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AN OVERVIEW OF URBAN MOBILITY AND THE IMPLEMENTATION OF AN AREA TRAFFIC CONTROL SYSTEM IN SURABAYA




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Anthony Fitts and Peter Midgley

Jakarta, 31 March 2010

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ACRONYMS

ATCS	Area Traffic Control System
BRT	Bus Rapid Transit
CBD	Central Business District
CCTV	Closed Circuit
DAMRI	Djawatan Angkoetan Motor Repoeblik Indonesia (City Bus Operator)
ELV	Extra Low Voltage
GTZ	German Technical Assistance
GUI	Graphical User Interface
ITS	Intelligent Transport System
LRT	Light Rail Transit
PLC	Programmed Logic Controller
PTIPS	Public Transport Information Priority System
Rp	Rupiah
UPS	Uninterrupted Power Supply
SCATS	Sydney Coordinated Adaptive Traffic System
SCOOTS	Split Cycle and Offset Optimization Tool
SNCF	Société Nationale des Chemins de fer Français (French Railways)
SUTP	Sustainable Urban Transport Project
TMC	Traffic Management Centre

EXECUTIVE SUMMARY

This report provides technical assistance in regards to the implementation of an ATCS. The first stage is to connect 15 intersections to an ATCS. This will provide benefits in improved operation and management of the road network. Coordination, where appropriate, can be achieved, better selection of cycle and phase times can also be achieved.

Ultimately, an ATCS can be configured to provide priority for different transport modes, in particular public transport.

However, improvements and upgrades with the intersection and pedestrian crossing infrastructure are required. This is highlighted in the report.

A review of the urban transport network and specific proposals for the development of urban transport in Surabaya including the Bus Rapid Transit was been undertaken.

CHAPTER 1: BACKGROUND

1.1 BACKGROUND

As road traffic volumes increase in Surabaya, the result is an increase in traffic congestion for all road users and a potential increase in accidents. A proposal is to deploy an ATCS within an Intelligent Transport System consisting of CCTV and Variable Message Signs.

In the 1990s, an ATCS was installed in Surabaya using a SANCO technology (Spain). Some of the traffic signals in Surabaya have fixed time programs using the SAINCO system, CONTRAF and PLC controllers. This system has a number of inefficiencies, being maintenance and lack of sustainability with future systems (ex. Public Transport priority systems).

1.2 GOAL

The goal of this activity is to contribute to the long term development of Indonesia by providing appropriate technical support to develop and implement an ATCS in Surabaya, East Java.

1.3 OBJECTIVES

The objectives as stated by Surabaya City Council at a meeting on the 18 March 2010 are to:

- Improve safety
- Increase traffic flow
- Environmental sustainable

CHAPTER 2: IDENTIFY LOCATIONS FOR ATCS

2.1 SITES

Sites to be connected to an ATCS as identified by Surabaya City Council are in Table 1. Refer to **Annexe 1** for the map locations.

Table 1: Sites to be connected to an ATCS (stage 1) as identified by Surabaya City Council

Surabaya CC Site Number	Intersection Name
1	Jalan Diponegoro/Jalan Raya Darmo/Jalan Wonokromo
2	Jalan Diponegoro/Jalan Cillwung
3	Jalan Dipenegoro/Jalan Kutal
4	Jalan Dipenegoro/Jalan Musi
5	Jalan Dipenegoro/Jalan Dr. Sutomo
6	Jalan Raya Dipenegoro/Jalan RA. Kartini
7	Jalan Raya Dipenegoro/Jalan Pasar Kembang/Jalan Banyu Urip
8	Jalan Kedung Doro/Jalan Kedungsari
9	Jalan Kedung Doro/Jalan Embong Malang
10	Jalan Praban/Jalan Blauran
11	Jalan Tembaan/Jalan Bubutan
12	Jalan Tembaan/Jalan Pahlawan
13*	Jalan Kebon Rojo/Jalan Veteran
14	Jalan Praban/Jalan Tunjungan
15	Jalan Raya Darmo/Jalan Dr. Sutomo/Polisi Istimewa (includes Jalan Raya Darmo/Jalan RA. Kartini)

**After a discussion with City of Surabaya (25/03/10), Site No 13 may not be included in Stage 1 due to budget reasons*

The following comments are provided on the sites to be connected to an ATCS:

The proposed sites are on Jalan Dipenegoro (intersections 1 to 7) are ideal for an ATCS, due to the spacing between intersections, minimal side road or kerb side friction, constant speeds and dedicated right and u-turning lanes.

The other sites can be connected to an ATCS and will have benefits of better traffic control and reduced delays. Some of the other locations can be setup with coordination as they have similar traffic volumes on the main road and because they are closely spaced.

Jalan Raya Darmo/Jalan RA. Kartini is connected to the same controller as Jalan Raya Darmo/Jalan Dr. Sutomo/Polisi, this ensures coordination via a hardwire connection for northbound traffic. The right turn at RA Kartini operates twice in the cycle, to reduce delays for right turners. A software timer can be used in a new program to improve the coordination.

It is recommended that Jalan Tembaan/Jalan Semarang/Jalan Dupak/Jalan Pasar Turi is connected due to the spacing and the traffic patterns volumes, as soon as possible (i.e. Stage 2).

Figure 1 shows stationary queues at Jalan Tembann/Jalan Bubutan, in the PM peak heading west to Jalan Tol Surabaya-Gresik, blocking northbound traffic on Jalan Bubutan. Therefore it is recommended that intersection Jalan Tembaan/Jalan Semarang/Jalan Dupak/Jalan Pasar Turi is included in an ATCS system so as a coordination can be provided to clear the PM peak traffic. Consideration could be given to installing departure side queue detectors to restrict traffic heading westbound to ensure north/south traffic is not affected. Other works are required, such as reviewing the parking to better manage the traffic and improve capacity.

Figure 1: PM peak traffic on Jalan Tembaan (heading towards Jalan Tol Surabaya – Gresik) blocking northbound traffic on Jalan Bubutan

Source: Field trips March 2010

The typical traffic volumes on Jalan Diponegoro (survey undertaken 23 June 2009), one of main north-south arterials are shown in Table 3. Approximately 60000 vehs/day on a week day use Jalan Diponegoro. Seven of the fifteen sites for the first stage of the proposed ATCS are on Jalan Diponegoro.

Table 2: Traffic volumes on Jalan Diponegoro

Northbound Traffic Volumes on Jalan Diponegoro	
Period	Volumes
AM peak (9:00 to 10:00)	2130
PM peak (18:20 to 19:20)	2022
Total (5:00 to 21:00)	27187
Southbound Traffic Volumes on Jalan Diponegoro	
AM peak (7:20 to 8:20)	2065
PM peak (16:10 to 17:10)	2661
Total (5:00 to 21:00)	29033

The traffic flow patterns for motor bikes and light vehicles are shown in Figure 2 and 3 for northbound and southbound.

Figure 2: Traffic flows (Motor Cycles and Light Vehicles) from 5:00 to 21:00 on Jalan Diponegoro (northbound)

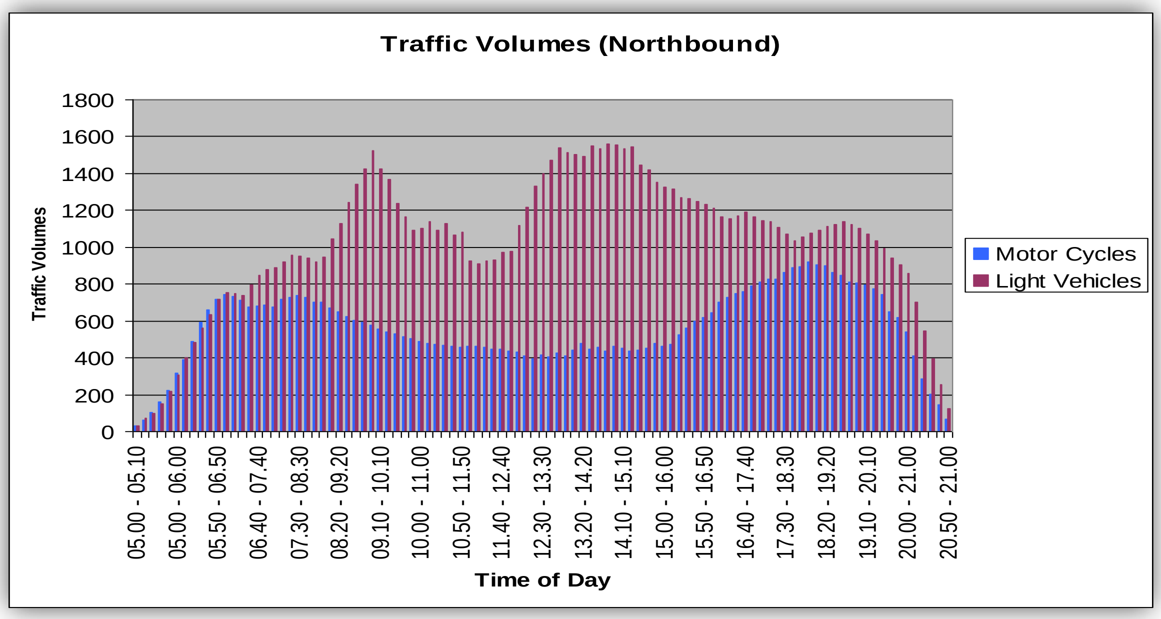
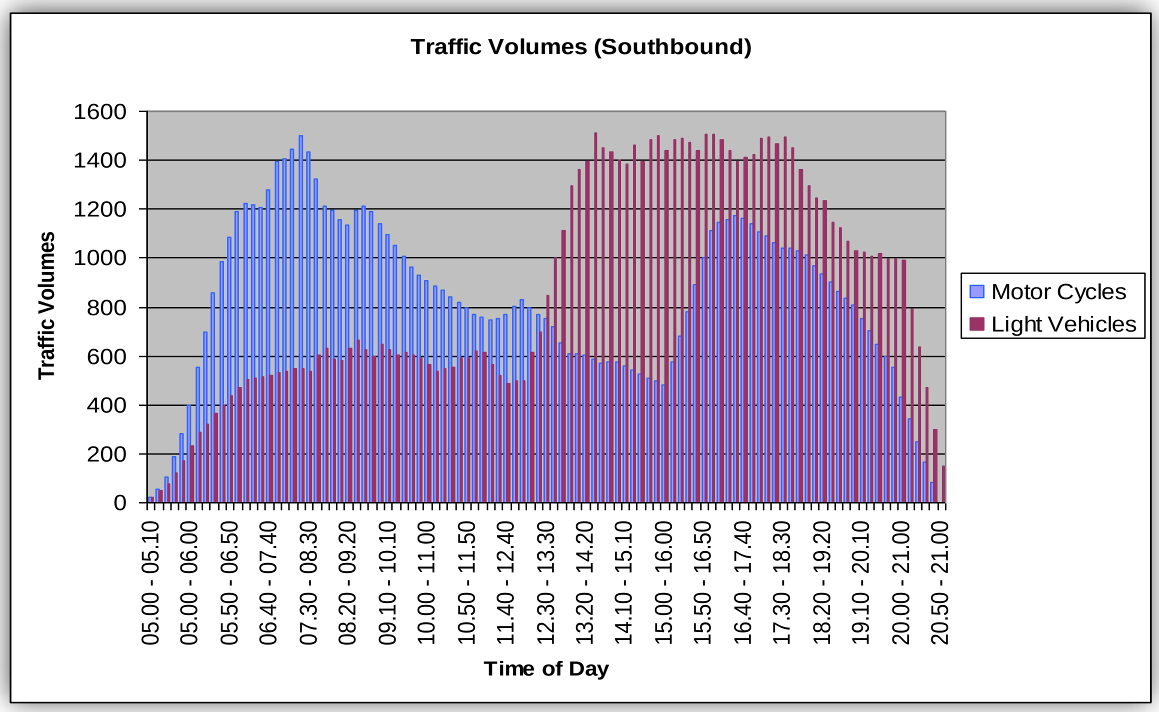


Figure 3: Traffic flows (Motor Cycles and Light Vehicles) from 5:00 to 21:00 on Jalan Diponegoro (southbound)



Source: City of Surabaya

The traffic volumes and flows vary over the day and the day of the week, which results in fixed time systems being inefficient. ATCS will vary the green times and cycle times, dependent on traffic volumes and levels of congestion. Also, ATCS will collect traffic volume data 24 hours a day, 7 days a week, so analysis and trending can be undertaken.

2.2 CONTROLLERS

2.2.1 Existing Controllers

As stated in a presentation provided by Surabaya City Council, some of the existing controllers are as follows:

- Sainco Traffic controllers – 6
- ConTraff – 7 units
- PLC – 42 units

New controllers are required to ensure that detector inputs and signal outputs are mapped. The latest traffic signal operational features will be included in the design (refer to 2.2.4). Also, the new controllers have software interlocking to ensure conflicting movements will not operate simultaneously.

2.2.2 Controllers with UPS

It is recommended that SCATS compatible controllers are installed with UPS systems to ensure traffic signals still operate when power failures occur, which according to Surabaya City Council, is frequent.

A new controller can have an in-built UPS, which costs an additional $AUD1,000 - $2,000.

UPS are required to power a site for minimum of 6hrs (without mains power), but typically can power a site for at least 9hrs.

2.2.3 Controllers with ELV

SCATS compatible controllers can operate with 42 volts with the following benefits:

- Safer for technicians - in the case of electrocution, 42 volts is non-deadly. Also, as the Signal Groups would be powered with 42 volts, the technicians will be able to operate on the site (e.g. lanterns) without potentially switching off the site.
- Safer for public - if a pedestal gets knocked down, live wires can be exposed, but instead of 240v, it will only be 42v.
- 5-10% reduction in power consumption.
- When used in conjunction with LEDs lanterns, up to 90% reduction in power consumption can be realized, most of the reduction in power comes from the LEDs.

2.2.4 New Traffic Signal Operational Designs

Traffic signal controllers should be upgraded at least every 15 to 20 years to ensure the controllers are being supported by manufacturers. An audit of the cabling is required to determine if there are sufficient cabling cores to drive signal group outputs.

Detailed traffic signal layout plans are required to enable the designs. The plans will include the following features:

Hardware (pedestals, lanterns and displays), number of lanes, linemarking, position of vehicle detectors, phasing and any static signing.

With new controllers, a new design or personality will be undertaken which allows the following:

Allocating signal group numbers, this is important when configuring an ATCS, particularly where signal groups are conditional (i.e. only operate for part of the phase).

Allocating detector numbering, this is important when configuring an ATCS where some Strategic detectors will be used to control the main operating parameters (i.e. cycle time, phase time and offsets). Other detectors will have tactical functions, calling and extending signal groups and phases.

The phase sequence will be designed to provide efficient operation. Phases can be skipped if not demanded or the phase sequence can be altered. Special phases can be programmed for major events (ex. festivals) and for priority for alternate transport modes (ex. Bus phases).

Detector functions are programmed to call and extend phases.

Special conditions can be programmed (ex. Repeat phases, special conditions for different road users – priority phases for buses and pedestrian conditions).

Timesettings (i.e. pedestrian timesettings, yellow and allred times and minimum green times) will be designed.

Fallback operation (i.e. Flexilink) which is a fixed time operation, and normally operates when communications are faulty, is included in the new program. The fallback operation maintains typical coordination and typical phase times.

2.3 DETECTION SYSTEMS

The detection system is important component of an ATCS. It provides detection of vehicles to call side road movements or phases (a group of non-conflicting movements) and to provide information about traffic volumes and occupancy to determine how congested an approach may be. Strategic decisions can be made by an ATCS to adjust the cycle time, phase green time and offsets for coordination purposes so as to manage the operation efficiently.

Detectors can be inductance detectors, pedestrian push buttons, video detectors, infra red, microwave and wireless studs.

The condition of the road surface and the kerb and channel in Surabaya (refer to Fig. 4), particularly on the side road approaches, means inductance detector loops will be difficult to install.

The main road on Jalan Diponegoro has full depth asphalt which allows for inductance detectors to be installed.

Video detection could be used on side roads. It maybe necessary to have wireless communications between the video detectors and the traffic signal controller, as hard wiring the detectors may be problem due to the services (ex. drainage) and lack of kerbing.

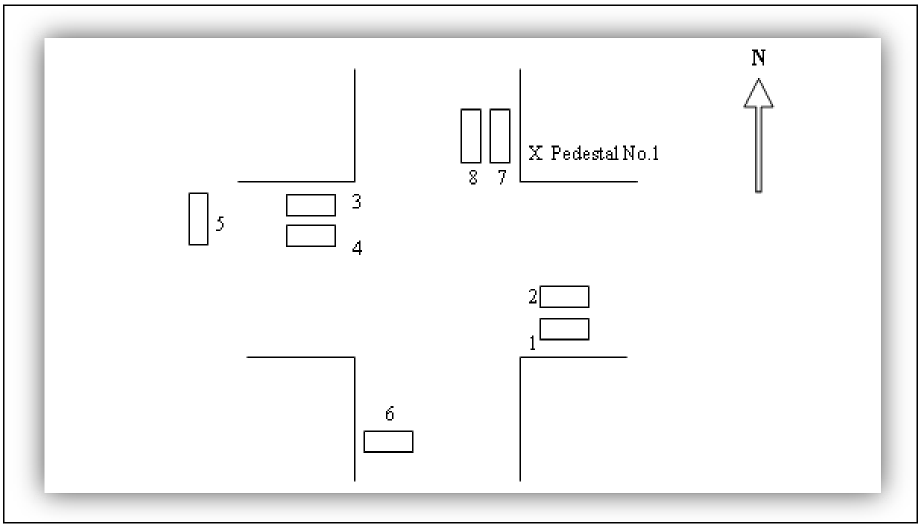
If video detection is required on an approach, an adequate outreach or offset from a pedestal is required. Height is also important, to overcome optical occlusion. Information from video detection manufacturers indicates a height of 7.0 m is required for a 4 lane approach.

