

## 4.5 Forecast of Number of Vehicles by Vehicle Type and Division in the CMR

In this Section, the forecasts of the vehicles by the following vehicles types and cases which correspond to the three (3) Economic Development scenario of the CMR are described; Car, Motorcycles, Bus, Van, 3-Wheelers (Taxi) and Lorry (freight vehicle).

### 4.5.1 Comments and Summary

#### 1) Characteristic of the Number to be forecasted.

In general, these exist the following two (2) levels of the forecast;

**Level 1 :** Forecast of the number of the vehicles based on consumers purchasing power of vehicles and production activity level in an area concerned. Accordingly, the forecasted number means a potential demand on its vehicles because any unfavourable factor which effects the realization of the demand is not reflected in the forecast.

**Level 2 :** Forecast of the number of vehicles, taking into account traffic management polices along with the factor described in the Level 1 above. Accordingly, the forecasted number represents the number to be realized on the traffic network concerned i.e. number of vehicles acting on the traffic network.

The forecast at the Level 2 can be obtained through the following processes:

**Process 1:** Findings of problems in field of the traffic management covering an area concerned which would occur in case of adoption of the Level 1 forecast.

**Process 2:** Establishment of traffic management polices to solve or mitigate the problems.

**Process 3 :** Calculation of number of vehicles where the policies are reflected.

Therefore, the forecast carried out in this Section is classified as the Level 1 forecast, and is used as input to the Level 2, Process 1.

#### 2) Key point for forecasting a long-term potential Demand on Vehicle under repaid changing Situation on the Demand Structure.

The Study Team foresees that the Sri Lankan national economy grow steadily but at relatively high rate during the coming two decades, which development of unused resources endowed in the country will surely support the economic growth. At the same time, it is also foreseen that her promotion of economic liberalization policy bring about big change in her economic structure, especially, demand structure.

A long-term forecast of the potential demand on the vehicles till the year 2020 is conducted in this analysis. Accordingly, we have to suppose that a structural change in this demand on vehicles surely occur in future too and the change is tried to be reflected in the forecast.

The structural change can not, in general, be imagined from past trend on the demand, especially during a rapid economic development stage where the Sri Lankan economy is now in. Analysis on the past trend is very useful for a short-term forecast, but gives just referential information to the long term forecast.

In short, we have to foresee the structural change which almost surely occurs in future to carry out the long-term forecast of potential demand on the vehicles.

### 3) Summary of Forecast of number of vehicles by vehicle type and District in the CMR till the year 2020

The summary (Base case) is tabulated in Tab. 4.15. Total number of vehicles in the CMR is forecasted to increase at 7.0% / annum till the year 2020, which exceeds the expected economic growth rate of 6.4% / annum. Increases in Car and Motorcycle with high rates generates the exceed.

**Tab. 4.15 (Summary) Forecast of CMR Vehicle Ownerships by  
Vehicle Type - Base case -**

**1. Number of Vehicles**

		CMR	Colombo	Gampaha	Kalutara
Car	1996	93,656	77,549	12,272	3,835
	2010	546,130	422,620	45,650	27,860
	2020	1,074,500	788,430	222,350	63,720
Motorcycle	1996	237,047	120,122	86,164	30,761
	2010	694,090	349,020	259,820	85,250
	2020	1,061,500	533,100	400,620	127,780
Bus	1996	10,872	6,599	3,055	1,218
	2010	15,340	9,290	4,350	1,700
	2020	17,450	10,570	4,960	1,920
Van	1996	74,014	54,055	14,808	5,151
	2010	90,810	66,370	18,180	6,260
	2020	126,680	92,360	25,660	8,660
3 Wheelers	1996	32,841	21,262	8,571	3,008
	2010	45,770	29,580	12,050	4,140
	2020	56,240	36,330	14,850	5,060
Lorry	1996	18,614	13,213	3,992	1,409
	2010	29,660	21,010	6,440	2,210
	2020	40,870	28,940	8,920	3,010
Total	1996	467,044	292,800	128,862	45,382
	2010	1,421,800	897,890	396,490	127,420
	2020	2,377,240	1,489,730	677,360	210,150
Subtotal (Car and Motorcycle)	1996	330,703	197,671	98,436	34,596
	2010	1,240,220	771,640	355,470	113,110
	2020	2,136,000	1,321,530	622,970	191,500

Source: 1996 : University of Moratuwa, unpublished

2010,2020 : Consultants forecast.

## 2. Average Annual changing Rates during the Period 1996 – 2020 (% / annum)

	CMR	Colombo	Gampaha	Kalutara
Car	10.7	10.1	12.8	12.4
Motorcycle	6.5	6.4	6.6	6.1
Bus	2.0	2.0	2.0	1.9
Van	2.3	2.3	2.3	2.2
3 Wheeler	2.3	2.3	2.3	2.2
Lorry	3.3	3.3	3.4	2.1
Total	7.0	7.0	7.2	6.6
Subtotal	8.1	8.2	8.0	7.4

## 3. Per-capita Number of Cars Motorcycles

		CMR	Colombo	Gampaha	Kalutara
Car	1996	0.020	0.039	0.007	0.004
	2010	0.088	0.161	0.041	0.023
	2020	0.140	0.245	0.072	0.047
Motorcycle	1996	0.051	0.060	0.050	0.033
	2010	0.112	0.133	0.110	0.071
	2020	0.139	0.166	0.130	0.095
Total	1996	0.071	0.099	0.057	0.037
	2010	0.201	0.294	0.151	0.095
	2020	0.279	0.411	0.202	0.142

### 4.5.2 Forecast of Car Ownership by DS Division

#### 1) Outline of Forecasting Method

##### (1) Outline of a Method adopted in CUTS.

The Study Team adopts the forecasting method which is described below.

CUTS also adopted the same formula for forecasting the total number of Car ownership in the CMR (see CUTS, WP5, P50).

$$\log_c (10P / (0.4 - P)) = A + B \log_c Y + C \log_c T \quad \dots\dots (1)$$

P : : Car ownership per capita

0.4 : Saturation level of car ownership per capita in the CMR

Y : GDP per capita at constant prices

T : Number of years since a defined year (Base year) 0

A,B,C :Parameters

Constants A, B and C are estimated based on cross-sectional data (car ownership per capita and GDP per capita) from sixty (60) developing countries and adjusted to fit the formula to explain past trends in the CMR.

The formula is called a Logistic Curve. The curve has the characteristic of rising gradually in the beginning then speedily in the interim and finally leveling off at saturation, which is assumed to be 0.4 car ownership per capita. The curve is adapted since it explains the nature of vehicle ownership well. However, it automatically requires the following assumption: the trend of the explanatory variable in the future must be the same as that for other developing countries, since the parameters A, B and C are estimated using data from these countries.

## 2) Forecasting Procedures of Car Ownership by DS Division

Forecasting is carried out largely applying the following two steps: forecast at the CMR and District level, and forecasting at the DS Division level.

### (1) CMR and District level

#### Procedure 1 – 1: Forecast of CMR Car Ownership

The forecast is carried out applying the following formula:

$$\log_e (10P / (0.4 - P)) = -12.0775 + 1.165 \log_e Y + 0.36 \log_e T$$

P : Car ownership per capita in the CMR in the future.

-12.0775: Constant: It is adjusted so that both the values for left and right-hand sides of the formula in 1996 are equal. The Study Team adopted an estimate for 1996 divisional car ownership from the University of Moratuwa.

0.4 : Saturation level of car per capita in the CMR cited from the CUTS Report.

Y : Future GDP per capita in the CMR

T : Number of years since 1996 (1996 = 0)

1.165 and 0.36 : Constants (parameters) cited from the CUTS Report

The forecasted number of car ownership works as a control total for sum of the forecasted one by District.

### Procedure 1 – 2 : Forecast of District Car Ownership

Forecasting is carried out applying the following formulas:

$$\log_e (10P / 10.4 - P) = A^j + 1.165 \log_e Y^j + 0.36 \log_e T$$

$A^j$  : for Colombo District : -11.5729

Gampaha District : -13.0932

Kalutara District : -13.2620

$Y^j$  : GDP per capita by District tabulated in Table 4-15

**Tab. 4.16 Forecast of Per Capita GDP by District in the CMR  
(unit: Rs at 1982 constant prices / capita)**

#### 1. Base Case

	1996	2005	2010	2020
CMR	18,357	26,209	34,438	50,738
Colombo District	21,815	30,891	40,305	59,800
Gampaha District	17,591	25,367	33,547	47,365
Kalutara District	12,414	17,646	23,316	36,918

#### 2. High Case

	1996	2005	2010	2020
CMR	18,357	27,263	37,881	60,725
Colombo District	21,815	32,153	44,380	71,659
Gampaha District	17,591	26,396	36,930	56,761
Kalutara District	12,414	18,247	25,491	43,688

#### 3. Low Case

	1996	2005	2010	2020
CMR	18,357	25,190	31,435	42,133
Colombo District	21,815	29,673	36,752	49,582
Gampaha District	17,591	23,914	30,597	39,269
Kalutara District	12,414	17,017	21,418	30,900

Source: Consultant's forecast

**Procedure 1 – 3 : Adjustment of forecasts by District so that the Sum of the Forecasts is equivalent to be the CMR Total**

**Procedure 1 – 4 : Forecast of DS Division Car Ownership**

The procedure for calculating Division car ownership is as follows;

- 1 : Calculation of cars per capita in 1996, using the number of car ownership by DS Division and population in 1996.
- 2 : For the forecast years 2005 and 2010, forecasts are made in accordance with the following sub-procedures:
- 3 : Determination of car ownership ratios at for the forecast years based on the Base Case values shown in Tab. 4.17.
- 4 : Calculation of the number of car ownership in the year concerned using the car-ownership ratios and forecasted population in that year.
- 5 : Finalization of the forecasted number of cars by DS Division (output of the Procedure 4 ) so that sum for the DS Divisions is equivalent to their relevant District.
- 6: Calculation of cars per capita by DS Division in the year concerned in order to calculate cars per capita in the next forecasting year.
- 7: For 2020, the forecast is carried out applying Procedure 4 with the ratio for 2010, population for 2020, and Procedure 5.

The car-ownership ratios by forecasting year are tabulated in Tab. 4.17. The ratios are calculated by interpolation and extrapolation of data in Table 9.5.2, CUTS, WP5 P129 – 130.

Tab. 4.17 Cars per Capita from 1996 to 2020

1996	2005			2010			2020		
	L	B	H	L	B	H	L	B	H
0.010	0.021	0.028	0.032	0.028	0.042	0.053	0.042	0.069	0.094
0.011	0.022	0.029	0.033	0.030	0.043	0.055	0.045	0.071	0.098
0.012	0.023	0.031	0.035	0.031	0.045	0.057	0.046	0.073	0.101
0.013	0.024	0.032	0.036	0.032	0.049	0.059	0.048	0.077	0.105
0.014	0.026	0.033	0.038	0.034	0.049	0.062	0.050	0.080	0.109
0.015	0.027	0.035	0.039	0.035	0.051	0.064	0.051	0.083	0.113
0.016	0.028	0.037	0.041	0.037	0.053	0.067	0.054	0.081	0.118
0.170	0.030	0.038	0.043	0.039	0.055	0.069	0.056	0.089	0.121
0.0175	0.031	0.040	0.045	0.040	0.058	0.072	0.058	0.093	0.126
0.018	0.033	0.042	0.047	0.042	0.060	0.075	0.060	0.096	0.131
0.019	0.034	0.044	0.049	0.044	0.063	0.078	0.064	0.100	0.136
0.0195	0.036	0.046	0.051	0.046	0.065	0.081	0.066	0.103	0.141
0.021	0.038	0.048	0.053	0.048	0.068	0.084	0.068	0.108	1.146
0.023	0.039	0.050	0.055	0.050	0.071	0.087	0.072	0.112	0.151
0.025	0.041	0.052	0.057	0.053	0.074	0.091	0.074	0.119	0.158
0.027	0.044	0.054	0.060	0.055	0.077	0.095	0.077	0.122	0.164
0.028	0.046	0.057	0.062	0.058	0.080	0.098	0.081	0.126	0.170
0.030	0.048	0.059	0.065	0.060	0.083	0.102	0.084	0.131	0.176
0.032	0.050	0.062	0.068	0.063	0.087	0.106	0.088	0.136	0.182
0.033	0.053	0.065	0.071	0.066	0.090	0.111	0.092	0.140	0.190
0.035	0.055	0.068	0.074	0.069	0.094	0.115	0.096	0.146	0.197
0.037	0.058	0.071	0.079	0.072	0.098	0.120	0.100	0.152	0.205
0.039	0.061	0.074	0.080	0.076	0.102	0.124	0.105	0.158	0.212
0.041	0.064	0.078	0.084	0.079	0.107	0.130	0.108	0.164	0.221
0.430	0.067	0.081	0.087	0.083	0.111	0.134	0.114	0.170	0.228
0.045	0.071	0.085	0.091	0.087	0.116	0.140	0.118	0.177	0.237
0.047	0.074	0.089	0.095	0.090	0.120	0.146	0.122	0.182	0.247
0.050	0.078	0.093	0.099	0.095	0.125	0.151	0.128	0.189	0.255
0.052	0.082	0.097	0.103	0.099	0.131	0.157	0.133	0.198	0.265
0.055	0.086	0.101	0.107	0.104	0.136	0.163	0.139	0.205	0.275
0.058	0.090	0.106	0.112	0.108	0.142	0.170	0.144	0.213	0.286
0.061	0.095	0.111	0.117	0.114	0.148	0.177	0.151	0.221	0.296
0.064	0.099	0.116	0.122	0.118	0.154	0.184	0.156	0.229	0.307
0.067	0.104	0.121	0.127	0.124	0.160	0.191	0.163	0.238	0.319
0.070	0.110	0.126	0.132	0.130	0.167	0.199	0.169	0.248	0.332
0.073	0.115	0.132	0.138	0.136	0.174	0.207	0.177	0.257	0.344
0.077	0.121	0.138	0.144	0.142	0.181	0.215	0.184	0.267	0.357
0.081	0.127	0.144	0.150	0.149	0.188	0.224	0.192	0.276	0.371
0.086	0.133	0.151	0.156	0.155	0.197	0.232	0.199	0.288	0.384
0.090	0.140	0.158	0.163	0.163	0.205	0.242	0.208	0.298	0.399
0.095	0.147	0.165	0.170	0.170	0.213	0.251	0.216	0.309	0.413
0.100	0.154	0.172	0.177	0.187	0.222	0.261	0.226	0.322	0.429
0.105	0.162	0.180	0.185	0.186	0.231	0.272	0.234	0.333	0.446
0.111	0.170	0.188	0.193	0.195	0.241	0.283	0.245	0.347	0.462
0.116	0.178	0.197	0.201	0.204	0.251	0.294	0.255	0.359	0.480
0.122	0.187	0.206	0.210	0.213	0.262	0.304	0.265	0.373	0.503



