Table 7.2: Comparison of Service Level on Road by Alternative Plan, Klang Valley, 2005

| Indicators | Base Plan (Do-Nothing) | Plan 1-1 | Plan 1-2 | Plan 2-1 | Plan 2-2 | Plan 2-3 | Plan 2-4 |
|---|---|---|---|---|---|---|---|
| Total Road Length (km) | 819 | 1,199 | 1,228 | 1,228 | 1,228 | 1,228 | 1,228 |
| Average Travel Speed (Kph) | 11 | 22 | 24 | 27 | 27 | 27 | 26 |
| Average Trip Length (km/trip) | 15.2 | 13.1 | 12.6 | 12.4 | 12.4 | 12.4 | 12.6 |
| Average Travel Time (min/trip) | 79 | 36 | 31 | 27 | 27 | 28 | 29 |
| Congestion Degree | 3.26 | 1.16 | 1.09 | 1.00 | 1.01 | 1.01 | 1.04 |

Table 7.3: Comparison of Public Transport Service by Alternative Plan, Klang Valley, 2005

| Factors | Base Plan | Plan 1-1 | Plan 1-2 | Plan 2-1 | | | Plan 2-2 | | | Plan 2-3 | | | Plan 2-4 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Bus | Bus | Bus | Bus | MRT/LRT | Total | Bus | MRT/LRT | Total | Bus | MRT | Total | Bus | LRT | Total |
| No. of Passengers Assigned ('000 Pass) | 3034 | 3046 | 3046 | 2395 | 1337 | 3732 | 2549 | 1135 | 3684 | 2697 | 945 | 3639 | 2870 | 671 | 3541 |
| Average Trip Length (km/passenger) | 11.3 | 10.9 | 10.9 | 9.7 | 15.1 | 11.7 | 10.0 | 15.1 | 11.6 | 10.0 | 16.1 | 11.6 | 11.3 | 8.9 | 10.9 |
| Average Travel Time (min/passenger) | 83 | 49 | 47 | 39 | 26 | 34 | 41 | 24 | 35 | 41 | 28 | 38 | 48 | 19 | 42 |

## 7.3 Financial Analysis

### (1) General

Financial analysis is made to determine whether the enterprises to be established for operation of LRT/MRT system will be profitable or not. As mentioned in Section 7.1, four(4) plans concerning the introduction of the Mass Transit System will be evaluated financially. For each of these plans the effect of cordon pricing policy on the enhancement of revenues will be evaluated.

The financial analysis is made in three(3) steps, namely:–

* Determination of Financial Rate of Return
* Sensitivity Analysis on Financial Rate of Return
* Cash Flow Analysis

Prior to making the financial analysis, the following assumptions are set up:-

(a) Revenue of the Mass Transit System is estimated using the same fare structure of the existing stage bus system.
(b) The Mass Transit System is opened to public either in the year 1991 or in the year 2005.
(c) Construction of the Mass Transit System will start 3 years before the opening year to the public. This means that the construction period would be three years.
(d) The project life of the Mass Transit System is thirty(30) years.

(2) Revenues and Costs

Table 7.4 shows the tabulation of revenues and costs of the MRT/LRT System in each alternative plan. The project cost includes both infrastructure cost and vehicle cost of the completed MRT/LRT system in each alternative plan. Revenues for the year 1995 and 2005 are calculated from outputs of the Public Transport Passenger Assignment Model.

Table 7.4: Summary of Revenues and Costs of MRT/LRT Systems (In 1985 Prices)

| Alternative Plan | Project Cost (M$ million) | Operation/Maintenance (M$ million) | | Revenues (M$ million/year) (Without Cordon Pricing) | | Revenues (M$ million/year) (With Cordon Pricing) | |
|---|---|---|---|---|---|---|---|
| | | 1995 | 2005 | 1995 | 2005 | 1995 | 2005 |
| Plan 2-1 | 3514 | 53.4 | 76.3 | 254.3 | 370.6 | 259.6 | 378.3 |
| Plan 2-2 | 2141 | 45.6 | 61.1 | 226.5 | 318.0 | 232.0 | 325.7 |
| Plan 2-3 | 1384 | 35.4 | 54.8 | 188.7 | 274.9 | 194.3 | 283.1 |
| Plan 2-4 | 1920 | 19.0 | 27.1 | 78.0 | 113.6 | 81.3 | 118.4 |

(3) Results of Financial Analysis

The financial rate of return for four(4) Mass Transit System Introduction Plans are calculated and shown in Table 7.5.

Table 7.5: Financial Rate of Return for Alternative Mass Transit Introduction Plans

| Alternative Plan | Year of Opening | |
|---|---|---|
| | 1991 | 2005 |
| Plan 2-1 | 5.9 | 9.1 |
| Plan 2-2 | 8.9 | 11.6 |
| Plan 2-3 | 12.3 | 16.7 |
| Plan 2-4 | 1.7 | 4.2 |
| Plan 2-1-W | 6.1 | 9.3 |
| Plan 2-2-W | 9.2 | 11.9 |
| Plan 2-3-W | 12.7 | 17.5 |
| Plan 2-4-W | 2.0 | 4.4 |

From the above table, the following observations can be made:–

(a) Although the fare structure of the Mass Transit System (both MRT and LRT Systems) is as low as that of the Stage Bus System, the financial rate of return for Plan 2-3 (MRT Only) is 12.3% (if opened in 1991) or 16.7% (if opened in 2005). Plan 2-3-W (Plan 2-3 with cordon pricing introduction plan) could increase the financial rate of return by about 0.4% to 0.8%. This plan (either Plan 2-3 or Plan 2-3-W) is found to be financially feasible for implementation.

(b) The financial rate of return for Plan 2-2 (MRT and LRT Systems) is 8.9% (1991) or 11.6% (2005). The introduction of cordon pricing could increase the financial rate of return by about 0.3%. This plan shows an acceptable level of the financial rate of return for the Mass Transit System.

(c) The financial rate of return for Plan 2-1 (MRT and LRT Systems) is 5.9% (1991) or 9.1% (2005). The introduction of cordon pricing could increase the financial rate of return by about 0.2%. The plan shows an acceptable level of financial rate of return for the Mass Transit System only if the opening to public is prolonged till 2005.

(d) The financial rate of return for Plan 2-4 (LRT Only) is 1.7% (1991) or 4.2% (2005). The introduction of cordon pricing could only increase the financial rate of return by about 0.2 to 0.3%. The indicated financial rate of return is too low for this plan to be financially feasible even if the opening year to the public is the year 2005.

In order to elucidate a more effective investment plan for Plan 2-3 or Plan 2-3-W, a phasing plan for Plan 2-3 is formulated as follows:–

| Phase | Target Opening Year | Line/Section of MRT System |
|---|---|---|
| I | 1991 | * Line/section of MRT System<br>* Kepong-Shah Alam |
| II | 1996 | * Kuala Lumpur Central - Ampang<br>* Selayang-Taman Eastern<br>* Shah Alam-Port Klang<br>* Sungei Way-Subang Airport |
| III | 2000 | * Kepong-Rawang<br>* Kuala Lumpur Central – Bangi New Town |

The financial rate of return for Plan 2-3 and Plan 2-3-w according to this phasing plan is calculated and compared to the original plan as shown in Table 7.6.

**Table 7.6: Financial Rate of Return of Phasing Plan**

| Plan | Without Cordon Pricing | With Cordon Pricing |
|---|---|---|
| Plan 2-3, Original Plan | 12.3% | 12.7% |
| Plan 2-3, Phasing Plan | 13.9% | 14.4% |

Note . The opening year to public of the original plan is 1991

The financial rate of return indicates that Plan 2-3 with a Phasing Plan is found to be more financially viable then the original Plan 2-3 both with or without cordon pricing by 1.7% and 1.6% respectively.

As the second stage of the financial analysis, a sensitivity analysis on the financial rate of return is made. The factors to be tested in the sensitivity analysis are considered as follows:–

1. Number of Passengers and/or Amount of Revenue
1.1 20% Reduction of Passengers or Revenues
1.2 50% Reduction of Passengers or Revenues
2. Growth of Passenger
2.1 50% Reduction of Growth in Passengers
3. Construction Costs
3.1 20% Increase of Construction Costs
3.2 50% Increase of Construction Costs
4. Combination of Factors
4.1 20% Reduction of Passengers or Revenues and 20% Increase of Construction Costs
4.2 50% Reduction of Growth in Passengers and 20% Increase of Construction Costs

Table 7.7 shows the results of the financial analysis. According to this table, the following observations can be made.--

(a) The most sensitive factor to the financial rate of return is the reduction of number of passengers or amount of revenue. Even with 50% reduction of passengers or revenues as assumed, the financial rate of return for Plan 2-3 with a Phasing Plan is 4.0% (without cordon pricing) or 4.7% (with cordon pricing).

(b) The sensitivity analysis for Plan 2-4 (LRT Only) indicates that most of the financial rate of return are below zero.

(c) Compared to the other alternative plans, the financial rate of return of Plan 2-3 with a Phasing Plan is found to be most superior to all the factors tested on. Except for a 50% reduction of passengers or revenues, the financial rate of return of this plan is all above the acceptable level for Mass Transit System.

**Table 7.7 : Results of Sensitivity Analysis on Financial Rate of Return for Alternative Mass Transit System Introduction Plans, 1991**

| | | Plan 2-1 | Plan 2-2 | Plan 2-3 (Original) | Plan 2-3 (Phasing) | Plan 2-4 | Plan 2-3-W (Original) | Plan 2-3-W (Phasing) |
|---|---|---|---|---|---|---|---|---|
| 1.1 | 20% Reduction of Passengers/Revenues | 3.8 | 6.5 | 9.3 | 10.4 | 0.0 | 9.8 | 10.9 |
| 1.2 | 50% Reduction of Passengers/Revenues | 0.0 | 1.7 | 3.8 | 4.0 | 0.0 | 4.4 | 4.7 |
| 2.1 | 50% Reduction of Growth in Passengers | 3.9 | 7.4 | 10.1 | 10.8 | 0.0 | 10.6 | 11.2 |
| 3.1 | 20% Increase of Construction Costs | 4.5 | 7.4 | 10.3 | 11.6 | 0.6 | 10.7 | 12.0 |
| 3.2 | 50% Increase of Construction Cost | 3.0 | 5.5 | 8.2 | 9.0 | 0.0 | 8.5 | 9.4 |
| 4.1 | 20% Reduction of Passengers and 20% Increase of Construction Costs | 2.6 | 5.0 | 7.7 | 8.4 | 0.0 | 8.1 | 8.9 |
| 4.2 | 50% Reduction of Growth in passenger and 20% Increase of Construction Costs | 2.5 | 5.8 | 8.2 | 8.5 | 0.0 | 8.6 | 8.9 |

As the third step of the finacial analysis, the cash flow analysis for the Mass Transit System in Plan 2-3 Phasing Plan is made and its results are summarized in Table 7.8. It is observed that depending on the interest rate on loans for infrastructure construction the number of years required for repayment varies from 14 years to 19 years, if interest rate is 6% to 12% respectively. When cordon pricing scheme is considered, the repayment period could also be shortened by one year.

Table 7.8 Cash Flow Status of Mass Transit System in Plan 2-3, Phasing Plan According to Varying Interest Rate Chargeable on Loan Taken

| Plan | Interest Rate | No. of Years Required for Repayment |
|---|---|---|
| Plan 2-3, Phasing (Phase I to be opened in 1991) | 6% | 14 Years |
| | 8% | 15 Years |
| | 10% | 17 Years |
| | 12% | 19 years |
| Plan 2-3-W, Phasing (Phase I to be opened in 1991) | 6% | (13 Years) |
| | 8% | (14 Years) |
| | 10% | (16 Years) |
| | 12% | (18 Years) |

Note . Assuming 3% per annum inflation from 1988

(4) Conclusion

The Plan 2-3-W, Phasing Plan investment in Mass Transit System could produce a profit in real terms of M$4725.7 million in 1985 prices (see Table 7.9) and yield a financial rate of return of 14.4%. Table 7.10 further indicates that considering a 12% interest rate on loan the investment could start to break even as soon as 5 years after opening and to have a positive cumulative net balance 18 years after opening.

Table 7.9: Annual Costs and Revenues of Mass Transit System in Plan 2-3-W, Phasing Plan in Real Terms (M$million in 1985 Prices)

| Year | Infra-structure Cost | Vehicle Cost | Operating Cost | Cost Total | Revenue | Net Income | Cumulative Net Income |
|---|---|---|---|---|---|---|---|
| 1988 | 48.1 | | | 48.1 | | -48.1 | -48.1 |
| 1989 | 96.2 | | | 96.2 | | -96.2 | -144.3 |
| 1990 | 96.2 | 69.5 | | 165.7 | | -165.7 | -310.0 |
| 1991 | | | 5.9 | 5.9 | 45.2 | 39.3 | -270.7 |
| 1992 | 69.0 | | 5.9 | 74.9 | 46.9 | -28.0 | -298.7 |
| 1993 | 138.0 | | 5.9 | 143.9 | 48.7 | -95.2 | -393.9 |
| 1994 | 138.0 | 132.8 | 5.9 | 276.7 | 50.6 | -226.1 | -620.0 |
| 1995 | | | 18.2 | 18.2 | 125.1 | 106.9 | -513.1 |
| 1996 | | | 18.2 | 18.2 | 129.8 | 111.6 | -401.5 |
| 1997 | 45.6 | | 18.2 | 63.8 | 134.8 | 71.0 | -330.5 |
| 1998 | 91.1 | | 18.2 | 109.3 | 140.0 | 30.7 | -299.8 |
| 1999 | | 368.3 | 18.2 | 477.6 | 145.4 | -332.2 | -632.0 |
| 2000 | | | 54.8 | 54.8 | 234.5 | 179.7 | -452.3 |
| 2001 | | | 54.8 | 54.8 | 243.5 | 188.7 | -263.6 |
| 2002 | | | 54.8 | 54.8 | 252.9 | 198.1 | -65.5 |
| 2003 | | | 54.8 | 54.8 | 262.6 | 207.8 | 142.3 |
| 2004 | | | 54.8 | 54.8 | 272.6 | 217.8 | 360.1 |
| 2005 | | | 54.8 | 54.8 | 283.1 | 228.3 | 588.4 |
| 2006 | | | 54.8 | 54.8 | 288.5 | 233.7 | 822.1 |
| 2007 | | | 54.8 | 54.8 | 294.0 | 239.2 | 1061.3 |
| 2008 | | | 54.8 | 54.8 | 299.7 | 244.9 | 1306.2 |
| 2009 | | | 54.8 | 54.8 | 305.4 | 250.6 | 1556.8 |
| 2010 | | | 54.8 | 54.8 | 311.3 | 256.5 | 1813.3 |
| 2011 | | | 54.8 | 54.8 | 317.2 | 262.4 | 2075.7 |
| 2012 | | | 54.8 | 54.8 | 323.3 | 268.5 | 2344.2 |
| 2013 | | | 54.8 | 54.8 | 329.5 | 274.7 | 2618.9 |
| 2014 | | | 54.8 | 54.8 | 335.8 | 281.0 | 2899.9 |
| 2015 | | | 54.8 | 54.8 | 342.3 | 287.5 | 3187.4 |
| 2016 | | | 54.8 | 54.8 | 348.8 | 294.0 | 3481.4 |
| 2017 | | | 54.8 | 54.8 | 355.5 | 300.7 | 3782.1 |
| 2018 | | | 54.8 | 54.8 | 362.3 | 307.5 | 4089.6 |
| 2019 | | | 54.8 | 54.8 | 369.3 | 314.5 | 4404.1 |
| 2020 | | | 54.8 | 54.8 | 376.4 | 321.6 | 4725.7 |
| Total | 813.3 | 570.6 | 1265.4 | 2649.3 | 7375.0 | 4725.7 | |

Notes: (1) Inflation is not considered in this calculation

Table 7.10: Repayment Schedule for Mass Transit System in Plan 2-3-W, Phasing Plan

| Year | Revenue | Operation & Maintenance Cost | Net Income | Interest Payment | Annual Profit/ Loss | Loan for Infra-structure construction | Toal Inflow | Loan Repayment | Vehicle Cost | Total Outflow | Balance at Year | Cumulative Balance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1988 | | | | 6.3 | -6.3 | 52.6 | 46.3 | 0.0 | 0.0 | 52.6 | -6.3 | -6.3 | |
| 1989 | | | | 19.3 | -19.3 | 108.3 | 89.0 | 0.0 | 0.0 | 108.3 | -19.3 | -26.4 | |
| 1990 | | | | 32.7 | -32.7 | 111.5 | 78.8 | 0.0 | 80.6 | 192.1 | -113.3 | -142.9 | |
| 1991 | 54.0 | 7.0 | 47.0 | 32.7 | 14.3 | 0.0 | 14.3 | 27.2 | 0.0 | 27.2 | -12.9 | -172.9 | |
| 1992 | 57.7 | 7.3 | 50.4 | 39.6 | 10.8 | 84.9 | 95.7 | 27.2 | 0.0 | 112.1 | -16.4 | -210.0 | |
| 1993 | 61.7 | 7.5 | 54.2 | 57.4 | -3.2 | 174.8 | 171.6 | 27.2 | 0.0 | 202.0 | -30.4 | -265.6 | |
| 1994 | 66.0 | 7.7 | 58.3 | 75.7 | -17.4 | 180.1 | 162.7 | 27.2 | 173.3 | 380.6 | -217.9 | -515.4 | |
| 1995 | 168.1 | 24.5 | 143.6 | 72.4 | 71.2 | 0.0 | 71.2 | 71.2 | 0.0 | 71.2 | 0.0 | -577.2 | |
| 1996 | 179.7 | 25.2 | 154.5 | 63.9 | 90.6 | 0.0 | 90.6 | 71.2 | 0.0 | 71.2 | 19.4 | -627.1 | |
| 1997 | 192.2 | 25.9 | 166.3 | 63.1 | 103.2 | 65.0 | 168.2 | 71.2 | 0.0 | 136.2 | 32.0 | -670.4 | |
| 1998 | 205.6 | 26.7 | 178.9 | 70.6 | 108.3 | 133.8 | 242.1 | 71.2 | 0.0 | 205.0 | 37.1 | -713.7 | |
| 1999 | 219.9 | 27.5 | 192.4 | 78.7 | 113.7 | 137.8 | 251.5 | 71.2 | 557.1 | 766.1 | -514.6 | -1313.9 | |
| 2000 | 365.3 | 85.4 | 279.9 | 70.1 | 209.8 | | 209.8 | 105.3 | 0.0 | 105.3 | 104.5 | -1367.1 | |
| 2001 | 390.7 | 87.9 | 302.8 | 57.4 | 245.4 | | 245.4 | 77.7 | 0.0 | 77.7 | 167.7 | -1363.5 | |
| 2002 | 418.0 | 90.6 | 327.4 | 48.1 | 279.3 | | 279.3 | 77.7 | 0.0 | 77.7 | 201.6 | -1325.5 | |
| 2003 | 447.1 | 93.3 | 353.8 | 38.8 | 315.0 | | 315.0 | 77.7 | 0.0 | 77.7 | 237.3 | -1247.3 | |
| 2004 | 478.0 | 96.1 | 381.9 | 29.5 | 352.4 | | 352.4 | 77.5 | 0.0 | 77.5 | 274.9 | -1122.1 | |
| 2005 | 511.3 | 99.0 | 412.3 | 20.2 | 392.1 | | 392.1 | 33.7 | 0.0 | 33.7 | 358.4 | -898.4 | |
| 2006 | 536.7 | 101.9 | 434.8 | 16.1 | 418.7 | | 418.7 | 33.7 | 0.0 | 33.7 | 385.0 | -621.2 | |
| 2007 | 563.3 | 105.0 | 458.3 | 12.1 | 446.2 | | 446.2 | 100.7 | 0.0 | 100.7 | 345.5 | -350.2 | LOSS |
| 2008 | 591.5 | 108.2 | 483.3 | 0.0 | 483.3 | | 483.3 | 0.0 | 0.0 | 0.0 | 483.3 | 91.1 | PROFIT |
| 2009 | 620.8 | 111.4 | 509.4 | 0.0 | 509.4 | | 509.4 | 0.0 | 0.0 | 0.0 | 509.4 | 600.5 | |
| 2010 | 651.8 | 114.7 | 537.1 | 0.0 | 537.1 | | 537.1 | 0.0 | 0.0 | 0.0 | 537.1 | 1137.6 | |
| 2011 | 684.1 | 118.2 | 565.9 | 0.0 | 565.9 | | 565.9 | 0.0 | 0.0 | 0.0 | 565.9 | 1703.5 | |
| 2012 | 718.1 | 121.7 | 596.4 | 0.0 | 596.4 | | 596.4 | 0.0 | 0.0 | 0.0 | 596.4 | 2299.9 | |
| 2013 | 753.9 | 125.4 | 628.5 | 0.0 | 628.5 | | 628.5 | 0.0 | 0.0 | 0.0 | 628.5 | 2928.4 | |
| 2014 | 791.3 | 129.1 | 662.2 | 0.0 | 662.2 | | 662.2 | 0.0 | 0.0 | 0.0 | 662.2 | 3590.6 | |
| 2015 | 830.9 | 133.0 | 697.9 | 0.0 | 697.9 | | 697.9 | 0.0 | 0.0 | 0.0 | 697.9 | 4288.5 | |
| 2016 | 872.0 | 137.0 | 735.0 | 0.0 | 735.0 | | 735.0 | 0.0 | 0.0 | 0.0 | 735.0 | 5023.5 | |
| 2017 | 915.4 | 141.1 | 774.3 | 0.0 | 774.3 | | 774.3 | 0.0 | 0.0 | 0.0 | 774.3 | 5797.8 | |
| 2018 | 960.0 | 145.3 | 815.6 | 0.0 | 815.6 | | 815.6 | 0.0 | 0.0 | 0.0 | 815.6 | 6613.4 | |
| 2019 | 1008.9 | 149.7 | 859.2 | 0.0 | 859.2 | | 859.2 | 0.0 | 0.0 | 0.0 | 859.2 | 7472.6 | |
| 2020 | 1059.1 | 154.2 | 904.9 | 0.0 | 904.9 | | 904.9 | 0.0 | 0.0 | 0.0 | 904.9 | 8377.5 | |
| 2021 | 1111.8 | 158.8 | 953.0 | 0.0 | 953.0 | | 953.0 | 0.0 | 0.0 | 0.0 | 953.0 | 9330.5 | |
| 2022 | 1167.2 | 163.6 | 1003.6 | 0.0 | 1003.6 | | 1003.6 | 0.0 | 0.0 | 0.0 | 1003.6 | 10334.1 | |
| 2023 | 1225.3 | 168.5 | 1056.8 | 0.0 | 1056.8 | | 1056.8 | 0.0 | 0.0 | 0.0 | 1056.8 | 11390.9 | |
| 2024 | 1286.4 | 173.6 | 1112.8 | 0.0 | 1112.8 | | 1112.8 | 0.0 | 0.0 | 0.0 | 1112.8 | 12503 7 | |
| 2025 | 1350.5 | 178.8 | 1171.7 | 0.0 | 1171.7 | | 1171.7 | 0.0 | 0.0 | 0.0 | 1171.7 | 13675.4 | |
| Total | 21515.2 | 3450.8 | 18064.4 | 904.7 | 17159.7 | 1048.0 | 18208.5 | 1048.8 | 811.0 | 2908.6 | 15299.9 | | |

Notes: (1) Project is assumed to begin in the year 1988 and to be opened to the public in the year 1991.

(2) 12% interest rate on loan for infrastructure construction is assumed.

(3) 3% inflation rate is assumed.

## 7.4 Economic Evaluation

Further evaluation is necessary to determine which plan is preferable from the national economic view point in addition to the functional suitability and financial analysis, the following items are to be evaluated from the economic view point in this section.

(a) Road Network Proposals
(b) Mass Transit System Introduction Proposals
(c) Transport Policy Measures
(d) Transport Masterplan Proposals

### 7.4.1 Road Network Proposals

(1) Road Network Proposals in 2005

Two(2) alternative road network proposals which have been discussed in Chapter 5 are evaluated through comparison analysis between costs and benefits. The benefits derived from the road network improvement proposals are estimated using the highway network assignment models and the transportation costs. Table 7.11 shows the annual benefits in the year 2005. According to the estimation, the generation of an amount of M$6,361 million (Plan 1-1) or M$7,095 million (Plan 1-2) in annual benefits could be expected while the road network improvement costs required for each plan are M$4,080 million (Plan 1-1) and M$4,330 million (Plan 1-2) respectively.

Consequently, the single year Benefit-Cost Ratio in the year 2005 (B/C Ratio in 2005) is calculated and summarized in Table 7.15. From this table, the following observations can be made:–

(a) Both alternative road network plans are economically feasible
(b) The road network plan of Plan 1-2 has a higher economic indicator than that of Plan 1-1.

Table 7.11 . Annual Benefits Derived from Road Network Proposals in 2005

| | Plan 1-1 | Plan 1-2 | Difference between Plan 1-1 and 1-2 |
|---|---|---|---|
| Car Users' Saving in: | | | |
| * Vehicle Operating Cost | 1057.2 | 1214.1 | 156.9 |
| * Time Cost | 2497.3 | 2783.5 | 286.2 |
| Sub-total | 3554.5 | 3997.6 | 443.1 |
| M/Cycle Users' Saving in: | | | |
| * Vehicle Operating Cost | 51.3 | 60.7 | 9.4 |
| * Time Cost | 221.7 | 248.8 | 27.1 |
| Sub-total | 273.0 | 309.5 | 36.5 |
| Bus Users' Savings in: | | | |
| * Time Cost | 895.9 | 940.5 | 44.6 |
| Bus Operators' Savings in: | | | |
| * Vehicle Operating Cost | 153.8 | 164.3 | 10.5 |
| Truck Operators' Saving in: | | | |
| * Vehicle Operating Cost | 1483.6 | 1682.9 | 199.3 |
| Total | 6360.8 | 7094.8 | 734.0 |

Unit . Million Ringgit Per Annum

Table 7.12. Single Year Benefit-Cost Ratio by Road Network Plans in 2005, Klang Valley

| Items | Plan 1-1 | Plan 1-2 |
|---|---|---|
| Cost of Roads (M$million) | 4,080 | 4,330 |
| Annualized Cost at 12% (M$million) | 546 | 580 |
| Annual Benefit (M$million) | 6,361 | 7,095 |
| B/C Ratio | 11.6 | 12.2 |

(2) Road Network Proposal in 1995

In order to identify priority projects among the road projects the cost effective analysis is made for each proposed road. It is assumed that the cost effectiveness can be expressed as a function of traffic volume:–

$$X = f(Q, L)$$

where:–

X = Cost effectiveness
Q = Traffic volume
L = Length of road

The single year cost effectiveness of link i ($X_i^t$) can be expressed as follows:–

$$X_i^t = \frac{Q_i^{tw} \times L_i - Q_i^{two} \times L_i}{C_i}$$

Where:–

$X_i^t$ = Cost effectiveness of link i in year t

$Q_i^t$ = Traffic volume on link i in year t

$L_i$ = Length of link i

$C_i$ = Construction cost of link i

w, wo = With project and without project

The priority ranking $P_i$ of link i is given by the following equation:–

$$P_i = \int X_i^t \left(\frac{1}{1+r}\right)^t dt$$

$$= \frac{1-\beta^{10}}{1-\beta} \times \frac{\Delta Q_{95} \times L_i}{C_i}$$

Where:–

$P_i$ : Priority Rating of Link i

r: Discount Rate

$$\beta: \left\{\frac{\Delta Q_{2005}}{\Delta Q_{1995}}\right\}^{1/10} \Big/ (1+r)$$

Based on the priority rating calculated by the abovementioned formula, the priority road projects expected to be completed by the year 1995 are identified and the road network in the year 1995, which is incorporated with the priority projects is evaluated economically.

Table 7.13 shows the single year benefit cost ratio in the year 1995.

