

10.1.7 Recommendation

(1) Immediate Action Plan

As discussed in the previous chapters, the immediate action plan alternatives for the model area were appraised in two ways: a qualitative aspect and a quantitative aspect. In the qualitative aspect, based on the relative comparison of traffic flow from the viewpoints of private vehicles, buses, and pedestrians, it was concluded that Alternatives 2-1 and 2-2 were likely to be the most favourable plans. In the quantitative aspect, on the other hand, the traffic flow analysis by Dynamic Simulation estimated that Alternative 2-2 had the highest potential to improve the current traffic flow situations, keeping the balance between the central collector road traffic and peripheral arterial road traffic.

Judging from these two of analysis, it was concluded that Alternative 2-2, which is a package plan involving construction of bus transit malls, pedestrian malls, and bus lanes and intensification of through traffic of private vehicles, should be proposed on the grounds of consequential improvement of the traffic flow in the collector roads and relatively small negative influence on the arterial roads after the enforcement of the public transport priority system in the model area.

In spite of the very stringent traffic regulation and control adopted by Alternative 2-2, this adoption comes with the proviso that its influence on private vehicle users will be minimised to the full extent by scrutinising more detailed relevant data.

(2) Issues on Loading and Unloading

As mentioned in section 10.2.1, "Features of Modal Area", the major part of the area has been characterised as an area of retail and wholesale shops. Many loading / unloading vehicles go back and forth in this area every day. In the plan recommended in this section, many pedestrian spaces such as pedestrian malls and bus transit malls are proposed. After implementation of this plan, much attention has to be paid to these activities in order not to discourage the current economic vitality. Loading / unloading vehicles are permitted to enter the pedestrian mall located beside the Central Market even at present. The following regulations should be introduced in order to keep the current commercial activities as it is, once the recommended plan is implemented:

- To allow small lorries to load and unload on pedestrian malls and transit malls only during limited time periods.
- To allow large lorries to load and unload on those malls only at night time.

10.2 Future Development Plan

10.2.1 Features of Model Area

(1) Building

1) Overall

The selected Model Area is so-called "China Town" in KL. This area has served as the central business district since the first development of KL. Although new large commercial and office buildings has recently been constructed along Jln. Sultan Ismail and Jln. Tun Razak including the KLCC, its function as a business district for the surrounding local economic activities is still remains even today.

Due to its historical role as the old business district, bus terminuses are located in the area. Therefore, many city buses plunge into this area. Roads are not wide enough to meet the traffic demand including the buses, and the area has seriously suffered from traffic congestion.

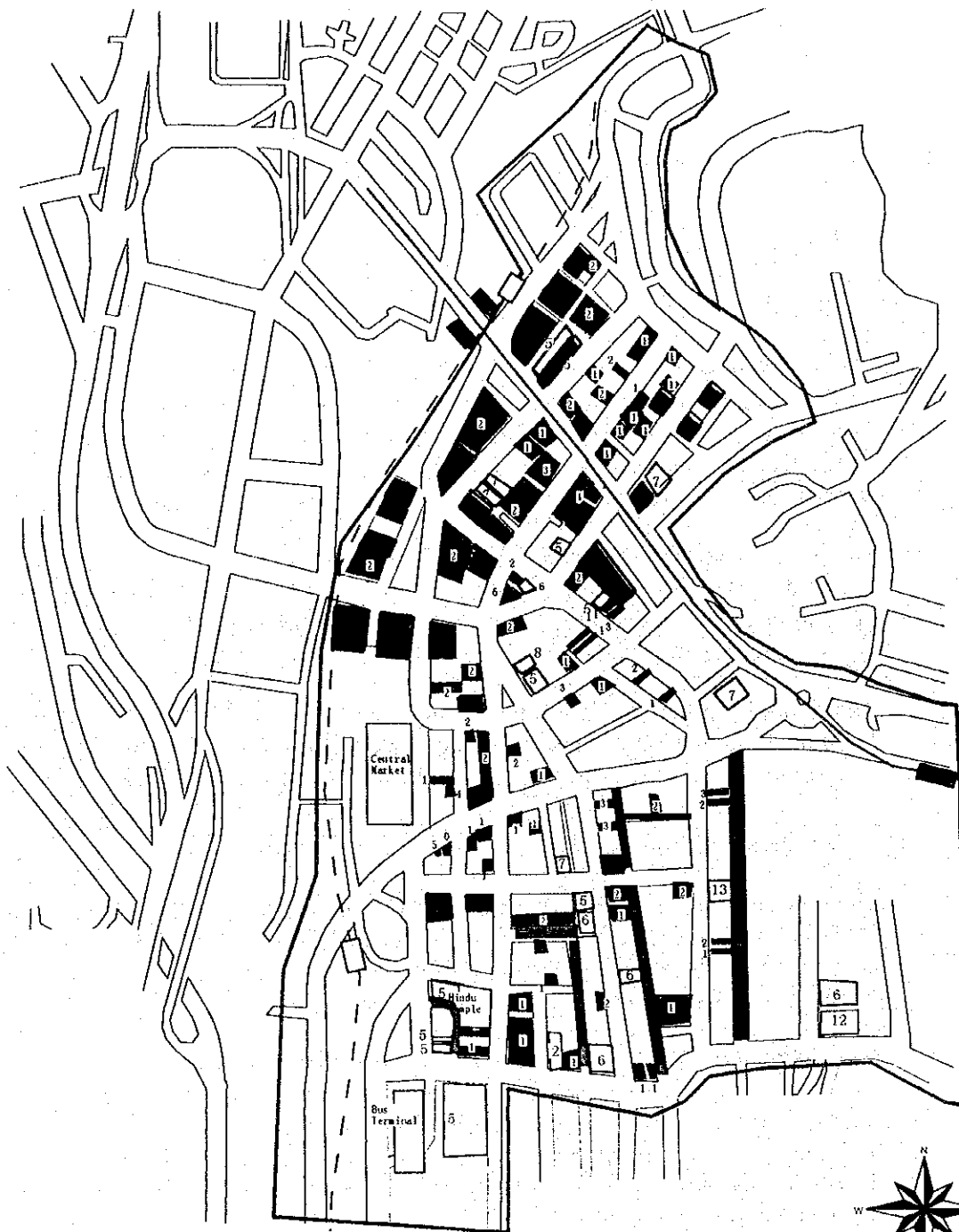
The Central Market, which is a transit attraction, is located in the area. In addition, the unique architecture of the old buildings in China Town also attract many local and foreign tourists. Thus, even more traffic is generated in the area.

2) Distribution of Old Building

The buildings in the Model Area can be classified into two broad categories, that is, "Old building" and "Very old building". The definition of "Old building" is that it is aged but still has more than five-year life-time, while the "Very old building" needs immediate repair work or re-generation.

Most of the old and very old buildings consist of one or two stories, of which the ground floor is usually occupied by retail shops for local services, whilst the first floor and/or the second floor are usually for residential use. Many are stone-made buildings constructed in 1800s with a Chinese facade. Such buildings are distributed everywhere in the Model Area. Some of them are pretty much run-down and poorly maintained.

Some of these buildings are now under renovation while some around the Central Market and in certain other places are under the city's renewal plan. Although the buildings may be important heritages and worth preserving for future descendants, revitalisation of the building and the surrounding area needs to start soon to provide a better living environment for people living in this area.



LEGEND






- | | |
|---|--|
|  Impassable for Car |  Bank Financing Insurance |
|  Old | |
|  Very Old 1 Story | |
|  More than 5 Stories | |

Figure 10.2.1

Distribution of Buildings by Use

SMURT-KL
 Study on Integrated Urban Transportation Strategies
 for
 Environmental Improvement in Kuala Lumpur

3) Business Activities

As the area was a central business district in the early history of KL, many financial and insurance institutions concentrate in the area, especially in the northern part (see Figure 10.2.1). Another characteristic is the distribution of retail shops selling miscellaneous goods to local residents, goldsmiths, and locally-made souvenir shops catering to tourists.

4) Height of Building

Figure 10.2.1 shows buildings of more than five stories which are widely spread all over the area. However, high-storey buildings cannot be observed along Jln. Cheng Lock, which is one of the arterial roads in the area. This indicates that this high potential land is still under-utilised at present.

(2) Transportation Facility

1) Road

The Road network consists of narrow carriageways for vehicles and narrow sidewalks. Often the sidewalks are occupied by hawkers in some sections and do not allow smooth walking. Some parts of the roads are blocked to vehicles due to illegal obstruction by hawkers or shops in the southern part of the area. On the contrary, no impassable roads were observed in the northern part of the area. This difference is due to the characteristics of each area, where the northern part is mainly a business district whereas the southern part is a mixed-use land. These conditions thus worsen the traffic flow and create unfriendly pedestrian walks.

2) Parking

A parking survey was conducted in the Model Area in order to obtain information about the parking characteristics such as the purpose for parking, parking duration, and so forth, as well as parking facility distribution.

Three types of parking facilities exist in the area, i.e., on-road parking, open space parking, and indoor parking. Parking facility conditions are shown in Table 10.2.1.

The parking survey revealed that the parking capacity was 741 lots for motorcycles and 2,377 lots for passenger cars including both open space parking and indoor parking.

Table 10.2.1 Parking Facility

| Area | Type | No. Of Facilities | Capacity | |
|-------|----------|-------------------|------------|-------|
| | | | Motorcycle | P.Car |
| A | On-road | 3 | 145 | 25 |
| | Open | 4 | 118 | 207 |
| | Building | 1 | 30 | 172 |
| | Total | 8 | 293 | 404 |
| B | On-road | 1 | 0 | 15 |
| | Open | 7 | 51 | 819 |
| | Building | 6 | 407 | 1139 |
| | Total | 14 | 458 | 1973 |
| Total | On-road | 4 | 145 | 40 |
| | Open | 11 | 169 | 1026 |
| | Building | 7 | 437 | 1311 |
| | Total | 22 | 751 | 2377 |

Source: SMURT-KL

The number of vehicles using parking facilities by type was counted and the turnover was surveyed (see Table 10.2.2).

Table 10.2.2 Turnover of Parking

| Area | Type | Average Parking /day | | Av. Duration(hrs) | | Turnover | |
|-------|----------|----------------------|-------|-------------------|-------|------------|-------|
| | | Motorcycle | P.Car | Motorcycle | P.Car | Motorcycle | P.Car |
| A | On-road | 400 | 103 | 1.0 | 4.0 | 2.76 | 4.12 |
| | Open | 280 | 670 | 2.0 | 2.0 | 2.37 | 3.24 |
| | Building | 50 | 250 | 6.0 | 4.0 | 1.67 | 1.45 |
| | Total | 730 | 1023 | 2.4 | 3.1 | 2.49 | 2.53 |
| B | On-road | | 50 | | 3.0 | 0.00 | 3.33 |
| | Open | 10 | 831 | 0.0 | 5.2 | 0.20 | 1.01 |
| | Building | 498 | 1513 | 6.3 | 5.3 | 1.22 | 1.33 |
| | Total | 508 | 2394 | 6.3 | 5.1 | 1.11 | 1.21 |
| Total | On-road | 400 | 153 | 1.0 | 3.8 | 2.76 | 3.83 |
| | Open | 290 | 1501 | 2.0 | 4.1 | 1.72 | 1.46 |
| | Building | 548 | 1763 | 6.3 | 5.1 | 1.25 | 1.34 |
| | Total | 1238 | 3417 | 3.9 | 4.4 | 1.65 | 1.44 |

Source: SMURT-KL

The major results are listed below:

- On-road parking duration by motorcycle was as short as 1.0 hour;

- Big differences were observed on parking duration by type of facility in the range of 1.0 to 6.3 hours; and
- The average turnover was around 1.5 times per day.

3) Bus Network

With respect to the current bus operation system including route network, frequency, and so forth, the detailed conditions are described in section 10.1 in this report.

4) Rail-based Transport Facility

The LRT System I by STAR is currently being operated and there are two rail-system stations in the area, i.e., Plaza Rakyat and Masjid Jamek. Another LRT line, System II, by Putra is under construction and is expected to open to the public in the near future. This line has two stations named Pasar Seni and Benteng in the area. In total, the area is served by four rail-system stations, which are located around at the boundary of the area.

(3) Current Characteristics of the Area

The current characteristics of the area were summarised by the following sections (see Figure 10.2.2):

1) Area I

Area I is characterised as a business district made up of financial and insurance offices with small and localised service outlets including restaurants, retail shops, and so on. Many high-storey buildings could be observed, with some very old and densely concentrated buildings along Jln. Tun H. S. Lee. The characteristics of Area I will not drastically change even in the future.

2) Area II

The characteristics of Area II are very similar to those of Area I, mainly consisting of banking institutions and small retail shops. Old buildings are concentrated along Jln. Tun Perak, where the LRT station is located. Since Jln. Tun Perak is one of the arterial roads in the area, the area along the road has to be redeveloped to meet its development potential and the characteristics of the area as well.

3) Area III

The Central Market is located in Area III where many local and foreign tourists were observed. Open space parking is located along Jln. Cheng Lock in the southern part of the Area III.

4) Area IV

Area IV consists of a large department store, food service shops such as restaurants and fast-food shops, and various retail shops including goldsmith shops. On the opposite side of Jln. Silang, large buildings with off-road ground parking were observed.

5) Area V

A small department store and various retail shops are located in Area V, servicing mainly the local residents.

6) Area VI

This area is located along Jln. Cheng Lock, and retail shops densely concentrated in the area occupy many old buildings. Many small lorries for loading and unloading of goods were observed on Jln. Hang Lekir.

7) Area VII

Offices and retail shops are located for local service. An Indian temple is located in Area VII, and redevelopment work by the scrap and build method is in progress in the surrounding area.

8) Area VIII

There are many small local shops such as restaurants, miscellaneous goods, souvenir shops, and so on. Local people and some foreign tourists gather in this area for entertainment and shopping. Hawkers and shops occupy some part of the roads, and this affects the through traffic.

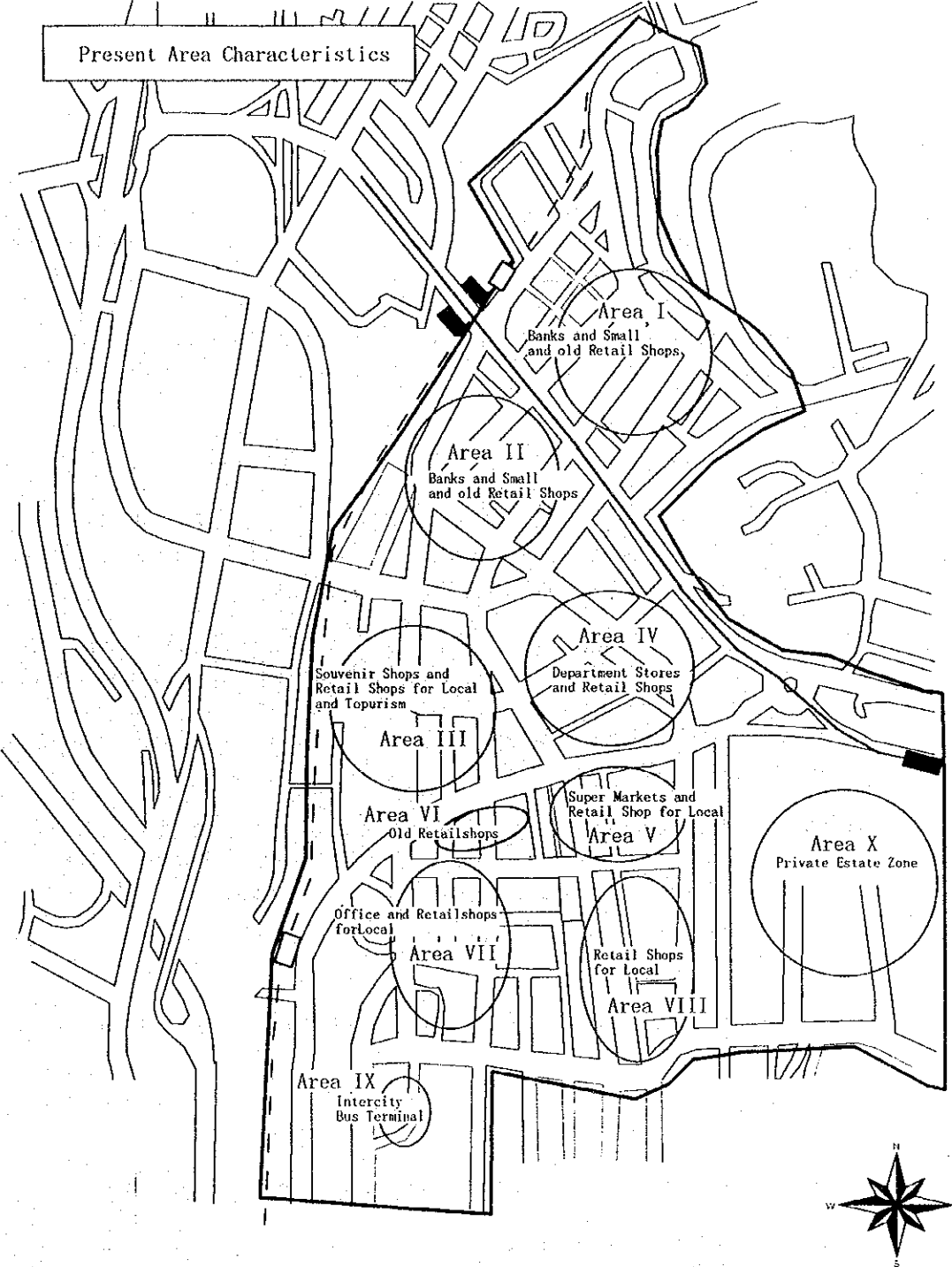
9) Area IX

The Klang Inter-city Bus Terminal is located in this area, and Jln. Sultan, the access road to the bus terminal, is always congested with inter-city buses going out of and coming into the bus terminal.

10) Area X

This area is occupied mainly by comparatively large private estates such as school, church, and so on. No traffic jam could be observed in the area at present. It is necessary to maintain the present traffic situation in the area.

Present Area Characteristics



LEGEND

Figure 10.2.2

Characteristics of Area

SMURT-KL
 Study on Integrated Urban Transportation Strategies
 for
 Environmental Improvement in Kuala Lumpur

10.2.2 Future Perspective

(1) Problems and Issues

Considering the current development trend in the Central Planning Area (CPA), it is obvious that the Model Area is losing development potential as a commercial business district in comparison with other newly developed areas such as those along Jln. Sultan Ismail and Jln. Tun Razak. This implies that the main financial institutions and other service companies which support the business activities will need to relocate to areas along Jln. Sultan Ismail and on the eastside of the CPA year by year.

Regarding the future development direction of the Model Area, it would be pointless to re-establish it as the pivotal central business district in the area again. Newly developed or developing areas such as the KLCC and Star City will play a dominant role as the real central business district. It is doubtful that the Model Area could compete with such newly developed areas.

The Model Area should aim to become an entertainment place including developments for tourists with restaurants, goldsmiths, souvenir shops, and so on. The area should not aim at high-storey building development but low-storey buildings. Such a development policy will attract both local residents, and domestic and foreign tourists.

In addition, it is recommended that draw a blueprint be drawn up stipulating that souvenir shops in the area should not provide brand goods but only local souvenirs for tourists and practical goods for local residents.