Figure 4: Road surface on Jalan Dr. Sutomo at Jalan Diponegoro/Jalan Dr. Sutomo

Source: Field trips March 2010

Figure 5 shows a typical detector map with stop line detectors and if required queue detectors. It is important that detectors are installed in each lane, normally 4.5 m in length and 0.7 m from the lane line marking.

Figure 5: Typical vehicle detector layout



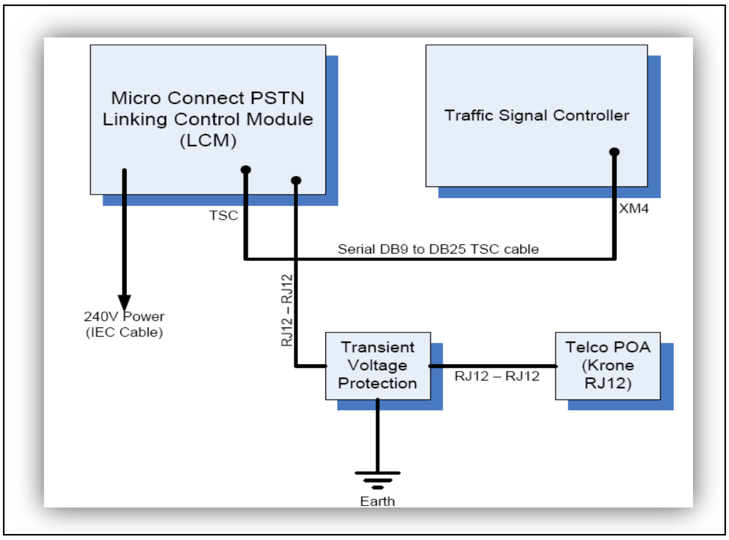
Source: VicRoads

2.4 COMMUNICATIONS

The controllers are connected to ATCS using the following options:

Standard voice-grade telephone line with a PSTN module in the controller

Figure 6: PSTN Communications



Source: Micro Connect Pty Ltd, Linking Module Installation Manual

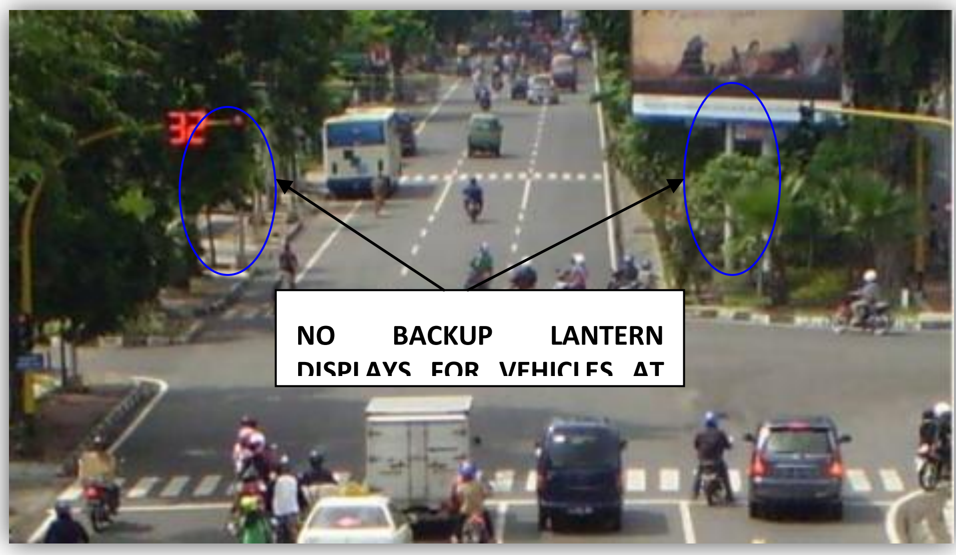
Wireless and fibre optic communications can be utilised.

2.5 LANTERN HARDWARE

2.5.1 Vehicle lanterns

The lantern hardware requires reviewing, to ensure approaches have adequate displays. Figure 7 shows an approach on Jalan Diponegoro where there are no secondary displays. Often vehicles at the stop line will be 'tooted' by vehicles from behind to informed them that the phase has started.

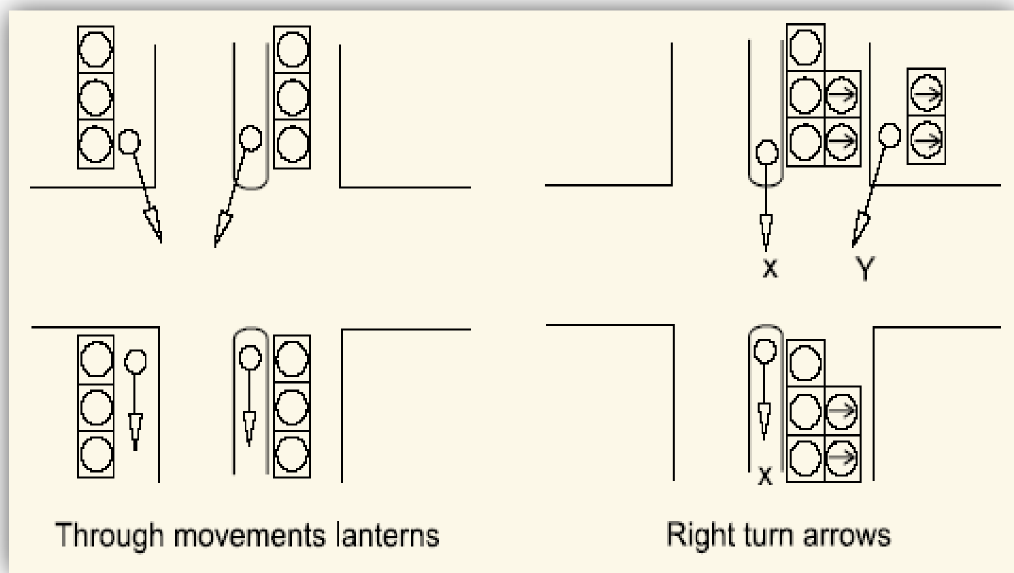
Figure 7: Lantern displays on Jalan Diponegoro



Source: Field trips March 2010

Typical lantern displays arrangement (primary, secondary and tertiary) are shown in figure 8.

Figure 8: Typical lantern displays



Source: Vicroads Traffic Engineering Manual

2.5.2 Pedestrian Lanterns

Many of pedestrian lanterns at signalizing intersections are not operating. It is recommended that pedestrian lanterns are audited and repaired. Push buttons should be installed and programmed in new designs, so as pedestrian signal groups operate on demand only. This will improve compliance for vehicles and pedestrians.

Figure 9: Typical pedestrian crossing where the pedestrian lantern is not operating

Source: Field trips March 2010

It is recommended that all zebra crossings on the main roads are signalized to protect and give priority to pedestrians.Tabel : Jumlah Jembatan Penyeberangan dan Zebra Cross di Jalur Tengah These zebra crossings are usually crossing 3 or more lanes on main roads. The signalized pedestrian crossings can be linked to an ATCS, to minimize stops and delays. Currently, pedestrians are crossing with speeding traffic not stopping at the zebra crossings. Police often have to 'man' these crossings to ensure vehicles will stop for pedestrians. This is unsafe, particularly for the elderly and young, who are the main group using these crossings.

Table 3: Number of Zebra Crossings in the Central Area

No	Road	Zebra Crossings	
		With Signals	Without Signals
1	A. Yani	1	9
2	Wonokromo	1	1
3	Raya Darmo	-	-
4	Urip Sumoharjo	-	-
5	Basuki Rahmat	1	-
6	Embong Malang	1	-
7	Blauran	1	-
8	Bubutan	2	1
9	Indrapura	2	3
10	Perak Barat / Perak Timur	1	7
11	Rajawali	-	-
12	Veteran	-	-
13	Pahlawan	2	1
14	Gemblongan	2	1
15	Tunjungan	1	2
16	Gubernur Suryo	1	1
17	Panglima Sudirman	2	1

Source: City of Surabaya

2.5.3 Other Hardware

Push buttons should be accessible for all pedestrians (i.e. mounting height should be 1 m) and adjacent the crossing. Standard layout plans can be provided.

A number of pedestals have terminal strip covers missing where electrical cables are exposed. The covers should be replaced to ensure safety for pedestrians and to ensure water does not affect the cabling.

Figure 10: A pedestal with terminal strip cover missing, with exposed wiring

Source: Field trips March 2010

2.5.4 LED lanterns

Some locations, have LED lanterns, it is recommended that all lanterns are eventually upgraded to LED. The benefits of LED are as follows:

- 80% reduction in power consumption.
- The typical reliability of today's LEDs is 7 - 10yrs, whereas an incandescent bulb can fail within 1yr.
- The LED aspect is only deemed as 'failed' when more than 20% of the pixels are expired.
- LEDs are more brighter and conspicuous - proven to increase intersection safety.
- LEDs can operate via a UPS, due to the low power that is drawn.

2.6 COUNTDOWN CLOCKS

At most intersections, there are countdown clocks for vehicles. Countdown clocks work with a fixed time system as the phase times do not change, but only when there is a plan change.

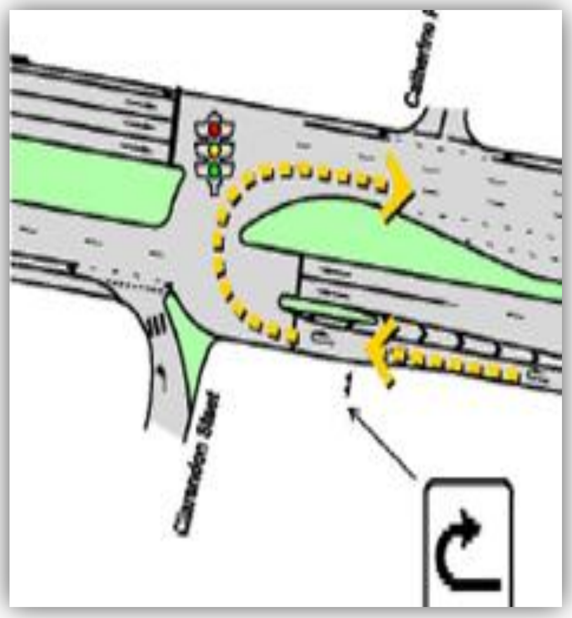
With an ATCS system, the cycle and phase times change every cycle and phases can terminate early if there are no vehicles. Therefore the countdown clocks are not able to be used, unless on the main road phase and the last 10 secs or so are counted down. This is similar to the operation at locations in Kuala Lumpur with SCATS.

2.7 U-TURNS

The current U-turns at centre median openings, reduce the capacity by effectively blocking the right lane in both directions, as vehicles are turning from a shared lane. A dedicated U turn lanes should be considered. If a dedicated U-turn lane cannot be implemented because of insufficient width or services, then a U turn from the left side of the carriageway should be investigated. This will result in the movements being controlled, similar to the layout in Figure 11.

If a BRT is implemented, it is critical that the BRT is not restricted by turning movements and the capacity at these locations is not further impacted. Controlled pedestrian movements could also operate at these locations, in the shadow of the U-turn movement.

Figure 11: An existing U turn operation at Jalan Raya Jend. Ahmad Yani and proposed U turn layout from left hand side of a median opening



Source: Field trips March 2010 and VicRoads P turn

CHAPTER 3: AREA TRAFFIC CONTROL SYSTEM IMPLEMENTATION

3.1 ATCS

There are a number of Area Traffic Control Systems available, SCATS and SCOOTS being the most widely used ATCS. Table 5 shows studies with the two systems when comparing to fixed time systems.

Table 4: Comparison of ATCSs

ATCS	Reduction in Travel Time (%)	Reduction in Delay (%)	Reduction in Stops (%)	Comments
SCOOT	6	22	17	Requires advance detectors. Public transport priority is available.
SCATS	8	28	42	Requires stop line detectors. GUI provides user friendly setup, monitoring and operation. Public transport priority and unusual congestion detection are available.

Source: Adaptive Traffic Signals, Kevin Fehon, Principal, DKS Associates, ITE District 6 2004 Annual Meeting

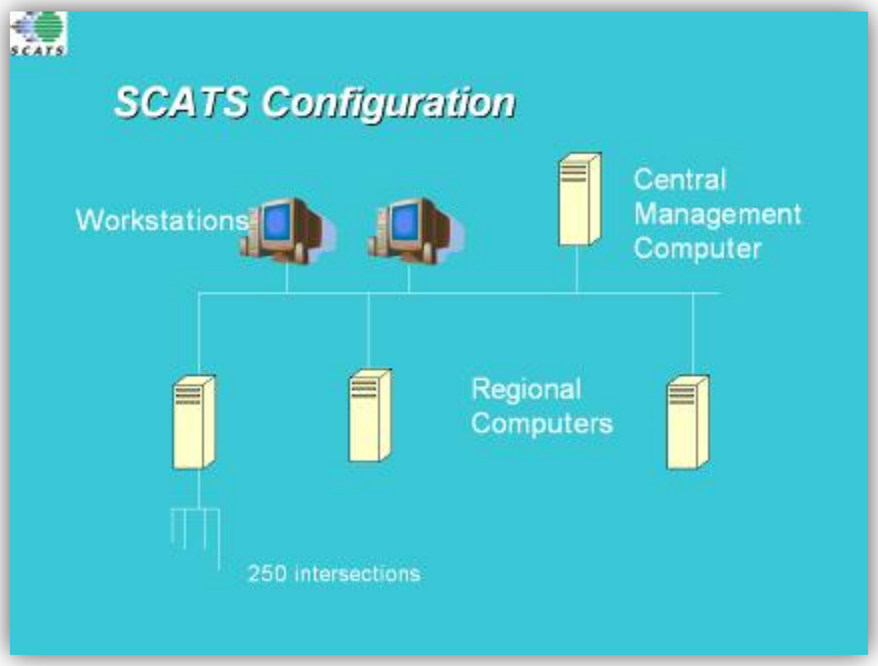
This report recommends SCATS to be implemented in Surabaya, as there are many SCATS installations in the Asia Pacific region (ex. Singapore, Malaysia, New Zealand, Australia and China). The networking of Road Authorities in the region provides on going support and training opportunities. The model of installing 10 to 15 intersections in the first stage has been adopted by the above countries. After successful implementation and operating benefits, the ATCS have expanded to other sites.

SCATS is a comprehensive traffic management system, its main function is to control traffic. However, it also provides many additional features, such as:

- On line traffic monitoring
- Access control
- Operational data collection
- Alarm and event management

The SCATS configuration is shown in figure 12.

Figure 12: SCATS configuration



Source: VicRoads SCATS training presentation

3.1.1 Central Manager

The Central Manager does not control any traffic, the CM networks the regional computers and has a database (Microsoft Access or SQL Server) that contains:

- The TCP/IP location of each regional computer
- Access data for up to 200 users
- Graphics data for each intersection
- Master copy of Action Lists (use to modify the operation for planned conditions) for each Regional computer
- The current state of every intersection's alarms
- Site notes for each intersection
- Route Preemption Plans (for emergency vehicles and special events)
- Incident Management Plans
- Streeter finder information
- Real time Time/Distance Diagrams

3.1.2 Regional Computer

A regional computer can manage up to 250 intersections. Therefore Surabaya City Council will initially require one regional computer.

250 subsystems, 900 Strategic Inputs, 900 Strategic Approaches and 500 Links

30 Users can be connected simultaneously

3.2 INTEGRATION WITH PUBLIC TRANSPORT NETWORKS

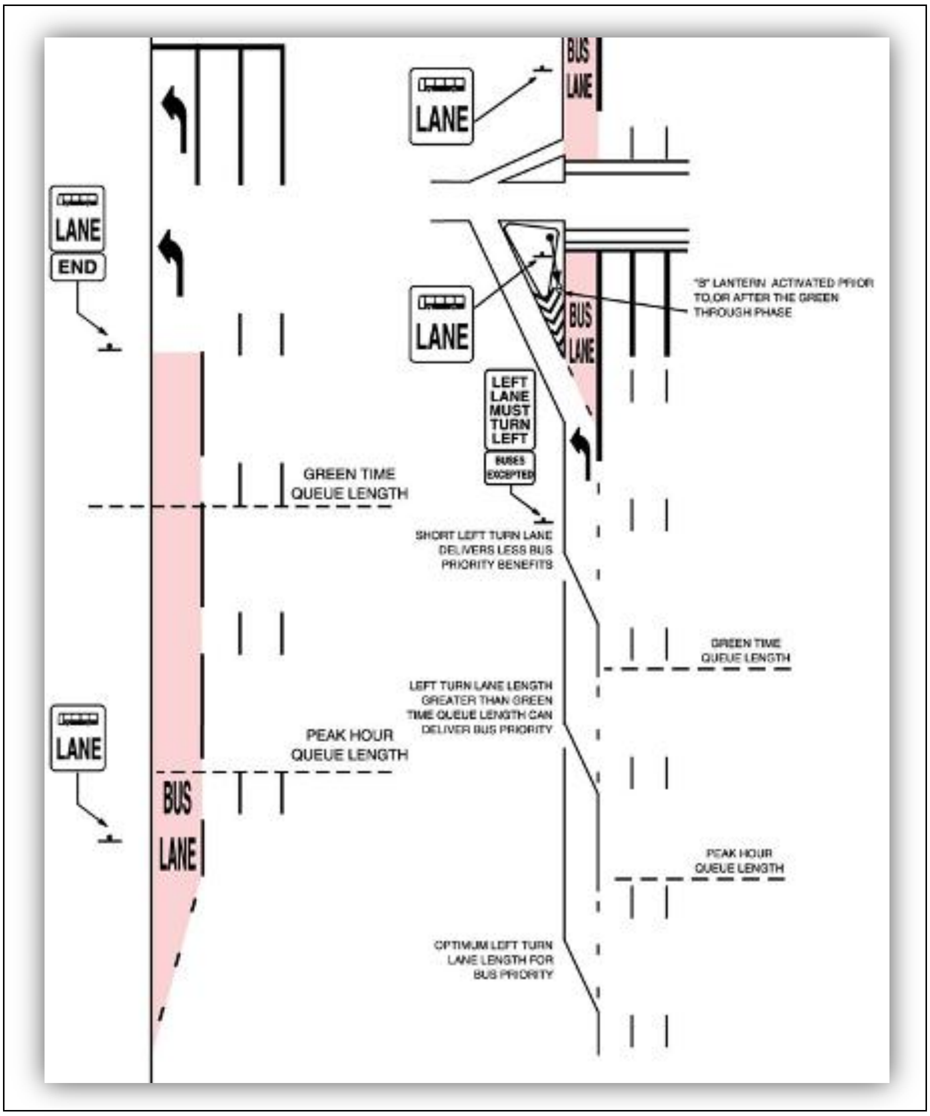
3.2.1 Intersection Level

Priority for public transport can be undertaken at the intersection level by providing active priority with early starts, extensions and exclusive public transport phases. These priority phases can be invoked by time of day or depending on congestion or peak flow.