The single year benefit cost ratio shows that the road network in the year 1995 is economically feasible.

**Table 7.13: Single Year Benefit Cost Ratio for Road Network in Klang Valley, 1995**

| | |
|---|---|
| Project Costs (M$million) | 1,371 |
| Annualized Cost at 12% (M$million) | 184 |
| Annual Benefit (M$million) | 2,328 |
| B/C Ratio | 12.7 |

### 7.4.2 Mass Transit System Introduction Proposals

(1) Mass Transit System Introduction Proposals in 2005

Four(4) alternative mass transit system introduction proposals are evaluated on the basis of the costs and benefits in the year 2005.

The benefits derived from the Mass Transit System being introduced are estimated and shown in Table 7.14. On the other hand, the mass transit system introduction costs required ranging from M$1,384 million (Plan 2-3) to M$3,514 million (Plan 2-1).

Therefore, the single year B/C ratio in the year 2005 is calculated and shown in Table 7.15. From this table, the following observations can be made:—

(a) All Mass Transit System introduction proposals are found to be economically feasible if these proposals are implemented in the year 2005.

(b) Plan 2-3 (MRT Only) has the highest economic indicator among the alternative proposals.

Table 7.14: Annual Benefits by Alternative Mass Transit System Introduction Plans

| Items | Plan 2-1 | Plan 2-2 | Plan 2-3 | Plan 2-4 |
|---|---|---|---|---|
| Car Users' Saving in: | | | | |
| * Vehicle Operating Cost | 274.6 | 261.3 | 251.4 | 201.9 |
| * Time Cost | 320.4 | 311.6 | 302.3 | 261.6 |
| Sub-total | 595.0 | 572.9 | 553.7 | 463.5 |
| M/Cycle Users' Saving in: | | | | |
| * Vehicle Operating Cost | 21.8 | 20.0 | 18.7 | 12.2 |
| * Time Cost | 32.9 | 31.7 | 30.5 | 24.8 |
| Sub-total | 54.7 | 51.7 | 49.2 | 37.0 |
| Bus Users' Savings in: | | | | |
| * Time Cost | 76.5 | 58.5 | 44.3 | 10.7 |
| Transit Users' Savings in : | | | | |
| * Time Cost | -116.2 | -98.2 | -76.1 | -37.2 |
| Bus Operators' Savings in: | | | | |
| * Vehicle Operating Cost | 116.6 | 103.3 | 95.2 | 55.3 |
| Transit Operators' Savings in: | | | | |
| * Transit Operating Cost | -76.3 | -61.1 | -54.8 | -27.1 |
| Truck Operators' Saving in: | | | | |
| * Vehicle Operating Cost | 101.0 | 97.0 | 93.6 | 78.9 |
| Total | 751.3 | 724.1 | 705.1 | 581.1 |

Unit: Million Ringgit Per Annum

Table 7.15: Single Year Benefit-Cost Ratio by Mass Transit System Introduction Plans in 2005, Klang Valley

| Items | Plan 2-1 | Plan 2-2 | Plan 2-3 | Plan 2-4 |
|---|---|---|---|---|
| Cost of Mass Transit System (M$million) | 3514 | 2141 | 1384 | 1920 |
| Annualized Cost at 12% (M$million) | 470 | 287 | 185 | 257 |
| Annual Benefit (M$million) | 751 | 724 | 705 | 581 |
| B/C Ratio | 1.6 | 2.5 | 3.8 | 2.3 |

(2) Priority of the Mass Transit System Lines

In order to identify the priority ranking of the Mass Transit System Lines, the cost effective analysis is also made as in the case of the road proposals. The cost effectiveness of a Mass Transit Line can also be expressed as the following equations:–

$$X = f(Q, L, C)$$

Where:–

X = Cost effectiveness
Q = Passenger Volume
L = Length
C = Construction Cost

The priority rating ($P_i$) can also be expressed as follows.–

$$P_i = \int X_i^t \left(\frac{1}{1+r}\right)^r dt = \frac{1-\beta^{10}}{1-\beta} \times \frac{\Delta Q_{1995} \times L_i}{C_i}$$

Where:–

$P_i$ : Priority Rating of Line i

r: Discount Rate

$$\beta : \left\{\frac{\Delta Q_{2005}}{\Delta Q_{1995}}\right\}^{1/10} \Big/ 1+r$$

Based on the priority rating calculated by the abovementioned formula, the priority of the Mass Transit System lines is identified as follows.–

Priority 1
* Kuala Lumpur - Kepong
* Kuala Lumpur - Shah Alam
* Kuala Lumpur - Taman Eastern

2
* Kuala Lumpur - Ampang
* Taman Eastern - Selayang
* Shah Alam - Port Klang
* Sungei Way - Subang Airport

3
* Kepong - Rawang
* Kuala Lumpur - Bangi New Town

(3) Mass Transit System Introduction Proposal in 1995

The Mass Transit System Network in 1995 which consists of the network identified as the priority 1 and 2 is evaluated economically.

Table 7.16 shows the single year benefit-cost ratio in the year 1995.

The economic indicator shows that the Mass Transit System introduction plan in 1995 is found to be economically feasible.

**Table 7.16: Single Year Benefit Cost Ratio for Mass Transit System Klang Valley, 1995**

| | |
|---|---|
| Project Cost (M$ million) | 788 |
| Annualized Cost at 12% (M$ million) | 105 |
| Annual Benefit (M$ million) | 221.9 |
| B/C Ratio | 2.1 |

### 7.4.3 Transport Policy Options

Two(2) alternative transport policy options, one is without the cordon pricing scheme and the other with the cordon pricing scheme are also evaluated on the basis of the costs and benefits in the year 2005.

Table 7.17 shows the net benefit derived from the introduction of the cordon pricing. From this table, the net benefit derived from the cordon pricing introduction are positive indicating the cordon pricing introduction plan is economically justified.

Table 7.17: Net Benefits Due to Introduction of Traffic Limitation Measure by Alternative Plan, Kuala Lumpur, 2005

| Items | Plan 1-1W | Plan 1-2W | Plan 2-1W | Plan 2-2W | Plan 2-3W | Plan 2-4W |
|---|---|---|---|---|---|---|
| Car Users' Saving. | | | | | | |
| * Vehicle Operating Cost | 25.5 | 23.6 | 19.3 | 20.5 | 19.9 | 21.5 |
| * Time Cost | 19.4 | 20.2 | 11.3 | 14.6 | 11.7 | 14.4 |
| Sub-total | 44.9 | 43.8 | 30.6 | 35.1 | 31.6 | 35.9 |
| M/Cycle Users' Saving: | | | | | | |
| * Vehicle Operating Cost | 1.0 | 0.9 | 0.7 | 0.8 | 0.8 | 0.9 |
| * Time Cost | 1.1 | 1.1 | 0.6 | 0.8 | 0.6 | 0.7 |
| Sub-total | 2.1 | 2.0 | 1.3 | 1.6 | 1.4 | 1.6 |
| Bus Users' Savings in: | | | | | | |
| * Time Cost | -9.7 | -10.6 | -2.4 | -4.9 | -3.3 | -5.4 |
| Transit Users' Savings in: | | | | | | |
| * Time Cost | 0.0 | 0.0 | -1.8 | -5.5 | -1.2 | -3.6 |
| Bus Operators' Savings in: | | | | | | |
| * Vehicle Operating Cost | 2.9 | 2.5 | 0.8 | 1.5 | 1.1 | 2.0 |
| Truck Operators' Saving: | | | | | | |
| * Vehicle Operating Cost | 31.4 | 28.2 | 28.2 | 27.6 | 28.2 | 28.4 |
| Government's Saving: | | | | | | |
| * Maintenance/Operating Cost | -2.0 | -2.0 | -2.0 | -2.0 | -2.0 | -2.0 |
| Net Benefit | 69.6 | 63.9 | 54.7 | 53.4 | 55.9 | 56.9 |

Unit: Million Ringgit Per Annum

### 7.4.4 Proposed Transportation Plan

Following the conclusions of the economic evaluation of the alternative plans, Plan 2-3 is found to be the most superior. It has also been concluded that the private vehicle restraint strategy in the form of cordon pricing scheme as Plan 2-3-w could further enhance the superiority of this plan over all other plans. Hence the proposed transportation plan recommended as the Transportation Masterplan 2005 for Klang Valley shall be the realization of Plan 2-3-w in 2005 which consists of the following components:–

* 137 km of MRT System
* 1228 km of Road in the Road Network Plan 1-2
* Introduction of cordon pricing scheme as an optional transport management measure in Kuala Lumpur.

In order to achieve the target set out for the Transportation Masterplan 2005, a phasing plan is formulated based on the priority ranking of each project in the Masterplan. A phasing plan describes the process of attaining the Masterplan target by allowing an investment schedule which could generate sufficient benefits. The phasing plan so formulated consists of the following components by the year 1995, i.e.:–

* 84 km of MRT System
* 929 km of roads from Phase 1 of Plan 1-2
* Introduction of cordon pricing scheme to Kuala Lumpur

An economic analysis is performed to confirm the economic feasibility of implementing this phasing plan.

The benefits derived from phasing of the transportation plan is calculated on the basis of the following method illustrated in Figure 7.2. Benefit is defined as the difference between the transport cost in the 'Do-Nothing' case and that in the case when the transportation plan is fully carried out.

Table 7.18 shows the yearly stream of benefits and costs derived from the realization of the proposed transportation plan as a result of the economic evaluation. The investments in this plan could be expected to yield a net present value of M$16,609 million and a very high economic rate of return of 64.7%. A benefit-cost ratio of 6.4 could be expected (Table 7.19).

Therefore, from the results of the economic analysis, the proposed transportation plan is found to be economically feasible and is hence recommended as the Transportation Masterplan 2005 for Klang Valley.

Table 7.18: Yearly Stream of Benefits and Costs Derived from Proposed Transportation Masterplan, Klang Valley (M$ million at 1985 Prices)

| Year | Before Discount | | Discounted @ 12% | |
|---|---|---|---|---|
| | Costs | Benefits | Costs | Benefits |
| 1988 | 203.7 | | 181.9 | |
| 1989 | 203.7 | | 162.4 | |
| 1990 | 203.7 | | 145.0 | |
| 1991 | 361.4 | 428.0 | 229.7 | 272.0 |
| 1992 | 376.9 | 856.1 | 213.8 | 485.8 |
| 1993 | 392.4 | 1284.1 | 198.8 | 650.6 |
| 1994 | 407.9 | 1712.1 | 184.5 | 774.5 |
| 1995 | 423.3 | 2140.2 | 171.0 | 864.4 |
| 1996 | 499.4 | 2568.2 | 180.1 | 926.1 |
| 1997 | 517.2 | 3067.1 | 166.6 | 987.5 |
| 1998 | 535.0 | 3566.1 | 153.8 | 1025.2 |
| 1999 | 552.7 | 4065.0 | 141.8 | 1043.4 |
| 2000 | 570.5 | 4564.0 | 130.8 | 1045.9 |
| 2001 | 588.3 | 5062.9 | 120.3 | 1036.0 |
| 2002 | 606.1 | 5561.8 | 110.7 | 1016.1 |
| 2003 | 623.8 | 6060.8 | 101.8 | 988.6 |
| 2004 | 641.6 | 6559.7 | 93.5 | 955.4 |
| 2005 | 659.4 | 7058.7 | 85.7 | 917.9 |
| 2006 | 340.5 | 7557.6 | 39.5 | 877.5 |
| 2007 | 340.5 | 7557.6 | 35.3 | 783.5 |
| 2008 | 340.5 | 7557.6 | 31.5 | 699.5 |
| 2009 | 340.5 | 7557.6 | 28.1 | 624.6 |
| 2010 | 340.5 | 7557.6 | 25.1 | 557.7 |
| 2011 | 340.5 | 7557.6 | 22.4 | 497.9 |
| 2012 | 340.5 | 7557.6 | 20.0 | 444.6 |
| 2013 | 340.5 | 7557.6 | 17.9 | 396.9 |
| 2014 | 340.5 | 7557.6 | 16.0 | 354.4 |
| 2015 | 340.5 | 7557.6 | 14.3 | 316.4 |
| 2016 | 340.5 | 7557.6 | 12.7 | 282.5 |
| 2017 | 340.5 | 7557.6 | 11.4 | 252.3 |
| 2018 | 340.5 | 7557.6 | 10.1 | 225.2 |
| 2019 | 340.5 | 7557.6 | 9.1 | 201.1 |
| 2020 | 340.5 | 7557.6 | 8.1 | 179.6 |
| Total | 13474.1 | 167918.8 | 3073.7 | 19683.1 |

Table 7.19 : Economic Indicators of Proposed Transportation Masterplan, Klang Valley

| | (At 1985 Prices) |
|---|---|
| Benefit Cost Ratio | 6.4 |
| Net Present Value (M$ million) | 16,609 |
| Economic Rate of Return (%) | 64.7 |

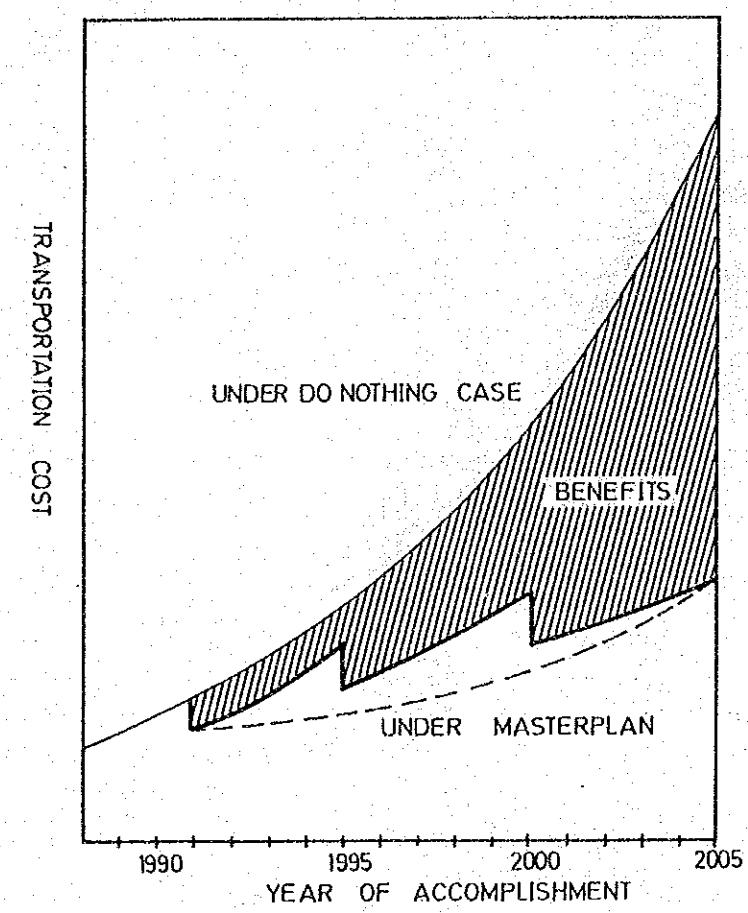



Table 7.19: Economic indicators of Proposed Transportation Masterplan, Klang Valley

As the second step of the economic evaluation, a sensitivity analysis on the benefit cost ratio of the proposed transportation plan is made. The factors to be tested in this sensitivity analysis are considered as follows:–

1. Benefits
1.1 20% Reduction of Benefits
1.2 50% Reduction of Benefits
2. Growth of Benefit
2.1 50% Reduction of Growth in Benefit
3. Construction Costs
3.1 20% Increase of Construction Costs
3.2 50% Increase of Construction Costs
4. Combination of Factors
4.1 20% Reduction of Benefits and 20% Increase of Construction Costs
4.2 50% Reduction of growth in Benefit and 20% Increase of Construction Costs

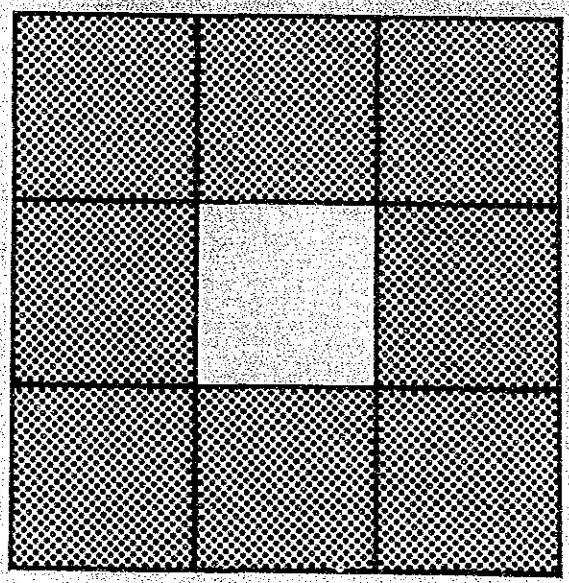
Table 7.20 shows the results of the sensitivity analysis. According to this table, the following observations can be made:–

(a) Even if the benefits are reduced by 50% from the original estimates, the proposed transportation plan is still found to be economically feasible.

(b) Even if the construction costs are increased by 50% from the original estimates, the proposed transportation plan is still economically feasible.

**Table 7.20: Sensitivity Analysis On The B/C Ratio Of Proposed Transportation Plan, Klang Valley, 2005**

| Factors | Benefit Cost Ratio |
|---|---|
| Proposed Transportation Plan | 6.4 |
| 20% Reduction of Benefits | 5.2 |
| 50% Reduction of Benefits | 3.3 |
| 50% Reduction of Growth in Benefit | 3.6 |
| 20% Increase of Construction costs | 5.4 |
| 50% Increase of Construction costs | 4.3 |
| 20% Reduction of Benefits and 20% Increase of Construction costs | 4.3 |
| 50% Reduction of growth in Benefits and 20% Increase of Construction costs | 3.0 |



# CHAPTER 8 : PROPOSALS OF TRANSPORTATION DEVELOPMENT FOR KLANG VALLEY TO YEAR 2005

# 8. PROPOSALS OF TRANSPORTATION DEVELOPMENT FOR KLANG VALLEY TO YEAR 2005

## 8.1 Proposed Ocerall Transport Policies

To achieve the goals and objectives set up in Chapter 5, the following overall transport policies are proposed : –

TP-1 To restructure the trend of present transport development in preventing a totally motorized society through encouraging the development of mass transit system and improvement of the conventional bus transport system. This implies that a balanced transport system is the most desirable system for the Klang Valley.

TP-2 To attain the future development pattern consisting of an urban system of six (6) growth centres with Bukit Tinggi Twin City, an effective regional transportation network consisting of a hierarchial road network system and the mass transit railway system shall be established.

TP-3 The existing transportation facilities shall be effectively utilized as much as possible so as to obtain maximum effects and minimum social and capital costs.

TP-4 The transportation development shall meet the varied transport demands both for the people and goods taking into account specific needs to have the transport modes comprised of both innovative and conventional forms.

TP-5 To achieve efficiency on transport development both infrastructure augmentation measures and the policy measures such as the traffic limitation programmes shall be considered.

TP-6 The transportation network to be provided shall be free from symptoms of the transport diseconomies such as bottleneck and stopshorts.

TP-7 Efforts should be directed to establish a road system based on functions to carry and accomodate different types of traffic including the provision of cycle path and pedestrian walks in residential zones hence ensuring the possibility of maintaining a safe and conducive living environment.

TP-8 Efforts should be directed to monitor traffic and hence reduce the occurrence of traffic accidents by the use of various traffic management methods.

## 8.2 Proposed Transportation Masterplan to Year 2005

The transportation masterplan which is the most efficient and likely to achieve the identified objectives in line with the identified overall transport policies is proposed.

(1) Mass Transit Railway System

A mass Transit Railway System is to be introduced as the major infrastructure of the public transportation system in the major corridors in the Klang Valley and viewed as a strategy for promoting urban and regional development. The proposed Mass Transit Railway Network consists of five (5) lines totalling 137 kilometers in length, i.e. : –

MR-1 Port Klang Line from Kuala Lumpur to Port Klang

MR-2 Northern Line from Kuala Lumpur to Rawang

MR-3 Batu Caves Line from Kuala Lumpur to Selayang

MR-4 Southern Line from Kuala Lumpur to Bangi New Town

MR-5 Ampang Line from Kuala Lumpur to Ampang

This system can be accomplished with comparatively lower investment costs by maximizing the utilization of the existing KTM (Malayan Railway) reserves and facilities.

(2) Road Network Plan

The proposed six (6) urban centres with Bukit Tinggi will be interlinked by expressways and/or primary roads. The road network proposed for the Kuala Lumpur Conurbation shall be fully developed as a radial and circumferential road network in line with the urban development structure of a polycentric city with four (4) sub-centres at Damansara, Wangsa Maju, Bandar Tun Razak and Bukit Jalil.

The road network proposed for the Kuala Lumpur-Klang Corridor shall be developed into a multi-linear ladder pattern following the east-west axis urban development concept and those for the other corridors in the Klang Valley as simple or multiple linear ladder pattern.

(3) Monitoring System

Transport demands vary accordingly to the social, economic and landuse conditions and changes. Since the future transport demands are predicted on the basis of assumptions made on the future landuse and socio-economic conditions, it follows that the future traffic demands should be carefully monitored in relation to the proposed transportation systems. The Study Team, therefore, proposes : –

(a) to strengthen the monitoring system on the traffic demands and the transportation systems.

(b) that the Klang Valley Planning Secretariat in the Prime Minister's Department should constantly monitor and analyze the transport situations in Klang Valley so as to prepare proper countermeasures and coordination whenever any problem should arise in future.

(c) to review the transport study every five (5) years.

## 8.3 Public Transportation System Plan

### 8.3.1 Mass Transit Railway Introduction Plan

(1) General

Although it was not the case in Malaysia, many other countries have witnessed the growth and development of urban railway as an important determinant in urban growth and structure. The terminus of urban railway system in cities unanimously became the focus of urban activities such as finance, commercial, shopping, administration and even recreation. Technological innovations have further helped to improve the urban railway system in providing faster, more comfortable, less polluting, energy saving form of urban transport.

The important role given to urban railway in many cities in the world is basically on the virtue of its many advantages as a mode of transport in meeting the large demand in volume as well as pattern in urban travel.

The urban railway has many advantages that road based public transport cannot compete.

(1) Urban railway is an efficient and competent line-haul public transport capable of moving large volume of passengers in lesser time, requiring lesser urban space and lesser unit of energy per person transported.

(2) It is a more reliable form of public transport because of its lesser tendency for break-down and with its exclusive R.W.W., it has a better chance in keeping to schedule hence higher punctuality.

(3) It has less adverse environmental impact, as it is powered by non-polluting energy and requiring less of the precious urban space.

(4) As an efficient and cheap form of public transport, it has great potential in playing a catalyst role for the planning of new towns and urban centres.

The time has come for Malaysia in general and Klang Valley in particular to develop the railway system in providing urban transit rail transport as an alternative public transport in helping to mitigate some of the urban transport woes generated by the ever increasing volume of urban travel demand.

(2) The proposed Mass Transit Railway System

The proposed Mass Transit Railway System for Klang Valley is the Mass Rapid Transit Railway (MRT) System which can be seen in many large cities in the world.

The MRT system is recommended for Klang Valley for its : –

- ability to serve as a regional rail transport extending to the planned six growth centres as well as a suburban railway within Kuala Lumpur Conurbation
- capacity to move medium to high volume of passengers
- higher travel speed thus shortening travel time between the major urban centres
- adaptability to utilize existing rail facilities is an advantage in saving initial capital outlays.

The existing KTM rail facilities and reserves are infact passing through or pass by or located at the six (6) growth centres. This fact thus makes it more justified that such facilities should be more fully utilized.

The proposed MRT System will thus feature trains formed by 2 to 6 coaches running on the existing KTM metre gauge rails and powered by DC 1500 volt electricity.

The system characteristics of the proposed system can be summarized as : –

| | |
|---|---|
| Total Track Length | 137 km |
| Train Length | 20.0 m |
| Track Width | 1.000 m |
| Maximum Speed | 85 kph |
| Operational Speed | 40 to 60 kph |
| Live Load | 120 tons/veh |
| Maximum Frequency | 20 trains/h |
| Vehicle Capacity | 250 passengers/veh |
| Train Capacity | 10,000 – 30,000 pass/hr for each direction |
| Maximum Gradient | 1.5% |
| Minimum Horizontal Curve Radius | 600 m |
| Station Spacing | 2 to 4 km |

(a) The Vehicle

The proposed train vehicle shown in Figure 8.1 will be of 20 m in length with three doors on either side featuring long bench seating (for local commuter trains) or box-seating (for express trains). Each vehicle can accomodate up to 250 passengers per vehicle.

| | |
|---|---|
| Capacity | 250 passengers |
| Seated | 54 Passengers |
| Standing (7 pp/sq.m) | 196 Passengers |
| Vehicle Length | 20.0 metres |
| Width | 2.8 metres |
| Height | 4.1 metres |

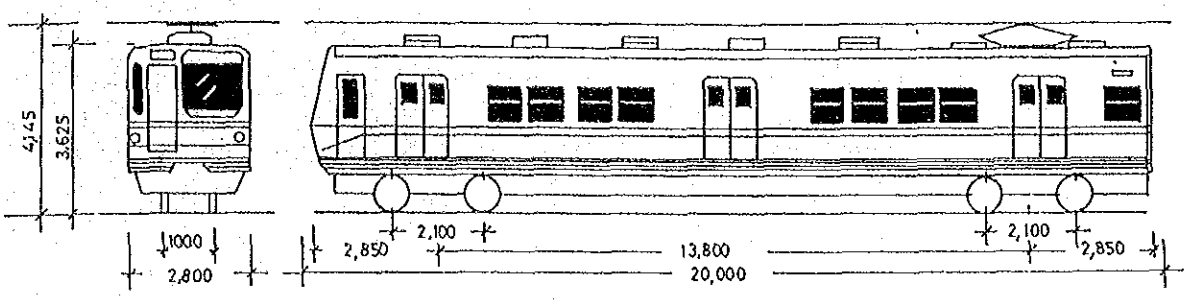



Figure 8.1 : A Typical Train Coach for The Mass Rapid Transit Railway

(b) The MRT Network

The proposed MRT System will run on a network totalling 137 km in length made up by five lines (Figure 8.2).

| | Line Name | From | To | Length (km)* |
|---|---|---|---|---|
| MR-1 | Port Klang Line | Kuala Lumpur | Klang | 49.3 |
| MR-2 | Northern Line | Kuala Lumpur | Rawang | 31.8 |
| MR-3 | Batu Caves Line | Kuala Lumpur | Selayang | 17.3 |
| MR-4 | Southern Line | Kuala Lumpur | Bangi New Town | 31.6 |
| MR-5 | Ampang Line | Kuala Lumpur | Ampang | 11.4 |

(*Note : The total length is only about 137 km due to overlapping of routes)

(i) MR-1 : Port Klang Line

This is the longest line with a track length of approximately 49.0 km (inclusive of 6 km spur from Sungei Way to Subang International Airport) starts from Kuala Lumpur New Central Station to be located at the present car depot at Brickfields, runs along the KTM track towards the west, passing through major population concentration areas such as Petaling Jaya, Subang Jaya, Shah Alam, Klang and terminates at Port Klang Station.

The airport spur will start from Sungei Way Station in Subang Jaya and tuns on KTM freight line currently under construction and terminates at a new station to be built at the airport terminal.

(ii) MR-2 : Northern Line

With a length of about 32 km this line starts at the New Central Station, runs on the existing KTM main line towards the north, passing through one of the four designated Kuala Lumpur sub-centres of Kepong, the new development area of Segambut, Sungei Buloh, Kuang and terminates at Rawang Station.

(iii) MR-3 : Batu Caves Line

The line has a length of 17 km with 4.7 km of which as common line with the Northern line from the New Central Station to Kg. Kasipillay Station and a new line of 3.6 km extending from the Batu Caves Station to Selayang Township.