(2) Area Development Perspective

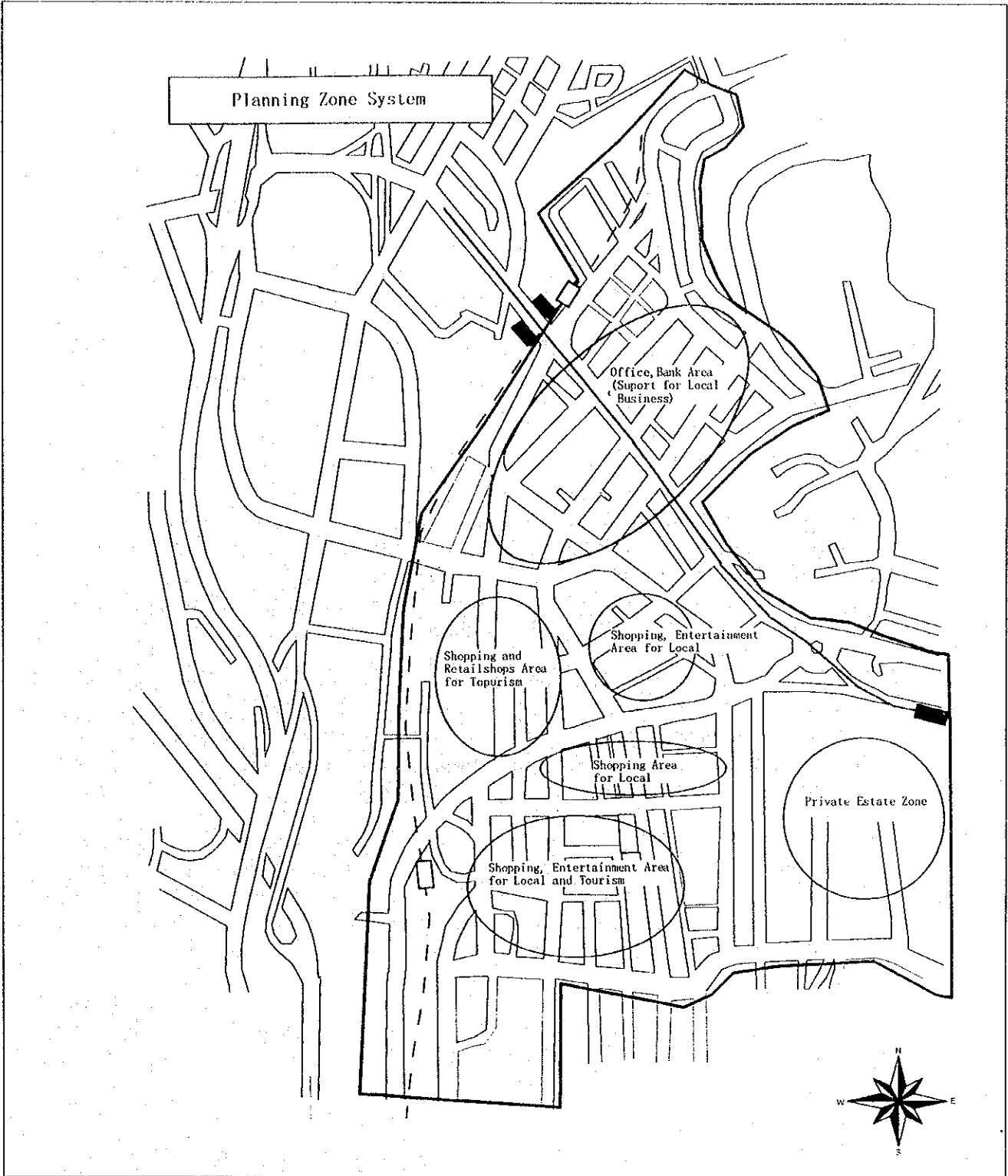
Taking the above into account, the following planning zoning system is considered (see Figure 10.2.3).

1) Overall

The Model Area can be mainly divided into four groups by its nature;

- 1 Business district (Areas I and II)
- 2 Shops and department stores for local use (Areas IV, VI, and VII)
- 3 Shops for local and foreign tourists (Areas III, V, and VIII)
- 4 Private estate zone (Area X)

Taking these situations into account, the following development steps are considered as the area's development strategy:



LEGEND

Figure 10.2.3

Zoning System for Planning Perspective

SMURT-KL
 Study on Integrated Urban Transportation Strategies for Environmental Improvement in Kuala Lumpur

a. First step

As the first step, the initial development emphasis should be placed on the northern part of the Model Area focusing on the following:

- to promote development in the northern part of the Model Area along Jln. Cheng Lock in order to increase its attractiveness and to cater to the demand of the local residents and foreign tourists currently visiting this area.
- to redevelop the old retail shops to upgrade the daily business services and to create a public space for pedestrians and bus services in the northern part of the Model Area.

b. Second Step

Although the initial development emphasis may be put on the northern part of the Model Area, the Model Area has limitations in its ability to attract people, whether locals or foreigners. This is because it is extremely difficult for this area to compete with other newly developed areas such as the KLCC. This limitation implies that the development potential for the area is greatly limited.

On the other hand, the southern part of the Model Area does not have any conspicuous features except for some minor localised entertainment areas in downtown. In others words, people do not feel any strong amenity or attraction to this area at present. In short, development potential will diminish if the area is not properly transformed in the future.

It can be easily imagined that the whole Model Area will lose its competitiveness year by year. It is essential to review the power of activities to develop the area in the future. In the end, the southern part of the Model Area has to play an important role by attracting more people with its characteristics in the future in order to support the whole area.

In this context, the southern part of the Model Area has to alter its characteristics through urban re-generation program. Newly developed urban facilities, buildings, attractions among others in the southern area would be a seed for further development of the whole Model Area.

2) Area I and II

It seems that the characteristics of Areas II and I will not drastically change even in the future and they will remain as business districts for local business activities with banking, financing, and insurance offices. The blocks with old and densely concentrated buildings should be redeveloped. In addition, this redevelopment plan will create more space for public use such as station plazas, bus stops, and so forth which will create a better and comfortable transport environment.

3) Area III

In Area III, attractive facilities such as the Central Market and goldsmiths are located. Taking advantage of these facilities, the area should be developed as a commercial area of non-daily goods for locals and of souvenir shops for both local and foreign tourists. Moreover, old buildings are located along Jln. Cheng Lock. This block should be redeveloped in the future from a city planning point of view to provide a public space for pedestrians and bus bays.

4) Area IV

Local-use supermarkets, departmental stores and retail shops are located in the area. No major change will take place even in the future although some minor redevelopment may occur.

5) Area V and VIII

Areas V and VIII are typical of the Model Area in that they have local-use retail shops, restaurants, departmental stores, souvenir shops, and so forth. These varied facilities appear to be attracting many people into these areas. It is necessary to develop these current features even in the future and to provide better transport facilities especially for pedestrian traffic.

6) Area VI

Area VI is located along Jln. Cheng Lock, one of the arterial roads. As old buildings are concentrated here, they should be redeveloped to meet the land development potential and create more space for the public.

7) Area VII

Offices, retail shops, and Indian and Chinese temples are located in this area. The area should be redeveloped as a new entertainment area, which containing local and international restaurants, amusement centres, souvenir shops, and so forth, in order to cater to both locals and foreigners demand, using the drastic scrap and build method. Drastic transformation of the town seems necessary to bring about prosperity to the whole Model Area, and certainly this is the only way for the area to survive in the future.

8) Area X

Area X will remain as it is because it does not have much area for development even in the future due to the existence of private estates and their characteristics.

(3) Schematic Planning Concept

Based on the future perspective for the area mentioned above, the schematic concept of the planning was drawn as shown in Figure 10.2.4.

The essential issues of this planning concept are summarised below:

1) Establishment of Pedestrian-friendly Environment

By providing good public modes including four LRT stations and bus transport services on the arterial roads will encourage residents and visitors to use public transport to the Model Area, creating a pedestrian-friendly environment. Undoubtedly, with the introduction of a traffic cell system will increase the attractiveness of the area, attracting more local and foreign people. In addition, transforming the roads in the area in a semi-mall system will certainly be effective.

2) Drastic Redevelopment of Blocks

The old buildings in the area are one of the main reasons for the declining amenity and attractiveness to the area. In this context, it is necessary to undertake drastic redevelopment by the scrap and build method in the areas where old buildings are concentrated. Some renovation of buildings can be observed even at present, and this indicates the necessity of redevelopment in the area.

3) Provision of Inter-modal Facilities at Rail Station

In order to promote the usage of public transport and create a pedestrian-friendly environment, the provision of inter-modal facilities among transport systems is essential.

4) Bus Operation System

The high volume of buses is one of the causes of traffic congestion in the Model Area. Bus operation has to be limited to only on the arterial roads with bus bays and open spots for pedestrians along the arterial roads as well.

5) Car Circulation System

Through traffic also has to be prohibited from plunging into the area except for local traffic with destinations in the area.

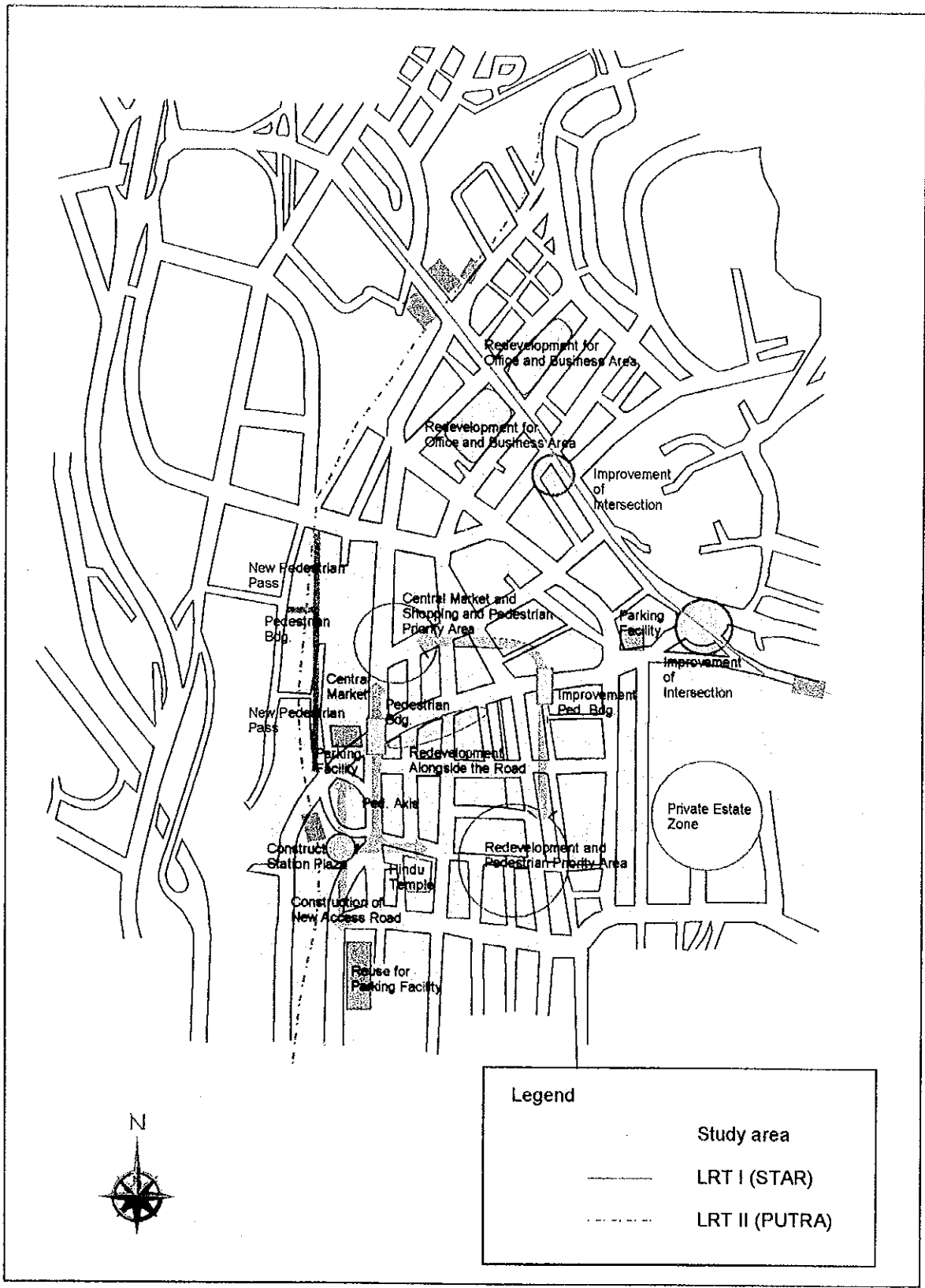


Figure 10.2.4 Schematic Planning Concept

6) Provision of Car Parking Lots

In order to create a pedestrian-friendly environment, it is necessary to provide car parking lots on the fringe of the Model Area, and this would enable visitors to walk around the area.

10.2.3 Development Plan of Transport Facilities

(1) Major Planning Issues

1) Traffic Circulation System

The traffic circulation system for through traffic is shown in Figure 10.2.5. All through traffic is prevented from plunging into the Model Area in order to establish a pedestrian-friendly environment. Minor improvements should be implemented for smoother traffic flow (see Figure 10.2.6).

2) Parking Lots

Two new parking lots are provided: near the Masjid Jamek railway station and by the redeveloped Klang Bus Terminal. This would enable private car users to come to the area and park their cars.

3) Bus Operating Route System

The current bus operation has terminuses in the Model Area and a considerable number of buses are passing through the area. All buses should operate only on arterial roads to maintain the pedestrian environment inside the area. Through the redevelopment plan, bus bays with open spaces for pedestrians should be provided along the arterial roads.

4) Pedestrian Facility Plan

a. Pedestrian Network

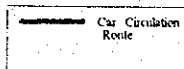
The idea of a pedestrian mall system is introduced in the area to attract locals and tourists to activate and to keep vitality of the area. There are three rail stations in the area i.e., Masjid Jamek, Pasar Seni, and Plaza Rakyat. A distance which people can walk without pain is estimated at around 350 meters through the pedestrian survey. Since the three stations are closely located within almost this distance, and from parking areas are provided at the boundary of the Model Area, a well functioning pedestrian network connecting the stations will be very attractive and convenient for both people who come by rail and by their car. (see Figure 10.2.7).



LEGEND



Parking Space



Car Circulation Route

Figure 10.2.5

Traffic Circulation for Through Traffic

SMURT-KL

Study on Integrated Urban Transportation Strategies for Environmental Improvement in Kuala Lumpur

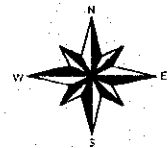
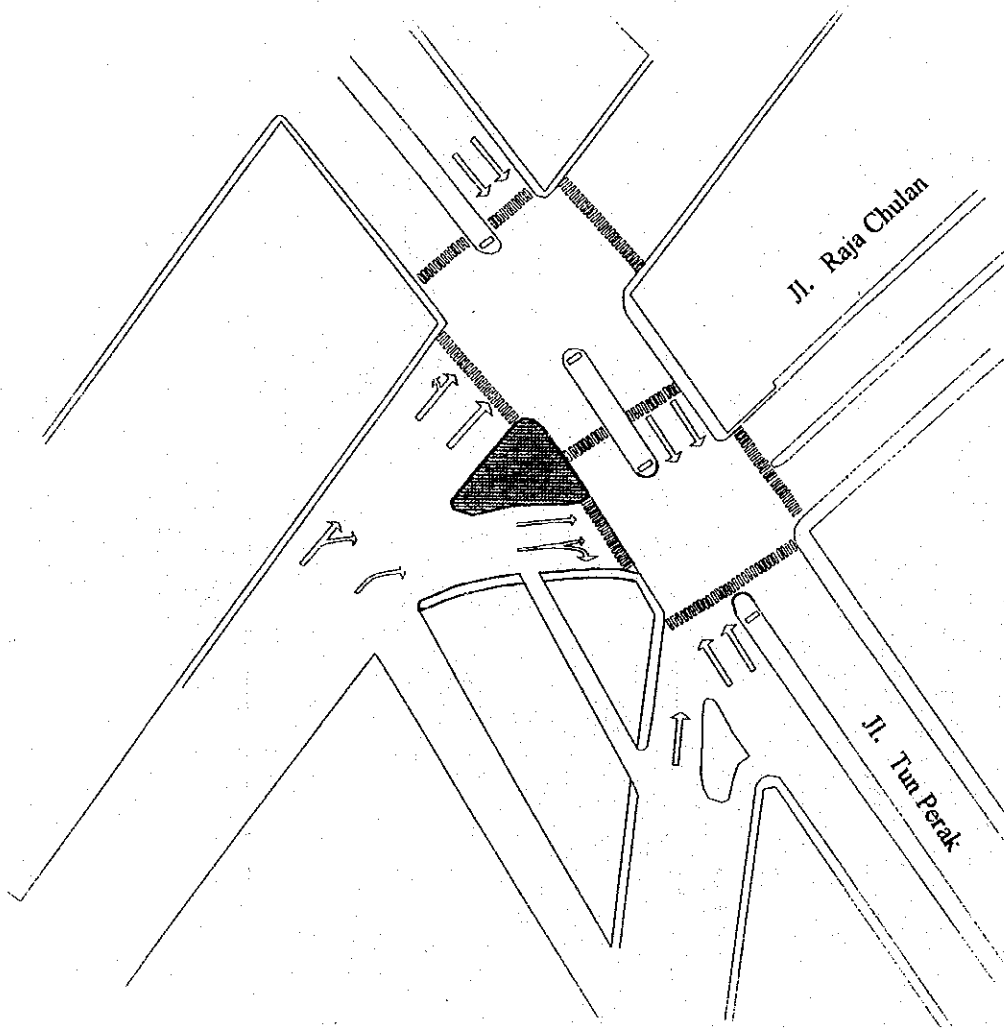
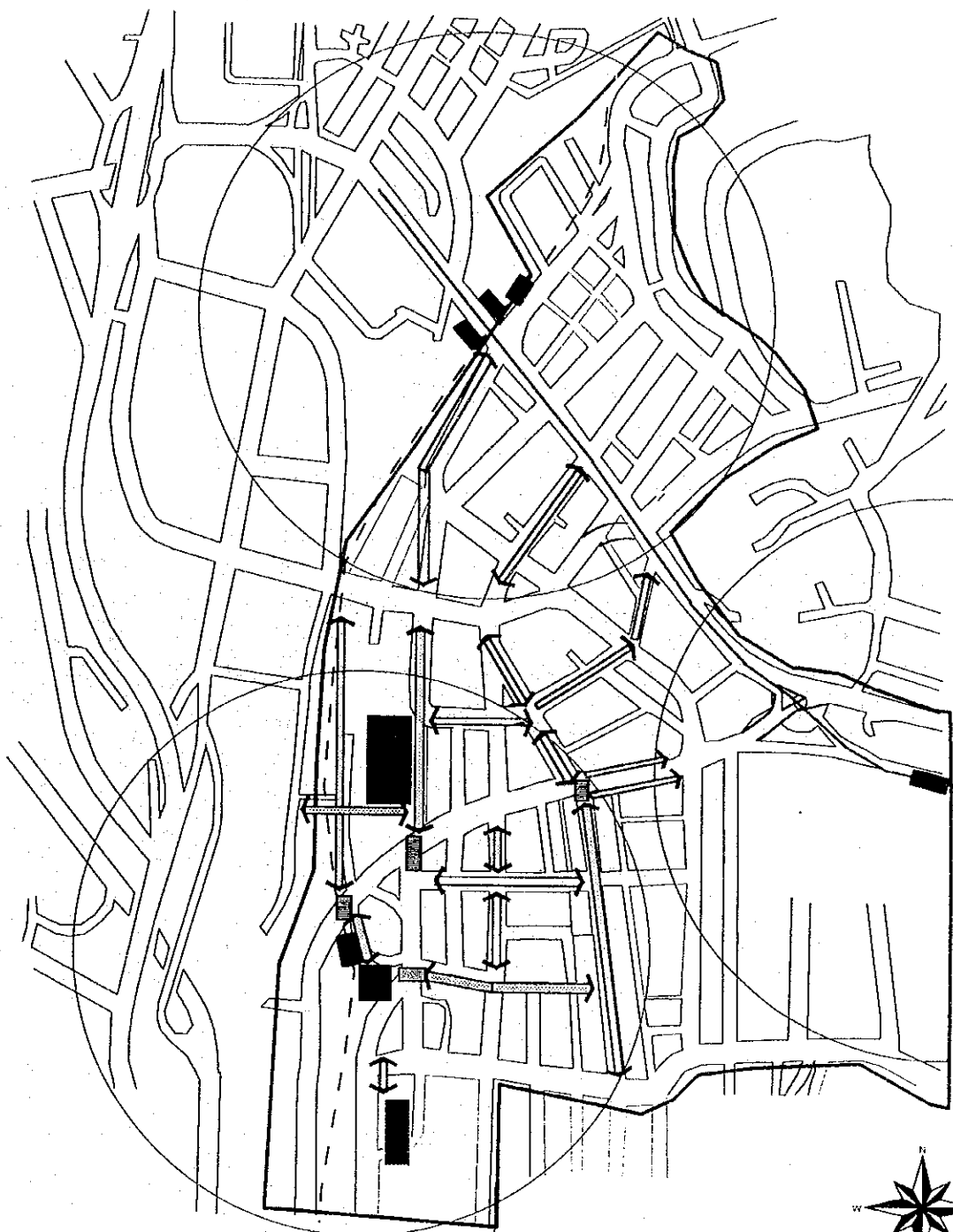