If buses are in their own right of way, a normal vehicle detector can be used to demand bus phases. If the buses are in a shared road way, the buses require selective detection via transponders or combination of vehicle detections that are only activated when a vehicle with the size of a bus occupies the loops.

Passive priority can be setup using a SCATS system where traffic can be 'gated' or restricted to prioritize approaches which have public transport movements.

Figure 13: Bus queue jump lanes



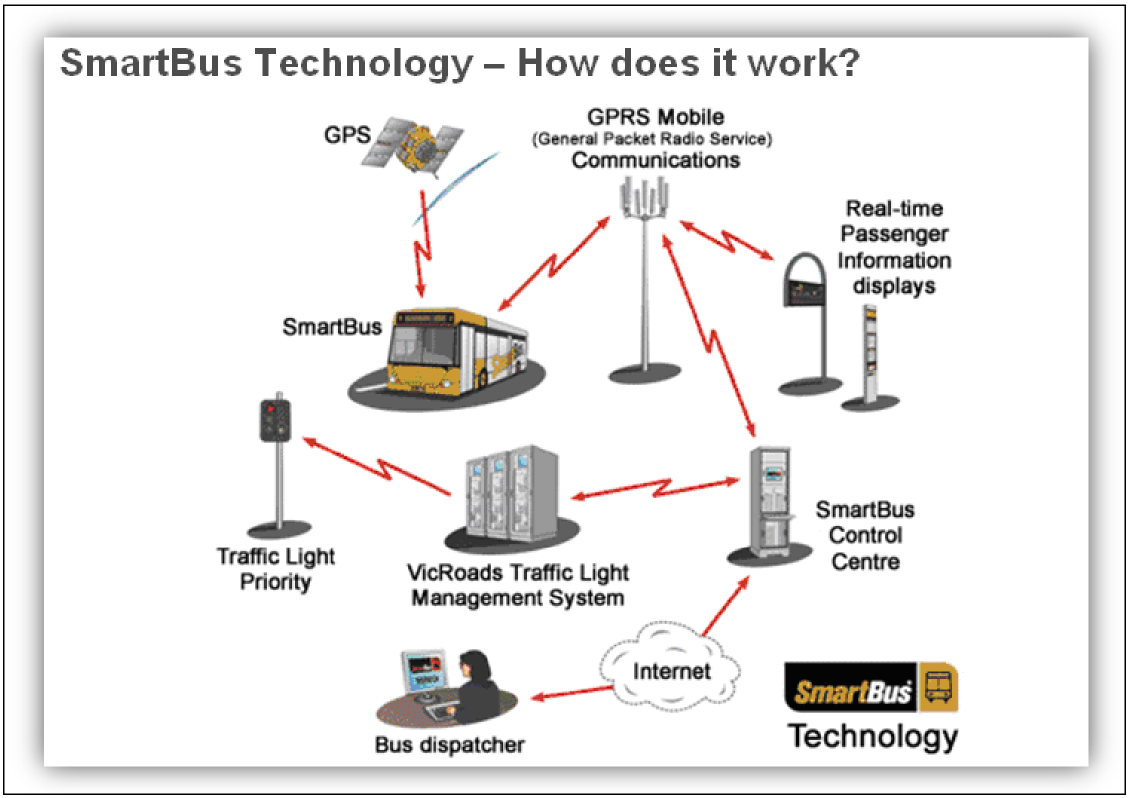
Source: VicRoads Bus Priority Toolkit

3.2.2 System Level

There are a number of systems that can be used with SCATS (i.e PTIPS) that monitor the position and schedule of the buses and if the buses are running late (typically 2 minutes), then priority can be requested to extend the green time at the downstream intersections.

Buses are required to be fitted with modem/GPS equipment and can be linked to provide real time information at bus stops. Refer to Figure 14 for the VicRoad's SmartBus configuration.

Figure 14: Configuration of VicRoads' SmartBus system



Source: VicRoads

3.3 SUSTAINABILITY

To ensure systems are operating as per design, maintenance checks and audits should be undertaken on a regular base (ex. 3 months). A traffic engineering review of the operating parameters should be undertaken at least every 3 years. Operational improvements can be undertaken as required.

3.4 MAINTENANCE OF THE SYSTEM

A maintenance contract should be setup to ensure the operating components (i.e. controller, detectors, communications and hardware) are maintained to a determined standard. Example contact documentation can be provided.

3.5 TRAINING

Training should be undertaken for transfer of knowledge so as local engineers and technicians can manage, operate and adjust the traffic signal operation as required. The training will consist of at least one week and include information of the operating modes, configuration of data, optimizing operational data and interrogating alarms.

Training on the maintenance of traffic signal controller should also be undertaken by the controller manufacturer.

3.6 BENEFITS

The main benefits of ATCS are reduction in travel time, delays and stops. Annexe 4 shows typical 'green wave' coordination for Jalan Diponegoro (Jalan Pasar Kembang to Jalan Raya Darmo) for different traffic flow patterns. SCATS will selection one of the coordination plans only when the traffic flow measured is considered tidal (ex. traffic is 1.5 greater than the traffic in the opposite direction). Otherwise the offsets selected are to provide the best two way coordination.

Priority can also be setup for pedestrians and bicycles (refer to Bicycle Victoria web site www.bv.com.au).

Figure 15: Giving priority to bicycles

Source: Bicycle Victoria

3.7 TRAFFIC MANAGEMENT CENTRE

A Traffic Management Centre (TMC) can be located at City of Surabaya offices where access to the CCTV monitors is available. SCATS can be accessed by up to 200 users. However, only Traffic personnel should have monitoring access.

To change SCATS operating parameters, only trained staff should have privilege. Security access is required with different levels of responsibilities being provided.

The Traffic Management Centre shall have all the ITS systems (ATCS, CCTV, VMS) and can be used by other agencies and stakeholders, if required (ex. major events and incidents). Ultimately bus or public transport operators can use the facilities to track and monitor buses operations.

Annexe 5 has the typical functions of a Traffic Management Centre. Many TMCs operate 24 hours/7 days a week.

CHAPTER 4: RECOMMENDATIONS FOR ATCS

4.1 RECOMMENDATIONS FOR ATCS

It is recommended that an ATCS (SCATS) is implemented in Surabaya to provide adaptive traffic signal control operation and be an important component of the ITS strategy.

New traffic signal controllers, preferably with UPS and ELV, will need to be installed and commissioned. The controllers will have new traffic signal operation designs mapping new detector inputs. Detail traffic signal layout plans will be required. An audit of the cabling, is required, to ensure there are sufficient cores to drive signal outputs.

Detection system (SCATS detector loops) using a combination of inductance loops, video detection and push buttons will need to be installed.

Communications between the controller and regional computer is required.

Computer equipment and software will be required to operate the ATCS.

Upgrading vehicle and pedestrian lanterns should be part of an improvement program.

Upgrading pedestals, particularly if video detection is required to ensure adequate height and positioning is enabled.

The setup of an ATCS will be undertaken by specialist Traffic Engineering personnel. This should include training for local staff to ensure systems are maintained and optimized.

The ATCS can be integrated with Bus Priority, pedestrian and bicycle systems. This can be done at a later stage, if required.

It is recommended that INDII provides an independent reviewer function for the implementation of the ATCS and other systems.

4.2 FAQS

A number of questions have been raised, the following answers are provided:

Q. How does SCATS operate, if under police control?

A. If traffic is allowed to operate during the red, under police control, the data will not provide accurate information about volumes and occupancy. If police control, is a regular event, locking typical cycle times, phase times and offsets is the best way to manage this situation. When police leave the site, the operation can readjust, if required.

Q. How does SCATS operate when the intersections are congested?

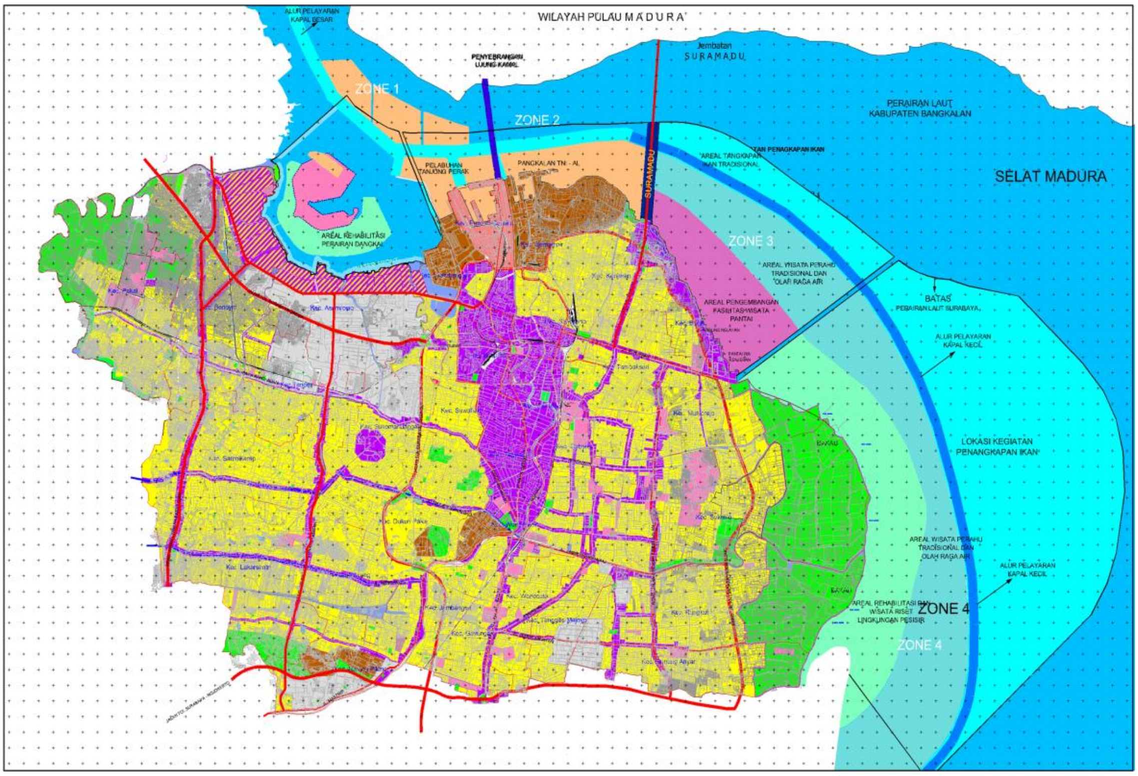
A. SCATS normal operation is to equalize the Degree of Saturation or the congestion on all critical approaches. However, operating strategies are required to setup SCATS to prioritize approaches and it maybe necessary to restrict or ‘gate’ traffic into congested areas. SCATS is an effective Traffic Management tool, to control traffic demand and to give priority to alternate transportation modes.

CHAPTER 5: URBAN TRANSPORT OVERVIEW

5.1 URBAN TRANSPORT OVERVIEW

The city of Surabaya has developed over the years a coherent spatial development strategy and the broad elements of the transport system that would be necessary to serve it (see Figure 16, below).

Figure 16: Spatial Development Plan: Surabaya 2009-2029



Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

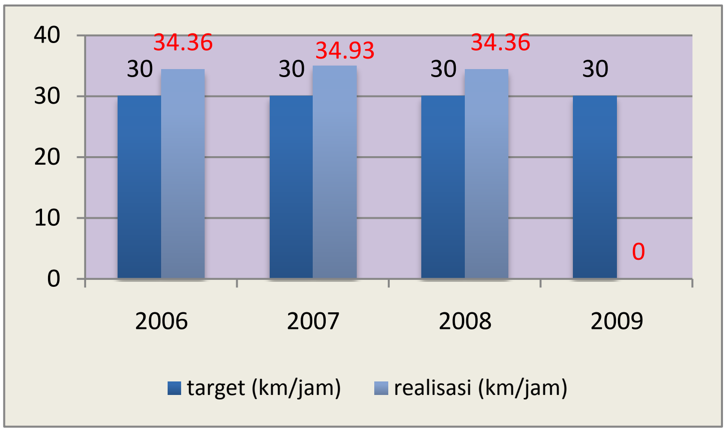
More importantly, since 2000, the city has made strenuous efforts to improve ambient air quality, reduce pollution and develop a sustainable transport system. Unfortunately, although ambient air quality has improved little progress has been achieved in managing demand, improving public transport or mobility for pedestrians and non-motorized transport. This, combined with improvements to the road system, has resulted in increased car volumes and a significant increase in motorcycle ownership and use (the motorcycle fleet has increased from 631,000 in 2002 to just over 1 million in 2008).

The modal split data confirms the increasing share of private cars and motorcycles. In 1995 around 65% of motorized trips were made by private cars and motorcycles, and 35% by public transport (including taxis). GTZ SUTP surveys in January and February 2000, indicated that 70% of peak period trips in the main north-south corridor were made by private cars and motorcycles, and 30% by public transport (of which only one third was by city bus and the remainder by microbus). [1]

[1] Efforts Toward Sustainable Urban Transport and Clean Air in Surabaya: An Integrated Approach, Surabaya City Planning Board (Bappeda), Paper submitted to the Clean Air Initiative in East Asian Cities, Bangkok 12–14 February 2001.

In 1998, the World Bank estimated that, if no actions were taken by the city, by the year 2010 average vehicle speeds on main roads would be less than 10km/h and more than half of main road links would be operating at or above capacity. As the result of significant improvements to the primary road network, especially within and around the central area, traffic conditions have improved and congestion has decreased. This is evidenced by average speeds of around 34 km/h (see Figure 17, below) that are well above the 10 km/h estimated by the World Bank.

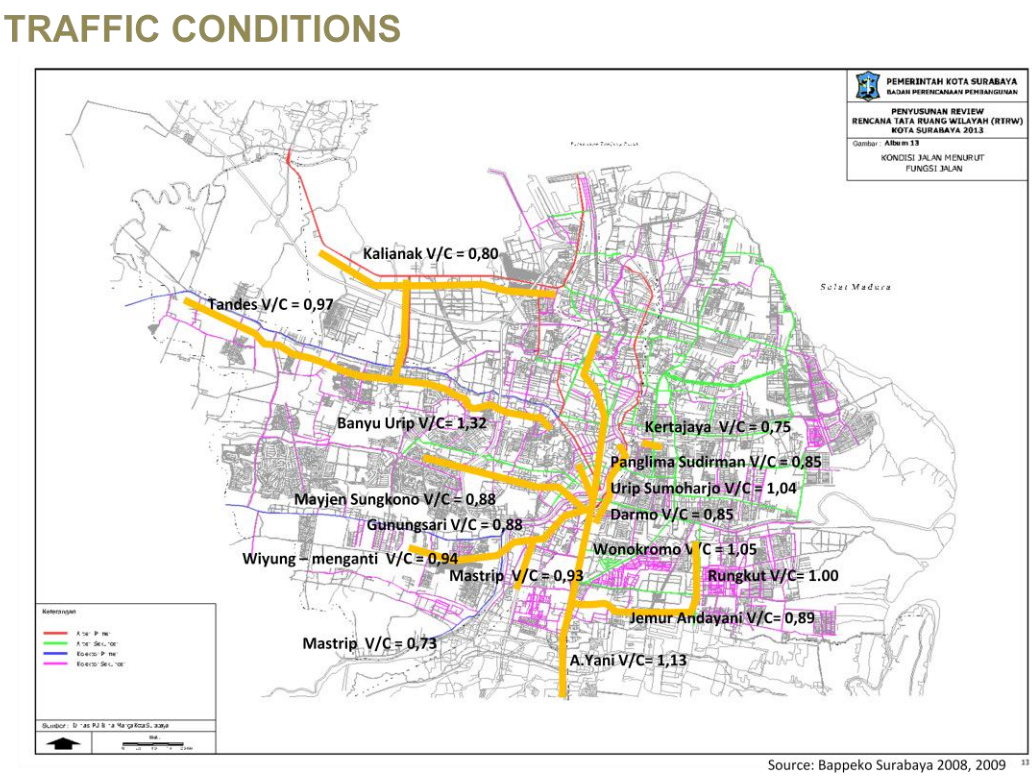
Figure 17: Improvement in average speed of vehicles compared to targets (2006-08)



Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

Volume-to-Capacity Ratios below 1.0 on all but four sections of the most heavily trafficked network sections (see Figure 18, below).

