Urban and Regional Development Plans Formulation & Implementation Guidelines, 2014

Volume II B

Ministry of Urban Development

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Issue and revision record

Revision	Date	Originator	Checker	Approver	Description	Standard

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Appendix Title **Page**

Volume II B: Appendices of the URDPFI Guidelines, 2014

Appendix A. Making of the Guidelines

A.1 Background and Objective

The first National level planning guidelines 'The Urban Development Plans Formulations and Implementation Guidelines' (UDPFI) were framed in 1996. Since then, many changes have taken place in the field of urban development especially in view of emerging needs and requirements of urban settlements due to rapid population growth and other reasons like globalization and liberalization. The towns and cities have been more dynamic in nature and are subject to unprecedented changes in terms of requirements of infrastructure and other basic services/ amenities. Besides, new emerging aspects like inclusive planning, sustainable habitat, land use and transport integration at planning stage, preparation of Comprehensive Mobility Plans (CMP) for urban transport, Service Level Benchmarks, disaster management, environmentally sustainable transport and urban reforms have given a new dimension to the planning process. Therefore, it necessitated to revisit the UDPFI Guidelines, 1996.

The Ministry of Urban Development (MoUD), through the standard tendering procedures, awarded the task to revise the guidelines to Mott MacDonald (referred to as Consultant) in August 2013. The time frame was 9 months. The objective was to revise 'The Urban Development Plans Formulation & Implementation (UDPFI) Guidelines, 1996' and formulate-

"The Urban and Regional Development Plans Formulation & Implementation (URDPFI) Guidelines, 2014"

A.2 Terms of Reference (ToR)

Ministry of Urban Development proposed to formulate the URDPFI Guidelines, 2014 to accommodate the future needs of the ever growing population coupled with urbanization with the following Terms of Reference (ToR):

- Review the UDPFI Guidelines, 1996, revise and prepare the URDPFI guidelines;
- Undertake stakeholder consultation with all relevant stakeholders;
- Consult key Ministries and the Planning Commission, NCRPB, MMRDA and other relevant State and Central Ministries, Bodies or Authorities;
- Study relevant Central and State Laws , rules and regulations;
- Address to the data available with *BHUVAN*, ISRO, NESAC, NUIS Census 2001 and 2011, Survey of India and GIS database of NIC;
- Integration of different types of plans;
- Identify the gaps where new set of norms and standards for plan formulation are required;
- Suggest a clear-cut framework for plan formulation in view of the emerging scenario of the country's urbanization and overall vision;
- Suggest the new set of norms and standards, zoning regulations including integrated development of peri-urban areas which are easily comprehensible and user-friendly;
- Suggest framework and standards, for transit oriented development, affordable housing projects and slum redevelopment and incorporate principles of inclusive development;
- Suggest set of norms and standards for land use and transport integration at planning stage itself, integration of CMP with the master plan of the planning area;

- Suggest planning, regulatory and enforcement mechanisms for effectively dealing with challenges of urbanization;
- Suggest set of norms and standards for earthquake prone areas, environmentally fragile zones such as CRZ areas and hazard prone areas etc.;
- Suggest mechanism for improving economic opportunities of cities;
- Include framework for Crisis/Disaster Management Plans as part of Development Plan;
- Suggest mechanism and avenues for participatory planning; and
- Suggest various resource mobilization options and institutional supporting systems for urban development.
- Assess the Legal Implications and framework for plan preparation, monitoring and impact assessment of the Master Plans.
- Evolve participatory plan approach including planning at ULBs, planning for peri-urban areas and provide for integration between different levels of plan.

A.3 Scope of Work

While formulating the URDPFI Guidelines, 2014 the following issues was to be focussed upon as was indicated by the MoUD:

1. The service level benchmarks developed by the MoUD.
2. A broad based consultation process by developing a discussion portal and disseminating the Guidelines in regional language.
3. Integration between different levels of plans including integration of City Development Plan and Comprehensive Mobility Plan (CMP) with statutory Master Plan.
4. Integrated land use transport planning with priority to public transport and non-motorised transport.
5. A separate volume on legal aspects.
6. Need for assessing the impact of the plan on growth, employment etc. in a quantifiable manner to make it more acceptable to various stakeholders.
7. A separate chapter should be included on redevelopment of inner city areas as well the city as a whole, with densification along mass transit corridors.
8. A separate Chapter on Urban Transport Impact Assessment for different land use scenarios in terms of overall travel demand, average trip length Maximum time of travel by public transport (for 80% of the trips) in peak time.
9. Guidelines for regional planning including for interstate region that would require cross cutting interventions from zonal administration.
10. Norms and standards for earthquake prone areas, environmentally fragile zones such as CRZ areas and hazard prone areas etc.
11. Framework to make Crisis/Disaster Management Plans a part of Development Plan.
12. Use of GIS technologies for plan formulation including integration with *Bhuvan* and Google Map etc.
13. Dovetailing the guidelines with various statutory provisions as also the recommendations of 2nd Administrative Reforms Commission and the Working Group on Urban Planning.
14. Measures to tackle the problems arising out of the transition of rural areas into peri urban and urban areas.

15. Include guidelines for special purpose cities, industrial towns, smart cities, port cities, sport cities, heritage cities, medicities, IT corridors, corridor (main and subsidiary), SEZ, Hi tech cities, greenfield towns, hill towns etc.
16. Focus on land suitability and urban renewal norms.
17. One National Workshop and three Regional Workshops to be organized with at least one workshop in the eastern region with State T&CP Department, Urban Development Department, Transport Department, Traffic Police, Development Authorities, UMTAs and Local Bodies.
18. Links with the National Building Code and parameter under National Mission for Sustainable Habitat.
19. Include plans for water, sanitation and drainage.
20. Principles for determination of the costs (capital & recurring) to implement the different aspects of the plan along with specific measures to meet such costs.
21. Uniform/ standardisation of colour code
22. Framework for implementation of the plan, including governance of the same.
23. Ultimately, the URDPFI guidelines should culminate in a responsive planning system.

A.4 Deliverables

The project was delivered in six stages as tabulated below:

Table A.1: Deliverables of the project

Stages	Description	Deliverables
Stage I- Inception	Finalization of road map for completion of the project	Inception Report
Stage II- Review	Review of UDPFI Guidelines, 1996 and Gap Identification	Report on reviews of existing UDPFI guidelines, 1996
Stage III- Consultation	Regional Workshops	Recommendations of regional workshops at major cities
Stage IV- Draft	Framing of new guidelines, including the legal document	Revised UDPFI Guidelines – Draft Stage
Stage V- National workshop	National Workshop to deliberate on the first Draft Report	Report of recommendations in the Workshop
Stage VI- Final	Incorporation of the final recommendations	Final Report- UDPFI Guidelines, 2013

Source: Terms of reference of the project

A.5 Approach and Methodology for the Revision Study

A.5.1 Approach

With the vision to encompass and provide for the holistic urban and regional development for the entire land cover of India, the approach followed in the formulation of URDPFI Guidelines, 2014 comprised of a participatory consultation of the various stakeholders through the following pathways, viz:

1) **Formulation of Technical Core Group (TCG):** TCG was formed by MoUD for this revision. The consultant held periodic interactions with the TCG members formally and informally for getting inputs. The role of TCG members included:
    - Co-ordination with the consultant on technical aspects
    - Technical inputs & area specific recommendations
    - Review the consultant's work at various stages
    - Guide & support - data collection, stakeholder consultation and workshops

2) **Google Discussion Group:** An online group was facilitated by TCPO which allowed interface of various planners and practitioners for the following:
    - Technical inputs & area specific recommendations
    - Sharing of information
    - Technical feedback & interaction

3) **Monthly Review Meetings with MoUD:** Monthly review meetings were held by MoUD for the consultant to appraise the progress of the project and highlight the key issues for inclusion in the guidelines.

4) **Key Consultations:** The foremost criteria adopted in provisions of the URDPFI guidelines, 2014 were to make them in concomitance with the provisions of the Policies/ Guidelines/ Acts/ Bills of various other Ministries and Departments.

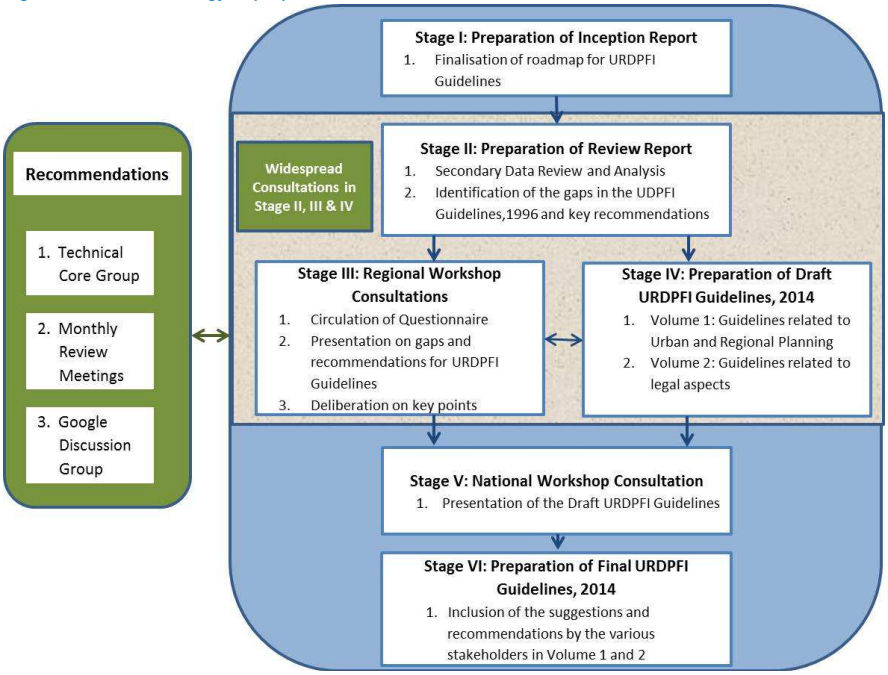
5) **Regional workshops and National Consultative meeting:** A total of five Regional workshops were conducted to invite comments from all the 35 States and Union Territories of India. Regional workshops were organised wherein the planning aspects varying across States were discussed and approach to planning in future was directed. Regional workshops were held at Panchkula, Mysore, Goa, Guwahati and Bhubaneswar. The National Consultative meeting was organised in New Delhi on the 4th of April 2014 to deliberate on the aspects of the guidelines to holistically consult with National and State level stakeholders.

All the key suggestions, comments and provisions obtained from the legal documents, authentic reference and the consultations held have been comprehensively incorporated in the URDPFI Guidelines, 2014 amongst other inclusions upon appraisal at various stages.

A.5.2 Methodology

The methodology adopted for formulation of the guidelines is described in the figure below:

Figure A.1: Methodology of preparation of URDPFI Guidelines, 2014



Source: MM

A.5.2.1 Stage I - Inception

The Inception stage comprised of brainstorming sessions for finalisation of road map of URDPFI guidelinesand a kick off meeting with the MoUD. The major aspects covered in the inception study/report were:

- Finalisation of methodology and work plan.
- Framework and locations for regional workshop,
- List of stakeholders to be consulted including Ministries & Departments, ULBs, Experts and Institutes and issue of authorisation letter,
- Suggestions on datato be referred.
- Selection of the State Town & Country Planning Acts, cities for case studies
- Formation of the Technical Core Group as suggested by the consultant.
- Discussion on the overall National consultation framework and stakeholders & set up of “Google Discussion Group”.

A.5.2.2 Stage II - Review& Analysis

The second stage undertook secondary data review & analysis of the UDPFI guidelines, 1996. During this stage the stakeholder consultations were initiated which followed through the Stages III and IV.

Secondary Data Review: The secondary data of various Ministries, Departments, Institutions and Professional Bodies uploaded on websites such as of Planning Commission; Ministry of Urban Development; Ministry of Drinking Water Supply and Sanitation; Ministry of Environment and Forests; Department of Land Resources, Ministry of Rural Development, etc. and various City Master/ Development Plans were identified for review and analysis. Some of the important references included - Report of the Working Group on Urban Strategic Planning, Twelfth Five Year Plan, Public Private Partnership Toolkit of ADB and MoUD, JNNURM CDP Toolkit, The Land Acquisition, Rehabilitation and Resettlement Act, 2013, Handbook on Service Level Benchmarking, National Urban Sanitation Policy, NDMA Guidelines for Disaster Management, State Town and Country Planning Acts of Tamil Nadu, Karnataka, Himachal Pradesh, Mizoram, Bihar, Maharashtra and Gujarat, The Kerala Town and Country Planning Ordinance, 2013 etc.

Based on the secondary data review, analysis and consultations; the gaps in the UDPFI guidelines, 1996 were identified. As an output of analysis, the recommendations for formulation of URDPFI guidelines were listed. The gaps and updations were finalised in close consultation with the TCG and MoUD.

Stakeholder consultations: After secondary data review, consultations were through telephonic conversation/ email/ face to face meetings. This undertook in depth interview and assisted in crystallisation of the vision of the URDPFI guidelines. The major consultations corresponding to the information obtained were:

Table A.2: Major Stakeholder Consultations and Key Inputs(in addition to MoUD)

Sr. No.	Particulars	Consultations
1.	Planning Process	a) Planning Commission b) Registrar General of India c) Survey of India (SoI) d) Town and Country Planning Organisation, Delhi (TCPO) e) Ahmedabad Urban Development Authority (AUDA) f) Delhi Development Authority (DDA) g) Association of Municipalities and Development Authorities (AMDA) h) Jawaharlal Nehru National Urban Renewal Mission (JNNURM) i) School of Planning & Architecture, Delhi (SPA, Delhi)
2.	Urban Planning Approach	a) Ministry of Shipping b) Ministry of Tourism Indian Green Building Council (IGBC) c) Directorate General of Defence Estates d) Delhi Urban Arts Commission (DUAC) e) Institute of Town Planners (ITP) f) EMBARQ, India g) Hyderabad Metropolitan Development Authority (HMDA)

Sr. No.	Particulars	Consultations
3.	Regional Planning	a) Delhi Mumbai Industrial Corridor Development Corporation (DMICDC) b) Mumbai Metropolitan Region Development Authority (MMRDA) c) National Capital Regional Planning Board (NCRPB) d) Urban Development & Urban Housing Department, Government of Gujarat e) Town and Country Planning Department, Goa f) Town and Country Planning Department, Kerala g) School of Planning & Architecture, Delhi (SPA, Delhi)
4.	Sustainability&Disaster Management	a) Ministry of Environment and Forests (MoEF) b) Central Pollution Control Board (CPCB) c) National Disaster Management Authority (NDMA) d) National Institute of Disaster Management (NIDM) e) Indian Green Building Council (IGBC)
5.	Planning Techniques	a) Geological Survey of India (GIS) b) National Remote Sensing Centre (NRSC) c) National Urban Information System (NUIS) d) Survey of India (SoI) e) Hyderabad Metropolitan Development Authority (HMDA) for GIS mapping
6.	Transport Planning	a) Ministry of Road Transport and Highways (MoRTH) b) Central Road Research Institute (CRRI) c) Institute of Urban Transport (IUT) d) Airport Authority of India (AAI) e) Indian Institute of Technology, Delhi (IIT- Delhi) f) School of Planning & Architecture, Delhi (SPA, Delhi) g) Centre for Environment Planning and Technology (CEPT)
7.	Water, Drainage, Waste Management&Social Infrastructure Planning	a) Ministry of Water and Sanitation b) Central Ground Water Board c) Central Public Health & Environmental Engineering Organisation (CPHEEO) d) Bureau of Indian Standards (BIS)
8.	Development Promotion Regulation	a) Bureau of Indian Standards (BIS) b) Ministry of Social Justice and Empowerment c) Airport Authority of India (AAI)
9.	Resource Mobilisation	a) Ministry of Rural Development b) Town and Country Planning Organisation, Delhi (TCPO) c) Centre for Good Governance d) Delhi Development Authority (DDA)

An exhaustive contact list is given in Appendix A.7.

A.5.2.3 Stage III – Regional Workshop Consultation

The preparation of the Draft URDPFI Guidelines and organisation of Regional Workshops at five locations were held. The agenda of the regional workshop consultations were:

- Learning from State specific best practices and planning innovations
- Identification of the sources to bridge data gaps
- Sharing of guidelines/ policies and other data

The agenda was attained by a three step procedure followed in the workshops:

a) **Circulation of questionnaire:** the questionnaire consisting section on information sharing and data sharing was circulated in advance to the identified stakeholders for receiving their comments
b) **Presentation:** presentation of the identification of gaps in UDPFI guidelines,1996 and major recommendations for the URDPFI Guidelines,2014
c) **Deliberations on key points**

During the workshops most of the States responded to the questionnaire circulated and provided database for reference. Alongwith this, some States gave presentations on chosen best practices such as Planning in Hilly Areas by Shimla, Himachal Pradesh; Regional planning process by Goa, Plan preparation process by Kerala, Village level planning in Rajasthan etc. The Regional Workshops provided a good platform for communication of URDPFI vision and dovetailing the expectations of the various stakeholders and also getting inputs on best practices.

States and UTs of Andhra Pradesh, Himachal Pradesh, Karnataka, Kerala, Maharashtra, Puducherry, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand, Goa, Sikkim, Tripura, Odisha shared comments on UDPFI Guidelines, 1996 and suggestions for the URDPFI Guidelines, 2014 in writing. Ministries including Ministry of Defence, Directorate General of Defence Estates, Ministry of Shipping, Ministry of Railways, Ministry of Rural Development, Ministry of Road, Transport and Highways, Ministry of Water Resources extended great help in the formulation of the Guidelines.

Further suggestions were invited from the States & Institutes on “Google Discussion Group”. Some academic institutions such as Indian Institute of Technology, Kharagpur; School of Planning and Architecture, Vijaywada, College of Engineering, Pune, Department of Architecture and Planning, College of Engineering, Trivandrum shared their comments.

Recommendations from Regional Consultation: At this stage an analysis of the suggestions was made and a concise recommendation report of all the workshops was prepared. The key points from the recommendation report were appropriately addressed in the URDPFI Guidelines upon consultation with MoUD and TCG.

A.5.2.4 Stage IV – Drafting of URDPFI Guidelines

Drafting of Volume I- Guidelines related to Urban and Regional Planning

Based on the inputs from stage I to III and the gaps in the existing UDPFI guidelines, the Draft URDPFI guidelines were prepared containing the following points. In preparation of the guidelines, some of the sections of UDPFI Guidelines were retained which were applicable in the current planning scenario.

- Reclassification of the urban settlements
- Recommended planning system, Planning process including the inter relationships between various plans and their contents
- Resource mobilisation and options for land assembly, fiscal resource mobilisation and institutional set up.
- A separate chapter on Regional Planning including peri-urban area and land use classification
- Revised urban planning approach and planning based on city typologies such as hilly, inner city, industrial, heritage/ religious/ tourism, port, medical and sport cities. An introduction to the planning aspects of compact city covering TOD and Mixed use, green city/ township and Smart city.
- Inclusion of mandatory aspects of sustainability- sustainable transportation viz a viz landuse planning, disaster management, environment statutory obligations etc.
- Techniques for plan preparation including GIS based planning through use of *Bhuvan* and allied portals.
- Guidelines for assessment of infrastructure demand for the newer kind of integrated developments
- Dovetailing with various statutory provisions including recommendations of 2nd Administrative Reforms Commission, Working Group on Planning, 73rd and 74th CAA.
- A chapter on recommendations and action plan based on rationality.

Drafting of Volume II- Guidelines related to National Level legal aspects

A separate volume on Legal aspects was formulated, especially focussing on:

- Implications of 73rd&74th CAA
- The Right to Fair Compensation and Transparency in Land Acquisition Rehabilitation and Resettlement Act, 2013
- Suggestions on the revision of Model Regional and Town Planning and Development Law, 1985 and Model Municipal Law, 2006
- Some of the State level Legal framework were compared to bring out advantages and disadvantages
- Legal requirements for industrial developments
- Other National level legal requirements for heritage and environment conservation

The draft URDPFI guidelines including its chapterisation structure was prepared in consultation with the various stakeholders. Further draft technical sections were shared with respective agencies for their inputs such as NRSC, NDMA, AAI, various departments of SPA, Delhi etc. who confirmed the provisions with reference to their statutory requirements/ key suggestions. The glossary of the reference is given in Appendix A.8.

The draft URDFPI guideline was widely circulated on MoUD website, Google Discussion Group, web links and to all Ministries, inviting comments and suggestions for inclusion/ making modifications in the guidelines. Comments were received from more than 20 sources before and 22 sources after the National Workshop, which were sorted, examined and considered for inclusion.

A.5.2.5 Stage V & Stage VI: National Consultative Meeting and formulation of Final URDPFI Guidelines, 2014

National Consultative was held on 4th April, 2014 in Delhi to have holistic consultation on the Draft Guidelines. Stakeholders for the workshop were finalised in close consultation with MoUD.

Total of 174 participants attended the National Workshop, including the following:

- Ministries participated – Ministry of Water Resources, Ministry of *Panchayati Raj*, Ministry of Shipping, Ministry of Defence
- Participating States & Union Territories (about 16) -Andhra Pradesh (HMDA), Assam, Chandigarh, Chhattisgarh, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, NCT Delhi, Orissa, Puducherry, Rajasthan, Uttarakhand, Uttar Pradesh andWest Bengal.
- Other agencies participated- AIA, CPCB, CPHEEO, CSO, CPWD, Delhi Metro, Department of Post and Telegraph, Geological Survey of India, IUT, INTACH, Indian Port Association, International Boundary Directorate, National Disaster Management Authority, RGI, and Survey of India.
- ParticipatingPlanning Institutes- College of Engineering Trivandrum, IIT Roorkee, Mysore Institute of Development Studies, NIT Warangal and SPA Delhi.

Based on the comments and recommendation on the Draft Guidelines and outputs of consultative meeting including monthly review meetings with MoUD, the Draft Guidelineswas updated as Final URDPFI Guidelines, 2014.

A.6 Organisation of the Research Study

A.6.1 Project Team

As constituted by MoUD

A.6.2 Technical Core Group Team

As per MoUD, Office Memorandum, dated 2nd September, 2013.

Joint Secretary (UD), MoUD, Chairperson

Chief Planner, TCPO, Member Convenor

Consultative Members

India Urban Space Foundation

Town Planner, TCPO

Chief Regional Planner, NCRPB

Director, NIUA

Director General, Institute of Urban Transport, MoUD

Director, Centre for Research, Documentation & Training (CRDT), Institute of Town Planners India

Head, Department of Physical Planning, School of Planning & Architecture, New Delhi

Head, Deptt of Transport Planning, School of Planning & Architecture, New Delhi

A.7 Contact List

Table A.3: Contact list for consultation and data collection

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
1	Ahmedabad Urban Development Authority	Ms. NeelaMunshi, Chief Town Planner	Sardar Vallabhbhai Patel Sankul, Usmanpura, Ashram Road, Ahmedabad - 380 014 Phone - +91-79-27545051 - 54	Face to face meeting, Mail	• Sustainable Development Plan Strategy, • Use of TDR, • Urban Water Bodies Redevelopment • Local Area Plan
2	Airport Authority of India	Ms. KalpanaSethi	Executive Director (Planning) "C" Block, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi – 110003 Phone – 011-24654084 Email – edplg@aai.aero	Face to face meeting, Mail	• Zone within which NOC is required from AAI for construction. • Height restrictions. • Minimum distance of airport from Green areas. • Suggestions from AAI. • Restrictions in the aerodrome buffer zone,
		Mr.Pawan Kumar Nagpal	Executive Director (Engg.) – 1 B Block – III Floor, Corporate Head Quarters Phone 011-24693697 Email – edengg@aai.aero	Face to face meeting, Mail	
3	Association of Municipalities and Development Authorities	--	7/6, Sirifort Institutional Area, August Kranti Marg, New Delhi-110 049, India Phone - 91-11-26494486, 26497973	Library research	• Municipal Ward as the Basic Urban Planned Development Area, • Changing Urban Scenario for Good Governance
4	Bureau of Indian Standards	Mr. Sanjay Pant, Scientist & Director (Civil Engineering)	Bureau of Indian Standards ManakBhavan 9 Bahadur Shah Zafar Marg New Delhi 110 002 (INDIA) Phone: 011-23230131 Extn 4402 Fax: 011-23235529 e-mail: sanjaypant@bis.org.in	Face to face meeting, Mail, Telephonic	• Special Requirements for Urban Planning in Hilly Areas • National Building Codes, 2005 • City typology
5	Central Ground Water Board, Ministry of Water Resources	Mr. S. K. Suneja	Central Ground Water Board, Bhujal Bhawan, NH-IV, Faridabad, 121001, Ph.: +91-129-2419075, Email: chmn-cgwb@nic.in	Face to face meeting, Mail	• Artificial recharge unit • Aquifer Mapping
		Mr.Sushil, Chairman		Face to face meeting, Mail, Telephonic	• Salient features of Provision of Rainwater Water Harvesting, Central Ground Water Board' for artificial recharge techniques.