Figure 10.2.6

Improvement of Intersection

SMURT-KL
 Study on Integrated Urban Transportation Strategies
 for
 Environmental Improvement in Kuala Lumpur



LEGEND







-  Rail station
-  Rail station plaza
-  Pedestrian mall
-  Semi mall
-  Pedestrian bridge
-  Central market

Figure 10.2.7

Concept Plan of Pedestrian Network

SMURT-KL
 Study on Integrated Urban Transportation Strategies
 for
 Environmental Improvement in Kuala Lumpur

b. Cross Section of Pedestrian-friendly Path

Many roads in the Model Area are too narrow for all modes of transport. In order to improve these narrow roads, it is necessary to provide pedestrian-friendly paths which could coexist with the car traffic, with the priority on maintaining traffic safety in the area (see Figures 10.2.8-9).

5) Inter-modal Facility Plan

One of the important issues in establishing a pedestrian-friendly environment is to provide easily transfer facilities among public transport facilities.

The Masjid Jamek station of LRT system I and Benteng station of LRT system II are connected by an underground gangway for easy transfers.

In addition, two railway station plazas are provided in the plan near the Masjid Jamek and Pasar Seni railway stations. The one near the Masjid Jamek railway station is expected to be constructed at the open space created as a result of area redevelopment. On the other hand, another rail station plaza is provided in front of the Pasar Seni railway station with an elevated deck connecting directly to the railway station and to the surroundings sidewalks. In the station plaza, three bus booths are provided for passengers to the area (see Figure 10.2.10).

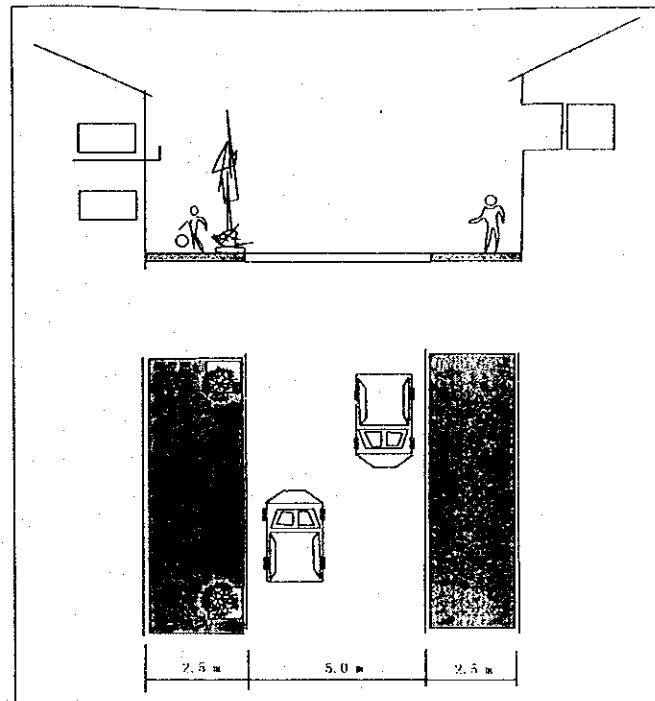
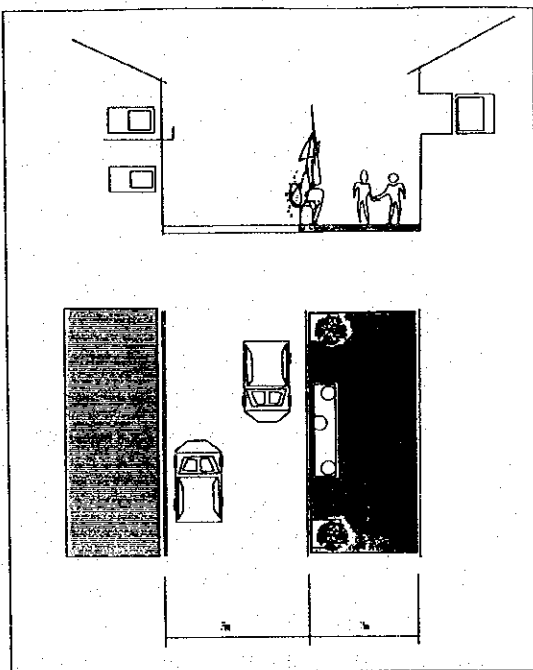
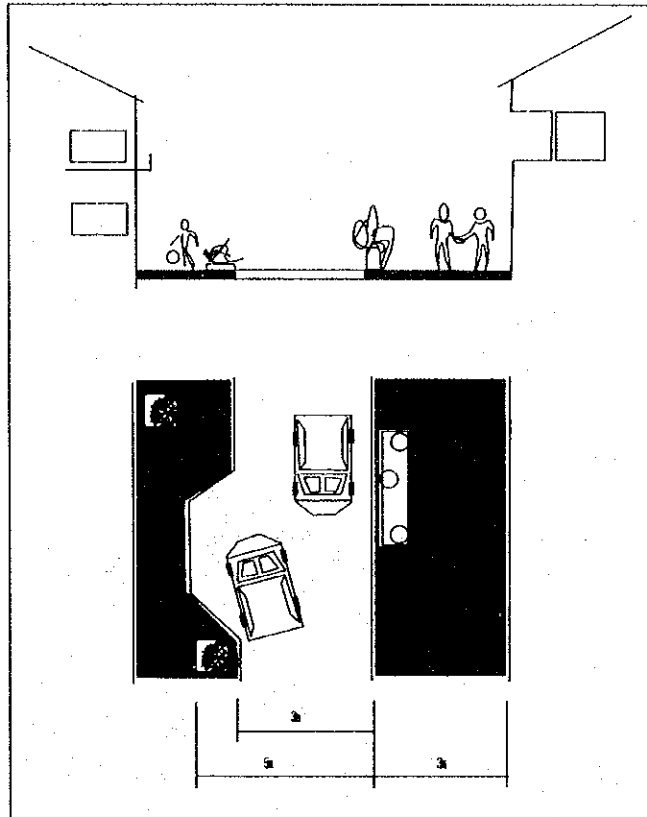


Figure 10.2.8 Cross Section of Pedestrian-friendly Path (Small Road)

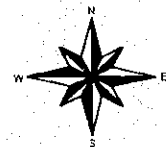
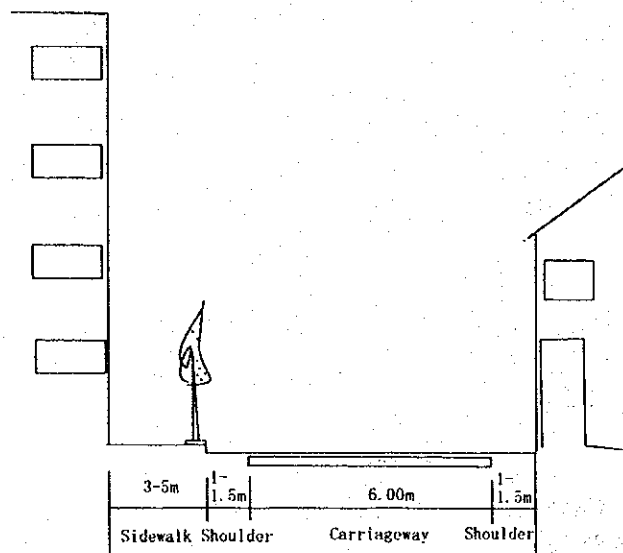
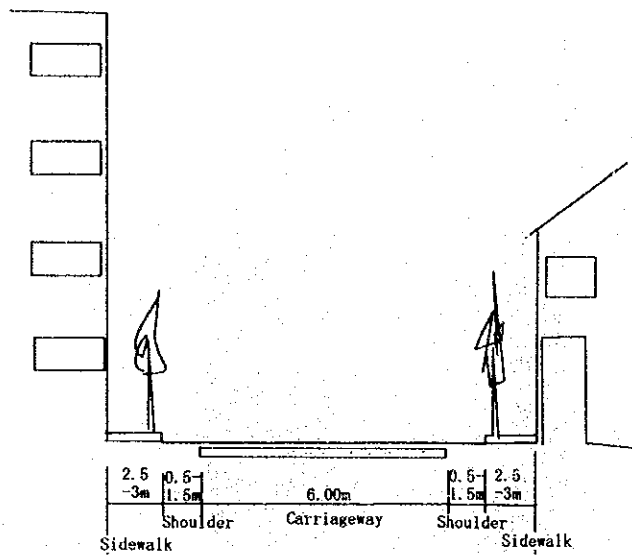


Figure 10.2.9

Cross Section of Pedestrian-friendly Path (Large Road)

SMURT-KL
 Study on Integrated Urban Transportation Strategies
 for
 Environmental Improvement in Kuala Lumpur

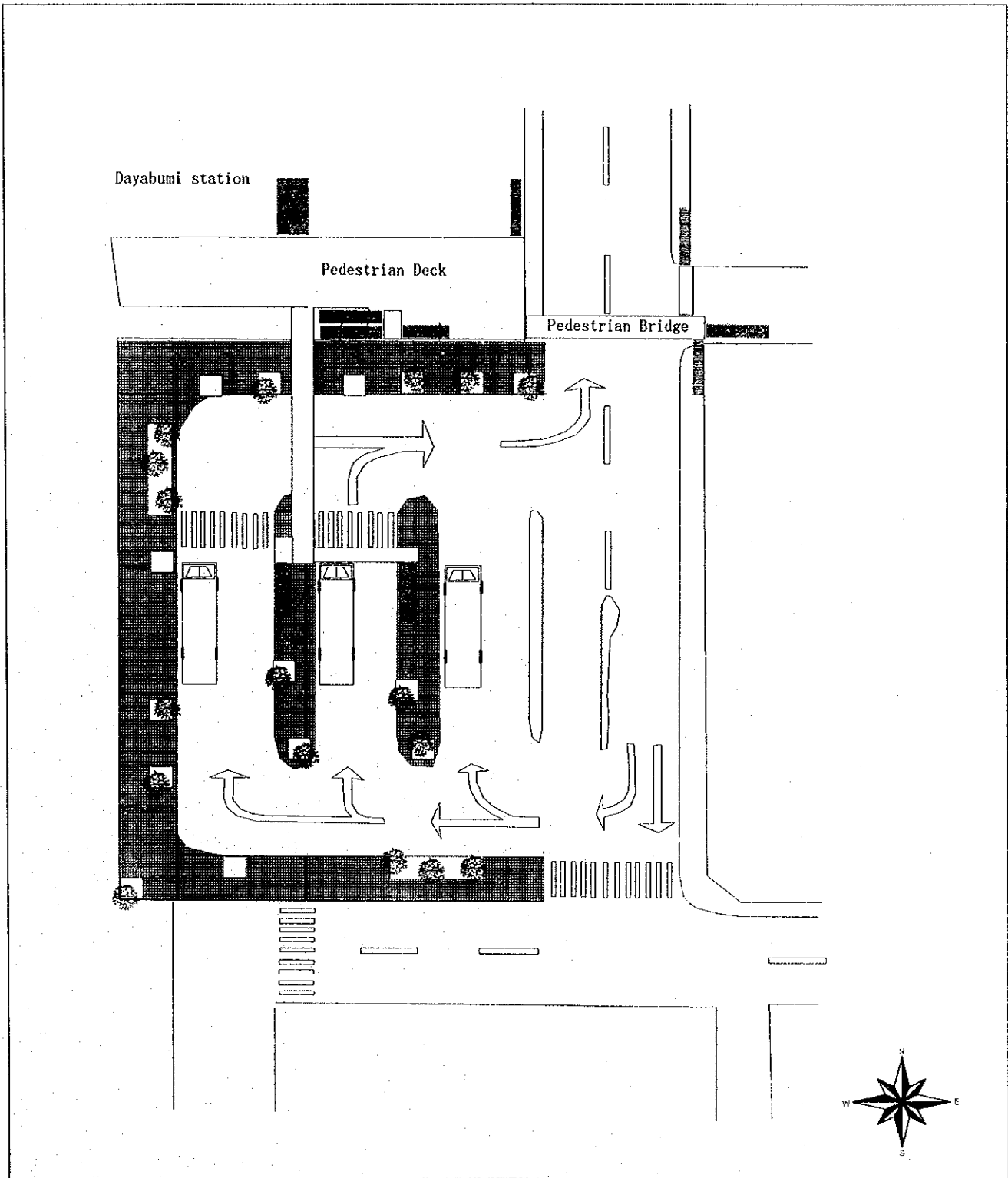


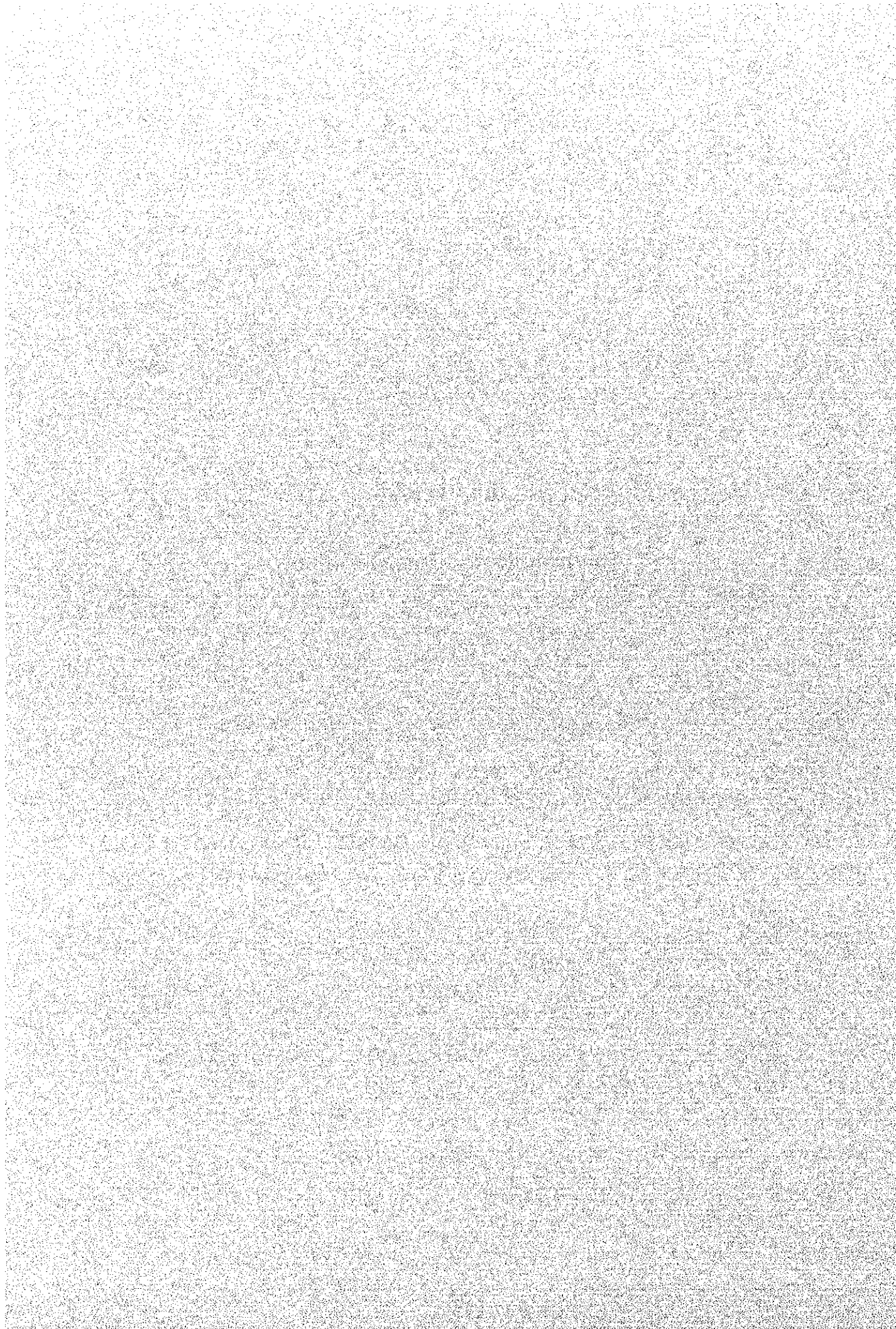
Figure 10.2.10

Station Plaza

SMURT-KL
 Study on Integrated Urban Transportation Strategies
 for
 Environmental Improvement in Kuala Lumpur

Chapter 11

Environmental Consideration



Chapter 11 Environmental Consideration

11.1 Environmental Aspect of Human Activity

Human activities have greatly influenced the environment. When the influence exceeds the mitigating capacity of the environment, environmental deterioration will start. Therefore it is important to minimise the possible environmental influence from human activities within the mitigating capacity of nature. This idea is the core environmental facet of sustainable development.

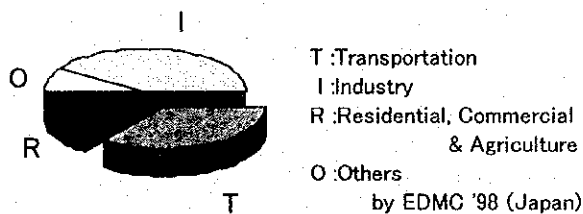


Figure 11.1.1 Final Energy Consumption of Malaysia

One of the important factors that influence the environment is human energy consumption. Generally, higher energy consumption means a higher probability of pollutant emission and a greater necessity for a detailed assessment of the impact. The final energy consumption of Malaysia is shown in Figure 11.1.1. The transportation sector consumed 31% of the national final energy. Thus the energy consumption of the transportation sector is worth discussing.

