FINAL REPORT

Appendix

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01. Master Plan for HMA

Master Plan for HMA is independently submitted.

02. Cost Estimation for Master Plan

Cost Estimation for Master Plan

				1st Phase		2nd Phase	
1 ITSCC			Qty	Price	Total	Qty	Total
	1)	Central System	1	117,441,500	117,441,500	1	25,000,000
		Composed by following units					
		(1) ITSCC Server	1	3,000,000	3,000,000		
		(2) External Storage Device	1	2,000,000	2,000,000		
		(3) Large Display (DLP6Monitor)	1	48,000,000	48,000,000		
		(4) CCTV Monitor (52inch)	12	120,000	1,440,000		
		(5) Workstation	10	100,000	1,000,000		
		(6) Laser Printer (Color)	1	325,000	325,000		
		(7) Laser Printer (B/W)	1	150,000	150,000		
		(8) UPS power supply with 30 minute backup (30KVA	1	750,000	750,000		
		(9) Power distribution board (16 circuit	2	50,000	100,000		
		(10) Software	1	50,000,000	50,000,000		
		(11) Modified Software		25,000,000	0	1	25,000,000
		(11) Subtotal			106,765,000		0
		(12) Installation(10% of Above)	10%		10,676,500	10%	0
		(13) Total (Price for 1 set)			117,441,500		25,000,000
	2)	Total Cost			117,441,500		25,000,000

2 Web Information System			Qty	Price	Total	Qty	Total
	1)	Central System	1	8,030,000	8,030,000	1	8,030,000
		Composed by following units					
		(1) Internet Server					
		(2) Internet Application Server	1	1,800,000	1,800,000	1	1,800,000
		(3) Firewall					
		(4) Storage Device	1	500,000	500,000	1	500,000
		(5) Software	1	5,000,000	5,000,000	1	5,000,000
		(6) Subtotal			7,300,000		7,300,000
		(7) Installation(10% of Above)	10%		730,000	10%	730,000
		(8) Total (Price for 1 set)			8,030,000		8,030,000
	2)	Total Cost			8,030,000		8,030,000

3 Probe System			Qty	Price	Total	Qty	Total
	1)	Central System	1	56,650,000	56,650,000	1	18,150,000
		Composed by following units					
		(1) Probe Server	1	1,000,000	1,000,000	1	1,000,000
		(2) Storage Device	1	500,000	500,000	1	500,000
		(3) Software	1	50,000,000	50,000,000		0
		(4) Modified Software		15,000,000	0	1	15,000,000
		(5) Subtotal			51,500,000		16,500,000
		(6) Installation(10% of Above)	10%		5,150,000	10%	1,650,000
		(7) Total (Price for 1 set)			56,650,000		18,150,000
	2)	On Boad Unit		5,500	0		
		Composed by following units					
		(1) Probe Sensor	1	5,000	5,000		
		(2) Subtotal			5,000		
		(3) Installation(10% of Above)	10%		500		
		(4) Total (Price for 1 set)			5,500		
	3)	Total Cost			56,650,000		18,150,000
1～3 sub total					182,121,500		51,180,000

4 ATCC			Qty	Price	Total	Qty	Total
	1)	Central System (Up to 25unit)	2	2,970,000	5,940,000	4	11,880,000
		Composed by following units					
		(1) ATCC Server	1	1,000,000	1,000,000	1	1,000,000
		(2) Storage Device	1	500,000	500,000	1	500,000
		(3) Software	1	1,200,000	1,200,000	1	1,200,000
		(4) Subtotal			2,700,000		2,700,000
		(5) Installation(10% of Above)	10%		270,000	10%	270,000
		(6) Total (Price for 1 set)			2,970,000		2,970,000
	2)	On Road Unit	34	4,246,000	144,364,000	85	360,910,000
		Composed by following units					
		(1) Image Sensor	2	130,000	260,000	2	260,000
		(2) Processing Unit	2	1,600,000	3,200,000	2	3,200,000
		(3) Backup Battery	2	100,000	200,000	2	200,000
		(4) Pole	2	50,000	100,000	2	100,000
		(5) Foundation	2	50,000	100,000	2	100,000
		(6) Subtotal			3,860,000		3,860,000
		(7) Installation(10% of Above)	10%		386,000	10%	386,000
		(8) Total (Price for 1 set)			4,246,000		4,246,000
	3)	Total Cost			150,304,000		372,790,000

Cost Estimation for Master Plan

				1st Phase			2nd Phase	
5 CCTV			Qty	Price	Total	Qty	Total
	1)	Central System (Up to 50unit)	2	1,925,000	3,850,000	8	15,400,000
		Composed by following units					
		(1) CCTV Server	1	1,000,000	1,000,000	1	1,000,000
		(2) Storage Device	1	500,000	500,000	1	500,000
		(3) Software	1	250,000	250,000	1	250,000
		(4) Subtotal			1,750,000		1,750,000
		(5) Installation(10% of Above)	10%		175,000	10%	175,000
		(6) Total (Price for 1 set)			1,925,000		1,925,000
	2)	On Road Unit	55	550,000	30,250,000	375	206,250,000
		Composed by following units					
		(1) CCTC Camera	1	400,000	400,000	1	400,000
		(2) Pole	1	50,000	50,000	1	50,000
		(3) Foundation	1	50,000	50,000	1	50,000
		(4) Subtotal			500,000		500,000
		(5) Installation(10% of Above)	10%		50,000	10%	50,000
		(6) Total (Price for 1 set)			550,000		550,000
	3)	Total Cost			34,100,000		221,650,000

6 MET			Qty	Price	Total	Qty	Total
	1)	Central System	1	2,750,000	2,750,000		
		Composed by following units					
		(1) MET Server	1	1,000,000	1,000,000		
		(2) Storage Device	1	500,000	500,000		
		(3) Software	1	1,000,000	1,000,000		
		(4) Subtotal			2,500,000		
		(5) Installation(10% of Above)	10%		250,000		
		(6) Total (Price for 1 set)			2,750,000		
	2)	On Road Unit	6	4,666,200	27,997,200		
		Composed by following units					
		(1) Thermometer sensor	1	150,000	150,000		
		(2) Rain gage sensor	1	144,000	144,000		
		(3) Rainfall detector sensor	1	124,000	124,000		
		(4) Vane anemometer sensor	1	294,000	294,000		
		(5) Visibility meter sensor	1	1,370,000	1,370,000		
		(6) Meteorological observation station	1	1,960,000	1,960,000		
		(7) Backup Battery	1	100,000	100,000		
		(8) Pole	1	50,000	50,000		
		(9) Foundation	1	50,000	50,000		
		(10) Subtotal			4,242,000		
		(11) Installation(10% of Above)	10%		424,200		
		(12) Total (Price for 1 set)			4,666,200		
	3)	Total Cost			30,747,200		

7 Flood			Qty	Price	Total	Qty	Total
	1)	Central System (Up to 16unit)	1	2,200,000	2,200,000	7	15,400,000
		Composed by following units					
		(1) Flood Server	1	1,000,000	1,000,000	1	1,000,000
		(2) Storage Device	1	500,000	500,000	1	500,000
		(3) Software	1	500,000	500,000	1	500,000
		(4) Subtotal			2,000,000		2,000,000
		(5) Installation(10% of Above)	10%		200,000	10%	200,000
		(6) Total (Price for 1 set)			2,200,000		2,200,000
	2)	On Road Unit	14	770,000	10,780,000	111	85,470,000
		Composed by following units					
		(1) Flood Sensing Module	1	170,000	170,000	1	170,000
		(2) Alarm Control Unit	1	330,000	330,000	1	330,000
		(3) Backup Battery	1	100,000	100,000	1	100,000
		(4) Pole	1	50,000	50,000	1	50,000
		(5) Foundation	1	50,000	50,000	1	50,000
		(6) Subtotal			700,000		700,000
		(7) Installation(10% of Above)	10%		70,000	10%	70,000
		(8) Total (Price for 1 set)			770,000		770,000
	3)	Total Cost			12,980,000		100,870,000

8 VMS			Qty	Price	Total	Qty	Total
	1)	Central System (Up to 50unit)	1	4,950,000	4,950,000	2	9,900,000
		Composed by following units					
		(1) VMS Server	1	1,000,000	1,000,000	1	1,000,000
		(2) Storage Device	1	500,000	500,000	1	500,000
		(3) Software	1	3,000,000	3,000,000	1	3,000,000
		(4) Subtotal			4,500,000		4,500,000
		(5) Installation(10% of Above)	10%		450,000	10%	450,000
		(6) Total (Price for 1 set)			4,950,000		4,950,000
	2)	On Road Unit	42	13,343,000	560,406,000	54	720,522,000
		Composed by following units					
		(1) VMS Board	1	10,300,000	10,300,000	1	10,300,000
		(2) Backup Battery	1	1,600,000	1,600,000	1	1,600,000
		(3) Cantilever	1	180,000	180,000	1	180,000
		(4) Foundation	1	50,000	50,000	1	50,000
		(5) Subtotal			12,130,000		12,130,000
		(6) Installation(10% of Above)	10%		1,213,000	10%	1,213,000
		(7) Total (Price for 1 set)			13,343,000		13,343,000
	3)	Total Cost			565,356,000		730,422,000

Cost Estimation for Master Plan

				1st Phase			2nd Phase	
9 Pollution			Qty	Price	Total	Qty	Total	
	1)	Central System(Up to 10unit)	1	2,750,000	2,750,000		0	
		Composed by following units						
		(1) Pollution Server	1	1,000,000	1,000,000	1	1,000,000	
		(2) Storage Device	1	500,000	500,000	1	500,000	
		(3) Software	1	1,000,000	1,000,000	1	1,000,000	
		(4) Subtotal			2,500,000		2,500,000	
		(5) Installation(10% of Above)	10%		250,000	10%	250,000	
		(6) Total (Price for 1 set)			2,750,000		2,750,000	
	2)	On Road Unit	10	7,260,000	72,600,000		0	
		Composed by following units						
		(1) Pollution sensor (NOx,SO_2,CO,CO_2,O_2)	1	6,500,000	6,500,000	1	6,500,000	
		(2) Backup Battery	1	100,000	100,000	1	100,000	
		(3) Subtotal			6,600,000		6,600,000	
		(4) Installation(10% of Above)	10%		660,000	10%	660,000	
		(5) Total (Price for 1 set)			7,260,000		7,260,000	
	3)	Total Cost			75,350,000		0	
1～9 sub total					1,050,958,700		1,476,912,000	

10 Signal System			Qty	Price	Total	Qty	Total
	1)	Central System	1	7,150,000		2	14,300,000
		Composed by following units					
		(1) Signal Server	1	1,000,000	1,000,000	1	1,000,000
		(2) Storage Device	1	500,000	500,000	1	500,000
		(3) Software	1	5,000,000	5,000,000	1	5,000,000
		(4) Subtotal			6,500,000		6,500,000
		(5) Installation(10% of Above)	10%		650,000	10%	650,000
		(6) Total (Price for 1 set)			7,150,000		7,150,000
	2)	On Road Unit	221	6,094,000		179	1,090,826,000
		Composed by following units (4Ways junction)					
		(1) Signal (vehicle)	8	50,000	400,000	8	400,000
		(2) Signal (pedestrian)	8	15,000	120,000	8	120,000
		(3) Vehicle sensor	8	200,000	1,600,000	8	1,600,000
		(4) Pole	16	20,000	320,000	16	320,000
		(5) Foundation	16	50,000	800,000	16	800,000
		(6) Local control unit	1	2,000,000	2,000,000	1	2,000,000
		(7) UPS	1	300,000	300,000	1	300,000
		(8) Subtotal			5,540,000		5,540,000
		(9) Installation(10% of Above)	10%		554,000	10%	554,000
		(10) Total (Price for 1 set)			6,094,000		6,094,000
	3)	Total Cost			0		1,105,126,000

11 Signal for Pedestrians			Qty	Price	Total	Qty	Total
	1)	On Road Unit		1,221,000	0	400	488,400,000
		Composed by following units (1 Place)					
		(1) Signal (vehicle)	2	50,000	100,000	2	100,000
		(2) Signal (pedestrian)	2	15,000	30,000	2	30,000
		(3) Pole	4	20,000	80,000	4	80,000
		(4) Foundation	4	50,000	200,000	4	200,000
		(5) Local control unit	1	500,000	500,000	1	500,000
		(6) UPS	1	200,000	200,000	1	200,000
		(7) Subtotal			1,110,000		1,110,000
		(8) Installation(10% of Above)	10%		111,000	10%	111,000
		(9) Total (Price for 1 set)			1,221,000		1,221,000
	2)	Total Cost			0		488,400,000
1～11 sub total					1,050,958,700		3,070,438,000

12 ERP System			Qty	Price	Total	Qty	Total
	1)	Central System		32,450,000	0		0
		Composed by following units					
		(1) ERP Server	1	22,000,000	22,000,000		0
		(2) Storage Device	1	500,000	500,000		0
		(3) Software	1	7,000,000	7,000,000		0
		(4) Subtotal			29,500,000		0
		(5) Installation(10% of Above)	10%		2,950,000	10%	0
		(6) Total (Price for 1 set)			32,450,000		0
	2)	On Road Unit		31,625,000	0		0
		Composed by following units (3Lane for 1Place)					
		(1) Lane System	3	6,500,000	19,500,000		0
		(2) Plaza System	1	8,500,000	8,500,000		0
		(3) UPS	1	750,000	750,000		0
		(4) Subtotal			28,750,000		0
		(5) Installation(10% of Above)	10%		2,875,000	10%	0
		(6) Total (Price for 1 set)			31,625,000		0
	3)	Total Cost			0		0

Cost Estimation for Master Plan

				1st Phase			2nd Phase	
13 Lane Control System			Qty	Price	Total	Qty	Total
	1)	Central System		3,850,000	0		0
		Composed by following units					
		(1) Lane Control Server	1	1,000,000	1,000,000		0
		(2) Storage Device	1	500,000	500,000		0
		(3) Software	1	2,000,000	2,000,000		0
		(4) Subtotal			3,500,000		0
		(5) Installation(10% of Above)	10%		350,000	10%	0
		(6) Total (Price for 1 set)			3,850,000		0
	2)	On Road Unit		4,455,000	0		0
		Composed by following units (1Lane for 1Place)					
		(1) Barrier Gate	2	400,000	800,000		0
		(2) Sign Board+Signal	2	1,000,000	2,000,000		0
		(3) Local Control Unit	1	500,000	500,000		0
		(4) UPS	1	750,000	750,000		0
		(5) Subtotal			4,050,000		0
		(6) Installation(10% of Above)	10%		405,000	10%	0
		(7) Total (Price for 1 set)			4,455,000		0
	3)	Total Cost			0		0

14 Parking System (Basic System)			Qty	Price	Total	Qty	Total
	1)	Central System		3,850,000	0		0
		Composed by following units					
		(1) Parking Server	1	1,000,000	1,000,000		0
		(2) Storage Device	1	500,000	500,000		0
		(3) Software	1	2,000,000	2,000,000		0
		(4) Subtotal			3,500,000		0
		(5) Installation(10% of Above)	10%		350,000	10%	0
		(6) Total (Price for 1 set)			3,850,000		0
	2)	On Road Unit		7,755,000	0		0
		Composed by following units					
		(1) Barrier Gate	2	400,000	800,000		0
		(2) Vehicle Detector	2	1,000,000	2,000,000		0
		(3) Informetion Board (Outside)	1	2,000,000	2,000,000		0
		(4) Local Control Unit	1	1,500,000	1,500,000		0
		(5) UPS	1	750,000	750,000		0
		(6) Subtotal			7,050,000		0
		(7) Installation(10% of Above)	10%		705,000	10%	0
		(8) Total (Price for 1 set)			7,755,000		0
	3)	Total Cost			0		0

15 Parking System (Advanced System)			Qty	Price	Total	Qty	Total
	1)	Central System		3,850,000	0		0
		Composed by following units					
		(1) Parking Server	1	1,000,000	1,000,000		0
		(2) Storage Device	1	500,000	500,000		0
		(3) Software	1	2,000,000	2,000,000		0
		(4) Subtotal			3,500,000		0
		(5) Installation(10% of Above)	10%		350,000	10%	0
		(6) Total (Price for 1 set)			3,850,000		0
	2)	On Road Unit		17,655,000	0		0
		Composed by following units (100 vehicle spaces for parking)					
		(1) Barrier Gate	2	400,000	800,000		0
		(2) Vehicle Detector	100	100,000	10,000,000		0
		(3) Informetion Board (Inside)	5	200,000	1,000,000		0
		(4) Informetion Board (Outside)	1	2,000,000	2,000,000		0
		(5) Local Control Unit	1	1,500,000	1,500,000		0
		(6) UPS	1	750,000	750,000		0
		(7) Subtotal			16,050,000		0
		(8) Installation(10% of Above)	10%		1,605,000	10%	0
		(9) Total (Price for 1 set)			17,655,000		0
	3)	Total Cost			0		0

System Total	1,050,958,700	3,070,438,000

03. Proposal for Establishment of ITSC as SPV

This document was prepared for internal discussion of HMDA for consideration of establishment of ITSC as SPV, in response to request by HMDA

JICA SPECIAL ASSISTANCE FOR PROJECT

IMPLEMENTATION (SAPI)

FOR

THE ASSISTANCE FOR THE INTRODUCTION OF ITS

ON ROADNETWORK

IN

HYDERABAD METROPOLITAN AREA

Establishment of

ITS CENTRE as SPV

June, 2012

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
JICA STUDY TEAM Constituted by
NIPPON KOEI CO., LTD.
EAST NIPPON EXPRESSWAY CO., LTD.
METROPOLITAN EXPRESSWAY CO., LTD.

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1 Background

Japan International Cooperation Agency (JICA) has been assisting for ITS implementation on Outer Ring Road (ORR) in Hyderabad, under Assistance for the Introduction of ITS Related to the Hyderabad Outer Ring Road Construction Project. Aiming at the synergy effect by applying the ITS in the city of Hyderabad, the project for preparation of ITS Master Plan for Hyderabad Metropolitan Area has been formulated.

JICA dispatched a survey mission (JICA Mission) to HGCL (Hyderabad Growth Corridor Limited) and HMDA (Hyderabad Metropolitan Development Authority) during January – March in 2011 for the purpose of project formulation.

As a result, HGCL/HMDA and JICA Mission confirmed that both parties would sincerely cooperate with each other with a view to contributing toward the smooth introduction of ITS in Hyderabad Metropolitan Area. An MOU between HGCL and JICA was signed for preparation of Master Plan for introduction of ITS in Hyderabad Metropolitan Area and supporting for implementation of Pilot Project(s).

2 Objectives of the Study

ITS is one of the key technologies for achieving an ideal traffic society. The ultimate objects of ITS are summarise as following;

1. Safety Improvement
2. Environmental Mitigation
3. Economic Growth (Enhancement of Economic Productivity of Industries, Organisations and Others)
4. Enhancement of Mobility, Convenience and Comfort

In order to achieve above objectives, a number of related issues in Hyderabad Metropolitan Area need to be addressed. The issues extend to the road infrastructures, traffic discipline, vehicle growth, organisations, decision making processes and etc. To resolve these issues, both hardware measures and software measures are required. The hardware measures include such as road infrastructure improvement and software measures such as organisational improvement and utilization of information technology for the road transportation sector. In this context, an ITS Master Plan for Hyderabad Metropolitan Area is currently under preparation by the Study, with more focus on the software measures. Thus, the establishment of ITS Centre is proposed. The objectives of the ITS Centre are as follows;

1. It functions as a central agency for continuous initiatives for ITS in Hyderabad Metropolitan Area,
2. It plays as an authorized agency for collection of all road/traffic data and provision of the traffic information to the users and relevant agencies,
3. It is responsible for planning, implementing, operating, evaluating the ITS and

expansion,

4. It coordinates with the National ITS Policy for ITS development/expansion in Hyderabad Metropolitan Area
5. It carries out businesses with governmental and non-governmental agencies for selling out the generated traffic information for revenue generation for operation and maintenance of ITS Centre.

3 Critical Issues in Hyderabad from View Point of ITS

The most critical issues in Hyderabad from a view points of ITS are as follows;

1. Absence of Centrally Coordinated Administrative Structure
2. Absence of Quantitative Traffic Data
3. Insufficient Basic Infrastructure
4. Insufficient Proper Facility Maintenance
5. Absence of National Framework

(1) Absence of Centrally Coordinated Administrative Structure

The different agencies are planning ITS related facilities in Hyderabad. However these plans are not sufficiently coordinated among the involved agencies and it results in the lack of integration and proper maintenance. The planning, implementation and evaluation of the traffic management, road/transport infrastructure and urban development need to be carried out in well coordinated manner among the related agencies. It then shall be based on the correct comprehension of the current situation in Hyderabad, which is realised by the quantitative data. It is assumed that these factors are prime causes of the issues in Hyderabad.

(2) Absence of Quantitative Traffic Data

The road infrastructure and traffic management need to be properly planned, implemented and evaluated for the effects. This is realised by utilizing the accumulated quantitative traffic data. However there does not exist any basic facilities which enable to collect, accumulate and evaluate the measures taken. Nor any importance is placed on this by the implementation and planning bodies.

It is planned to replace/install a number of CCTV in the Hyderabad. However the CCTV is to be used to visually confirm the condition at site to assist the operation.

Thus, the traffic/transportation measures such as road construction in the city, lane marking are taken on ad-hoc bases, not achieving the fundamental solution.

(3) Insufficient Basic Infrastructure

The prime component of ITS is data collection of the traffic condition, which is measured by the equipment. The road infrastructure and traffic discipline need to be in place to properly collect the data on traffic. The examples include i) properly designed junctions/intersections, straight-shaped road, well-prepared footpath, and etc for road infrastructure and ii) lane keeping, vehicle queues in order on the roads, following the signals and etc for traffic discipline.

(4) Insufficient Proper Facility Maintenance

Some preliminary facilities are in place in Hyderabad. They include CCTV at junctions, traffic signals, signal jumping violation equipment and etc. However many of them are not properly working due to insufficient proper maintenance. The reasons for this derive from the related issues including lack of human resources, finances, infrastructures, know-how, coordination among the agencies and etc. Assurance of the proper maintenance needs to be addressed for sustainable ITS operation.

(5) Absence of National Framework

The ITS is a broad concept, not only limited to particular facilities such as traffic signals. It involves a wide range of different subsystems and needs to be properly integrated/harmonized to function as a whole. It is ideal to prepare the ITS in the individual cities under the framework of the National Policies. However the introduction of ITS has just started in recent years in India and thus any established National policies have yet been in place.

4 Required Measures of ITS for Hyderabad

Under above conditions, the required measures realised by the ITS in Hyderabad are;

1. Basic Data Collection and Proper Monitoring
2. Proper Road and Traffic Strategy Scheme
3. Proper Road Management Scheme
4. Proper Traffic Control Scheme
5. Proper Decision Making Scheme
6. ITS Promotion on Commercial Base
7. Coordination with Central Government for National Level ITS Policy
8. Establishment of Central Organisation

(1) Basic Data Collection and Proper Monitoring

The basic scheme which enables to collect basic traffic data and proper monitoring on traffic shall be in place. The basic traffic data includes the real time traffic conditions such as

traffic volume, travel time, occupancy etc by section and on-road/road-side condition data collection.

(2) Proper Road and Traffic Strategy Scheme

The scheme which realises proper road and traffic strategy such as preparation of road infrastructures with lane marking, junction improvement, foot path/road crossing, traffic demand control need to be in place.

(3) Proper Road Management Scheme

The basic scheme which enables proper road management shall be in place. For example, the major bottle neck on the road network needs to be quantitatively identified by the traffic volume by vehicle size and the road condition damaged by the flood to be properly monitored. These data shall be utilized for road infrastructure improvement in such ways as i) proper current condition comprehension, ii) bottle neck identification, iii) new road network/existing road improvement planning, iv) construction, v) evaluation of the project.

(4) Proper Traffic Control Scheme

The basic scheme which enables proper traffic control shall be in place. For example, the road traffic shall be properly controlled in accordance with the traffic condition which continuously changes. In order to realise this, dynamic real time traffic monitoring and control is required.

(5) Proper Decision Making Scheme

The basic scheme which enables proper decision making in timely manner by the involved agencies shall be prepared place. For example, quantitative analysis for proper decision for planning becomes realised by storing real time data, aggregating, analyzing and visualizing. The monitored data and analysed results shall be shared among the related agencies and provided to general public in timely manner. Once proper decision making environment is prepared, further required policies such as introduction of electronic road pricing for traffic demand management can be properly planned. (Short term or long term)

(6) ITS Promotion on Commercial Base

Financial mechanism needs to be in place for continuous operation of ITS. The possible scheme includes incorporation of toll charge on the major road in the future, IC-Card usage such as common mobility card, selling out the value added traffic information to the private sector. The scheme which generates the revenue on the commercial base needs to be prepared.

(7) Coordination with National Government for National ITS Policy

As discussed above, a National ITS policies need to be in place so as to derive Regional and Local ITS policies. But at present, ITS is prepared at Regional levels in India. It is critical that the regional ITS is implemented under the framework of the National ITS Policy which is set out by the Government of India.

(8) Establishment of Central Organisation

The entity that enables all above needs to be prepared. It shall play the roles for initiating the ITS development, coordinating among the involved agencies/upper level ministries, taking care of standardization, taking charges for planning, management and promotion of ITS.

The improvement of the road and transportation infrastructures such as road network expansion, fly-over construction and etc, enforcement and education for improvement of traffic discipline need to be accelerated in parallel with/in accordance with the improvement of ITS as well. In such circumstances, an independent single agency is favourable.

The measures are taken to resolve the issues as illustrated in the Figure below.

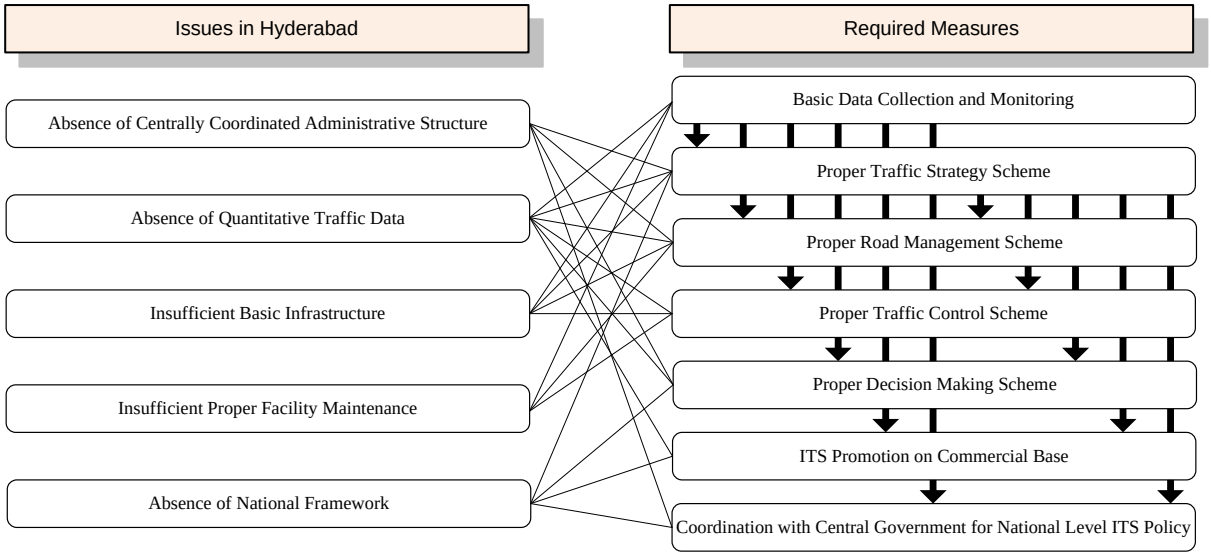


Figure 4-1 Issues and Required Measures

5 Functions of ITS CENTRE

To realise the above, it is proposed to equip the following functions with the ITS Centre;

1. Collection of traffic data from the road-side/probe based sensors and human based information through the related agencies (like Probe data of APSRTC etc)
2. Traffic information provision to the public through internet, SMS, call centre
3. Traffic information provision for traffic flow control through VMS on road-side
4. Automatic traffic signal control and related facilities for traffic flow control
5. Analysis of real-time dynamic data and off-line based accumulated data for identifying bottle neck of traffic, before and after evaluation of the project
6. Planning and evaluation of traffic management and road infrastructure
7. Owning the right of traffic data generated by ITS CENTRE
8. Sales of the generated traffic information to private sector
9. Management of standardization of ITS technologies and related data such as digital road map
10. Management of road inventory
11. Management of ITS equipment
12. Operation and management of clearing house of common mobility card

The image of the ITS CENTRE in the phase-1 is shown in the following figure.

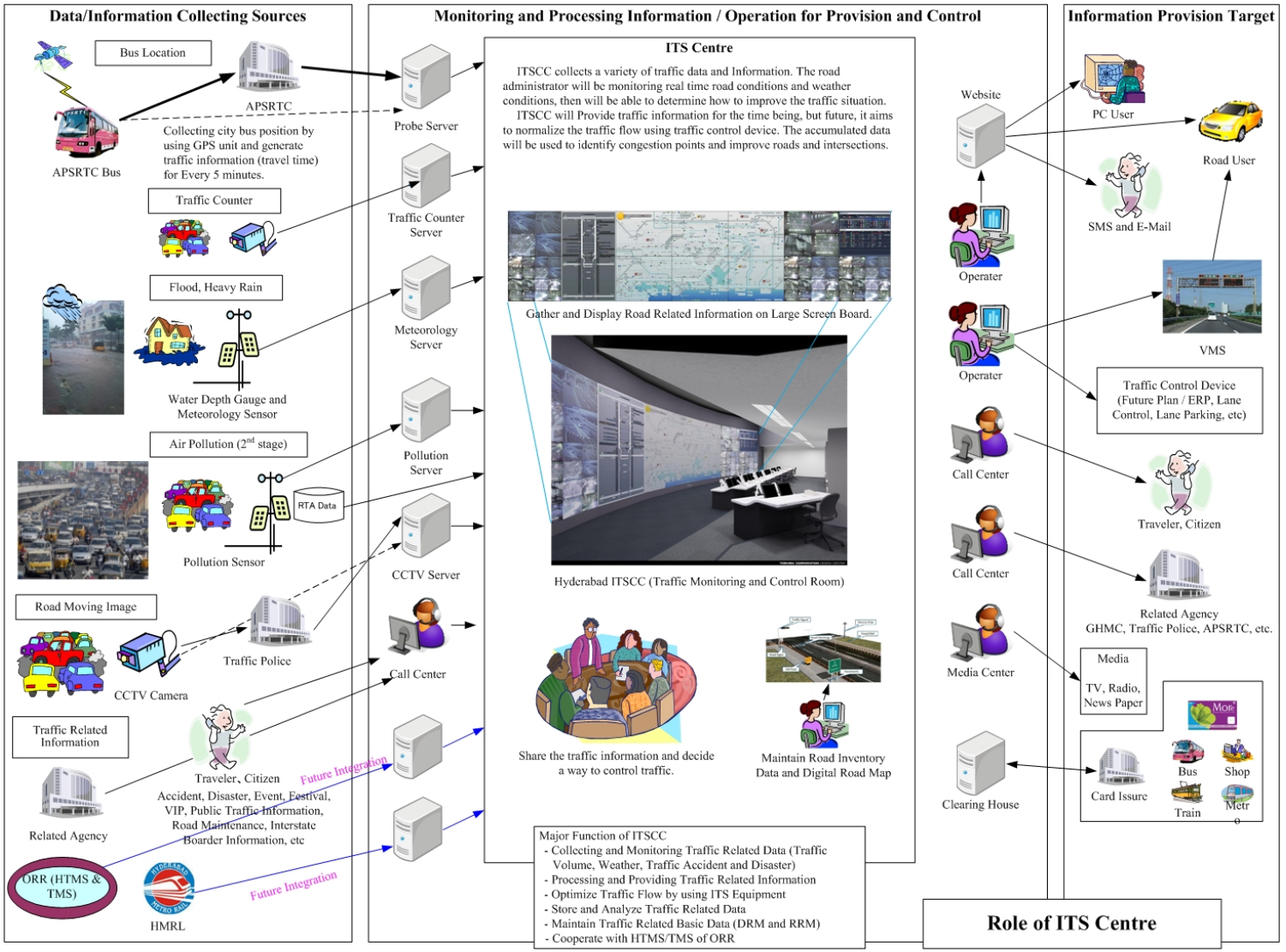


Figure 5-1 Role of ITS Centre

6 Organization Structure of ITS CENTRE

For the above functions, the following organisation structures are at least required for the ITS Centre;

(1) Project Director

S/he is a personnel who supervises and is responsible for overall operations of the ITS Centre. S/he takes responsibility for reporting/coordination to/with upper level/external agencies as well.

(2) Traffic Monitoring and Control Division

It dynamically monitors the real time traffic conditions in the city by the data measured by the ITS equipment and supported by CCTV. It instructs to the officers at site as necessary in the case of traffic events, manipulates the ITS equipment for traffic control and coordinates with the necessary external agencies.

(3) Telephone Call Centre

It handles the enquiries from the general public and provides the advices and verbal information on traffic to them.

(4) Media Centre

It handles the enquiries from media such as new papers, radio stations, TV stations and etc and provides the information on traffic to them to be published.

(5) Research and Planning Division

It analyses the off-line based stored data on traffic. It plans necessary measures on infrastructure improvement and traffic management based on the analysis.

(6) Equipment Maintenance Division

It maintains the hardware ITS equipment.

(7) Computer System Division

It takes care for server systems in ITS Centre, software maintenance and network monitoring for ITS. The tasks include taking care for office system equipment in the Centre.

(8) Commercial Division

It handles the business for selling out the generated traffic information to governmental/non-governmental agencies for assuring the profit for ITS Centre operation.

(9) Administrative Division

This is a division which is required for running activities of ITS Centre as an organisation.

- Human Resource Section: It handles the personnel affairs required for ITS Centre
- Finance Section: It handles the financial affairs required for ITS Centre
- Accounting Section: It handles the accounting affairs required for ITS Centre
- Legal Section: It handles the legal affairs required for ITS Centre
- Public Section: It handles public relations and accountabilities for ITS Centre
- General Affairs Section: It handles such affairs as labour management, welfares etc

(10) Staff Division

- Cleaning and Helpers: It takes care for cleanings and any support required for daily activities

(11) Organisation structure of ITS Centre

The organisational structure of ITS Centre is shown in the Figure below.

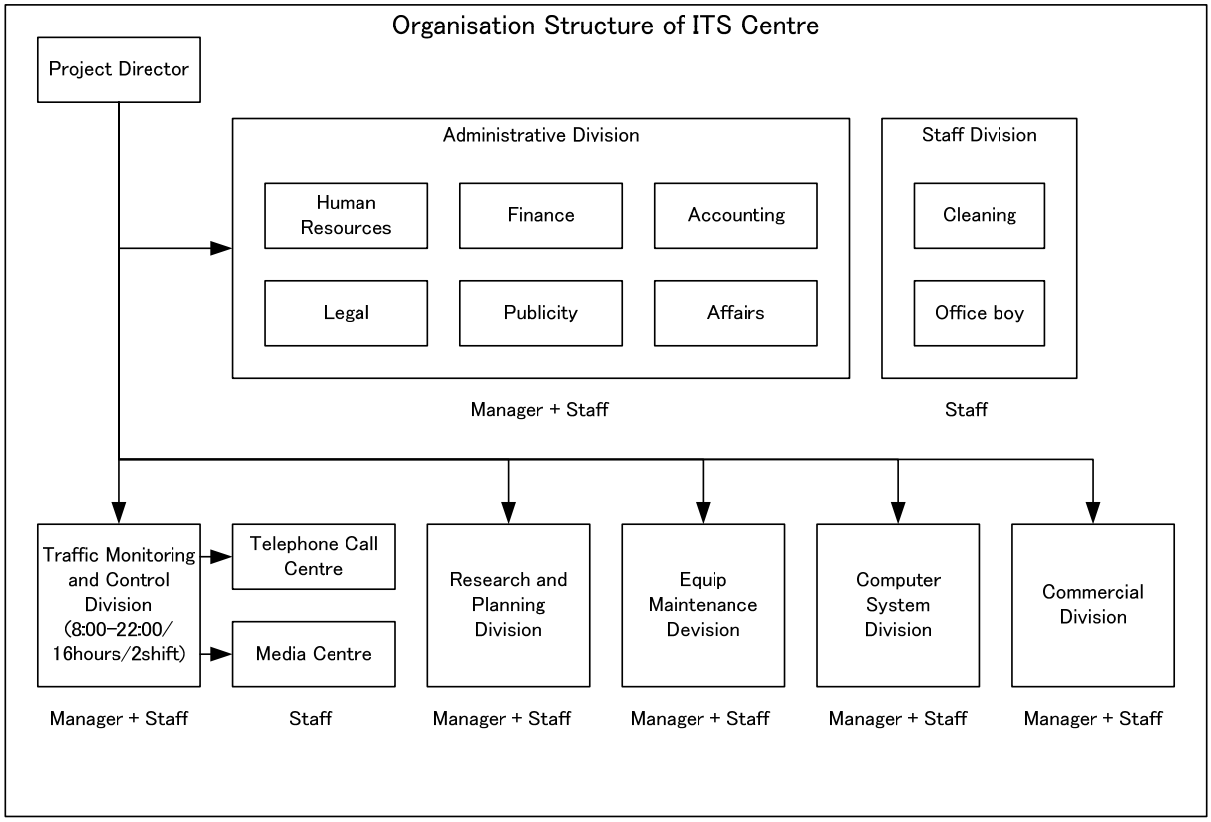


Figure 6-1 Organization Structure of ITS Centre

The road is used for 24 hours and 365 days. Thus the road service needs to be continuously offered. However the operation cost for the human resources becomes high if 24 hours operation is provided. Hence, it is proposed to operate from morning till night during initial phase considering the current condition that the road usage is relatively low during night and 24 hour operation will be provided in future.

The above structure would be more simplified if the ITS Centre is prepared under existing agency such as traffic police or HMDA.

7 Road Map for ITS in Hyderabad

The road map for ITS in Hyderabad is set out as shown in the Figure below based on the following concepts;

7-1 Phased-Wise Implementation Policy

In consideration of the current condition in Hyderabad and required measures, the ITS shall be prepared in phased-wise manner. The first priority shall be preparation of the basis ITS component and more advanced menus are gradually expanded. The road infrastructures need to be improved along with expansion of ITS. The advanced ITS components are gradually introduced in accordance with road infrastructure improvement and maturity of ITS industry.

On the basis of this discipline, the following phased-wise expansion policies are set out;

Table 7-1 Phased-Wise Implementation Policy

Phases	Policy
Phase-1 (1-5 years)	Establishment of ITSCC Preparation of Basic ITS Component
Phase-2 (6-10 years)	Expansion of Basic ITS Component Introduction of Advanced ITS Component
Phase-3 (After 10 years)	Expansion of More Advanced ITS Component

The information technology advancement is very rapid in nature. Hence, it is appropriate to set out for 5 years for Phase-1 and 10 years for Phase-2. The systems to be introduced in the phase-3 will have to be re-considered because the surrounding environment will become significantly different such as emergence of new technology in future, due to the same reason of the rapid technological advancement.

7-2 Area Wise Expansion Policy

The ITS equipment will be installed to cover the major roads and important areas in the city

at first in the Phase-1. The targets include national roads, Inner Ring Roads and other critical locations including heavily congested sections in the centre of the city. The coverage areas will be gradually expanded in the following phases and ultimately covers the entire areas of Hyderabad in the phase-3.

The prioritization is set out in accordance with the road classification shown above.

Table 7-2 Installation Policy

Phases	Policy
Phase-1 (5 years)	The equipment will be installed on principal roads, which are National Highway (NH) and Inner Ring Road (IRR), major state highway (SH), and other critical locations in city to cover the major traffic.
Phase-2 (10 years)	The equipment will be expanded along the distribute roads, which are other state highway (SH) and existing radial road, major link road connecting between the state highway and the radial road, and other critical locations in the city.
Phase-3 (After 10 years)	The equipment will be expanded along other link roads, which are major link roads connecting the major junctions, and major residential roads.

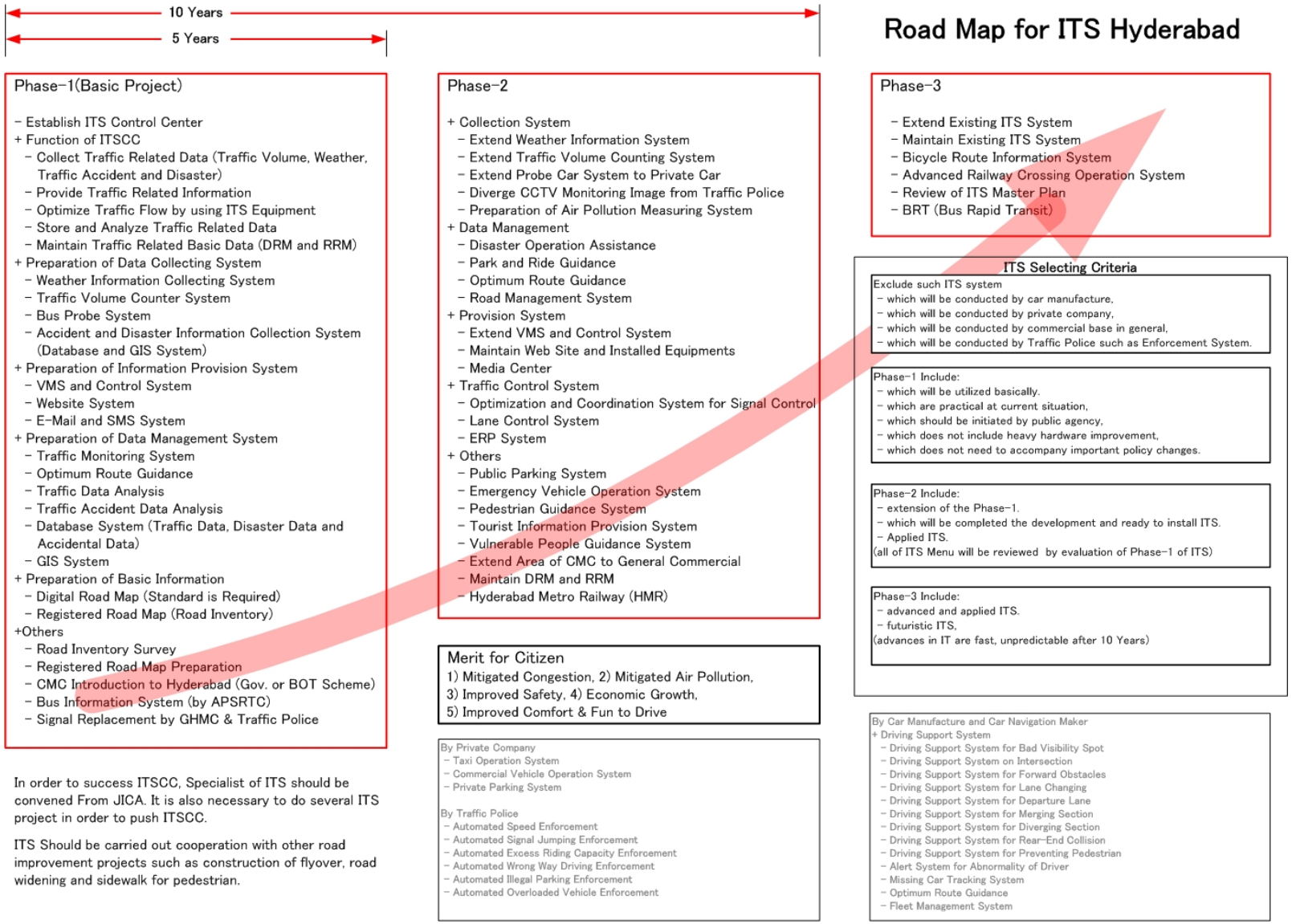


Figure 7-1 Road Map for ITS in Hyderabad

8 Approximate Cost for Phase

The approximate cost for the phased-wise implementation is shown in the Table below.As the nature of ITS, the technological advancement is very rapid and the involved factors for estimate such as the systems to be introduced in future are not clear now. Therefore, the costs including the operation and maintenance are estimated only for phase-1 and phase-2 as follows.