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
6	Central Pollution Control Board	Mr.Sudhakar Mr. Anand Kumar Ms. Piyali	Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, Delhi - 110 032	Face to face meeting, Mail	• State Zoning Atlas manual • Manual on preparation of Zoning atlas at district level
7	Central Public Health & Environmental Engineering Organisation	Mr. V.K Chaurasia, Joint Adviser (PHEE)	Room No. 660 A, NirmanBhavan, Maulana Azad Road, New Delhi – 110011. Phone: (o) 011-23061144, (R) 0120-2417613 Email: vijchaurasia@yahoo.co.in	Face to face meeting, Mail, Telephonic	• CPHEEO manual for- • Sewerage and Sewage Treatment • Rain Water Harvesting (RWH) • Drainage • Storm Water • Toilets
		Dr. M. Dhindhyalan (Joint Advisor) Deputy Adviser (PHE)	Neerman Bhawan, Room Number- 658 'A', New Delhi. Phone: 011-23061571, Email: mdheen@gmail.com	Face to face meeting, Mail, Telephonic	• Allocation of land for water infrastructure, STP, • Provisions for Septic Management, Regional landfill, • Treated sewage and its reuse • Decentralised waste water management
8	Centre for Good Governance	Mr.KarunakarReddy.R., Knowledge Manager , CGG,	Dr. MCR HRD Institute of A.P. Campus), Road No. 25, Jubilee Hills, Hyderabad 500033 Andhra Pradesh	Telephonic	• Land-based Resource Mobilisation, • Innovative Practices of Local Resource Mobilisation
9	Central Road Research Institute	Dr.Errampalli Madhu, Principal Scientist, Transportation Planning Division	Central Road Research Institute (C.R.R.I.), Mathura Road New Delhi-110025, INDIA Tel:+91-11-26312268 (Off) +91-99580 80643 (Mobile) +91-11-26923114 (Res) Email: madhu.crri@nic.in, errampalli.madhu@gmail.com	Face to face meeting, Mail, Telephonic	• Travel Demand Modelling
10	Delhi Development Authority	Mr. J.B Ksirsagar, Chief Planner, TCPO & Commissioner Planning DDA	Town & Country Planning Organization Government of India Ministry of Urban Development E- Block, Vikas Bhawan, I.P. Estate, New Delhi-110002	Face to face meeting	• Land Pooling Techniques • Land use planning study
11	Delhi Mumbai Industrial Corridor Development Corporation	Mr Abhishek Chaudhary, Vice President - Corporate Affairs	Room No. 341B, 03rd Floor, Hotel Ashok, Diplomatic Enclave, 50B Chanakyapuri, New Delhi -110021	Face to face meeting, Mail	• Perspective Plan and Master Plan of DMIC • A technical discussion with DMICDC on regional planning aspects

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
		&Company Secretary	Email: abhishekchaudhary@dmicdc.com Ph.: 9810027336		
12	Delhi Urban Art Commission	Mr. Raj Rewal, Chairman, DUAC	duac74@gmail.com,	Mail	• Guidelines/ points for inclusion/ revision of UDPFI guidelines
13	Directorate for Spatial Planning and Water, Government of the Netherlands	Henk Snoeken, Acting Director for Spatial Development	Henk.Snoeken@minienm.nl	Mail	• Public participation&Participation process • Participation in official environmental impact assessments • Dutch national urban planning policy document
14	Embarq, India	Mr. Amit Bhatt, Strategy Head, Urban Transport	87, 2nd Floor, New MangalaPuri, MG Road, New Delhi 110030, abhatt@embarqindia.org +91 9868453595	Face to face meeting, Mail	• Land & transport integration , TOD • Issues and challenges in planning • Street Vendors as Pedestrian Infrastructure
		Ms. Sonal Shah	sshah@embarqindia.orgsshah@embarqindia.org	Mail	• Gender Consciousness in Urban Planning and Regulations
15	Geological Survey of India	Mr Gurprit Singh Jaggi, Director, GSI	Geological Survey of India, A-II, Pushpa Bhawan, Madangir Road, New Delhi-110 062. Tel: 011- 29053777 (O) FAX : 011-29962671, 29051328	Face to face meeting	• Integration of GSI with Bhuvan maps, • Geo-environmental profile in the Metadata base (procedure)
16	Hyderabad Metropolitan Development Authority	Mr.Sarma, Consultant, Hyderabad Metropolitan Development Authority	HMDA, Hyderabad	Face to face meeting, Mail	• Development plan preparation in GIS platform, • Site analysis strategies
17	Indian Green Building Council	Mr Praveen Kumar Soma, Senior Counsellor	CII-Sohrabji Godrej Green Business Centre, Survey No. 64, Kothaguda Post, Near HITEC City, R. R. Dist., Hyderabad -500 084, Ph.: +91 40 4418 5121, Email: praveen.soma@cii.in	Face to face meeting, Mail	• Work done in the field of the Green Buildings, • Green Townships and Green SEZs by Indian Green Building Council. • NBC, 2005 Codes for sustainable Development
		Mr RitabrataSen, Engineer	ritabrata.sen@cii.in		
		Mr V Nagesh Gupta, Counsellor	nagesh.gupta@cii.in		
18	Indian Institute of Technology (IIT)	Prof.Geetam Tiwari, Professor,	TRIPPS, Indian Institute of Technology,	Face to face meeting	• Travel Demand Modelling • Freight complex

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
	Delhi	Department of Civil Engineering	Room MS 815 (Main Building) HauzKhas, New Delhi Ph.: 011- 26858703 Email: geetamt@gmail.com		• Non Moterised Transport modal split • Transit Oriented Development • Sampling size of various transport surveys • Design standards related to Urban Expressways • Urban Road Design Standards
19	Indian Institute of Technology (IIT) Kharagpur	Dr. B.K. Sengupta, professor, Department of Architecture and Regional Planning	B-185, IIT campus, 03222-255303, 282700, 277190	Mail, Face to face meeting during regional workshop at Bhubneshwar	• Comments on UDPFI Guidelines, 1996
20	Institute of Town Planners, India	Dr.Meshram, President, ITPI	4-A, Ring Road, I.P.Estate, New Delhi – 110002	Face to face meeting	• City typologies, • Hill cities consideration
		Dr.Kulsheshtra		Face to face meeting	• Regional Planning • Plan process concept • Plan formulation • 74th CAA provision • Participatory approach
21	Institute of Urban Transport	Mr.C. L. Kaul, Executive Secretary (IUT), Mr. M. L. Chotani, Consultant, IUT	Institute of Urban Transport (India) 1st Floor, Anand Vihar Metro Station Building, Entry adjacent to Gate No 1, Delhi - 110 092 (INDIA), Ph.: (+91) 11 66578700 – 709, Fax.: (+91) 11 66578733/44, Email: info@iutindia.org	Face to face meeting, Mail, Telephonic	• Revised toolkit for CMP • Sampling Size • Travel Demand Modelling
22	Jawaharlal Nehru National Urban Renewal Mission	Mr. Anand Mohan, Director, JnNURM	Room No: 340 C, Ph.: 23062194, Email: anandmohan2006@hotmail.com	Face to face meeting, Mail	• General information regarding Project • Tool kits provided by JnNURM • CDPs of various cities • Integration of GIS in planning
23	Ministry of Defence, Directorate General of Defence Estates	Dr. D. K Malik, Additional Directorate General	Ph: 011-25674976 Email: dkmalik1958@gmail.com	Face to face meeting, Mail, Telephonic	• Suggestions for inclusions in UDPFI Guidelines

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
		Mr. Ajay Kumar Sharma, IDES, Deputy Director General	Ph: 011-25676979, 9990699002 Email: ajayced@gmail.com	Face to face meeting	• The Cantonment Act, 2006
		Mr. N. V Satyanarayana, Dy. Director General (Cantts)	Ph: 011-25676979, 9968608234 Email: nvsatya2008@gmail.com	Face to face meeting, Mail	• Review of the Cantonment section in the Guidelines
24	Ministry of Environment and Forest	Mr.Maninder Singh, Joint Secretary (EIA)	Paryavaran Bhawan, CGO Complex, Lodhi Road, New Delhi – 110003 , Email: jsicmoef@gmail.com	Mail, Telephone	• Technical aspects of environmental obligations and planning requirements by MoEF
		Mr Susheel Kumar, Additional Secretary	C-II/51, Shahjahan Road, Ph.: 24362285,24363918 (F) ,23073953 Email: asmefsusheel@gmail.com	Mail	
25	Ministry of Road Transport and Highway	Mr. R.K. Pandey, Chief Engineer (Planning)	Room No. 249, Office of Minister for Road Transport & Highways, Ph.: 23739085	Face to face meeting, Telephonic	• Urban road design standards
26	Ministry of Rural Development, Land Department	Mr.Charanjit Singh, Director, Land Reforms, Department of Land Resources	Nirman Bhawan, NBO Building, G- Wing, Maulana Azad Marg New Delhi-110011 T +91 11 23062456 Email: da-dolr@nic.in	Face to face meeting, Telephonic	• Draft National Land Policy, • National Land RecordModernization Programme (NLRMP)
27	Ministry of Social Justice & Empowerment	Dr.VikramSima Rao Director (DD-III & National Awards)	Ministry of Social Justice and Empowerment, Room. No. 740, 'A', Wing, Shastri Bhawan, Dr.Rajendra Prasad Road, New Delhi - 110001 (India) Ph: 011 23383464 Email: vickybotha@hotmail.com	Telephonic, Mail	• The Persons with Disabilities Act, 1995, Guidelines • Space Standards for Barrier Free Built Environment for Disabled and Elderly Persons
28	Ministry of Shipping	Dr.Vishwapati Trivedi, Secretary	Transport Bhawan, Room No. 401, SansadMarg,New Delhi,110001 Phone: 011-23714938 Email: secyship@nic.in	Mail, Letter	• Consultation with Ministry of Shipping

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
29	Ministry of Tourism	Mr.S.K.Mohanta, DPA Grade "B"	Phone: 91-11-23013072 Email: mohanta@nic.in	Face to face meeting, Mail	• Eco-tourism guidelines for tourism cities
30	Ministry of Water & Sanitation	Mr Pankaj Jain, Secretary	Room No. 247, A Wing, NirmanBhavan, New Delhi – 110001, Ph.: 23061207, Email:ppsdws@nic.in	Face to face meeting, Mail	• Technical aspects on Water supply standards, Water quality standards, Service level benchmarking, Sewerage System, Effluent quality standards etc.
31	Mumbai Metropolitan Regional Development Authority (MMRDA)	Ms. Uma Adusumilli, Chief Planner.	E Block, MMRDA Building, Opposite Driven in Theatre, BandraKurla Complex, Bandra East, Mumbai, Maharashtra 400051 Ph: 022-26594060, 022-26591237 Email: umaplanner@gmail.com	Mail, Telephonic	• Regional plan of MMR
32	National Capital Region Planning Board	Mr. J.N. Barman, Director, Planning Wing	National Capital Region Planning Board, Core-IV B,First Floor, India Habitat Centre, Lodhi Road, New Delhi- 110003. Ph.: 24628179 Email: ncrpb-jd1@nic.in		• Revised Regional plan, GIS based Plan
33	National Disaster Management Authority	Dr. Anita Bhatnagar Jain, JS (Policy & Plan)	Email: 'anita.bhatnagar@nic.in	Mail, Telephonic	• Sensitive Landuse Planning document, • National Plan for Disaster
		Mr. Rajesh Kumar Singh (Director)	Room no. 326, NDMA Bhawan,A-1, safdarjung enclave new delhi-110029, singhkrajesh@hotmail.com	Face to face meeting, mail	• Disaster Management guidelines • District Disaster Management Plan • Sensitive land use planning document
34	National Institute of Disaster Management	Dr. Anil K. Gupta, Associate Professor	5-B, IIPA Campus, I.P. Estate, M.G. Road, New Delhi – 110002 Ph.: 23724311 Email: anil.nidm@nic.in	Face to Face Meeting	• National Mission on Sustainable Habitat, National Building Code Of India 2005 (covering hazard components), • Disaster Management Guidelines, Chennai master plan (sensitive to urban flood)
35	National Remote Sensing Centre	Dr.K.Venugopala Rao, Group Head Urban Studies & Geo Informatics Group, NRSC	ISRO, Department of Space,Balanagar, Hyderabad-500037, A.P. Tel: +914023884556 Fax: +914023884259 Venu_koppaka@nrsc.gov.in	Face to face meeting, Mail	• Bhuvan database and services • GIS application of Bhuvan in Master plan preparation (including pilot project of Nalgonda) • Consultation with Hyderabad Metropolitan Development Authority (HMDA) for understanding the process of Hyderabad Metropolitan Development Plan formed in GIS platform

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
		Mr. Arul Raj, Bhuvan, NRSC, Ms. Reedhi, Engg. SD, Geo Informatics Group			• NUIS landuse layers for the core city area
36	National Urban Information System	Dr.Debjani Ghosh, Mr.Sandeep Thakur, Mr.Jagan Shah	Indian habitat Centre, Core 4B, Lodhi Road, 110003 Tel: 91-11 24617517/43 dghosh@niua.org	Mail	• NUIS mapping, • Latest status and utilisation for planning
		Mr.Mohd.Monis Khan, Town & Country Planner	Town & Country Planning Organization Government of India Ministry of Urban Development Email: khanmonis@yahoo.com	Face to face meeting	• Status of NUIS on 18.02.13
37	Planning Commission	Mr.RakeshRanjan, Advisor, HUD	Yojana Bhawan, New Delhi-110001	Face to face meeting	• Considering the economic aspects while preparation of plans • Consider the factors of migration into urban areas • Emphasis of 'Mixed Land Use ' • Optimum Use of Land • planning of urban areas more economically optimum
38	Registrar General of India	Dr. D.K. Dey, Additional Director	Office of The Registrar General and Census Commissioner, 2/A, Man Singh Road, New Delhi - 110011, Tel: +91-11-23070629, 23381623,23381917, 23384816, Email: rgoffice.rgi@nic.in	Face to face meeting	• Census database, • PCA data for social-economic development, • Census Atlas, • National Commission on Population
39	School of Planning and Architecture	Ms. SanjukktaBhaduri HoD Urban Planning	Email: sanjukta.bhaduri@gmail.com, s.bhaduri@spa.ac.in	Face to Face Meeting	• Mixed uses of land, Alternative to Master Plan approach – Two slides
40	School of Planning and Architecture	Mr.Sewaram, HoD, Transport Planning	Department of Transport Planning, School of Planning and Architecture, 4-Block-B, Indraprastha Estate, New Delhi 110002	Face to Face Meeting	• Transport Planning
41	School of Planning and Architecture	Mr.Mahaveer, HoD, Transport Planning	4-Block-B, Indraprastha Estate, New Delhi 110002	Face to Face Meeting	• Regional Planning
42	Survey of India	Maj. Gen. RC Padhi, Additional Surveyor	Indian Institute of Surveying and Mapping, SOI, Uppal, Hyderabad-	Telephone	• NUIS mapping,

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
		General, SOI	500039, Tel: 040-27201181, 040-27202059		• District Planning Series
43	Town and Country Planning Organisation, Delhi	Mr. J.B. Kshirsagar Chief Planner, Town and Country Planning Organisation Mr.R.Srinivas Town and Country Planner, Head, Metropolitan &Union Territories Division, Town and Country Planning Organisation Mr.Sudeep Roy, Asstt Town and Country Planner Town and Country Planning Organization	Town & Country Planning Organization Government of India Ministry of Urban Development E- Block, Vikas Bhawan, I.P. Estate, New Delhi-110002 Ph-23370837(O),9810636758(M) 0120- 4297227(R) Email: srinimetro@gmail.com	Face to Face Meeting, Mail, Telephonic	• Zoning regulations, • Institutional requirement, • Master plan studies • Various studies and interactions during the project
44	Urban Development & Urban Housing Department, Government Of Gujarat	Mr.G.R.Aloria, Principal Secretary	Email: us-ud@gujarat.gov.in	Mail	• Metropolitan plan formulation • Empowering the ULB
• Consultation during Regional Workshops and comments shared					
45	Town & Country Planning, Government of Karnataka	Mr Shantappa. B. Honnur, Director	Office of the Director of Town & Country Planning, M. S. Building, Gate No. 3, Bangalore – 500 001 Ph.: 984515 0829 Email: shanthonnur@gmail.com	Mail	• Views and information pertaining to Department of Town and Country Planning, Government of Karnataka
46	Town Planning & Valuation Department, Maharashtra	Mr K. S. Akode, Director	Town Planning & Valuation Department, Central Office, Pune-411 001	Mail	• Review, study and recommendations for applying Planning Standards for various urban area in the State of Maharashtra

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
47	Town & Country Planning Organization, Puducherry	Mr S. Ragunathan Chief Town Planner - cum - Secretary, SLNA, JNNURM	Town and country Planning Department, Puducherry (SLNA for JNNURM) Puducherry	Mail	• Puducherry Bye-Law Amendment 2013, Puducherry City Development Plan, Puducherry Master Plan, Puducherry Master plan document, Puducherry TCP Act, 1969, Yanam Master Plan
48	Town Planning Organisation, Government of Tripura	--	TCPO, 3rd floor of Khadya Bhawan, Pandit Nehru Complex, Gurkhabasti, Agartala, Tripura	Mail	• Comments on the UDPFI Guidelines, 1996
49	Town Planning Department, Government of Uttarakhand	Mr S. K. Pant, Senior Planner	Town Planning Department, 53, Tomar Complex, Dehradun, Uttarakhand	Mail	• Comments on the UDPFI Guidelines, 1996
50	Indian Institute of Technology (IIT) Kharagpur	Dr.Jaydip Barman, Professor and Head of Department	Department of Architecture and Regional Planning, Indian Institute of Technology, Kharagpur- 721 302	Mail	• Observation on review of UDPFI Guidelines, 1996
51	Government of Sikkim	Ms Devika Sharma Chettri, Additional Chief Town Planner	Urban Development & Housing Department, GoS, Gangtok, Ph: 03592-202900	Mail	• Comments on the UDPFI Guidelines, 1996
52	College of Engineering, Pune	Prof.PratapRaval, Professor	College of Engineering, Pune, Maharashtra Ph.: 9422506124, Email: pushpak20@yahoo.co.uk	Mail	• Views regarding revision of UDPFI and inclusion in new guidelines.
53	Town Planning Department Rajasthan	Mr. Praveen Jain, Chef Town Planner, Government of Rajasthan	Town Planning Department, opp. Birla Temple, JLN Marg, Jaipur - 04 Telephone no.: 0141-2563702, email: cto-rj@nic.in	Face to face meeting in the regional workshop	• Comments on the UDPFI Guidelines, 1996 • Suggestions on Infrastructure fund, planning norms, Small town level planning
		Mr. Pradeep Kapoor, Town Planning Department , Government of Rajasthan	p.kapoor57@gmail.com	Face to face meeting in the regional workshop and mail	• Planning provision in the State • Affordable Housing Policy and Integrated Township Policy of Rajasthan
54	Urban Development & Housing Department, Sikkim	Mr.Dinek Gurung, Sr.Architect-cum-Town Planner	Urban Development & Housing Department, Government of Sikkim, Gangtok-737101 Ph: 9933032718	Face to face meeting in the regional workshop and mail	• Comments on the UDPFI Guidelines, 1996

S.No.	Agency Name	Name & Designation	Address and Contact number	Mode of Contact	Key points consulted
			gurungdinker@gmail.com		
55	Directorate of Town Planning, Odisha	Mr. Mishra	Chief Town Planner, Directorate of Town Planning, "Block IV, Unit 5", Bhubaneswar-751001 (Tel:0674–2392294, Fax:0674–2395574) E-mail: dtpodisha@gmail.com	Face to face meeting in the regional workshop	• Comments on the UDPFI Guidelines, 1996 • Orissa Development Authority Manual, • OTP & IT Act, 1956

A.8 Glossary

A.8.1 List of reference made in the guidelines *(as sources, footnotes, references in the volumes)*

Table A.4: List of reference made in the guidelines (as sources, footnotes, references in the volumes)

S. No.	Particulars	Sources
1	73rd & 74th Constitutional Amendment Act	http://indiacode.nic.in/coiweb/amend/amend73.htmhttp://indiacode.nic.in/coiweb/amend/amend74.htm
2	A Gendered Perspective of the Shelter-Transport-Livelihood Link: The Case of Poor Women in Delhi. Transport Reviews, Volume 26 (1), p 63-80	Wilson, Anand, Anvita and Tiwari, Geetam;1987
3	Advisory Note – Septage Management in Urban India, 2013	Ministry of Urban Development (MoUD)
4	Affordable Housing Policy, 2009	Government of Rajasthan
5	Ahmedabad CDP	Jawaharlal Nehru National Urban Renewal Mission (JnNURM)
6	Ahmedabad Draft Comprehensive Development Plan 2021 (Second Revised) Ahmedabad Urban Development Authority Part III: General Development Regulations - Draft	Ahmedabad Urban Development Authority (AUDA)
7	Airport Development Reference Manual, 9th edition	International Air Transport Association (IATA)
8	Aizawl Master Plan	Aizawl Development Authority
9	Alternative Modes of Assembly And Development of Land and Housing in the NCT of Delhi	Association of Municipalities and Development Authorities (AMDA)
10	Ancient Monuments and Archaeological Sites and Remains Act, (Amendment and Validation) 2011	Archaeological Survey of India (ASI)
11	Approach to the Twelfth Five Year Plan	Planning Commission
12	Arizona Department of Commerce	
13	Basic Statistics for Local Level Development (BSLLD)	Ministry of Statistics & Programme Implementation (MoS&PI)
14	BBMP Model of SWM	www.bbmp.gov.in
15	Bihar Urban Planning and Development Act 2012	Patna Municipal Corporation
16	Bio-Medical Waste (Management and Handling) Rules, 1998	Ministry of Environment and Forest (MoEF)
17	Canada, British Columbia Table	http://www.thinkcity.ca/node/289
18	Case Study: Kankaria Lake, Ahmedabad	http://www.narendramodi.in/kankaria-lake-development-project-restores-iconic-lake-to-itsgrandeur/
19	Case Studies in Design Excellence for Mid-Sized Urban / Inner Suburban Medical Centers	AIA Potomac Valley
20	Census of India, 2001	Office of the Registrar General and Census Commissioner, India, Ministry of Home Affairs
21	Chemical Terrorism Disaster Guidelines-N	National Disaster Management Authority (NDMA)

S. No.	Particulars	Sources
22	City Development Plan (CDP) Delhi	Department of Urban Development
23	Climate Proofing Guwahati, Assam City resilience strategy and Mainstreaming Plan, Synthesis Report, 2013	Tata Energy Research Institute (TERI)
24	Coastal Regulation Zone (CRZ) Notification, 2011	Ministry of Environment and Forest (MoEF)
25	Code of Practice (Part-I) Cross Section (Urban Road)	Ministry of Urban Development (MoUD)
26	Community Planning Assistance Program	American Planning Association
27	Compendium of Sewage Treatment Technologies, 2009	National River Conservation Directorate, Ministry of Environment and Forest (MoEF)
28	Comprehensive Mobility Plans: Preparation Toolkit	Ministry of Urban Development (MoUD)
29	Conditions of engagement of professional services and scale of professional fees and charges	Institute of Town Planners, India (ITPI)
30	Consolidated FDI Policy, 2011	Department Of Industrial Policy & Promotion (DIPP)
31	Creative Financing of Urban Infrastructure in India through Market-based Financing and Public-Private Partnership Options	Chetan and Hitesh Vaidya, Metropolitan Congress, Sydney, October 22-26, 2008.
32	Draft UTTIPEC Guidelines, 2012	http://www.uttipec.nic.in/index1.asp?linkid=31&langid=1
33	Defining, Meaning & Evaluating Carrying Capacity in European Tourism Destinations	University of Aegean, Greece
34	Delhi Land Pooling Policy	Town and Country Planning Organisation (TCPO)
35	Designing Green Modules for New Urban Spaces in West Bengal-Workshop	Department for International Development (DFID)
36	Determining Sustainable Development Density using the Urban Carrying Capacity Assessment System, 2004	University College London (UCL) (available at: https://www.bartlett.ucl.ac.uk/casa/pdf/paper78.pdf)
37	Development of Toolkit under Sustainable Urban Transport Project, Land Use Transport Integration and Density of Urban Growth, 2013	Ministry of Urban Development, Government of India
38	Development of Training Material under Sustainable Urban Transport Project, Reference Guide Volume 2 Demand Assessment	Ministry of Urban Development (MoUD)
39	Disaster Management of India	Ministry of Home Affairs (MoHA)
40	Debt Market Component	Indo-US Financial Institutions Reform and Expansion Project FIRE(D)
41	Delhi-Mumbai Industrial Corridor	http://www.dmicdc.com/
42	Draft Development Plan (DDP) - Dholera Special Investment Regional Development Authority (DSIRDA)	Dholera Special Investment Regional Development Authority (DSIRDA)
43	Draft Guidelines for Development of Special Economic Zone (SEZ)s	Town and Country Planning Organisation (TCPO)
44	Draft Special Regulation for Installation of Telecom Towers in Urban Areas	Government of Odisha
45	Eleventh Five Year Plan 2007-12 Volume-I	Planning Commission
46	Energy Conservation Building Code (ECBC)	Ministry of Power (MoP)
47	Environment Protection Act, 1986	Ministry of Environment and Forest (MoEF)

S. No.	Particulars	Sources
48	Environmental Impact Assessment (EIA) notification, 2006	Ministry of Environment and Forest (MoEF)
49	Explosive Rule, 2008	Department Of Industrial Policy & Promotion (DIPP)
50	FDI Indian Road Congress (IRC) 2013	Department Of Industrial Policy & Promotion (DIPP)
51	Flood Management Guidelines	National Disaster Management Authority (NDMA)
52	Forest Conservation Act, 1980	Ministry of Environment and Forest (MoEF)
53	A Gendered Perspective of the Shelter-Transport-Livelihood Link: The Case of Poor Women in Delhi	Wilson, 1987; Anand, Anvita and Tiwari, Geetam. 2006. Transport Reviews, Vol 26 (1), p 63-80
54	Good Governance Guide	Municipal Association of Victoria (at: http://www.goodgovernanceguide.org.au/)
55	Good Governance & Transparency- Their Impact on Development	Saladin Al-Jurf ; (Article at http://heinonline.org/HOL/LandingPage?handle=hein.journals/tlcp9&div=22&id=&page)
56	Greater Bangalore Water and Sewerage Project (GBWASP), India	Indo-US Financial Institutions Reform and Expansion Project - Debt Market Component FIRE(D)
57	Greater Hyderabad Biodiversity Index, 2012	Greater Hyderabad Municipal Corporation (GHMC)
58	Greenest City Action Plan, City of Vancouver	http://www.greencitytimes.com/Sustainable-Cities/vancouver-greenest-city-2020.html
59	Guidance Note on Municipal Solid Waste Management on a Regional Basis	Ministry of Urban Development (MoUD)
60	Guidebook on PPP Infrastructure	UN Economic and Social Commission for Asia and the Pacific (ESCAP)
61	Guide on Artificial Recharge to Ground Water	Central Ground Water Board
62	Guideline Note - Municipal Solid Waste Management on Regional Basis	Ministry of Urban Development (MoUD)
63	Guidelines and Space Standards for Barrier Free Built Environment for Disabled and Elderly Persons	Central Public Works Department (CPWD)
64	Guidelines and Toolkits for Urban Transport Development in Medium Sized Cities in India	Ministry of Urban Development (MoUD), Asian Development Bank (ADB)
65	Guidelines and Toolkits for Urban Transport Development in Medium Sized Cities in India - Guidelines for Non-Motorised Transport Measures: Policy and Options	Ministry of Urban Development (MoUD)
66	Guidelines and Toolkits for Urban Transport Development Module 1 Comprehensive Mobility Plan	PADECO Co., Ltd., Tokyo, JAPAN
67	Guidelines for Decentralised Wastewater management	Ministry of Urban Development (MoUD)
68	Guidelines for Declaration of Eco-Sensitive Zones Around National Parks & Wildlife Sanctuaries	Ministry of Environment & Forest (MoEF)
69	Guidelines for FDI in Development of Integrated Township,2002	Press Note, Department Of Industrial Policy & Promotion (DIPP)

S. No.	Particulars	Sources
70	Guidelines for Financial Assistance to State Government	Ministry of Tourism (MoT)
71	Guidelines for High Rise Buildings, 2012	MoEF Office Memorandum
72	Guidelines for Preparation of Slum Free City Plan of Action	Ministry of Housing & Urban Poverty Alleviation (MoHUPA)
73	Guidelines for establishment of National Investment and Manufacturing Zones (NIMZ)	Department Of Industrial Policy & Promotion (DIPP)
74	Gujarat Integrated Township Policy, 2008	Gujarat Urban Development Company Ltd. (GUDC)
75	Handbook of Service Level Benchmarking	Ministry of Urban Development (MoUD)
76	Highway Design Manual	Department of Transportation, New York State (USA)
77	Himachal Pradesh Integrated Township Scheme(Draft)	Government of Himachal Pradesh
78	Historic Urban Landscape (Recommendation), 2011	UNESCO's General Conference
79	Improving Urban Water Supply & Sanitation Services - Advisory Note	Ministry of Urban Development (MoUD)
80	Improving Local Governance and Service Delivery: Citizen Report Card Learning Tool Kit, 2007	Asian Development Bank (ADB) & Asian Development Bank Institute (ADBI)
81	India's Fifth National Report to the Convention on Biological Diversity, 2014	Ministry of Environment and Forest (MoEF)
82	Indian Public Health Standards (IPHS), 2012	Ministry of Health and Family Welfare
83	Indian Road Congress (IRC) 103-2012	Indian Road Congress (IRC), Ministry of Road Transport & Highways (MORTH)
84	Indian Road Congress (IRC) 106-1990	Indian Road Congress (IRC), Ministry of Road Transport & Highways (MORTH)
85	Indicative Dwelling Unit Sizes	Naya Raipur Master Plan
86	Industrial Chemical-Disaster Management Guidelines-N	National Disaster Management Authority (NDMA)
87	Integrated District Planning Manual	Planning Commission
88	Integrated Township Policy, Housing & Urban Planning Department	Government of Uttar Pradesh
89	Institute of Town Planners, India (ITPI) Article	Mr.A.K. Jain, Commissioner (Planning), Delhi Development Authority
90	Indian Standards (IS) 10500: 2012	Bureau of Indian Standards (BIS)
91	Jawaharlal Nehru National Urban Renewal Mission (JnNURM) CDP Toolkit	Ministry of Urban Development (MoUD)
92	Kerala Ordinance, 2013	Government of Kerala
93	Land Acquisition Act, 1894	Ministry of Law & Justice (MoLJ)
94	Land Pooling Notification-Delhi	The Gazette of India
95	Land Suitability Analysis for Urban Planning Environmental assessment in an Ecologically Sensitive Coastal Area of Eastern China Based upon Multi-Criteria Mechanism	Nanjing University, China (website)
96	Landfill Gas Management Facilities Design Guidelines	Ministry of Environment, British Colombia
97	Major Port Trust Act, 1963	Ministry of Shipping (MoS)