If the energy consumption of development is minimised, the environmental influence will decrease. Therefore, energy saving is a vital issue for environmental conservation and sustainable development.

Accordingly, the introduction of public transportation has considerable merit in terms of sustainable development. Energy consumption rate by person and per km in Japan shows that trains are twelve times and buses are four times more efficient than the passenger cars. (Figure 11.1.2) The introduction of public transportation is thus effective for environmental mitigation.

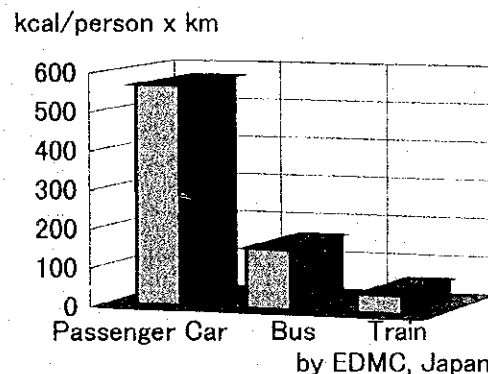


Figure 11.1.2 Energy Consumption by Mode (Japan, 1996)

In order to establish an urban environmental policy, the concept

of energy saving and increased energy efficiency is one of the indispensable approaches. Although environmental mitigation using the energy saving approach may be regarded as an indirect method, it is effective in the environmental mitigation of energy intensive sectors. Besides, CO₂ emission which leads to global warming should be treated in conjunction with energy saving.

It is desirable to adopt the management of human activities as well as the abatement of pollutants in establishing an environmental policy. In KL, the management of urban transportation is regarded as the core of atmospheric pollution mitigation and improvement. Because the traffic demand originates from people activities and the traffic movement of anonymous people results in various type of environmental problems, urban management is required to handle the environmental aspects of transportation properly and to improve the atmospheric condition.

The haze episode in 1997 showed the typical relation between human activities and the environment. Human activities without careful consideration towards environmental conservation will result in a deterioration which people will not be able to resolve.

11.2 Current Atmospheric Pollution Concerning Transportation in KL

According to the Malaysian Environmental Quality Report 1996, the overall air quality status throughout the country in 1996 was generally good and no case of serious haze was registered in 1996. The Air Pollution Index (API) was generally between good and moderate in 1996 for the Klang Valley Region.

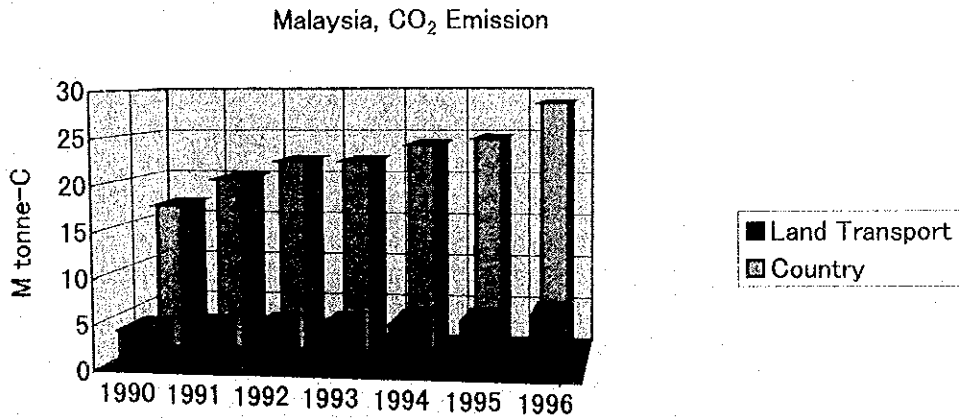
The Malaysian Environmental Quality Report 1997 showed that the air quality was generally good during the first six months until the advent of haze in mid-July which lasted till November 1997. The API sometimes exceeded the 100 level in Kuala Lumpur during that period. An API index of over 100 means an "unhealthy state". The air quality returned to normal in November coinciding with the monsoon season. Throughout 1997, the level of gaseous pollutants and lead in ambient air remained below the Recommended Malaysian Guidelines.

The haze episode, of 1997, was severe. In order to treat it, one must differentiate the position of the actual origin and the areas affected by the haze and other generic ambient air pollution. Generally illegal economic activities combined with unfavourable weather conditions produce haze. Thus haze should be treated as an item which requires a specific approach for mitigation. SRFA (the Sub-Regional Fire-Fighting Arrangement) launched air and ground surveillance in June 1998 to prevent regional haze.

However there are some problems with the ambient air quality in Kuala Lumpur. The detailed study of the Study Team revealed unfavourable conditions in limited areas, i.e. the vicinities of busy traffic intersection. Daily NO₂ levels in some areas exceeded the WHO daily guideline and the 8 hours' CO at a busy intersection showed

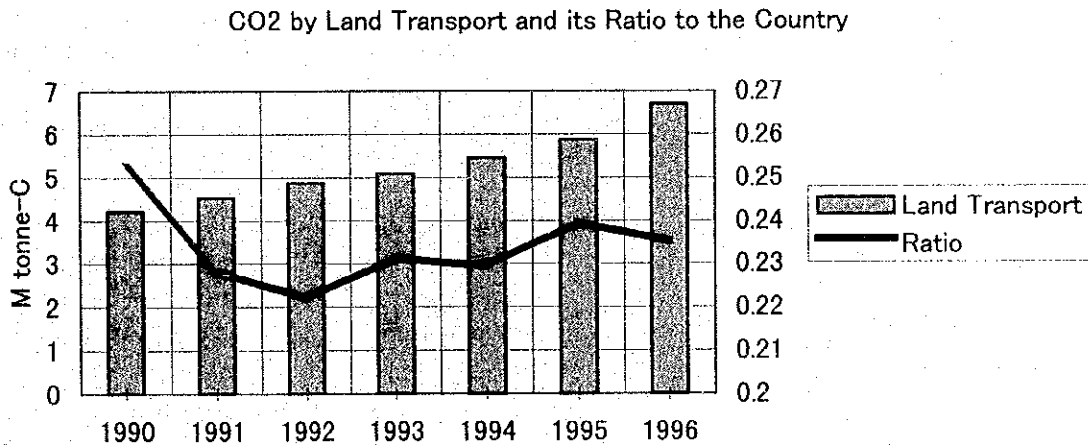
CO₂ Emission in Malaysia

Currently the reduction of CO₂ is a global concern. The CO₂ emission can be estimated by using the energy balance tables of Malaysia. The trend in CO₂ emission in Malaysia is as follows. Generally the total CO₂ emission will increase along with economic development.



CO₂ by Land Transport in Malaysia

CO₂ emission by land transport, including CO₂ from vehicles, is as follows. The ratio is approximately 23%, and the share of land transport is significant.

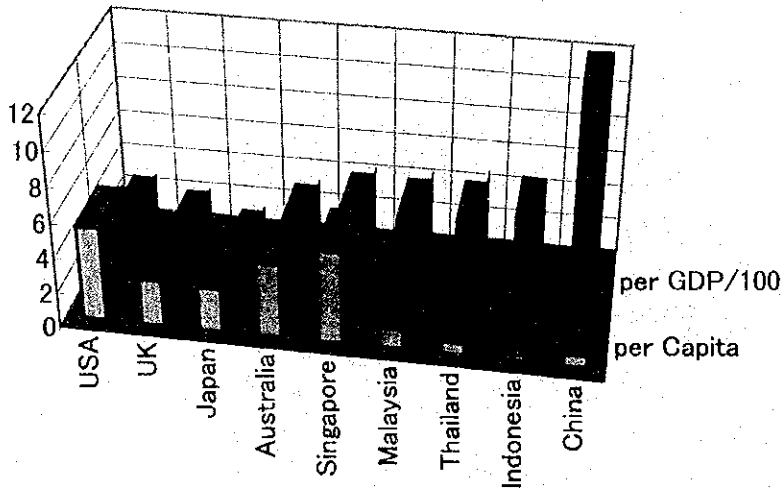


Sooner or later the reduction of CO₂ emission from vehicles will become an important objective. One of the CO₂ reduction measures is the improvement of fuel efficiency of vehicles. High fuel efficiency means a low consumption of fuel therefore a low emission amount of CO₂. Another measure is to introduce alternative energy, electric power, or any fuel which has a lower carbon content per unit energy than petrol and diesel.

CO₂ Emission per Capita and per GDP

CO₂ emissions per capita and per GDP are shown below. Malaysia's figures for these values follows that of developed countries. The trend is for CO₂ per capita will have to increase and CO₂ per GDP will decrease for the time being.

CO₂ Emission per Capita and per GDP, 1995



Source : Energy Data and Modelling Centre (Japan), 1998, compiled from IEA data
 per Capita : ton-C/Capita, per GDP : ton-C/million US \$

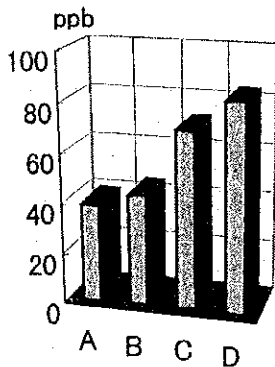


Figure 11.2.1 NO₂ Daily Average at Intersections

a value in excess of the Malaysian recommended guideline. Other than NO₂ and CO, similar type of situation may be expected, especially for PM10. NO₂ levels are illustrated in Figure 11.2.1.

A, B, C, and D corresponds to the intersections of Sultan Ismail and Raja Abudullah, Loke Yew and Hang Tuah, Putra and Raja Laut, and Pudu and Cheng Lock respectively. The Malaysian Guideline for NO₂ is designated for a one hour value, i.e. 170ppb (0.32mg/m³), and the guideline of WHO (0.15mg/m³ or 73ppb) is designated for the daily average. Because the data of the Study Team was analysed in terms of daily average, the corresponding value of the WHO is applied for evaluation. The value at intersection D exceeded the WHO guideline.

Further, the opinion survey of the Study Team revealed that approximately 80% of the working persons and students in KL regarded air pollution in KL as being serious. (Figure 11.2.2)

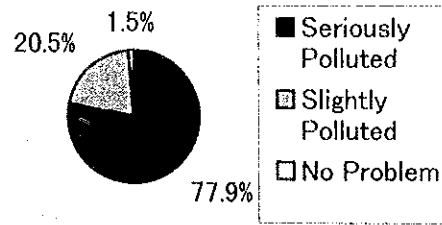
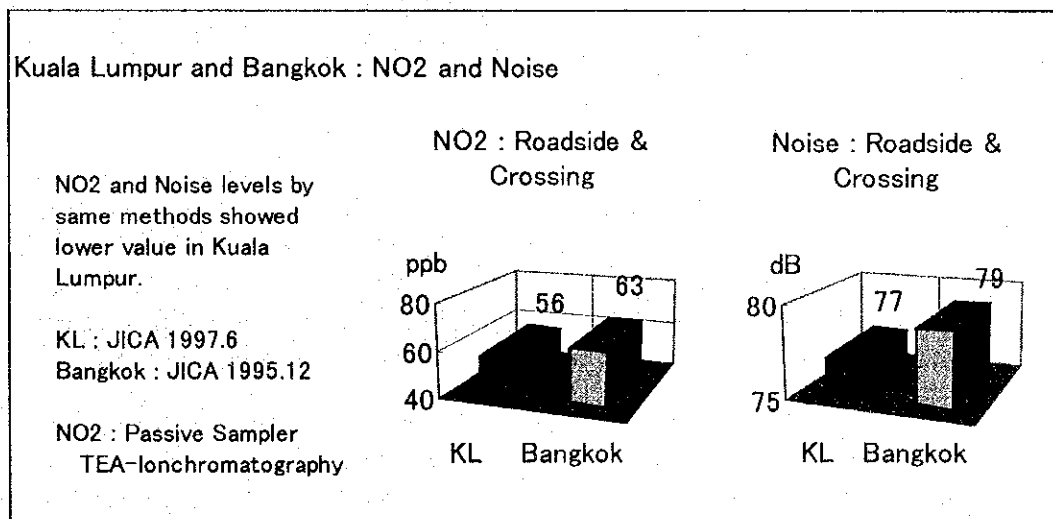


Figure 11.2 2
Opinion Survey,
Existing Air Quality in KL

It is essential when establishing an environmental policy to pay the utmost attention to the five human senses. The conversion of the understanding of the five senses into scientific words is always necessary. The difference between monitored data and human opinions may point to the difference in reviewing subjects. The senses focus on the surroundings where they are actually living and the subject cannot be limited only to substances monitored by instruments,

The current atmospheric situation in KL can be recognised as being good to moderate, but some areas, especially the vicinities of busy traffic intersections, are not favourable. And people want a steady improvement of atmospheric conditions. This is the summary of the atmospheric situation in KL.

The current transportation situation in KL reveals an urgent need to apply mitigation policies. At first the transportation mitigation policies should be screened based on the understanding of the atmospheric situation.



11.3 Environmental Improvement

11.3.1 Urban Environmental Management

The policy for urban environmental improvement is closely related to the urban management policy. Initially, groups of people form an urbanised area, then they generate human interactive energy, and consume physical energy. In this stage, effective energy consumption cannot be expected, an environmental consideration for whole area cannot be formulated, transportation facilities may be poor, and traffic congestion may happen. A good urban environment cannot be realised by laissez-faire type of urban management.

There are many genres in urban management. The urban transportation management is an important genre and has close connection with urban environmental mitigation. The transportation sector has contributed the major share of urban air pollution. Vehicles also contribute to noise pollution. The realisation of traffic management and the introduction of public transportation may lessen the urban environmental burden greatly. Urban transportation policies can be recognised as environmental policies.

Generally, cities experience growth and metamorphosis. It is necessary for urban management to anticipate the urban growth and establish adequate policies beforehand. If there is heavy traffic congestion and unfavourable pollution at intersections, it implies a failure in adapting adequate policies in advance.

According to the Air Quality Management Study for the Klang Valley Region. (1993, JICA), wind speed was generally very low and therefore pollutants were likely to stagnate in the atmosphere. And the strong solar radiation and high temperature suggested a greater possibility of photochemical reaction. Thus, the natural condition of KL cannot be viewed as being favourable from the point of view of atmospheric pollution.

Well-designed urban structures can mitigate natural conditions and prevent them from environmental deterioration. Many cities are trying to convert themselves into a more environmentally friendly structure. The experiences of many cities suggest that the basic ideas for environmental conservation concerning transportation, are the introduction of public transportation and the limited utilisation of private vehicles, and that transformation into an environmentally friendly structure type is not an easy task.

For KL, the enhancement of public transportation, i.e. the introduction of rail-based transportation and the renovation of the public bus system, should have the first priority. Rail-based transportation is expanding now. Although the improvement of public bus system has already started, substantial parts are still under planning. The transfer of the bus terminal to a more suitable area and the restructuring of the bus routes are the urgent issues for urban environmental mitigation.

Excessively crowded public areas implies a high density of energy consumption, and

may have a high probability of causing atmospheric pollution and noise problems.

The Study Team has studied the transportation policies which would be beneficial for the urban environmental management in KL. In section 11.3.4, after discussing environmental policies, the current amount of pollutants emission from vehicles and that of the future will be discussed.

11.3.2 Development of Environmental Technology of Vehicles

(1) Environmental Requirement

The requirements for contemporary motorised vehicles are changing toward reducing the pollutant emission to the lowest level possible. In order to keep up with the requirements, broad development is being undertaken and various policies are being introduced. Motorised vehicles have caused serious problems but are still indispensable for modern life. This is a serious dilemma in the modern world. People intend to solve the environmental facet of this dilemma by reducing the amount of pollutants. Motorised vehicles which do not satisfy the requirements will soon be phased out in the future, together with the players in the motor vehicle industry. Who are unable to follow in this trend.

This trend can be regarded as being favourable for environmental mitigation. Appropriate practical policies for the introduction of low emission vehicles should be implemented now. If one rides this favourable trend, both the mitigation of pollutants, and the reduction of CO₂ will become a reality without undue difficulty.

Generally, the atmospheric condition in Kuala Lumpur is between good to moderate. However, there are some unfavourable areas in terms of human health and the senses. Many people perceive air pollution in KL to be serious. Further environmental policies for vehicles are necessary. Besides, it is necessary to consider the reduction of global warming gas, such as CO₂, in order to secure further sustainable development in Malaysia. These issues can be mitigated by integrating national policy. Technologies for lowering air pollutant emission and CO₂ already exist, and Malaysia should be able to improve them. The implementation of the pertinent policy mix will enhance the introduction of the necessary technologies.

(2) Development

Today environmental friendly vehicles are being developed rapidly. Their main objectives are pollution abatement and CO₂ reduction. The research and development is wide ranging, and various results are being obtained. Some of them are the direct injection of fuel into the combustion cylinder; the introduction of alternative vehicle energy; the development of extremely low emission vehicle; and the development of secondary battery and fuel cell cars. These are summarised in Figure 11.3.1.

Regarding the conventional internal combustion engine, current progress in terms of pollution mitigation has been remarkable progress. The typical technologies are as follows.

- 1) Introduction of electronic precise control for various engine parts operation using electronic sensors and micro-computers
- 2) Modification of engine configuration
- 3) Direct injection of petrol and diesel into the combustion cylinder
- 4) Improvement of the catalytic converter

Utilising these technologies, pollutant emission can be reduced significantly and fuel economy can be improved approximately by 30% for petrol engines and by 15% for diesel engines. Thus the current technology development will benefit pollution mitigation.

Currently environmental awareness and environment-oriented activities are the important issue for car producers. The more stringent the environmental regulations in many countries become, people will prefer more environment-friendly cars. The development of environmental technologies is essential for survival. It is better to select, develop, and introduce adequate technologies for reducing pollutants together with CO₂.

