

## TABLE OF CONTENTS

### EXECUTIVE SUMMARY

#### 1. INTRODUCTION

1.1	BACKGROUND.....	1-1
1.2	STUDY AREA AND PERSPECTIVE.....	1-1
1.3	STUDY OBJECTIVES .....	1-3
1.4	SCOPE OF WORK.....	1-3
1.5	STUDY AREA TRANSPORT CHARACTERISTICS .....	1-15
1.6	TOURIST TRAFFIC .....	1-18
1.7	STUDY PROGRESS AND SUBMISSIONS.....	1-19
1.8	COMPOSITION OF REPORT.....	1-21

#### 2. TRAVEL DEMAND ASSESSMENT

2.1	PRIMARY TRAFFIC SURVEYS AND DATA ANALYSIS .....	2-1
2.2	APPROACH FOR DEMAND MODELING.....	2-3
2.3	BASE YEAR TRANSPORT NETWORK AND TRAFFIC ZONE SYSTEM.....	2-6
2.4	MODEL STRUCTURE .....	2-6
2.5	TRIP GENERATION & ATTRACTION .....	2-9
2.6	TRIP DISTRIBUTION MODEL .....	2-13
2.7	MODAL SPLIT MODEL .....	2-18
2.8	MODAL SPLIT CALIBRATION RESULTS.....	2-20
2.9	TRIP ASSIGNMENT MODEL .....	2-20
2.10	PEAK HOUR MODEL VALIDATION .....	2-21
2.11	FORECAST OF PLANNING PARAMETERS .....	2-24
2.12	ASSUMPTIONS FOR TRANSPORT DEMAND FORECASTING.....	2-28
2.13	TRANSPORT DEMAND FORECAST FOR BUSINESS AS USUAL (BAU) SCENARIO, 2041 .....	2-28
2.14	TRANSPORT DEMAND FORECAST ON MASS TRANSIT NETWORK .....	2-29
2.15	DESIGN RIDERSHIP .....	2-34

#### 3. SYSTEM DESIGN

3.1	INTRODUCTION.....	3-1
3.2	PERMANENT WAY.....	3-1
3.3	TRACK STRUCTURE .....	3-3
3.4	TRACTION SYSTEM.....	3-10
3.5	ROLLING STOCK .....	3-14
3.6	VENTILATION AND AIR-CONDITIONING SYSTEM.....	3-20
3.7	E&M SYSTEMS .....	3-30
3.8	SOLAR ENERGY HARNESSING SYSTEM.....	3-33
3.9	SIGNALLING SYSTEM.....	3-34

3.10	TELECOMMUNICATION SYSTEM.....	3-39
3.11	AUTOMATIC FARE COLLECTION SYSTEM.....	3-47
3.12	PLATFORM SCREEN DOORS.....	3-53
<b>4.</b>	<b>CIVIL ENGINEERING</b>	
4.1	GEOMETRIC DESIGN PRINCIPLES.....	4-1
4.2	CORRIDOR SELECTION.....	4-6
4.3	ENGINEERING SURVEY AND ALIGNMENT DESIGN.....	4-10
4.4	GEOTECHNICAL INVESTIGATION.....	4-21
4.5	ROUTE ALIGNMENT.....	4-46
4.6	ASI MONUMENTS IN VARANASI.....	4-76
4.7	STATIONS.....	4-82
4.8	CONSTRUCTION METHODOLOGY.....	4-87
4.9	TRAFFIC MANAGEMENT PLAN DURING CONSTRUCTION.....	4-118
4.10	MUCK DISPOSAL.....	4-120
4.11	IMPROVEMENT OF FOOTPATHS/ WALKWAYS IN INFLUENCE ZONE OF THE STATIONS.....	4-121
4.12	UTILITY DIVERSION.....	4-122
4.13	LAND REQUIREMENT.....	4-163
<b>5.</b>	<b>STATION PLANNING AND INTERMODAL INTEGRATION</b>	
5.1.	COVERAGE.....	5-1
5.2.	STATION AREA CHARACTERISTICS.....	5-2
5.3.	STATION PLANNING.....	5-29
5.4.	ARCHITECTURAL DEFINITIONS.....	5-98
5.5.	INTERMODAL INTEGRATION AND DISPERSAL FACILITIES.....	5-106
5.6.	PARKING AT STATIONS.....	5-118
5.7.	TRANSIT ORIENTED DEVELOPMENT.....	5-118
5.8.	FEEDER SERVICES.....	5-122
5.9.	TRAFFIC MANAGEMENT PLAN DURING CONSTRUCTION.....	5-127
<b>6</b>	<b>DISASTER MANAGEMENT MEASURES</b>	
6.1	INTRODUCTION.....	6-1
6.2	NEED FOR DISASTER MANAGEMENT MEASURES.....	6-1
6.3	SERIOUS INCIDENTS REQUIRING DISASTER MANAGEMENT MEASURES.....	6-2
6.4	PROVISIONS UNDER DISASTER MANAGEMENT ACT, 2005.....	6-3
6.5	PROVISIONS AT METRO STATIONS/OTHER INSTALLATIONS.....	6-5
6.6	PREPAREDNESS FOR DISASTER MANAGEMENT.....	6-5
<b>7</b>	<b>DISABLE FRIENDLY FEATURES</b>	
7.1	COVERAGE.....	7-1
7.2	RAIL TRANSPORT SYSTEM.....	7-1
7.3	METRO RAILWAY STATIONS.....	7-2
7.4	EMERGENCY EGRESS/EVACUATION.....	7-20