(iv) MR-4 : Southern Line

The Southern Line of 32 km in length runs from the New Central Station on KTM line towards the south passing through Seputih, Sg. Besi area, Bandar Tun Razak, Serdang, Kajang and on to a new extended track of 3.5 km to Bangi New Township.

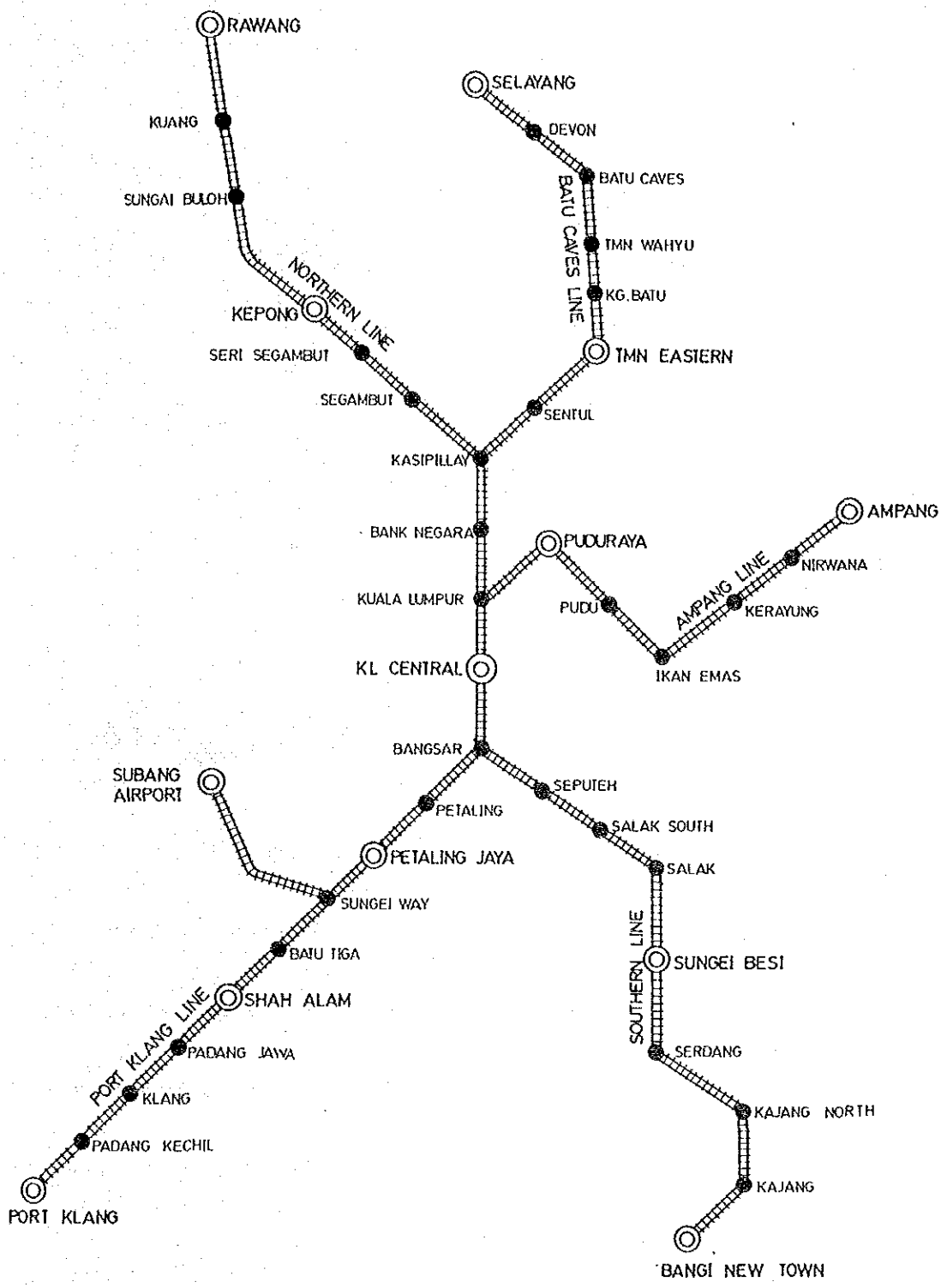
(v) MR-5 : Ampang Line

This will be the shortest line of 11 km including a new connecting line from Kuala Lumpur Station to the existing KTM Puduraya terminus of approximately 2 km as elevated track. This line passes through the developed areas of Pudu, housing areas at Cheras and terminates at Ampang.

(c) Tracking

Double tracking is proposed for the MRT System to enable higher frequency services of up to 20 trains/hr and reduce risks of train collision accidents.

Since most of the existing KTM track is single track except for the part between Kg. Kasipillay to Salak South, a distance of about 10 km which has already been double tracked, the MRT System thus requires laying of a new single track for about 110 km along the KTM track whose rails, ballast and sleeper can be partially utilized upon improvement for the higher speed MRT trains. Rails to be used is of the 50 kg/m type on pre-cast concrete sleepers which rest on 25 cm thick ballast (Figure 8.3).




LEGEND

RAILWAY TRACK LINE

MAIN OR TERMINAL STATION

LOCAL OR JUNCTION STATION

Figure 8.2:
The Proposed MRT System Network

**KLANG VALLEY TRANSPORTATION STUDY**

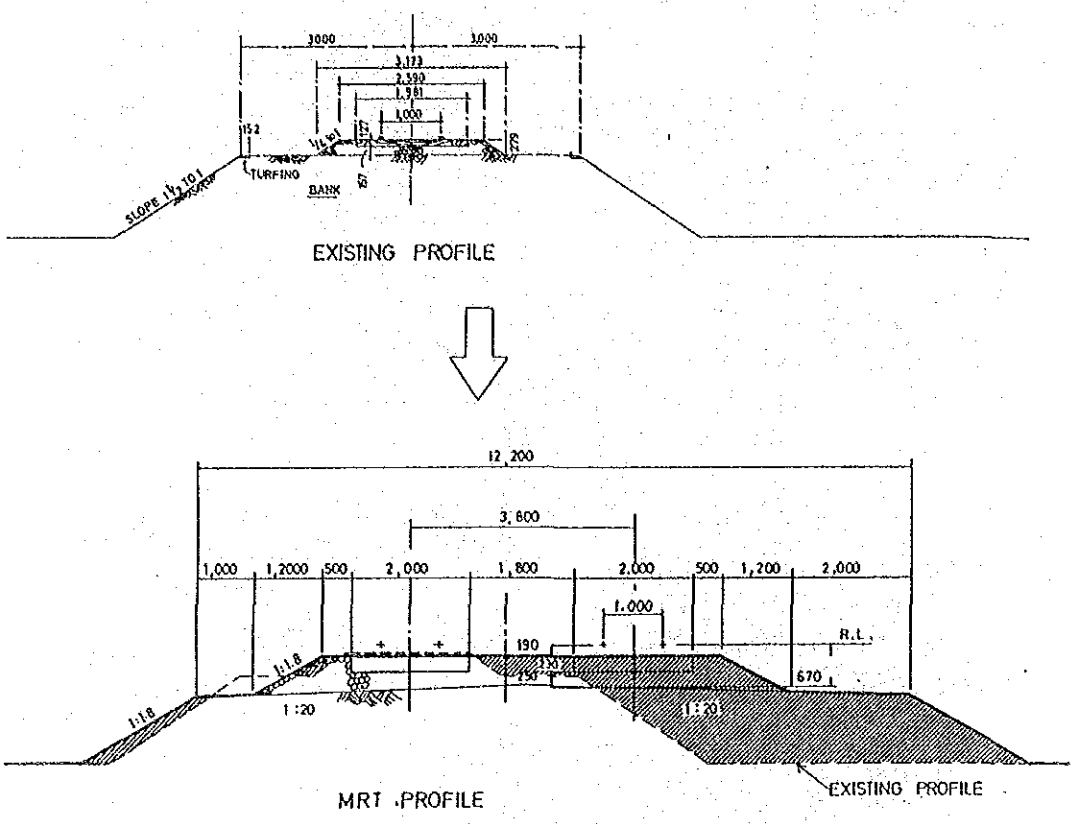



Figure 8.3 : Proposed Bed Profile For Double Tracking For The MRT System

The meter gauge track is proposed instead of the standard gauge for the MRT System because : –

- it is most economical and rational to use the existing raack allowing alternative train operation by KTM trains
- it is not necessary for commuter trains to achieve such high speed as offered by the standard gauge
- If the standard gauge is to be used for the MRT System, the present facilities of meter gauge type such as tracks, bridges must be improved to enable the alternative use by MRT trains (standard gauge) and KTM trains (meter gauge). This is unfavourable from the technical and economic view points. If meter gauge is used for the MRT System, immediate effects can be produced and with much lower initial investment cost.
- the standard gauge to be implemented for the new East-West Line has not been committed by the Malaysian Government. Even if this is adopted in future, the present meter gauge track may be expanded to have a double gauge line.

(d) Electrification

The MRT System will be electrified to achieve higher energy efficiency, higher speed, smoother acceleration and decelaration hence more comfortable and lower maintenance cost.

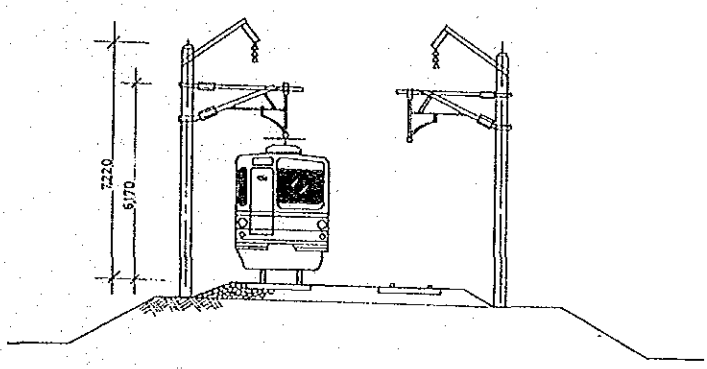



**Figure 8.4 : Proposed Overhead Trolley And Feeder System Of Power Supply For the MRT System**

(e) Signalling and Communication

The automatic block signalling system consisting of signal lights, electric switching machines, track circuits, relay interlocking devices and Centralised Train Control Devices (CTC) is proposed. The intermittent controlled Automatic Train Stop Devices (ATS) is to be provided for added safety. At grade crossings, automatic siren and gates are installed.

Telephone and train radios are to be provided for efficient communication between trains and CTC centre.

(f) Workshop and Depot

The main car depot for the MRT is proposed to be located at Segambut, 9 km from the Central Station to be developed on the existing Brickfields KTM Marshalling yard.

The existing Sentul KTM workshop needs to be improved to handle MRT trains.

(3) Other Related Facility Plan

To compliment the proposed MRT System and making it into an attractive and condusive form of urban public transport, supportive facilities have to be developed along with the system.

(i) Provision of Feeder services to and from the MRT stations

(ii) Construction of functional station plazas to effect smoother mode transfer to and from other modes like buses, taxi, private cars and motorcycles

(iii) Preparation of landuse plans along MRT corridors and around the proposed stations allowing or encouraging the development of multi-storey apartments, offices, commercial complexes, shopping centres in an effort to further expand the train ridership.

The existing public transport modes especially mini and stage buses are to play the role of feeder services to MRT. Existing bus routes parallel to MRT lines need to be rerouted to avoid competition to MRT but instead to gather passengers and 'feed' them to MRT stations.

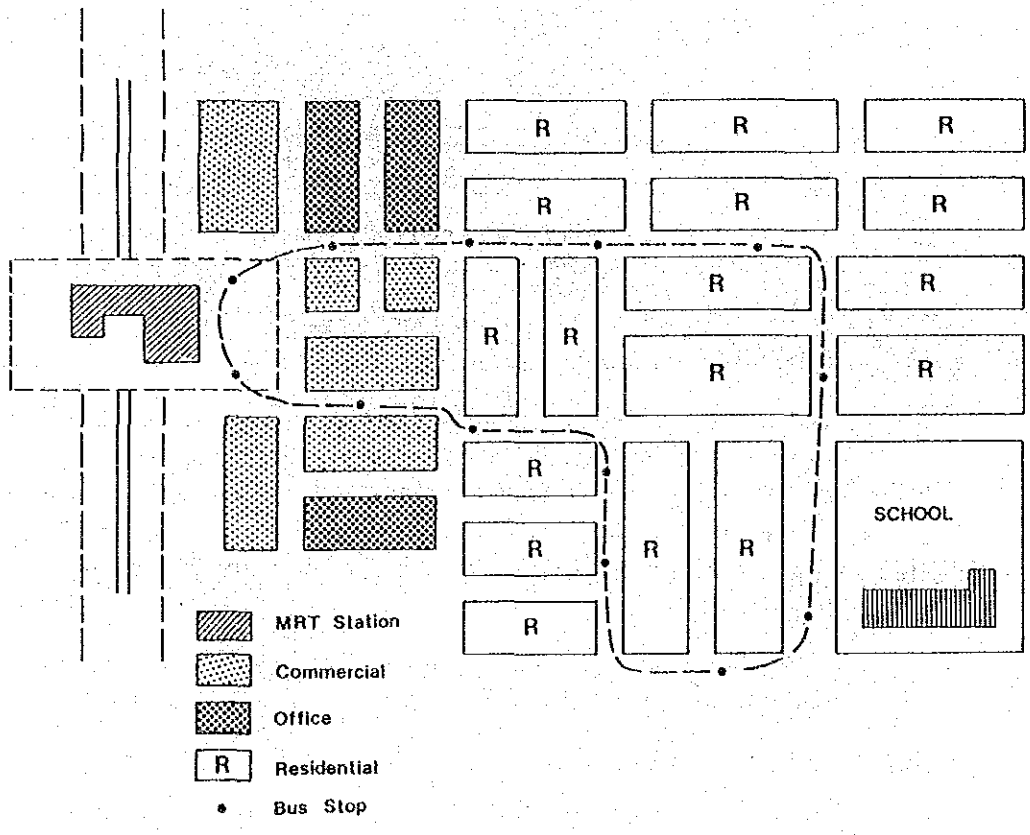



Figure 8.5 : Conceptual Bus Feeder System To MRT

Typical layout plans for the development of station plazas at intermediate stations and terminal stations are shown in Figures 8.6 and 8.7. Annexed to the station building are bus laybys, taxi stands to facilitate mode transfer. Parking for private vehicles, motorcycle/bicycle are provided.

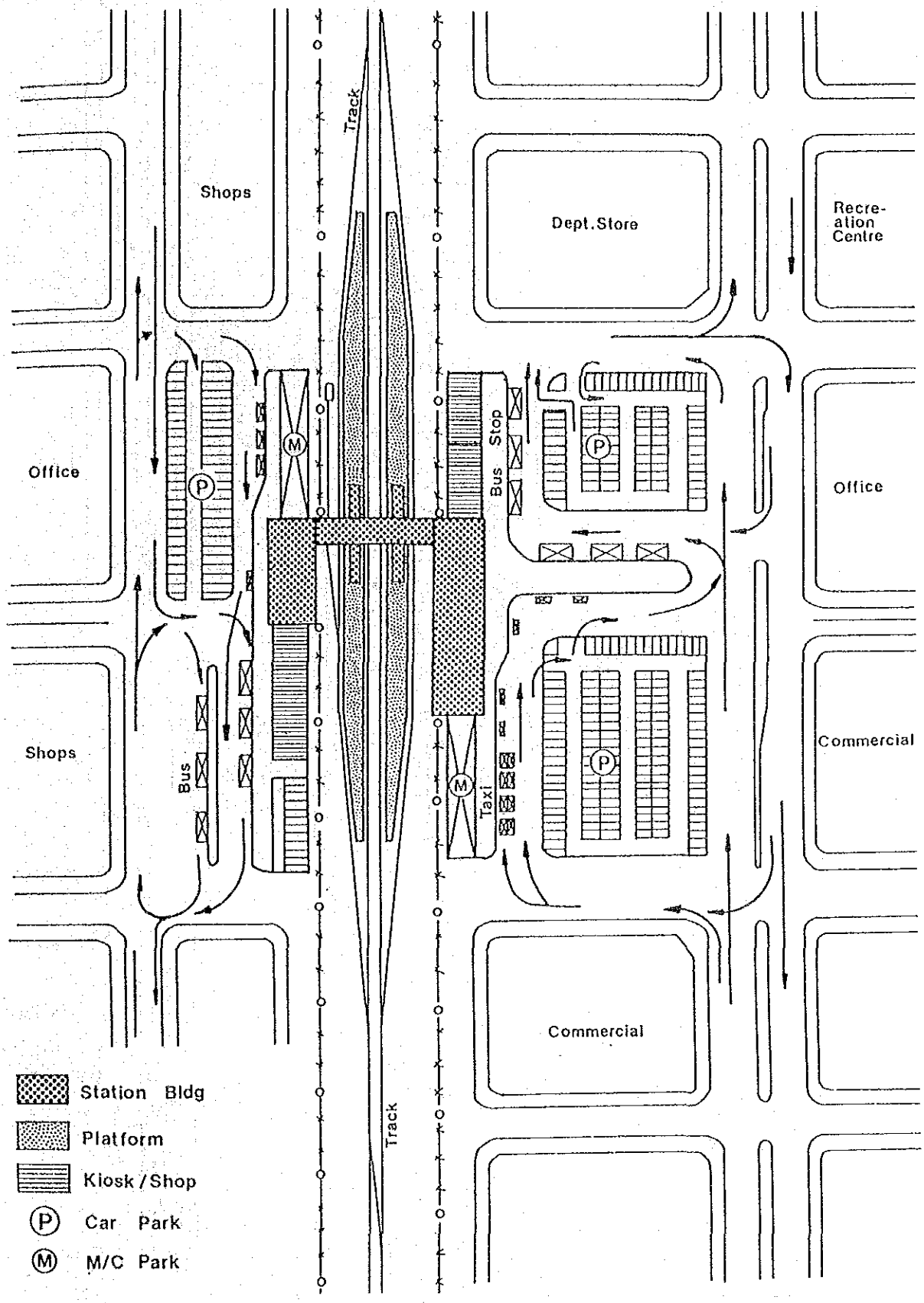



Figure 8.6 : Typical Layout Plan For Station Plaza At Intermediate MRT Station

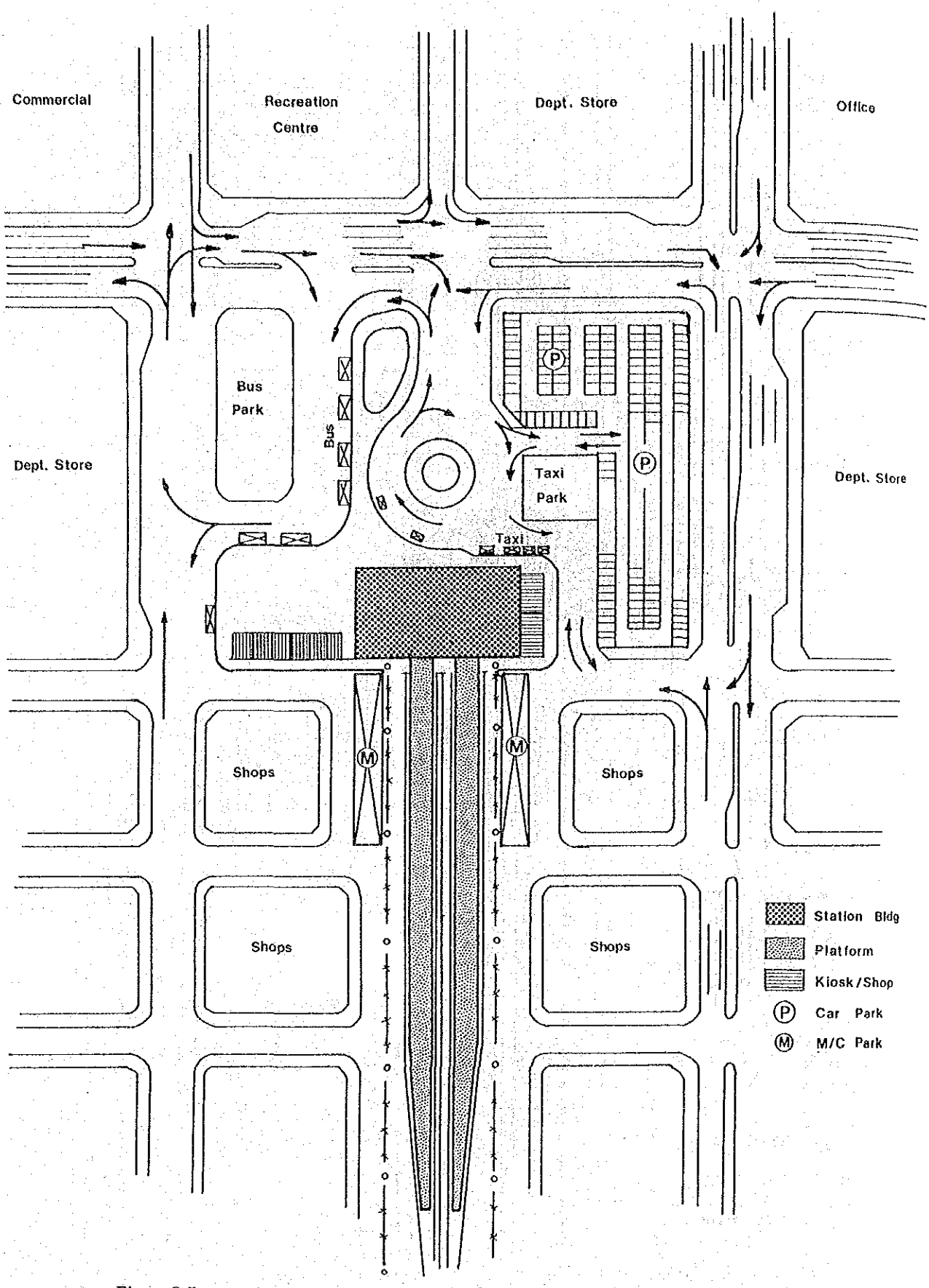



Figure 8.7 : Typical Layout Plan For Station Plaza At Terminal MRT Station

(4) System Cost Estimates

(a) Construction Cost

The total MRT System is estimated to cost M$1384 million at an unit cost of about 10.1 million/km.

Table 8.1 : Cost Breakdown Of Total System Cost

| Component | | Cost in M$ Million | % to Total |
|---|---|---|---|
| (I) | Land Acquisition | 98 | 7.1 |
| (II) | Infrastructure Works | 371 | 26.8 |
| | • Railway Bed | (140) | (10.1) |
| | • Station | (155) | (11.2) |
| | • Track | (76) | (5.5) |
| (III) | Electrification | 155 | 11.2 |
| (IV) | Signal/Telecom | 62 | 4.5 |
| (V) | Vehicle | 570 | 41.2 |
| (VI) | Yard/Workshop | 56 | 4.0 |
| (VII) | Others | 72 | 5.2 |
| Total | | 1384 | 100.0 |

Out of the total, the largest share of 41.2%, or M$570 million is for the MRT vehicles followed by 26.8% for infrastructure works. By line, (Table 8.2), the longest Port Klang line would cost M$360 million followed by M$302 million for the Southern Line to Bangi New Town, M$288 million for the Northern Line. By unit km, Ampang Line is the most costly because of the need to construct the costly elevated link over Jalan Cheng Lock connecting the Central Station to Puduraya.

Table 8.2 : Cost Estimate By Line of the MRT System

| | Line | Length (km) | Cost in M$ Million | Cost in M$ Million/km |
|---|---|---|---|---|
| MR-1 | Port Klang Line | 49.3 | 360 | 7.30 |
| MR-2 | Northern Line | 31.8 | 288 | 9.06 |
| MR-3 | Batu Caves Line | 17.3 | 213 | 12.31 |
| MR-4 | Southern Line | 31.6 | 302 | 9.56 |
| MR-5 | Ampang Line | 11.4 | 221 | 19.39 |
| Total | | 141.4 | 1384 | 10.10 |

(b) Operational/Maintenance Cost

The operational and maintenance cost by line is estimated as in Table 8.3.

**Table 8.3 : Estimated Annual Operational/Maintenance Cost By Line of the MRT System**

| | Line | Annual Operational/ Maintenance Cost in M$ Million | Unit Cost (M$ Million/km) |
|---|---|---|---|
| MR-1 | Port Klang Line | 13.7 | 0.28 |
| MR-2 | Northern Line | 15.4 | 0.48 |
| MR-3 | Batu Caves Line | 7.1 | 0.41 |
| MR-4 | Southern Line | 12.8 | 0.41 |
| MR-5 | Ampang Line | 5.8 | 0.51 |
| Total | | 54.8 | 0.40 |

The annual operational/maintenance cost for the total system is estimated at M$54.8 million per annum.

(5) Phasing Plan

For more effective and rational capital investment, the implementation of the proposed MRT System is divided into three (3) phases. Among the total system, priority line/sections are designated for earlier implementation than others based on the rationals as : --

(i) to enable the system to run with a reasonable size of passenger volume from the beginning stage

(ii) to ensure the project is a profitable one from the beginning stage

(iii) to lower the initial capital investment

(iv) to enable the construction of the first stage of implementation as early as possible

(v) to induce desirable rapid development along important corridors

The proposed network (Plan 2-3) is split into two (2) portions to test for their differential in merits as a rail service. Portion 1 designated as Plan 2-3-1 is the combination of Port Klang Line, Ampang line and Batu Caves Line. Portion 2, designated as Plan 2-3-2 is the remaining Northern Line and Southern Line.

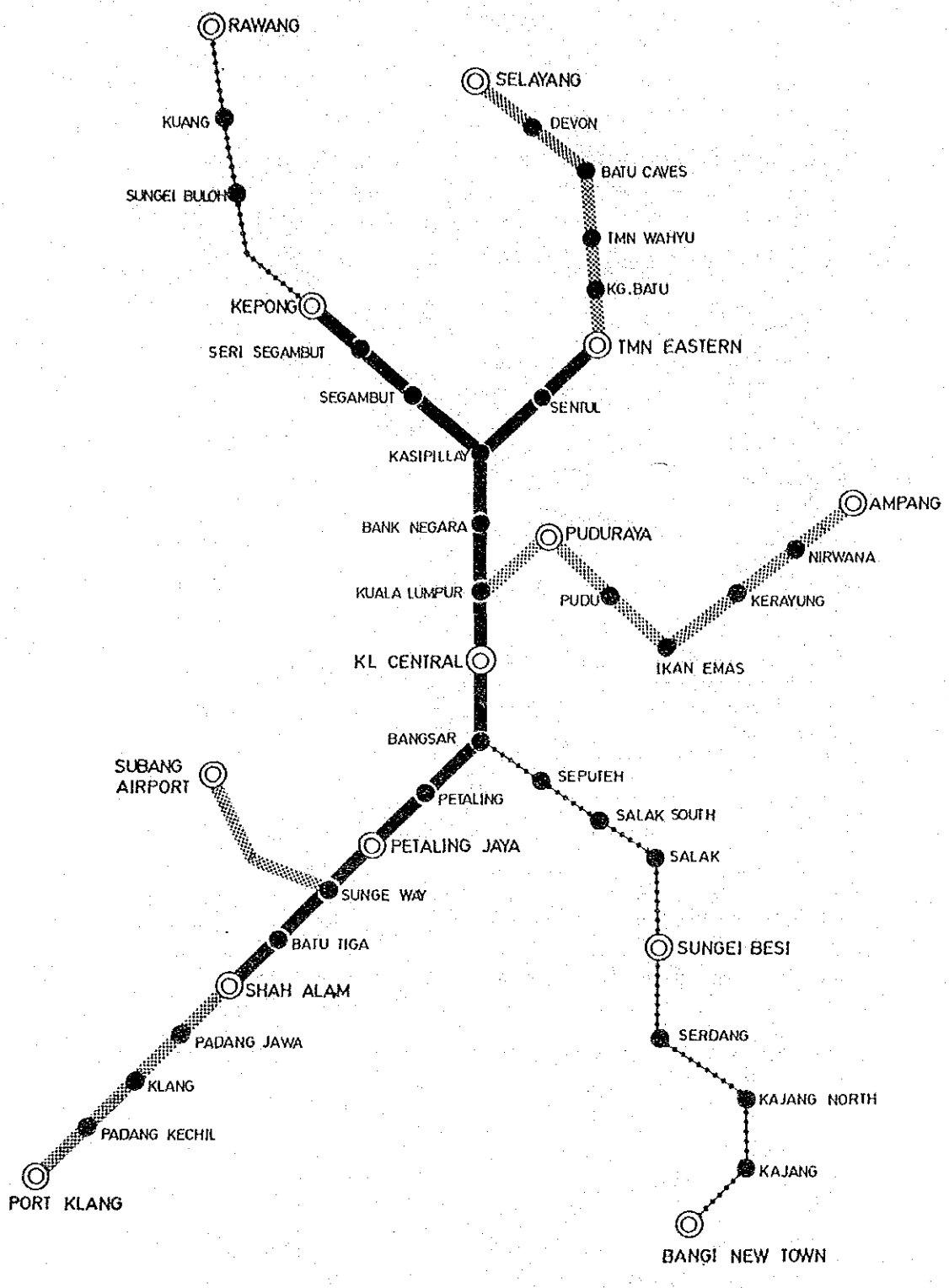
Passenger volume, fare, revenue, construction and operation cost analysis show that Plan 2-3-1 is superior over Plan 2-3-2 with a ratio of Fare/Operation Cost and Annual Pass.km/Project cost of 5.13 and 1.96 perspectively, compared to 4.05 and 1.76 of those of Plan 2-3-2 in 1995.