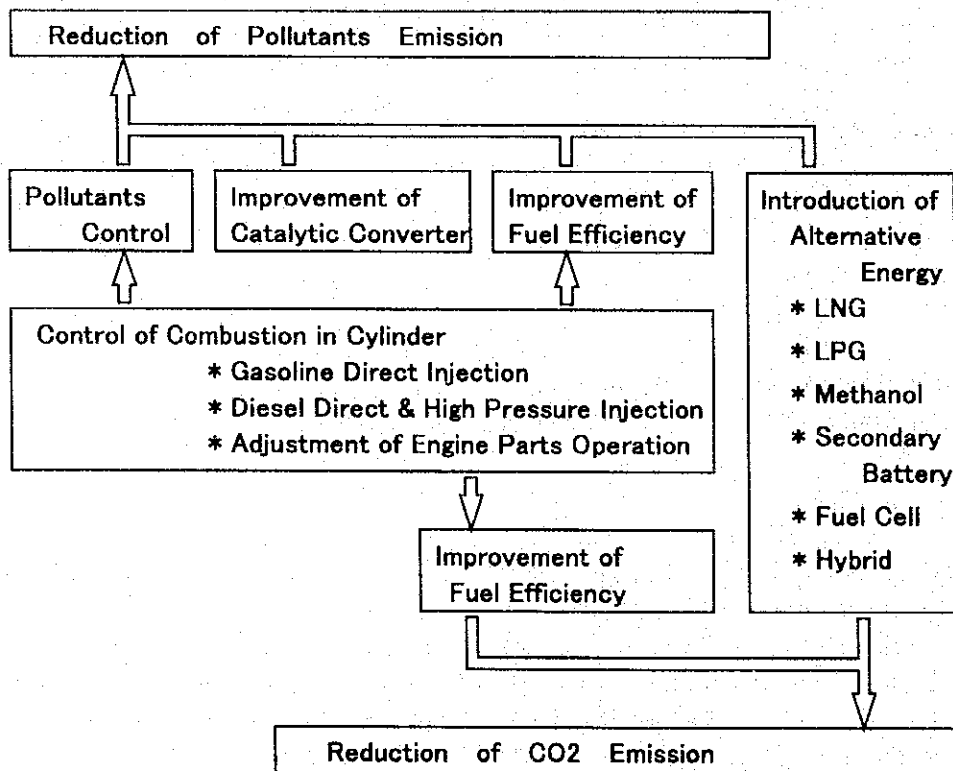


Figure 11.3.1 Development of Environmental Technology

11.3.3 Environmental Policy for Individual Vehicles

(1) Regulation for Exhaust Gas

1) Four Wheeler

According to the 1997 report of the DOE, motor vehicle emission was the principal source of air pollution. Its share reached 81% of the combined estimated emissions. Motor vehicles continue to increase in number and they emit a large volume of pollutants, HC, NO_x, CO, particulate matter, and so forth. Minimising of the emission from a vehicle's exhaust is essential for environmental management. The proper regulation of pollutant emission from motor vehicles using urban management policies can mitigate the atmospheric condition to a sustainable level. The following regulations are currently enforced in Malaysia.

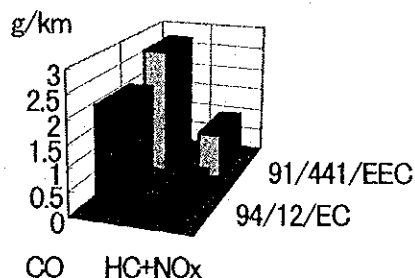


Figure 11.3.2 Emission Standard (Passenger Car)

Table 11.3.1 Current Emission Standard

| Standard | Model | Vehicle Type |
|-------------------------|-----------------------|---------------------------------|
| Petrol Vehicles | | |
| ECE 15.04 | before 97.01.01 | less than 3.5 t |
| 91/441/EEC | on and after 97.01.01 | Passenger Car, less than 2.5 t |
| 93/59/EEC | on and after 97.01.01 | Commercial Car, less than 3.5 t |
| Diesel Vehicle | | |
| ECE 15.04 and ECE 24.03 | before 97.01.01 | less than or equal 3.5 t |
| ECE 49 | before 97.01.01 | more than 3.5 t |
| 93/59/EEC | on and after 97.01.01 | less than or equal 3.5 t |
| ECE 49.02 (EURO 1) | on and after 97.01.01 | more than 3.5 t |

The emission standard in Malaysia follows that of the EC. Currently the EC is adopting 94/12/EC for passenger cars. The current Malaysian standard for passenger cars (new models after Jan. 1, 1997) is 91/441/EEC. The values of these standards are depicted in Figure 11.3.2. The values for current the EC standard, i.e. 94/12/EC are 2.2g/km for CO and 0.5g/km for HC+NO_x, and these values are 20% and 50% lower than the values of the current Malaysian standard, i.e. 91/441/EEC.

Many passenger cars in KL conform to ECE15/04. Due to the difference in test procedures, the value of this standard cannot be compared with that of the other two standards, i.e. 91/441/EEC and 94/12/EC. However, ECE 15/04 is regarded as being considerably lenient. It is said that the regulation value of ECE 15/04 could be attained without installing a catalytic converter.

The introduction of 94/12/EC for petrol vehicles on and after Jan. 1, 2000 is already planned in Malaysia. It is necessary to implement this schedule for petrol vehicles and to introduce further regulation for diesel vehicles. The current atmospheric pollution and the increasing trend in car registration in KL demands the introduction of further regulations. Furthermore, the advance in vehicle technology in the world makes it possible to introduce further regulations without much technological difficulties.

2) Motorcycle

As for motorcycles, exhaust emission standards are being studied but have not yet been applied yet. The authorities and the motorcycle industry are discussing the applicability of the Taiwan Stage 2 regulation and ECE 40.02.

Although NO_x emission is small, the volume of CO and HC emitted from motorcycles is not negligible but considerable.

Figure 11.3.3 shows the share of motorcycle

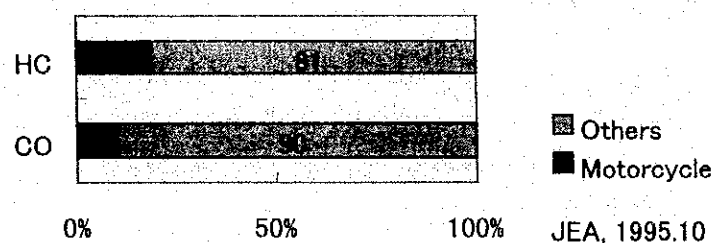


Figure 11.3.3 Emission Volume of Motorcycle

emission out of the total vehicle emission in Japan. In Kuala Lumpur, the number of motorcycles is 577,000 and it has a 35% share of the 1,643,000 registered motorvehicles. This share is higher than that of Japan. Therefore the emission from motorcycles in Kuala Lumpur should be significant and cannot be ignored.

The regulation for motorcycles should also be introduced in Malaysia, and the regulation should be appropriate in view of the considerable amount of pollutants emitted by them. The regulation for motorcycle emission should not be overlooked for too long.

Many passenger cars in KL conform to ECE15/04. Due to the difference in test procedures, the value of this standard cannot be compared with that of the other two standards, i.e. 91/441/EEC and 94/12/EC. However, ECE 15/04 is regarded as being considerably lenient. It is said that the regulation value of ECE 15/04 could be attained without installing a catalytic converter.

The introduction of 94/12/EC for petrol vehicles on and after Jan. 1, 2000 is already planned in Malaysia. It is necessary to implement this schedule for petrol vehicles and to introduce further regulation for diesel vehicles. The current atmospheric pollution and the increasing trend in car registration in KL demands the introduction of further regulations. Furthermore, the advance in vehicle technology in the world makes it possible to introduce further regulations without much technological difficulties.

2) Motorcycle

As for motorcycles, exhaust emission standards are being studied but have not yet been applied yet. The authorities and the motorcycle industry are discussing the applicability of the Taiwan Stage 2 regulation and ECE 40.02.

Although NO_x emission is small, the volume of CO and HC emitted from motorcycles is not negligible but considerable.

Figure 11.3.3 shows the share of motorcycle

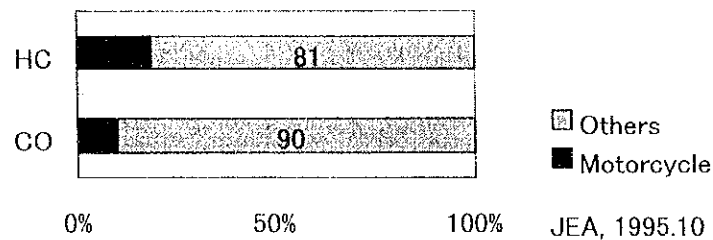


Figure 11.3.3 Emission Volume of Motorcycle

emission out of the total vehicle emission in Japan. In Kuala Lumpur, the number of motorcycles is 577,000 and it has a 35% share of the 1,643,000 registered motorvehicles. This share is higher than that of Japan. Therefore the emission from motorcycles in Kuala Lumpur should be significant and cannot be ignored.

The regulation for motorcycles should also be introduced in Malaysia, and the regulation should be appropriate in view of the considerable amount of pollutants emitted by them. The regulation for motorcycle emission should not be overlooked for too long.

(2) Regulation for Noise

The 2nd stage regulation for motorcycles was implemented on Jan. 1, 1990. For cars and lorries, the regulation was implemented on Jul. 16, 1987. In 1997, curbside enforcement campaigns by the DOE State Offices with the co-operation of the Royal Malaysian Police revealed that 1,405 motorcycles out of 5,999 had violated the permissible noise limit. (Malaysia Environmental Quality Report 1997, DOE)

In addition to individual vehicles compliance with the regulations by, the mitigation of noise generated by vehicles is another issue. The measured noise level in the CBD in KL cannot be regarded as being low.

According to the Malaysia Environmental Quality Report 1996 and 1997, DOE, the share of noise complaint is 4% of the total complaints. The public's awareness of noise may not be critical now. The deafening noise of full accelerating motorcycles after the signal changes will become a significant issue in KL once the amenity level of the city has been improved and people have more chances to walk and stroll in the CBD.

The motorists' driving etiquette is an indispensable element in noise mitigation. If excessive acceleration and cutting-in were avoided through courteous driving then the noise level would decrease. Public environmental awareness is a powerful tool in fostering courteous driving. To nurture the public's noise awareness, it may be useful to show the noise level at selected intersections using a real-time signboard. An increased public awareness of courteous driving will play a key role.

(3) Introduction of LEV

It is one-sided to stress only the further implementation of emission regulations when the introduction of low emission vehicle (LEV) is also indispensable. LEV has much lower emissions than the current emission standards in developed countries. One type of LEV is the natural gas vehicle (NGV). Typical pollutant emission of NGV is illustrated in Figure 11.3.4 and Figure 11.3.5. Current leading NGV technologies can realise substantially lower emission than this figure.

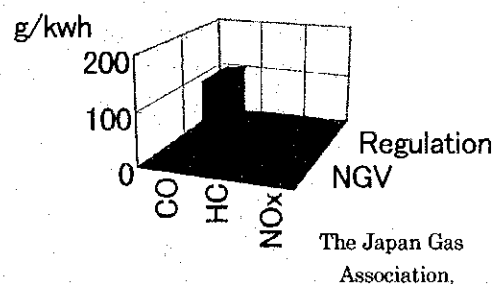
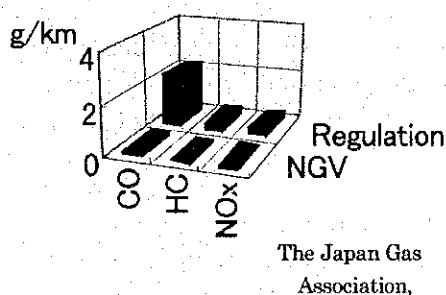


Figure 11.3.4 NGV:Light Duty Lorry Figure 11.3.5 NGV:Medium Duty Lorry

(2) Regulation for Noise

The 2nd stage regulation for motorcycles was implemented on Jan. 1, 1990. For cars and lorries, the regulation was implemented on Jul. 16, 1987. In 1997, curbside enforcement campaigns by the DOE State Offices with the co-operation of the Royal Malaysian Police revealed that 1,405 motorcycles out of 5,999 had violated the permissible noise limit. (Malaysia Environmental Quality Report 1997, DOE)

In addition to individual vehicles compliance with the regulations by, the mitigation of noise generated by vehicles is another issue. The measured noise level in the CBD in KL cannot be regarded as being low.

According to the Malaysia Environmental Quality Report 1996 and 1997, DOE, the share of noise complaint is 4% of the total complaints. The public's awareness of noise may not be critical now. The deafening noise of full accelerating motorcycles after the signal changes will become a significant issue in KL once the amenity level of the city has been improved and people have more chances to walk and stroll in the CBD.

The motorists' driving etiquette is an indispensable element in noise mitigation. If excessive acceleration and cutting-in were avoided through courteous driving then the noise level would decrease. Public environmental awareness is a powerful tool in fostering courteous driving. To nurture the public's noise awareness, it may be useful to show the noise level at selected intersections using a real-time signboard. An increased public awareness of courteous driving will play a key role.

(3) Introduction of LEV

It is one-sided to stress only the further implementation of emission regulations when the introduction of low emission vehicle (LEV) is also indispensable. LEV has much lower emissions than the current emission standards in developed countries. One type of LEV is the natural gas vehicle (NGV). Type typical pollutant emission of NGV is illustrated in Figure 11.3.4 and Figure 11.3.5. Current leading NGV technologies can realise substantially lower emission than this figure.

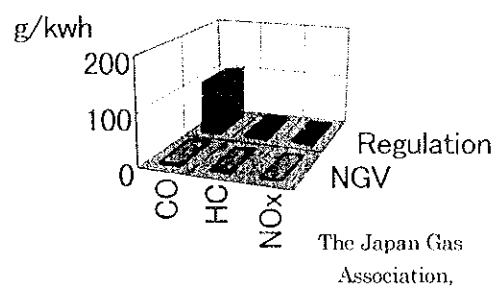
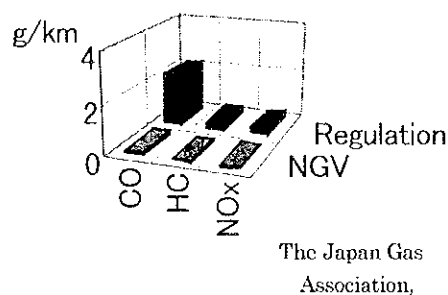


Figure 11.3.4 NGV:Light Duty Lorry Figure 11.3.5 NGV:Medium Duty Lorry

There are many types of LEV as shown in Table 11.3.2. Because of its energy resources and technology, it may be suitable for Malaysia to focus on NGVs. Malaysia produces a lot plenty of natural gas in its gas fields. Natural gas taxies have been already utilised in the Klang Valley and one natural gas fuelling station has been constructed in Sarawak. The enhancement of introducing NGV forms the mainframe of LEV policies. The public sector should lead in the introduction of LEV.

Table 11.3.2 Low Emission Vehicle Type

| Power Mechanism | Internal Combustion Engine | Hybrid | Electric Motor |
|-------------------------|--------------------------------|----------------|--------------------------------|
| Type (Energy Source) | Natural Gas LPG Methanol | Engine + Motor | Secondary Battery Fuel Cell |

NGV technologies have realised a low pollutants emission, relatively small CO₂ emission, and lower noise pollution than diesel vehicles. The substitution of petrol or diesel vehicles with NGVs will result in a significant pollution reduction. Therefore, broad introduction of NGV will surely mitigate unfavourable pollution level in Kuala Lumpur. The advance in substitution for the same size of vehicles will reduce CO₂ emission closely to 30 %.

In order to introduce NGVs, various issues must be raised. The major issues are the supply of NGV, preparation of infrastructure for natural gas distribution, incentives to use them, expansion of the NGV mass transportation system, and the scenario for introducing them. NGV is more suitable for urban use today, and the current pollution level demands rapid introduction of NGVs in the urban areas.

(4) Periodic Inspection and Roadside Surveillance of Motor Vehicles

According to the Road Transport Act 1987, the periodic inspection of motor vehicles is stipulated in part IIA for traffic safety and environmental mitigation. The Road Transport Department presides over this periodic inspection. The stipulation of inspection is applied to commercial vehicles and not to private passenger cars. The test procedure includes tests for exhaust gas emission and sound level. Under the jurisdiction of the Road Transport Department, PUSPAKOM carries out the inspections.

Similar to other regulatory systems, the periodic inspection system should be maintained based on the public support. The vehicles running on public roads are public in nature, regardless of whether the ownership is public or private. Therefore the inspection system has the public nature, and should be maintained as a social

system. It is one of the essential factors for enhancing the practical effect of such type of social system that citizens recognise its public nature. This type of recognition is a common perception in environmental mitigation and sustainable development. This perception is developed through daily public relations. Necessity of vehicles maintenance in reducing pollutants will be realised as a results.

DOE, with the co-operation of the Royal Malaysian Police, conducts an enforcement campaign for emission control. The area Watch and Sanction Inspection (AWASI) programme by the DOE's mobile squad has effectively reduced, the number of vehicles with excessive exhaust: roadside inspections for motorcycle noise are also undertaken by DOE State Offices with the co-operation of Royal Malaysian Police. A approvals for car and lorry noise of new models are undertaken by the Standards and Industrial Research Institute of Malaysia (SIRIM). These are the inspections and surveillance of vehicles, in addition to the periodic inspection by the RTD.

Excessive emissions of black smoke from lorries and white smoke from motorcycles may be a sign of poor maintenance. Thus, more effective inspection system is required and surveillance ability should be improved. It is also required to call for people's environmental awareness.

In order to develop a more effective inspection and surveillance system, it is better to integrate political will of the related agencies and to formulate co-operative efforts in addition, public relations and enlightenment of the drivers and owners about proper maintenance and its positive effects for environment should be enhanced.

11.3.4 Estimation of Pollutant Emissions of Development Plan

(1) Evaluation Method

1) Pollutants Emission from Vehicle

Two types of estimations were carried out, one for the long-term transportation development plan, and the other for the short-term CPA traffic control/management plan. The applied methods for both estimations were based on the final report of Air Quality Management Study for the Klang Valley Region, 1993 JICA. Emission volume from vehicles was calculated by the multiplying emission factor of the vehicle, the driving distance, and the vehicle volume. The emission factor represents the emission volume per unit vehicle and unit distance, and depends on the vehicle type, engine type, and running speed. The vehicle age was taken into consideration a through deteriorating rate of emission factor. To establish the future emission factor, proper regulation was considered. The details of the estimations are described in Appendix 11.

Concerning long-term development, the estimation of pollutant emission was carried out for the Study Area of the SMURT-KL, and the estimated years were 1997 and 2020. The emission factors are summarised in Table 11.3.3 and Table 11.3.4. The vehicle type of emission factor was four.

Table 11.3.3 Emission Factor, 1997

| Vehicle Type | Item | Average Travel Speed(km/h) | | | | | | | | | | | |
|---------------|------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
| Motorcycle | CO | 60.78 | 41.49 | 31.84 | 26.41 | 23 | 20.6 | 18.73 | 17.17 | 15.83 | 14.69 | 13.76 | 13.04 |
| | NOx | 0.2 | 0.18 | 0.17 | 0.17 | 0.17 | 0.17 | 0.18 | 0.19 | 0.2 | 0.2 | 0.21 | 0.21 |
| Car | CO | 48.7 | 31.72 | 23.64 | 19.12 | 16.18 | 13.99 | 12.21 | 10.7 | 9.42 | 8.36 | 7.53 | 6.92 |
| | NOx | 1.87 | 1.92 | 1.98 | 2.06 | 2.13 | 2.21 | 2.28 | 2.34 | 2.4 | 2.45 | 2.49 | 2.53 |
| Public Bus | CO | 22.76 | 18.09 | 14.64 | 12.05 | 10.1 | 8.61 | 7.47 | 6.6 | 5.93 | 5.43 | 5.06 | 4.79 |
| | NOx | 14.49 | 12.92 | 11.68 | 10.7 | 9.94 | 9.36 | 8.94 | 8.65 | 8.49 | 8.44 | 8.52 | 8.71 |
| Heavy Vehicle | CO | 20.26 | 16.1 | 13.03 | 10.73 | 8.99 | 7.67 | 6.65 | 5.88 | 5.28 | 4.83 | 4.5 | 4.27 |
| | NOx | 15.24 | 13.58 | 12.28 | 11.25 | 10.45 | 9.84 | 9.39 | 9.09 | 8.92 | 8.88 | 8.95 | 9.15 |

Table 11.3.4 Emission Factor, 2020

| Vehicle Type | Item | Average Travel Speed (km/h) | | | | | | | | | | | |
|---------------|------|-----------------------------|-------|-------|------|------|------|------|------|------|------|------|------|
| | | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 |
| Motorcycle | CO | 19.38 | 13.23 | 10.15 | 8.42 | 7.33 | 6.57 | 5.97 | 5.48 | 5.05 | 4.69 | 4.39 | 4.16 |
| | NOx | 0.08 | 0.07 | 0.07 | 0.07 | 0.07 | 0.07 | 0.08 | 0.08 | 0.08 | 0.08 | 0.09 | 0.09 |
| Car | CO | 10.66 | 6.79 | 4.97 | 3.97 | 3.33 | 2.87 | 2.5 | 2.19 | 1.93 | 1.72 | 1.55 | 1.43 |
| | NOx | 0.47 | 0.48 | 0.5 | 0.52 | 0.54 | 0.56 | 0.58 | 0.6 | 0.61 | 0.62 | 0.63 | 0.65 |
| Public Bus | CO | 2.36 | 1.88 | 1.52 | 1.25 | 1.05 | 0.89 | 0.78 | 0.69 | 0.62 | 0.56 | 0.53 | 0.5 |
| | NOx | 0.76 | 0.68 | 0.61 | 0.56 | 0.52 | 0.49 | 0.47 | 0.45 | 0.44 | 0.44 | 0.44 | 0.45 |
| Heavy Vehicle | CO | 2.19 | 1.74 | 1.41 | 1.16 | 0.97 | 0.83 | 0.72 | 0.64 | 0.57 | 0.52 | 0.49 | 0.46 |
| | NOx | 0.84 | 0.75 | 0.68 | 0.62 | 0.57 | 0.54 | 0.52 | 0.5 | 0.49 | 0.49 | 0.49 | 0.5 |

Concerning the short-term CPA traffic control/management plan, a similar method was applied, as described in Appendix 11.