Figure 18: Current traffic conditions (2008-2009)



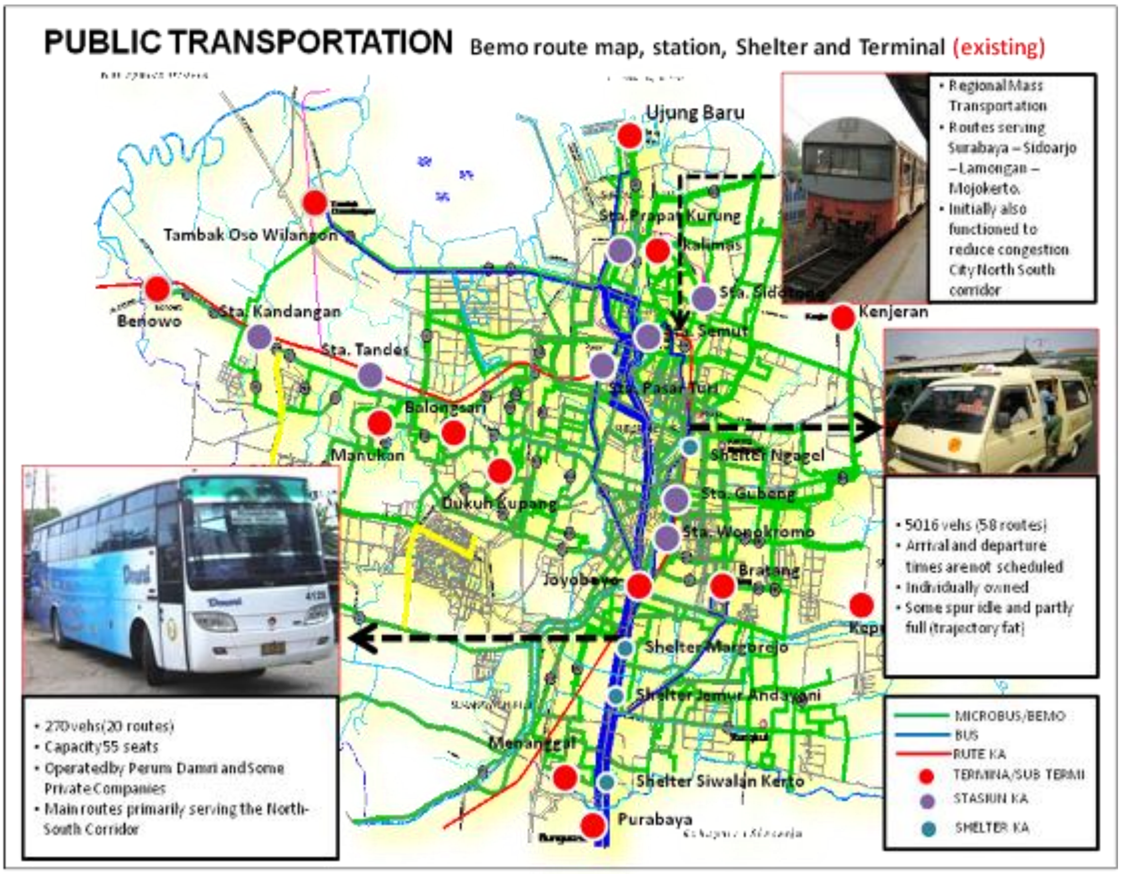
Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

While traffic conditions have improved, the average distance traveled per vehicle is increasing due to the extensive one-way system in and around the CBD and the use of "U-Turns" along the many divided carriageways that make up the primary network. There has been a deterioration in conditions for non-motorized transport (essentially pedestrians but also cyclists and becak drivers), despite considerable improvements to sidewalks along many sections of the primary network within the CBD. Equally, traffic control has not been able to keep pace with demand due to the failure of the traffic control system following the demise of the signal and traffic control equipment supplier. Finally, the public transport system is not able to meet current demand and is unlikely to meet the challenges of the future without major changes in the way it is managed and operated.

5.2 EXISTING PUBLIC TRANSPORT SYSTEM

As can be seen from Figure 19, below, the current public transport system in Surabaya comprises city buses, microbuses and rail services.

Figure 19: Existing Public Transport Network in Surabaya



Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

With 5,000 vehicles and 58 routes, microbuses are providing by far the majority of public transport service in Surabaya. The city bus service is operated by DAMRI and limited to 270 buses on 20 routes concentrated along the north-south corridor. With the exception of the 55 seat "Patas" air conditioned fleet, the majority of the fleet comprises 85 seat city buses that are 12 to 15 years old. The 8 to 10 seat microbuses are operated by owner-drivers and most seem to be relatively new and well maintained. The railway operates limited commuter services for passengers living in the surrounding areas outside of the city.

Becaks also form an important part of the public transport system as they provide local neighborhood services. The current becak fleet is not known but there were around 40,000 becaks operating in Surabaya in 2001.

5.3 PUBLIC TRANSPORT ISSUES

5.3.1 City Buses

- The service does not follow a schedule and while city buses serve the north-south corridor, the microbuses serve the east-west links and the rest of the network;
- Most bus stops are inaccessible by foot and by bus due to interference by illegally parked vehicles, becaks, etc (see Figure 20a); and many buses not roadworthy and are uncomfortable (see Figure 20b).

Figure 20: (a) Inaccessible bus stop with DAMRI Patas bus and (b) typical DAMRI city bus

Source: Field trips March 2010

5.3.2 Microbuses

- There are no schedules and passengers often have to wait inside the bus until it is full before the driver will depart (see Figure 21, below);

Figure 21: Microbuses

Source: Field trips March 2010

- Although the city bus and microbus fares are comparable (around 2,000 to 3,000 Rp), the microbus fare is for a single journey on a given route. This means that a trip involving a transfer from one microbus to another will incur an additional fare. The route structure is such that there are frequent transfers.
- Many routes coincide with bus routes;
- Individual private operators are difficult to regulate in terms of safety and passenger complaints.

5.3.3 Rail Service

- Single track operation combined with 11 level (at grade) road crossings within the city, limits the range of service possible (see Figure 3.3, below) and There are no east-west links.

Figure 22: At grade rail crossing

Source: railpictures.net

5.3.4 Becaks

Although they are not meant to travel on the primary network, many can be seen on main road sections (where they have difficulty crossing main roads) and around market areas and microbus stops (see Figure 3.4, below).

Figure 23: Becaks at Microbus stops and trying to cross main roads at a signalized intersection

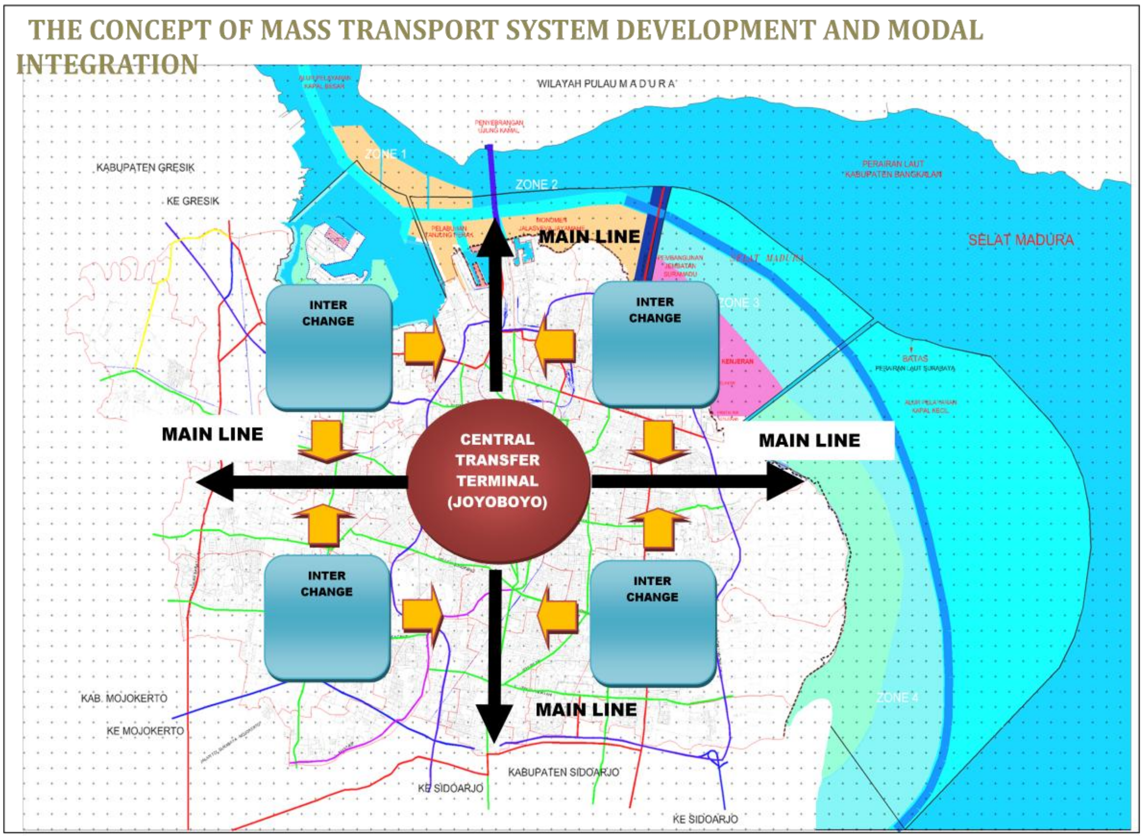
Source: Field trips March 2010

CHAPTER 6: PUBLIC TRANSPORT DEVELOPMENT STRATEGY

6.1 PUBLIC TRANSPORT DEVELOPMENT STRATEGY

The current public transport development strategy relies on introducing a system of mass transit to link the city center (CBD) with sub-centers within the city and with metropolitan centers located to the south and west of the city. Feeder services would link districts with the mass transit network and interchanges would link local areas with the feeder services (see Figure 22).

Figure 24: Public Transport Development Strategy



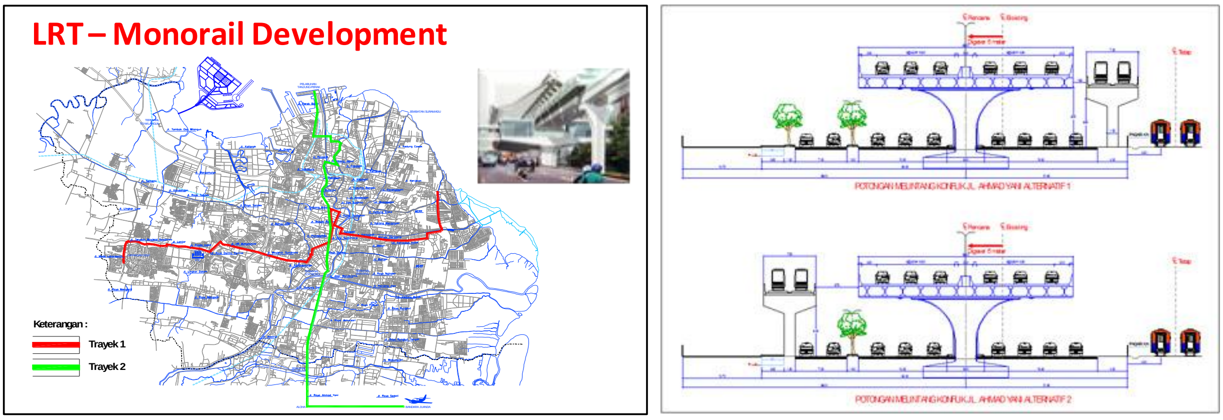
Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

6.2 PUBLIC TRANSPORT PROPOSALS

Studies have been undertaken to improve public transport by introducing a mass transit system. A study undertaken in 2005 by the Department of Transportation, Province of East Java compared various options and recommended the introduction of a monorail system [2] along the north-south corridor of the city (see Figure 25, below) and integrated with a proposed toll road along the southern section of the corridor.

[2] Kajian Pengembangan Kereta Api Monorail Aeromovel Di Gerbangkertosusila (Laporan Akhir), Dinas Perhubungan Propinsi Jawa Timur, 2005 (MS PowerPoint Presentation) [Railway Development Study: Monorail/Aeromovel (Final Report), Department of Transportation Province of East Java]

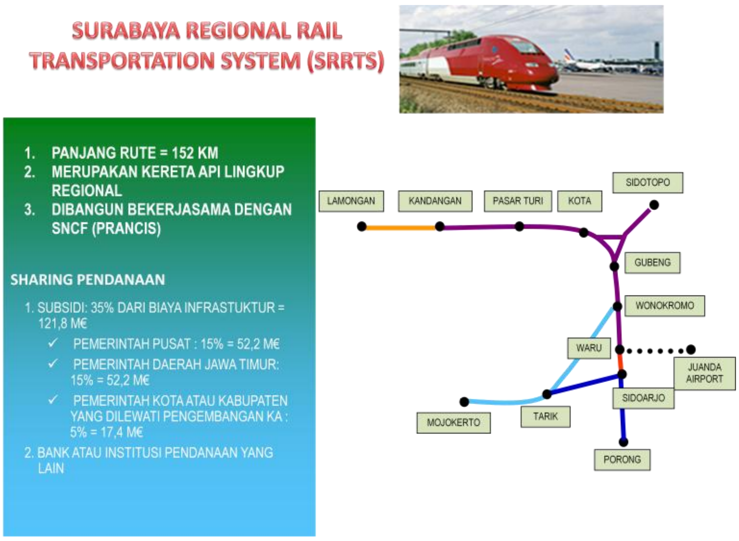
Figure 25: Proposed Monorail alignment and Toll Road Cross Section



Source: Kajian Pengembangan Kereta Api Monorail Aeromovel Di Gerbangkertosusila, Dinas Perhubungan Propinsi Jawa Timur, 2005

At the same time (in 2005), the Ministry of Transport commissioned the French rail company, SNCF International, to examine the potential for developing a regional express commuter line serving the Surabaya metropolitan area [3] (see Figure 26, below) parallel with the north-south monorail proposal.

Figure 26: Proposed Surabaya Regional Rail Express Commuter Line

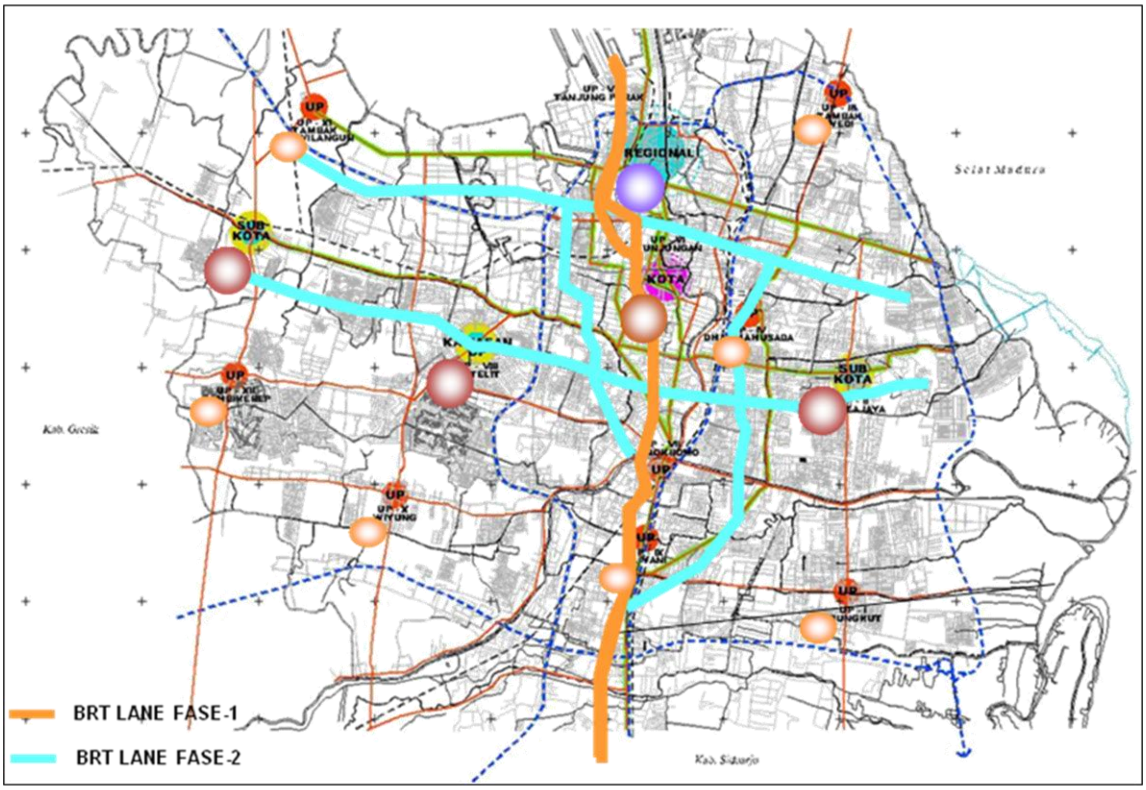


Source: BAPPEKO, Surabaya

In 2006, the city administration (with local consultant assistance) examined the potential for developing a Bus Rapid Transit (BRT) system based on the “TransJakarta” system that had been opened in Jakarta. The study was completed in 2007 and recommended the development of a BRT network, the first stage of which would serve the heavily trafficked north-south corridor (see Figure 27, below), 40 km is length with 47 stations (spaced just over 1 km apart) serving an estimated demand of 3,868 passengers/hour/direction with 75 buses during peak hour and 1,627 passengers/hour/direction with 32 buses off-peak. Headways would be 1.5 during peak periods and 5 minutes off peak. The total bus fleet requirements for this service were estimated to be 83 buses with a seating capacity of 85 passengers. Buses and stations would be air conditioned and “high floor” similar to those adopted in the TransJakarta system.

