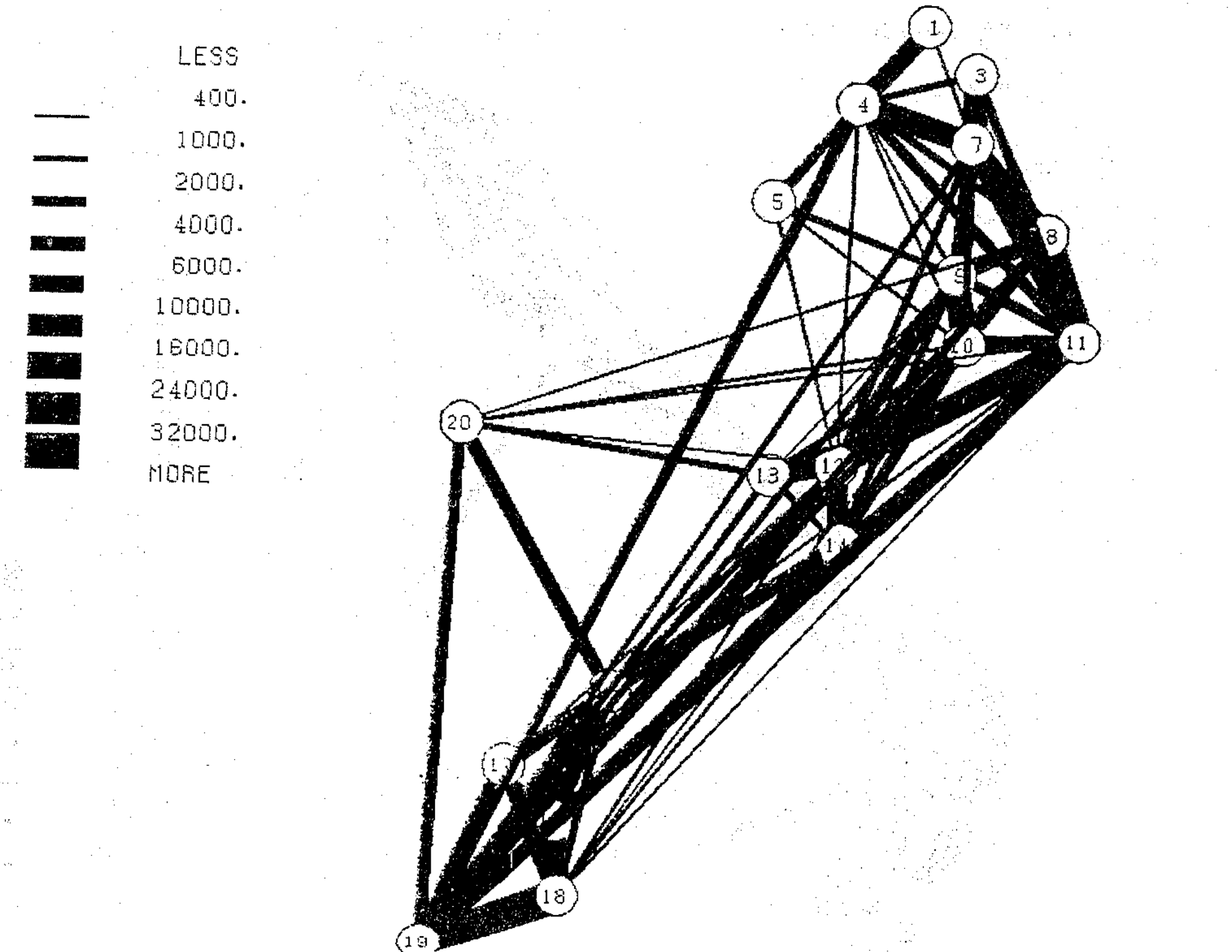


Fig. 2-1-2(1) Desire Line in the Year 1999/2000 (Case A)

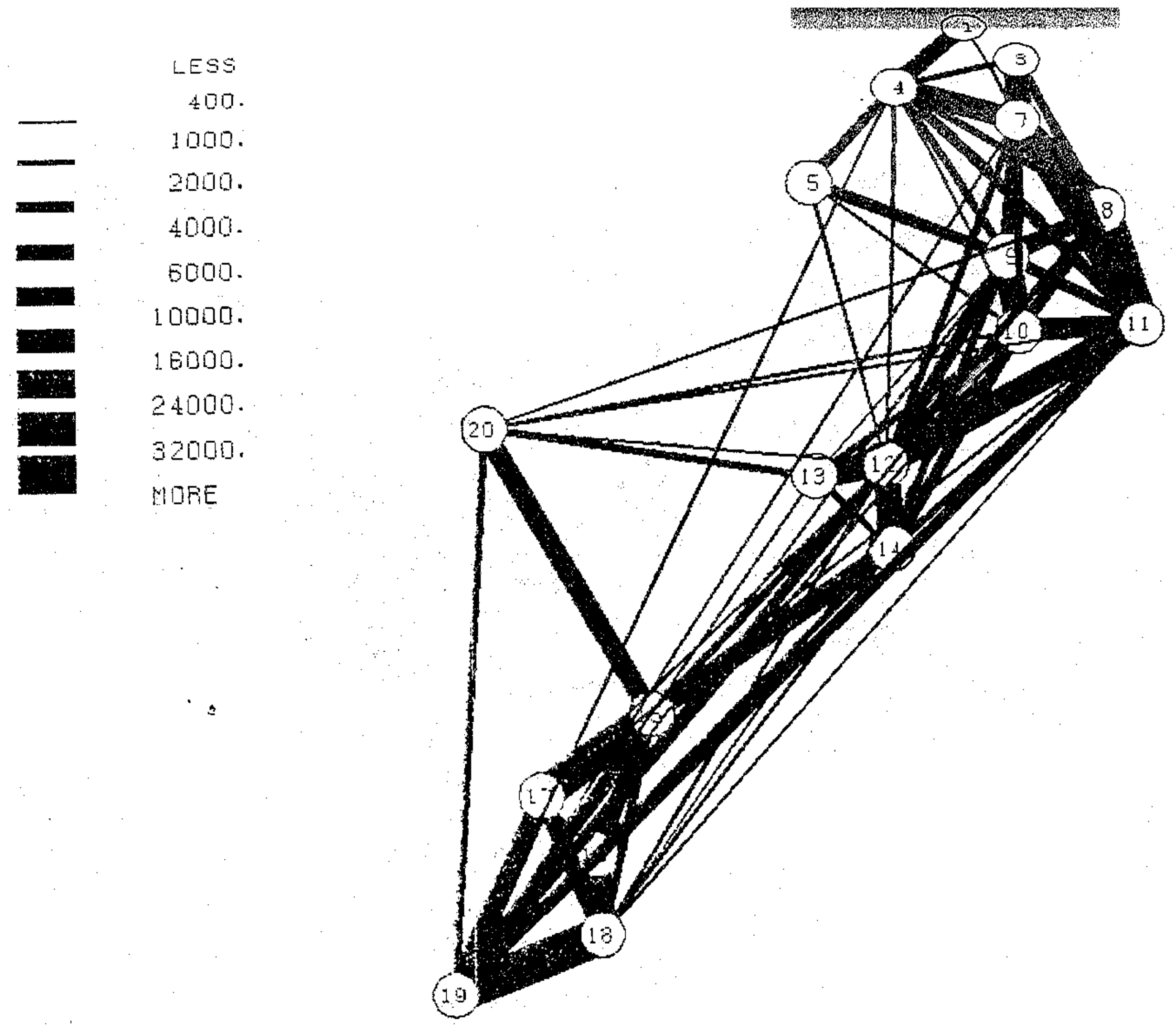


Fig. 2-1-2(2) Desire Line in the Year 1999/2000 (Case B)

Fig. 2-1-3 Highway Classification

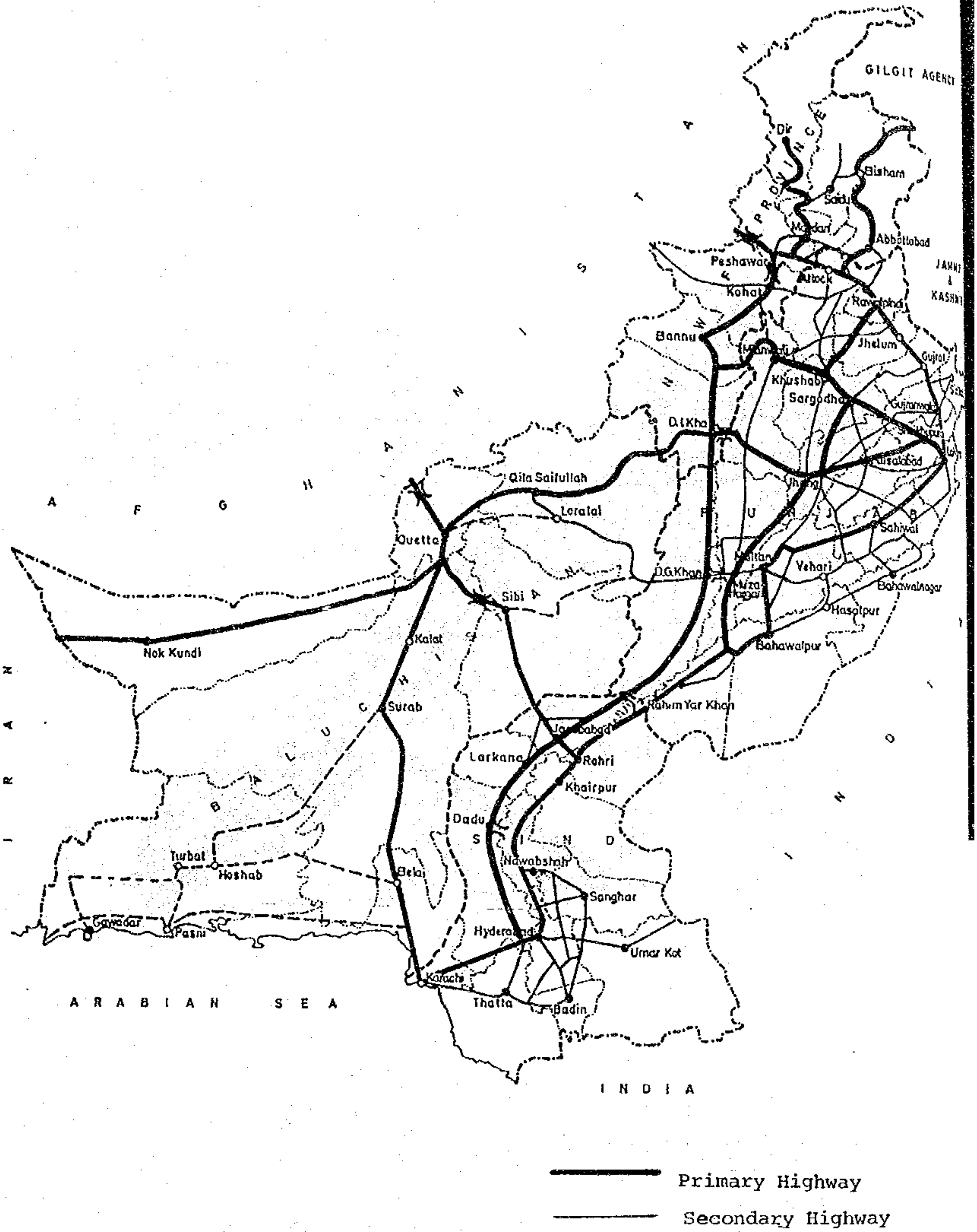


Fig. 2-1-4 Typical Cross Section

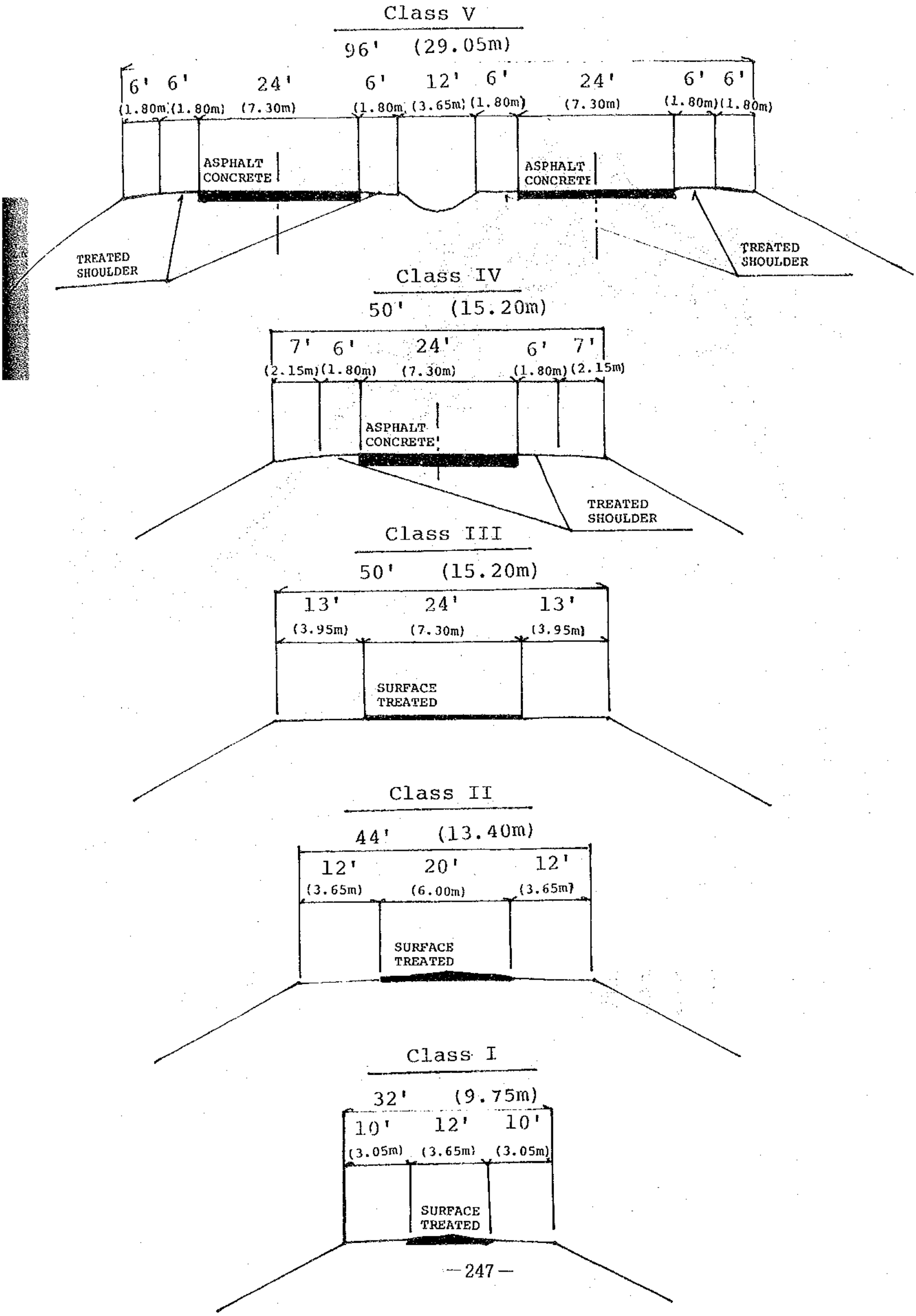


Fig. 2-1-5(1) Traffic Assignment in the Year 1987/88 (Case A)

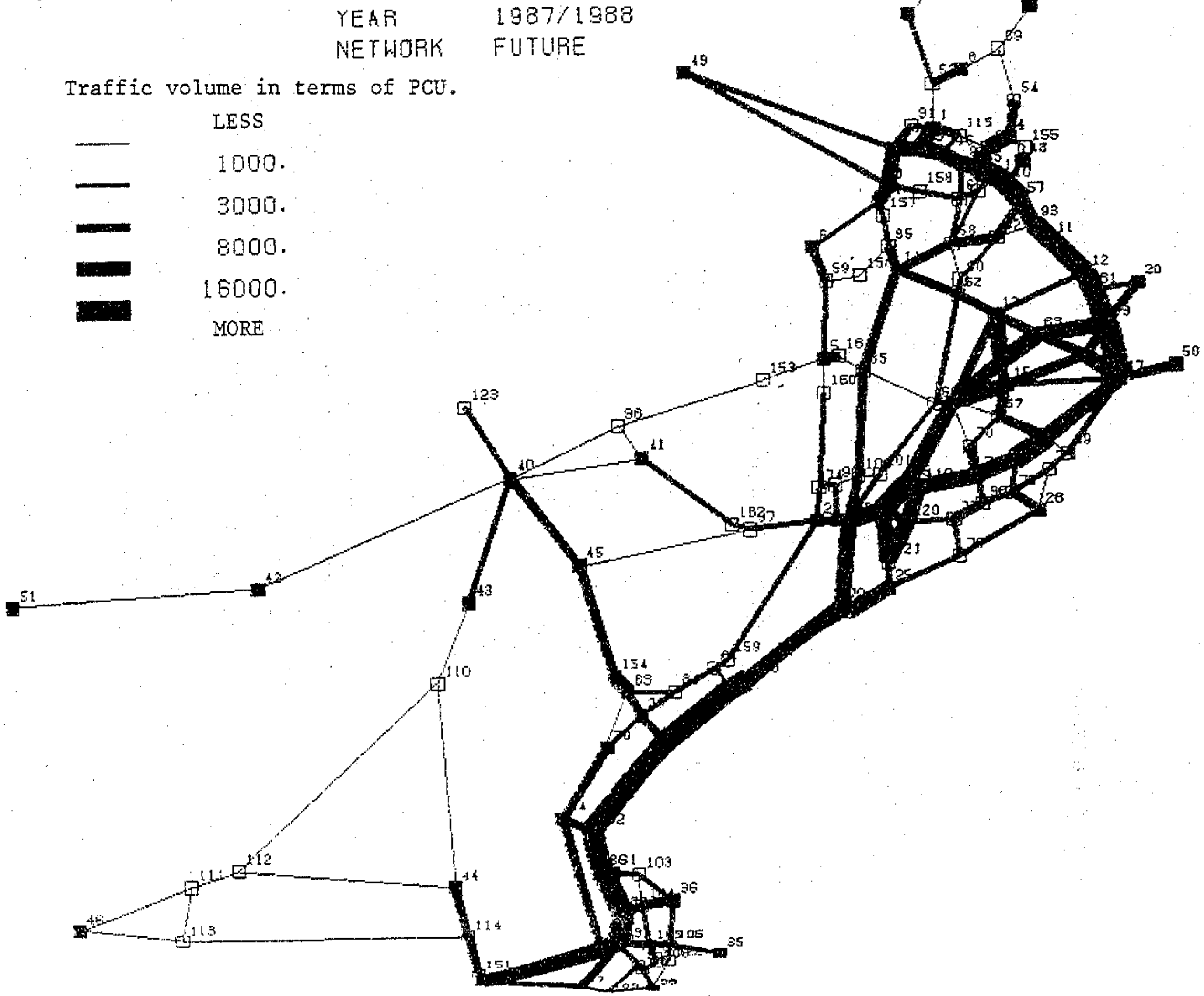


Fig. 2-1-5(2) Traffic Assignment in the Year 1987/88 (Case B)

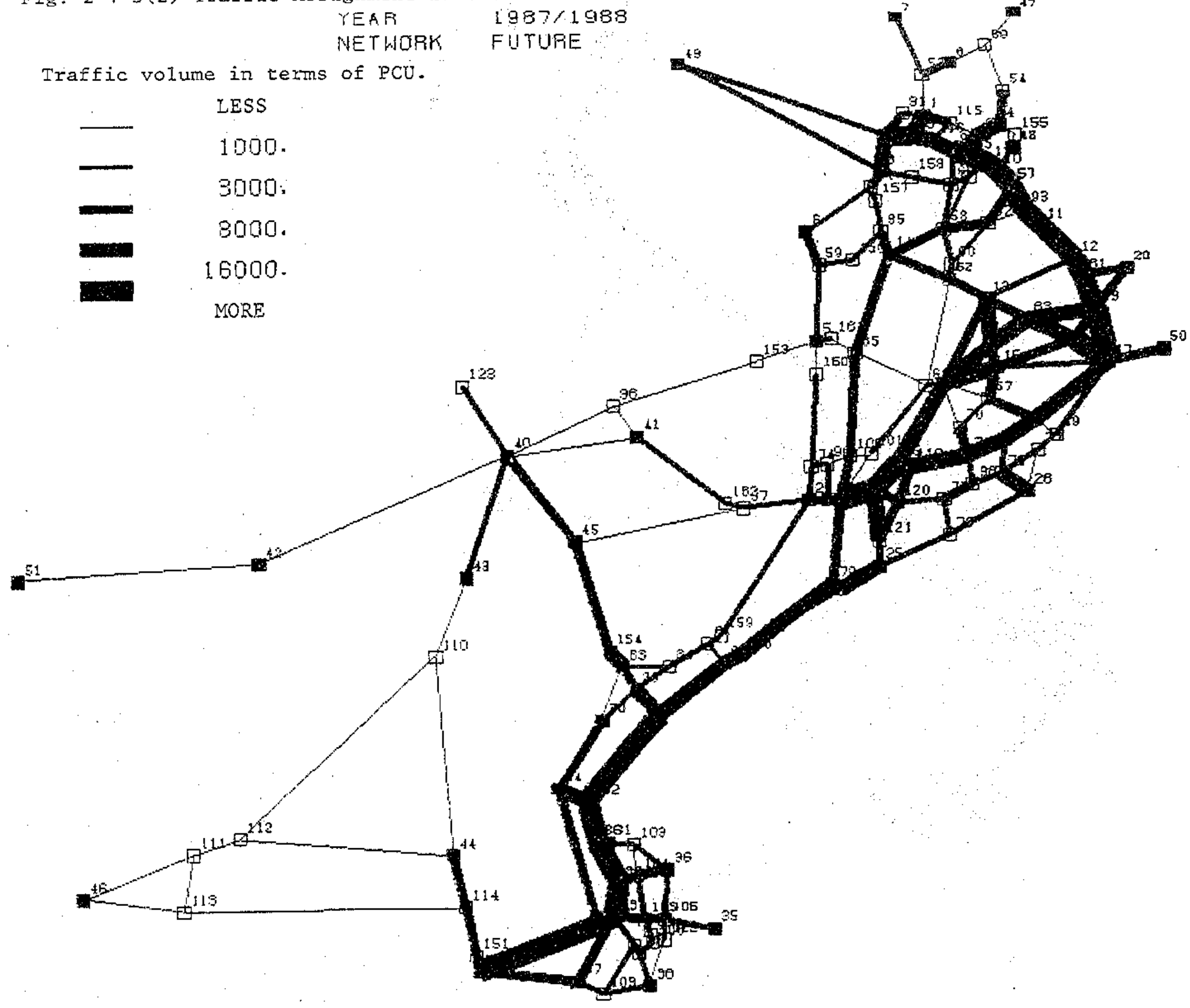


Fig. 2-1-6(1) Traffic Assignment in the Year 1999/2000 (Case A)

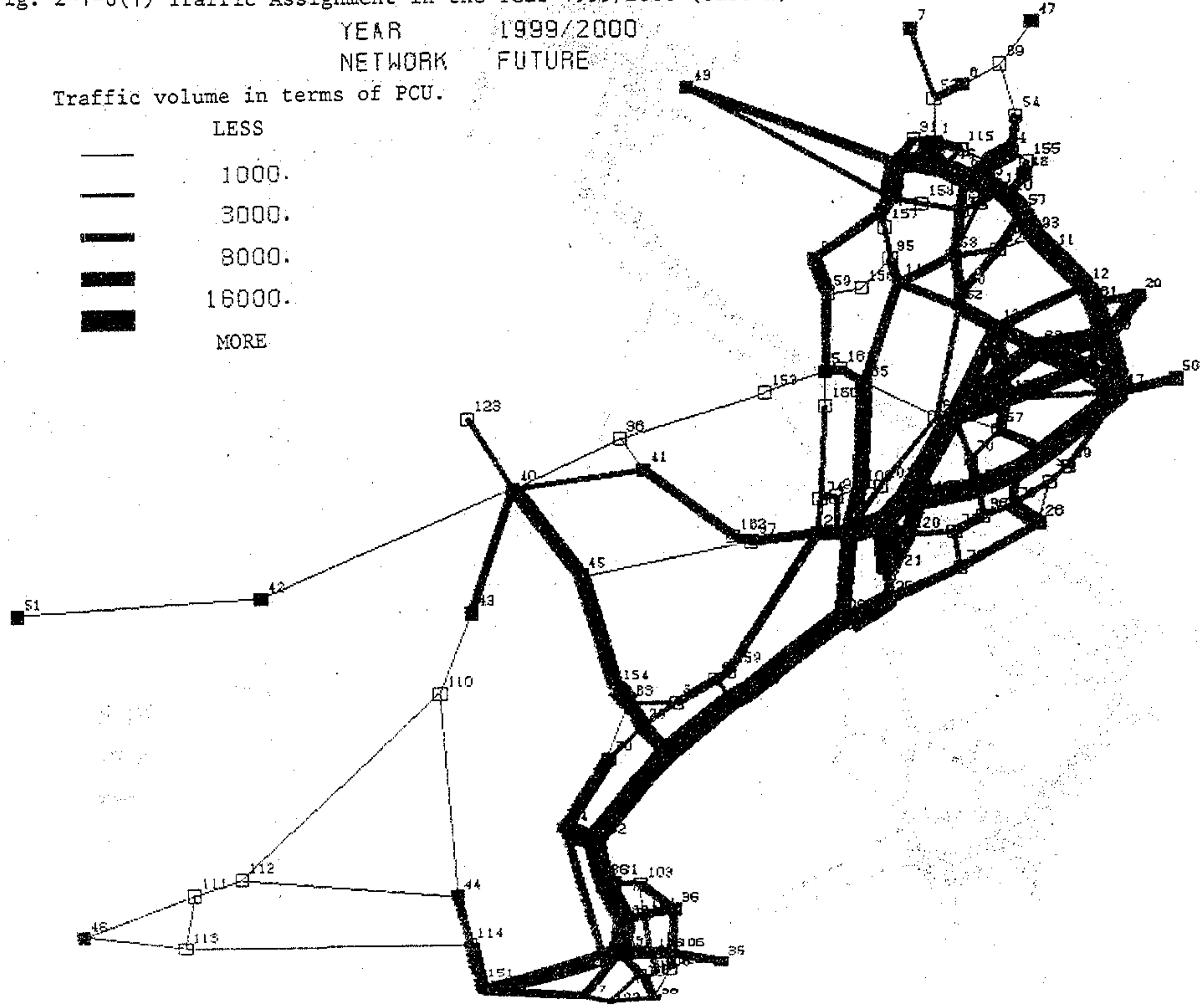


Fig. 2-1-6(2) Traffic Assignment in the Year 1999/2000 (Case B)