Table 8.4 : Comparison Of Performances Of Plan 2-3-1 And Plan 2-3-2

| Item | Plan 2-3-1 | | Plan 2-3-2 | |
|---|---|---|---|---|
| | 1995 | 2005 | 1995 | 2005 |
| No. of Passengers ('000/day) | 390.4 | 472.9 | 192.9 | 332.9 |
| Passenger km/day (in '000) | 3873 | 4778 | 2168 | 4121 |
| Fare (M$ '000/day) | 230 | 283 | 118 | 219 |
| Project Cost (M$ Million) | 691 | 727 | 431 | 501 |
| Operation/Maintenance Cost (M$ Million/year) | 15.7 | 19.4 | 10.2 | 17.7 |
| Passenger/km | 5553 | 6727 | 2808 | 4846 |
| Fare/Operation Cost | 5.13 | 5.11 | 4.05 | 4.33 |
| Annual Passenger km/ Project Cost | 1.96 | 2.3 | 1.76 | 2.8 |

Table 8.5 : Phasing Plan For the MRT System

| Phase | Year | Lines/Sections | km | Project Cost (M$ Million) |
|---|---|---|---|---|
| I | 1987 – 1990 | KL-Shah Alam | (24) | |
| | | KL-Tmn Eastern | ( 7) | 310 |
| | | Kg. Kasipillay–kepong | ( 7) | |
| II | 1991 – 1995 | KL-Ampang | (11) | |
| | | Tmn Eastern-Selayang | (10) | |
| | | Sg. Way-Subang Airport | ( 6) | 478 |
| | | Shah Alam-Port Klang | (19) | |
| III | 1996 – 2000 | KL-Bangi New Town | (32) | 596 |
| | | Kepong-Rawang | (21) | |




**LEGEND**

| | | |
|---|---|---|
| ▬▬ | PHASE I 1990 (38KM) | KL – SHAH ALAM (24KM)<br>KL – TMN EASTERN (7KM)<br>KASIPILLAY – KEPONG (7KM) |
| ▨▨ | PHASE II 1995 (46KM) | KL – AMPANG (11KM)<br>TMN EASTERN – SELAYANG (10KM)<br>SG. WAY – SUBANG – AIRPORT (6 KM)<br>S. ALAM – P.KLANG (19KM) |
| ••••••• | PHASE III 2000 (53KM) | KL - BANGI NEW TOWN (32KM)<br>KEPONG – RAWANG (21KM) |

Figure 8.8:
Phasing Plan of MRT Project

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(6) Management Organization for MRT System

The proposed MRT System following the proposed phasing plan would still require considerable capital investment of M$310 million by 1990, M$788 million by 1995 and M$1384 million by 2005. It is infact difficult for any single private enterprise or enterprises to raise such fund.

Moreover, the proposed MRT System is basically aimed at providing a public transport for the people in Klang Valley. The Study therefore proposes that the MRT System be developed under a joint-venture between the Government of Malaysia and private enterprises.

A MRT corporation possible called the Klang Valley Transit Company Limited (KVTC) may be established with the sole function of developing and operating the MRT System.

(a) Construction of MRT System

(b) Operation of the MRT

(c) Land development along the MRT Lines

(d) Development and management of facilities at or around MRT stations

The KVTC shall be organized with active participation from : –

(a) Selangor State Government or Selangor State Development Corporation (PKNS)

(b) Kuala Lumpur City Hall (DBKL)

(c) Malayan Railway (KTM)

(d) Private Enterprises

8.3.2 **Bus Transport Plan**

(1) General Policies

Forecasts of the future transport demands in Klang Valley predicted in this Study indicated that bus transport passengers in future are expected to increase even after the introduction of the Mass Transit System.

This suggests that the bus transport development plan ought to be considered both on a short term and long term basis. For the short term plan, improvement to the bus transport system is required quite substantially because the introduction of the Mass Transit System might be delayed due to financial constraints of the Government.

In this connection, the following bus transport policies can be adopted : –

(a) In line with the privatization policy, the deregulation policy for the bus transport system be employed so as to revitalize the bus transport industry.

(b) Provision of better bus transport services so as to attract more public transport passengers.

(c) Provision of better bus transport facilities.

(d) Modernization of bus operating/management system.

(2) Bus Transport Development Plan

(a) Deregulation of Government Controls

In recent years privatization and deregulation policies have gained much popularity among governments throughout the world. Experiences in the United States and in Japan have shown that deregulation of the transport industry has brought about formation of new enterprises in the transport industry leading to a revitalization of the industry. Enterpreneurial competition in the transport industry in these countries has led to lower cost of operations yet better public transport services besides creating more employment opportunities in the process.

The existing bus operating policy in Malaysia is to franchise the bus routes to bus companies. The result is a monopoly of one bus company serving a particular area. It is proposed that such control of bus operational area should be deregularised whenever possible. A double or triple bus operators system should be encouraged to provide healthy competition and to revitalize the existing bus transport industry.

(b) Bus Service Improvement

In order to improve bus services, the following measures should be implemented by bus operators : –

(i) Expansion of bus services into newly developed areas

(ii) Improvement of services in existing bus routes

(iii) Improvement in attractiveness and reliability of bus operation

(iv) Shorter bus headway time

(v) Introduction of express or limited express services from new town centres to the Central Planning Area of Kuala Lumpur

(c) Bus Fleet Improvement

(i) The bus fleet improvement programme should consist of a continuous process of buying additional buses to meet the increase in bus passenger demand and the replacement of buses aged 12 years old and above. Based on a survey of the existing age distribution of bus fleets and the forecast of future bus passenger demand, the number of new buses required between 1988 and 2005 is estimated as below : –

| Period | No. of New Buses Required |
|---|---|
| 1980 – 1990 | 360 |
| 1991 – 1995 | 1,200 |
| 1996 – 2000 | 1,400 |
| 2001 – 2005 | 1,425 |
| Total | 4,385 |

(ii) The new buses to be purchased should be equipped with two (2) doors, low floor and preferably air conditioned. In view of the legal loading capacity of minibuses being increased to 35 passengers from the original 16 persons, the engine capacity or horse power of the new minibuses should be upgraded for better operational performance.

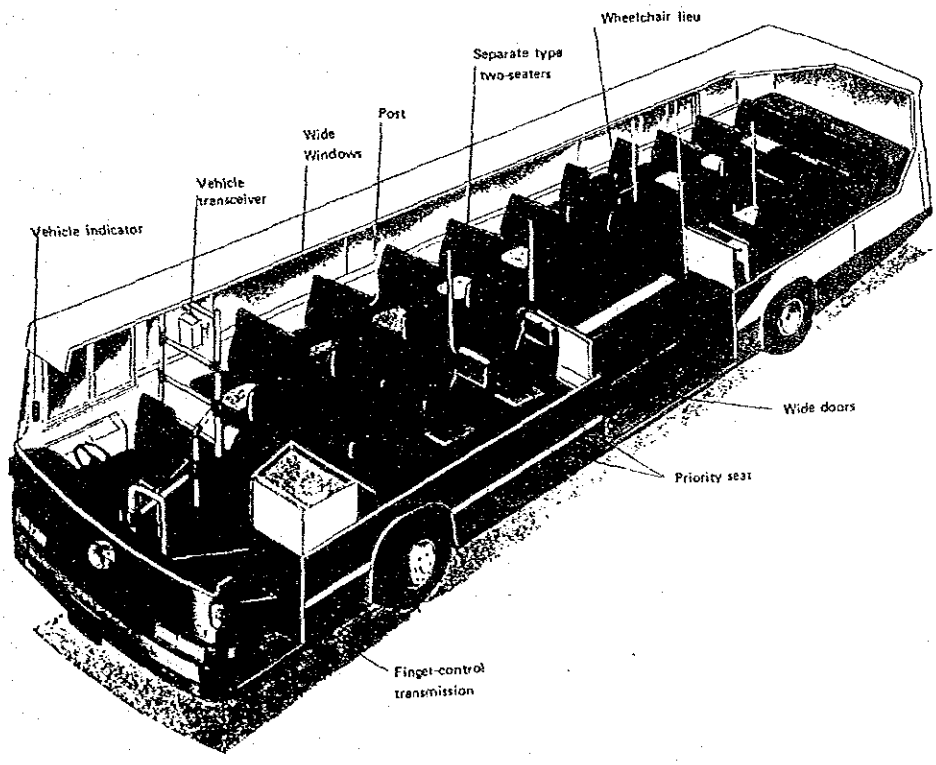



Figure 8.9: Example of a Low-Floor, Wide Door Bus Coach

(iii) As an encouragement for bus operators to replace old buses, the existing policy through tax incentives should be continued.

(iv) Establishment of three (3) common sharing bus depots two of which are to be located in the Kuala Lumpur Conurbation and one in Klang. These depots are to ensure a well maintained bus fleet so as to minimize breakdown and reduce maintenance costs.

(d) Fare and Pricing Policy

The following policies concerning bus fare should be implemented : –

(i) The present fare structure which was reviewed in 1984 is generally acceptable to the bus users. It is proposed that the present fare structure be maintained for as long as possible. With the recent decline in oil and fuel cost, bus companies should be encouraged to channel savings in operational costs to expediate replacement of old age fleet and to improve the overall bus fleet conditions to provide better services without any change to bus fare.

(ii) To encourage private vehicle users to use bus transport, premium bus services using air conditioned, comfortable seating only coaches could be implemented. A premium bus fare structure should then be imposed for such buses only.

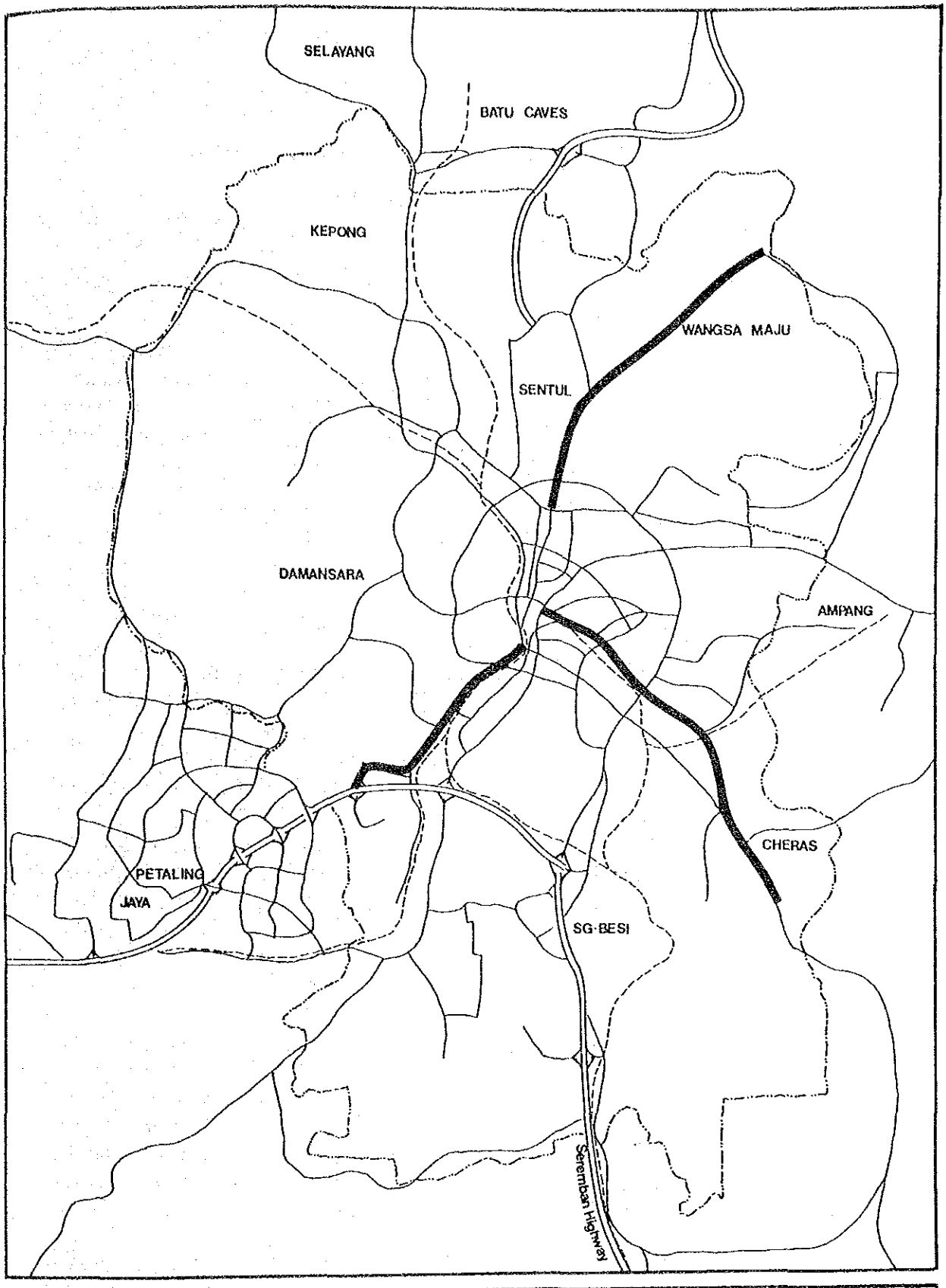
(iii) The physically handicapped and elderly persons should be provided with discounted or free fare as a social equity policy.

(iv) In the long term when MRT system has been introduced, a common ticketing system shall be encouraged to ease inter-modal transfer and to encourage a greater usage of public transportation.

(e) Bus Transport Facility Improvement

The following improvements in bus transport facilities should be implemented : –

(i) Bus priority lanes should be set up on major arterial roads which have high bus volume (more than 100 buses per hour during peak hours) in order to ensure that the buses can maintain their operational speed. In principle bus priority lanes are reserved lanes for buses, i.e. other motor vehicles on the lane should give way to buses at all time. During the morning and evening peak hours these reserved lanes should be made bus exclusive lanes (bus only lanes). The following roads with high bus volume have been identified for possible implementation when they have been improved or widened (see Figure 8.10).




**LEGEND**

- Proposed Bus Priority Lanes
- Existing Highway
- Existing Roads
- Railway

Figure 8.10:
Proposals for Bus Priority Lanes

SCALE
0 1 2 3 4 5Km

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(1) Jalan Pantai – Jalan Bangsar – Jalan Travers

(2) Jalan Pudu – 7th km Jalan Cheras

(3) Jalan Pahang/Jalan Genting Klang

(ii) Establishment of intra-state bus terminals at all major growth centres in the Klang Valley

Bus terminals to facilitate bus passengers demand in Bandar Tun Razak, Wangsa Maju, Bukit Jalil and Bukit Tinggi shall be required as these areas are not serviced by the MRT system. For the growth centres service by the MRT system such as Petaling Jaya, Shah Alam, Klang, Bandar Baru Bangi and others, facilities for the buses to drop and pick-up passengers should be incorporated in the station design.

(iii) Continuous Improvement of Bus Stands/Shelter

In the past few years, bus stands/shelters in the Federal Territory and Petaling Jaya have been improved tremendously. In order to provide public transport users protection against the elements as well as beautification of street vista, a continuous improvement programme for bus stands/shelters should be maintained not only in Kuala Lumpur and Petaling Jaya but also be extended to the other urban centres in the Klang Valley. Priority can be given to the improvement of bus stands/shelters at the major commercial area and high-density residential area. The cost of this programme could either be fully borne by the private sector or be shared equally between the private and public sectors.

(iv) Improvement of Bus Information System

In order to encourage greater bus transport usage, the public should be made aware of the bus route network as well as the bus service timetable at all bus stops/shelters. Up-to-date information on routes, destinations and headway time should be provided as information boards at the bus stop/shelters. The implementation of this programme should go hand in hand with the implementation of bus stops/shelters improvement plan.

(v) Continuous Improvement of Pedestrian Facilities

Since walking is often unavoidable by the bus users, properly planned and well designed pedestrian facilities linking bus stops/shelters to the major commercial and business centres in the city area will contribute to a safer and more conducive walking environment for bus users through a separation of road space for vehicles and pedestrians.

(vi) Introduction of Feeder Services to MRT System

When the Mass Transit System is introduced to the Klang Valley in future, it is necessary to utilize the Mass Transit System effectively. In this connection, competitive bus routes with the MRT system should be rerouted and the feeder bus services to the MRT stations should be provided.

(vii) Modernization of Bus Operating/Management System

Modern management techniques should be practised by bus transport operators to reduce cost of operation on one hand and to increase productivity on the other hand. While general guidelines can be prepared by the government, their implementation rests solely on the initiative of the bus companies. Bus transport operators should be made to realize that their survival in the industry depend upon a revitalization of operations to promote more attractive and reliable bus service. The following are some suggesions for consideration : –

(1) Improve the existing cost control methods to identify any operational deficiency

(2) Improve the existing method of bus service planning and bus/crew schedulling in order to optimise the use of resources

(3) Introduction of One Man Operation Ticketing System (OTS) to save labour cost

(4) Introduction of employee training to instill better driving habits, courtesy and good public relations

(3) Cost of Bus Transport Development Plan

Since the transport development plans is part and parcel of the whole transportation masterplan, in the estimation of its implementation cost, many items would have already been accounted for in the other plans. For example, the cost of bus terminals have been estimated in the Transport Terminals Plan, the cost of local bus centres to be developed at the MRT stations have been included in the cost estimation of MRT stations and the implementation cost for bus priority lanes is considered negligible when cost of road improvement and widening have been considered in the Road Plan. Therefore, in this section only the cost directly related to the bus transport have been estimated and presented in Table 8.6. The proposed plan calls for an expenditure of about M$50.3 million up to the year 1990 or a total requirement of M$478.5 million up to the year 2005.

**Table 8.6 : Estimated Cost Of Bus Improvement Plan For Klang Valley**

(in M$ '000)

| ITEM | | 1980 – 1990 | 1991 – 1995 | 1996 – 2000 | 2001 – 2005 | Total |
|---|---|---|---|---|---|---|
| New Buses | | 36,100 | 119,900 | 140,100 | 142,500 | 438,600 |
| Bus Shelters and Information boards | Within Federal Territory | 1,980 | 3,300 | 3,300 | 3,300 | 11,880 |
| | Within Selangor | 2,178 | 3,630 | 3,630 | 3,630 | 13,068 |
| Bus Depots | | 10,000 | 5,000 | – | – | 15,000 |
| Total Cost | | 50,258 | 131,830 | 147,030 | 149,430 | 478,548 |

## 8.4 Road Plan

### 8.4.1 Road Planning Factors

In formulating the road plan, five (5) major factors are considered.

(a) Regional Development Strategy

(b) Road Hierarchy

(c) External Effects

(d) Traffic Demands

(e) Effectiveness

These planning factors are further elaborated below : –

(1) Regional Development Strategy

To achieve the planned regional development targets in the Klang Valley is one of the major concerns of transportation planning especially road planning. The recommended regional development strategy is to disperse urban functions to newly established growth centres with a regional structure of six (6) growth centres with Bukit Tinggi.

The road plan to be proposed should therefore be directed to achieve the proposed regional development goals and objectives.

(2) Road Hierarchy

Roads can be classified into four (4) categories according to their designated functions.

(a) Expressways

Expressways are designed to carry long distance vehicular movements between principal urban centres. Expressways normally have divided carriageways with no direct frontage access. Intersections of expressways with other primary and district distributors are principally provided in the form of grade-separated intersections or interchanges.

(b) Primary Distributors

Primary distributors are designed to serve vehicular movements between principal urban areas such as between commercial and employment centres and sub-urban residential areas. Primary distributors may also serve traffic within a large urban area such as between commercial subcentres within a metropolitan. These roads have divided carriageways with no direct frontage access unless it is unavoidable. Most of the intersections are at-grade and signalized or with channelization islands.

(c) District Distributors

These roads are designed to serve vehicular movements within the urban area by forming the link between the primary distributor and the access roads within the surrounding area. These roads are normally single carriageway with some frontage access. Intersections are at-grade and major intersections are signalized.

(d) Local Roads and Streets

The function of these roads is to provide access to residence, business establishments or lands in the adjoining area. Some of these roads may take the form of service roads to shops. These roads are single carriageway with unlimited frontage access. Signal control is provided only when necessary or when they intersect with primary or district distributors.

Based on the definition of road functions, it is necessary to plan for a proper road network.

(3) External Effects

Any transportation system may have external effects including environmental and social effects. In principal, the transportation plan seeks to minimize these external effects.

(4) Traffic Demands

The principal objective of road planning is to accomodate the anticipated future traffic demands. The road network planned for should be able to provide an appropriate capacity for the projected traffic demands.

(5) Effectiveness

The proposed road plan seeks to alleviate the forecasted transport diseconomies such as high traffic congestion degree, long travel time or slow travel speed. The effectiveness of the road plan in reducing congestion has to be maximized in relation to project costs.

### 8.4.2 Road Network Pattern

The evaluation of the Alternative Plan 1-1 and 1-2 in Chapter 7 indicates that Plan 1-2 is superior to Plan 1-1.

Alternative Plan 1-2 advocates the improvement of bus transport and road construction/improvement according to Road Plan Alternative 2 discussed in Chapter 5. The network according to this Alternative 2 will therefore be proposed for the Masterplan.

The proposed road network pattern has the objectives of : –

(a) linking the planned new growth centres to the established ones so as to encourage growth in the former and to disperse activities from the latter.

(b) meeting the forecasted future transport demands hence providing mobility for people and goods.

(c) forming an adequate road network for promoting the proposed landuse plan.

(d) constructing alternative roads to the congested ones so as to disperse traffic away from the traffic bottleneck points.

(e) upgrading and improving the congested roads and intersections hence removing the traffic bottlenecks.

Following these guidelines, the proposed expressway network in the Klang Valley Region is illustrated in Figure 8.11. The road networks comprising of primary distributors and district distributors in Kuala Lumpur Conurbation Area and Other Klang Valley Area are shown in Figures 8.12 and 8.13 respectively.

It is proposed that the road network in Kuala Lumpur be fully developed as a radial and circumferential road network configuration while that in the other areas be developed as a linear ladder pattern.

### 8.4.3 Proposed Road Plan

The proposed plan seeks to make full use of the existing road system, to form an adequate road network between the six (6) growth centres with Bukit Tinggi Twin City to meet the future traffic demands and capable of alleviating the foreseeable traffic problems. Such aims can be established by : –

(1) Construction of new roads

(2) Improvement of existing roads

(3) Construction of grade-separated intersections and improvement of intersections

Continuous efforts for construction and improvement of the road system in the Central planning Area (CPA) of Kuala Lumpur have been made by the Government and most of the planned projects have already been implemented or is currently under implementation. Therefore, the efforts for construction and improvement of the road system in the coming two (2) decades shall be focussed in the outskirt areas of Kuala Lumpur Conurbation in Particular the radial roads and the other parts of the Klang Valley.

A total of six (6) major road construction/improvements have been approved and committed in the Klang Valley shown in Table 8.7. The widening of Federal Highway II (RC-3) and widening of Jalan Cheras (RC-4) are being privatized. Both of these are to be implemented as packages which include the improvement of intersections/roundabouts (see Figure 8.14).

Table 8.8 shows the summary of the committed and proposed road projects in the Klang Valley. The total road construction and improvement projects proposed amount to a sum of M$4329.8 million.