Table 8-1 Approximate Cost by Phase

Unit=INR

Cost Type	Items	PHASE 1	PHASE 2
Onetime cost	Equipment Capital Cost	1,30,00,00,000	3,20,00,00,000
Cost spread across 5 years	Equipment maintenance Cost	13,00,00,000	32,00,00,000
	Organization Resource Cost	14,23,00,000	22,00,00,000
	Organization Operation Cost	3,12,00,000	5,00,00,000
	Total Maintenance Costs	30,35,00,000	59,00,00,000

Human Resource cost includes salaries to the ITS centre staff and is estimated for Phase-1(for years 1 to 5) and Phase-2 (for years 6 to 10) on yearly basis considering year to year increment of 10% in the cost. An increment of 10% is considered based on the fact that inflation and other related economic factors influence the increase in the human resource costs.

Organization Operation cost includes power usage, Communication usage, Transportation usage and Water usage etc. These costs are also considered for Phase-1(for years 1 to 5) and Phase-2 (for years 6 to 10) on yearly basis considering year to year increment of 10% in the cost because of inflation and other influencing factors.

Despite the difficulties in estimating the cost in the phase-3 in regard of the nature of ITS as described above, the capital cost for the expectable major components are estimated. The breakdown of the capital cost by phase is show in the Table below.

Table 8-2 Approximate Capital Cost by Phase

S. No	Devices	PHASE 1		PHASE 2		PHASE 3	
		Units	Approx Cost (INR)	Units	Approx Cost (INR)	Units	Approx Cost (INR)
1	ITS CENTRE		157,441,500		25,000,000		25,000,000
2	TRAFFIC SIGNALS	0	0	200	1,225,950,000	200	1,225,950,000
3	PEDESTRAIN SIGNALS	250	305,250,000	250	305,250,000	400	488,400,000
4	TRAFFIC COUNTERS	34	151,328,138	85	378,320,344	227	1,010,337,862
5	CCTV	48	28,548,837	375	223,037,790	427	252,175,000

S. No	Devices	PHASE 1		PHASE 2		PHASE 3	
		Units	Approx Cost (INR)	Units	Approx Cost (INR)	Units	Approx Cost (INR)
6	MET SENSORS	6	30,747,200				
7	FLOOD SENSORS	14	1,298,000	111	100,870,000		
8	VARIABLE MESSAGE SIGNS(VMS)	42	565,356,000	64	863,852,000	100	1,344,200,000
9	POLLUTION SENSORS	0		10	75,350,000	10	75,350,000
10	Subtotal		1239,969,675		3,196,630,134		4,404,617,000
11	Contingency (Approx. 5% of Above Subtotal)		62,000,000		160,000,000		210,000,000
12	**Total Estimated Approx Cost**	**Ph-1**	**1,300,000,000**	**Ph- 2**	**3,360,000,000**	**Ph-3**	**4,500,000,000**

9 Formation of ITS CENTRE as SPV

Based on the considerations so far, it is recommended to establish a Special Purpose Vehicle (SPV) for ITS Centre by the following reasons;

- The strong leadership is required for continuous initiatives for ITS in Hyderabad specifically regarding the condition where any substantial ITS have not been in place,
- The coordination among related agencies are strongly required due to the characteristics of ITS, of which domain extends across the different agencies. The different agencies include the central government in line with the National Level ITS Policy, neighbouring administrative bodies in Andhra Pradesh State, agencies in transportation sectors and parties in the private sectors,
- The simplified structure for operation and coordination among the related agencies is more favourable, considering the current condition of the complex jurisdictional structures in the road transportation sector,
- The ITS Centre shall have a function for conduction businesses for revenue generation by interacting with the private sector.

The SPV shall function as execution body for operation, planning, evaluation of the project on the bases of the above concept. It shall be invested by such agencies as HMDA, GHMC, RTA and APSRTC. The human resources are provided by these agencies. It will own and maintain

the ITS equipment, monitors the traffic flow and controls the traffic. The decision on the traffic control will be made by the personnel deputed from the traffic police to the ITS Centre.

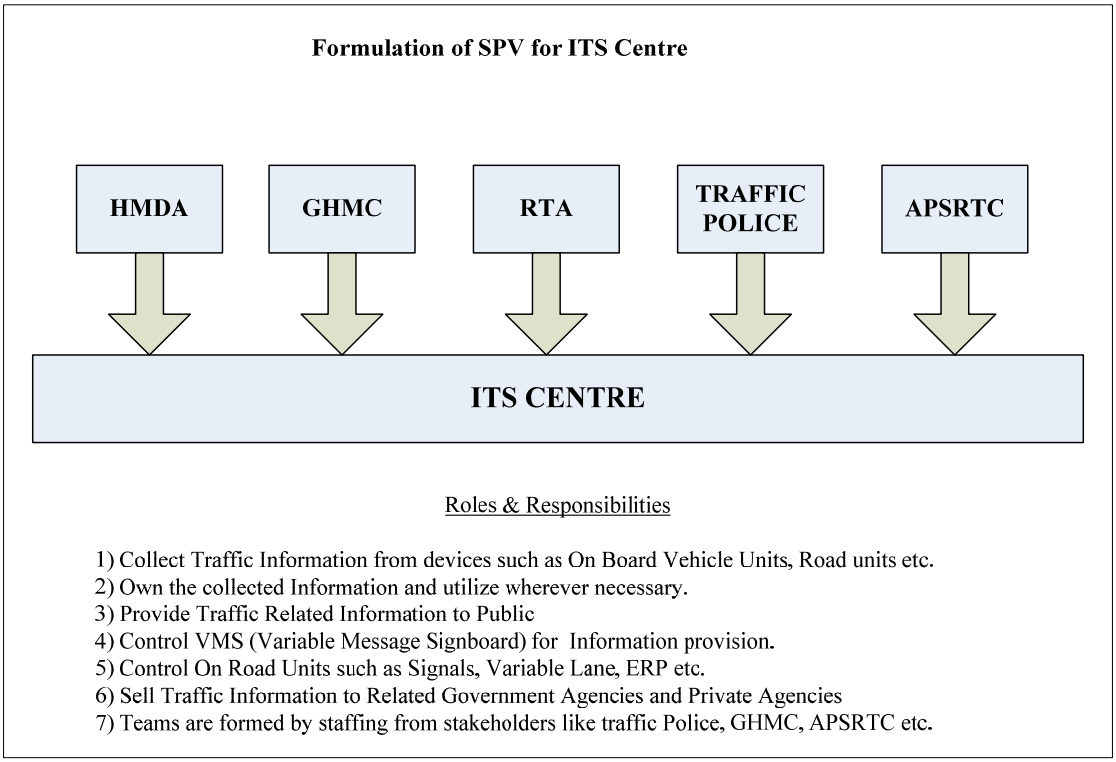


Figure 9-1 Formulation of SPV for ITS Centre

10 Revenue scheme for ITS Centre

10-1 Revenue Schemes in General

(1) Summary of Possible Revenue Schemes

The possible revenue schemes in general exist as follows;

1. Expenditure by Tax (basic principle)
2. Toll Charge Collected by Electronic Road Pricing (ERP), Imposed on the Road Usage
3. Introduction of Special Purpose Fund for Road Sector (e.g. Increment of Fuel Tax, Vehicle Taxes etc)
4. Advertisement
5. Selling Out Data
6. Selling Out Traffic Information to Road Traffic Information Providers
7. Service Charges for Clearing House of Common Mobility Card

(2) Basic Principle

Preparation of ITS will be taken-up generally in parallel with Road infrastructure development and this helps the local authority to reduce the costs of implementations. Across the world, development of road infrastructure and the related installations are generally part of the Government expenditure as a provision of public service/project and are covered by the tax collected. In essence, ITS shall be regarded as a social infrastructure which is an extension of road infrastructure.

However, funding for the Road and related infrastructure is taken-up under various schemes across the world. Many of the transport related infrastructures in the major cities of the world are prepared by the public private partnership (PPP) and are operated / managed by collecting various kinds of services charges from the users such as express way user charges, navigation guidance provision fees and BOT etc. Singapore is one of the countries where the electronic road pricing (ERP) as a traffic demand management has been successfully implemented and the scheme of the collection of the charges from the users are well established.

Some of major examples of the revenue methods applied are introduced as follows .

(3) Expressway Usage Charges

It is a normal aspect to collect usage fee from the users in the case of the expressway, the toll road in a certain section, bridges and etc for the construction and maintenance these Road, Bridges and etc.

In Japan, Toll charges on the expressway are collected from the expressway road users on the bases of the beneficiary payment principle. Nowadays in Japan, the toll charges are collected at exit by the electronic toll collection system using the on-board unit installed on the vehicles. In U.S.A., the costs for the expressway are covered by the tax. In Europe, the toll charges on the expressways are collected from the large-sized trucks in recent years. As the road network expands to all over Europe nowadays; the cost for maintenance for the damage on the road caused by the passing vehicle became an issue. The toll charges are collected from the trucks based on the used distance by detecting the GPS.

(4) Congestion based Charges

Congestion Charge is a variable toll charge that depends on the level of congestion and is intended to reduce the congestion by discouraging vehicles to use specific roads during peak hours of traffic and also reduce the environmental pollution as pollution levels increase with the level of congestion. This kind of charge is collected in the form of ERP (Electronic Road pricing) in Singapore.

These methods of road pricing were started with the theory that usage charges are not only for the construction and maintenance of roads, but these charges shall depend on externalities such as congestion because of using peak hours, pollution and noise etc. It is a general opinion that

Driver must pay for the externalities he impose on others.

The ERP system is based on a relatively simple dashboard-mounted device. Motorists insert a cash card into the Invehicle Unit (IU) when they are on the road. As their cars pass overhead gantries set up along the strategic roads, the card-reader is activated by a microwave signal. There is a beep and the toll is deducted from a CashCard – a pre-paid smart card, which can be credited at all local post offices, banks, petrol kiosks or automated teller machines.

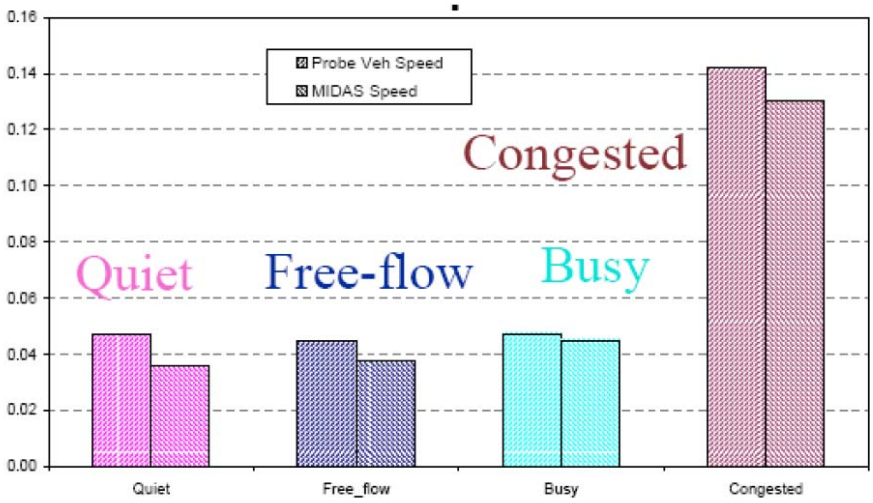


Figure 10-1 Levels of Pollution Depends on Congestion Level

(5) Car Navigation, Smart Phone, Internet

In Japan, vehicle information communication system (VICS) is a leading road traffic information provision system which is available in nation-wide. The road and traffic data is collected from the road administrators and police and the data is edited and distributed by the VICS centre, a semi-governmental organisation. The road/traffic information distributed by the VICS centre is provided to the users by the car navigation. The car navigation manufactures are obliged to pay certain amount to the VICS centre for covering the cost. The small amount for this payment is included in the unit hardware price of the car navigation, in turn collected from the car navigation purchasers.

In the case of the smart phone and inter-net, the users pay the fees for the information on congestion to the service providers. But in the case that the information service is offered free of charge, the service providers cover their cost by the advertisement fees in general.

(6) BOT

The BOT scheme is applied to the road construction and maintenance in many cases particularly in the developing countries which face the chronicle budgetary deficit. In general, the concessionaire is given a certain period for construction and operation, and they collect these costs by charging from the road users and cover the cost for construction, operation and maintenance.

The BOT scheme is applied to the southern section of the ORR. In the case of the BOT on

ORR, the concessionaire is paid the annuity by the AP government. The source of the annuity is covered by the tax, which means that the cost for the operation and management of the ORR is being borne by the general public. The advantage of this case is that the management of the road by the concessionaire as the private sector becomes stable because the revenue for them is assured.

The traffic signal jumping enforcement system (E-Challan System) of the traffic police has been prepared and operated by the BOT. The concessionaire obtains 20% of the penalties collected from the violated road users. It is assumed that the basic concept on this is that the costs for 20% increment provided to the concessionaire can be sufficiently covered by the violation penalties amount increased by introduction the system.

The concessionaire of the bus location system, which is under preparation by the APSRTC, obtains 10% of the bus fees. It is also assumed that the cost for 10% can be covered by the increased bus usage because of improved convenience by introducing the bus location system.

(7) Cases in Other Countries

For ITS implementation on highways, the road construction includes the cost of ITS implementation and can be executed under BOT scheme. The maintenance cost is supported through collection of charges such as ETC toll collection. However, in the case of the roads in the city, the ITS cost has to be managed by employing such scheme as preparation of a fund with such components as tax collection on fuel, fee for vehicle registration renewals once in 2 to 3 years, electronic road pricing (ERP), etc.

In the case of Japan, ITS maintenance is the responsibility of police and is run through state funding.

In Singapore, the ERP system has been in place since 1998 for traffic demand management in the city and on the first day of its implementation, the usual morning rush hour traffic from 7:30 a.m. to 9:30 a.m. along one of the heavily congested roads were decreased by 17%.

In Indonesia, as part of efforts to ease traffic congestion, the Government has passed the regulatory law in June, 2011 for ERP implementation in five major cities Medan, Jakarta, Surabaya, Bandung and Makassar.

In Vietnam, as a communist country, all systems are owned by the Government and ERP was implemented in Ho Chi Minh City (HCM).

10-2 Proposed Revenue Scheme for ITS Centre

The sustainable operation of ITS Centre by covering the required cost needs to be taken into account for formulation of SPV. The possible revenues can be mainly categorized into two (2) different sources.

The one is from public fund such as tax.

The other is from selling out the traffic information to the interested parties including public and private sectors.

(1) Tax Model

In essence, the traffic information is to be provided to the public as public services. The traffic flow control is also to be offered to the public for realizing better condition of the traffic. Thus these do not generate any revenues. In other words, this aspect holds legitimacy for being covered by the public funds.

(2) Commercial Model

On the other hand, the generated traffic information based on the dynamic real time traffic movement or aggregated data on traffic based on the statistics will have added-values, and they can be utilized for a number of purposes such as utilization for more accurate arrival time of APSRTC buses or taxies, utilization of infrastructure improvement, urban development or logistic centre development etc, market analysis for commercial activities such as retail premises deployment strategies by private companies, development of traffic related and more valued-added user applications by software developers. In other words, it holds a possibility that the generated traffic data by the ITS Centre can be sold out to the interested parties in both government and private sectors.

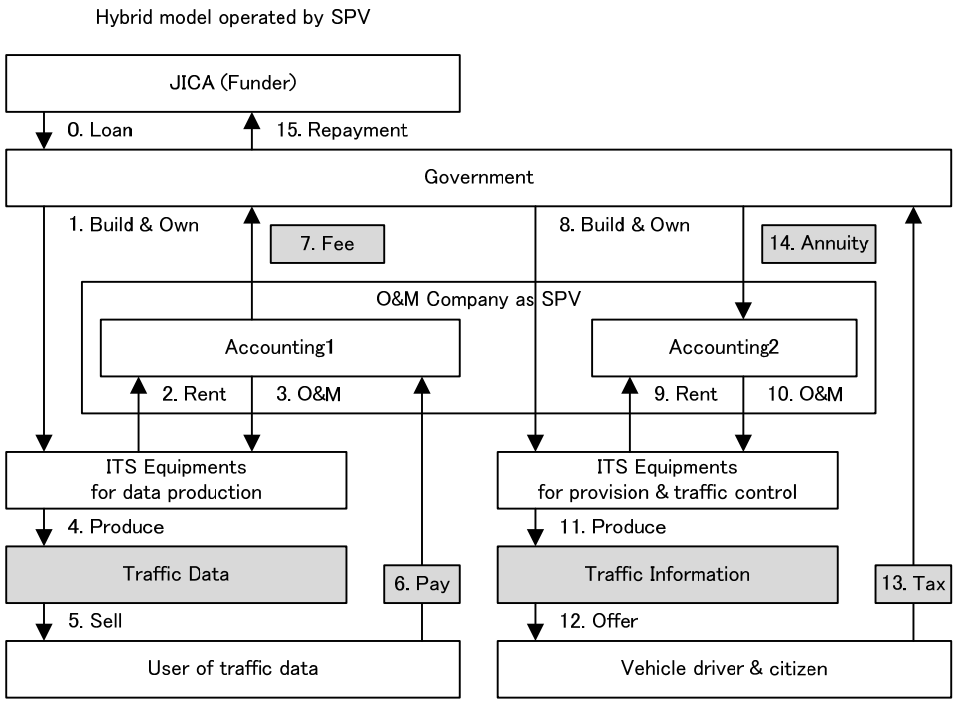
(3) Proposed Model (Combination of Above)

Considering these, the structure of SPV which is combined by fee collection as business and tax utilized schemes is recommended, as illustrated in the Figure below.

In this case, the capital cost is provided by JICA Loan to the Government. The ITS equipment is prepared and owned by the Government through the SPV. The SPV assures the quality of services and products which is generation of traffic data. The traffic data is to be sold out by SPV to the interested parties. Some proportion of the income obtained by this will be utilized for operation and maintenance of ITS Centre and remaining proportion will be given to the government for the Loan repayment.

The traffic information and traffic control will be offered to the users as public services. The certain amount of the cost for the operation and maintenance of ITS Centre will be collected through the tax from the users to the government in return of the services provided by the ITS Centre. The required cost for operation and maintenance will be provided by the government to the ITS Centre in the form of the annuity.

Hybrid Model: Commercial and Tax & Annuity (SPV)

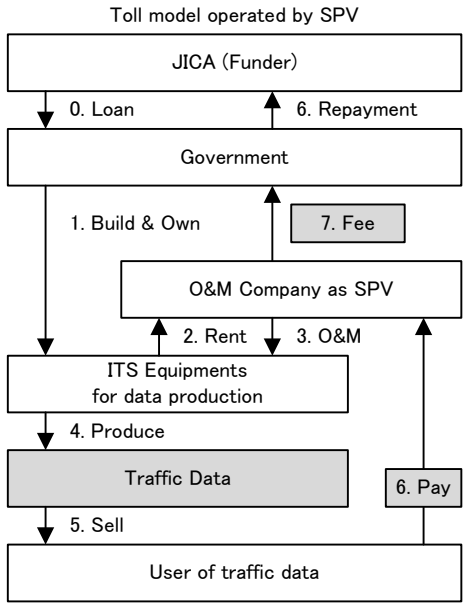


(4) Other Options

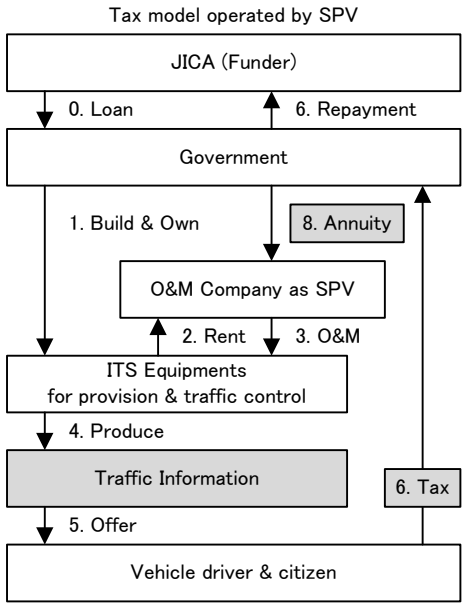
In addition to the above recommended model, other options are exemplified for considerations as follows;

(a) ITS Centre: Build by Government, Operated and Maintained by SPV

Commercial Model (SPV)

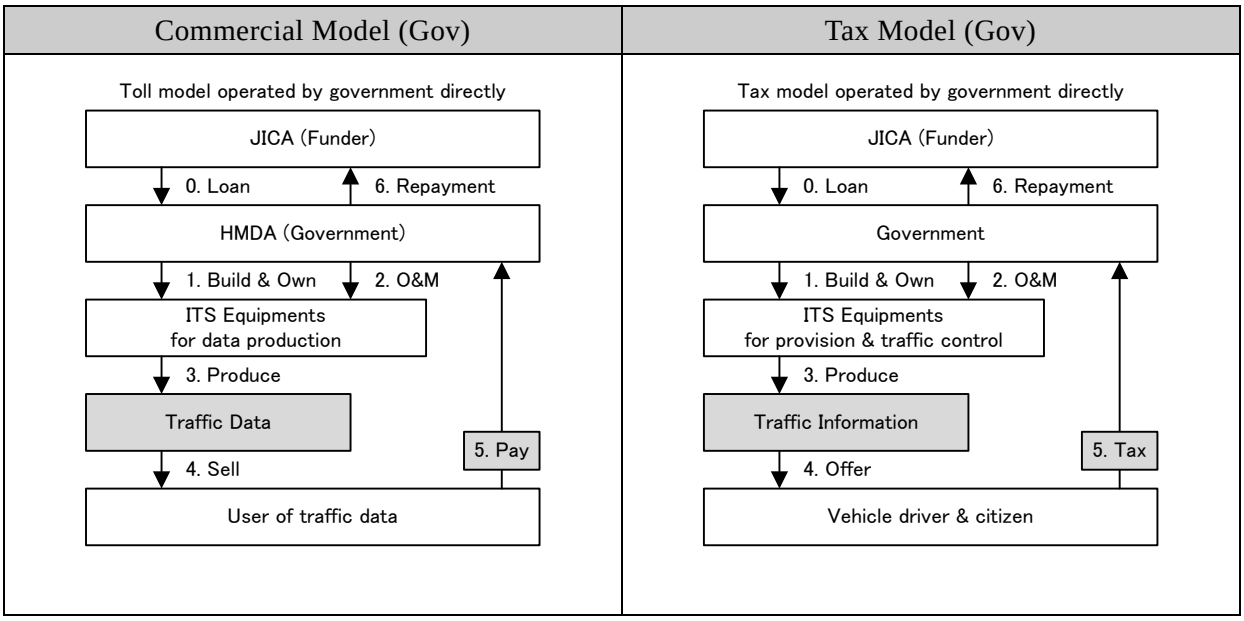


Tax & Annuity Model(SPV)



The above both show the cases of creation of SPV for operation and maintenance of ITS equipment and facilities. In this case, the Government builds ITS equipments and facilities and the SPV operates and maintains, which are the same with the recommended hybrid model above in this aspect. The differences between the figure on the left and right are the revenue sources, namely either commercial base or tax base.

(b) ITS Centre: Build, Operated and Maintained by Government

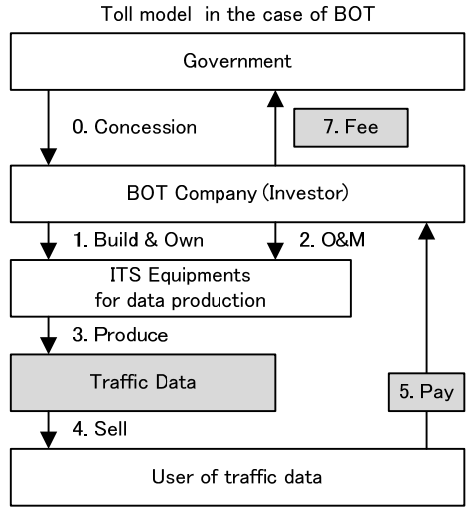
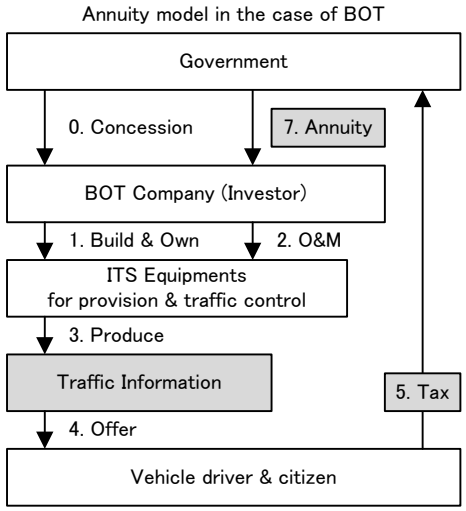


The above both show the cases directly operated by the Government. The Government builds the ITS equipment and facilities and takes care for operation and maintenance as well. In these cases, the ITS Centre will be prepared and operated under the division of the existing governmental agency.

The figure on the left shows the fee collection model under this scheme. The Government directly gains the revenue by selling the traffic data as their products to the interested parties.

The figure on the right shows the tax collection model under this scheme. The operation cost will be covered by the tax revenue.

(c) ITS Centre: Build, Operated and Maintained by Private (BOT)

Commercial Model (BOT)	Tax & Annuity Model (BOT)
	

The above both show the cases that the ITC Centre is built and operated under BOT scheme by the private agency. The differences between the figures on the left and right are the revenues sources, namely by commercial base or tax/annuity base.

Neither above are recommendable due to the following reasons;

1. The revenue is not sufficient for assuring both benefit for the concessionaires and covering the cost for the operation,
2. The entire system will be handled by the concessionaires in these cases. This is not suitable in regard of the concept and roles/responsibilities of the ITS Centre. The initiatives need to be taken by the governmental side.

10-3 Case Studies for Revenue Generation

The conceivable cases are studied for revenue generation for the ITS Centre in this section.

10-4 Commercial Model

(1) Revenue Generation by Advertisements

When the ITS CENTRE offers the traffic information by website, SMS and E-mail, it is easy to introduce the advertisement by attaching to these media. The income generated by the advertisement will increase according to the number of users who use these devices.

Assumed Conditions;

1. The vehicle population in 2010 by RTA is estimated at 36,83,000.
2. 5% of above will use the traffic information. The number of user becomes 184,150, estimating roughly about 200,000.
3. They use 10 times a day.
4. The advertising fee is INR0.01 which is almost same cost of SMS.

On the above condition, the income generated by the advertisement per year is estimated as follows.

200,000 users x 10 time x 365 day x INR 0.01 = INR 73,00,000 = INR 0.73 crore p.a.

(2) Revenue Generation by Selling Out Traffic Related Data

The ITS CENTRE collects and aggregates the various data such as travel speed, traffic volume, vehicle type, vehicle density, flood, rainfall, wind direction, wind strangeness and etc.

It shall be offered to public by free of charge. But the ownership of the data should belong to the owner of ITS equipment. If the ownership of the data is not defined, the data can be copied and modified by the unknown users.

The aggregated such data is quite useful and valuable in terms of comprehension of the traffic conditions and analysis for future status. Hence, there is high possibility of demand for the data by such agencies as government, market company, consultant and investors and etc.

The examples of the aggregated data which can be sold include;

1. Traffic volume
2. Travel speed
3. Congestion status
4. Vehicle classification
5. Weather condition

Assumed Conditions;

1. The number of user is estimated at 100 organisations including 20 governments.
2. The fee of the data for one year is set at INR100,000 for government and INR200,000 for private company.
3. The users do not sell the data again assured by the restriction of the ownership.
4. The average valid terms of the usage is set for 5 years.

On the above condition, the revenue generated by selling data is estimated as follows;
20 governments x 5 years x INR 100,000 = INR 1,00,00,000 = INR 1.00 core
80 private company x 5 years x INR 200,000 = INR 8,00,00,000 = INR 8.00 crorer
It becomes 9.00 crore in total for 5 years (1.8 crore per annum)

10-5 Tax & Annuity Model

(1) Collection of User Charges for ITS at New Vehicle Registration

The nominal fee called ITS charge to be collected at the time of vehicle registration is one of the conceivable options for revenue for ITS Centre.

The RTA currently collects three types of fees from the car owner at the registration of the new vehicle as follows;

- Life tax (12% or 14 % according to car price)
- Registration fee (INR20-600 according to car type)
- User charge (INR100-200 according to car type)

The vehicle registration per year is approximately estimated at 350,000. If the ITS charge of INR 200 is charged on each new vehicle at the time of registration, the INR 700,000 can be additionally collected per year.

(2) Increase of Fine Collected by Enforcement

According to the traffic police, the amount of E-Challan is collected by the traffic police in Hyderabad during the year of 2010-2011 as follows;

- INR19,73,21,645 by Hyderabad traffic police
- INR16,39,34,769 by Cyberabad traffic police
- Total amount become INR36,12,56,414 (= about 36 crore)

It is reported that 70% of work-load of the traffic police is spent on the traffic regulation and only 30% of the work-load on the enforcement. More work-load on enforcement shall be spent. It is mostly assumed that such large proportion on the traffic regulation is due to the adverse traffic conditions and existing traffic signals, of which 40% are not properly working.

If the road traffic infrastructure is improved, the enforcement can be strengthened spending more human resource of the traffic police on the enforcement activities. It will consequently lead to increment of collection of e-challan. Then some proportion out of the increased e-challan may be allocated to the operation and maintenance for the ITS Centre. For example,

- The collected amount of e-challan is increased by 1.5 times because of strengthened enforcement due to the road traffic infrastructure improvement
- 20% of the increased e-challan is allocated to ITS Centre

On the above condition, the additional amount for the ITS Centre can be generated from the e-challan as follows;

INR 36 crore x 0.5 x 20% = INR 3.60 crore

The HTRIMS is currently under planning in Hyderabad. The replacement of the existing signals is included in the HTRIMS project, and it may help the above stories.

(3) Relocation of Current Tax

Another possible revenue generation is relocation of some proportions of existing taxes which are collected by various agencies in Hyderabad.

(a) Lift tax Collected by RTA

The annual life tax is collected by RTA and the amount is reported at about INR 673 crore per year. If 1% of the amount is relocated , an amount of INR 6.73 crore is collected

(b) E-Challan Collected by Traffic Police

Yearly E-Challan amount collected by traffic police is estimated to be INR 36 crore. If 1% of this amount is relocated, an amount of INR 0.36 crore is collected.

(c) Property Tax Collected by GHMC

Yearly property tax collected by GHMC is estimated to be about INR 517 crore. If 1% of this amount is relocated, an amount of INR 5.17 crore is collected.

(d) Summary

If relocation of part of the amount of currently collected taxes is considered as explained above, the possible scenarios are as listed below;

Tax or fee	Collected by	Amount at 2011	1% of amount	2% of amount

Life tax	RTA	673 crore	6.73 crore	13.46 crore
E-challan	Traffic Police	36 crore	0.36 crore	0.72 crore
Property tax	GHMC	517 crore	5.17 crore	10.34 crore

(4) Conclusion

The conceivable annual revenue scenarios are summarised in the Table below. Some of them may involve complex and sensitive issues in regard of tax re-allocation. Nonetheless, all these scenarios hold potentials for assuring the revenues for the ITS Centre. In addition, it shall be noted that the future growth of vehicles is not considered for the revenue projection summarized in the Table below, thus the amount may become much higher.

Hence, the administrative decisions at higher level are highly recommended.

Revenue items	Amount
Advertising	0.73 crore
Sales of traffic data	1.80 crore
New user charge (ITS Charge) whilst Vehicle registration	7.00 crore
Strengthened Enforcement	3.60 crore
Reallocation of life tax	6.73 crore
Reallocation of e-challan	0.36 crore
Reallocation of property tax	5.17 crore

Basic Information (Appendix)

The basic information based on the available data is summarised for the case studies. They include i) vehicle population in Hyderabad in 2009, 2010 and 2011, ii) number of registered vehicles per annual in 2009, 2010 and 2011 by RTA, iii) amount of life tax collected by RTA during the year of 2009-10 and 2010-11, iv) amount of e-challan collected by the traffic police during the year of 2010-11.

a. Vehicle Population in Hyderabad

No	Vehicle Type	2009	2010	2011
1	Two Wheelers	22,73,376	24,91,080	27,18,170
2	Motor Cars / Jeeps	4,52,495	5,02,904	5,53,776
3	Good Vehicles	1,57,129	1,68,372	1,81,891
4	Stage Carriage / Mini Buses	20,882	25,853	29,247
5	Auto Rickshaws	89,601	1,00,106	1,06,623
6	Taxis	40,364	42,609	46,122
7	Tractors	9,659	10,485	11,286
8	Others	19,310	35,116	35,917
9	Total	30,62,816	33,76,525	36,83,032

b. Annual Vehicle Registrations by RTA in Hyderabad

No	Vehicle Type	2009	2010	As on 30 Nov 2011
1	Two Wheelers		2,17,704	2,27,090
2	Motor Cars/Jeeps		50,409	50,872
3	Good Vehicles		11,243	13,519
4	Stage Carriage/Mini Buses		4,971	3,394
5	Auto Rickshaws		10,505	6,517
6	Taxis		2,245	3,513
7	Tractors		826	801
8	Others		15,806	801
9	Total		3,13,709	3,06,507

c. Life Tax Collected by RTA in Hyderabad

No.	Year	Amount Collected (INR CRORE)
1	2009-10	522.16
2	2010-11	673.01

d. E-Challan Collected by Traffic Police in Hyderabad

No.	Traffic Police	Year	Amount Collected INR
1	Hyderabad	2010-11	19,73,21,645
2	Cyberabad	2010-11	16,39,34,769
3	Total		36,12,56,414

04. Pre-Qualification Document

Pre-Qualification Document is submitted together with Tender Documents.

05. Tender Documents

Tender documents are composed of the following documents.

These documents are independently submitted.

Volume & Section	Contents
Volume I	
Section I	· Invitation for Tender (IFT)
Section II	· Instruction to Tenderer (ITT)
Section III	· Form of Tender and Appendix to Tender (FOT)
Section IV	· Pricing Document (PRD)
Section V:	· Conditions of Contract
Part I	· General Conditions (COC-GC)
Part II	· Conditions of Particular Specifications (COC-PA)
Volume II	
Section VII	Employer's Requirements
Part A	· General Technical Specification (GTS)
Part B	· Particular Technical Specifications (PTS)
Part C	· Operation and Maintenance Specifications (OMS)
Volume III	
Section VIII	· Employer's Requirements Drawings

06. Operation and Maintenance Manual

Operation and Maintenance Manual

for

Hyderabad City Intelligent Transportation System

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- This Operation and Maintenance (O&M) Manual describes basic principle for the purpose of the smooth implementation for City ITS O&M as of November 2013. This Manual is recommended to revise after the installation of City ITS equipment and the O&M proposal from Contractor.

Part A: General

1. General Rules

1.1 Objectives

This Manual stipulates the procedure of City Intelligent Transportation System (hereinafter referred to as "City ITS") for the Hyderabad metropolitan road network under the contract with Hyderabad Metropolitan Development Authority (hereinafter referred to as "HMDA") to ensure safe and efficient traffic on the Hyderabad metropolitan road network.

1.2 Applicable Laws, Regulations and Manuals

The personnel engaged in the City ITS operation and maintenance shall comply with the applicable laws and HMDA's regulations in addition to this Manual in discharging the duty.

1.3 Code of Conduct

The personnel engaged in the City ITS operation and maintenance shall consider traffic safety as first and utmost priority and act to protect safety of road user, and the personnel engaged in the Hyderabad metropolitan road network operation.

The personnel engaged in the City ITS operation and maintenance shall treat road users with courteous and polite manner and carry out his duty quickly and correctly.

The personnel engaged in the City ITS operation and maintenance shall always wear a uniform during their working hours.

Intelligent Transportation System Centre (hereinafter referred to as "ITSC") staff cannot leave his position without reason during working hours.

Shifting to next team shall be smooth and promptly without causing any service gap.

Manipulation of any equipment or devices shall be correctly and promptly compile with manipulation manual prepared by contractor.

When failure and abnormalities of equipment are observed, report to the related maintenance persons immediately.

ITSC staff shall strive for acquisition of related knowledge and improvement of technical skill, strive for courteous attitude and not make uncomfortable to customers/visitors. The staff shall carry an employee ID card in order to show it all the time, and always keep clothing clean and wear it correctly and nicely.

All employees at ITSC, and maintenance team members shall compile with HMDA (D) GM's instructions.

1.4 Confidentiality

The staff shall not disclose personal information of road users and other persons that he obtained through the work to third party.

The staff shall not disclose traffic date, accident data, incident data, operation log of equipment and other data to the third party without written consent of the HMDA.

Information related police activities which could be known during working hours shall not be leaked to outside of ITSC.

Operation manual, maintenance manual, operation record, traffic data and other documents provided to or prepared by HMDA shall not be reproduced or brought outside the ITSC premises

without written permission of the HMDA.

1.5 Functions of City ITS

In order to achieve objectives mentioned above, City ITS provides with the following functions:

- Collection of information on traffic, weather and road conditions,
- Provision of information on incident and unfavorable conditions on the Hyderabad metropolitan road network to road users,
- Implementation of countermeasures in case of incident to secure traffic safety and minimize adverse impact on the traffic, and
- Perform as command centre in case of incident and coordinate among the agencies concerned.

1.6 Scope of Work

The City ITS provides in the works listed below. Detailed operation and maintenance procedure of the works is given at latter part of the manual.

(1) Monitoring of traffic on the Hyderabad metropolitan road network through CCTV and ATCC system

(2) Monitoring of weather condition using Flood System and Meteorological System

(3) Detection of incidents

(4) Information dissemination through VMS

(5) Monitoring and maintenance of equipment operation

(6) Information exchange with other organizations concerned

(7) Keeping operation and maintenance log

1.7 Organization Structure for City ITS

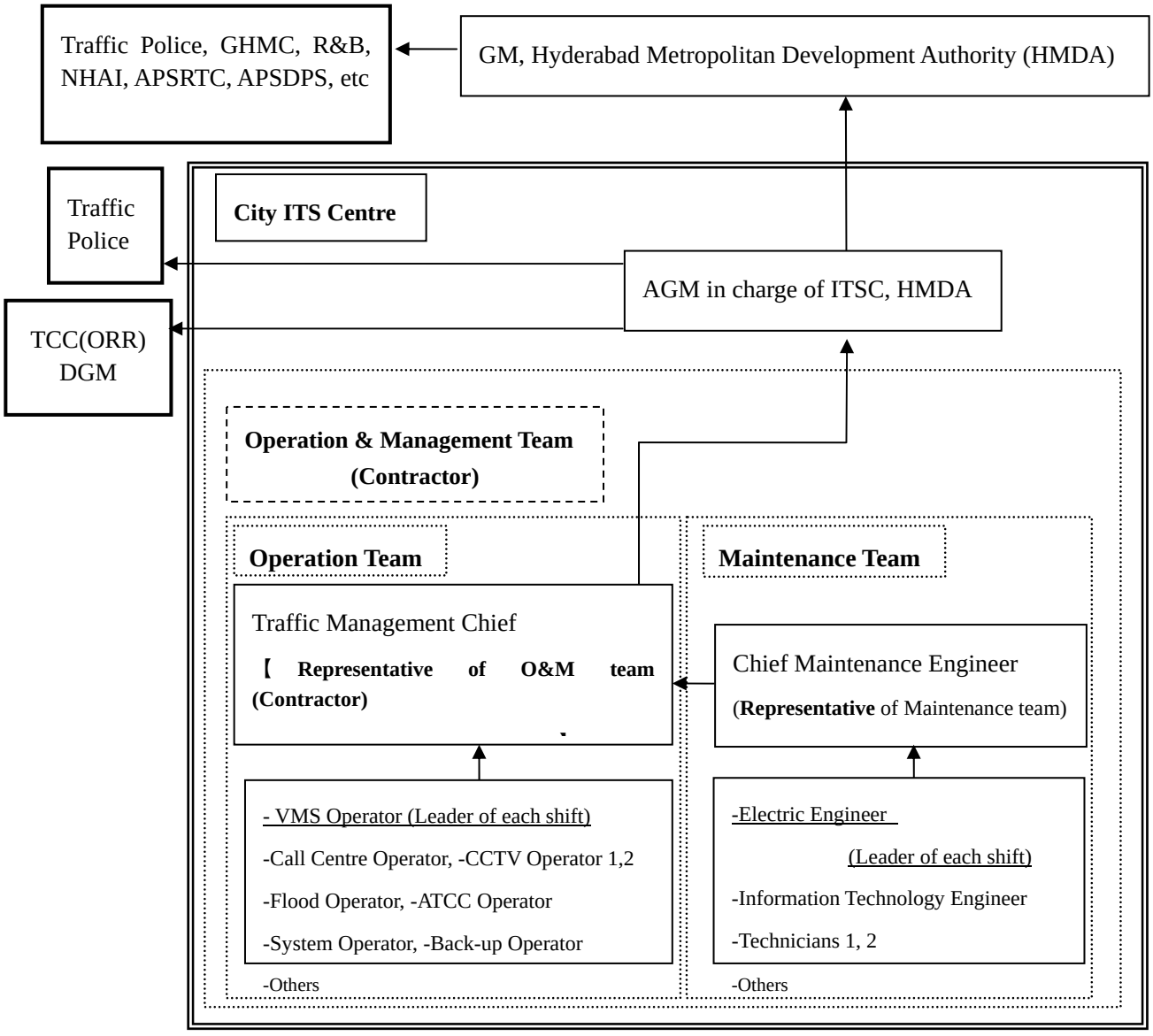
The following figure shows the organization structure of City ITS and the information flow by arrows. Under the comprehensive supervision of GM, HMDA, the Operation and Maintenance team on City ITS is formulated.

GM, HMDA is responsible for traffic management of the roads in Hyderabad Metropolitan area and for policy related coordination with traffic police, GHMC, R&B, NHAI, APSRTC, APSDPS and related organizations.

Under GM at HMDA, AGM in charge of ITSC supervises the Operation and Maintenance team of City ITS. The AGM will have smooth and direct communication with traffic police in ITSC for quick countermeasure implementation against traffic incidents real time basis. As per ORR, the AGM will also communicate with DGM Traffic Control Centre (ORR) as necessary.

In the organization structure in the Contractor's side, Traffic Management Chief controls Operation team in City ITS. Chief Maintenance Engineer controls Maintenance team. As a whole, Traffic Management Chief comprehensively manages Operation & Maintenance team in City ITS. He shall reports incidents and events to the AGM without delay.

The role of the Operation team and the Maintenance team is described in the latter part in this manual.



Part B: City ITS Operation Manual

2. City ITS Operation

The City ITS Operation shall be executed in accordance with the procedures as set forth herein and instructions given by HMDA. The system shall be in operation for 24 hours a day and 7 days a week without interruption.

2.1 Organizational setup

In performing the City ITS operation, Traffic Management Chief shall establish the organizational setup in ITSC, located in Nanakramguda IC. The organization structure consists of Traffic Management Chief as the representative of the Operation team, Call Centre Operator, CCTV Operator 1&2, VMS Operator, Flood Operator, ATCC Operator, System Operator and Back-up Operator.

2.2 The Roles of ITSC staff

Traffic Manager Chief is responsible for traffic information management of the roads in Hyderabad Metropolitan area in real time basis in the operation stage. He supervises all operator teams at ITC Centre.

An operation team consists of nine (9) persons of one (1) Traffic Management Chief and eight (8) operators with the task assigned as shown below.

No.	Position	Main functions
1	Traffic Management Chief	• Responsible for overall management of ITSC • Monitoring all contents of sub-systems • Instruct operators whenever it require
2	VMS Operator (VMS)	• Leader of each shift • Create and editing of VMS message to be displayed • Select the information as per priority and display selected VMS • Input and record of events
3	CCTV Operator 1 (CCTV / Video Wall)	• Monitor the CCTV images • Utilize PTZ function and understand the situation whenever CCTV sends the serious incident image and inform Manager and VMS operator. • Manipulate Video Wall console if necessary
4	CCTV Operator 2	• Monitor the CCTV images which cannot be covered by operator 1 • Utilize PTZ function and understand the situation whenever CCTV sends the serious incident image and inform Manager and VMS operator.
5	Call Center Operator	• Receiving phone call information/data from public and other agencies • Record the call information/data • Providing necessary information/data to related agencies if

		necessary • Collect and reply any necessary information/data to answer enquiry for caller from public and other agencies • Collect necessary information from related agencies such as VIP movement, road works
5	VMS Operator (VMS)	• Create and editing of VMS message to be displayed • Select the information as per priority and display selected VMS • Input and record of events
6	Flood Operator (Flood / MET)	• When alarm issues, inform CCTV operator to check the water logging spot. • When alarm issues since MET data send by APSDPS beyond the threshold, operator inform the Manager and VMS operator
7	ATCC Operator (ATCC / Probe / Static Data Analyzer)	• Collect the information regarding traffic speed and congestion from ATCC • Whenever heavy traffic congestion is found, find the time to destination. • Analyze the traffic data and make a report periodically and whenever manager request.
8	System Operator	• Monitor functionality of FLD, ATCC, MET and Probe equipment/communication • Maintain all network system in ITSC including Security & Incident Management Service • Up-gradation of systems
9	Back-up Operator	• Back-up staff for the above operators except system operator
10	Others	• Necessary number of administrator staff, security guard, cleaning helper, peon and other staff

Traffic Management Chief supervises operators as daytime basis. Regarding operators, one day is divided into three (3) shifts. One party consists of 9 members (No. 2-9) and total 4 parties including back-up. VMS operator is the leader of each shift.