[3] Rendi A. Witular, French firm plans to develop railroads in Aceh, Surabaya, Jakarta Post, 19 January 2005

Figure 27: Proposed Surabaya Bus Rapid Transit Network



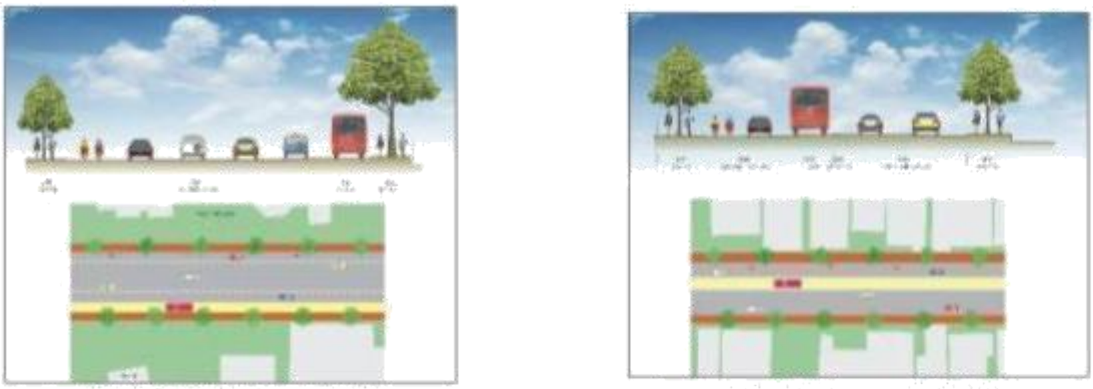
Source: Transportation Policies In Surabaya -Towards Sustainability, Ir. Irvan Wahyudrajad, Head of Transportation Infrastructure Division, Transportation Department, Surabaya City Government, 2009

For most of it's the route, the BRT Phase 1 line would be a separated alongside the median (see Figure 28, below), but along the one-way system within the central area, the line would be uni-lateral - along one side of the road (see Figure 29, below).

Figure 28: Typical median BRT busway plans and cross sections

Source: Studi Kelayakan Pengembangan Angkutan Massal (BRT), 2007

Figure 29: Typical un-lateral BRT busway plans and cross sections



POTONGAN MELINTANG GUBERNUR SURYO

POTONGAN MELINTANG PANGLIMA SUDIRMAN

Source: Studi Kelayakan Pengembangan Angkutan Massal (BRT), 2007

The demand projections assume transfers of passengers from city buses (that would be replaced by the BRT) and from microbus passengers, private car users and motorcyclists according to the table shown in Figure 5.6, below. These assumptions are derived from questionnaire surveys of 1,000 people who were asked if they would transfer to the BRT.

Table 5: BRT Passenger demand estimates

No	Vehicle Type	Passengers/hour/direction		
		2006	2011	2016
1	City Bus	1,523	1,981	2,727
2	Microbus	601	782	1076
3	Private Car	245	319	439
4	Motor Cycle	1,499	1,950	2,685
Total		**3,868**	**5,032**	**6,928**

Source: Studi Kelayakan Pengembangan Angkutan Massal (BRT): Laporan Rencana, 2006 (MS PowerPoint Presentation)

6.3 BRT ISSUES

Although the BRT study is very complete, it will require more work in the following key areas:

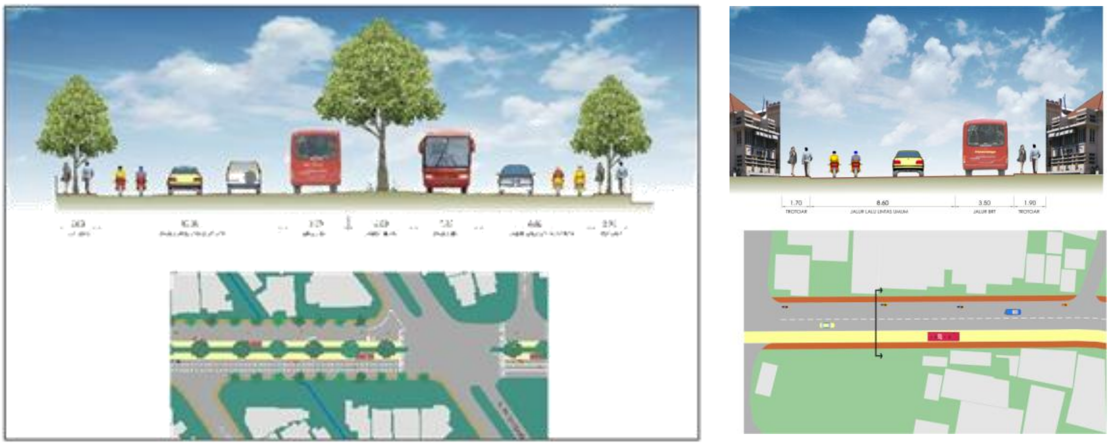
6.3.1 Demand Projections

A sensitivity analysis is required to assess the viability of the proposal assuming (a) only city bus passengers use the BRT; and (b) city bus and microbus passengers use the BRT. Until there are demand management measures that will encourage private car users and motorcyclists to shift to BRT, it is unlikely that the system will attract this group of potential passengers. This would apply to any form of proposed mass transit. As the demand would be reduced by half, it is unlikely that the proposal would meet the minimum economic rate of return to justify the investment. More work will therefore be necessary to assess how the BRT can be made attractive to non-public transport users (especially motorcyclists).

6.3.2 Busway Design

The current proposals only indicate in a diagrammatic way the layout of the BRT “busway” (see Figure 30) and it will be essential to undertake detailed analysis of the existing road and junction conditions (including turning movements and frontage access requirements) and then to design the busway at a scale of 1:500 along with changes that will be required to existing roads, junctions, sidewalks and so on to accommodate the BRT system. This will have a major impact on the cost estimates, performance and economic viability.

Figure 30: Examples of diagrams that will require extensive analysis to determine appropriate detailed junction redesign and frontage access requirements

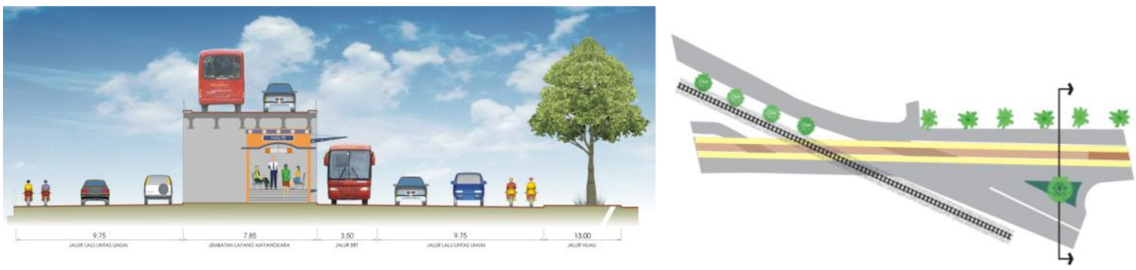


Source: Studi Kelayakan Pengembangan Angkutan Massal (BRT): Laporan Rencana, 2006 (MS PowerPoint Presentation)

6.3.3 Right of Way

Although for the most part it would appear that the BRT busway can be integrated within the existing road right of way, there is one section at Mayangkara Utara where the BRT would have to operate in mixed traffic and use the two lane flyover over the railway line (see Figure 31).

Figure 31: Mixed use at Mayangkara Utara



Source: Studi Kelayakan Pengembangan Angkutan Massal (BRT), 2007

In addition, the section north of the flyover is very reduced in width with a very dense kampung fronting the road to the west and commercial activities to the east. This section will require extensive study and possibly extensive civil works and resettlement to enable the BRT line to pass through without hindrance from traffic and frontage activities. There may be a case here to develop a shopping/market concourse above and integrated with the BRT station.

6.3.4 Stations

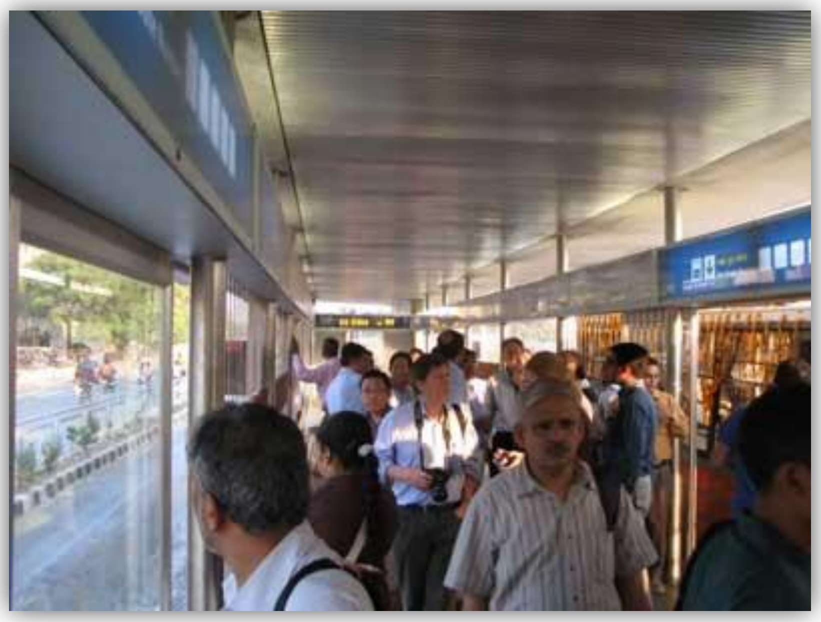
The station design illustrated in the study report does not represent adequately the size and scale of station that would be necessary to accommodate passengers safely and allow for speedy boarding and alighting (that are essential to the success of any BRT system). The proposed platform width of 3.5 metres for a central "island" station in the example in Figure 32, is an absolute minimum.

Figure 32: Example of narrow (3.5 m) station design

Source: Studi Kelayakan Pengembangan Angkutan Massal (BRT): Laporan Rencana, 2006 (MS PowerPoint Presentation)

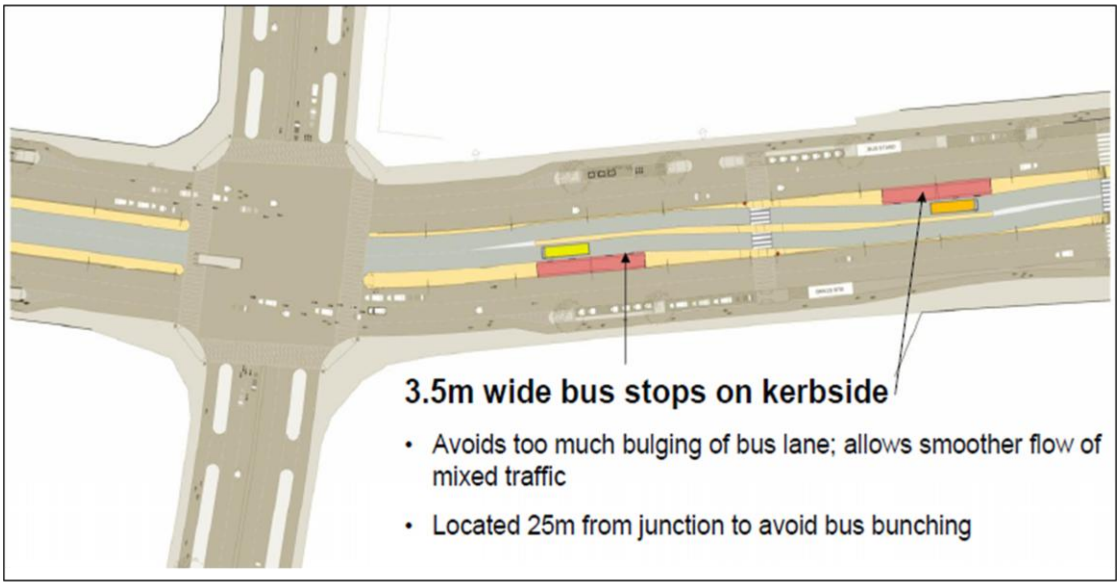
Although some central stations in Ahmedabad are 3.5 metres wide, they can easily become congested (see Figure 33) whereas kerbside station widths of 3.5 metres are acceptable, as illustrated in Figure 34.

Figure 33: Ahmedabad central island station



Source: Paul Villarete, Cebu City Planning and Development Coordinator, and Cebu City BRT Project Development Officer, Philippines

Figure 34: Ahmedabad kerbside stations



Source: JANMARG Ahmedabad Bus Rapid Transit System, Ahmedabad Municipal Corporation, 2009.

The stations appear to be designed to accommodate a single standard bus (similar to the TransJarkarta system). Most BRT systems in other countries operate articulated buses (and some bi-articulated buses) to handle demand, avoid bus bunching and facilitate boarding and alighting. The Surabaya system should be capable of accommodating articulated buses in terms of busway design and, most importantly, station length (to allow for future expansion of the service).

6.3.5 Private Sector Participation

Opportunities should be investigated for private sector involvement in the design and implementation of the BRT system. It will be especially important to examine land and BRT mixed development opportunities. An example of this is the integration of the BRT station with the Mater Hill Clinic complex in Brisbane (see Figure 35).

Figure 35: BRT integrated development (Mater Hill Clinic, Brisbane) – BRT line is in red

Source: Brisbane South East Busway, Barry Broe and Barry Gyte, 2001

6.3.6 Integration with Non-Motorized Transport

Opportunities should also be looked at for integrating BRT with pedestrian streets within the central area. This approach can often be attractive to developers interested in city centre renewal (see Figure 36)

Figure 36: Example of integrated BRT and pedestrian street in Bogota, Colombia

Source: Carlosfelipe Pardo, ITDP Colombia

6.3.7 BRT and Microbuses

The microbuses play a major role in providing public transport services in Surabaya and yet they appear not to have consulted in the design of the BRT system. The BRT study does include microbuses as feeder services to the main BRT lines and there is mention of transfer points at the proposed BRT stations (although no plans are shown). It will be essential to bring the microbus owner-drivers (and their respective associations) into the design process and to discuss with them the possibilities for them to be involved in the operation and management of the system. Several BRT operations in other countries (such as the Transmilenio in Bogota, Colombia) have incorporated owner-drivers successfully within the system and this has been a win-win situation both for the microbus owner-drivers and the BRT system.

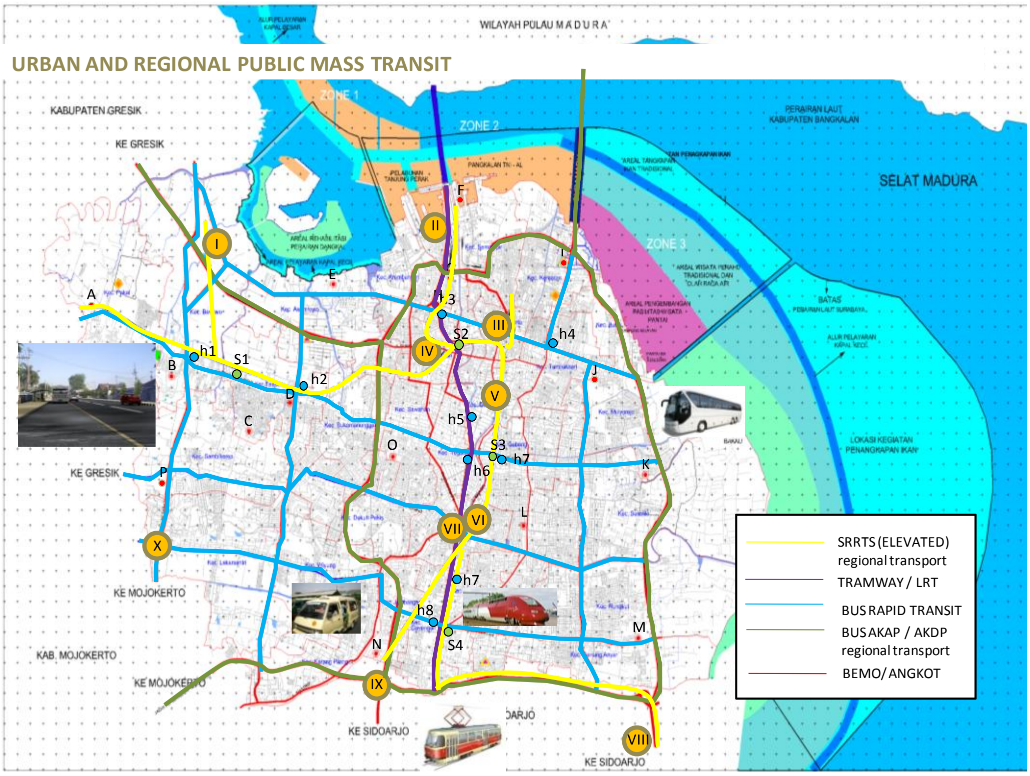
Involving microbus owner-drivers in the BRT system design process will provide opportunities to discuss ways to improve microbus services throughout the city (such as introducing scheduling, integrated fares, etc.) and improve the quality and maintenance of the vehicles (through access to micro-credit facilities). In addition, this will provide an opportunity to assess driver training needs as well as micro-business management training needs and develop responsive training programs.