7.5	STREET DESIGN .....	7-22
7.6	PARKING LOTS.....	7-25
<b>8</b>	<b>SECURITY MEASURES IN METRO SYSTEM</b>	
8.1	INTRODUCTION.....	8-1
8.2	THREE PILLARS OF SECURITY .....	8-1
8.3	DIFFERENT PHASES OF SECURITY .....	8-2
8.4	SCOPE OF WORK .....	8-3
8.5	STUDY AREA TRANSPORT CHARACTERISTICS .....	8-3
<b>9.</b>	<b>TRAIN OPERATION PLAN</b>	
9.1	TRAIN OPERATION PHILOSOPHY .....	9-1
9.2	TRAFFIC DEMAND .....	9-2
9.3	TRAIN FORMATION.....	9-2
9.4	TRAIN OPERATION PLAN.....	9-4
9.5	HOURLY TRAIN OPERATION PLAN .....	9-8
9.6	VEHICLE KILOMETER .....	9-9
9.7	ROLLING STOCK REQUIREMENT .....	9-10
<b>10.</b>	<b>MAINTENANCE DEPOT</b>	
10.1	INTRODUCTION.....	10-1
10.2	MAINTENANCE PHILOSOPHY .....	10-1
10.3	PLANNING OF MAINTENANCE FACILITIES SETUP .....	10-2
10.4	ROLLING STOCK MAINTENANCE NEEDS .....	10-2
10.5	DEPOT CUM WORKSHOP LAYOUT .....	10-5
10.6	INFRASTRUCTURE FACILITIES PLANNED AT DEPOT .....	10-6
10.7	DEPOT CUM WORKSHOP PLANNING.....	10-8
10.8	PLANT AND MACHINERY.....	10-14
<b>11.</b>	<b>POWER SUPPLY SYSTEM</b>	
11.1	COVERAGE .....	11-1
11.2	POWER REQUIREMENT.....	11-1
11.3	NEED FOR HIGH RELIABILITY OF POWER SUPPLY .....	11-3
11.4	SOURCES OF POWER SUPPLY.....	11-3
11.5	AUXILIARY POWER ARRANGEMENTS .....	11-6
11.6	TRACTION POWER SUPPLY .....	11-7
11.7	STANDBY DIESEL GENERATOR (DG) SETS.....	11-10
11.8	STRAY CURRENT CORROSION PROTECTION MEASURES .....	11-11
11.9	ELECTROMAGNETIC INTERFERENCE (EMI) AND ELECTROMAGNETIC COMPATIBILITY (EMC) .....	11-13
11.10	SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) SYSTEM.....	11-14
11.11	ENERGY SAVING MEASURES.....	11-14
11.12	ELECTRIC CONSUMPTION .....	11-15

**12. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT**

12.1	OBJECTIVE OF ENVIRONMENTAL IMPACT ASSESSMENT (EIA) .....	12-1
12.2	ENVIRONMENTAL LEGISLATION .....	12-1
12.3	ENVIRONMENTAL BASELINE DATA .....	12-2
12.4	POSITIVE ENVIRONMENTAL IMPACT .....	12-19
12.5	NEGATIVE ENVIRONMENTAL IMPACTS .....	12-21
12.6	ENVIRONMENTAL MANAGEMENT PLAN .....	12-30
12.7	ENVIRONMENTAL MONITORING PLAN .....	12-46
12.8	SUMMARY OF COST ESTIMATE.....	12-48
12.9	SOCIAL IMPACT ASSESSMENT.....	12-49

**13. COST ESTIMATES AND FINANCIALS**

13.1	CAPITAL COSTS .....	13-1
13.2	OPERATION AND MAINTENANCE COST .....	13-21
13.3	ECONOMIC ANALYSIS .....	13-25
13.4	FINANCIAL ANALYSIS .....	13-31
13.5	FUNDING OPTIONS .....	13-46
13.6	FINANCING MODELS ADOPTED IN INDIAN CITIES .....	13-46
13.7	FINANCING OPTIONS FOR VARANASI MRTS.....	13-52
13.8	PROPOSED FUNDING FOR THE PROJECT .....	13-54
13.9	IMPLEMENTATION PLAN .....	13-57

**LIST OF TABLE**

TABLE 1.1: DECADAL POPULATION GROWTH IN VARANASI URBAN AREA .....	1-2
TABLE 1.2: POPULATION IN VDA AREA- 2015 (IN LAKH) .....	1-3
TABLE 1.3: MONTH WISE TOURIST ARRIVAL IN VARANASI .....	1-18
TABLE 1.4: STUDY PROGRESS .....	1-19
TABLE 1.5: IMPORTANT PRESENTATIONS/ SITE VISITS/ REVIEW MEETINGS.....	1-20
TABLE 2.1: DISTRIBUTION OF DAILY PASSENGER TRIPS BY MODE .....	2-2
TABLE 2.2: INTRACITY & INTERCITY TRIPS ASSIGNED IN BASE YEAR - 2015 .....	2-8
TABLE 2.3: TRIP GENERATION SUBMODELS - 2015 .....	2-10
TABLE 2.4: SUMMARY OF OUTPUT OF TRIP PRODUCTION MODEL .....	2-11
TABLE 2.5: SUMMARY OF OUTPUT OF TRIP ATTRACTION FOR HBW TRIPS .....	2-12
TABLE 2.6: ATTRACTION MODEL CALIBRATION RESULTS.....	2-13
TABLE 2.7: DISTRIBUTION MODELS CALIBRATION RESULTS.....	2-18
TABLE 2.8: MODAL SPLIT MODEL CALIBRATION RESULTS.....	2-20
TABLE 2.9: COMPARISON OF OBSERVED AND MODELED FLOWS AT SCREENLINE LOCATIONS.....	2-24
TABLE 2.10: FORECASTED POPULATION OF STUDY AREA FOR HORIZON YEARS .....	2-25
TABLE 2.11: WORK FORCE PARTICIPATION IN STUDY AREA FOR BASE AND HORIZON YEARS.....	2-25
TABLE 2.12: ZONEWISE FORECASTED POPULATION AND EMPLOYMENT FOR HORIZON YEARS .....	2-25
TABLE 2.13: DAILY MOTORIZED INTRACITY TRIPS BY VARIOUS MODES IN BAU SCENARIO, 2041.....	2-29
TABLE 2.14: DAILY RIDESHIP ON METRO SYSTEM IN YEAR 2021, 2031 & 2041 .....	2-29
TABLE 2.15: PEAK HOUR SECTION LOADS ON PHASE-I METRO CORRIDORS.....	2-33
TABLE 2.16: PEAK HOUR STATION LOADS ON PHASE-I METRO CORRIDORS .....	2-33
TABLE 2.17: DESIGN SECTION LOAD ON METRO CORRIDORS IN YEARS 2021, 2031 & 2041 .....	2-35
TABLE 3.1: BROAD FEATURES OF ROLLING STOCK .....	3-17
TABLE 3.2: COACH DIMENSIONS .....	3-17
TABLE 3.3: CARRYING CAPACITY OF METRO RAIL.....	3-18
TABLE 3.4: WEIGHT OF MASS RAIL VEHICLES (TONS).....	3-18
TABLE 3.5: REQUIREMENT OF LIFTS & ESCALATORS .....	3-31
TABLE 3.6: STANDARDS TO BE ADOPTED FOR SIGNALLING SYSTEM.....	3-38
TABLE 3.7: TELECOMMUNICATION SYSTEM USED IN DIFFERENT METROS .....	3-39
TABLE 3.8: STANDARDS TO BE ADOPTED FOR TELECOMMUNICATION SYSTEMS.....	3-46
TABLE 3.9: STANDARDS PROPOSED FOR AFC SYSTEMS .....	3-52
TABLE 4.1: DESIGN CRITERIA .....	4-2
TABLE 4.2: HORIZONTAL CURVE PARAMETERS .....	4-2
TABLE 4.3: LENGTH OF TRANSITIONS OF HORIZONTAL CURVES .....	4-3
TABLE 4.4: TRACK CENTRE AND HEIGHT IN ELEVATED SECTION .....	4-3
TABLE 4.5: TRACK CENTRE AND DEPTH IN UNDERGROUND SECTION .....	4-4
TABLE 4.6: GRADIENT PARAMETERS .....	4-5
TABLE 4.7: VERTICAL CURVE PARAMETERS .....	4-5
TABLE 4.8: RADIUS, CANT AND PERMITTED SPEED .....	4-6
TABLE 4.9: LIST OF GPS CONTROL POINTS.....	4-12
TABLE 4.10: LIST OF GCP CONTROL POINTS AND TBMS.....	4-13
TABLE 4.11: GEOLOGICAL SUCCESSION IN VARANASI.....	4-24
TABLE 4.12: GEOLOGICAL SUCCESSION IN VARANASI.....	4-28
TABLE 4.13: SUMMARY OF BORE HOLES OF CORRIDOR-I .....	4-29
TABLE 4.14: SUMMARY OF BORE HOLES IN CORRIDOR-II .....	4-30