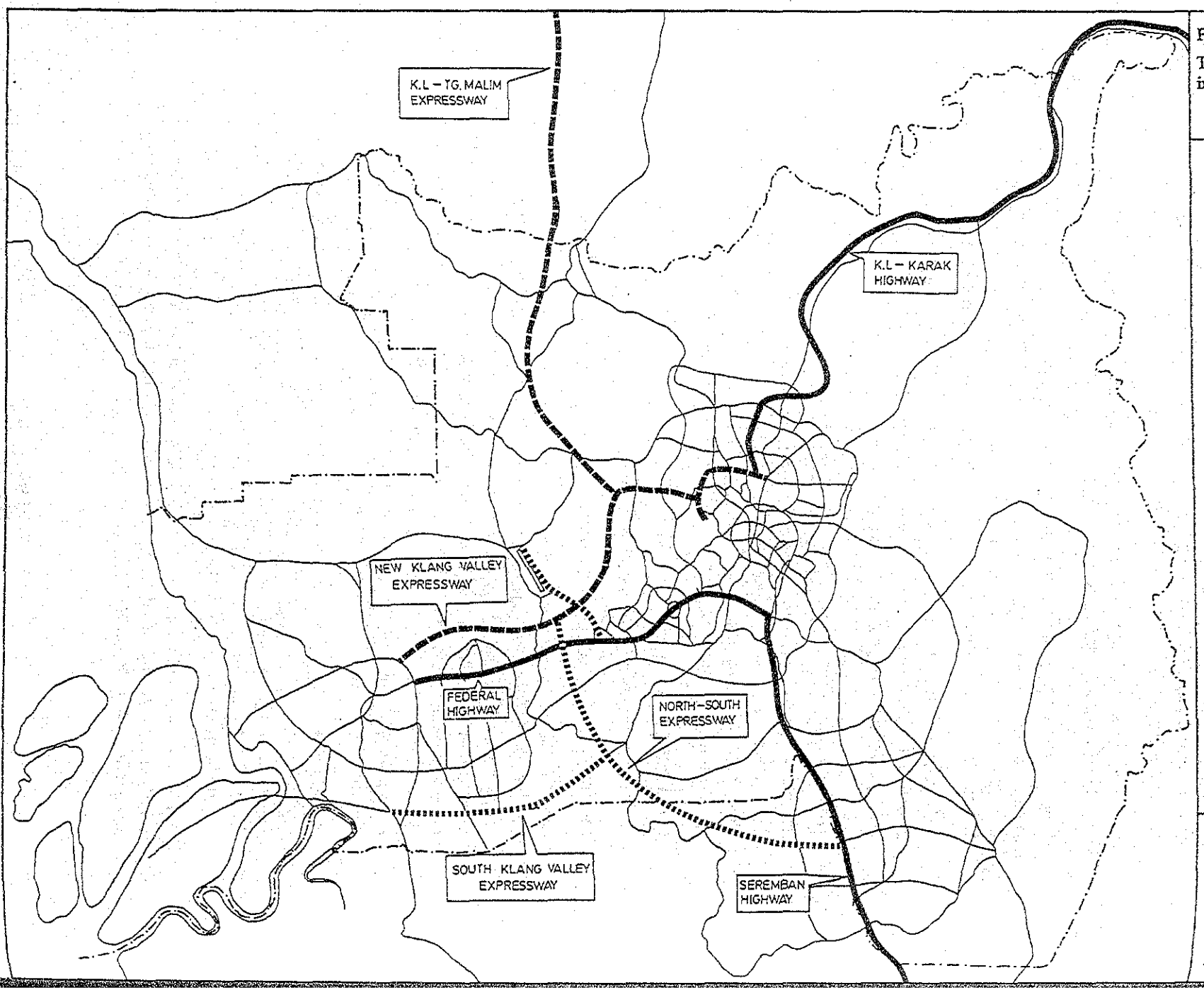


Figure 8.11:
The Proposed Highway Network in the Klang Valley Region

LEGEND

EXISTING HIGHWAY

COMMITTED HIGHWAY

PROPOSED HIGHWAY

SCALE

0 5 10 15 KM

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LEGEND

PRIMARY DISTRIBUTOR

DISTRICT DISTRIBUTOR

EXPRESSWAY

ACCESS ROAD

SCALE

0 1 2 3 4 5 KM

KLANG VALLEY TRANSPORTATION STUDY

Figure 8.12:
The Proposed Primary and District Distributor Network in Kuala Lumpur Conurbation Area

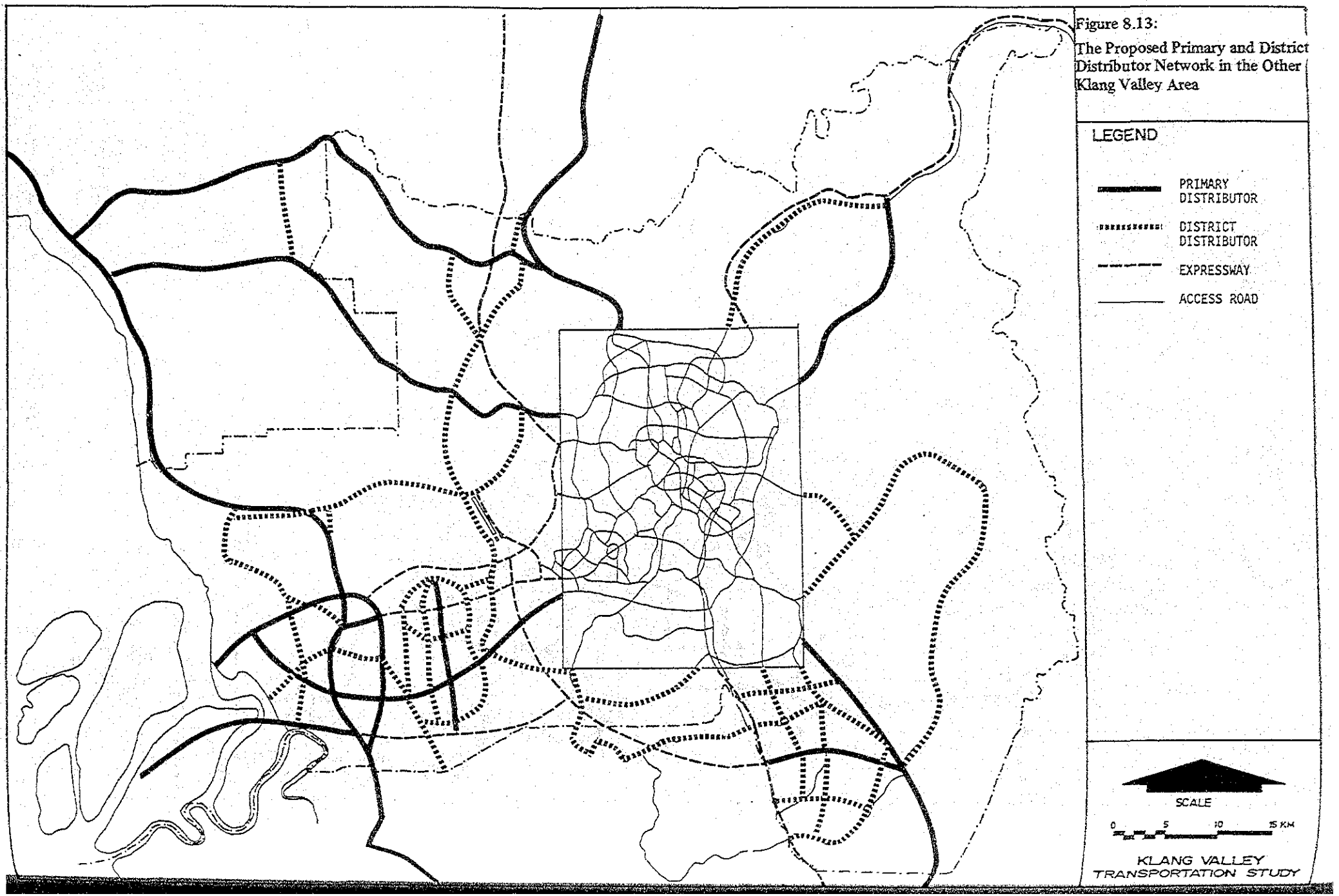



Figure 8.13:
The Proposed Primary and District Distributor Network in the Other Klang Valley Area

Table 8.7 : Summary Of Committed Road Projects In Klang Valley

| Code | Name of Project | Total Length (km) | No. of Lanes | Type of Improvement | Project Cost (M$ million) |
|---|---|---|---|---|---|
| RC-1 | New Klang Valley Expressway | 40.0 | Divided 4-lane & 6-lane | Construction | 508.0 |
| RC-2 | Kuala Lumpur-Tanjung Malim Expressway | 67.0 | Divided 4-lane & 6-lane | Construction | 428.8 |
| RC-3 | Widening of Federal Route II | 14.0 | Divided 6-lane | Widening | 113.0 |
| RC-4 | Jalan Cheras Widening and Others | 4.5 | Divided 6-lane | Widening | 110.0 |
| RC-5 | Kuala Lumpur-Karak Highway Extension | 1.4 | 2-lane | Construction | 7.5 |
| RC-6 | Federal Route 1 | 5.3 | Divided | Construction | 80.0 |
| | TOTAL | 132.2 | | | 1247.3 |

Table 8.8 : Summary Table Of Committed And Proposed Road And Interchange Projects

| | Road Length and/or No. | Project Cost in M$ million |
|---|---|---|
| Committed Road and Interchange Projects | 132.2 km and 9 nos. | 1,247.3 |
| Road Projects | | |
| New Construction : | | |
| 6-lane | 54.6 km | 657.2 |
| 4-lane | 308.7 km | 2,002.6 |
| 2-lane | 44.8 km | 125.8 |
| Sub-total | 408.1 km | 2,785.6 |
| Widening : | | |
| 2-lane to 6-lane | 34.9 km | 106.1 |
| 2-lane to 4-lane | 326.9 km | 595.2 |
| 4-lane to 6-lane | 116.6 km | 297.7 |
| Upgrading | 14.5 km | 9.6 |
| Sub-total | 492.9 km | 1,008.6 |
| Total | 901.0 km | 3,794.2 |
| Interchange Project New Construction | 41 nos. | 517.0 |
| Grand Total | 901.0 km 41 nos. | 4,311.2 |

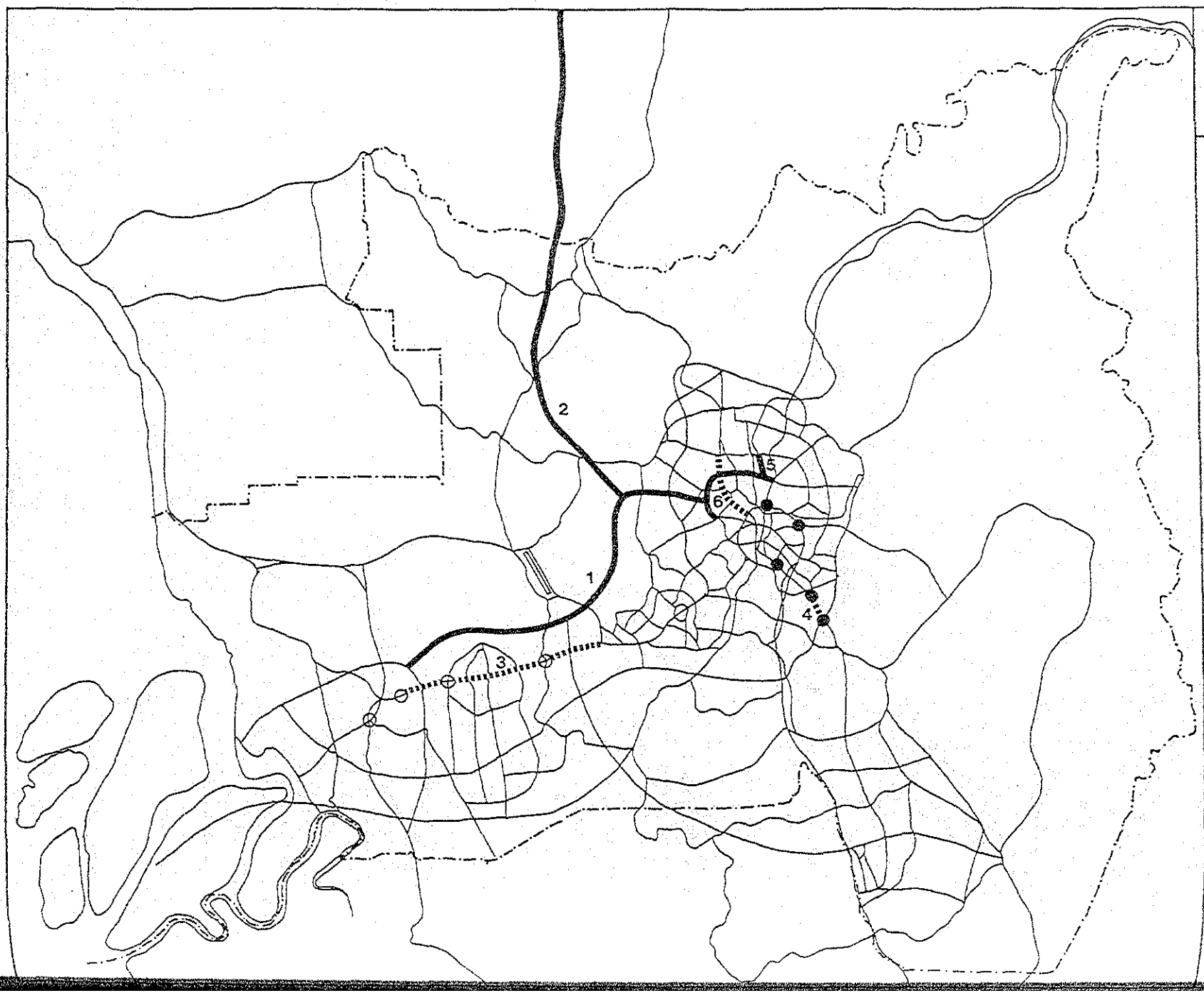



Figure 8.14:
Committed Road Project in Klang Valley

LEGEND

- NEW CONSTRUCTION
- ROAD IMPROVEMENT
- 1 NEW KLANG VALLEY EXPRESSWAY
- 2 K.L-TG.MALIM EXPRESSWAY
- 3 FEDERAL ROUTE II IMPROVEMENT PAKAGE
  - ○ Intersection Improvement at Batu Batu Tiga,Shah Alam West,Berkeley Roundabout And Seven Legged Roundabout
- 4 JALAN CHERAS IMPROVEMENT PAKAGE
  - ● Intersection Improvement At Jln Pahang Roundabout, Edinburgh Roundabout, 5.5th Km Jln Cheras Roundabout, 8th Km Jln Cheras Roundabout, Jln Ampang / Tun Razak Intersection
- 5 K.L-KARAK HIGHWAY EXTENSION
- 6 FEDERAL ROUTE I IMPROVEMENT

SCALE
0 5 10 15 KM

KLANG VALLEY TRANSPORTATION STUDY

Table 8.9 contains the list of proposed road projects by corridors, namely : –

(a) Within Kuala Lumpur Conurbation

(b) Southern Corridor (Kuala Lumpur-Bangi New Town Corridor)

(c) Western Corridor (Kuala Lumpur-Petalling Jaya-Shah Alam-Klang Corridor)

(d) Northern Corridor (Kuala Lumpur-Selayang-Rawang Corridor)

(e) Eastern Corridor (Kuala Lumpur-Bukit Tinggi Corridor)

Figures 8.15 to 8.18 show the necessary road proposals for Klang Valley to be implemented by the year 2005. These are roads which either require improvement works or are new constructions in each of the major corridors in Klang Valley.

The proposed intersection/junction improvement projects are listed up by corridors in Table 8.10.

**Table 8.9 : Summary Table Of Road Development Proposals In Klang Valley**

(a) Proposed Road Projects in Kuala Lumpur Conurbation

| Code No. | Name of Project | Length (km) | Road Classification* | Type of Improvement | Typical Cross Section** | Project Cost (MS'000) | Remarks |
|---|---|---|---|---|---|---|---|
| RK-1 | Damansara Transit | 2.7 | PRI | Construction | P-4 | 57,730 | |
| RK-2 | Jalan Sultan Ismail Extension | 1.0 | PRI | Construction | P-6 | 34,800 | |
| RK-3 | Jalan Munshi Abdullah Extension | 5.5 | DIS | Construction | D-4 | 69,225 | |
| RK-4 | Jalan Raja Abdullah Extension | 0 | DIS | Construction | D-4 | 0 | |
| RK-5 | Middle Ring Road | 2.8 | PRI | Construction/ Widening | P-6 | 62,846 | |
| RK-6 | Widening of Jalan Ipoh | 3.2 | PRI | Widening | P-4 | 3,744 | |
| RK-7 | Upgrading of Jalan Kepong | 7.3 | PRI | Upgrading | P-4 | 10,416 | |
| RK-8 | Northern Part of Middle Ring Road (II) | 22.1 | PRI | Construction/ Widening | P-6 | 132,402 | |
| RK-9 | Federal Route I from Kepong I/C to Selayang | 8.0 | PRI | Widening | P-6/ P-4 | 20,232 | |
| RK-10 | North-South Connection | 4.2 | DIS | Construction | D-4 | 27,090 | |
| RK-11 | East-West Connection | 3.0 | DIS | Construction | D-4 | 17,238 | |
| RK-12 | Batu-Cave-Wangsa Maju Extension | 8.2 | DIS | Construction | D-4 | 50,940 | |
| RK-13 | Jalan Gombak Widening | 7.0 | DIS | Widening | D-4 | 8,190 | |
| RK-14 | Jalan Genting Klang Widening | 4.9 | PRI | Widening | P-6 | 11,466 | |
| RK-15 | Selayang Traffic Dispersal Scheme | 6.7 | DIS | Construction/ Widening | D-4 | 26,415 | |
| RK-15-2 | Selayang Traffic Dispersal Scheme | 10.8 | DIS | Construction | D-4 | 43,800 | |
| RK-16 | Selayang Traffic Dispersal Scheme | 13.9 | DIS | Construction | D-4 | 59,373 | |
| RK-17 | Eastern Route | 7.0 | PRI | Construction | P-4 | 65,790 | |

Note : *EXP – Expressway
PRI – Primary Distributor
DIS – District Distributor

** – For typical cross section of road types, see Figure 8.19.

| Code No. | Name of Project | Length (km) | Road Classi-fication* | Type of Improvement | Typical Cross Section** | Project Cost (M$'000) | Remarks |
|---|---|---|---|---|---|---|---|
| RK-18 | Jalan Gurney Extension | 6.9 | DIS | Construction/ Widening | D-4 | 34,473 | |
| RK-19 | Northern Route | 6.3 | PRI | Construction | P-4 | 62,370 | |
| RK-20 | Jalan Ampang Widening | 9.9 | PRI | Widening | P-4 | 19,188 | |
| RK-21 | Southern Part of Middle Ring Road (II) | 9.1 | PRI | Construction | P-6 | 79,156 | |
| RK-22 | Jalan Kampung Pandan Extension | 7.9 | DIS | Construction | D-4 | 8,649 | |
| RK-23 | Middle Ring Road (II) Extension | 8.5 | PRI | Construction | P-6 | 70,150 | |
| RK-24 | Jalan Cheras Widening | 7.9 | PRI | Widening | P-6/ P-4 | 15,168 | |
| RK-25 | Middle Ring Road (II) Extension | 18.5 | PRI | Construction | P-6 | 187,040 | |
| RK-26 | Jalan Sungei Besi Widening | 17.0 | DIS | Widening | D-4 | 22,896 | |
| RK-27 | Jalan Kuchai Lama Widening | 3.8 | DIS | Widening | D-4 | 7,614 | |
| RK-28 | Jalan Klang Lama Upgrading | 10.5 | PRI | Upgrading | P-4 | 20,160 | |
| RK-29 | Jalan Pantai Dalam Widening | 4.2 | DIS | Construction/ Widening | D-4 | 12,834 | |
| RK-30 | Jalan Maarof Widening | 3.7 | DIS | Widening | D-4 | 7,719 | |
| RK-31 | Jalan Damansara Widening | 14.4 | PRI | Widening | P-6/ P-4 | 31,722 | |
| RK-32 | Western Route | 11.6 | PRI | Construction | P-4 | 133,640 | |
| RK-33 | Jalan Duta-Petaling Jaya Route | 6.1 | DIS | Construction | D-4 | 48,495 | |
| RK-34 | Kepong Transit Route | 6.4 | DIS | Construction | D-4 | 41,280 | |
| RK-35 | Jalan Segambut Widening | 2.1 | DIS | Widening | D-4 | 2,457 | |
| RK-36 | Jalan Duta Widening | 1.5 | PRI | Widening | P-6 | 2,880 | |
| RK-37 | District Road | 8.8 | DIS | Construction/ Widening | D-4 | 43,032 | |
| RK-38 | Bandar Tun Bazak District Road | 7.0 | DIS | Construction/ Upgrading | D-4 | 45,150 | |
| RK-39 | Jalan Cheras Extension | 2.4 | DIS | Construction | D-4 | 29,520 | |
| RK-40 | East-West Link | 6.3 | PRI | Construction | P-4 | 45,738 | |
| RK-41 | Jalan Puchong Widening | 8.6 | PRI | Widening | P-4 | 20,124 | |
| RK-42 | Wangsa Maju District Roads | 4.0 | DIS | Construction | D-4 | 25,800 | |
| RK-43 | Jalan Penchala Extension | 2.5 | DIS | Construction | D-4 | 2,100 | |
| RK-44 | Jalan Dato Abu Bakar Widening | 1.2 | DIS | Construction | D-4 | 1,404 | |
| RK-45 | Airport Road Connection | 1.4 | DIS | Construction | D-4 | 13,860 | |
| RK-46 | Pantai Dalam District Road | 2.0 | DIS | Construction | D-4 | 15,900 | |
| Sub-total | | 318,9 | | | | 1,752,216 | |

Note : *EXP – Expressway
PRI – Primary Distributor
DIS – District Distributor

** – For typical cross section of road types, see Figure 8.19.

(b) Proposed Road Projects in Kuala Lumpur-Bangi New Town Corridor

| Code No. | Name of Project | Length (km) | Road Classification* | Type of Improvement | Typical Cross Section** | Project Cost (M$'000) | Remarks |
|---|---|---|---|---|---|---|---|
| RS-1 | North-South Expressway Link | 11.6 | EXP | Construction | E-4 | 151,960 | |
| RS-2 | Ampang-Hulu Langat Road | 6.6 | DIS | Construction | D-2 | 16,560 | |
| RS-3 | Kajang Bypass | 21.7 | PRI | Construction | P-2 | 47,376 | |
| RS-4 | Bangi Transit Route | 17.8 | DIS | Construction | D-4 | 83,950 | |
| RS-5 | Federal Route 1 Widening | 24.9 | DIS | Widening | D-4 | 58,266 | |
| RS-6 | East-West Link in Bangi | 11.3 | DIS | Construction | D-2 | 2,457 | |
| RS-7 | Bangi-Kajang Road | 7.8 | DIS | Widening | D-4 | 13,104 | |
| RS-8 | Bangi New Town District Road | 68.0 | DIS | Construction/ Widening/ Upgrading | D-4/ D-2 | 114,340 | |
| RS-9 | Kuala Lumpur-Seremban Road | 21.3 | EXP | Widening | E-6 | 60,492 | |
| RS-10 | Jalan Balakong Upgrading | 11.7 | DIS | Widening | D-4/ D-2 | 13,689 | |
| RS-11 | Jalan Sungei Besi Widening | 5.5 | DIS | Widening | D-4/ D-2 | 18,975 | |
| Sub-total | | 208.2 | | | | 581,169 | |

Note : *EXP – Expressway
PRI – Primary Distributor
DIS – District Distributor

** – For typical cross section of road types, see Figure 8.19.

(c) Proposed Road Projects in Kuala Lumpur-Shah Alam-Klang Corridor

| Code No. | Name of Project | Length (km) | Road Classification* | Type of Improvement | Typical Cross Section** | Project Cost (M$'000) | Remarks |
|---|---|---|---|---|---|---|---|
| RW-1 | Shan Alam Highway | 23.0 | PRI | Construction | P-6 | 130,870 | |
| RW-2 | South Klang Valley Expressway | 20.4 | EXP | Construction | E-4 | 185,580 | |
| RW-3 | South Klang Straits Bypass | 9.7 | PRI | Construction | P-4 | 64,030 | |
| RW-4 | Pulau Lumut Access Road | 18.9 | PRI | Construction | P-4 | 58,289 | |
| RW-5 | Jalan Meru Bypass | 12.1 | PRI | Construction | P-4 | 28,556 | |
| RW-6 | Meru-Kg.Subang Road | 8.5 | DIS | Construction | D-2 | 21,250 | |
| RW-7 | North-South Linkage in Klang | 10.1 | DIS | Construction | D-4 | 46,995 | |
| RW-8 | Shah Alam District Road | 65.2 | DIS | Construction/ Widening | D-4 | 288,616 | |
| RW-9 | North Klang Straits Bypass | 16.0 | PRI | Widening | P-4 | 37,440 | |
| RW-10 | Jalan Langat Widening | 8.8 | PRI | Widening | P-4 | 20,592 | |
| RW-11 | Jalan Kapar Widening | 15.6 | DIS | Widening | D-4 | 36,504 | |
| RW-13 | Jalan Meru Widening | 17.4 | PRI | Widening | P-4 | 20,358 | |
| RW-14 | Puchong Batu Tiga Road | 23.4 | DIS | Widening/ Upgrading | D-4/ D-2 | 27,378 | |
| RW-15 | New Klang Valley Exp. Widening | 40.5 | EXP | Widening | E-6 | 116,310 | |
| RW-16 | Air Port Road | 3.7 | PRI | Widening | P-6 | 8,658 | |
| RW-17 | Jalan Kg.Jawa Widening | 11.0 | DIS | Widening | D-4/ D-2 | 11,880 | |
| Sub-total | | 294.3 | | | | 1,103.306 | |

Note : *EXP – Expressway
PRI – Primary Distributor
DIS – District Distributor

** – For typical cross section of road types, see Figure 8.19.

(d) Proposed Road Projects in Kuala Lumpur-Selayang-Rawang Corridor

| Code No. | Name of Project | Length (km) | Road Classi-fication* | Type of Improvement | Typical Cross Section** | Project Cost (M$'000) | Remarks |
|---|---|---|---|---|---|---|---|
| RN-1 | Federal Route 1 from Selayang to Rawang | 15.2 | PRI | Widening | P-4 | 23,788 | |
| RN-2 | Kg.Subang-Rawang Road | 11.8 | DIS | Construction/ Upgrading | D-2 | 27,612 | |
| RN-3 | Subang-Sungei Buloh Road | 1.1 | DIS | Upgrading | D-2 | 1,287 | |
| RN-4 | Rawang/Kuala Selangor Road | 3.3 | DIS | Widening | D-4 | 3,861 | |
| RN-5 | Kuala Lumpur-Tg.Malim Expressway | 17.5 | EXP | Widening | E-6 | 49,700 | |
| RN-6 | Kuala Lumpur-Kuala Selangor Road | 11.3 | PRI | Widening/ Upgrading | P-4/ P-2 | 26,442 | |
| Sub-total | | 60.2 | | | | 132,690 | |

(e) Proposed Road Projects in Kuala Lumpur-Bukit Tinggi Corridor

| Code No. | Name of Project | Length (km) | Road Classi-fication* | Type of Improvement | Tipical Cross Section** | Project Cost (M$'000) | Remarks |
|---|---|---|---|---|---|---|---|
| RE-1 | Kuala Lumpur-Karak Highway | 27.7 | EXP | Widening | E-4 | 94,180 | |
| RE-2 | Bukit Tinggi Transit | 20.1 | PRI | Construction | P-4 | 130.650 | |
| Sub-total | | 47.8 | | | | 224,830 | |

Note : *EXP – Expressway
PRI – Primary Distributor
DIS – District Distributor

** – For typical cross section of road types, see Figure 8.19.

## Table 8.10 : Proposed Intersection Improvement/Construction Projects In Klang Valley

(a) Kuala Lumpur Conurbation

| Code No. | Name of Project | Length (km) | Road Classification | Type of Improvement # | Typical Cross Section | Project Cost (M$ '000) | Remarks |
|---|---|---|---|---|---|---|---|
| I-1 | Jalan Tun Razak/Jalan Gurney | – | – | 2 | – | 12,000 | |
| I-2 | Jalan Kepong/Jalan Damansara | – | – | 3-1 | – | 8,500 | |
| I-3 | Jalan Kepong/Middle Ring Road (II) | – | – | 3-1 | – | 8,500 | |
| I-4 | Jalan Ipoh/Middle Ring Road (II) | – | – | 2 | – | 12,000 | |
| I-5 | Jalan Gombak/Middle Ring Road (II) | – | – | 2 | – | 12,000 | |
| I-6 | Jalan Genting Klang/Middle Ring Road (II) | – | – | 3-2 | – | 9,500 | |
| I-7 | Northern Route/Middle Ring Road (II) | – | – | 3-2 | – | 9,500 | |
| I-8 | Jalan Ampang/Middle Ring Road (II) | – | – | 2 | – | 12,000 | |
| I-9 | Jalan Ipoh/Selayang Road | – | – | 2 | – | 12,000 | |
| I-10 | Jalan Genting Klang/Northern Route | – | – | 2 | – | 12,000 | |
| I-11 | Northern Route/Eastern Route | – | – | 2 | – | 12,000 | |
| I-12 | Middle Ring Road Extension/ Middle Ring Road (II) | – | – | 2 | – | 12,000 | |
| I-13 | Jalan Cheras/Middle Ring Road (II) | – | – | 2 | – | 12,000 | |
| I-14 | Middle Ring Road (II)/East-West Link | – | – | 2 | – | 12,000 | |
| I-15 | Middle Ring Road/Seremban Highway | – | – | 2 | – | 12,000 | |
| I-16 | Jalan Cheras/Railway Crossing | – | – | 5 | – | 8,000 | |
| I-17 | Middle Ring Road (II)/Jalan Puchong | – | – | 2 | – | 12,000 | |
| I-18 | Middle Ring Road (II)/Jalan SS 8/1 | – | – | 3-1 | – | 8,500 | |
| I-19 | Jalan Damansara | – | – | 2 | – | 12,000 | |
| I-20 | Jalan Duta/Jalan Semantan | – | – | 2 | – | 12,000 | |
| I-21 | Jalan Duta/New Klang Valley Expressway | – | – | 3-2 | – | 16,000 | |
| I-22 | Jalan Segambut Railway Crossing | – | – | 5 | – | 8,000 | |
| I-23 | Jalan Templer Railway Crossing | – | – | 5 | – | 8,000 | |
| I-24 | New Klang Valley Expressway/ Jalan Damansara | – | – | 3-2 | – | 24,000 | |
| I-25 | Federal Route 1/Bangi Transit Route | – | – | 3-2 | – | 16,000 | |
| I-26 | Jalan Kinabalu/Jalan Syed Putra | – | – | 4 | – | 20,000 | |
| I-27 | Railway Crossing in Sungei Buloh | – | – | 5 | – | 8,000 | |
| Sub-total | | | | | | 320,500 | |