(continued)

1996	2005			2010			2020		
	L	B	H	L	B	H	L	B	H
0.128	0.196	0.215	0.218	0.223	0.273	0.318	0.270	0.388	0.517
0.134	0.206	0.225	0.228	0.233	0.284	0.331	0.287	0.402	0.536
0.140	0.216	0.235	0.237	0.244	0.296	0.344	0.300	0.418	0.557
0.146	0.227	0.245	0.248	0.256	0.308	0.358	0.313	0.434	0.577
0.152	0.238	0.257	0.258	0.267	0.322	0.372	0.325	0.451	0.600
0.159	0.250	0.268	0.269	0.280	0.335	0.387	0.339	0.468	0.622
0.165	0.263	0.280	0.281	0.293	0.349	0.403	0.352	0.486	0.646
0.172	0.276	0.293	0.293	0.306	0.363	0.419	0.366	0.503	0.670
0.179	0.289	0.306	0.305	0.320	0.379	0.435	0.382	0.524	0.695
0.186	0.304	0.320	0.318	0.335	0.395	0.453	0.397	0.544	0.722

Source : Consultant estimate, estimated by interpolation and extrapolation of data entered in the Table 9.5.2, CUTS, WPS, P129 - 130.

### 3) Results of Forecast

The forecast by District is shown in Tab. 4.19 and the forecast by DS Division in Tab. 4.20. In Tab. 4.18, the elasticity of car ownership in relationship to economic growth in the CMR is presented. The elasticity decreases as time passes for all three economic development scenarios. The elasticity for the period 2010 – 2020 for the High Case exceeds 1.00 marginally. This means that the car ownership during the period will increase at almost the same rate as the expected GDP growth rate.

Note that in 2020, cars per capita will not exceed 0.4, (assumed saturation level), except for the Colombo DS Division.

**Tab. 4.18 Elasticity of Car Ownership in Relation to Economic Growth in the CMR**

		Base case	High case	Low case
1996	Elasticity <sup>*1</sup>	2.52	2.38	2.70
	A.A.C.R. of <sup>*2</sup> car ownership(%/annum)	15.6	16.2	15.1
2005	GDP Growth Ratio (%/annum) <sup>*3</sup>	6.2	6.8	5.6
2005	Elasticity	1.36	1.28	1.46
	A.A.C.R. of car ownership	9.5	10.5	8.6
2010	GDP Growth Ratio	7.0	8.2	5.9
2010	Elasticity	1.13	1.06	1.21
	A.A.C.R. of car ownership	7.0	7.5	6.3
2020	GDP Growth Ratio	6.2	7.1	5.2

Source : Consultant's estimate

Note \*1 : Elasticity = A.A.C.R of car ownership / GDP growth rate

Note \*2 : Average Annual Growth Rate

Note \*3 : - Period : 1998 – 2005

Tab. 4.19 Forecast of Car Ownership by District

## 1. Base Case

## 1-1 : Car ownership

	1996 *1	2005	2010	2020
CMR	93,656	346,600	546,130	1,074,500
Colombo District	77,549	276,240	422,620	788,430
Gampaha District	12,272	54,380	95,650	222,350
Kalutara District	3,835	15,980	27,860	63,720

## 1-2 : Car ownership per capita

	1996	2005	2010	2020
CMR	0.020	0.060	0.088	0.140
Colombo District	0.039	0.112	0.161	0.245
Gampaha District	0.007	0.025	0.041	0.072
Kalutara District	0.004	0.014	0.023	0.047

## 1-3 : Average Annual Growth Rates (%/annum)

	CMR	Colombo	Gampaha	Kalutara
1996 - 2005	15.6	15.2	18.0	17.2
2005 - 2010	9.5	8.9	12.0	11.8
2010 - 2020	7.0	6.4	8.8	8.6
1996 - 2020	10.7	10.1	12.8	12.4

## 2. High Case

## 2-1 : Car ownership

	1996 *1	2005	2010	2020
CMR	93,656	360,350	594,810	1,224,560
Colombo District	77,549	286,700	457,100	877,970
Gampaha District	12,272	56,950	106,710	268,200
Kalutara District	3,835	16,700	31,000	78,390

## 2-2 : Car ownership per capita

	1996	2005	2010	2020
CMR	0.020	0.062	0.096	0.160
Colombo District	0.039	0.116	0.174	0.273
Gampaha District	0.007	0.026	0.045	0.087
Kalutara District	0.004	0.015	0.026	0.058

## 2-3 : Average Annual Growth Rates

	CMR	Colombo	Gampaha	Kalutara
1996 - 2005	16.2	15.6	18.6	17.8
2005 - 2010	10.5	9.8	13.4	13.2
2010 - 2020	7.5	6.7	9.7	9.7
1996 - 2020	11.3	10.6	13.7	13.4

(continued)

## 3. Low Case

## 3-1 : Cars

	1996 *1	2005	2010	2020
CMR	93,656	333,200	502,250	928,820
Colombo District	77,549	266,880	391,020	694,470
Gampaha District	12,272	50,970	86,070	181,290
Kalutara District	3,835	15,350	25,160	53,060

## 3-2 : Cars per capita

	1996	2005	2010	2020
CMR	0.020	0.058	0.081	0.121
Colombo District	0.039	0.108	0.149	0.216
Gampaha District	0.007	0.023	0.036	0.059
Kalutara District	0.004	0.014	0.021	0.039

## 3-3 : Average Annual Growth Rates

	CMR	Colombo	Gampaha	Kalutara
1996 - 2005	15.1	14.7	17.1	16.7
2005 - 2010	8.6	7.9	11.0	10.4
2010 - 2020	6.3	5.9	7.7	7.7
1996 - 2020	10.0	9.6	11.9	11.6

Source : Consultant's forecast

No. \*1 : Source: University of Moratuwa (unpublished)

Tab. 4.20 Forecast of Car Ownership by DS Division

1. Base case						
	*1 1996	2005	2010	2020	Per Capita 2020	A.A.C.R 1996 2020
<b>COLOMBO DISTRICT</b>	77,549	276,240	422,620	788,430	0.245	10.15
Hanwella	556	6,990	11,560	25,460	0.108	17.27
Colombo	50,370	162,400	240,340	417,460	0.440	9.21
Homagama	1,270	7,760	12,700	25,730	0.113	13.36
Kaduwella	3,491	13,370	21,150	43,600	0.179	11.09
Kesbewa	2,179	9,380	15,270	31,220	0.125	11.73
Kolonnawa	1,957	9,480	15,160	29,860	0.118	12.02
Moratuwa	2,365	11,510	18,810	39,550	0.118	12.45
Nugegodo	15,361	55,350	87,630	175,550	0.241	10.68
<b>GAMPAHA DISTRICT</b>	12,272	54,380	95,650	222,350	0.072	12.83
Attanagala	704	3,520	6,140	13,620	0.072	13.14
Biyagama	1,133	3,380	6,180	14,070	0.072	11.07
Divalapitiya	338	2,530	4,120	7,930	0.072	14.05
Gampaka	1,265	5,860	10,930	29,480	0.072	14.02
Ja-Ela	1,039	4,210	7,360	15,170	0.072	11.82
Katana	1,081	5,910	10,760	27,790	0.072	14.49
Kelaniya	1,884	4,450	6,690	14,070	0.072	8.74
Mahara	1,129	3,610	6,140	12,650	0.072	10.62
Mirigana	495	3,490	5,830	11,110	0.072	13.84
Minuwangoda	584	3,800	6,520	13,340	0.072	13.92
Negombo	919	7,050	13,700	41,640	0.072	17.22
Wattala	1,230	3,490	5,860	11,240	0.072	9.66
Weke	471	3,080	5,420	10,240	0.072	13.69
<b>KALUTARA DISTRICT</b>	3,835	15,980	27,860	63,720	0.047	12.42
Agalawatta	112	1,450	2,490	5,250	0.047	17.39
Bandaragama	379	2,110	3,440	9,750	0.047	14.49
Baruwala	402	2,020	3,480	7,480	0.047	12.95
Bulathsinhala	57	860	1,550	3,690	0.047	18.98
Dodangoda	96	950	1,710	3,990	0.047	16.80
Horana	493	2,200	3,970	9,430	0.047	13.08
Kalutara	692	2,100	3,680	7,810	0.047	10.63
Matugama	227	1,400	2,560	5,770	0.047	14.43
Panadura	1,334	2,120	3,650	7,870	0.047	7.68
Walallawita	43	770	1,330	2,680	0.046	18.79
<b>WESTERN PROVINCE</b>	93,656	346,600	546,130	1,074,500	0.140	10.70

(continued)

2. High case						
	1996	2005	2010	2020	Per Capita 2020	A.A.C.R 1996 2020
<b>COLOMBO DISTRICT</b>	77,549	286,700	457,100	877,970	0.273	10.64
Hanwella	556	7,710	12,910	28,220	0.120	17.78
Colombo	50,370	163,390	251,200	457,900	0.483	9.63
Homagama	1,270	8,560	14,170	27,360	0.120	13.65
Kaduwella	3,491	16,000	26,630	54,640	0.224	12.14
Kesbewa	2,179	10,190	17,100	34,200	0.137	12.16
Kolonnawa	1,957	10,320	17,330	33,790	0.134	12.60
Moratuwa	2,365	12,540	21,510	44,760	0.134	13.03
Nugegodo	15,361	57,990	96,250	197,100	0.271	11.12
<b>GAMPAHA DISTRICT</b>	12,272	56,950	106,710	268,200	0.087	13.71
Attanagala	704	4,220	6,870	16,420	0.087	14.02
Biyagama	1,133	3,500	6,910	16,960	0.087	11.19
Divalapitiya	338	2,320	4,610	9,570	0.087	14.95
Gampaka	1,265	6,060	12,210	35,570	0.087	14.91
Ja-Ela	1,039	4,360	8,220	18,300	0.087	12.70
Katana	1,081	6,120	12,020	33,510	0.087	15.38
Kelaniya	1,884	4,640	7,300	16,970	0.087	9.59
Mahara	1,129	3,740	6,870	15,270	0.087	11.46
Mirigana	495	3,600	6,510	13,400	0.087	14.73
Minuwangoda	584	3,940	7,280	16,090	0.087	14.82
Negombo	919	7,290	15,300	50,230	0.087	18.14
Wattala	1,230	3,600	6,560	13,560	0.087	10.52
Weke	471	3,260	6,050	12,350	0.087	14.58
<b>KALUTARA DISTRICT</b>	3,835	16,700	31,000	78,390	0.058	13.40
Agalawatta	112	1,470	2,730	6,500	0.059	18.44
Bandaragama	379	2,210	4,270	12,060	0.059	15.51
Baruwala	402	2,120	3,820	8,750	0.059	13.69
Bulathsinhala	57	900	1,700	4,560	0.059	20.03
Dodangoda	96	990	1,870	4,930	0.058	17.83
Horana	493	2,300	4,350	11,690	0.059	14.09
Kalutara	692	2,200	4,030	9,660	0.059	11.61
Matugama	227	1,470	2,810	7,150	0.059	15.46
Panadura	1,334	2,220	4,000	9,730	0.059	8.63
Walallawita	43	810	1,420	3,380	0.058	19.94
<b>WESTERN PROVINCE</b>	93,656	360,350	594,810	1,224,560	0.160	11.31

(continued)