2) Road Network, Traffic Volume, and Traffic Speed

The road network, traffic volume and the speed data of the respective vehicle type were prepared by the transport planning group of the SMURT-KL Study, and these data were applied for the estimation.

The Study Area was divided into 250m x 250m grid units. The emission amount from each grid represents the cumulative emission from vehicles when it runs in the grid area.

(2) Pollutant Emission Amount in the Long-Term Development Plan

The estimation of 2020 pollutant emission from vehicles in the Study area was simulated. The year 2020 is the target year of the Long-Term Development Plan,

and the details of the Plan are described in Chapter 8. Since 2020 is too far into the future to estimate the environmental situations and regulations, the assumed emission conditions for the simulation did not fully depend on authorised ones. Besides, current situations were simulated as well. The conditions are presented in Table 11.3.5.

Table 11.3.5 Conditions of Estimation

| 1997 | | 2020 |
|--------------|--|--|
| Four Wheeler | Petrol Vehicle : ECE 15.04, 91/441/EEC, 93/59/EEC Diesel Vehicle : ECE 15.04, ECE 49, 93/59/EEC, ECE49.02 | Commercial Vehicle : Natural Gas Vehicle Others (Petrol) : 94/12/EC |
| Motorcycle | Without Regulation | Taiwan Stage 2 |

The amount of NOx and CO emission from vehicles was simulated in the 250m x 250m grid. The simulation results are illustrated in Figure 11.3.6 to Figure 11.3.11. The NOx and CO emission amount for the area is as follows.

Table 11.3.6 Emission Amounts of Pollutant

| | NOx t/year | CO t/year |
|--------------------------|---------------|--------------|
| 1997 | 19,100 | 272,000 |
| 2020 Without Master Plan | 7,800 | 165,000 |
| 2020 With Master Plan | 7,900 | 136,000 |

Although traffic volume will have increased by 2020, the estimated pollutant emission in the area decreased remarkably. In 2020 the implementation of the Mater Plan, NOx and CO emission volume in the area will drop by 60% and 50% respectively, compared to the 1997 values. If emission is reduced to the level of the standard listed in Table 11.3.5, environmental conditions would be sustainable.

The expansion of human activities will result in the development and economic growth of the area. The accumulation of development activities up till the year 2020 will bring about great changes. In order to maintain the environment throughout these changes, it is necessary to apply clear and long-term environmental policies.

