Footpath Fix

A guide to implementing footpaths in Indian cities

ITDP

April 2018/ Advait Jani, Pranjal Kulkarni, Nashwa Naushad

india@itdp.org
india.itdp.org

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Acknowledgements

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Contents

Introduction

Many Indian cities are now beginning to acknowledge the fundamental role of walking in everyday life. Major efforts are underway in various cities to implement 'complete streets' that cater to the needs of all, especially those who were traditionally ignored such as pedestrians, cyclists, and public transport users.

Good footpaths make walking safe and attractive. They are of an optimal height and have adequate width; are continuous, obstacle-free, and shaded; and include dedicated spaces that cater to the needs of different users of the street. The first volume of the Footpath Series by ITDP — *Footpath Design* — highlighted key concepts and standards for the design of a good footpath.

Surface design is just the first step. Construction detailing is an equally critical step that many footpath projects fail at, missing the goal of providing good walkability. Improper planning and design of utilities, along with poor execution, result in frequent excavations that affect the usability and attractiveness of the footpaths.

In this second volume — *Footpath Fix* — ITDP attempts to provide urban designers, municipal engineers and contractors guidance on construction detailing, especially that of different utilities. *Footpath Fix* aims to highlight the typical steps of project implementation in chronological order that can ensure a good product. Site conditions could necessitate reordering of these steps, as per the decision of the architect and engineers. This reference guide also highlights the precautions that must be taken at each stage of the construction process.

For a more comprehensive resource on street design, practitioners should refer to ITDP's Better Streets, Better Cities: A Guide to Street Design in Urban India, available at www.itdp.org/betterstreets.

Pre-excavation

involves preparation before excavation, trial runs and piloting a sample stretch of the proposed design.

Trial run at the intersection of DB-TV Swamy roads in Coimbatore

Preliminary preparation

to test out the proposed footpath design for on-site challenges

1 Centreline marking

The centreline, as identified in the design stage, should be accurately marked on the street as per the drawings.

The consultant should take the help of the Corporation for marking the line.

Pegs along with paint/ chalk should be used to mark the centreline in case the latter washes off.

The centreline should be used as reference for marking all other alignment lines thereafter such as median, kerb, etc

2 Kerbline marking

The footpath kerb, parking slots and property entrances should be marked using paint/chalk powder as per the proposal.

Marking on the road should be done preferably at night when vehicular movement is less and manageable.

Support & cooperation from the Traffic Police is necessary for traffic management, especially at night.

Proposed parking spaces and property entrances marked as per design

At intersections, kerbline marking should start 10m from the corner to allow for adjustment of the turning radius as required.

3 Utility boxes

Overground utility components include utility poles with overhead wires, surface-mounted feeder pillars, utility mains, transformers etc.

These may need to be upgraded, consolidated, realigned or newly installed as per the proposal and should be marked accordingly.

4 Mapping bus routes

Mapping of bus routes, one-ways and traffic movements should be done by the designers to make an informed decision on the bus shelters to be shifted/added, and also to chart out a diversion route for buses. (This mapping would have been done during design but should be updated during construction in consultation with the Traffic Police)

5 Trial run

Testing the proposal on-ground allows the designers, officials and traffic police to understand the changes required in the design. Trials are generally carried out for intersections rather than whole street stretches as they require a greater level of thought and detailing.

Appealing design patterns encourage usage during the trial run and thus help validate the design.

Prior to the trial run, necessary permission should be obtained from the Traffic Police whose support is vital for traffic management during the trial.

Cones, ribbons and barricades should be used to mark out the design. These help in streamlining vehicular movement and also allow quick changes to be made during the trial itself.

6 Pilot stretch

Following the trial run, it is advisable to pilot the construction on a stretch of minimum length (mostly without excavation) away from the intersection. This helps showcase the design, especially the materials, street furniture, etc. and also the workmanship, to stakeholders.

Pilot stretch in Coimbatore - 10m

Concrete finish

Lamp Post

Kerb Stone

Landscape Elements

Paver Blocks

Pilot stretch in Pune - 15m

7 Other formalities

Other formalities to be taken care of by the contractor and engineers prior to the execution of work on site, include:

- Necessary permissions from concerned government authorities
- Provision of alternate temporary facilities for vehicular and pedestrian movement
- Barricading of site and provision of reflectors, signages, retro-reflective sign boards, lighting, etc. for the safety of users
- Liaising closely with the owners of private properties and shops, about any reconstruction, reinstatement and relocation work, so as to cause minimum or no inconvenience.
- Abiding by safety regulations for the workers on site.

8 Demolition

of existing footpath where required, with care to avoid damage to the substructure/superstructure to be reused

The decision to demolish or retain any subsurface component like open drains and trenches, and superstructure including utility boxes, electric poles, lamp posts, etc, should be taken during the design stage in consultation with the respective line agencies. Existing components, if reusable, can be accomodated in the proposed section.

During demolition, debris should be cleared regularly from the site.

It is advisable to finish construction on one side before proceeding to the other, so there is sufficient space for movement of vehicles and pedestrians.

The contractor should make alternative arrangements for entrances, affected boundary walls, gates, etc. of private properties and reinstate the same post-completion.

Sub-surface construction

involves careful excavation and management of underground utilities, providing a firm base for laying the footpath.

D.P Road, Pune

Excavation

as per the proposed design and utilities to be laid

Authorities to be involved: Representatives from concerned line agencies, Traffic Police, contractor, engineers, designers, MEP expert. A landscape/ biodiversity specialist is preferred to manage excavation around existing trees.

Underground utility mapping, involving the mapping of all utility lines running underground, is necessary for precise excavation to prevent damage to these lines. Ideally, the mapping should be done prior to the design stage, by the Corporation and respective line agencies as a separate project by itself.

In the absence of such a survey, the design consultant should collect this information from respective line agencies. Alternatively, the contractor can dig trial pits at regular intervals of 30-50m to locate the UG utilities. The concerned city officials should facilitate coordination between the consultants and line agencies.

Trial pit for each chainage

Marking utility positions on the road after GPR survey

Following non-invasive, geo-physical surveys, the utilities can be marked on the road using the following colours:

- Stormwater
- Electricity
- Telecom
- Sewer
- Water
- Gas

Members from concerned line agencies should be present on site during excavation. The utility lines, if damaged at this stage, should be repaired by the respective agencies to avoid disruption in services.

The Corporation should foresee and plan for the following:

- Compensation cost for telecomm service providers in the BOQ
- Cost for shifting overhead cables underground
- Time required for correspondence with various line agencies and obtain necessary approvals

9 **Excavation** should be planned to suit the depth at which the utility lines are to be laid.

The ground should not be excavated 2 metres around tree trunk, to prevent damage to the tree.

Excavation should be avoided just before the rains, to prevent stagnation of water and consequent accidents & health issues.

Excavation should not damage the foundation of private compound walls

10 **Preparation of base for utility lines:** The excavated area should be levelled and compacted before laying the utility lines, as per IRC-36:2010.

The bed should be a layer of granular material free of stone fragments, or of PCC in the case of soft soil.