With a concerted effort on the part of the city government, it should be possible to convert the microbus system in Surabaya from a marginal activity into a viable public transport enterprise that will attract passengers and hopefully stem the growth in the ownership and use of motorcycles.

6.3.8 BRT or LRT?

The discussion presentation prepared by the city for presentation to the new Mayor (who will be elected following the elections scheduled for April 28, 2010) has a plan that shows an LRT along the north-south section of the proposed BRT network (see Figure 37). Although the status of this is unclear and there appears to be no feasibility study for the scheme, it seems that it is a project that has been proposed by the Ministry of Transport in Jakarta without due consultation with the authorities in Surabaya. The justification for this proposal is not evident but experience with LRT projects in other countries suggests that the capital and operating costs would be substantially higher than a BRT system.

Figure 37: Proposed Urban and Regional Mass Transit with LRT along the North-South corridor



Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

6.3.9 Where Does The BRT Proposal Stand?

The BRT proposal has not been approved by the City of Surabaya. It is not clear why.

- There appear to be jurisdictional issues concerning the ability of the city to implement a BRT system on a national road.
- There also appears to be an interest on the part of Jasa Marga to develop an elevated toll road along part of the BRT alignment.
- There also appears to be a concern that the microbus owners may oppose a BRT system for fear of losing passengers.
- There is a LRT proposal along the BRT Phase 1 alignment

These issues need to be resolved urgently.

- Discussions need to be held urgently with the national road authorities (Bina Marga) to resolve what appears at first glance to be a “non-issue” given that the TransJakarta BRT has been using national road alignments is Jakarta for several years now without any problems.
- Equally urgent is the need to clarify the interest of Jasa Marga in building a toll road along the southern section of the north-south corridor. The city will need to assess whether bringing toll

road traffic to edge of the CBD will assist or detract from the city's goal of developing a sustainable city environment and reducing traffic within the central area.

- The issue of microbus owner-drivers opposing the BRT can be readily resolved by the actions set out in section 6.3.7 above.
- The rationale, backing and status of the LRT proposal should be clarified by the Ministry of Transport. However, the city should resist yet another two-to-three year study of a technology that is known (and proven) to be less cost effective than BRT. To avoid the types of delays that Jakarta has suffered from studying a plethora of "mass transit" technologies over the last three decades, it would make more sense to proceed with examining in detail the potential for developing a BRT system (based on the existing study) while keeping open the option of an "elevated" solution if it proves impossible or too costly to develop an "at-grade" BRT system.

6.4 BRT AND ATCS

The lack of decision concerning the BRT proposal will not in itself cause any delay in the implementation of the first phase of the proposed ATCS. The proposed ATCS system can be adapted to a BRT system. Clearly it would be preferable if the BRT detailed design was available and approved as the ATCS system could then dovetail perfectly with the location and operation of the BRT.

The ATCS is a powerful tool for managing not just traffic but the whole road based transport system and urban mobility within the city. It should therefore be designed and implemented over phases that will allow for the system to be progressively integrated with public transport and non-motorized improvement measures that are designed to enhance mobility and with demand management measures that are designed to encourage people to rely less on motorized transport (cars and motorcycles).

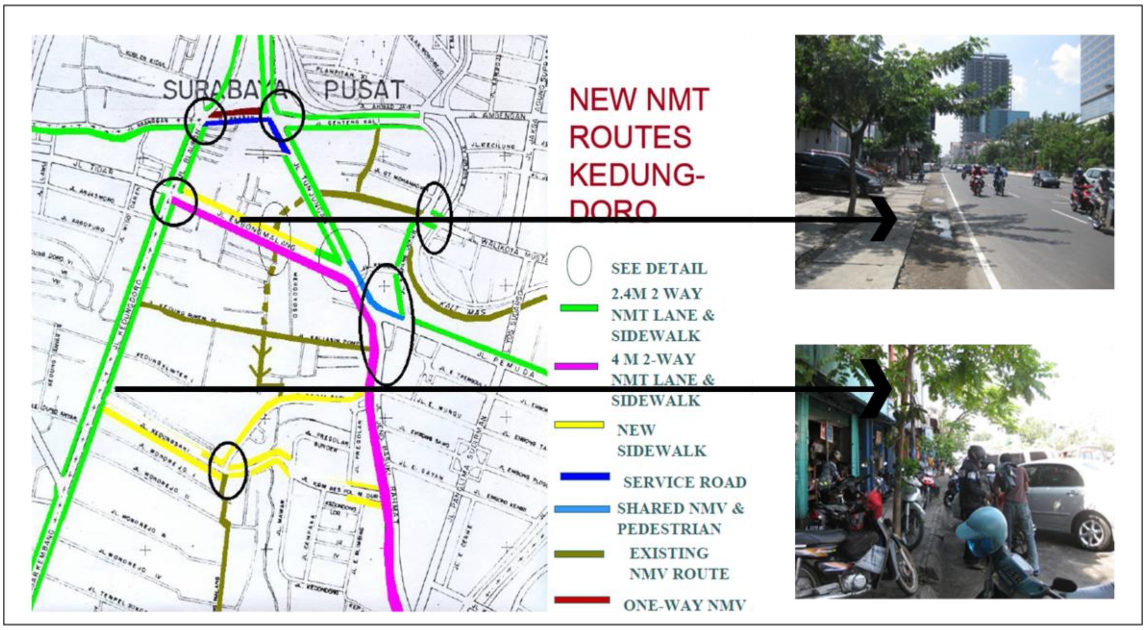
For this to work, decisions will have to be taken sooner rather than later on issues like Bus Rapid Transit.

CHAPTER 7: NON-MOTORISED TRANSPORT

7.1 NON-MOTORIZED TRANSPORT

Between 1998 and 2001, with the assistance of the GTZ The German Technical Cooperation – Sustainable Urban Transport Project (SUTP), the city developed plans and policies to towards achieving a sustainable transport system for the city, including "car free days", facilities for pedestrians and cyclists, emission reduction programs, air pollution monitoring, vehicle inspection and maintenance, etc [4]. Progress in implementing these measures has been frustrated, apparently, by opposition from some 'traditional' transport planning officials, who focused more on improving conditions for motorized [5]. For example, the proposals for non-motorized transport for Kendungdoro were not implemented (except for some sidewalk improvements) whereas the road infrastructure has been improved significantly (see figure 38).

Figure 38: Non-Motorized Transport Proposals (2003) and situation today



Source: Manfred Breithaupt, How Urban Regions Count Traffic, Transport Activity, Energy, and Emissions – Experiences From Surabaya / Indonesia, presented at the TRB 82nd Annual Meeting, Washington, 16 Jan. 2003 and INDII site visit March, 2010

7.2 PEDESTRIAN FACILITIES

Since 2006, sidewalk improvements have been made to many primary roads in and around the CBD (see Figure 39, below).

[4] Manfred Breithaupt, How Urban Regions Count Traffic, Transport Activity, Energy, and Emissions – Experiences From Surabaya / Indonesia, presented at the TRB 82nd Annual Meeting, Washington, 16 Jan. 2003.

[5] idem

Figure 39: Sidewalk improvements 2006-2010

Source: Transportation Policies In Surabaya -Towards Sustainability, Ir. Irvan Wahyudrajad, Head of Transportation Infrastructure Division, Transportation Department, Surabaya City Government, 2009

In 2010 raised pedestrian crossings are being implemented in 20 locations (see Figure 40, below) where secondary roads intersect with primary roads.

Figure 40: An example of a recently implemented raised pedestrian secondary road crossing

Source: Field visit, March 2010

These measures are very effect in "traffic calming" (slowing down vehicles approaching the pedestrian crossing) and in giving pedestrians priority. They need to be replicated at ALL pedestrian crossings, especially those along the primary roads and those controlled by traffic signals. Given the width of the primary roads (four-to-six lanes), it will be essential to provide for pedestrian refuges every two-to-three lanes (see the example in Figure 41, below).

Figure 41: Existing signalized pedestrian crossing and proposed schematic modification to raise the crossing and add a safety refuge

Source: Field visit, March 2010

These measures need to be incorporated within the design of the proposed ATCS and should result from extensive pedestrian movement surveys that will need to be undertaken throughout the city but especially within the CBD and market areas. In addition, surveys need to be undertaken of current footpaths and pavements throughout the city. Conditions in many streets are such that pedestrians are forced to walk for some distance in the road due to broken drains, exposed tree roots, broken surfaces, street vendors, pedestrian crossings that lead nowhere or simply the lack of any form of sidewalk (see Figures 42 and 43, from field visits, below).

Figure 42: Lack of sidewalks, encroachment by street vendors and tree root damage

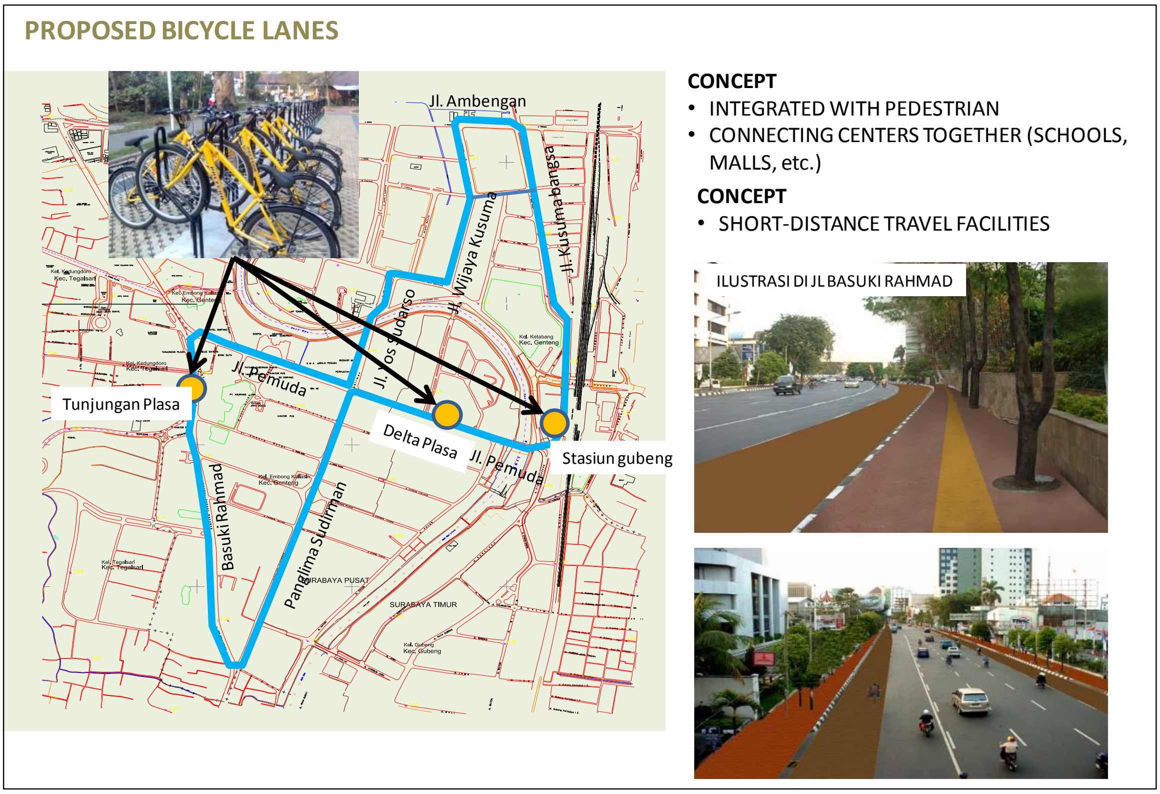
Figure 43: Broken drains, encroachment by vehicles and a crossing that leads nowhere

It is suggested that the results of these surveys be discussed with local neighborhood organizations and other stakeholder groups to ascertain priorities and assistance with on-going maintenance. Examples of best practice in undertaking pedestrian facility surveys are provided in the Annexes.

7.3 NON-MOTORIZED VEHICLES AND CYCLISTS

There is a proposal to implement a bicycle lane network within the central area (see Figure 44, below).

Figure 44: Proposed Bicycle Lanes



Source: Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi, 2009 (MS PowerPoint Presentation)

It is not clear what the status is of this proposal or what it is designed to achieve. Evidence from field visits suggest there are relatively few cyclists in the city undoubtedly due to the complete lack of facilities for cyclists and the danger of attempting to cycle on or across the primary road network. The climate is also not conducive to cycling. The situation may not be capable of change until some form of affordable and reliable electric bike becomes commercially available. Nevertheless, it would be important to assess the potential for cycling and for providing a comprehensive cycle network in anticipation of changes in behavior and technology.

Becaks are still an important source of transport within residential neighborhoods but there is little evidence of any becak facilities in the city nor are there apparently any proposals to improve conditions for them. Views are mixed concerning becaks. Some view them as part of a past that should be eliminated and forgotten, others view them as an important contribution to urban mobility. What is clear is that they provide an income for a substantial number of people. It would be possible to convert becaks into a relatively “clean” 21st century mode of transport with the adoption of battery powered electric motors using pedelec technology (a form of hybrid bicycle) and there is no reason why becak drivers should not make use of cell phones and smart cards to provide an “on demand service”. One approach would be to include them in the pedestrian surveys outlined above and discuss with possible improvements in service and facilities in consultation with neighborhood committees and other stakeholders.

CHAPTER 8: AIR QUALITY

8.1 AIR QUALITY

Since 2001, Surabaya has had a Regional Air Quality Monitoring Center with air quality monitoring equipment installed in five locations [6]. The ambient air quality parameters which are measured are PM10, SO2, O3, NO2, CO. The measurements and the resultant Pollutant Standards Index (PSI) are published on public data display panels, the internet, the radio and also in newspapers. As can be seen from Figure 45, below, the PSI for March 27, 2010 was 44 (in the "good" range).

Figure 45: Surabaya Pollutant Standards Index (PSI) on the Internet

Car Free Days were also initiated in 2001 in several streets in the heart of the city. These are still observed every Sunday as part of the pollution reduction effort and citizen awareness programs (see Figure 46, below). They also serve as an important tool in educating young people in the potential to move around safely without using a car or motorcycle. These programs should be extended to residential neighborhoods and other parts of the city and linked to programs to promote fitness and encourage the use of more sustainable modes, including public transport as well as making more ecological use of the car and the motorcycle through training in eco-driving techniques.

[6] Ambient Air Quality Management in Surabaya, Indonesia, 2003

Figure 46: Car Free Day along Jalan Raya Darmo (Sunday March 28, 2010 at 09h30)

Source: Field Visit, March 2010

CHAPTER 9: RECOMMENDATIONS FOR URBAN TRANSPORT

9.1 STRATEGIC VISION AND URBAN MOBILITY PLANNING

In order to develop the current discussion document (Bahan Diskusi RPJMD 2011-2015: Program Pengembangan Transportasi) into a viable strategic vision and implantable urban mobility program that can be adopted by the soon to be elected new city Mayor, the city will require technical assistance. This should be designed to assist the city in developing a coherent and comprehensive urban mobility strategy that draws on local initiatives (such as parking, pedestrian facilities, cycle lanes, etc) and international best practice to improve mobility for all citizens in a sustainable and cost effective manner and reduce dependence on private cars and motor cycles (unsustainable modes). This would include investigating options for improved coordination at the city level and the for the Surabaya metropolitan area (in cooperation with the provincial government and surrounding municipalities).

In addition, there will be a need for workshops, training and stakeholder involvement on how to manage demand transport within the Surabaya context (this is probably the greatest challenge confronting the city in terms of urban mobility).

9.2 BUS RAPID TRANSIT

In order to develop the existing BRT pre-feasibility study into a viable and implementable project, the city will require technical assistance and exposure to appropriate international best practice (for example on system design in India, on land development opportunities in Brisbane, on fare and microbus integration from Colombia, on busway insertion from Quito, Ecuador, station design from several countries, etc.).

Particular attention will need to be made to detailed analysis and design of the busway alignment through congested areas, narrow cross sections and at critical intersections. Station design to ensure rapid boarding and alighting, as well as easy and safe pedestrian access, is critical. As the system will rely on transfers from express buses to feeder buses, considerable attention will need to me made to ease of transfer and interchange. BRT systems require integrated fare systems, ideally using smart card technology, with capable and independent overall management. Finally, the type of buses to be used will be critical to the success or failure of the system. Even if initially, the demand profile will require single buses, the system design (especially the stations) will need to be able to accommodate articulated buses (to avoid bunching when demand increases).

9.3 BUS RAPID TRANSIT AND MICROBUS OWNER-DRIVERS

Technical assistance and access to international best practice will be required to assist the city in ensuring that microbus owner-drivers are fully integrated within the BRT system design process. This will also provide opportunities to discuss ways to improve microbus services throughout the city (such as introducing scheduling, integrated fares, etc.) and improve the quality and maintenance of the vehicles (through access to micro-credit facilities). In addition, this will provide an opportunity to assess driver training needs as well as micro-business management training needs and develop responsive training programs.

9.4 NON-MOTORIZED TRANSPORT

Technical assistance and access to international best practice will be required to assist the city in undertaking extensive pedestrian movement surveys throughout the city but especially within the CBD and market areas. Surveys also need to be undertaken of the physical condition of footpaths and pavements throughout the city. The results of this work would be used to undertake pilot projects to assess the viability and impact of remedial measures (such as raised pedestrian crossings, pedestrian refuges, etc) at high concentrations of pedestrian movement. In addition, the potential for cycling should be investigated as, despite climatic conditions, experience internationally has shown that with the introduction of priority measures to ensure safety, cycling can become an attractive alternative to motorized transport.