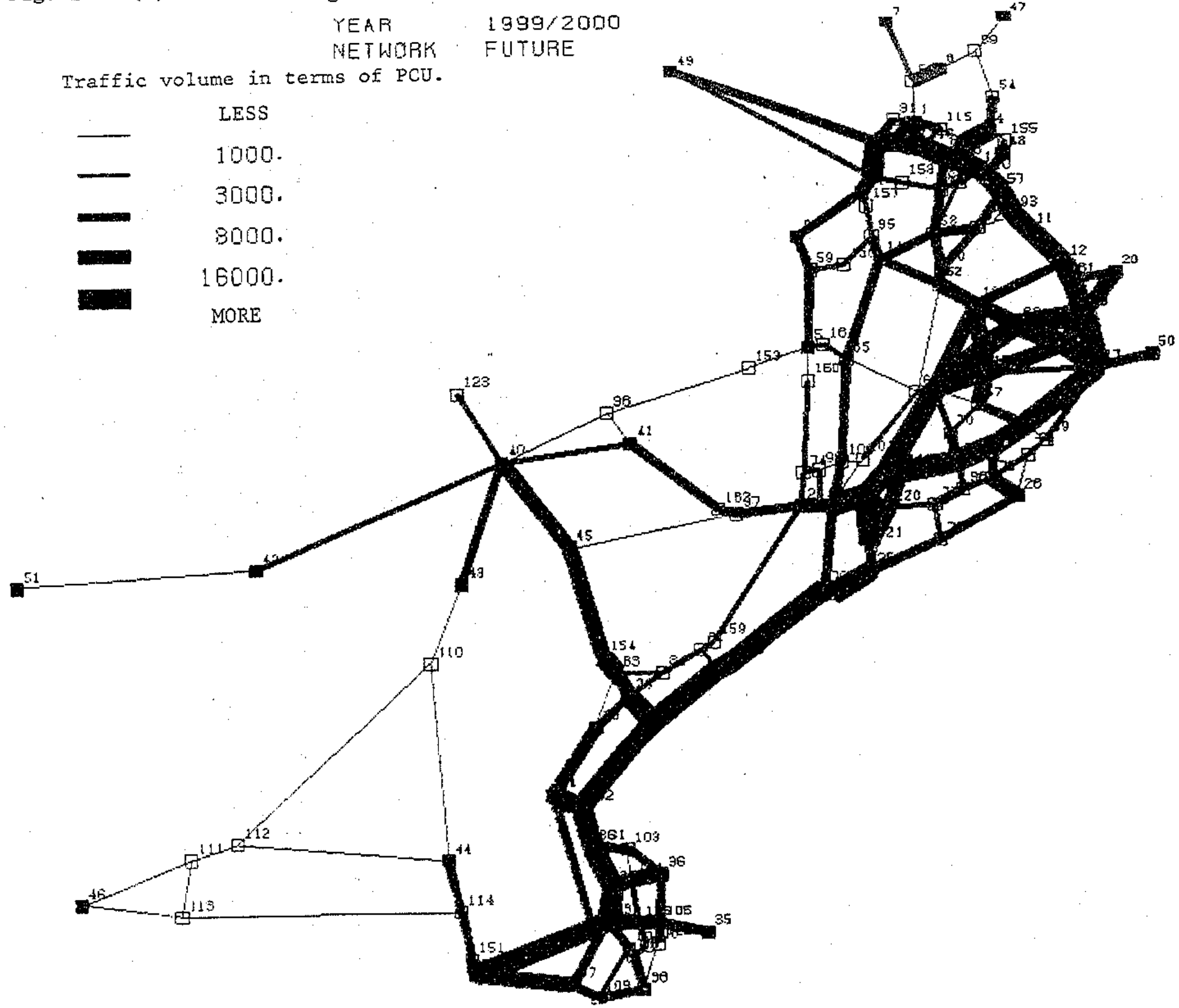


Table 2-1-1 Road Construction Standards for Highway Planning

Class	ADT on Opening (Mixed Traffic)	Type of Pavement	Formation Width	Right of Way	Design Speed (km/hr)	Level of Service on Opening
I	100 - 500	12-ft (3.65m) Surface Treated	32ft (9.75m)	110feet (33.53m)	L: 80 R: 65 M: 40	C
II	501 - 1500	20-ft (6.0m) Surface Treated	44ft (13.40m)	110feet (33.53m)	L: 90 R: 80 M: 50	B
III	1501 - 4000	24-ft (7.3m) Surface Treated	50ft (15.20m)	220feet (67.05m)	L: 95 R: 80 M: 60	B
IV	4001 - 8000	24-ft (7.3m) Asphaltic Concrete + 6-ft Treated Shoulder	50ft (15.20m)	220feet (67.05m)	L: 100 R: 90 M: 70	B
V	8001 - 48,000	2 x 24ft (7.3m) Asphaltic Concrete + 6-ft Treated Shoulder	96ft (29.05m)	220feet (67.05m)	L: 110 R: 100 M: 80	B

Note: The mixed traffic ADT of Class IV in above Road Construction Standards might be modified to be 4001 - 7200 for practical Pakistan Standard, although the ADP categorization is based on the information prevalent up to May, 1982.

Table 2-1-2 Design Speed (Vmax)

Type of Terrain	Type of Road Surface	width (0.1m)				
		≤36	36< ≤60	60< ≤72	72< ≤108	73x2
Flat	Metalled Good	80	90	95	100	110
	Metalled Poor	60	70	70	75	80
	Un-Metalled	40	45	-	-	-
Rolling	Metalled Good	65	80	80	90	100
	Metalled Poor	50	60	60	70	75
	Un-Metalled	30	40	-	-	-
Mountainous	Metalled Good	40	50	60	70	80
	Metalled Poor	30	35	45	50	60
	Un-Metalled	20	25	-	-	-

Table 2-1-3 Capacity (Qmax) Mixed Traffic

Type of Terrain	width (0.1m)				
	≤36	36< ≤60	60< ≤72	72< ≤108	73x2
Flat	500	1,500	4,000	8,000	48,000
Rolling (0.9xFlat)	450	1,350	3,600	7,200	43,000
Mountainous (0.7xFlat)	350	1,000	2,800	5,600	34,000

Table 2-1-4 Operating Criteria and Maximum Service Volumes under Ideal Condition

Level of Service	Description	Operating Speed (mph)	Volume/ Capacity Ratio	Maximum Service Volume
		Passenger vehicles per hour in both directions		
A	Free flow	60 (96km)	.20	400
B	Stable flow	50 (80km)	.45	900
C	Stable flow	40 (64km)	.70	1400
D	Approaching unstable flow	35 (56km)	.85	1700
E	Unstable flow	30	1.00	2000
F	Forced flow	30	Not meaningful	

Source: Highway Capacity Manual, pp. 302-3

Table 2-1-5(1) List of Links

PUNJAB PROVINCE

LINK NO.	NO. OF NODE	NAME OF NODE	
051001	150 - 27	S/P Bound	- Rahimyar Khan
02	27 - 29	Rahimyar Khan	- Rohri
03	79 - 80	Trinda	- Chani Goth
04	80 - 25	Chani Goth	- Bahawalpur
05	25 - 121	Bahawalpur	- Lodhran
06	121 - 23	Lodhran	- Multan
07	23 - 75	Multan	- Kabirwala
08	75 - 119	Kabirwala	- Khanewal
09	119 - 72	Khanewal	- Chichawatni
10	72 - 24	Chichawatni	- Sahiwal
11	24 - 71	Sahiwal	- Okara
12	71 - 17	Okara	- Lahore
13	17 - 19	Lahore	- Gujranwala
14	19 - 61	Gujranwala	- Wazirabad
15	61 - 12	Wazirabad	- Gujrat
16	12 - 11	Gujrat	- Jhelum
17	11 - 93	Jhelum	- Sohawa
18	93 - 57	Sohawa	- Mandra
19	57 - 10	Mandra	- Rawalpindi
20	10 - 117	Rawalpindi	- Tarnaul
21	117 - 55	Tarnaul	- Hasanabdal
051022	55 - 9	Hasanabdal	- Attock
351023	55 - 152	Hasanabdal	- P/N Bound
001024	10 - 48	Rawalpindi	- Murree
25	48 - 155	Murree	- P/N Bound
26	156 - 95	N/P Bound	- Kalabagh
27	95 - 14	Kalabagh	- Minawali
28	157 - 95	N/P Bound	- Kalabagh
29	158 - 68	N/P Bound	- Basal
30	68 - 56	Basal	- Fateh Jang
31	56 - 117	Fateh Jang	- Tarnaul
32	159 - 21	S/P Bound	- D.G.Khan
33	21 - 74	D.G. Kahn	- Shadan Lund
34	74 - 160	Shadan Lund	- P/N Bound
35	17 - 18	Lahore	- Sheikhupura
36	18 - 15	Sheikhupura	- Faisalabad
37	15 - 16	Faisalabad	- Jhang
38	16 - 66	Jhang	- Athara Hazari
39	66 - 65	Athara Hazari	- Sarai Krishma
40	65 - 161	Sarai Krishma	- P/N Bound
41	162 - 97	B/P Bound	- Bewata
42	97 - 21	Bewata	- D.G. Khan
43	79 - 22	T.M. Ranah	- Muzaffargarh
44	22 - 101	Muzaffargarh	- Rangpur
45	101 - 66	Rangpur	- Athara Hazari
46	66 - 62	Athara Hazari	- Khushab
47	62 - 60	Khushab	- Pail
48	60 - 92	Pail	- Chakwal
49	92 - 57	Chakwal	- Mandra
50	17 - 50	Lahore	- Indian Bound
51	21 - 85	D.G. Khan	- Karamad Qureshi
52	85 - 22	Karamad Qureshi	- Muzaffargarh
53	22 - 23	Muzaffargarh	- Multan
54	75 - 16	Kabirwala	- Jhang
55	16 - 13	Jhang	- Sargodha
001056	13 - 12	Sargodha	- Gujrat
57	18 - 63	Sheikhupura	- Pindi Bhattian
58	63 - 13	Pindi Bhattian	- Sargodha
59	13 - 62	Sargodha	- Khushab
60	62 - 14	Khushab	- Mianwali
61	18 - 19	Sheikhupura	- Gujranwala
62	19 - 20	Gujranwala	- Sialkot
63	20 - 61	Sialkot	- Wazirabad
64	17 - 15	Lahore	- Faisalabad
65	25 - 78	Bahawalpur	- Hassalpur
66	78 - 26	Hassalpur	- Bahawalnagar
67	26 - 76	Bahawalnagar	- Arifwala
68	76 - 24	Arifwala	- Sahiwal
69	67 - 15	Sumundri	- Faisalabad
70	15 - 64	Faisalabad	- Chiniot
71	64 - 13	Chiniot	- Sargodha
72	27 - 80	Rahimyar Khan	- Chani Goth
73	26 - 73	Bahawal Nagar	- Bunga Hayat
74	69 - 71	Dipalpur	- Okara
75	77 - 78	Vahari	- Hassalpur
76	119 - 120	Kahnewal	- Jahanian
77	120 - 121	Jahanian	- Lodhran
111078	23 - 120	Multan	- Jahanian
79	120 - 77	Jahanian	- Vehari
80	77 - 98	Vehari	- Burewala
81	98 - 76	Burewala	- Arifwala
82	76 - 73	Arifwala	- Bunga Hayat
83	73 - 69	Bunga Hayat	- Dipalpur
84	69 - 17	Dipalpur	- Lahore
85	67 - 70	Sumundri	- Rajana
86	98 - 72	Burewala	- Chichawatni
87	72 - 70	Chichawatni	- Rajana
88	70 - 16	Rajana	- Jhang
89	16 - 64	Jhang	- Chiniot
90	64 - 63	Chiniot	- Pindi Bhattian
91	63 - 19	Pindi Bhattian	- Gujranwala
92	22 - 100	Muzaffargarh	- Chowk Munda
93	100 - 65	Chowk Munda	- Sarai Krishma
94	65 - 14	Sarai Krishma	- Mianwali
95	14 - 58	Minawali	- Talagang
96	60 - 58	Pail	- Talagang
97	58 - 68	Talagang	- Basal
98	68 - 9	Basal	- Attock
99	58 - 56	Talagang	- Fateh Jang
100	93 - 92	Sohawa	- Chakwal
101	92 - 58	Chakwal	- Talagang
102	16 - 67	Jhang	- Sumundri
103	67 - 71	Sumundri	- Okara
104	74 - 99	Shadan Lund	- Kot Addu
105	99 - 100	Kot Addu	- Chowk Munda
106	100 - 101	Chowk Munda	- Pangpur
107	85 - 99	Karamad Qureshi	- Kot Addu

Table 2-1-5(2) List of Links

SIND PROVINCE

LINK NO.	NO. OF NODE	NAME OF NODE	
052001	39 - 118	Karachi	- Kotri
2	118 - 33	Kotri	- Hyderabad
3	33 - 87	Hyderabad	- Hala
4	87 - 86	Hala	- Sakrand
5	86 - 102	Sakrand	- Moro
6	102 - 32	Moro	- Khairpur
7	32 - 29	Khairpur	- Rohri
8	29 - 82	Rohri	- Ubauro
9	82 - 150	Ubauro	- S/P Bound
252010	39 - 151	Karachi	- S/P Bound
652011	29 - 28	Rohri	- Shikarpur
652012	28 - 83	Shikarpur	- Jacobabad
652013	83 - 154	Jacobabad	- S/B Bound
002014	118 - 34	Kotri	- Dadu
15	34 - 30	Dadu	- Larkana
16	30 - 28	Larkana	- Shikaupur
17	28 - 84	Shikarpur	- Kund Kot
18	84 - 81	Kund Kot	- Kashmor
19	81 - 159	Kashmor	- S/P Bound
20	33 - 105	Hyderabad	- Tnado Allayar
21	105 - 106	Tando Allayar	- Mirpur Khas
22	106 - 35	Muirpur Khas	- Umar Kot
002023	39 - 37	Karachi	- Thatta
24	37 - 33	Thatta	- Hyderabad
002025	34 - 102	Dadu	- Moro
26	86 - 31	Sakrand	- Nawabshah
27	31 - 103	Nawabshah	- Gupchani
28	103 - 36	Gupchani	- Sanghar
29	36 - 106	Sanghar	- Mirpur Khas
30	106 - 122	Mirpurkhas	- Digri
31	122 - 38	Digri	- Badin
32	38 - 109	Badin	- Sujwal
33	109 - 37	Sujwal	- Thatta
34	33 - 107	Hyderabad	- Tando Mohammad Kuhan
35	107 - 88	Tando M.Khan	- Matli
36	88 - 38	Matli	- Badin
37	103 - 104	Gupchani	- Shahdadpur
38	104 - 105	Shahdadpur	- Tando Allayar
39	105 - 108	Tando Allayar	- Toali
40	108 - 88	Toali	- Matli
41	107 - 109	Tando M. Khan	- Sujwal
42	81 - 82	Kashmor	- Ubauro
112043	87 - 104	Hala	- Shahdadpur
44	104 - 36	Shahdadpur	- Sanghar
45	30 - 83	Larkana	- Jacobabad
46	83 - 84	Jacobabad	- Kund Kot
47	108 - 122	T.G. Ali	- Digri

N.W.F.P.

LINK NO.	NO. OF NODE	NAME OF NODE	
053001	9 - 116	Attock	- Jehangira
2	116 - 53	Jehangira	- Nowshera
3	53 - 2	Nowshera	- Peshawar
4	2 - 49	Peshawar	- Afghan. Bound
353005	152 - 90	P/N Bound	- Haripur
6	90 - 4	Haripur	- Abbottabad
7	4 - 54	Abbottabad	- Mansehra
8	54 - 89	Mansehra	- Besham
9	89 - 47	Besham	- Sazin
503010	5 - 153	D.I. Khan	- N/B Bound
11	155 - 4	P/N Bound	- Abbottabad
12	59 - 156	Jajazai	- N/P Bound
13	94 - 157	Jatta	- N/P Bound
14	49 - 3	Parachinar	- Kohat
15	3 - 158	Kohat	- N/P Bound
16	160 - 5	P/N Bound	- D.I. Khan
17	5 - 59	D.I. Khan	- Jajazai
18	59 - 6	Jajazai	- Bannu
19	6 - 94	Bannu	- Jatta
20	94 - 3	Jatta	- Kohat
21	3 - 2	Kohat	- Peshawar
22	161 - 5	P/N Bound	- D.I. Khan
003023	53 - 1	Nowshera	- Mardan
24	1 - 52	Mardan	- Chakdara
25	52 - 7	Chakdara	- Dir
26	2 - 91	Peshawar	- Charsadda
27	91 - 1	Charsadda	- Mardan
28	1 - 115	Mardan	- Swani
29	115 - 90	Swabi	- Haripur
30	52 - 8	Chakdara	- Saidu Sharif
31	8 - 89	Saidu Sharif	- Besham
32	116 - 115	Jehangira	- Swabi
33	2 - 1	Peshawar	- Mardan

BALUCHISTAN PROVINCE

LINK NO.	NO. OF NODE	NAME OF NODE	
254001	151 - 114	S/B Bound	- Wingai
2	114 - 44	Wingai	- Bela
3	44 - 110	Bela	- Surab
4	110 - 43	Surab	- Kalat
5	43 - 40	Kalat	- Quetta
5	40 - 49	Quatta	- Afghan Bound
504007	153 - 96	N/B Bound	- Qila Saifullah
8	96 - 40	Qila Saifullah	- Quetta
654009	154 - 45	S/B Bound	- Sibi
10	45 - 40	Sibi	- Quetta
004011	40 - 41	Quetta	- Loralai
12	41 - 162	Loralai	- B/P Bound
13	40 - 42	Quetta	- Dalbandin
14	42 - 51	Dalbandin	- Iran Bound
15	44 - 112	Bela	- Hoshab
16	112 - 111	Hoshab	- Pidapak
17	111 - 46	Pidapak	- Gawadar
18	110 - 112	Surab	- Hoshab
19	114 - 113	Wingai	- Pasani
004020	113 - 46	Pasani	- Gawardar
21	111 - 113	Pidarak	- Pasani
22	41 - 96	Loralai	- Qila Saifullah
23	45 - 97	Sibi	- Bewata

Table 2-1-6 (1) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
1	52001	160	3	75	5	1	13327.	4532.4	V	B	80	***	***	12132.	4031.8	V	B	81	***	***
2	52002	15	3	70	5	4	12512.	3973.5	V	B	81	***	***	11465.	3539.5	V	B	81	***	***
3	52003	55	3	69	5	3	13869.	3721.7	V	B	82	***	***	12817.	3291.9	V	B	82	***	***
4	52004	38	3	75	5	3	10182.	3578.6	V	B	83	***	***	8832.	3013.9	V	B	84	***	***
5	52005	68	3	75	5	4	9860.	3585.6	V	B	83	***	***	8158.	2874.3	V	B	85	***	***
6	52006	132	3	75	5	4	7662.	2526.2	V	B	86	***	***	7755.	2603.8	V	B	86	***	***
7	52007	22	3	75	5	4	9278.	2989.5	V	B	84	***	***	9563.	3131.7	V	B	83	***	***
8	52008	109	3	75	5	4	6325.	2446.4	V	A	***	***	***	4998.	1888.8	V	A	***	***	***
9	52009	13	3	75	5	3	5709.	2167.3	V	A	***	***	***	4597.	1705.2	IV	D	***	***	83
10	51001	48	3	62	5	3	5307.	2057.5	V	A	***	***	***	4263.	1619.4	IV	D	***	***	84
11	51002	100	3	61	5	3	5289.	2021.3	V	A	***	***	***	4305.	1599.5	IV	D	***	***	84
12	51003	12	3	61	5	4	3152.	1200.2	IV	C	***	83	***	2476.	934.5	IV	B	***	***	***
13	51004	70	3	58	5	3	4388.	1486.2	IV	D	***	81	86	3490.	1162.4	IV	C	***	81	***
14	51005	18	3	64	5	3	4354.	1480.4	IV	D	***	80	85	3725.	1243.8	IV	C	***	81	***
15	51006	75	3	64	5	4	3185.	828.2	IV	C	***	81	***	3207.	883.1	IV	C	***	81	***
16	51007	44	3	62	5	4	7293.	2174.7	V	B	86	***	***	7327.	2188.6	V	B	86	***	***
17	51008	13	3	63	5	4	4604.	1107.5	IV	D	***	82	86	4628.	1108.5	IV	D	***	82	86
18	51009	79	3	62	5	4	4664.	1291.8	IV	D	***	81	85	4182.	1091.0	IV	C	***	82	***
19	51010	40	3	62	5	4	5565.	1588.1	V	A	***	***	***	4962.	1336.5	IV	D	***	82	85
20	51011	37	3	69	5	4	6306.	1755.4	V	A	***	***	***	5934.	1596.4	V	A	***	***	***
21	51012	130	3	75	5	4	4955.	1378.5	IV	D	***	81	85	4625.	1238.4	IV	D	***	81	85
22	51013	67	3	96	5	5	10026.	1449.0	V	B	86	***	***	10126.	1472.5	V	B	86	***	***
23	51014	32	3	80	5	3	8421.	1647.2	V	A	***	***	***	9677.	2161.9	V	B	85	***	***
24	51015	15	3	84	5	3	7565.	1716.2	V	A	***	***	***	9154.	2368.9	V	B	84	***	***
25	51016	52	3	85	5	3	7235.	1634.7	V	A	***	***	***	8001.	1954.4	V	A	***	***	***
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	V	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	V	[illegible]	[illegible]	[illegible]	[illegible]

TER: (terrain) 1; Mountainous 2; Hilly 3; Flat

TYPE; (surface) 1; Earth 2; Gravel 3; Bituminous Surface Single
4; Pavement (Double) 5; Pavement (Tripple)

COND; (surface condition) 1; Good 2; Fairly Good 3; Flat 4; Poor 5; Very Poor

Table 2-1-6 (2) List of Candidate Project by the Year 1987/1988 (1st stage construction)