S. No.	Particulars	Sources
98	Manual for Integrated District Planning	Planning Commission
99	Manual for the Preparation of Town and Regional Planning Maps	Town and Country Planning Organisation (TCPO)
100	Manual on Artificial Recharge of Ground Water	Central Ground Water Board (CGWB), Ministry of Water Resources
101	Manual on Municipal Solid Waste Management	Central Public Health and Environmental Engineering Organisation (CPHEEO)
102	Manual on Preparation of City Sanitation Plans (CSPs)	Ministry of Urban Development (MoUD)
103	Manual on Rain Water harvesting and Conservation	Central Public Works Department (CPWD)
104	Manual on Sewerage and Sewage Treatment (Draft Third edition)	Central Public Health and Environmental Engineering Organisation (CPHEEO)
105	Manual on Sewerage and Sewage Treatment (second edition)	Central Public Health and Environmental Engineering Organisation (CPHEEO)
106	Master Plan for Delhi, 2001 and 2021	Town and Country Planning Organisation (TCPO), MCD
107	Master Plan of Delhi (MPD) 2021	Delhi Development Authority (DDA)
108	Medical Tourism Magazine	http://www.medicaltourismassociation.com/en/medical-tourism-magazine.html
109	Methodology to estimate and forecast district and city GDP	McKinsey & Company's note to MoUD, 17th April 2014
110	Micro & Small Enterprises - Cluster Development Programme	Ministry of Micro, Small & Medium Enterprises (MoMSME)
111	Model Building Bye-laws	Town and Country Planning Organisation (TCPO)
112	Mumbai Waterway System	Inland Waterways Authority of India (IWAI)
113	Municipal Accounting-ULB Level Reform	http://Jawaharlal Nehru National Urban Renewal Mission (JnNURM).nic.in/wp-content/uploads/2011/01/Mandatory_Primer_2-Mun-Acc.pdf
114	Municipal Finance Improvement Programme, Jawaharlal Nehru National Urban Renewal Mission (JnNURM)	Ministry of Urban Development (MoUD)
115	Municipal Finance in India: An Assessment	Department of Economic Analysis and Policy, Reserve Bank of India (RBI)
116	National Accounts Statistics: Manual On Estimation Of State And District Income, 2008	Central Statistics Office (CSO)
117	National Building Codes of India 2005	Bureau of Indian Standards (BIS)
118	National Electricity Policy , 2005	Ministry of Power (MoP)
119	National Environmental Policy 2006	Ministry of Environment & Forest (MoEF)
120	National Disaster Management Guidelines Chemical Disasters (Industrial)	National Disaster Management Authority (NDMA)
121	National Disaster Management Guidelines Management of Floods	National Disaster Management Authority (NDMA)
122	National Disaster Management Hand Book for Training and Capacity Building of Civil Defence	National Disaster Management Authority (NDMA)

S. No.	Particulars	Sources
	and Sister Organisations, 2012	
123	National Manufacturing Policy, 2011	Department Of Industrial Policy & Promotion (DIPP)
124	National Mission on Sustainable Habitat	Ministry of Urban Development (MoUD)
125	National Municipal Accounting Training Manual	Ministry of Urban Development (MoUD)
126	National Policy On Disaster Management, 2009	Ministry of Home Affairs (MoHA)
127	National Policy on Urban Street Vendors, 2009	Ministry of Housing & Urban Poverty Alleviation (MoHUPA)
128	National PPP Policy 2011	http://www.pppinindia.com/
129	National Urban Housing and Habitat Policy, 2007	Ministry of Housing & Urban Poverty Alleviation (MoHUPA)
130	National Urban Sanitation Policy	Ministry of Urban Development (MoUD)
131	National Urban Transport Policy 2006	http://urbanindia.nic.in/
132	National Wildlife Action Plan (NWAP) 2002-2016	Forest Department, Andaman & Nicobar
133	News Article: DCB to Develop Weekly Market, Pune Cantonment Board Plans Building Complex on Space at Cantt Court, CDP Khadli Cantonment	Times of India
134	Norms & Standards for Capacity of Airport Terminals	Planning Commission
135	Norms and Standards - Hill areas	Town and Country Planning Organisation (TCPO), Government of Himachal Pradesh (http://himachal.nic.in/tcp/chap6.htm)
136	Notification for Integrated Township, 2007	Government of Rajasthan
137	Odisha Infrastructure Development Fund	Government of Odisha
138	Oil Mines Regulations, 1984	Directorate General of Mines Safety
139	Overseas Development Institute, UK	Wikipedia
140	Paper on Urbanisation by K. C. Sivaramakrishnan and B. N. Singh	http://planningcommission.nic.in/reports/sereport/ser/vision2025/urban.pdf
141	Participation Tools for Better Community Planning	Local Government Commission & The California Endowment (at: http://lgc.org/wordpress/docs/freepub/community_design/guides/Participation_Tools_for_Better_Community_Planning.pdf)
142	Participatory Urban Planning And Service Delivery To Urban Poor	Participatory Research in Asia (PRIA)
143	Peri-Urban Area	http://periurban14.org/
144	Petroleum and Natural Gas Regulatory Board (PNGRB) Notification	Petroleum and Natural Gas Regulatory Board (PNGRB)
145	Planning and Development, 2025: Professional and Academic Challenges	Town and Country Planning Organisation (TCPO)
146	Pooled Finance Development Scheme - Toolkit	Ministry of Urban Development (MoUD)
147	PPP Toolkit for Improving PPP Decision Making Process	Ministry of Finance (MoF)
148	Practitioner's Guide, 2006	Multifunctional Intensive Land Use (MILUnet)

S. No.	Particulars	Sources
149	Preparation of District Disaster Management Plan (DDMP)	National Disaster Management Authority (NDMA)
150	Preparation of State Disaster Management Plans	National Disaster Management Authority (NDMA)
151	Performa for Environmental Appraisal of Mining Projects, Ministry of Environment and Forest (MoEF)	Ministry of Environment and Forest (MoEF)
152	Press note on quarterly estimates of Gross Domestic Product for the third quarter (October-December) of 2013-14	Central Statistics Office (CSO)
153	Proposed Karkadooma Transit Oriented Development (TOD) Project	http://uttipec.nic.in/writereaddata/linkimages/6080492270.pdf
154	Public Private Partnership, 2004	International Monetary Fund (IMF)
155	Rajasthan Township Policy, 2010	Government of Rajasthan
156	Rajiv Awas Yojana (RAY), Guidelines for Preparation of Slum Free City Plan of Action	Ministry of Housing & Urban Poverty Alleviation (MoHUPA)
157	Rapid Training Programme, Jawaharlal Nehru National Urban Renewal Mission (JnNURM)	Ministry of Urban Development (MoUD)
158	RAY - Scheme Guidelines 2013-2022	Ministry of Housing & Urban Poverty Alleviation (MoHUPA)
159	Reading Material on Planning Techniques	JH Ansari and Shri Mahavir, Institute of Town Planners, India (ITPI), 2002
160	Recommendations of the Inter-Ministerial Committee for Accelerating Manufacturing in Micro, Small & Medium Enterprises Sector, 2013	Ministry of Micro, Small and Medium Enterprises (MoMSME)
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Appendix B. Basic Planning Definition

Table B.1: Chapterwise Basic Planning Definitions

Sr. No.	Particular	Definitions	Source
	Chapter 3: Plan Formulation		
1	Agriculture	Includes horticulture, farming, raising of crops, fruits, vegetables, flowers, grass, fodder, trees or any other kind of cultivation, dairy, animal husbandry, breeding and keeping of live-stock, including cattle, horses, donkeys, mules, pigs, fish, poultry and bees; and use of land which is ancillary to the farming of land or any other agriculture purposes, but shall not include the use of land attached to a building for the purposes of a garden to be used alongside such building.	Model Regional and Town Planning and Development Law
2	Amenities	Include roads and streets, open spaces, parks, recreational grounds, playgrounds, water and electric supply, street lighting, sewerage, drainage, public works and other utilities, services and conveniences.	Model Regional and Town Planning and Development Law
3	Development	The carrying out of building, engineering, mining or other operations in, on, over or under land or the making of any material change, in any building or land, or in the use of any building or land and includes sub-division of any land.	Model Regional and Town Planning and Development Law
4	Development Plan	A plan for the development or redevelopment or improvement of an area within the jurisdiction of a Planning Authority and includes a Regional Development Plan, a Metropolitan Development Plan, Area Development Plan, Town Development Plan, Zonal Development Plan, District Development Plan, or any other plan or scheme prepared under relevant Act by whatsoever name known.	Bihar Urban Planning and Development Act, 2012
5	Disposal	Discharge, deposition or dumping of any liquid or solid waste onto land or water so that it may enter the environment.	National Urban Sanitation Policy, City Sanitation Plan Manual
6	Domestic sewage	All forms of wastewater derived from residential properties, as well as black water and grey water from commercial and institutions buildings.	National Urban Sanitation Policy, City Sanitation Plan Manual
7	Floor Space Index	The quotient or the ratio of the Total Covered area of all floors to the total area of the plot, multiplied by 100.	Bihar Urban Planning and Development Act, 2012
8	Infrastructure	Any project, public amenity or public utility or service, which is required for smooth, productive and efficient functioning of the Planning Area such as trunk infrastructure, access from or to the nearest major road, bulk supply of drinking water (surface water and ground water with trunk line), power (electric substation and network), health, education facilities, transport (major roads such as national highways, state highways, major district roads, other district roads, , bridges, bypasses and underpasses), common effluent treatment plants (CETP), sewage treatment plant (STP), solid waste disposal system and receptacles, communication network, sectorial shopping markets, institutional buildings, malls and multiplexes, cinema halls, community halls, open air theatres, playgrounds, civic and cultural facilities, public parking areas etc.	Bihar Urban Planning and Development Act, 2012
9	Land Use	The major use for which a land is being used on any specified date.	Bihar Urban Planning and Development Act, 2012
10	Local Authority	A municipal corporation or committee or board or district board or other authority legally entitled to, or entrusted by the government with the control or management of a municipal or local fund or which is permitted by the government to exercise the powers of a	Model Regional and Town Planning and Development Law

Sr. No.	Particular	Definitions	Source
		local authority, and includes a town improvement trust; and a local authority is a "Local Authority Concerned" if any land within its local limits falls in the area of a plan prepared or to be prepared under relevant Act.	
11	Plan	The statement of proposals, policies and development briefs for securing, promoting and regulating development in a Planning Area, and includes a map or maps or sets of documents or all of them.	Bihar Urban Planning and Development Act, 2012
12	Planning Area	A territorial unit demarcated and declared by the Government for the purposes of planning under *relevant* Act and shall be known by such name as the Government may decide.	Bihar Urban Planning and Development Act, 2012
13	Public Place	Any place or building which is open to the use and enjoyment of the public whether it is actually used or enjoyed by the public or not and whether the entry is regulated by any charge or not.	Bihar Urban Planning and Development Act, 2012
14	Residence	Includes the use for human habitation of any land or building or part thereof, the use of gardens, grounds, garages, stables and out-houses, if any, appertaining to such land or building, and "Residential" shall be construed accordingly.	Model Regional and Town Planning and Development Law
15	Sanitation	Interventions (usually construction of facilities such as latrines) that improve the management of excreta and promote sanitary (healthy) conditions.	National Urban Sanitation Policy, City Sanitation Plan Manual
16	Scheme	A Development scheme and includes a plan or plans together with the descriptive matter, if any, relating to such a scheme.	Model Regional and Town Planning and Development Law
17	Septage	Mixture of wastewater and sludge removed from a septic tank during cleaning operations.	National Urban Sanitation Policy, City Sanitation Plan Manual
18	Septic tank	A form of on-plot sanitation for the anaerobic treatment of sewage/black water.	National Urban Sanitation Policy, City Sanitation Plan Manual
19	Sewage	A mixture of wastewater from all urban activates from residential, commercial properties. It may also contain a component of industrial wastewater.	National Urban Sanitation Policy, City Sanitation Plan Manual
20	Sewerage	A network of interconnected sewers in an area, district or town.	National Urban Sanitation Policy, City Sanitation Plan Manual
21	Utility	Services such as roads including approach roads, bridges, bypasses and underpasses, street lights, water supply system, sewerage system, storm water drainage system, electrical network, communication network, sewage treatment plants, percolation wells, solid waste disposal system, collection, treatment, discharge and disposal of industrial, institutional and township waste, gas pipeline, common effluent treatment plants (CETP), spaces for informal services, and any other as may be delineated by the Government.	Bihar Urban Planning and Development Act, 2012
22	Wastewater	Liquid waste from households or commercial or industrial operations, along with any surface water/storm water.	National Urban Sanitation Policy, City Sanitation Plan Manual
23	Wastewater treatment	A combination of physical, chemical and biological processes to remove suspended solids, dissolved pollutants, and pathogens and render the water harmless to the environment.	National Urban Sanitation Policy, City Sanitation Plan Manual

Sr. No.	Particular	Definitions	Source
	Chapter 4: Resource Mobilisation		
1	Accommodation Reservation	Allows the land owners to develop the sited reserved for an amenity in the development plan using full permissible FSI/FAR on the plot subject to agreeing to entrust and handover the built-up area of such amenity to the local authority free of all encumbrances and accept the full FAR/FSI as compensation in lieu therefore.	UDPFI Guidelines
2	Accrual Concept	Occurrence of claims and obligations in respect of incomes or expenditures, assets or liabilities based on happening of any event, passage of time, rendering of services, fulfilment (partially or fully) of contracts, diminution in values, etc., are recorded even though actual receipts or payments of money may not have taken place.	Administrative Staff College of India, (Regional Capacity Building Hub)
3	Bilateral Organizations	Government agencies or non-profit organizations based in a single country while the agencies provide aid in other countries.	--
4	Bio-medical waste	any waste generated during diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto or in the production or testing of biologicals.	Municipal Bill
5	Budget grant	The total sum entered on the expenditure side of a budget estimate under a major head and adopted by the Municipality, and includes any sum by which such budget grant is increased or reduced by transfer from or to other heads in accordance with the provisions of this Act and the rules and the regulations made thereunder.	Municipal Bill
6	Building	a structure constructed for whatever purpose and of whatever materials, and includes the foundation, plinth, walls, floors, roofs, chimneys, fixed platforms, verandas, balconies, cornices or projections or part of a building or anything affixed thereto or any wall (other than a boundary wall of less than three metres in height) enclosing, or intended to enclose, any land, sign or outdoor display-structure but does not include a tent, shamiana or tarpaulin shelter.	Municipal Bill
7	Citizen's charter	The document declaring the functioning, obligations, duties and commitments of a public authority for providing goods and services effectively and efficiently with acceptable level of standards, time limits and designation of public servants for delivery and grievance redress.	Citizen's Bill
8	Dwelling House	A masonry building constructed, used, or adapted to be used, wholly or principally for human habitation.	Municipal Bill
9	e-Government	Use Information Communication Technology to organize and manage the government administrative processes, specifically the interactive procedures between government and public.	e-Government: Singapore Study
10	FDI	Investment by non-resident entity/ person resident outside India in the capital of an India economy.	FDI Circular
11	Grants-in-aid	Grants-in-aid are payments, transfers or devolution of funds, in cash or in kind, in the nature of donations or contributions by one government (grantor) to another government, body, institution or individual (grantee).	Indian Government Accounting Standard (IGAS), 2007
12	Industrial township	Such urban area or part thereof as the Governor may, having regard to the size of the area and the municipal services being	Municipal Bill

Sr. No.	Particular	Definitions	Source
		provided or proposed to be provided by an industrial establishment in that area and such other factors as he may deem fit, by notification, specify to be an industrial township.	
13	Land	"Land" includes benefits to arise out of land, and things attached to the earth or permanently fastened to anything attached to the earth.	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
14	Land Acquisition	The acquisition of land for some public purpose by a government agency from individual landowners as, authorised by the law, after paying a government-fixed compensation to cover losses incurred by landowners from surrendering their land to the concerned government agency.	Wikipedia
15	Local Bodies	*Panchayati Raj* Institutions and Urban Local Bodies under the provisions of Article 243 and Article 12 of the Constitution.	Indian Government Accounting Standard (IGAS), 2007
16	Multilateral organisations	International organisations whose membership is made up of member governments, who collectively govern the organisation and are its primary source of funds and spend it on projects in various countries.	--
17	Service	All goods and services, including functions, obligations, responsibility or duty, to be provided or rendered by a public authority.	Citizen's Bill
18	Transferable Development Right (TDR)	A process of making available certain amount of additional built up area in lieu of the area relinquished or surrendered by the owner of the land whose land or a part thereof, is required for public purposes such as construction and widening of roads, development of parks, playgrounds, green area civic amenities, recreational uses, urban infrastructure, implementation of development control and Zoning Regulations and conservation of heritage sites or such other purposes as Government may notify so that he can use the extra built up area either himself or transfer it to another person for a consideration.	Bihar Urban Planning and Development Act, 2012
	Chapter 7: Sustainability Guidelines		
1	Accessibility	The ability to reach desired goods, services and activities.	Ministry of Urban Development, 2008
2	Buffer Zone	Buffer zones are areas created to enhance the protection of a conservation area, often peripheral to it, inside or outside. Within Buffer zones, certain legal and/or customary restrictions are placed upon resource use and/or is managed to reduce the negative impacts of restrictions on the neighbouring communities	http://www.biodiversitya-z.org/areas/10 / A-Z of Areas of Biodiversity Importance
3	Climate Change	A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer.	Global Warming Policy Foundation , IPCC
4	Coastal Area/ Zone	The coast is a unique environment where land, sea and atmosphere interact and interplay continuously influencing a strip of spatial zone defined as coastal area/ zone. Coastal area/zones are the areas having the influence of both marine and terrestrial processes.	Coastal Zones of India, ISRO, 2012

Sr. No.	Particular	Definitions	Source
5	Deforestation	The direct human-induced conversion of forested land to non-forested land.	http://www.cbd.int/doc/publications/cbd-ts-43-en.pdf UNFCCC – Marrakech Accords
6	Disaster	A catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made cause, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or destruction of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.	The Disaster Management Act, Ministry of Law and Justice, 2005
7	Disaster Management	A continuous and integrated process of planning, organising, coordination and implementing measures which are necessary or expedient for- ▪ prevention of damage or threat of any disaster; ▪ mitigation or reduction of risk of any disaster or its severity or consequences; ▪ capacity-building; ▪ preparedness to deal with any disaster; ▪ prompt response to any threatening disaster situation or disaster; ▪ assessing the severity or magnitude of effects of any disaster; ▪ evacuation, rescue and relief; ▪ rehabilitation and reconstruction	The Disaster Management Act, Ministry of Law and Justice, 2005
8	Ecological Sanitation	A form of dry sanitation that involves separation of faeces and urine in order to facilitate recycling of nutrients in local agricultural systems.	Manual City Sanitation Plan Preparation (CSP), National Urban Sanitation Policy
9	Mitigation	"Mitigation" means measures aimed at reducing the risk, impact or effects of a disaster or threatening disaster situation	The Disaster Management Act, Ministry of Law and Justice, 2005
10	Eco-Sensitive Zones	The extent of eco-sensitive zones as following: ▪ Many of the existing protected areas have already undergone tremendous development in close vicinity to their boundaries. Some of the protected areas actually lying in the urban setup (Eg. Guindy National Park, Tamil Naidu, Sanjay Gandhi National Park, Maharashtra, etc.). Therefore, defining the extent of the eco-sensitive zones around protected areas will have to be kept flexible and protected area specific. The width of the eco-sensitive zone and type of regulations will differ from protected area to protected area. However, as a general principle the width of the eco-sensitive zone could go up-to 10 Kms around a protected area as provided in the Wildlife Conservation Strategy-2002. ▪ In case where sensitive corridors, connectivity and ecologically important patches, crucial for landscape linkages, are even beyond 10 Kms width, these should be included in the eco-sensitive zone. ▪ Further, even in context of a particular protected area, the distribution of an area of eco-sensitive zone and the extant of regulation may not be uniform all around and it could be of variable width and extent.	Guidelines for declaration of Eco-Sensitive Zones Around National Parks and Wild Life Sanctuaries, MoEF, 2011

Sr. No.	Particular	Definitions	Source
11	Environmentally sensitive zone/ area	Environmental sensitive zones may be defined as areas with identified environmental resource with 'incomparable values' which require special attention for their conservation. All Earthquake/landslide prone, cliffs and environmentally hazardous area, areas adjacent to fault lines, areas with slope higher than 45 degree (NBC, 2005), flood plain, wetlands and areas adjacent to major drainage lines for general guidance, other areas identified by State Disaster Management Authority to be included in the environmentally sensitive areas.	National Environmental Policy, 2006 ; NBC, 2005, and Aizwal Master Plan
12	Preparedness	"Preparedness" means the state of readiness to deal with a threatening disaster situation or disaster and the effects thereof	The Disaster Management Act, Ministry of Law and Justice, 2005
13	Sustainable Development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.	Brundtland Commission, 1987
	Chapter 8: Simplified Planning Techniques		
1	GIS (Geographical Information System)	A system which provides computerized mechanisms for integrating various geo information data sets and analysing them in order to generate information relevant to planning needs in a context.	Indian Space Research Organisation
2	Mapping	Representation of earth's pattern as a whole or part of it on a plane surface with conventional signs, drawn to a scale and projection so that each and every point on it corresponds to the actual terrestrial position.	UDPFI Guidelines
3	Primary Data	Data collected for the first time and is always given in the form of raw material and original in character.	--
4	Remote Sensing	Science of acquiring information about the Earth's surface without actually being in contact with it.	National Remote Sensing Centre
5	Secondary Data	Second hand data initially collected by some other investigator for other purpose but used by an investigator for his/her own purpose later.	--
	Chapter 9: Infrastructure		
1	Adult Education Centre	A premise having the facility of formal education and training to adults with flexible timings.	Master Plan for Delhi, 2021
2	Anganwari	Anganwari as space provision at residential housing/ neighbourhood level is a centre to provide service for children of 0-6yrs age, pregnant women, feeding mothers, etc. under the Integrated Child Development Scheme (ICDS).	Master Plan for Delhi, 2021
3	Artificial Recharge	Artificial recharge to ground water is a process by which the ground water reservoir is augmented at rate exceeding that under natural conditions of replenishment.	Rain water Harvesting Techniques, Ministry Of Water Resources Central Ground Water Board, 2003
4	Banquet hall	A premise to hold small public gatherings, community functions, marriages etc.	Master Plan for Delhi: 2021
5	Burial ground	A premise with facilities for burying of dead bodies.	Master Plan for Delhi: 2021
6	Bus Terminal	A premise used by public transport agency to park the buses for short duration to serve the population. It may include the related	Study on Zoning

Sr. No.	Particular	Definitions	Source
		facilities for passengers.	Regulation, TCPO, 2004
7	Central/State Government Office	A premise used for the offices of Central/State Government.	Study on Zoning Regulation, TCPO, 2004
8	Civil defence and home guards etc.	A premise having facilities for offices and other functions of civil organization for internal defence.	Master Plan for Delhi: 2021
9	Continuous Water Supply/ 24-7 Water Supply	24-7 supply is achieved when water is delivered continuously to every customer of the service 24 hours a day, every day of the year, through a transmission and distribution system that is continuously full and under positive pressure throughout all of its pipelines and networks.	Guidance Notes for Continuous Water System, MoUD, 2009
10	Convenience Shopping centre	A group of shops in residential area serving a population of about 5000 persons and if required for 2,000 persons in hill residential areas	Master Plan for Delhi: 2021 & Study on Zoning Regulation, TCPO, 2004
11	Crèche and Day care Centre	A premise having nursing facilities for young children during day time. The center may be managed by an individual or an institution on commercial or non-commercial basis.	Study on Zoning Regulation, TCPO, 2004
12	Cremation ground	A premise with facilities of performing last rites of dead bodies by burning.	Master Plan for Delhi: 2021
13	Crematorium	A premise with facilities for last rites of the deceased.	Master Plan for Delhi: 2021
14	Decentralised Wastewater Management	The collection, treatment, and disposal/reuse of wastewater from individual homes, clusters of homes, isolated communities, industries, or institutional facilities, as well as from portions of existing communities at or near the point of waste generation	Guidelines For Decentralized Wastewater Management, MoUD, 2012
15	Dharamshala and its equivalent	A premise providing temporary accommodation for short duration on no profit basis.	Master Plan for Delhi: 2021
16	Dhallao and Dustbin	A premise used for collection of garbage for its onward transportation	Study on Zoning Regulation, TCPO, 2004
17	District Centre	A group of shops in residential area serving a population of about 500000 persons.	Master Plan for Delhi: 2021
18	District Meter Area	The term district metering is used to describe the method whereby flow meters are installed on all major supply lines and strategic points within the distribution system.	O & M Manual, Kolkata Metropolitan Water & Sanitation Authority
19	Disaster management centre	A premise having facility of disaster emergency, backup, hospital facility, training centre for disaster preparedness, wireless communication etc.	Master Plan for Delhi: 2021
20	Dispensary	A premise having facilities for medical advice and provision of medicine, managed by public or charitable institutions.	Master Plan for Delhi: 2021
21	Dispensary for pet animal and birds	Premises having facilities for medical advice and provision of medicines to pet animals and birds, managed by public/ private or charitable institutions.	Master Plan for Delhi: 2021
22	District police office and battalion	A premise having facilities for the offices and paramilitary forces.	Master Plan for Delhi: 2021

Sr. No.	Particular	Definitions	Source
23	Electric Sub-Station	A premise having electrical installation and transformer for distribution of power.	Study on Zoning Regulation, TCPO, 2004
24	Effluent	The wastewater that flows out of a treatment system (in this case septic tank) or supernatant liquid discharged from the septic tank.	Advisory Note: Septage Management In Urban India, MoUD, 2013
25	Exhibition-cum Fair Ground	A premise having facilities for the exhibition and display and other cultural activities for a group of participants.	Master Plan for Delhi: 2021
26	Farm house	A dwelling house on a farm.	Master Plan for Delhi: 2021
27	Fire post	Premises with lesser degree of facilities for firefighting. The post may be attached to specific premises with fire prone activities.	Master Plan for Delhi: 2021
28	Fire station	A premise having facility for firefighting for a catchment area assigned to it. It may include residence of essential staff.	Master Plan for Delhi: 2021
29	Fire training institute	A premise having facilities of training for emergency times in case of fire, building collapse etc.	Master Plan for Delhi: 2021
30	Gas Godown	A premise having the facility of wholesale storage of LPG, godown, etc.	Master Plan for Delhi: 2021
31	*GauShala*/ Dairy farm	A premise with facilities for rearing and processing of dairy products. It may have temporary structure for sheds of animals and birds.	Study on Zoning Regulation, TCPO, 2004
32	General and head post office with administrative office	A premise with facility for postal and telecommunication to and from a number of post offices attached to it.	Master Plan for Delhi: 2021
33	Government Land	Land owned by the Central/State/Local Govt.	Study on Zoning Regulation, TCPO, 2004
34	Hospital	A premise providing medical facilities of general or specialised nature for treatment of indoor and outdoor patients. It may be managed by public, private or charitable institution.	Master Plan for Delhi: 2021
35	Hotel	A premise used for lodging of 15 persons or more.	Master Plan for Delhi: 2021
36	Informal Unit	Retail/service unit, stationary or mobile, work place without roof including small Khokhas on roadside	Study on Zoning Regulation, TCPO, 2004
37	International convention centre	A premise having all facilities for international /national conferences, meetings, symposium etc.	Master Plan for Delhi: 2021
38	Jail	A premise with facilities for detention, confinement and reform of criminals under the law.	Master Plan for Delhi: 2021
39	Library/ reading room	A premise having a large collection of books for reading and reference for general public or specific class.	Study on Zoning Regulation, TCPO, 2004
40	Local shopping centre	A group of shops in residential area serving population of 15,000 persons.	Master Plan for Delhi: 2021