# Note : For types of intersection improvement/construction, see Figure 8.20.

(b) Kuala Lumpur-Shah Alam-Klang Corridor

| Code No. | Name of Project | Length (km) | Road Classification | Type of Improvement # | Typical Cross Section | Project Cost (MS '000) | Remarks |
|---|---|---|---|---|---|---|---|
| IW-1 | Shah Alam Highway/North-South Expressway | – | – | 2 | – | 24,000 | |
| IW-2 | Shah Alam Highway/Hicom Road | – | – | 2 | – | 12,000 | |
| IW-3 | Shah Alam Highway | – | – | 2 | – | 12,000 | |
| IW-4 | Shah Alam Highway | – | – | 2 | – | 12,000 | |
| IW-5 | Shah Alam Highway | – | – | 2 | – | 12,000 | |
| IW-6 | Shah Alam Highway | – | – | 2 | – | 12,000 | |
| IW-7 | South Klang Valley Expressway | – | – | 3-1 | – | 8,500 | |
| IW-8 | South Klang Valley Expressway | – | – | 1 | – | 24,000 | |
| IW-9 | South Klang Valley Expressway | – | – | 3-2 | – | 16,000 | |
| IW-10 | New Klang Valley Expressway | – | – | 1 | – | 24,000 | |
| IW-11 | Railway Crossing in Klang | – | – | 5 | – | 8,000 | |
| IW-12 | Railway Crossing in Klang | – | – | 5 | – | 8,000 | |
| Sub-total | | | | | | 172,500 | |

(c) Kuala Lumpur-Bangi Corridor

| Code No. | Name of Project | Length (km) | Road Classification | Type of Improvement # | Typical Cross Section | Project Cost (MS '000) | Remarks |
|---|---|---|---|---|---|---|---|
| IS-1 | Bangi Transit Route/ Bangi-Kajang Route | – | – | 3.2 | – | 16,000 | |
| IS-2 | Railway Crossing in Kajang | – | – | 5 | – | 8,000 | |
| Sub-total | | | | | | 24,000 | |

# Note : For types of intersection improvement/construction, see Figure 8.20.


LEGEND

- New Road Construction
- Road Widening / Upgrading
- Grade Separated Railway Crossing
- Interchange / Intersection

Figure 8.15:
Proposed Road Projects in
Kuala Lumpur Conurbation

SCALE

0 1 2 3 4 5Km

KLANG VALLEY
TRANSPORTATION STUDY

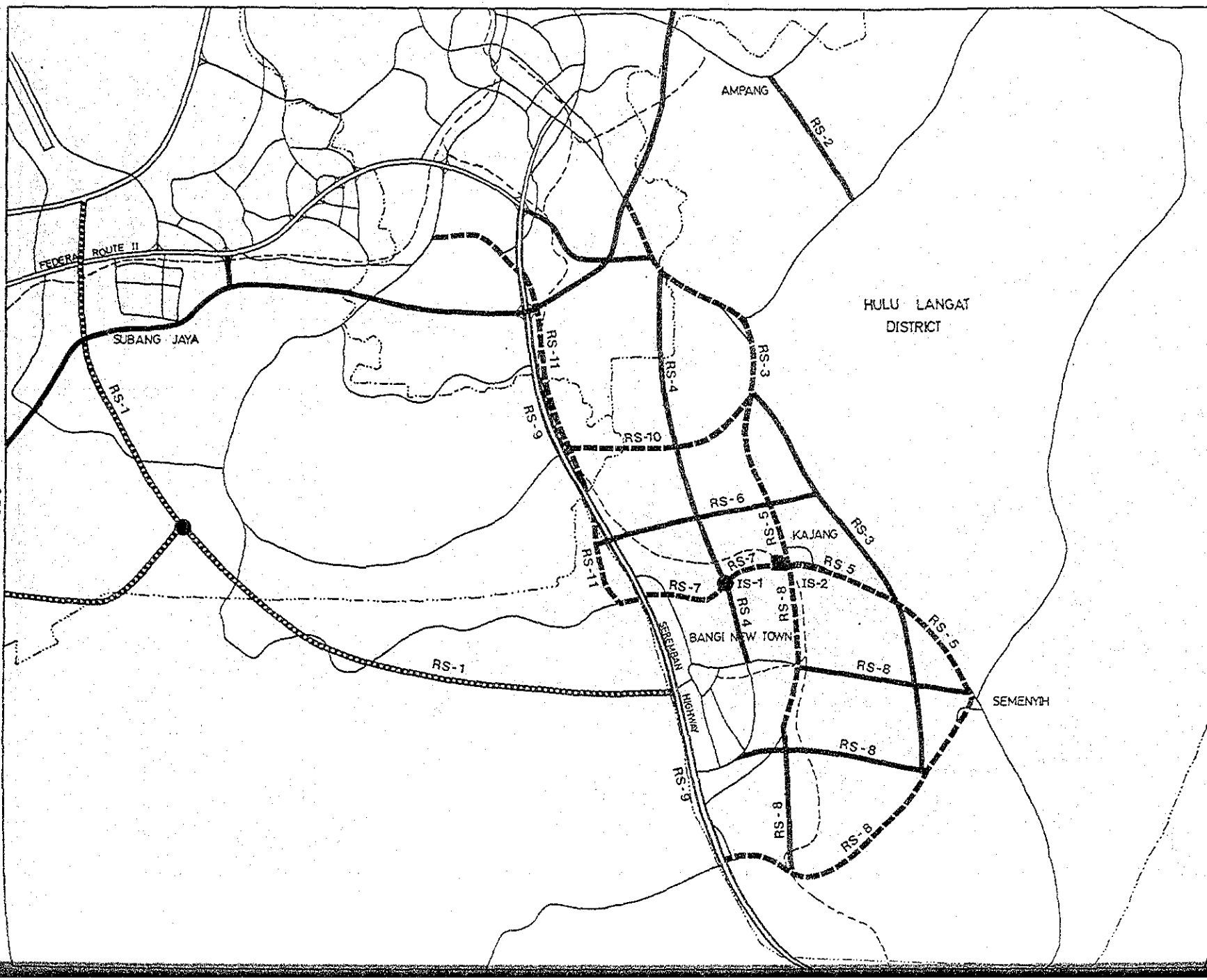



Figure 8.16:
Proposed Road Projects in Kuala Lumpur-Bangi Corridor

LEGEND

- New Road Construction
- Road Widening / Upgrading
- Grade Separated Railway Crossing
- Interchange / Intersection
- Expressway Widening

KLANG VALLEY TRANSPORTATION STUDY

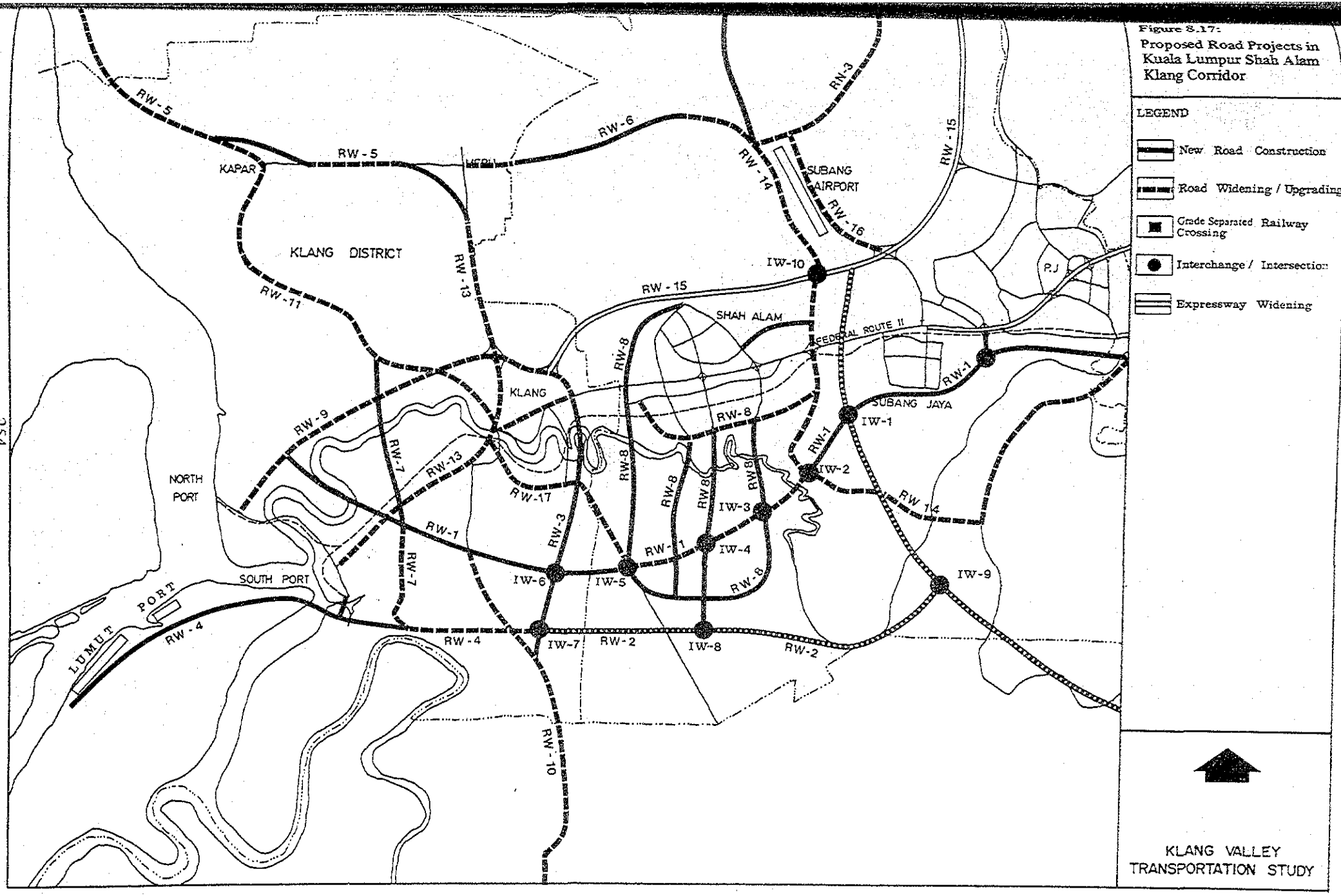



Figure 8.17:
Proposed Road Projects in Kuala Lumpur Shah Alam Klang Corridor

LEGEND

- New Road Construction
- Road Widening / Upgrading
- Grade Separated Railway Crossing
- Interchange / Intersection
- Expressway Widening

KLANG VALLEY TRANSPORTATION STUDY

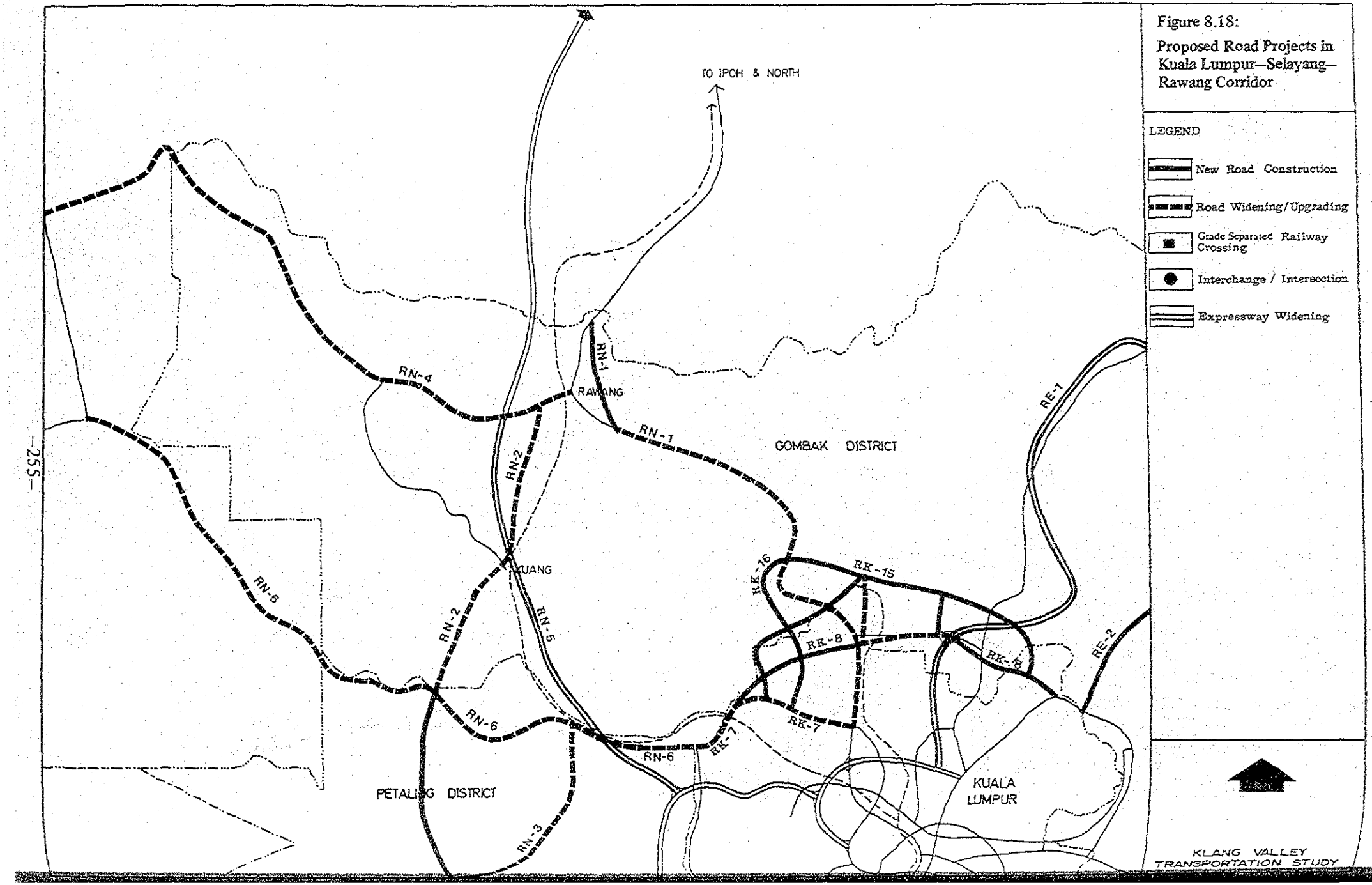
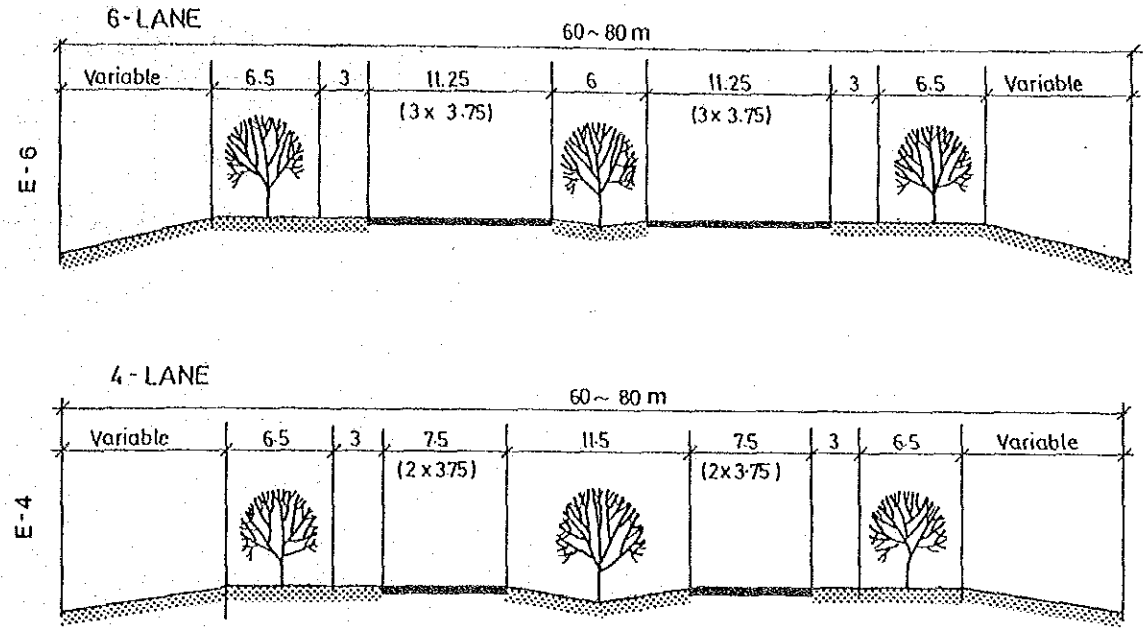
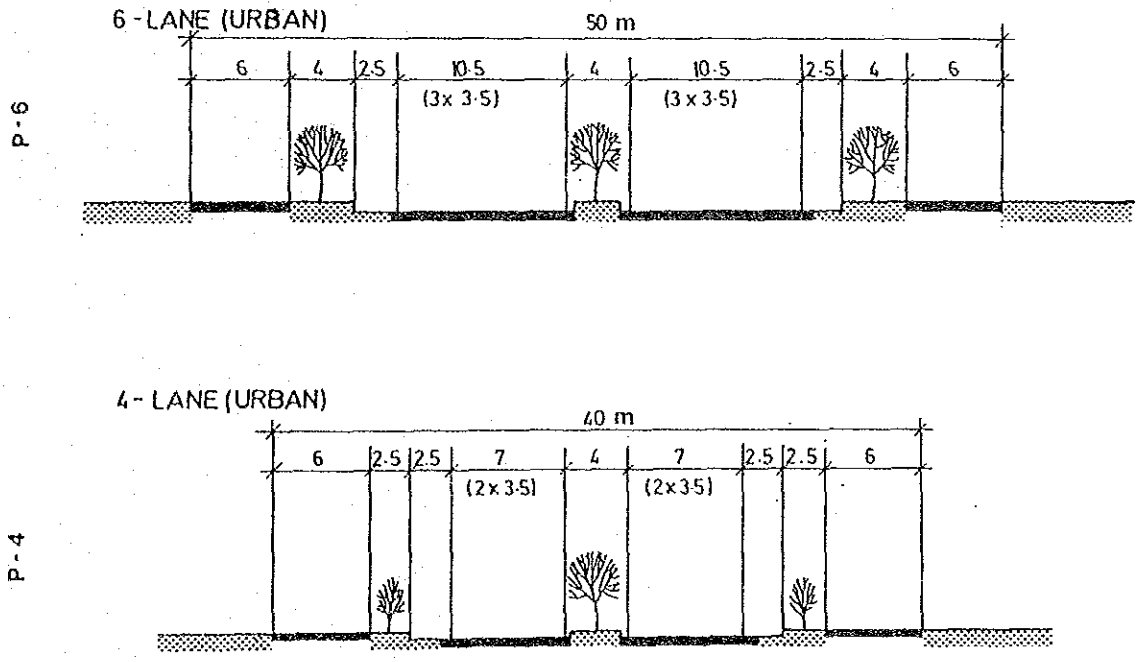



Figure 8.18:
Proposed Road Projects in Kuala Lumpur–Selayang–Rawang Corridor

EXPRESSWAY




PRIMARY DISTRIBUTORS

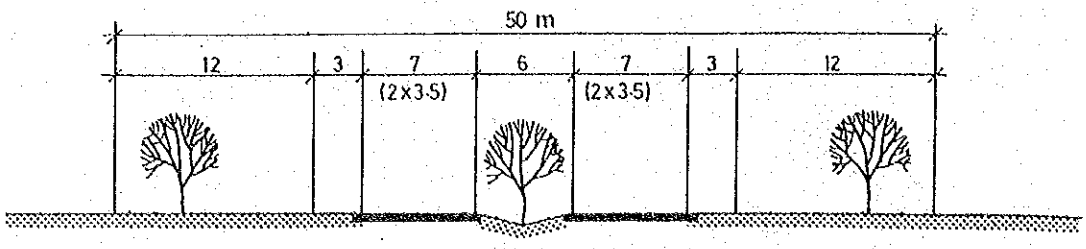



TYPICAL CROSS SECTION (1)

**Figure 8.19 : Typical Cross Section of Proposed Road**

4 - LANE (RURAL)

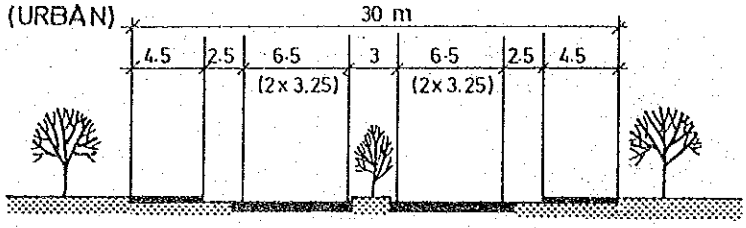
P-4-R




DISTRICT DISTRIBUTOR

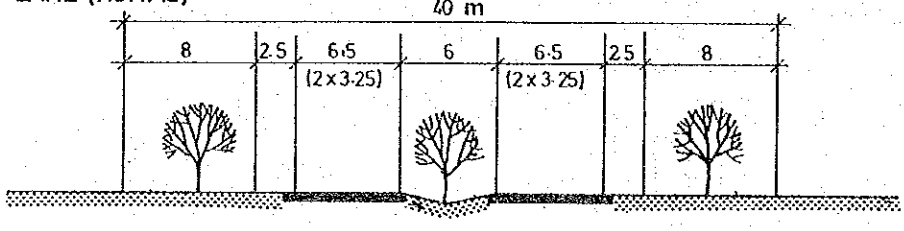
4 - LANE (URBAN)

D-4



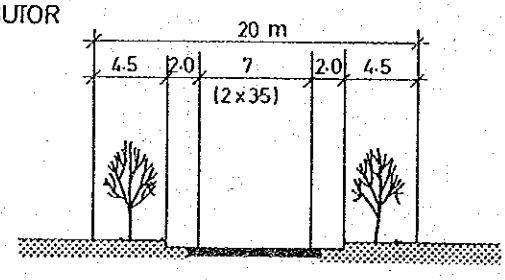

4 - LANE (RURAL)

D-4-R




LOCAL DISTRIBUTOR

D-2




TYPICAL CROSS SECTION (2)

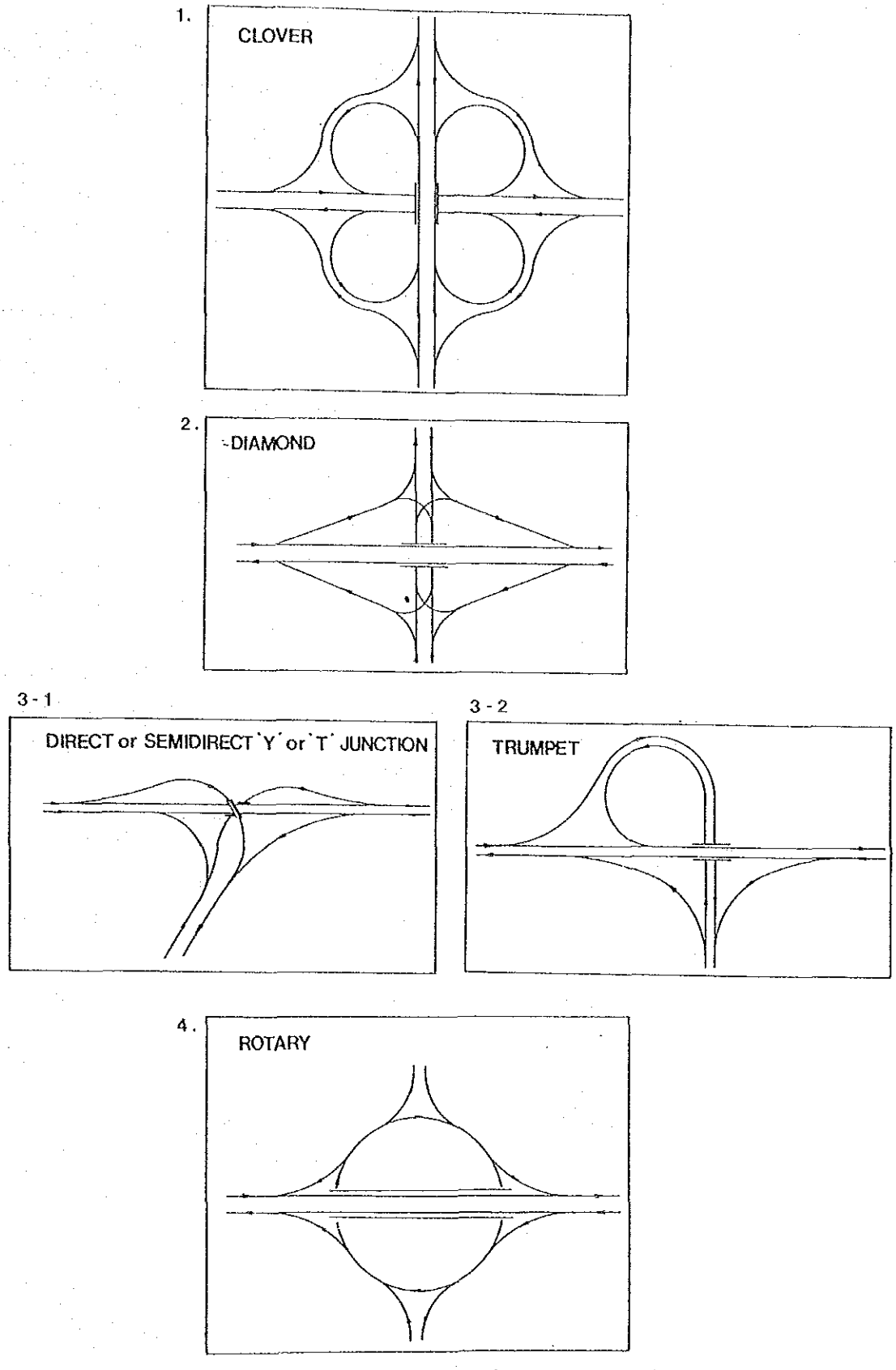



Figure 8.20 : Typical Configuration of Proposed Interchanges

## 8.5 Private Vehicle Restraint Measure in Kuala Lumpur

Several recommendations have been made in the past transportation studies for Kuala Lumpur in limiting traffic in the central area of Kuala Lumpur. Typical recommendations which are still feasible from the technical and social viewpoints are : –

(a) High parking charge levied in the central area together with public transportation improvement.

(b) Cordon pricing on private car users entering the central area together with public transportation improvement.

Continuous efforts such as parking charge levied by parking meters for on-street parking in the central area and construction of bus shelters and rerouting of inner area bus routes for public transportation improvement have been made. However, the cordon pricing scheme, once planned, was suspended indefinitely. This may be because the Inner and Middle Ring Roads, when they were completed, were able to disperse traffic coming from the outskirts around the central area without passing through so that traffic concentration had become to some degree, stabilized.

Since then, urban development which features multi-storeyed buildings has been in progress along and within the Inner Ring Road and has been sprawling outwards resulting in inducing more traffic into the central area.

The employment in the Central Planning Area is expected to increase rapidly in future. This fact manifests that the traffic concentration so induced will not be able to be dispersed in the near future, considering that road improvement and further provision of parking space cannot be expected much.

The Study Team re-examines the possibility of introducing the cordon pricing as a traffic limitation measure in this study. The results of the examination show that the introduction of the cordon pricing is economically feasible.

Therefore, the Study Team proposes the following programmes which could be implemented : –

(a) Motor car users with less than 4 persons in the vehicle would be charged for travelling into the Central Area within the Inner Ring Road during the morning peak hours but buses, emergency and motor cycles would be exempted from the charge. By the introduction of this scheme, traffic congestion on the major roads can be expected to reduce.