HIGHWAY SECTION SEQ	LINK-NO	LENGTH (KM)	EXISTING ROAD TER.	WIDTH (10CM)	TYPE	COND.	PLAN A: A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	PLAN B: A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
27	51018	32	2	74	5	3	6824.	1465.7	V	A	***	***	***	7137.	1592.2	V	A	***	***	***
28	51019	29	3	73	5	3	7097.	1679.1	V	A	***	***	***	7457.	1831.1	V	A	***	***	***
29	51020	16	3	133	5	3	11809.	2451.4	V	B	81	***	***	13200.	3037.4	V	B	81	***	***
30	51021	30	3	113	5	3	8177.	1779.8	V	A	***	***	***	9166.	2193.9	V	B	85	***	***
31	51022	45	2	74	5	3	6678.	1515.7	V	A	***	***	***	7261.	1759.9	V	A	***	***	***
32	53001	14	3	60	5	3	4904.	919.7	IV	C	***	***	***	5311.	1069.4	IV	D	***	***	85
33	53002	36	3	60	5	3	3972.	831.6	IV	C	***	84	***	4349.	977.3	IV	C	***	83	***
34	53003	23	3	100	5	3	7498.	1180.0	V	A	***	***	***	8159.	1447.1	V	A	***	***	***
35	53004	53	1	65	5	4	1303.	211.8	III	C	***	85	***	1303.	211.8	III	C	***	85	***
36	252010	18	3	73	3	3	2984.	539.1	III	D	***	80	86	2983.	538.8	IV	B	***	***	***
37	254001	82	3	50	3	3	1708.	423.7	III	C	***	86	***	1707.	423.5	III	C	***	86	***
38	254002	77	2	38	3	3	1689.	416.3	III	C	***	84	***	1689.	416.0	III	C	***	84	***
39	254003	293	1	38	3	3	230.	88.6	I	E	***	***	***	230.	88.6	II	B	***	***	***
40	254004	69	2	38	3	3	230.	88.6	I	D	***	***	***	230.	88.6	I	D	***	***	***
41	254005	144	2	61	3	4	1207.	139.6	III	B	***	***	***	1308.	182.7	III	B	***	***	***
42	254006	131	2	51	3	4	1283.	206.2	III	B	***	***	***	1283.	206.2	III	B	***	***	***
43	351023	14	3	75	5	3	4368.	720.5	IV	C	***	84	***	4960.	973.8	IV	C	***	82	***
44	353005	3	2	67	5	3	3240.	661.1	IV	C	***	85	***	3796.	899.2	IV	C	***	83	***
45	353006	54	1	69	5	3	5675.	717.0	V	A	***	***	***	6234.	955.7	V	A	***	***	***
46	353007	24	1	65	5	3	1891.	218.7	III	C	***	***	***	1891.	218.7	III	C	***	***	***
47	353008	122	1	66	5	5	259.	35.1	II	B	***	***	***	259.	35.1	II	B	***	***	***
48	353009	157	1	66	3	3	102.	29.3	II	A	***	***	***	102.	29.3	II	A	***	***	***
49	503010	141	2	39	3	4	158.	53.4	I	C	81	86	***	122.	38.9	I	B	81	***	***
50	504007	210	1	44	3	5	158.	53.4	I	C	80	84	***	122.	38.9	I	B	80	***	***
51	504008	175	1	37	3	5	202.	41.1	I	C	***	***	***	256.	82.3	II	B	***	***	***
52	652011	43	3	69	5	4	2534.	670.7	IV	B	***	***	***	3541.	1105.1	IV	C	***	84	***

Table 2-1-6 (3) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
53	652012	42	3	61	5	4	2182.	634.6	IV	B	81	***	***	2776.	897.1	IV	C	81	86	***
54	652013	8	3	66	5	4	3387.	1110.6	IV	C	***	84	***	4146.	1443.2	IV	D	***	83	86
55	654009	148	3	48	4	4	2326.	639.9	III	D	***	82	86	2743.	825.4	IV	B	80	***	***
56	654010	163	1	56	5	3	1986.	700.6	IV	C	80	86	***	1910.	676.8	IV	C	80	86	***
57	1024	63	1	65	5	4	1018.	126.2	III	B	***	***	***	1018.	126.2	III	B	***	***	***
58	1025	9	1	35	5	4	362.	63.6	II	B	***	***	***	362.	63.6	II	B	***	***	***
59	3011	55	1	35	5	4	230.	21.5	I	C	***	83	***	230.	21.5	I	C	***	83	***
60	3012	39	2	48	4	4	286.	82.7	II	B	***	***	***	399.	131.4	II	B	***	***	***
61	1026	54	3	33	5	3	286.	82.7	II	B	***	***	***	399.	131.4	II	B	***	***	***
62	1027	48	3	33	5	3	2909.	875.4	IV	C	81	86	***	1994.	585.8	III	C	***	83	***
63	3013	999	1	33	3	4	944.	374.0	III	C	82	86	***	454.	183.0	II	C	82	84	***
64	1028	999	1	28	3	4	944.	374.0	III	C	82	86	***	454.	183.0	II	C	82	84	***
65	3014	186	1	42	5	4	871.	129.8	III	B	***	***	***	871.	129.8	III	B	***	***	***
66	3015	50	3	54	4	4	396.	89.9	II	B	***	***	***	432.	102.9	II	B	***	***	***
67	1029	38	3	30	5	3	450.	103.0	II	B	***	***	***	494.	118.4	II	B	***	***	***
68	1030	40	3	30	5	3	522.	106.3	II	B	***	***	***	563.	119.5	II	B	***	***	***
69	1031	30	3	61	5	3	711.	119.3	II	C	***	***	81	736.	123.6	II	C	***	***	82
70	2014	196	3	54	5	3	1353.	444.4	III	B	***	***	***	1353.	444.4	III	B	***	***	***
71	2015	123	3	54	5	3	1837.	520.4	III	C	***	***	***	1823.	512.5	III	C	***	***	***
72	2016	63	3	54	5	4	781.	127.3	II	C	***	***	83	1001.	218.4	II	D	***	***	***
73	2017	64	3	54	5	4	479.	136.3	II	B	***	***	***	479.	136.3	II	B	***	***	***
74	2018	47	3	54	5	2	765.	267.3	II	C	***	***	84	806.	281.4	II	D	***	***	***
75	2019	2	3	54	5	1	846.	278.6	II	D	***	80	85	773.	242.8	II	C	***	80	***
76	1032	224	3	31	5	3	846.	278.6	II	D	***	80	85	773.	242.8	II	C	***	80	***
77	1033	53	3	35	5	3	979.	312.7	III	B	***	***	***	979.	312.7	III	B	***	***	***
78	1034	106	3	37	5	3	408.	138.9	II	D	***	***	***	408.	138.9	II	[illegible]	***	***	***

Table 2-7-6 (4) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION-- SEQ	LINK-NO	LENGTH (KM)	----EXISTING ROAD---- TER.	WIDTH (10CM)	TYPE	COND.	------IMPROVEMENT FOR MASTER PLAN A------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	------IMPROVEMENT FOR MASTER PLAN B------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
79	3016	62	3	62	5	4	356.	131.1	II	B	***	***	***	356.	131.1	II	B	***	***	***
80	3017	95	3	40	5	4	760.	173.2	II	C	***	***	82	746.	164.0	II	C	***	***	81
81	3018	47	3	58	5	2	1426.	273.3	III	B	***	***	***	1517.	306.9	III	C	***	86	***
82	3019	98	2	54	5	2	827.	212.0	III	B	***	***	***	814.	203.8	II	D	***	***	***
83	3020	29	3	40	5	5	5583.	629.6	IV	C	***	83	***	4694.	425.9	IV	C	***	86	***
84	3021	65	1	50	5	3	4767.	999.6	V	A	***	***	***	4327.	861.2	IV	D	***	***	84
85	1035	38	3	140	5	3	5454.	1146.5	V	A	***	***	***	8548.	1915.5	V	B	86	***	***
86	1036	97	3	69	5	3	2819.	488.6	III	D	***	***	***	2953.	562.1	IV	B	***	***	***
87	1037	82	3	70	5	3	3849.	1059.0	IV	C	***	81	***	3965.	1125.5	IV	C	***	80	***
88	1038	32	3	61	5	3	1004.	310.0	III	B	***	***	***	1004.	310.0	III	B	***	***	***
89	1039	94	3	26	5	3	259.	66.5	I	D	***	***	86	240.	62.6	I	C	***	***	***
90	1040	999	3	28	5	3	221.	65.1	II	B	***	***	***	282.	93.6	II	B	***	***	***
91	3022	999	3	28	5	3	1781.	678.7	III	C	82	84	***	1222.	239.1	III	B	***	***	***
92	4011	217	1	36	2	5	228.	39.5	I	C	80	83	***	96.	21.7	I	B	82	***	***
93	4012	189	1	36	3	5	791.	323.7	III	B	81	***	***	757.	308.8	III	B	81	***	***
94	1041	8	3	27	2	3	791.	323.7	II	D	***	82	85	757.	308.8	II	D	***	82	86
95	1042	84	1	30	5	3	890.	370.9	III	C	81	86	***	654.	271.2	III	B	81	***	***
96	2020	34	3	73	3	3	2078.	469.8	III	C	***	***	82	2195.	516.3	III	C	***	***	84
97	2021	32	3	60	3	3	2638.	577.7	III	D	***	***	85	2768.	629.5	III	D	***	***	84
98	2022	74	3	36	3	3	1129.	276.9	III	B	***	***	***	1181.	297.3	III	B	***	***	***
99	2023	102	3	73	3	3	2158.	640.3	III	C	***	***	86	2584.	822.3	III	D	***	***	***
100	2024	100	3	55	3	3	1276.	401.0	III	B	***	***	***	1276.	401.0	III	B	***	***	***
101	2025	999	3	55	3	3	2748.	988.9	IV	C	82	86	***	4196.	1614.6	IV	D	81	84	86
102	2026	21	3	73	3	4	2152.	417.7	III	C	***	84	***	2416.	530.6	III	C	***	83	***
103	2027	16	3	36	3	3	501.	98.7	II	B	***	***	***	662.	167.7	II	C	***	82	***
104	2028	48	3	36	3	3	852.	192.2	II	C	***	80	***	1191.	337.8	III	B	81	***	***

Table 2-1-6 (5) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
105	2029	68	3	42	3	3	1077.	265.7	III	B	***	***	***	1113.	273.4	III	B	***	***	***
106	2030	40	3	33	3	4	1106.	243.0	III	B	***	***	***	1106.	243.0	III	B	***	***	***
107	2031	45	3	33	3	4	217.	51.2	I	C	***	81	***	217.	51.2	I	C	***	81	***
108	2032	81	3	33	3	5	563.	163.3	II	C	***	85	***	561.	162.6	II	C	***	85	***
109	2033	24	3	33	3	5	1139.	316.6	III	B	***	***	***	1136.	315.2	III	B	***	***	***
110	2034	34	3	64	3	5	1083.	220.5	III	B	***	***	***	1095.	225.4	III	B	***	***	***
111	2035	16	3	58	3	5	1416.	368.1	III	B	***	***	***	1436.	377.0	III	B	***	***	***
112	2036	52	3	64	3	5	1060.	244.2	III	B	***	***	***	1073.	249.9	III	B	***	***	***
113	2037	30	3	36	3	4	193.	48.0	I	B	***	***	***	193.	48.0	I	B	***	***	***
114	2038	55	3	55	3	3	1271.	309.1	III	B	***	***	***	1271.	309.1	III	B	***	***	***
115	2039	45	3	38	3	4	608.	169.0	II	C	***	***	***	608.	169.0	II	C	***	***	***
116	2040	26	3	33	3	5	608.	169.0	II	C	***	***	***	608.	169.0	II	C	***	***	***
117	2041	77	3	36	3	5	601.	139.4	II	C	***	***	***	601.	139.4	II	C	***	***	***
118	2042	31	3	40	3	5	731.	239.6	II	C	***	***	***	731.	239.6	II	C	***	***	***
119	112043	26	3	54	3	4	2376.	334.8	III	C	***	84	***	2598.	428.3	III	C	***	83	***
120	112044	40	3	50	3	3	1907.	352.9	III	C	***	84	***	2186.	470.8	III	C	***	82	***
121	112045	135	3	40	3	3	16.	3.8	I	A	***	***	***	16.	3.8	I	A	***	***	***
122	112046	76	3	46	3	2	873.	186.5	II	C	***	82	***	919.	194.3	II	C	***	82	***
123	1043	129	3	50	5	4	2872.	1089.5	IV	C	***	84	***	2452.	879.8	IV	B	***	***	***
124	1044	63	3	30	5	3	588.	217.7	II	C	***	84	***	326.	103.6	II	B	***	***	***
125	1045	92	3	30	5	3	593.	240.9	II	C	***	82	***	397.	145.3	II	B	***	***	***
126	1046	138	3	30	5	4	536.	217.0	II	C	82	86	***	136.	54.3	I	B	83	***	***
127	1047	46	1	37	5	3	644.	150.1	III	B	***	***	***	850.	223.8	III	B	***	***	***
128	1048	58	3	30	5	3	545.	87.8	II	B	***	***	***	575.	100.3	II	C	***	84	***
129	1049	62	3	43	5	3	1724.	274.0	III	B	***	***	***	1786.	309.0	III	C	***	86	***
130	1050	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	C	[illegible]	[illegible]	[illegible]

Table 2-1-6 (6) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION-- SEQ	LINK-NO	LENGTH (KM)	----EXISTING ROAD---- TER.	WIDTH (10CM)	TYPE	COND.	------IMPROVEMENT FOR MASTER PLAN A------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	------IMPROVEMENT FOR MASTER PLAN B------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
131	1051	999	3	35	5	4	1495.	524.9	III	C	81	85	***	1522.	536.2	III	C	81	85	***
132	1052	26	3	42	5	3	1735.	551.1	III	C	***	83	***	1762.	562.5	III	C	***	83	***
133	1053	34	3	63	5	3	5619.	1739.9	V	A	***	***	***	6180.	1934.0	V	A	***	***	***
134	1054	113	3	58	5	3	4016.	1414.7	IV	D	***	83	86	3889.	1364.4	IV	C	***	83	***
135	1055	117	3	39	5	4	1809.	549.7	III	C	***	82	***	1779.	534.0	III	C	***	83	***
136	1056	171	3	60	5	4	1040.	154.9	II	C	***	***	***	1041.	159.1	II	C	***	***	***
137	1057	70	3	73	5	3	3214.	786.6	IV	C	***	85	***	3766.	988.6	IV	C	***	83	***
138	1058	63	3	36	5	3	1833.	381.0	III	C	***	84	***	1948.	426.1	III	C	***	84	***
139	1059	47	3	73	5	3	2730.	632.0	IV	B	***	***	***	2813.	677.0	IV	C	***	86	***
140	1060	89	3	61	5	3	1191.	329.8	III	B	***	***	***	1131.	319.7	III	B	***	***	***
141	1061	53	3	59	5	3	1633.	330.9	III	C	***	***	***	1688.	373.0	III	C	***	***	***
142	1062	48	3	57	5	3	3498.	514.5	IV	C	***	86	***	3577.	531.4	IV	C	***	86	***
143	1063	42	3	47	5	3	784.	148.4	III	B	***	***	***	1248.	336.4	III	B	***	***	***
144	1064	138	3	61	5	4	617.	108.9	II	C	***	***	***	617.	108.9	II	C	***	***	***
145	1065	91	3	30	5	3	1738.	102.9	III	B	***	***	***	1723.	98.3	III	B	***	***	***
146	1066	78	3	60	5	4	870.	168.9	II	D	***	***	86	842.	158.9	II	C	***	***	***
147	1067	40	3	36	5	3	1910.	380.0	III	C	***	82	***	2948.	828.8	IV	C	80	85	***
148	1068	46	3	55	5	3	728.	118.6	II	C	***	***	***	1109.	276.8	III	B	***	***	***
149	1069	40	3	63	5	3	1802.	298.9	III	C	***	***	***	1836.	310.1	III	C	***	***	***
150	1070	37	3	60	5	3	2612.	713.7	III	D	***	***	82	2854.	777.8	IV	C	***	86	***
151	1071	52	3	58	5	3	3364.	874.7	IV	C	***	80	***	3379.	881.4	IV	C	***	80	***
152	1072	107	3	35	5	4	481.	90.9	II	B	***	***	***	481.	90.9	II	B	***	***	***
153	1073	130	3	37	5	4	330.	65.9	I	D	***	***	***	330.	65.9	I	D	***	***	***
154	1074	25	3	61	5	3	111.	12.8	II	A	***	***	***	111.	12.8	II	A	***	***	***
155	1075	50	3	36	5	4	390.	82.0	II	B	***	***	***	390.	82.0	II	B	***	***	***
156	1076	31	3	60	5	3	2827.	1141.6	IV	C	80	85	***	2229.	890.2	IV	B	80	***	***

Table 2-1-6 (7) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION-- SEQ	LINK-NO	LENGTH (KM)	----EXISTING ROAD---- TER.	WIDTH (10CM)	TYPE	COND.	------IMPROVEMENT FOR MASTER PLAN A------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	------IMPROVEMENT FOR MASTER PLAN B------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
157	1077	57	3	60	5	3	2827.	1141.6	IV	C	***	85	***	2229.	890.2	IV	B	***	***	***
158	111078	40	3	45	5	3	1443.	333.5	III	C	***	***	***	1443.	333.5	III	C	***	***	***
159	111079	57	3	51	5	3	1001.	283.6	III	B	***	***	***	1001.	283.6	III	B	***	***	***
160	111080	35	3	61	5	3	1323.	355.6	III	B	***	***	***	1323.	355.6	III	B	***	***	***
161	111081	40	3	43	5	3	1003.	274.5	III	B	***	***	***	1003.	274.5	III	B	***	***	***
162	111082	54	3	60	5	4	557.	148.9	II	C	***	***	***	557.	148.9	II	C	***	***	***
163	111083	24	3	35	5	3	463.	144.8	II	B	***	***	***	463.	144.8	II	B	***	***	***
164	111084	138	3	55	5	3	598.	154.5	II	C	***	***	***	598.	154.5	II	C	***	***	***
165	111085	48	3	56	5	3	930.	242.4	III	B	***	***	***	930.	242.4	III	B	***	***	***
166	111086	48	3	58	5	3	719.	156.4	II	C	***	***	***	719.	156.4	II	C	***	***	***
167	111087	40	3	52	5	4	1121.	302.9	III	B	***	***	***	1121.	302.9	III	B	***	***	***
168	111088	51	3	38	5	3	336.	57.1	II	B	***	***	***	344.	59.4	II	B	***	***	***
169	111089	82	3	61	5	4	2908.	1041.6	IV	C	82	86	***	3382.	1215.2	IV	C	81	85	***
170	111090	33	3	61	5	3	2908.	1041.6	IV	C	80	85	***	3823.	1324.4	IV	C	80	84	***
171	111091	99	3	61	5	4	2921.	941.9	IV	C	81	86	***	3535.	1117.9	IV	C	81	84	***
172	111092	60	3	30	5	3	2162.	778.7	III	D	80	83	86	1437.	476.3	III	C	80	85	***
173	111093	104	3	50	5	3	2120.	755.3	III	D	***	82	86	1377.	450.5	III	C	***	85	***
174	111094	125	3	50	5	3	1739.	661.7	III	C	***	83	***	1210.	440.4	III	B	***	***	***
175	111095	99	3	33	5	4	1337.	437.4	III	B	***	***	***	1337.	444.4	III	B	***	***	***
176	111096	47	3	35	5	4	131.	42.0	II	A	***	***	***	413.	128.5	II	B	82	***	***
177	111097	82	3	30	5	4	836.	272.2	III	B	84	***	***	1063.	337.7	III	B	83	***	***
178	111098	81	2	33	5	4	836.	272.2	III	B	84	***	***	1052.	333.1	III	B	83	***	***
179	111099	87	3	47	5	4	691.	201.2	II	C	***	***	***	691.	201.2	II	C	***	***	***
180	111100	68	3	31	5	4	418.	82.2	II	B	***	***	***	418.	82.2	II	B	***	***	***
181	111101	46	3	32	5	4	1171.	425.5	III	B	83	***	***	1268.	473.3	III	B	83	***	***
182	111102	64	3	37	5	3	146.	25.7	I	B	***	***	***	146.	25.7	I	B	***	***	***

Table 2-1-6 (8) List of Candidate Project by the Year 1987/1988 (1st stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
183	111103	57	3	58	5	3	1115.	220.4	III	B	***	***	***	1127.	225.1	III	B	***	***	***
184	111104	29	3	30	5	5	793.	246.3	II	D	***	***	***	793.	246.3	II	D	***	***	***
185	111105	29	3	30	5	4	314.	97.7	II	B	***	***	***	314.	97.7	II	B	***	***	***
186	111106	31	3	30	5	4	187.	67.5	I	C	***	***	***	187.	67.5	I	C	***	***	***
187	111107	50	3	55	5	1	788.	216.2	II	C	***	***	***	788.	216.2	II	C	***	***	***
188	3023	23	3	62	5	2	4773.	719.1	IV	C	***	81	***	5083.	852.4	IV	C	***	81	***
189	3024	66	2	59	5	2	2360.	396.7	III	C	***	***	***	2479.	447.7	III	D	***	***	85
190	3025	132	1	36	4	2	545.	127.2	II	C	***	***	***	549.	129.1	II	C	***	***	***
191	3026	29	3	73	4	3	3102.	488.3	III	D	***	***	***	3102.	488.3	III	D	***	***	***
192	3027	28	3	73	4	3	654.	110.1	II	C	***	***	***	654.	110.1	II	C	***	***	***
193	3028	46	3	71	4	3	1757.	241.0	III	B	***	***	***	1757.	241.0	III	B	***	***	***
194	3029	999	1	71	4	3	572.	53.4	II	C	***	***	***	572.	53.4	II	C	***	***	***
195	3030	35	3	48	5	2	2193.	287.3	III	C	***	83	***	2288.	327.9	III	C	***	83	***
196	3031	82	1	36	5	3	0.	0.1	I	A	***	***	***	0.	0.1	I	A	***	***	***
197	3032	33	3	61	4	3	1173.	159.3	II	D	***	***	***	1173.	159.3	II	D	***	***	***
198	4013	344	2	39	4	3	137.	27.1	I	B	***	***	***	224.	64.8	I	C	***	83	***
199	4014	366	3	39	2	3	0.	0.0	I	A	***	***	***	0.	0.0	I	A	***	***	***
200	4015	328	3	36	1	4	226.	87.3	I	C	***	***	***	226.	87.3	I	C	***	***	***
201	4016	118	3	36	2	4	230.	22.4	I	C	***	***	***	230.	22.4	I	C	***	***	***
202	4017	230	3	36	2	4	7.	1.9	I	A	***	***	***	7.	1.9	I	A	***	***	***
203	4018	530	2	36	2	4	7.	1.9	I	A	***	***	***	7.	1.9	I	A	***	***	***
204	4019	999	3	36	3	4	19.	7.5	I	A	***	***	***	19.	7.5	I	A	***	***	***
205	4020	169	3	36	3	4	19.	7.5	I	A	***	***	***	19.	7.5	I	A	***	***	***
206	4021	115	3	36	3	4	15.	5.7	I	A	***	***	***	15.	5.7	I	A	***	***	***
207	4022	72	1	36	3	4	182.	32.4	I	C	***	***	***	182.	32.4	I	C	***	***	***
208	4023	272	2	36	3	4	102.	42.2	I	B	83	***	***	7.	2.9	I	A	***	***	***

Table 2-1-7 (1) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
1	52001	160	3	75	5	1	29371.	10484.1	VI	C	***	94	***	24766.	8573.2	V	C	***	90	***
2	52002	15	3	70	5	4	27178.	9167.7	VI	C	***	96	***	22349.	7216.7	V	C	***	92	***
3	52003	55	3	69	5	3	28296.	8325.9	VI	C	***	97	***	23133.	6277.4	V	C	***	93	***
4	52004	38	3	75	5	3	21810.	8002.5	V	C	***	92	***	15935.	5591.2	V	B	***	***	***
5	52005	68	3	75	5	4	21446.	8070.7	V	C	***	92	***	14640.	5279.7	V	B	***	***	***
6	52006	132	3	75	5	4	16673.	5777.8	V	C	***	98	***	18209.	6612.2	V	C	***	96	***
7	52007	22	3	75	5	4	20114.	6833.8	V	C	***	94	***	22459.	7941.0	V	C	***	93	***
8	52008	109	3	75	5	4	14377.	5678.2	V	B	87	***	***	9435.	3611.1	V	B	91	***	***
9	52009	13	3	75	5	3	13084.	5086.2	V	B	88	***	***	8808.	3310.9	V	B	93	***	***
10	51001	48	3	62	5	3	12200.	4827.1	V	B	89	***	***	8186.	3143.9	V	B	94	***	***
11	51002	100	3	61	5	3	14278.	5584.5	V	B	88	***	***	9760.	3682.5	V	B	92	***	***
12	51003	12	3	61	5	4	10922.	4200.3	V	B	92	***	***	8403.	3140.8	V	B	95	***	***
13	51004	70	3	58	5	3	11713.	4072.0	V	B	91	***	***	9213.	3058.7	V	B	94	***	***
14	51005	18	3	64	5	3	11221.	3992.2	V	B	91	***	***	9276.	3177.7	V	B	93	***	***
15	51006	75	3	64	5	4	16525.	5821.8	V	C	90	97	***	12074.	3994.4	V	B	92	***	***
16	51007	44	3	62	5	4	18707.	6187.9	V	C	***	95	***	15204.	4766.4	V	B	***	***	***
17	51008	13	3	63	5	4	8935.	2243.4	V	B	94	***	***	8387.	2006.3	V	B	96	***	***
18	51009	79	3	62	5	4	9307.	2693.1	V	B	93	***	***	8298.	2244.1	V	B	95	***	***
19	51010	40	3	62	5	4	11293.	3365.7	V	B	90	***	***	9658.	2667.7	V	B	92	***	***
20	51011	37	3	69	5	4	12617.	3710.7	V	B	88	***	***	11523.	3243.0	V	B	89	***	***
21	51012	130	3	75	5	4	10085.	2953.9	V	B	91	***	***	9088.	2540.9	V	B	93	***	***
22	51013	67	3	96	5	5	18780.	2939.9	V	B	***	***	***	19806.	3291.2	V	B	***	***	***
23	51014	32	3	80	5	3	16689.	3550.9	V	B	87	***	***	19780.	4791.5	V	C	***	97	***
24	51015	15	3	84	5	3	14932.	3640.0	V	B	87	***	***	18823.	5205.5	V	C	***	96	***
25	51016	52	3	85	5	3	14019.	3372.1	V	B	88	***	***	15726.	4091.2	V	B	87	***	***
26	51017	38	2	81	5	3	15984.	3563.2	V	B	***	***	***	16837.	3912.4	V	B	***	***	***