TABLE 4.15: SUMMARY OF BORE HOLES FOR DEPOTS.....	4-31
TABLE 4.16: ENGINEERING PARAMETERS OF EACH LAYER MET ALONG CORRIDOR I.....	4-33
TABLE 4.17: ENGINEERING PARAMETERS OF EACH LAYER MET ALONG CORRIDOR II.....	4-36
TABLE 4.18: ENGINEERING PARAMETERS OF EACH LAYER MET ALONG DEPOT.....	4-38
TABLE 4.19: SBC OF CONTINUOUS STRIP FOUNDATION (DEPOT LOCATIONS).....	4-42
TABLE 4.20: SAFE LOAD CARRYING CAPACITY & SAFE UPLIFT CAPACITY CORRIDOR-I.....	4-43
TABLE 4.21: SAFE LOAD CARRYING CAPACITY & SAFE UPLIFT CAPACITY CORRIDOR-II.....	4-44
TABLE 4.22: SAFE LOAD CARRYING CAPACITY & SAFE UPLIFT CAPACITY OF DEPOT.....	4-44
TABLE 4.23: ALIGNMENT DESCRIPTION.....	4-48
TABLE 4.24: INTERCHANGE STATIONS OF CORRIDOR-1.....	4-50
TABLE 4.25: MAJOR ROADS ALONG CORRIDOR-1.....	4-51
TABLE 4.26: MAJOR ROADS ACROSS CORRIDOR-1.....	4-51
TABLE 4.27: ABSTRACT OF HORIZONTAL CURVES OF CORRIDOR-1.....	4-52
TABLE 4.28: DETAILS OF HORIZONTAL CURVES OF CORRIDOR-1.....	4-53
TABLE 4.29: ABSTRACT OF GRADIENTS OF CORRIDOR-1.....	4-55
TABLE 4.30: DETAILS OF GRADIENTS FOR CORRIDOR-1.....	4-55
TABLE 4.31: LOCATION OF PORTALS CORRIDOR - 1.....	4-57
TABLE 4.32: BREAK-UP OF ALIGNMENT LENGTH FOR CORRIDOR-1.....	4-57
TABLE 4.33: ALIGNMENT DESCRIPTION OF CORRIDOR - II.....	4-68
TABLE 4.34: INTERCHANGE STATIONS OF CORRIDOR-2.....	4-71
TABLE 4.35: MAJOR ROADS ALONG CORRIDOR-2.....	4-71
TABLE 4.36: MAJOR ROADS ACROSS CORRIDOR-2.....	4-71
TABLE 4.37: ABSTRACT OF HORIZONTAL CURVES OF CORRIDOR-2.....	4-71
TABLE 4.38: DETAILS OF HORIZONTAL CURVES OF CORRIDOR-2.....	4-73
TABLE 4.39: ABSTRACT OF GRADIENTS OF CORRIDOR-2.....	4-74
TABLE 4.40: DETAILS OF GRADIENTS OF CORRIDOR-2.....	4-74
TABLE 4.41: LOCATION OF SPECIAL SPANS CORRIDOR - 2.....	4-75
TABLE 4.42: LOCATION OF PORTALS CORRIDOR - 2.....	4-75
TABLE 4.43: BREAK-UP OF ALIGNMENT LENGTH FOR CORRIDOR-2.....	4-75
TABLE 4.44: LIST OF ANCIENT MONUMENTS ALONG METRO CORRIDORS.....	4-79
TABLE 4.45: LIST OF STATIONS FOR CORRIDOR-1.....	4-84
TABLE 4.46: LIST OF STATIONS FOR CORRIDOR-2.....	4-85
TABLE 4.47: COMPARATIVE ANALYSIS OF TYPES OF STRUCTURAL ARRANGEMENTS.....	4-96
TABLE 4.48: DIMENSIONS OF TBM.....	4-101
TABLE 4.49: MERITS AND DEMERITS OF TOP-DOWN METHOD.....	4-113
TABLE 4.50: QUANTITY OF MUCK.....	4-120
TABLE 4.51: UTILITY RESPONSIBILITY DEPARTMENTS.....	4-123
TABLE 4.52: DETAILS OF SEWER LINE– CORRIDOR 1.....	4-125
TABLE 4.53: DETAILS OF SEWER LINE– CORRIDOR 2.....	4-126
TABLE 4.54: DETAILS OF STROM WATER DRAINAGE– CORRIDOR 1.....	4-127
TABLE 4.55: DETAILS OF STROM WATER DRAINAGE– CORRIDOR 2.....	4-128
TABLE 4.56: DETAILS OF SHAHI NALLAH – CORRIDOR 1.....	4-128
TABLE 4.57: DETAILS OF SHAHI NALLAH – CORRIDOR 2.....	4-129
TABLE 4.58: DETAILS OF ELECTRIC CABLES – CORRIDOR 1.....	4-131
TABLE 4.59: DETAILS OF ELECTRIC CABLES – CORRIDOR 2.....	4-133
TABLE 4.60: DETAILS OF SEWER PIPE LINES – CORRIDOR 1.....	4-136
TABLE 4.61: DETAILS OF SEWER PIPE LINES – CORRIDOR 2.....	4-137
TABLE 4.62: UP JAL NIGAM – PEYJAL : WATER SUPPLY PIPE LINES – CORRIDOR I.....	4-139
TABLE 4.63: UP JAL NIGAM – PEYJAL : WATER SUPPLY PIPE LINES – CORRIDOR II.....	4-140
TABLE 4.64: BSNL – NTR OFC.....	4-141
TABLE 4.65: BSNL – SSA OFC.....	4-142
TABLE 4.66: BSNL - COPPER CABLES.....	4-145
TABLE 4.67: VODAPHONE - OFC CABLES.....	4-154