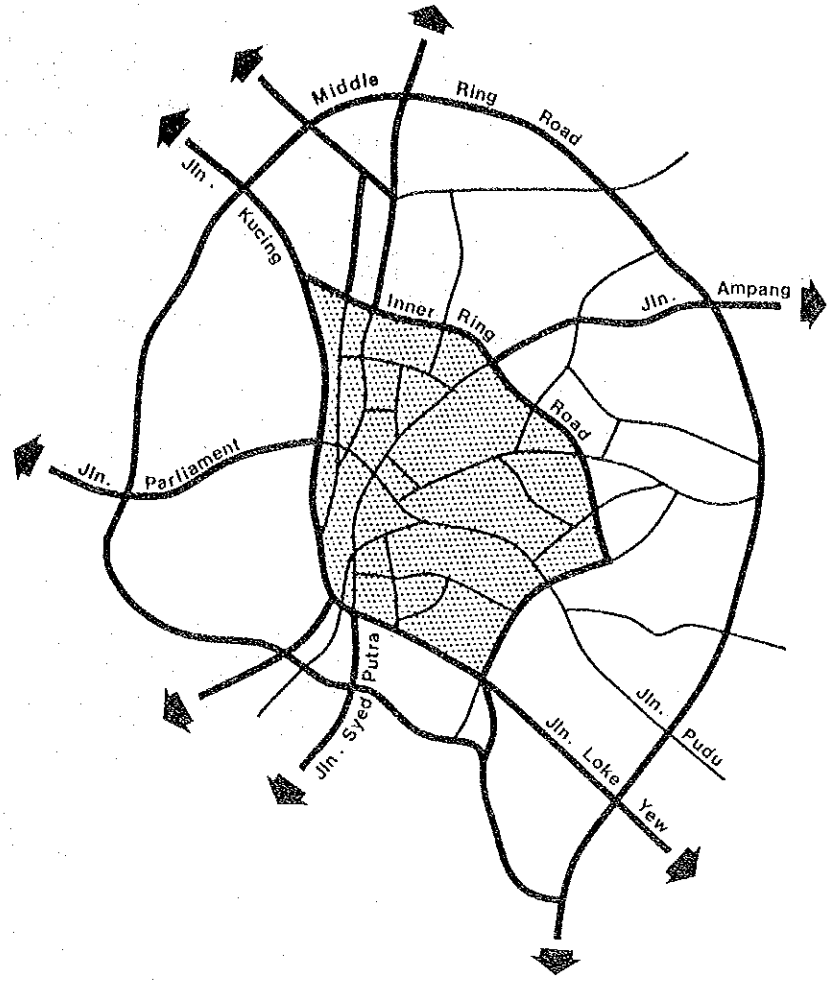



Figure 8.21 : Proposed Traffic Restraint Zone

The coverage area for cordon pricing may be extended to the area within the Middle Ring Road in the later stage when the complimentary measures are implemented and greater benefits can be derived from the extension.

(b) The cordon charge is recommended at two (2) dollars per day or fifty (50) dollars per month levied by means of pre-purchased stickers which would be displayed on the vehicle windscreen.

(c) This would earn the Government a large amount of revenue with less initial costs.

(d) As supportive measures to the cordon pricing scheme, the following measures are to be implemented simultaneously : –

- Traffic surveillance and control system especially in the Central Area of Kuala Lumpur
- Implementation of the MRT System, Phase 1
- Implementation of bus lanes in particular : –
  - Jalan Pahang and Jalan Genting Klang
  - Jalan Cheras

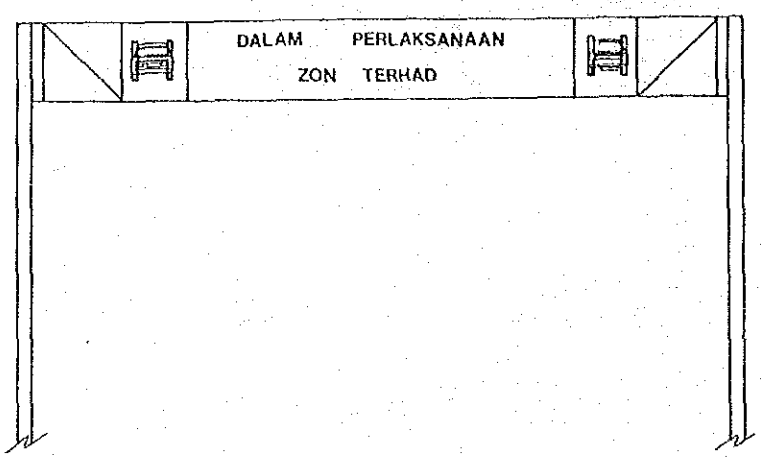



Figure 8.22 : Example Of A Display Gate At Checkpoint To The Traffic Restraint Zone

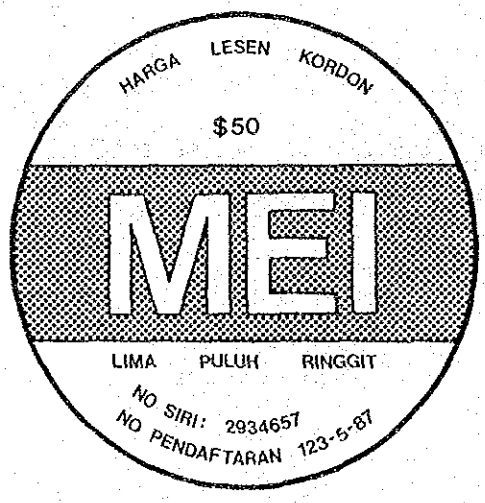



Figure 8.23 : Example Of The Cordon Charge Sticker

If motor car users including taxi users would be charged $2.00 per day or $50.000 per month for travelling into the Central Planning Area (CPA) of Kuala Lumpur for periods from 6.00 a.m. to 10.00 a.m., the reduction of trips entering to CPA is calculated as follows : –

**Table 8.11 : Reduction Of Motorcar Trips Entering The CPA Of Kuala Lumpur, 1995**

| | Daily Trips into CPA | Morning Peak (6 – 10) Ratio (%) | Trips into CPA at Morning Peak | Trip Reduction rate (%) at Morning Peak | Reduced Trips | Reduction Rate to Daily Trips (%) |
|---|---|---|---|---|---|---|
| To Work | 39,227 | 89 | 34,910 | 20 | 6,980 | 18 |
| To School | 1,286 | 74 | 950 | 20 | 190 | 15 |
| Business | 28,119 | 16 | 4,500 | 20 | 900 | 3 |
| Private | 42,604 | 20 | 8,520 | 20 | 1,700 | 4 |
| To Home | 17,860 | 4 | 710 | 20 | 140 | 1 |
| Sub-total | 129,096 | 38 | 49,590 | | 9,920 | 8 |
| Taxi | 29,371 | 20 | 5,870 | 20 | 1,170 | 4 |
| Total | 158,467 | 35 | 55,460 | | 11,090 | 7 |

According to this table, 7% of total trips or 11,000 motorcar trips into the CPA can be reduced using the cordon pricing scheme.

The revenues from the cordon pricing are estimated as follows: –

**Table 8.12 : Estimated Revenues For Cordon Pricing**

| Year | Annual Revenue (M$) |
|---|---|
| 1991 | 24,179,000 |
| 1995 | 26,620,000 |
| 2005 | 33,855,000 |

The revenue collected from this traffic management measure should however be channeled back for the improvement of roads and public transport facilities.

In order to obtain the available data about effects on traffic entering the CPA of Kuala Lumpur when the cordon pricing is introduced, the travel attitude survey for private car owner was conducted in June 1986.

Based on the data obtained from the travel attitude survey and experiences of the cordon pricing in Singapore, effects on traffic are estimated as shown in Figure 8.24.

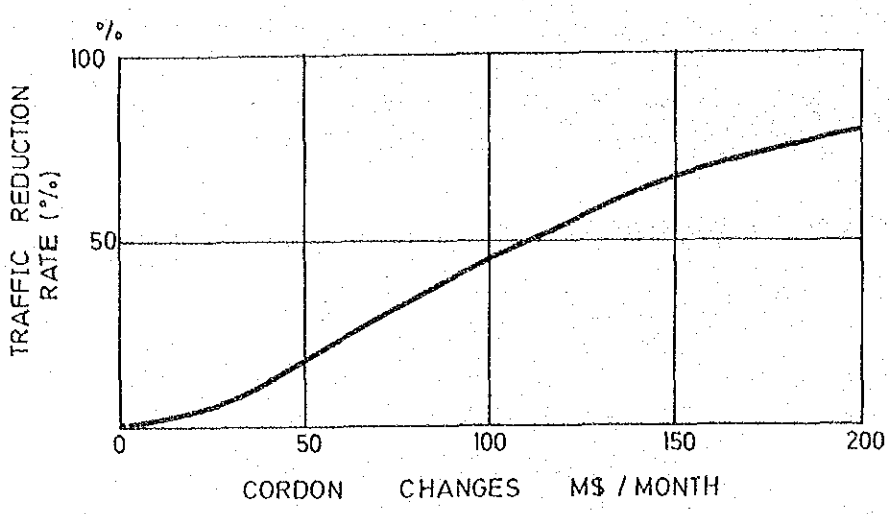



**Figure 8.24 : Reduction Rate By Cordon Charges**

If the cordon charge is increased, there is a corresponding increase in the rate of traffic reduction. The rate of 20% at $50.00 is adopted in this Study.

## 8.6 Other Traffic Management Measures

### 8.6.1 Traffic Surveillance and Control System

As far as conventional traffic engineering devices and techniques applied to Kuala Lumpur are concerned, remarkable progress has been attained. However, another aspect of traffic management that is, prompt reaction for traffic control devices, such as signals, detour implementation, special enforcement and incident responses according to the traffic situations is not properly activated in a coordinate manner though this is keenly needed here.

As such, the Study Team proposes the traffic surveillance and control system. Its objectives are : –

(a) Traffic Surveillance

To detect automatically the up-to-date traffic information such as volume, speed and congestion degree and then to process it collectively in a manner that traffic management officials can continuously monitor the traffic situations for prompt reaction to the first aid counter-measures.

(b) Centre Activities

To establish a centre where traffic management activities such as incident detection, detour implementation, special enforcement, dynamic control of the traffic control devices, etc. are activated through monitoring the traffic situation. This centre will also take the initiative to prepare the traffic improvement programmes.

(c) Traffic Control

To centrally control the traffic, control devices such as changeable message signs, road side radio, traffic signals, etc. should be through the traffic

information collected so that adverse effects caused by incident and congestion will be mitigated to a minimum, resulting in a balanced and more effective traffic flow.

From the view point of jurisdiction and early implementation two systems are proposed to be implemented without delay, one of which covers federal access controlled trunk road network within the Federal Territory and Federal Route II from Kuala Lumpur and Shah Alam and Airport route (Figure 8.25). The other system covers Kuala Lumpur Conurbation (Figure 8.26).

The former is categorized as the advanced type of Freeway Surveillance and Control System which has been implemented in the developed countries. The latter features the innovation of the existing area traffic control system, the surveillance of the traffic on the major arteries and the queue length on the approaches to the critical intersection and the changeable message signs to be installed strategically before the important intersections. Petaling Jaya area traffic control system is proposed to be implemented as its sub-system.

The proposed area coverage for the Traffic Surveillance and Control System is shown in Figure 8.27.

The estimated costs for the traffic surveillance and control system projects are as follows : –

Table 8.13 : Estimated Costs For Traffic Surveillance And Control System

| Items | Project Cost (MS '000) |
|---|---|
| 1) Equipment | 53,856 |
| • Central Equipment | 13,605 |
| • Software | 10,173 |
| • Local Equipment | 30,078 |
| 2) Installation | 15,048 |
| 3) Others | 3,096 |
| Total | 72,000 |

**Locations of Vehicle Detectors**

- Mainline detectors at 800 m spacing.
- On and off ramps
- Queue detectors on the off ramps where congestion recurrs

**Locations of CCTV Cameras**

- Recurrent congestion sites or road sections

**Locations of Changeable Message Signs**

- Upstream of interchanges where recurrent congestion takes place
- Upstream of accident prone sites
- Upstream of key interchange for route selection

**Locations of Detectors**

- Federal Route II between Pantai Baru interchange and University interchange

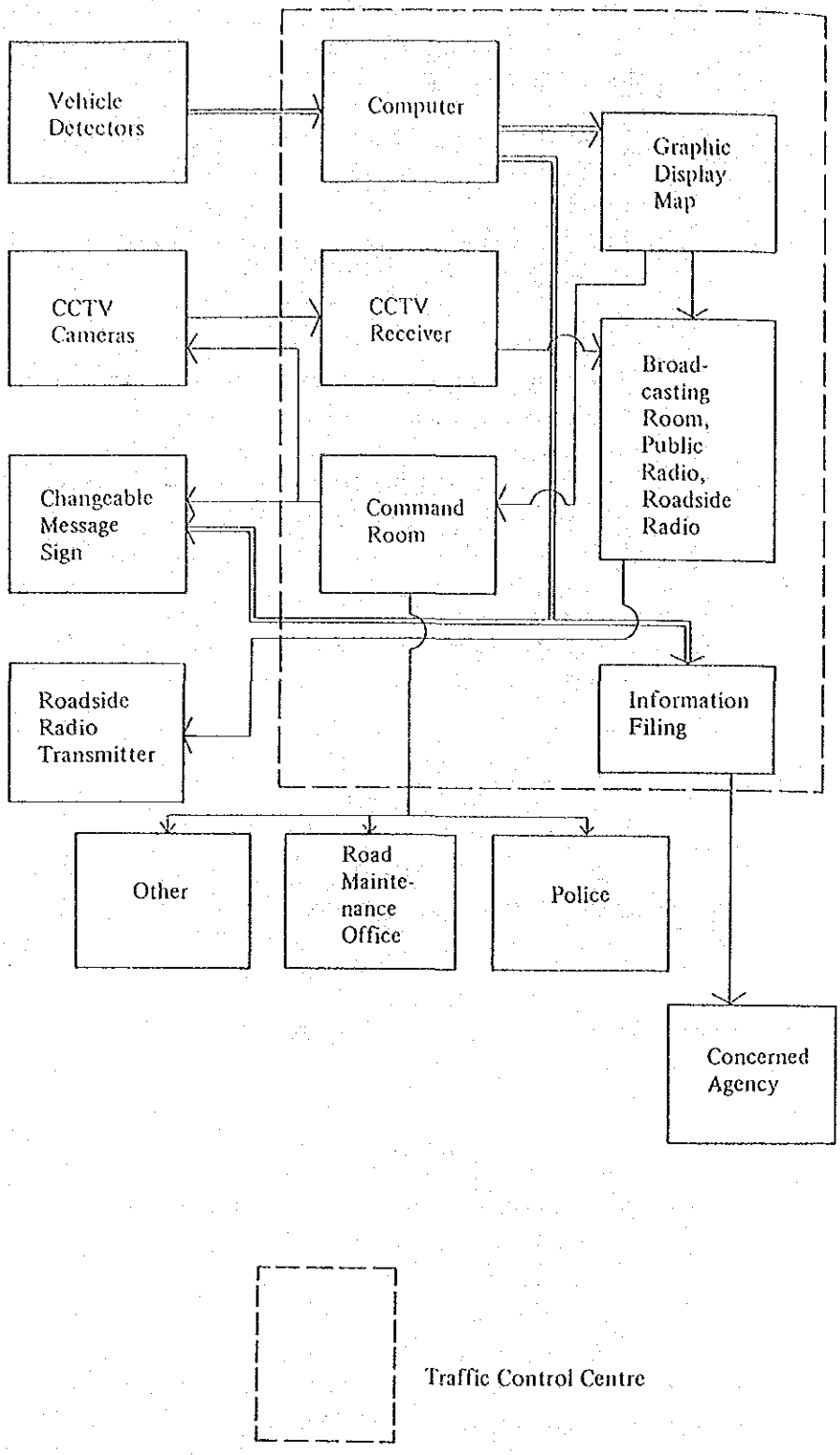



**Figure 8.25 : An Illustration Showing The Flow of Functions And Activities *Of Expressway Traffic Surveillance* And Control System**

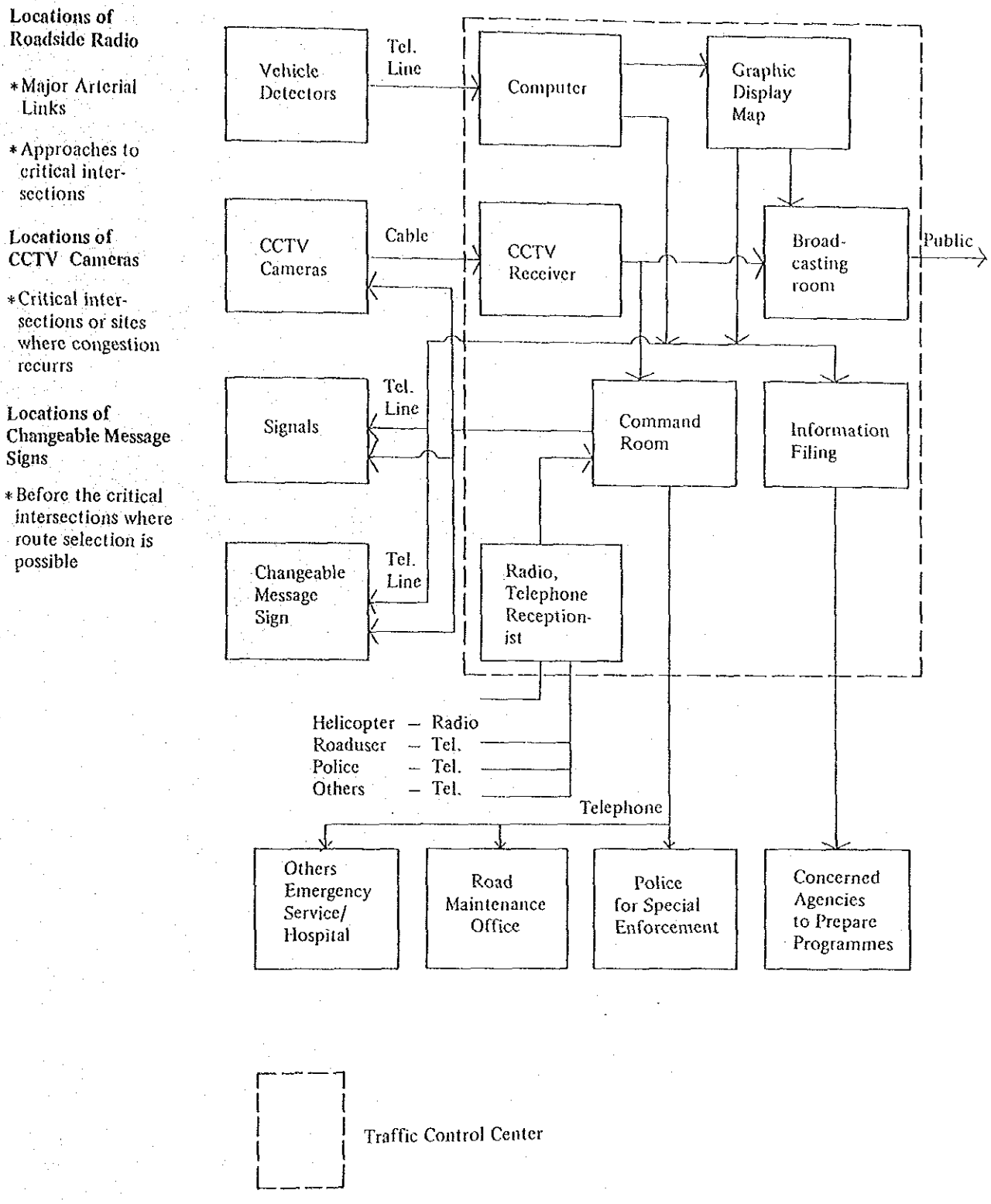



**Figure 8.26 : An Illustration Showing The Flow Of Functions And Activities Of Kuala Lumpur Traffic Surveillance And Control System**

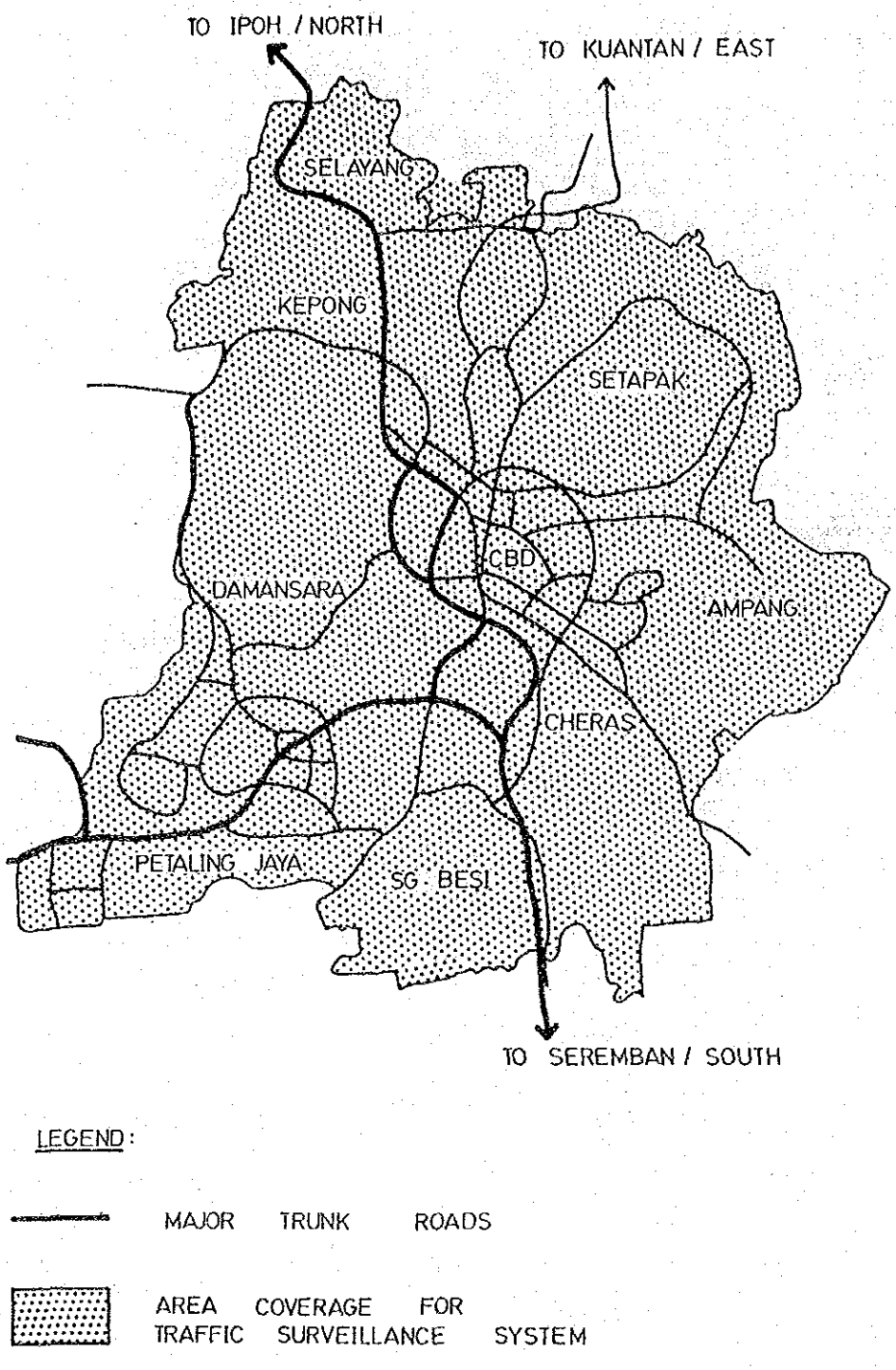



**Figure 8.27 : Area Coverage For Traffic Surveillance And Control System**

### 8.6.2 Parking Plan in the CPA of Kuala Lumpur

(1) Present Parking Condition

According to the parking survey conducted in June 1986, 52,000 parking lots are available in the CPA of Kuala Lumpur, of which 44,700 lots or 86% are off-street parking and the remaining 7,300 lots or 14% are on street parking. However, the overall utilization rate of the total parking lots is comparatively low, at about 58%.

**Table 8.14 : Parking Lots Provided And Utilized, CPA Of Kuala Lumpur, 1985**

| Type of Parking | Parking Lots Provided | | Parking Lots Utilized | |
|---|---|---|---|---|
| | Number | % to Total | Number | % to Total |
| Off-Street Parking | 44,735 | 86 | 24,495 | 81 |
| Building | 31,638 | 61 | 16,768 | 55 |
| Open Space | 13,097 | 25 | 7,727 | 26 |
| On-Street Parking | 7,280 | 14 | 5,824 | 19 |
| Parking Lot | 7,280 | 14 | 5,824 | 19 |
| Total | 52,015 | 100 | 30,319 | 100 |

Source : Parking Survey in 1986.

Based on the vehicular trips in 1985 obtained from H.I.S. data and parking characteristics, the parking demands are estimated as follows : –

**Table 8.15 : Peak Hour Parking Demands, CPA Of Kuala Lumpur, 1985**

| | Trip Ends | Ratio of Parking to Trip Ends | Trip Ends for Parking Plan | Ratio of Peak Hour Parking to Daily Parking | Peak Hour Parking Demands |
|---|---|---|---|---|---|
| Passenger Car | | | | | |
| To Work | 52,706 | 0.8 | 42,165 | 0.6 | 25,299 |
| To School | 51,806 | 0.8 | 194 | 0.4 | 78 |
| Business | 51,806 | 0.6 | 31,084 | 0.25 | 7,771 |
| Private | 93,449 | 0.6 | 56,069 | 0.15 | 14,017 |
| To Home | 28,908 | 0.8 | 23,126 | 0.1 | 2,312 |
| Sub-total | 227,111 | | 152,638 | – | 49,478 |
| Lorry | | | | | |
| Permit Type "A" | 2,490 | 0.6 | 1,494 | 0.25 | 373 |
| Permit Type "C" | 12,881 | 0.6 | 7,729 | 0.25 | 1,932 |
| Permit Type "Decontrolled" | 27,149 | 0.6 | 16,289 | 0.25 | 4,072 |
| Sub-total | 42,520 | 0.6 | 25,512 | | 6,377 |
| Total | 269,631 | | 178,150 | – | 55,855 |

This balance between the parking lots utilized and parking demands estimated is about 25,500 which is seen as curb-side parking which causes traffic congestion.

(2) Future Parking Demands and Cost Estimates

The parking demands in the CPA of Kuala Lumpur in 2005 is estimated using vehicular trips under Plan 2-3 and existing parking characteristics.

Consequently, peak hour parking demands are estimated as follows : –

| | Plan 2-3, Year 2005 | |
|---|---|---|
| | Without Cordon Pricing | With Cordon Pricing |
| Parking Demands | 79,420 | 75,710 |

On the other hand, supplies of the parking lots are estimated on the basis of the following assumptions : –

(a) Off-street parking in building will increase in proportion with employment in CPA.

(b) Both off-street parking in open space and on-street curb-parking will be constant in number as in 1985.

(c) Other curb-parking including illegal parkings will reduce about one-half in number as in 1985.