Sr. No.	Particular	Definitions	Source
41	LPG godown including booking office	A premise for the booking, storing and supply of LPG to local population.	Master Plan for Delhi: 2021
42	Multipurpose community hall, barat ghar	A premise having an enclosed space for various social and cultural activities.	Master Plan for Delhi: 2021
43	Municipal Solid Waste	According to MSW Rules 2000, MSW includes commercial and residential wastes generated in municipal or notified areas in either solid or semi-solid form excluding industrial hazardous wastes but including treated bio-medical wastes.	Toolkit for Solid Waste Management, Ministry of Urban Development, 2012
44	Night Shelter	A premise having the facility for providing the night accommodation to individuals without any charges. It may be run by local government or voluntary agencies.	Master Plan for Delhi: 2021
45	Nursing Home/ Maternity home/ Polyclinic	A premise having medical facilities for indoor and outdoor patients having upto 50 beds. It may be managed by a doctor or a group of doctors. In case of polyclinic, it shall be managed by a group of doctors.	Master Plan for Delhi: 2021
46	Old Age Home/ Care Centre for Physically/ Mentally Challenged	A premise having the facility of caring and training boarding and lodging of the elderly/ physically/ mentally challenged.	Master Plan for Delhi: 2021
47	Observatory & Weather Office	A premise with facilities for research and development of data relating to weather and forecasting thereof.	Master Plan for Delhi: 2021
48	Orphanage	A premise having the facility of boarding of children who are bereaved of parents. It may or may not have educational facilities.	Master Plan for Delhi: 2021
49	Park	A premise used for recreational/leisure activities. It may have on it related landscaping, parking facilities, public toilet, fencing etc. It will include lawns, open spaces, green etc.	Study on Zoning Regulation, TCPO, 2004
50	Play Ground	A premise used for outdoor games. It may have on it landscaping, parking facilities, public toilet, etc	Study on Zoning Regulation, TCPO, 2004
51	Police firing range	A premise having facilities for firing practice of the paramilitary forces.	Master Plan for Delhi: 2021
52	Police Line	An area having facilities for work and residential accommodation of paramilitary forces.	Master Plan for Delhi: 2021
53	Police post	A premise having facility for a local police post of a temporary nature or on smaller scale as compared to a police station.	Master Plan for Delhi: 2021
54	Police station	A premise having facilities for offices of local police post.	Master Plan for Delhi: 2021
55	Police training institute/ college	A premise having facilities for training of paramilitary forces.	Master Plan for Delhi: 2021
56	Primary health centre/family welfare	A premise having facilities for treating indoor and outdoor patients having upto 10-15 beds. It may be managed by a public or charitable institution on non-commercial basis. It includes family welfare centre and maternity home.	Master Plan for Delhi: 2021

Sr. No.	Particular	Definitions	Source
	centre/ Diagnostic Centre		
57	Primary School	A premise having educational and playing facilities for students upto V standard.	Study on Zoning Regulation, TCPO, 2004
58	Radio and TV Station	A premise with facilities for recording, broadcasting and transmission of news and other programmes through the respective medium. It may include some hostel accommodation for guest artists, transmission facilities like towers, etc.	Study on Zoning Regulation, TCPO, 2004
59	Rain Water Harvesting	Rain water harvesting is the technique of collection and storage of rain water at surface or in sub-surface aquifers, before it is lost as surface run-off.	Rain water Harvesting Techniques, Ministry Of Water Resources Central Ground Water Board, 2003
60	Recreational Club	A premise having the facility for recreation with indoor sports, swimming pool, outdoor sports, socializing and gathering space for small functions with restaurant.	Master Plan for Delhi: 2021
61	Regional MSW Facility/Management	A 'Regional MSW Facility' means a waste management facility or system of any kind (whether in relation to collection, transportation, treatment or disposal of MSW or a combination of any or all of them), which collects, manages or receives or disposes (as the case may be) MSW from more than one Authority.	Municipal Solid Waste Management on a Regional Basis, Ministry of Urban Development
62	Retail Shop	A premise for sale of commodities directly to consumer with necessary storage	Study on Zoning Regulation, TCPO, 2004
63	Research and Development Center	A premise providing facilities for research and development in any specific field.	Study on Zoning Regulation, TCPO, 2004
64	Restaurant	A premise used for serving food items on commercial basis including cooking facilities. It may have covered or open space or both for sitting arrangement.	Master Plan for Delhi: 2021
65	Street	Any means of access, namely, highway, street lane, pathway, alley, stairway, passageway, carriageway, footway, square, place or bridge, whether a thoroughfare or not, over which the public have a right of passage or access or have passed and had access uninterruptedly for a specified period, whether existing or proposed in any scheme, and includes all bunds, channels, ditches, storm-water drains, culverts, sidewalks, traffic islands, roadside trees and hedges, retaining walls, fences, barriers and railings within the street lines.	National Building Code: 2005
66	Secondary School	A premise having educational and playing facilities for students from VI to X standard.	Study on Zoning Regulation, TCPO, 2004
67	Senior Secondary School	A premise having educational and playing facilities for students from X to XII standard.	Study on Zoning Regulation, TCPO, 2004
68	Septage	The settled solid matter in semi-solid condition usually a mixture of solids and water settled at the bottom of septic tank. It has an offensive odour, appearance and is high in organics and pathogenic microorganisms.	Advisory Note: Septage Management In Urban India, MoUD, 2013
69	Septic tank	An underground tank that treats wastewater by a combination of	Advisory Note:

Sr. No.	Particular	Definitions	Source
		solids settling and anaerobic digestion.	Septage Management In Urban India, MoUD, 2013
70	Sludge	The settled solid matter in semi-solid condition – it is usually a mixture of solids and water deposited on the bottom of septic tanks, ponds, etc.	Advisory Note: Septage Management In Urban India, MoUD, 2013
71	Technical Training Centre/ Institute, Nursing and Paramedic Institute	A premise with facilities for training in discipline of technical nature. It includes technical school and industrial training institute.	Master Plan for Delhi: 2021
72	Traffic and police control room	A premise of temporary structures having facilities for managing of traffic and law & order related issues.	Master Plan for Delhi: 2021
73	Transit Oriented Development	"Transit Oriented Development is essentially any development, macro or micro that is focused around a transit node, and facilitates complete ease of access to the transit facility, thereby inducing people to prefer to walk and use public transportation over personal modes of transport.	UTTIPEC, Delhi Development Authority, 2012
74	Unaccounted-for Water / Non-Revenue Water	Unaccounted-for Water (UFW) is the difference between the quantity of water supplied to a city's network and the metered quantity of water used by the customers.	Manual on Water Supply and Treatment, CPHEEO, 1999
75	University Campus	A premise having an educational institution designed for instruction, examination, or both, of students in many branches of advanced learning, conferring degrees in various faculties, and often embodying colleges and similar institutions.	Master Plan for Delhi: 2021
76	Veterinary hospital for pet animal and birds	A premise having medical facilities for indoor and outdoor treatment of pet animal and birds. It may be managed by a public or charitable institution or on community basis.	Master Plan for Delhi: 2021
77	Veterinary Institute	A premise having educational and playing facilities for students of undergraduate and post graduate in veterinary courses along with research facilities under a university.	Master Plan for Delhi: 2021
78	Weekly market	An area used once in a week by a group of informal shop establishments in the form of a market. These markets shift from one area to another on different days of the week.	Master Plan for Delhi: 2021
79	Wholesale Trade	A premise from where goods and commodities are sold and delivered to retailers. The premise includes storage, godown and loading & unloading facilities.	Study on Zoning Regulation, TCPO, 2004
	Chapter 10: Simplified Development Promotion Regulations		
1	Clinic	A premise with facilities for treatment of outdoor patients by a doctor.	Master Plan for Delhi : 2021
2	Floor Area Ratio (FAR)	The quotient obtained by dividing the total covered area (plinth area) on all floors by the area of the plot, FAR = Total covered area of the floors/Plot area	National Building Code: 2005
3	Group	Housing for more than one dwelling unit, where land is owned	National Building Code:

Sr. No.	Particular	Definitions	Source
	Housing	jointly (as in the case of cooperative societies or the public agencies, such as local authorities or housing boards, etc) and the construction is undertaken by one agency.	2006
4	Habitable Room	A room occupied or designed for occupancy by one or more persons for study, living, sleeping, eating, and kitchen, if it is used as a living room, but not including bathrooms, water-closet compartments, laundries, serving and store pantries, corridors, cellars, attics, and spaces that are not used frequently or during extended periods.	National Building Code: 2007
5	Open Spaces	An area, forming an integral part of the plot, left open to the sky.	National Building Code: 2008
6	Parking Space	An area enclosed or unenclosed, covered or open, sufficient in size to park vehicles, together with a drive-way connecting the parking space with a street or alley and permitting ingress and egress of the vehicles.	National Building Code: 2009
7	Post office	A premise with facility for postal communication for public use	Master Plan for Delhi : 2021 & Study on Zoning Regulation, TCPO, 2004
8	Poultry farm	A premise with facility for rearing and processing of poultry products. It may have temporary structures for sheds of birds.	Master Plan for Delhi : 2021
9	Residential Flat	Residential accommodation for one family/ household as part of group housing.	Master Plan for Delhi : 2021
10	Residential plot- Housing	A premise for one or more than one dwelling unit and may have on it one main building block and one accessory block for garages and service personnel.	Master Plan for Delhi : 2021
11	Service Apartment	A premise fully furnished, serviced and self-contained with meal preparation used for short-term corporate and accommodation	Master Plan for Delhi : 2021
12	Mumty	A structure with a roof over a staircase and its landing built to enclose only the stairs for the purpose of providing protection from weather and not used for human habitation	National Building Code: 2005
13	Tower like structures	Structures shall be deemed to be tower like structures when the height of the tower like portion is at least twice the height of the broader base at ground level.	National Building Code: 2005

Source: As given

Appendix C. PPP Models in existing scenario

C.1 Introduction

Public Private Partnership (PPP) is infusion of private capital and management in provision of services that have traditionally been provided by the government. Adequate risk transfer from the government to the private sector is a key feature of PPPs along with the delivery of high-quality and cost-effective services to consumers and the government[1].

C.2 Existing scenario

Reforms of 1990 brought/started economic liberalisation in India. The role of government underwent transformation from provider to facilitator as a result. Initially it was in the form of privatisation but after following international experiences PPP was introduced in India. The tendency of the private sector to undervalue social infrastructure, and the large sunk costs associated with providing much economic infrastructure, has been obstacle to privatization. Thus PPPs began to emerge significantly as a means of obtaining private sector capital and management expertise for infrastructure investment (both to carry on where privatization had left off and as an alternative where there had been obstacles to privatization).

It has emerged as one of the leading PPP markets in the world, due to several policy and institutional initiatives taken by the central as well as many state governments. Over the years an elaborate eco-system for PPPs has developed, including institutions, developers, financiers, equity providers, policies and procedures[2].

The growing role of PPP in India has led for the requirement of national policy. As a result Government of India in 2011 published a draft National PPP Policy which is under public consultation currently.

C.3 Public Private Partnership: Alternate Definitions

- **Government of India:**

'PPP means an arrangement between a government or statutory entity orgovernment owned entity on one side and a private sector entity on the other,for the provision of public assets and/ or related services for public benefit,through investments being made by and/or management undertaken by theprivate sector entity for a specified time period, where there is a substantialrisk sharing with the private sector and the private sector receivesperformance linked payments that conform (or are benchmarked) to specified,pre-determined and measurable performance standards.'

- **The International Monetary Fund (IMF):**

'Public-private partnerships (PPPs) refer to arrangements where the private sector supplies infrastructure assets and services that traditionally have been provided by the government.' (IMF 2004,)

[1]Sources: Public Private Partnership, IMF, 2004

[2]Source: National PPP Policy 2011 - Draft for Consultation

- **The World Bank:**

'PPP programs are projects that are for services traditionally provided by the public sector, combine investment and service provision, see significant risks being borne by the private sector, and also see a major role for the public sector in either purchasing services or bearing substantial risks under the project.' (World Bank 2006)

- **The Asian Development Bank (ADB):**

'PPPs broadly refer to long-term, contractual partnerships between the public and private sector agencies, specifically targeted towards financing, designing, implementing, and operating infrastructure facilities and services that were traditionally provided by the public sector (ADB 2006)

- **The European Union:**

'A PPP is the transfer to the private sector of investment projects that traditionally have been executed or financed by the public sector' (European Commission 2003).

C.4 Public Private Partnership (PPP) in India

PPP in India has evolved in the past decade and several projects of PPP have been completed in infrastructure sector apart from residential/commercial development and these can be considered for understanding the critical aspects of such project implementation in future.

Some of the case studies are as follow:

1. Alandur Underground Sewerage Project
2. Timarpur Okhla Integrated Municipal Solid Waste Management Project
3. Hyderabad Metro
4. Vadodara Halol Toll Road

These projects were considered owing to the key learning and observations derived from them, some to be emulated and others to be mitigated. Each of the case studies belongs to different sectors.

Alandur Underground Sewerage Project:

The Alandur Sewerage Project (ASP) was initiated in the year 1996. The ASP was the first project in the municipal water sector to be taken through the Public PrivatePartnership route in India.The proposed sewerage system was to be designed for the estimated population of about 300,000in 2027 and was planned to be completed within a five-year period from its inception date.

AlandurMunicipality (AM), located adjacent to Chennai, forms a part of the Chennai Metropolitan Area. With a population of around 165,000 (Census of India, 2011), the municipality is a residential suburb of Chennai with predominantly residential and commercial activities. Approximately one-fourth of its populationlives in slums. Prior to 1996, the town did not have an underground sewerage system and all

sewage was managedwith individual septic tanks.In 1996, AM announced an ambitious plan to construct an underground sewerage system and wastewater treatment facility with the participation of the private sector, contribution from the public,and payment to be provided by the city.

The AlandurMunicipality worked in partnership with theTamil Nadu Urban Infrastructure Financial Services Limited (TNUIFSL), the state asset managementcompany and with USAID's Financial Institution Reform and Expansion (FIRE) Project.

The construction of the underground sewerage system in Alandur town was done on a BOQ (Bill ofQuantities) basis, and the sewerage treatment plant (STP) on a BOT (Build, Operate and Transfer)basis. Besides the construction responsibility, the contractor was also required to undertake theoperation and maintenance of the sewerage system for a period of five years from the date ofcompletion of the construction, on a fixed fee basis. The collection of tariff and provision of newconnections during the O&M phase was to be undertaken by the municipality directly. Key features of the project are given below:

Table C.1: Alandur Sewerage Project Details

Alandur Underground Sewerage Project	
PPP Project Structure & Concession Period	O&M Contract (5 Years) BOT Annuity (14 Years)
State and year PPP contract signed	Tamil Nadu 2005
Project Cost	INR 41.28 Crore
Salient Features	• The construction of the underground sewerage system in Alandur town, involving the laying of pipes, construction of pumping station, etc., was done on a BOQ (Bill of Quantities) basis, and the Sewerage Treatment Plant (STP) on a BOT (Build, Operate and Transfer) basis. • Besides the construction responsibility, the contractor was also required to undertake the operation and maintenance of the sewerage system for a period of five years from the date of completion of the construction, on a fixed fee basis. • The collection of tariff and provision of new connections during the O&M phase was to be undertaken by the municipality directly
Key Learning	• Beneficiary participatory approach • Stakeholder involvement and interdepartmental coordination • Political will and strong decision making, especially at the grass-root level • Acceptance of fiscal discipline • Implementing an effective fee system • Assurances on payment to the Private Sector Participant • Access to finance for the municipality • Technical and financial assistance from other institutions • Transparency in bidding and contracting procedures

Source: Public Private Partnership Projects in India, Compendium of Case Studies, Department of Economic Affairs, Ministry of Finance, Government of India

Public Private Partnership Projects in India, Compendium of Case Studies, Department of Economic Affairs, Ministry of Finance, Government of India

Timarpur Okhla Integrated Municipal Solid Waste Management Project

Delhi generates 7,000 metric tonnes (MT) of Municipal Solid Waste (MSW) daily, which is expectedto increase to 18,000 MT by 2021. The present landfill sites that are being utilized for disposingthe garbage are approaching their full capacity. Municipal Corporation of Delhi (MCD) has thus embarked on a project to reduce the amountof MSW being disposed in the landfill sites and utilizing the waste for productive purposes such asgeneration of power from waste. MCD has identified two locations, namely Timarpur and Okhla,for implementing this project. The project has been undertaken on Built, Own, Operate and Transfer (BOOT) basis.

The project is registered with the United Nations Framework Convention on Climate Change(UNFCCC) for the Clean Development Mechanism (CDM) to earn 2.6 million Certified EmissionReductions (CERs) over a ten-year period.

Table C.2: Timarpur-Okhla Integrated MSWM Project details

Timarpur Okhla Integrated Municipal Solid Waste Management Project	
PPP Project Structure & Concession Period	BOOT (25 Years)
State and year PPP contract signed	Delhi 2008
Project Cost	INR 200 Crore
Salient Features	• Infrastructure included plants for converting MSW to Refuse Derived Fuel (RDF), capable of processing 1300 TPD at Okhla and 650 TPD at Timarpur, a bio-methanation plant capable of handling of 100 TPD of green waste at Okhla, a water recovery plant capable of handling up to 6 MLD of treated sewage at the Okhla site for recycling into process water and cooling water and a Power plant with a generation capacity of 16 MW at Okhla • The salient features included - Solid and liquid waste can be treated in the same complex. The treatment process is well integrated in terms of inputs and output. The complex generates compost and methane from the Bio-methanation process, fuel from the RDF plant and power from the RDF fluff and methane.
Key Learning	• Project Preparedness • Government Support • Innovative Use of Technology • Consumer Education

Source: Public Private Partnership Projects in India, Compendium of Case Studies, Department of Economic Affairs, Ministry of Finance, Government of India

Hyderabad Metro

Hyderabad is a growing city that covers 625 square kilometres of municipal corporation areaand 6,852 square kilometres of metropolitan area. The burgeoning population has put Hyderabad's transportation system under immense pressure. To address this need, the Government of Andhra Pradesh (GoAP) has

planned a MassRapid Transit system (MRTS) covering three high traffic density corridors of Hyderabad. Theproject is planned to be developed on a PPP basis through the Build Operate Transfer (BOT)mode.

Hyderabad Metro Rail Ltd, a fully owned Public Sector Undertaking of GoAP is currentlyimplementing the Hyderabad Metro Rail Project. The project is to be developed under a concessionagreement on BOT basis. Underthe concession agreement, the operator has to design, finance, construct, operate, and maintain the3 corridors and transfer the assets at the end of the concession period.

Table C.3: Hyderabad Metro Details

Hyderabad Metro Project	
PPP Project Structure & Concession Period	BOT (35 Years)
State and year PPP contract signed	Andhra Pradesh 2008
Project Cost	INR 200 Crore
Salient Features	• Under the concession agreement, the operator has to design, finance, construct, operate, and maintain the 3 corridors and transfer the assets at the end of the concession period. • In addition, the operator would also have access to the commercial development of land available at the depots (212 acres) and 10% of the carpet area of the station sites identified in the concession agreement. This aggregates to a cumulative maximum of 12.5 million square feet in the case of depots and a cumulative maximum of 6 million square feet in the case of stations. • The SPV would also be allowed to undertake real estate development over the parking and circulation areas at stations.
Key Learning	• Real Estate Development along with metro project • Transfer of Traffic Risk • Creation of Right of Way • Issues of Promoter Backing

Source: Public Private Partnership Projects in India, Compendium of Case Studies, Department of Economic Affairs, Ministry of Finance, Government of India

Vadodara Halol Toll Road

VHTR was an initiative commissioned as a part of the Vision 2010 – an infrastructure masterplan developed by the Government of Gujarat (GoG). Theproject involved widening and strengthening of 32 kilometres (km) of the existing two-lane StateHighway (SH 87) connecting Vadodara to the industrial town of Halol into a four-lane tolledexpressway.

The Vadodara Halol Toll Road (VHTR) was one of the first State Highway widening projectsdeveloped on a Public Private Partnership basis in India and it has subsequently paved the way fora large number of projects to be undertaken on a similar format in Gujarat and the rest of India.

The VHTR project is developed under the Built, Own, Operate and Transfer (BOOT) basis.

Table C.4: Vadodara Halol Toll Road Details

Vadodara Halol Toll Road Project	
PPP Project Structure & Concession Period	BOOT (30 Years)
State and year PPP contract signed	Gujarat 1998
Project Cost	INR 161 Crore
Salient Features	• Under the concession agreement, construction aspects included design and completion of the road, including the pavement, cross drainage system, bridges, toll facilities, medians, separators, road furniture, and horticultural aspects. • The O&M aspects included the toll collection, operating the toll plaza, traffic regulation and maintenance of the facility. It also includes special maintenance activities such as eliminating potholes in the pavements, replacing drainage structures, road markings and signage, cleaning lanes, shoulders, right-of-way strips, structures, maintaining operational installations and drainage facilities.
Key Learning	• The criticality of pre development market assessment • Competitive bidding can ensure a better deal • Need to create a balanced risk return profile • Conflicts of Interest should be identified early and avoided • Innovative Financing Mechanisms • Environmentally and socially responsive development framework

Source: Public Private Partnership Projects in India, Compendium of Case Studies, Department of Economic Affairs, Ministry of Finance, Government of India

Appendix D. List of ITPI Recognised Institutes

Table D.1: List of Institutes offering various courses in Town Planning and recognised by ITPI

Sr. No.	State	Institute
1	Punjab	Guru Ramdas School of Planning, Amritsar
2	Haryana	Amity University*,Gurgaon
3	NCT Delhi	School of Planning and Architecture , New Delhi Institute of Town Planners, India
4	Uttarakhand	Indian Institute of Technology, Roorkee
5	Uttar Pradesh	GautamBudh University*, Greater NOIDA Amity University* , NOIDA
6	Madhya Pradesh	Maulana Azad National Institute of Technology (MANIT), Bhopal School of Planning and Architecture, Bhopal
7	Uttar Pradesh	GautamBudh University*, Greater NOIDA Amity University* ,NOIDA
8	Madhya Pradesh	Maulana Azad National Institute of Technology (MANIT), Bhopal School of Planning and Architecture, Bhopal
9	Jharkhand	BIT*, Mesra, Ranchi
10	West Bengal	IIT, Kharagpur Bengal Engineering and Science University, Shibpur
11	Bihar	NIT, Patna
12	Gujarat	CEPT University, Ahmedabad Sardar Vallabhbhai Patel National Institute of Technology, Surat Bhai Kaka Centre for Human Settlements, Arvind Bhai Patel Institute of Environmental Design,VallabhVidhyanagar
13	Maharashtra	Government College of Engineering, Pune Vishvesharaiya National Institute of Technology, Nagpur
14	Rajasthan	Malviya National Institute of Technology *
15	Andhra Pradesh	JNTU, Hyderabad School of Planning & Architecture , Vijaywada
16	Karnataka	Institute of Development Studies, Mysore
17	Tamil Nadu	School of Architecture& Planning, Chennai
18	Kerala	College of Engineering, Thiruvananthapuram

Source: Planning and Development, 2025: Professional and Academic Challenges, TCPO
*Applicants under recognition process by ITPI

Appendix E. Biodiversity Index Indicators

Table E.1: Biodiversity Index Indicators

S.no.	Indicators	Calculation	Score Range
1	Proportion of Natural Areas in the city	(Total Area of Natural Areas) ÷ (Total Area of the City) × 100	0 point: <1% 1 point: 1%-6% 2 points: 7%-13% 3 points: 14%-20% 4 points: >20%
2	Connectivity measures or ecological networks to counter habitat fragmentation	(1 / A total)(A12 + A22 + A32 + …+ An2)	1 point <0.787 2 points 0.787-0.883 3 points 0.884-0.979 4 points >0.979
3	Native bird species in built up areas (other than natural areas)	Number of bird species in built-up areas	1 point < 10 2 points 11-23 3 points 24-53 4 points >53
4	Change in number of native species[3]	Net change in number of native species	1 point: No loss of species 2 points: 1 species increase 3 points: 2 species increase 4 points: 3 species or more increase
5	Proportion of natural protected areas	(Area of protected or secured natural areas) ÷ (Total area of the city) × 100	N.A.
6	Proportion of invasive alien species of vascular plants (as opposed to native species)	(Number of invasive alien species) ÷ (Number of native species) × 100	0 point: >30% 1 point: 21%-30% 2 points: 11%-20% 3 points: 1%-10% 4 points <1%
7	Regulation of quantity of water	(Total permeable area) ÷ (Total terrestrial area of the city)	1 point <0.307 2 points 0.307-0.4785 3 points 0.4786-0.65 4 points >0.65
8	Climate regulation: carbon storage and cooling effect of vegetation	(Tree canopy cover) ÷ (Total terrestrial area of the city) × 100	1 point <0.07454 2 points 0.07454-0.160 3 points 0.160-0.339 4 points >0.339
9	Tree canopy cover on terrestrials area	Tree Count and Tree Cover Mapping	N.A.
10	Recreational and education services (areas of park with natural areas and protected or secured natural areas per 1000 persons)	(Parks Area with natural areas and protected or secured natural areas) ÷ 1000 persons	0 point: <0.1 ha/ 1000 persons 1 point: 0.1-0.3 ha/ 1000 persons 2 points: 0.4-0.6 ha/ 1000 persons 3 points: 0.7-0.9 ha/ 1000 persons 4 points: >0.9 ha/ 1000 persons
11	Recreational and	Number of visits per year	0 point: 0 formal educational visit/ year

[3]Indicators 4-8 (Vascular plants, Birds, Butterflies, Reptiles, Freshwater fish)

S.no.	Indicators	Calculation	Score Range
	education services (Number of formal educational visit per child per park)		1 point: 1 formal educational visit/ year 2 points: 2 formal educational visit/ year 3 points: 3 formal educational visit/ year 4 points: >3 formal educational visit/ year 4
12	Budget allocation for biodiversity	(Amount spent on biodiversity related administration) ÷ (Total budget of city)	1 point <0.74 2 points 0.74-2.50 3 points 2.51-4.26 4 points >4.26
13	Number of biodiversity projects implemented in the city per year	Number of biodiversity projects implemented in the city per year	1 point <4 2 points 4-9 3 points 10-14 4 points >14
14	Rules, regulations and policy – existence of local biodiversity strategy and action plan	Existence of local biodiversity strategy and action plan (LBSAP), National Biodiversity Strategy and Action Plan (NBSAP)	0 point: No LBSAP 1 point: LBSAP not aligned with NBSAP 2 points: LBSAP incorporates elements of NBSAP, but does not include any CBD initiatives 3 points: LBSAP incorporates elements of NBSAP, and includes 1-3 CBD initiatives 4 points: LBSAP incorporates elements of NBSAP, and includes more than 4 CBD initiatives
15	Institutional capacity – Essential biodiversity - related function	Number of essential biodiversity related functions includes biodiversity centres, botanical gardens, herbaria, zoological gardens or museums, insectariums, etc.	1 point: 1 function 2 points: 2 function 3 points: 3 function 4 points: > 3 function
16	Institutional capacity – Inter Agency Cooperation	Number of city or local government agencies involved in inter-agency corporation pertaining to biodiversity matters	0 point: 1 or 2 agencies cooperate on biodiversity matters 1 point: 3 agencies cooperate on biodiversity matters 2 points: 4 agencies cooperate on biodiversity matters 3 points: 5 agencies cooperate on biodiversity matters 4 points: More than 5 agencies cooperate on biodiversity matters
17	Participation and partnership: public consultation process	Existence and state of formal or informal public consultation process pertaining to the biodiversity related matters	0 point: No routine or informal process 1 point: Formal or informal process being considered as part of the routine process 2 points: Formal or informal process being planned as part of the routine

S.no.	Indicators	Calculation	Score Range
			process 3 points: Formal or informal process in the process of being implemented as part of the routine process 4 points: Formal or informal process exists as part of the routine process
18	Participation and partnership: Institutional partnership	Number of institutional partnerships	0 point: No formal/ informal partnership 1 point: City in partnership with 1-6 other national or sub-national agencies/ private company/ NGO/ academic institutions/ international organizations 2 points: City in partnership with 7-12 other national or sub-national agencies/ private company/ NGO/ academic institutions/ international organizations 3 points: City in partnership with 13-19 other national or sub-national agencies/ private company/ NGO/ academic institutions/ international organizations 4 points: City in partnership with 20 or more other national or sub-national agencies/ private company/ NGO/ academic institutions/ international organizations
19	Is biodiversity or nature awareness included in the school curriculum?	Based on the query “Is biodiversity or nature awareness is included in the school curriculum?”	0 point: Biodiversity or elements of it are not covered in the school curriculum 1 point: Biodiversity or elements of it are being considered for inclusion in the school curriculum 2 points: Biodiversity or elements of it are being planned for inclusion in the school curriculum 3 points: Biodiversity or elements of it are in the process of being implemented in the school curriculum 4 points: Biodiversity or elements of it are included in the school curriculum
20	Education and awareness: public awareness events	Number of natural awareness and Biodiversity events in the city	0 point: 0 outreach events/year 1 point: 1-59 outreach events/year 2 points: 60-149 outreach events/year 3 points: 150-300 outreach events/year 4 points: > 300 outreach events/year

Source: Greater Hyderabad City Biodiversity Index, Greater Hyderabad Municipal Corporation, 2012

Appendix F. Transport Survey Format

F.1 Review of Existing Studies, Reports and Plans

Name of studies / reports / Plans	Major Problems / Issues addressed	Major Strategies	Major Proposed Projects / Plans

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.2 Ongoing and Planned Projects

Description: Ongoing, planned and proposed projects in the existing reports or studies, or identified by relevant agencies, should be summarized and listed.