TABLE 4.68: TATA CABLES (TCTS) - OFC CABLES .....	4-156
TABLE 4.69: RELIANCE JIO (4G) - OFC CABLES .....	4-157
TABLE 4.70: BHARATI AIRTEL - OFC CABLES .....	4-160
TABLE 4.71: PGCILL – OFC CABLES.....	4-161
TABLE 4.72: IDEA CELLULAR –OFC CABLES .....	4-162
TABLE 4.73: LAND REQUIREMENT (PERMANENT: CORRIDOR - I).....	4-164
TABLE 4.74: LAND REQUIREMENT (PERMANENT: CORRIDOR - II).....	4-167
TABLE 4.75: LAND REQUIREMENT (TEMPORARY : CORRIDOR - I) IN SQM.....	4-169
TABLE 4.76: LAND REQUIREMENT (TEMPORARY : CORRIDOR - II) IN SQM.....	4-169
TABLE 4.77: CORRIDOR-1 : LAND & STRUCTURES REQUIREMENT (IN HA).....	4-170
TABLE 4.78: CORRIDOR-2 : LAND & STRUCTURES REQUIREMENT (IN HA).....	4-171
TABLE 5.1: INTER-STATION DISTANCE AND TYPE OF PROPOSED STATIONS .....	5-1
TABLE 5.2: STATION BOARDING/ ALIGHTING IN DESIGN YEAR .....	5-30
TABLE 5.3: LOS CRITERIA FOR PEDESTRIANS .....	5-33
TABLE 5.4: SPACE REQUIREMENT SYNTHESIS FOR OPERATIONAL ROOMS IN TERMINAL STATIONS .....	5-41
TABLE 5.5: DESIGN OF STATION TYPES.....	5-60
TABLE 5.6: ROOM SCHEDULE FOR UNDERGROUND STATION TYPE A.....	5-64
TABLE 5.7: ROOM SCHEDULE FOR UNDERGROUND STATION TYPE B.....	5-68
TABLE 5.8: ROOM SCHEDULE FOR UNDERGROUND STATION TYPE C.....	5-73
TABLE 5.9: ROOM SCHEDULE FOR UNDERGROUND STATION TYPE D .....	5-79
TABLE 5.10: ROOM SCHEDULE FOR INTERCHANGE UNDERGROUND STATION TYPE E .....	5-84
TABLE 5.11: ROOM SCHEDULE FOR UNDERGROUND STATION TYPE F.....	5-90
TABLE 5.12: ROOM SCHEDULE FOR UNDERGROUND STATION TYPE G .....	5-94
TABLE 5.13: DETAILS OF PARKING & PROPERTY DEVELOPMENT FOR PHASE-I CORRIDOR.....	5-122
TABLE 5.14: FEEDER BUS SYSTEM FOR PHASE I METRO CORRIDORS.....	5-124
TABLE 5.15: BICYCLE SHARING SCHEME FOR PHASE I METRO CORRIDORS.....	5-127
TABLE 5.16: TRAFFIC INTENSITY ALONG PROPOSED METRO CORRIDORS – 2015 .....	5-128
TABLE 5.17: TRAFFIC INTENSITY ALONG PROPOSED METRO CORRIDORS – 2023 .....	5-133
TABLE 7.1: SPECIFICATIONS FOR RAMPS.....	7-12
TABLE 9.1: YEAR WISE MAXIMUM PEAK HOUR PEAK DIRECTION TRIPS (PHPDT).....	9-2
TABLE 9.2: CARRYING CAPACITY OF COACHES .....	9-3
TABLE 9.3: TRAIN OPERATION PLAN, HEADWAY AND CAPACITY PROVIDED .....	9-3
TABLE 9.4: VEHICLE KILOMETER: BHU TO BHEL .....	9-9
TABLE 9.5: VEHICLE KILOMETER: BENIABAGH TO SARNATH.....	9-9
TABLE 9.6: ROLLING STOCK REQUIREMENT .....	9-10
TABLE 10.1: RAKE REQUIREMENT FOR DIFFERENT HORIZON YEARS .....	10-2
TABLE 10.2: PROPOSED MAINTENANCE SCHEDULE .....	10-3
TABLE 10.3: SCHEDULE OF CLEANING .....	10-4
TABLE 10.4: INSPECTION AND WORKSHOP LINES PROVIDED FOR VARANASI METRO CORRIDORS .....	10-7
TABLE 11.1 : POWER DEMAND ESTIMATION (MVA) .....	11-2
TABLE 11.2 : SOURCES OF POWER SUPPLY.....	11-4
TABLE 11.3 : POWER DEMAND PROJECTION FOR VARIOUS SOURCES.....	11-5
TABLE 12.1: SCOPING MATRIX FOR THE PROJECT.....	12-2