**Table 8.16 : Future Parking Demand Projection In 2005 Under Plan 2-3-w in the CPA Of Kuala Lumpur**

| | Trip Ends | Ratio of Parking to Trip Ends | Trip Ends for Parking Plan | Ratio of Peak Hour Parking to Daily Parking | Peak Hour Parking Demands |
|---|---|---|---|---|---|
| Passenger Car | | | | | |
| To Work | 62,905 | 0.8 | 50,324 | 0.60 | 30,194 |
| To School | 4,681 | 0.8 | 3,745 | 0.40 | 1,498 |
| Business | 86,411 | 0.6 | 51,847 | 0.25 | 12,962 |
| Private | 120,534 | 0.6 | 72,320 | 0.15 | 10,848 |
| To Home | 96,523 | 0.8 | 77,218 | 0.10 | 7,722 |
| Sub-total | 371,044 | – | 255,454 | – | 63,224 |
| Lorry | | | | | |
| Permit Type "A" | 27,223 | 0.6 | 16,334 | 0.25 | 4,084 |
| Permit Type "C" | | | | | |
| Permit Type "Decontrolled" | 56,018 | 0.6 | 33,611 | 0.25 | 8,403 |
| Sub-total | 83,241 | | 49,945 | | 12,487 |
| Total | 454,285 | – | 305,399 | – | 75,711 |

Since the parking supply is estimated at 65,160 vehicles, the shortage of parking lots, therefore is as follows : –

Table 8.17 : Estimation Of Parking Shortage In CPA by 2005

| | Plan 2-3 | Plan 2-3-w |
|---|---|---|
| Peak Hour Parking Demands | 79,420 | 75,710 |
| Parking Supplies | 65,160 | 65,160 |
| Shortagw | 14,260 | 10,552 |
| Effictive Utilization Rate | 0.9 | 0.9 |
| Additional Parking Lots Required | 15,840 | 11,720 |
| Required Costs (M$ Million) | 294.6 | 218.0 |

Unit : Vehicles

(3) Recommendations

The results of the examinations show that even if Plan 2-3 with the cordon pricing is employed as the future transport system, additional parking spaces of about 12,000 parking lots are required by the year 2005.

The following recommendations can be made : –

(a) Parking supply within the CPA be controlled and monitored within the targetted parking lots.

(b) Extension of prohibition of curb-parkings on major distributors.

(c) As supporting measures to encourage mode shift from the private modes to the public modes, parking charges be controlled covering the public as well as the private facilities.

(d) Enforcement on illegal curb-parkings and encouraging off-street parkings.

### 8.6.3 Pedestrian Facility Improvement

Within Kuala Lumpur CPA, pedestrian side-walk and paths have undergone impressive improvement. Pedestrian facilities has to be continuously improved and expanded in providing more conducive, safe and comfortable environment to encourage waling and hence indirectly encourage the use of public transport throughout the city.

For Kuala Lumpur and the other urban centres in the Klang Valley, continuous effort should be made :

(1) To improve the pedestrian network system consisting of foot-paths, side walks, malls, grade-separated crossings and pedestrian decks; whereby this

networks are carefully planned to connect major urban activity areas with transport terminals such as bus, MRT/LRT terminals.

(2) To provide pedestrian paths and network in residential areas or neighbourhoods connecting residential units to local urban centres and public transport terminals or bus-stop.

## 8.7 Transport Terminals

The establishment of two (2) types of transport terminal, that is, bus terminal and freight terminal is proposed.

### 8.7.1 Bus Terminal

Presently, there are three bus terminals in Kuala Lumpur, two in Klang and one each in Kajang and Rawang.

The problems of the existing bus terminals are summarized as follows : –

(1) The major interstate bus terminals are located in the central area of Kuala Lumpur. These locations are rather unpreferable from the view point of transport economy as the inter-state buses are forced to pass through the congested area, contributing further traffic congestion in the city centre.

(2) The terminals at Puduraya and Klang Bus Station which are predominant in terms of the number of passengers are already over utilized during the peak hour. The situation in Puduraya Terminal in particular is more serious, having no room for future expansion.

(3) Eastbound bus routes are split among Puduraya and Jalan Pekeliling Terminals and some at Medan Tuanku stop.

(4) The passenger facilities at Jalan Pekeliling are extremely poor and inadequate.

In order to cope with the above problems and to promote further development of the public transport system, two new inter-state bus terminals in Kuala Lumpur and four intra-state bus terminals at the sub-centres in Kuala Lumpur and Bukit Tinggi Twin City are proposed.

The bus transport system in the future should be incorporated with the proposed MRT system, thus it is important to take the interrelation fully into consideration for selecting the terminal location.

The concepts of the two new inter-state bus terminals are as follows : –

(a) North New Terminal

This new terminal is to operate the north and east bound inter-state buses which will be shifted from Puduraya and Pekeliling Terminal.

As for the location, a possible site is Sentul which will be a gateway to Kuala Lumpur from north and east after the completion of the New Klang Valley Expressway (For convenience sake, "Sentul Terminal" represents this new terminal in this Study).

(b) South New Terminal

This terminal is to operate the south bound inter-state buses which will be dueby shifted from Puduraya Terminal.

A noteworthy location is the site of Pudu MRT station proposed in this Study ("Pudu Terminal" represents this new terminal in this Study).

Figure 8.28 shows the proposed location of the inter-state bus terminals.

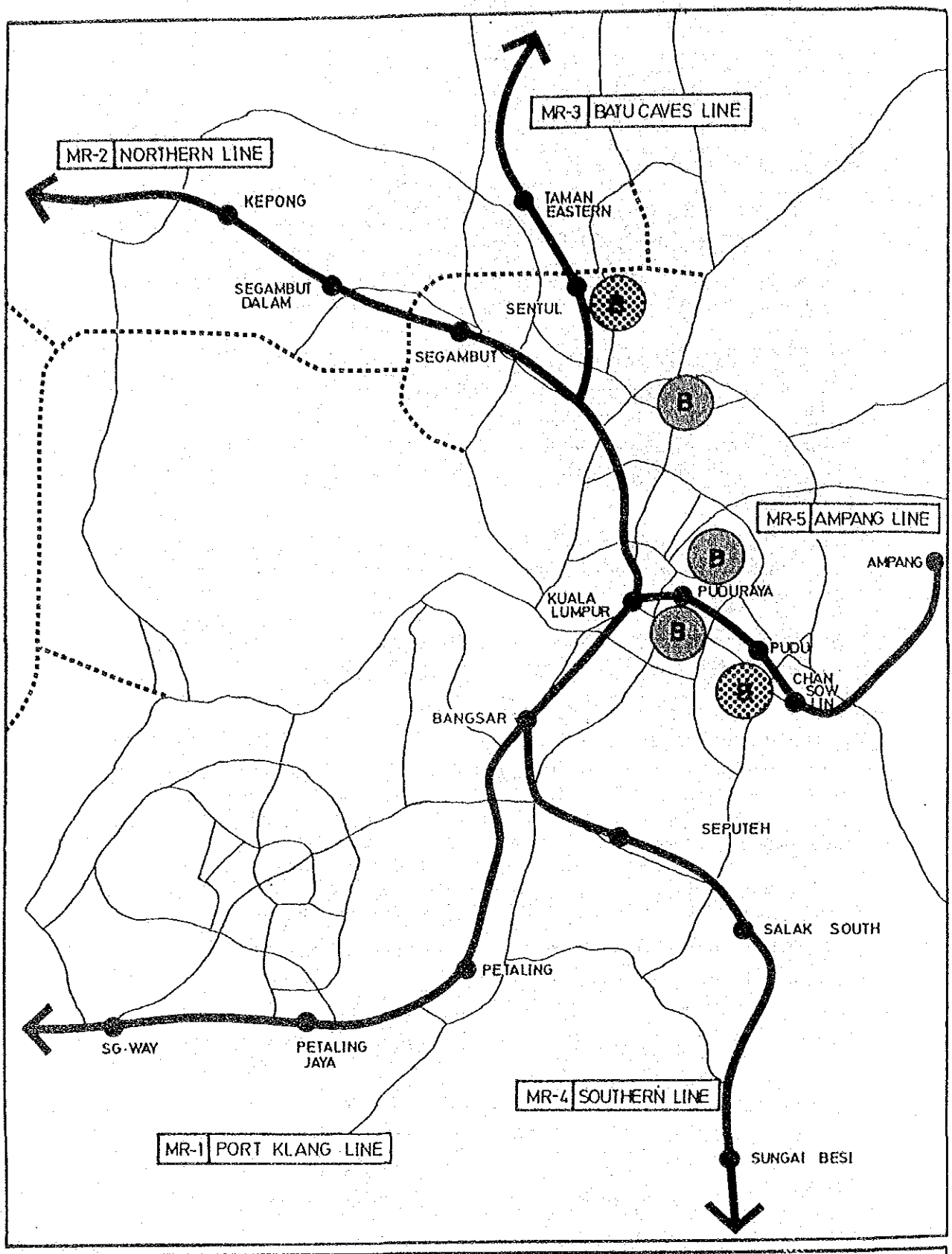
Thus, the existing two terminals at Puduraya and Pekeliling will be converted to exclusive intra-state bus use. Accordingly, the congestion in and around the Puduraya Terminal can be mitigated. Furthermore, the east bound inter-state buses are collected to the new Sentrul Terminal, which may improve passenger convenience.

Table 8.18 shows the proposed allocation of bus routes among terminals. It is found that the route allocation will be extremely simplified after the completion of the two new terminals.

On the other hand, most of the west bound buses which are presently operated at the Klang Bus Station in Kuala Lumpur will be replaced by the proposed MRT service.

As stated before, many MRT stations are proposed along the MRT lines. For the effective usage of the two public transport systems, it is also proposed to develop local bus passenger facilities (local bus centres) at the proposed major MRT stations such as Petaling Jaya, Shah Alam, Klang, Kepong, Selayang, Bangi New Town etc.

In case that the proposed MRT system is not realized, the renewal and expansion of Klang Terminal and the construction of new terminals at the growth centres such as Petaling Jaya, Shah Alam, etc will be additionally required.




LEGEND

- EXISTING BUS TERMINAL
- PROPOSED BUS TERMINAL
- PROPOSED MRT
- PROPOSED HIGHWAY

Figure 8.28:
Proposed Inter-State Bus Terminals Location in Kuala Lumpur Conurbation

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Table 8.18 : Proposed Reallocation of Bus Routes Among Terminals

| Terminal | Type of Service | | 1986 | 1990 | 1995 | 2000 | 2005 |
|---|---|---|---|---|---|---|---|
| Ruduraya | Inter-state | North | 179 | 223 | | | |
| | | South | 293 | 364 | | | |
| | | East | 29 | 36 | | | |
| | | Sub-total | 501 | 623 | | | |
| | Intra-state | | 1140 | 1313 | 1567 | 1870 | 2232 |
| Pekeliling | Inter-state | East | 90 | 112 | | | |
| | Intra-state | | 224 | 244 | 272 | 304 | 339 |
| Klang | West/Intra-state | | 1789 | 2029 | 2375 | 2789 | 3255 |
| Others | Inter-state | East | 13 | 16 | – | – | – |
| Sentul | Inter-state | North | – | – | 292 | 384 | 504 |
| | | East | – | – | 215 | 283 | 372 |
| | | Sub-total | – | – | 507 | 667 | 876 |
| Pudu | Inter-state | South | – | – | 478 | 628 | 825 |

(Numbers indicate number of buses per day)

The main objectives of the proposed four intra-state bus terminals are to provide an efficient bus service connecting the CBD of Kuala Lumpur with each sub-centre district not covered by the proposed MRT service in particular the Wangsa Maju urban sub-centre.

Other possible locations are Bukit Tinggi and the other two sub-centres in Kuala Lumpur at Bandar Tun Abdul Razak, Bukit Jalil.

(A) Planning Conditions

The planning conditions for each bus terminal are established on the basis of the following assumptions derived from the bus terminal survey.

(1) The terminal facilities are planned for the year 2005.

(2) No. of bus departures/arrivals during the peak hour : 10% of the daily buses

(3) Average berthing duration during the peak hour : 34 min/bus

(4) Average area required for bus berth

Wide roadway type : 200 sq.m

Narrow roadway type : 100 sq.m

(5) Average berthing duration of taxi : 10 min/taxi

(6) Average parking duration of private cars : 30 min/car

(7) The proposed inter-state bus terminal requires a terminal building and car and taxi parking spaces in addition to the ordinary bus facilities, while the proposed intra-state bus terminal requires only shelters for passengers instead of the terminal building.

(B) Construction Cost

The required land area and the construction cost for each bus terminal are calculated as shown in Table 8.19. The total construction cost is estimated to be $68.6 million.

Table 8.19 : Estmated Construction Cost Of the Bus Proposed Terminals

| | No. of Berths Required | Total Land Area (sq.m) | Construction Cost (M$ '000) |
|---|---|---|---|
| Inter-state Bus Terminals | | | |
| (a) Sentul Terminal | | | |
| 1st Stage | 21 | 10,500 | 24,100 |
| 2nd Stage | 15 | 6,100 | 3,100 |
| Total | 36 | 16,600 | 2 7,200 |
| (b) Pudu Terminal | | | |
| 1st Stage | 19 | 9,900 | 24,400 |
| 2nd Stage | 14 | 6,100 | 4,000 |
| Total | 33 | 16,000 | 28,400 |
| Intra-state Bus Terminals | | | |
| (1) Bandar Tun Abd.Razak | 22 | 4,900 | 2,900 |
| (2) Wangsa Maju | 18 | 4,000 | 2,400 |
| (3) Bukit Jalil | 36 | 7,000 | 4,300 |
| (4) Bukit Tinggi | 36 | 7,600 | 3,400 |
| Total Cost | | | 68,600 |

(C) Financial Analysis of Inter-state Bus Terminals

A financial analysis was carried out to evaluate the proposed inter-state bus terminals. The annual revenue and operating costs for the analysis were calculated based on information collected from the Bus Terminal Survey.

The implementation schedule was assumed as follows : –

| | | |
|---|---|---|
| Stage 1 : | 1992 | Engineering Study and Tender |
| | 1993 | Land Acquisition |
| | 1994 | Construction |
| | 1995 | Open to Public |
| Stage 2 : | 2003 | Engineering Study and Tender |
| | 2004 | Construction |
| | 2005 | Open to Public |

The financial evaluation indicates that both terminals are financially viable as shown in Table 8.20

**Table 8.20 : Financial Analysis Of the Proposed Inter State Bus Terminals**

| Item | Sentul Terminal | Pudu Terminal |
|---|---|---|
| Benefit Cost Ratio (B/C) | 1.03 | 1.17 |
| Net Present Value ($000) (Discounted at 12%) | 461.9 | 2818.8 |
| Internal Rate of Return (FIRR %) | 12.4 | 14.5 |

### 8.7.2 Freight Terminal

(1) General

Presently, the Malayan Railway Marshalling Yard at Brickfields, the Container Terminal at Sungei Wang and several garages of truck operators scattered in Kuala Lumpur and Petaling Jaya are functioning as collecting and distributing terminus for goods in the Klang Valley.

The absence of properly planned and operated freight terminals to cater for the inland freight traffic has resulted in : –

(a) uneconomical operation of trucks

(b) traffic congestion caused by disorderly stopping, loading or unloading by trucks

(c) encroachment of truck traffic on residential area creating noise pollution, damaging the local access roads and potential accident hazards.

(2) Concept of Freight Terminal

Freight terminal is defined as an interchange facility for freight traffic connecting inter-city line hauls and intra-city collection and distribution modes. Major functions at freight terminals are : –

- loading and unloading of goods
- classification of goods by destination
- temporary storage of goods
- truck parking and rest areas for drivers

These functions are illustrated below –

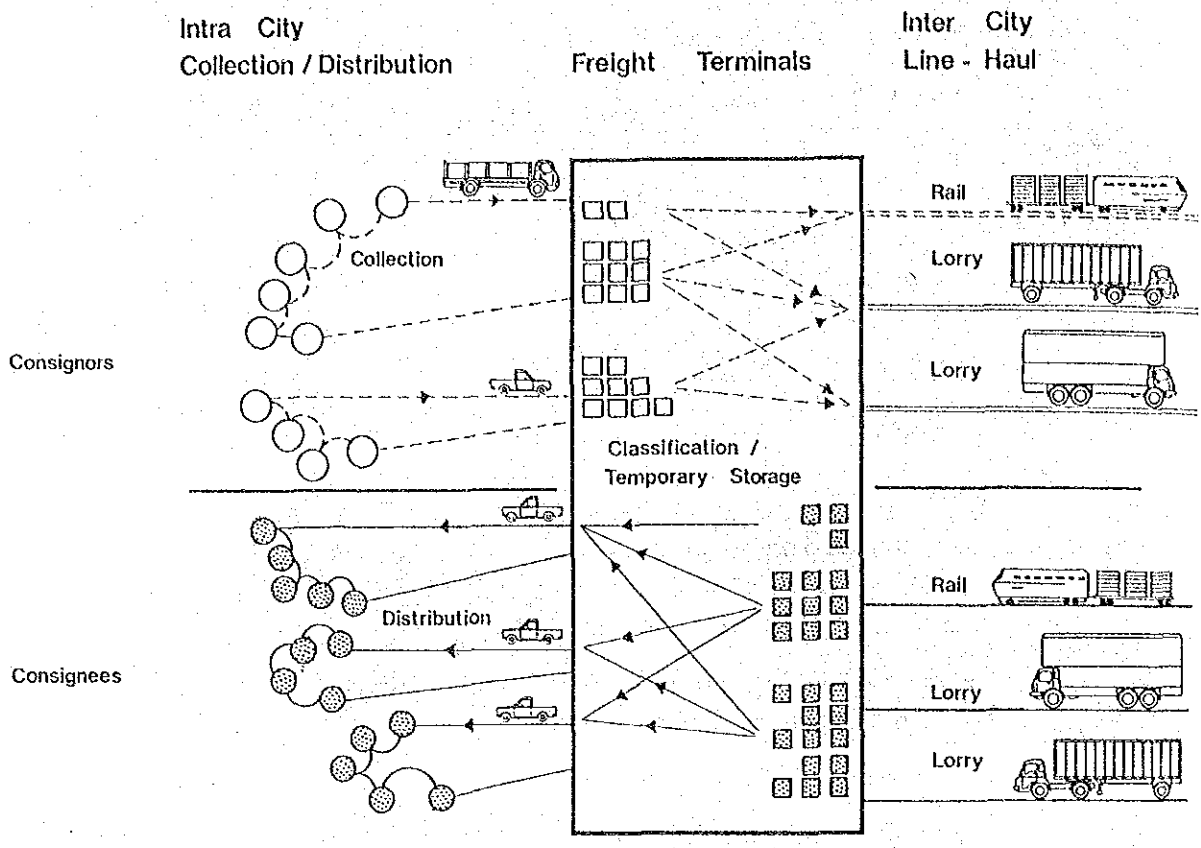



**Figure 8.29 : Functions of Freight Terminal**

(3) Freight Traffic Demands

The freight traffic demands for freight terminals are estimated on the basis of the following assumptions : –

(a) 40% of consumer manufactured goods and 10% of machineries are potential freight to be handled at the terminals

(b) The freight traffic flow pattern is based on the results of the cordon line interview survey conducted in 1985

Based on these assumptions, the freight traffic demand for freight terminals in 1985 is estimated at 2,035 tons per day which is approximately 6.8% of the total inter-city freight traffic in Klang Valey (Table 8.21).

The future demands are estimated by assuming a growth rate of 4.7% for the period 1985 to 2005 on the basis of the average annual growth rate of Gross Domestic Product (GRP) and its elasticity. Table 8.22 shows the estimated growth of freight traffic demands to the year 2005.

Table 8.21 : Estimated Commodity Demands For Freight Terminals, Klang Valley, 1985

(unit : tons/day)

| | Inbound | Outbound | Through | Total |
|---|---|---|---|---|
| North bound/ East bound | 291.3 | 713,1 | 53.7 | 1058.1 |
| South bound | 311.6 | 610.8 | 54.6 | 977.0 |

Note : It is assumed that about 40% of commodity flow using lorries on the cordon line are needed to be handled at truck terminals.

Table 8.22 : Estimated Commodity Demands For Freight Terminals, Klang Valley, 1985 – 2005

(unit : tons/day)

| | North bound/ East bound | South bound | Total |
|---|---|---|---|
| 1985 (Base Year) | 1058.1 | 977.0 | 2035.1 |
| 1995 | 1674.9 | 1546.5 | 3221.4 |
| 2005 | 2651.2 | 2448.0 | 5099.2 |

(4) Proposed Freight Terminals

Two freight terminals are proposed in the Kuala Lumpur Conurbation area.

(a) The North Terminal – to be strategically located at the crossroads for the north and east bound lorry traffic.

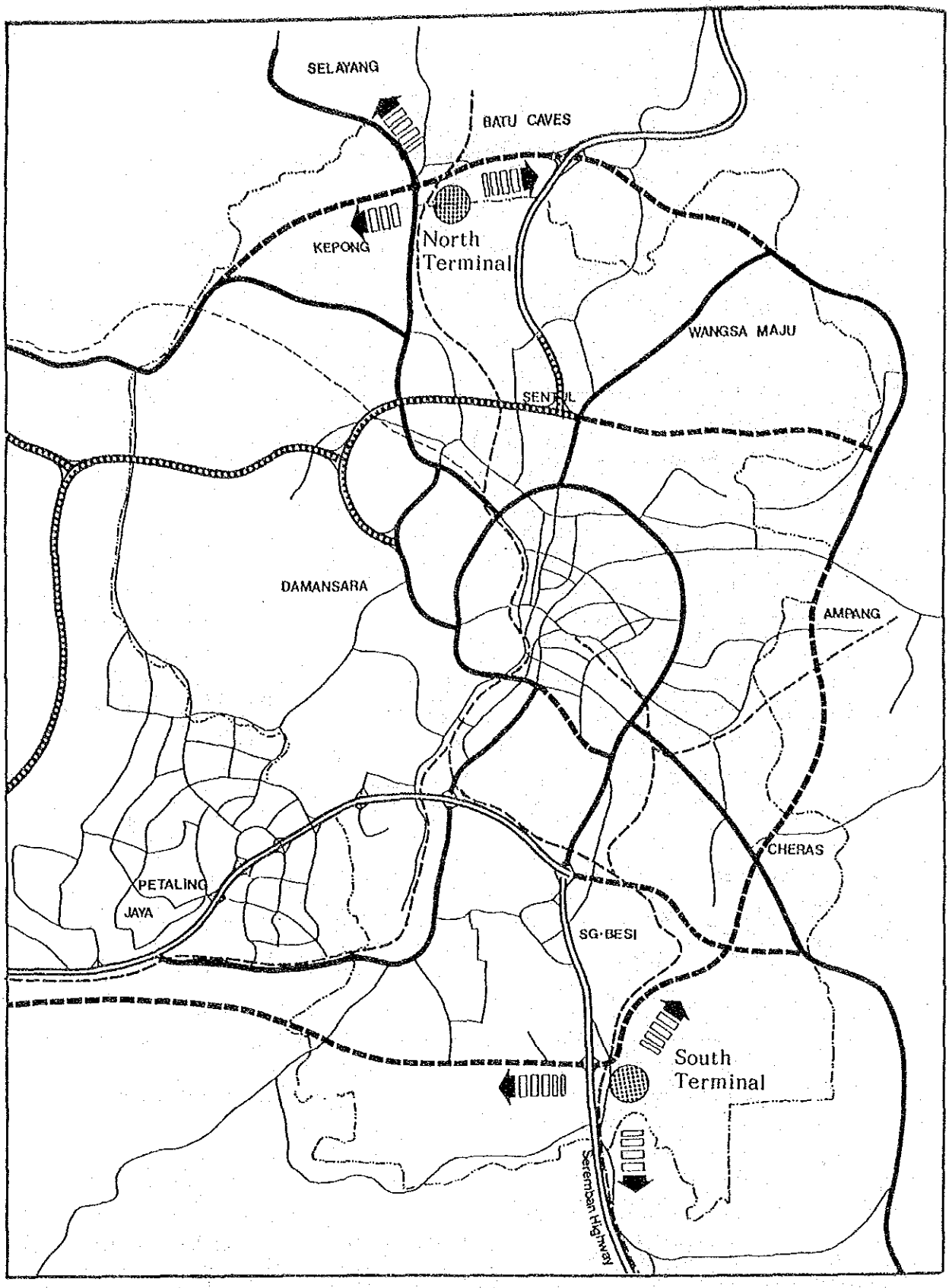
With the completion of the New Klang Valley Expressway, and the Middle Ring Road II as well as the planned Wholesale Market nearby, an advantageous location would be the disused tin mine area along Jalan Ipoh (Figure 8.30).

(b) The South Terminal – to be carefully located at the crossroads of expressways leading to the south.

With the proposed Middle Ring Road II extension to join up with Kuala Lumpur-Seremban Highway, a strategic location would be at Sungei Besi.

Both these possible locations also allow the possible utilization of rail transport for freight as the KTM rails pass by these two locations.

A multi-mode freight terminal is also required at the Klang Port area where container cargoes can be readily handled and distributed by various transport modes to Klang Valley and other regions.




LEGEND

- Existing Expressway
- Proposed Expressway
- Existing Major Road
- Proposed Major Road
- Railway
- Proposed Freight Terminals

**Figure 8.30 :**
**Proposed Location of Freight Terminals in Kuala Lumpur Conurbation**

SCALE 0 1 2 3 4 5Km

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(5) Freight Terminal Facility Plan

To function effectively as a terminus for loading, unloading classification and storage of goods, the proposed terminals shall have to be equipped with facilities as : --

- Terminal Component
  - -- platform
  - -- apron
  - -- front office area
- Parking Lots
- Administration Building
- Workshop and Filling Station
- Access and Compound Roadway
- Open Space
- Warehouse (depending upon the requirements of lorry operators)

The required number of truck platforms at the terminals in 1995 and 2005 are four and seven, both for the north terminal and south terminals (Table 8.23). Each platform is assumed a size of 100 m by 20 m based on the assumption that 5.0 square meters is needed to handle one ton of freight per day.

The terminals are to be constructed in 1990 to meet the demands of 1995 as the first stage. They will then be expanded to cope with the demands of 2005 as the second stage (Table 8.24).

**Table 8.23 : Number Of Platform Lots And Platforms Required For The Proposed North And South Terminals**

| Year | North-South Terminal | | South Terminal | |
|---|---|---|---|---|
| | No. of Platform Lot | No. of Platform Lot | No. of Platform Lot | No. of Platform Lot |
| 1985 (Base Year) | 76 | 3 | 70 | 3 |
| 1995 | 120 | 4 | 111 | 4 |
| 2005 | 190 | 7 | 175 | 7 |

Table 8.24 : **Proposed Floor Space By Functional Facility By Stage For The Proposed North And South Freight Terminals**

| Terminal Component | Floor Area in Sq.m. | | |
|---|---|---|---|
| | 1st Stage | 2nd Stage | Total |
| 1. Terminal Component | | | |
| Platform | 8,400 | 6,300 | 14,700 |
| Apron | 12,600 | 9,450 | 22,050 |
| Front Office Area | 480 | 360 | 840 |
| Sub-total | 21,480 | 16,100 | 37,580 |
| 2. Parking Area | 17,800 | 13,350 | 31,150 |
| 3. Administration Bldg. | 5,200 | 3,900 | 9,100 |
| 4. Workshop | 1,500 | 1,120 | 2,620 |
| 5. Road | 18,400 | 13,800 | 32,200 |
| 6. Open Space | 9,200 | 6,900 | 16,100 |
| Total | 73,580 | 55,170 | 128,750 |

(6) Cost and Profitability

(a) Construction and Operation Costs

The construction cost of the proposed terminals is estimated at M$15.2 million for the first stage and M$11.4 million for the second stage. The annual operating cost is estimated to be M$304,400 for the first stage and M$228,200 for the second stage.

Table 8.25 : **Estimated Construction Cost For The Proposed North And South Freight Terminals**

| Items | Construction Cost (M$ '000) | | |
|---|---|---|---|
| | Stage 1 | Stage 2 | Total |
| Engineering | 1,200 | 900 | 2,100 |
| Land Preparation | 1,290 | 970 | 2,260 |
| Terminal Component | 3,390 | 2,540 | 5,930 |
| Parking/Roads | 1,820 | 1,360 | 3,180 |
| Others | 6,140 | 4,600 | 10,740 |
| Contingency | 1,380 | 1,040 | 2,420 |
| Total | 15,220 | 11,410 | 26,630 |

(7) Financial Analysis of Truck Terminals

A financial analysis for the proposed truck terminals is carried out to determine their profitability.

The implementation schedule for the truck terminals is assumed as follows : –