## 3. Low case

	1996	2005	2010	2020	Per Capita 2020	A.A.C.R 1996 2020
<b>COLOMBO DISTRICT</b>	77,549	266,880	391,020	694,470	0.216	9.56
Hanwella	556	6,050	9,680	20,990	0.089	16.33
Colombo	50,370	164,670	234,610	387,780	0.409	8.88
Homagama	1,270	6,710	10,630	20,350	0.089	12.25
Kaduwella	3,491	12,330	19,260	38,190	0.157	10.48
Kesbewa	2,179	8,120	13,000	25,460	0.102	10.79
Kolonnawa	1,957	8,100	13,250	25,290	0.100	11.25
Moratuwa	2,365	9,850	16,440	33,510	0.100	11.68
Nugegodo	15,361	51,050	74,150	142,900	0.196	9.74
<b>GAMPAHA DISTRICT</b>	12,272	50,970	86,070	181,290	0.059	11.87
Attanagala	704	3,330	5,450	10,940	0.058	12.11
Biyagama	1,133	3,150	5,490	11,300	0.058	10.01
Divalapitiya	338	2,350	3,660	6,370	0.058	13.01
Gampaka	1,265	5,440	9,700	23,690	0.058	12.98
Ja-Ela	1,039	3,910	6,530	12,190	0.058	10.80
Katana	1,081	5,500	9,550	22,330	0.058	13.45
Kelaniya	1,884	4,510	7,110	13,920	0.071	8.69
Mahara	1,129	3,270	5,460	10,170	0.058	9.59
Mirigana	495	3,240	5,160	8,930	0.058	12.81
Minuwangoda	584	3,540	5,790	10,720	0.058	12.89
Negombo	919	6,560	12,160	33,470	0.058	16.16
Wattala	1,230	3,240	5,210	9,040	0.058	8.67
Weke	471	2,930	4,800	8,220	0.058	12.65
<b>KALUTARA DISTRICT</b>	3,835	15,350	25,160	53,060	0.039	11.16
Agalawatta	112	1,390	2,210	4,370	0.039	16.49
Bandaragama	379	2,030	3,450	8,110	0.039	13.61
Baruwala	402	1,940	3,100	6,220	0.039	12.09
Bulathsinhala	57	830	1,380	3,060	0.039	18.05
Dodangoda	96	910	1,520	3,320	0.039	15.90
Horana	493	2,110	3,520	7,850	0.039	12.22
Kalutara	692	2,010	3,270	6,500	0.039	9.78
Matugama	227	1,350	2,270	4,810	0.039	13.57
Panadura	1,334	2,040	3,250	6,540	0.039	6.85
Walallawita	43	740	1,190	2,280	0.039	17.99
<b>WESTERN PROVINCE</b>	93,656	333,200	502,250	929,820	0.122	10.04

### 4.5.3 Forecast of Motorcycle Ownership by DS Division

#### 1) Outline of Forecasting Method

##### (1) Forecasting Method and Procedures

The method is almost the same as the one applied to forecast of car ownership at both the CMR and District level and DS Division level.

Therefore, only ownership at the CMR and District level is examined in detail here.

##### (2) Forecasting Formula and Estimating Procedures of the Parameters in the Formula

Forecast of the motorcycle ownership at the CMR and District levels are carried out applying the following formula.

$$M_t^j = A_{1996}^j \times (1.0 + e^j \times g^j)^{t-1}$$

$M_t^j$  : Number of the Motorcycle Ownership at the CMR and/or the District j level in year t.

$A_{1996}^j$  : Number of the motorcycle ownership in 1996.

CMR : 237,047

Comombo District : 120,122

Gampaha District : 86,164

Kalutota District : 30,761

Source : University of Moratuwa, unpublished.

$e^j$  : Elasticity of the number of the motorcycle ownership to the economic growth for the CMR and District.

$g^j$  : Economic Growth Rates by CMR and District and case (Base, High and Low Cases).

However, as mentioned in the CUTS, Vol. 1 p13, it is very difficult to forecast the number of motorcycles in future. Therefore, the Study Team devised the above formula to utilize the information in CUTS report as effectively as possible, taking into consideration economic growth and motorcycle ownership and the trade-off relationship between the demand for motorcycles and car ownership.

Based on the above, the Study Team adopts the following set of elasticity ( $e^j$ ):



**Tab. 4.21 Elasticity of CMR and District Motorcycle Ownership in relation to Economic Growth**

	1996   2005	2005   2010	2010   2020
Base Case	1.40	0.96	0.70
High Case	1.30	0.75	0.55
Low Case	1.46	1.35	1.00

Elasticity is then finalized applying the following procedures:

- Procedure 1 : Calculation of elasticity implicitly implied in the CUTS forecast.
- Procedure 2 : Modification of the elasticity to fit the Study Team's economic development scenarios (the scenarios adopted in the CUTS is much different from that of the Study Team's ones).
- Procedure 3 : Forecast of motorcycle ownership at the CMR level adopting the Study Team's development scenarios.
- Procedure 4: Finalization or re-modification of elasticity by checking tentative forecasts with forecasted car ownership.

## 2) Results of Forecast.

The forecasts by District are tabulated in Tab. 4.22 and the forecasts by DS Division and economic development scenarios in Tab. 4.23.

The number of motorcycles per capita in 1996 is 0.051. It is expected to be 0.139 in the Base Case, 0.131 in the High Case and 0.153 in the Low Case in 2020.

The average annual growth rate for motorcycle ownership for the period of 1996 – 2020 in the Base Case is 6.5% / annum, lower by 1.5% / annum than that of the CUTS report (8.0%/annum, Medium case, period 1995 – 2015). Though the economic growth scenario supposed by the Study Team is set higher by about 2% / annum points than the one by the CUTS, a speedy substitution of cars for the motorcycles is surely expected as per capita income increases in future.

Tab. 4.22 Forecast of CMR Motorcycle Ownership by District

## 1. Base Case

	Number of Motorcycle				Per Capita		A.A.C.R.* <sup>2</sup>
	<sup>*1</sup> 1996	2005	2010	2020	1996	2020	1996   2020
CMR	237,047	501,400	694,090	1,061,500	0.051	0.139	6.45
Colombo District	120,122	255,620	349,020	533,100	0.060	0.166	6.41
Gompaha District	86,164	183,350	259,820	400,620	0.050	0.130	6.61
Kalutara District	30,761	62,430	85,250	127,780	0.033	0.095	6.11

## 2. High Case

	Number of Motorcycle				Per Capita		A.A.C.R.* <sup>2</sup>
	<sup>*1</sup> 1996	2005	2010	2020	1996	2020	1996   2020
CMR	237,047	508,080	684,750	1,004,380	0.051	0.131	6.20
Colombo District	120,122	258,800	344,620	505,460	0.060	0.157	6.17
Gompaha District	86,164	185,670	255,410	377,720	0.050	0.122	6.67
Kalutara District	30,761	63,610	84,710	121,200	0.033	0.090	5.88

## 3. Low Case

	Number of Motorcycle				Per Capita		A.A.C.R.* <sup>2</sup>
	<sup>*1</sup> 1996	2005	2010	2020	1996	2020	1996   2020
CMR	237,047	480,850	705,380	1,171,060	0.051	0.153	6.88
Colombo District	120,122	249,900	356,590	591,210	0.060	0.184	6.87
Gompaha District	86,164	169,340	260,210	436,220	0.050	0.141	6.99
Kalutara District	30,761	61,610	88,580	143,630	0.033	0.107	6.63

Source : Consultant's forecast

Note <sup>\*1</sup>: Source : University of Moratuwa, unpublished.

<sup>\*2</sup>: Average Annual Changing Rate (%/annum)

Tab. 4.23 Forecast of Motorcycles by Division in the CMR

## 1. Base case

	1996 *	2005	2010	2020	Per Capita 2020	A.A.C.R. 1996 - 2020
<b>Colombo District</b>	120,122	255,620	349,020	533,100	0.166	6.41
Hanwella	4,434	10,330	19,400	32,800	0.140	8.70
Colombo	53,656	107,880	144,350	207,410	0.219	5.80
Homagama	7,591	17,500	24,030	35,540	0.156	6.64
Kaduwellla	8,335	18,560	25,540	41,220	0.169	6.69
Kesbawa	9,559	20,180	27,650	42,170	0.169	6.64
Kolonnawa	5,882	13,240	23,490	35,520	0.140	7.78
Moratuwa	7,165	17,040	29,130	47,050	0.140	8.16
Nugegoda	23,500	50,890	55,430	91,390	0.126	5.82
<b>Gampaha District</b>	86,164	183,350	259,820	400,620	0.130	6.61
Attanagala	6,133	11,640	16,100	23,670	0.125	5.79
Biyagama	5,776	11,970	16,840	25,470	0.131	6.38
Divulapitiya	6,123	10,040	12,410	15,650	0.142	4.00
Gampaha	7,924	21,570	30,750	55,790	0.136	8.47
Ja-Ela	7,507	15,190	20,170	27,490	0.131	5.56
Katana	7,716	17,440	28,180	48,310	0.125	7.94
Kelaniya	5,486	10,990	17,120	24,460	0.125	6.43
Mahara	6,241	11,850	16,100	22,000	0.125	5.38
Mirigama	6,068	10,930	15,260	19,310	0.125	4.94
Minuwangoda	7,908	15,950	20,840	27,870	0.151	5.39
Negombo	6,970	22,860	35,870	72,410	0.125	10.24
Wattala	6,881	12,580	15,980	20,380	0.131	4.63
Weke	5,431	10,340	14,200	17,810	0.125	5.07
<b>Kalutara District</b>	30,761	62,430	85,250	127,780	0.095	6.11
Agalawatta	1,813	4,200	7,500	10,530	0.095	7.61
Bandaragama	4,611	10,210	11,710	19,530	0.095	6.20
Beruwala	3,648	6,980	10,500	14,980	0.095	6.06
Bulathsinghala	1,423	2,800	4,660	7,390	0.095	7.11
Dodangoda	1,368	2,980	5,150	7,990	0.095	7.63
Horana	5,531	10,360	11,930	18,900	0.095	5.25
Kalutara	4,037	8,260	11,070	15,650	0.095	5.81
Matugama	2,118	5,280	7,710	11,570	0.095	7.33
Panadura	5,161	9,110	11,000	15,760	0.095	4.76
Walallawita	1,051	2,250	4,020	5,480	0.095	7.12
<b>Western Province</b>	237,047	501,400	694,090	1,061,500	0.139	6.45

## 2. High case

Continued

	1996 *	2005	2010	2020	Per Capita 2020	A.A.C.R. 1996 - 2020
<b>Colombo District</b>	120,122	258,800	344,630	505,460	0.157	6.17
Hanwella	4,434	10,850	14,230	23,120	0.099	7.12
Colombo	53,656	107,790	134,310	184,980	0.195	5.29
Homagama	7,591	17,810	22,960	32,840	0.144	6.29
Kaduwella	8,335	18,140	23,600	36,220	0.149	6.31
Kesbawa	9,559	20,630	26,360	38,270	0.154	5.95
Kolonnawa	5,882	13,830	24,600	36,540	0.144	7.91
Moratuwa	7,165	18,000	31,170	48,410	0.144	8.29
Nugegoda	23,500	51,750	67,670	105,080	0.144	6.44
<b>Gampaha District</b>	86,164	185,670	255,410	377,720	0.122	6.67
Attanagala	6,133	11,890	16,310	23,110	0.122	5.68
Biyagama	5,776	12,270	16,400	23,890	0.123	6.09
Divulapitiya	6,123	10,140	11,380	13,470	0.122	3.34
Gampaha	7,924	21,860	29,000	50,090	0.122	7.99
Ja-Ela	7,507	14,380	19,510	25,780	0.123	5.28
Katana	7,716	17,940	28,550	47,200	0.123	7.84
Kelaniya	5,486	11,300	17,340	23,900	0.123	6.32
Mahara	6,241	12,090	16,310	21,500	0.123	5.29
Mirigama	6,068	11,190	15,460	18,870	0.123	4.84
Minuwangoda	7,908	15,940	18,860	22,660	0.122	4.48
Negombo	6,970	23,350	36,340	70,750	0.123	10.14
Wattala	6,881	12,760	15,560	19,110	0.123	4.35
Weke	5,431	10,560	14,390	17,390	0.122	4.97
<b>Kalutara District</b>	30,761	63,610	84,170	121,200	0.090	5.88
Agalawatta	1,813	4,360	7,450	9,980	0.090	7.37
Bandaragama	4,611	10,190	11,640	18,520	0.090	5.96
Beruwala	3,648	7,130	10,430	14,210	0.090	5.83
Bulathsinghala	1,423	2,920	4,630	7,010	0.090	6.87
Dodangoda	1,368	3,070	5,110	7,580	0.090	7.39
Horana	5,531	10,560	11,860	17,920	0.090	5.02
Kalutara	4,037	8,460	11,000	14,840	0.090	5.57
Matugama	2,118	5,430	7,660	10,980	0.090	7.10
Panadura	5,161	9,160	10,930	14,960	0.090	4.53
Walallawita	1,051	2,330	4,000	5,200	0.090	6.89
<b>Western Province</b>	237,047	508,080	684,750	1,004,380	0.131	6.20