TER; (terrain) 1; Mountainous 2; Hilly 3; Flat

TYPE; (surface) 1; Earth 2; Gravel 3; Bituminous Surface Single 4; Pavement (Double) 5; Pavement (Tripple)

COND; (surface condition) 1; Good 2; Fairly Good 3; Flat 4; Poor 5; Very Poor

Table 2-1-7 (2) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
27	51018	32	2	74	5	3	13079.	2997.8	V	B	88	***	***	13772.	3286.1	V	B	87	***	***
28	51019	29	3	73	5	3	13717.	3450.0	V	B	88	***	***	14232.	3683.4	V	B	87	***	***
29	51020	16	3	133	5	3	23072.	5176.1	V	C	***	95	***	26196.	6500.6	V	C	***	92	***
30	51021	30	3	113	5	3	15964.	3732.3	V	B	87	***	***	18174.	4666.0	V	C	***	98	***
31	51022	45	2	74	5	3	12867.	3113.1	V	B	88	***	***	14265.	3696.0	V	B	87	***	***
32	53001	14	3	60	5	3	9771.	1917.5	V	B	96	***	***	10328.	2141.0	V	B	94	***	***
33	53002	36	3	60	5	3	7998.	1751.6	V	A	***	***	***	8540.	1973.5	V	B	98	***	***
34	53003	23	3	100	5	3	13903.	2325.2	V	B	90	***	***	15147.	2848.6	V	B	88	***	***
35	53004	53	1	65	5	4	2429.	430.8	IV	C	***	98	***	2429.	430.8	IV	C	***	98	***
36	252010	18	3	73	3	3	5947.	1209.4	IV	D	***	89	97	5819.	1162.8	V	A	***	***	***
37	254001	82	3	50	3	3	3524.	952.5	IV	C	***	96	***	3430.	915.4	IV	C	***	97	***
38	254002	77	2	38	3	3	3479.	934.2	IV	C	***	94	***	3385.	897.0	IV	C	***	95	***
39	254003	293	1	38	3	3	230.	88.6	II	B	***	***	***	230.	88.6	II	B	***	***	***
40	254004	69	2	38	3	3	230.	88.6	II	B	***	***	***	230.	88.6	II	B	***	***	***
41	254005	144	2	61	3	4	2323.	346.0	IV	B	90	***	***	2456.	413.0	III	C	***	90	***
42	254006	131	2	51	3	4	1283.	206.2	III	B	***	***	***	1283.	206.2	III	B	***	***	***
43	351023	14	3	75	5	3	8711.	1591.9	V	A	***	***	***	10002.	2141.3	V	B	96	***	***
44	353005	3	2	67	5	3	6576.	1467.2	V	A	***	***	***	7787.	1983.4	V	B	97	***	***
45	353006	54	1	69	5	3	11107.	1569.2	V	B	91	***	***	12332.	2087.5	V	B	88	***	***
46	353007	24	1	65	5	3	1891.	218.7	III	C	***	***	***	1891.	218.7	III	C	***	***	***
47	353008	122	1	66	5	5	259.	35.1	II	B	***	***	***	259.	35.1	II	B	***	***	***
48	353009	157	1	66	3	3	102.	29.3	II	A	***	***	***	102.	29.3	II	A	***	***	***
49	503010	141	2	39	3	4	158.	53.4	II	A	***	***	***	122.	38.9	II	A	***	***	***
50	504007	210	1	44	3	5	158.	53.4	II	B	***	***	***	122.	38.9	II	A	***	***	***
51	504008	175	1	37	3	5	202.	41.1	II	B	***	***	***	256.	82.3	II	B	***	***	***
52	652011	43	3	69	5	4	5012.	1425.1	V	A	***	***	***	6967.	2273.3	V	A	***	***	***

Table 2-1-7 (3) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
53	652012	42	3	61	5	4	4477.	1373.7	V	A	***	***	***	5682.	1918.3	V	A	***	***	***
54	652013	8	3	66	5	4	6611.	2227.8	V	A	***	***	***	7845.	2789.0	V	B	96	***	***
55	654009	148	3	48	4	4	4470.	1281.5	IV	C	***	90	***	5123.	1594.0	V	A	***	***	***
56	654010	163	1	56	5	3	3960.	1422.4	V	A	***	***	***	3704.	1331.9	V	A	***	***	***
57	1024	63	1	65	5	4	1754.	201.6	III	C	***	91	***	1754.	201.6	III	C	***	91	***
58	1025	9	1	35	5	4	619.	102.4	II	C	***	90	***	619.	102.4	II	C	***	90	***
59	3011	55	1	35	5	4	403.	34.7	II	B	88	***	***	403.	34.7	II	B	88	***	***
60	3012	39	2	48	4	4	366.	115.8	II	B	***	***	***	715.	261.7	II	D	***	88	97
61	1026	54	3	33	5	3	366.	115.8	II	B	***	***	***	715.	261.7	II	C	***	89	***
62	1027	48	3	33	5	3	1889.	549.5	IV	B	***	87	***	2654.	836.7	IV	B	***	***	***
63	3013	999	1	33	3	4	431.	178.6	III	B	***	88	***	485.	198.2	II	D	***	***	98
64	1028	999	1	28	3	4	431.	178.6	III	B	***	88	***	485.	198.2	II	D	***	***	98
65	3014	186	1	42	5	4	871.	129.8	III	B	***	***	***	871.	129.8	III	B	***	***	***
66	3015	50	3	54	4	4	859.	230.5	II	D	***	90	97	932.	262.0	II	D	***	89	95
67	1029	38	3	30	5	3	986.	267.3	III	B	90	***	***	1073.	304.9	III	B	89	***	***
68	1030	40	3	30	5	3	983.	221.9	III	B	90	***	***	1072.	260.1	III	B	89	***	***
69	1031	30	3	61	5	3	1342.	252.2	III	B	***	***	***	1323.	250.1	III	B	***	***	***
70	2014	196	3	54	5	3	1353.	444.4	III	B	***	***	***	1353.	444.4	III	B	***	***	***
71	2015	123	3	54	5	3	3687.	1098.5	IV	C	***	93	***	3588.	1048.1	IV	C	***	93	***
72	2016	63	3	54	5	4	1409.	239.5	III	B	***	***	***	1882.	426.5	III	C	***	94	***
73	2017	64	3	54	5	4	479.	136.3	II	B	***	***	***	479.	136.3	II	B	***	***	***
74	2018	47	3	54	5	2	1246.	447.6	III	B	***	***	***	1108.	389.2	III	B	***	***	***
75	2019	2	3	54	5	1	1231.	413.5	III	B	***	***	***	919.	285.7	III	B	***	***	***
76	1032	224	3	31	5	3	1231.	413.5	III	B	***	***	***	919.	285.7	III	B	***	***	***
77	1033	53	3	35	5	3	979.	312.7	III	B	***	***	***	979.	312.7	III	B	***	***	***
78	1034	106	3	37	5	3	408.	138.9	II	B	***	***	***	408.	138.9	II	B	***	***	***

Table 2-1-7 (4) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
79	3016	62	3	62	5	4	356.	131.1	II	B	***	***	***	356.	131.1	II	B	***	***	***
80	3017	95	3	40	5	4	2674.	848.6	IV	C	89	98	***	1568.	395.3	III	C	***	96	***
81	3018	47	3	58	5	2	3705.	992.6	IV	C	***	94	***	2872.	667.0	IV	B	***	***	***
82	3019	98	2	54	5	2	2651.	872.5	IV	C	88	97	***	1599.	432.9	III	C	***	94	***
83	3020	29	3	40	5	5	9160.	1109.8	V	A	***	***	***	7913.	692.9	IV	D	***	***	96
84	3021	65	1	50	5	3	8480.	1828.8	V	B	91	***	***	7770.	1543.9	V	B	94	***	***
85	1035	38	3	140	5	3	10399.	2385.8	V	B	93	***	***	17592.	4381.5	V	B	***	***	***
86	1036	97	3	69	5	3	4237.	655.1	IV	C	***	89	***	5138.	930.5	IV	D	***	87	96
87	1037	82	3	70	5	3	6321.	1719.6	V	A	***	***	***	5141.	1450.0	V	A	***	***	***
88	1038	32	3	61	5	3	1004.	310.0	III	B	***	***	***	1004.	310.0	III	B	***	***	***
89	1039	94	3	26	5	3	259.	66.5	I	D	***	***	***	240.	62.6	I	C	***	***	***
90	1040	999	3	28	5	3	1781.	678.7	III	C	89	94	***	877.	304.6	III	B	92	***	***
91	3022	999	3	28	5	3	1781.	678.7	III	C	***	***	***	1222.	239.1	III	B	***	***	***
92	4011	217	1	36	2	5	551.	124.2	II	C	***	93	***	615.	175.0	II	D	88	93	97
93	4012	189	1	36	3	5	2139.	888.2	IV	C	***	95	***	1763.	728.2	IV	C	87	98	***
94	1041	8	3	27	2	3	2139.	888.2	III	D	***	90	96	1763.	728.2	III	C	***	92	***
95	1042	84	1	30	5	3	2220.	932.3	IV	C	***	94	***	1791.	750.3	IV	C	88	97	***
96	2020	34	3	73	3	3	4131.	1088.2	IV	C	***	92	***	4369.	1184.7	IV	C	***	91	***
97	2021	32	3	60	3	3	4922.	1234.0	IV	D	***	89	97	5194.	1344.6	IV	D	***	88	96
98	2022	74	3	36	3	3	2132.	568.0	III	C	***	91	***	2251.	612.9	III	C	***	90	***
99	2023	102	3	73	3	3	4122.	1322.6	IV	C	***	90	***	4770.	1597.1	IV	D	***	87	95
100	2024	100	3	55	3	3	1276.	401.0	III	B	***	***	***	1276.	401.0	III	B	***	***	***
101	2025	999	3	55	3	3	6277.	2375.7	V	A	***	***	***	11634.	4720.8	V	B	90	***	***
102	2026	21	3	73	3	4	4059.	852.1	IV	C	***	95	***	4609.	1091.8	IV	C	***	91	***
103	2027	16	3	36	3	3	984.	193.2	II	D	***	90	98	1344.	347.3	III	B	87	***	***
104	2028	48	3	36	3	3	1680.	377.6	III	C	***	98	***	2438.	703.0	III	D	***	89	97

Table 2-1-7 (5) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

-HIGHWAY SECTION-- SEQ	LINK-NO	LENGTH (KM)	----EXISTING ROAD---- TER.	WIDTH (10CM)	TYPE	COND.	------IMPROVEMENT FOR MASTER PLAN A------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	------IMPROVEMENT FOR MASTER PLAN B------- A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
105	2029	68	3	42	3	3	2002.	495.8	III	C	***	92	***	2126.	518.6	III	C	***	91	***
106	2030	40	3	33	3	4	1733.	341.8	III	C	***	97	***	1733.	341.8	III	C	***	97	***
107	2031	45	3	33	3	4	346.	74.5	II	B	88	***	***	346.	74.5	II	B	88	***	***
108	2032	81	3	33	3	5	1173.	366.2	III	B	87	***	***	1166.	363.5	III	B	87	***	***
109	2033	24	3	33	3	5	2419.	725.7	III	D	***	90	97	2406.	720.2	III	D	***	90	97
110	2034	34	3	64	3	5	1744.	369.0	III	C	***	96	***	1789.	388.7	III	C	***	95	***
111	2035	16	3	58	3	5	2312.	620.5	III	D	***	88	98	2394.	656.1	III	D	***	87	97
112	2036	52	3	64	3	5	1718.	410.4	III	C	***	95	***	1771.	433.3	III	C	***	95	***
113	2037	30	3	36	3	4	193.	48.0	I	B	***	***	***	193.	48.0	I	B	***	***	***
114	2038	55	3	55	3	3	1271.	309.1	III	B	***	***	***	1271.	309.1	III	B	***	***	***
115	2039	45	3	38	3	4	608.	169.0	II	C	***	***	***	608.	169.0	II	C	***	***	***
116	2040	26	3	33	3	5	608.	169.0	II	C	***	***	***	608.	169.0	II	C	***	***	***
117	2041	77	3	36	3	5	601.	139.4	II	C	***	***	***	601.	139.4	II	C	***	***	***
118	2042	31	3	40	3	5	731.	239.6	II	C	***	***	***	731.	239.6	II	C	***	***	***
119	112043	26	3	54	3	4	4002.	582.2	IV	C	***	98	***	4533.	804.0	IV	C	***	93	***
120	112044	40	3	50	3	3	3459.	704.7	IV	C	***	98	***	4115.	980.3	IV	C	***	93	***
121	112045	135	3	40	3	3	16.	3.8	I	A	***	***	***	16.	3.8	I	A	***	***	***
122	112046	76	3	46	3	2	1188.	295.4	III	B	***	***	***	1040.	248.6	II	D	***	***	90
123	1043	129	3	50	5	4	4380.	1774.2	IV	D	***	***	95	1682.	645.1	IV	B	***	***	***
124	1044	63	3	30	5	3	588.	217.7	II	C	***	***	***	326.	103.6	II	B	***	***	***
125	1045	92	3	30	5	3	593.	240.9	II	C	***	***	***	397.	145.3	II	B	***	***	***
126	1046	138	3	30	5	4	536.	217.0	II	C	***	***	***	136.	54.3	I	B	***	***	***
127	1047	46	1	37	5	3	2667.	863.8	IV	C	88	93	***	2056.	622.1	IV	C	***	96	***
128	1048	58	3	30	5	3	1597.	384.4	III	C	88	96	***	1224.	250.3	III	B	88	***	***
129	1049	62	3	43	5	3	3240.	585.9	IV	B	***	***	***	2931.	513.0	III	D	***	***	96
130	1050	68	3	75	5	2	2775.	383.0	III	C	***	***	***	2775.	383.0	III	C	***	***	***

Table 2-1-7 (6) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

-HIGHWAY SECTION--			----EXISTING ROAD----				------IMPROVEMENT FOR MASTER PLAN A-------							------IMPROVEMENT FOR MASTER PLAN B-------						
SEQ	LINK-NO.	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
131	1051	999	3	35	5	4	3270.	1195.9	IV	C	***	94	***	3141.	1143.4	IV	C	***	94	***
132	1052	26	3	42	5	3	3698.	1243.1	IV	C	***	92	***	3565.	1190.4	IV	C	***	92	***
133	1053	34	3	63	5	3	8977.	2760.4	V	B	92	***	***	9492.	2915.6	V	B	90	***	***
134	1054	113	3	58	5	3	9151.	3358.2	V	B	93	***	***	7562.	2735.4	V	B	96	***	***
135	1055	117	3	39	5	4	3681.	1174.2	IV	C	***	92	***	3549.	1116.1	IV	C	***	92	***
136	1056	171	3	60	5	4	1916.	290.3	III	C	***	98	***	1887.	293.0	III	C	***	98	***
137	1057	70	3	73	5	3	9790.	2897.8	V	B	95	***	***	10575.	3230.3	V	B	93	***	***
138	1058	63	3	36	5	3	3561.	815.9	IV	C	***	94	***	3875.	935.8	IV	C	***	92	***
139	1059	47	3	73	5	3	4619.	1145.4	IV	D	***	87	96	4964.	1304.4	IV	D	***	***	94
140	1060	89	3	61	5	3	1686.	492.4	III	C	***	90	***	1868.	572.3	III	C	***	89	***
141	1061	53	3	59	5	3	3046.	652.3	IV	C	***	97	***	3488.	781.1	IV	C	***	94	***
142	1062	48	3	57	5	3	6017.	928.8	IV	D	***	***	95	6213.	957.8	IV	D	***	***	94
143	1063	42	3	47	5	3	1350.	266.7	III	B	***	***	***	2461.	709.1	III	D	***	88	95
144	1064	138	3	61	5	4	617.	108.9	II	C	***	***	***	617.	108.9	II	C	***	***	***
145	1065	91	3	30	5	3	3028.	192.7	III	C	***	92	***	2964.	174.4	III	C	***	92	***
146	1066	78	3	60	5	4	1589.	328.1	III	C	***	96	***	1479.	289.2	III	C	***	98	***
147	1067	40	3	36	5	3	3524.	721.7	IV	C	***	93	***	5788.	1704.4	V	A	***	***	***
148	1068	46	3	55	5	3	1367.	229.5	III	B	***	***	***	2147.	566.7	III	D	***	89	98
149	1069	40	3	63	5	3	3067.	499.5	IV	C	***	98	***	3510.	654.6	IV	C	***	94	***
150	1070	37	3	60	5	3	4204.	1152.4	IV	C	***	88	***	6233.	1795.6	V	A	***	***	***
151	1071	52	3	58	5	3	5593.	1477.3	V	A	***	***	***	5900.	1576.7	V	A	***	***	***
152	1072	107	3	35	5	4	481.	90.9	II	B	***	***	***	481.	90.9	II	B	***	***	***
153	1073	130	3	37	5	4	330.	65.9	II	B	***	***	***	330.	65.9	II	B	***	***	***
154	1074	25	3	61	5	3	111.	12.8	II	A	***	***	***	111.	12.8	II	A	***	***	***
155	1075	50	3	36	5	4	390.	82.0	II	B	***	***	***	390.	82.0	II	B	***	***	***
156	1076	31	3	60	5	3	4370.	1799.7	IV	D	***	***	94	4066.	1644.7	IV	D	***	88	97

Table 2-1-7 (7) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

HIGHWAY SECTION SEQ	LINK-NO	LENGTH (KM)	EXISTING ROAD TER.	WIDTH (10CM)	TYPE	COND.	PLAN A A D T	PLAN A AXLE LOAD	PLAN A IMPROVE TYPE	PLAN A LEV.	PLAN A A-B	PLAN A B-C	PLAN A C-D	PLAN B A D T	PLAN B AXLE LOAD	PLAN B IMPROVE TYPE	PLAN B LEV.	PLAN B A-B	PLAN B B-C	PLAN B C-D
157	1077	57	3	60	5	3	4370.	1799.7	IV	D	***	***	94	4066.	1644.7	IV	D	***	88	97
158	111078	40	3	45	5	3	1443.	333.5	III	C	***	***	***	1443.	333.5	III	C	***	***	***
159	111079	57	3	51	5	3	1001.	283.6	III	B	***	***	***	1001.	283.6	III	B	***	***	***
160	111080	35	3	61	5	3	1323.	355.6	III	B	***	***	***	1323.	355.6	III	B	***	***	***
161	111081	40	3	43	5	3	1003.	274.5	III	B	***	***	***	1003.	274.5	III	B	***	***	***
162	111082	54	3	60	5	4	557.	148.9	II	C	***	***	***	557.	148.9	II	C	***	***	***
163	111083	24	3	35	5	3	463.	144.8	II	B	***	***	***	463.	144.8	II	B	***	***	***
164	111084	138	3	55	5	3	598.	154.5	II	C	***	***	***	598.	154.5	II	C	***	***	***
165	111085	48	3	56	5	3	930.	242.4	III	B	***	***	***	930.	242.4	III	B	***	***	***
166	111086	48	3	58	5	3	719.	156.4	II	C	***	***	***	719.	156.4	II	C	***	***	***
167	111087	40	3	52	5	4	1121.	302.9	III	B	***	***	***	1121.	302.9	III	B	***	***	***
168	111088	51	3	38	5	3	666.	117.9	II	C	***	93	***	697.	126.3	II	C	***	92	***
169	111089	82	3	61	5	4	10449.	3877.6	V	B	93	***	***	12448.	4370.8	V	B	91	***	***
170	111090	33	3	61	5	3	10183.	3780.5	V	B	93	***	***	9219.	3358.7	V	B	93	***	***
171	111091	99	3	61	5	4	7167.	2471.1	V	B	98	***	***	6499.	2162.4	V	A	***	***	***
172	111092	60	3	30	5	3	4173.	1548.2	IV	D	***	89	97	2100.	679.6	III	D	***	***	97
173	111093	104	3	50	5	3	3754.	1376.1	IV	C	***	89	***	1930.	612.5	III	C	***	***	***
174	111094	125	3	50	5	3	1646.	600.3	III	C	***	***	***	1489.	532.7	III	C	***	88	***
175	111095	99	3	33	5	4	1699.	559.7	III	C	***	87	***	1782.	610.5	III	C	***	87	***
176	111096	47	3	35	5	4	1091.	370.7	III	B	92	***	***	1080.	375.1	III	B	89	***	***
177	111097	82	3	30	5	4	2346.	813.5	IV	B	89	***	***	2100.	727.4	III	D	***	89	97
178	111098	81	2	33	5	4	2084.	706.6	III	D	***	90	96	1843.	621.8	III	D	***	88	98
179	111099	87	3	47	5	4	691.	201.2	II	C	***	***	***	691.	201.2	II	C	***	***	***
180	111100	68	3	31	5	4	418.	82.2	II	B	***	***	***	418.	82.2	II	B	***	***	***
181	111101	46	3	32	5	4	924.	317.6	III	B	***	***	***	1514.	575.8	III	C	***	87	***
182	111102	64	3	37	5	3	146.	25.7	I	B	***	***	***	146.	25.7	I	B	***	***	***

Table 2-1-8 (8) List of Candidate Project by the Year 1999/2000 (2nd stage construction)

HIGHWAY SECTION			EXISTING ROAD				IMPROVEMENT FOR MASTER PLAN A							IMPROVEMENT FOR MASTER PLAN B						
SEQ	LINK-NO	LENGTH (KM)	TER.	WIDTH (10CM)	TYPE	COND.	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D	A D T	AXLE LOAD	IMPROVE TYPE	LEVEL OF SERVICE LEV.	A-B	B-C	C-D
183	111103	57	3	58	5	3	1963.	399.4	III	C	***	90	***	1988.	408.3	III	C	***	89	***
184	111104	29	3	30	5	5	793.	246.3	II	D	***	***	***	793.	246.3	II	D	***	***	***
185	111105	29	3	30	5	4	314.	97.7	II	B	***	***	***	314.	97.7	II	B	***	***	***
186	111106	31	3	30	5	4	187.	67.5	I	C	***	***	***	187.	67.5	I	C	***	***	***
187	111107	50	3	55	5	1	788.	216.2	II	C	***	***	***	788.	216.2	II	C	***	***	***
188	3023	23	3	62	5	2	8156.	1312.0	V	A	***	***	***	8952.	1654.1	V	B	98	***	***
189	3024	66	2	59	5	2	4309.	795.0	IV	C	***	90	***	4600.	920.0	IV	D	***	89	98
190	3025	132	1	36	4	2	1055.	265.3	III	C	***	97	***	1078.	275.2	III	C	***	96	***
191	3026	29	3	73	4	3	3102.	488.3	III	D	***	***	***	3102.	488.3	III	D	***	***	***
192	3027	28	3	73	4	3	654.	110.1	II	C	***	***	***	654.	110.1	II	C	***	***	***
193	3028	46	3	71	4	3	1757.	241.0	III	B	***	***	***	1757.	241.0	III	B	***	***	***
194	3029	999	1	71	4	3	572.	53.4	II	C	***	***	***	572.	53.4	II	C	***	***	***
195	3030	35	3	48	5	2	3926.	570.1	IV	C	***	97	***	4153.	667.8	IV	C	***	95	***
196	3031	82	1	36	5	3	0.	0.1	I	A	***	***	***	0.	0.1	I	A	***	***	***
197	3032	33	3	61	4	3	1173.	159.3	II	D	***	***	***	1173.	159.3	II	D	***	***	***
198	4013	344	2	39	4	3	258.	64.4	II	B	95	***	***	507.	172.3	II	C	***	96	***
199	4014	366	3	39	2	3	1.	0.0	II	A	***	***	***	1.	0.0	II	A	***	***	***
200	4015	328	3	36	1	4	226.	87.3	I	C	***	***	***	226.	87.3	I	C	***	***	***
201	4016	118	3	36	2	4	230.	22.4	I	C	***	***	***	230.	22.4	I	C	***	***	***
202	4017	230	3	36	2	4	13.	4.1	I	A	***	***	***	13.	4.1	I	A	***	***	***
203	4018	530	2	36	2	4	13.	4.1	I	A	***	***	***	13.	4.1	I	A	***	***	***
204	4019	999	3	36	3	4	45.	18.4	I	A	***	***	***	45.	18.4	I	A	***	***	***
205	4020	169	3	36	3	4	45.	18.4	I	A	***	***	***	45.	18.4	I	A	***	***	***
206	4021	115	3	36	3	4	15.	5.7	I	A	***	***	***	15.	5.7	I	A	***	***	***
207	4022	72	1	36	3	4	182.	32.4	I	C	***	***	***	182.	32.4	I	C	***	***	***
208	4023	272	2	36	3	4	184.	76.2	I	C	***	92	***	135.	56.3	I	B	92	***	***

2-2 Road Transport Plan

It is to be noted that this study does not deal with the intra-city road transportation.

(1) Passenger Transport

1) Vehicle Type-wise Passenger km

Vehicle type-wise transport volume of inter-zonal traffic is estimated for following 2 cases.