11 Management of underground utilities

to minimise obstructions on footpath and avoid unnecessary excavations to access them in the future

Utility carriers and access: Utility lines are carried either through ducts or trenches and are accessed through manholes when needed. The consultant should create a set of plans and sections showing existing, relocated and proposed utility lines along with manholes, for future reference.

Ducts

Ducts are long-lasting casing pipes (RCC/HDPE/GI) which carry utility lines and are buried directly in the ground on a PCC bed/compacted soil layer, eliminating the need for a concrete passage.

RCC Hume Pipes

HDPE pipes

300mm DWC HDPE Pipe

Trenches

A trench/ utility tunnel is a concrete passage built underground to carry utility lines, covered with an in-situ concrete slab or precast concrete covers

Trenches built to carry different underground utilities

Duct vs Trench	Trenches are better suited on stretches with no obstacles and hence are not ideal in urban areas.
Cost	The laying of ducts costs only 30-35% as that of the construction of trenches.[1]
Time	Ducts require less time for execution than trenches.
Flexibility	Ducts provide greater flexibilty and can be maneuvered around trees & obstructions.
Sustainability	Ducts are more environmentally sustainable- trenches use cement concrete for construction, prevent rain water percolation & obstruct growth of tree roots

Ducts are recommended for all underground utilities, provided that manholes are located at regular intervals.

"Installation of service lines through casing pipes facilitates easy withdrawal of the carrier line in case of maintenance or replacement without need for cutting the road. Interference to traffic and disturbance to pavement structure are avoided." - IRC: 98-1997

Manholes

Manholes are underground chambers through which utility lines can be accessed for cleaning, repair, replacement and drawing future connections. The exact details for provision of manholes for different utilities should be obtained from the respective utility departments. Manhole covers should be of non-corrosive, strong material with low resale value to avoid theft.

Manhole cover made of FRC

Conical manhole for stormwater

Multiple utility lines in one manhole due to lack of space

1. TenderSURE.Specifications for Urban Roads Execution

Manholes should be provided at regular intervals, in consultation with the respective agencies.

Spacing should also be adjusted based on adjoining property sizes (for private utility connections, which are drawn from manholes).

Manhole covers should be aligned with the footpath finish level.

Manholes for drawing private connections from utilities should not be placed in a single line. They should be staggered to avoid disturbance and damage to other cables.

Manholes should be avoided on cycle tracks.

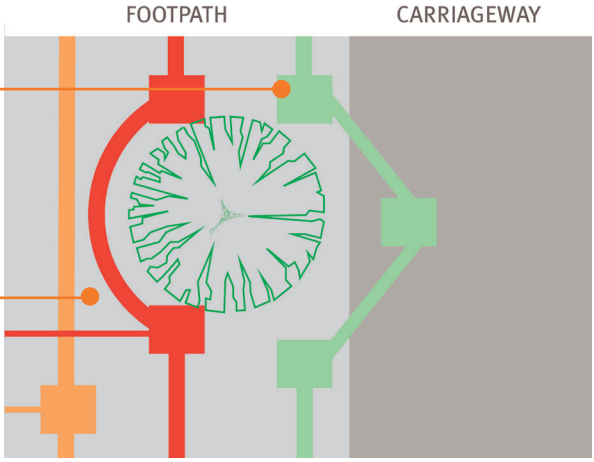
It is recommended that manholes be provided on the bulb-outs of the footpath.

Utilities around trees

Where trees obstruct the continuous passage of new utility lines, the lines should be carried around the trees via ducts as shown in the figure below*. Lines that carry viscous content like sewer lines/SWD have larger diameters and hence cannot be easily manoeuvred around trees. Additional manholes would be required in these cases, as shown.

Sewer, water and storm water lines are diverted through a series of manholes.

Other utilities can be maneuvered around the tree through a flexible duct.



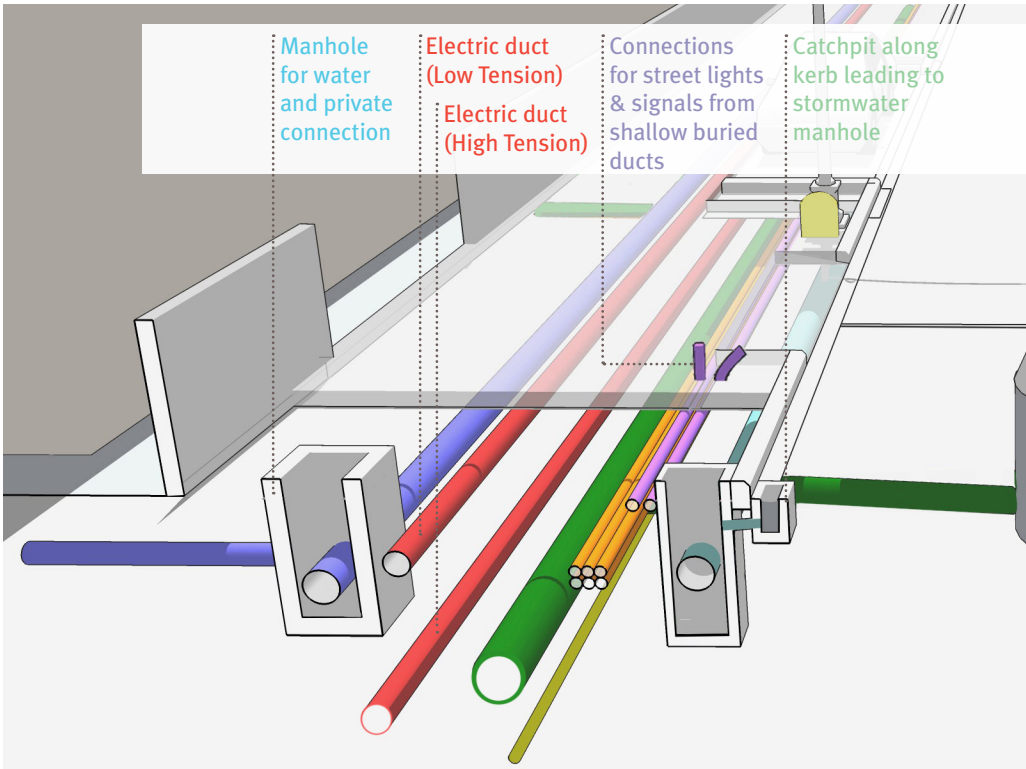
To prevent damage to trees, excavation should be stopped 2m around trees.

Other ways of preventing damage are by pruning and trimming the roots.