## 3. Low case

Continued

	1996 *	2005	2010	2020	Per Capita 2020	A.A.C.R. 1996 - 2020
<b>Colombo District</b>	120,122	249,900	356,590	591,210	0.184	6.87
Hanwella	4,434	9,640	14,240	27,190	0.116	7.85
Colombo	53,656	109,070	151,250	235,700	0.249	6.36
Homagama	7,591	17,170	24,280	39,080	0.172	7.07
Kaduwella	8,335	17,130	24,820	43,630	0.179	7.14
Kesbewa	9,559	19,430	27,500	44,800	0.180	6.65
Kolonnawa	5,882	12,240	18,730	31,540	0.125	7.25
Moratuwa	7,165	15,690	23,630	41,790	0.125	7.62
Nugcgoda	23,500	49,530	72,140	127,480	0.175	7.30
<b>Gampaha District</b>	86,164	169,340	260,210	436,220	0.141	6.99
Attanagala	6,133	10,690	15,860	25,530	0.135	6.12
Biyagama	5,776	11,300	17,780	29,050	0.149	6.96
Divulpitiya	6,123	9,250	13,090	17,970	0.163	4.59
Gampaha	7,924	20,270	32,740	61,440	0.150	8.91
Ja-Ela	7,507	14,050	21,150	31,620	0.150	6.17
Katana	7,716	15,930	25,400	48,720	0.126	7.98
Kelaniya	5,486	10,020	15,300	24,300	0.125	6.40
Mahara	6,241	10,900	16,220	24,170	0.138	5.80
Mirigama	6,068	10,090	14,670	21,400	0.139	5.39
Minuwangoda	7,908	14,700	21,480	30,810	0.167	5.83
Negombo	6,970	20,980	35,320	78,090	0.135	10.59
Wattala	6,881	11,770	17,220	23,920	0.153	5.33
Weke	5,431	9,390	13,980	19,200	0.135	5.40
<b>Kalutara District</b>	30,761	61,610	88,580	143,630	0.107	6.63
Agalawatta	1,813	4,060	7,650	11,620	0.105	8.05
Bandaragama	4,611	10,110	12,890	23,070	0.112	6.94
Beruwala	3,648	6,870	10,720	16,530	0.105	6.50
Bulathsinghala	1,423	2,790	4,760	8,160	0.105	7.55
Dodangoda	1,368	2,800	5,250	8,830	0.105	8.08
Horana	5,531	10,360	12,820	21,910	0.110	5.90
Kalutara	4,037	8,200	11,300	17,270	0.105	6.24
Matugama	2,118	5,190	7,860	12,780	0.105	7.78
Panadura	5,161	9,070	11,230	17,410	0.105	5.20
Walallawita	1,051	2,160	4,100	6,050	0.105	7.57
<b>Western Province</b>	237,047	480,850	705,380	1,171,060	0.153	6.88

#### 4.5.4 Forecast of Bus Ownership by DS Division

##### 1) Outline of Forecasting Method

Bus ownership was not forecasted in CUTS. The only the data for the Study Team's forecast is the forecasts of bus trips by economic development scenario for the CMR contained in CUTS. The Study Team assumes that the following factors, which are essential for forecasting, are reflected in the CUTS bus trip forecast:

- The forecast for all passenger trips in the CMR in the future and
- The consideration of future modal split taking into account bus, motorcycle, van, and 3-wheeler modes of transport.

##### (1) Forecasting Formula and Parameter.

Using the CUTS data and her economic development scenarios, the Study Team applied the following formula for forecasting bus ownership in the CMR and the CMR's Districts and DS Divisions:

$$B_t = B_{1996} \times (1.0 + e \times g)^{t-1}$$

$B_t$  : Number of Buses in the CMR, Districts and/or DS Divisions in year t.

$B_{1996}$  : Number of Buses in the CMR, Districts and/or DS Division in 1996.

(Source: University of Moratuwa, unpublished).

$e$  : Parameter; Elasticity of number of bus trips to the economic growth determined by the economic development scenarios.

$g$  : Economic growth rates by District provided by the Study Team.

In Tab. 4.24, the elasticity of bus trip in relation to economic growth is shown and is applied in the Study Team's forecast hereinafter.

Tab. 4.24 Elasticity of Bus Trips in Relation to Economic Growth

	1996   2010	2010   2020
Bus case	0.386	0.209
High Case	0.386	0.087
Low Case	0.386	0.410

The basic data used for estimating elasticity are as follows:

• Bus trips (1000)

1996	2000	2015	
2,600.7	2,824.1	Low Case	: 3,390.3
		Medium case	: 3,230.1
		High Case	: 3,034.9

• Assumed economic growth rates in the CUTS (%/annum)

1995	2000	
2000	2015	
4.3	Low Case	: 3.0
	Medium case	: 4.3
	High Case	: 5.5

Source: CUTS, Vol. 1, p18 and 20

## (2) Forecasting Procedures

Procedure 1 : Forecast of Bus Ownership at District level, using the forecasting formula and the District economic growth rates shown above. The elasticity is shown in Tab. 4.23. The forecast works a control totals over the DS Division forecasting.

Procedure 2: Forecast of Division bus ownership, using the same formula, economic growth rates and elasticity as the ones applied in Procedure 1, and the number of Bus Ownership by DS Division in 1996.

Procedure 3: Adjustment of Division forecasts (output of the Procedure 2) using District control totals.

## 2) Results of Forecast

Forecasts by District is tabulated in Tab. 4.25 and the forecasts by DS Division in Tab. 4.26.

Tab. 4.25 Forecast of Number of Bus by District in the CMR

## 1. Base Case

	Number of Bus				A.A.C.R.* <sup>2</sup>
	<sup>*1</sup> 1996	2005	2010	2020	1996   2020
CMR	10,872	13,430	15,340	17,450	1.99
Colombo District	6,599	8,160	9,290	10,570	1.98
Gompaha District	3,055	3,780	4,350	4,960	2.04
Kalutara District	1,218	1,490	1,700	1,920	1.91

## 2. High Case

	Number of Bus				A.A.C.R.* <sup>2</sup>
	<sup>*1</sup> 1996	2005	2010	2020	1996   2020
CMR	10,872	13,710	16,010	17,030	1.89
Colombo District	6,599	8,330	9,700	10,320	1.88
Gompaha District	3,055	3,860	4,540	4,830	1.93
Kalutara District	1,218	1,520	1,770	1,880	1.82

## 3. Low Case

	Number of Bus				A.A.C.R.* <sup>2</sup>
	<sup>*1</sup> 1996	2005	2010	2020	1996   2020
CMR	10,872	13,140	14,720	18,180	2.17
Colombo District	6,599	8,000	8,920	11,010	2.16
Gompaha District	3,055	3,670	4,160	5,160	2.21
Kalutara District	1,218	1,470	1,640	2,010	2.11

Source : Consultant's forecast

Note \*<sup>1</sup>: Source : University of Moratuwa, unpublished.

\*<sup>2</sup>: Average Annual Growth rate (%/annum)



Tab. 4.26 Forecast of Number of Bus Ownership by DS Division

## 1. Base Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>6,599</b>	<b>8,160</b>	<b>9,290</b>	<b>10,570</b>
Hanwella	425	530	600	680
Colombo	2,446	3,020	3,440	3,920
Homagama	352	440	500	560
Kaduwellla	491	610	690	790
Kesbewa	653	810	920	1,050
Kolonnawa	439	540	620	700
Moratuwa	313	390	440	500
Nugegoda	1,480	1,830	2,080	2,370
<b>Gampaha District</b>	<b>3,055</b>	<b>3,780</b>	<b>4,350</b>	<b>4,960</b>
Attanagala	18	20	30	30
Biyagama	345	430	490	560
Divulapitiya	199	250	280	320
Gampaha	345	430	490	560
Ja-Ela	297	370	420	480
Katana	206	250	290	330
Kelaniya	215	270	310	350
Mahara	573	710	820	930
Mirigama	155	190	220	250
Minuwangoda	206	250	290	330
Negombo	87	110	120	140
Wattala	233	290	330	380
Weke	176	220	250	290
<b>Kalutara District</b>	<b>1,218</b>	<b>1,490</b>	<b>1,700</b>	<b>1,920</b>
Agalawatta	34	40	50	50
Bandaragama	181	220	250	290
Beruwala	98	120	140	150
Bulathsinghala	46	60	60	70
Dodangoda	64	80	90	100
Horana	149	180	210	240
Kalutara	235	290	330	370
Matugama	92	110	130	150
Panadura	283	350	390	450
Walallawita	36	40	50	60
<b>Western Province</b>	<b>10,872</b>	<b>13,430</b>	<b>15,340</b>	<b>17,450</b>

## 2. High Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>6,599</b>	<b>8,330</b>	<b>9,700</b>	<b>10,320</b>
Hanwella	425	540	620	660
Colombo	2,446	3,090	3,600	3,830
Homagama	352	440	520	550
Kaduwellla	491	620	720	770
Kesbewa	653	820	960	1,020
Kolonnawa	439	550	650	690
Moratuwa	313	400	460	490
Nugegoda	1,480	1,870	2,180	2,310
<b>Gampaha District</b>	<b>3,055</b>	<b>3,860</b>	<b>4,540</b>	<b>4,830</b>
Attanagala	18	20	30	30
Biyagama	345	440	510	550
Divulapitiya	199	250	300	310
Gampaha	345	440	510	550
Ja-Ela	297	370	440	470
Katana	206	260	310	330
Kelaniya	215	270	320	340
Mahara	573	720	850	910
Mirigama	155	200	230	250
Minuwangoda	206	260	310	330
Negombo	87	110	130	140
Wattala	233	290	350	370
Weke	176	220	260	280
<b>Kalutara District</b>	<b>1,218</b>	<b>1,520</b>	<b>1,770</b>	<b>1,880</b>
Agalawatta	34	40	50	50
Bandaragama	181	230	260	280
Beruwala	98	120	140	150
Bulathsinghala	46	60	70	70
Dodangoda	64	80	90	100
Horana	149	190	220	230
Kalutara	235	290	340	360
Matugama	92	110	130	140
Panadura	283	350	410	440
Walallawita	36	40	50	60
<b>Western Province</b>	<b>10,872</b>	<b>13,710</b>	<b>16,010</b>	<b>17,030</b>

## 3. Low Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>6,599</b>	<b>8,000</b>	<b>8,920</b>	<b>11,010</b>
Hanwella	425	520	570	710
Colombo	2,446	2,970	3,310	4,080
Homagama	352	430	480	590
Kaduwella	491	600	660	820
Kesbawa	653	790	880	1,090
Kolonnawa	439	530	590	730
Moratuwa	313	380	420	520
Nugegoda	1,480	1,790	2,000	2,470
<b>Gampaha District</b>	<b>3,055</b>	<b>3,670</b>	<b>4,160</b>	<b>5,160</b>
Attanagala	18	20	20	30
Biyagama	345	410	470	580
Divulapitiya	199	240	270	340
Gampaha	345	410	470	580
Ja-Ela	297	360	400	500
Katana	206	250	280	350
Kelaniya	215	260	290	360
Mahara	573	690	780	970
Mirigama	155	190	210	260
Minuwangoda	206	250	280	350
Negombo	87	100	120	150
Wattala	233	280	320	390
Weke	176	210	240	300
<b>Kalutara District</b>	<b>1,218</b>	<b>1,470</b>	<b>1,640</b>	<b>2,010</b>
Agalawatta	34	40	50	60
Bandaragama	181	220	240	300
Beruwala	98	120	130	160
Bulathsinghala	46	60	60	80
Dodangoda	64	80	90	110
Horana	149	180	200	250
Kalutara	235	280	320	390
Matugama	92	110	120	150
Panadura	283	340	380	470
Walallawita	36	40	50	60
<b>Western Province</b>	<b>10,872</b>	<b>13,140</b>	<b>14,720</b>	<b>18,180</b>

#### 4.5.5 Forecast of Van Ownership by DS Division

##### 1) Outline of Forecasting Method

The forecasting methodology and assumptions are the same as those for buses.

The forecasting formula is as follows:

$$V_t = V_{1996} \times (1.0 + e.g)^{t-1}$$

- $V_t$  : Van Ownership in the CMR, Districts and/or DS Divisions in year t.  
 $V_{1996}$  : Vans Ownership in the CMR, District and/or DS Divisions in 1996. (Source: University of Moratuwa, unpublished)  
 e : Parameter, Elasticity of number of van trips in relation to the economic growth determined by economic development scenario.  
 g : Economic growth rates by District provided by the Study Team.

In Tab. 4.27, the elasticity of van trips in relation to economic growth is shown and is applied to the Study Team's forecast hereinafter..

**Tab. 4.27 Elasticity of Van Trips in Relation to Economic Growth**

	1996   2010	2010   2020
Base Case	0.372	0.335
High Case	0.372	0.238
Low Case	0.372	0.335

The basic data used for estimation of the elasticity are as follows:

- Van trips (1000), including 3-Wheeler trips.

1996	2000	2015	
368.1	398.7	Low Case	: 494.0
		Medium case	: 494.0
		High Case	: 485.0

- The economic growth rates in the CUTS (same as Bus case)

## 2) Results of Forecast.

Forecasts by District are tabulated in Tab. 4.28 and those by DS Division in Tab. 4.29.

**Tab. 4.28 Forecast of Van Ownership by District in the CMR**

### 1. Base Case

	Number of Vans				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	74,014	90,810	103,130	126,680	2.26
Colombo District	54,055	66,370	75,200	92,360	2.26
Gompaha District	14,808	18,180	20,830	25,660	2.32
Kalutara District	5,151	6,260	7,100	8,660	2.19

### 2. High Case

	Number of Vans				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	74,014	92,610	107,470	127,070	2.28
Colombo District	54,055	67,680	78,370	92,670	2.27
Gompaha District	14,808	18,540	21,700	25,720	2.33
Kalutara District	5,151	6,390	7,400	8,680	2.20

### 3. Low Case

	Number of Vans				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	74,014	88,890	99,080	117,800	1.96
Colombo District	54,055	65,080	72,270	85,900	1.95
Gompaha District	14,808	17,650	19,960	23,810	2.00
Kalutara District	5,151	6,160	6,850	8,090	1.90

Source : Consultant's forecast

Note \* 1: Source : University of Moratuwa, unpublished.