Survey Methods: Literature review and interview survey with relevant agencies

Project Status										
Project / Programme	**Cost estimation**	**Implementing Agency**	**Brief description of project**	**Completed**	**Ongoing / under construction**	**D/D Stage (Fund Committed)**	**Waiting Fund**	**Planning (F/S) Stage**	**On Pipeline or some movement**	**No Progress**

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.3 Outline of Road Network

		Metropolitan Area	Municipal Area	City Core
Road Length	National Highway length (km)			
	State Highway length (km)			
	Other Arterial Road length (km)			
	Secondary Road length (km)			
Road Density by road type	Road Density of Arterial Road (km/km^2)			
	Road Density of all roads (km/km2)			
Major Road Infrastructure	Number of Rotaries			
	Number of signalised Inter sections			
	Number of Flyovers			
	Number of Railway Overbridge			
	Number of Railways Underpass			
	Number of Railway Railway Level crossing			

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.4 Inventory of Arterial Road Network

Name of Road	Section		Length (km)	Right of Way (M)	Width of carriage way (M)	No. of Lanes	Width of Footpath		Traffic volume (PCU/Day)	Parking regulations along roadway	Abutting Land use	Road surface (G/F/P)*	Remarks encroachment Existence of roadway hazards, etc.
	From	To					Left	Right					

* G:GOOD, F:FAIR, P:POOR

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.5 Inventory of Flyovers and Underpasses

Name of Flyover / Underpass	Location / direction of flyover / underpass	Length (m)	Width (m)	No. of Lanes	Width of footpath (m)		Traffic Volume (PCU/Day)
					Left	Right	

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.6 Inventory of Major Intersections

Name of Intersections	Geometric Characteristics (shape of intersections, number of lanes etc.)	Inflow Traffic Volume (PCI/Day)	Traffic control devices (such as signalized etc.)	Existence of pedestrian crosswalks	Existence of Traffic Calming Measures (such as rumble strips, etc.)	Existence of intersection hazards (such as obstructed signals/signs, unregulated intersections that are unsafe for pedestrians, etc.)

Note: Critical intersections should be identified and inventoried, in particular those intersections that are important from the viewpoint of the entire road network or that are heavily congested. It is anticipated that approximately 10-30 intersections will be selected. Available traffic counts should be included or referenced and the requirement for new or updated surveys identified.

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.7 Inventory of Parking Facilities

Location	Ownership of facility Public / Private / Informal	The number of parking spaces / vehicle types	Parking Tafiff	Occupancy rate during peak hours	Condition of street markings	Type of restriction (e.g. for on-street)

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.8 Inventory of Traffic Control Facilities

	Metropolitan Area	Municipal Area	City Core
Number of traffic signals			
Existence of area traffic control system			
Type of signal operation (automatic or manual by Police)			

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.9 Inventory of Pedestrian Facilities

Location (street)	Type of facility (footpath, overpass, underpass)	Length (m)	Width of footpath		Safety	Comfort	Convenience	Obstructions (if any)	Continuity of the walkway	Existing pavement conditions)	Adequate drainage facilities	Clear markings
			Left	Right								

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

Note: Safety, Comfort and Convenience be rated as- 1(poor), 2(fair), 3(partially good), 4(good) and 5(very good).

F.10 Inventory of NMV Facilities

Location (street)	Type of facilities (NMV Path, Overpass, underpass)	Description	Obstructions (if any)	Existing pavement conditions	Adequate drainage facilities	Clear markings	Adequacy of signage / signaling	Existence of parking restrictions to safeguard pedestrian right-of-way etc.	Adequacy of NMV and Pedestrian and Vehicle Flow Separation (such as on-street lanes etc.)

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.11 Inventory of Level Crossings

Location (street)	TVU	Traffic volume (vehicle/day)	Road width (m)	Number of Lanes	Number of closures per day	Total time of closures	Average time of closures	Total number of stopped vehicle	Average number of stopped vehicles per closures

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.12 Availability of Public Transport Types / Para-Transit Modes

	City Core	Urban Area	Sub-urban Area
	(Available or not available)		
Inter city bus			
Large Bus			
Mini Bus			
Taxi			
Auto Rickshaws			
Cycle Rickshaws			
Hand pull Rickshaws			

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.13 Inventory of Bus Operation, Maintenance, and Economic and Productivity Indicators

Bus Operation and Maintenance						**Economic and Productivity Indicators**					
Bus operator	Vehicle loads	Vehicle headways	Service period	Typical route speeds	Service reliability	Passengers per vehicle-hour or vehicle-km	Cost for employee per vehicle-hour or vehicle-km	Cost of recovery	Passenger transfers	Passenger comfort and safety (F)	Passenger comfort and safety (M)

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

Outline of Bus Operation									
Bus Operator	Type of operator (Public, Private, or Association of independent drivers)	Number of vehicle type by bus drivers	Number of bus routes	Operating vehicle - distance (vehicle-km)	Number of bus stops	Number of bus terminals	Fare structure		
							Off-hours	Peak-hours	Special schemes (for students, elderly, women etc.)

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.14 Inventory of Para-Transit

Number of Operators	Number of type of registered vehicles	Fare	Revenue	Cost (operating and fixed)	Operating distance and hours (km and hour)	Average age of vehicles	Conditions of vehicles	Type of ownership and degree of regulation	Jurisdictional areas of operators (if any)	License fees and franchise costs)

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.15 Inventory of Major Intermodal Interchanges

Name of Interchange facilities	Location	Layout and size of facilities	Determination of capacity and geometric characteristics of pedestrian walkways	Number of daily and hourly (peak) passengers	Number of hourly/daily vehicle movements	Number of transport operators houses	Number of loading births	Availability of loading births to accept various bus types

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.16 Summary of Traffic Accidents

	5 years ago	4 years ago	3 years ago	2 years ago	1 year ago
Total number of accidents					
involving pedestrians					
involving cyclists					
Involving cars					
Involving buses					
Number of injured or dead					
Number of dead					
Number of injured					
Identification of hazardous locations					
Major accident causes					

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.17 Summary of Enforcement

	Municipality Area	Metropolitan Area
Number of Traffic Police		
Existing Traffic Regulations		
Costs and types of violations		
Fines for traffic violations		
Number of police trap activities		
Manner of enforcement		
Organizational structure of enforcement body		

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.18 Inventory of Agencies / Organizations Relating to Urban Transport

Name of agency/department	Function and responsibility of agency/department	Relationship to other agency	Organization chart	Number of staffs	Annual Budget	Profitability and financial sustainability (only for operators)
State Government						
Transport Department						
Public Works Department						
Regional Transport Authority						
State Transport Company						
Municipality						
Metropolitan Development Authority						
State Government						
Transport Department						
Bus Operators						
Associations of Rickshaws or Taxis						
Ferry Operators						
Other relevant agencies (if any)						

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.19 Assessment of Planning, Implementation and Coordination Capacity

	Assessment
Planning and Implementation Capacity:	
Staffing capacity for urban transport planning	
Data capture capability e.g. systems for periodic traffic data collection	
Financial resources to implement planned transportation projects	
Experience in Public-Private Partnerships (PPP)	
Coordination Capability:	
Control over small private developers in planning supporting infrastructure	
Systems or processes to integrate transport and urban planning agencies	
Systems or process to integrate land use plans with transport plans	
Role and impact of workers/transport operator's unions	
Division of duties between State Government and Urban Local Bodies (ULB)	
Planning and Implementation Capacity:	

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.20 Inventory Environmental Monitoring Data

	Standard	Location 1	Location 2	Location 3	Location 4	Location 5
Ambient for Air Quality Data						
NO_x						
SO_x						
Pb						
Noise						
Water Quality						

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.21 Typical Urban Transport Issues

Issue	Severity
Traffic Congestion	
City-Wide Traffic Congestion	
Traffic Congestion on Major Roads at Peak Hours	
Narrow Streets Contributing to Congestion	
Waiting or Parked Vehicles Contributing to Congestion	
Slow Vehicles (Bicycle, Cycle Rickshaw, Auto Rickshaw, Two wheeler)	
Contributing to Congestion	
Existing Bus System	
Lack of (Public) Bus Operator	
Lack of Bus Routes (i.e. bus routes are far from residence/commercial area)	
Lack of Bus Vehicles	
Poor Maintenance of Publicly Operated Bus Vehicles (e.g. level of breakdowns and pollution generation	
Poor Maintenance of Privately Operated Bus Vehicles	
Proliferation of Disorganized Private Bus Services (including mini buses)	
Low Profitability of Bus Operators	
Lack of Bus Driver Training	
Parking	
Major Streets are too Narrow for Parking	
Problems Caused by Parking of Private Vehicles	
Problems Caused by Parking/Waiting of Rickshaws and Auto-Rickshaws	
Lack of Parking Areas at Station/Bus Terminals	
Lack of Land for Off-Street Parking Lots	
Lack of Regulations for Parking Measures (including development control standards)	
Parking Policy and Guidelines	

Issue	Severity
Safety	
Vehicle-Vehicle Accidents	
Accidents Involving Pedestrians	
Accidents Involving Cyclists	
Accidents Involving Auto/Cycle Rickshaws	
Level of Driver Education Training/Licensing	
Lack of approach to make women's travel by Public Transport and NMT safer, affordable, comfortable and convenient.	
Enforcement	
Enforcement of Illegal Traffic Movements or Speeding	
Enforcement of Illegal Traffic Parking	
Enforcement of Unlicensed Private Vehicle Motorists	
Enforcement of Illegal Bus/Para-Transit Operators	
Lack of Enforcement Resources (traffic police and equipment)	
Environmental	
Air Pollution	
Traffic Noise	
Planning and Implementation Capacity	
Guidance for Making City Transport Policy/Plans	
City Master Plans Do Not Reflect Actual Situation on the Ground	
Lack of Sufficient Urban Transport Planners within the City Government	
City Officials Dealing with Transport Planning Lack Experience or Training in Transport Planning	
Lack of Data Collection Capability e.g. Periodical Traffic Surveys (inc. traffic volume survey)	
Lack of Financial Resources to Implement Planned Transportation Projects	
Lack of Knowledge of Public-Private Partnerships (PPP)	

Issue	Severity
Lack of understanding of the gendered aspects of travel	
Lack of gender specific transport data	
Lack of women Urban Transport Planners at mid and senior levels within city government.	
Coordination Capability	
Small Private Developers Do Not Make Strategic Provision for TransportInfrastructure	
Transport and Urban Planning Agencies Do Not Coordinate or Integrate Plans and Processes	
Land Use Plans are Not Coordinated with Transport Plans	
Workers/Transport Operator's Unions Obstruct Improvements	
Division of Duties between State Government and Urban Local Bodies (ULB) is Not Clear	
Transport/Traffic Regulations	
Bus/Paratransit (Auto-Rickshaw, Cycle Rickshaw) Operators are Not Adequately Regulated	
Para Transit Vehicles are Not Adequately Regulated	

F.22 Population and Socio-economic Situation

	Metropolitan Area			Municipality Area			Ward 1	Ward 2	Ward 3	Ward 4
Population										
Number and size of household										
Population growth trend										
Population density										
	Male	Female	Total	Male	Female	Total				
Number of Workers by category										
Main Workers										
Cultivator										
Agriculture										
Labour										
Household Industry										
Others										
Marginal Workers										
Non Workers										
Average Personal Income										
Average Household Income										

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.23 Vehicle Ownership Data

	Total in Metropolitan Area	Total in Municipality Area				Ward 1	Ward 2	Ward 3	Ward 4
Number of Registered Vehicles by Type									
Passenger Vehicle									
Small Passenger Vehicle									
Small Truck									
Heavy Truck									
Auto Rickshaws									
Cycle Rickshaws									
Buses									
Mini Bus									
Motorcycles (two wheeler)									
			Number of users						
			Male	Female	Total				
Number of households having Bicycle									
Number of households having Scooter, Motorcycle, Mope									
Number of households having Car, Jeep, Van									
Number of Licensed Drivers by License Type									

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.24 Traffic Count Surveys (Screen Line Survey and Cordon Survey)

Location:	Section(To/From):	Date / Month / Year:
Count Station No.:	Direction:	Day:
	Road Name & No.:	

	Passenger Vehicles								Good Vehicles				Grand Total
	Heavy Fast	Light Fast				Slow			Heavy Fast	Light Fast		Total	
	Bus	Mini Bus	Car	2-Wheel	3-Wheel	Cycle	Others	Total	Truck	LCV	Others		
6-7 AM													
7-8 AM													
8-9 AM													
10-11 AM													
11-12 AM													
12-1 PM													
1-2 PM													
2-3 PM													
3-4 PM													
4-5 PM													
5-6 PM													

F.25 Traffic Count Survey (Intersection Turning Movement Survey)

Location:	Direction From:		Date / Month / Year:
Count Station No.:	Direction:	Right Turn/Straight/Left Turn:	Day:
Road Name & No.:			

	Passenger Vehicles								Good Vehicles				Grand Total
	Heavy Fast	**Light Fast**				**Slow**			**Heavy Fast**	**Light Fast**		**Total**	
	Bus	Mini Bus	Car	2-Wheel	3-Wheel	Cycle	Others	Total	Truck	LCV	Others		
6-7 AM													
7-8 AM													
8-9 AM													
10-11 AM													
11-12 AM													
12-1 PM													
1-2 PM													
2-3 PM													
3-4 PM													
4-5 PM													
5-6 PM													

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.26 Queue Length Survey

Queue length	Reading in Meters	Hour			Elapse Time
Sequence of reading*	Queue length (m)	(hr.)	(min.)	(Sec.)	(Sec.)

* G = Start of Green, R= Start of Red, ZS=Start of Zero Queue, ZE= End of Zero Queue

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.27 Travel Speed and Time Survey

Name of Road:	From:	To:	
From Km:	To Km:	No. of Trip:	
		Date:	
		Time:	

Sl.No.	Distance		Control	First Stop Watch		Second Stop Watch		Cause of Delay
	Km	M	Points	Journey Time		Delay Time		
				Min.	Sec.	Min.	Sec.	

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.28 Household O-D Survey

Household Summary												
Date: / Day:				**Enumerator:**						**Sample No.:**		
1. Address				2. Head of the Household:								
				3. Numbers of Family Members								
				4. Vehicles Owned:			Passenger Car	2-Wheeler	Bicycle	Auto	Others	
						5 Years Ago						
						Present						

5. Details of Household Members:											
				Monthly Income (Rs.)		Monthly Export on Transport (Rs.)		Availability of Driver License	Working / School Location		
Member No.	Sex (M/F)	Age	Occupation *	5 Years ago	Present	5 Years ago	Present				

* Occupation, 1-Govt. Service, 2-Pvt. Service, 3-Business, 4-Student, 5-House-wife, 6-Retired Person, 7-Unemployed

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.29 Household O-D Survey

Trip Summary

6. Details of each trip

Sl. No.	Member No.[1]	Traffic Mode[2]	No.in vehicle	Where did this trip begin[3]	Where did this trip end[3]	Trip purpose[4]	Travel Time	Travel cost

Note: [1]Referring to the numbers described in "5. Details of Household Members"

[2]1-Bus, 2-Mini Bus, 3-Car, 4-Two-wheeler (motorcycle). 5-Three-wheeler (Auto-rickshaw), 6-Bicycle, 7-Railway, 8-Walk

[3] Put zone number

[4] 1-Going to work, 2-Going to school, 3-Going home, 4-Shopping, 5-Leisure, and 6-Business

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.30 Roadside O-D Survey

Sl. No.	Direction (inbound or outbound)	Time	Traffic Mode [2]	No. of Passenger	Where did this trip begin? [2]	Where did this trip end? [2]	Trip purpose [3]

Note: [1] 1-Bus, 2-Mini Bus, 3-Car, 4-Two-wheeler, (motorcycle), 5-Three wheeler (Auto-rickshaw), 6-Bicycle, 7-Railways, 8-walk

[2] Put zone together

[3] 1-Going to work, 2-Going to school, 3-Going home, 4-Shopping, 5-Leisure and 6-Business

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

F.31 Public Transport and Freight Vehicle Movement Survey

Sl.No.	Name of Company	Location	Parking location	Vehicle type	Where did this trip begin? [1]	Where did this trip end? [1]	Number of passengers or Type of Cargo

Note: [1] Put zone number

	Essential/ITEM A (Bold font)
	Preferable (ITEM B)
	Optional / ITEM (Italic Font)

Appendix G. Standard Layout of Map

G.1 Introduction

The layout of map should facilitate convenient reading of the map and location of essential information as given below:

Margin

- A trimming margin of 10 mm all around or the purpose of trimming and edge binding.
- A second margin with thick firm line indicating the outer limits of the drawing. Such margin of filing edge could be 25 mm while on other three sides it could be 15 mm for all sizes of maps.

Title

The title of the map should be as short as possible and should include the general title as well as sub-title. Size of letters used for the sub-titles should be generally one to two sizes smaller than the size of letters used for the main title.

Normally, the title block should contain the following particulars:

- Name of the office
- Drawing number and the title of the drawing
- Signature of the dealing officer
- Date of preparation / revision / alteration

Title block should be located at the bottom right hand corner of the sheet in a simple manner. Recommended size of title block is 150 mm X 100 mm for sizes A2 and larger and 150 mm X 75 mm for sizes A3 and A4.

North Point

Indication of north point is essential on the drawing and it could be located immediately above the title block. Wherever possible, north point should be shown along with the windrose. The north point on a map should, as far as possible, point upwards.

Scale

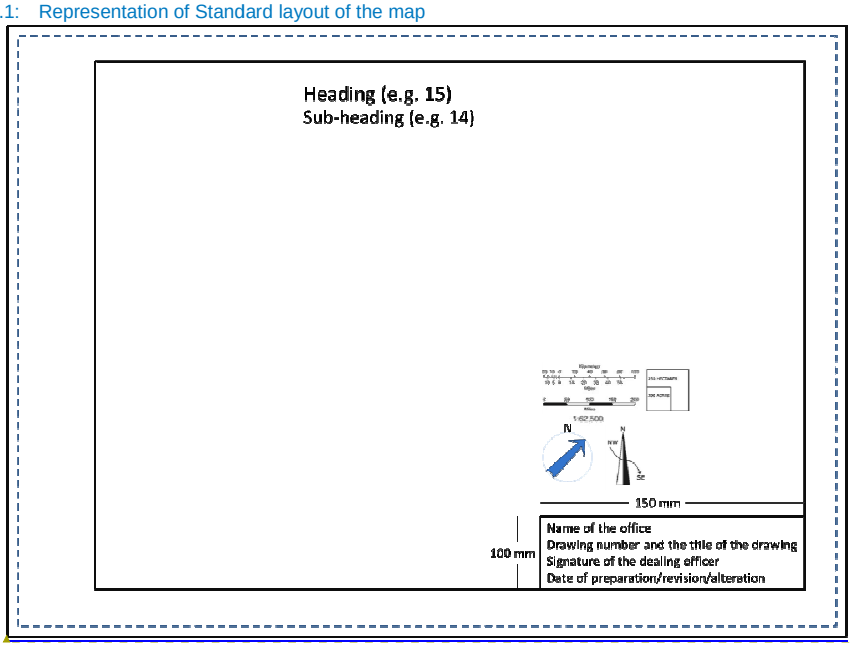
- Graphic scale: Graphic scale is one of the essential requirements of map and preferably it should be given in metric system for the convenience of reproduction. The graphic scale could be drawn above the title block.
- Spatial scale: In addition to graphic scale, the spatial scale should also be given on all plans. The spatial scale should consist of square with metric sides and the area covered by the square should be given inside the square. Such spatial scale could be located above the graphic scale in the drawing.
- Numeric scale: A numeric scale giving representation fraction (R.F.) e.g. 1:10,000 should be given below the graphic sale.

Numbering

A systematic numbering of maps / drawings would be convenient for reference. Respective department/ organization may allow its own numbering system based on standardised methods such as:

- Systematic numbering
- Consecutive numbering
- Sectional numbering

Figure G.1: Representation of Standard layout of the map



Source: Compilation & representation of various source and UDPFI Guidelines

G.2 Map Enlargement and Reduction

Maps are generally available in different size and scales from different sources. All these maps could be brought in a required uniform scale by employing any of the following methods:

- Square method
- Similar triangle method
- Pantograph (mechanical method)
- Optical pantograph method
- Photographic method (optical)
- Digital method

The last three methods require sophisticated equipment, but they produce more accurate maps.

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~~G.1~~G.3 Map Notation

Planning exercise of settlements require preparation of maps to depict on ground conditions and variety of data relating to physical and socio-economic aspects which play crucial role in decision making and showing plans in spatial context. Broadly, these maps could be grouped under 2 categories.

- Survey and study maps
- Development plan maps/Proposal maps

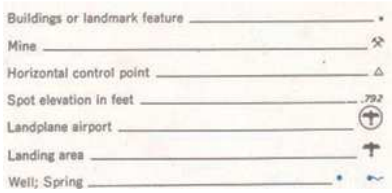
It is important that the manner of preparing survey and study maps must be closely related and in many cases identical to the preparation of proposal maps to facilitate the quick correlation of proposals with the existing conditions. Therefore, the notations and symbol used in both sets of maps should be similar as far as possible. Notations and symbols are language by themselves and need to be designed properly for easy understanding. For uniformity of presentation, it is also necessary to establish uniform practices in regard to the information to be included in these maps. Taking into consideration the standardisation of notations and information content of the maps, type of notations to be adopted can be grouped in three broad categories as following:

- Point
- Line
- Polygon

Point

Point data on map shall be used for depicting prominent feature, like building or highest point. Details that could be shown as point feature, varies depending on the scale of map. Following are some examples of point features that could brought under standard frame work on State level.

Figure G.2: Survey of India Toposheet



Source: Survey of India

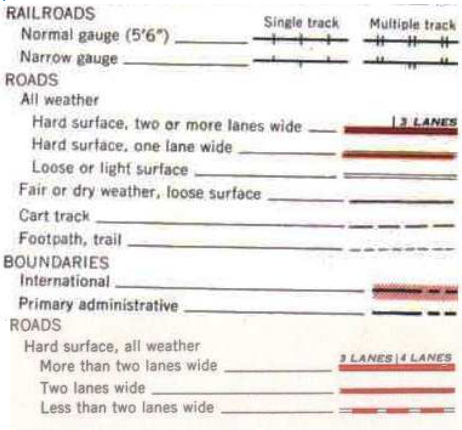
Figure G.3: International Study inputs

Source: Activity Centre Zone Mapping Style Guide, State Government Victoria

Line

Linear features could be boundaries, transportation network or water bodies' etc. Standardisation in linear features, specifically administrative boundaries shall be made at States' level. Boundary symbols as used by Survey of India organisation can be used by states as it will bring uniformity in boundary features at national level.

Figure G.4: Survey of India Toposheet



Source: Survey of India

Polygon

A calibration in colour, notation and font used in maps should be made by state departments so that maps of a State depict information in uniform manner and are relatively easy for comparison and study by public. Mode of preparation of map on different platforms has impact on colour and notation. Thus, a standardised format of legend shall be made. RGB (Red Green Blue) colour specification can be provided for computer based platforms like GIS or CAD etc. Following are examples of such RGB colour specifications:

- Red: **255:51:0**
- Purple: **102:0:204**
- Yellow: **255:255:0**
- Green: **0:153:0**
- Orange: **255:153:0**

Font's specifications can also be provided in terms of style, size and colour. Though these provisions will vary as per the scale and site of the sheet and be accordinglyprovided.

Appendix H. Cadastral Map Overlay

H.1 Introduction

The process of preparing base map by overlaying satellite imagery over cadastral maps has been referred from chapter-6 of 'Space based information support for decentralized planning (SIS-DP) Manual: Preparation of Geo-spatial layers using (Cartosat – 1 Pan + LISS-IV Mx) Orthorectified Satellite Imagery' of ISRO. The manual (part -2) is available for public and can be downloaded from the link: http://www.bhuvan-panchayat.nrsc.gov.in/assets/Manual-Part2.pdf.

H.2 Process of base map formulation by overlaying Satellite images over cadastral maps

For overlaying cadastral map with satellite image it is required that cadastral map to be generated in vector mode. In this process the main tasks are acquisition of cadastral maps, scanning and digitization of cadastral maps and generation of vector data. Once the cadastral maps in vector mode are available, geo-referencing of these maps can be done.The geo-referencing of digital cadastral maps and overlaying with satellite image consists of the following steps:

- Acquisition of GCP's
- Transformation model development and assessment
- Geo-referencing of cadastral maps
- Validation of Geo-referenced map, in Isolation
- Validation of Geo-referenced map, with neighbourhood
- Mosaic generation at revenue inspector (RI), *taluka* and district level

Comment [T1]: Section 6.3.2.4.2

Comment [T2]: Section 6.3.2.4.3

H.2.1 Acquisition of ground control points:

Sufficient numbers of GCP's shall be identified on the vector cadastral map and on satellite image. The characteristics of the GCP's are intersections of parcel boundaries, river/stream with parcel boundary, of roads with parcel boundaries, roads with rivers and corners of water tanks. The GCPs should spread uniformly in the entire map.

H.2.2 Transformation model assessment:

Transformation model is applied for geo-referencing the cadastral map. The area of the village, number of sheets covered in a single village, condition of the cadastral map sheets, number and characteristics of GCPs collected and terrain conditions the affect polynomial model. The transformation model is accepted when the actual root mean square and residual errors arrived are less than the threshold values i.e. 6 m in either direction.

H.2.3 Geo-referencing of cadastral maps:

Once the transformation model is accepted, the vector cadastral map is geo-referenced through affine transformation[4] in GIS environment. The outputs are further validated both visually and mathematically.

H.2.4 Validation of Geo-referenced map, in isolation:

Output product validation is an essential element in development of land information system. The geo-referenced vector file of each village is validated with reference to the merged product. The geo-referenced vector file is overlaid on the reference image and initial validation is carried out through visual checking. If the parcel boundaries coincide with the image features and deviations/displacements are not observed, the geo-referencing is successful. Feature matching is checked in the following order of priority; tanks, water bodies, tank bunds, ponds, road, rail, canal, stream, *nalla*, river, field bunds, forest boundary / vegetation boundary, *abadi* (village settlement).

H.2.5 Validation of Geo-referenced map, with neighbourhood reference:

This validation is carried out to ensure that the village boundary is matching with all adjoining village boundaries. The boundary should match perfectly. However, in accordance with the terrain conditions, the boundary (overlap/under lap) error tolerance in undulating terrains is kept around 15 m and in hilly areas, the tolerance is around 25 m (Srinivasa Rao et al., 2003b).

H.2.6 Mosaic generation at Revenue, taluka and district level:

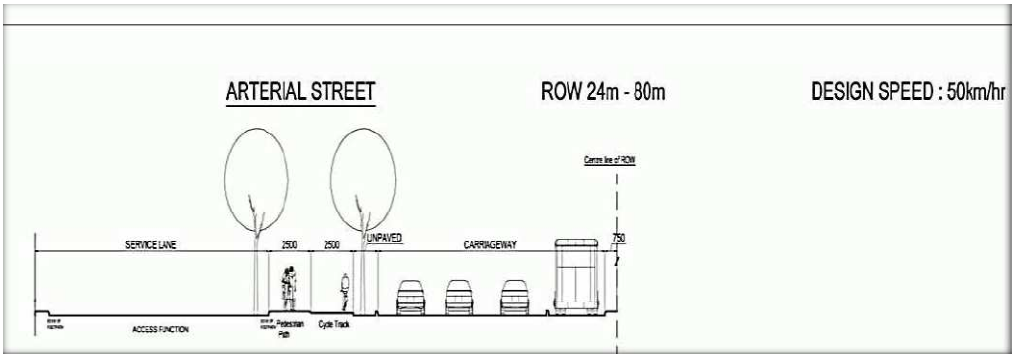
After geo-referencing the cadastral maps to the required accuracy standards, a number of maps are mosaiced at the next higher administrative level. While mosaicing, feature continuity as well as attribute accuracy is to be maintained. These are the final products of geo-referencing of cadastral maps and can be used as base map. These products are directly linked to LIS and GIS databases.