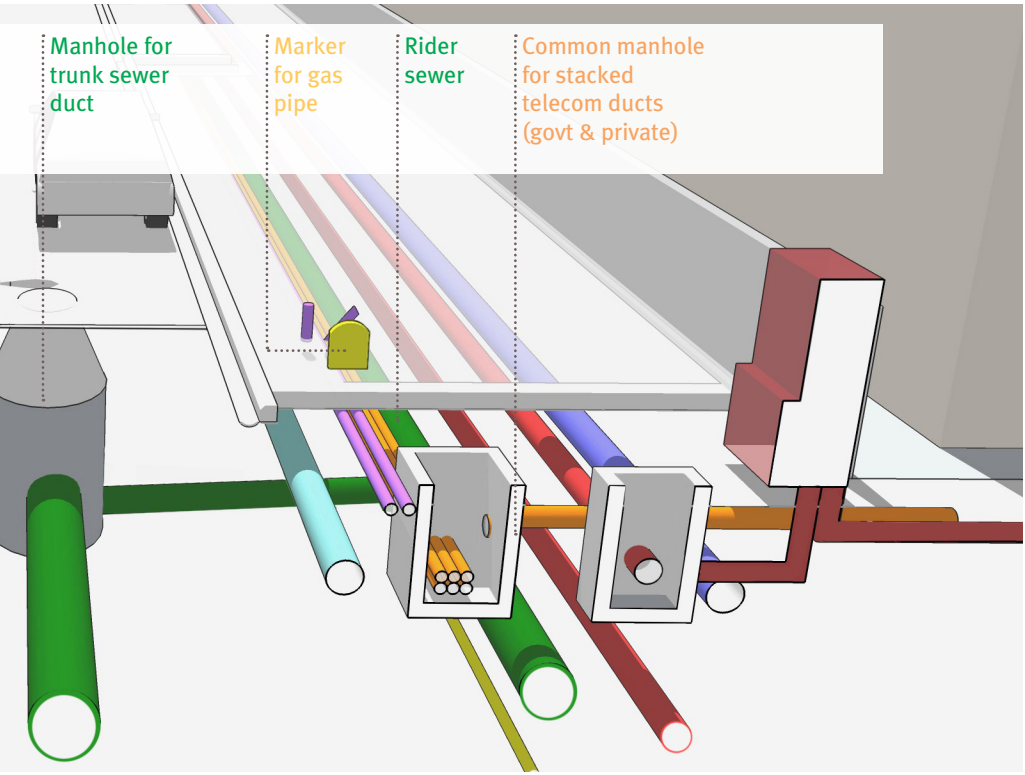
Technical advice from a horticulturist is recommended. Transplantation is adviced as the last resort and should be decided based on expert counsel depending on the tree species. Also, the placement of utilities should be coordinated with the location of trees so that trees are not disturbed if utilities are dug up for maintenance or replacement.