In the night tight shift (i.e. Traffic Management Chief is not in ITSC), VMS operator shall as act for the substitution.

2.3 Close coordination with other organizations

City ITS operation team is conducted by close cooperation with related agencies such as traffic police, ambulance & fire brigades through DGM in order to restore any adverse event immediately.

2.4 Briefing at shift change

Shift time of operators shall be arranged in such a way that there will be an overlapping period of at least 15 minutes. During the overlapped period, new operation team shall be briefed by the previous operation team as to the following:

- General traffic condition
- Weather condition
- Existing incidents and accident being disposed of

- On-going and scheduled work and event on Hyderabad Metropolitan Area
- Messages being displayed on VMS
- Equipment malfunctioned and the status of maintenance work
- Other matters that need attention of the operation team

Leader of each shift shall hand over all reports to the leader of the next shift. When the last shift of the day finishes the duty, Traffic Management Chief checks all reports and files them. He submits them to the HMDA .

2.5 Confirmation of equipment condition

At the start of a shift, operators shall confirm the condition of all equipment through operation or through the workstations. If there is a new failure that was not reported by the previous shift team, the operator shall record it and report it to the maintenance team for proper maintenance action.

During the operation of the system, if the operator detects any abnormality of the equipment, software, or database, he shall report it to the maintenance team for proper maintenance action. The operator shall refrain from manipulating equipment, modifying operating parameters, reloading software or other action without instruction by the maintenance staff when abnormal or defective behavior of the equipment or software is found.

3. Operation of CCTV system

3.1 System Setup

The CCTV system shall be set to sequential display mode in which video image from all CCTV cameras is sequentially displayed on the multiple video monitors. The number of monitors used and scanning interval of each video camera are user selectable. Image recording function shall be set to ON and image from all CCTV cameras shall be recorded automatically.

3.2 Operation

1) Monitoring

The CCTV operator shall from time to time watch the CCTV monitor which sequentially displays video image from all cameras at pre-set interval to monitor and confirm normal traffic flow.

If any abnormality is found in the video image, the operator shall discontinue sequential changeover mode and select and fix the camera that captures the scene of incident, and observe the incident. If the incident is the type that requires assistance, the operator shall inform relevant agencies of the incident and request appropriate action to be taken.

If a report of incident is received and incident location is within the coverage area of a CCTV camera, the operator shall select the CCTV camera of incident location, operate the camera and focus on the incident to monitor to get first-hand information of the incident.

2) Incident detection

If any incident is identified by the CCTV operator, CCTV operator shall contact the relevant agencies such as traffic police, fire brigades, ambulance etc. for their action.

After the contact with the relevant agencies, Traffic Management Chief shall request VMS operator to display appropriate messages on the VMS at appropriate location and direction.

When Traffic Management Chief confirms that the traffic condition has become normal, Traffic Management Chief shall request VMS operator to remove the messages or change the message with second priority. Traffic Management Chief shall inform the relevant agencies of the

termination of the incident.

3) Variable message sign

If the serious incident which affects traffic flow or traffic safety, captured by CCTV or reported from other agencies, the VMS operator shall operate VMS console and display the incident information on the VMS of suitable location as per the operating procedure of VMS.

4) Failure of Equipment

If the CCTV console receives fault signal or no diagnosis signal response from CCTV, CCTV operator shall contact the maintenance team and report the location and status of equipment with failure.

4. Operation of Automatic Traffic Counter-cum-Classifier (ATCC) System

4.1 System Setup

No specific system setup is required for ATCC once its normal operation is confirmed at the time of system commissioning.

4.2 Operation

1) Abnormal traffic condition

If abnormal data are found, the ATCC operator shall confirm whether the actual traffic flow is different from the normal, or the data is erroneous. If the data is found erroneous, the ATCC operator shall inform the maintenance team for further investigation.

2) Monthly review

At the end of every month, the ATCC operator shall go through the data collected by the ATCC for any abnormality that could have been overlooked during daily operation. If an abnormal data is found, the operation shall further examine the data and determine whether the traffic condition became abnormal due to an incident or the ATCC equipment was defective. If any abnormality that is attributable to erroneous system operation is found, the operator shall inform the maintenance team for further investigation.

3) Failure of Equipment

If ATCC console receives fault signal or no diagnosis signal response from ATCC, the operator shall contact the maintenance team and report the location and status of equipment with failure for proper maintenance action.

5. Operation of Flood (FLD) System

5.1 System Setup

Threshold value for water logging shall be determined as HMDA instruction and reviewed from time to time, in particular after heavy rain to confirm that the values are appropriate.

5.2 Operation

1) Monitoring

When weather is good, no particular operation on the meteorological system is required by the Flood operator. When heavy rain is expected at vicinity of flood monitoring systems at roadside, Flood operator request CCTV operator to capture the image continuously and observe the water logging condition.

2) Abnormal weather condition

The FLD system issues an alarm when level of water exceeds the threshold.

If an alarm is issued, Flood operator shall request VMS operator to display appropriate messages on the VMS at appropriate location and direction with the approval of Traffic Management Chief.

Once an alarm is issued, Flood operator shall check the data and CCTV image and confirm the water logging condition.

When the level of water has returned to the normal level, Flood operator shall request VMS operator to remove messages or change the message and request to Call Center operator to inform related agencies with the approval of Traffic Management Chief.

3) Monthly review

At the end of every month, the Flood operator shall go through the data collected and provide these data to ATCC operator to make a static data of water logging at each monitoring spots and request VMS Operator to record these static data. If any abnormality that is attributable to erroneous system operation is found, the operator shall inform the maintenance team for further investigation.

5.3 Failure of Equipment

If ITS workstation receives fault signal or no diagnosis signal response from FLD, Flood operator shall contact the maintenance team and report the location and status of equipment with failure for proper maintenance action.

6. Operation of Meteorological (MET) System

6.1 System Setup

No specific system setup is required for MET since all data is sent from APSDPS to ITSC. Threshold value for rainfall and wind velocity shall be determined as per HMDA instruction and reviewed from time to time, in particular after heavy rain or strong wind to confirm that the values are appropriate.

6.2 Operation

1) Monitoring

When weather is good, no particular operation on the meteorological system is required by the Flood operator. When weather is bad or expected to become bad, Flood operator shall review and confirm the weather condition from time to time. The frequency is not fixed but must be adjusted depending on the weather condition.

2) Abnormal weather condition

The MET system issues an alarm when average wind velocity or cumulative rainfall exceeds the pre-defined threshold.

If an alarm is issued, Flood operator shall request VMS operator to display appropriate messages on the VMS at appropriate location and direction with the approval of Traffic Management Chief.

Once an alarm is issued, Flood operator shall check the data from APSDPS and confirm the weather condition.

When the wind velocity or precipitation has returned to the normal level, Flood operator shall request VMS operator to remove messages or change the message with the approval of Traffic Management Chief and request to Call Center operator to inform related agencies.

3) Monthly review

At the end of every month, the Flood operator shall go through the data collected and provide these data to ATCC operator to make a static data of wind velocity and cumulative rainfall.

7. Operation of Schematic Map

7.1 Update of System

Schematic Map on Video Wall displays following items.

a) Road networks (ORR, IRR, NH, SH and others) except any road which bus is not running on

b) Location of road side equipment (ATCC, CCTV, FLD, VMS)

c) Traffic congestion status

d) Water logging condition

e) Incident (Traffic accident, Disabled vehicle, Obstacle on the road, Vehicle fire, Disaster, etc.)

f) Regulation (Lane closure, Road closure)

System Operator shall maintain any change/adding/removal of location of road side equipment and any information which will display on schematic map.

System Operator confirm that the regular update of Digital Road Map (DRM) , which is provided by the DRM supplier, is surely carried out and properly reflect DRM patch.

7.2 Operation

1) Monitoring

When any information, which should be shown on the schematic map, received from related agencies through Call Center Operator, CCTV Operator 1 shall manipulates console and confirm the correct information need to be displayed on schematic map.

When future road work information is received from related agencies through Call Center Operator, VMS Operator input that information into event console.

2) Failure of Equipment

If any unclear visible information is confirmed by Traffic Management Chief or any Operators, System Operator shall inform the Maintenance Team for further investigation.

If any discrepancy occurs between provided DRM and schematic map, System Operator shall inform the Maintenance Team for further investigation.

8. Operation of Probe System

8.1 System Setup

No specific system setup is required for Probe since all bus tracking data is sent from APSRTC to ITSC at an interval of less than one (1) minutes.

8.2 Update of System

Call Centre Operator contacts to APSRTC frequently and whenever any changes are founded between current bus schedule and planning schedule, System Operator shall update the system in advance of commencement of new schedule. Examples of schedules are described below.

a) Shifting/Adding/Removal of bus stops on each bus route

b) Changing/Adding/Removal of bus route

8.3 Operation

1) Monitoring

When ATCC operator finds abnormal traffic congestion displayed on Digital Road Map of video wall, ATCC operator request to CCTV operator to capture the spot where congestion had started. If the congestion starting spot is out of coverage area of CCTV, ATCC operator request to Call Center operator to contact traffic police to find the cause. Simultaneously, ATCC operator requests to VMS operator to display necessary information on VMS on appropriate location and direction with the approval of Traffic Management Chief.

2) Monthly review

At the end of every month, the ATCC operator shall make the monthly traffic status report, which can describe and organize the traffic data by location, day, week, time and direction wise. ATCC Operator requests VMS Operator to input these static data into event console.

9. Operation of Variable Message Sign

9.1 Types of Information Provided

Different types of message will be displayed on the VMS. These types are summarized below. With regard to the message format, the sample messages presented in “IRC:SP: 85-2010, Guidelines for Variable Message Signs.

1) Advance warning message

Advance warning message gives the road users running at upstream section an advance notice of the incident at downstream section. The incident includes traffic congestion, slow traffic, accident, water logging, road closure, fallen objects, road works and weather conditions. The message is effective in reducing possibility of secondary incidents.

2) Advisory message

Advisory message provides the road users with useful information about a specific problem along their route. This information allows the road users to change their speed or lane in advance of the problem area, or the road users may elect to voluntarily take an alternative route to their destination.

3) Early notice

Early notice informs the road users of a planned event such as road works. This type of message has lower priority than other types of message and will be displayed only when there is no real-time message to be shown.

9.2 Language used

Three languages, English, Hindi, and Telugu will be used for VMS. Thus the VMS operator shall be fluent in these languages. Except short message, messages will be displayed in one of the three languages. Message shall carry the same meaning regardless of the language used. For short message that can be expressed in one line, the same message may be displayed simultaneously in three lines.

9.3 Message Composition Method

All messages to be displayed on VMS shall be approved by Traffic Management Chief before actually shown on the VMS. Likewise, removal of the message being displayed requires approval

by Traffic Management Chief.

VMS operator can choose message creation from three (3) methods as indicated below.

1) Combination of pre-defined message

The word which are frequently used such as “accident”, “congestion”, ”construction work”, “slow down” and so on are used to compose a message combination by selection at VMS console. They contain words indicating location, event and instruction.

2) Ready-made message

VMS operator may select one of the ready-made messages stored in VMS console.

3) Manual composition

Any message which VMS operator cannot select from VMS console, operator can create any message through keyboard.

4) Graphic symbols

VMS operator may provide a graphic symbol that graphically represent an incident and help road users to understand instantly without reading messages.

9.4 Message display

Upon reception of incident information from other operators or directly from other agencies, the VMS operator shall display proper message on the VMSs at appropriate locations and direction without undue delay.

If the VMS on which new message is to be displayed is already showing a message, the VMS operator shall evaluate the priority of the current and new incidents and propose to Traffic Management Chief whether the message being displayed is replaced with the new message or not.

9.5 Message removal

Upon reception of the notice that an incident for which a message is displayed has been resolved, the VMS operator shall remove the message or replace with other message immediately. The message of the incident that has been resolved shall not be displayed unnecessarily.

The VMS operator shall check the effectiveness of all the messages being displayed at every 15 minutes and confirm the message needs to be continued or removed. The operator shall remove the message or replace with another message if the message being displayed is no longer applicable.

10. Security & Incident Management Service

The City ITS Project shall be designed for an end-to-end multi-layer security blanket to protect applications, services, data and the infrastructure from malicious attacks or theft from external (through internet) and internal (through intranet) hackers. Using Firewalls and Intrusion detection systems such attacks and theft should be controlled and well supported (and implemented) with the security policy. The virus and worms attacks should be well defended with Gateway level Anti-virus system, along with workstation level Anti-virus mechanism. City ITS should be designed to make use of the Secure Socket Layer (SSL)/Virtual Private Network (VPN) technologies to have secured communication between Applications and its end users. Furthermore, all the system logs should be properly stored & archived for future analysis and forensics whenever desired.

Security service would be prepared for each of the following types of incidences:

1) Virus Attack

Any virus infection and passing of malicious code shall be monitored at the gateway level or user complains of virus infection shall be logged and report by monthly report.

2) Denial of Service (DoS) Attack

Non availability of any services shall be analyzed and forensic evidence shall be examined to check whether it was due to external DoS attack.

3) Intrusion

Intrusion is an illegal act of entering, seizing, or taking possession of data hosted by City ITS.

4) SPAM

SPM is an unsolicited bulk messages, especially advertising, indiscriminately. SPAM statistics on monthly basis shall be monitored through reports generated by Anti SPAM software.

11. Operation Records and Reports

11.1 Deployment

The operation team shall prepare and submit to HMDA as minimum the following reports on deployment:

a) Shift plan of the operation team with the name of traffic management chief and operators on a weekly basis.

b) Daily attendance record with In time and Out Time for all operation staff working at ITSC.

11.2 Operation Record and Report

The operation team shall prepare and submit the various reports as stipulated herein in a form mutually agreed with HMDA. Each report shall contain as a minimum the information listed.

Traffic Management Chief shall prepare the following reports:

a) Daily report

- List of incident responded by incident category
- Contact summary (numbers by category) with calls, traffic police and other relevant agencies

b) Monthly report

- Number of contact with caller, patrol, police, The Employer and others for each day.
- Number of incident occurred by category for each day
- Number of emergency contact call
- Number of other contacts

Operators who responded to a call (normally Communication Operator) shall prepare the reports listed below. The report shall be compiled immediately after responding to the call and shall not be left unrecorded.

c) Emergency Response Report

- Incident location
- Weather

- Road condition
- Vehicle condition
- Contact record
- Dispatch record
- Traffic regulation implemented

d) Call Record

- Time
- Party contacted
- Incoming or outgoing
- Call content

e) Clearing Record of Object on Road

- Time when information is received
- Receiver
- Contact source
- Caller
- Type or kind and name of object
- Location and direction
- Lane number

f) Ambulance Information Report

- Date and time
- Reason for dispatch
- Location and direction
- ID of ambulance dispatched
- Service rendered

g) Fire Engine Information Report

- Date and time
- Reason for dispatch
- Location and direction
- ID of fire engine dispatched
- Service rendered

Part C: City ITS Maintenance Manual

12. City ITS Maintenance

The City ITS Maintenance shall be executed in accordance with the procedures as set forth herein and instructions given by HMDA. The Maintenance team shall be in operation for 24 hours a day and 7 days a week without interruption.

12.1 Organizational setup

In performing the City ITS maintenance, the Traffic Management Chief establishes the organizational setup in ITSC building, located in Nanakramguda IC as main base, and Ghatkesar IC as sub-base. The organization structure consists of Chief Maintenance Engineer as the Representative of Maintenance team, Electric Engineer, Information Technology Engineer and Two (2) numbers of Technicians.

12.2 The Role of Maintenance Staff

Chief Maintenance Engineer shall set up the necessary number of maintenance staff to undertake the maintenance work in shift on a 24-hour a day and 7-day a week basis. The team shall consist of the number of persons of suitable expertise. Under normal condition, they will engage in the preventive maintenance work. In the event of malfunction or damage to the equipment or operational problem of server system and network, the team shall be dispatched to the site immediately to attend to the incident.

Chief Maintenance Engineer supervises engineers as daytime basis. In the night tight shift (i.e. Chief Maintenance Engineer is off-duty), Electric Engineer shall as act for the substitution. Three (3) shifts shall be adopted for City ITS maintenance. One party consists of 4 members (No. 2-4) and total 4 parties including back-up.

	Designation	Task and responsibility
1.	Chief Maintenance Engineer	Responsible for overall maintenance of City ITS
2.	Electric Engineer	-Leader of each maintenance team -Responsible for maintenance of all equipment comprising the City ITS.
3.	Information Technology Engineer	Responsible for maintenance of all Network, Software and database used in the City ITS.
4.	Two (2) numbers of Technicians	Two technicians work with the above engineers.
5.	Others	Necessary number of administrator staff, security guard, cleaning helper, peon and other staff

12.3 Briefing at shift change

Shift time of maintenance engineers shall be arranged in such a way that there will be relevant overlapping period. During the overlapped period, new engineer team shall be briefed by the previous maintenance team as to the following:

- General condition of equipment and software
- Equipment malfunctioned and the status of maintenance work
- On-going and scheduled maintenance work on Hyderabad Metropolitan Area
- Other matters that need attention of the operation team

Leader of each shift shall hand over all reports to the leader of the next shift. When the last shift of the day finishes the duty, Chief Maintenance Engineer checks all reports and files them. He submits them to the HMDA.

12.4 Confirmation of equipment condition

At the start of a shift, maintenance engineers shall confirm the condition of all equipment. If there is a new failure that was not reported by the previous shift team, the new maintenance engineer shall record it and start proper maintenance action.

13. Preventive Maintenance

The Maintenance team shall perform the preventive maintenance of all equipment and software supplied under HMDA in accordance with the preventive maintenance schedule including scheduled downtime to be proposed by the Maintenance team and approved by the HMDA.

13.1 Inspection Item for Preventive Maintenance

The representative of Maintenance team shall prepare and submit to HMDA a list of inspection items for all preventive maintenance work. The inspection item list shall indicate the type of inspection to be performed monthly, bi-annually and annually. The list of inspection items and cycle is presented in Attachment 1 for the Operation & Maintenance.

13.2 Schedule for Preventive Maintenance

The Chief Maintenance Engineer shall prepare and submit to HMDA a schedule for all preventive maintenance work including scheduled downtime through Traffic Management Chief.

The schedule shall be in sufficient detail to indicate which part of the monthly inspections is to be performed in each week and which part of the bi-annual and annual inspections is to be performed in each month and the number of maintenance engineers and technicians to be assigned to the work.

The Chief Maintenance Engineer will be required to revise the schedule if the work load and the manpower assignment are unbalanced or unrealistic.

13.3 Check List

The Chief Maintenance Engineer shall develop and prepare check lists to be used for preventive maintenance for each type of equipment and software, and submit them for HMDA for the approval through Traffic Management Chief. The checklists shall include the type of equipment, equipment ID, location, date of inspection, name of inspector, check item, and remarks.

The check list shall be used every time a periodical inspection of the equipment is made and results

of the inspection shall be recorded together with other details.

The Chief Maintenance Engineer is required to submit a copy of all recorded check lists every month and as requested by HMDA at any time through Traffic Management Chief.

13.4 Software Preventive Maintenance

The Maintenance team shall perform preventive maintenance of the software to be provided under HMDA as part of the maintenance work. The Maintenance team shall exert the utmost care not to inadvertently damage the software and database, and cause erroneous or abnormal operation of the City ITS.

The items for software maintenance shall include but not be limited to the following:

- Monitoring of CPU, memory and disk space utilization
- Monitoring of system availability over TCP/IP
- Monitoring of anti-virus and system security software operation
- Backup of the system and restoration of the system when necessary.
- Monitoring and review of system and event logs.

System modification:

The work to be done consists of modifying the system, system parameter and other operating conditions and to improve the operation or to conform to new operational requirements. The work shall be done as directed by HMDA.

14. Corrective Maintenance and Accident Repair

The Maintenance team shall provide corrective maintenance and accident repair on a 24-hour a day, 7-day a week basis. Upon reception of a failure notice by the contact person, the Maintenance team shall log the notice and determine the nature and severity of the failure, and dispatch the maintenance crew to the site. Immediate action shall be taken to safeguard the public at any time if the failure is of nature that causes hazardous condition.

If the fault cannot be permanently repaired immediately, a temporary repair or remedial measure sufficient to safeguard the operation of the City ITS shall be effected by the Maintenance team and HMDA shall be so notified. Permanent repairs shall be completed as soon as possible, and in all cases within 96 hours of notification unless extended in unusual circumstances, such as lack of a particular foreign spare part.

The downtime of corrective maintenance that is not attributable to Maintenance team will be determined by mutual negotiation. The Chief Maintenance Engineer shall report unavoidable downtime including response time and resolution time through Traffic Management Chief, and HMDA shall assess the downtime and permit the Maintenance team to consider the downtime for the calculation of the service levels.

14.1 Inspection of Faulty Parts

The Maintenance team shall inspect the faulty parts and submit a report describing the nature of the failure to the HMDA together with his opinion whether the failure is caused by defect, inappropriate operation, act by the third party, normal wear and tear or other reasons.

14.2 Fault Report and Work Order

Each and every corrective maintenance and accident repair work shall be documented on the fault report form and work order form by Maintenance team. The Chief Maintenance Engineer shall

prepare and submit the form together with the list of inspection items for the approval of HMDA through Traffic Management Chief. A copy of completed work order forms shall be submitted with the monthly invoice.

14.3 Maintenance Records and Reports

The Chief Maintenance Engineer shall prepare and submit a monthly records and reports in the form and contents as specified herein and as agreed with HMDA through Traffic Management Chief.

The Maintenance team shall maintain a comprehensive record of all maintenance and repair activities and spare parts consumptions and inventory. The records shall include as a minimum maintenance check lists, fault reports, spare parts receiving and consumption records, and work orders. These records shall be kept in a database and various operations including but not limited to search and retrieval of fault record by specified key, statistical processing of records into performance index, and parameters.

Part D: Service Level Requirement

15. Service Level Requirements

15.1 Definition on Service Level Requirements

The terms used in Part D: Service Level Requirement have the meaning described hereunder.

Availability:	Availability means electronic equipments and software operating normally for its intended function. Availability can be calculated on a monthly, quarterly, half yearly and yearly moving average of each unit of the sub systems. However, in this specification, availability is calculated on quarterly in order to harmonize with quarterly payment. The term "availability" shall mean the time period for which the specified services/components with specified technical and service standards are available to the Employer and users. Availability, in percentage, of any component (Non IT & IT) can be calculated as: $Availability = (1 - \frac{Downtime - ScheduledDowntime}{Totaltime - ScheduledDowntime}) * 100$
Downtime:	"Downtime" shall mean the time period for which the specified services/components with specified technical and service standards are not available to the Employer and users.
Scheduled downtime:	"Scheduled downtime" is time period required for preventative maintenance, corrective maintenance, new initiatives undertaken by the Contractor or performance enhancement measures with approval of the Employer. It shall not be considered while calculating availability.
Response time:	Response time is time period, for corrective maintenance, from receiving notification of failure at ITS Centre to arriving at the maintenance job site
Resolution time:	Resolution time is time period, for corrective maintenance, from arriving at the maintenance job site of failure to completing the permanent or temporary remedial measure
Customer Assistance	"Customer Assistance" means the 24X7X365 support to provide information on the road, weather, traffic condition through phone to road users.
Quarterly Billing Value (QBV)	Quarterly Billing Value (QBV) is the amount claimed based on price bid by the Contractor for every quarter for delivering the O&M services as specified in the Employer's Requirement.
Service Level Table	Service level table is the table showing the expected service levels of the Employer and service level measurement and payment criteria for O&M services delivered by the Contractor during the O&M period.
Foreign spare parts:	Spare parts which are manufactured in foreign countries and are not regularly available in India.

15.2 Service Level Requirements

Service level means the operation & maintenance service delivery criteria established for the services specified in service table. The purpose of Service Levels specified in the Service Levels Tables is to clearly define the levels of service which shall be provided by City ITS Operation and Maintenance (hereinafter referred to as "O&M") team to HMDA during O&M period i.e. Five Years from the date of Final Acceptance Certificate. The service level parameters mentioned in the service level table shall be measured on a quarterly basis as per the individual service level parameter requirements, through appropriate service level measurement tool like Enterprise Management Solution (EMS)/Network Management System (NMS). Measurement of service levels for systems shall be automatic using reports from appropriate management tool like EMS. Measurement of service levels for services, which are not delivered using a dedicated tool, will be carried out using appropriate and relevant reports from the Service Desk tool for ticket open and close times. For such services, the City ITS O&M team will create a ticket for every service rendered. For services delivered using dedicated tools, measurement of service levels will be carried out using appropriate and relevant reports from the respective tools

Measurement of Service Level parameters will be carried out on cumulative basis in a quarter. Non meeting service levels would attract a penalty for every hour of downtime beyond the downtime permissible.

The City ITS O&M team needs to ensure that the service levels as per service level table being compiled. The City ITS O&M team needs to submit service level report along with the quarterly payment invoice. In the event the service level is not achieved, service level penalty as applicable on the quarterly payment would be charged as per Service Level Table.

If the performance of the system/services is degraded significantly at any given point in time during the contract and if the immediate measures are not implemented and issues are not rectified to the complete satisfaction of HMDA, then the HMDA will have the right to take appropriate corrective actions including termination of the Agreement.

The City ITS O&M team and HMDA shall regularly review the performance of the services being provided by HMDA and the effectiveness of the Service Levels. The HMDA is responsible for development and implementation of appropriate management tools like EMS/NMS, which shall be basis for all project reviews.

The City ITS O&M team shall report downtime that is not attributable to the team, such as public communication failure or thunderbolt, to HMDA within three (3) days after the failure. The HMDA shall assess the downtime and permit City ITS O&M team to consider downtime for the calculation of service level.

Service Levels Table (Measured quarterly using EMS/NMS)

S..No	Parameter	Formula	Target	Severity	Penalty	Example	How to Measure
1.	**Traffic Control Centre Equipment**						
1	Server Availability (ITSC & Data Back-up Centre and internet servers including the OS, database and any other application	Availability= {1-{[(A-C)/(B-C)] *100}} Where A= Time for which system is down B = Total Time C= Scheduled downtime Total Time shall measured on 24hoursX30daysX3 months basis	Minimum 99.85% Uptime	Critical	Non meeting of service levels would attract a penalty calculated on cumulative basis in quarter 1% of the QBV or Rs. 50,000/- (whichever is higher) for every 1 hour of down time at a stretch or in parts up to total down time of 2 hours. This down time shall be calculated over and above the total hours of downtime permissible. Beyond 2 hours of down time, 2% of the QBV or 1.0 lakh for every 1 hour of entire down time at a stretch or in parts QBV is the Quarterly Billing Value	If downtime is 2 hours more than the permissible downtime total penalty calculation is as follows: Penalty = 2*1% QBV or 2*50,000/- (whichever is higher) If downtime is 3 hours more than the permissible downtime Penalty = 3*2% QBV or 3*1,00,000/- (whichever is higher)	Log reports of the system System log files shall be conclusive and should provide sufficient proof of the availability of the system. O&M team shall have sole responsibility to make the system available as quickly as possible to meet the service level requirements. Any scheduled down time for maintenance shall be with prior written permission from HMDA. Downtime required for maintenance , new initiatives undertaken by O&M team or performance enhancement measures with prior approval of HMDA shall not be considered while calculating availability
2	Operator Console Availability (Traffic Management Chief, Call Centre,CCTV1,CCTV2, VMS, Flood, ATCC, System)		99.85%	Critical			
3	Storage Availability (Including power availability , network availability , availability of links to applications and databases)		99.85%	Critical			
4	Video Wall		99.85%	Critical			
5	Network Connectivity Between ITSC –Data Back-up Centre – Road side equipment		99.70%	Critical			
S..No.	Parameter	Formula	Availability	Severity	Penalty	Example	Measurement

2. Field Equipments Service Levels							
6	Average Uptime Time period of the .ATCC	Availability= {1-{[(A-C)/(B-C)] *100}} Where A= Time for which system is down B = Total Time C= Scheduled downtime Total Time shall measured on 24hoursX30daysX3 months basis	99.00%	Critical	Non meeting of service levels would attract a penalty calculated on cumulative basis in quarter 0.5% of the QBV or Rs. 25,000/- (whichever is higher) for every 1 hour of down time at a stretch or in parts up to total down time of 2 hours.. This down time shall be calculated over and above the total hours of downtime permissible. Beyond 2 hours of down time, 1% of the QBV or 50,000/- for every 1 hour of entire down time at a stretch or in parts	If downtime is 2 hours more than the permissible downtime total penalty calculation is as follows: Penalty = 2*0.5% QBV or 2*25,000/-(whichever is higher) If downtime is 3 hours more than the permissible downtime Penalty = 3*1% QBV or 3*50,000/- (whichever is higher)	Log reports of the system System log files shall be conclusive and should provide sufficient proof of the availability of the system. O&M team shall have sole responsibility to make the system available as quickly as possible to meet the service level requirements. Any scheduled down time for maintenance shall be with prior written permission from HMDA. Downtime required for maintenance , new initiatives undertaken by O&M team or performance enhancement measures with prior approval of The HMDA shall not be considered while calculating availability
7	Average Uptime Time period of the CCTV Camera.						
8	Average Uptime Time period of the FLD.						
9	Average Uptime Time period of the VMS						
10	Average Uptime Time period of UPS						
3. Related Civil & Minor Works Service Levels							
11	Any Physical damage to the Equipment Posts should be restored within 7 days to the normal state			Medium	1% of the QBV or 50,000/- (whichever is higher) for every 2 days of delay		
4. Customer Service Levels							
12	Any complaint /query made by road user/stakeholders to be resolved within 3 days			Medium	0.5% of the QBV or 25,000/- (whichever is higher) for every 2 days of delay		
S..No.	Parameter	Formula	Availability	Severity	Penalty	Example	Measurement
5.Compliances & Reporting procedure Service Levels							

13	Submission of Reports	The O&M team shall submit the monthly reports and reports as requested by HMDA.	Reports for the previous month shall be submitted by the 7th of the next month. Penalty shall be levied only after the 10th of the month of submission.	Medium	1 % of the QBV or 50,000/- (whichever is higher) for every 1 day of delay in submission on an incremental basis to a maximum of 5 %.		
6. Security and Incident management Service Levels							
14	For every Virus attack reported and not resolved within 8 hours			Critical	Rs. 10,000		
15	For every incidence of Denial of service attack.			Critical	Rs. 500,000		
16	For every incidence of Data Theft, O&M team is subject to penalty and / or punishment applicable under the IT act or any other prevailing laws of the State / Country at that point in time, which shall be over and above the said penalty.			Critical	Rs. 500,000		
17	Intrusion (An illegal act of entering, seizing, or taking possession of data hosted by City ITS)			Critical	Rs. 200,000		
18	SPAM (unsolicited bulk messages, especially advertising, indiscriminately)		95.0% (not less than 70%)	Medium	0.5% of Quarterly Billing Value (QBV) for drop in Service level by every 5% on a pro rata basis		
S..No.	Parameter	Formula	Availability	Severity	Penalty	Example	Measurement
7. Training							

19	Participant Pass Rate	(No. of Participants who score at least 80% marks in the first Assessment Test / No. of Participants who took the test)* 100	100%	Critical	For all trainings conducted in a period, 0.01% of TCV (Total Contract Value) for drop in service level by every 10%	If for all trainings conducted in location quarter, Pass percentage is 56%, penalty calculation is as follows : Total drop in service level = (80 - 56) = 24% Total penalty = (24/10)*0.01 = 0.024% of TCV	Retraining to be provided by the successful bidder to all participants scoring less than 80% at no additional cost Score on Assessments done after completion of training. Tests shall be designed by the successful bidder, approved by The HMDA and administered and assessed by HMDA
8. Change Request -Software							
20	Delay in Implementation of Change request from signed off timelines in Change Control Note		Signed off timelines as agreed in Change Control Note		10% of cost for implementation of change request for drop in service level by every 25%	If the Change is implemented in 10.5 days and the signed off timeline with the Employer was 7 days, total penalty calculation is as follows: Total drop in service level = (10.5-7) = 3.5 days = (3.5/7)*100 = 50% Total penalty = (50 / 25)*10% = 20% of cost for implementation of change request	Delay will be calculated against signed-off time lines.

The downtime (In hours) of each component shall be totaled to arrive at the actual penalty leviable. For instance if CCTV1 is down for 1 hours and CCTV2 is down for 2 hours, then total camera downtime shall be 3 hours

Total penalty shall not exceed 20% of QBV in each quarter, If three consecutive quarterly deductions exceed more than 20% of respective QBV, will be considered as an event of default or termination. O&M team has to obtain certification from the HMDA latest by the end of third quarter.

16. Service Level Review Process

- Either The HMDA or O&M team may raise an issue by documenting the business or technical problem, which presents a reasonably objective summary of both points of view and identifies specific points of disagreement with possible solutions.

- A meeting or conference call will be conducted to resolve the issue in a timely manner. The documented issues will be distributed to the participants at least 24 hours prior to the discussion if the issue is not an emergency requiring immediate attention.

- The HMDA and O&M team shall develop an interim solution, if required, and subsequently the permanent solution for the problem at hand. The Project Manager, City ITS project will then communicate the resolution to all interested parties.

- In case the issue is still unresolved, the arbitration procedures described in the Conditions of Contract Part II Conditions of Particular Applications will be applicable.

Reference for preventative maintenance:

City ITS Inspection Item and Cycle

ITSC Server

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
ITSC Server and each Sub-System Server	Appearance condition		○		Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Heat generation		○		Visual and handling check	To checking whether heat is generated of not.
	System server and other equipment		○		Check by tool and visual	To checking condition of damage, overheating and disconnection of wire. The screw should be tightened if necessary.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
UPS	Appearance condition		○		Visual check	To check condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To check the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To checking whether input voltage specific gravity and temperature of liquid is within regulated value or not.

ITSC Video wall

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
LCD display	Appearance condition	○			Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Working condition	○			Visual and handling check	To check display status by handling and update of latest inform
	Measuring voltage	○			Check with instrument	To check whether input voltage is within regulated value or not.
UPS	Appearance condition		○		Visual check	To check condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To check the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To check whether input voltage specific gravity and temperature of liquid is within regulated value or not.

ITSC Operator Console

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
ITS Centre Console	Appearance condition		○		Visual check	To checking condition of dirt, rusting, damage, deformation, and abrasion of coating Cleaning.
	Heat generation		○		Visual and handling check	To check whether heat is generated of not.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
	Image quality of display		○		Visual and operation check	To adjust image quality of display, if necessary.
UPS	Appearance condition		○		Visual check	To checking condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To checking the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To checking whether input voltage specific gravity and temperature of liquid is within regulated value or not.

Firewall & Network equipment

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
Firewall	Appearance condition		○		Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
Network equipment	Appearance condition		○		Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Measuring voltage		○		Check with instrument	To checking whether input voltage is within regulated value or not.

CCTV System

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
CCTV	Appearance condition	○			Visual check	To checking condition of trace of rusting, damage and cleaning lens with using fabric and brush.
	Working condition		○		Visual check	To checking condition of tilt, pan and zooming movement. Calibration.
	Focusing condition		○		Operation check	Adjustment of focus
	Video output condition			○	Visual and operation check	To check condition of image and quality
	Sensitivity condition			○	Visual and operation check	Adjustment of sensitivity condition
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
	Condition of insulation resistance and ground resistance			○	Check with instrument	To check the condition of insulation resistance and ground resistance weather it is within regulated level or not.
	Rusting and damage of support and foundation			○	Visual check	To check condition of rusting, crack or damage of support and foundation including anchor.
Network equipment	Appearance condition		○		Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
UPS	Apparent condition		○		Visual check	To check condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To check the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To check whether input voltage specific gravity and temperature of liquid is within regulated value or not.

Variable Message Sign System

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
Variable message sign	Appearance condition	○			Visual check	To check condition of trace of dewfall or leaking water, rusting, damage, lock, opening and shutting of door. Cleaning
	Working condition of Lighting Function			○	Visual and operation check	To check the luminance and color tone condition.
	Condition of Breaker, Transformer and Surge Protection Device			○	Visual, odor, handling and abnormal noise check	To check condition of defacement, damage, odor, abnormal noise and overheat. Cleaning
	Fixed condition and abnormality check of printed board and relay			○	Visual, odor, handling and abnormal noise check	To check the loose of fixed condition. It should be tightened if necessary. To checking condition of defacement, damage, odor, abnormal noise and overheat.
	Loose of each terminal parts			○	Visual and handling check	To check the condition of loose of terminal parts. The screw should be tightened if necessary.
	Display condition of LED			○	Visual and handling check	To check the loose of fixed condition. It should be tightened if necessary.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
	Condition of insulation resistance and ground resistance			○	Check with instrument	To check the condition of insulation resistance and ground resistance whether it is within regulated level or not.
	Rusting and damage of support and foundation			○	Visual check	To check condition of rusting, crack or damage of support and foundation including anchor.
Network equipment	Appearance condition		○		Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
UPS	Apparent condition		○		Visual check	To check condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To check the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To check whether input voltage specific gravity and temperature of liquid is within regulated value or not.

ATCC System

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
ATCC	Appearance condition	○			Visual check	To check condition of trace of rusting, damage and deformation. To clean lens with using fabric and brush.
	Focusing condition		○		Operation check	Adjustment of focus
	Video output condition			○	Visual and operation check	To check condition of image and quality
	Sensitivity condition			○	Visual and operation check	Adjustment of sensitivity condition
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
	Condition of insulation resistance and ground resistance			○	Check with instrument	To check the condition of insulation resistance and ground resistance whether it is within regulated level or not.
	Rusting and damage of support and foundation			○	Visual check	To check condition of rusting, crack or damage of support and foundation including anchor.
Network equipment	Appearance condition		○		Visual check	To check condition of dirt, rusting, damage, deformation, and abrasion of coating. Cleaning.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
UPS	Apparent condition		○		Visual check	To check condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To check the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To check whether input voltage specific gravity and temperature of liquid is within regulated value or not.

Flood Monitoring System

Equipment	Inspection Object	Frequency of Inspection			Inspection Method	Inspection Item
		Monthly	Bi-Annual	Annual		
FLD: Road side equipment	Appearance condition of observation instruments	○			Visual check	To checking condition of rusting, deformation, damage, and overheat. To clean all observation instruments (Electrode contact type sensor) .
	Working condition of all instruments		○		Visual and operation check	To check measuring condition and calibration of all observation instrument
	Fixed condition of all instruments		○		Visual and handling check	To check the loose of fixed condition. The screw should be tightened if necessary.
	Fixed condition and abnormality check of printed board and relay			○	Visual, odor, handling and abnormal noise check	To check the loose of fixed condition. It should be tightened if necessary. To check condition of deformation, damage, odor, abnormal noise and overheat.
	Loose of each terminal parts			○	Visual and handling check	To check the condition of loose of terminal parts. The screw should be tightened if necessary.
	Condition of insulation resistance and ground resistance			○	Check with instrument	To check the condition of insulation resistance and ground resistance whether it is within recorded level or not.
	Measuring voltage		○		Check with instrument	To check whether input voltage is within regulated value or not.
	Rusting and damage of support and foundation			○	Visual check	To check condition of rusting, crack or damage of support and foundation including anchor.
UPS	Appearance condition		○		Visual check	To check condition of rusting and damage.
	Fixed condition of cable connectivity.			○	Visual check	To check the loose of cable connectivity. The screw should be tightened if necessary.
	Checking voltage, specific gravity and temperature of liquid			○	Check with instrument	To check whether input voltage specific gravity and temperature of liquid is within regulated value or not.