9.5 ORIGIN-DESTINATION DATA AND TRANSPORT MODELS

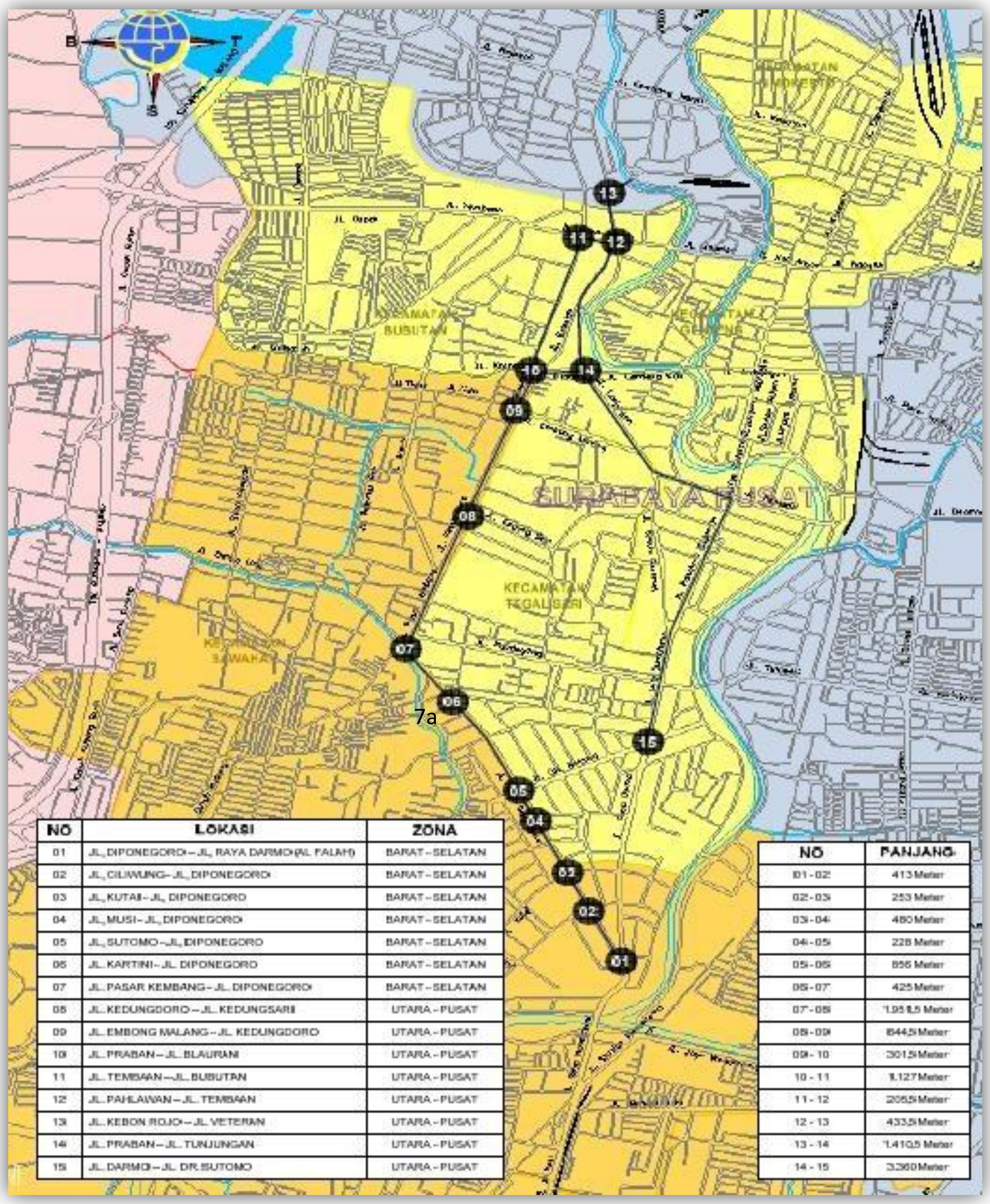
There has been no origin-destination surveys or transport modeling undertaken in Surabaya since 1997. With the increase in population, activities, vehicles and road network, it is certainly time to undertake a comprehensive survey of trip patterns. Many of the decisions concerning mass transit and public transport require an understanding of current and future travel patterns. Technical assistance is therefore required to assist the city in determining the type of transport model that would be appropriate (and cost effective) and be capable of providing updated information in the future.

9.6 LEADERSHIP AND STAKEHOLDER PARTICIPATION

International experience shows that the cities that have successfully addressed urban mobility issues have, for the most part, had leaders who understood the issues and were willing to take risks to solve them, often with innovative measures. Surabaya is fortunate in that it has managed to keep ahead of congestion on its arterial road network and it has at its disposal a group of talented and motivated staff within its transport department. A new Mayor will be appointed within the next few months, the time is therefore ripe for the strategic visions and ideas prepared by the technical staff to be presented and discussed with the city leadership in a convincing and politically attractive manner. At the same time, stakeholders and the population at large need to be informed and consulted about the technical options that are available to improve mobility in the city. Both activities require special skills that could be strengthened and provided by targeted technical assistance familiar with the local situation.

ANNEXES

ANNEXE 1: SURABAYA NETWORK – ATCS LOCATIONS



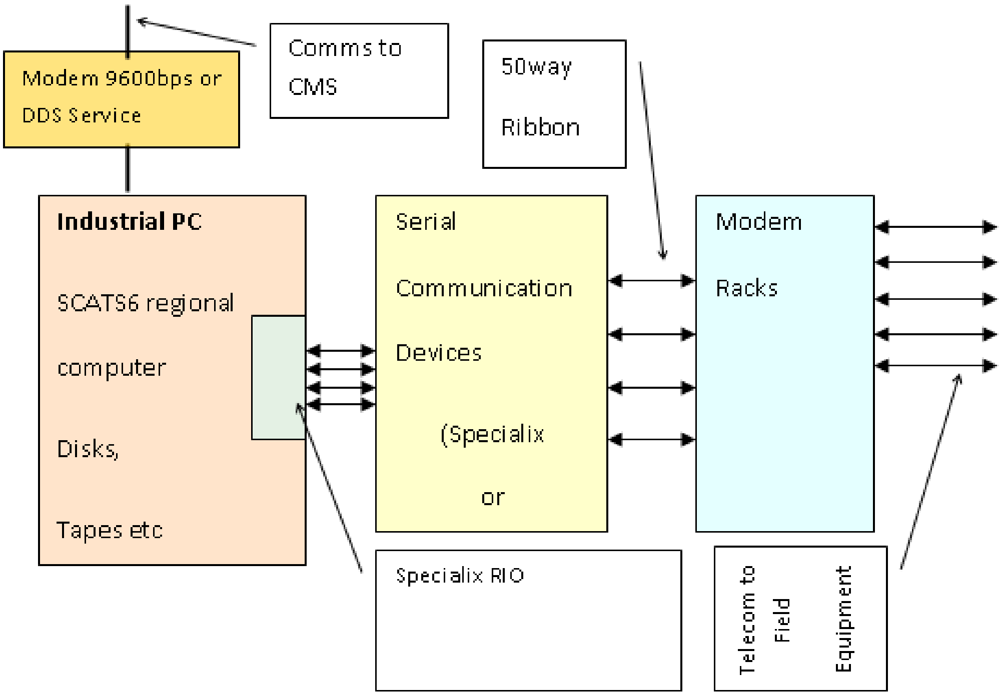
NO	LOKASI	ZONA
01	JL. DIPONEGORO – JL. RAYA DARMO (AL FALAH)	BARAT - SELATAN
02	JL. CILIWUNG – JL. DIPONEGORO	BARAT - SELATAN
03	JL. KUTAI – JL. DIPONEGORO	BARAT - SELATAN
04	JL. MUSI – JL. DIPONEGORO	BARAT - SELATAN
05	JL. SUTOMO – JL. DIPONEGORO	BARAT - SELATAN
06	JL. KARTINI – JL. DIPONEGORO	BARAT - SELATAN
07	JL. PASAR KEMBANG – JL. DIPONEGORO	BARAT - SELATAN
08	JL. KEDUNGDORO – JL. KEDUNGSARI	UTARA - PUSAT
09	JL. EMBONG MALANG – JL. KEDUNGDORO	UTARA - PUSAT
10	JL. PRABAN – JL. BLAURAN	UTARA - PUSAT
11	JL. TEMBAAN – JL. BUBUTAN	UTARA - PUSAT
12	JL. PAHLAWAN – JL. TEMBAAN	UTARA - PUSAT
13	JL. KEBON ROJO – JL. VETERAN	UTARA - PUSAT
14	JL. PRABAN – JL. TUNJUNGAN	UTARA - PUSAT
15	JL. DARMO – JL. DR.SUTOMO	UTARA - PUSAT

NO	PANJANG
01 - 02	413 Meter
02 - 03	253 Meter
03 - 04	480 Meter
04 - 05	228 Meter
05 - 06	856 Meter
06 - 07	425 Meter
07 - 08	1.951,5 Meter
08 - 09	844,5 Meter
09 - 10	301,5 Meter
10 - 11	1.127 Meter
11 - 12	205,5 Meter
12 - 13	433,5 Meter
13 - 14	1.410,5 Meter
14 - 15	3.360 Meter

ANNEXE 2: SCATS 6 COMPUTER SYSTEM ARCHITECTURE

The SCATS 6 computer runs in an Industrial PC environment. The Industrial PC has been chosen for its additional qualities relating to cooling, and robustness over normal office-based PC systems.

The SCATS6 kernel software runs in the PC, and handles all traffic data and calculations. Communications to intersections are handled via communication host cards inserted inside the PC, which in turn communicate with serial communication devices, each capable of handling 16 intersections. These devices connect via an adapter card to interface to 50way modem cables, and then to the modem racks, which handle communication of data between the regional computer installation and the field controllers.



Typical Equipment List

Hardware / Software component requirements for a SCATS 6 regional computer with VAXCMS system support:

Item	Description	Qty
1.1	Computer hardware comprising the following: Windows NT Server Industrial rated PC (Advantech Model 610) 19" rack mountable computer with the following options: BX Chipset motherboard Pentium III CPU (450Mhz or higher) 2 serial, 1 Parallel ports PCI bus for RIO PCI host card (see 1.3) SVGA adapter ATAPI interface CD-ROM drive 4.3Gb (or higher) HDD 1.44 Mb FDD	1

Item	Description	Qty
	250W power supply Windows NT 4.0 Workstation (OEM) software Win '95 Keyboard and integrated track-mouse on slide-out tray 15" monitor 128Mb Intel Certified RAM Intel PCI or embedded 10/100Mhz network card Norton Anti-virus software for Windows NT	
1.2	19" Equipment rack to accommodate computer and communications hardware 675mm deep, 1915mm high. Tinted "plexiglass' front door, solid panel rear door. Shelf for monitor. Shelf for Processor. Vented lid. 12way 240V GPO distribution. Hardware mounting screws and fixtures. Cable Ties.	1
1.3	Specialix RIO host card, Or Digi C/X Host adapter card (Note that one card required for each 128 intersections to be connected)	1
1.4	Specialix RRC16/RJX RJ45 RS-232 data concentrators Or Digi C/Con16 16 Channel RS-232 data concentrators (Note: one unit required per each 16 intersection slots)	8 (gives 128 slots)
1.5	Specialix RRC16 to 50 way modem adapters Or Digi C/Con16 to 50 way modem adapters (Note: one unit required per each 16 intersection slots)	8 (gives 128 slots)
1.6	3.0 Metre 50way ribbon cables	16 (gives 128 slots)
1.7	Philips or AWA SCATS modem racks and cabinet to suit intersection requirements	As req'd
1.8	19" rack to house modems	As req'd
1.9	SCATS 6 software licence (Roads and Traffic Authority NSW)	1
2.1	DDS line, 9600bps with asynch to synch converter, with cable to connect to PC Com port for communicating with SCATS Communications Server (Central System)	1
2.2	SCATTERM 2.5.32 (or later) SCATS terminal software	1
2.3	(Optional – if tape backup system employed) SA1522B or 3940UW Adaptec SCSI controller 4mm DAT 2Gb tape drive for backup/restore (Integrated or External enclosure) NovaBack tape backup software (www.novastor.com)	1
2.4	(Optional if UPS employed) Uninterruptible Power Supply minimum 1KVA capacity recommended with 1 hr standby operation	1

SCATS6 Computer Installation Quality Procedure, May 2000, Advantech Design

General items of Work in required to set up a SCATS system

Item of Work
Preliminary inspection, Liaison, Telecom etc
Liaison with local contractors
Liaison with communications authority
Connection of Telecom lines to controllers
Loop cutting design & preparation
Saw cutting loops
Connection if loops to Feeder Cables
Wiring of Distribution Frame (Telecom lines at central system)
Testing of telecommunications lines to controllers
Installation of SCATS Computer System (pre-built in Australia)
Review current traffic signal operation
Prepare operation sheets for each site
Design and implement Masterlink data (for coordination)
Design and implement Flexilink data (fallback)
SCATS and signal operation training (with on site inspections)

ANNEXE 3: ITS (INSTITUT TEKNOLOGI SEPULUH NOVEMBER) PROPOSAL FOR IMPLEMENTATION FOR ATCS

The staged implementation plan, as proposed by ITS, is supported. A number of SCATS installations (ex. DBKL, Kuala Lumpur, Malaysia) have commenced with a trial or a section of the network being setup, commissioned and with training and support.

Local contractors need to be trained and supported by controller manufacturers and traffic system hardware (i.e. video detectors) to ensure equipment is operating as per design. A maintenance regime needs to be setup.

Traffic Engineering can be undertaken by a number of Road Authorities (ex. RTA, NSW and VicRoads, Victoria, Australia). The traffic engineering includes assisting with the new controller designs, setting up operational data (i.e. Masterlink and Flexilink operation). Masterlink is the adaptive operation, where phase, cycle times and offsets are adjusted every cycle and Flexilink is the fixed time fallback operation. Typically it would take two weeks to commission 15 sites, as soon as the sites are connected to an ATCS.

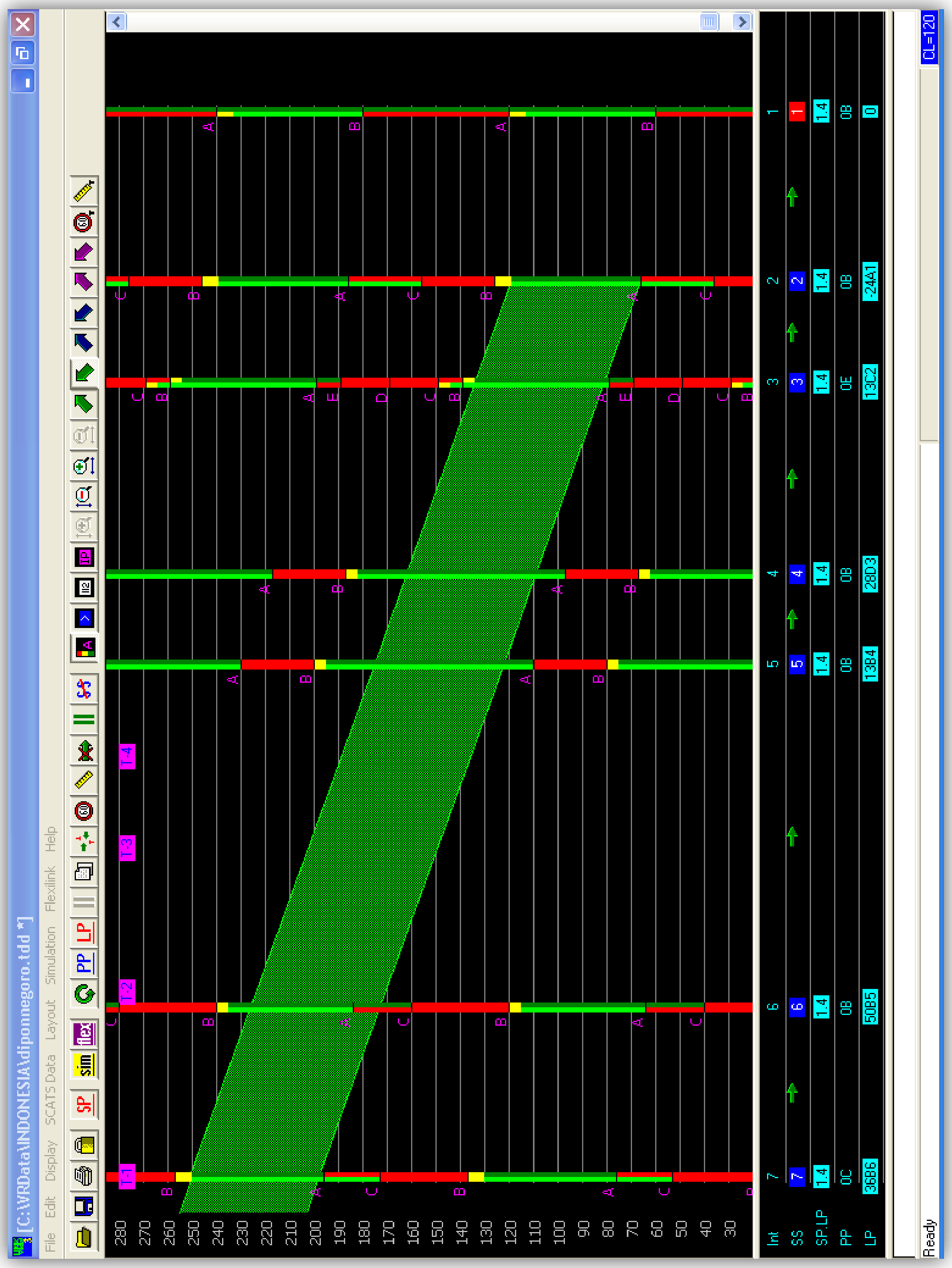
Training should be an additional one week for basic operation. More advance training can be provided after further stages of implementation (ex. advance training has been provided for other road authorities, as their ATCS expands).