Case A : It is assumed that present tendency will continue.

Case B : It is assumed that Pakistan railway will be utilized much more for freight transport.

Table 2-2-1 Projection of Vehicle Type-wise Passenger-Km

Fiscal year		1980/81		1987/88		1999/00	
Case	Item	Passenger km (billion)	Share (%)	Passenger km (billion)	Share (%)	Passenger km (billion)	Share (%)
A	Motor car & Wagon	5.06	13.8	7.68	13.8	13.63	13.8
	Bus	31.53	86.2	47.84	86.2	84.28	86.2
	Total	36.59	100.0	55.52	100.0	98.91	100.0
B	Motor car & Wagon	5.06	13.8	7.66	13.8	13.54	13.9
	Bus	31.53	86.2	47.96	86.2	83.63	86.1
	Total	36.59	100.0	55.62	100.0	97.17	100.0

Note: JICA Study Team estimates

According to Table 2-2-1 there is not much difference between case A and B, because these cases pertain to passenger transporting.

2) Induction Planning of Buses of Semi-Public Sector

The most serious problem semi-public sector is now suffering from is unstable and disorganized procurement of buses.

Present share traffic of semi-public sector in each province is shown in Table 2-2-2.

Table 2-2-2 Passenger-km Transported by Bus and Its Share in 1980/81

Province	Organization	Passenger-km/year (million)	Share (%)
Punjab	PRTB	2,460	12.6
	Private	17,139	87.4
	Subtotal	19,599	100.0
Sind	SRTC	270	3.6
	Private	7,208	96.4
	Subtotal	7,478	100.0
NWFP	NWFP RTB	835	23.5
	Private	2,719	76.5
	Subtotal	3,554	100.0
Baluchistan	-	-	-
	Private	895	100.0
	Subtotal	895	100.0
Total	Semi public	3,565	11.3
	Private	27,961	88.7
	Total	31,526	100.0

Source : Result of inter-city demand forecast in this study, Operational results of semi-public sector.

Note : SRTC obtained 80 new buses in 1981/82.

Distinctive feature seen in this table is that SRTC shares only 3.6% in Sind Province, while PRTB in Punjab and NWFP RTB have 12.6% and 23.5% of shares in each province.

It is quite favorable and in line with the basic policy proposed in the Fifth Five Year Plan that private sector shall develop and extend their business actively. However, it does not mean that semi-public sector should cut down or stop their operations due to their continuous deficits. So long as the purpose of private sector is to pursue their own profits, for the sake of social welfare , semi-public sector should keep a certain share in passenger transport.

One of the most important factor in this program is that semi-public sector should purchase required buses every year according to plan, once the share is fixed. This would make it possible to stabilize its managements, which would consequently increase operational efficiency.

In this study referring to the present condition, the shares of semi-public sector are assumed as follows:

1. PRTB and SRTC : 10%

   Population density of these area is high and investment by private sector can be on higher scale.

2. NWFP RTB : 20%

   Population density is rather low and investment by private sector can not be so high as compared with Punjab and Sind province.

Based on afore-mentioned share, purchase program of buses is estimated according to the procedure shown in Fig. 2-2-1 , and investment program has been indicated in Table 2-2-3.

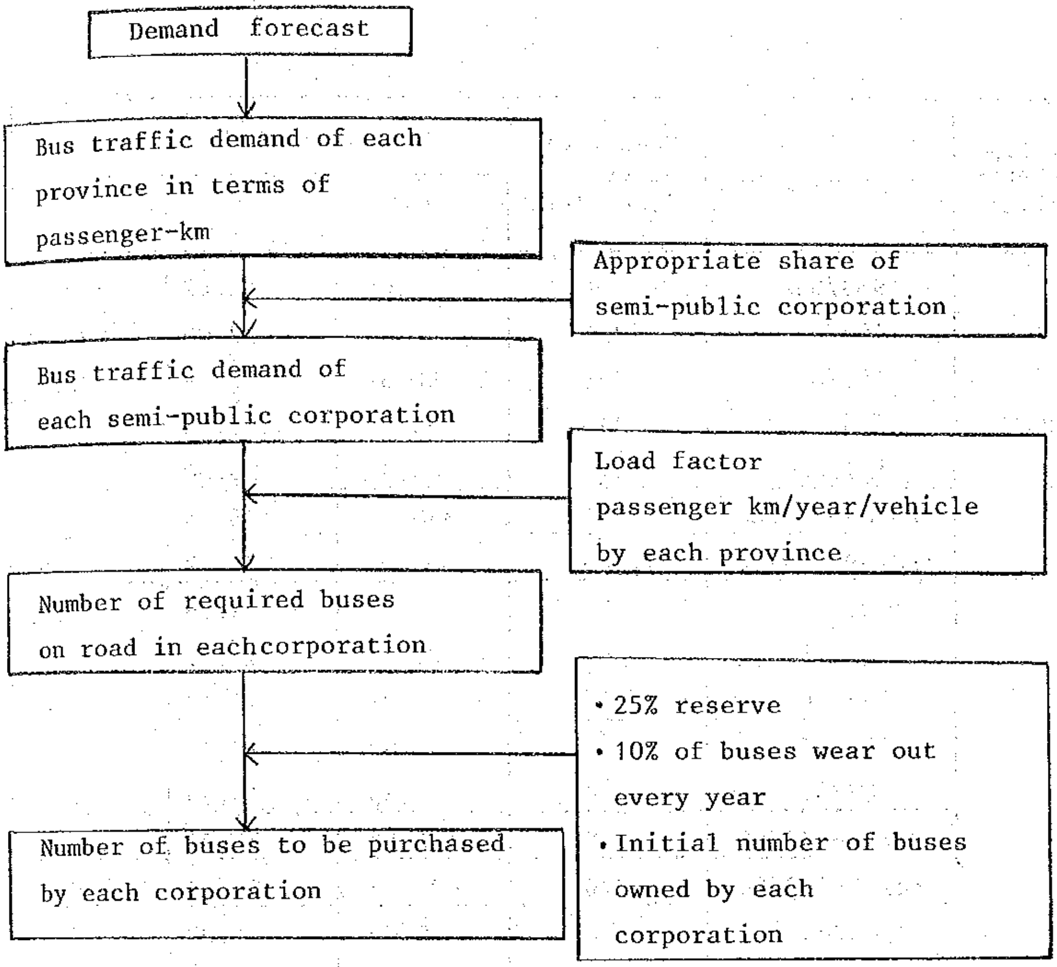


Fig. 2-2-1 Work Flow to Estimate Purchase Program of Buses

Table 2-2-3 Required Number of Buses and Cost of Semi-Public Sector

Item / Organization	Fiscal year	Number of buses (vehicles)	Cost (million Rs)		
			Local	FEC	Total
PRTB	1983/84	190	105.05	55.42	160.47
	'84/85	110	60.82	32.09	92.91
	'85/86	110	60.82	32.09	92.91
	'86/87	115	63.58	33.55	97.13
	'87/88	120	66.35	35.00	101.35
	'83/84-'87/88	645	356.62	188.15	544.77
	'88/89-'99/00	1,965	1086.45	573.19	1659.64
SRTC	1983/84	85	47.00	24.79	71.79
	'84/85	40	22.12	11.67	33.79
	'85/86	45	24.88	13.13	38.01
	'86/87	45	24.88	13.13	38.01
	'87/88	50	27.65	14.59	42.24
	'83/84-'87/88	265	146.53	77.31	223.84
	'88/89-'99/00	770	425.73	224.61	650.34
NWFP	1983/84	0	0.00	0.00	0.00
	'84/85	35	19.35	10.21	29.56
	'85/86	50	27.65	14.59	42.24
	'86/87	50	27.65	14.59	42.24
	'87/88	50	27.65	14.59	42.24
	'83/84-'87/88	185	102.30	53.98	156.28
	'88/89-'99/00	830	458.91	242.11	701.02
Grand total	'83/84-'87/88	1,095	605.45	319.44	924.89
	'88/89-'99/00	3,565	1971.09	1039.91	3011.00
	'83/84-'99/00	4,660	2576.54	1359.35	3935.89

Notes: (1) Basis of cost estimates is shown in Table 2-2-4

(2) There is no difference between case A and B for number of buses to Purchase.

Table 2-2-4 Basis of Cost Estimates
(Unit Price of Bus (FIAT) .)

(million Rs/bus)

Particulars	(A) Local	(B) FEC	(A)+(B) Total
1. Cost of chasis (CBU)	0.1611	0.2636	0.4247
2. Cost of body fabrication including sales tax	0.1818		0.1818
3. Cost of spare parts 10% of FEC		0.0264	0.0264
150% of initial buy of spares	0.0396		0.0396
4. Subtotal	0.3825	0.2900	0.6725
5. Civil work-depot, machinery, major over-haul, non- commercial vehicles, working capital and contingency	0.1704	0.0017	0.1721
Total	0.5529	0.2917	0.8446

Notes: (1) Data is based on fleet expansion plan of KTC from 1979/80 to 1983/84.

(2) Costs of civil work-depot, machinery etc. is estimated by multiplying its ratio to cost of chassis,body and spare parts given in aforesaid report.

(2) Freight Transport

1) Freight Traffic Demand up to 1987/88 and 1999/00

Freight ton km of inter-zonal traffic in future is shown in Table 2-2-5.

Table 2-2-5 Freight Traffic Demand Forecast

(million ton km)

Case Fiscal year	1980/81	1987/88	1999/00
A	16514	29952	66519
B	16514	26296	51561

Notes : (1) Case A is assumed that present tendency will continue.

(2) Case B is assumed that Pakistan Railway will be utilized more for freight transport in future.

(3) This is the results of JICA study team estimates.

(4) Intra-zonal traffic is excluded from this data.

2) Study on Economy of Freight Transport by Large Size Truck

a) Procedure of The Study

In this clause, study is conducted about economy of freight transport according to the procedure shown in Fig. 2-2-2.

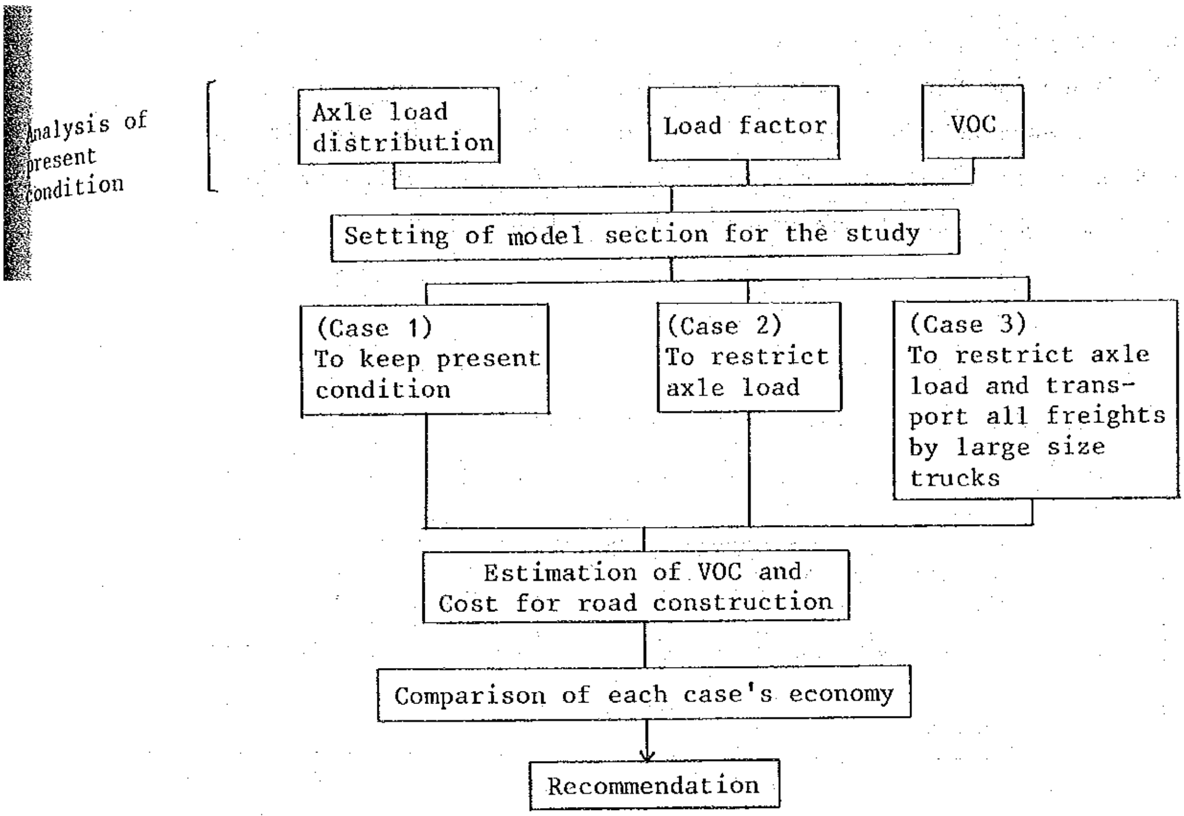


Fig. 2-2-2 Work Flow of Study on Freight Transport Economy

b) Analysis of Present Condition

① Type-wise Vehicles Share of Freight Traffic Volume

2 axles trucks occupy 85-93% out of total freight traffic volume, and share of large size trucks such as 3, 4 and 5 axles trucks is only 3-5% in inter-city trunk routes. (See Table 2-2-6)

Table 2-2-6 Type-wise Vehicles Freight Traffic Volume

(upper vehicles/day, lower %)

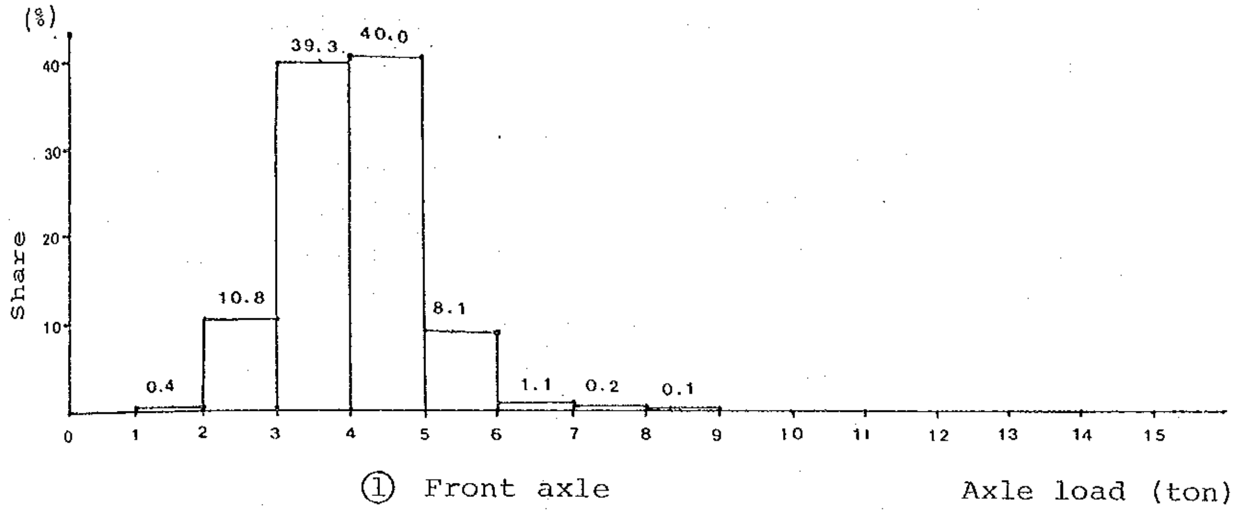
Place	Type / Item	Pick up Van	2axles Truck	3axles Truck	4axles Truck	5axles Truck	Others	Total
Jhelum Bridge	Traffic volume	328	2468	76	19	4	21	2916
	Share	11.2	84.7	2.6	0.7	0.1	0.7	100.0
Sadiqabad	Traffic volume	68	2560	27	53	9	30	2747
	Share	2.5	93.2	1.0	1.9	0.3	1.1	100.0
Karachi (Super Highway)	Traffic volume	405	5106	33	229	6	10	5789
	Share	7.0	88.1	0.6	4.0	0.1	0.2	100.0
Total	Traffic volume	801	10134	136	301	19	61	11452
	Share	7.0	88.5	1.2	2.6	0.2	0.5	100.0

Source : Traffic Volume Survey 1982 NTRC

② Axle Load Distribution

2 axles truck

Axle load distribution of 2 axles truck is shown in Fig. 2-2-3.



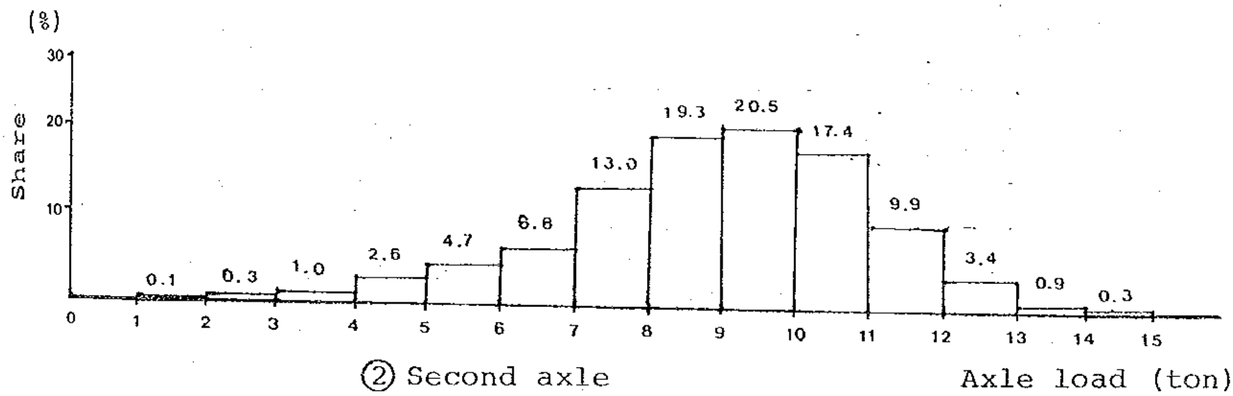


Fig. 2-2-3 Axle Load Distribution of 2 Axles Truck

Source: Axle Load Survey 1981 NTRC.

4 axles truck

4 axles truck (FIAT semi-trailor) is selected for the study of transport economy among heavy multi-axles truck.

Axles load survey is not sufficient for multi-axles trucks. So the study team estimated axle load distribution by the following procedure.

① Load distribution is estimated by the load distribution pattern of 2 axles truck and pay load (20 ton) of FIAT semi-trailor.

② Gross weight distribution is estimated by adding unladen weight (13 ton) of FIAT semi-trailor to the former load distribution.

③ Axle loads are assigned to each 4 axles by bearing ratio shown in Table 2-2-7.

Table 2-2-7 Bearing Ratio Axle Loads (FIAT semi trailor)

Axles	Front (Single)	Second (Single)	Third (Single)	Fourth (Single)	Gross (Single)
Axle loads (kg)	4593	11432	10103	9585	35713
Ratio of axle loads	0.13	0.32	0.28	0.27	1.00

Source : Axle Load Survey 1981 NTRC

Result is shown in Fig. 2-2-4.

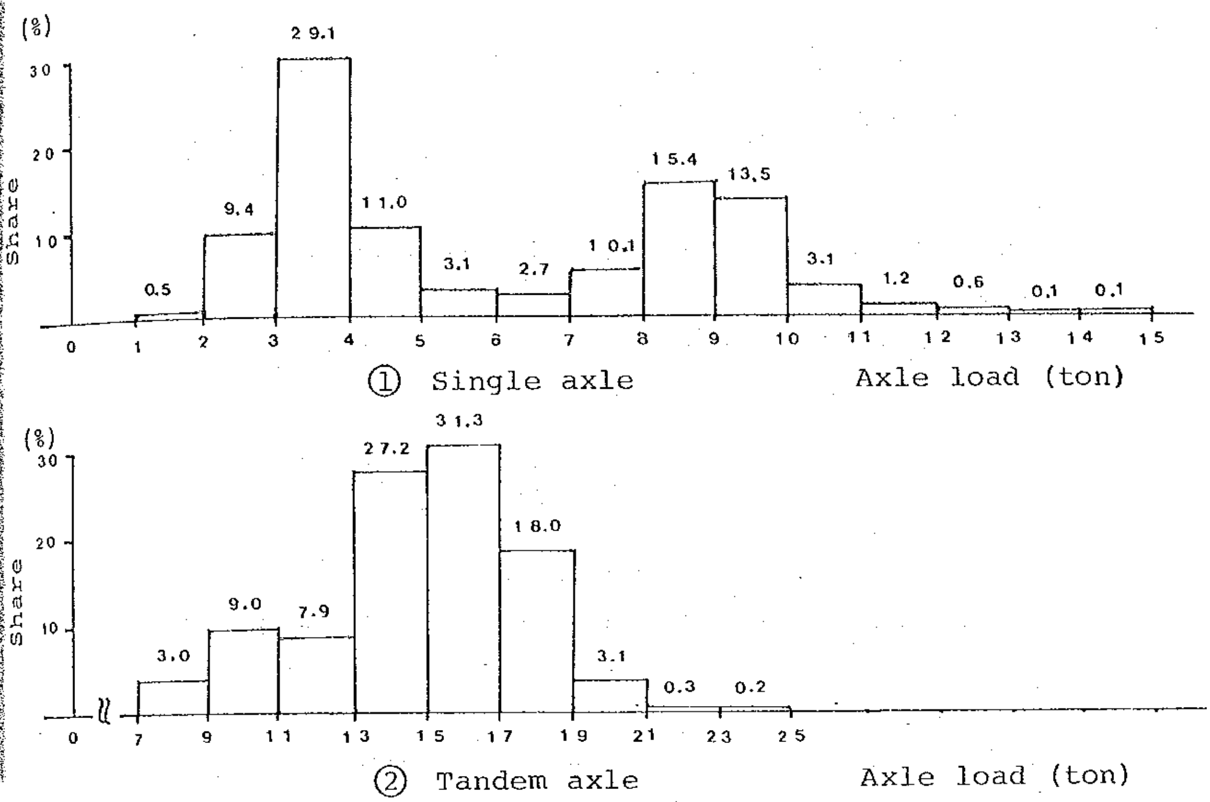


Fig. 2-2-4 Axle Load Distribution of 4 Axles Truck

In most of the countries, maximum axle load is limitted to 10 tons for single and 18 tons for tandem axles. But the results mentioned above indicate that 16% of axle load of 2 axles truck exceed 10 tons.

c) Cost Evaluation of Freight Transport

Economic cost of freight transport is studied for following 3 cases.

<u>Case 1</u>

- Type-wise vehicles share will continue at the present conditions (2 axles: 96.2%, 4 axles: 3.8%)
- Axle loads will not be regulated.

<u>Case 2</u>

- Type-wise vehicles share will continue at the present conditions.
- Maximum axle loads will be regulated to 10 tons for single and 18 tons for tandem axle.

<u>Case 3</u>

- Trucks will be replaced completely to 4 axles trucks (ex. FIAT semi-trailor)
- Maximum axle loads will be regulated.

Road construction cost is estimated under the following conditions:

· Design period	:	20 years
· Road length	:	1 km
· Number of lanes	:	2 lanes (paved)
· Freight traffic demand in initial year	:	7 million ton/year
· Annual growth rate	:	0%
· C B R	:	5%

- Pavement design is based on "Road note 29"

Result is shown in Table 2-2-8.

Table 2-2-8 Pavement Design and Construction Cost

Case		Subbase	Basecoarse	Surface	Total
1	Thickness (mm)	280	255	165	700
	Cost (Rs/km)	-	-	-	3,459,700
2	Thickness (mm)	260	230	125	615
	Cost (Rs/km)	-	-	-	3,330,840
3	Thickness (mm)	260	230	125	615
	Cost (Rs/km)	-	-	-	3,330,840

Note : Land acquisition cost is excluded.

Road construction cost becomes maximum when pavement is designed to endure excessive axle loads for 20 years. But results of case 3 indicate that freight transport by large size multi-axles' truck will not cause the increase of road construction cost so long as axle load is regulated deliberately.

Considering the above analyses, the first recommendation is to regulate axle load 10 tons for single and 18 tons for tandem axle. Then 129,000 Rs/km will be saved for 2 lanes road construction.

As a matter of fact, the real condition is more complicated in Pakistan. Pavement of roads constructed in previous years are not sufficinet, and excessive axle loads are considered to be accelerating the wearing out of the roads. So more savings can be expected by axle loads regulation, when maintenance cost is accounted.

Vehicle operating cost of 2 axles truck and 4 axles truck is shown in Table 2-2-9.

Table 2-2-9 Economic Vehicle Operating Cost

(Rs/ton.km)

Item \ Type		2 axles truck (Bedford) Pay load: 9 ton	4 axles truck (Fiat semi-trailor) Pay load: 20 ton
Fuel		0.0633	0.0415
Oil		0.0033	0.0021
Tyre		0.0151	0.0388
Maintenance	Labour	0.0084	0.0038
	Parts	0.0139	0.0284
Depreciation		0.0319	0.0580
Capital cost		0.0310	0.0635
Crew cost		0.0489	0.0220
Total		0.2158	0.2581

According to this result, freight transport by large size truck is more economical in respect of fuel, oil and crew cost, but not preferable in respect of depreciation and capital cost as compared with 2 axles truck.