REFERENCE : Forms of Operation Work Report

(Form 1)

Emergency Response Report

Date: (dd/mm/yyyy): _____ **Time: (hh/mm):** _____

Location & Condition of Incident

Section (From JCT – To JCT)	Kilo-Post	Direction	Weather	Road Surface Condition	Traffic Regulation
-					

Vehicle

Owner/Driver Name		Vehicle type/brand	
Owner/Driver Name		Vehicle type/brand	

Vehicle Problem

Overheat	
Engine problem	
Tire punch	
Fuel problem	

Battery/electronic	
Belt/cable	
Others:	

Accident

# of injured	
Hospital to be taken	
Wrecker required?	

Source of Information (✔)

ECB (ID)		HGCL	
Police		Road user	
Patrol team		Others	

Contents:

Record of dispatch of related agencies

Agency	Time to Contacted	Contents
Patrol	:	
Police	:	
Ambulance	:	
Fire Engine	:	
HGCL	:	
Wrecker	:	
Others	:	

Call Record

Time	From/To	Contents

(Form 2)

Call Record

Date: (dd/mm/yyyy) _____ Time: (hh/mm)

Subject				
Time	Contact media	Person contacted	Incoming or Outgoing	Contents
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	
			In・Out	

Contact method: ECB, Mobile, Land phone, or others (specify)

(Form 3)

Record of Work Zone

Date: (dd/mm/yyyy)

No.	Location				Cause	Planned Time		Actual Time		Remark
	Kilo post	From JCT - To JCT	Direction	Regulated Lane		Start	End	Start	End	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

(Form 4)

Daily Report

Date: (dd/mm/yyyy)

Record of Incident

Shift	No. of accidents	No. of accidents with causality	No. of broken vehicles	No. of fallen objects / obstructions	No. of vehicle fire	Others	Remarks
Day Shift							
Night Shift							
Total							

Total Contacts to TCC

Shift	From	N. of calls	Remarks
Day Shift	Mobile		
	Others		
Night Shift	Mobile		
	Others		

Any Particular Record if necessary

Name & Signature of Duty Operators

Shift	Traffic Management Chief	Operator 1	Operator2	Operator 3	Operator 4
Day Shift	(name)				
	(signature)				
Night Shift					

(Form 5A)

Monthly Report (1) Month of , 2013

Day	DoW	No. of contacts for Incidents					Number of Incidents						
		Phones	Police	Maintenance	HMDA	Others	Accident	Causality	Broken Vehicle	Obstruction	Vehicle Fire	Others	Violated
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													
17													
18													
19													
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													
31													
Total													
Grand Total													

(Form 5B)

Monthly Report (2) Month of 2013

Day	Do W	No. of Work Zone		No. of Emergency Contact/Call			No. of Contact/Call			Remark
		Accident	Others	Mobile	Land Phone	Others	Inquiry	Media	Claim	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
Total										
Grand Total										

REFERENCE : Form of Maintenance Work Report

【Form1】

City ITS Maintenance Work Daily Report

Date : (dd/mm/yyyy)

Position	Name	Signature
Chief Maintenance Engineer		

Date DD/MM/YY	Weather _____	Name & Signature of Maintenance Engineer _____
Equipment _____		Working Hours Receiving notification (A) : Start of work (B) : Completion of work (C) :
Response Time (D:B-A) : Resolution Time (E:C-B) : Downtime (F:D+E) :		
Working Location		
Work Content		
Special Instruction or Comment		

【Form 2】

System Error/Equipment Malfunction Report

Date : (dd/mm/yyyy)

Position	Name	Signature
Chief Maintenance Engineer		

Equipment	Name & Signature of Maintenance Engineer
(A) Failure starting Date and Time DD/MM/YY	Response time (D:B-A)
(B) Fixing starting Date and Time DD/MM/YY	Resolution time (E:C-B)
(C) Restoration Date and Time DD/MM/YY	Downtime (D+E)
Location	
Failure System or Equipment	
Content of Repairmen Work	
Special Instruction or Comment	
Propose for Improvement	

【Form 3】

City ITS (Equipment, System) Monthly Preventative Maintenance Schedule（Month of ）

Date: (dd/mm/yyyy) _____

Position	Name	Signature
Chief Maintenance Engineer		

Date	Name of Maintenance Team	Facility Name	Location	Content of Inspection	Scheduled downtime	Comments
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
23						
24						
25						
26						
27						
28						
29						
30						
31						

【Form 4】

City ITS (Equipment, System) Monthly Corrective Maintenance Schedule（Month of ）

Date: (dd/mm/yyyy) _____

Position	Name	Signature
Chief Maintenance Engineer		

Date	Name of Maintenance Team	Facility Name	Location	Content of Inspection	Response Time	Resolution Time	Downtime	Comments
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
23								
24								
25								
26								
27								
28								
29								
30								
31								

07. Cost Estimation for Pilot Project

City ITS Project COST

Price Schedule		Item	Units	Unit Rate	CapEX		Reference No
					From Abroad (in Japanese	Within India (in Rs)	
PS 1 & 2	A	System Design	LS			50,000,000	(1)
	B	Factory Acceptance Test	LS			50,000,000	(2)
	C	ITS Centre System Equipment					
	C1 & C2	ITS Server	LS			10,000,000	(3)
		Web&Msg server	LS			16,000,000	(4)
		Video wall(LCD x 20 units) with video	1		22,000,000		(5)
		Operator Console	LS			1,350,000	(6)
		Printers colour	1	325,000		325,000	(7)
		Printers B/W	1	150,000		150,000	(8)
		Firewall and Network Equipment	1			3,000,000	(9)
		UPS	LS			3,606,000	(10)
		PDB	1			50,000	(11)
		Probe Car System Equipment	LS			111,000,000	(12)
		MET Data System Equipments	LS			6,120,000	(13)
		ATCC Equipments	LS			163,900,000	(14)
		CCTV Equipments	LS			39,900,000	(15)
		FLD Equipments	LS			17,160,000	(16)
		VMS Equipments	LS			200,250,000	(17)
	C3 & C4	Software	LS			102,000,000	(18)
	C7	Interior works	LS			1,000,000	(19)
		Sub Total of PS 1 & 2			**22,000,000**	**775,811,000**	
		Sub Total of PS 1 & 2 (INR)	**1 INR =**		**1.6** Japanese Yen	**789,561,000**	
PS 3	A	Performance Security & Insurance			22,000,000	4,300,000	(20)
	B	Customs Duties, Taxes other charges			385,800,000	52,750,000	(21)
	C	Port handling, clearance, local transport , Insurance during transit etc.			300,000	3,000,000	(22)
		Sub Total of PS 3			408,100,000	60,050,000	
		Sub Total of PS 3 (INR)				**315,112,500**	
PS 4		Installation services including tests			2,200,000	100,599,805	(23)
PS 5		O&M Manuals			24,200,000	13,550,000	(24)
PS 6		Training				8,000,000	(25)
		Sub Total of PS 4 TO PS 6			26,400,000	122,149,805	
		Sub Total of PS 4 TO PS 6 (INR)				**138,649,805**	
						1,243,323,305	
PS 7		O&M Cost for 5 years				325,947,669	(27)
		Mandatory Spare Parts	LS		1,000,000	31,650,000	(28)
		Maintenance Equipment	LS			3,400,000	(29)
		Sub Total of PS 7			1,000,000	360,997,669	
		Sub Total of PS 7 (INR)				**361,622,669**	
		Total Cost				**1,604,945,974**	

1,610,000,000

City ITS O & M Cost

Sl. No.	Designation	Qualification	Experience	No. of Persons per shift	No. of Shifts	Addl. Staff	Total Staff	Salary	Cost per month	Cost/year					Total Cost	Reference No
										10%of increment every year						
										1st year	2nd year	3rd year	4th year	5th year		
A.	**Operation**															
I	**Man Power**															
1	Project Mananger (50%)	B Tech (IT/EC/EE)	15+ years	1	1	0	1	150,000	75,000	900,000	990,000	1,089,000	1,197,900	1,317,690	5,494,590	
	Operation Team															
2	Traffic Management Chief	B Tech (EC/EE)	10+ years	1	1	0	1	70,000	70,000	840,000	924,000	1,016,400	1,118,040	1,229,844	5,128,284	
3	Operators															
a	Call Centre	Three languages		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
b	CCTV1 (CCTV/Video Wall)	Degree with Computers /IT		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
c	CCTV2	Degree with Computers /IT		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
d	VMS	Three languages		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
e	Flood (Flood/MET)	Degree with Computers /IT		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
f	ATCC (ATCC/Probe/Static Data	Degree with Computers /IT		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
g	System	B Tech (IT/EC/EE)	8+ years	1	3	1	4	50,000	200,000	2,400,000	2,640,000	2,904,000	3,194,400	3,513,840	14,652,240	
h	Back up	Three languages		1	3	1	4	20,000	80,000	960,000	1,056,000	1,161,600	1,277,760	1,405,536	5,860,896	
4	Managerial & Administrative Staff			2	1	0	2	20,000	40,000	480,000	528,000	580,800	638,880	702,768	2,930,448	
5	Supporting Staff	10th		2	3	1	7	8,000	56,000	672,000	739,200	813,120	894,432	983,875	4,102,627	
II	Administrative Experiences	LS						50,000	50,000	600,000	660,000	726,000	798,600	878,460	3,663,060	
III	Office Vehicle	1	No.					30,000	30,000	360,000	396,000	435,600	479,160	527,076	2,197,836	
								Sub Total (A)	1,081,000	**12,972,000**	**14,269,200**	**15,696,120**	**17,265,732**	**18,992,305**	**79,195,357**	
B.	**Maintenance**															
I	**Man power**															
1	Project Mananger (50%)	B Tech (IT/EC/EE)	15+ years	1	1	0	1	150,000	75,000	900,000	990,000	1,089,000	1,197,900	1,317,690	5,494,590	
	Maintenance Team															
2	Chief Maintenance Engineer	B Tech (IT/EC/EE)	10+ years	1	1	0	1	70,000	70,000	840,000	924,000	1,016,400	1,118,040	1,229,844	5,128,284	
3	Electrical Engineer	B Tech (EC/EE)	10+ years	1	3	1	4	50,000	200,000	2,400,000	2,640,000	2,904,000	3,194,400	3,513,840	14,652,240	
4	Information Technology Engineer	B Tech (IT/EC/EE)	10+ years	1	3	1	4	50,000	200,000	2,400,000	2,640,000	2,904,000	3,194,400	3,513,840	14,652,240	
5	Technicians	Diploma (IT/EC/CE)		2	3	2	8	30,000	240,000	2,880,000	3,168,000	3,484,800	3,833,280	4,216,608	17,582,688	
6	Supporting staff	ITI		1	3	1	4	10,000	40,000	480,000	528,000	580,800	638,880	702,768	2,930,448	
7	Office Subordinates	10th		1	3	1	4	8,000	32,000	384,000	422,400	464,640	511,104	562,214	2,344,358	
II	Administrative Experiences	LS						50,000	50,000	600,000	660,000	726,000	798,600	878,460	3,663,060	
III	Generator	LS	12lts/hr					200,000	200,000	2,400,000	2,640,000	2,904,000	3,194,400	3,513,840	14,652,240	
IV	Patrol Vehicles	2	Nos					75,000	150,000	1,800,000	1,980,000	2,178,000	2,395,800	2,635,380	10,989,180	
								Sub Total	1,257,000	15,084,000	16,592,400	18,251,640	20,076,804	22,084,484	92,089,328	
V	**Equipment Maintenance**									**1%**	**1%**	**4%**	**7%**	**10%**		
						Qty	Total Cost Rs	Cost per Unit in Rs		First Year	2nd Year	3rd Year	4th Year	5th Year	Total	
1	ITSC	**1 INR =**	**1.6** Japanese Yen			1	89,224,684	89,224,684		892,247	892,247	3,568,987	6,245,728	8,922,468	20,521,677	
2	Probe Car System					1	56,000,000	56,000,000		560,000	560,000	2,240,000	3,920,000	5,600,000	12,880,000	
3	Meteorological Monitoring System					1	3,500,000	3,500,000		35,000	35,000	140,000	245,000	350,000	805,000	
4	CCTV					56	51,620,000	921,786		516,200	516,200	2,064,800	3,613,400	5,162,000	11,872,600	
5	ATCC					70	135,700,000	1,938,571		1,357,000	1,357,000	5,428,000	9,499,000	13,570,000	31,211,000	
6	FLD					14	11,700,000	835,714		117,000	117,000	468,000	819,000	1,170,000	2,691,000	
7	VMS					28	195,870,000	6,995,357		1,958,700	1,958,700	7,834,800	13,710,900	19,587,000	45,050,100	
								Sub Total		5,436,147	5,436,147	21,744,587	38,053,028	54,361,468	125,031,377	
								Sub Total (B)		**20,520,147**	**22,028,547**	**39,996,227**	**58,129,832**	**76,445,953**	**217,120,706**	
								Total O & M Cost (A+B)		**33,492,147**	**36,297,747**	**55,692,347**	**75,395,564**	**95,438,258**	**296,316,063**	
								Profit(10%)		3,349,215	3,629,775	5,569,235	7,539,556	9,543,826	29,631,606	
								Grand Total		**36,841,362**	**39,927,522**	**61,261,582**	**82,935,120**	**104,982,084**	**325,947,669**	**(27)**
								Percentage of O&M Cost		**11%**	**12%**	**19%**	**25%**	**32%**		
								Percentage of Total City ITS Cost		**2.295%**	**2.488%**	**3.817%**	**5.167%**	**6.541%**	**20.309%**	
								Based on HGCL's Payment Criteria		**2.00%**	**2.00%**	**4.00%**	**5.00%**	**7.00%**	**20.00%**	

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	Reference No
A	System Design										
A1	Complete System Design and Obtain Approval from the Employer's Representative	LS	1						50,000,000	50,000,000	
	Sub-total for A						**0**			**50,000,000**	(1)
B	Factory Acceptance Test										
B1	Factory Acceptance tests at Place of manufacture including travel and subsistence costs of Employer/Employer's Representative in attending the test	LS	1						30,000,000	30,000,000	
B2	Factory Acceptance Test for integration test of all sub-systems of the ITSC	LS	1						20,000,000	20,000,000	
	Sub-total for B						**0**			**50,000,000**	(2)
C	ITS Centre System Equipment										
C1	ITSC Server	No	2						5,000,000	10,000,000	(3)
C2	Web & MSG Server	No	2						8,000,000	16,000,000	(4)
C3	Video Wall (LCD 55inch) *20set	No	1			20,000,000	20,000,000			0	(5)
C4	Video Switches	No	1			2,000,000	2,000,000			0	(5)
C5	Operator Console for Traffic Management Chif (Three Monitors)	No	1						150,000	150,000	(6)
C6	Operator Console for Call Center (Two Monitors)	No	1						120,000	120,000	(6)
C7	Operator Console for CCTV (Two Monitors)	No	1						120,000	120,000	(6)
C8	Operator Console for Video Wall (Two Monitors)	No	1						120,000	120,000	(6)
C9	Operator Console for VMS (Two Monitors)	No	1						120,000	120,000	(6)
C10	Operator Console for Flood/MET (Two Monitors)	No	1						120,000	120,000	(6)
C11	Operator Console for ATCC/Probe/Static Data Analyzer (Two Monitors)	No	1						120,000	120,000	(6)
C12	Operator Console for System Operator (Two Monitors)	No	1						120,000	120,000	(6)
C13	Operator Console as spara (Two Monitors)	No	1						120,000	120,000	(6)
C14	Operator Console for HMDA (Two Monitors)	No	1						120,000	120,000	(6)
C15	Operator Console for Traffic Police (Two Monitors)	No	1						120,000	120,000	(6)
C16	Operations Laser Printer (Colour)	No	1						325,000	325,000	(7)
C17	Operations Laser Printer (Black)	No	1						150,000	150,000	(8)
C18	Firewall and Network Equipment	LS	1						3,000,000	3,000,000	(9)
C19	Uninterruptible Power Supply (UPS) For Server Rack	No	5						500,000	2,500,000	(10)
C20	Uninterruptible Power Supply (UPS) For Operator Consoles (0.5KVA)	No	11						50,000	550,000	(10)
C21	Uninterruptible Power Supply (UPS) For Operator Consoles (1.0KVA)	No							50,000	0	(10)
C22	Uninterruptible Power Supply (UPS) For Operator Consoles (1.5KVA)	No							50,000	0	(10)
C23	Uninterruptible Power Supply (UPS) For Video Wall（10.0KVA）	No	1						556,000	556,000	(10)
C24	Power Distribution Board (PDB)	No	1						50,000	50,000	(11)
C25	Interior works at Operation and Server Rooms at ITSC	LS	1						1,000,000	1,000,000	(19)
C26	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for C						**22,000,000**			**35,481,000**	
D	Software										
D1	ITSC Server Software	No	2						50,000,000	100,000,000	(18)
D2	Web & MSG Server Software	No	2						1,000,000	2,000,000	(18)
D3	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for D						**0**			**102,000,000**	
E	Probe Car System Equipment										
E1	Probe Server	No	2						5,000,000	10,000,000	
E2	Probe Server Software	No	2						50,000,000	100,000,000	
E3	Network Equipment (APSRTC)	No	1						1,000,000	1,000,000	
E4	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for E						**0**			**111,000,000**	(12)
F	Meteorological Monitoring System Equipment										
F1	MET Server	No	2						1,500,000	3,000,000	
F2	MET Server Software	No	2						1,000,000	2,000,000	
F3	MET Workstation (APSDPS)	No	1						120,000	120,000	
F4	Network Equipment (APSDPS)	No	1						1,000,000	1,000,000	
F5	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								

	Sub-total for F						**0**			**6,120,000**	(13)
G	Automatic Traffic Counters-cum-classifier System Equipment										
G1	ATCC Server	No	2						3,000,000	6,000,000	
G2	ATCC Server Software	No	2						2,400,000	4,800,000	
G3	Image recognition detector (including Processing unit)	No	70						1,730,000	121,100,000	
G4	Network Equipment	No	42						500,000	21,000,000	
G5	Media Converter	No	42						50,000	2,100,000	
G6	Cabinet	No	44						100,000	4,400,000	
G7	Pole TYPE-A (including manufacturing and galvanizing)	No	26						100,000	2,600,000	
G8	Pole TYPE-B (including manufacturing and galvanizing)	No	15						100,000	1,500,000	
G9	Pole TYPE-C (including manufacturing and galvanizing)	No	1						100,000	100,000	
G10	Pole TYPE-D (including manufacturing and galvanizing)	No	2						150,000	300,000	
G11	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for G						**0**			**163,900,000**	(14)
H	Closed Circuit Television Camera System Equipment										
H1	CCTV Server	No	2						3,000,000	6,000,000	
H2	CCTV Server Software	No	2						500,000	1,000,000	
H3	CCTV Camera (including CCTV Controller)	No	56						400,000	22,400,000	
H4	Network Equipment	No	14						500,000	7,000,000	
H5	Media Converter	No	14						50,000	700,000	
H6	Cabinet	No	14						100,000	1,400,000	
H7	Pole (including manufacturing and galvanizing)	No	14						100,000	1,400,000	
H8	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for H						**0**			**39,900,000**	(15)
I	Flood Monitoring System Equipment										
I1	FLD Server	No	2						1,500,000	3,000,000	
I2	FLD Server Software	No	2						500,000	1,000,000	
I3	Flood Monitoring Detector	No	42						170,000	7,140,000	
I4	Processing Unit	No	14						430,000	6,020,000	
I5	Pole (including manufacturing and galvanizing)	No							100,000	0	
I6	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for I						**0**			**17,160,000**	(16)
J	Variable Message Sign System Equipment										
J1	VMS Server	No	2						1,500,000	3,000,000	
J2	VMS Server Software	No	2						3,000,000	6,000,000	
J3	VMS Board	No	28						5,000,000	140,000,000	
J4	VMS Controller	No	28						1,000,000	28,000,000	
J5	Network Equipment	No	28						500,000	14,000,000	
J6	TYPE-A GantryTYPE (including manufacturing and galvanizing)	No	3						1,000,000	3,000,000	
J7	TYPE-B Cantilever support (including manufacturing and galvanizing)	No	7						250,000	1,750,000	
J8	TYPE-C Cantilever support (including manufacturing and galvanizing)	No	18						250,000	4,500,000	
J9	Any other item(s) considered necessary to comply with the Scope of Works	LS	1								
	Sub-total for J						**0**			**200,250,000**	
	Total for Item Nos. A to J						**22,000,000**			**775,811,000**	(17)
K	Mandatory Spare Parts										
K1	Operator Console	No	1				0		100,000	100,000	
K2	55 inch LCD display panel	No	1			1,000,000	1,000,000			0	
K3	ATCC Sensor unit	No	5				0		300,000	1,500,000	
K4	ATCC processing unit printed circuit board (each type)	No	5				0		1,000,000	5,000,000	
K5	ATCC power supply unit	No	5				0		430,000	2,150,000	
K6	CCTV camera	No	5				0		200,000	1,000,000	
K7	CCTV processing unit printed circuit board (each type)	No	5				0		100,000	500,000	
K8	CCTV power supply unit	No	5				0		100,000	500,000	

K9	FLD sensor	No	3				0		170,000	510,000	
K10	FLD processing unit printed circuit board (each type)	No	3				0		330,000	990,000	
K11	FLD power supply unit	No	3				0		100,000	300,000	
K12	VMS LED display unit	No	50				0		250,000	12,500,000	
K13	VMS printed circuit board (each type)	No	5				0		250,000	1,250,000	
K14	VMS power supply unit	No	5				0		250,000	1,250,000	
K15	VMS ventilation fan	No	5				0		50,000	250,000	
K16	Centre Network Equipment	No	1				0		1,000,000	1,000,000	
K17	Media Convertor	No	5				0		50,000	250,000	
K18	Roadside Network Equipment	No	5				0		500,000	2,500,000	
K19	Lightning arrestor or equivalent	No	5				0		20,000	100,000	
	Sub-total for K						**1,000,000**			**31,650,000**	(28)
L	Maintenance Equipment										
L1	Maintenance computer (notebook computer)	No	4						100,000	400,000	
L2	Digital Multi meter	No	4						20,000	80,000	
L3	Insulation Resistance Meter	No	4						15,000	60,000	
L4	Dielectric strength meter	No	4						150,000	600,000	
L5	Ground Resistance Meter	No	4						15,000	60,000	
L6	Oscilloscope	No	1						200,000	200,000	
L7	Network analyser	No	1						2,000,000	2,000,000	
	Sub-total for L						**0**			**3,400,000**	(29)
	Total for Items L and L						**1,000,000**			**35,050,000**	
	Price Schedule No.1 design, manufacture and supply of plant and equipment (including mandatory spare parts and maintenance equipment) supplied from abroad									**825,236,000**	
	Price Schedule No.2 design, manufacture and supply of plant and equipment (including mandatory spare parts and maintenance equipment) supplied from within India										

Price Schedule No.3

Item Nos	Description	Unit	Quantity	Rate		Amount		Reference No
				Foreign Currency(*)	Indian Rupees(Rs)	Foreign Currency(*)	Indian Rupees(Rs)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
A	Preliminary							
A1	Provision of Performance Security	LS	1	4,000,000	300,000	4,000,000	300,000	
A2	Insurance							
A2.1	Insurance for Works and Contractor's equipment	LS	1	5,000,000	2,000,000	5,000,000	2,000,000	
A2.2	Insurance against Injury to persons and damage to property	LS	1	12,000,000	2,000,000	12,000,000	2,000,000	
A2.3	Insurance for workers	LS	1	1,000,000		1,000,000	0	
	Sub-total for Item A					**22,000,000**	**4,300,000**	(20)
B	Customs Duties and Taxes and Other Charges for Plant and Equipment (including Mandatory Spare Parts and Maintenance Equipment) supplied from Abroa							
B1	ITS Centre System equipment	LS	1		15,000,000	0	15,000,000	
B2	Software	LS	1	22,800,000		22,800,000	0	
B3	Probe Car System equipment	LS	1	105,000,000	6,700,000	105,000,000	6,700,000	
B4	Meteorological Monitoring (MET) System equipmen	LS	1	9,000,000	7,900,000	9,000,000	7,900,000	
B5	Automatic Traffic Counters-cum-classifier (ATCC) System equipmen	LS	1	9,000,000	2,800,000	9,000,000	2,800,000	
B6	Closed Circuit Television (CCTV) Camera System equipment	LS	1	12,000,000	5,500,000	12,000,000	5,500,000	
B7	Flood Monitoring (FLD) System equipment	LS	1	9,000,000	3,800,000	9,000,000	3,800,000	
B8	Variable Message Sign (VMS) System equipmen	LS	1	219,000,000	6,800,000	219,000,000	6,800,000	
B9	Mandatory spare parts	LS	1		3,500,000	0	3,500,000	
B10	Maintenance equipment	LS	1		750,000	0	750,000	
	Sub-total for Item B					385,800,000	52,750,000	(21)
C	Port Handling, Port Clearance, Local Transportation, Insurance during Transit and other Incidental Service							
C1	Plant and equipment (including mandatory spare parts and maintenance equipment) supplied from abroad	LS	1	300,000	2,000,000	300,000	2,000,000	
C2	Plant and equipment (including mandatory spare parts and maintenance equipment) supplied from within India	LS	1		1,000,000	0	1,000,000	
C3	Other Incidental services not specifically described in Price Schedules but considered necessary to comply with the Scope of Works	LS	1			0	0	
	Sub-total for Item C					300,000	3,000,000	(22)
	Total for Price Schedule No.3 Port handling, port clearance, local transportation, insurance and other incidental services including customs taxes and duties and other charges for plant and equipment (including mandatory spare parts and maintenance equipment) supplied from abroad and within Employer's country					408,100,000	60,050,000	
						1.52	328,536,842	

Price Schedule No.4

Item Nos	Description	Unit	Quantity	Rate		Amount		Reference No
				Foreign Currency(*)	Indian Rupees(Rs)	Foreign Currency(*)	Indian Rupees(Rs)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
A	Installation Services							
A1	ITS Centre (ITSC) System complete with ITSC Server with External Storage Device, Web & MSG Server, Video Wall, Video Switches, Operator Console for Traffic Management Chif, Operator Console for Call Center, Operator Console for Video Wall, Operator Console for FLD/MET, Operator Console for ATCC/Probe/Static Data Analyzer, Operator Console for System, Operator Console for Traffic Police, Operations Laser Printer (Colour), Operations Laser Printer (Black), Firewall and Network Equipment, Un-interupted Power Supply (UPS) For Servers Rack, Un-interupted Power Supply For Operator Consoles,Un-interupted Power Supply For Video Wall, Power Distribution Board (PDB), power and data cable, cable laying and	Set	1	2,200,000	13,748,100	2,200,000	13,748,100	
A2	Probe Car System complete with Probe Server, Network Equipment, power and data cable, cable laying and termination, grounding and interior works.	Set	1		11,100,000		11,100,000	
A3	MET System equipment complete with MET Server, Workstation, Network Equipment, power and datacable, cable laying and termination, for MET and control software.	Set	1		612,000		612,000	
A4	ATCC System equipment complete with ATCC Server, Image recognition detector and processing unit, Network Equipment, Media Converter, Cabinet, power and datacable, cable laying and termination, grounding, for ATCC and control software.	Set	70		228,143		15,970,000	
A5	Construction of foundation and erection of pole for TYPE-A	No	26		10,000		260,000	
A6	Construction of foundation and erection of pole for TYPE-B	No	15		10,000		150,000	
A7	Construction of foundation and erection of pole for TYPE-C	No	1		10,000		10,000	
A8	CCTV Camera System equipment complete with CCTV Server, Operator Console for CCTV, CCTV Camera and Controller, Network Equipment, Media Converter, Cabinet, power and datacable, cable laying and termination, grounding, for CCTV and control software.	Set	56		68,750		3,850,000	
A9	Construction of foundation and erection of pole	No	1		140,000		140,000	
A10	FLD System equipment complete with FLD Server, Flood Monitoring Detector, Processing Unit, Network Equipment, power and datacable, cable laying and termination, grounding, for FLD and control software.	Set	14		122,571		1,716,000	
A11	Construction of foundation and erection of pole	No	13		0		0	
A12	VMS System equipment complete with VMS Server, Operator Console for VMS, VMS Board, VMS Controller, Network Equipment, power and datacable, cable laying and termination, grounding, for VMS and control software.	Set	28		682,143		19,100,000	
A13	Construction of foundation and erection of gantry for TYPE-A	No	3		100,000		300,000	
A14	Construction of foundation and erection of gantry for TYPE-B	No	7		25,000		175,000	
A15	Construction of foundation and erection of gantry for TYPE-C	No	18		25,000		450,000	
	Sub-total for Item Nos. A1 to A16					**2,200,000**	**67,581,100**	
B	Test on Completion for a Portion of Works							
B1	Acceptance test of ITSC system	No	1		6,874,050		6,874,050	
B2	Acceptance test of Probe Car system	No	1		5,550,000		5,550,000	
B3	Acceptance test of MET system	No	1		306,000		306,000	
B4	Acceptance test of ATCC system	No	70		117,071		8,195,000	
B5	Acceptance test of CCTV system	No	56		35,625		1,995,000	
B6	Acceptance test of FLD system	No	14		61,286		858,000	
B7	Acceptance test of VMS system	No	28		357,589		10,012,500	
	Sub-total for Item Nos. B1 to B8					**0**	**33,790,550**	
C	Test on Completion for the Works							
C1	Test on Completion for the Works	LS	1		3,379,055		3,379,055	
	Sub-total for Item Nos. C1					**0**	**3,379,055**	
	Total for Price Schedule No.4 Installation Services including Tests					**2,200,000**	**104,750,705**	(23)

1.52 106,198,073

Price Schedule No.5

Item Nos	Description	Unit	Quantity	Rate		Amount		Reference No
				Foreign Currency(*)	Indian Rupees(Rs)	Foreign Currency(*)	Indian Rupees(Rs)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1	System Design Manual	LS	1	5,000,000	1,000,000	5,000,000	1,000,000	
2	System Operation's manual	LS	1	5,000,000	1,000,000	5,000,000	1,000,000	
3	Software Manual	LS	1	10,000,000	1,500,000	10,000,000	1,500,000	
4	Hardware Manual	LS	1		3,000,000	0	3,000,000	
5	Maintenance Manual	LS	1	2,000,000	3,000,000	2,000,000	3,000,000	
6	Manager's manual	LS	1		1,000,000	0	1,000,000	
7	Operator's manual	LS	1		1,000,000	0	1,000,000	
8	As-Built Drawings	LS	1		1,000,000	0	1,000,000	
9	Other Documentation (including spare parts drawings and catalogue) considered necessary to comply with the Scope of Works	LS	1	2,200,000	1,050,000	2,200,000	1,050,000	
	Total for Price Schedule No.5 Operation and Maintenance Manuals, As-built Drawings and Other Documentations					24,200,000	**13,550,000**	(24)
						1.52	29,471,053	

Price Schedule No.6

Item Nos	Description	Unit	Quantity	Rate		Amount		Reference No
				Foreign Currency(*)	Indian Rupees(Rs)	Foreign Currency(*)	Indian Rupees(Rs)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
1	Management and Operations Training	LS	1		4,000,000		4,000,000	
2	Maintenance Training	LS	1		4,000,000		4,000,000	
	Total for Price Schedule No.6 Training						**8,000,000**	(25)

	As per estimate			As per Payment criteria	
Cost of Works	180	84.91		80%	169.6
Cost of O&M	32	15.09		20%	42.4
Total Contract Cost	**212**	100.00		100	**212**

Release of Performance Security

	Time		Performance Security with HGCL	Release of Performance Security			Performance Security with HGCL	Release of Performance Security	
Commencement	T	10% Total Contract Price	21				21		
Final Acceptance Certificate	T+18 months	50% of PS of Works+ PS of O&M Cost	12	9			12.6	8.4	
Defect Liability Period	T+18 months+ 2 Years	50% of Remaining PS of Works+ 50% of PS of O&M Cost	1.5	9	1.5		2.1	8.4	2.1
Taking Over Certificate	T+18 months+ 2 Years+3 Years	Remaining PS of O&M Cost			1.5				2.1

Release of Retention Money

	Time		Retention Money with HGCL	Release of Retention Money			Retention Money with HGCL	Release of Retention Money	
Commencement	T		0				0		
Final Acceptance Certificate	T+18 months	10% cost of works	18	9			16.8	8.4	
Defect Liability Period	T+18 months+ 2 Years	50% of (10% cost of works)+ 10% of 2 years O&M Cost	9+1.2	9			8.4+1.68	8.4	
Taking Over Certificate	T+18 months+ 2 Years+3 Years	10% of 2 years O&M Cost+ 10% of 3 years O&M Cost	1.2+1.8		3		1.68+2.52		4.2

HGCL's Proposed Payment Criteria

Price Schedule Item No.	Cost Component	Percentage of Total Cost (As per Estimate)	HGCL's Proposed Payment Criteria	Proposed Payment* (% of Total Cost)	
1	2	3	4	5	
PS 1&2	Works cost	68.744	80%	64.81%	
PS 3		11.380		10.73%	
4		4.172		3.93%	
5		0.205		0.19%	
6		0.354		0.33%	
Sub Total 1 to 6		84.855		80.00%	
7	O&M Cost	1.528	20%	1st Year	2.00%
		1.647		2nd Year	2.00%
		2.809		3rd Year	4.00%
		3.985		4th Year	5.00%
		5.175		5th Year	7.00%
		15.145		20%	
Total		100	100%	100%	

*Formula to be adopted for payment

$$\text{Proposed Payment of PS Item (1 to 6)} = \frac{\text{Cost of Item(1 to 6)* 80\%}}{\text{Sum of Cost of Item 1 to 6}}$$

Example:

$$\text{Proposed payment for PS 1 \&2} = \frac{\text{Cost of Item 1 \& 2}}{\text{Sum of Cost of Item 1 to 6}} = \frac{68.744 * 80\%}{84.855} = 64.81\%$$

$$\text{Proposed payment for PS 3} = \frac{\text{Cost of Item 3}}{\text{Sum of Cost of Item 1 to 6}} = \frac{11.38 * 80\%}{84.855} = 10.73\%$$

Performance Security

	Time	Performance Security (PS) with HGCL	Release of Performance Security (PS)
Commencement	T	10% Total Contract Price	
Final Acceptance Certificate	T+18 months	60% of PS	40% of PS
Defect Liability Period	T+18 months+ 2 Years	30% of PS	30% of PS
Taking Over Certificate	T+18 months+ 2 Years+3 Years		30% of PS

Retention Money

	Time	Retention Money (RM) with HGCL	Release of Retention Money (RM)
Commencement	T		
Final Acceptance Certificate	T+18 months	50% of Works RM	50% of Works RM
Defect Liability Period	T+18 months+ 2 Years	50 % of O&M RM of 2 years	50% of Works RM + 50 % of O&M RM of 2 Years
Taking Over Certificate	T+18 months+ 2 Years+3 Years		Balance RM

08. Supplemental Traffic Survey

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INTRODUCTION

Background

Hyderabad is a vast city of more than 1,900 sq. km area. The City is primarily spread out in a radial fashion, as can be determined based on the existing road network. The road network of Hyderabad is as noted below:

External Roads Network of Hyderabad

- National Highways (NH)
  - NH 7 on the South towards Bangalore
  - NH 9 on the West towards Mumbai
  - NH 7 on the North towards Nagpur
  - NH 202 on the East towards Warangal
  - N 9 on the East towards Vijayawada
- State Highways (SH)
  - SH on the West towards Shankarpalli
  - SH on the North towards Narsapur
  - SH on the North towards Karimnagar
  - SH on the South towards Nagarjuna Sagar
  - SH on the South towards Srisailam
- Other Roads connecting rural locations

Major Internal Road Network of Hyderabad

- Inner Ring Road
- Radial Roads
- Outer Ring Road

The Inner Ring Road is located around the core area of the City. The Outer Ring Road is located towards the outer boundary of the city. The Radial Roads generally connect the Inner Ring Road and the Outer Ring Road. Figure 1 shows the existing road network map of Hyderabad. Table 1 to Table 3 show the information for the Outer Ring Road, Inner Ring Road and Radial Roads respectively.

Purpose of Traffic Survey

Several segments of the Inner Ring Road and Radial Roads are congested. It is proposed to introduce Intelligent Transportation Systems (ITS) in the internal road network of Hyderabad. This report was prepared for the "Assistance for the Introduction of ITS on road network in Hyderabad Metropolitan area in India" project. The broad scope of this Traffic Survey is:

- Obtain Traffic Volume Data
- Obtain Origin-Destination road side interview

This report, "Volume 1 – Traffic Volume Data Collection" describes the Traffic Volume Data collection and the preliminary analysis.

The report, "Volume 2 – Origin-Destination Data Collection" describes the Origin-Destination Data collection and the preliminary analysis.

Figure 1: Existing Road Network Map

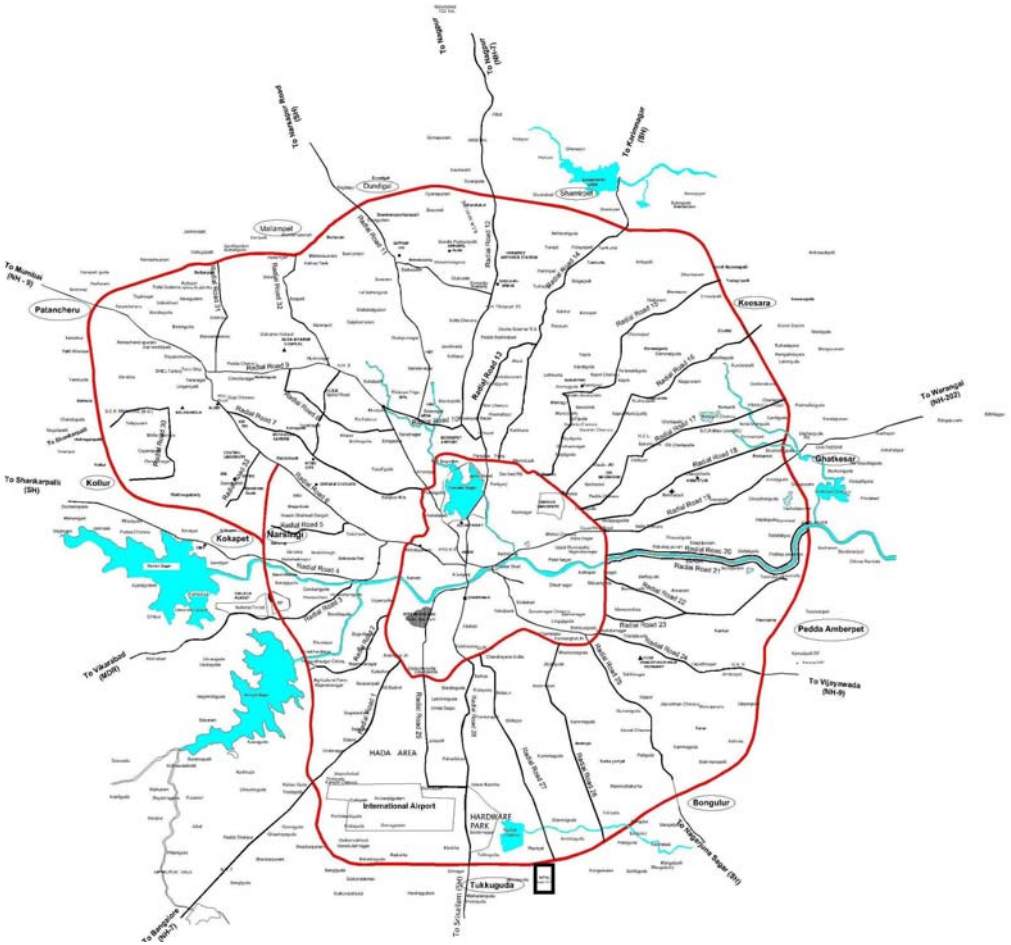

Table 1: Outer Ring Road Information

Segment - From	Segment - To	Service Road		Outer Ring Road	
		Lanes	Speed Limit (KMPH)	Lanes	Speed Limit (KMPH)
Gatchibowli	Narsingi	2 lanes - each side	30	8LD	120
Narsingi	APPA	2 lanes - each side	30	8LD	120
APPA	Rajendra Nagar	2 lanes - each side	30	8LD	120
Rajendra Nagar	Samshabad	2 lanes - each side	30	8LD	120
Narsingi	Kokapet	2 lanes - each side	30	8LD	120
Kokapet	Kollur	2 lanes - each side	30	8LD	120
Kollur	Patancheru	2 lanes - each side	30	8LD	120
Patancheru	Gandigudem	2 lanes - each side	30	8LD	120
Gandigudem	Dundigal	2 lanes - each side	30	8LD	120
Dundigal	Surarguda (Medchal Road)	2 lanes - each side	30	8LD	120
Surarguda (Medchal Road)	Shamirpet	2 lanes - each side	30	8LD	120
Shamirpet	Keesara	2 lanes - each side	30	8LD	120
Keesara	Ghatkesar	2 lanes - each side	30	8LD	120
Ghatkesar	Pedda Amberpet	2 lanes - each side	30	8LD	120
Pedda Amberpet	Vijayawada Highway	2 lanes - each side	30	8LD	120
Vijayawada Highway	Bonguluru	2 lanes - each side	30	8LD	120
Bonguluru	Patelguda	2 lanes - each side	30	8LD	120
Patelguda	Tukkuguda	2 lanes - each side	30	8LD	120
Tukkuguda	Sangiguda	2 lanes - each side	30	8LD	120
Sangiguda	Samshabad	2 lanes - each side	30	8LD	120

Table 2: Inner Ring Road Information

Road No.	Road Name	Segment - From	Segment - To	Present Condition		
				Width (feet)	Lanes	Speed Limit (KMPH)
1	IRR 1	Aramghar Jn	ANG Ranga University	150	8	50
2	IRR 2	ANG Ranga University	Rethi bowli Jn	150	8	50
3	IRR 3	Rethi bowli Jn	Punjagutta	150	8	50
4	IRR 4	Punjagutta	Paradise	150	8	50
5	IRR 5	Paradise	Patny	150	8	50
6	IRR 6	Patny	Mettuguda	150	8	50
7	IRR 7	Mettuguda	Tarnaka Jn	150	8	50
8	IRR 8	Tarnaka Jn	Habsiguda	150	8	50
9	IRR 9	Habsiguda	Birappagadda	150	8	50
10	IRR 10	Birappagadda	Uppal Junction	150	8	50
11	IRR 11	Uppal Junction	Nagole	150	8	50
12	IRR 12	Nagole	Mansoorabad	150	8	50
13	IRR 13	Mansoorabad	LB Nagar Junction	150	8	50
14	IRR 14	LB Nagar Junction	Bhairamalguda	150	8	50
15	IRR 15	Bhairamalguda	Champapet	150	8	50
16	IRR 16	Champapet	Chandaryana gutta	150	8	50
17	IRR 17	Chandaryana gutta	Udamgadda	150	8	50
18	IRR 18	Udamgadda	Aramghar Jn	150	8	50

Table 3: Radial Roads Information

Road No.	Road Name	Segment - From	Segment - To	Existing		Proposed	
				Lanes	Speed Limit (KMPH)	Lanes	Speed Limit (KMPH)
1	Bangalore High way	Katedhan	Samshabad	6LD	50	8LD	50
2	Himayat Sagar Road	Waliya Mahmood Nagar	Himayat Sagar Colony	4LU	40	4LD	40
3	Chevella Road	Hydershahi Guda	AP Police Academy	4LU	40	4LD	40
4	Osman Sagar Road	Rethibowli	Manchirevula	4LU	40	6LD	50
5	Narsingi Road	Tolichowki	Narsingi	2LU	40	2LD	40
6	Old Bombay Road	Mehdipatnam	HCU Depot	4LU	40	4LD	40
7	Panjagutta - HiTech City Road	Panjagutta	HCU Depot	4LU	40	4LD	40
8	Allapur Road	Sanathnagar	Madinaguda	4LU	40	4LD	40
9	NH 9 - Bombay Highway	Panjagutta	Patancheru	4LU	40	8LD	50
10	Balanagar Road	Tarbund	Musapet	2LU	40	4LD	40
11	Dundigal Road	Balanagar	Dundigal	4LU	40	6LD	50
12	NH 7 / Nagpur Highway	Bowanpalli	Surarguda	4LU	40	8LD	50
13	Brig Syed Road	Tarbund	Saraswathi Nagar	2LU	40	4LD	40
14	Shamirpet Road / Rajeev Rahadari	Patny	Shamirpet	4LU	40	6LD	50
15	Sainikpuri Road	Mettuguda	Timmaipalli	2LU	30	4LD	40
16	Kushaiguda Road	Tarnaka	Cherial	2LU	40	4LD	40
17	Cherlapalle Road	Habsiguda	Cherlapalli	2LU	40	4LD	40
18	Pocharam Road	Uppal	Pocharam	2LU	40	4LD	40
19	Warangal Highway	Uppal	Ghatkesar	4LU	40	8LD	50
20	Mutialguda Road / North Moosi	Nagol	Bacharam	-	-	4LD	40
21	Kotlapuram Road / South Moosi	Nagol	Bacharam	-	-	4LD	40
22	Bandlaguda Road	Nagol	Kuntlur	2LU	40	4LD	40
23	Mansurabad Road	Bharat Nagar	Timalguda	2LU	40	4LD	40
24	NH 9 / Vijayawada Highway	Bahadurguda	Ambarpet	4LU	40	8LD	50
25	Nagarjuna Sagar Road	Karmanghat	Bonguluru	4LU	40	6LD	50
26	Nadergul Road	Karmanghat	Patelguda	2LU	40	4LD	40
27	Mallapur Road	Chandrayana Gutta	Kongarkalan	2LU	40	4LD	40
28	Srisailam Highway	Falaknuma	Tukkuguda	4LU	40	6LD	50
29	Mamidipalli Road	Udamgadda	Imarat Kancha	2LU	40	4LD	40
30	Osman Nagar Road	Nalagandla	Kollur	2LU	40	4LD	40
31	Aminpur Road	BHEL	Vadugapalli	2LU	40	4LD	40
32	Nizampet Road	Hydernagar	Mallampet	2LU	40	4LD	40
33	ISB Road	Gatchibowli	Kokapet	6LD	50	6LD	50

METHODOLOGY

The traffic volume data was obtained at a total of 17 locations as identified by the JICA Study team. The locations are as noted in Table 4. The locations were numbered from 23 to 40 as earlier data was available for the Outer Ring Road with locations numbered from 1 to 22. Further it should be noted that at location 38 volume data collection was not conducted.

Table 4: List of Locations for Volume Data Collection

Sl. No.	Location Name	Latitude	Longitude
23	Begumpet Rd	17.444675	78.467048
24	Mahatma Gandhi Rd / Near Paradise	17.443395	78.487465
25	Near Rail Nilayam	17.440795	78.505452
26	Tarnaka	17.426787	78.53103
27	Uppal Traffic Circle	17.401594	78.560218
28	L.B Nagar Traffic Cir	17.346537	78.550969
29	Santosh Nagar	17.343588	78.507029
30	Near Falaknuma	17.326704	78.476554
31	Mohan Reddy Nagar	17.314321	78.444153
32	NH7 - Near Samshabad	17.321696	78.431981
33	Golconda Rd	17.376791	78.429337
34	Tolichowki	17.396019	78.429272
35	Masab Tank Rd	17.398615	78.444314
36	Panjagutta X Road	17.426731	78.452425
37	RTC X Road	17.406769	78.496628
39	Abids / Jambagh Junction	17.383626	78.475122
40	Bahadurpura	17.35665	78.454732

The data collection included mid-block volume counts or intersection turning movement counts. Also, the data was obtained for either 14-hours (7:00 AM to 9:00 PM) or for 24-hours (7:00 AM to 7:00 AM). This information was finalized as per discussions with the JICA Study team. Table 5 to Table 6 show the list of locations for mid-block traffic volume and for the intersection turning movement counts respectively.