\*2: Average Annual changing rate (%/annum)

Tab. 4.29 Forecast of Van Ownership by DS Division

## 1. Base Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>54,055</b>	<b>66,370</b>	<b>75,200</b>	<b>92,360</b>
Hanwella	698	860	970	1,190
Colombo	32,180	39,510	44,770	54,980
Homagama	1,361	1,670	1,890	2,330
Kaduwellla	2,447	3,000	3,400	4,180
Kesbawa	2,302	2,830	3,200	3,930
Kolonnawa	1,235	1,520	1,720	2,110
Moratuwa	2,723	3,340	3,790	4,650
Nugegoda	11,109	13,640	15,450	18,980
<b>Gampaha District</b>	<b>14,808</b>	<b>18,180</b>	<b>20,830</b>	<b>25,660</b>
Attanagala	1,016	1,250	1,430	1,760
Biyagama	1,195	1,470	1,680	2,070
Divulapitiya	544	670	770	940
Gampaha	1,063	1,310	1,490	1,840
Ja-Ela	1,473	1,810	2,070	2,550
Katana	1,860	2,280	2,620	3,220
Kelaniya	1,659	2,040	2,330	2,880
Mahara	1,055	1,300	1,480	1,830
Mirigama	550	680	770	950
Minuwangoda	693	850	970	1,200
Negombo	1,578	1,940	2,220	2,730
Wattala	1,698	2,080	2,390	2,940
Weke	424	520	600	730
<b>Kalutara District</b>	<b>5,151</b>	<b>6,260</b>	<b>7,100</b>	<b>8,660</b>
Agalawatta	132	160	180	220
Bandaragama	449	550	620	750
Beruwala	944	1,150	1,300	1,590
Bulathsinghala	105	130	140	180
Dodangoda	129	160	180	220
Horana	730	890	1,010	1,230
Kalutara	946	1,150	1,300	1,590
Matugama	251	310	350	420
Panadura	1,413	1,720	1,950	2,380
Walallawita	52	60	70	90
<b>Western Province</b>	<b>74,014</b>	<b>90,810</b>	<b>103,130</b>	<b>126,680</b>

## 2. High Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>54,055</b>	<b>67,680</b>	<b>78,370</b>	<b>92,670</b>
Hanwella	698	870	1,010	1,200
Colombo	32,180	40,290	46,660	55,170
Homagama	1,361	1,700	1,970	2,330
Kaduwellla	2,447	3,060	3,550	4,200
Kesbawa	2,302	2,880	3,340	3,950
Kolonnawa	1,235	1,550	1,790	2,120
Moratuwa	2,723	3,410	3,950	4,670
Nugegoda	11,109	13,910	16,110	19,040
<b>Gampaha District</b>	<b>14,808</b>	<b>18,540</b>	<b>21,700</b>	<b>25,720</b>
Attanagala	1,016	1,270	1,490	1,760
Biyagama	1,195	1,500	1,750	2,080
Divulapitiya	544	680	800	940
Gampaha	1,063	1,330	1,560	1,850
Ja-Ela	1,473	1,840	2,160	2,560
Katana	1,860	2,330	2,730	3,230
Kelaniya	1,659	2,080	2,430	2,880
Mahara	1,055	1,320	1,550	1,830
Mirigama	550	690	810	960
Minuwangoda	693	870	1,020	1,200
Negombo	1,578	1,980	2,310	2,740
Wattala	1,698	2,130	2,490	2,950
Weke	424	530	620	740
<b>Kalutara District</b>	<b>5,151</b>	<b>6,390</b>	<b>7,400</b>	<b>8,680</b>
Agalawatta	132	160	190	220
Bandaragama	449	560	640	760
Beruwala	944	1,170	1,360	1,590
Bulathsinghala	105	130	150	180
Dodangoda	129	160	190	220
Horana	730	910	1,050	1,230
Kalutara	946	1,170	1,360	1,590
Matugama	251	310	360	420
Panadura	1,413	1,750	2,030	2,380
Walallawita	52	60	70	90
<b>Western Province</b>	<b>74,014</b>	<b>92,610</b>	<b>107,470</b>	<b>127,070</b>

## 3. Low Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>54,055</b>	<b>65,080</b>	<b>72,270</b>	<b>85,900</b>
Hanwella	698	840	930	1,110
Colombo	32,180	38,740	43,020	51,140
Homagama	1,361	1,640	1,820	2,160
Kaduwellla	2,447	2,950	3,270	3,890
Kesbawa	2,302	2,770	3,080	3,660
Kolonnawa	1,235	1,490	1,650	1,960
Moratuwa	2,723	3,280	3,640	4,330
Nugegoda	11,109	13,370	14,850	17,650
<b>Gampaha District</b>	<b>14,808</b>	<b>17,650</b>	<b>19,960</b>	<b>23,810</b>
Attanagala	1,016	1,210	1,370	1,630
Biyagama	1,195	1,420	1,610	1,920
Divulapitiya	544	650	730	870
Gampaha	1,063	1,270	1,430	1,710
Ja-Ela	1,473	1,760	1,990	2,370
Katana	1,860	2,220	2,510	2,990
Kelaniya	1,659	1,980	2,240	2,670
Mahara	1,055	1,260	1,420	1,700
Mirigama	550	660	740	880
Minuwangoda	693	830	930	1,110
Negombo	1,578	1,880	2,130	2,540
Wattala	1,698	2,020	2,290	2,730
Weke	424	510	570	680
<b>Kalutara District</b>	<b>5,151</b>	<b>6,160</b>	<b>6,850</b>	<b>8,090</b>
Agalawatta	132	160	180	210
Bandaragama	449	540	600	710
Beruwala	944	1,130	1,260	1,480
Bulathsinghala	105	130	140	160
Dodangoda	129	150	170	200
Horana	730	870	970	1,150
Kalutara	946	1,130	1,260	1,490
Matugama	251	300	330	390
Panadura	1,413	1,690	1,880	2,220
Walallawita	52	60	70	80
<b>Western Province</b>	<b>74,014</b>	<b>88,890</b>	<b>99,080</b>	<b>117,800</b>



#### 4.5.6 Forecast of 3-Wheeler Ownership by District

##### 1) Outline of Forecasting Method

The forecasting methodology and assumptions are the same as those for van and bus. Moreover, 3-wheelers trip elasticity in relation to economic growth is identical with that for the van, since the 3-wheeler trips are included with van trips (see Tab. 4.27). Therefore, only the number of 3-wheelers by District and/or Division in 1996 is different from vans.

##### 2) Results of Forecast

Forecast by District is tabulated in Tab. 4.30 and forecasts by DS Division in Tab. 4.31.

**Tab. 4.30 Forecast of Number of 3-Wheelers by District in the CMR**

##### 1. Base Case

	Number of 3-Wheelers				A.A.C.R*2
	<sup>*1</sup> 1996	2005	2010	2020	1996   2020
CMR	32,841	40,290	45,770	56,240	2.27
Colombo District	21,262	26,110	29,580	36,330	2.26
Gompaha District	8,571	10,520	12,050	14,850	2.32
Kalutara District	3,008	3,660	4,140	5,060	2.19

##### 2. High Case

	Number of 3-Wheelers				A.A.C.R*2
	<sup>*1</sup> 1996	2005	2010	2020	1996   2020
CMR	32,841	41,080	47,710	56,410	2.28
Colombo District	21,262	26,620	30,830	36,450	2.27
Gompaha District	8,571	10,730	12,560	14,890	2.33
Kalutara District	3,008	3,730	4,320	5,070	2.20

(continued)

## 3. Low Case

	Number of 3-Wheelers				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	32,841	39,420	43,990	52,300	1.96
Colombo District	21,262	25,600	28,430	33,790	1.95
Gompaha District	8,571	10,220	11,560	13,780	2.00
Kalutara District	3,008	3,600	4,000	4,730	1.90

Source : Consultant's forecast

Note \* 1: Source : University of Moratuwa, unpublished.

\* 2: Average Annual Changing rate (%/annum)

Tab. 4.31 Forecast of 3-Wheeler Ownership by DS Division

## 1. Base Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>21,262</b>	<b>26,110</b>	<b>29,580</b>	<b>36,330</b>
Hanwella	456	560	630	780
Colombo	12,143	14,910	16,890	20,750
Homagama	779	960	1,080	1,330
Kaduwella	1,161	1,430	1,620	1,980
Kesbewa	1,021	1,250	1,420	1,740
Kolonnawa	742	910	1,030	1,270
Moratuwa	967	1,190	1,350	1,650
Nugegoda	3,993	4,900	5,560	6,820
<b>Gampaha District</b>	<b>8,571</b>	<b>10,520</b>	<b>12,050</b>	<b>14,850</b>
Attanagala	570	700	800	990
Biyagama	624	770	880	1,080
Divulapitiya	564	690	790	980
Gampaha	763	940	1,070	1,320
Ja-Ela	795	980	1,120	1,380
Katana	791	970	1,110	1,370
Kelaniya	725	890	1,020	1,260
Mahara	651	800	920	1,130
Mirigama	538	660	760	930
Minuwangoda	665	820	940	1,150
Negombo	679	830	950	1,180
Wattala	741	910	1,040	1,280
Weke	465	570	650	810
<b>Kalutara District</b>	<b>3,008</b>	<b>3,660</b>	<b>4,140</b>	<b>5,060</b>
Agalawatta	153	190	210	260
Bandaragama	401	490	550	670
Beruwala	364	440	500	610
Bulathsinghala	125	150	170	210
Dodangoda	125	150	170	210
Horana	519	630	710	870
Kalutara	426	520	590	720
Matugama	201	240	280	340
Panadura	609	740	840	1,020
Walallawita	85	100	120	140
<b>Western Province</b>	<b>32,841</b>	<b>40,290</b>	<b>45,770</b>	<b>56,240</b>

## 2. High Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>21,262</b>	<b>26,620</b>	<b>30,830</b>	<b>36,450</b>
Hanwella	456	570	660	780
Colombo	12,143	15,200	17,610	20,820
Homagama	779	980	1,130	1,340
Kaduwellla	1,161	1,450	1,680	1,990
Kesbawa	1,021	1,280	1,480	1,750
Kolonnawa	742	930	1,080	1,270
Moratuwa	967	1,210	1,400	1,660
Nugegoda	3,993	5,000	5,790	6,850
<b>Gampaha District</b>	<b>8,571</b>	<b>10,730</b>	<b>12,560</b>	<b>14,890</b>
Attanagala	570	710	840	990
Biyagama	624	780	910	1,080
Divulapitiya	564	710	830	980
Gampaha	763	960	1,120	1,330
Ja-Ela	795	1,000	1,170	1,380
Katana	791	990	1,160	1,370
Kelaniya	725	910	1,060	1,260
Mahara	651	820	950	1,130
Mirigama	538	670	790	930
Minuwangoda	665	830	970	1,160
Negombo	679	850	1,000	1,180
Wattala	741	930	1,090	1,290
Weke	465	580	680	810
<b>Kalutara District</b>	<b>3,008</b>	<b>3,730</b>	<b>4,320</b>	<b>5,070</b>
Agalawatta	153	190	220	260
Bandaragama	401	500	580	680
Beruwala	364	450	520	610
Bulathsinghala	125	150	180	210
Dodangoda	125	150	180	210
Horana	519	640	750	870
Kalutara	426	530	610	720
Matugama	201	250	290	340
Panadura	609	760	870	1,030
Walallawita	85	110	120	140
<b>Western Province</b>	<b>32,841</b>	<b>41,080</b>	<b>47,710</b>	<b>56,410</b>

## 3. Low Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>21,262</b>	<b>25,600</b>	<b>28,430</b>	<b>33,790</b>
Hanwella	456	550	610	720
Colombo	12,143	14,620	16,240	19,300
Homagama	779	940	1,040	1,240
Kaduwellla	1,161	1,400	1,550	1,850
Kesbewa	1,021	1,230	1,370	1,620
Kolonnawa	742	890	990	1,180
Moratuwa	967	1,160	1,290	1,540
Nugegoda	3,993	4,810	5,340	6,350
<b>Gampaha District</b>	<b>8,571</b>	<b>10,220</b>	<b>11,560</b>	<b>13,780</b>
Attanagala	570	680	770	920
Biyagama	624	740	840	1,000
Divulapitiya	564	670	760	910
Gampaha	763	910	1,030	1,230
Ja-Ella	795	950	1,070	1,280
Katana	791	940	1,070	1,270
Kelaniya	725	860	980	1,170
Mahara	651	780	880	1,050
Mirigama	538	640	730	860
Minuwangoda	665	790	900	1,070
Negombo	679	810	920	1,090
Wattala	741	880	1,000	1,190
Weke	465	550	630	750
<b>Kalutara District</b>	<b>3,008</b>	<b>3,600</b>	<b>4,000</b>	<b>4,730</b>
Agalawatta	153	180	200	240
Bandaragama	401	480	530	630
Beruwala	364	440	480	570
Bulathsinghala	125	150	170	200
Dodangoda	125	150	170	200
Horana	519	620	690	820
Kalutara	426	510	570	670
Matugama	201	240	270	320
Panadura	609	730	810	960
Walallawita	85	100	110	130
<b>Western Province</b>	<b>32,841</b>	<b>39,420</b>	<b>43,990</b>	<b>52,300</b>

#### 4.5.7 Forecast of Number of Lorries (Freight vehicle)

##### 1) Outline of Forecasting Method

In order to forecast lorry ownership, the Study Team decided to adopt the equation below. This equation uses the strong relationship between GDP (a proxy for cargo volume to be transported) and the number of lorries (The forecasting method described in CUTS was not considered, since its estimates varied greatly from actual figures.):

$$L_t = L_{1996} \times (1.0 + e \times g)^{t-1996}$$

$L_t$  : Number of Lorries in the CMR, Districts and/or DS Divisions in year t.