Comment [T3]: Section 6.3.2.4.3

[4]Affine Transformation: A geometric transformation that scales, rotates, skews, and/or translates images or coordinates between any two Euclidean spaces. It is commonly used in GIS to transform maps between coordinate systems. In an affine transformation, parallel lines remain parallel, the midpoint of a line segment remains a midpoint, and all points on a straight line remain on a straight line.

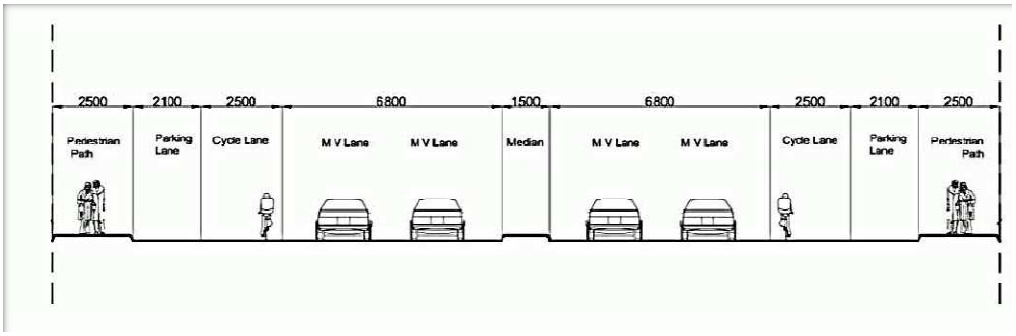
Appendix I. Road Cross Sections

Figure I.1: Cross Section Distributary Road



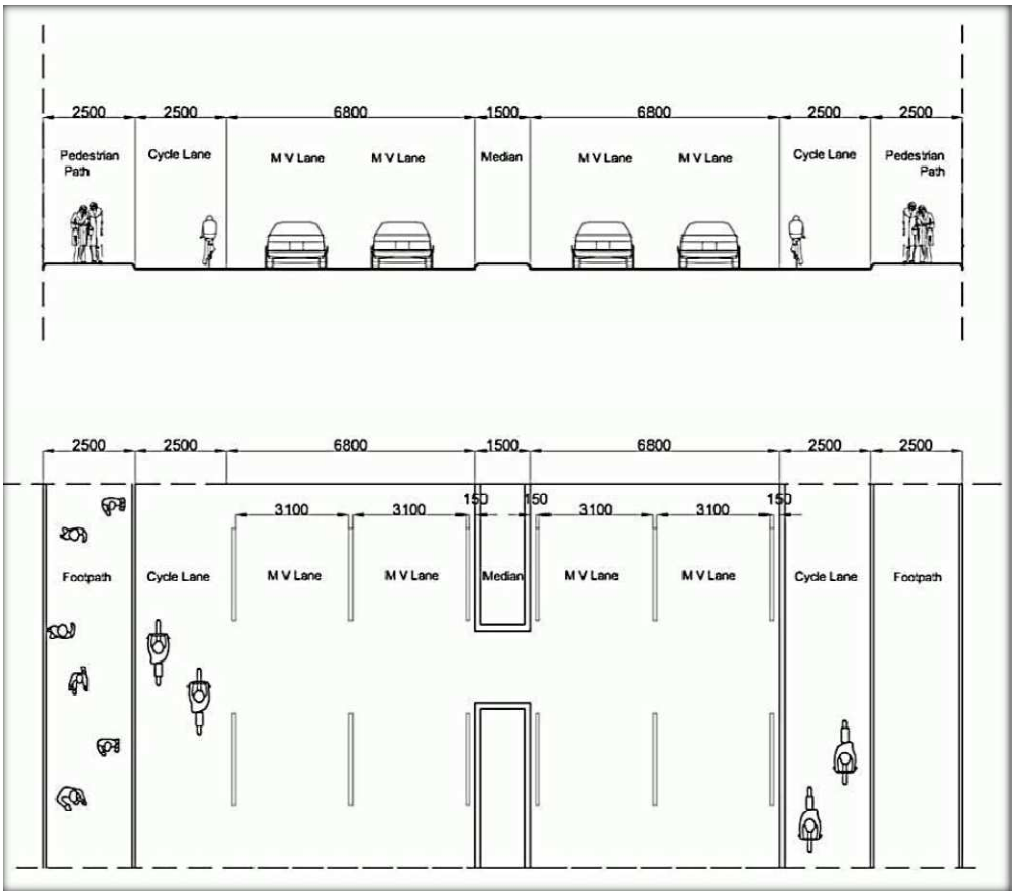
Source: Code of Practice Part-1, MoUD, 2012

Figure I.2: Cross Section Distributary Road



Source: Code of Practice Part-1, MoUD, 2012

Figure I.3: Cross section of Access road



Source: Code of Practice Part-1, MoUD, 2012

Appendix J. Travel Demand Modelling Process

J.1 Trip Generation

The first step in travel forecasting is trip generation. In this step, information from land use, population, and economic forecasts are used to estimate how many trips will be made to and from each zone.

Types of Most Commonly Used Trip Generation Models

- Regression models: equations such as:
  - Total trips = 1.1*population,
  - Home-based work trips = 1.5*total employment, etc;
- Cross-classification tables based on: household size, number of workers, income class, vehicle ownership, etc.;
- Special generator models: used for generators such as airports, colleges, amusement parks, green spaces, etc.;
- Separate rates for peak and off-peak trips.

Assumptions and limitations:

- Pedestrian and bicycle trips are usually excluded from trip generation models.
- Commercial vehicles need to be generated separately.
- Care should be taken before interchanging vehicle trip rates with person trip rates.

Validation and Reasonableness Checking for trip generation

- Compare trips per household to the regional average. There should be a valid explanation if numbers are too high or too low.
- Review trips per household by purpose.
- Ensure that trip productions and trip attractions balance well. Check trip rates and adjust if they do not balance
- Create GIS color-coded maps of productions and attractions to review for errors. Use special generators for facilities such as schools, hospitals, malls, and recreational facilities such as parks, playgrounds, etc.
- Make model external trips and visitor trips using external cordon and visitor surveys.
- Make sure Commercial Vehicle and Freight Travel is included in the model

J.2 Trip Distribution

The trip distribution model estimates number of trips travelled from one zone to another. Trip generation only finds the number of trips that begin or end at a particular zone. The process of trip distribution links the trip ends to form an origin-destination pattern. Trip distribution is used to represent the process of destination choice (i.e. "I need to go shopping, but where should I go to meet my shopping needs?").

The most commonly used procedure for trip distribution is called the gravity model. The gravity model takes the trips produced at one zone and distributes to other zones based on both the size of the other zones (as measured by their trip attractions) and the composite cost (travel time, distance or cost for all modes available) to other zones. A zone with many trip attractions (say, a large shopping center) will

receive a greater number of distributed trips than one with few attractions (a small shopping center). The mathematical formula for a gravity model is shown below:

$$T_{ij} = P_i \left(\frac{A_j F_{ij} K_{ij}}{\sum_{k=1}^{zones} A_k F_{ij} K_{ik}} \right)$$

Where,

T_{ij}= the number of trips from zone i to zone j,

P_i = the number of trip productions in zone

A_j= the number of trip attractions in zone j,

F_{ij}= the friction factor relating the spatial separation between zone i and zone j, and

K_{ij}= an optional trip-distribution adjustment factor for interchanges between zone i and zone j.

Distance to possible destinations is the other factor used in the gravity model. The number of trips to a given destination decreases as the distance to the destination increases (it is inversely proportional). This is represented in a factor called friction factor. It is inversely proportional to the distance or travel time between two zones. Friction factors are used to calibrate trip lengths from the model to observed data. The most common formulation of friction factors is through a gamma function as shown below:

$$F_{ij} = a \, X \, t_{ij} X \, e^{cxt_e}$$

Where,

F_{ij} = the friction factor between zones i and j,

a, b, and c = model coefficients; both b and c should, in most cases, be negative; a is a scaling factor and can be varied without changing the distribution,

t_{ij}= the travel time between zones i and j, and

e = the base of the natural logarithms.

Validation and Reasonableness Checking for trip distribution

- Compare trip length frequency from model and survey data.
  - Do this for every purpose
  - Do this for distance and time
  - If different, adjust friction factors in the model
  - Maximum of 5-10% difference in observed and modelled.
- Compare trip patterns from the model to data from O-D Surveys.
  - Aggregate data into districts and compare trips
  - Look at north-south and east-west trips

J.3 Modal Split

Mode choice is one of the most critical parts of the demand modelling process. It is the step where trips between a given origin and destination are split into trips using available modes such as two-wheeler, car, private vehicle, public transport, etc. Calculations are conducted that compare the attractiveness of travel by different modes to determine their relative usage. All proposals to improve public transport or to change the ease of using private vehicles are passed through the mode split/private vehicle occupancy process as part of their assessment and evaluation. It is important to understand what factors are used and how the process is conducted in order to plan, design, and implement new systems of transportation. The most common mathematical formulation of a mode choice model is a logit model and is as follows:

$$P_i = \frac{e^{u_i}}{\sum_{i=1}^{k} e^{u_i}}$$

Where,

P_i = the probability of a traveller choosing mode i,

u_i = a linear function of the attributes of mode i that describe its attractiveness, also known as the utility of mode i, and

$\sum_{i=1}^{k} e^{ui}$ = the summation of the linear functions of the attributes of all the alternatives, k, for which a choice is available

The utility function is calculated based on the following equation:

$$u_i = a_i + b_i + IVTT_i + c_i \times OVTT_i + d_i \times COST_i$$

Where,

$IVTT_i$ = the in-vehicle travel times for mode i,

$OVTT_i$ = set of variables measuring the out-of-vehicle travel times for mode i—walk, wait, and transfer times—may all be kept separate or combined, depending on the calibrated structure of the model,

$COST_i$ = the cost of mode i,

a_i = mode-specific coefficient (constant) to account for mode bias not measurable with the level of service variables,

b_i= coefficient for the IVTT variables of mode

c_i = a set of coefficients for OVTT variables of mode i, and

d_i= coefficient for COST variable of mode i

Key Points about Mode Split

- Mode split is done by a comparison of the "disutility" of travel between two points for the different modes that are available.
- "Disutility" is a term used to represent a combination of the travel time, cost, and convenience of a mode between an origin and a destination.
- Travel time is divided into two components: in-vehicle time to represent the time when a traveller is actually in a vehicle and moving, and out-of-vehicle time, which includes time spent travelling outside of the vehicle (time to walk to and from bus/rail stops, waiting time, transfer time).
- Out-of-vehicle time is used to represent "inconvenience" and the coefficient for out-of-vehicle time is typically several times larger than for in-vehicle time, reflecting the fact that travellers do not like to wait or walk long distances to their destinations. The size of the multiplier will be different depending upon the purpose of the trip.
- For public transport trips, the cost of the trip is usually measured as the average public transport fare for that trip, while for private vehicle trips, cost is found by adding the parking cost to the length of the trip and multiplying by cost per kilometer. Private vehicle cost is based on a "perceived" cost per kilometer (on the order of 5-10 cents/kilometer), which only includes fuel and oil costs and does not include ownership, insurance, maintenance, and other fixed costs (total costs of private vehicle travel are much higher).
- Disutility equations also contain a "modal constant", represents other characteristics or travel modes that are not explicitly captured by the variables in the model, but that may influence the choice of mode (such as a difference in comfort between public transport and private vehicles). A model will have n-1 constants with ‘n’ being the number of modes.
- Once disutilities are estimated for the various choices between an origin and a destination, the trips are split among various modes based on the relative differences between disutilities. A large advantage will mean a high percentage for that mode.

All model coefficients are estimated using actual traveller data.

Types of Mode Choice Models:

- **Factoring of vehicle trips -** In this model, fixed factors are used to factor total trips into trips by mode. This is based on fixed data from surveys. This is not recommended for long-term projects with high investment
- **Binomial logit model -** In this model, only two modes are considered: private vehicle and public transport. This is a simpler model and should be used when short on time and data.
- **Multinomial logit model -** This is the most common type of model used to compare a number of modes. Variations of the model include nested logit and hierarchical logit, which splits total trips first into public and private vehicles, and then into categories such as two- and four-wheelers, bus, rail, etc.

Table J.1:Factors Affecting Mode Choice

Factor	Private Vehicle	Public Transport
In-Vehicle Time	Congested driving Time	Time riding public transport
Out-of-Vehicle Time	Walk to Vehicle from parking	Walk to stop, wait/transfer time, walk from stop to destination
Cost	Cost of fuel, parking, tolls	Fare

Source: Development of Training Material under Sustainable Urban Transport Project, Reference Guide Volume 2 Demand Assessment, MoUD

Validation and Reasonableness Checking for modal split

- Compare observed modal split to estimated modal split
  - Do this for every purpose
  - Maximum of 5-10% difference in observed and modelled.
- A typical range for value of in-vehicle time coefficient is between -0.015 and -0.02.
- A typical range for value of out-of-vehicle time coefficient is 2- 3 times the in-vehicle coefficient.
- Constant terms should not be too high or low.
- Perform sensitivity tests to make sure model is stable.
  - Increase/decrease travel times/fares of highway and PT
  - Change socioeconomic data

The first three steps of modelling generate total person trips in the region. Before assigning them to road network, person trips need to be converted into vehicle trips. The first step in this process is to split private vehicles trips into private vehicle driver and private vehicle passenger trips. Private vehicle occupancy analysis is often a highly simplified process that uses fixed private vehicle occupancy rates for a given trip purpose or for household size and private vehicle ownership categories.

Trips are then converted into an origin-destination format for conducting daily assignments. Traffic varies considerably throughout the day and during the week. The travel demand forecasts are made on a daily basis for a typical weekday and then converted into peak-hour conditions. Daily trips are multiplied by an "hour adjustment factor", for example, 10%, to convert them into peak-hour trips. The number assumed for this factor is very critical. A small variation, say, plus or minus one percent, will make a significant difference in the level of congestion that would be forecast on a network. Most models are unable to represent how travellers tend to cope with congestion by changing the time they make their trips, although advanced travel demand models and activity models represent time of travel explicitly.

J.4 Traffic Assignment

Once trips have been split into highway and public transport trips, the specific route that they use to travel from their origin to their destination must be found. These trips are then assigned to that route in the step called traffic assignment. Traffic assignment is conducted differently for highway trips and public transport trips.

The process first involves the calculation of the shortest path from each origin to all destinations (usually the minimum time path is used). Trips for each O-D pair are then assigned to the links in the minimum path, and the trips are added up for each link. The assigned trip volume is then compared to the capacity of the link to see whether it is congested. If a link is congested, the speed on the link needs to be reduced to result in a longer travel time on that link. When speeds and travel times are changed, the shortest path may change. Hence, the whole process must be repeated many times (iterated) until there is an equilibrium between travel demand and travel supply. Trips on congested links will be shifted to uncongested links until this equilibrium condition occurs. There are a variety of ways in which the calculations are done to reach network equilibrium. One way to get a feel for the accuracy of the models is to look at the resulting speeds on the network. These should be realistic after equilibrium.

Public transport trip assignment is done in a similar way, except that public transport headways are adjusted rather than travel times. Public transport headways (minutes between vehicles) affect the capacity of a public transport route. Low headways mean that there is more frequent service and a greater number of vehicles. Public transport supply and demand are also recalculated to reach equilibrium between supply and demand.

It is important to understand the concept of equilibrium. If a highway or public transport route is congested during peak hours, its excess trips will be shifted to alternative routes. If the alternative routes are also congested, the final results will show congestion over a wide part of the network. In the real world, this congestion will eventually dissipate overtime.

Another important step in assignment is the time of day analysis. Daily trip patterns need to be converted into peak-time period traffic. A key assumption needed is the portion of daily travel that occurs during the peak period. This is normally used as a constant, and conventional travel models have very limited capability to describe how travellers will shift their trips to less congested times of the day.

Validation and Reasonableness Checking for traffic assignment

The following summaries should be prepared:

- Compare traffic volumes with observed counts.
  - Volumes by road class
  - Volumes by area type
  - Volumes by screenlines
  - Volumes at external cordons
  - Observed vs. estimated speeds

- Compare PT ridership from the model with observed ridership.
- Ridership by route groups should be within +/- 15%

J.5 Model Forecasts

Forecasting is the process of using a fully calibrated and validated model to estimate future year traffic volumes and public transport ridership.

Inputs for Forecasts

- Socioeconomic data, such as population, income class, and employment forecasts;
- List of approved highway and public transport projects and a list of projects to be evaluated.

Transportation forecasting processes should consider a broad range of alternatives. There can be alternative modes of transportation, alternative locations of different systems, alternative levels of capacity, or alternative policies. This would include the following:

- **A no-build alternative:** This is basically the status quo with continuing maintenance and operation of the current transportation system. It may include substantial efforts to improve the efficiency and utilization of existing transportation systems. These are considered as an alternative to building new systems. Developing a no-build alternative is a must for evaluating other alternatives. Every new investment alternative has to be compared to the no-build alternative to see if the improvement justifies the cost.
- **Travel demand management policies:** Transportation services require a broad range of policies to function. Travel demand management involves efforts to make the current system more efficient and to use techniques to reduce demand during critical periods. This is not unlike programs that utility companies have used to promote energy conservation among their customers. Some of the techniques that could be used include: use of priority techniques for high occupancy vehicles, parking regulation, efforts to shift when travel occurs, promotion of telecommuting, public transport service improvements, use of pricing techniques, etc.
- **Land use alternatives:** Different land use patterns and policies can be used to affect travel demand and to affect the use of natural resources. These could include concentrated urban development patterns, increased suburban growth, or some combination.
- **Modal alternatives:** Different modes of transportation such as highway, public transport, ride sharing, freight, etc. should be considered. Generally, transportation plans are concerned with picking the best combination of modes to deal with a particular problem. Single-mode plans such as a highway plan, public transport plan, etc. should not be done without first considering other modes. All options should be considered in order to develop a balanced transportation system.
- **Capacity changes:** The capacity of each mode (number of lanes, how often public transport vehicles operate) can be varied in different alternatives. Highway capacity depends on many factors besides the number of lanes, such as intersection characteristics, traffic signal systems, and the characteristics of access along the highway.
- **Alternative locations:** Proper location of public transport and highway facilities is an important part of their success. Facilities should be located to serve travel markets and to facilitate land development patterns that are good for the community.

Appendix K. Road Safety Checklist

K.1 Introduction

To encourage road safety, checklists have been provided in this section which can be utilised at various stages of project life cycle.

Table K.1: Road Safety Checklists

Checklist No.	Checklist
1	Audit : Stage:1 During feasibility study
2	Audit: Stage:2 Completion of preliminary design
3	Audit: Stage:3 Completion of detailed design
4	Audit : Stage:4 During construction stage
5	Audit : Stage:5 Completion of construction/pre-opening
6	Audit: Stage:6 On existing roads or during Operation & Management
7	Planning
8	Alignment
9	Cross-section
10	Junctions
11	Road signs
12	Road markings
13	Lighting
14	Roadside hazards
15	Roadside facilities
16	Vulnerable road users
17	Development proposals
18	Maintenance work

Source: Manual on Road Safety Audit, IRC: SP: 88-2010, Page 67

K.2 CHECKLIST 1 –Audit: Stage 1 (During Feasibility Study)

1. What is the category of road for which the feasibility study has been carried out e.g., Expressway, National Highway, State Highway or Other Roads?
2. Is the road intended to carry high-speed traffic or serve local access needs only?
3. What kind of traffic is likely ranging from high speed mixed traffic or for more general use, including bicycles and significant pedestrian traffic?
4. Do the chosen type of road and the standards, alignment and cross-section offer optimum road safety to all groups of road user including disabled in combination with the expected traffic density and speeds?
5. Does the project follow existing roads or is it a 'green field project' and what are the effects of this?
6. Check whether appropriate design standards have been used having regard to the scope of the project, and its function in relation to the traffic mix.

7. Check the appropriateness of the designs for the design volume and traffic characteristics.
8. Has access control been proposed?
9. Will the proposed scheme be compatible with the standard of conjoining road sections?
10. Will there be sufficient opportunities for overtaking?
11. Are the number and distribution of intersections appropriate in relation to:
    a. The desired function of the new road?
    b. Impact on the surrounding, adjacent and/or off-loaded road network (does the project simply move present problems)?
    c. Accessibility for public transport and emergency vehicles?
12. Are junction types shown the safest available at each location, in relation to the expected turning volumes?
13. Are the proposed horizontal and vertical alignments consistent with visibility requirements both along the road and junctions?
14. Has lighting been planned? If so, does the lighting offer maximum safety, both on links and at junctions?
15. Will the project have any effect on existing pedestrian and cycle routes?
16. Does the project include measures for vulnerable road-users and if so, do these measures offer maximum safety?
17. Do the available accident data for the existing/adjacent road network give reason to expect particular road safety problems in the proposed project?
18. Whether non-motorised traffic is expected to cause problems?
19. What is the likelihood of future widening?
20. Do the gradients, curves and general design approach fit in with the class of terrain and likely weather or environmental aspects?
21. Check any special events creating unusual or hazardous conditions and any other matter, which may have a bearing on safety.
22. Other checks pertinent to the project at discretion of auditor or client.

K.3 CHECKLIST 2 - Audit: Stage 2 (Completion of Preliminary Design)

1. Have all recommendations from the previous stage been followed? If not, why not?
2. Is the desired speed compatible with the cross-section and other design elements and is the desired speed realistic?
3. Cross-section:
    a. Has delineation of the carriageway with a kerb been proposed?
    b. Is there adequate space for all groups of road users?
    c. Is there appropriate separation between various groups of road users?
4. Horizontal and Vertical alignment and visibility:
    a. Does the proposed alignment satisfy any demands on visibility at junctions and sight distances on free sections?
    b. Will sight distances/visibility be blocked by traffic signs, guardrails, bridge parapets, buildings, rigid obstacles or plantations (now and in the future)

   c. Can parts of the project constitute a risk, especially in combination (e.g. peaks in the vertical alignment plus sharp horizontal bends, crests of hills plus traffic signals)?
5. Are the lane widths, shoulders, medians and other cross-section features in accordance with standard design and adequate for the function of the road?
6. Check whether there are undesirable variations in cross-section design. Check cross-falls, which could affect safety, particularly where sections of existing highway have been utilized, or where there have been compromises to accommodate access to abutting properties.
7. Check the safety aspects of shoulder provision, including the provision of paved and earthen shoulders, the width and treatment on embankments and cross-fall of shoulders? Are the shoulders likely to be used by slow-moving vehicles or cyclists?
8. Check for the provision of climbing lanes in hilly sections where vertical gradients are steep for considerable length of the highway?
9. Junctions, interchanges and their design:
   a. Will road users coming from all directions (including side roads) be able to see that they are approaching a conflict area? Are give-way lines, stop lines, turning lanes and ramps clearly visible?
   b. Are existing conjoining and intersecting roads appropriately adjusted and matched to the new road (without sharp bends and gradients)?
   c. Do the routes of road users through the junction seem clear for all directions and manoeuvres?
   d. Is there sufficient space for all types of vehicles to undertake all manoeuvres?
   e. Are the crossing facilities for pedestrians and non-motorised traffic adequate and safe?
   f. Can parking cause problems?
   g. Have roundabouts been considered?

(*In urban areas, ghost markings and left-turning lanes with islands are safest; they prevent overtaking and assist pedestrians and cyclists who are crossing the road*.)

10. Decide whether or not old, unremoved section of road can give undesired optical directions.
11. Special points at roundabouts:
   a. Are all entrance lanes curved and is speed adequately reduced?
   b. Will the central island be visible?
   c. Are the measures taken for the benefit of pedestrians from a safe stopping distance and cycle traffic adequate?
12. At the junction/transition to existing roads (especially from multi-lane to two-lane, dual to single carriageway):
   a. Are there sudden changes of alignment?
   b. Does the road standard change too rapidly, or can road users clearly see and recognize the transition in good time?
   c. Would a roundabout be able to mitigate any sudden changes in standards and alignment?
13. Are existing junctions and intersections adjusted and matched to the new road appropriately (without sharp bends and gradients)?
14. Are there any constructions that will be difficult to drain and are the cross-fall and any gutter gradient adequate at the critical spots?
15. Are there places where there is a risk of flooding?

16. Will overtaking be prevented at critical places (not simply by restrictions, but also by making it quite apparent that overtaking is prohibited)?
17. If signs and road markings have been proposed:
    a. Are the markings consistent and are they adequate?
    b. Has the quantity of information been kept at a reasonable level?
18. If markings have not been proposed: will special markings be necessary?
19. Is there any risk that cannot be "marked out of existence"?
20. Will there be any large sign constructions? If so; will guardrails or breakaway safety devices protect them?
21. Has it been proposed that lighting be located on the outside or inside of bends?
22. Will it be possible to carry out maintenance work (on lighting, gantries, plantations, etc.) safely and without using the carriageway or cycle path?
23. Is the landscaping design or plantation likely to lead to a lowering of safety with mature or seasonal growth? Is frangible vegetation appropriate?
24. Are there arrangements for safe access by emergency vehicles? Check the design of medians and barriers, and the ability of emergency vehicles to stop without necessarily disrupting traffic?
25. Pedestrians
    a. Have pedestrian needs been considered?
    b. If footpaths are not specifically provided, is the road layout safe for use by pedestrians, particularly at blind corners and on bridges?
    c. Are pedestrian subways or footbridges sited to provide maximum use?
    d. Is the avoidance of footbridges or subways possible by crossing the road at grade?
    e. Has specific provision been made for pedestrian crossings, school crossings or pedestrian signals?
    f. Are pedestrian refuges/kerb extensions needed?
    g. Whether needs of disabled road users taken care of?
26. Have the needs of public transport users been considered? Are bus stops positioned for safety?
27. Is lighting envisaged in specified locations of the project? Are the difficulties of illuminating sections of the road caused by trees or over bridges, for example? Are there any aspects of the provision of the lighting poles, which would require consideration from the safety point of view in their being struck by vehicles?
28. Is adequate safe access to the work site available?
29. Are there any factors requiring specific road safety provision, including maintenance?
30. Are there any traffic management features, which would require special attention during construction or during the transition from construction to full operation?
31. Other checks made at discretion of auditor or client.

K.4 CHECKLIST 3 - Audit: Stage 3 (Completion of Detailed Design)

1. Have all recommendations from the previous stage been followed? If not, reasons thereof?
2. Visibility, sight distance
   a. Are horizontal and vertical alignments consistent with the required visibility requirements?
   b. Confirm whether the standard adopted for provision of visibility in the design is appropriate for the ruling design speed and for any unusual traffic mix.
   c. Check whether sight lines are obstructed by:
      i. Safety fences
      ii. Boundary fences
      iii. Street furniture
      iv. Parking facilities
      v. Signs
      vi. Landscaping
      vii. Bridge abutments
   d. Check whether railway crossings, bridges and other hazards are conspicuous.
   e. Will sight lines to be obstructed by temporary features such as parked vehicles in lay-byes or parked or queued traffic has been taken care of?
3. Check whether the design standards are appropriate for all the new requirements of the proposed project and check for consistency of general standards and guidelines such as lane widths, camber and cross-fall.
4. Cross-sections:
   a. Are cross-falls appropriate?
   b. Is there a suitable gutter gradient or is the carriageway laid at a suitable height above the shoulder?
5. Lighting columns, traffic signals, sign standards, etcetera:
   a. Have requirements on safe distances to carriageway and cycle path been observed?
   b. Have breakaway safety devices or such like been proposed?
6. Signs and markings:
   a. Are markings consistent along the entire road section?
   b. Is the information clear?
   c. Are there enough signs?
   d. Are there too many signs?
   e. Will signs mask each other or traffic signals (be sure to include all plans for signs and markings in your assessment)?
   f. Are the signs correctly positioned, without obstructing sight distances/visibility in anyway?
7. Are the proposed types of kerb stone/edge marking appropriate?
8. Lighting:
   a. Is there any risk that the lighting can be optically misleading and will it have any detrimental effects on traffic signals and signs?
   b. Are there any unlit areas that could conceal hazards?
   c. Will an illuminated side road mislead road users on the planned, unlit road?

d. Are all pedestrian crossings illuminated (not merely the formally marked crossings, but also unmarked places where pedestrians could be expected to cross)?
e. Will powerful illumination of adjoining areas or strongly illuminated advertisements cause problems?