Table 5: List of Locations for Mid-Block Traffic Volume

Sl. No.	Location Name	No. of Hours
23	Begumpet Rd	14-hours
29	Santosh Nagar	14-hours
31	Mohan Reddy Nagar	14-hours
34	Tolichowki	14-hours
35	Masab Tank Rd	24-hours
40	Bahadurpura	14-hours

Table 6: List of Locations for Intersection Turning Movement Counts

Sl. No.	Location Name	No. of Hours
24	Mahatma Gandhi Rd / Near Paradise	24-hours
25	Near Rail Nilayam	14-hours
26	Tarnaka	14-hours
27	Uppal Traffic Circle	24-hours
28	L.B Nagar Traffic Cir	14-hours
30	Near Falaknuma	14-hours
32	NH7 - Near Samshabad	24-hours
33	Golconda Rd	14-hours
36	Panjagutta X Road	24-hours
37	RTC X Road	24-hours
39	Abids / Jambagh Junction	14-hours

It is necessary to obtain the traffic volume data for various modes of traffic separately. Generally, buses exhibit different travel characteristics than personal vehicles. Further, trucks movements is governed by commodity demand and supply, and is based on industrial / warehouse land uses. In order to capture all such trends, the traffic data was obtained for the following modes of vehicles as per discussions with the JICA Study team:

- Motor Cycle
- Auto Rickshaw / 3-Wheelers
- Cars / Jeeps / Vans
- Mini Bus
- Bus
- Light Cargo Vehicle
- Small Trucks - 2 Axle
- Medium Trucks - 3 Axle
- Large Trucks
- Others

In order to ascertain the traffic pattern for various periods of the day / night, the traffic volume data was obtained in 15-minutes interval. Generally, the traffic characteristics are different on weekends (due to closure of regular offices and schools), and the start of the week (due to a spillover of weekend impact). From past experience, it was noted that the weekdays Monday to Friday represent a typical weekday. Therefore, it was decided to obtain traffic on a typical weekday only. Also, in order to verify the directionality of the traffic, it was decided to obtain the traffic volume data separately for each direction of traffic.

DATA COLLECTION

Preparatory Work

A reconnaissance survey was conducted to review the various locations. The specific location for the mid-block locations was identified such that the flow of traffic is not impeded by upstream or downstream intersections. Also, the number of personnel required at each location was identified depending on the traffic intensity. Further, the existing traffic movements were noted at the intersections, and special situations were noted. Permission was obtained from the traffic police department before commencing the data collection.

The data was obtained through manual counting. The following shifts were utilized for the data collection:

For 14-hour Counts:

Shift 1: 07:00 – 14: 00
Shift 2: 14:00 – 21:00

For 24-hour Counts:

Shift 1: 07:00 – 15: 00
Shift 2: 15:00 – 23:00
Shift 3: 23:00 – 07:00

For mid-block volume counts, each shift included four personnel per direction of traffic, and additional personnel were provided for relief and coordination. In certain locations traffic was obtained separately for the flyovers / underpass. In such cases, additional personnel were deployed. For the intersection turning movement counts, at least three persons were deployed per each movement of the traffic and additional personnel were provided for high traffic movements. Additional personnel were provided for relief and coordination.

Quality Control

- Training sessions were conducted for all data collectors and supervisors. A mock exercise was conducted, and all personnel were assessed.
- All data collectors were monitored by a Supervisor.
- Data coordinators were appointed to coordinate with the supervisors, data collectors, support staff, and other personnel to ensure that all work proceeded as planned, and with the desired quality.
- All work was constantly reviewed by Traffic Engineers.
- All data collectors were provided with additional personnel for relief during their shifts for breaks.
- Supervisors conducted random inspections, and verified the data collectors work.
- Data for each 15-minute interval was obtained on a separate sheet of paper for each movement separately.
- All data sheets were filed by the supervisor immediately every 15-minutes.
- All the forms were verified and were entered into a database, and all data was verified for accuracy of data entry.
- The data in the database was reviewed again to sort out inaccurate data.

Miscellaneous Measures

- A safe location was identified at each location, wherein the data collectors can stay safely out of the traffic.

- All data collectors and supervisors were provided with safety vests.
- Traffic flow was not obstructed for any reason.

Data Report

Table 7 shows the list of the data collection locations with the data collection dates and times. During the data collection, three incidents were worth noting.

- Location 26 – Tarnaka: Due to some local disturbance in the area, per the instructions of the local police, traffic data collection was stopped at 8:45 PM (15 minutes earlier than planned). However, it was noticed that the peak traffic pattern was already captured in the earlier time periods.
- Location 27 – Uppal: An accident occurred at the intersection at about 11:15 AM. Traffic flow was affected for about 15 minutes, but was restored to normal situation by about 11:30 AM.
- Location 36 – Panjagutta: It was raining from 7:00 AM to 9:00 AM. During this time, the traffic was noticed to be marginally low, but was normal after the rain stopped.

Table 7: Data Collection Dates and Time

Sl. No.	Location Name	Date	Time
23	Begumpet Rd	1-Nov-2011	7:00 AM - 9:00 PM
24	Mahatma Gandhi Rd / Near Paradise	4-Nov-2011	7:00 AM - 7:00 AM
25	Near Rail Nilayam	2-Nov-2011	7:00 AM - 9:00 PM
26	Tarnaka	2-Nov-2011	7:00 AM - 8:45 PM
27	Uppal Traffic Circle	4-Nov-2011	7:00 AM - 7:00 AM
28	L.B Nagar Traffic Cir	2-Nov-2011	7:00 AM - 9:00 PM
29	Santosh Nagar	31-Oct-2011	7:00 AM - 9:00 PM
30	Near Falaknuma	1-Nov-2011	7:00 AM - 9:00 PM
31	Mohan Reddy Nagar	31-Oct-2011	7:00 AM - 9:00 PM
32	NH7 - Near Samshabad	3-Nov-2011	7:00 AM - 7:00 AM
33	Golconda Rd	1-Nov-2011	7:00 AM - 9:00 PM
34	Tolichowki	31-Oct-2011	7:00 AM - 9:00 PM
35	Masab Tank Rd	3-Nov-2011	7:00 AM - 7:00 AM
36	Panjagutta X Road	3-Nov-2011	7:00 AM - 7:00 AM
37	RTC X Road	4-Nov-2011	7:00 AM - 7:00 AM
39	Abids / Jambagh Junction	2-Nov-2011	7:00 AM - 9:00 PM
40	Bahadurpura	31-Oct-2011	7:00 AM - 9:00 PM

Table 8 shows the summary of the mid-block volumes data collected at the site. Table 9 shows the Intersections Turning Movement Counts Direction Index, and Table 10 shows the Intersections Turning Movement Counts Volume Summary.

Table 8: Summary of Mid-Block Volumes

Sl. No.	Location Name	No. of Hours	Direction	Direction Reference	Volume
23	Begumpet Rd	14-hours	Eastbound	From Panjagutta	48,480
			Westbound	From Paradise	52,396
			Eastbound - Flyover	From Panjagutta	27,351
			Westbound - Flyover	From Paradise	50,042
29	Santosh Nagar	14-hours	Northbound	From Chandrayan Gutta	23,506
			Southbound	From Santosh Nagar	20,559
31	Mohan Reddy Nagar	14-hours	Northbound	From Katedan	14,408
			Southbound	From Durga Nagar	13,681
34	Tolichowki	14-hours	Eastbound	From Tolichowki	45,672
			Westbound	From Mehdipatnam	54,507
35	Masab Tank Rd	24-hours	Eastbound	From Samshabad	15,650
			Westbound	From Masab Tank	17,601
			Eastbound - Flyover	From Samshabad	780
			Westbound - Flyover	From Masab Tank	1,764
40	Bahadurpura	14-hours	Northbound	From Zoo Park	27,495
			Southbound	From Bahadurpura	24,081

Table 9: Intersection Turning Movement Counts – Directions Index

Sl. No.	Location Name	Northbound	Southbound	Eastbound	Westbound
14-Hours					
25	Near Rail Nilayam	From Secunderabad	From East Maredpally	From Clock Tower	From Rail Nilayam
26	Tarnaka	From Habsiguda	From Secunderabad	From Osmania Unv	From Lalapet
28	L.B Nagar Traffic Cir	From Karmanghat	From Nagole	From Hayat Nagar Road	From Vanastalipuram
30	Near Falaknuma	From Katedan	From Kanchan Bagh	From Falaknuma	From Barkas
33	Golconda Rd	From Attapur	From Mehdipatnam	From Fort Road	From Puranapool
39	Abids / Jambagh Junction	From Afzalgunj	From Abids	From Nampally	From Jambagh Road
24-Hours					
24	Mahatma Gandhi Rd / Near Paradise	From Tankbund	From Boinpally	From Begumpet	From Secunderabad
27	Uppal Traffic Circle	From Nagole	From Tarnaka	From Ramanthapur	From Ghatkesar
32	NH7 - Near Samshabad	From Samshabad	From Zoo park	From Mehdipatnam	From Chandrayangutta
36	Panjagutta X Road	From Khairatabad	From Ameerpet	From Banjara Hills	From Begumpet
37	RTC X Road	From Narayanaguda	From Secunderabad	From Ashok Nagar	From Nallakunta

Table 10: Intersections Turning Movement Counts – Volume Summary

Sl. No.	Location Name	NBL	NBT	NBR	NBU	SBL	SBT	SBR	SBU	EBL	EBT	EBR	EBU	WBL	WBT	WBR	WBU	Total
14-Hours																		
25	Near Rail Nilayam	17,760	26,969	19,825	3,894	26,795	10,106	23,762	4,973	16,606	22,247	5,819	2,385	18,926	21,313	13,235	3,442	**2,38,057**
26	Tarnaka*	14,892	8,628	15,725	434	11,325	10,741	9,538	996	6,578	5,128	4,932	605	17,492	17,129	12,052	948	**1,37,143**
28	L.B Nagar Traffic Cir	20,318	16,533	6,726	1,031	14,802	16,176	17,622	1,748	9,497	13,638	12,827	1,081	5,055	19,361	20,006	1,021	**1,77,442**
30	Near Falaknuma	3,810	2,938	3,801	255	3,366	4,458	4,688	377	4,700	5,161	3,857	168	4,035	5,060	6,078	499	**53,251**
33	Golconda Rd	9,214	37,180	4,894	548	4,118	13,143	3,140	392	10,864	15,648	10,104	252	7,661	7,109	5,045	386	**1,29,698**
39	Abids / Jambagh Junction	20,288	19,620	-	1,990	-	10,669	13,455	1,178	6,952	-	19,674	688	6,131	18,174	19,362	-	**1,38,181**
24-Hours																		
24	Mahatma Gandhi Rd / Near Paradise	9,456	36,343	22,052	2,366	13,397	14,938	16,432	3,301	27,683	19,344	10,058	4,318	13,839	23,089	13,364	2,376	**2,32,356**
27	Uppal Traffic Circle	13,930	19,341	34,836	6,350	18,151	36,086	10,212	7,809	3,890	30,785	20,027	3,798	27,010	41,658	41,762	11,078	**3,26,723**
32	NH7 - Near Samshabad	7,713	63,344	9,005	833	19,544	24,787	3,650	990	17,270	10,068	9,316	2,703	6,266	13,199	11,779	4,502	**2,04,969**
	NH7 - Near Samshabad - Underpass	-	-	-	-	-	-	-	-	-	16,334	-	-	-	25,632	-	-	**41,966**
36	Panjagutta X Road	22,555	77,114	2,923	5,323	18,963	83,151	1,578	2,073	15,448	19,485	2,572	5,739	18,136	29,697	456	452	**3,05,665**
37	RTC X Road	9,928	27,319	14,793	2,443	16,323	15,150	13,729	11,922	10,341	16,865	6,021	700	11,515	27,262	18,161	4,732	**2,07,204**

* 13.75 hours only

VOLUME DATA ANALYSIS

The traffic volume data obtained in 15-minute intervals was entered into Excel spreadsheets for easier review and analysis. The data for each location was reviewed graphically to identify any outliers. Further, the data was reviewed by each mode at each location again graphically to identify any outliers. Generally, it was observed that the data exhibited a normal traffic patterns with peak hours during business hours. Certain modes of traffic (such as personal vehicles) were less during night times, and heavy trucks traffic volume was less during day time. These patterns were recognized to be generally acceptable.

To analyze the traffic volume, the different modes of traffic were converted to equivalent Passenger Car Units (PCU). The PCU factors were obtained from the Indian Roads Congress (IRC) publication 106-1990 "Guidelines for Capacity of Urban Roads in Plain Areas" and are shown in Table 11.

Table 11: Recommended PCU Factors for Various Types of Vehicles on Urban Roads

Vehicle Type		Equivalent PCU Factors	
		Percentage composition of Vehicle type in traffic stream	
		5%	**10% and above**
Fast Vehicles			
1	Two wheelers, Motor Cycle or Scooter, etc.	0.50	0.75
2	Passenger car, pick-up van	1.00	1.00
3	Auto-rickshaw	1.20	2.00
4	Light Commercial Vehicle	1.40	2.00
5	Truck or Bus	2.20	3.70
6	Agricultural Tractor Trailer	4.00	5.00
Slow Vehicles			
7	Cycle	0.40	0.50
8	Cycle Rickshaw	1.50	2.00
9	Tonga (Horse drawn vehicle)	1.50	2.00
10	Hand cart	2.00	3.00

Extract from: IRC: 106-1990, Guidelines for Capacity of Urban Roads in Plain Areas

The PCU is dependent on the percentage composition of vehicle type in traffic stream and differs for each vehicle type. Initially, the option of using different PCU for each of the locations was considered. However, the following reasons were reviewed:

- Earlier data was available from the ORR reports which utilized one-set of PCU factors
- To be consistent with the ORR Reports, the same set of PCU factors should be utilized or the data from the ORR reports have to be adjusted using one-set of PCU factors.
- Further, in developing a regional model or comparing different regions, it is necessary to utilize a common factor for accurate comparison.

The data obtained in this study was reviewed and it was noticed that the PCU factors utilized in the earlier ORR study are applicable for this data also. Therefore, common factors were used for the PCU factors for all locations as shown in Table 12. Table 13and Table 14 show the PCU Summary for mid-block locations and intersections respectively.

Table 12: PCU Factors Used based on IRC Guidelines

Vehicle Type		Equivalent PCU Factors
1	Two wheelers, Motor Cycle or Scooter, etc.	0.75
2	Auto-rickshaw	2.00
3	Passenger car, pick-up van	1.00
4	Mini Bus	1.40
5	Bus	2.20
6	Light Cargo Vehicle	1.40
7	Small Trucks - 2 Axle	2.20
8	Medium Trucks - 3 Axle	2.20
9	Large Truck orTractor-trailer(Multi Axel)	4.00
10	Others (Construction vehicles / Tractors, etc)	4.00

Table 13: PCU Summary at Mid-Block Locations

Sl. No.	Location Name	No. of Hours	Direction	PCU
23	Begumpet Rd	14-hours	Two-way road	1,17,170
			Two-way flyover	78,752
29	Santosh Nagar	14-hours	Two-way	48,686
31	Mohan Reddy Nagar	14-hours	Two-way	37,873
34	Tolichowki	14-hours	Two-way	1,18,621
35	Masab Tank Rd	24-hours	Two-way road	43,739
			Two-way flyover	3,147
40	Bahadurpura	14-hours	Two-way	64,596

Table 14: PCU Summary at Intersections

Sl. No.	Location Name	NBL	NBT	NBR	NBU	SBL	SBT	SBR	SBU	EBL	EBT	EBR	EBU	WBL	WBT	WBR	WBU	Total (PCU)
14-Hours																		
25	Near Rail Nilayam	22,014	30,039	22,124	4,813	39,479	13,461	34,943	5,729	24,047	26,537	6,883	2,781	22,863	26,370	15,803	3,285	**3,01,171**
26	Tarnaka*	15,703	10,951	19,329	498	11,827	12,883	11,123	1,113	6,911	6,313	5,385	652	21,423	22,901	12,860	1,007	**1,60,880**
28	L.B Nagar Traffic Cir	25,044	22,228	8,236	1,472	17,652	19,670	19,697	2,365	11,511	19,117	15,297	1,257	6,417	25,957	24,417	1,213	**2,21,549**
30	Near Falaknuma	4,864	3,916	5,048	333	4,333	6,389	5,943	454	5,849	6,616	5,373	217	5,278	6,242	8,015	599	**69,467**
33	Golconda Rd	11,325	43,976	6,024	627	4,418	18,014	3,979	428	14,059	22,672	11,546	285	10,390	8,374	5,619	489	**1,62,224**
39	Abids / Jambagh Junction	25,204	24,592	-	2,309	-	13,473	18,233	1,392	8,371	-	25,092	865	6,345	22,006	22,851	-	**1,70,733**
24-Hours																		
24	Mahatma Gandhi Rd / Near Paradise	11,413	40,575	27,657	2,660	16,853	18,434	17,863	3,849	36,957	25,917	12,733	5,305	17,595	30,208	16,904	3,000	**2,87,923**
27	Uppal Traffic Circle	17,443	26,173	51,453	8,209	24,579	57,627	12,978	10,038	5,487	42,355	23,607	5,260	37,364	62,046	55,457	19,719	**4,59,792**
32	NH7 - Near Samshabad	9,649	73,848	12,567	866	29,616	40,646	5,395	1,040	21,388	10,246	13,011	3,192	8,369	18,646	16,939	5,262	**2,70,677**
	NH7 - Near Samshabad - Underpass	-	-	-	-	-	-	-	-	-	18,440	-	-	-	25,962	-	-	**44,402**
36	Panjagutta X Road	29,256	93,029	3,795	5,788	23,086	1,01,079	2,000	2,015	20,321	22,945	3,240	6,666	22,029	37,424	520	551	**3,73,741**
37	RTC X Road	12,440	33,386	17,313	2,724	20,934	19,105	15,965	14,718	12,334	23,991	7,565	772	15,413	34,758	25,761	5,356	**2,62,534**

* 13.75 hours only

Mid-Block Volume Data Analysis

The obtained data was totaled to develop the hourly traffic volumes. Both the directions of traffic at each location was reviewed, and generally it was observed that the data exhibited directional distribution, signifying that the data was acceptable. It was also observed that both the directions of traffic exhibited certain similarities such as the total volumes were generally comparable, signifying the validity of the data. The data was further totaled to obtain the combined two-directions total traffic at each location. For the locations with 24-hour data, the data was subjected to a 12-hour comparison, which identified that most of the traffic volume was present during the business hours, and the second 12-hours traffic was comparatively lower.

Appendix A shows the Mid-Block Volume Data Analysis worksheets.

The traffic volume data analysis can be summarized as noted below.

23 – Begumpet Road

The location no. 23, Begumpet Road, exhibited the highest volume of traffic with 1,00,806 vehicles in both directions. In addition, 77,393 vehicles were observed on the flyover in both directions. This location is located towards the center of the city, and is part of the inner ring road, and is known to be a busy location and is an important location for future improvements. The traffic on the road was found to be directionally balanced, and also exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 10:00 AM and 11:00 AM and constituted of 12,472 vehicles in both directions for the road. The evening peak hour was noticed between 6:00 PM to 7:00 PM and constituted of 6,444 vehicles in both directions for the road. The flyover traffic was not directionally distributed. This imbalance is attributed to the local businesses, local access restrictions, and local traffic behavior in that area. The morning peak hour was noticed between 11:00 AM and 12:00 PM and constituted of 5,578 vehicles in both directions for the flyover. The evening peak hour was noticed between 5:00 PM to 6:00 PM and constituted of 9,741 vehicles in both directions for the flyover. On the road, the 2-wheelers contributed to about 50% of the traffic volume, and autos and cars contributed to about 20% each. Since this data was not collected in the nights, the trucks activity was noticed to be less. On the flyover, 2-wheelers contributed to about 56% of the traffic volume, while autos and cars contributed to about 14% and 27% respectively.

29 – Santosh Nagar

The location no. 29, Santosh Nagar, exhibited traffic of 44,065 vehicles in both directions. This location is located in the south-east quadrant of the city, and is generally known to be a mid-volume category location. The traffic on the road was found to be directionally balanced, and also exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 9:00 AM and 10:00 AM and constituted of 3,992 vehicles in both directions. The evening peak hour was noticed between 5:00 PM to 6:00 PM and constituted of 4,027 vehicles in both directions. The 2-wheelers contributed to about 51% of the traffic volume, and autos and cars contributed to about 17% and 26% respectively. Since this data was not collected in the nights, the trucks activity was noticed to be less. This road connects the inner ring road to the central part of the city, and could become a major radial connector in the future.

31 – Mohan Reddy Nagar

The location no. 31, Mohan Reddy Nagar, exhibited traffic of 28,089 vehicles in both directions. This location is located in the south-east quadrant of the city, and is generally known to be a low-volume category location. The traffic on the road was found to be directionally balanced. However, this road did not exhibit any specific morning or evening peak hour of traffic. The peak hour was noticed between 12:00 PM and 1:00 PM and constituted of 3,142 vehicles in both directions. The 2-wheelers contributed to about 38% of the traffic volume, and autos and cars contributed to about 22% and 17% respectively. Trucks were observed to be contributing to about 20% of the traffic volume. The lack of the specific AM / PM peak hour is acceptable for this location, as it is more of an industrial location, and the road forms a parallel connection to the National Highway. The presence of trucks in the morning periods further supports the character of the road.

34 – Tolichowki

The location no. 34, Tolichowki, exhibited traffic of 1,00,179 vehicles in both directions. This location is located in the south-west quadrant of the city, and is generally known to be a busy-volume road. This road is also known as the Old Bombay Highway, and connects the western parts of the city including the areas such as Mehdipatnam, Gatchibowli, Narsingi, etc.. The traffic on the road was found to be directionally balanced and also exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 9:00 AM and 10:00 AM and constituted of 11,933 vehicles in both directions, and the evening peak hour was noticed between 6:00 PM to 7:00 PM and constituted of 6,353 vehicles in both directions. The 2-wheelers contributed to about 47% of the traffic volume, and autos and cars contributed to about 19% and 22% respectively. Since this data was not collected in the nights, the trucks activity was noticed to be less.

35 – Masab Tank

The location no. 35, Masab Tank, near the PV Narasimha Rao Flyover, exhibited traffic of 33,251 vehicles in both directions. In addition, 2,544 vehicles were observed on the flyover in both directions. This location is located towards the south-west of the city, and is part of the inner ring road, and is known to be a busy location. This road forms acts as a major connector road to the airport. The traffic on the road was found to be directionally balanced, and also exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 9:00 AM and 10:00 AM and constituted of 1,553 vehicles in both directions for the road. The evening peak hour was noticed between 5:00 PM to 6:00 PM and constituted of 2,563 vehicles in both directions for the road. On the road, the 2-wheelers contributed to about 30% of the traffic volume, and autos and cars contributed to about 15% and 30% respectively. Buses contributed to about 17% on the road. The flyover traffic was not directionally distributed. This imbalance is attributed to the presence of the airport and the alternate routes available. The data was obtained for 24-hours at this location. An important trend was noticed at this location. Buses activity was observed to surge at certain times of the day / night. This activity was found to be “normal” at this location, as these buses primarily served the airport traffic. The surges in the bus traffic volume was observed to follow a pattern similar to the demand at the airport. On the flyover, 2-wheelers, autos and trucks are prohibited. The primary traffic utilizing the flyover was observed to be airport bound traffic. Further, the comparison of the 12-hour, 14-hour and 24-hour volumes of this road indicated that the primary activity on this road occurs in the first 12-hour of the day, which is consistent with the character of the surrounding locations (being primarily residential / commercial).

40 - Bahadurpura

The location no. 40, Bahadurpura, exhibited traffic of 51,576 vehicles in both directions. This location is located in the south-east quadrant of the city, just north of the Nehru Zoological Park and is generally known to be a mid-volume category road. The traffic on the road was found to be directionally balanced and also exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 11:00 AM and 12:00 PM and constituted of 5,889 vehicles in both directions, and the evening peak hour was noticed between 3:00 PM to 4:00 PM and constituted of 4,930 vehicles in both directions. The 2-wheelers contributed to about 52% of the traffic volume, and autos and cars contributed to about 24% and 10% respectively. Buses were observed to be about 8% of the traffic volume. Since this data was not collected in the nights, the trucks activity was noticed to be less. This location is an important tourist location due to its proximity to the zoo park, which can be seen from the traffic pattern (i.e., the traffic pattern does not follow the regular morning / evening peak; and the presence of the relatively high number of buses). Further, the area has several research offices and facilities, which also provide buses to their employees. This road could be developed further for better connectivity to the central parts of the city.

Intersection Turning Movement Data Analysis

The obtained data was totaled to develop the hourly traffic volumes. The traffic volume was developed for each movement of the traffic, and was totaled to obtain the total intersection volume for each hour. The peak hours of the traffic were reviewed and were generally found to be constant with the traffic pattern of that location.

Appendix B shows the Intersection Turning Movement Data Analysis worksheets.

The traffic data analysis can be summarized as noted below.

25 – Rail Nilayam

The location no. 25, Rail Nilayam, exhibited traffic of 2,38,057 vehicles at the intersection in 14-hours. This intersection is located in the north-east quadrant of the city, just north of the Secunderabad Railway Station and is generally known to be a high-volume category intersection. This intersection connects several areas such as Secunderabad, Paradise, Maredapally and Tarnaka. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 11:00 AM and 12:00 PM and constituted of 20,395 vehicles, and the evening peak hour was noticed between 3:00 PM to 4:00 PM and constituted of 18,816 vehicles. The 2-wheelers contributed to about 38% of the traffic volume, and autos and cars contributed to about 21% and 28% respectively. Buses were observed to be about 8% of the traffic volume. Since this data was not collected in the nights, the trucks activity was noticed to be less. This intersection connects several important locations, and it would be beneficial to provide alternate routes.

26 - Tarnaka

The location no. 26, Tarnaka, exhibited traffic of 137,143 vehicles at the intersection in 14-hours. This intersection is located in the north-east quadrant of the city, just east of Osmania University and is generally known to be a high-volume category intersection. The intersection has a flyover in the north-south direction, but these counts were not considered. This

intersection connects several areas such as Osmania University, Tarnaka, Lalaguda, Habsiguda, etc. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 9:00 AM and 10:00 AM and constituted of 11,714 vehicles, and the evening peak hour was noticed between 5:00 PM to 6:00 PM and constituted of 11,806 vehicles. These peak hours generally coincided with the operating hours of the University. The 2-wheelers contributed to about 51% of the traffic volume, and autos and cars contributed to about 22% and 19% respectively. Since this data was not collected in the nights, the trucks activity was noticed to be less.

28 – LB Nagar

The location no. 28, LB Nagar, exhibited traffic of 1,77,442 vehicles at the intersection in 14-hours. This intersection is located in the south-east quadrant of the city and is generally known to be a high-volume category intersection. This intersection connects several areas such as Uppal, Dilshuknagar, Karmanghat, etc., and also provides connectivity to the NH 9. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 11:00 AM and 12:00 PM and constituted of 15,112 vehicles, and the evening peak hour was noticed between 5:00 PM to 6:00 PM and constituted of 14,998 vehicles. The 2-wheelers contributed to about 39% of the traffic volume, and autos and cars contributed to about 19% and 27% respectively. Buses were observed to be about 8% of the traffic volume, and trucks about 6% of the traffic volume. Since this data was not collected in the nights, the trucks activity was noticed to be comparatively less. Since this intersection connects the National Highway, the trucks activity is excepted to be high, as was exhibited in the 14-hour counts.

30 – Near Falaknuma

The location no. 30, near Falaknuma, exhibited traffic of 53,251 vehicles at the intersection in 14-hours. This intersection is located in the south-east quadrant of the city and is generally known to be a medium-volume category intersection. The intersection has a flyover in the north-south direction, but these counts were not considered. This intersection connects several areas such as Falaknuma, Samshabad, Uppal, etc. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 11:00 AM and 12:00 PM and constituted of 4,337 vehicles, and the evening peak hour was noticed between 4:00 PM to 5:00 PM and constituted of 4,470 vehicles. The 2-wheelers contributed to about 41% of the traffic volume, and autos and cars contributed to about 28% and 18% respectively. Buses were observed to be about 9% of the traffic volume. Since this data was not collected in the nights, the trucks activity was noticed to be less.

33 – Near Golconda

The location no. 33, near Golconda, exhibited traffic of 129,698 vehicles at the intersection in 14-hours. This intersection is located in the south-west quadrant of the city and is generally known to be a high-volume category intersection. The intersection is located below the PV Narasimha Rao flyover, which runs in the north-south direction, but these counts were not considered. This intersection connects several areas such as Mehdipatnam, Langar House, Samshabad, etc. The traffic at this intersection did not exhibit any specific morning or evening peak hours. The peak hour traffic was observed to be between 12:00 PM and 1:00 PM and constituted of 11,586 vehicles. The 2-wheelers contributed to about 48% of the traffic volume, and autos and cars contributed to about 23% and 16% respectively. Buses were observed to be about 5% of the traffic volume. Since this data was not collected in the nights, the trucks activity was noticed to be less.

39 – Jambagh Junction

The location no. 39, Jambagh Junction, exhibited traffic of 138,181 vehicles at the intersection in 14-hours. This intersection is located to the south of the city, close to the business centers, and is generally known to be a high-volume category intersection. The Jambagh Road is a one-way street, while the remaining three legs of the intersection are two-way streets. This intersection connects several areas such as Nampally, Abids, Koti, Afzalgunj, etc, and lies along the NH 9, and is also located south of the Nampally Railway Station. The traffic at this intersection did not exhibit any specific morning or evening peak hours. The peak hour was noticed between 6:00 PM and 7:00 PM and constituted of 12,046 vehicles. The 2-wheelers contributed to about 45% of the traffic volume, and autos and cars contributed to about 27% and 20% respectively. Buses were observed to be about 7% of the traffic volume. Since this data was not collected in the nights, the trucks activity was noticed to be less.

24 – MG Road near Paradise

The location no. 24, MG Road near Paradise, exhibited traffic of 2,32,356 vehicles at the intersection in 24-hours. This intersection is located to the north of the city, close to the business centers, and is generally known to be a high-volume category intersection. The intersection has a flyover in the east-west direction, but these counts were not considered. This intersection is part of the inner ring road, and connects several areas such as Begumpet, Secunderabad, Bowenpally, Tankbund, etc. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 10:00 AM and 11:00 AM and constituted of 14,839 vehicles, and the evening peak hour was noticed between 7:00 PM to 8:00 PM and constituted of 17,800 vehicles. The 2-wheelers contributed to about 40% of the traffic volume, and autos and cars contributed to about 19% and 27% respectively. Buses were observed to be about 9% of the traffic volume. Trucks were observed to be about 3% of the traffic volume, i.e. about 8,000 trucks, which is a significant activity.

27 – Uppal Traffic Circle

The location no. 27, Uppal Traffic Circle, exhibited traffic of 3,26,723 vehicles at the intersection in 24-hours. This intersection is located to the east of the city and is generally known to be a high-volume category intersection. This intersection is part of the inner ring road, and connects several areas such as Tarnaka, Ramanthapur, Nagole, etc, and provides connectivity to the Warangal Highway. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 10:00 AM and 11:00 AM and constituted of 19,589 vehicles, and the evening peak hour was noticed between 6:00 PM to 7:00 PM and constituted of 18,570 vehicles. The 2-wheelers contributed to about 34% of the traffic volume, and autos and cars contributed to about 17% and 22% respectively. Buses were observed to be about 11% of the traffic volume. Trucks were observed to be about 15% of the traffic volume, i.e. about 49,000 trucks, which is a significant activity due to its proximity to the Warangal Highway.

32 – NH7 near Samshabad

The location no. 32, NH7 near Samshabad, exhibited traffic of 2,04,969 vehicles at the intersection in 24-hours. This intersection is located to the south of the city, on the way to the Samshabad airport and is generally known to be a high-volume category intersection. The intersection is below the PV Narasimha Rao flyover, but these counts were not considered. Further, the intersection has an underpass in the east-west direction, and these counts were

taken separately, and constitute 41,966 vehicles in 24-hours. This intersection connects several areas such as Mehdipatnam, Samshabad, Chandrayangutta, Zoo Park, etc, and provides connectivity to the airport. The traffic at this intersection did not exhibit any specific morning or evening peak hour, but the traffic in the early morning to noon was generally found to be high. The peak hour was noticed between 12:00 PM and 1:00 PM and constituted of 23,378 vehicles. The primary reason for the high volume in the morning hours is attributed to the research facilities / offices located towards the north of the intersection, which was further justified by the higher bus volumes in the morning hours. The 2-wheelers contributed to about 33% of the traffic volume, and autos and cars contributed to about 14% and 30% respectively. Buses were observed to be about 11% of the traffic volume or about 23,000 buses which is relatively high. Trucks were observed to be about 11% of the traffic volume, i.e. about 23,000 trucks, which is a significant activity.

36 – Panjagutta X Road

The location no. 36, Panjagutta X Road, exhibited traffic of 3,05,665 vehicles at the intersection in 24-hours. This intersection is located to the west of the city within the business center and is generally known to be a high-volume category intersection. This intersection is part of the inner ring road and lies on the National Highway 9, and connects several areas such as Banjara Hills, Ameerpet, Khairatabad, Begumpet, etc. The intersection has a flyover in the east-west direction, but was not considered in these counts. Further, the intersection has right-turn restrictions, i.e., no right turns are allowed for any of the four legs of the intersection. However, several vehicles were observed to be making right turns illegally, with higher vehicles during the absence of traffic police. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 10:00 AM and 11:00 AM and constituted of 22,995 vehicles, and the evening peak hour was noticed between 6:00 PM to 7:00 PM and constituted of 28,643 vehicles. The 2-wheelers contributed to about 36% of the traffic volume, and autos and cars contributed to about 25% and 34% respectively. Buses were observed to be about 4% of the traffic volume or about 11,500 vehicles. It should be noted that this route provides connectivity to the Kukatpally bus depot, and several buses ply along this route during nights and early morning, in addition to the regular city buses. Trucks were observed to be about 1.5% of the traffic volume, i.e. about 5,000 trucks, primarily in the night times.

37 – RTC X Road

The location no. 37, RTC X Road, exhibited traffic of 2,07,204 vehicles at the intersection in 24-hours. This intersection is located to the east of the city within the business center and is generally known to be a high-volume category intersection. This intersection connects several areas such as Ashok Nagar, Vidyanagar, Musheerabad, Narayanaguda, etc., and is surrounded by several movie theaters. The traffic at this intersection exhibited the morning and evening peak hour of traffic. The morning peak hour was noticed between 11:00 AM and 12:00 PM and constituted of 13,300 vehicles, and the evening peak hour was noticed between 7:00 PM to 8:00 PM and constituted of 16,752 vehicles. The 2-wheelers contributed to about 37% of the traffic volume, and autos and cars contributed to about 24% and 28% respectively. Buses were observed to be about 8% of the traffic volume or about 17,119 vehicles. It should be noted that this route connects the bus bhavan and the bus depot at that location (which is why this location is known as RTC – Road Transport Corporation – X roads). Trucks were observed to be about 3% of the traffic volume, i.e. about 6,000 trucks.

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METHODOLOGY

The earlier report, "Volume 1 – Traffic Volume Data Collection" describes the Traffic Volume Data collection and the preliminary analysis.

This report, "Volume 2 – Origin-Destination Data Collection" describes the Origin-Destination Data collection and the preliminary analysis.

The Origin-Destination (OD) data was obtained at a total of 17 locations as identified by the JICA Study team. The locations are as noted in Table 1. The locations were numbered from 23 to 40 as earlier data was available for the Outer Ring Road with locations numbered from 1 to 22. Further it should be noted that at location 31 OD collection was not conducted.

Table 1: List of Locations for Volume Data Collection

Sl. No.	Location Name	Latitude	Longitude
23	Begumpet Rd	17.444675	78.467048
24	Mahatma Gandhi Rd / Near Paradise	17.443395	78.487465
25	Near Rail Nilayam	17.440795	78.505452
26	Tarnaka	17.426787	78.53103
27	Uppal Traffic Circle	17.401594	78.560218
28	L.B Nagar Traffic Cir	17.346537	78.550969
29	Santosh Nagar	17.343588	78.507029
30	Near Falaknuma	17.326704	78.476554
32	NH7 - Near Samshabad	17.321696	78.431981
33	Golconda Rd	17.376791	78.429337
34	Tolichowki	17.396019	78.429272
35	Masab Tank Rd	17.398615	78.444314
36	Panjagutta X Road	17.426731	78.452425
37	RTC X Road	17.406769	78.496628
38	Old MLA Quarters	17.397842	78.482836
39	Abids / Jambagh Junction	17.383626	78.475122
40	Bahadurpura	17.35665	78.454732

The data was obtained for 14-hours (7:00 AM to 9:00 PM) at each of the locations. This information was finalized as per discussions with the JICA Study team. The OD data was obtained for the following modes of vehicles as per discussions with the JICA Study team:

- Motor Cycle
- Auto Rickshaw / 3-Wheelers
- Cars / Jeeps / Vans
- Light Cargo Vehicle
- Small Trucks - 2 Axle
- Medium Trucks - 3 Axle
- Large Trucks

In order to ascertain the traffic pattern for various periods of the day / night, the OD data was obtained in 1-hour intervals and separately for each direction of traffic. Table 2 shows the data and time of the OD Data collection.

Table 2: Date and Time of OD Data Collection

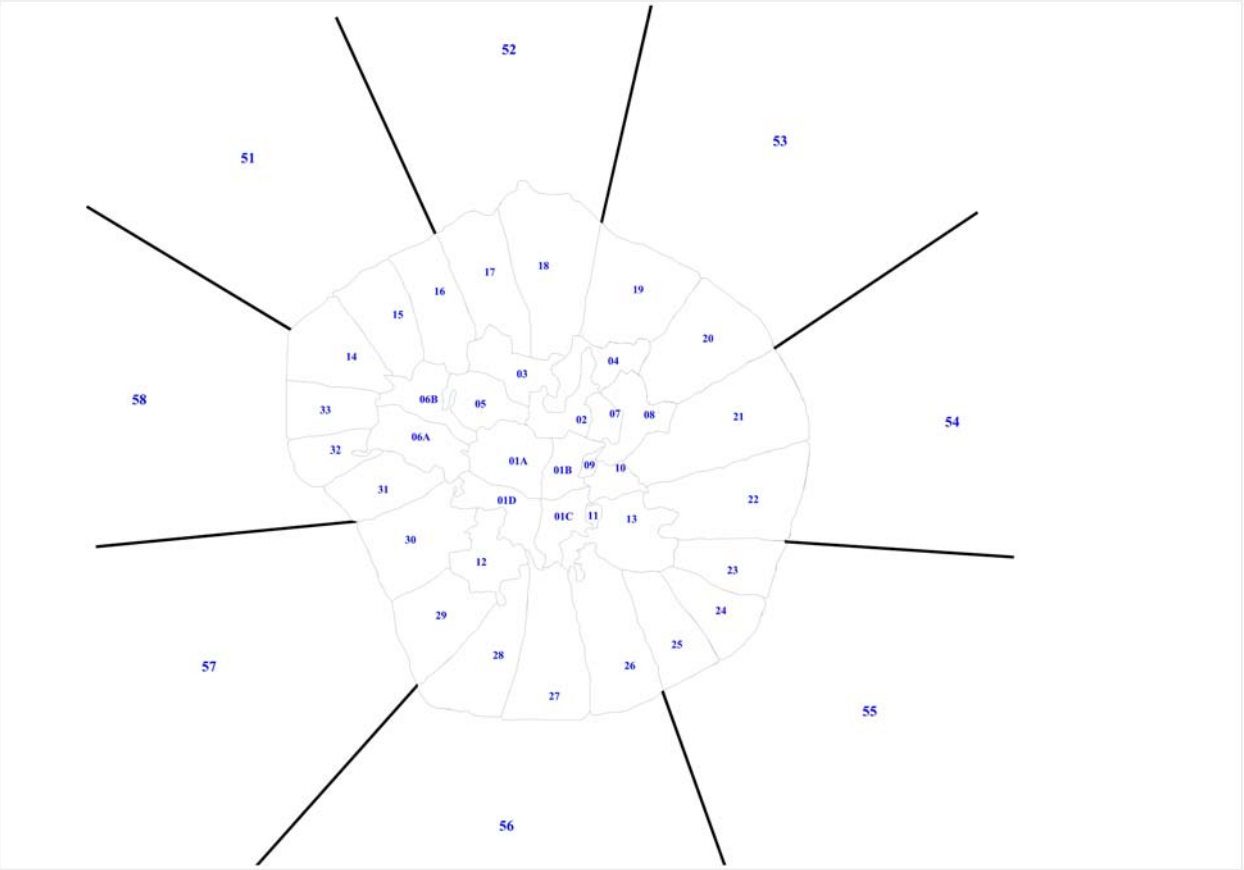
Sl. No.	Location Name	Date	Time
23	Begumpet Rd	1-Nov-2011	7:00 AM - 9:00 PM
24	Mahatma Gandhi Rd / Near Paradise	4-Nov-2011	7:00 AM - 9:00 PM
25	Near Rail Nilayam	2-Nov-2011	7:00 AM - 9:00 PM
26	Tarnaka	2-Nov-2011	7:00 AM - 9:00 PM
27	Uppal Traffic Circle	4-Nov-2011	7:00 AM - 9:00 PM
28	L.B Nagar Traffic Cir	2-Nov-2011	7:00 AM - 9:00 PM
29	Santosh Nagar	31-Oct-2011	7:00 AM - 9:00 PM
30	Near Falaknuma	1-Nov-2011	7:00 AM - 9:00 PM
32	NH7 - Near Samshabad	3-Nov-2011	7:00 AM - 9:00 PM
33	Golconda Rd	1-Nov-2011	7:00 AM - 9:00 PM
34	Tolichowki	31-Oct-2011	7:00 AM - 9:00 PM
35	Masab Tank Rd	3-Nov-2011	7:00 AM - 9:00 PM
36	Panjagutta X Road	3-Nov-2011	7:00 AM - 9:00 PM
37	RTC X Road	4-Nov-2011	7:00 AM - 9:00 PM
38	Old MLA Quarters	1-Nov-2011	7:00 AM - 9:00 PM
39	Abids / Jambagh Junction	2-Nov-2011	7:00 AM - 9:00 PM
40	Bahadurpura	31-Oct-2011	7:00 AM - 9:00 PM

The OD zones were developed in discussion with the JICA study team. The zones were selected to be similar to a previous study conducted for the Outer Ring Road. However, as this study focus is on the inner ring road, a few zones were further sub-divided. Table 3 shows the list of the OD zones and Figure 1 shows the OD zone map.

Table 3: List of Origin-Destination Zones

Centroid Zones	Area Name
1A	Municipal Corporation of Hyderabad - North-west
1B	Municipal Corporation of Hyderabad - North-east
1C	Municipal Corporation of Hyderabad - south-east
1D	Municipal Corporation of Hyderabad - south-west
2	Secunderabad Cantonement
3	Qutbullapur
4	Alwal
5	Kukatpally
6A	Serilingampally - South
6B	Serilingampally - North
7	Malkajgiri
8	Kapra
9	Osmania University
10	Uppalkalan
11	Gaddinnaram
12	Rajendra Nagar
13	LB Nagar
14	Ramachandrapuram, Patancheru, RC Puram BHEL Township & Rural Area
15	Rural Areas
16	Rural Areas
17	Rural Areas
18	Rural Areas
19	Singaipally & Rural Areas
20	Rural Areas
21	Makta bibi sahebguda & Rural Areas
22	Kuntloor & Rural Areas
23	Rural Areas
24	Rural Areas
25	Injapur, Jillelguda & Rural Areas
26	Nadergul & Meerpet
27	Balapur, Kothapet, Venkatapur, Mallapur & Rural Areas
28	Shamshabad & Rural Areas
29	
30	Hydershahkot & Rural Areas
31	Rural Areas
32	Rural Areas
51	Narsapur Road
52	National Highway 7 (Nagpur Highway)
53	Karimnagar Road and Keesara Road
54	National Highway 202 (Warangal Highway)
55	National Highway 9 (Vijayawada Highway) and Nagarjuna Sagar Road
56	Srisailam Highway
57	National Highway 7 (Bangalore Highway) and Vikarabad Road
58	National Highway 9 (Mumbai Highway) and Shankarpalli Road

Figure 1: Origin-Destination Zone Map



DATA COLLECTION

Preparatory Work

A reconnaissance survey was conducted to review the various locations. The specific location for the OD locations was identified such that the flow of traffic is not impeded by upstream or downstream intersections. Also, the number of personnel required at each location was identified depending on the traffic intensity. Permission was obtained from the traffic police department before commencing the data collection.