TABLE 12.2: ENVIRONMENTAL ATTRIBUTES AND FREQUENCY OF MONITORING .....	12-3
TABLE 12.3: SAMPLING LOCATIONS FOR SOIL.....	12-5
TABLE 12.4: RESULTS OF LABORATORY ANALYSIS OF SOIL SAMPLE .....	12-7
TABLE 12.5: EXISTING LAND USE PATTERN .....	12-8
TABLE 12.6: DESCRIPTION OF WATER QUALITY MONITORING LOCATIONS.....	12-11
TABLE 12.7: PHYSICO-CHEMICALS ANALYSIS OF WATER SAMPLES IN PROJECT AREA.....	12-12
TABLE 12.8: METEOROLOGICAL DATA.....	12-14
TABLE 12.9: RAINFALL (MM) IN STUDY AREA.....	12-14
TABLE 12.10: AIR QUALITY RESULT.....	12-15
TABLE 12.11: NATIONAL AMBIENT AIR QUALITY STANDARDS.....	12-16
TABLE 12.12: AMBIENT NOISE LEVEL MONITORING RESULT in dB(A).....	12-16
TABLE 12.13: AMBIENT NOISE STANDARDS CRITERIA.....	12-17
TABLE 12.14: SUMMARY OF TREE INVENTORY .....	12-17
TABLE 12.15: REDUCTION IN DAILY VEHICLES TRIPS .....	12-20
TABLE 12.16: REDUCTION IN FUEL CONSUMPTION (LITER) .....	12-20
TABLE 12.17: NET SAVING ON FUEL EXPENDITURE (RS LAKH) .....	12-21
TABLE 12.18: POLLUTION REDUCTION (TONS/YEAR) .....	12-21
TABLE 12.19: NOISE LEVELS (LDN) IN dB(A) AT DIFFERENT DISTANCES .....	12-27
TABLE 12.20: WATER REQUIREMENT .....	12-28
TABLE 12.21: COST FOR TRAINING PROGRAMME.....	12-43
TABLE 12.22: COST OF ESTABLISHMENT OF ENVIRONMENTAL DIVISION.....	12-44
TABLE 12.23: CONSTRUCTION STAGE MONITORING SCHEDULE.....	12-46
TABLE 12.24: OPERATION STAGE MONITORING SCHEDULE .....	12-48
TABLE 12.25: SUMMARY OF COST ESTIMATE.....	12-48
TABLE 12.26 :LAND REQUIREMENT AND AQUITION (IN HA) .....	12-51
TABLE 12.27: DETAILS OF AFFECTED STRUCTURES.....	12-51
TABLE 12.28: MAGNITUDE OF PROJECT IMPACTS.....	12-53
TABLE 12.29: IMPACT ON PAFS AND PAPS.....	12-53
TABLE 12.30: TITLEHOLDERS AND NON-TITLEHOLDERS.....	12-53
TABLE 12.31: LOSS OF RESIDENCE .....	12-54
TABLE 12.32: LOSS OF LIVELIHOOD .....	12-54
TABLE 12.33: LOSS OF COMMON PROPERTY RESOURCES .....	12-54
TABLE 12.34: GENDER AND SEX RATIO.....	12-55
TABLE 12.35: RELIGIOUS GROUP .....	12-55
TABLE 12.36: SOCIAL GROUP.....	12-56
TABLE 12.37: AGE GROUP OF PAPS .....	12-56
TABLE 12.38: MARITAL STATUS OF PAPS.....	12-57
TABLE 12.39: FAMILY PATTERN .....	12-57
TABLE 12.40: SIZE OF FAMILY .....	12-57
TABLE 12.41: EDUCATIONAL ATTAINMENT OF PAPS .....	12-58
TABLE 12.42: FAMILY MONTHLY INCOME .....	12-58
Table 12.43: OCCUPATIONAL PATTERN OF PAFS .....	12-59
TABLE 12.44: OCCUPATIONAL PATTERN OF PAFS .....	12-60
TABLE 12.45: ENTITLEMENT MATRIX.....	12-61
TABLE 12.46: ENTITLEMENT MATRIX.....	12-62
TABLE 12.47: INDICATORS FOR MONITORING OF RAP PROGRESS.....	12-68
TABLE 12.48: COST FOR RESETTLEMENT & REHABILITATION* .....	12-69
TABLE 13.1: LAND & STRUCTURES REQUIREMENT (IN HECTARES) FOR CORRIDOR-I .....	13-2
TABLE 13.2: LAND & STRUCTURES REQUIREMENT (IN HECTARES) FOR CORRIDOR-II .....	13-2
TABLE 13.3: BASIS OF RATES.....	13-4
TABLE 13.4: ABSTRACT OF COST ESTIMATE OF CORRIDOR-1 & 2 .....	13-9
TABLE 13.5: CAPITAL COST ESTIMATE CORRIDOR-1.....	13-10



TABLE 13.6: CAPITAL COST ESTIMATE CORRIDOR-2.....	13-15
TABLE 13.7: DETAILS OF TAXES AND DUTIES CORRIDOR – 1.....	13-19
TABLE 13.8: DETAILS OF TAXES AND DUTIES CORRIDOR – 2.....	13-20
TABLE 13.9: O & M COST FOR BHU TO BHEL CORRIDOR (COST IN RS CRORE).....	13-23
TABLE 13.10: O & M COST FOR BENIA BAGH TO SARNATH CORRIDOR (COST IN RS CRORE).....	13-24
TABLE 13.11: KEY EVALUATION ASSUMPTIONS.....	13-25
TABLE 13.12: ASSUMPTIONS FOR VOC & VOT.....	13-26
TABLE 13.13: TRANSPORT DEMAND FORECAST ON PHASE-I MRTS CORRIDORS.....	13-27
TABLE 13.14: FACTORS USED FOR CONVERTING PROJECT INPUTS AND OUTPUT TO ECONOMIC COSTS.....	13-28
TABLE 13.15: COST BENEFIT STREAM: ECONOMIC PRICES.....	13-29
TABLE 13.16: PROJECT EIRR – SENSITIVITY ANALYSIS.....	13-31
TABLE 13.17: CAPITAL COSTS.....	13-31
TABLE 13.18: DETAILS OF COMPLETION COSTS (RS IN CRORE).....	13-32
TABLE 13.19: YEAR WISE FUND REQUIREMENTS WITHOUT TAXES (RS. IN CRORE).....	13-32
TABLE 13.20: YEAR WISE FUND REQUIREMENTS WITH TAXES (RS IN CRORE).....	13-32
TABLE 13.21: YEAR WISE FUND REQUIREMENTS WITH CENTRAL TAXES (RS IN CRORE).....	13-33
TABLE 13.22: OPERATION AND MAINTENANCE COSTS (RS IN CRORE).....	13-33
TABLE 13.23: EXPECTED RIDERSHIP ON PHASE-I MRTS CORRIDORS IN HORIZON YEARS.....	13-34
TABLE 13.24: TRIP LENGTH DISTRIBUTION.....	13-35
TABLE 13.25: MRTS FARE STRUCTURE FOR VARANASI METRO.....	13-36
TABLE 13.26: PROJECT FIRR - COSTS WITH CENTRAL TAXES WITHOUT PROPERTY DEVELOPMENT ( BOTH CORRIDORS).....	13-38
TABLE 13.27: ESTIMATED RENTAL INCOME FROM PROPERTY DEVELOPMENT (RS. IN CRORE).....	13-41
TABLE 13.28: TOTAL REVENUE COLLECTION (RS. IN CRORE).....	13-42
TABLE 13.29: PROJECT FIRR BOTH CORRIDORS - WITH PROPERTY DEVELOPMENT & GRANT FROM STATE AND CENTRAL GOVERNMENTS (RS IN CRORE).....	13-44
TABLE 13.30: PROPOSED FINANCING OF PROJECT.....	13-55
TABLE 13.31: CASH FLOW STATEMENT FOR VARANASI MRTS FOR GRANT SCENARIO (RS IN CRORE).....	13-56
TABLE 13.32: PROJECT IMPLEMENTATION SCHEDULE.....	13-58