9. Junctions, interchanges and their design:
   a. Will road users coming from all directions (including side roads) be able to see that they are approaching a conflict area? Are give-way lines, stop lines, turning lanes and ramps clearly visible?
   b. Are existing conjoining and intersecting roads appropriately adjusted and matched to the new road (without sharp bends and gradients)?
   c. Do the routes of road users through the junction seem clear for all directions and manoeuvres?
   d. Is there sufficient space for all types of vehicles to undertake all manoeuvres?
   e. Are the crossing facilities for pedestrians and non-motorised traffic adequate and safe?
   f. Can parking cause problems?
   g. Have roundabouts been considered?

(In urban areas, ghost markings and left-turning lanes with islands are safest; they prevent overtaking and assist pedestrians and cyclists who are crossing the road.)

10. Decide whether or not old, unremoved section of road can give undesired optical directions.
11. Special points at roundabouts:
    a. Are all entrance lanes curved and is speed adequately reduced?
    b. Will the central island be visible?
    c. Are the measures taken for the benefit of pedestrians from safe stopping distance and cycle traffic adequate?
12. At the junction/transition to existing roads (especially from multi-lane to two-lane, dual to single carriageway):
    a. Are there sudden changes of alignment?
    b. Does the road standard change too rapidly, or can road users clearly see and recognise the transition in good time?
    c. Would a roundabout be able to mitigate any sudden changes in standards and alignment?
13. Are existing junctions and intersections adjusted and matched to the new road appropriately (without sharp bends and gradients)?
14. Guardrails, hedges and railings:
    a. Are all vulnerable areas protected?
    b. Are bridge pillars, steel posts and trees etc., protected by guardrails where necessary?
    c. Are there places where hedges are necessary to prevent pedestrians from crossing?
    d. Are the chosen hedges/guardrails "light" enough?
    e. Does guardrails/road side furniture have any hazardous sharp protruding edges?
15. Road surface:
    a. Has a porous type of surface been chosen?
    b. Will an exceptionally high-friction surface be necessary in especially exposed places?
    c. Would a change of surface as a purely visual signal to road users be of benefit? Used in this way, could a change of surface be misunderstood by road users?

16. At junction/transition to existing road network (especially from multi-lane to two-lane, end of central reserve)
    a. Is there sufficient advance warning?
    b. Are reflector posts correctly positioned?
    c. Are ghost markings appropriate in connection with the merging of two lanes?
    d. Is there continuity of edge markings?
17. For two-lane sections prepared for expansion to four lanes with central reserve (e.g. expressways built as "semi-motorways"):
    a. Will road users be clear everywhere that they are not on a one-way, two-lane carriageway?
    b. Should night illumination of signs be of extra high standard?
    c. Is overtaking prevented at all points where prevention is necessary?
    d. Should special measures be adopted at bridges built with a view to future expansion?
18. Examine adjoining areas for potential safety problems (airfield, signals for maritime traffic and railways, flying golf balls etc.).
19. Additional temporary signs will be necessary for most new constructions. In this context consider:
    a. Is the text, etc. comprehensible and correct?
    b. Have all signs etc., been positioned safely?
    c. When will they be removed?

(Be sure also to use the separate checklists for specific facilities and measures.)

20. Landscaping:
    a. Is there advertising conflict between landscaping and visibility requirements? Has ultimate growth height been considered and potential obstructions to pedestrian visibility and potential for trees to become collision objects?
    b. Will maintenance of soft landscaping be safe?
21. Plantations:
    a. Will plantations obscure visibility and has a maximum height been specified?
    b. Are plantations likely to encroach on markings or lighting?
    c. Will fully-grown trees constitute a hazard (have the requirements on distances to rigid obstacles be observed)?
    d. Can maintenance be carried out safely?
22. Lay byes:
    a. Are there any lay-byes available in the section?
    b. Is the bye properly located and it is not inconvenient to the drivers to stop the vehicles?
    c. Is there any need to modify the lay-bye design (if yes, suggest the parameters that need modification)?
    d. Are advance warning signs and markings properly guiding the driver about the lay-bye?
    e. Is there any need of any additional signs and markings?
23. Check provision for pedestrians to cross safely at intersections, signalised and pedestrian crossings, refuges, kerb extensions and at other locations.

24. Are median barriers necessary and have they been properly detailed? Are there any design features such as end conditions which require special attention?
25. Are there any poles located adjacent to moving traffic which could be sited elsewhere?
26. Have frangible or breakaway poles been detailed?
27. Is the unprotected median width adequate to accommodate lighting poles?
28. Are there any obstructions, which are likely to create a safety hazard and can they be mitigated or relocated?
29. Is a crash barrier provided wherever necessary and is it properly detailed?
30. Check whether access to structures and road furniture is safe. Check that the road or utilities in the road reserve can be maintained safely. Both road users and maintenance personnel should be considered.
31. Check that the requirements for the traffic management of the construction site and safety measures needed for workers and road users have been adequately spelled out from the safety point of view including the transition from the existing arrangements to the construction site and from the construction site to the final layout can be effected safely.
32. Check for the arrangement for temporary and permanent traffic control devices, including possible signals, temporary diversion etc.
33. Check that the design duly considers the needs of persons with disabilities.
34. Other checks made at discretion of auditor or client.

K.5 CHECKLIST 4 - Audit: Stage 4 (During Construction Stage)

1. Have all recommendations from the previous stage been followed? If not, why not?
2. Whether information regarding the construction zone approaching has been provided well in advance or not?
3. Whether standard procedure and contract conditions provided for proper management of the construction site and road users are properly and safely accommodated?
4. Whether the transitions from the existing road to the site of works safely and clearly laid out?
5. Whether the width of the lanes is satisfactory for the traffic passing through the works area?
6. Whether sight and stopping distances adequate at site of works and at intersections?
7. Whether bus stops appropriately located with adequate clearance from the traffic lane for safety and visibility.
8. Whether appropriate street lighting or other delineation provided at the road works to ensure that the site is safe at night? Check the night time visibility of traffic control devices.
9. Check for proper education and training programme for site operators and managers, which would assist in creating and maintaining safer environment for construction workers and road users.
10. For clear and sufficient information to the road user, advance warning signs installed or not?
11. Is there any provision of marked lanes for safe and clearly guiding road users?

12. Whether suitable measures provided through construction zones to control driver behaviour?
13. Check for the adequacy of traffic control devices (such as signs, markings, cones, drums, delineators, barricades, flashing lights etc.) required for each zone i.e., at advance warning zone, at approach transition zone and at work zone? Check for placement and visibility of these control devices.
14. Has permission been taken while changing the standard layouts from safety point of view?
15. Whether police and other emergency services been consulted?
16. Check for proper care and attention for pedestrian and non-motorised traffic at construction sites.
17. Check for adequate safety provisions for the elderly and persons with disabilities.
18. Whether construction workers provided with protective clothing etc. reflecting jackets, hard hats, gloves etc.?
19. Whether flagmen are available on duty at the appropriate places? Check for proper traffic management practice to avoid inhibiting traffic to pass clear of work site and necessary attention to roadside safety.
20. Whether the temporary diversion is provided at work zones in compliance with the contract and traffic management plan approved by the Engineer.
21. Whether the Traffic Management Plan at work site prepared and submitted by the Contractor to the Engineer for approval.
22. Is the Supervision Engineer ensuring the required quality of traffic management plan?
23. Whether arrangements of First Aid Box and other emergency care exist for persons getting injured.
24. Whether suitable speed reducing measures are provided at work zones.
25. Other checks made at discretion of auditor or client.

K.6 CHECKLIST 5 - Audit: Stage 5 (Completion of Construction/Pre-Opening)

1. Have all recommendations from the previous stages been followed? If not, why not? (*Involve the site engineer*)
2. Test the installations of traffic control devices as a road user: by car, by truck, by bus, by cycle and on foot - from disabled road user angle. Also in the dark/ night hours.
3. Examine the carriageway for defects, especially at junctions to existing roads.
4. Has the opening of the road facility been adequately publicized?
5. How will the transition phase proceed?
6. Check that provision for emergency vehicle access and stopping is safe?
7. Check that all delineators and pavement markings are correctly in place.
8. Check that all signs and other traffic control devices are correctly in place. Check that they are likely to remain visible at all times.
9. Check that the road markings as installed have sufficient contrast with the surfacing and are clear of debris.
10. Check that all lighting operating is effective from safety point of view.
11. Check that no roadside hazard has been installed or overlooked.

12. Check that the form and function of the road and its traffic management are easily recognised under likely operating conditions.
13. Check that all temporary arrangements, signing, etcetera have been removed and replaced by permanent arrangements.
14. Other checks made at discretion of auditor or client.

K.7 CHECKLIST 6 - Audit: Stage 6 (On Existing Roads or During Operation &Management)

1. Carryout inspection - do not forget to take the results of accidents analysis and relevant checklists with you.
2. Does the actual function of the road correspond to its intended function?
3. Are the prevailing speed levels within desirable limits?
4. Do the equipment and standard of the road correspond to its function, speed level and classification? (Use checklist 2 and 3, as well as any specific checklists, which are relevant.)
5. Do road users park in ways that could constitute hazards?
6. Do plantations obscure visibility or the view of signs?
7. Are the surface and carriageway markings in good condition?
8. Are there any signs that road users drive over islands or kerbs or that the routes taken by motorists through junctions and bends are less than ideal?
9. Are there signs of other conflict situations and minor accidents?
10. Are the specified distances to rigid obstacles maintained for all groups of road users?
11. Are medians and islands of adequate width for the likely users?
12. Are there signs of pedestrian traffic in places that seem hazardous to pedestrians?
13. Does there appear to be a need for more or better crossing facilities for pedestrians?
14. Does there appear to be a need for more or better facilities for cyclists?
15. Has due consideration been given to children, the elderly, persons with disabilities?
16. Are bus stops and bus bays safely located with adequate visibility and clearance to the traffic lane?
17. Any provisions for parking satisfactory in relation to traffic operations and safety?
18. Are all locations free of construction or maintenance equipment, and any signing or temporary traffic control devices that are no longer required?
19. Are overtaking opportunities available for heavy vehicles where volumes are high?
20. Are the road boundaries free of any activities that are likely to distract drivers?
21. Is the location of rest areas and truck parking areas along the route appropriate and adequate?
22. Is sufficient warning provided in advance of breaks in service roads and openings in medians for traffic using multilane highway?
23. Are there reasonable traffic calming measures in place for the road stretches passing through habitations and built up areas?
24. Other checks made at discretion of auditor or client.

K.8 CHECKLIST 7 - Planning

1. Is there a development plan or development strategy for the area and, if so, does the project conform to this?
2. Is the proposed design appropriate in relation to the forecast traffic volumes, traffic characteristics and the adjoining land use?
3. Does the route fit in with the physical constraints imposed by the topography? Does the route serve major generators of traffic in a safe and adequate manner?
4. Is the frequency of junctions and their type appropriate for the function of the road and its design speed?
5. Does the project road fit in well with the existing road network? (Check for potential problems at the connections - will changes in traffic volumes cause problems)
6. Does the project road relieve routes or sites with bad accident records? Does it have any harmful effects on safety on the surrounding road network?

K.9 CHECKLIST 8 - Alignment

1. Is the proposed design speed appropriate to the function of the road, the mix of traffic likely to use it, and the road environment? (Check whether different sections need different design speeds?).
2. If the speed is not up to the mark of design speed, whether proper cautionary sign have been provided?
3. Does the alignment (horizontal and vertical) give sufficient forward visibility for the selected design speed? (Check for inadequate stopping sight distances)
4. Check for consistency throughout the route; note any location where alignment standard changes abruptly and is not as would be expected by drivers.
5. Do the horizontal and vertical alignments fit together comfortably? (Check for bad combinations, such as a sharp bend immediately after a summit curve, and sag curve within a bend).
6. Does the alignment provide safe overtaking opportunities? Does it avoid creating situations where the forward visibility is marginal for overtaking (neither clearly adequate nor inadequate)?
7. Does the treatment at curves, proposed if any, make appropriate, adequate and safe provision for transition curves, super elevation and carriageway and formation widening?
8. Does the vertical alignment pose excessive demands on the power of heavy vehicles? Has it been designed so those maximum grades are interspersed with recovery grades? Are there passing places to enable faster vehicles to overtake slow-moving heavy vehicles?
9. Is the transition between project road and the existing road(s) i.e., access roads handled safely?

K.10 CHECKLIST 9 - Cross-Section

1. Are the widths of the carriageway, shoulders, medians (if any), service roads in accordance with standards and adequate for the function of the road and volume and the mix of traffic likely to use it?
2. Check whether bridges have footpaths and they have proper gradients/crash barriers.
3. Note any location where the cross-section standard changes abruptly along the route or is otherwise inconsistent with driver expectations.
4. Identify any locations where the capacity of the roadway is restricted and note locations of regular traffic congestion.
5. Have the shoulders and side slopes been designed to a safe standard and note any locations with inadequate shoulder width?
6. Have the side drains been designed to a safe standard? Are the batter slopes and drains safe for run-off vehicles to traverse?
7. Is the transition between the project road and the existing road(s) handled safely? (Check for major changes in standards).
8. Check whether the cross-section has adequate provision for the Vulnerable Road Users including persons with disabilities:
    a. Pedestrians: Have paved footpath, adequate refuge width on median and proper ramps, up and down kerbs, where there is regular pedestrian traffic?
    b. Bicyclists: Segregated areas (e.g. paved shoulders) where numbers are significant.

K.11 CHECKLIST 10 - Junctions

General

1. Is the general layout of junction caters safely for all road users including disabled road users? (Check whether there are other junctions too close to it. Check whether approaching drivers will get a clear view of it. Check with respect to pedestrians, cyclists and two wheelers etc.)
2. The type of junction (T-type, staggered, signal controlled, roundabout) suitable for the function of the two or more roads, the traffic volume, the traffic movements (pedestrians and vehicular) and the site constraints? Is it safest alternative?
3. Is the layout of the junction adequate for all permitted vehicular movements and for all types of vehicles?
4. Will the general type of junction, its layout and the priority rules be recognised by approaching drivers well in time? Is the route through junction as simple and clear as possible? (Check for unusual or over-complicated layouts? Check that signages and marking are correct and clear?)
5. Does the layout encourage slow controlled speeds at and on the approach to stop/ give way lines and other critical decision points? (Check for Y and skew junctions, which can be a problem. Also roundabout with inadequate deflection?)
6. Are the sight lines at and on the approach to stop/give way lines and other critical decision points adequate and unobstructed? (Check for Y and skew junction, which can be problem. Check signs, lighting columns, pedestrian guardrails etc.?)

7. Is there adequate provision for channelising the different streams of traffic? (Check the provision for right turn lanes, deceleration lanes and acceleration lanes?)
8. Is adequate provision made for pedestrians and non-motorised vehicles?
9. Is the provision of night time lighting adequate, if not what the deficiencies are?
10. Are junction(s) at that stretch having proper markings, signs and studs to avoid accidents?

Roundabouts

1. Is the geometry simple and easily understood? (Pay attention to roundabouts which are not circular, or which have awkward entry paths).
2. Are there too many entries for safe efficient operation? Are they sufficiently separated from each other to avoid confusion?
3. Does the design deflect entering traffic sufficiently to ensure entry speeds are safer? (Check entry path curvature, centre island size and positioning).
4. Is there visibility for entering traffic adequate? (Check if visibility is too good, if it encourages entry speeds which are too high)
5. Is the visibility for circulating traffic adequate?
6. Has the Central Island been designed to be forgiving to errant vehicles?
7. Has adequate provision been made for pedestrians to cross the arms of the junction?
8. Have the needs of cyclists and other non-motorised vehicles been considered?
9. Does the signing make the priorities clear? (Entering traffic must giveway to circulating traffic).

Signal-Controlled Junction

1. Does the signal sequence conform to the requirements of the regulations and standards?
2. Do the signals clearly indicate which movements are allowed at any one time? Are the timings of various phases of signal cycle adequate?
3. Are the signal heads positioned so that drivers can see them easily, and in time to react (stop or go)?
4. Are the signals for competing phases located in such a way that they are visible only to the traffic for which they are intended?
5. Are all right turning movements protected as far as possible?
6. Do the signing; marking and channelisation make it clear to drivers what path they should take through the junction?
7. Are pedestrian crossing places marked, and are pedestrians channelled to these crossings?
8. Are the pedestrian signals positioned so those pedestrians can see them?
9. Whether the pedestrian crossing signal controls are provided where appropriate? If so, there is a need for the crossing movements to be fully protected from conflicting traffic movements for example where there will be serious conflicts with turning traffic.

Vegetation and Plantation

1. Is the top of vegetation in the traffic island as well as channelisers, dividers less than 600 mm above the road top level for a length of 15 m from the end of the dividers?
2. Is the vegetation/plantation at the corners of the junction retracted for enough back from the edge of the shoulders to afford clear view of approaching traffic to the driver?
3. Are there no branches of trees projecting over the road berms/pavement at a height less than 7 m?

K.12 CHECKLIST 11 - Road Signs

1. Is the provision for road signs (regulatory, warning and informatory signs and delineators) adequate and in accordance with standards? (Check with respect to size, shape and placement etc.)
2. Check for any unauthorized traffic signs and use of non-standard signs (colour and shape).
3. Location and spacing of signs:
   a. Note locations where there are too many signs placed.
   b. Note the signs placed too close to each other.
4. Note if all traffic signs are clearly visible and are prominently displayed for the intended road users.
5. Find any instances where the legibility of the information on traffic signs is inadequate, bearing in mind the speed of vehicles and the amount of information displayed.
6. Determine effectiveness of traffic signs by observing them at night and identify any lack of reflectivity.
7. Examine type of sign posts used and record situations where sign posts constitute a fixed roadside hazard or where the use of frangible sign posts should be considered.
8. Are there any situations where traffic signs themselves are obstructing essential 'Line of Sight' for drivers and pedestrians.
9. Regulatory and Warning signs:
   a. Are appropriate regulatory signs provided where necessary?
   b. Are warning signs provided only where they are warranted?
10. Informatory signs:
    a. Has signing been done on a systematic route or regional strategy that it is logical and meets needs of unfamiliar driver?
    b. Are all important junctions provided with advance direction sign, distance information sign and intersection sign etc.?
    c. Are these signs correctly positioned to enable the required timely action to be taken by the intended drivers?
    d. Find instances of poor legibility and poor arrangement of information on signs.
    e. Overhead signs - size, message information adequate, languages as per IRC standards.

K.13 CHECKLIST 12 - Road Markings

1. General adequacy and visibility of road markings, during day/night time and in wet/ dry weather conditions
2. Has correct type of markings been used in various situations (e.g. lane line, edge line etc.)?
3. Are correct colours used for laying road markings?
4. Is there any deficiency in the delineation of merge and diverge areas, including situations where 'through' traffic may inadvertently lead into auxiliary and turn lanes?
5. Are zebra crossing markings provided at junctions and mid-blocks of the sections(depending upon the movement of pedestrian)?
6. Is positioning of stop lines appropriate?
7. Are the directional arrows marked on the pavement guiding the driver or creatingconfusion to the driver?
8. Are there locations where there is a lack of 'Hazard markings' at approach end ofisland, medians and culverts/ bridges etc.?
9. Have retro-reflective markers been installed? Where coloured markers are used, havethey been installed correctly?
10. If chevron alignment markers are installed, have the correct types of markers beenused?

K.14 CHECKLIST 13 - Lighting

1. Is there any need of lighting on the project roads, or parts of it, to be lighted at night(particularly where there are pedestrians and parking along the road) importantinterchanges, bus bays, truck lay byes, toll plazas?
2. Are the proposed lighting scheme and illumination levels of an appropriate standard,consistent with the needs of the location, pedestrian and other factors?
3. Identify the locations where street lighting columns constitute a hazard to traffic (on theoutside of sharp curves, on small islands, noses of medians) or which may conflictvisually with traffic signals or signs?
4. Does the existing street lighting enhance as 'route guidance', rather than confuse thedrivers' ability to 'see the direction of the route ahead'?
5. Are the appropriate types of poles used for all locations and correctly installed(e.g. slip-base at correct height, rigid poles protects if within clear zone)?
6. Has lighting for signs, particularly overhead signs, been provided where necessary?
7. Are there any lighting or telephone poles close to the edge of the berms so as to posehazard to traffic?
8. Are there any lighting poles in the median unprotected by crash barriers?

K.15 CHECKLIST 14 - Roadside Hazards

1. Is a clear zone provided in accordance with the guidelines? Is the appropriate treatment or projection provided for any objects within the clear zone?
2. Are bridge and culvert parapets and other obstructions close to moving traffic? If so, can they be relocated? If not, are they adequately provided with signs and, where necessary, protected by safety barrier?
3. Are bridge parapets designed to contain errant vehicles, where the speed and volume of traffic warrants them?
4. Are the ends of bridge parapets, bridge railing and pedestrian guardrail/crash barriers of a safe design?
5. Are there any poles or columns along the road and comment on whether some or anyof them can be removed, relocated to less hazardous positions etc.
6. Is there a degree of hazard associated with large trees, boulders, etc. and whether these can be treated to improve roadside safety?
7. Do the trees and other vegetation obstruct driver and pedestrian sight lines, which are essential for safe traffic operation?
8. Are there any 'fixed roadside objects', which occur within the roadway? Comment on the need to treat them in terms of road safety?
9. Is there an existence of roadside stalls and other roadside business activities within the right of way of the road?
10. Are the provided crash barriers suitable for the purpose?
11. Is the length of crash barrier at each installation adequate? Are the crash barrierinstalled correctly?
12. Is the provided barrier/fencing in the clear zone free of separate horizontal rails?
13. Is there adequate delineation/visibility of barriers and fences during nighttime?
14. Are there any thorny bushes by the roadside, whose branches are likely to hurt the passengers occupying the window seat of a vehicle, especially a non-AC bus?
15. Is any thick growth of vegetation by the roadside enough far back from the edge of thepavement to enable a driver to take protective steps in time if any human or animal should run across the road from behind or within the vegetation?
16. Are there any sharp edged or pointed fixtures or tops of supporting verticals on themedian crash barriers or on dividers which can hurt a motor cyclist in case of acollision or crash or loss of balance.?
17. Are there any village name boards or direction boards by the roadside with pointedends to hurt a passenger in a bus on window seat?
18. Bridges/Canal crossings: Are the open spaces by the side of ends of Parapetscovered by protective crash barriers or walls to prevent vehicles going into the river orcanal?
19. Have the roadside trees close to edge of berms, which cannot be removed for want ofpermission of tree authority, been made visible at night and day by white washing/ pasting reflective tape on them?
20. Is the height of vegetation in the median at breaks in median at junctions or for U Turnsor for pedestrian crossings reduced to less than 60 cm for a length of 20 m to afford complete visibility to drivers?
21. Is the height of vegetation in the median less than 60 cm on curves?
22. Is the median clear of any trees with trunks with girth greater than 30 cm? If not, aresuch locations enveloped by protective crash barriers?

23. Are fixing details of pipe railing such that the entire length of pipe is smooth andcontinuous without any projection on roadward side?
24. Are entrances to abandoned roads properly fenced off?

K.16 CHECKLIST 15 - Roadside Facilities

1. Do the cross-section, alignment and signages encourage drivers to adjust their speedon entering the town or village and maintain it at an appropriate level? (Check that it will be quite clear to drivers that the road environment is changing and that they slow down).
2. Is there adequate and safe provision for pedestrians and non-motorised traffic to walkalongside the road and to cross it? (Check for provision of footpaths, shoulders andsafe crossing places and whether pedestrian movements are controlled andchannelled by guardrail in busy places?)
3. Are the design and provision of roadside parking and access to properties adequate,controlled and safe?
4. Has the opportunity been taken to improve the traffic and parking situation in the town and villages through which the road passes? (Check for junction improvements, access control, provision of service lanes, parking areas and bus stops).
5. Are bus stop locations safe and proper and whether the provision for buses to stand clear of traffic lanes has been made? Also is there need for lighting at these locations for the security and safety of passengers?
6. Is there any need for overtaking opportunities along the route at regular intervals on divided roads, particularly where traffic flows are high or in hilly terrain?
7. Considerthe need for rest areas and other roadside stopping places e.g., truck stops, scenic view points, wayside picnic areas etc, and note any current 'unofficial' places where vehicles stop and the degree of hazard that this involves.

K.17 CHECKLIST 16 - Vulnerable Road Users

1. Has there been a survey of non-motorised vehicle and pedestrian flows?
2. Will there be any major conflicts between motorised traffic and pedestrians and other disabled / handicapped road users?
3. Have pedestrians need for crossing the road and walking safely alongside it been adequately provided for? (Check particularly in towns and villages and at all junctions - check shoulder width - check whether it is desirable and feasible to provide asegregated footway - check whether steps are provided where pedestrians will haveto climb high embankments).
4. Is the provision for pedestrians and non-motorised vehicles at bridges and narrow sections adequate in relation to pedestrian and vehicular traffic volumes and traffic speeds?
5. Have measures been taken to reduce the accident risk for children going to and fromroadside schools (Pedestrian guardrail may be needed to prevent children fromrunning out into the road)?
6. Have the need of cyclists and other non-motorised vehicles been provided for (Checkshoulder width - check the need and feasibility of segregated cycle/cycle rickshawlanes, especially in towns)?
7. Are bicycle safe grates provided at drainage pits where necessary?
8. Does the volume of motorcycle traffic justify the provision of separate lanes? (Checkin towns).
9. Are bus stops appropriately located with adequate clearance from the traffic lane forsafely and visibility?
10. Where necessary, is fencing installed to guide pedestrians and cyclists at crossings or overpasses?

CHECKLIST 17 - Development Proposals

1. Horizontal Alignment:
   a. Is visibility satisfactory at proposed access, including that for pedestrians?
   b. Are curve radii and forward visibilities satisfactory?
   c. Are verge widths satisfactory?
2. Vertical Alignment:
   a. Are gradients satisfactory?
   b. Are sight and stopping distances maintained?
3. Parking Provision:
   a. Is off-site parking adequate to minimise on street parking and associated risks?
   b. Are parking areas conveniently located, with adequate turning facilities?
4. Servicing Facilities:
   a. Are off street loading/unloading areas provided?
   b. Are there any turning facilities for large vehicles?
   c. Is emergency vehicles access provided for?
5. Landscaping:
   a. Does landscaping affect visibility at junctions, bends or access points?
   b. Is tree planting proposed where vehicles are most likely to run off road?
6. Traffic Signs and Road Markings:
   a. Have necessary traffic signs and road markings been provided as part of development?
7. Other Traffic Control Devices - Road Side furniture, delineators, crash barriers, guard rails, etc.
8. Others:
   a. Will there be area-wide effect on other roads?
   b. Will design keep speeds down where necessary?
   c. Are number of access points to busy roads minimised by layout?
   d. Are footpaths (sidewalks) necessary and provided adequately?
   e. Are cycle tracks required?
   f. Is street lighting required/ adequate?
   g. Are bus bays and stops safely located?
   h. Are dropped crossings provided at preferred pedestrian route or crossing points?
   i. Is pedestrian guardrail provided where walkways join the highway?
   j. Are truck lay byes required?
   k. Are toll plazas congestion free?

K.18 CHECKLIST 18 - Maintenance Work

1. Is it publicised to the necessary extent about road works, including applicable speedlimits and diversions?
2. Are temporary traffic signals or road markings adequate and does the message reachall road users?
3. Has a temporary speed limit been suggested and is it proper?
4. Will the unaffected road users misunderstand temporary traffic signals?
5. Is the standard of proposed signs adequate?
6. Will it be necessary to illuminate critical points?
7. Will the work site, enclosing material, etc. behave as a rigid obstacle?