The data was obtained through roadside interviews by stopping vehicles and interviewing the drivers. In case of Autorickshaws, the passengers were interviewed. The following shifts were utilized for the data collection:

Shift 1: 07:00 – 14: 00
Shift 2: 14:00 – 21:00

Quality Control

- Training sessions were conducted for all data collectors and supervisors. A mock exercise was conducted, and all personnel were assessed.
- All data collectors were monitored by a Supervisor.
- Data coordinators were appointed to coordinate with the supervisors, data collectors, support staff, and other personnel to ensure that all work proceeded as planned, and with the desired quality.
- All work was constantly reviewed by Traffic Engineers.
- All data collectors were provided with additional personnel for relief during their shifts for breaks.
- Supervisors conducted random inspections, and verified the data collectors work.
- Data for each 1-hour interval was obtained separately for each movement separately.
- All data sheets were filed by the supervisor immediately every hour
- All the forms were verified and were entered into a database, and all data was verified for accuracy of data entry.
- The data in the database was reviewed again to sort out inaccurate data.

Miscellaneous Measures

- A safe location was identified at each location, wherein the data collectors can safely stop and interview the vehicles.
- All data collectors and supervisors were provided with safety vests.
- Traffic flow was not obstructed for any reason.

Data Report

During the data collection, three incidents were worth noting.

- Location 26 – Tarnaka: Due to some local disturbance in the area, per the instructions of the local police, data collection was stopped at 8:45 PM (15 minutes earlier than planned).
- Location 27 – Uppal: An accident occurred at the intersection at about 11:15 AM. Traffic flow was affected for about 15 minutes, but was restored to normal situation by about 11:30 AM.

- Location 36 – Panjagutta: It was raining from 7:00 AM to 9:00 AM. During this time, the traffic was noticed to be marginally low, but was normal after the rain stopped. OD survey was conducted after the rain stopped.

ORIGIN-DESTINATION DATA ANALYSIS

The Origin-Destination (OD) interview data was obtained during the same time as the traffic volume data except at location 38, Old MLA Quarters, where volume data was not obtained. This data was entered into an Excel spreadsheet for easier review and analysis. The data was reviewed for incomplete or inconsistent information, and all such data records were deleted. It should be noted that OD data was not obtained for Mini Bus, Bus or other vehicles as per discussions with the JICA study team.

The OD data records were compared to the Volume Data count to review the sample size of the OD data at each location on an hourly basis for each mode of vehicles. It was generally observed that the OD data was spread out throughout the day, and was not concentrated at any time interval, which is acceptable.

The OD data from all the locations was combined to develop a master database with all the records of the OD interviews. It was observed that 16,112 OD interviews were collected, which is a very significant achievement. Out of these records, 14,339 were male respondents and 1773 were female respondents. Also, 8,201 respondents preferred to use the IRR for traveling between their Origin and Destination, while 7,911 respondents indicated that they may not be utilizing the IRR for that particular trip, as their trip required them to travel through city streets.

Table 4 to Table 13shows the various responses for different variables.

Table 4: Responses by Vehicle Type

Vehicle Type	Code	No. of Respondents
2W	1	**6369**
Auto	2	**2825**
Car	3	**4321**
LCV	6	**952**
Small Trucks - 2 Axle	7	**785**
Medium Trucks - 3 Axle	8	**568**
Large Truck orTractor-trailer	9	**292**
Total		**16112**

Table 5: Responses by Gender

Gender	Code	No. of Respondents
Male	M	**14339**
Female	F	**1773**
Total		**16112**

Table 6: Responses by Age Rank

Age Rank	Code	No. of Respondents
15 - 19	1	**448**
20 -24	2	**2036**
25 -29	3	**4721**
30 - 34	4	**4792**
35 - 39	5	**1998**
40 - 44	6	**1181**
45 - 49	7	**516**
50 - 54	8	**257**
55 - 59	9	**72**
60+	10	**91**
Total		**16112**

Table 7: Responses by Occupation

Occupation	Code	No. of Respondents
Government Employee	1	**1246**
Business	2	**3224**
Professional (doctor / lawyer / engineer, etc.)	3	**626**
Teacher / Professor	4	**729**
Software Engineer	5	**938**
Temporary Employee / Labor	6	**1043**
Other Private Employee	7	**2718**
Student	8	**1255**
Housewife	9	**599**
Retired	10	**60**
Unemployed	11	**1077**
Truck Driver	12	**2597**
Total		**16112**

Table 8: Responses by Monthly Income

Monthly Income	Code	No. of Respondents
None (Retired / Un-employed / Dependent)	1	**2991**
Less than Rs. 5,000	2	**745**
Rs. 5,000 - Rs. 10,000	3	**2741**
Rs. 10,001 - Rs. 15,000	4	**5217**
Rs. 15,001 - Rs. 20,000	5	**1535**
Rs. 20,001 - Rs. 25,000	6	**1556**
Rs 25,001 - Rs. 30,000	7	**619**
Rs. 30,001 - Rs. 35,000	8	**311**
Rs. 35,001 - Rs. 40,000	9	**154**
Rs. 40,001 - Rs. 45,000	10	**89**
Rs. 45,001 - Rs. 50,000	11	**48**
More than Rs. 50,000	12	**106**
Total		**16112**

Table 9: Responses by Trip Purpose

Trip Purpose 2	Code	No. of Respondents
Office / Work	1	**3699**
Business Meeting	2	**817**
Home	3	**3834**
School / College / Tuition	4	**1165**
Sightseeing	5	**185**
Entertainment	6	**398**
Meals / Restaurant	7	**259**
Retail / Shopping	8	**1244**
Visiting Friends / Family	9	**430**
Out of station (going / coming)	10	**1484**
Logistics (for all trucks)	11	**2597**
Total		**16112**

Table 10: Responses by Trip Frequency

Trip Frequency	Code	No. of Respondents
Every day (7 days a week)	1	**322**
Every Weekday (5 / 6 days a week)	2	**7414**
1-2 times every week	3	**4687**
1-2 times per month	4	**3563**
1-2 times per year	5	**126**
Total		**16112**

Table 11: Responses by No. of Hours of Travel

No. of Hours	Code	No. of Respondents
Up to 1 hour	1	**10043**
Up to 2 hours	2	**2642**
Up to 3 hours	3	**546**
Up to 4 hours	4	**37**
5 or more hours	5	**2844**
Total		**16112**

Table 12: Respondents utilizing the Inner Ring Road

Using IRR	No. of Respondents
Yes	**8201**
No	**7911**
Total	**16112**

Table 13: Respondents preferring Alternate Route

Prefer Alternate Route	No. of Respondents
Yes	**6537**
No	**1664**
Total	**8201**

Further, from the master OD table the "Zone Matrix" was developed. Zone Matrix refers to the users traveling from one zone to another, separately as Origin and as a Destination. It should be noted that a total of 45 zones were utilized for the OD interviews. The obtained Zone Matrix refers to a 45 x 45 matrix. It was observed that several trips originated and ended within the same zone. Such a phenomenon represented intra-zonal trips and was found to be acceptable. From the Zone Matrix, it was observed that the Central City, which represented the core of the city, constituted a majority of the trips. This detailed review of the Zone Matrix revealed a traffic pattern which, from local knowledge, was found to be comparable to the expected traffic pattern. Table 14 shows the zone matrix.

Appendix A shows the OD data analysis worksheets.

Table 14: Zone Matrix

Destination																																											
Origin	**01A**	**01B**	**01C**	**01D**	**02**	**03**	**04**	**05**	**06A**	**06B**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**	**Total**
01A	197	267	148	119	60	21	21	19	37	34	21	11	16	28	31	97	94	4	8	17	15	13	15	5	4	6	5	2	19	20	60	87	86	27	5	2	10	31	10	0	3	18	14	20	21	**1748**
01B	207	257	169	105	62	19	33	39	17	37	22	13	38	21	25	91	23	10	3	13	12	15	13	14	5	5	4	7	21	26	48	95	71	27	6	6	10	17	15	14	9	14	12	17	18	**1705**
01C	193	159	232	143	61	29	37	28	28	32	41	18	56	38	37	69	49	10	6	12	16	13	15	9	12	13	11	9	15	21	47	57	56	32	1	6	5	45	17	19	12	11	7	15	7	**1749**
01D	162	121	108	67	45	23	21	30	24	18	27	25	26	31	20	40	39	8	5	6	16	10	16	5	4	4	6	8	8	20	20	45	50	15	1	8	11	35	7	9	8	12	5	12	15	**1196**
02	38	78	72	55	0	0	1	3	3	2	3	6	5	2	28	18	9	3	1	3	0	0	2	2	0	5	5	3	13	7	16	18	10	8	0	1	1	1	1	0	3	5	4	3	8	**446**
03	21	48	40	25	0	0	0	0	0	0	3	3	5	12	15	15	14	0	0	0	0	0	1	4	3	5	6	1	7	9	10	19	8	2	0	0	0	3	2	0	1	5	5	4	3	**299**
04	41	39	46	41	4	2	0	0	4	8	0	0	9	0	17	12	12	1	0	1	0	0	0	0	0	0	0	0	4	2	8	14	7	5	2	3	3	0	0	0	0	5	6	7	6	**309**
05	25	36	45	30	2	0	0	0	0	0	5	2	6	5	18	12	11	0	0	0	0	0	3	1	2	2	0	3	4	6	3	13	14	2	5	0	0	7	1	1	0	6	4	7	3	**284**
06A	28	38	38	24	7	0	4	0	0	0	13	3	3	13	10	20	23	0	0	0	0	0	1	1	1	2	1	1	1	6	15	23	16	2	2	0	0	18	2	2	0	4	4	6	5	**337**
06B	18	17	35	30	3	0	1	0	0	0	4	2	2	18	19	19	22	0	0	0	0	0	1	1	3	2	5	1	1	5	12	19	9	2	1	0	0	14	10	2	0	6	0	1	2	**287**
07	24	32	40	39	4	2	0	3	3	12	0	0	11	3	6	14	19	3	0	5	0	0	0	0	0	0	0	0	2	4	2	10	13	7	1	3	2	0	0	0	0	9	4	4	9	**290**
08	23	32	27	19	7	3	0	4	6	5	0	0	8	9	4	13	15	2	0	1	0	0	0	0	0	0	0	0	5	4	6	5	9	2	0	1	1	0	0	0	0	4	7	6	11	**239**
09	23	29	35	12	4	7	15	3	2	3	8	14	0	29	11	18	21	5	0	4	1	3	3	7	6	11	6	7	7	8	10	12	9	4	0	2	1	7	5	8	4	2	4	3	2	**375**
10	16	25	41	42	11	7	0	12	16	11	5	2	15	29	10	11	20	0	1	2	0	0	1	1	6	7	10	3	5	1	2	11	14	14	4	4	2	8	7	6	2	5	8	14	17	**428**
11	42	23	28	19	19	10	11	5	6	7	8	7	7	13	1	26	12	8	4	3	7	1	5	1	3	4	5	1	2	5	10	18	15	6	1	3	2	7	5	7	4	3	2	3	5	**384**
12	67	64	110	54	31	16	12	9	27	16	6	8	20	10	15	30	17	4	4	3	2	2	1	4	2	2	5	0	3	16	13	17	30	5	1	6	11	24	9	5	10	3	3	2	10	**709**
13	47	30	48	47	14	11	7	11	20	16	14	6	9	22	14	18	22	5	0	4	1	4	3	3	0	0	1	0	1	8	11	16	15	9	3	8	8	5	6	1	2	9	8	11	13	**511**
14	3	6	13	11	0	0	0	0	0	0	3	0	1	1	5	6	6	0	0	0	0	0	0	1	0	0	0	0	0	4	1	0	2	0	0	0	0	6	0	0	0	0	0	0	1	**70**
15	2	1	10	3	0	0	0	0	0	0	2	0	0	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4	1	4	5	0	0	0	0	0	0	0	0	2	1	0	0	**41**
16	12	2	13	14	0	0	0	0	0	0	0	0	1	0	4	4	1	0	0	0	0	0	0	0	0	0	0	0	0	2	5	11	8	2	0	0	0	0	0	0	0	1	0	1	5	**86**
17	13	3	12	5	0	0	0	0	0	0	0	0	1	0	3	7	1	0	0	0	0	0	0	0	0	0	0	0	0	4	5	8	8	2	2	0	0	0	0	0	0	0	1	1	1	**77**
18	9	4	10	6	0	0	0	0	0	0	0	0	7	0	10	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	0	1	0	0	0	0	0	0	3	2	2	2	**66**
19	10	5	16	10	1	0	0	0	1	0	0	0	5	0	4	3	5	1	0	0	0	0	0	0	0	0	0	0	0	2	4	3	1	1	1	0	0	0	0	0	0	0	1	2	4	**80**
20	4	8	11	6	0	1	0	2	2	2	0	0	3	3	4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	2	1	0	2	1	1	0	0	0	0	0	0	1	0	1	1	**59**
21	7	6	14	9	1	1	0	1	1	1	0	0	2	8	2	4	4	5	0	3	0	0	0	0	0	0	0	0	0	1	1	3	3	5	3	1	0	0	0	0	0	2	7	4	6	**105**
22	4	9	7	8	2	0	0	1	5	10	0	0	0	7	8	3	0	3	0	2	0	0	0	0	0	0	0	0	0	0	2	7	5	7	2	1	0	0	0	0	0	4	2	4	5	**108**
23	6	7	11	13	3	1	0	1	2	3	0	0	5	5	5	3	4	2	0	2	0	2	0	0	0	0	0	0	0	0	1	2	1	3	1	0	1	1	0	0	0	2	0	3	5	**95**
24	7	9	7	4	3	1	0	0	0	1	0	0	3	5	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	0	0	1	1	1	0	1	0	1	3	**58**
25	20	24	23	7	11	3	2	1	2	1	7	1	8	6	1	1	1	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	1	2	0	0	5	2	2	2	2	0	3	1	2	**145**
26	34	30	24	13	11	13	7	7	13	8	4	2	6	1	4	16	1	1	1	0	4	2	1	2	2	0	0	0	0	0	0	2	1	2	4	2	1	4	1	3	4	0	0	0	0	**231**
27	35	24	23	20	19	10	6	7	4	8	3	1	8	1	2	4	4	5	1	3	7	7	5	1	0	1	1	0	2	2	0	0	0	0	0	6	3	6	4	7	1	0	0	0	2	**243**
28	110	75	56	55	27	26	13	28	21	23	5	8	18	6	16	23	15	8	4	9	10	12	7	0	4	0	1	2	3	0	0	0	0	0	0	5	9	34	4	10	8	0	0	0	10	**665**
29	61	56	53	59	16	10	6	14	29	17	4	6	21	4	22	21	7	3	4	6	7	1	1	2	0	1	1	4	1	0	0	0	0	0	0	5	5	30	6	6	5	0	0	0	7	**501**
30	27	30	37	13	15	5	12	3	2	2	4	8	4	12	5	1	9	0	0	1	0	2	2	0	0	1	1	1	0	2	0	0	0	0	0	0	0	16	4	1	1	0	0	0	1	**222**
31	7	9	15	8	4	0	1	0	5	0	1	1	1	4	3	2	8	0	0	3	1	0	0	0	0	0	4	2	0	1	0	0	0	0	0	0	0	8	0	1	0	0	0	0	0	**89**
32	7	14	13	3	2	0	3	0	0	0	3	5	5	2	6	4	12	0	0	0	0	0	0	0	1	0	2	1	2	2	3	2	2	0	0	0	0	5	0	2	0	2	1	0	0	**104**
33	3	12	12	5	1	0	0	0	0	0	2	0	3	4	4	5	6	0	0	0	0	0	0	0	1	1	3	1	0	4	4	3	5	0	0	0	0	4	2	0	1	1	0	0	0	**87**
51	29	27	29	33	5	0	0	5	14	10	0	0	15	9	10	22	10	5	0	0	0	0	0	0	0	0	0	0	2	7	10	20	22	11	0	2	2	0	0	0	0	0	0	0	0	**299**
52	16	16	22	20	2	0	0	2	6	5	0	0	6	10	4	15	5	1	0	1	0	0	0	0	0	0	0	0	3	3	6	17	20	8	1	2	1	0	0	0	0	0	0	0	0	**192**
53	11	9	24	17	1	1	0	1	4	6	0	0	3	5	7	17	2	2	0	2	0	0	0	0	0	0	0	0	0	2	8	12	9	4	0	1	1	0	0	0	0	0	0	0	0	**149**
54	13	19	14	11	0	0	0	3	3	1	0	0	5	1	3	11	6	2	1	0	0	0	0	0	0	0	0	0	0	1	6	7	10	3	1	1	1	0	0	0	0	0	0	0	0	**123**
55	20	11	17	17	7	2	5	2	4	3	6	4	3	9	2	3	8	0	0	1	1	3	1	2	1	2	3	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	**140**
56	26	27	13	18	15	10	1	6	5	8	10	6	6	20	13	1	18	1	0	3	1	0	3	3	4	5	3	4	2	2	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	**237**
57	31	38	19	20	9	9	2	8	10	10	9	6	8	19	10	1	18	1	0	3	3	0	1	3	8	5	6	5	1	2	0	0	0	0	0	1	2	0	3	0	0	0	0	0	0	**271**
58	35	44	5	11	13	7	3	4	7	6	6	9	2	24	5	2	12	3	0	2	3	3	3	6	5	5	7	7	2	4	7	10	5	0	0	0	0	1	3	0	2	0	0	0	0	**273**
Total	**1734**	**1820**	**1785**	**1290**	**502**	**250**	**224**	**262**	**333**	**326**	**249**	**177**	**386**	**451**	**447**	**707**	**591**	**107**	**43**	**115**	**109**	**93**	**106**	**78**	**77**	**89**	**102**	**74**	**140**	**218**	**361**	**597**	**544**	**220**	**48**	**80**	**98**	**340**	**127**	**108**	**84**	**140**	**115**	**155**	**210**	**16112**

09. VMS Structural Design

Design Report

For

Structures supporting Variable Message Sign (VMS)

Client:

Asa Bhanu Technical Services Ltd

Prepared by

SatyaVani Projects And Consultants Pvt. Ltd.

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CONTENTS

1 INTRODUCTION

2 SCOPE

3 TECHNICAL DATA

4 LOAD CALCULATIONS

5 ANALYSIS

6 DESIGN

7 ANNEXURE

A. DESIGN

- STAAD DESIGN (OUT PUT)
- FOUNDATION DESIGN

B. DRAWINGS

1. INTRODUCTION:

This is an Analysis Report for supporting Variable Message Sign (VMS) for ***Asa Bhanu Technical Services Ltd.*** This report has been compiled primarily from the data available from client. The report gives clear and detailed technical specifications. Most of the details furnished are referred through standard codes and on chapters where necessary.

2.SCOPES:

The Structural Design shall cover the following works:

(1) Structural calculation including foundation for four cases

a) **Case 1**: F-shaped cantilever type structure for type-A VMS

b) **Case 2**: Gantry type structure with 20,000 mm width for type-A VMS

c) **Case 3**: Gantry type structure with 25,000 mm width for type-A VMS

d) **Case 4**: Gantry type structure with 25,000 mm width for type-B VMS

(2) Preparation of reference drawings.

(3) Preparation of Bill of Quantity (BOQ).

3.TECHNICAL DATA:

The Technical date presented here is as per the clients input.

- Minimum road clearance : 5.5mt
- Type-A VMS size:
  - Width : 6,000 mm,
  - Height : 2,000 mm,
  - Depth : 400 mm
  - Weight : 2,000 kg
- Type-B VMS size:
  - Width : 8,000 mm,
  - Height : 5,500 mm,
  - Depth : 1000 mm
  - Weight : 10,000 kg
- Wind Speed : 150 Km/h
- Grade of Concrete : M25
- Grade of Steel : Fe500
- Safe bearing capacity of soil : 250 kN/m^2 (Assumed)

4.LOAD CALCULATIONS:

Dead Load:

Dead load consists of the weight of complete Structure with VMS weight as mentioned in technical data.

Wind load:

Wind load on structure shall be calculated as per provisions of IS: 875(Part-III)-1987.

Wind Pressure Calculations:

Wind Speed (V_b): 42 m/sec (150 kmph)

Risk Coefficient (K_1): 1.0

Terrain Roughness Coefficient (K_2): 1.03

Topography factor (K3): 1

Design Wind Speed $V_z = V_b * K_1 * K_2 * K3$

$= 42*1*1.03*1$

$= 43.26$ m/s

Design Wind pressure $= 0.6 *(V_z)^2$

$= 1122$ N/m^2

Load combination:

1.0DL + 1.0WL (+Z direction)

1.0DL +1.0 WL (-Z direction)

5. ANALYSIS:

The Gantry type structure have been idealized as self supporting steel lattice structure with discrete elements, using finite element analysis software for individual loading cases and the loads are combined appropriately for all the cases.. The self weight of the GTS is calculated internally in the FE program.

6. DESIGN:

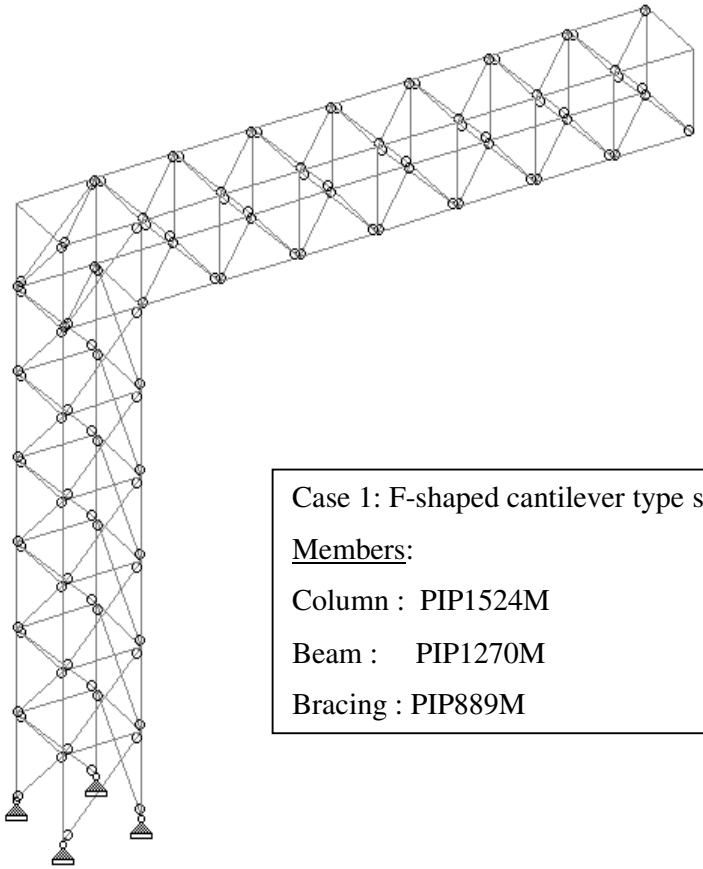
The structural element has been analyzed and designed using the software STAAD PRO.

Footings have been designed manually taking support from STAAD PRO support reactions.

ANNEXURE

A.DESIGN

STAAD DESIGN (OUTPUT)



Case 1: F-shaped cantilever type structure for type-A VMS

Members:

Column : PIP1524M

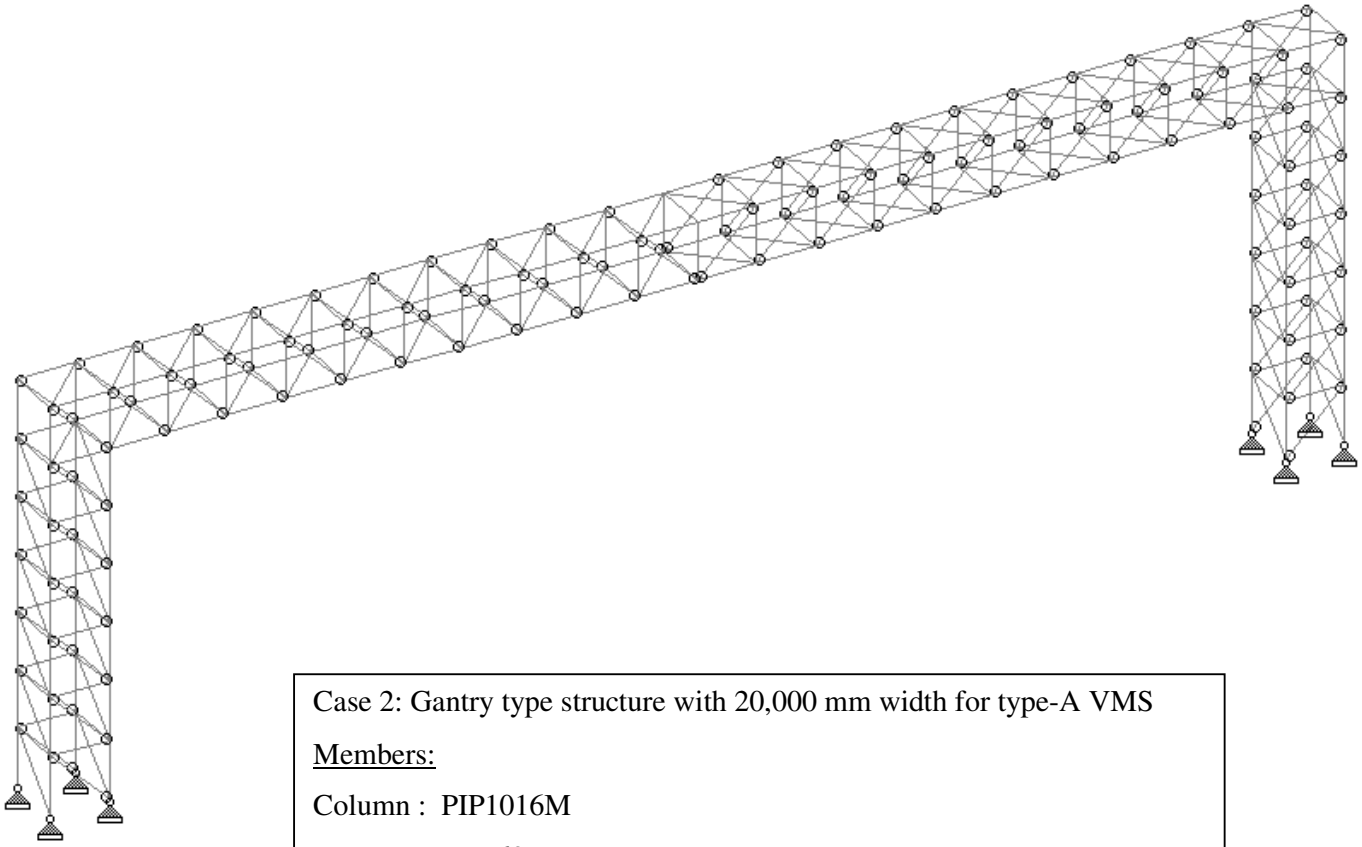
Beam : PIP1270M

Bracing : PIP889M

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
414	ST PIP1524.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.221	8
		49.32 T	0.00	0.97	0.00
415	ST PIP1524.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.217	6
		59.86 T	0.00	0.50	1.00
417	ST PIP1524.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.261	6
		70.84 T	0.00	0.66	1.00
438	ST PIP1270.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.218	8
		5.29 T	0.00	1.79	0.00
440	ST PIP1270.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.683	8
		80.30 C	0.00	3.50	0.00
441	ST PIP1270.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.251	8
		59.62 C	0.00	0.32	0.00
442	ST PIP1270.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.177	8
		36.86 C	0.00	0.39	0.00
443	ST PIP1270.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.091	8
		20.87 C	0.00	0.14	1.00
444	ST PIP1270.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.047	8
		9.65 C	0.00	0.11	1.00

----------< PAGE 5 Ends Here >----------



Case 2: Gantry type structure with 20,000 mm width for type-A VMS

Members:

Column : PIP1016M

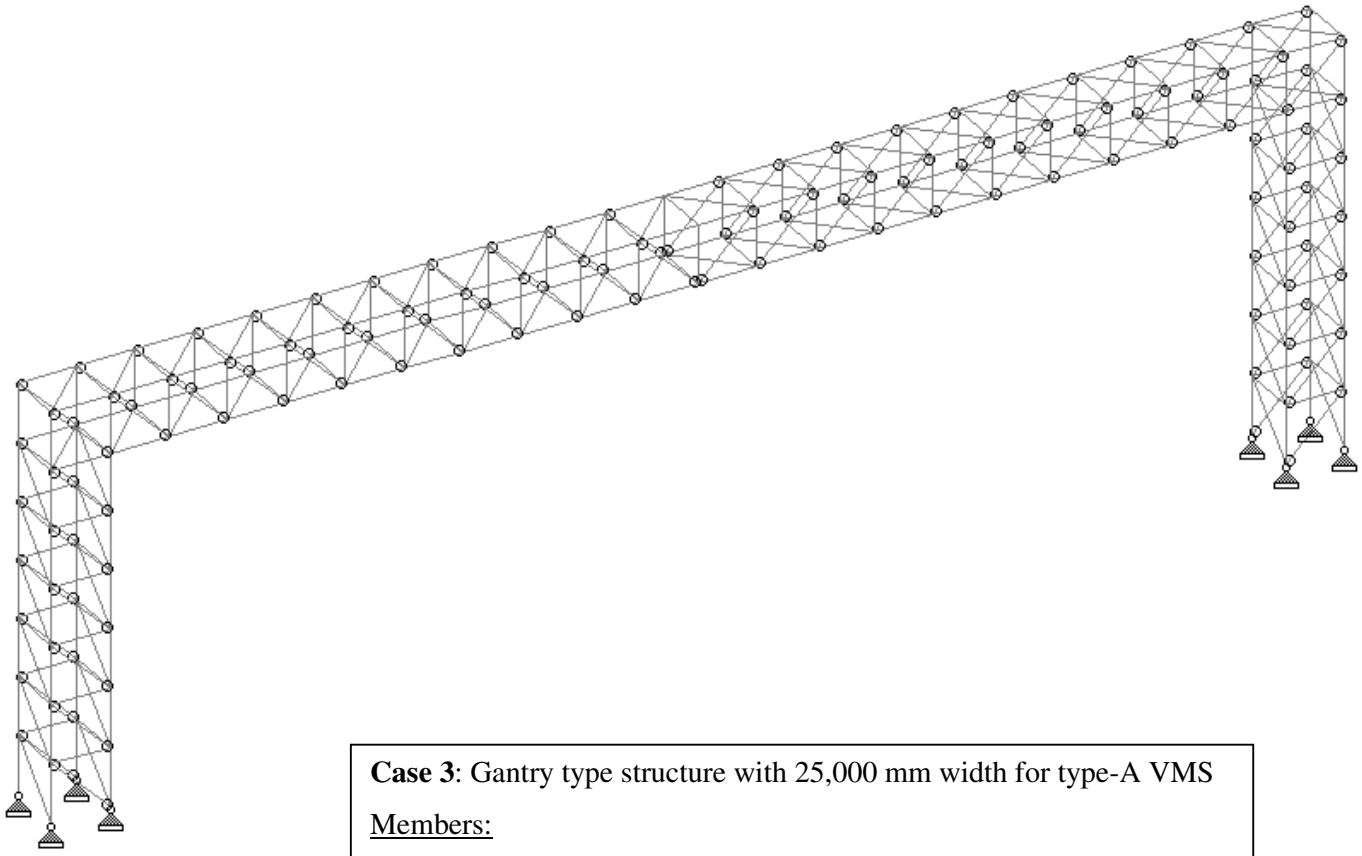
Beam : PIP760M

Bracing : PIP483M

Load 1

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
14	ST PIP483.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.210	8
		5.46 T	0.00	0.10	1.00
62	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.208	7
		23.13 C	0.00	0.05	1.01
63	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.156	8
		17.71 C	0.00	0.03	1.01
64	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.117	8
		13.44 C	0.00	0.02	0.59
65	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.170	9
		18.65 T	0.00	0.05	0.93
66	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.248	9
		28.04 T	0.00	0.05	0.84
67	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.318	9
		36.44 T	0.00	0.06	0.76
68	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.378	9
		43.60 T	0.00	0.06	0.67
69	ST PIP761.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.430	9
		49.21 T	0.00	0.08	0.84



Case 3: Gantry type structure with 25,000 mm width for type-A VMS

Members:

Column : PIP1143M

Beam : PIP889M

Bracing : PIP483M

Load 1

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
659 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.407	9
		60.54 T	0.00	0.11	0.52
660 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.264	9
		38.59 T	0.00	0.09	0.31
661 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.131	8
		19.38 C	0.00	0.04	0.52
662 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.239	6
		29.36 C	0.00	0.20	1.25
663 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.615	7
		42.17 C	0.00	1.27	0.00
664 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.206	9
		27.35 C	0.00	0.13	0.00
665 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.202	8
		29.28 T	0.00	0.07	1.15
666 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.353	8
		52.33 T	0.00	0.10	1.04
667 ST	PIP889.0M		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.482	8
		70.73 T	0.00	0.15	1.25

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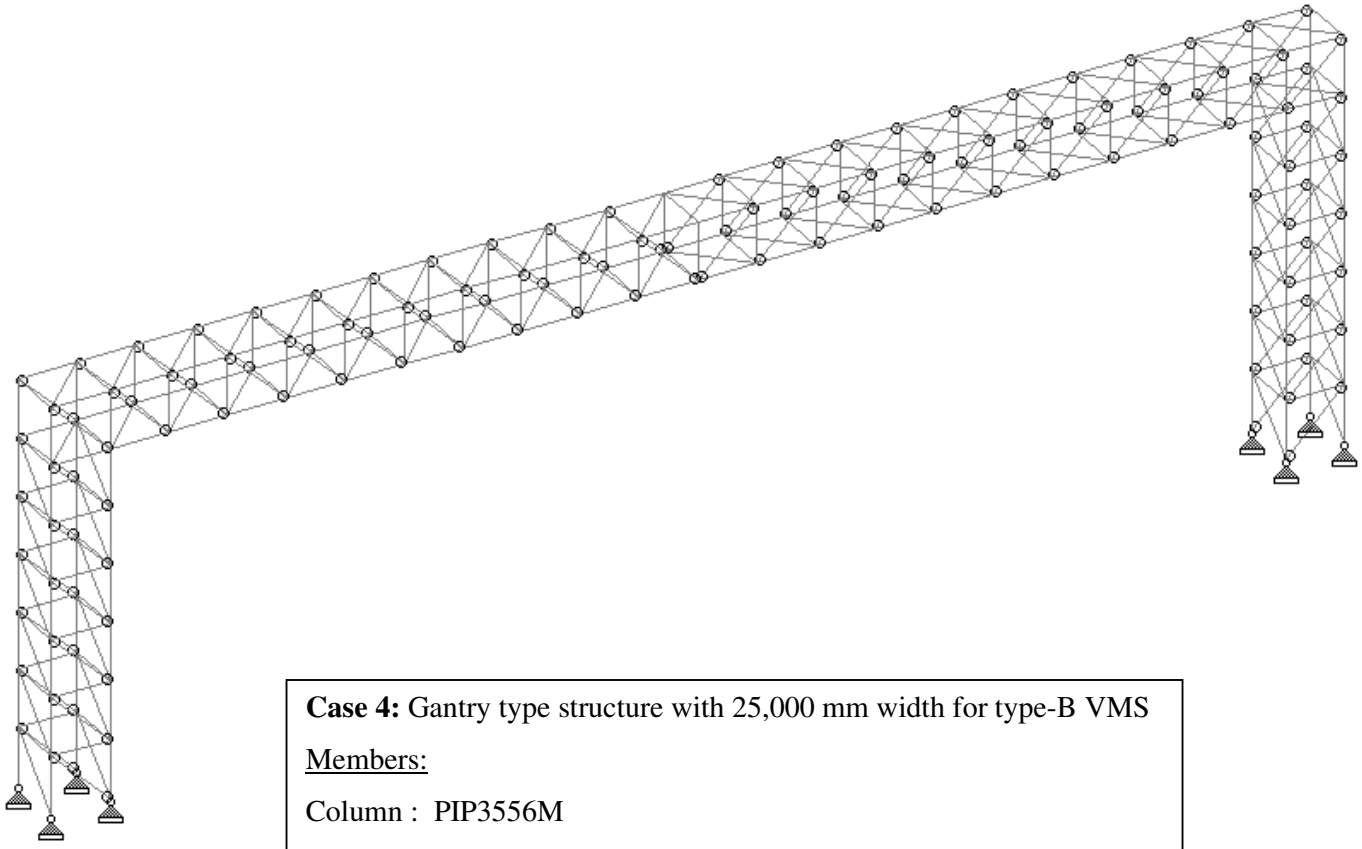


Case 4: Gantry type structure with 25,000 mm width for type-B VMS

Members:

Column : PIP3556M

Beam : PIP3239M

Bracing : PIP1143M

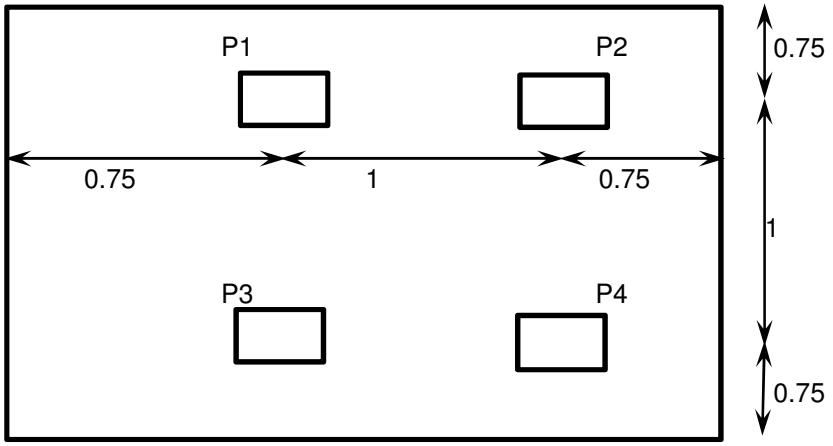
Load 1

ALL UNITS ARE - KN METE (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
625	ST PIP1143.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.647	9
		81.46 C	0.00	1.94	0.00
627	ST PIP1143.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.620	8
		81.39 C	0.00	1.76	0.00
629	ST PIP1143.0M		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.182	9
		17.76 C	0.00	0.68	0.00
654	PRI SMAT		(INDIAN SECTIONS)		
		PASS	IS-7.1.2	0.095	8
		62.93 C	-0.30	1.96	0.00
655	PRI SMAT		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.130	9
		77.54 T	1.26	-2.55	1.25
656	PRI SMAT		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.241	9
		159.12 T	1.34	-4.37	1.25
657	PRI SMAT		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.318	9
		220.24 T	1.42	-5.20	1.04
658	PRI SMAT		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.334	9
		236.32 T	1.51	-5.06	1.25
659	PRI SMAT		(INDIAN SECTIONS)		
		PASS	IS-6.2	0.286	9
		192.63 T	1.39	-5.02	0.00

FOUNDATION DESIGN

FOOTING DESIGN FOR CASE 1



Footing Width	=	2.5		X	2.5
Footing thickness	=	0.5	m		
Footing Area	=	6.25	m^2		
Depth of Footing from NGL	=	1.2	m		

LOADS

P1	=	45	kN
P2	=	45	kN
P3	=	-45	kN
P4	=	-45	kN

(-ve) - Tension (+ve) Compresion

Overturning Moment	=	90	kN-m
Resisting Moment	=	449	kN-m
FOS	=	4.99	

P/A + Mx/Zx + Mz/Zz	=	377.425	/	6.25	+	90	/ 2.5 * 2.5^2 / 6
	=	60.388		+	34.56	=	94.948
	=	60.388		-	34.56	=	25.83

cantilever bending moment M	$w l^2/2$	=	40.1
simply supported Bending Moment, M	$wl^2/8$	=	17.8
	$wl^2/10$		14.2
Maximum Bending Moment, Mu		=	40.1

Depth of footing from Bending Moment consideration

Charectaristic strength of concrete.f_{ck}	=	25	N/mm^2
Yeild strength steel.f_y	=	500	N/mm^2
Effective depth d=sqrt(Mu/0.138*fck	=	132	mm
Assumed overall depth, D	=	500	mm
Effective depth (d)	=	450	mm

Depth of footing from shear consideration

shear force	v	=	71	
	v/b*d	=	0.158	
max shear stress		=	0.29	SAFE

Steel Calculations **Bottom Reinforcement**

Adopt effective depth of footing is	=	450	mm
Provide overall depth	=	**500**	mm
Mu/bd^2	=	0.198	
Percentage of steel required	=	**0.049**	(SP 16 TABLE -4)
Area of steel Required	=	540	mm^2
Dia of Bar	=	**12**	mm
Area of one bar	=	113.0976	mm^2
Required spacing of steel	=	209.4	mm
Provided spacing of steel	=	**150**	mm

Pedestal

size	0.6		0.6		**1.75**	
mainbars	16	mm		=	8	no
stirrups	8	mm		@	**200**	spacing
no of pedestal				=	4	no

Estimation

Footing

concrete quantity	=	3.125	m3
steel quantity	=	157	kg

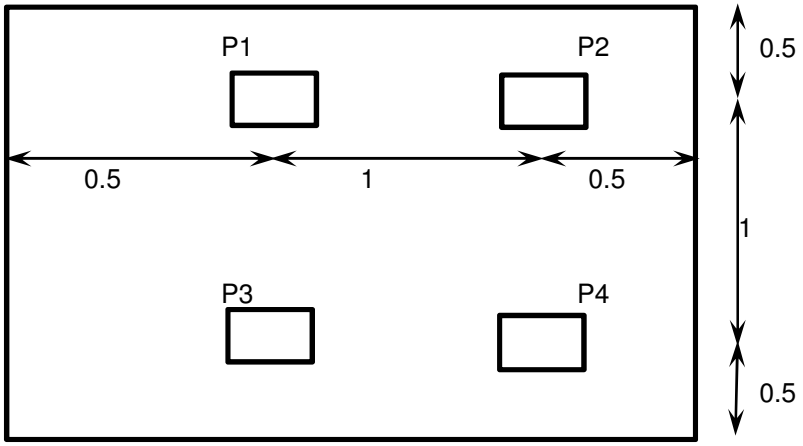
pedestal

concrete quantity	=	2.52	m3
steel quantity(main)	=	126.4	kg
stirups	=	64.09	kg

Total quantity

concrete	=	5.645	m3
steel	=	348	kg

FOOTING DESIGN FOR CASE 2



Footing Width	=	2		X	2
Footing thickness	=	0.45	m		
Footing Area	=	4	m^2		
Depth of Footing from NGL	=	1.2	m		

LOADS

P1	=	32	kN
P2	=	34	kN
P3	=	-32	kN
P4	=	-35	kN

(-ve) - Tension (+ve) Compresion

Overturning Moment	=	66	kN-m
Resisting Moment	=	257	kN-m
FOS	=	3.89	

P/A + Mx/Zx + Mz/Zz	=	270.2 /	4	+	66 /	2 * 2^2 / 6	
	=	67.55	+	49.5	=	117.05	
	=	67.55	-	49.5	=	18.05	

cantilever bending moment M	$w l^2/2$	=	21.9
simply supported Bending Moment, M	$wl^2/8$	=	21.9
	$wl^2/10$		17.6
Maximum Bending Moment, Mu		=	21.9

Depth of footing from Bending Moment consideration

Charectaristic strength of concrete.f_{ck}	=	25	N/mm^2
Yeild strength steel.f_y	=	500	N/mm^2
Effective depth d=sqrt(Mu/0.138*fck	=	98	mm
Assumed overall depth, D	=	450	mm
Effective depth (d)	=	400	mm

Depth of footing from shear consideration

shear force	v	=	88	
	v/b*d	=	0.219	
max shear stress		=	0.29	SAFE

Steel Calculations **Bottom Reinforcement**

Adopt effective depth of footing is	=	400	mm
Provide overall depth	=	**450**	mm
Mu/bd^2	=	0.137	
Percentage of steel required	=	**0.034**	(SP 16 TABLE -4)
Area of steel Required	=	480	mm^2
Dia of Bar	=	**10**	mm
Area of one bar	=	78.54	mm^2
Required spacing of steel	=	163.6	mm
Provided spacing of steel	=	**150**	mm

Pedestal

size	0.6		0.6		**1.75**	
mainbars	16	mm		=	8	no
stirrups	8	mm		@	**200**	spacing
no of pedestal				=	4	no