**LIST OF FIGURE**

FIGURE 1.1: STUDY AREA - VARANASI DEVELOPMENT AUTHORITY AREA .....	1-2
FIGURE 1.2: REGIONAL TRANSPORT CONNECTIVITY OF VARANASI .....	1-16
FIGURE 1.3: EXISTING ROAD CHARACTERISTICS ALONG MAJOR ARTERIAL ROADS .....	1-17
FIGURE 2.1: DISTRIBUTION OF DAILY PASSENGER TRIPS BY MODE .....	2-2
FIGURE 2.2: FOUR STAGE TRAVEL DEMAND MODEL .....	2-5
FIGURE 2.3: ZONING SYSTEM AND CODED BASE YEAR ROAD NETWORK .....	2-7
FIGURE 2.4: FOUR STAGE MODEL STRUCTURE.....	2-8
FIGURE 2.5: SCATTER PLOT: POPULATION VS TRIP PRODUCTION .....	2-11
FIGURE 2.6: ATTRACTION MODEL (HBW – LINEAR REGRESSION) .....	2-12
FIGURE 2.7: GRAVITY MODEL FORMULATION.....	2-16
FIGURE 2.8: SEQUENCES OF ACTIVITIES FOR CALIBRATING GRAVITY MODEL .....	2-17
FIGURE 2.9: MULTI-LOGIT FORMULAS (COMBINED SPLIT) .....	2-19
FIGURE 2.10: LOGIT MODEL SENSITIVITY .....	2-19
FIGURE 2.11: ASSIGNED PEAK HOUR TRAFFIC VOLUME ON NETWORK IN PCU - 2015 .....	2-23
FIGURE 2.12: ASSIGNED PEAK HOUR TRAFFIC ON NETWORK IN PCU - 2021.....	2-30
FIGURE 2.13: ASSIGNED PEAK HOUR TRAFFIC ON NETWORK IN PCU - 2031.....	2-31
FIGURE 2.14: ASSIGNED PEAK HOUR TRAFFIC ON NETWORK IN PCU - 2041.....	2-32
FIGURE 3.1: TYPICAL CROSS SECTION OF BALLASTLESS TRACK ON VIADUCT .....	3-6
FIGURE 3.2: 1 IN 9 TYPE TURN-OUT.....	3-7
FIGURE 3.3: 1 IN 7 TYPE TURN-OUT.....	3-8
FIGURE 3.4: SCISSOR CROSS-OVER (1 IN 9 TYPE).....	3-9
FIGURE 3.5: SIMPLIFIED VELOCITY – TIME OPERATION CURVE.....	3-19
FIGURE 3.6: CONCOURSE AIR HANDLING UNIT .....	3-27
FIGURE 3.7: PLATFORM SUPPLY DUCT FROM AIR HANDLING UNIT.....	3-27
FIGURE 3.8: STATION AIR CONDITIONING CLOSED SYSTEM SCHEME .....	3-29
FIGURE 3.9: STATION AIR CONDITIONING SECTION VIEW .....	3-29
FIGURE 3.10: TELECOMMUNICATION SYSTEM STRUCTURE.....	3-41
FIGURE 3.11 TRAIN CAB RADIO AND COMM. FACILITY FOR MAINTENANCE .....	3-42
FIGURE 3.12: MASTER CLOCK .....	3-43
FIGURE 3.13: PASSENGER INFORMATION DISPLAY SYSTEM .....	3-44
FIGURE 3.14: PIDS AT PLATFORM AND CONCOURSE .....	3-44
FIGURE 3.15: FARE COLLECTION TECHNOLOGY DEVELOPMENT.....	3-48
FIGURE 3.16: AFC OPERATION PROCESS .....	3-48
FIGURE 3.17: AFC SYSTEM ARCHITECTURE.....	3-49
FIGURE 3.18: BANKING INTERFACE .....	3-50
FIGURE 3.19: COMMON MOBILITY CARD OVERVIEW .....	3-51
FIGURE 3.20: NEAR FIELD COMMUNICATION .....	3-51
FIGURE 3.21: PLATFORM SCREEN DOOR .....	3-54
FIGURE 3.22: MANUAL SCREEN DOOR .....	3-55
FIGURE 3.23: EMERGENCY ESCAPE DOORS & FIXED SCREENS/PANELS .....	3-55
FIGURE 3.24: HALF HEIGHT PSD .....	3-57
FIGURE 3.25: FULL HEIGHT PSD .....	3-57
FIGURE 4.1: ALIGNMENT OPTIONS PARAMETERS.....	4-7
FIGURE 4.2: METRO ALIGNMENT, STATION LOCATIONS & STATION NAMES AS PROPOSED IN INCEPTION CUM OPTIONS REPORT.....	4-9
FIGURE 4.3: SEISMIC ZONES OF INDIA.....	4-26