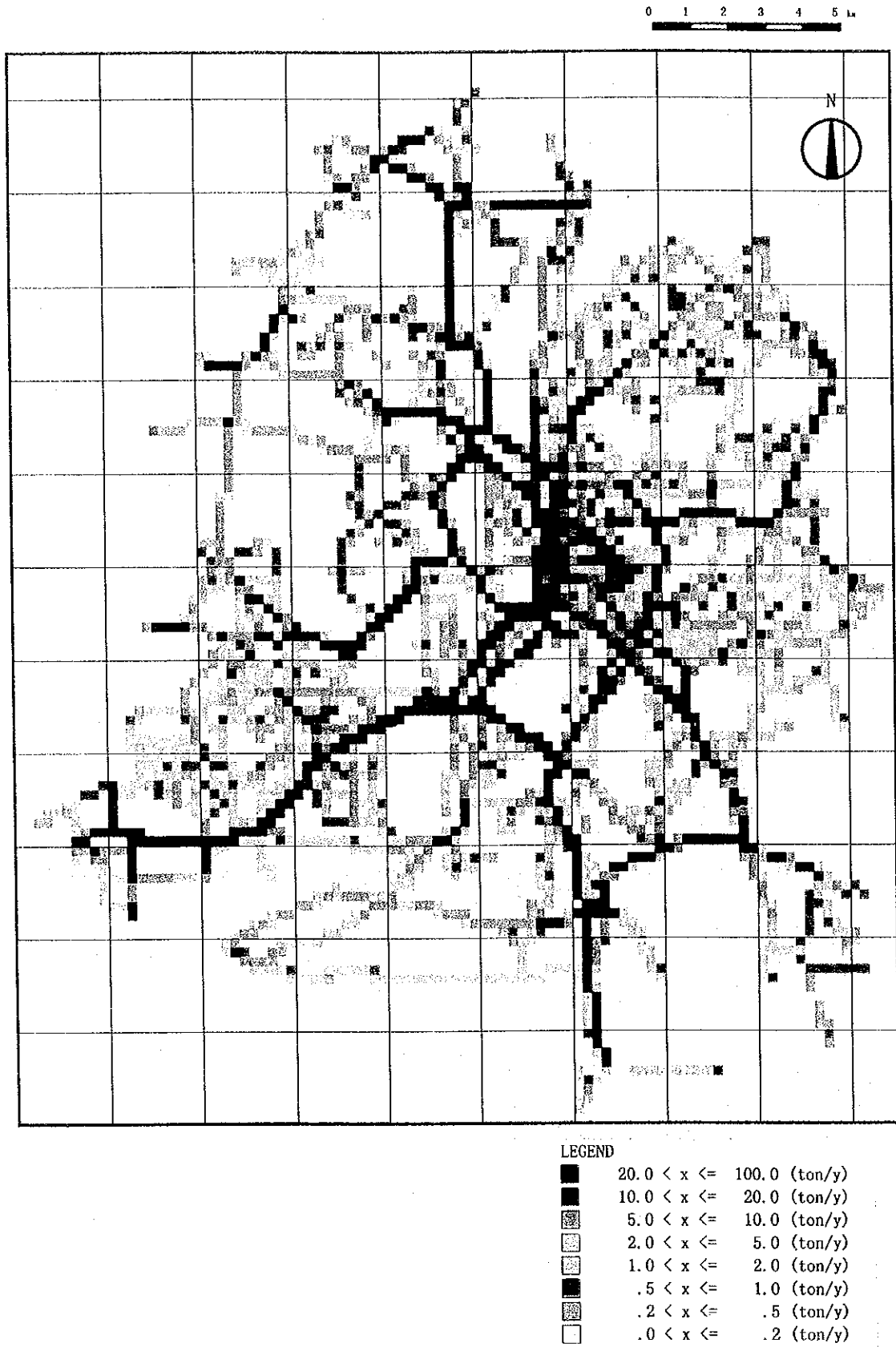


Figure 11.3.6 Estimation of NOx Emission, 1997

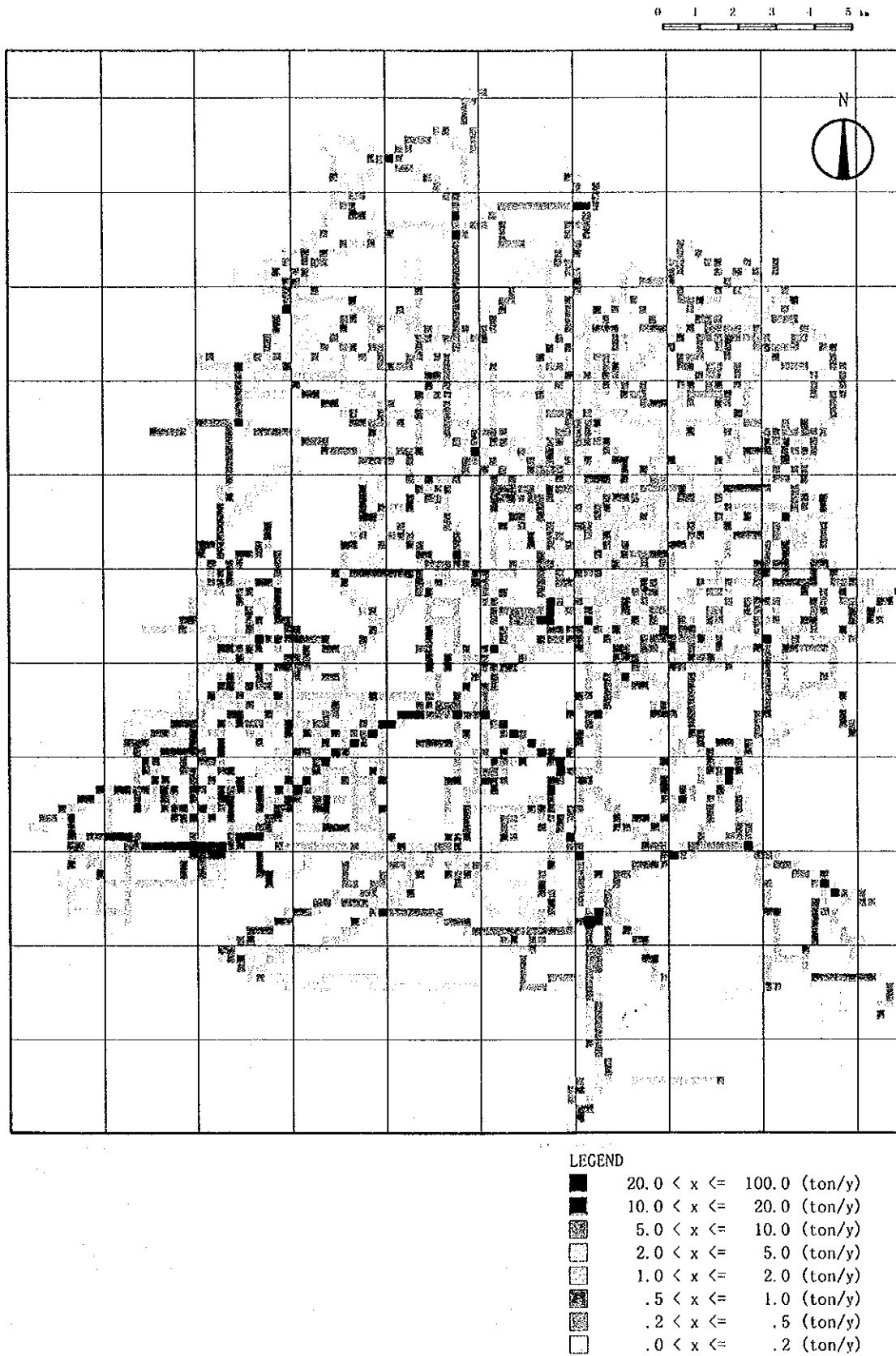


Figure 11.3.7 Estimation of NO_x Emission, 2020 without Master Plan

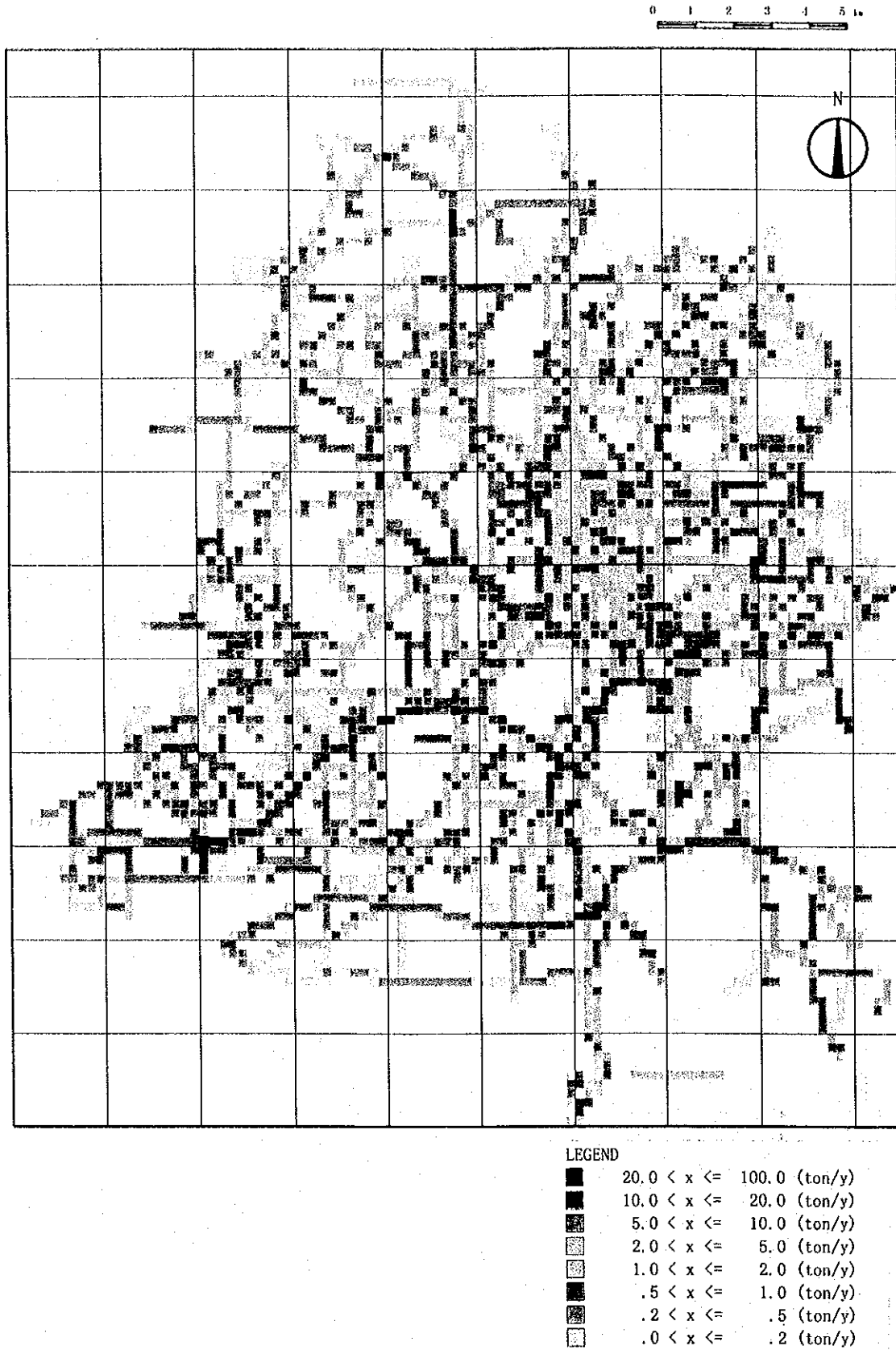


Figure 11.3.8 Estimation of NOx Emission, 2020 with Master Plan

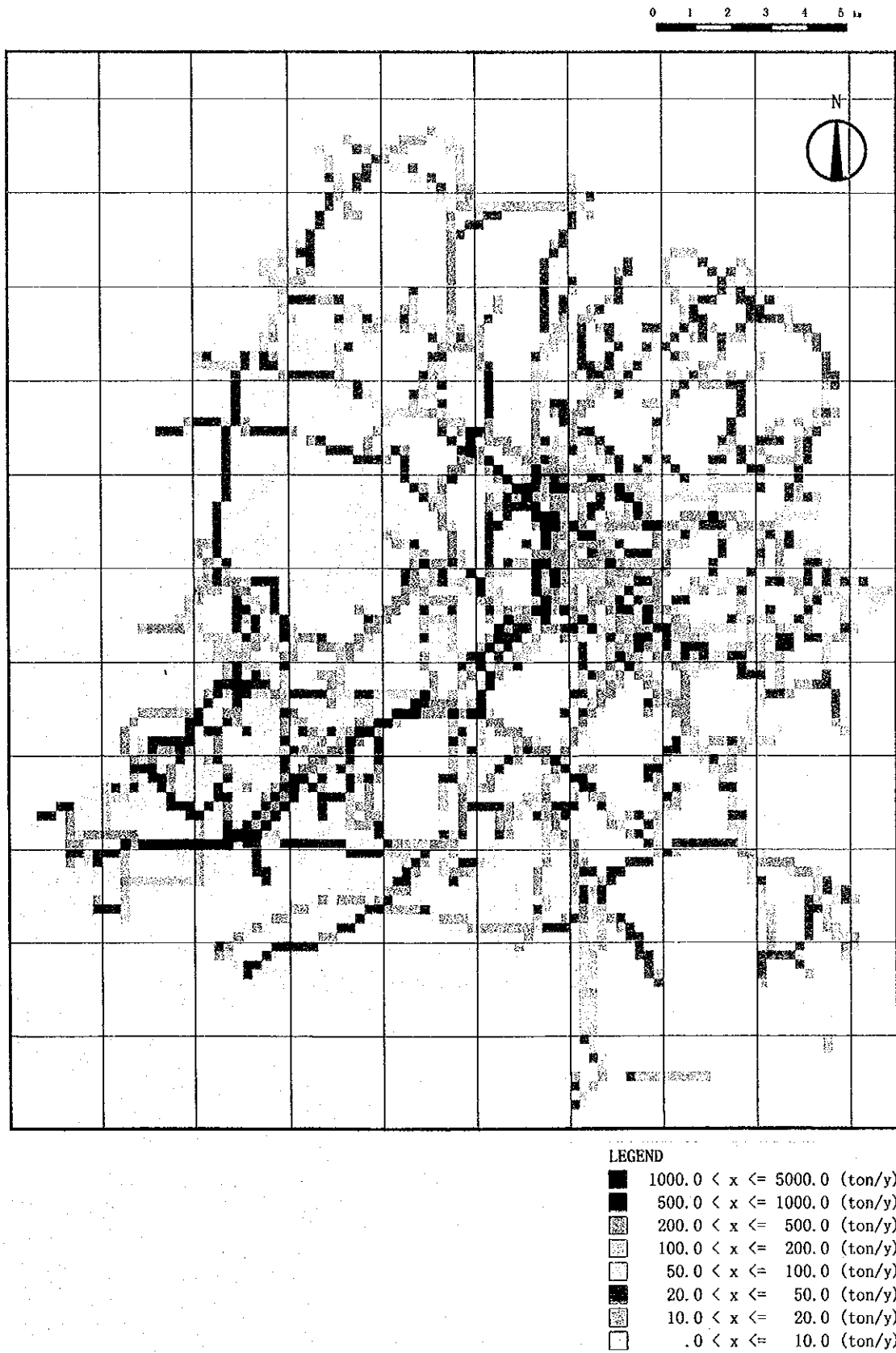
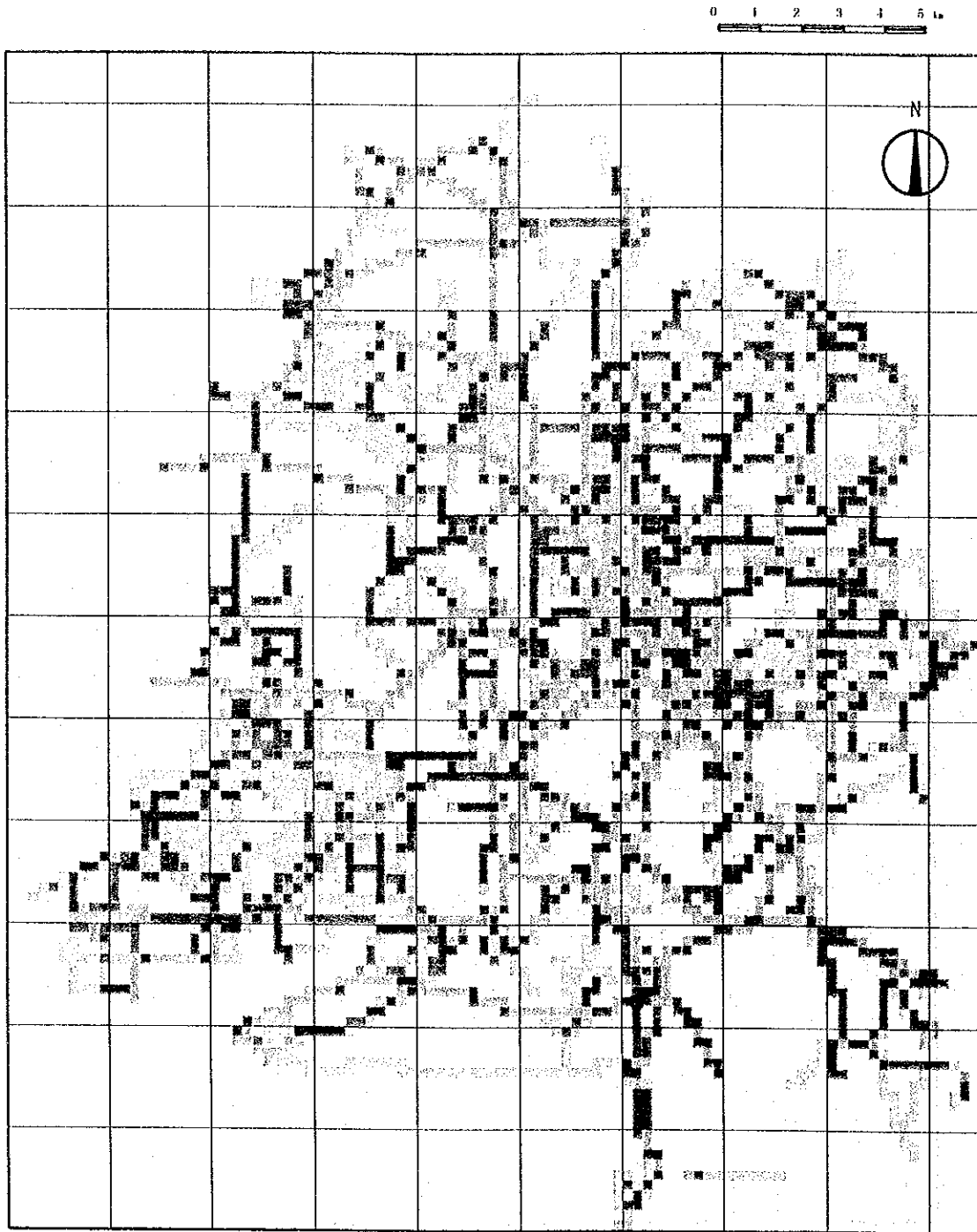


Figure 11.3.9 Estimation of CO Emission, 1997



LEGEND

| | |
|---|------------------------------|
| ■ | 1000.0 < x <= 5000.0 (ton/y) |
| ■ | 500.0 < x <= 1000.0 (ton/y) |
| ■ | 200.0 < x <= 500.0 (ton/y) |
| ■ | 100.0 < x <= 200.0 (ton/y) |
| ■ | 50.0 < x <= 100.0 (ton/y) |
| ■ | 20.0 < x <= 50.0 (ton/y) |
| ■ | 10.0 < x <= 20.0 (ton/y) |
| ■ | .0 < x <= 10.0 (ton/y) |

Figure 11.3.10 Estimation of CO Emission, 2020 without Master Plan

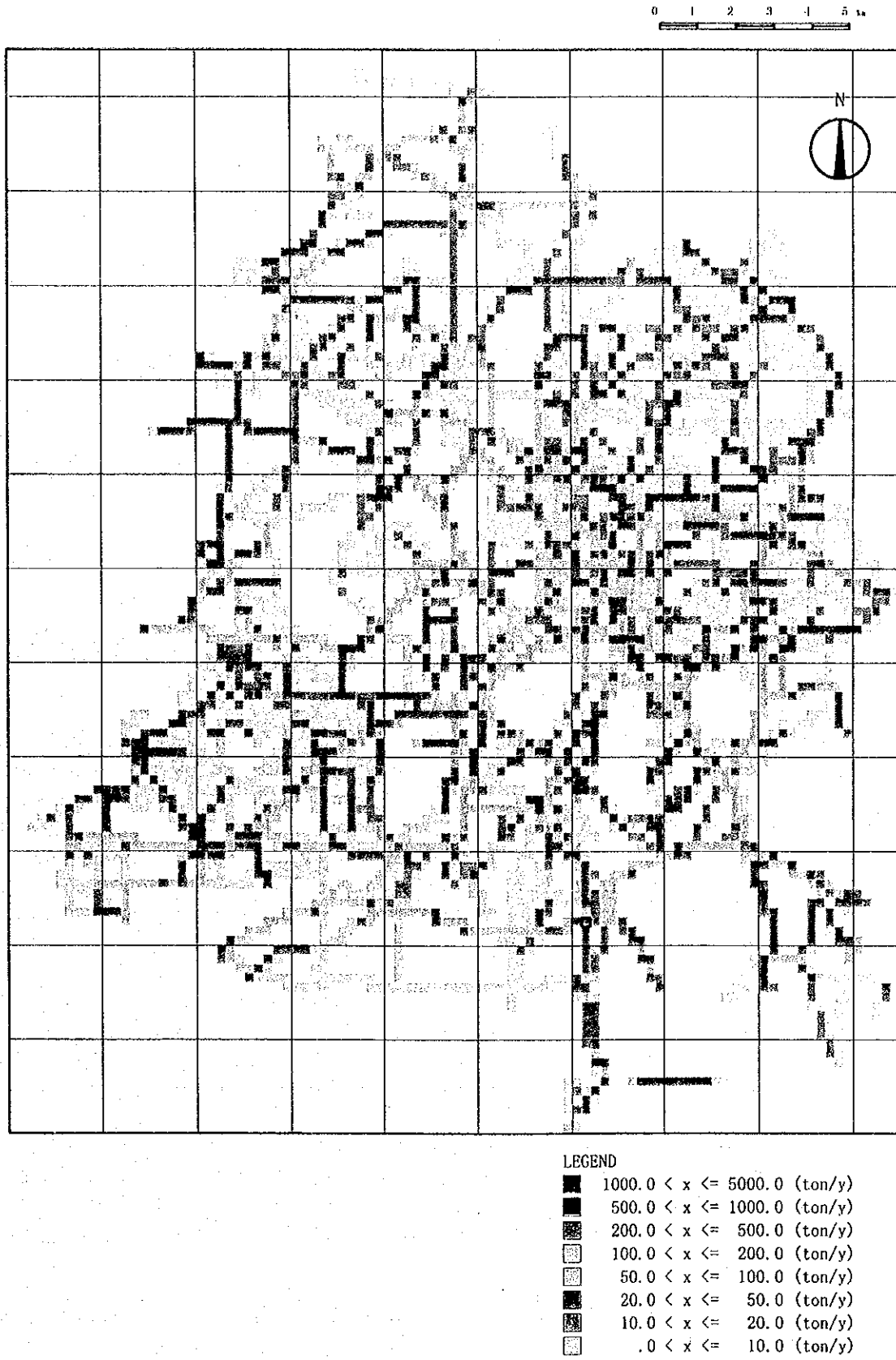


Figure 11.3.11 Estimation of CO Emission, 2020 with Master Plan

(3) Pollutant Emission of the Short-Term CPA Traffic Control/Management Plan

The estimation for the year 2000 was carried out using the traffic flow data from the dynamic simulation conducted by the Study Team. The simulation results are illustrated in Figure 11.3.12 to Figure 11.3.17. The result of emission volumes for NO_x and CO and the sum of fuel (petrol and diesel) consumption in terms of calorie in the CPA for the morning peak hour (from 07:30 to 08:30) are expressed in Table 11.3.7.

Table 11.3.7 Estimation for Short Term Traffic Plan (2000)

| | NO _x kg/h | CO kg/h | Fuel Consumption Gcal/h |
|---|-------------------------|------------|----------------------------|
| Without Package Plan | 227 | 4390 | 120 |
| With Package Plan | 263 | 4157 | 129 |
| Relative Value per Unit Car (With P. Plan / Without P. Plan) | 1.06 | 0.87 | 0.99 |

Package Plan: Reversible Flow Lane, Bus Priority lane, Improvement of Signal Control System, Improvement of Non-Signalised Roundabout

As described in Chapter 9, the implementation of the package plan in the CPA will improve traffic flow. The traffic volume will increase by approximately 10%. Regarding the environmental aspect, the one-hour amount of CO emission will decrease with the implementation of the package plan, but that of NO_x and fuel consumption will increase. The relative value, in terms of the amount for unit car, shows a significant decrease of CO, an increase of NO_x, and a slight decrease of fuel consumption. These results were derived by the characteristics of respective pollutant emission and fuel consumption related with the driving speed of vehicles.

Considering its various merits to the CPA, the package plan can be regarded as being sustainable. The decrease in CO and the time saving in human activity without excessive energy consumption are acceptable. However, to realise better ambient air in the CPA, it is necessary to introduce further mitigating measure for NO_x reduction.

The emission of NO_x depends on the age of the vehicle. Old vehicles have no devices against NO_x emission such as three-way catalytic converters, and they emit more NO_x than cars with converters. In the year 2000, the majority of vehicles will not be equipped with catalytic converters yet. The simulation depends on this condition.

The implementation of the current regulation 93/59/EEC and EURO 1 and the future regulation 94/12/EC from the year 2000 will maintain the emission level of NO_x from vehicles at quite a lower level than the previous regulations. The phasing-out of old vehicles and the introduction of cars complying with the regulation will be beneficial for reducing NO_x emission.