Underground utilities

along the cross-section of the road

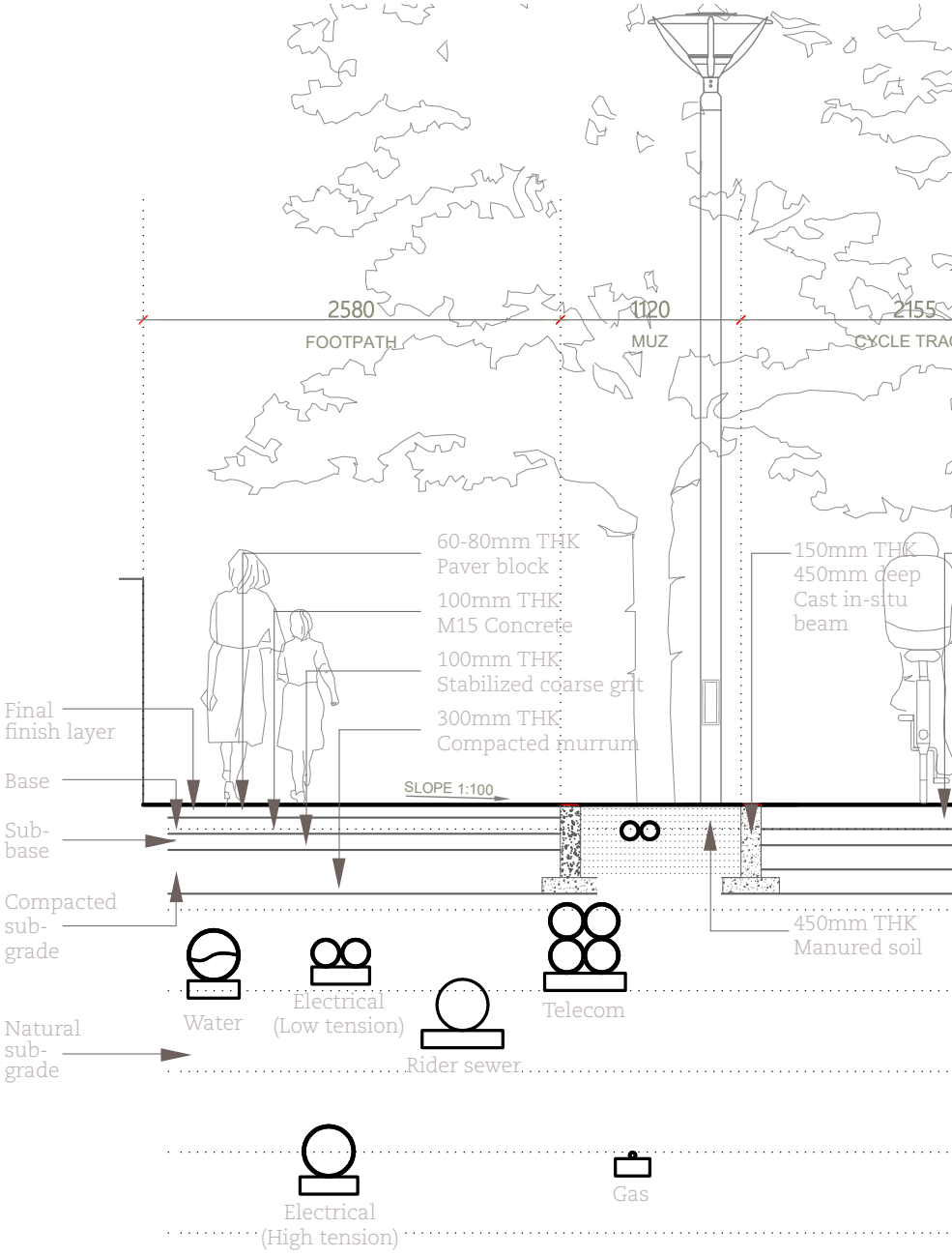


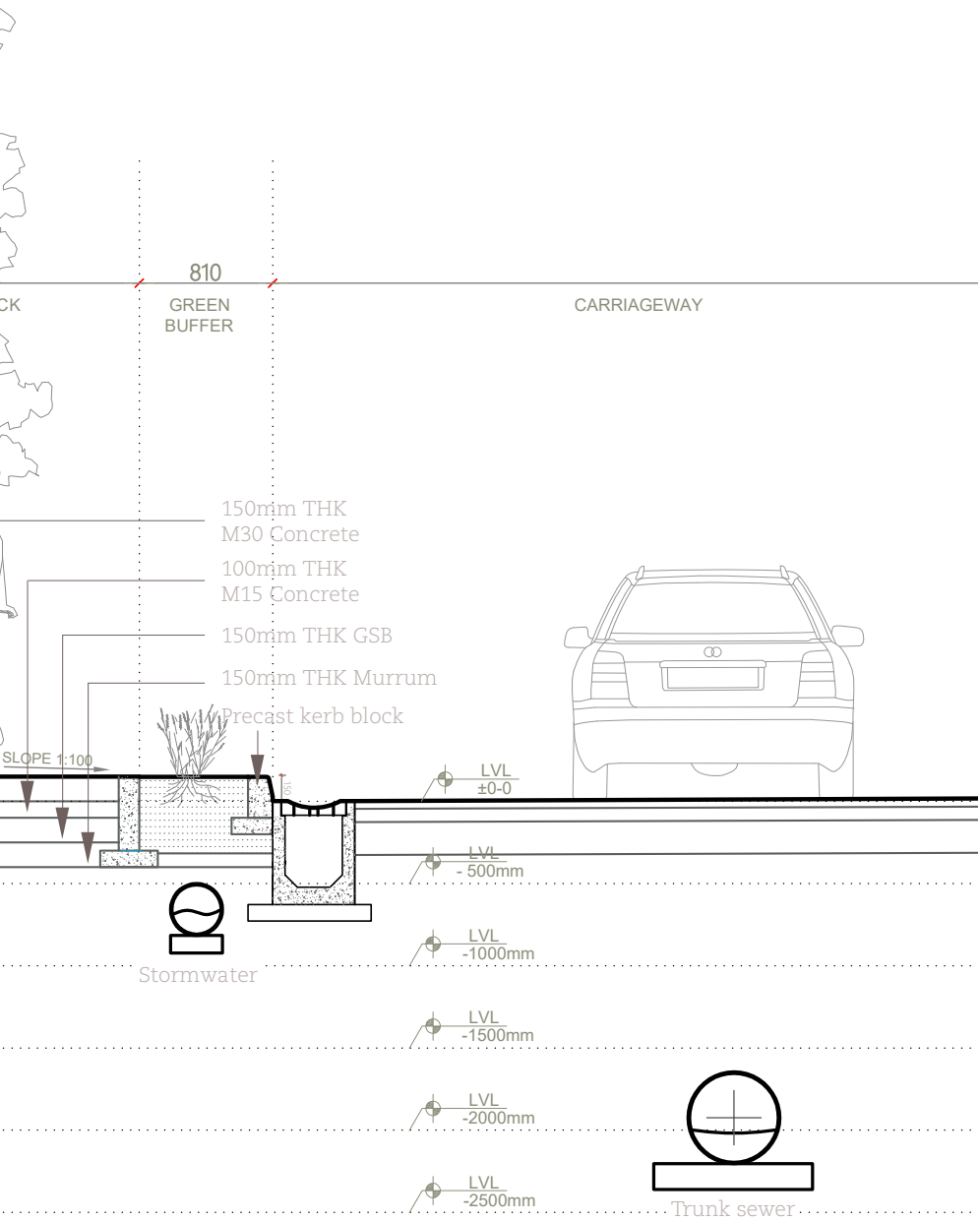
Category	Water	Electricity		Street Lighting & other fixtures		Stormwater
Utility Type	Main	Low-tension	High-tension	Side lines	At median	Main
Duct Material	MS/DIP	HDPE DWC	RCC-NP3	HDPE	HDPE	RCC-NP3
Duct size (dia)	150-300mm	150-300mm	300-450mm	100-200mm	300mm	500-1200mm
Depth	1-1.5m	0.6-1 m	1.5-2m	0-0.6m	0.6-1m	0.6-1m



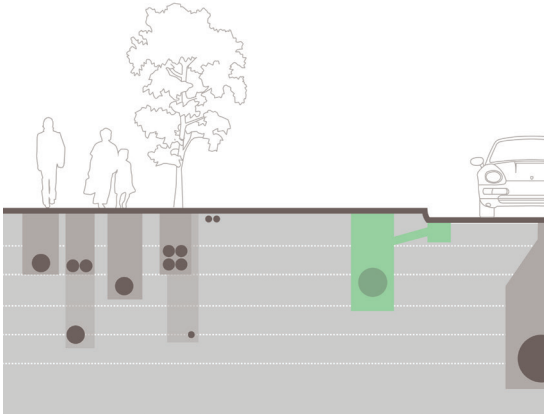
Sewage		Telecommunications		Private connections	Additional ducts
Rider sewer	Trunk sewer (under median)	Copper cables	Optic Fibres OFC	For each utility	Future additions
RCC Hume Pipe	RCC Hume Pipe	HDPE	HDPE	PVC/HDPE	HDPE
300-450mm	500-1000mm.	100-300mm	100-300mm	100mm	150mm
0.6-1m	2-6m	0.6-1m	0.6-1m	0.6-1m	0.6-1m

Typical cross-section across utilities



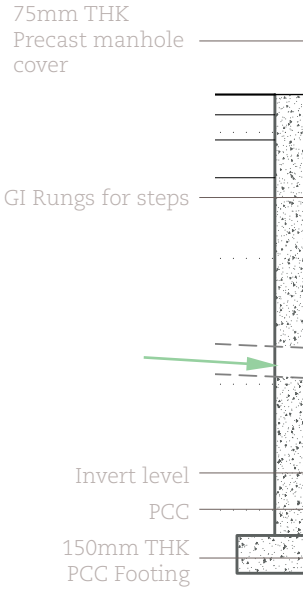

810
CK
GREEN
BUFFER
CARRIAGEWAY
150mm THK
M30 Concrete
100mm THK
M15 Concrete
150mm THK GSB
150mm THK Murrum
Precast kerb block
SLOPE 1:100
LVL
±0-0
LVL
- 500mm
LVL
-1000mm
LVL
-1500mm
LVL
-2000mm
LVL
-2500mm
Stormwater
Trunk sewer