FIGURE 4.4: EARTHQUAKE HAZARD MAP .....	4-27
FIGURE 4.5: LITHOLOGICAL SECTION ALONG CORRIDOR - I (0.00 KM TO 8.35 KM) .....	4-39
FIGURE 4.6: LITHOLOGICAL SECTION ALONG CORRIDOR - I (8.9 KM TO 18 KM) .....	4-40
FIGURE 4.7: LITHOLOGICAL SECTION ALONG CORRIDOR - II (13KM TO 21.6 KM) .....	4-41
FIGURE 4.8: PROPOSED VARANASI METRO CORRIDOR-1 .....	4-47
FIGURE 4.9: GANESHPUR DEPOT LAYOUT & CONNECTIVITY–OPTION 1 (RECOMMENDED).....	4-49
FIGURE 4.10: VARANASI CANTT OPTION-1 .....	4-59
FIGURE 4.11: VARANASI CANTT OPTION-2.....	4-61
FIGURE 4.12: BENIA BAGH OPTION-1 .....	4-62
FIGURE 4.13: BENIA BAGH OPTION-2 .....	4-63
FIGURE 4.14: BHU OPTION-1 .....	4-65
FIGURE 4.15: BHU OPTION-2 .....	4-66
FIGURE 4.16: CONNECTIVITY TO KASHI VISHWANATH TEMPLE.....	4-67
FIGURE 4.17: PROPOSED VARANASI METRO CORRIDOR-2 .....	4-69
FIGURE 4.18: ALIGNMENT NEAR SARNATH AND CHAUKHANDI STUPA .....	4-80
FIGURE 4.19: MAN MANDIR OBSERVATORY .....	4-81
FIGURE 4.20: SCHEMATIC DIAGRAM OF VARANASI METRO .....	4-86
FIGURE 4.21: TYPES OF SUPERSTRUCTURE .....	4-90
FIGURE 4.22: LAUNCHING OF BOX GIRDER SEGMENTS .....	4-91
FIGURE 4.23: PRECAST U-CHANNEL SUPERSTRUCTURE .....	4-92
FIGURE 4.24: LAUNCHING OF U-CHANNEL GIRDER.....	4-93
FIGURE 4.25: LAUNCHING OF I-GIRDER.....	4-94
FIGURE 4.26: CLC SPAN 75M + 105M + 75M AND STEEL SPAN 60M.....	4-94
FIGURE 4.27: TYPICAL BOX GIRDER VIADUCT SECTION .....	4-95
FIGURE 4.28: TYPICAL ELEVATED STATION.....	4-98
FIGURE 4.29: EARTH PRESSURE BALANCE TBM.....	4-99
FIGURE 4.30: TYPICAL TWIN TUNNEL ARRANGEMENT .....	4-100
FIGURE 4.31: LAUNCHING CHAMBER.....	4-103
FIGURE 4.32: TYPICAL ASSEMBLY OF TUNNEL BORING MACHINE .....	4-103
FIGURE 4.33: MAIN SHIELD ERECTION .....	4-104
FIGURE 4.34: ERECTOR, SCREW CONVEYOR & BACKUP SYSTEM .....	4-104
FIGURE 4.35: EXCAVATION .....	4-105
FIGURE 4.36: RING SEGMENT .....	4-105
FIGURE 4.37: TBM THROUGH THE DIAPHRAGM WALL .....	4-108
FIGURE 4.38: TBM PUSHED TO THE OTHER END OF THE STATION .....	4-108
FIGURE 4.39: CONSTRUCTION OF TUNNEL BY NATM.....	4-109
FIGURE 4.40: TYPICAL CROSS SECTION OF TWIN TUNNELS OF U/G STATION BY NATM.....	4-109
FIGURE 4.41: LATTICE GIRDER .....	4-111
FIGURE 4.42: DIAPHRAGM WALL .....	4-115
FIGURE 4.43: TYPICAL UNDERGROUND STATION.....	4-116
FIGURE 4.44: TYPICAL TRAFFIC DIVERSION PLAN (ROW> 32M).....	4-119
FIGURE 4.45: TYPICAL TRAFFIC DIVERSION PLAN (ROW< 32M).....	4-119
FIGURE 4.46: TYPICAL TRAFFIC DIVERSION PLAN (ROW< 32M).....	4-120
FIGURE 4.47: TYPICAL SECTION OF FOOTPATH .....	4-122
FIGURE 5.1: PRIORITY MRTS CORRIDORS ALONG WITH STATION LOCATIONS .....	5-3
FIGURE 5.2: PEDESTRIAN FLOW ANALOGY.....	5-33
FIGURE 5.3: ARRANGEMENT OF A TYPICAL ELEVATED STATION.....	5-34
FIGURE 5.4: ARRANGEMENT OF A TYPICAL UNDERGROUND STATION.....	5-34
FIGURE 5.5: CROSS-SECTION OF A TYPICAL ELEVATED STATION .....	5-35
FIGURE 5.6: CROSS-SECTION OF A TYPICAL UNDERGROUND STATION .....	5-35
FIGURE 5.7: TICKET VENDING MACHINES AT STATIONS .....	5-37
FIGURE 5.8: TICKET OFFICE AT STATIONS.....	5-37