Project Implementation Plan (2009-2015)

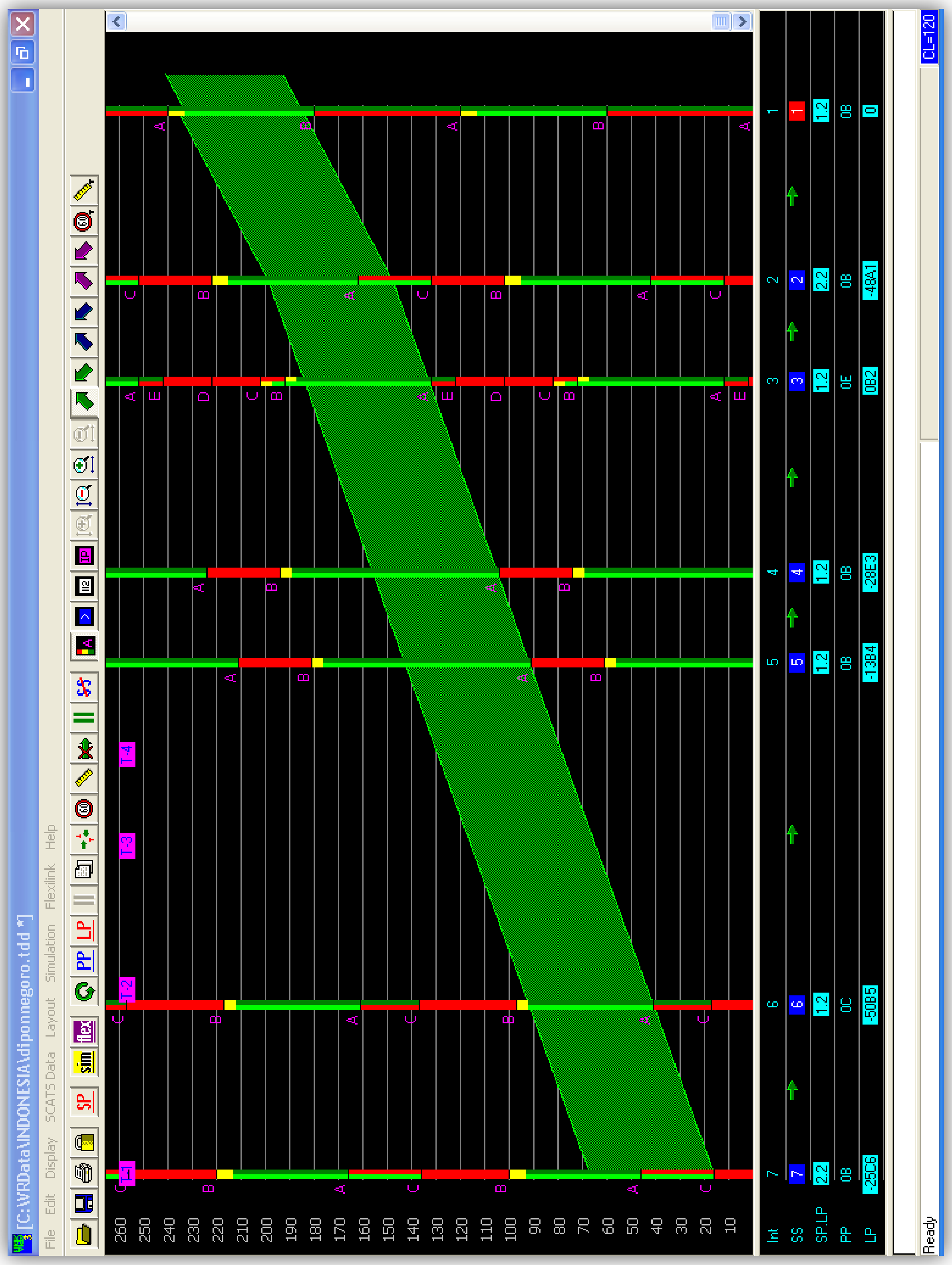
No.	Activities	2009	2010	2011	2012	2013	2014	2015
1.	Project Study, CCTV and VMS Trial Phase							
2.	Adaptive ATCS-ITS design and implementation of platform (phase-I) for 15 intersection		15					
3.	Traffic Engineering Refinement and Adaptive ATCS-ITS expansion (up to 128 intersection in 2015)			20	20	20	25	28
4.	Technical Assistance and Manpower Improvement (Technology transfer & Training)		TA-IndII					
5.	Preparation of other ITS services							

ANNEXE 4: PROPOSED COORDINATION (GREEN WAVE ON JALAN DIPONEGORO)

AM Peak (Jalan Pasar Kembang to Jalan Raya Darmo)



PM Peak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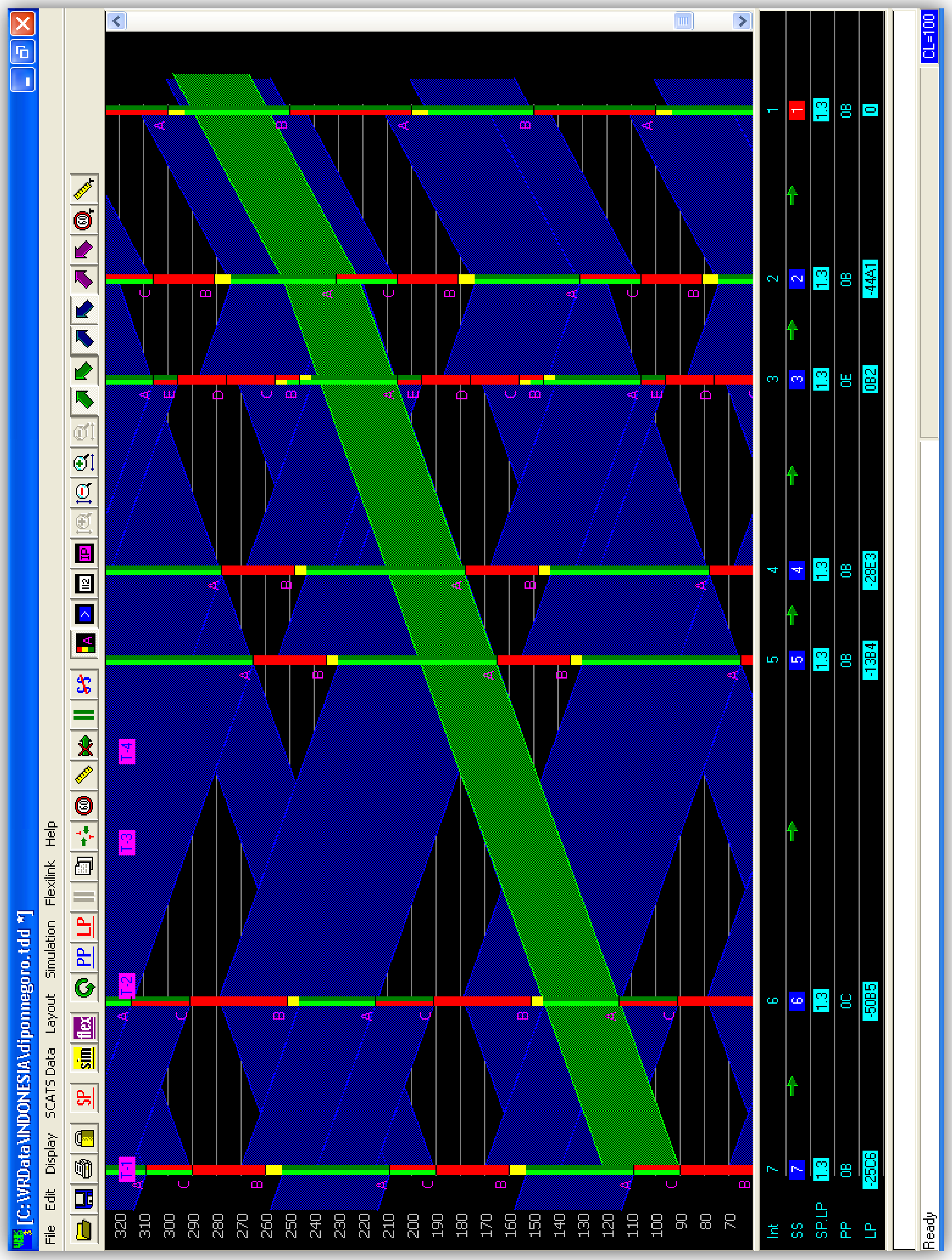


ANNEXE 5: A TRAFFIC MANAGEMENT CENTRE (RTA, SYDNEY)

At the heart of the Transport Management Centre is the 350m² Transport Operations Room (TOR). The TOR is operated 24 hours a day by staff working two 12-hour shifts. It's in this room that all of the TMC's statewide monitoring, reporting and control functions are carried out.

The Transport Operations Room.

04

Key features of the TOR include:

- A highly sophisticated **video switching system** enabling around 700 closed circuit television (CCTV) sites across NSW to be viewed and remotely moved.
- A **24-panel video wall,** which is supplemented by 30 large-scale monitors that allow computer-based graphics, mapping and reporting functions to be integrated and displayed.
- **18 dedicated operator consoles** providing operators access to real-time traffic information.
- Fully integrated **voice-based communications** so operators can simultaneously manage phone calls and radio traffic across the RTA and Police radio networks.
- The **Central Management Computer System (CMCS),** as the TMC's backbone, integrates all the operating and intelligent traffic management systems. As the core incident management system, CMCS analyses field data and provides for an efficient and effective response.

For example, it's from here that around 200 variable message signs (VMS) are programmed with traffic information and telephone calls about accidents and incidents are received.

When an incident occurs, CMCS analyses the affected area and prompts operators to apply pre-defined incident response plans, which include controlling VMS, variable speed limit signs and CCTV.

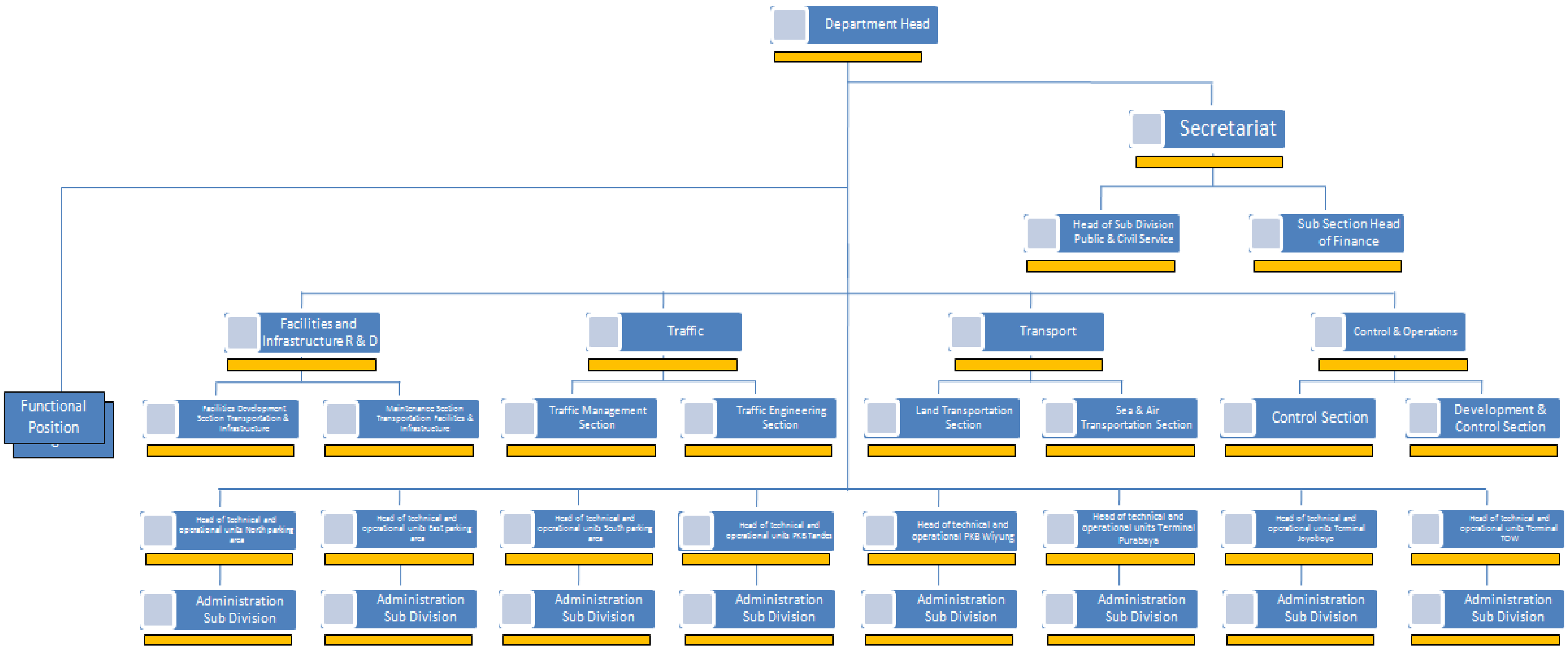
CMCS major applications

- Incident management
- Information dissemination
- Traffic monitoring
- Incident detection
- Motorway management
- Fault management

ANNEXE 6: ORGANIZATION CHART AND STAFFING: SURABAYA CITY DEPARTMENT OF TRANSPORTATION

ORGANIZATION CHART

SURABAYA CITY DEPARTMENT OF TRANSPORTATION



Staffing

NO	SECTION / FIELD	Civil Servants	Others	TOTAL
1	Secretariat	41	32	73
2	Transportation	13	17	28
3	Traffic	30	3	33
4	Control & Operations	34	8	42
5	R & D	10	5	15
6	Technical and operational units (North parking zone)	17	2	19
7	Technical and operational units (South parking zone)	24	4	28
8	Technical and operational units (East parking zone)	19	3	22
9	Technical and operational units (Terminal Purabaya)	137	77	214
10	Technical and operational units (Terminal Joyoboyo)	59	33	92
11	Technical and operational units (Termina TOW)	46	26	72
12	Technical and operational units (PKB Tandes)	29	27	56
13	Technical and operational units (PKB Wiyung)	28	25	53
Total		**487**	**260**	**747**

ANNEXE 7: DOCUMENTS RECEIVED AND REVIEWED

Transportation Policies In Surabaya -Towards Sustainability, Ir. Irvan Wahyudrajad, Head of Transportation Infrastructure Division, Transportation Department, Surabaya City Government, 2009 (MS PowerPoint Presentation)

Bahan Diskusi RPJMD 2011-2015: *Program Pengembangan Transportasi*, 2009 (MS PowerPoint Presentation)

Quo vadis sistim transportasi Surabaya ?, Togar Arifin Silaban, 2008 (Adobe Acrobat from Blog)

Studi Kelayakan Pengembangan Angkutan Massal Koridor Timur-Barat Di Kota Surabaya (Executive Summary and Full Report), 2007 (MS Word Documents)

Studi Kelayakan Pengembangan Angkutan Massal Koridor Timur-Barat Di Kota Surabaya (Laporan Akhir), Pemerintah Kota Surabaya, Badan Perencanaan dan Pembangunan Kota, 2007 (MS PowerPoint Presentation)

Studi Kelayakan Pengembangan Angkutan Massal Kota Surabaya (Executive Summary and Full Report), 2007 (MS Word Documents)

Studi Kelayakan Pengembangan Angkutan Massal (BRT), 2007 (MS PowerPoint Presentation)

Sustainable urban transport to improve city performance, Presented by City of Surabaya at the Asia Mayor Policy Dialogue, Kyoto, 23-24 April 2007 (Presentation in Adobe Acrobat format)

Studi Kelayakan Pengembangan Angkutan Massal (BRT): Laporan Rencana, 2006 (MS PowerPoint Presentation)

Air Quality Improving - Experiences of Surabaya City, Indonesia, Prepared by the City Government of Surabaya at the Sixteenth Asia Pasific Seminar on Climate Change "Asia Pasific Regional Approach to Climate Friendly and Climate Change - Resilient Society", Jakarta, Indonesia, 5 - 8 September 2006 (Presentation in Adobe Acrobat format).

Kajian Pengembangan Kereta Api Monorail Aeromovel Di Gerbangkertosusila (Laporan Akhir), Dinas Perhubungan Propinsi Jawa Timur, 2005 (MS PowerPoint Presentation)

ASIF: How Urban Regions Count Traffic, Transport Activity, Energy, and Emissions –Experiences From Surabaya / Indonesia, presented by Manfred Breithaupt, GTZ, at the TRB 82nd Annual Meeting, Washington, 16 January, 2003 (Presentation in Adobe Acrobat format).

Sustainable Urban Transport Approach Reducing Congestion and Pollution in Surabaya, presented by Togar Arifin Silaban at the ADB Regional Workshop: Transport Planning, Demand Management and Air Quality, 26-27 February 2002, Manila, Philippines (Paper in Adobe Acrobat format).

Efforts Toward Sustainable Urban Transport and Clean Air in Surabaya: An Integrated Approach, Surabaya City Planning Board (Bappeda), Paper submitted to the Clean Air Initiative in East Asian Cities, Bangkok 12–14 February 2001

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Micro Connect Pty Ltd, Linking Control Module Installation Manual, Revision 1.04