$L_{1996}$  : Number of Lorries in the CMR, District and/or DS Divisions in 1996.

(Source: University of Moratuwa, unpublished)

$e$  : Parameter, Elasticity of lorry ownership in relation to economic growth.

$g$  : Economic growth rates by District provided the Study Team.

The following elasticity is applied for the forecast:

$$e = 0.525$$

The elasticity is estimated on the following actual data. The elasticity is expected to change in the future due to changes in the composition of cargo and unit volume caused by a leveling up in the industrial structure in the future. This change is not reflected in this study.

The basic data used for the estimation is as follows.

	<u>No of Lorries</u> <sup>*1</sup>	<u>GDP</u> <sup>*2</sup>
1985	92,730	109,570
1994	116,284	159,269

Note \*1: Source : CUTS, WP5, p54

\*2: Source: Central Bank's Statistics, Millions in Rs,1982 constant prices.

The forecasting procedures are just same as the one in case of van.

## 2) Results of Forecast

Forecasts by District are tabulated in Tab. 4.32 and those by DS Division in 4.33.

**Tab. 4.32 Forecast of Lorry Ownership by District in the CMR**

### 1. Base Case

	Number of Lorries				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	18,614	24,810	29,660	40,870	3.33
Colombo District	13,213	17,630	21,010	28,940	3.32
Gompaha District	3,992	5,330	6,440	8,920	3.41
Kalutara District	1,409	1,850	2,210	3,010	2.14

### 2. High Case

	Number of Lorries				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	18,614	25,500	31,430	45,300	3.78
Colombo District	13,213	18,120	22,260	32,090	3.77
Gompaha District	3,992	5,470	6,830	9,890	3.85
Kalutara District	1,409	1,910	2,340	3,320	3.34

### 3. Low Case

	Number of Lorries				A.A.C.R.*2
	*1 1996	2005	2010	2020	1996   2020
CMR	18,614	24,070	28,050	36,740	2.87
Colombo District	13,213	17,150	19,870	26,020	2.86
Gompaha District	3,992	5,110	6,070	7,990	2.93
Kalutara District	1,409	1,810	2,110	2,730	2.79

Source : Consultant's forecast

Note \* 1: Source : University of Moratuwa, unpublished.

\* 2: Average Annual Changing rate (%/annum)

Tab. 4.33 Forecast of Lorry Ownership by DS Division

## 1. Base Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>13,213</b>	<b>17,630</b>	<b>21,010</b>	<b>28,940</b>
Hanwella	284	380	450	620
Colombo	8,801	11,740	13,990	19,280
Homagama	408	540	650	890
Kaduwellla	649	870	1,030	1,420
Kesbewa	257	340	410	560
Kolonnawa	479	640	760	1,050
Moratuwa	588	780	930	1,290
Nugegoda	1,747	2,330	2,780	3,830
<b>Gampaha District</b>	<b>3,992</b>	<b>5,330</b>	<b>6,440</b>	<b>8,920</b>
Attanagala	214	290	350	480
Biyagama	335	450	540	750
Divulapitiya	282	380	460	630
Gampaha	309	410	500	690
Ja-Ela	322	430	520	720
Katana	367	490	590	820
Kelaniya	483	640	780	1,080
Mahara	314	420	510	700
Mirigama	212	280	340	470
Minuwangoda	239	320	390	530
Negombo	300	400	480	670
Wattala	445	590	720	990
Weke	170	230	270	380
<b>Kalutara District</b>	<b>1,409</b>	<b>1,850</b>	<b>2,210</b>	<b>3,010</b>
Agalawatta	63	80	100	130
Bandaragama	160	210	250	340
Beruwala	146	190	230	310
Bulathsinghala	67	90	110	140
Dodangoda	68	90	110	150
Horana	294	390	460	630
Kalutara	189	250	300	400
Matugama	85	110	130	180
Panadura	311	410	490	670
Walallawita	26	30	40	60
<b>Western Province</b>	<b>18,614</b>	<b>24,810</b>	<b>29,660</b>	<b>40,870</b>



## 2. High Case

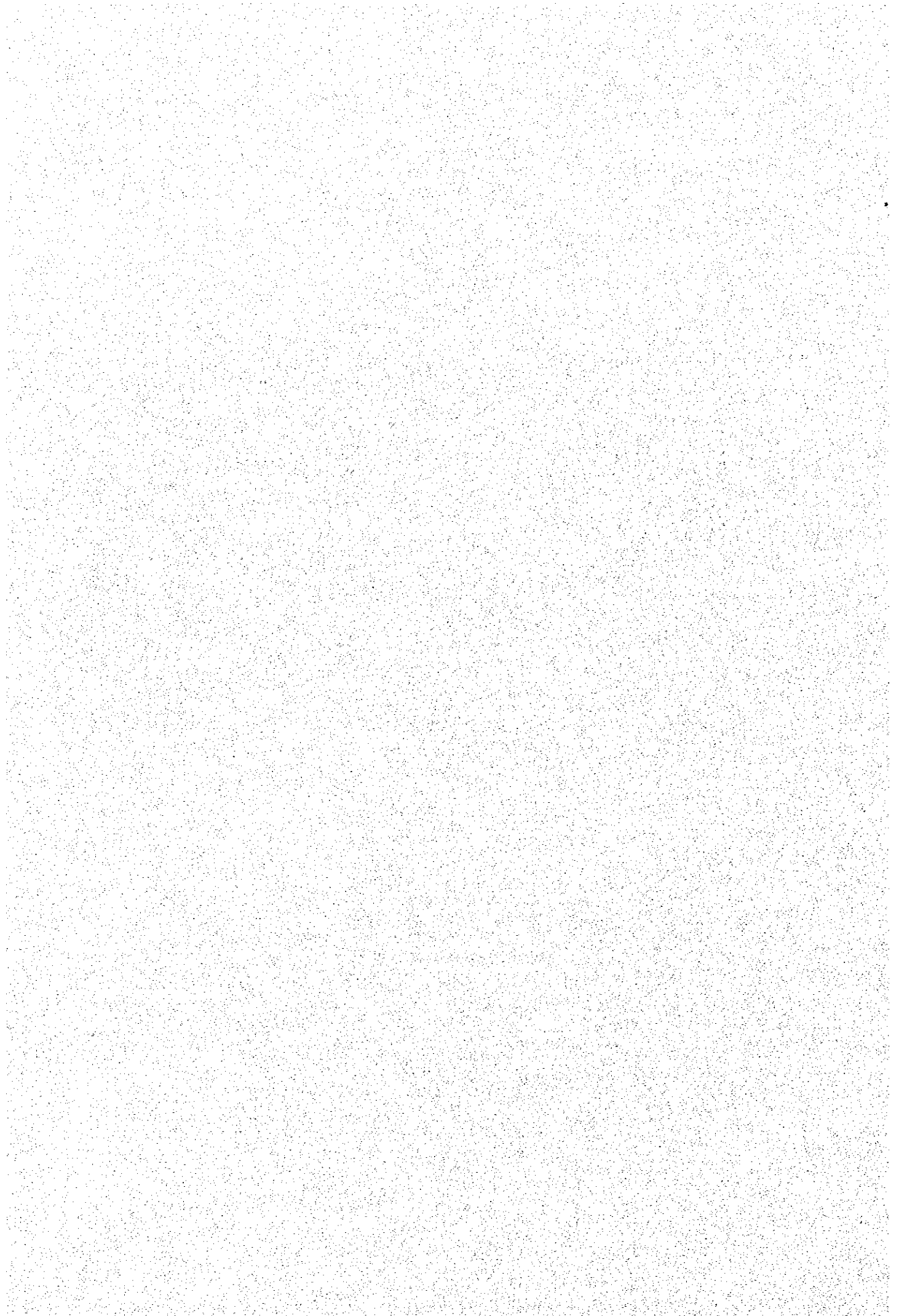
	1996	2005	2010	2020
<b>Colombo District</b>	<b>13,213</b>	<b>18,120</b>	<b>22,260</b>	<b>32,090</b>
Hanwella	284	390	480	690
Colombo	8,801	12,070	14,830	21,370
Homagama	408	560	690	990
Kaduwella	649	890	1,090	1,580
Kesbewa	257	350	430	620
Kolonnawa	479	660	810	1,160
Moratuwa	588	810	990	1,430
Nugegoda	1,747	2,400	2,940	4,240
<b>Gampaha District</b>	<b>3,992</b>	<b>5,470</b>	<b>6,830</b>	<b>9,890</b>
Attanagala	214	290	370	530
Biyagama	335	460	570	830
Divulapitiya	282	390	480	700
Gampaha	309	420	530	770
Ja-Ela	322	440	550	800
Katana	367	500	630	910
Kelaniya	483	660	830	1,200
Mahara	314	430	540	780
Mirigama	212	290	360	530
Minuwangoda	239	330	410	590
Negombo	300	410	510	740
Wattala	445	610	760	1,100
Weke	170	230	290	420
<b>Kalutara District</b>	<b>1,409</b>	<b>1,910</b>	<b>2,340</b>	<b>3,320</b>
Agalawatta	63	90	100	150
Bandaragama	160	220	270	380
Beruwala	146	200	240	340
Bulathsinghala	67	90	110	160
Dodangoda	68	90	110	160
Horana	294	400	490	690
Kalutara	189	260	310	450
Matugama	85	110	140	200
Panadura	311	420	520	730
Walallawita	26	40	40	60
<b>Western Province</b>	<b>18,614</b>	<b>25,500</b>	<b>31,430</b>	<b>45,300</b>

## 3. Low Case

	1996	2005	2010	2020
<b>Colombo District</b>	<b>13,213</b>	<b>17,150</b>	<b>19,870</b>	<b>26,020</b>
Hanwella	284	370	430	560
Colombo	8,801	11,420	13,240	17,330
Homagama	408	530	610	800
Kaduwella	649	840	980	1,280
Kesbewa	257	330	390	510
Kolonnawa	479	620	720	940
Moratuwa	588	760	880	1,160
Nugegoda	1,747	2,270	2,630	3,440
<b>Gampaha District</b>	<b>3,992</b>	<b>5,110</b>	<b>6,070</b>	<b>7,990</b>
Altanagala	214	270	330	430
Biyagama	335	430	510	670
Divulapitiya	282	360	430	560
Gampaha	309	400	470	620
Ja-Ela	322	410	490	640
Katana	367	470	560	730
Kelaniya	483	620	740	970
Mahara	314	400	480	630
Mirigama	212	270	320	420
Minuwangoda	239	310	360	480
Negombo	300	380	460	600
Waltala	445	570	680	890
Weke	170	220	260	340
<b>Kalutara District</b>	<b>1,409</b>	<b>1,810</b>	<b>2,110</b>	<b>2,730</b>
Agalawatta	63	80	90	120
Bandaragama	160	210	240	310
Beruwala	146	190	220	280
Bulathsinghala	67	90	100	130
Dodangoda	68	90	100	130
Horana	294	380	440	570
Kalutara	189	240	280	370
Matugama	85	110	130	160
Panadura	311	400	460	600
Walallawita	26	30	40	50
<b>Western Province</b>	<b>18,614</b>	<b>24,070</b>	<b>28,050</b>	<b>36,740</b>

# **CHAPTER 5**

## **TRAFFIC DEMAND**



## CHAPTER 5 TRAFFIC DEMAND

### 5.1 Objective

The main objective of this chapter is to calculate future traffic flows via the construction of a traffic demand model for the Outer Circular Highway (OCH) using existing traffic and socio-economic data, as well as information and data collected from a traffic survey executed by the Study Team. Indices such as travel time and vehicle-kilometers, which are determined by the traffic demand model, are then used to evaluate the OCH and its impact on the Colombo Metropolitan Region (CMR) for the target years of 2010 and 2020.

### 5.2 Overall Workflow

The overall workflow for estimating traffic demand is shown in Fig. 5.1. The three items that are representative of the work performed are traffic survey execution, traffic demand model construction, and future traffic demand forecasting. Each of these is taken up respectively in the sections that follow in this chapter.