FIGURE 5.9: TUNNEL VENTILATION FAN & DAMPERS .....	5-48
FIGURE 5.10: TUNNEL VENTILATION FAN ASSEMBLY AT CONCOURSE LEVEL.....	5-49
FIGURE 5.11: TUNNEL VENTILATION FAN ASSEMBLY AT PLATFORM LEVEL .....	5-49
FIGURE 5.12: TUNNEL VENTILATION FAN ASSEMBLY AT 3 LEVELS .....	5-50
FIGURE 5.13: ADVERTISEMENTS AT STATIONS.....	5-55
FIGURE 5.14: ADVERTISEMENTS ON ROLLING STOCK .....	5-56
FIGURE 5.15: ADVERTISEMENTS AT STATION PLATFORMS.....	5-57
FIGURE 5.16: PLAN OF UNDERGROUND STATION TYPE A .....	5-66
FIGURE 5.17: TYPICAL UNDERGROUND STATION TYPE A - SECTION.....	5-67
FIGURE 5.18: PLAN OF UNDERGROUND STATION TYPE B .....	5-71
FIGURE 5.19: TYPICAL UNDERGROUND STATION TYPE B - SECTION.....	5-72
FIGURE 5.20: PLAN OF UNDERGROUND STATION TYPE C .....	5-76
FIGURE 5.21: TYPICAL UNDERGROUND STATION TYPE C - SECTION .....	5-77
FIGURE 5.22: UNDERGROUND STATION TYPE D – SECTION.....	5-81
FIGURE 5.23: TYPICAL UNDERGROUND STATION TYPE D.....	5-82
FIGURE 5.24: PLAN OF TYPICAL INTERCHANGE STATION - TYPE E .....	5-86
FIGURE 5.25: TYPICAL INTERCHANGE STATION TYPE E - SECTION .....	5-88
FIGURE 5.26: ISOMETRIC VIEW OF ELEVATED STATION.....	5-91
FIGURE 5.27: PLAN OF TYPICAL ELEVATED STATION - TYPE F .....	5-92
FIGURE 5.28: TYPICAL ELEVATED STATION TYPE F - SECTION .....	5-93
FIGURE 5.29: PLAN OF TYPICAL ELEVATED STATION - TYPE G.....	5-96
FIGURE 5.30: TYPICAL ELEVATED STATION TYPE G - SECTION.....	5-97
FIGURE 5.31: VIADUCT PROFILE VIEW.....	5-98
FIGURE 5.32: ROOF TYPES .....	5-99
FIGURE 5.33: LOUVERS FOR VENTILATION .....	5-99
FIGURE 5.34: TRAFFIC DISPERSAL AND MANAGEMENT PLAN OF BHU METRO STATION .....	5-111
FIGURE 5.35: TRAFFIC DISPERSAL AND MANAGEMENT PLAN OF VARANASI CANTT METRO STATION .....	5-112
FIGURE 5.36: TRAFFIC DISPERSAL AND MANAGEMENT PLAN OF KASHI BUS DEPOT METRO STATION .....	5-113
FIGURE 5.37: TRAFFIC DISPERSAL AND MANAGEMENT PLAN OF GILAT BAZAR METRO STATION .....	5-114
FIGURE 5.38: TRAFFIC DISPERSAL AND MANAGEMENT PLAN OF BENIA BAGH METRO STATION .....	5-115
FIGURE 5.39: TRANSIT ORIENTED DEVELOPMENT FACILITIES.....	5-116
FIGURE 5.40: CONCEPT OF TRANSIT ORIENTED DEVELOPMENT NEAR METRO STATION .....	5-117
FIGURE 5.41: FEEDER SERVICES AT METRO STATIONS .....	5-118
FIGURE 5.42: PROPOSED FEEDER BUS ROUTES FROM IDENTIFIED METRO STATIONS .....	5-120
FIGURE 5.43: EXISTING ROWS AND TRAFFIC SURVEY LOCATIONS ALONG THE PROPOSED METRO CORRIDOR ..	5-123
FIGURE 5.44: SEQUENTIAL CUT-AND-COVER PHASED TOP-DOWN METHOD .....	5-126
FIGURE 5.45: BOTTOM UP METHOD OF CONSTRUCTION .....	5-130
FIGURE 5.46: DIVERSION PLAN FOR DLW ROAD DURING CONSTRUCTION OF BHU STATION .....	5-131
FIGURE 5.47: DIVERSION PLAN FOR RAJA BAZAR ROAD DURING CONSTRUCTION OF NADESAR STATION .....	5-132
FIGURE 5.48: DIVERSION PLAN FOR M.G. ROAD DURING CONSTRUCTION OF BHU STATION.....	5-135
FIGURE 5.49: DIVERSION PLAN FOR M.G. ROAD DURING CONSTRUCTION OF NADESAR STATION .....	5-136
FIGURE 7.1: WAY FINDING SIGNAGE .....	7-5
FIGURE 7.2: INTERNATIONAL SYMBOL OF ACCESS.....	7-5
FIGURE 7.3: GUIDING PAVER .....	7-8
FIGURE 7.4: WARNING PAVER.....	7-8
FIGURE 7.5: SIGNAGE FOR ACCESSIBLE WASHROOM .....	7-18
FIGURE 9.1: PHPDT DEMAND AND CAPACITY PROVIDED (2021) FOR BHU TO BHEL CORRIDOR.....	9-5
FIGURE 9.2: PHPDT DEMAND AND CAPACITY PROVIDED (2031) FOR BHU TO BHEL CORRIDOR.....	9-5
FIGURE 9.3: PHPDT DEMAND AND CAPACITY PROVIDED (2041) FOR BHU TO BHEL CORRIDOR.....	9-6
FIGURE 9.4: PHPDT DEMAND AND CAPACITY PROVIDED (2021) FOR BENIABAGH TO SARNATH.....	9-7
FIGURE 9.5: PHPDT DEMAND AND CAPACITY PROVIDED (2031) FOR BENIABAGH TO SARNATH CORRIDOR .....	9-7

FIGURE 9.6: PHPDT DEMAND AND CAPACITY PROVIDED (2041) FOR BENIABAGH TO SARANTH.....	9-8
FIGURE 10.1: RAKE VISITS TO DEPOTS AND WORKSHOPS .....	10-7
FIGURE 11 1 : TYPICAL HIGH VOLTAGE RECEIVING SUB – STATION (RSS) .....	11-6
FIGURE 11 2: TYPICAL INDOOR AUXILIARY SUB-STATION (ASS) .....	11-7
FIGURE 11 3 : TYPICAL TRACTION SUB STATION (TSS) .....	11-9
FIGURE 11.4: 750V DC THIRD RAIL CURRENT COLLECTION SYSTEM .....	11-10
FIGURE 11 5: SCADA SYSTEM .....	11-14
FIGURE 12.1: TOPOGRAPHICAL MAP OF VARANASI .....	12-4
FIGURE 12.2: SOIL MAP OF VARANASI DISTRICT .....	12-5
FIGURE 12.3: MONITORING LOCATION MAP FOR AIR, NOISE, WATER AND SOIL.....	12-6
FIGURE 12.4: GEOLOGICAL MAP OF UTTAR PRADESH .....	12-7
FIGURE 12.5: SEISMIC ZONING MAP OF UTTAR PRADESH .....	12-9
FIGURE 12.6: WIND ROSE DIAGRAM .....	12-15
FIGURE 12.7: PROPOSED GANESHPUR DEPOT FOR CORRIDOR-1 .....	12-18
FIGURE 12.8: RAP IMPLEMENTATION SCHEDULE FOR VARANASI METRO RAIL.....	12-66
FIGURE 13.1: EXPECTED TRIP DISTRIBUTION ON THE PROPOSED METRO CORRIDOR.....	13-35
FIGURE 13.2: FUNDING PATTERN OF KOLKATA METRO.....	13-47
FIGURE 13.3: FUNDING PATTERN OF DELHI METRO PHASE I .....	13-48
FIGURE 13.4: FUNDING PATTERN OF DELHI METRO PHASE II .....	13-48
FIGURE 13.5: FUNDING PATTERN OF DELHI METRO PHASE III .....	13-48
FIGURE 13.6: FUNDING PATTERN OF BANGALORE METRO.....	13-49
FIGURE 13.7: FUNDING PATTERN OF CHENNAI METRO.....	13-49
FIGURE 13.8: FUNDING PATTERN OF AIRPORT LINE .....	13-50
FIGURE 13.9: FUNDING PATTERN OF MUMBAI METRO LINE 1 .....	13-51
FIGURE 13.10: FUNDING PATTERN OF HYDERABAD METRO.....	13-51
FIGURE 13.11: PROPOSED FUNDING PATTERN UNDER SPV MODEL.....	13-55