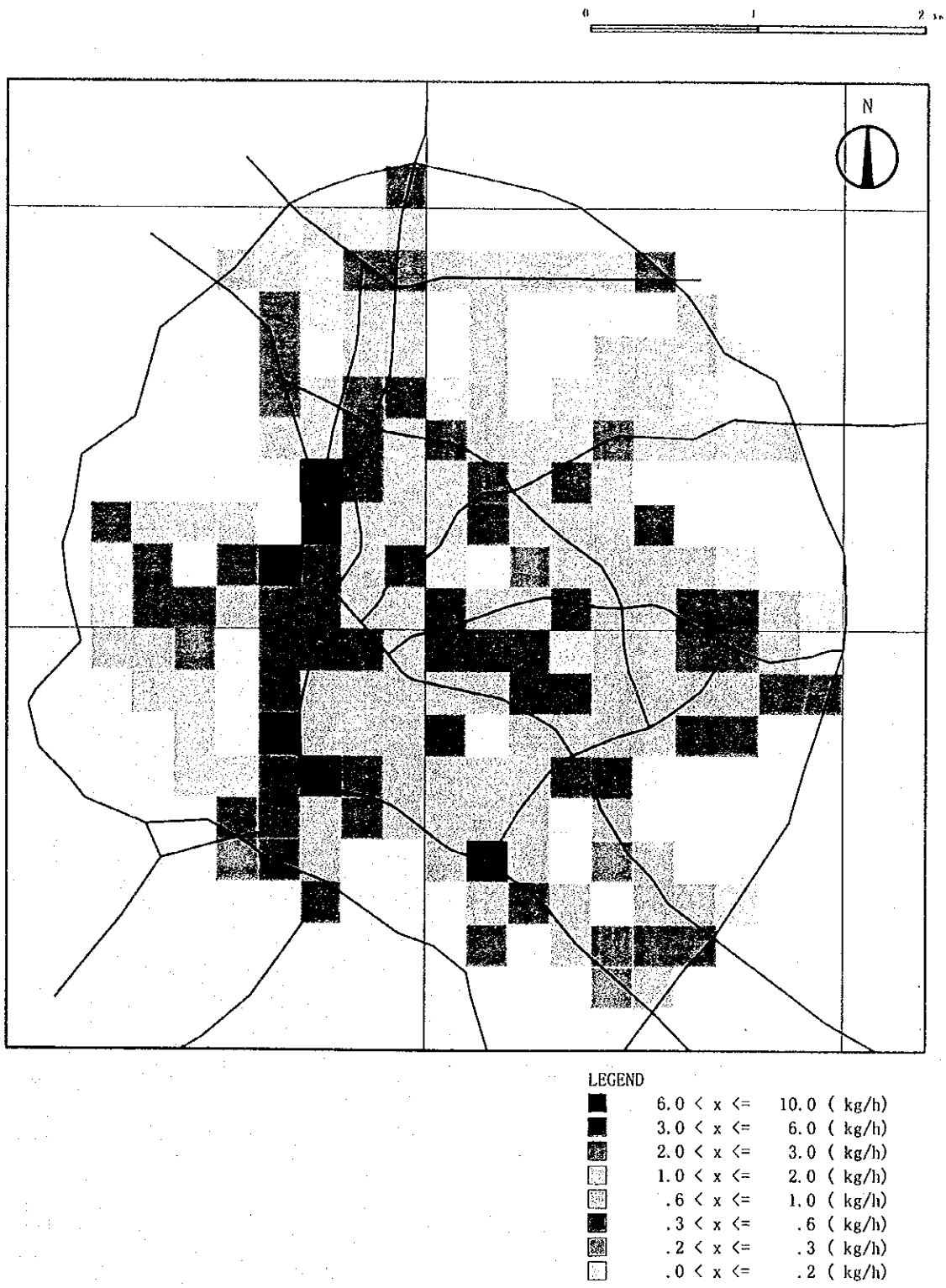


Figure 11.3.12 Estimation of NOx Emission, 2000 without Package Plan

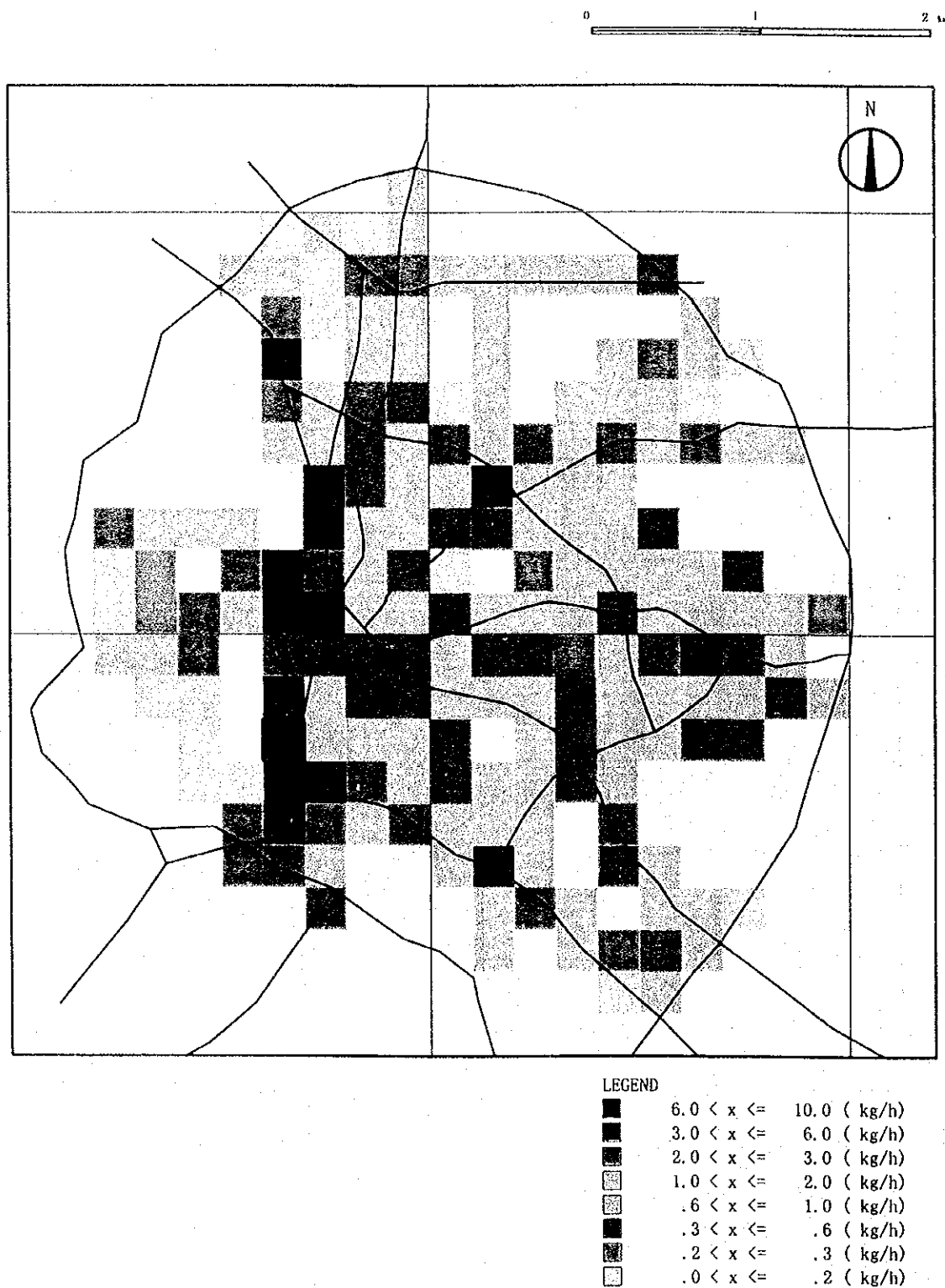


Figure 11.3.13 Estimation of NOx Emission, 2000 with Package Plan

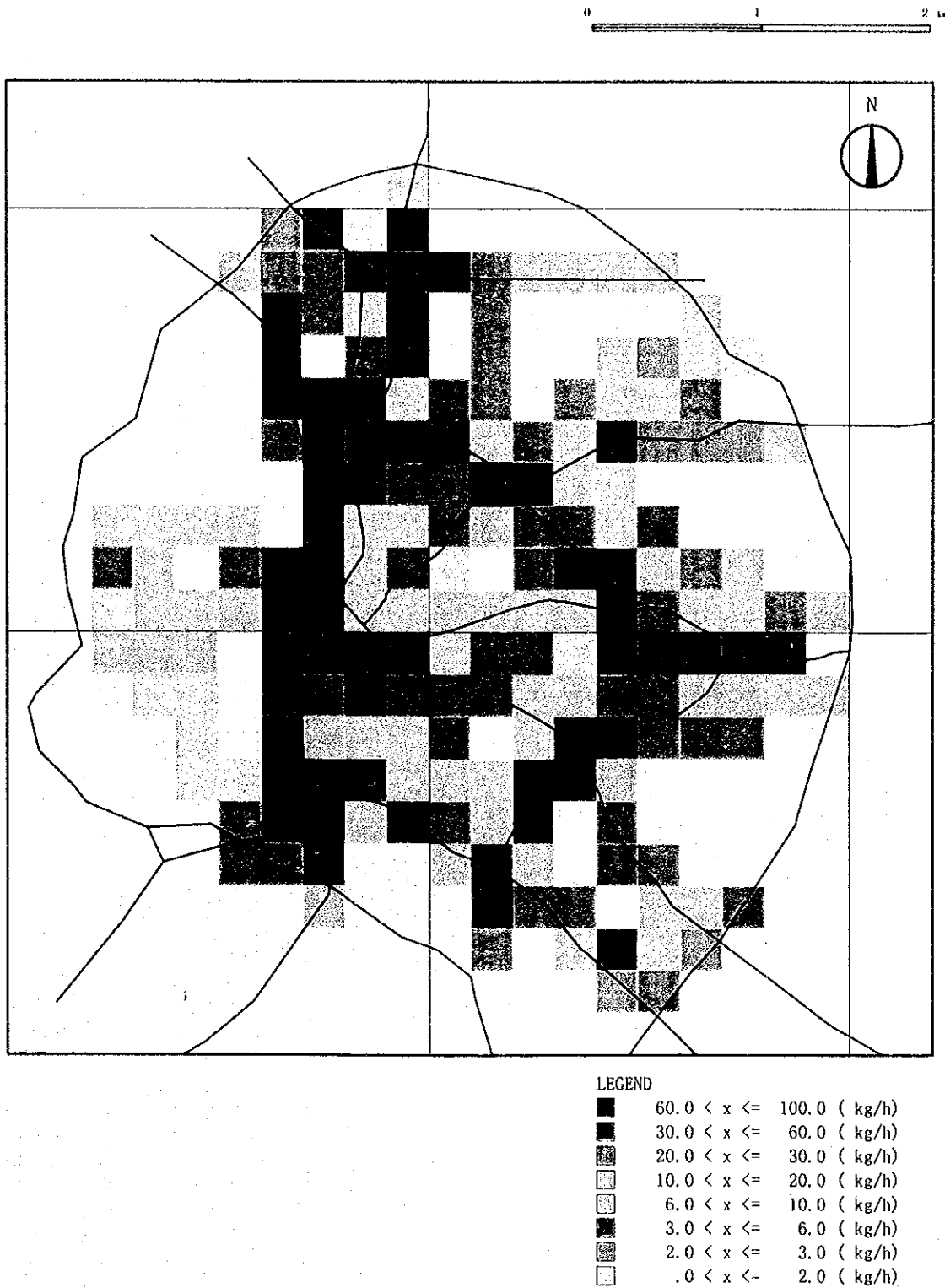
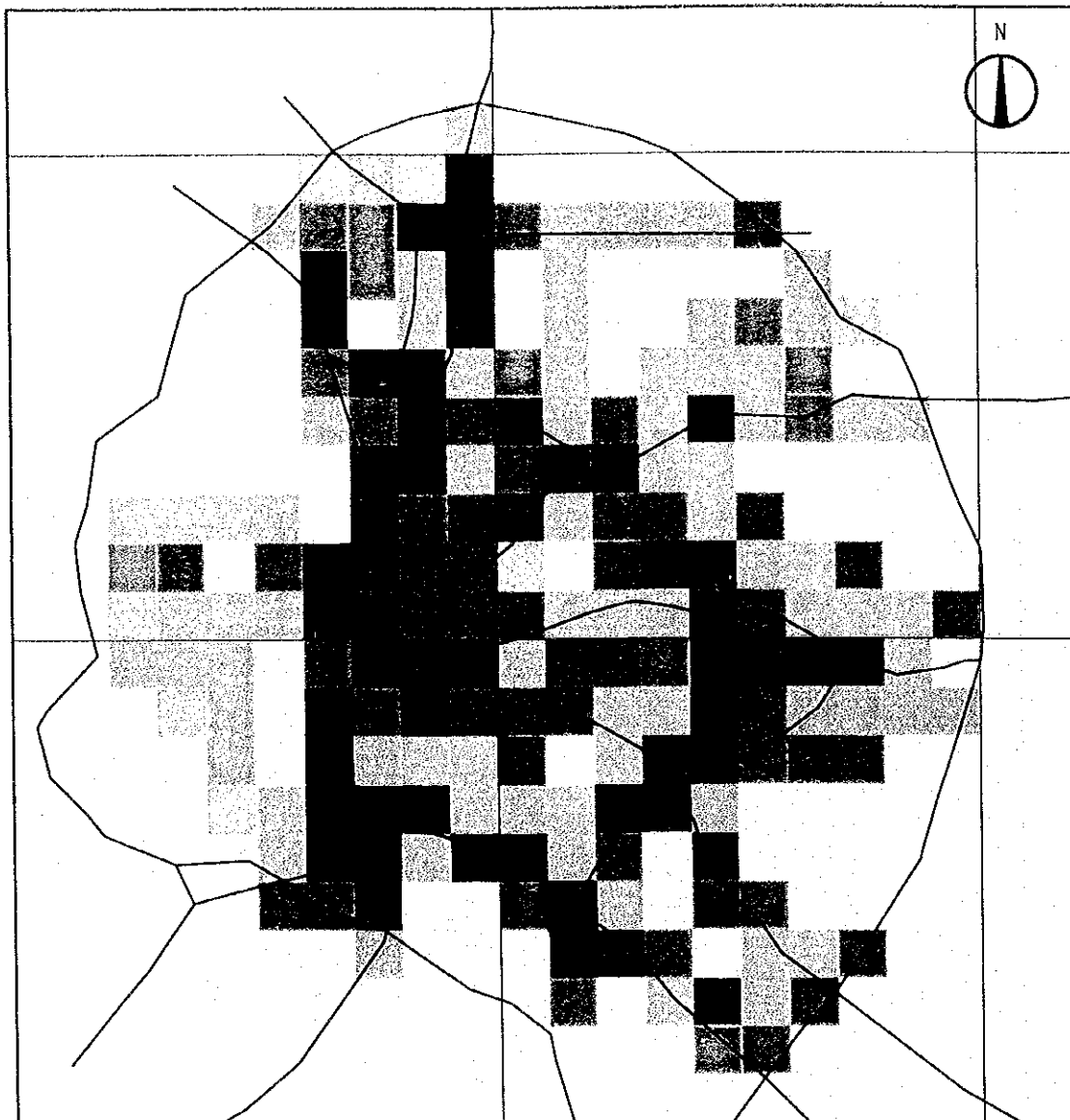


Figure 11.3.14 Estimation of CO Emission, 2000 without Package Plan



LEGEND

| | |
|--|---------------------------|
| | 60.0 < x <= 100.0 (kg/h) |
| | 30.0 < x <= 60.0 (kg/h) |
| | 20.0 < x <= 30.0 (kg/h) |
| | 10.0 < x <= 20.0 (kg/h) |
| | 6.0 < x <= 10.0 (kg/h) |
| | 3.0 < x <= 6.0 (kg/h) |
| | 2.0 < x <= 3.0 (kg/h) |
| | .0 < x <= 2.0 (kg/h) |

Figure 11.3.15 Estimation of CO Emission, 2000 with Package Plan

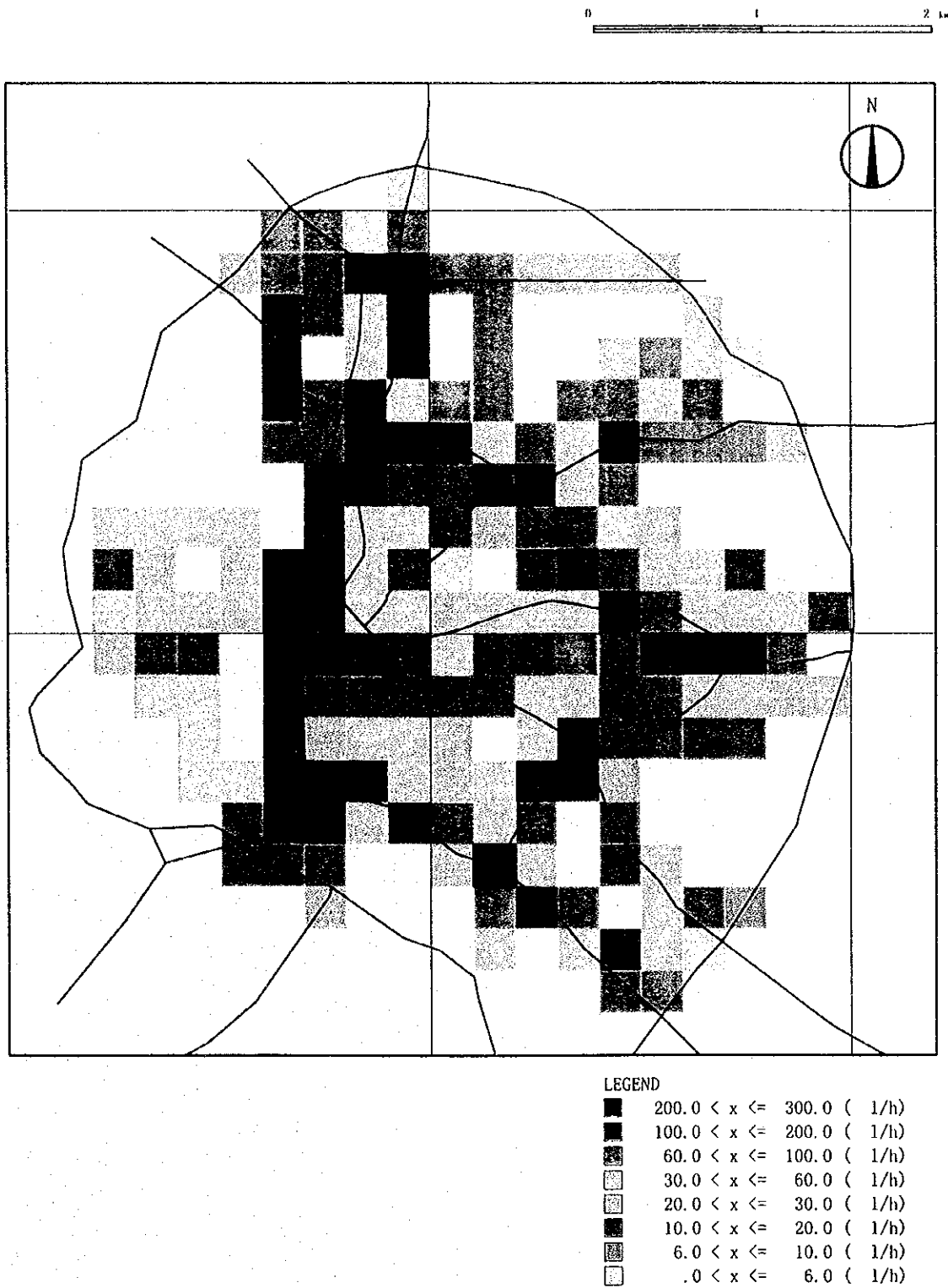
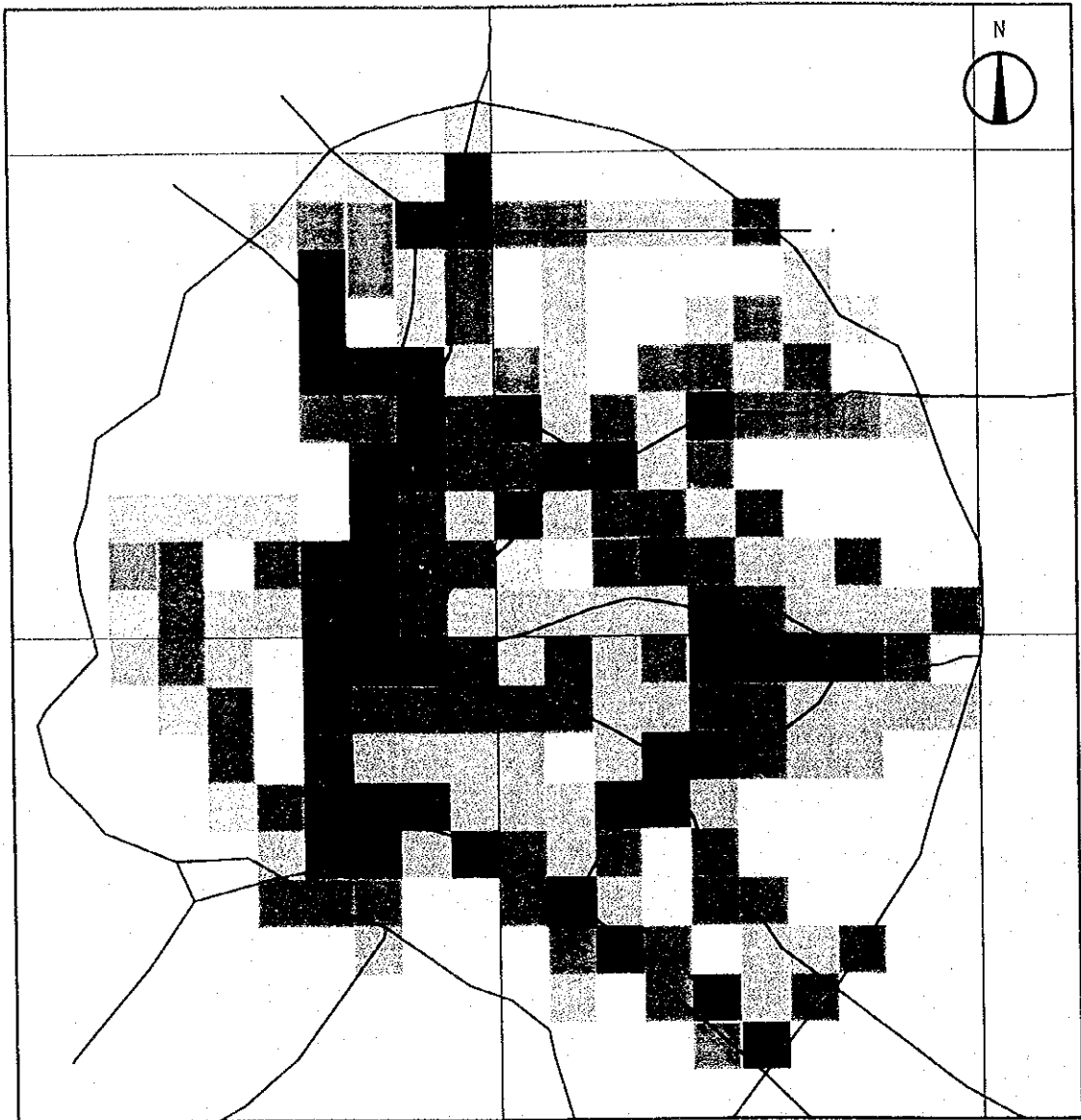
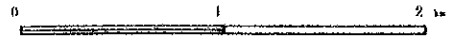


Figure 11.3.16 Estimation of Petrol Consumption, 2000 without Package Plan



LEGEND

| | |
|--|---------------------------|
| | 200.0 < x <= 300.0 (1/h) |
| | 100.0 < x <= 200.0 (1/h) |
| | 60.0 < x <= 100.0 (1/h) |
| | 30.0 < x <= 60.0 (1/h) |
| | 20.0 < x <= 30.0 (1/h) |
| | 10.0 < x <= 20.0 (1/h) |
| | 6.0 < x <= 10.0 (1/h) |
| | .0 < x <= 6.0 (1/h) |

Figure 11.3.17 Estimation of Petrol Consumption, 2000 with Package Plan

11.4 Policy Directions

(1) Environmental Mitigation Policy

Judging from the Malaysia Environmental Quality Report by the DOE, the air quality status in the Klang Valley Region is generally between good and moderate except during the haze episode. However, the detailed study of ambient air quality by the Study Team revealed unfavourable conditions at some limited areas of KL, and the opinion survey of the Study Team showed that the majority of people regarded air pollution in KL as being serious.

The expansion of human activities will result in development and economic growth in this area. On the other hand, it will increase the burden to the environment. The increase in vehicle number and traffic volume will result in a large volume of air pollutants. It is necessary to introduce mitigating measures for environmental conservation and sustainable development.

In order to realise environmental mitigation, further regulations for vehicle exhaust gas is the first step. The current atmospheric pollution and the increasing number of car registration in KL require the introduction of further regulations. The advances in vehicle technology in the world makes it possible to introduce further regulation in this country. In addition, the regulation for motorcycles should also be introduced.

The long-term policy for introducing LEVs is also important. The pollutant emission of LEVs is substantially lower than the current emission standards. Because of its energy resources and technology, it may be suitable for Malaysia to focus on NGVs. NGV is beneficial not only for its substantial reduction in pollutants but also for the reduction of CO₂.

(2) Environmental Impact Exerted by the Plan

1) Impact Exerted by the Plan

The environmental impact on society has to be considered from wide and various points of view such as emission gas, waste disposal, contamination of the water resources, and construction of buildings and structures. A main issue of this Study is the analysis of the countermeasures to mitigate traffic congestion and to formulate the urban transportation Master Plan for KL and its conurbation. For thus reason, environmental impact analysis is also focusing on the countermeasures and projects of the Master Plan. The contamination of water resources, waste disposal, preservation of forests and greenery, and ecological balance are not the main subject of the Study, and these items should be analysed under separate studies if necessary. As such, detailed countermeasures for the environmental preservation should be examined in environmental impact assessment of the Master Plan based on the current regulations in Malaysia.

2) Impact Exerted by the Short-term CPA Plan

The impact on two factors, CO₂ and NO_x, was analysed, comparing the cases with and without the package plans in the CPA. According to the results of the analysis, the total emission volume of CO₂ under the implementation of the package plan will be reduced by 13%.

On the contrary, that of NO_x in the case with the plan will increase slightly in comparison with the case without the plan, because the average vehicle running speed would have increased due to smoother traffic flow caused by the improvement package plan proposed in the Study. This increase in NO_x cannot be avoided under the current vehicle emission feature related to the speed, and the impact is not serious at present in KL.

3) Impact Exerted by the Master Plan for 2020

The same factors, i.e., both CO₂ and NO_x were analysed. A remarkable reduction in the emission of both gases was observed. However, the reduction was mainly contributed by the LEV's. With regard to CO₂, the implementation of the Master Plan will bring about a 18% reduction without the future improvements in the vehicle emission structure; on the other hand, the total emission of NO_x will increase slightly by 1.2% due to the same reason mentioned in the previous section.

4) Impact Exerted by Area Pricing and MSC

A reduction in CO₂ and NO_x can be expected due to the reduction in of total vehicular traffic volume after the relocation exercise to the MSC and the implementation of the Area Pricing scheme. The traffic volume will, however, increase year by year and the same results as the "Impact Exerted by the Master Plan for 2020" will be seen, since the Area Pricing and MSC are included in the Master Plan in the Study.