A Stormwater



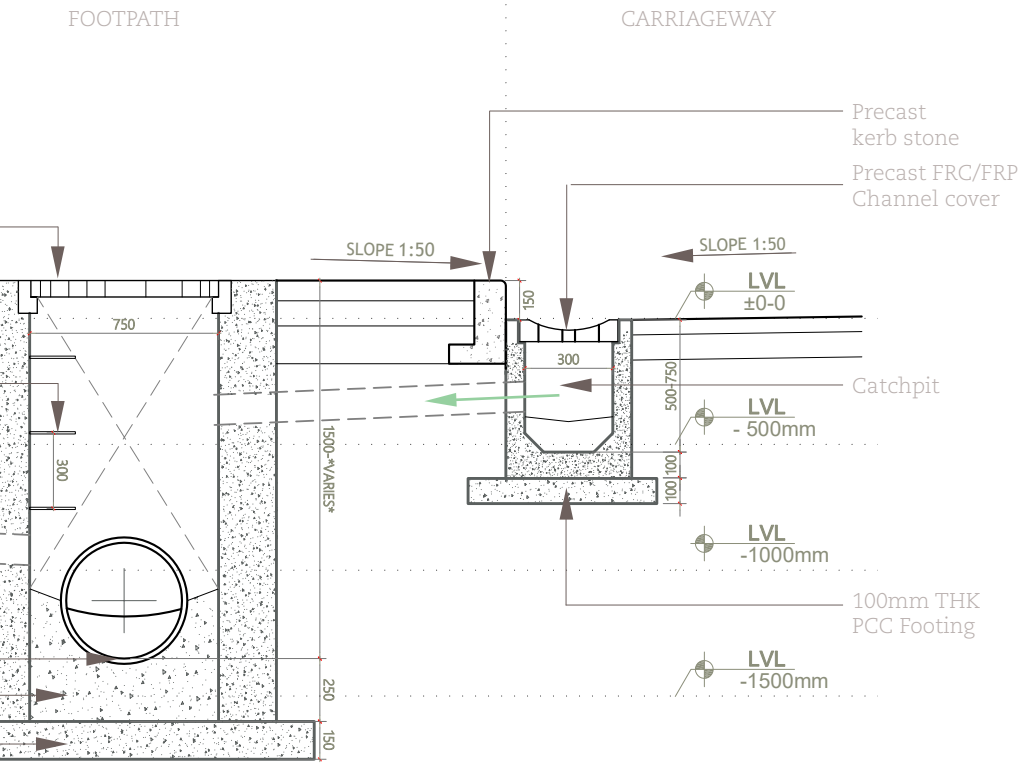
Main | RCC - NP3 | 500-1200mm dia

The process of stormwater management includes filtration (bioswales & catchpits), conveyance (ducts), infiltration (groundwater recharge pits), retention (retention tanks) and detention (reservoir).



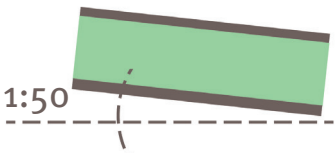
Preferred Location:

Along carriageway edge with silt catch pits at regular intervals



Section across stormwater manhole

Ducts are more advantageous than the conventional trenches especially for stormwater drains:



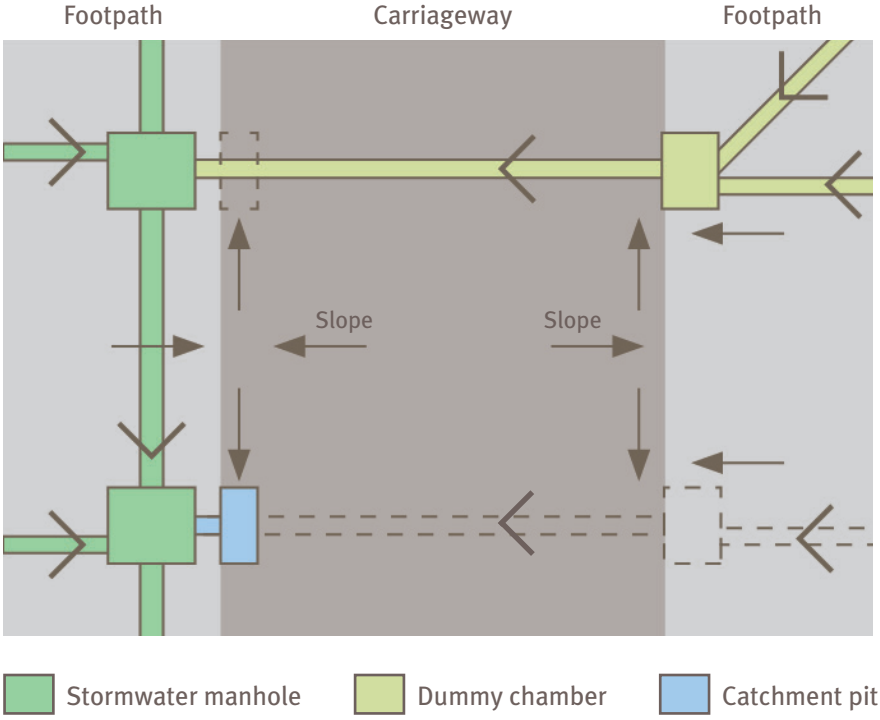
Laid inclined at 1:50 slope to encourage gravitational flow of stormwater

Connections from other utilities to properties can be easily made over ducts

Illegal sewer connections into SWD are prevented

In most cities in India, there is an **existing network** of stormwater trenches. In some cases, it is sustainable to reuse the existing trench after disilting, to carry other utility lines as well. Proposed stormwater ducts and existing trenches can be connected through manholes while maintaining the desired slope.

Stormwater drainage network



Storm Water Manholes collect water from the adjacent properties through ducts and from catchpits. They can have kerb-inlets on the surface to collect runoff water, removing the need for separate catchpits.

Dummy chambers act as intermediate manholes in stretches where lack of road space does not allow for a continuous stormwater duct. These chambers collect surface runoff and water from adjacent properties and which is then carried to the stormwater duct on the other side.

Catchment Pits collect surface runoff from the carriageway, sidewalk and private properties. The longitudinal and transverse gradient of the surface should be maintained as mentioned in IRC-SP-50 2013 (Guidelines on Urban Drainage) which recommends cross slopes of 2-2.5% for travel lanes.

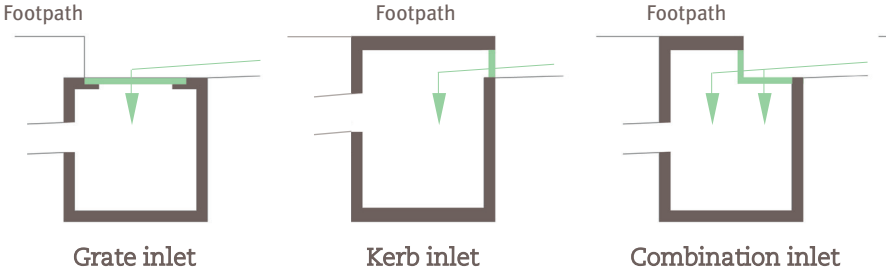
Catchment pits (catchpits)

Stormwater from the road flows along the saucer drain (along the kerb) into the catchment pit through inlets. Catchment or catch pits are designed such that silt is collected in the chamber through sand/gravel filters before the water flows into the main stormwater drain.

The depth of the catchpit can vary from 450-600mm, with a width of approximately (from section) Catchpits should be located at the lowest point of the street cross-section & at regular intervals decided by their size, average rainfall and the catchment area. Openings to catchpits should be at grade with the surrounding carriageway surface.

Catchpits are protected with grating to prevent solid waste from entering the chambers. Two types of grating are:

- Horizontal grates along the saucer drain
- Vertical openings along the kerb (can open into SWD directly)

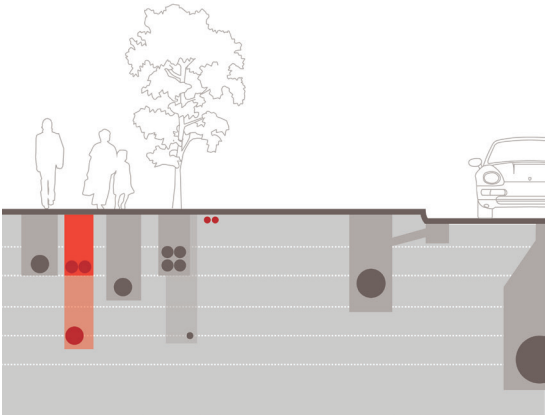


These inlets could be blocked by debris from floods or daily sweeping. Periodic cleaning is recommended.