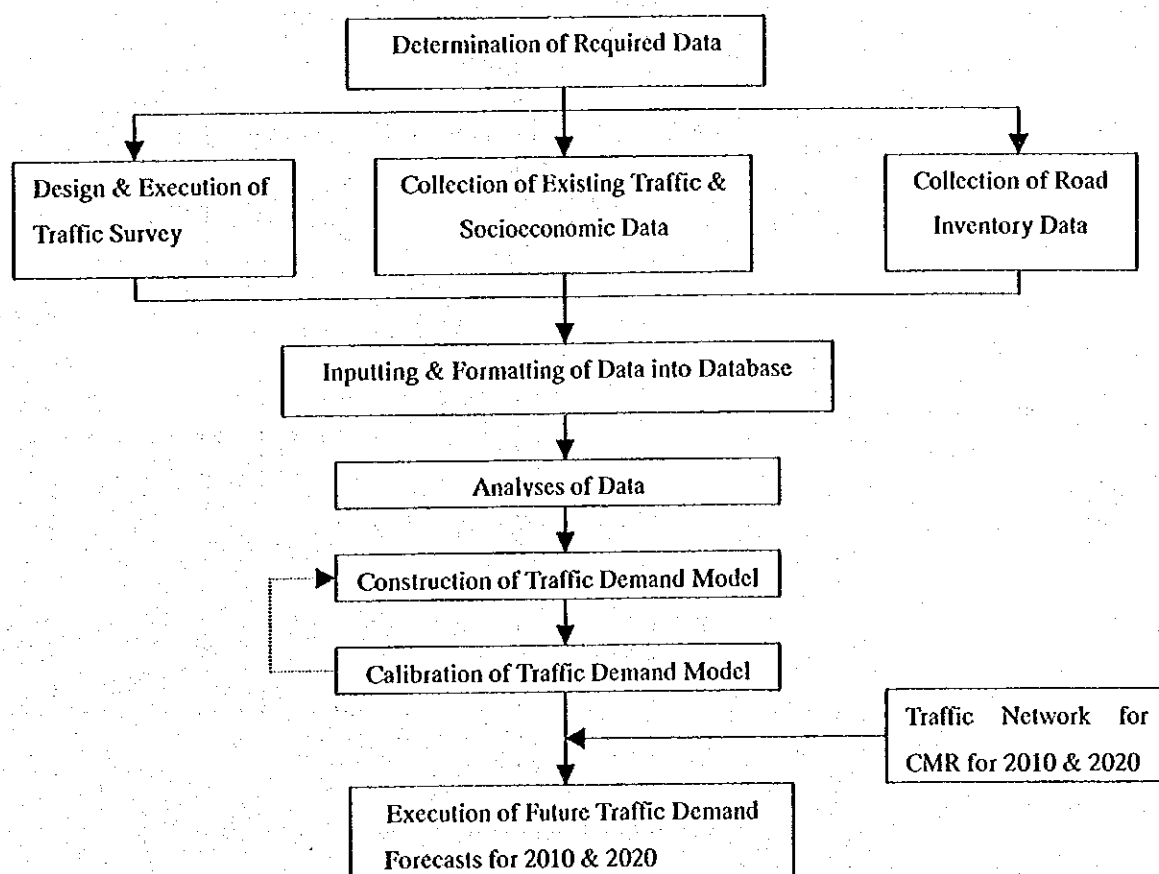


Fig. 5.1 Overall Workflow for Estimating Future Traffic Demand

### 5.3 Traffic Survey

The traffic survey was carried out from the beginning of January to the beginning of March 1999. The flow for traffic survey execution (including survey data handling) is shown in Fig. 5.2. As the figure indicates, the survey was first designed by the Study Team and finalized after consultations with the Road Development Authority (RDA) and Univ. of Moratuwa, in order to sufficiently account for local conditions. Engineering Consultants Limited (ECL), a local consultant selected by the Study Team via a designated JICA bidding process, was entrusted with survey execution. Enumerators, mostly from the Univ. of Moratuwa, were then recruited by ECL and trained by the university. The survey was then executed under the Study Team's supervision, with the Univ. of Moratuwa checking enumerator performance to ensure reliable data collection and quality. To convert the data into a form suitable for analysis and for the building of a traffic demand model, the data compiled by ECL was sent to the Univ. of Moratuwa and inputted and formatted in an electronic format designated by the Study Team.

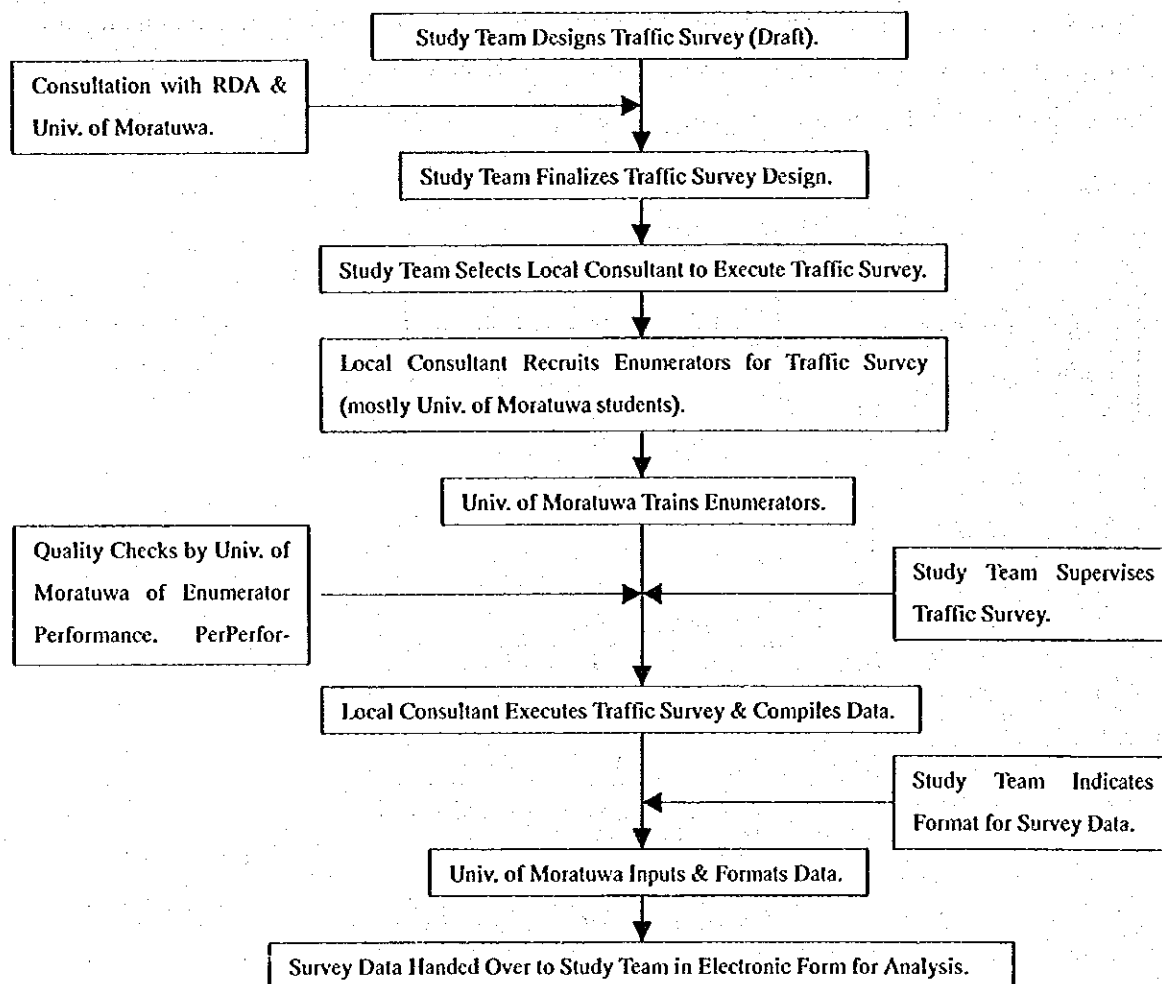


Fig. 5.2 Traffic Survey Execution & Traffic Data Handling

## 5.3.1 Execution Plan for Traffic Survey

The detailed execution plan for the traffic survey is shown in Tab. 5.1 below.  
Tab. 5.1 Execution Plan

Date	Day	Field Activity
04/01/99	Mon	Recruitment of Enumerators
05/01/99	Tue	Ditto
06/01/99	Wed	Ditto
07/01/99	Thu	Training of Enumerators at Traffic Laboratory of University of Moratuwa
08/01/99	Fri	Allocation of Duties to Enumerators
09/01/99	Sat	
10/01/99	Sun	Fixing of ATR Machines at Sites 3, 10, 11, 12, 13 & 14 (By RDA)
11/01/99	Mon	OD & MCC Surveys - Site 3 on Old Avisawella Road (Both Directions) OD & MCC Surveys - Site 10 on Route Parallel to Kelani River (Both Directions)
12/01/99	Tue	OD & MCC Surveys - Site 11 on Kacuwella Bridge (Both Directions) OD & MCC Surveys - Site 12 on Old Avisawella Rd (Both Directions)
13/01/99	Wed	OD & MCC Surveys- Site 13 on A4 (Both Directions) OD & MCC Surveys - Site 14 on Padukka Road (Both Directions)
14/01/99	Thu	Removal of ATR Machines at sites 3,10,11,12,13 & 14 (By RDA). Briefing of Enumerators on Bus Passenger Interview Survey. Bus Pass. Volume & Travel Speed Surveys
15/01/99	Fri	(Public Holiday)
16/01/99	Sat	
17/01/99	Sun	
18/01/99	Mon	Fixing of ATR Machines at Sites 1, 2, 5, & 6 (By RDA)
19/01/99	Tue	(Public Holiday)
20/01/99	Wed	OD, MCC & Bus Pass. Volume Surveys - Site 1 on A3 (Both Directions) OD, MCC & Bus Pass. Volume Surveys - Site 2 on A1 (Both Directions)
21/01/99	Thu	OD & MCC Surveys - Site 5 on A4 (Both directions) OD & MCC Surveys - Site 6 on Horana Road (Both Directions)
22/01/99	Fri	Travel Speed Survey - Route A3, Urugodawatta to Airport Turnoff (Both Directions) Travel Speed Survey - Route A1, Urugodawatta to Nittambuwa (Both Directions)
23/01/99	Sat	Bus Pass. Interview Survey
24/01/99	Sun	Removal of ATR Machines at Sites 1, 2, 5 & 6 (By RDA) Enumerator Meeting

25/01/99	Mon	Travel Speed Survey - Sri Jayawardana Pura Road, Kollupitiya to Kaduwela (Both Directions) Travel Speed Survey - Route A4, Colombo Fort to Meepe (Both Directions) Bus Pass. Interview Survey
26/01/99	Tue	Travel Speed Survey - Horana Road, Vilasita Nivasa to Pokunuwita Junction (Both Directions) Travel Speed Survey - Route A2, Kollupitiya to Kalutara Bridge (Both Directions) Bus Pass. Interview Survey
27/01/99	Wed	Travel Speed Survey - Route parallel to Kelani River, Peliyagoda to Dompe (Both Directions) Travel Speed Survey - Old Avissawella Road, Baseline Road to Hanwella (Both Directions) Bus Pass. Interview Survey
28/01/99	Thu	Scheduled Surveys Were Postponed Due to Unforeseen Circumstances
29/01/99	Fri	Ditto
30/01/99	Sat	
31/01/99	Sun	Fixing of ATR machines at Sites 15 & 16 (By RDA)
01/02/99	Mon	OD, MCC & Bus Pass. Volume Surveys - Site 15 on Horana Rd (Both Directions)
02/02/99	Tue	OD, MCC & Bus Pass. Volume Surveys - Site 16 on A2 - Near Kalutara Bridge (Both Directions) Bus Pass. Interview Survey
03/02/99	Wed	Bus Pass. Interview Survey
04/02/99	Thu	(Public Holiday)
05/02/99	Fri	Removal of ATR machines at Sites 15 & 16 (By RDA)
06/02/99	Sat	Enumerator Meeting
07/02/99	Sun	Fixing of ATR machines at Sites 4, 7, 8 & 9 (By RDA)
08/02/99	Mon	OD, MCC & Bus Pass. Volume Surveys - Site 4 on Parliament Rd (Both directions) OD, MCC & Bus Pass. Volume Surveys - Site 7 on A2 (Both directions)
09/02/99	Tue	OD, MCC & Bus Pass. Volume Surveys - Site 8 on A3 (Both directions) OD, MCC & Bus Pass. Volume Surveys - Site 9 on A1 (Both directions)
10/02/99	Wed	No surveys due to Student Council Elections at University of Moratuwa
11/02/99	Thu	Travel Speed Survey - Route parallel to Kelani River, Peliyagoda to Dompe (BD) Travel Speed Survey - Old Avissawella Road, Baseline Road to Hanwella (BD) Bus Pass. Vol.: Sites 5 & 10 Turn. Mov. Surveys at 6 Sites (Group 1) [1-1, 1-2, 1-3, 1-4, 1-5 & 1-6]
12/02/99	Fri	Removal of ATR machines at Sites 4, 7, 8 & 9 Travel Speed Survey - Sri Jayawardana Pura Road, Kollupitiya to Kaduwela (B: D:) Travel Speed Survey - Route A4, Fort to Meepe (B: D:) Bus Pass. Vol.: Sites 11 & 12
13/02/99	Sat	Enumerators Meeting
14/02/99	Sun	Fixing of ATR machines at Sites 30, 31, 32, 33 & 34 (By RDA)