8. Will there be safe access to the work place?
9. Has a safety zone been proposed and is it adequate?
10. Has due consideration been given to ail groups of road users in the layout of staggering and diversions?

Appendix L. Waste Water Recycling Techniques

L.1 Waste Stabilisation Pond Systems (WSPS)

Key features of the technology

- Simple to construct, operate and maintain
- Does not involve installation of expensive electro-mechanical equipment
- Operates on a combination of solar energy and natural forces and thereby has very low O&M costs.
- Extremely robust and can withstand hydraulic and organs shock loads
- Effluents from maturation pond are safe for reuse in agriculture and aquaculture.

Performance

- Can reliably produce high quality effluent with low BOD, SS, Fecal Coliform and high DO levels.
- BOD reduction of the order of 90% and more
- Suspended solids reduction is somewhat less due to possible overflow of algae
- Coliform reduction could be upto 6 long units
- Total nitrogen removal between 70-90%
- Total phosphorus removal between 30-45%

Specific requirements

- In case of unlined ponds, soil and geo-hydrological survey during planning stage to assess risk of groundwater contamination.
- Sulphate concentration in raw wastewater under 300 mg SO4/L to avoid odour nuisance.

Applicability

- Suitable under warm Indian climatic conditions
- For areas with easy availability of land
- In areas with social preference for aquaculture
- In areas with low, unreliable or expensive power supply.

L.2 Duckweed Pond System (DPS)

Key features of the technology

- Natural and simple wastewater system involving sheltered pond like culture clots
- A large pond subdivided into smaller cells through floating bamboo or other material to break the wave and wind action.
- Extremely rapidly growing floating duckward vegetation serving as a dynamic sink for organic carbon, dissolved nutrients and minerals.
- Thick mat of duckweed out competing and inhibiting growth of other aquatic plants.
- Pond functioning as a facultative lagoon with deeper layers under anaerobic environment.
- Retention period in the system 7-21 days
- Continuous process requiring intensive management for optimum production.
- Yield of large quantities of proteinaceous matter as fish feed or as a supplement for animal feed.

Performance

- **Can meet Indian discharge standards for BOD and SS.** Removal of Ammonical nitrogen (N) and Dissolved Phosphates (P) is also substantial.
- For settled wastewater, BOD and SS below 30mg/L are attainable at 12 detention.
- High nutrient and mineral removal due to uptake by duckweeds.

Specific requirements

- Primary treatment including screening, grease trap, grit removal and sedimentation.
- Preferably the influent BOD, SS and ammonia to be under 80 ppm, 100 pm and 50 ppm respectively.
- A series of smaller cells of around 10m x 10m to 10m x 30m to break the continuum in the pond (cell size as a function of wind speed, pond size and wave action.
- Cell borders made with floating bamboo mats or PVC profiles to shelter from wind and wave action
- Impermeable lining of clay or artificial liners in case of pervious and fractured strata
- Outlet structure with variable weir height
- Nitrogen loading of around 9 km/ha/day
- Small size culture ponds for duckweed seeding and as fish nursery ponds.
- Duckweed drying and processing unit in case of large harvest and for sale as animal feed
- In case of downstream aquaculture ponds – introduce suitable species of fishes e.g. Grass Carp., Common Carp, Silver Carp, Rohu, Mingal, Cattle and freshwater prawns.

Applicability

- Low strength domestic wastewater or after primary sedimentation with influent BOD – 80mg/l
- In combination with existing WSP
- **Rural and semi urban settlements** with easy land availability
- As a polishing pond for an existing activated sludge plant or other technology based STPs

L.3 Facultative Aerate Lagoon (FAL)

Key features of the technology

- Simple flow scheme without primary or secondary settling and sludge recirculation
- Deep lagoon with anerobic bottom layer and aerobic top layer.
- Simultaneous degradation of sludge in the bottom and dissolved organics in the top layer.
- Lower energy input corresponding to requirement for maintaining only desired DO levels in the top layer and not for creating completely mixed conditions.

Performance

- As per the information in literature based on Indian experience the following performance is expected from a well-functioning aerobic lagoon:
  - BOD removal 70-90%
  - Suspended solids removal 70-80%
  - Coliform removal 60-99%

Specific requirements

- Typical hydraulic detention time 3 days or more

- Depth between 2-5 m depending on local soil and groundwater conditions
- Effective outlet structure with baffles and stilling basin to prevent solids overflow.

Applicability
- Standalone system for sewage treatment
- As a pre-treatment unit for WSP
- As an up-gradation option for overloaded WSPs.

L.4 Trickling Filter (TF)

Key features of the technology
- A proven 100 year old technology
- Rugged system with simple and silent operation
- Lower process monitoring requirement as compared to ASP
- Consistent effluent quality.

Performance
- Performance of a slow rate trickling filter is comparable to ASP

Applicability
- Standalone treatment for sewage if operated at slow rates
- As a high rate roughing filter for high BOD wastewater.
- In combination with ASP for good and consistent performance

L.5 Activated Sludge Process (ASP)

Key features
- Proven and tested for more than 7-8 decades all over world
- Several modifications possible to meet specific requirements.

Performance
- Very good performance in terms of BOD and SS. Treated effluent can most often **satisfy the current Indian effluent discharge standards.** Performance is critically dependent on sludge settling characteristics and design of secondary clarifier. Sludge settling characteristics are typically influenced by bio-flocculation which in turn depends on growth rate of micro-organisms. Growth rate is generally controlled by controlling biological solids retention time / food to micro-organism ratio.

Specific requirements
- Un-interrupted power supply for aeration and sludge recirculation
- Maintenance of biomass concentration in the aeration tank and proper settling in the secondary clarifier.

Applicability

- The most widely used option for treatment of domestic wastewater for **medium to large towns** where land is scare.

L.6 Biological Filtration and Oxygenated reactor (BIOFOR) Technology

Key features of the technology

- Enhanced primary treatment with addition of coagulants and flocculants.
- High rate primary tube settlers and integrated thickening offering space economy.
- Two stage high rate filtration through a biologically active media and with enhanced external aeration.
- Co-current up flow movement of wastewater and air enable higher retention and contact.
- Treatment scheme excluding secondary sedimentation but recycling of primate sludge.
- Deep reactors enabling low land requirements.
- A compact and robust system.

Performance

- Suspended solids and BOD removal of 90% and 70% respectively in the primary clarifier.
- High quality effluent with BOD 10mg/L and total system efficiency of 94-99.9%
- Low turbidity with suspended solids under 15 mg/L and total system efficiency of 98%
- Pathogen removal of 2 on the log scale.

Specific requirements

- Addition of alum as coagulant (~@60 ppm)
- Polyelectrolyte for high rate sedimentation (~@0.2-0.3ppm) in tube settlers.
- Special and patented granular filter media `Bioloite' made of clay.
- Backwash of BIOFOR bed and recycle of the wastewater.
- Treatment (digestion) and disposal of sludge from clarifier (not provided at the STPs due to space limitations)

L.7 High rate Activated Sludge Biofor –F Technology

Key features

- In general, high level of mechanization and sophistication
- The flow scheme excludes primary sedimentation tank
- Superior aerated grit chamber and classifier
- Circular aeration tank with tapered air diffusion system
- Second stage aeration and rapid sand filtration through a biologically active filter media
- Dissolved air floatation for sludge thickening.
- Digester hearing and temperature controller anaerobic sludge digestion.
- Mixing of digester contents through biogas.
- Dynamic cogeneration of electrical and thermal energy through gas engines.

L.8 Fluidized Aerated Bed (FAB)

Key features of the technology

- A compact and robust system involving extended aeration process with submerged aeration
- Biomass growth on fluidized bed of plastic media enabling retention of biomass and long solid retention time in the reactor leading to low food to `micro-organism ratio' and higher organic removal.
- Two stage biological oxidation
- Flexibility in handling organic load by adjusting quantity of fluidized media
- Reactors upto 5 m deep enabling low land requirements
- Tube settlers again offer space economy
- Ability to withstand limited organic overload

Specific requirements

- Special grade plastic proprietary media custom made for offering high specific surface area
- Diffused aeration system
- Submerged stainless steel screens at the outlet of FAB reactors to prevent media overflow
- Tube settlers for compact clarifier.

Options

- Addition of coagulant and polyelectrolyte for compact plants
- Tertiary treatment of chlorination
- Sludge treatment through thickner and bag filter press or drying beds.

Performance

- High BOD removal with effluent concentration under 10mg/L
- High suspended solids removal with effluent concentration under 20mg/L
- Faecal coliforms removal of the order of 2-3 log scale at FAB-2 stage.

Applicability

- The FAB technology based system is particularly applicable for:
  - Small to medium flows in congested locations
  - Sensitive locations
  - Decentralized approach
  - Reliving existing overloaded STPs.

L.9 Submerged Aeration Fixed Film (SAFF) Technology

Key features of the technology

- Essentially a trickling filter with enhanced oxygen supply through submerged aeration
- Unconventional plastic media offering high void ratio and specific area compared to stone and aggregates.
- Large biomass and long solid retention time in the reactor leading to low `food to micro-organism ratio' and higher organic removal.
- Two stage biological oxidation

- Treatment scheme excluding primary sedimentation and sludge digestion
- Reactors upto 6 m deep enabling low land requirements.
- Tube settlers again offer space economy.

Applicability
- The SAFF technology based system is particularly applicable for:
  - Small to medium flows in congested locations
  - Sensitive locations
  - Decentralised approach
  - Reliving existing overloaded trickling filters.

L.10 Cyclic Activated Sludge Process (CASP)

Key features of the technology
- Essentially activated sludge process operated in batches through auto control
- Aeration and settling in one tank leading to lower plant foot print
- Savings in air/oxygen supply and hence energy
- Two levels of treatment possible depending on the requirement
- Treatment scheme excluding primary sedimentation and sludge digestion

Specific requirements
- Complete reliance on auto control, uninterrupted power supply is a must
- Diffused aeration system
- Several moving parts

Performance
- High BOD removal of 98% with effluent concentration under 10mg/L
- High suspended solids removal with effluent concentration under 20mg/L
- Faecal coliforms removal of the order of 2-3 on log scale.

Applicability
- The Cyclic Activated Sludge Process (CASP) may be applicable for:
  - Small to medium flows in congested locations
  - Sensitive locations
  - Decentralized approach
  - Reliving existing overloaded trickling filters.

L.11 Upflow Anaerobic Sludge Blanket Process (UASB)

Key features
- No mechanical components or external energy requirements in the reactor, therefore process not vulnerable to power cuts
- No primary treatment, suspended solid in the wastewater serve as carrier material for microbial attachment.

- Recovery of gas with high calorific value
- Low sludge production
- Relatively simple routine operation and maintenance
- Biological activity can be restarted without any external seeding or special care after interrupted operations.

Performance

- An UASB reactor can bring down the BOD of the domestic wastewater to 70-100 mg/L and suspended solids (TSS) to 50-100 mg/L. However, sludge washout from the reactor is possible and effluent BOD and TSS is very high during such episodes. The effluent is strongly anoxic with high immediate oxygen demand (IOD). Should not directly discharged into water bodies or used for aquaculture or irrigation without re-aeration.

Specific requirements

- Use of anticorrosive materials / paints on exposed surfaces
- Frequent cleaning / de-sludging of distribution / division boxes and influent pipes
- Skilled supervision during start-up and for control of biomass levels within the reactor
- Post treatment of the UASB effluent is invariably required.
- Control of toxic materials and sulfates in the wastewater is required for efficient operation.

Applicability

- The suitability of this technology may be doubtful as a stand-alone secondary treatment option.

Appendix M. Solid Waste Management - Best Practices

M.1 Introduction

As mentioned in Introduction chapter number 1 of volume I, Zero waste is gaining ground as being practicably achievable in Indian cities, which have the advantage of significant recycling and reuse in the solid waste management system. Those can be improved and coordinated with the view to moving towards 'zero waste' scenarios. Further, in order to achieve the SLBs, waste management techniques can be improved in all types of settlements. Some of the solid waste best practises are covered in this section, these are:

- Vellore Municipality, 2000
- Pimpri-Chinchwad Municipal Corporation (PCMC)
- Amritsar Municipal Corporation

M.2 Case: Vellore Municipality, 2000[5]

A zero waste management (ZWM) project in Tamil Nadu's Vellore district is an example of a successful Solid Waste Management programme and its benefits. ZWM is a technique of handling solid wastes that attempts to recover, recycle and reuse maximum waste.

- **Waste segregation at source**: This practice leads to reduction of space requirement for waste segregation at later stage.
- **Minimizes pollution**: ground water, land and air pollution created at landfill sites is avoided by doing away with disposal of wastes at dumpsites and landfills.

In Vellore Municipality, citizens were informed about the concept of ZWM and taught how to segregate waste at the household or respective source. Red and green dust bins were provided to each household unit for initiating waste segregation. Teams with two street beautifiers each, were formed. Each team was assigned 300 households and provided a tricycle and a set of hand tools. The tricycle had two compartments, one green and the other red, to collect organic and inorganic waste respectively.

The street beautifiers collect domestic garbage in their allocated zones. The waste collected in the households in green and red dust bins are emptied in the colour-matching compartment of the tricycle and brought to the zero waste centre. Inorganic waste is separated into more than 25 items under categories like bottles, plastics, metals, cardboard, paper, PVC etc. They are then packed and sold to local waste collectors and recyclers every month. Mixed waste (10-15 percent), which cannot be recycled, is sent to landfills.

The organic waste is composted and treated in two stages: (a) cattle dung/bio-dung composting (b) vermi-composting.

- **Cattle dung composting**: the organic waste is laid in a composting yard in large compartments and spread in different layers. Each layer is treated with cattle dung microbial inoculums. When the height

[5]India Sanitation Portal: United Nations Children's Fund (UNICEF), P Amudha

of a layer reaches 5 feet, it is covered with a polythene sheet. This first stage of composting takes 45 days. The polythene sheets trap the heat generated during anaerobic composting and increase the internal temperature to 70-75 degrees Celsius. This high temperature kills the pathogens. The moisture evaporates and condenses on the underside of the polythene. The cyclic movement of water also cycles the bacteria aiding rapid decomposition and reducing the volume to about one third in 15 days. After 50 days, the compost can be harvested, sieved and packed in bags for sale.

- **Vermi-composting**: semi-decomposed organic waste is put into vermi-composting beds after 15 days. The vermi-compost can be collected after 45 days. The rich composted manure is sieved and packed for agricultural purposes and afforestation activities.

The Vellore solid waste management project is now managed by village *Panchayats* supported by Residential Welfare Associations and SHGs. Each household and shop pays for waste collection. The funds collected from monthly subscriptions and sale of inorganic waste and organic manure are used for paying the street beautifiers and supervisors. The pilots in Vellore district are successful because of informed communities and their participation. Equally crucial to the success is the full involvement of local bodies and their commitment.

Due to information technology in Municipal Solid Waste Management (SWM) sector has equipped this sector with better management of this crucial mandatory functions under the urban domain, as per 12th Schedule of 74th CAA. Better management of SWM includes GPS based vehicle tracking system, tracking clearance of secondary collection points, GIS based shortest route identification to landfill / dumping site etc.

M.3 Case: Pimpri-Chinchwad Municipal Corporation (PCMC)[6]

Pimpri-Chinchwad is one of the cities who has done pioneering task of monitoring its SWM services through the use of ICT.

The city of Pimpri-Chinchwad located northwest of Pune, has an area 171 sq. km. with an estimated population of over 12.5 lakhs. PCMC deployed GPS based vehicle tracking system due to low capital cost of deployment and ease of operation. A step by step implementation strategy was followed at PCMC:

- **Step 1:** Selection of technology partner
- **Step 2:** Installation of GPS system on waste collection vehicles
- **Step 3:** Geo Coding of bins across the city
- **Step 4:** Development of web based application and public information system
- **Step 5:** Stabilization of system and training to stake holders

Brief on Solid Waste Management – "GPS & GIS enabled"

Geo coding of the all the bins across the city were marked on the GIS mapping database and real time vehicle movement (GPS location of the vehicle on which a GPS device was installed) were monitored against them as per route. Overall city vide 75 different routes were identified and geo coded with GIS

[6] JnNURM: Best Practices in e-Governance, MoUD (*http://www.jnnurm.nic.in/wp-content/uploads/2011/01/BP_SWM.pdf*)

map. An intelligence algorithm/logic was developed in web based application to flag the bin as “Served”, when a waste collector vehicle stops near a bin within a specified distance for a sufficient period.

Table M.1: Prior Conditions and Achievements of the Project

S. No.	Situation prior to proposed ICT based SWM system	Achievements
1	Monitoring of actual pick-up of the waste from the assigned bins/locality and the same was recorded purely on manual recording basis.	Monitor the actual movement and real time position of the vehicle.
2	Monitoring actual movement of the fleet and its productivity i.e. no. of bins picked by each vehicle on schedule basis.	Analyse the bin pick up status in real time.
3	Difficulty in tracking the non-compliance to the schedules.	Improve service delivery mechanism and achieve better information management.
4	Processes for validating the productivity of the fleet and payments were done purely based on manual records of no. of trips made by each vehicle.	Reducing the unwanted trips/detours/stoppages and enhance the productivity/utilization of the fleet.
5	Difficulty in locating the bins in a manual process.	Generate MIS and exception report to take informed decision.
6	Difficulty in monitoring actual pick up of the waste from the assigned bins/locality and dumping in the dumping yards and recoding of data is a manual process.	Greater accountability on field level staff.
7	Difficulty in preparing status reports as it is a manual process and takes a lot of time.	Timely completion of job with greater efficiency.
8		Measuring service level with benchmarks, making it compulsory to each ULB to achieve the benchmarks.
9		Improve public image and also offered a tool for RTI.

Source:JnNURM: Best Practices in e-Governance, MoUD (***http://www.jnnurm.nic.in/wp-content/uploads/2011/01/BP_SWM.pdf***)

M.4 Case: Amritsar Municipal Corporation[7]

Prior to the project, Amritsar city had no door-to-door collection of waste and heaps of garbage was seen in most of the localities. The sanitary conditions were very poor due to lack of unorganized system of collection and transportation.The Sanitation Zones of 4, 5, 6 and 7 were selected for collection and transportation of waste. The job was awarded to a private party in 2008 for operation and maintenance of the project facility.

The major activities under the project included:

- Provision of adequate machinery, equipment and staff for the project upgrading door to door services and SWM infrastructure.
- Vehicles have alarm system for house to house collection.
- Primary and secondary storage in bins.
- Prohibition of waste littering and arbitrary disposal of waste.
- Public awareness for better sanitation/ waste management.

[7]JnNURM-Toolkit for Solid Waste Management

- Provision of mobile covered bins and synchronized transportation mechanism, has removed *dhalaos* and *kudaghars*.
- Uniforms for the *safaisewaks*, drivers and supervisors etc.
- Transportation of waste through high capacity, covered vehicles.
- Provision of centralized complaint redressal system by the Contractor.
- Arrangement for processing facility with multiple product recovery (work is in progress through private participation)

Project Achievements:

- Improved door to door collection and efficient, hygienically safe transportation of waste to the landfill site.
- Improvement in the environmental conditions in the selected zones.
- Negligible littering in the streets due to awareness of the citizens, adequate bins, timely and effective collection of waste from the source and its regular transportation.
- Replacement of old *dhalaos*/*kudaghars* with colourful collection points, improving aesthetics of the area.
- Reduced manual handling of waste in collection and transportation.
- Greater awareness among citizens about cleanliness/ waste management.
- Reduction in expenditure on improving the waste collection/ transportation under SWM Rules.

Appendix N. Hierarchy of Social Infrastructure Development

Table N.1: Hierarchy of Social Infrastructure Development

Planning Unit	Population	S.No.	Facilities	No.	Area per Unit (Ha)	Total area (Ha)
Housing Area	5000	1	Pre Primary	2	0.08	0.16
		2	Primary school(I to V)	1	0.40	0.40
		3	Aanganwari - Housing area/ cluster	1	200 to 300 sqm	200 to 300 sqm
		4	Community Room	1	750 sqm	750 sqm
		5	Religious Facility	1	400 sqm	400 sqm
		6	Housing Area Park	1	0.50	0.50
		7	Residential unit play area	1	5000 sqm	5000 sqm
		8	Milk Distribution	1	150 sqm	150 sqm
		9	Convenience Shopping	1	1500 sqm	1500 sqm
Neighbourhood	5000-15,000	1	Senior Secondary School(VI to XII)	1-2	1.80	3.60
		2	Dispensary	1	0.08 to 0.12	0.08 to 0.12
		3	Community hall, mangalkaryayala, barat ghar/ library	1	2000 sqm	2000 sqm
		4	Neighbourhood park	1	1.00	1.00
		5	Neighbourhood Play area	1	1.50	1.50
		6	Local shopping including service centre	1	4600 sqm	4600 sqm
		7	Post office counter without delivery	1	85 sqm	85 sqm
		8	Bank with extension counters with ATM facility	1		
		8a	Floor area for counters		75 sqm	75 sqm
		8b	Floor are for ATM		6 sqm	6 sqm
Community	1 Lakh	1	Integrated School Without Hostel facility(I to XII)	1	3.50	3.50
		2	Integrated School With Hostel facility(I to XII)	1	3.90	3.90
		3	School for physically challanged	2	0.70	1.40
		4	College	1	5.00	5.00
		5	Nursing home, child welfare and maternity centre	1	0.20 to 0.30	0.20 to 0.30
		6	Polyclinic	1	0.20 to 0.30	0.20 to 0.30
		7	Intermediate Hospital (Category B)	1	1.00	1.00
		8	Intermediate Hospital (Category A)	1	3.70	3.70
		9	Multi-Speciality Hospital (NBC)	1	9.00	9.00
		10	Speciality Hospital (NBC)	1	3.70	3.70

Planning Unit	Population	S.No.	Facilities	No.	Area per Unit (Ha)	Total area (Ha)
		11	Family Welfare Centre	2	500 to 800sqm	1000 to 1600sqm
		12	Diagnostic centre	2	500 to 800sqm	1000 to 1600sqm
		13	Dispensary for pet animals and birds	1	300 sqm	300 sqm
		14	Music, dance and drama centre	1	1000 sqm	1000 sqm
		15	Recreational Club	1	10,000 sqm	10,000 sqm
		16	Meditation and spiritual Centre	1	5000 sqm	5000 sqm
		17	Community park	1	5.00	5.00
		18	Community level Multipurpose ground	1	2.00	2.00
		19	District Sports Centre	1	8.00	8.00
		20	LPG Godown/ Gas godown (inclusive of guard room)	2	520sqm	1040sqm
		21	Police Post	2	0.16	0.32
		22	Police Station	1	1.50	1.50
		23	Fire Station	1	1.00	1.00
		24	Community Centre with service centre	1	5.00	5.00
		25	Weekly Markets	1 to 2	0.40 to 0.80	0.40 to 0.80
		26	Organised Informal eating spaces	1	2000 sqm	2000 sqm
		27	Dhobi Ghat	1	5000 sqm	5000 sqm
		28	Telegraph Booking Counter	1	200 sqm	200 sqm
		29	Bank with locker, ATM and other banking facilities	1	2500 sqm	2500 sqm
District	5 Lakh	1	General Hospital (NBC)	2	6.00	12.00
		2	Veterinary Hospital for pets and animals	1	2000 sqm	2000 sqm
		3	Old age home	1	Max.1000 sqm	Max.1000 sqm
		4	District park	1	25.00	25.00
		5	District level multipurpose ground	1	4.00	4.00
		6	District Centre	1	40.00	40.00
		7	Cremation Ground	1	2.50	2.50
		8	Burial Ground	1	4.00	4.00
		9	Telephone exchange of 40,000 lines	1	4.00	4.00
		10	Telegraph booking and delivery office	1	1700 sqm	1700 sqm
		11	Head post office with delivery office	2	750 sqm	1500 sqm

Planning Unit	Population	S.No.	Facilities	No.	Area per Unit (Ha)	Total area (Ha)
		12	Head post office and administrative office	1	2500 sqm	2500 sqm
Zonal	10 Lakh	1	School for mentally challanged	1	0.20	0.20
		2	Technical Education Centre (A) – To include 1 Industrial Training Institute (ITI) and 1 Polytechnic	1	4.00	4.00
		3	Technical Education Centre (B) – To include 1 ITI, 1 Technical Centre and 1 Coaching Centre	1	4.00	4.00
		4	Engineering College	1	6.00	6.00
		5	Medical College	1	15.00	15.00
		6	Other Professional Colleges	1	2.00 to 6.00	2.00 to 6.00
		7	Nursing and Paramedical Institute	1	2000 sqm	2000 sqm
		8	Religious Facility	1	4.00	4.00
		9	Orphanage/ Children's Centre (One each)	1	Max.1000 sqm	Max.1000 sqm
		10	Care centre for physically mentally challenged	1	Max.1000 sqm	Max.1000 sqm
		11	Working women – men hostel	1	Max.1000 sqm	Max.1000 sqm
		12	Adult education centre	1	Max.1000 sqm	Max.1000 sqm
		13	Night Shelter	1	Max.1000 sqm	Max.1000 sqm
		14	Socio – Cultural centre/ Exhibition cum fair ground	1	15.00	15.00
		15	Science Centre	1	As per requirement	As per requirement
		16	Sub city park	1	100.00	100.00
		17	Sub city level multipurpose ground	1	8.00	8.00
		18	Divisional Sports Centre	1	20.00	20.00
		19	District office and battalion	1	4.80	4.80
		20	Police line	1	4.00 to 6.00	4.00 to 6.00
		21	District Jail	1	10.00	10.00
		22	Civil defence and home guards	1	2.00	2.00
		23	Local Wholesale Market / Mandi	1	10.00	10.00
Sub city centre	25 Lakh – 50 Lakh	1	Sub-city Centre	1	As per requirement	As per requirement
City	50 Lakh +	1	City Centre	1	As per requirement	As per requirement
		2	International Convention Centre	1	As per requirement	As per requirement

Planning Unit	Population	S.No.	Facilities	No.	Area per Unit (Ha)	Total area (Ha)
		3	Police Training Institute	1	5.00	5.00
		4	Police Firing Range	1	upto 10.00	upto 10.00
		5	Fire Training Institute/ College	1	3.00	3.00
Other Facilities		1	University Campus		10 to 60	10 to 60
		2	Veterinary Institute	As per Veterinary Council of India/ Ministry Norms		
		3	Petrol Diesel: Only filing station		30 m x 17 m	30 m x 17 m
		4	Petrol Diesel: Filling cum service station		36 m x 30 m	36 m x 30 m
		5	Petrol Diesel: Filling cum service station cum workshop		45 m x 36m	45 m x 36m
		6	Petrol Diesel: Filling station only for two and three wheelers		18m x 15m	18m x 15m
		7	CNG mother station		1080 sqm	1080 sqm
		8	Traffic and Police Control Room		As per requirement	As per requirement
		9	Police camp including Central Police Organisation/ Security Forces		upto 10.00	upto 10.00
		10	Sub fire station/ Fire Post		0.60	0.60
		11	Disaster Management Centre	One in each administrative zone	1.00 to 2.00	1.00 to 2.00
		12	Electric Crematorium	1 for large size towns	2.00	2.00
		13	Remote subscriber unit	1 for 3 km radius	300 sqm	300 sqm
		14	Reading room	City or sub city/District/ Community /neighbourhood Centre	-	-
		15	Rehabilitation Centre	As per requirement	-	-
		16	Police booth	At major intersections	10-12 sqm	

Source: Chapter 8, URDPFI Guidelines, 2014

Appendix O. The Constitution 73rd & 74th Amendment Act, 1992

Appendix P. The Right to FairCompensation and Transparency in Land Acquisition, Rehabilitation andResettlement Act, 2013

Appendix Q. The Model Regional and Town Planning and Development Law, 1985

Appendix R. The Model Municipal Law, 2003

Appendix S. National Manufacturing Policy, 2011

Appendix T. The Special Economic Zones Act, 2005

Appendix U. The Micro, Small and Medium Enterprises Development (MSMED) Act, 2006

Appendix V. The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010

Appendix W. The Environment (Protection) Act, 1986

Appendix X. The Forest Conservation Act, 1980

Appendix Y. The Cantonment Act, 2006