Other types of catchpits with pervious bottoms can help in infiltration of water thus **recharging groundwater.** Gravel pits, bioswales and other **filtration techniques** can also be used along with catchpits to remove silt and pollutants before releasing the stormwater into the drainage system.

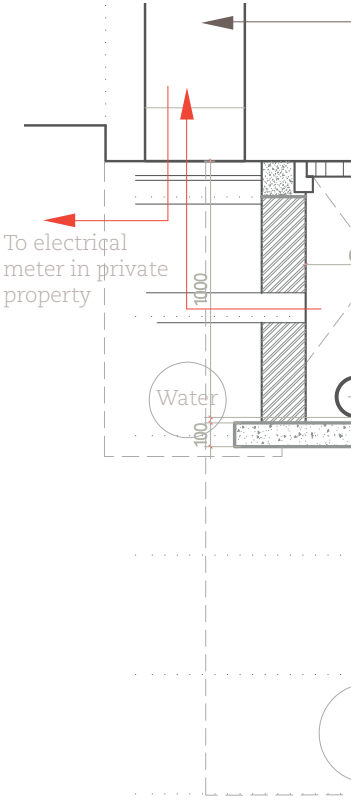
Inlet pipe & catchpit for SWD along property edge

B Electrical

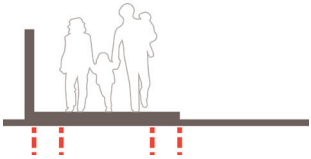


Low tension | HDPE DWC | 150-300mm dia
High tension | RCC-NP3 | 300-450mm dia

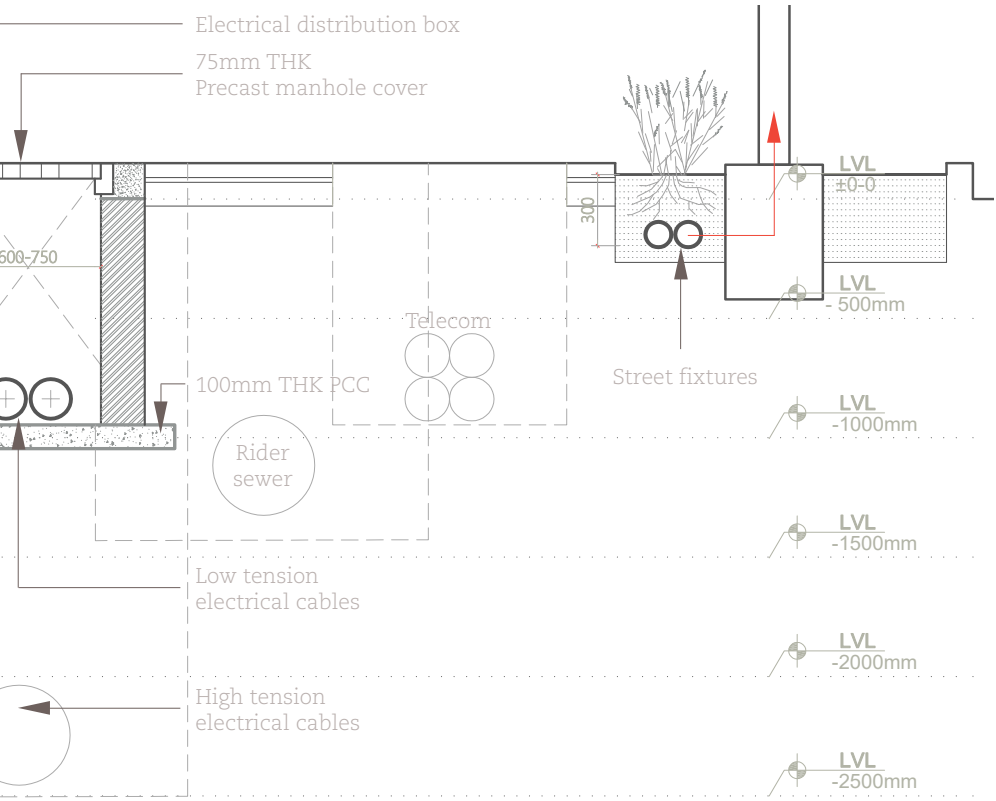
Electric lines include low & high tension cables which carry power to properties & transformers respectively, overhead cables and connections to streetlights, surveillance cameras, utility boxes/RMU units. To prevent digging of footpath in the future, it is advisable to shift overhead high tension cables underground.



Preferred Location



Along property edge or kerbside, so utility boxes can be placed at the edge without obstructing the footpath



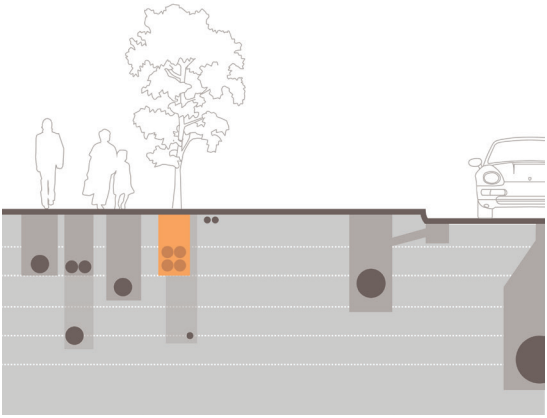
Section across electrical manhole

Not close to water supply lines, to avoid short circuit

Streetlights and other fixtures (Surveillance, Signages, Sensors and Signals)

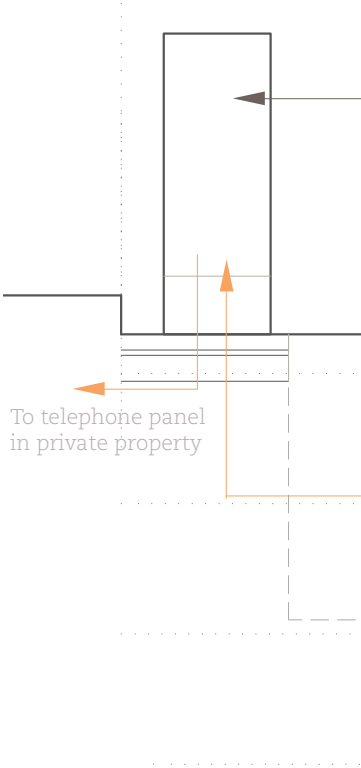
Cables for these, owing to their small size, can be bundled and buried directly in the planter zone at the edge of the footpath, eliminating the need for manholes and deep digging.