Estimation

Footing

concrete quantity	=	1.8	m3
steel quantity	=	71	kg

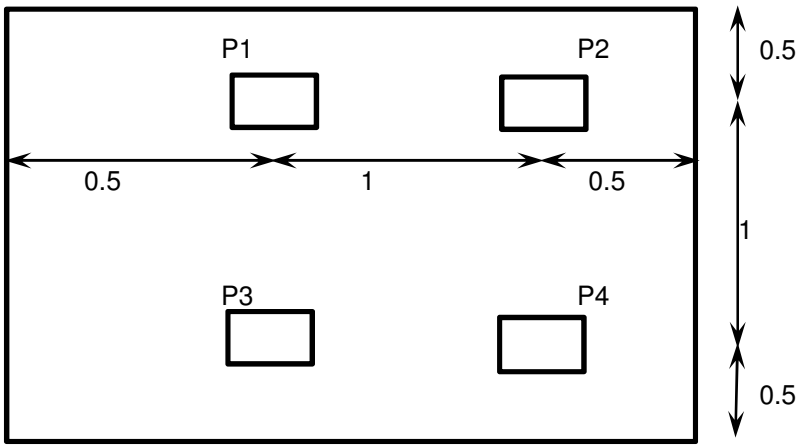
pedestal

concrete quantity	=	2.52	m3
steel quantity(main)	=	123.9	kg
stirups	=	64.09	kg

Total quantity

concrete	=	8.64	m3
steel	=	518	kg

FOOTING DESIGN FOR CASE 3



Footing Width	=	2		X	2
Footing thickness	=	0.55	m		
Footing Area	=	4	m^2		
Depth of Footing from NGL	=	1.2	m		

LOADS

P1	=	38	kN
P2	=	42	kN
P3	=	-38	kN
P4	=	-42	kN

(-ve) - Tension (+ve) Compresion

Overturning Moment	=	80	kN-m
Resisting Moment	=	266	kN-m
FOS	=	3.32	

P/A + Mx/Zx + Mz/Zz	=	280.2 /	4	+		80 /	2 * 2^2 / 6
	=	70.05	+		60	=	130.05
	=	70.05	-		60	=	10.05

cantilever bending moment M	$w l^2/2$	=	24.4
simply supported Bending Moment, M	$wl^2/8$	=	24.4
	$wl^2/10$		19.5
Maximum Bending Moment, Mu		=	24.4

Depth of footing from Bending Moment consideration

Charectaristic strength of concrete.f_c	=	25	N/mm^2
Yeild strength steel.f_y	=	500	N/mm^2
Effective depth d=sqrt(Mu/0.138*fck	=	103	mm
Assumed overall depth, D	=	550	mm
Effective depth (d)	=	500	mm

Depth of footing from shear consideration

shear force	v	=	98	
	v/b*d	=	0.195	
max shear stress		=	0.29	SAFE

Steel Calculations **Bottom Reinforcement**

Adopt effective depth of footing is	=	500	mm
Provide overall depth	=	**550**	mm
Mu/bd^2	=	0.098	
Percentage of steel required	=	**0.024**	(SP 16 TABLE -4)
Area of steel Required	=	600	mm^2
Dia of Bar	=	**12**	mm
Area of one bar	=	113.0976	mm^2
Required spacing of steel	=	188.5	mm
Provided spacing of steel	=	**150**	mm

Pedestal

size	0.6		0.6	**1.75**	
mainbars	16	mm	=	8	no
stirrups	8	mm	@	**200**	spacing
no of pedestal			=	4	no

Estimation

Footing

concrete quantity	=	2.2	m3
steel quantity	=	102	kg

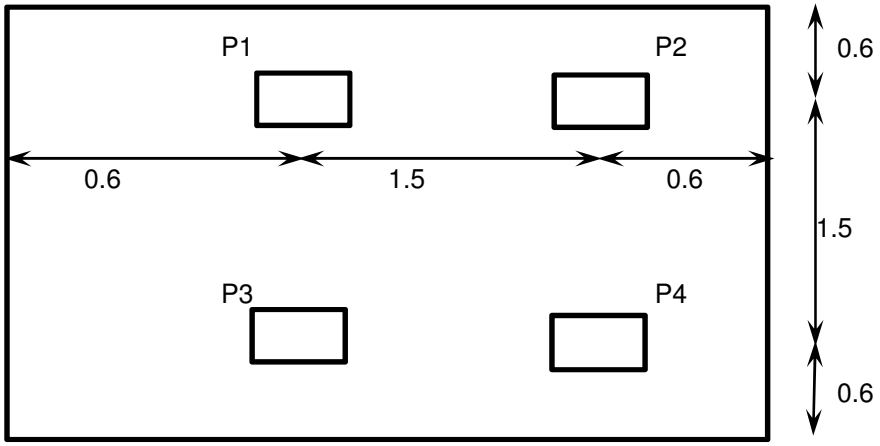
pedestal

concrete quantity	=	2.52	m3
steel quantity(main)	=	128.9	kg
stirups	=	64.09	kg

Total quantity

concrete	=	9.44	m3
steel	=	590	kg

FOOTING DESIGN FOR CASE 4



Footing Width	=	2.7		X	2.7
Footing thickness	=	0.65	m		
Footing Area	=	7.29	m^2		
Depth of Footing from NGL	=	1.5	m		

LOADS

P1	=	84	kN
P2	=	95	kN
P3	=	-84	kN
P4	=	-95	kN

(-ve) - Tension (+ve) Compresion

Overturning Moment	=	268.5	kN-m
Resisting Moment	=	699	kN-m
FOS	=	2.60	

P/A + Mx/Zx + Mz/Zz	=	608.6275 /	7.29	+	268.5 /	2.7 * 2.7^2 / 6
	=	83.48799726	+	81.84728 =	165.33527663465	
	=	83.48799726	-	81.84728 =	1.6407178783722	

cantilever bending moment M	$w l^2/2$	=	44.6
simply supported Bending Moment, M	$wl^2/8$	=	69.8
	$wl^2/10$		55.8
Maximum Bending Moment, Mu		=	69.8

Depth of footing from Bending Moment consideration

Charectaristic strength of concrete.f_{ck}	=	25	N/mm^2
Yeild strength steel.f_y	=	500	N/mm^2
Effective depth d=sqrt(Mu/0.138*fck*b	=	174	mm
Assumed overall depth, D	=	650	mm
Effective depth (d)	=	600	mm

Depth of footing from shear consideration

shear force	v	=	186	
	v/b*d	=	0.310	
	max shear stress	=	0.345	SAFE

Steel Calculations **Bottom Reinforcement**

Adopt effective depth of footing is	=	600	mm
Provide overall depth	=	**650**	mm
Mu/bd^2	=	0.194	
Percentage of steel required	=	**0.048**	(SP 16 TABLE -4)
Area of steel Required	=	720	mm^2
Dia of Bar	=	**16**	mm
Area of one bar	=	201.0624	mm^2
Required spacing of steel	=	279.3	mm
Provided spacing of steel	=	**150**	mm

Pedestal

size	0.6		0.6		**1.75**	
mainbars	16	mm	=		8	no
stirrups	8	mm	@		**200**	spacing
no of pedestal			=		4	no

Estimation

Footing

concrete quantity	=	4.7385	m3
steel quantity	=	243	kg

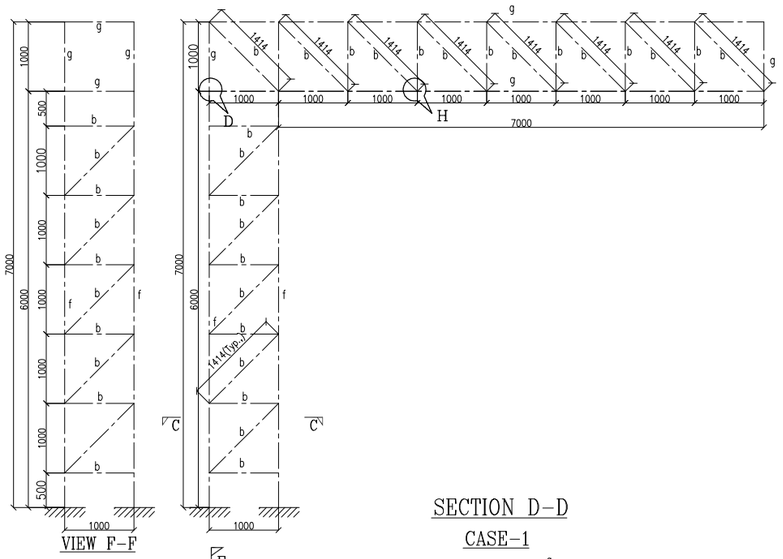
pedestal

concrete quantity	=	2.52	m3
steel quantity(main)	=	134.0	kg
stirups	=	64.09	kg

Total quantity

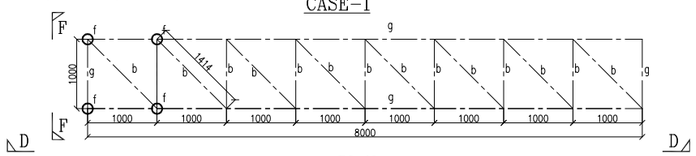
concrete	=	14.517	m3
steel	=	883	kg

B.DRAWINGS

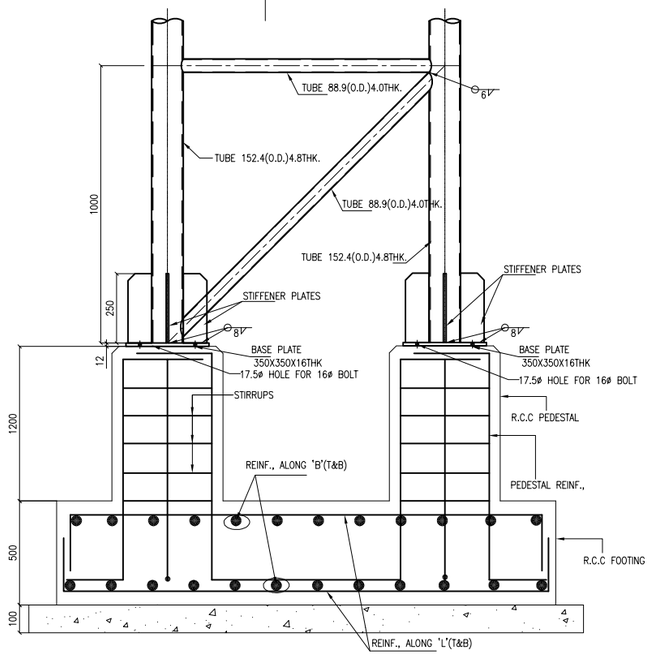


SECTION D-D

CASE-1



PLAN



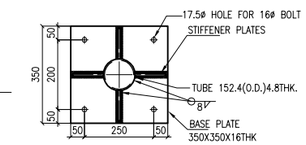
SECTION X-X

BOQ FOR 8M SPAN(APPROX.,):-

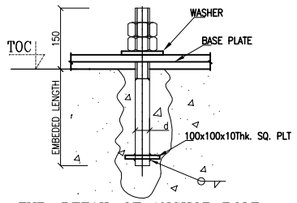
SL. NO.	ITEM NO.	SECTION	LENGTH	UNIT WT.	TOTAL WT
		MM	M	Kg/m	Kg
1	g	127.0 (OD)4.8Thk	32	14.50	464.00
2	f	152.4 (OD)4.8Thk	20	17.50	350.00
3	b	88.9 (OD)4.0Thk	128	8.36	1070.08
4		BP(350x350x16Thk)		125.6	123
5		ANCHOR BOLT	450	1.58	22.7
				TOTAL WEIGHT	2029.78

NOTE :-

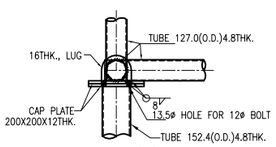
1. ALL DIMENSIONS ARE IN 'MM'.
2. ALL BOLTS AND NUTS SHALL CONFORM TO IS:1363-1992 (BOLTS ARE 8.8 GRADE).
3. BOLTS IN DIRECT TENSION SHALL BE PROVIDED WITH LOCK NUTS CONFORMING TO IS:1363-1992 OR DOUBLE COIL SPRING WASHERS CONFORMING TO IS:6755-1980.
4. STRUCTURAL GRADE CONFORMING TO IS:2062/IS:226.
5. ALL WELDS ARE 6MM CONTINUOUS FILLET UNLESS OTHERWISE NOTED.
6. WELDING PROCEDURES ARE TO BE AS PER IS:816-1969 & 9595-1980.
7. WELDING LENTHS WHEREVER INDICATED ARE MINIMUM REQUIRED HOWEVER FULL CONTACT LENTH TO BE WELDED IN ALL CASES UNLESS OTHERWISE NOTED.



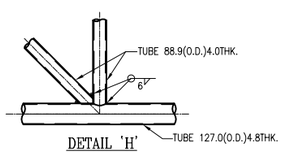
TYP., BASE PLATE DETAIL



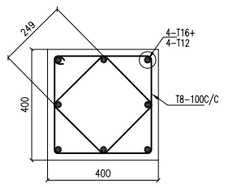
TYP. DETAIL OF ANCHOR BOLT



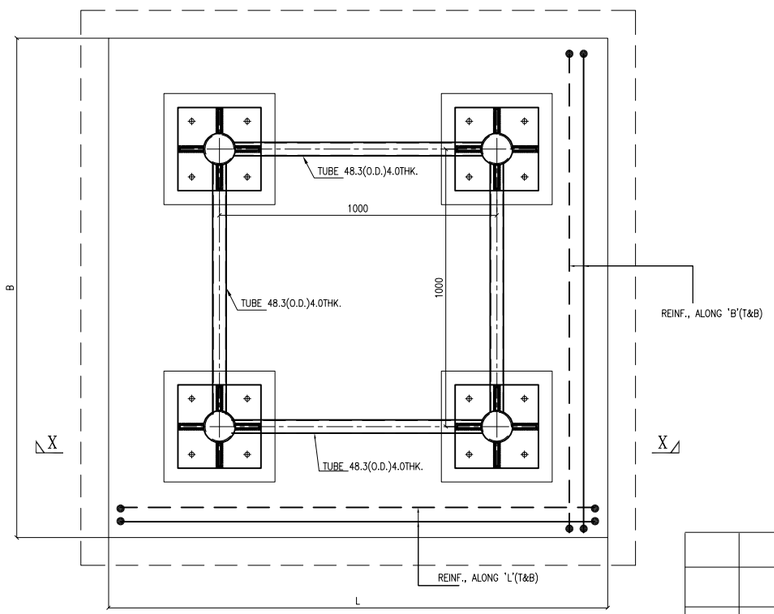
DETAIL 'D'



DETAIL 'H'



C/S OF PEDESTAL



VIEW C-C

NOTE:-
FOUNDATION SIZE & REINF., MAY VARY AFTER RECEIVING SOIL REPORT

FOR INFORMATION

REINF. DETAILS OF FOOTING :-

S.NO	SIZE L x B	DEPTH D	Nos.	TOP REINFORCEMENT		BOTTOM REINFORCEMENT	
				ALONG 'L'	ALONG 'B'	ALONG 'L'	ALONG 'B'
1	2500x2500	500	02	T10-200C/C	T10-200C/C	T12-150C/C	T12-150C/C

RevNo	Revision note	Date	Drawn	Checked

DRG. NO.	01
SCALE	1:100
DATE	04.10.12
DRN BY	T.R.LAKSHMI
DES BY	SENTHIL
CHKD BY	RK
CAD FILE:	-

STRUCTURAL

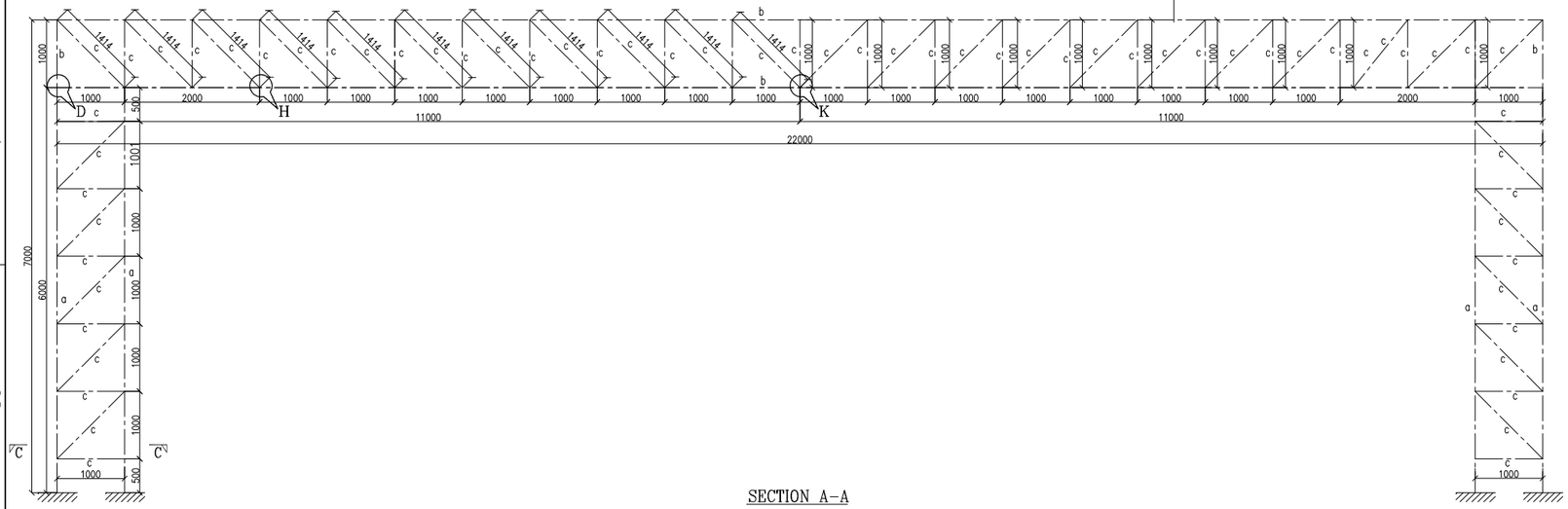
SATYAVANI PROJECTS & CONSULTANTS Pvt. Ltd.,
A-203, KUSHAL TOWERS, KHAIRATABAD, HYDERABAD-04
PH: 040-23321623, 23314437, 23314881, 66667401 FAX: 040-22308184
Visit Us @ : www.svpcpl.com

CLIENT: ASA BHANU TECHNICAL SERVICES LTD.

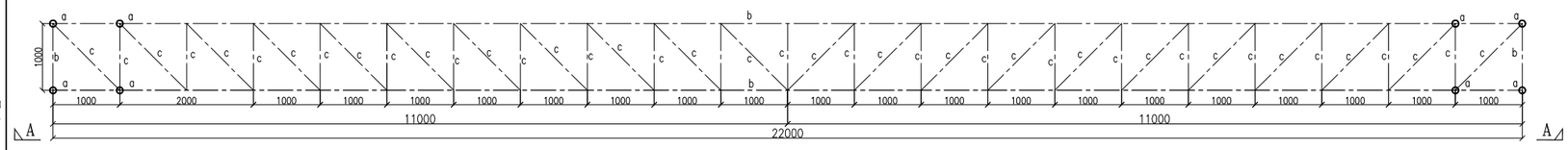
PROJECT: F-SHAPED CANTILEVER TYPE STRUCTURE WITH 8MTS.(CASE-1)

TITLE: G.A OF HORDING

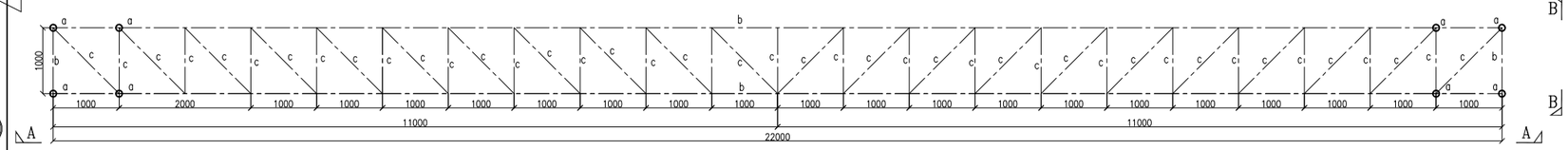
Cad file:-\\Strl\All Users\Chaitanya Data\Asa Bhanu Highway Sign Board supporting Structure\DWG\HORDINGS(04.10.12).-1dwg.dwg



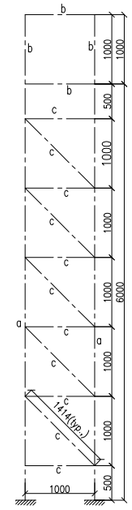
SECTION A-A
CASE-2



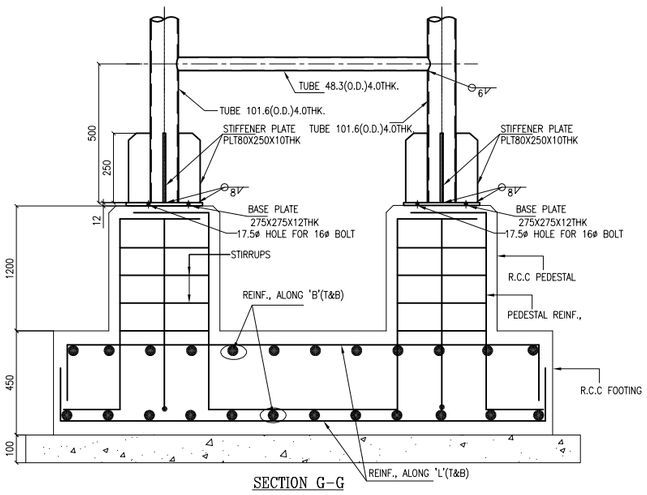
TOP VIEW



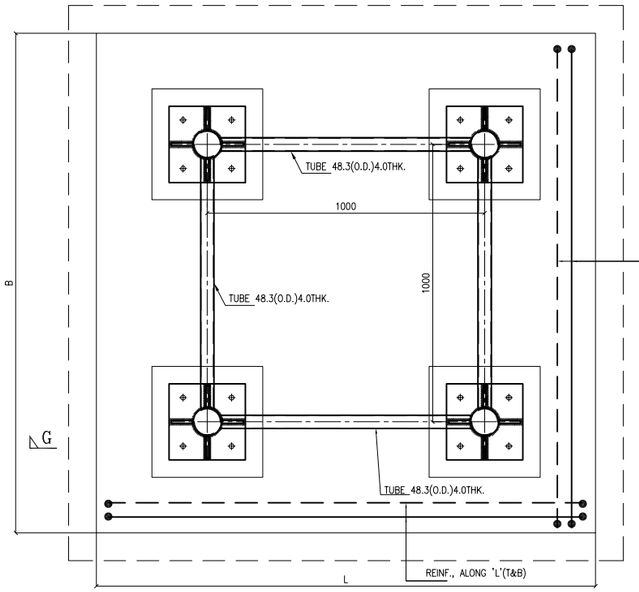
BOTTOM VIEW



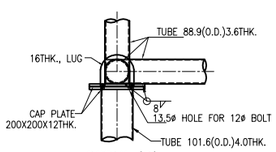
VIEW B-B



SECTION G-G



VIEW C-C



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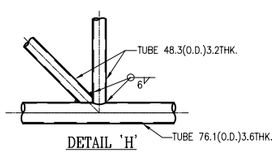

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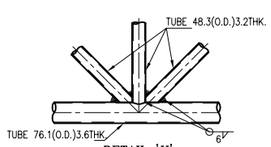
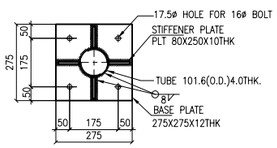
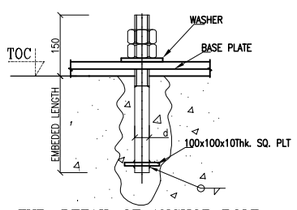


DETAIL 'K'



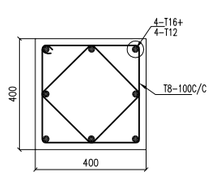
TYP., BASE PLATE DETAIL



TYP. DETAIL OF ANCHOR BOLT

BOQ FOR 20M SPAN(APPROX.,):-

SL. NO.	ITEM NO.	SECTION MM	LENGTH M	UNIT WT. Kg/m	TOTAL WT Kg
1	b	101.69(OD)4Thk	40	9.63	385.20
2	a	76.1(OD)3.6Thk	88	6.42	564.96
3	c	48.3(OD)3.2Thk	134	3.56	477.04
4		BP(275x275x12Thk)		94.2	57
5		ANCHOR BOLT	12.5	1.58	20
				TOTAL WEIGHT	1504.2



C/S OF PEDESTAL

NOTE :-
1. ALL DIMENSIONS ARE IN 'MM'.
2. ALL BOLTS AND NUTS SHALL CONFORM TO IS:1363-1992 (BOLTS ARE 8.8 GRADE).
3. BOLTS IN DIRECT TENSION SHALL BE PROVIDED WITH LOCK NUTS CONFORMING TO IS:1363-1992 OR DOUBLE COIL SPRING WASHERS CONFORMING TO IS:6755-1980.
4. STRUCTURAL GRADE CONFORMING TO IS:2062/IS:226.
5. ALL WELDS ARE 6MM CONTINUOUS FILLET UNLESS OTHERWISE NOTED.
6. WELDING PROCEDURES ARE TO BE AS PER IS:816-1969 & 9595-1980.
7. WELDING LENTHS WHEREVER INDICATED ARE MINIMUM REQUIRED HOWEVER FULL CONTACT LENTH TO BE WELDED IN ALL CASES UNLESS OTHERWISE NOTED.

REINF. DETAILS OF FOOTING :-

S.NO	SIZE L x B	DEPTH D	Nos.	TOP REINFORCEMENT ALONG 'L'	TOP REINFORCEMENT ALONG 'B'	BOTTOM REINFORCEMENT ALONG 'L'	BOTTOM REINFORCEMENT ALONG 'B'
1	2000x2000	450	02	T10-200C/C	T10-200/C	T10-150C/C	T10-150C/C

NOTE:-
FOUNDATION SIZE & REINF., MAY VARY AFTER RECEIVING SOIL REPORT

FOR INFORMATION

RevNo	Revision note	Date	Drawn	Checked

DRG. NO.	01
SCALE	1:100
DATE	04.10.12
DRN BY	T.R.LAKSHMI
DES BY	SENTHIL
CHKD BY	RK
CAD FILE:	-

STRUCTURAL

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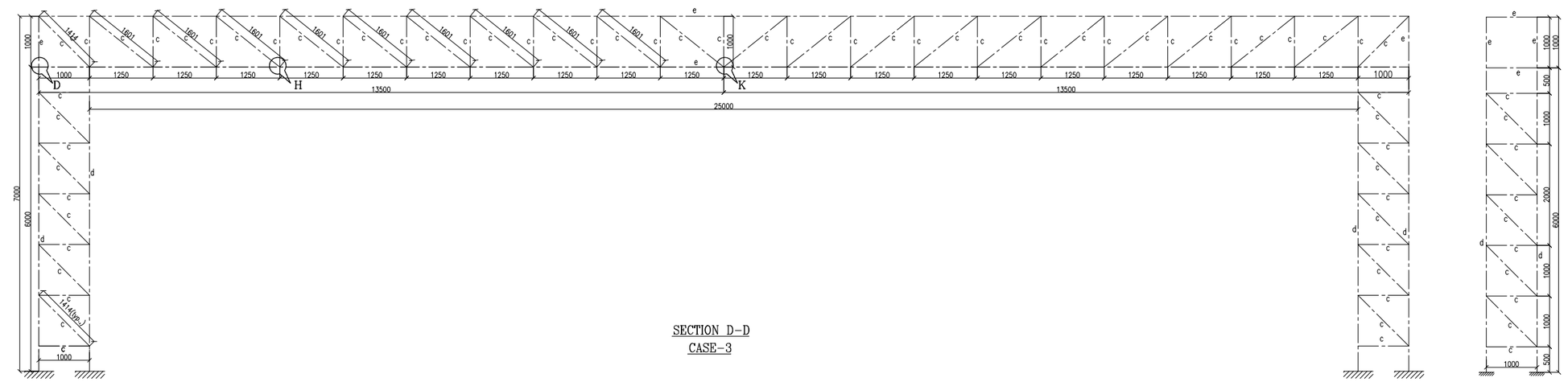
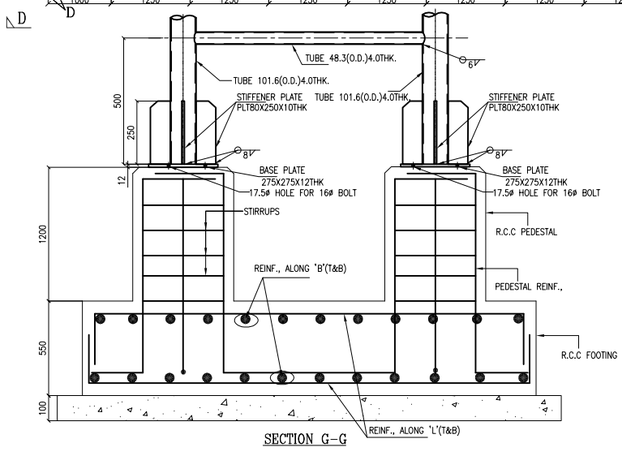
Visit Us @ : www.svpcpl.com

CLIENT: ASA BHANU TECHNICAL SERVICES LTD

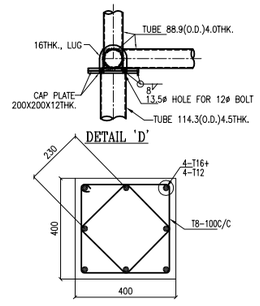
PROJECT: GANTRY TYPE STRUCTURE WITH 20MTS.(CASE-2)

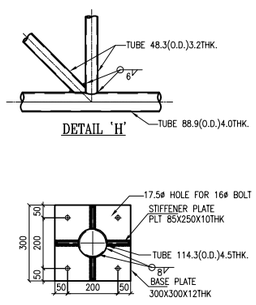
TITLE: G.A OF HORDING

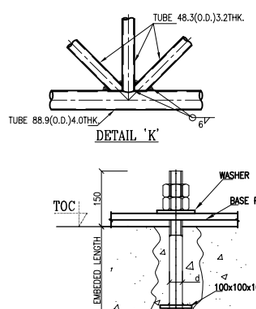


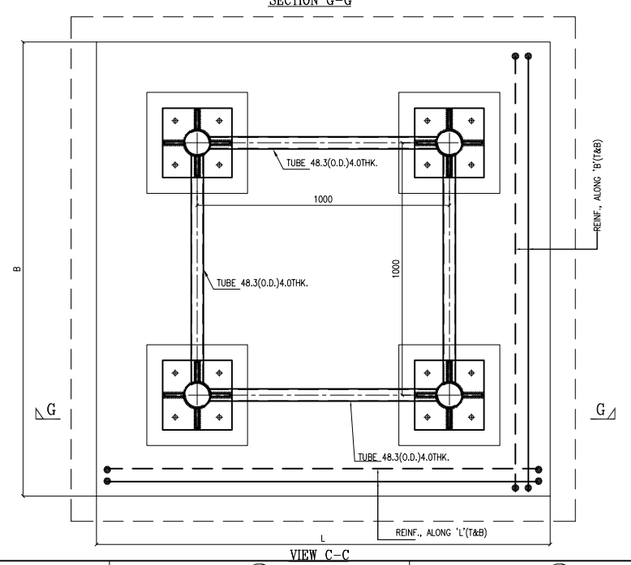


SECTION G-G









VIEW C-C

NOTE:-
FOUNDATION SIZE & REINF., MAY VARY AFTER RECEIVING SOIL REPORT

NOTE :-
1. ALL DIMENSIONS ARE IN 'MM'.
2. ALL BOLTS AND NUTS SHALL CONFORM TO IS:1363-1992 (BOLTS ARE 8.8 GRADE).
3. BOLTS IN DIRECT TENSION SHALL BE PROVIDED WITH LOCK NUTS CONFORMING TO IS:1363-1992 OR DOUBLE COIL SPRING WASHERS CONFORMING TO IS:6755-1980.
4. STRUCTURAL GRADE CONFORMING TO IS:2062/IS:226.
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6. WELDING PROCEDURES ARE TO BE AS PER IS:816-1969 & 9595-1980.
7. WELDING LENTHS WHEREVER INDICATED ARE MINIMUM REQUIRED HOWEVER FULL CONTACT LENTH TO BE WELDED IN ALL CASES UNLESS OTHERWISE NOTED.

BOQ FOR 25M SPAN(APPROX.,):-

SL. NO.	ITEM NO.	SECTION MM	LENGTH M	UNIT WT. Kg/m	TOTAL WT Kg
1	e	114.3(OD)4.5Thk	40	12.20	488.00
2	d	88.9 (OD)4.0Thk	108	8.36	902.88
3	c	48.3(OD)3.2Thk	142	3.56	505.52
4		BP(300X300x12Thk)		94.2	67
5		ANCHOR BOLT	450		22
				TOTAL WEIGHT	1985.4

REINF. DETAILS OF FOOTING :-

S.NO	SIZE L x B	DEPTH D	Nos.	TOP REINFORCEMENT ALONG 'L'	TOP REINFORCEMENT ALONG 'B'	BOTTOM REINFORCEMENT ALONG 'L'	BOTTOM REINFORCEMENT ALONG 'B'
1	2000x2000	550	02	T10-200C/C	T10-200C/C	T12-150C/C	T12-150C/C

FOR INFORMATION

RevNo	Revision note	Date	Drawn	Checked

DRG. NO.	01
SCALE	1:100
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DRN BY	T.R.LAKSHMI
DES BY	SENTHIL
CHKD BY	RK
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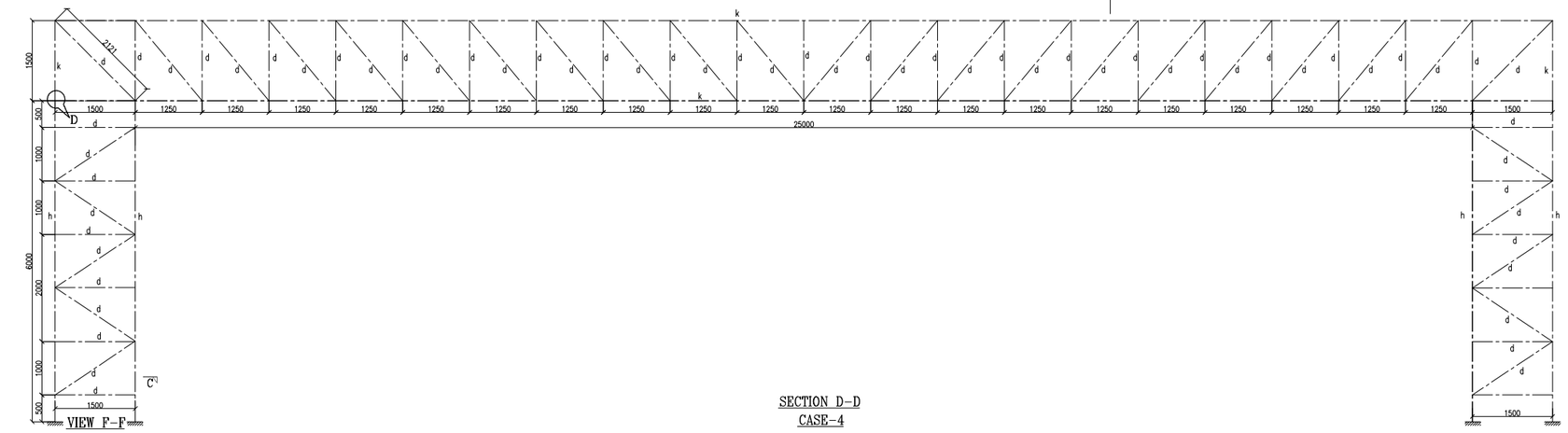
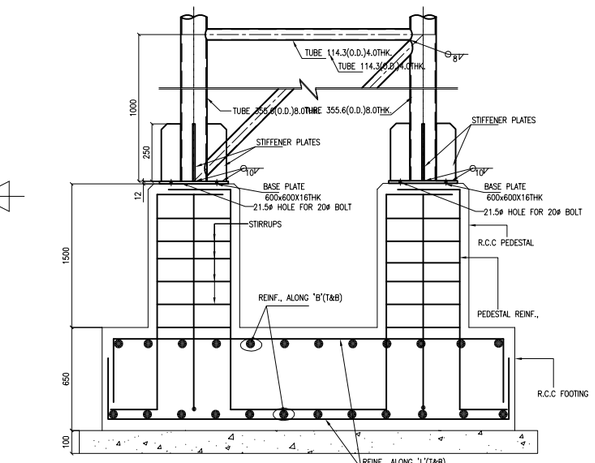
CLIENT: ASA BHANU TECHNICAL SERVICES LTD.

PROJECT: GANTRY TYPE STRUCTURE WITH 25MTS.(CASE-3)

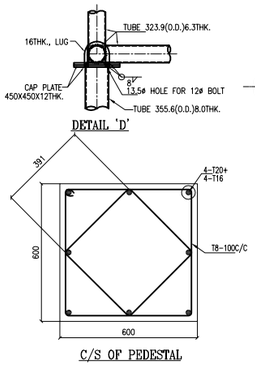
TITLE: G.A OF HORDING

Cad.file:-\\Str\All Users\Chaitanya Data\Asa Bhanu Highway Sign Board supporting Structure\DWG\HORDINGS(04.10.12).-1dwg.dwg



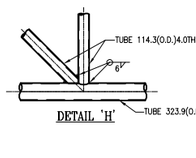


SECTION X-X



DETAIL 'D'

C/S OF PEDESTAL



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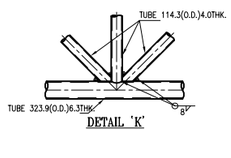

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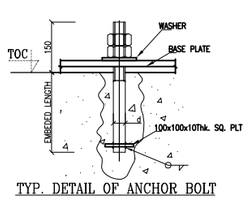
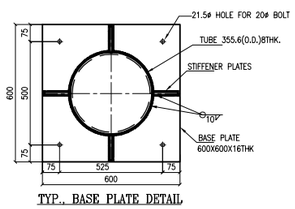
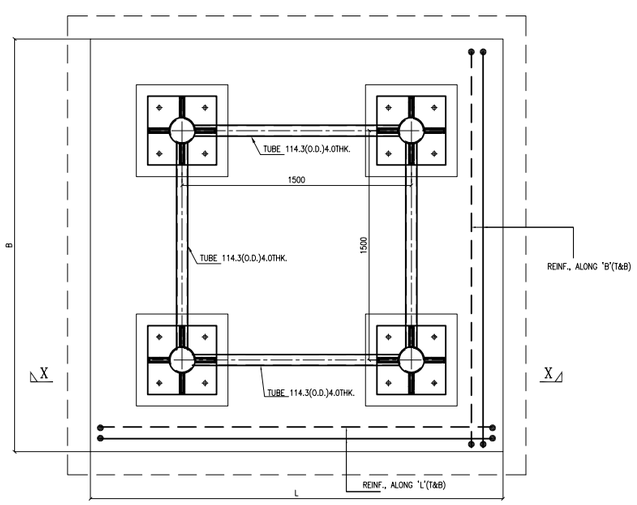


TYP. DETAIL OF ANCHOR BOLT



TYP., BASE PLATE DETAIL



VIEW C-C

REINF. DETAILS OF FOOTING :-

S.NO	SIZE L x B	DEPTH D	Nos.	TOP REINFORCEMENT		BOTTOM REINFORCEMENT	
				ALONG 'L'	ALONG 'B'	ALONG 'L'	ALONG 'B'
1	2700x2700	650	02	T10-150C/C	T10-150C/C	T16-150C/C	T16-150C/C

BOQ FOR 25M SPAN(APPROX.):-

SL. NO.	ITEM NO.	SECTION MM	LENGTH M	UNIT WT Kg/m	TOTAL WT Kg
1	k	323.9 (OD)6.3Thk	100	49.30	4930.00
2	d	114.3 (OD)4.5Thk	132	12.20	1610.40
3	h	355.6 (OD)8.0Thk	40	68.6	2744.00
4		BP(600x600x16Thk)		125.6	361.73
5		ANCHOR BOLT	600	2.46	47.23
				TOTAL WEIGHT	9693.36

NOTE :-
1. ALL DIMENSIONS ARE IN 'MM'.
2. ALL BOLTS AND NUTS SHALL CONFORM TO IS:1363-1992 (BOLTS ARE 8.8 GRADE).
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FOR INFORMATION

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CLIENT: ASA BHANU TECHNICAL SERVICES LTD.

PROJECT: GANTRY TYPE STRUCTURE WITH 25MTS.(CASE-4)

TITLE: G.A OF HORDING

Cad file:-\\Str\All Users\Chaitanya Data\Asa Bhanu Highway Sign Board supporting Structure\DWG\HORDINGS(04.10.12).-1dwg.dwg

10. Road Inventory Manual

JICA SPECIAL ASSISTANCE FOR PROJECT

IMPLEMENTATION (SAPI)

FOR

THE ASSISTANCE FOR THE INTRODUCTION OF ITS

ON ROAD NETWORK

IN

HYDERABAD METROPOLITAN AREA

IN

INDIA

Road Inventory Manual

March 2014

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
JICA STUDY TEAM Constituted by

N I P P O N K O E I C O . , L T D .
EAST NIPPON EXPRESSWAY CO., LTD.
METROPOLITAN EXPRESSWAY CO., LTD.

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Chapter 1 Function of Road Inventory Tool 1
Chapter 2 Hardware Requirement 3
Chapter 3 Program Setup Procedure 4
Chapter 4 Procedure for Solving Error of XAMPP Activation 10

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Figure 2 Showing Inventory Data and Image by Clicking the Certain Point on the Map 2
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Table 2 Configuration of Road Inventory Tool 3

Chapter 1　Function of Road Inventory Tool

(1)　Showing Road as per IRC Road Rank

If you select the road rank on the table right below, the intended road will be shown on the map with color as per the selected rank respectively.

Figure 1　Selecting and Showing Road on Road Inventory Tool

(2)　Showing Road Inventory Data

If you click the road on map, you will find the road inventory data of the selected section of the road in the table right middle in the window such as road name, road rank and road width.

If you click “next” or “back” under the table in the window, you can find the road inventory data of the corresponding road section together with images.

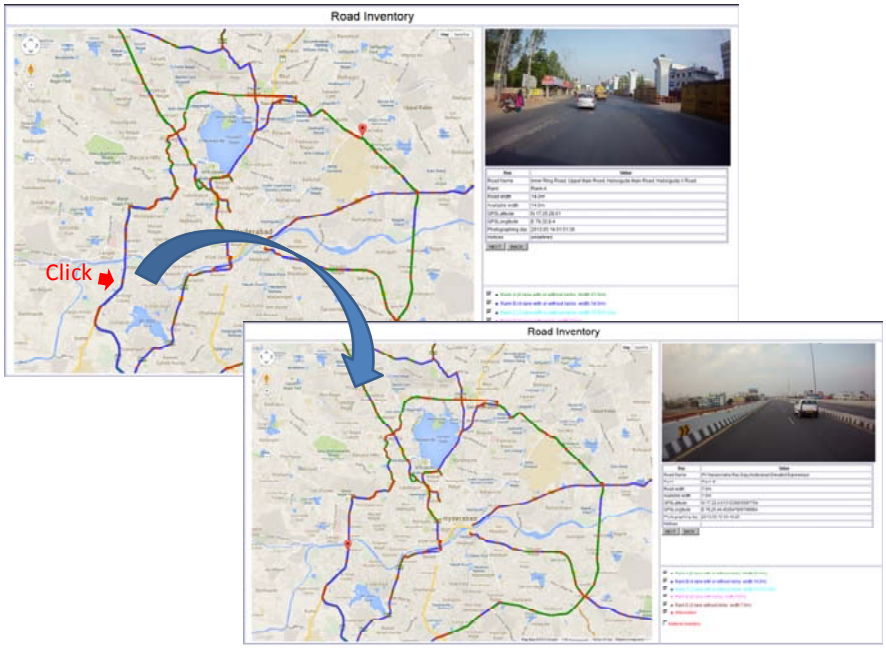


Figure 2 Showing Inventory Data and Image by Clicking the Certain Point on the Map

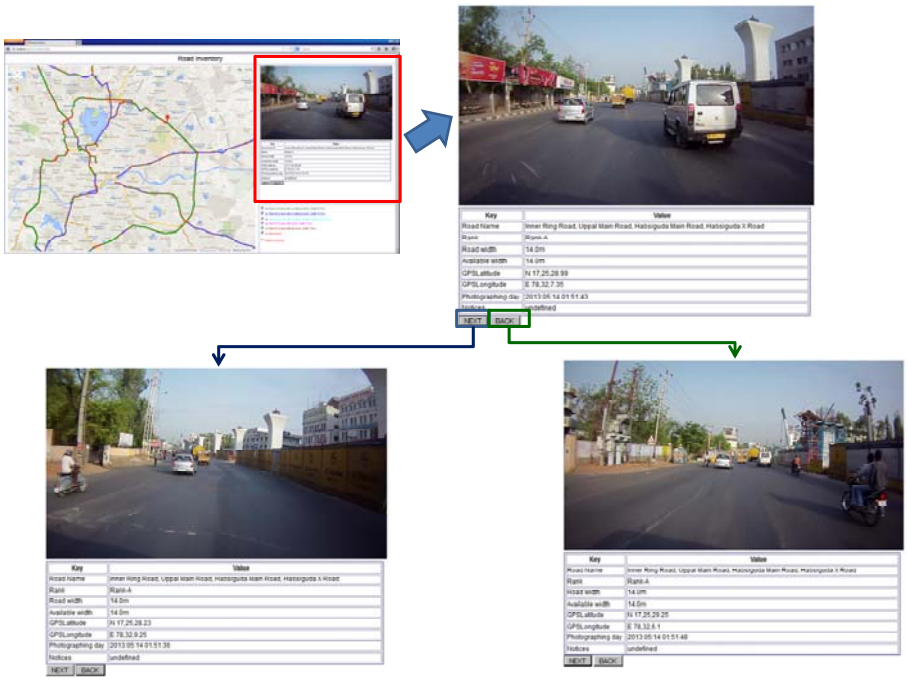


Figure 3 Continuously Showing Road Inventory Data by Clicking 'Next' or 'Back'

Chapter 2　Hardware Requirement

The hardware requirement and composition of system are as followings.