15/02/99	Mon	Travel Speed Survey - Horana Road, Vilasita Nivasa to Pokunuwita Junction (B: D) Travel Speed Survey - Route A2, Kpitiya to Kalutara Bridge (B:D) MCC at Sites 30, 31, 32, 33 & 34 Turn. Mov. Survey at 6 Sites (Group 1)
16/02/99	Tue	Travel Speed Survey - Route parallel to Kelani River, Peliyagoda to Doumpe (BD) Travel Speed Survey - Old Avissawella Road, Baseline Road to Hanwella (BD) Bus Pass. Vol: Sites 13 & 14 Turn. Mov. Survey at 5 Sites (Group 2) [2-1, 2-2, 2-3, 2-4 & 2-5] Travel Speed Survey - Sri Jayawardene Pura Road, Kollupitiya to Kacuwela (Both directions)
17/02/99	Wed	Travel Speed Survey - Route A4, Fort to Meepe (Both directions) Turn. Mov. Survey at 5 Sites (Group 2) Travel Speed Survey - Horana Road, Vilasita Nivasa to Pokunuwita Junction (B: D:)
18/02/99	Thu	Turn. Mov. Surveys at 5 Sites (Group 2) Removal of ATR machines at Sites 30, 31, 32, 33 & 34 (By RDA)
19/02/99	Fri	Travel Speed Survey - Route A3, Urugodawatta to Airport Turnoff (Both directions) Travel Speed Survey - Route A1, Urugodawatta to Nitambuwa (Both directions)
20/02/99	Sat	Turning Movement Surveys at 5 Sites (Group 3) [3-1, 3-2, 3-3, 3-4 & 3-5]
21/02/99	Sun	Removal of ATR machines at Sites 20, 23 & 24 (By RDA)
22/02/99	Mon	Fixing of ATR machines at Sites 17, 18, 19, 20, 21 & 22 (By RDA) MCC at Site 20
23/02/99	Tue	MCC at Sites 17, 18, 19, 21 & 22
24/02/99	Wed	Turning Movement Survey at 5 Sites (Group 3) Turn. Mov. Survey at 5 Sites (Group 3)
25/02/99	Thu	Travel Speed Survey - Route A5, Urugodawatta to Airport Turnoff (Both directions)
26/02/99	Fri	Travel Speed Survey - Route A1, Urugodawatta to Nitambuwa (Both directions) Bus Pass. Interview Survey Removal of ATR machines at Sites 17, 18, 19, 20, 21 & 22 (By RDA)
27/02/99	Sat	
28/02/99	Sun	Fixing of ATR Machines at Sites 23, 24, 25, 26, 27, 28, & 29 (By RDA)
01/03/99	Mon	(Public Holiday)
02/03/99	Tue	MCC at Sites 23, 24, 25, 26, 27, 28 & 29
03/03/99	Wed	
04/03/99	Thu	
05/03/99	Fri	Removal of ATR Machines at Sites 23, 24, 25, 26, 27, 28 & 29 (By RDA)

### 5.3.2 Roadside OD Survey, Traffic Volume Survey, Bus Passenger Volume Survey

In addition to the roadside OD (origin-destination) survey and traffic volume survey initially scheduled for execution, the Study Team carried out a supplemental bus passenger volume survey to gauge the number of trips made by bus. The roadside OD survey is important for gathering the basic data necessary for creating OD tables to be used in the traffic demand model, while the traffic volume survey is important for providing vehicle volume data used to calibrate the traffic assignment model. As for the bus passenger volume survey, this is crucial for grasping the demand for public transit and modeling the demand for public and private transport. The locations of these surveys are as shown in Fig.5.3, with their survey sheets shown in Tab. 5.2 to 5.4. The details of their execution are as described below.

#### 1) Roadside OD Interview Survey

- Survey Time: 12 hours for a single day.
- Survey Items:
  - For Passenger Vehicles: Place of origin/destination, permanent address, mode of transport, purpose of trip, no. of vehicle occupants, bus usage per week, private vehicle ownership.
  - For Freight Vehicles: Place of origin/destination, permanent address, types of goods carried, weight of goods, capacity of freight vehicle.
- No. of Survey Stations: 16 stations located on the major routes of Colombo.
- Survey Methodology: Drivers were interviewed for both directions and their answers recorded on-site. A minimum sampling rate of 10% was aimed for but varied depending on traffic volume.

#### 2) Traffic Volume Survey

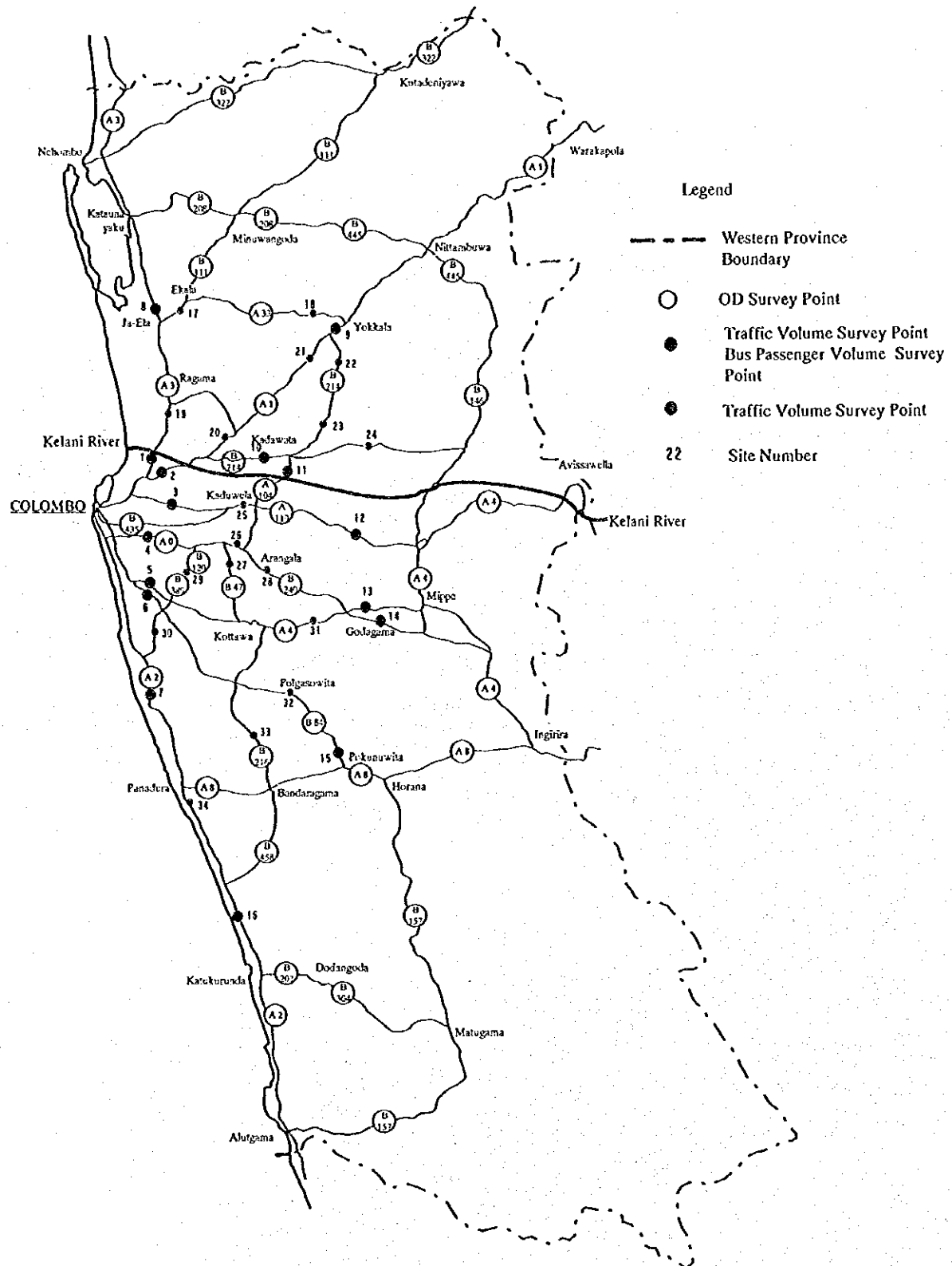
- Survey Time: 24 hours over a period of 3 days.
- Measurement Intervals: 15 minutes (total of 96 observations per day).
- No. of Survey Stations: 24 stations on major East-West routes (3 stations per route) covering an urban area, suburban area, and area near the prospective Outer Circular Highway. In addition, 10 survey stations on 5 major North-South routes.
- Survey Methodology: Manual classified counts for 8 vehicle classes together with automatic traffic counts.

#### 3) Bus Passenger Volume Survey

- Survey Time: 12 hours over a period of 3 days.
- No. of Survey Stations: Same 24 stations on the East-West routes described in the traf-

fic volume survey.

- **Bus Classification:** Divided into private and public buses, intra- and inter-provincial routes, and bus size (below 20 seats, 20-29 seats, 30-39 seats, and Over 4 seats).
- **Survey Methodology:** Non-intrusive visual inspection.



**Fig. 5.3 Locations for OD Survey, Traffic Volume Survey  
&  
Bus Passenger Volume Survey**

Tab. 5.2 (1) Roadside OD Passenger Survey Sheet

Name of Recorder(s)		Location		Date & Day		Direction		Time:	
Vehicle Type	Occup.	Origin	Type of Origin	Destination	Type of Destination	How many times a week do you usually ride the bus?	To:..... From:.....	When you use the bus, is a private vehicle available?	
1. Motorcycle	1	1. Village/Town	1. Home	1. Village/Town	1. Home	<input type="checkbox"/> times/week		Yes <input type="checkbox"/>	
2. 3-wheeler	2	.....	2. Work	.....	2. Work			No <input type="checkbox"/>	
3. Pass. Car, Van, Jeep, Taxi	3	2. DSD	3. School/Ed	2. DSD	3. School/Ed.				
4. Office Van	4	.....	4. Business/Personal	.....	4. Business				
5. School Van	5	3. District/Province	5. Social	3. District/Province	5. Social				

Fig. 5.2 (2) Roadside OD Survey Sheet for Goods Vehicles

Name of Recorder(s)		Location		Date & Day		Direction		Time:	
Vehicle Type	Occup.	Origin	Destination	Type of Commodity	Load	Capacity	To:..... From:.....		
1. Delivery Van	1	4. Village/Town	1. Village/Town	1. Processed Food	1. Empty	1. ....liters			
2. Trucks (2 axles)	2	.....	.....	2. Fish	2. 1/4	2. ....tons			
3. Large Trucks (Multi-axle)	3	5. DSD	2. DSD	3. Agri. Products	3. 1/2				
4. Trailer Trucks	4	.....	.....	4. Livestock	4. Full				
	5	6. District/Province	3. District/Province	5. Forestry Products	5. Overloaded				
		.....	.....	6. Industrial Products					
				7. Fertilizer					
				8. Construction Materials					
				9. Petroleum Products					
				10. Empty Containers					

**Tab. 5.3 Traffic Volume Survey Sheet (Manual Classified Counts)**

Name of Observer(s):								
Location:								
Direction: To:..... From:.....								
Date:								
Day:								
Weather: Dry <input type="checkbox"/> Wet <input type="checkbox"/>								
No. of Lanes/Direction: 1 lane <input type="checkbox"/> 2 lanes <input type="checkbox"/> 3 lanes or more lanes (write in no.) <input type="text"/>								
Road Surface Condition: Good <input type="checkbox"/> Fair <input type="checkbox"/> Poor <input type="checkbox"/>								
Time	No. of Vehicles by Type							
	Passenger Car	3-wheeler	Motorcycle	Minibus	Bus	Truck	Large Truck	Farm Vehicle
7:00 – 7:15								
7:15 – 7:30								
7:30 – 7:45								
7:45 – 8:00								
8:00 – 8:15								
8:15 – 8:30								
8:30 – 8:45								
8:45 – 9:00								
9:00 – 9:15								
9:15 – 9:30								
9:30 – 9:45								
9:45 – 10:00								
10:00 – 10:15								
10:15 – 10:30								
10:30 – 10:45								
10:45 – 11:00								
11:00 – 11:15								
11:15 – 11:30								
11:30 – 11:45								

**Tab. 5.4 Bus Passenger Volume Survey Sheet**

Name of Recorder(s):	Location:	Date: Day: Time:	Direction	
			To:..... ..... From:..... .....	
Route Name	Type of Bus Operator	Type of Bus Operation	Bus Size	Passenger Loading
..... .....	1.Public 2.Private	1. Intra-Provincial 2. Inter-Provincial	1. Below 20 Seats 2. 20 to 29 Seats 3. 30 to 39 Seats 4. Over 40 Seats	1. Empty 2. Less than 1/2 3. More than 1/2 4. Full No Standers 5. Full with Standers 6. Capacity 7. Capacity Overflow
..... .....	1.Public 2.Private	1. Intra-Provincial 2. Inter-Provincial	1. Below 20 Seats 2. 20 to 29 Seats 3. 30 to 39 Seats 4. Over 40 Seats	1. Empty 2. Less than 1/2 3. More than 1/2 4. Full No Standers 5. Full with Standers 6. Capacity 7. Capacity Overflow
..... .....	1.Public 2.Private	1. Intra-Provincial 2. Inter-Provincial	1. Below 20 Seats 2. 20 to 29 Seats 3. 30 to 39 Seats 4. Over 40 Seats	1. Empty 2. Less than 1/2 3. More than 1/2 4. Full No Standers 5. Full with Standers 6. Capacity 7. Capacity Overflow
..... .....	1.Public 2.Private	1. Intra-Provincial 2. Inter-Provincial	1. Below 20 Seats 2. 20 to 29 Seats 3. 30 to 39 Seats 4. Over 40 Seats	1. Empty 2. Less than 1/2 3. More than 1/2 4. Full No Standers 5. Full with Standers 6. Capacity 7. Capacity Overflow
..... .....	1.Public 2.Private	1. Intra-Provincial 2. Inter-Provincial	1. Below 20 Seats 2. 20 to 29 Seats 3. 30 to 39 Seats 4. Over 40 Seats	1. Empty 2. Less than 1/2 3. More than 1/2 4. Full No Standers 5. Full with Standers 6. Capacity 7. Capacity Overflow
..... .....	1.Public 2.Private	1. Intra-Provincial 2. Inter-Provincial	1. Below 20 Seats 2. 20 to 29 Seats 3. 30 to 39 Seats 4. Over 40 Seats	1. Empty 2. Less than 1/2 3. More than 1/2 4. Full No Standers 5. Full with Standers 6. Capacity 7. Capacity Overflow