C Telecommunication



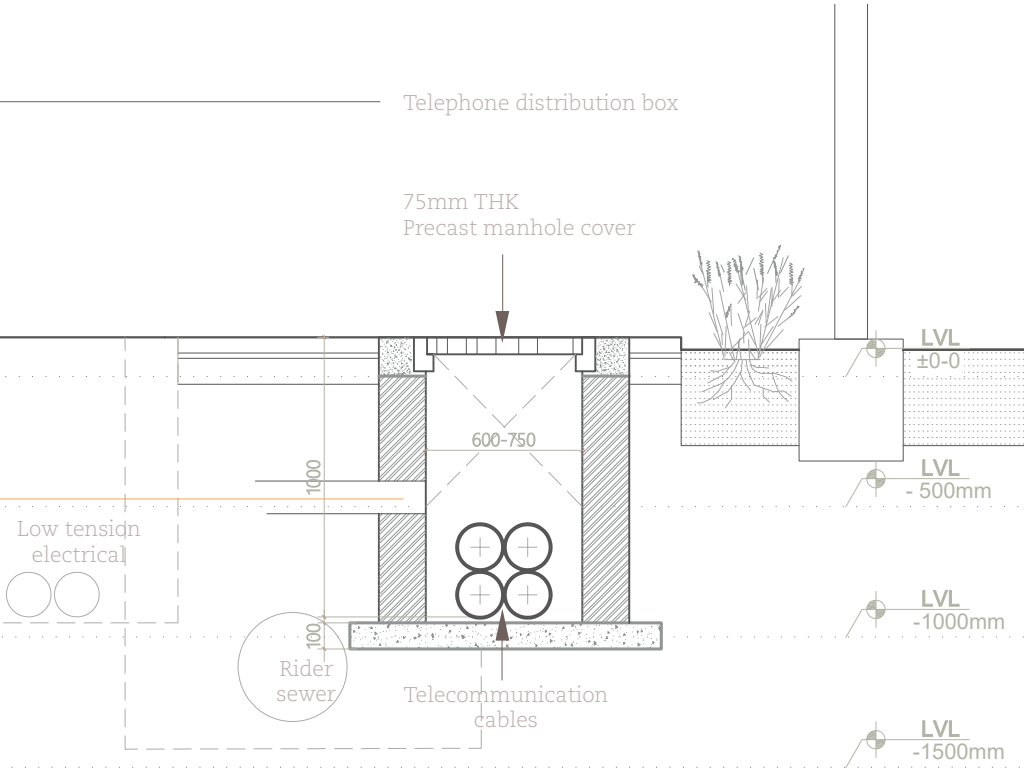
Copper cables | HDPE DWC | 150-300mm dia
OFC | HDPE DWC | 300-450mm dia

Telecomm lines include CATV/VI cables, optical fibre cables, conventional copper cables and connections for surveillance & security units. Common manholes should be provided for lines run by both public and private telecomm operators, such that the ducts are not disturbed during maintenance.

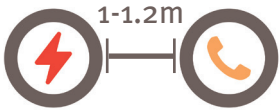


Preferred Location

Copper telecomm cables should not be placed close to electric cables, to avoid electrical interference due to induced voltage



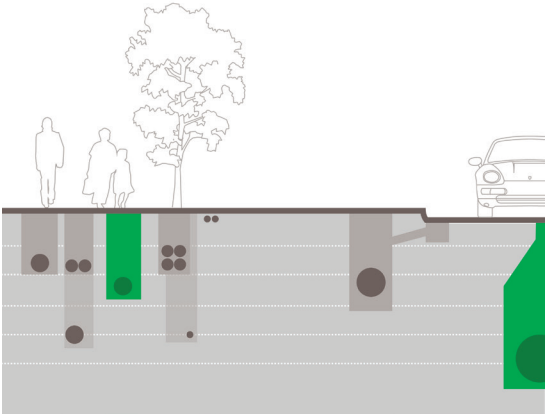
Section across telecom manhole



A minimum distance of 1 - 1.2m should be provided between the two to avoid induction.

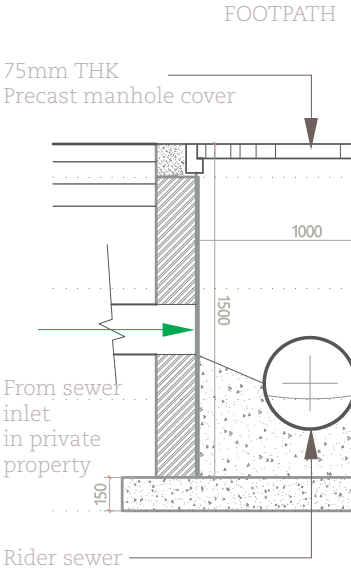
Lines run by government and private operators can be stacked, and accessed through a single manhole.

D Sewer

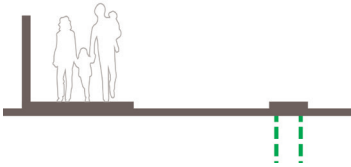


Rider | RCC Hume pipe | 300-450mm dia
Trunk | RCC Hume pipe | 500-1000mm dia

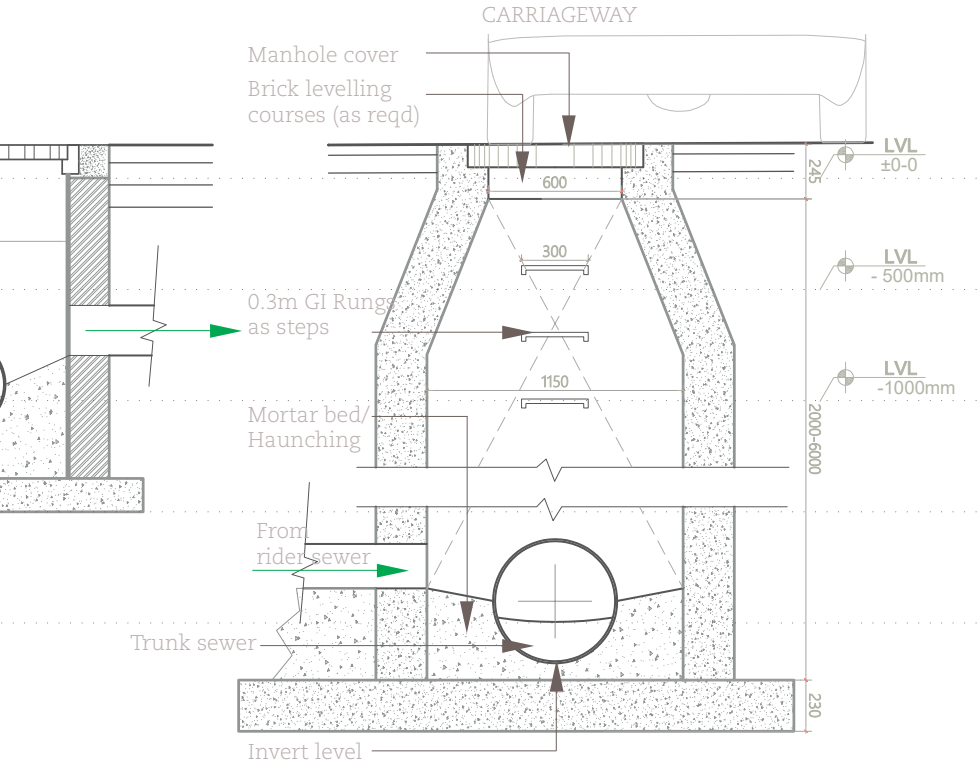
Sewer lines carry greywater and blackwater from residential and industrial discharge. They comprise the main trunk line and the connecting rider lines. If the site conditions do not allow for a continuous rider line, a dummy/ buffer chamber could be provided to connect new sewer lines from private properties to the main sewer line.