Through the cross-check of the data of various types of truck, it has been found that this is for the reason that the vehicle cost of the Bedford truck which is the most popular in Pakistan is lower than that of other trucks because 55% of its components is locally produced.

As there may arise the circumstances where the introduction of large size truck is indispensable to transport heavy construction machines, etc., we cannot make a conclusion solely from the standpoint of economics.

Therefore the second recommendation is that the introduction of large size truck will be made in a gradual manner lest the economy of vehicle cost and the work opportunities of drivers will be ignored.

(3) Number of New Vehicles Required

Number of new vehicles required in each year is estimated by the following steps:

① Traffic demand (vehicle type wise) is forecasted in terms of vehicle km/day.

② Number of required vehicles on road is calculated, dividing traffic demand by average mileage per day.

③ 10% of vehicle are supposed to be worn out in each year.

④ The difference between number of required vehicles on road and number of vehicles available from the previous year is considered to be number of required new vehicles.

Results are shown in Table 2-2-10.

Table 2-2-10 Number of Required Vehicles in Pakistan

(vehicles/year)

Case	Item / Type	Number of vehicles produced in 1979/80	Number of required new vehicles		
			1983/84	1987/88	1999/00
A	Bus	1,930	4,000	5,000	8,000
	Motor car /Wagon	1,619	33,000	38,000	62,000
	Truck	5,089	7,000	8,000	18,000
	Total	8,638	44,000	51,000	88,000
B	Bus	1,930	4,000	5,000	8,000
	Motor car /Wagon	1,619	33,000	38,000	62,000
	Truck	5,089	6,000	7,000	14,000
	Total	8,638	43,000	50,000	84,000

Notes: (1) Number of vehicles produced in 1979/80 is based on "Transport bulletin (Supplementary No. 1) NTRC 1981".

(2) Number of required new vehicles is estimated by JICA study team.

2-3 Railway Plan

2-3-1 Fundamentals of Railway Transportation

Railway transportation characteristics may be divided roughly into those of safety and economy for the purposes of the study. If the features of safety and economy can be fully realized in a certain area, then this area will be of great value to the railway and heighten its development potential. Though traffic demand has diversified and the share of traffic volume held by railways has been decreasing throughout the world, the economic environment and traffic demand in Pakistan highlights the advantages still held by the railways.

The primary feature of railways is safety. In the strict sense of the word, it is the maintenance of safety combined with speed and punctuality. In order to achieve this goal, railways are operated as a system in which rolling stocks and fixed installation are combined together in a highly sophisticated manner. In order to effectively control rolling stocks with a lesser degree of flexibility, much reliability and more functions must be given to the fixed installation than to the rolling stocks.

The second feature of railways is their economic advantages. The economy can be examined through the frameworks of mass transport and efficiency of transportation. From the experience throughout the world, it is a well known fact that the transportation cost is extremely lower than other modes of transport, and that railways offer an efficient transportation means.

Measures that can be taken by railways for achieving these several features are shown in Table 2-3-1.

(1) Improving Safety Devices

Safety devices include block instruments between railway stations, interlocking instruments within the station yards and control instruments of the trains, which are combined with fixed installations. Improvement of block devices is made in the form of automatic signalization and the improvement of interlocking devices is made through CTC and relay interlocking, and train control devices are improved through ATC, ATS and cabsignal systems. If there are about 50 trains each way per day in a section, automatic signaling, relay interlocking and ATS are in many cases used in combination. The improvements stated above make it possible to reduce the operating and handling time, and also to shorten the headway of trains.

Table 2-3-1 Measures by Railway Transportation

	Safety	Punctuality	Quickness	Mass transport	Transportation efficiency
Improving safety devices	o		o		
Increasing tractive force		o	o	o	
Increasing the number of trains				o	
Long-distance through transport			o		o
Concentration of goods stations			o		o

(2) Improving Tractive Force

Generally, the output of locomotives is increased and, as a result of this, the accelerating force can also be increased to make high speed trains possible. Also, on the other hand, it is possible to haul more wagons, so that the mass transportation will be intensified. Increases in output can be achieved by diesel traction and by electrification. More goods wagons can be hauled by locomotives of the same weight if electrification is introduced,[*1] and electrification is also more advantageous in view of energy efficiency and maintenance cost than diesel traction. However, electrification requires a considerable investment and thus, the effect of investment should be carefully examined for each system part prior to its introduction.

*1 An electric locomotive can have 20 to 25 percent larger output than a diesel locomotive of the same weight.

(3) Increasing the Number of Trains

If the traffic demand is low, the number of trains can be increased by shortening the block section and interval of stations on the single track. An excessive increase of the number of trains while maintaining a single track may reduce the average speed due to an increase in the waiting time for crossing, so that a double track needs to be introduced when the number of trains each way exceeds about 40. In districts where an increase in the number of trains is expected, economic activities become more vigorous, time becomes more valuable, and maximum speed is also increased in many cases.

(4) Long-distance Through Transport

If trains and locomotives are operated in restricted sections only, losses in time due to crossing, disconnection and coupling of locomotives, passenger cars and goods wagons at each connecting station cannot be ignored and may reduce the transportation efficiency. Because of this, through transportation from the origin to the destination is the best method for shortening transport time and for securing punctuality. Also, it is important for the locomotives and some specified passenger and goods train sets to maintain a regular operation schedule and to reduce the waiting time to a minimum for the enhancement of the transportation efficiency.

(5) Concentration of Goods Stations

For the purpose of through transport of goods trains, it is indispensable to concentrate the handling of goods in base railway stations instead of dispersed handling in small stations. Conventionally, goods were collected from small stations by shuttle trains, but freight sorting and train reformation was necessitated at marshalling goods and this resulted in an increase in the time of transportation. Because of this, it is most effective in the reduction of the required time to combine the operation through goods trains with pickup and delivery trucks at the base railway stations and to perform the door-to-door transportation. Also, the smaller the number of such base stations, the higher the efficiency in operation because of the simplification.

2-3-2 Present Transportation Problems

Pakistan Railways has a magnificent history of more than 120 years. Judging from the transport situation, its present problem is that goods trains seem to be being operated at a capacity much lower than designed capacity while passenger trains are being operated relatively smoothly. The causes of this problem are as follows:

(1) Long Operating Time of Goods Trains

1) Causes of Long Operating Time Due to Planning Problems

- A long waiting time is needed for crossing and passing of trains because of absolute block devices on both the single and double lines.
- A long time is needed for acceleration due to the insufficient tractive force of locomotives.
- A long time is needed for deceleration because vacuum brakes are used.
- A long time is needed because of track structure speed limitations (such as bridges).
- Maximum speed is limited by the goods wagons' structure.
- A long time is needed for the preparation of departure, inspection and adjustment due to the unsatisfactory performance of rolling stock.

2) Causes of Delay during Train Running

- Deterioration of locomotives and troubles due to insufficient maintenance work.
- Waiting time due to other trains in yards or terminal stations.
- Delays due to slowing down trains' maintenance work.
- Delays needed to confirm the signal indication because of the signals' insufficient luminous intensity due to oil lamps.

- Secondary delays due to inadequate communication facilities for controlling delayed trains.

(2) Causes of Low Efficiency of Rolling Stock Usage

- Irregular rotation system for locomotives for goods trains.
- Troubles in passenger cars and goods wagons.
- Detention of goods wagons due to the handling work at terminal stations.
- Delays in passenger handling time due to the insufficient capacity of passenger trains.
- Lower passenger seat reservation efficiency.

(3) Restrictions by Topographic Conditions

- Reduction of train hauling capacity due to gradient.
- Special operation regulations for steep slopes.

(4) Competition with Short Distance Transport

- Pressure upon the track capacity of commuter traffic.

2-3-3 Concept of the Transportation Plan

According to the results of the demand forecast, the passenger traffic demand for the year 2000 is estimated to be 46,662 million passenger-km for alternative A(estimated under the present share) and 47,377 million passenger-km for alternative B(longer traffic emphasized on railways), both of which are 3.1 times and 3.2 times greater respectively compared to the years 1980/81. In the case of goods, the demand is estimated to be 20,188 million t-km for alternative A and 36,357 million t-km for alternative B, both of which are 2.5 times and 4.5 times greater respectively compared to the years 1980/81.

Because of this, the present maximum number of one-way trains between Karachi and Samasata is 18 for passengers and 12 for goods and they may increase to 58 and 54 respectively by the year 2000 with a total of 112, making it almost impossible to operate this increase in number of trains in the year 2000 with the present transport facilities.

When making a transportation plan corresponding to the forecast traffic demand, the following measures can be considered:

- Alteration of the transportation system: Mainly changing software
- Development and improvement of transportation facilities: Mainly improving the hardware

Considering the problems in the present transportation, to make a system change, having harmony between hardware and software is considered indispensable.

2-3-4 Transportation System Alterations

(1) Train Operation System

According to the results of the demand forecast, it is required to provide more than 100 trains each way. However, if the number of trains increases, the frequency of the train delays affecting the other trains becomes higher and, because of this, it is necessary to reduce the number of trains.

Also, it is vitally important to avoid delays to the trains whenever possible by restricting the total volume of work such as track repair which may affect the train operation.

Some solutions which may improve the train operation are as follows:

- To form the train to fully utilize its hauling capacity
- To operate the locomotive for a longer distance
- To separate the drivers' rotation from the locomotive
- To regularize the operation of trains
- To separate the rotation of locomotives for passenger and goods trains
- To eliminate special operation regulations while improving the performances of rolling stock
- To establish the headway interval for track work and to control the overall volume of work

(2) Passenger Transportation

The passenger traffic volume is estimated to increase about 3.1 times (passenger-km) by the year 2000 and by 3.9 times between Karachi and Lahore. In order to cope with this demand, it is required to increase the capacity of each train since the increase in demand cannot be properly responded by increasing the number of trains alone. Because of this, it will be effective to increase the number of coaches or the capacity of each passenger coach. However, an increase in the number of coaches necessitates platform extensions so that the increasing of the capacity of passenger coaches seems to be more advantageous.

In the present study, it has been considered to slightly increase the capacity of sleeping cars and to increase the number of seats to the required capacity.

Long-distance train :	ACC 1:	Sleepers	28×1	= 28
	2nd 14:	Sleepers	16×14	= 224
		Sitters	72×14	= 1008
		Total		1260
Short-distance train:	2nd 15:	Sitters	96×15	= 1440

For short-distance trains, additional 10% transport capacity for allowing standing passenger has been considered. Passenger transportation measures are summarized below.

- Separate transport for long distance and short distance
- Increasing the capacity of long distance trains
- Increasing the number of coaches
- Increasing the number of seats

After making the plan stated above, the maximum number of passenger trains has been established for each section as shown in Table 2-3-2.

Table 2-3-2 Maximum Number of Passenger Trains (One Way)

Karachi ∿ Rohri	30
Rohri ∿ Samasata	29
Samasata ∿ Khanewal (Both Routes)	31
Khanewal ∿ Lahore	23
Khanewal ∿ Faisalabad	6
Khanewal ∿ Sargodha	3
Lahore ∿ Lala Musa	19
Lala Musa ∿ Rawalpindi	8
Rawalpindi ∿ Peshawar	3
Rohri ∿ Quetta	5

Source: Calculation by the Study Team

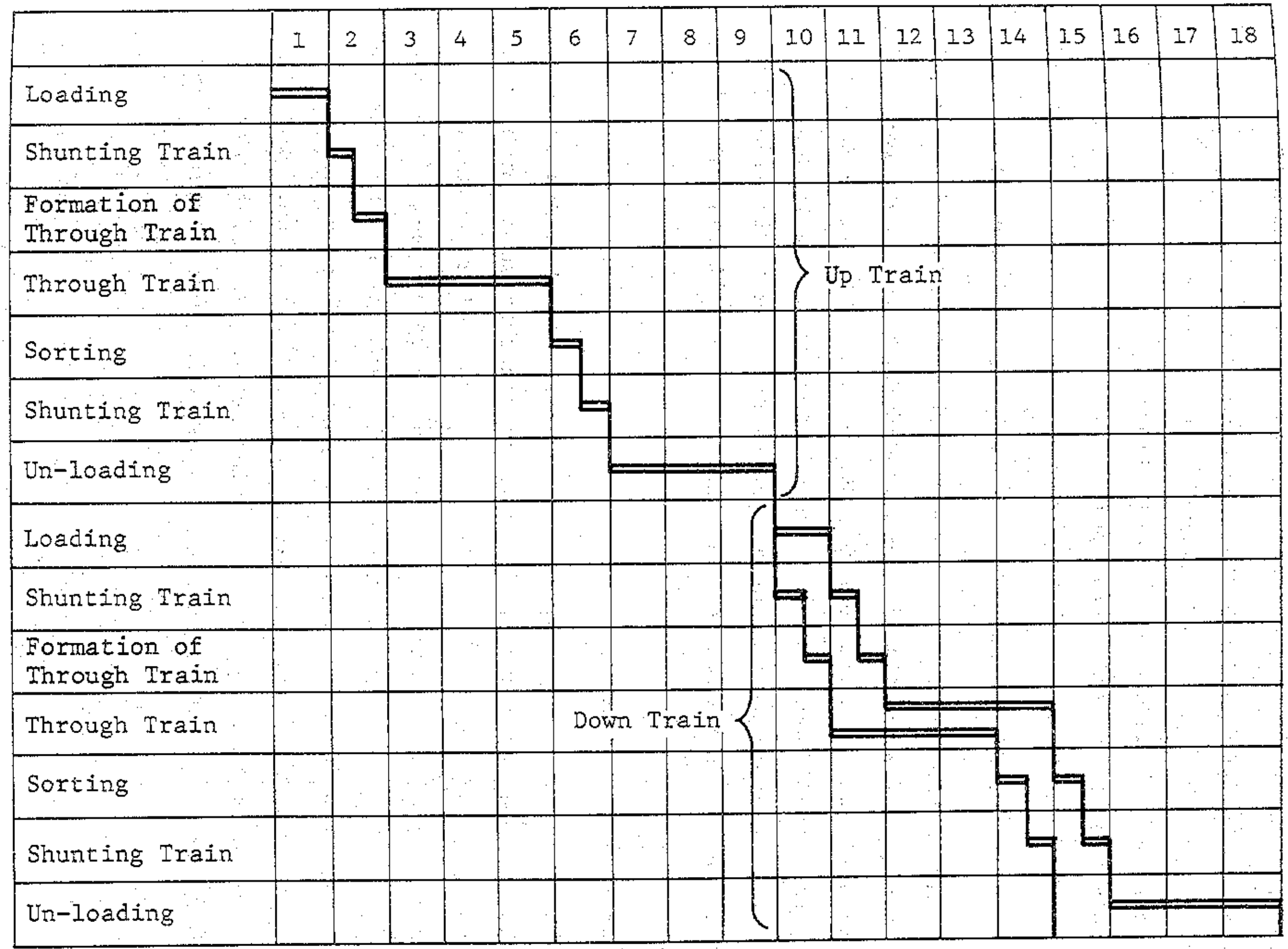
(3) Goods Transportation

As explained previously, there are many problems in the transportation of goods, and the system must be drastically changed in order to realize a transportation increase by 4.5 times. Because of this, it is meaningful to analyze the present transportation situation.

Fig. 2-3-1 shows the estimated turn-round of the ordinary goods wagons currently being used for the goods transport. At present, goods wagons spend about 2 days prior to the formation of through trains between the base stations, about 3 days for running, and about 4 days after arrival at the destination yard. A turn-round of 14 days is needed for one-way loading and of 18 days for round trip loading. About 40% of down goods wagons are loaded, and the average turn-round is about 15 days. This is close to statistical results.

The following three points should be considered with respect to present goods transportation:

- o Feeder transport by railway
- o Running time of trains
- o Waiting time for unloading



Note: Assumption based on the experience of japanese railways.

Fig. 2-3-1 Present Turn Round of Wagons (Assumption)

It is considered that freight transportation can be drastically improved by decreasing the three factors stated above. The following six measures are recommended to solve the problems:

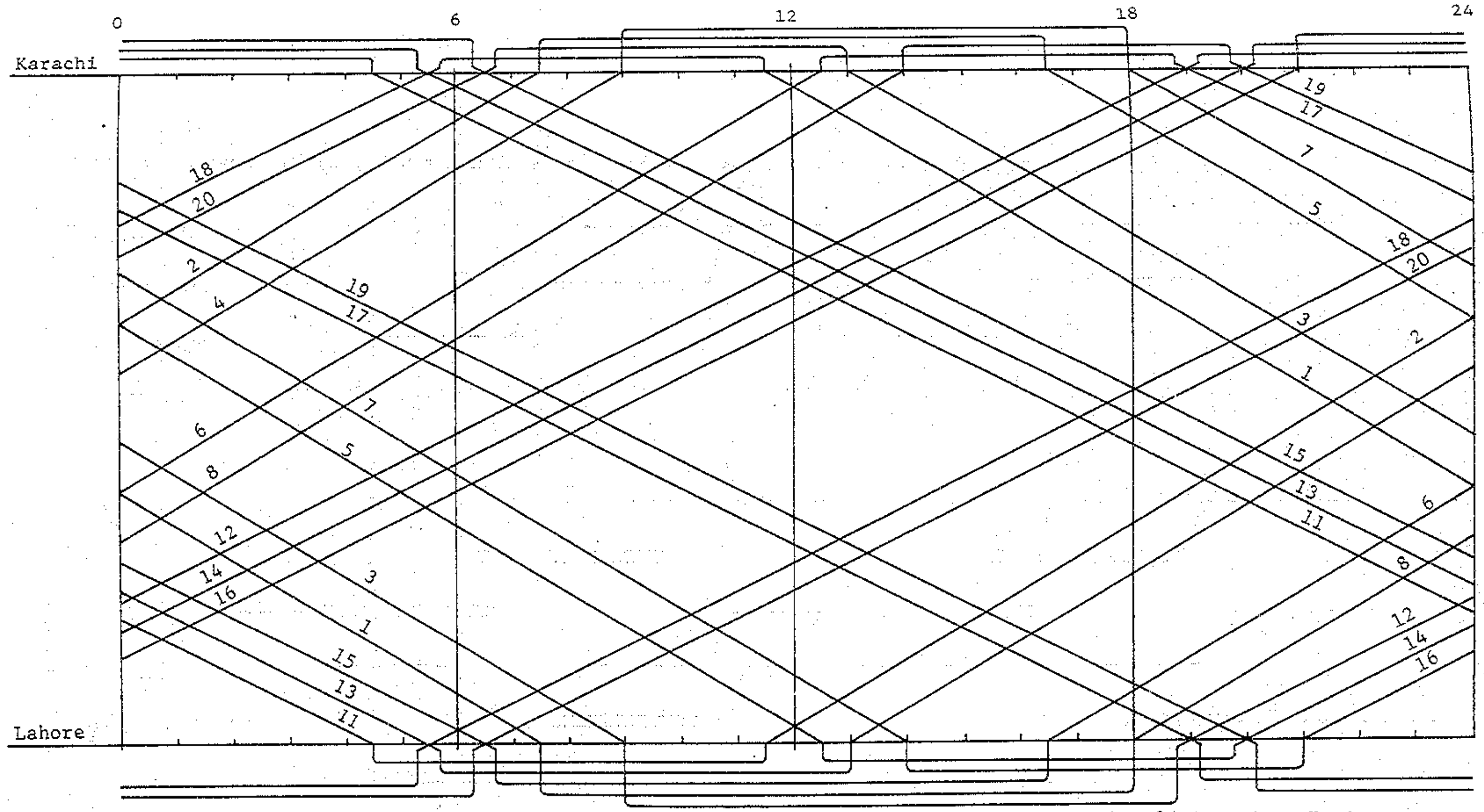
- Introduction of high speed trains between Karachi and Lahore
- Allocation of goods concentration base stations
- Establishing through trains between base stations
- Eliminating bottlenecks on the main lines
- Switching to truck feeder transport
- Maintaining warehouses at base stations

1) Introduction of High Speed Trains between Karachi and Lahore

According to the demand forecasts for the year 2000, it is estimated that the traffic volume in t-km from Karachi to Lahore and Faisalabad areas will amount to about 30% of the national total. In addition, the establishment of high speed transportation system to cope with future containerization in marine shipping is considered to be the best method to recovering the share of the railways in in-land traffic.

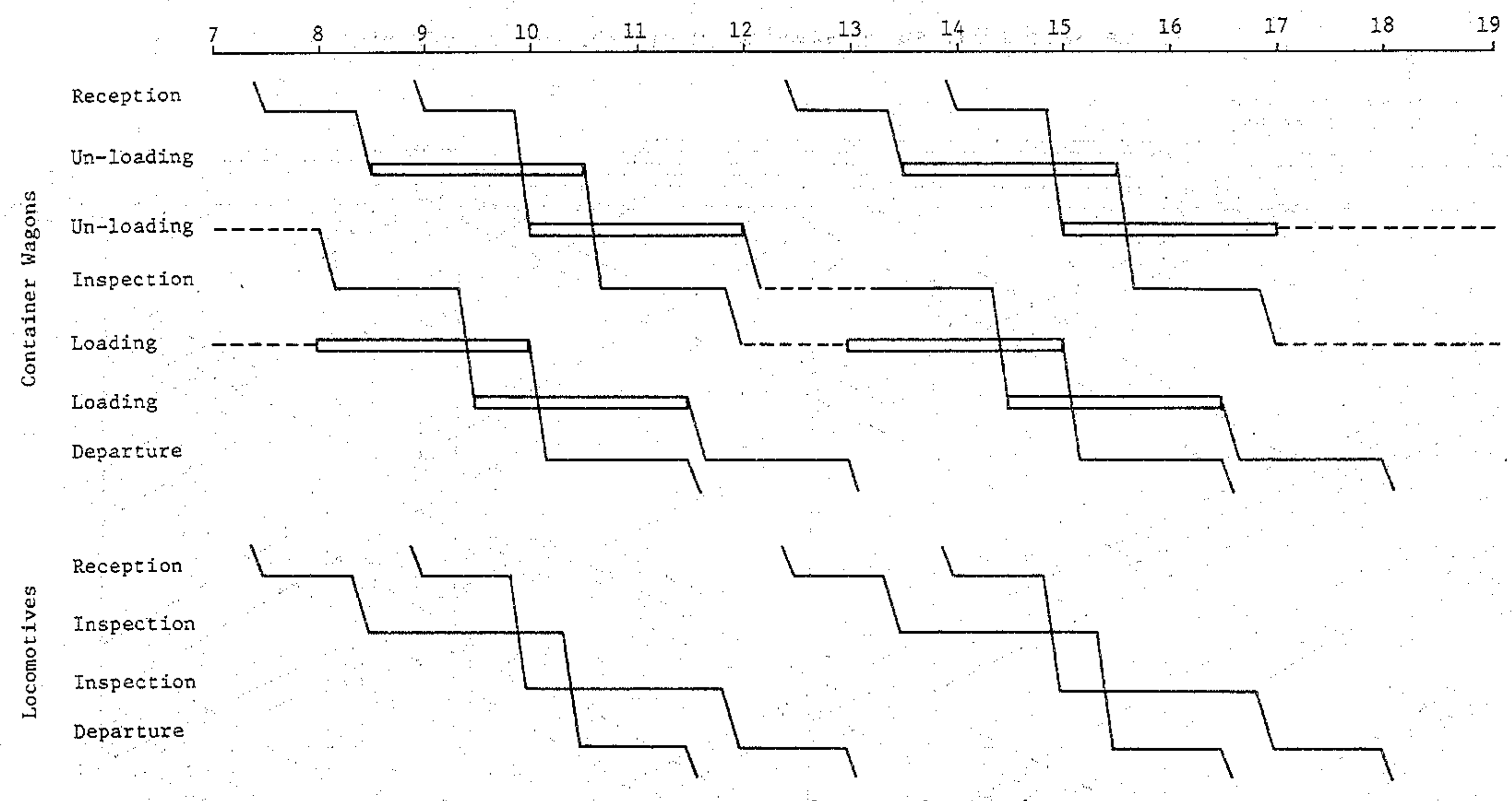
a) Container Transportation

In the year 2000, the containers to be sent to the up-country about 1,000 km away as bonded goods will be transported at high speed between Karachi and Lahore. In this case, 3000-t class train unit will be used, with four trains per day at an average speed of 60 km/h by the high output electric locomotives. In response to the containerization of marine shipping in 1988, a dry port at Lahore needs to be newly constructed and, since the demand is about 30% of that for the year 2000, transportation using two trains per day should be made with a 2000-ton class hauling capacity train being used for the time being.



No. 1 ∿ 8 Container Trains
No. 11 ∿ 20 High Speed Goods Trains

Fig. 2-3-2 An Example of Express Goods Train Diagram



Note: Locomotive working diagram shows exclusive rotation for container trains.