Table 1　Hardware Requirement

Items	Contents
OS	Windows7 Professional
Memory	More than 16GB
Software	XAMPP（used as WEB server） Firefox（used as Browser）
Others	Internet condition（To open Google MAP）

Table 2　Configuration of Road Inventory Tool

Items	Contents
System Configuration	WEB application
Development Language	Google MAP API V3 JavaScript

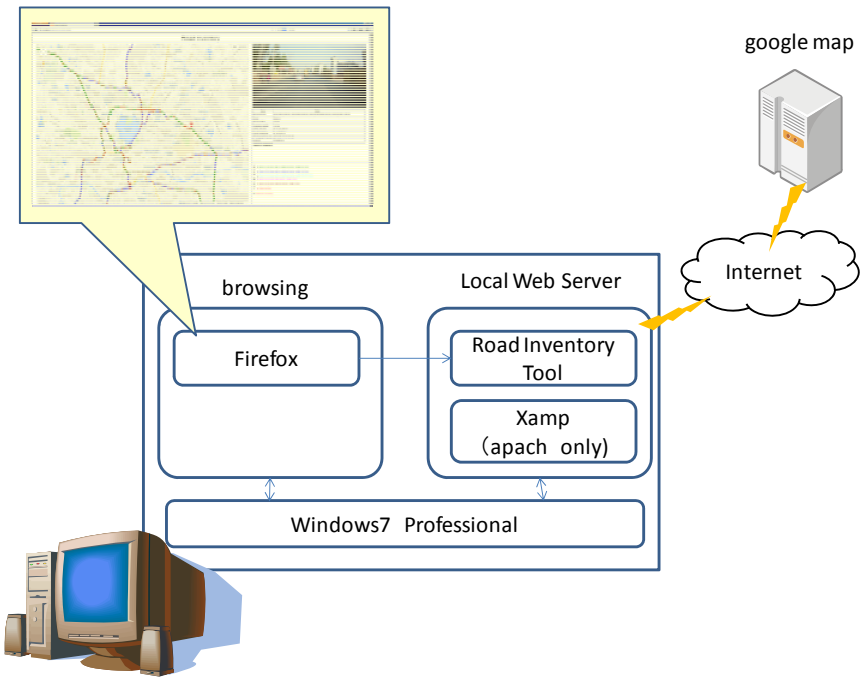


Figure 4　Configuration of Road Inventory Tool

Chapter 3 Program Setup Procedure

The following steps show the procedure for program setup.

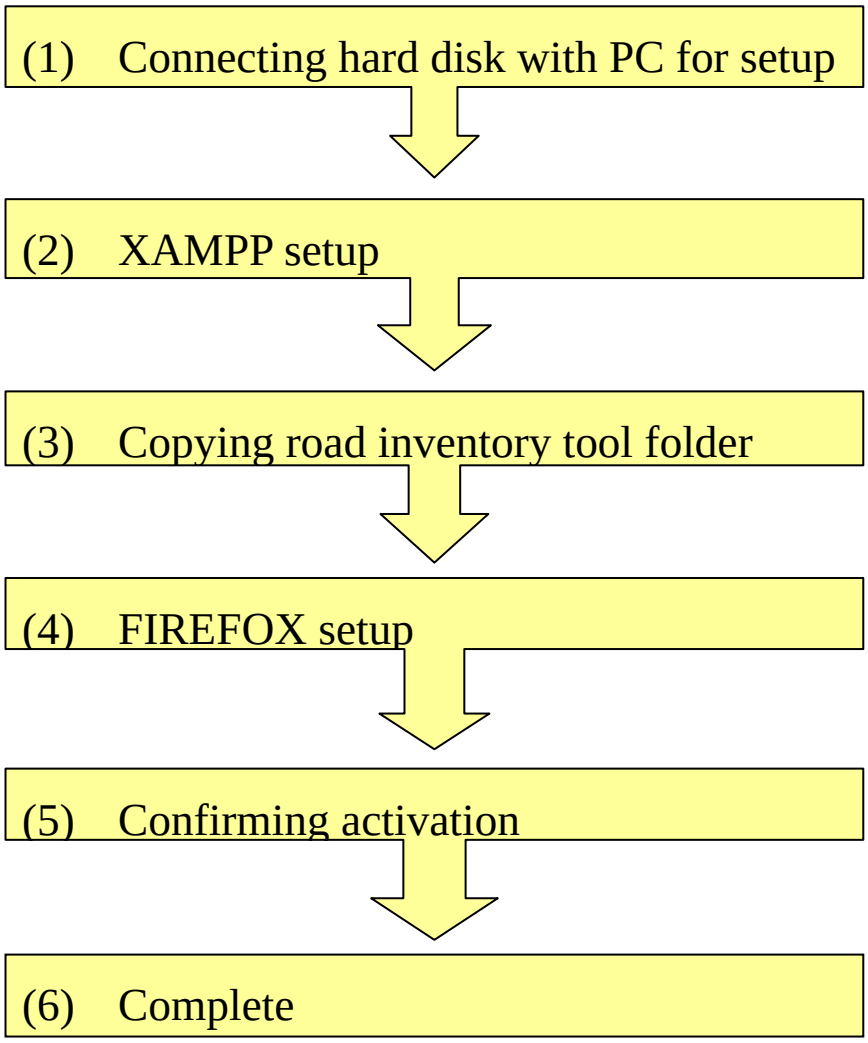


Figure 5 Program Setup Procedure

(1) Connecting hard disk with PC

Please connect hard disk for setup with USB board of PC and confirm the following files are saved in the hard disk.

- xampp-win32-1.8.2-1-VC9-installer
  (Setup program for web server to activate road inventory tool)
- Firefox Setup 23.0.1
  (Setup program for web browser to activate road inventory tool)
- demo2 folder
  (Folder which stores road inventory tool program)

Figure 6　Hard Disk and Connector

(2) XAMPP Setup

XAMPP is a web server application. The road inventory tool uses XAMPP. The following steps show how to setup XAMPP. Please start by clicking ‘xampp-win32-1.8.2-1VC9-installer’ and follow the steps shown below.

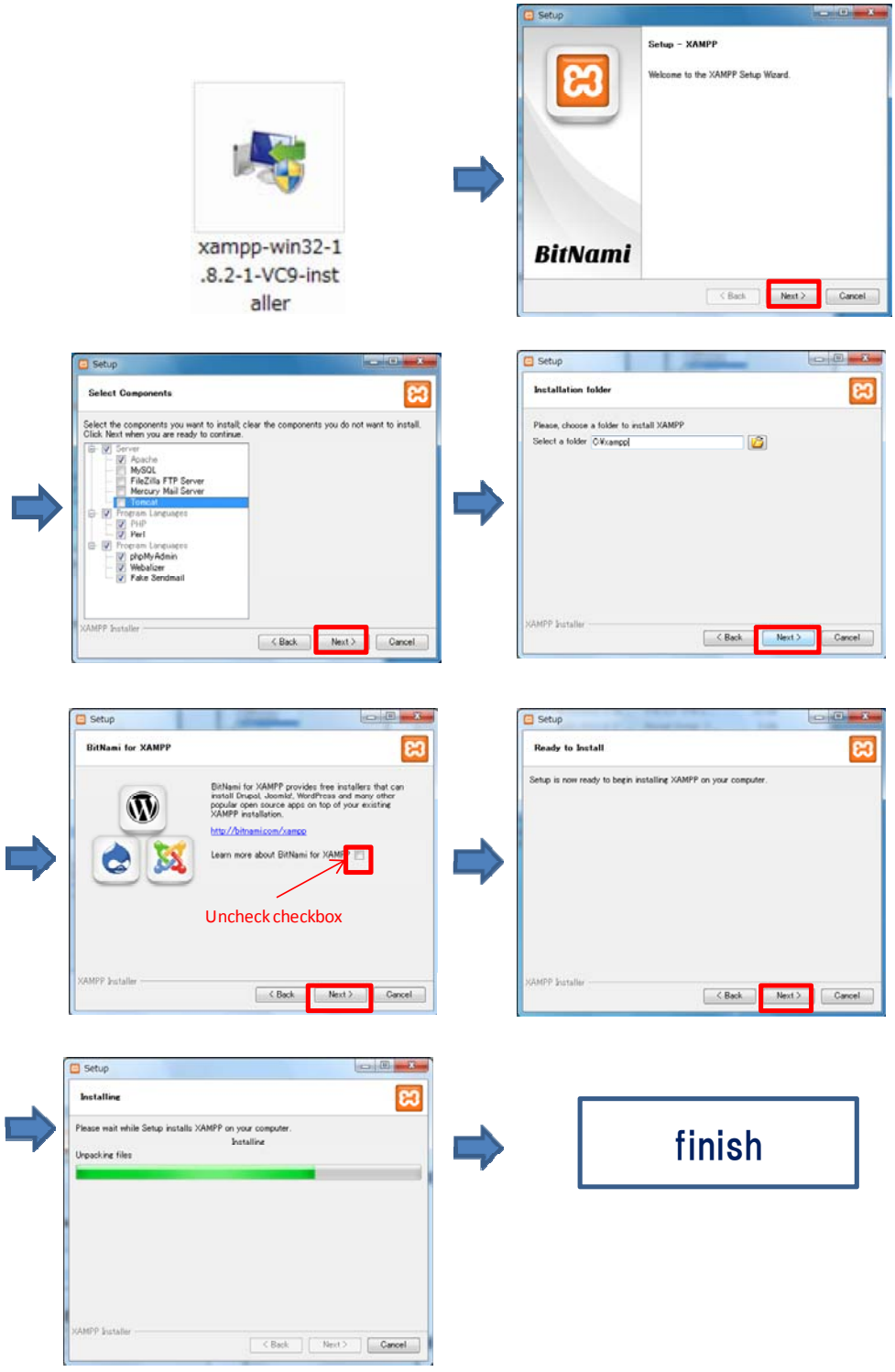


Figure 7 Procedure for XAMPP Setup

(3) Copying Road Inventory Tool Folder onto PC

After setting up XMAPP, 'XAMPP folder' will be created in C drive in your PC. Please copy 'demo2 folder' from hard disk into 'htdocs folder' inside of xampp folder in your PC. The folder composition is shown below.

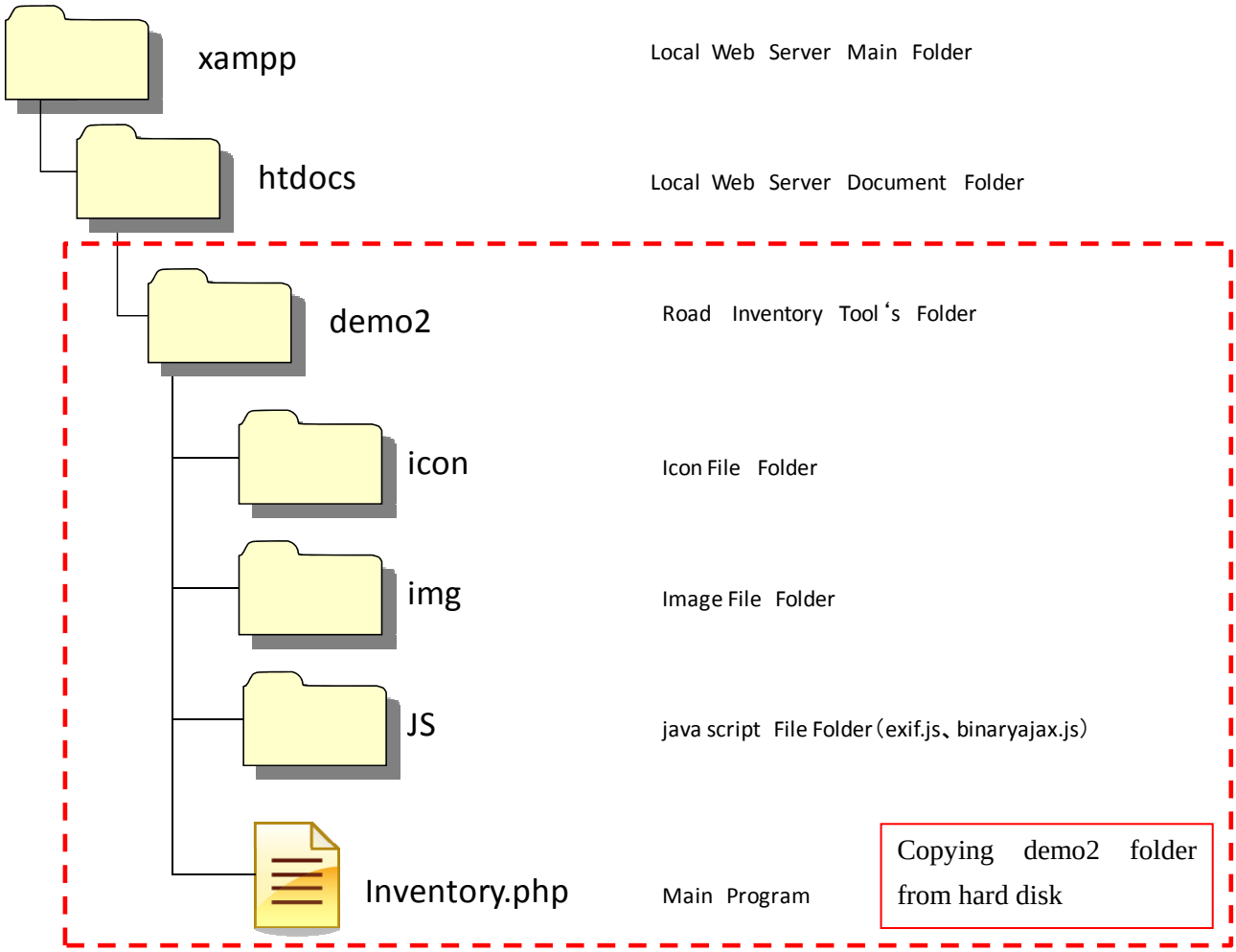


Figure 8 Folder Composition of Road Inventory Tool

(4) FIREFOX Setup

The road inventory tool uses ‘Firefox’ browser. The following steps show how to setup the Firefox. Please setup by clicking ‘Firefox Setup 23.0.1’ which is stored in the hard disk and follow the steps shown below.

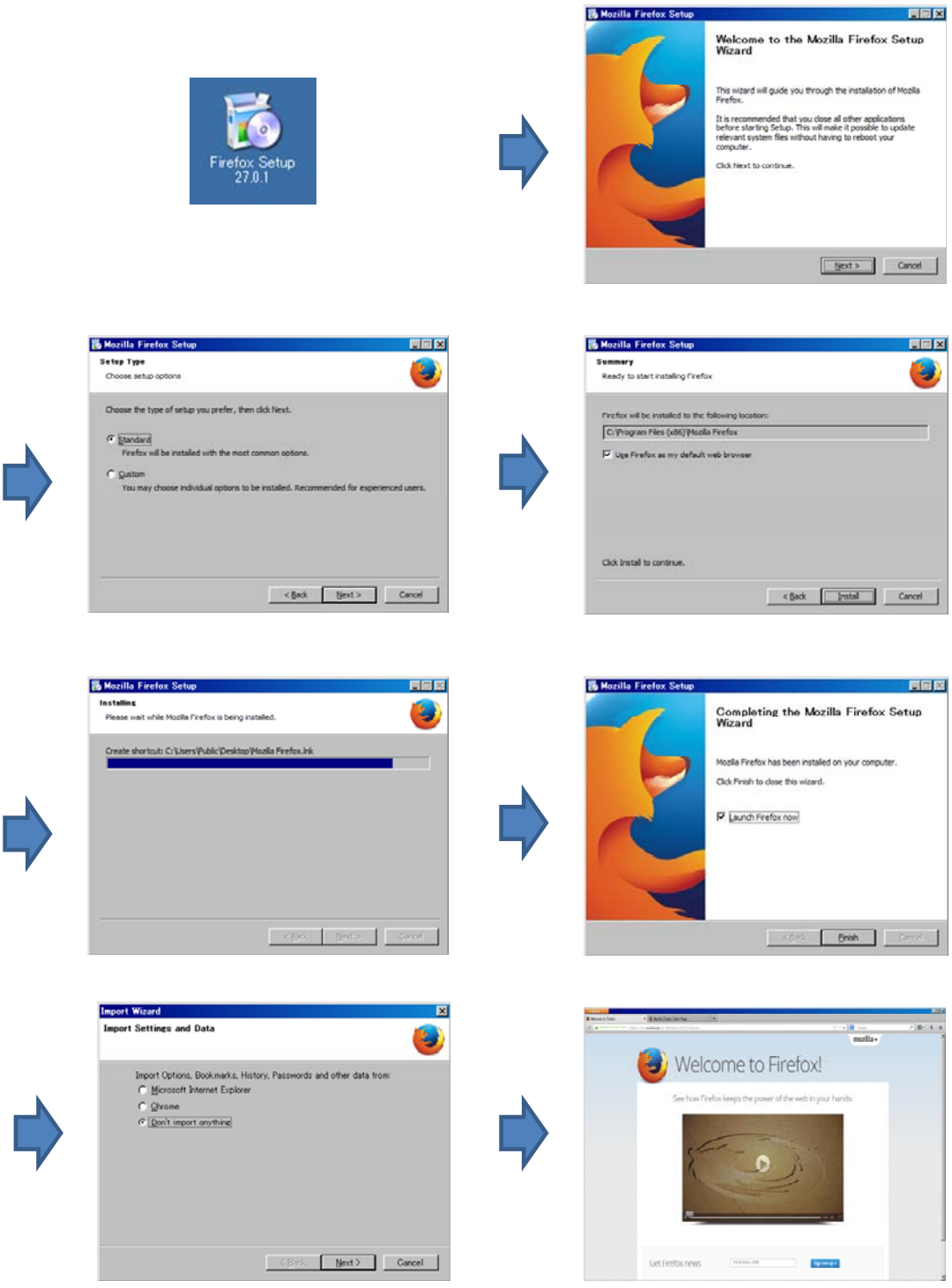


Figure 9 Procedure for FIREFOX Setup

(5) Confirming Activation

After setting up XAMPP, the icon ‘XAMPP-control Panel’ will be created on the desktop. Please activate ‘XAMPP-control’ by clicking the icon.

Then you activate the web server by clicking the ‘Start button’ of Apache of ‘XAMPP Control Panel Application’ as shown in Step1 below. If the color of Apache becomes green, XAMPP is successfully activated. Then you activate ‘Firefox’ and specify the local address of the road inventory tool in URL tab on the window as shown in Step2 below.

Note: Please shut down ‘Skype’ before activating the road inventory tool.

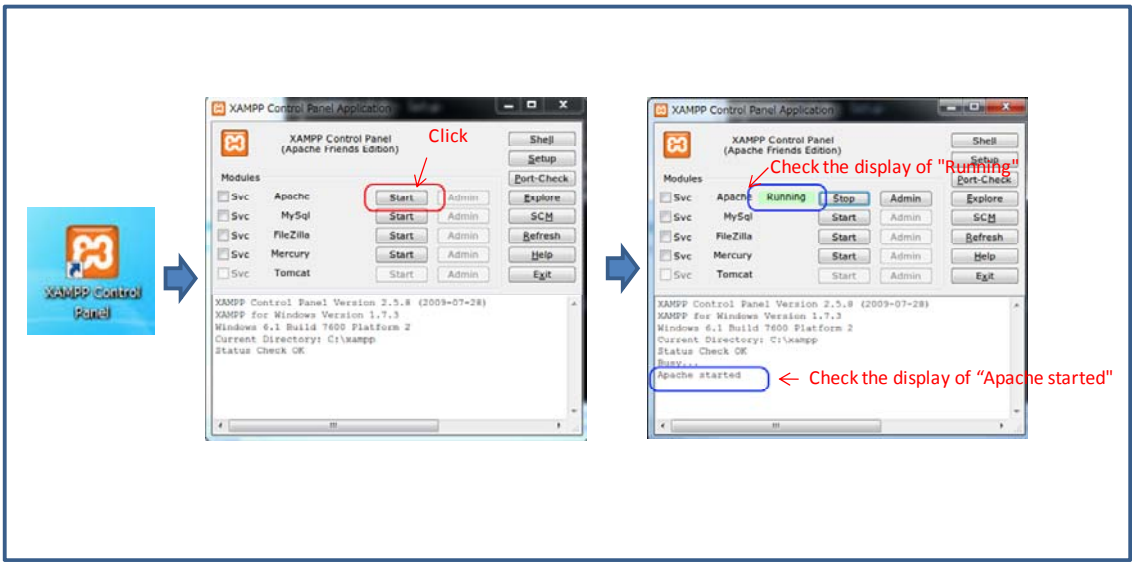
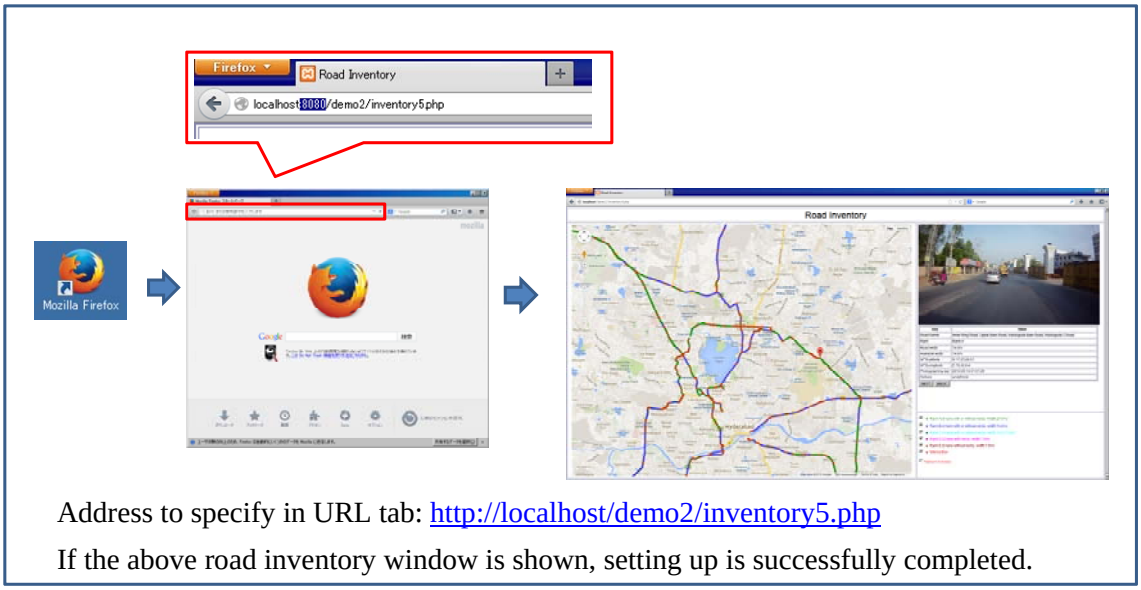


Figure 10 Step1: Activation of XAMPP Control Panel



Address to specify in URL tab: http://localhost/demo2/inventory5.php

If the above road inventory window is shown, setting up is successfully completed.

Figure 11 Step2: Activation of Road Inventory Tool

Chapter 4 Procedure for Solving Error of XAMPP Activation

This chapter explains how to solve the problem in case that XAMPP is not activated. The XAMPP, a web server application, uses port. If the port is busy, the XAMPP will not be activated and the error messages below, either left one or right one depending on configuration of your PC, will be shown. In this case, please follow the steps explained in this chapter.

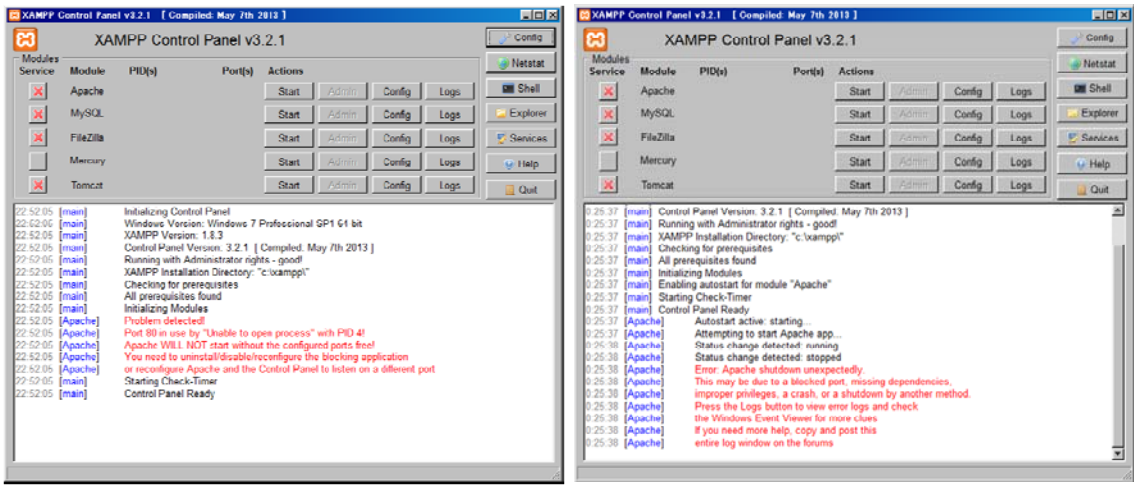


Figure 12 Error messages in case that XAMPP is not activated

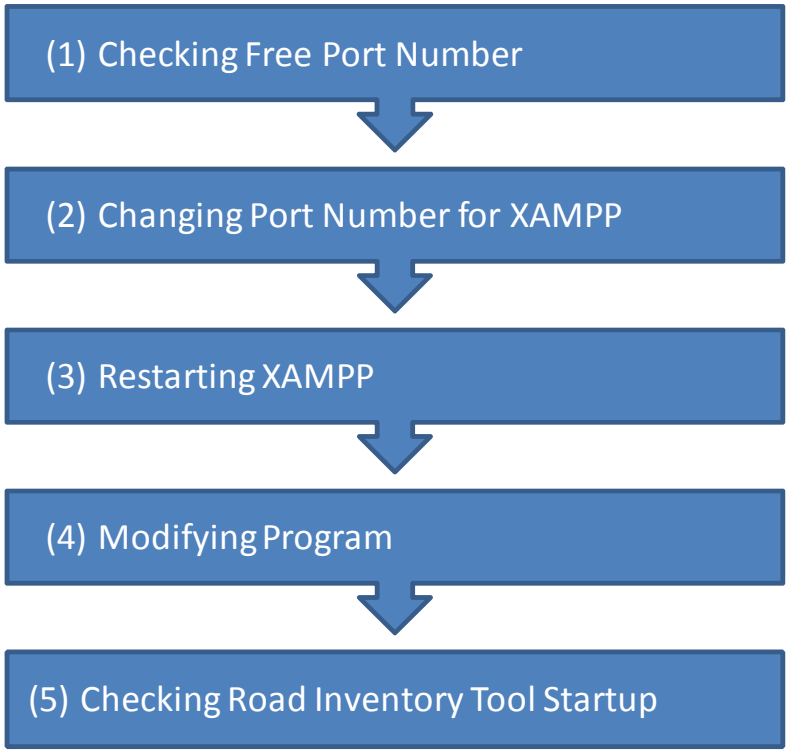


Figure 13 Procedure for Solving Error

(1) Checking Free Port Number

First, please check the free PORT, which is not in use, by the following steps:

1. Please click the ‘Netstat button’ on ‘XAMPP Control Panel’.
2. The Netstat window appears as below. It lists the busy ports which are already used.
3. The free port number is the one which is not listed in the Netstat window.

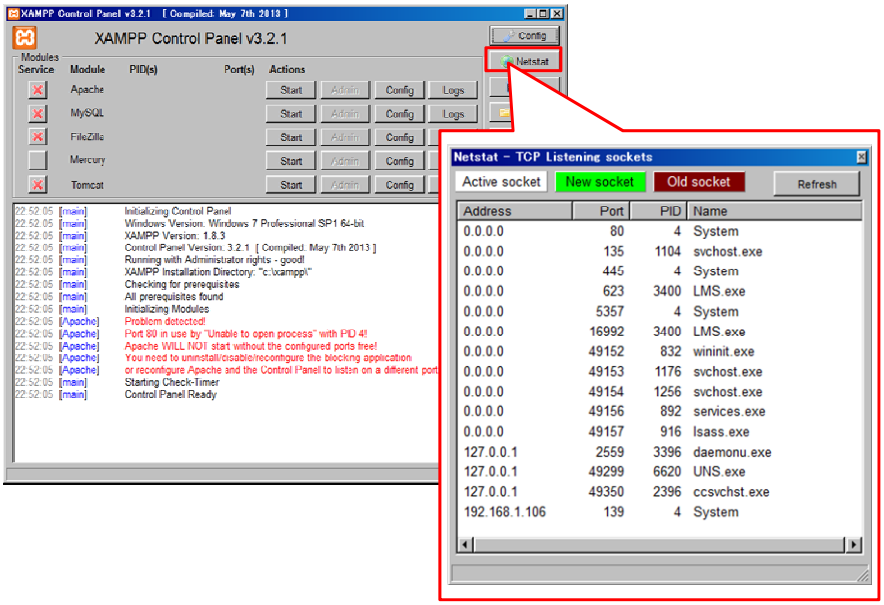


Figure 14 Netstat Window (Showing Busy Port)

(2) Changing Port Number for XAMPP

Then please change the port number for XAMPP to use the free port as follows:

1. Please open the file below, a configuration file, by Notepad exe.

   c :/ xampp / apache / conf / httpd.conf

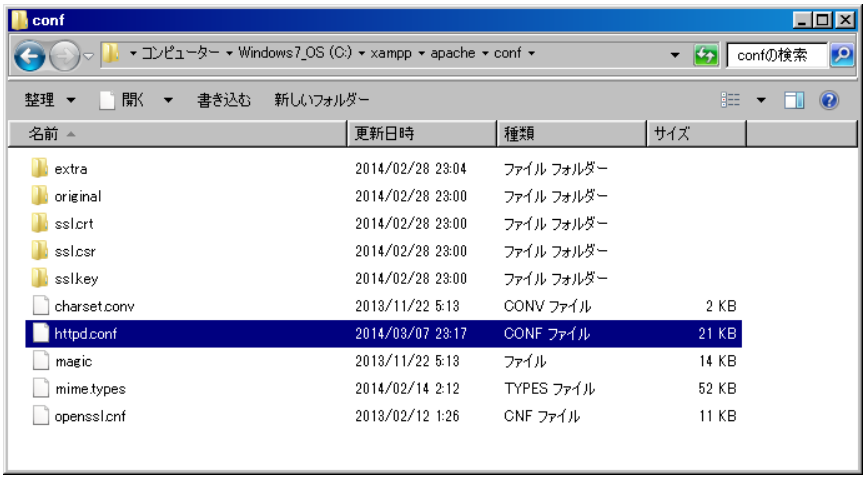


Figure 15 Configuration File of XAMPP

2. Please specify the free port number which you confirmed by Netstat window of XAMPP Control Panel, as shown in the below figure and save the configuration file.

There are two items which you need to specify the free port number on the file. One is 'Listen xxxx', and the other is 'Server Name localhost xxxx' as shown below. The below figures show the example of which the port number is changed from 80 to 8080.

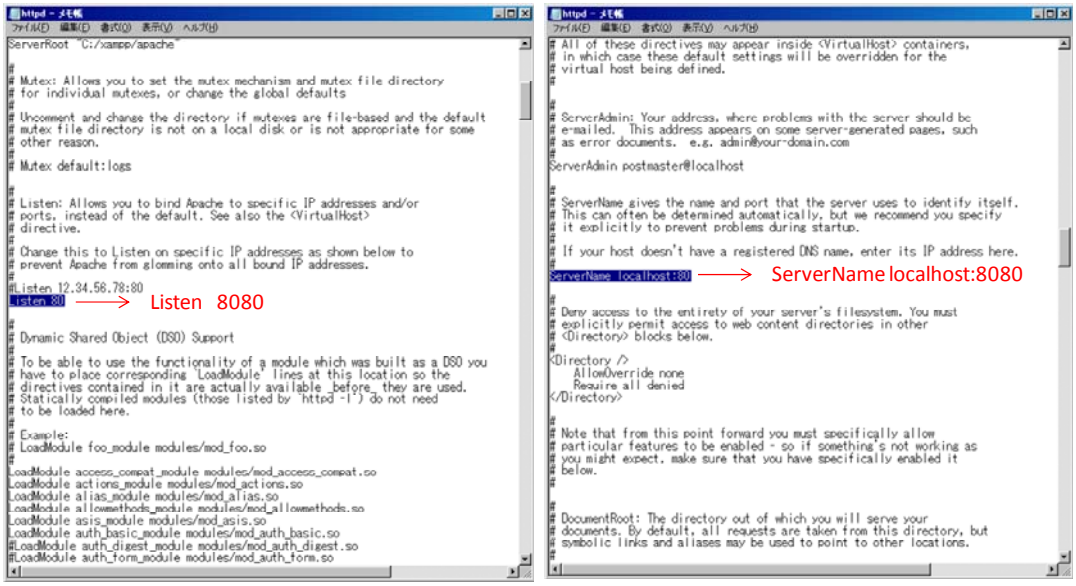


Figure 16 Specifying Port Number in Configuration File

(3) Restarting XAMPP

Then please restart XAMPP by the following steps:

1. Please click 'Start button' of Apache on XAMPP Control Panel.
2. Please check the following items after the Apache started. If the following items are confirmed, XAMPP is successfully started.

   - 'Status' is changed to 'Running' as shown below.

   - The background color of Apache is changed to green as shown below.

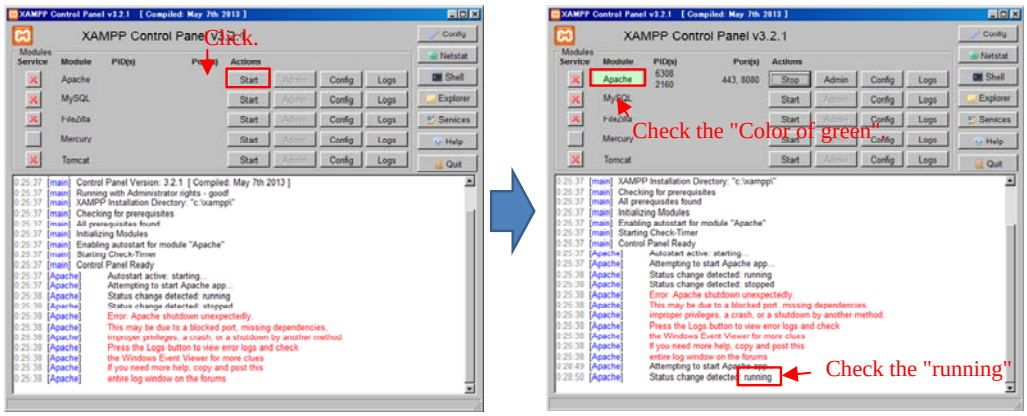


Figure 17 Restarting Confirmation of XAMPP

(4) Modifying Program

As a next step, please modify the program of the road inventory tool as follows:

1. Please open the file below, a road inventory program, by Notepad exe.

   c :/ xampp / htdocs/demo2/inventory5.php

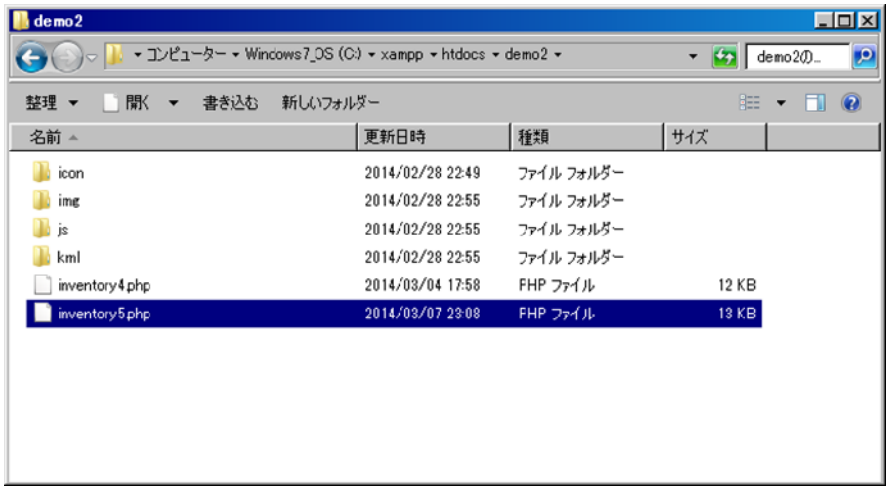


Figure 18 Program File of Road Inventory Tool

2. Please select “Edit” and “Replace” from Notepad menu to open string replace window as shown below.

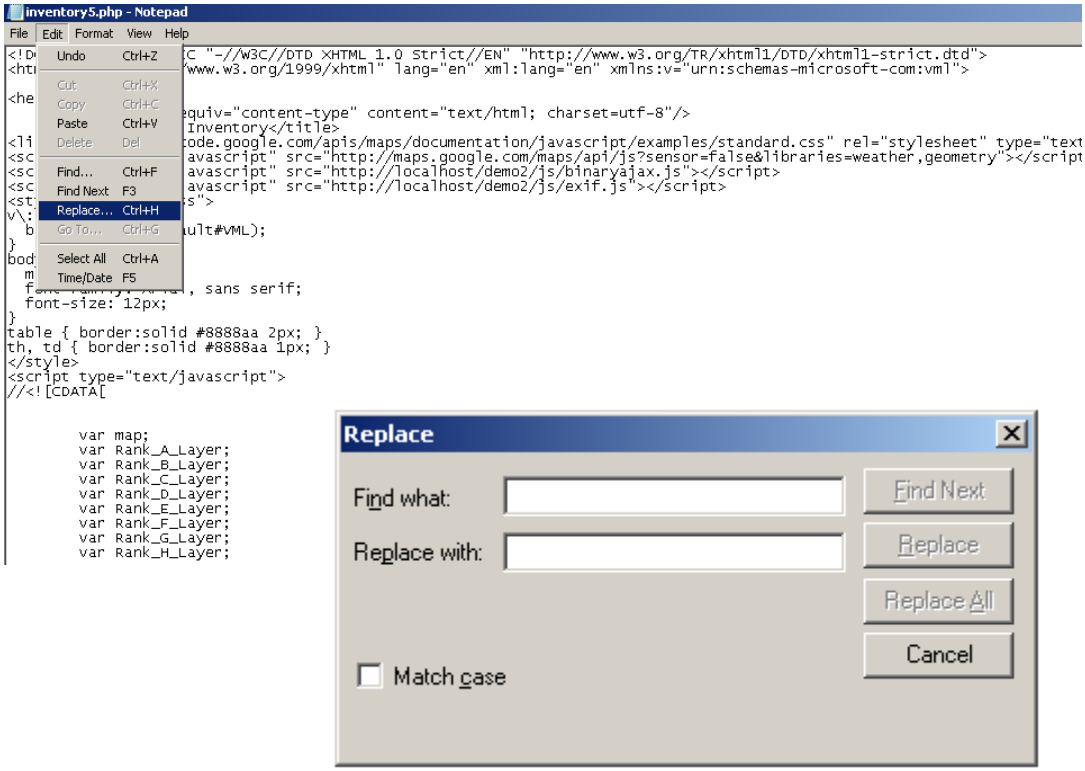


Figure 19 Replace Window of Notepad

3. Please replace the port number by the following steps:

- Enter "localhost:" in the "Find what" text box

- Enter the port number in "Replace with" text box

- Click "Replace All" button

- Save the file after replacing

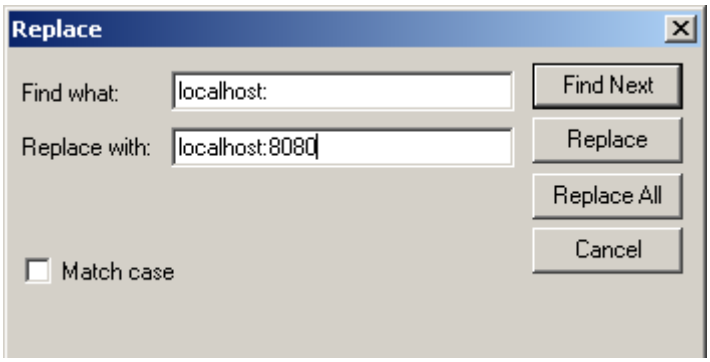


Figure 20 Specifying Intended Port Number to Replace

(5) Checking Road Inventory Tool Startup

Please startup the road inventory tool by specifying the following local address on URL tab of Firebox:

http://localhost:XXXX/demo2/inventory.5.php

(Note: above 'XXXX' is a port number)

If the road inventory tool is opened as shown below, all processes are successfully completed. If the road inventory tool is not opened, the specified port number may be already in use. In such case, please repeat the steps from (1) to (5), trying another port number.

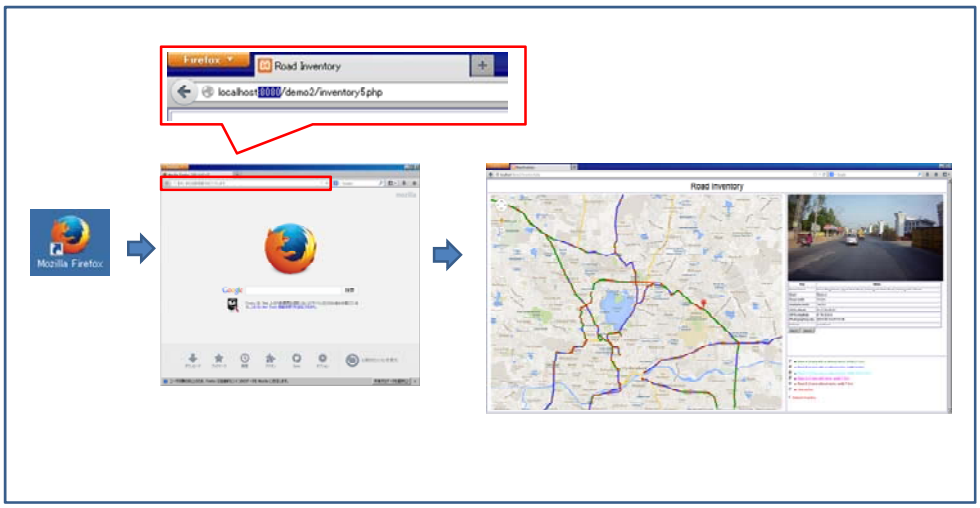


Figure 21 Startup of Road Inventory Tool

11. Road Inventory Software

Road Inventory Software is submitted independently in External Hard Drive