Fig. 2-3-3 Working Diagram at Terminals for Container Trains

Table 2-3-3 Performance of Container Trains

		1988	2000
Number of containers per year (up):		45,900	135,000
Number of containers per day:		153	450
Number of trains per day (one-way):		2	4
Average number of containers loaded per train:		77	113
Maximum number of containers loaded per train:		90	126
Number of goods wagons per train:		30	42
Average gross tonnage per train to be designed:		1995	2751
Locomotives:	KMR to SMA:	DL 3000 HP	EL 4000 KW
	SMA to LHR;	EL 3000 HP	EL 4000 KW

Source: Calculations based on the demand forecast by the Study Team

b) High Speed Goods Wagon Transportation

The percentage of container transportation from Karachi to Lahore and in the Faisalabad areas is less than 30% with the remainder being transported by goods wagons. Because of this, through round trip transportation with a fixed composition of the high speed goods wagons should be introduced. These trains with an average speed of about 50 km/h should be operated exclusively between Karachi and Lahore using the same type of locomotive as for container trains. The performance of these trains would be as shown in Table 2-3-4.

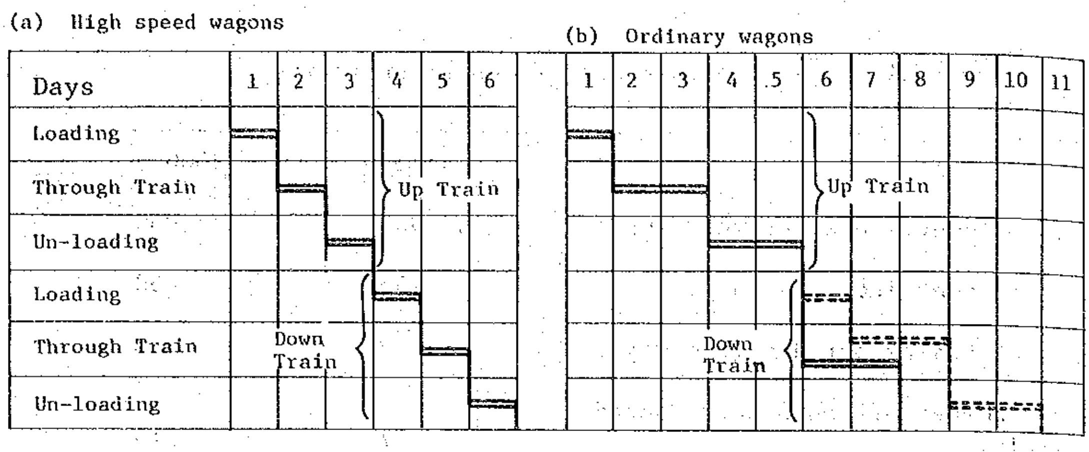


Fig. 2-3-4 Future Turn Round of Wagons

Table 2-3-4 Performance of High Speed Goods Trains

(Unit: t)

		1988	2000
Annual amount of transport (up):		762,000	2,830,000
Amount of transport per day:		2,540	9,433
Number of trains per day:		2	5
Average weight of load per train:		1,270	1,887
Capacity of load per train:		1,568	2,330
Number of goods wagons per train:		35	52
Gross tonnage per train to be designed (annual mean):		2,231	3,314
Locomotives:	KMR to SMA:	DL 3000 HP	EL 4000 KW
	SMA to LHR:	EL 3000 HP	EL 4000 KW

Source: Calculations based on the demand forecast by the Study Team

In addition to that for high speed trains, a forecast for the arrival of goods should be made, and taking-over of goods should be assigned. By doing this, the turn-round of goods wagons may be shortened and a 6 days turn-round may be assumed as shown in Fig. 2-3-4(a). These trains can carry more than half of the goods leaving Karachi and a greater part of goods leaving the Lahore and Faisalabad areas.

2) Allocation of Goods Concentration Base Stations

If goods are handled in many stations while the overall amount of freight is constant, the departure and arrival stations links increase, the operation of trains becomes more complicated, forming of goods trains and sorting becomes more frequent, and the time required for the transportation increases. Also, if the number of goods-handling stations is over-reduced, the transport demand will be converted to roads.

The criteria for selecting the goods concentration base stations are as follows:

- Stations located at the intersections of railway transport networks or at the central transportation points
- Stations located at central points of surrounding railways and roads
- Stations in central areas of economic activity
- Stations in cities having a large population
- Stations from where more than one feeder trip can be made daily
- The amount of shipping or arriving goods is sufficient for forming a train.

By referring to the above-listed criteria, 15 goods concentration base stations were selected as shown in Fig. 2-3-5.

It was assumed that the area of feeder transport from a base station is a radius of about 100km.

As for fertilizer transportation, for example, it was checked that each factory is within this distance. Therefore if there is a railway widening to the factory, through train will be prepared in proportion to the amount, but even if not, it is possible to transport from factory to the nearest base station by truck.

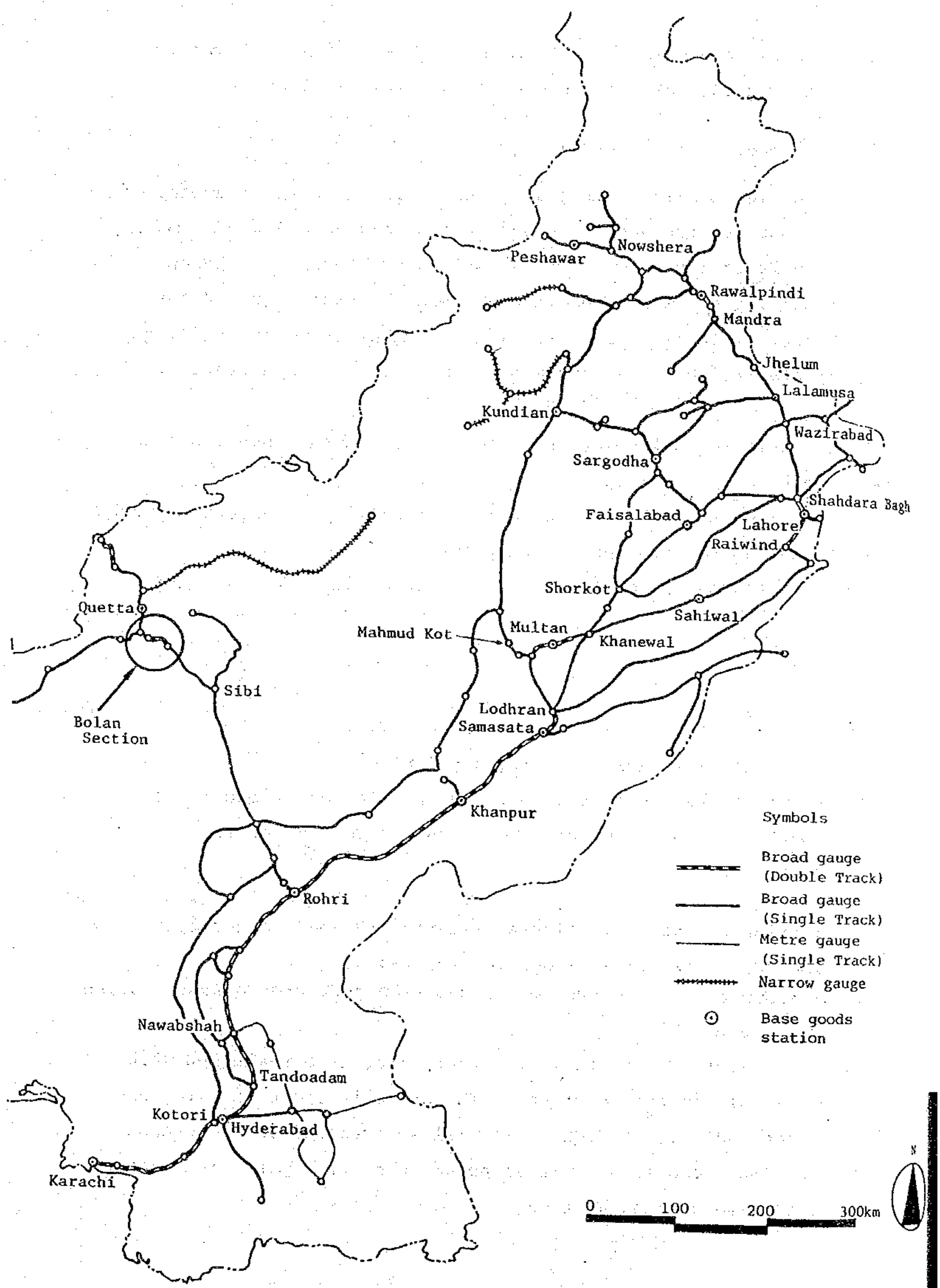


Fig. 2-3-5 Allocation of Base Goods Stations

3) Establishing Through Trains between Base Goods Stations

The time required for a goods train is greatly governed by the time at stations. Thus, it is desirable to run the trains from departure to destination without stops. However, stopping may become necessary because of crossings in single track sections, operation of locomotives, switching of drivers, or coupling or release of goods wagons inadequate for the through train. Among these, the coupling of goods wagons will require the longest stopping time. Particularly, fully UP loaded trains are heavy, so that the recovery operation for the delay of train operation will become difficult. In view of the above, the following strategies should be regarded when forming the trains and governing the operation:

- The smallest number of stops and the shortest time for the UP trains.
- Mid-way coupling of UP trains should be avoided as far as possible.
- At single track crossings UP trains should travel without stopping.
- By conforming to the above strategies, the rate of energy consumption may even be improved.

4) Elimination of Bottlenecks on the Main Lines

Another problem anticipated in through transportation is bottlenecks at points intermediate between the goods concentration base stations. At present, two such bottlenecks in this country are the continuous gradients over 1/25 of the line between Sibi and Kolpur and over 1/100 of the line between Lala Musa and Rawalpindi. To cope with this problem, the following countermeasures are recommended:

a) Between Sibi and Kolpur

Because of the unusually steep gradients, the following special operation is currently being conducted:

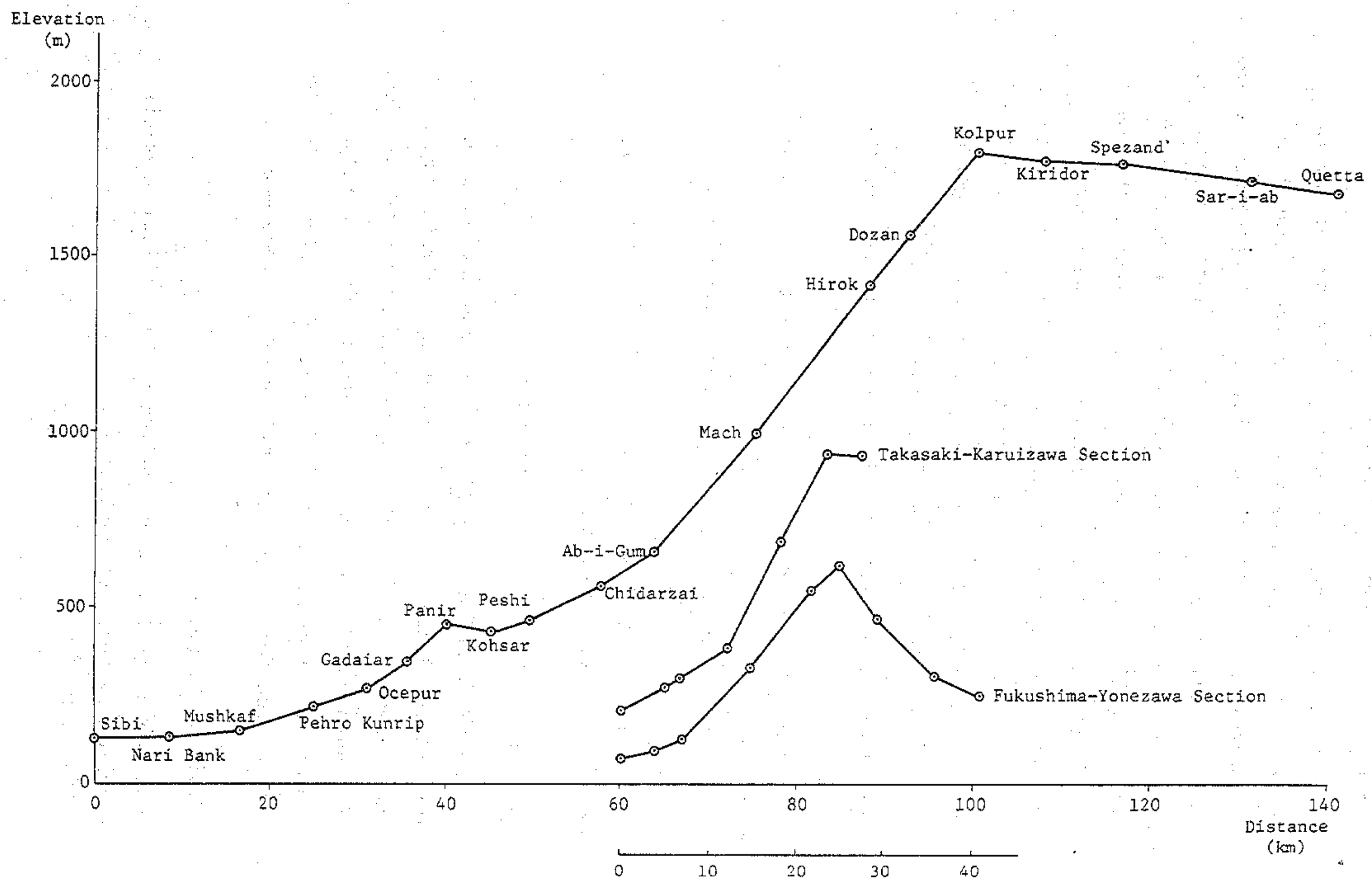


Fig. 2-3-6 Bolan Pass Vertical Section

- Because of the limit to the tonnage hauled most goods trains are divided or combined for operation at Ab-i-Gum or Kolpur.
- Diesel locomotives are equipped with speed-suppressive dynamic brakes.
- Since the required braking distance cannot be obtained with locomotive and loaded cars alone, several empty cars are coupled to secure the braking force.
- UP train requires an extra tractive force for moving the empty cars.
- Dynamic brakes alone are insufficient as speed-suppressing brakes so that air brake of locomotive and the continuous vacuum brakes of goods wagons are used in combination.
- Stopping at intermediate stations to cool wheels.
- Since the braking force of the vacuum brake is not strong, a brake inspection is performed on DOWN trains at Kolpur.

Because of these reasons, the running speed between Sibi and Kolpur is low at about 15 km/h, and additional time is spent at several stations. In order to solve these problems, the following countermeasures are recommended:

- Electrification between Sibi and Kolpur.
- To secure a tractive force of 1,000 tons for UP and DOWN trains.
- To add two electric locomotives to long-run diesel locomotives both UP and DOWN trains.
- To allocate 200-t to a Diesel locomotive and 2x400-t to electric locomotives for UP 1000-t train.
- Regenerative speed-suppressive brakes for electric locomotives should be used for DOWN 1000-t.

b) Between Lala Musa and Rawalpindi

Because of the continuous 1/125 gradient, trains are limited to within 1200 tons and are divided at Lala Musa. Since this gradient occurs in the section between Jhelum and Mandra, it is more advantageous from the overall viewpoint to perform a through operation with the aid of an additional locomotive for the steep gradient section for hauling with 1800-t in the case of non-electrification and for hauling with 2000-t after electrification.

5) Switching Feeder Transportation to Trucks

Concentration of delivery from the base stations can be performed by trucks or by shunting trains. In the case of shipping by railway, more time may be required because of the shunting of goods wagons at each station and the formation or sorting at the marshalling yards. Also, delays in work at intermediate stations may cause delays to long-distance trains and this loss cannot be ignored. In view of the number of trains to be operated in the year 2000, it is more advantageous to switch the feeder transport to trucks at each goods base stations, except for these sections with a small number of trains.

6) Maintaining Warehouses in the Base Stations

At base stations, it is required to quickly transfer goods from trains to trucks. However, conventionally, it has not been appropriate to keep the trucks waiting for unpunctual goods wagons and goods wagons inevitably had to stay over in the station for days.

For enhancement of efficiency in the operation of good wagons, it is indispensable to introduce higher speed goods trains and the through operation between base stations to allow the forecast of arrival, and thus eliminate the detention of the goods wagons.

Also, for certain goods not to be combined with trucks, it is desired to construct warehouses in the base station to decrease the number of stopped goods wagons. In addition, it is important to shorten the goods handling time by mechanization of the goods handling work.

Warehouse function at base stations will make it possible to decrease a turn round time of goods trains through storage of goods arriving at random by truck and its quick loading to or unloading from arrived goods wagons.

As a result, the turn-round time for ordinary goods trains can be shortened to about one week as shown in Fig. 2-3-4(b). It is expected that the DOWN goods from Lahore and Faisalabad areas will be shifted in the future to the high speed goods trains so that most ordinary goods trains will be returned as empty wagons.

From the calculations based on the transportation method described above, the number of goods trains for the year 2000 is expected to be as shown in Table 2-3-5.

2-3-5 Development of Transportation Facilities

The number of trains expected in the year 2000 for both passenger and goods is expected to be as shown in Table 2-3-6. Alternative A is applicable where the present share of railways in the inland transport remains the same, and Alternative B is for the type which depends on the long-distance railways.

By increasing the train unit and loading efficiency and by abolishing trains shunting, railway transportation coping with the demand forecast may be almost achieved with the numbers of trains listed below.

However, in order to operate this number of trains, it becomes necessary to considerably change the system and to improve and strengthen the facilities, which is summarized in Table 2-3-7.

Table 2-3-5 Maximum Number of Goods Trains (One Way)

	Alternative A	Alternative B
Karachi ∿ Rohri	23 (26)	36 (41)
Rohri ∿ Samasata	28 (31)	51 (56)
Samasata ∿ Khanewal (Both routes)	33 (36)	55 (60)
Khanewal ∿ Lahore	20 (23)	46 (51)
Khanewal ∿ Faisalabad	10	6
Khanewal∿ Sargodha	4	3
Lahore ∿ Lala Musa	20	26
Lala Musa ∿ Rawalpindi	17	19
Rawalpindi ∿ Peshawar	12	13
Rohri ∿ Quetta	10	22

Note: Number of trains converted to the trains of 2000-t hauling is shown in ( ).

Source: Calculations based on the demand forecast by the Study Team.

Table 2-3-6 Maximum Number of Trains (One Way)

	Alternative A	Alternative B
Karachi ∿ Rohri	53	66
Rohri ∿ Samasata	56	79
Samasata ∿ Khanewal	63	85
Khanewal ∿ Lahore	43	69
Khanewal ∿ Faisalabad	16	12
Khanewal ∿ Sargodha	7	6
Lahore ∿ Lala Musa	39	45
Lala Musa ∿ Rawalpindi	25	27
Rawalpindi ∿ Peshawal	15	16
Rohri ∿ Quetta	15	27

Source: Calculation based on the demand forecast by the Study Team

Table 2-3-7 Development and Improvement of Transportation Facilities

Objective	Development & Improvement projects	Section
Improving track capacity:	Automatic signals, relay interlocking, Tokenless and color light	HDR to RWP, ROH to QTA, KWL to ESLD, FSLD to WZD, SKO to SRQ, MHK to KDA,
	Double track	LON to RWP
Improving train speed & tractive force:	Electrification,	KMR to KWL, LHR to RWP SIB to KLR
	DL power up, Improving station loop	KOT, TDM, ROH, etc.
Container trains and high speed goods trains	Terminal improvement, New production of EL and wagons	KMR, LHR
Shortening of terminal staying time :	Improving terminal, Goods handling machines	13 base stations
Improvement of fundamentals of transport:	Procurement and Replacement of locomotives, passenger coaches, good wagons, Track renewal	

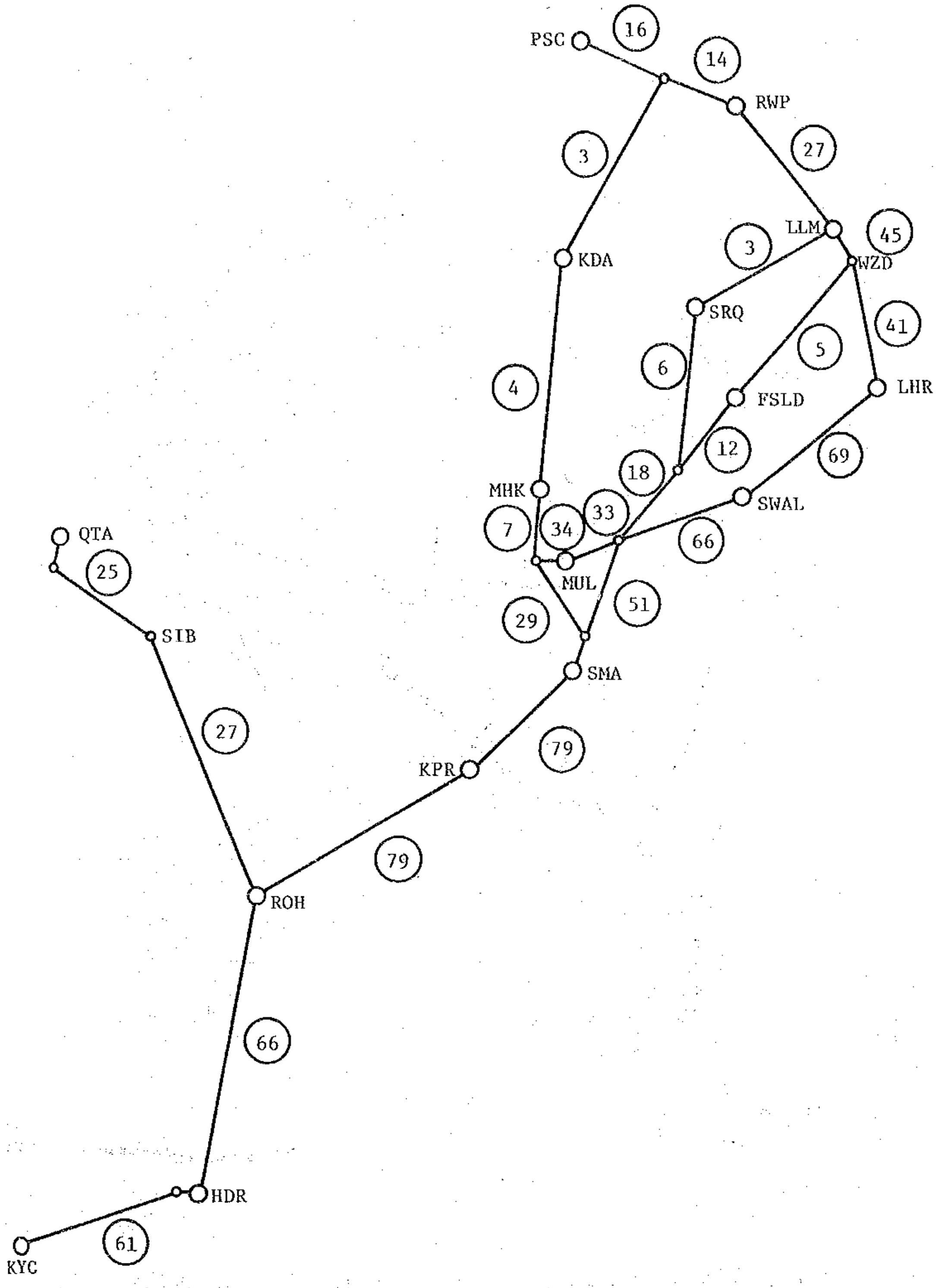


Fig. 2-3-7 Number of Trains (Passenger and Goods) Case B

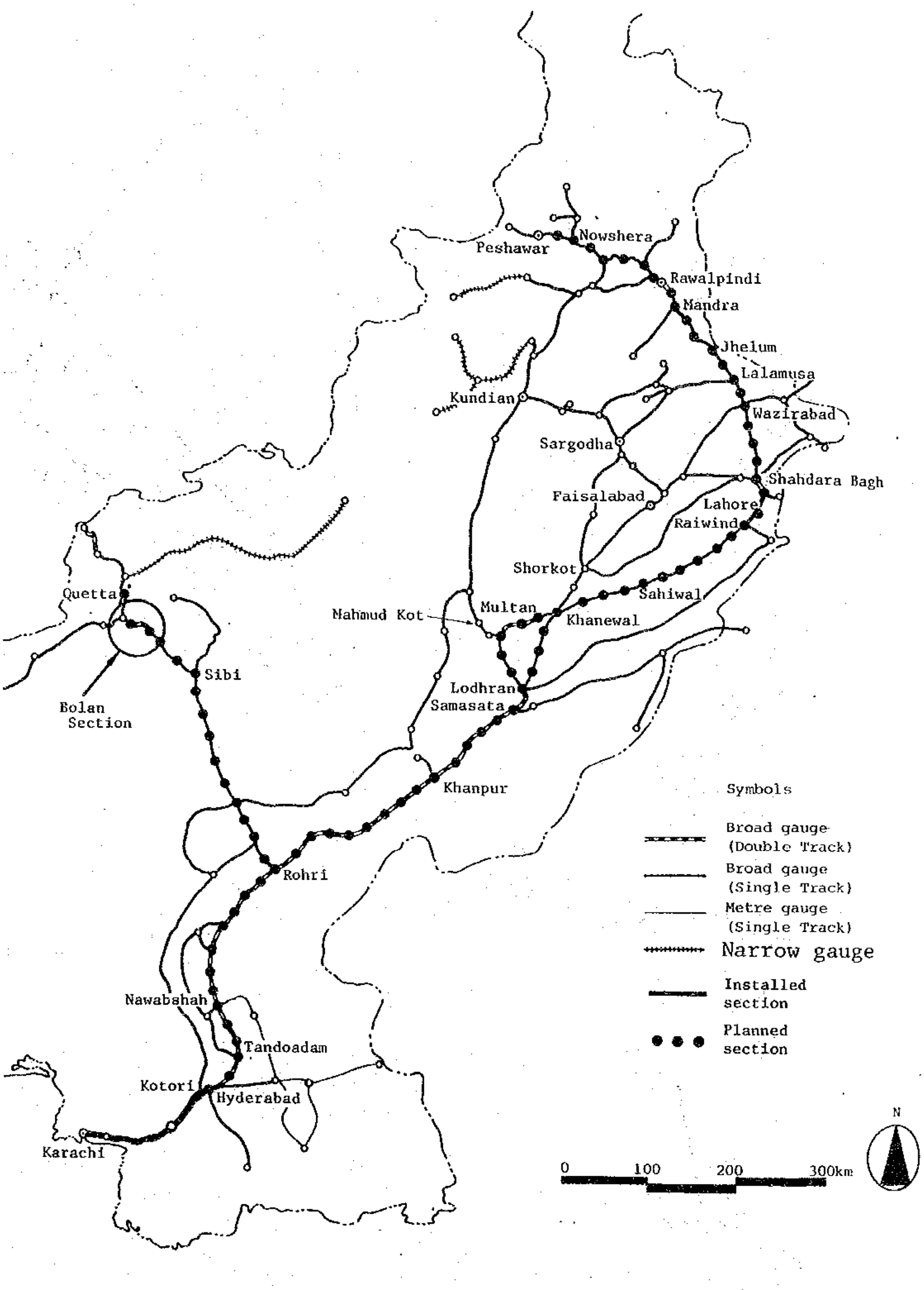


Fig. 2-3-8 Automatic Block and Relay Interlocking Device
(Masterplan)

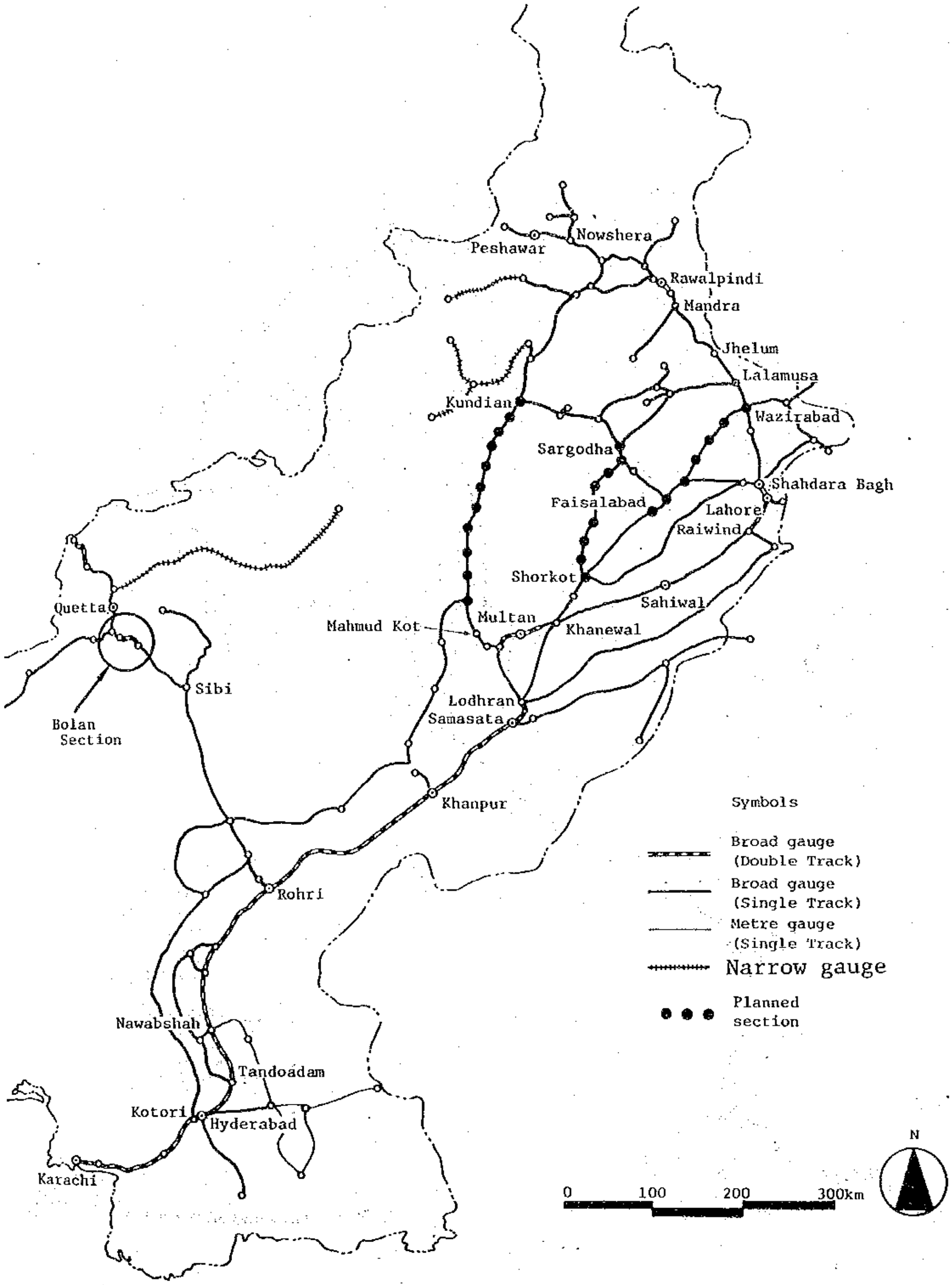


Fig. 2-3-9 Tokenless and Color Light Device (Masterplan)

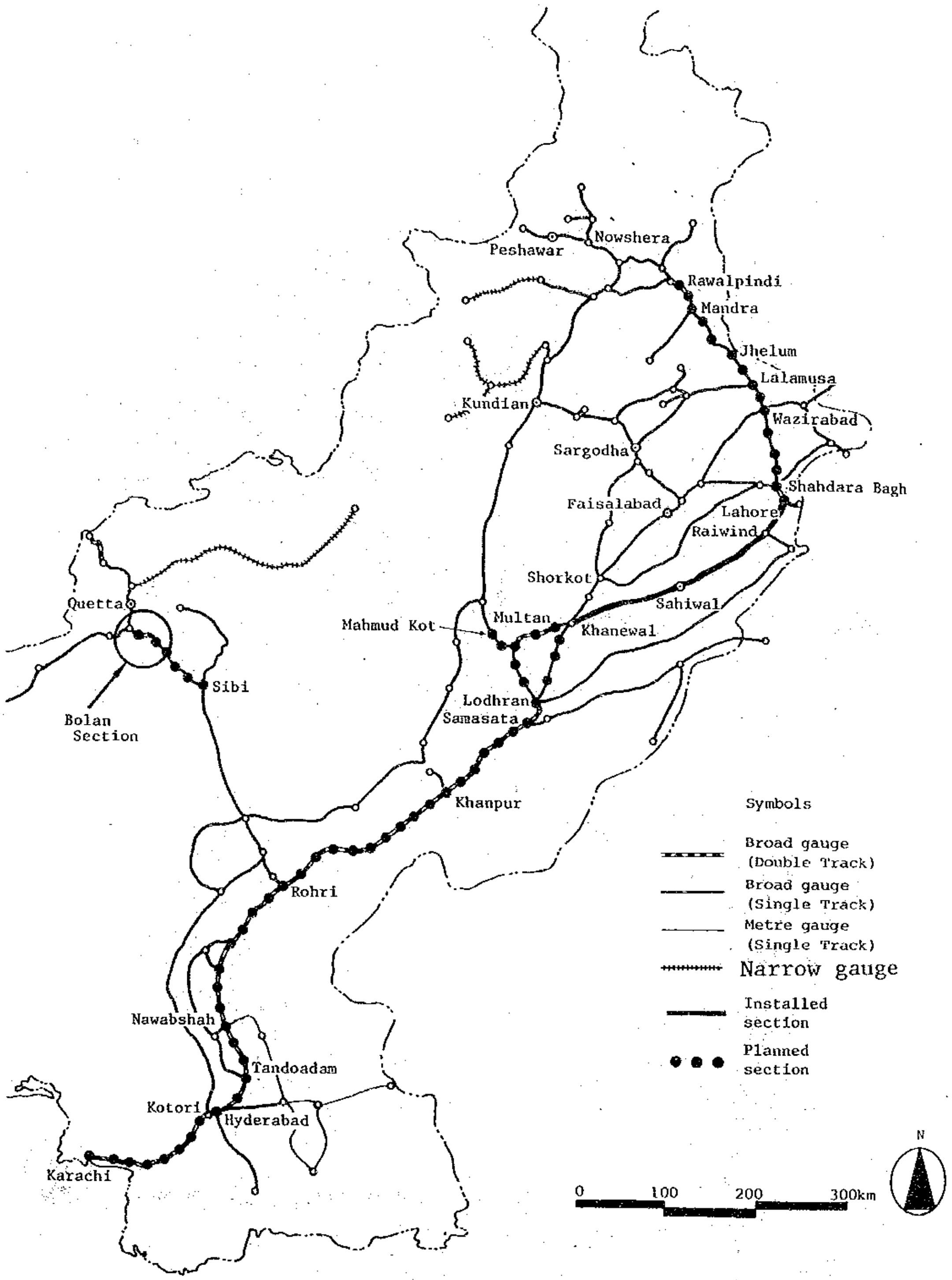


Fig. 2-3-10 Electrification (Masterpaln)

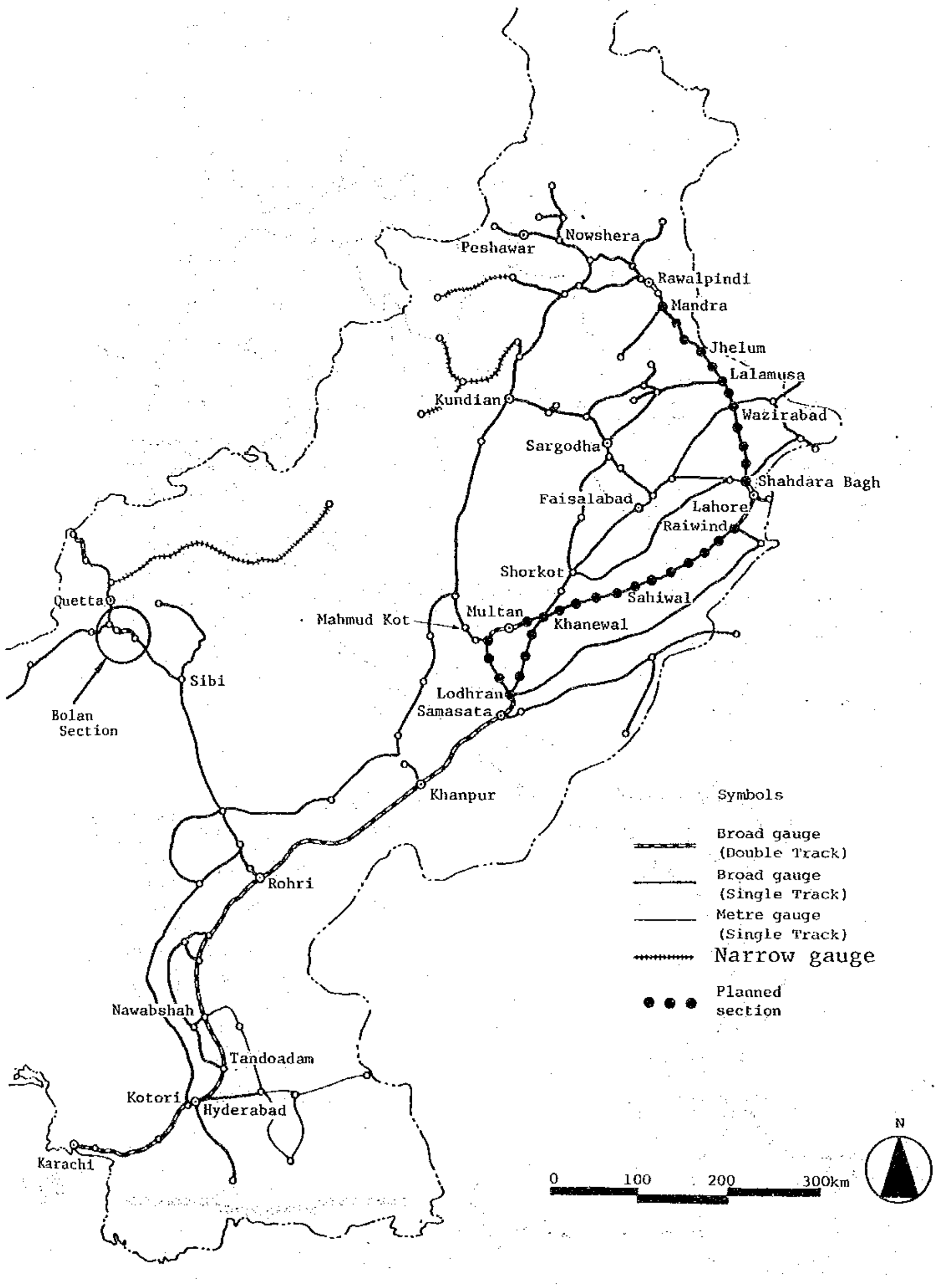


Fig. 2-3-11 Track Doubling (Masterplan)

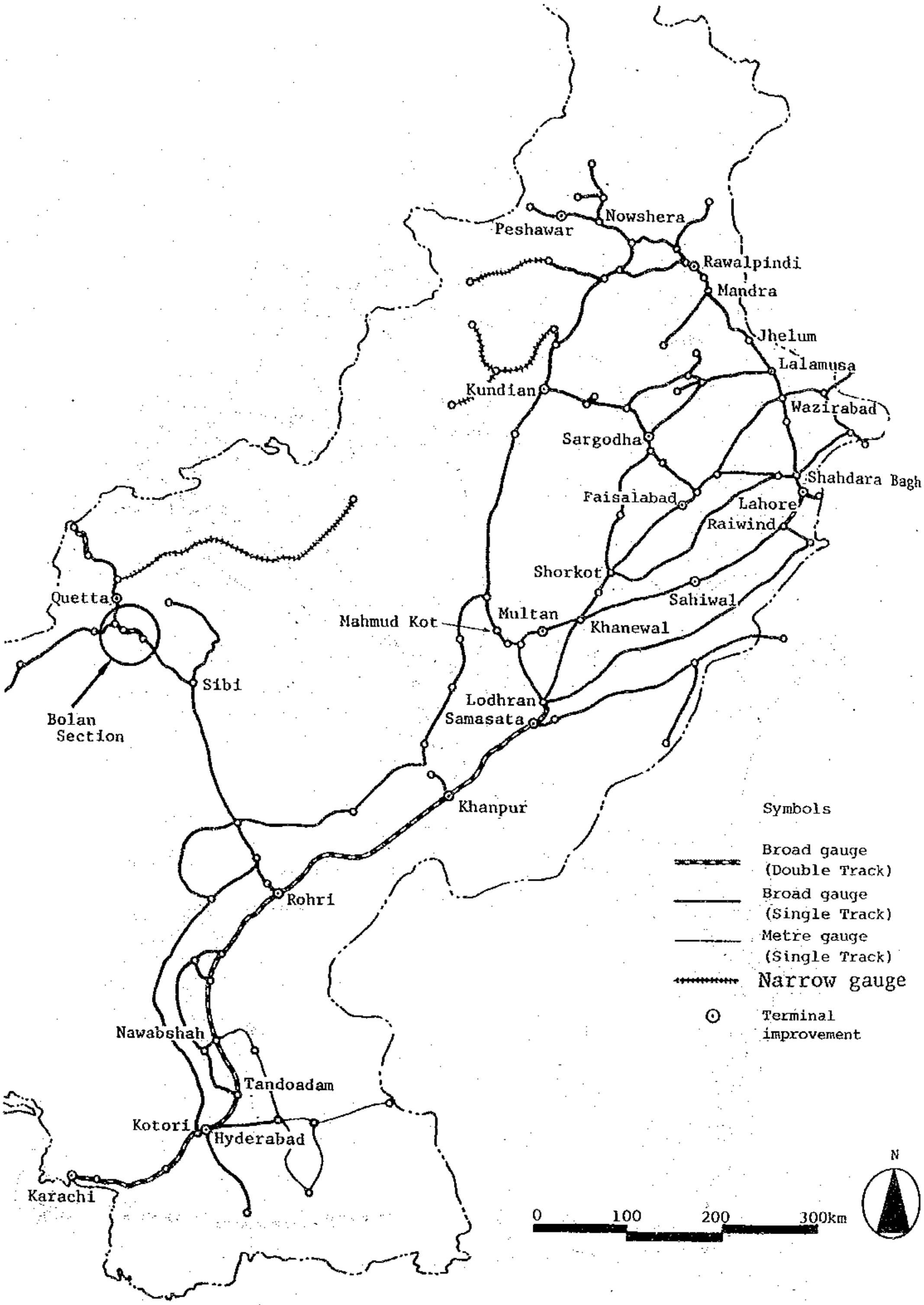


Fig. 2-3-12 Terminal Improvement (Masterplan)

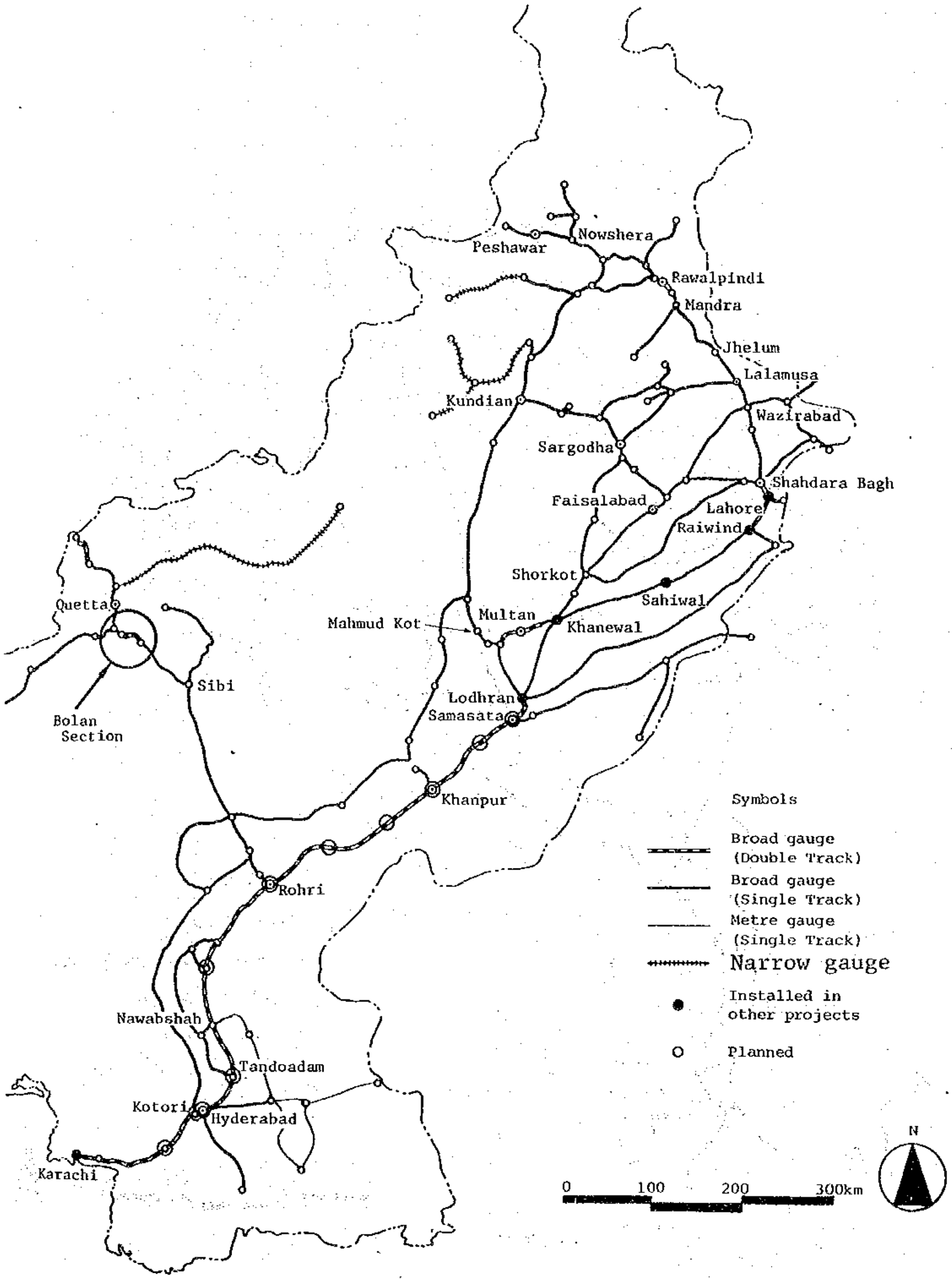


Fig. 2-3-13 Station Loop (Masterplan)

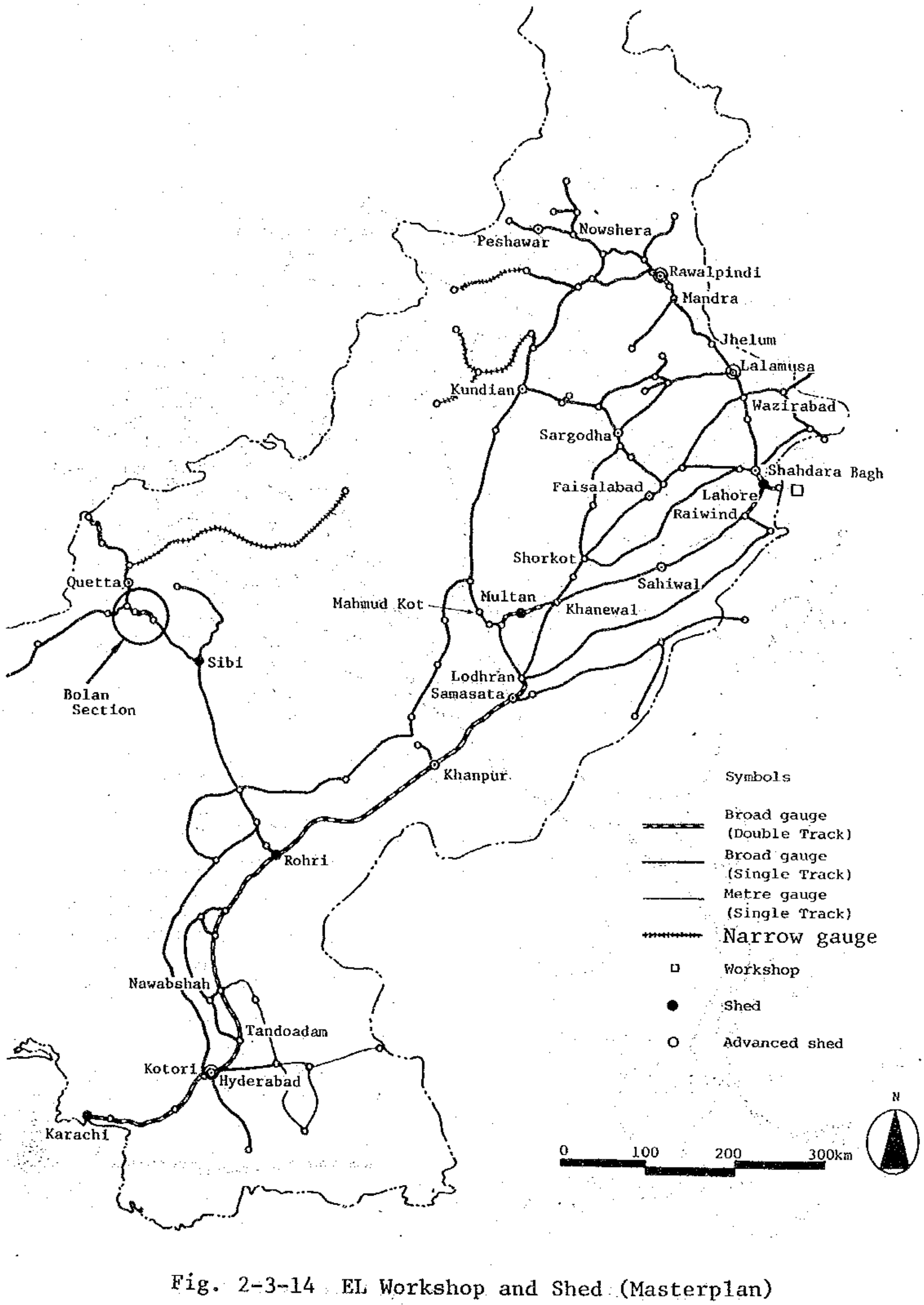


Fig. 2-3-14 EL Workshop and Shed (Masterplan)