Preferred Location



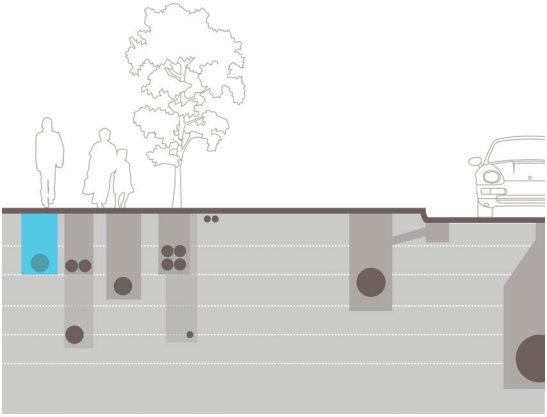
Trunk sewer line should be located below the carriageway, preferably under the median



Section across manhole for rider and trunk sewer

Rider sewer line should not be laid above water line, in order to avoid contamination of potable water with sewage water in case of a pipe burst.

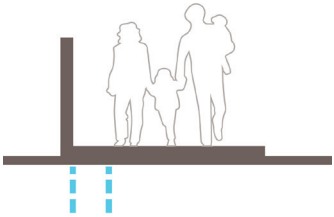
E Water



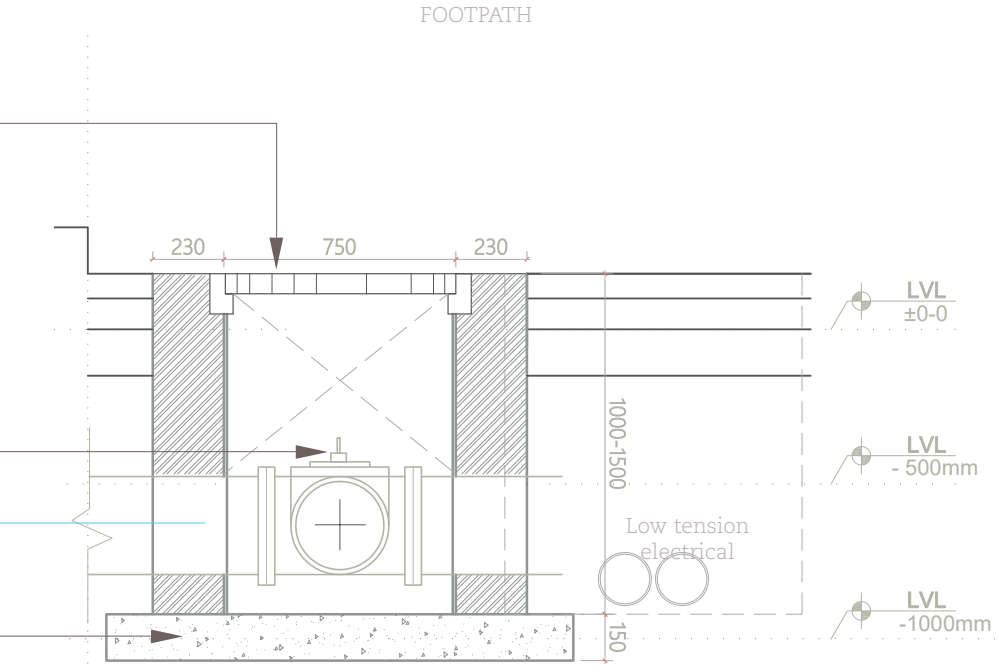
Copper cables | HDPEDWC | 150-300mm dia
OFC | HDPEDWC | 300-450mm dia

Water supply lines carry potable water under pressure, and can be placed on one or both sides of the carriageway. Chambers with control valves are generally provided before connecting the main supply to adjacent properties, additional connections can be made in future from these control chambers.

Preferred Location



Ducts carrying water could be provided at the property edge to avoid crossing of waterline over other utilities



Section across manhole for potable water

Gas mains and utilities carrying combustile material

Details should be obtained from the respective gas agency. Underground lines should be indicated by visible markers overground.

12 Sand filling

to create an even base before commencing above-ground construction

Once the utility lines are laid, the excavated area should be carefully backfilled in 2 stages:
1. Upto the top of pipe, with soil
2. Upto sub-grade level, with murrum

The filling is carefully compacted without damaging the ducts, before laying the sub-base.

Preparation of sub-base

After compacting of soil, a granular sub-base (GSB) of 100-150mm height is constructed with well-graded granular soil, usually upto the carriageway level. Additionally grit can be used to adjust the height of the footpath to the required 150mm (including the courses above ground level).

Alignment lines are drawn to mark the kerb, cycle track, pedestrian and green zones.

Above-ground construction

involves the laying of footpath along with street furniture & other fixtures and trees, and completing with required surface finish

Pilot stretch on J.M Road, Pune

Construction of footpath

comprising creation of the base upto surface finish

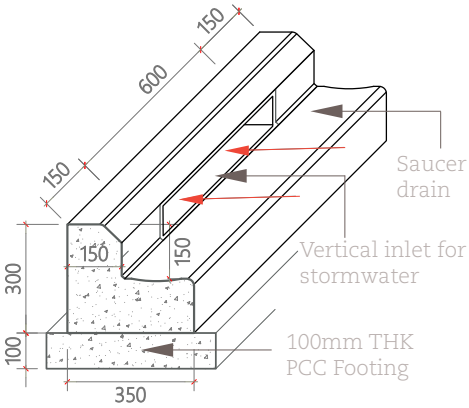
13 Laying of kerb stones

The final finished height of the footpath is marked by placing kerb stones along the edge. Prefab kerb stones are preferred over in-situ ones, as they are stronger, easy to install and have uniform finish.

Kerb stones are placed along the marked alignment lines.

The top level of the kerb-stone and the manhole cover should align with the final finished layer, not exceeding 150mm.

Saucer drains and openings to catchment pits should be laid along the footpath kerb to channelise and collect stormwater runoff. Saucer drains can also be provided along with the kerb stone as a monolithic unit.



Kerb block with saucer drain

The size of a saucer drain ranges from 450-600mm.

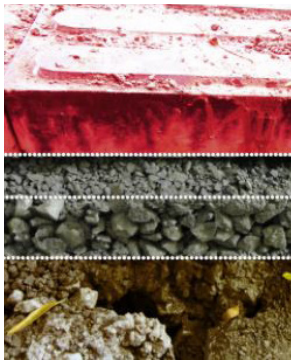
14 Preparation of bases for PCC finish & paver blocks

PCC Finish

A PCC layer of 100mm thickness (M15 for pedestrian, M30 for vehicular) is laid as base course.

Paver blocks and tiles

A 100mm thick compacted layer of coarse aggregate is laid within the kerb stone line, as base course for flexible paving.



Paving tiles/blocks are then laid on the compacted base to finish the footpath. This requires fine workmanship so as to ensure that the blocks are laid close together and do not come loose in the future.

15 Street fixtures

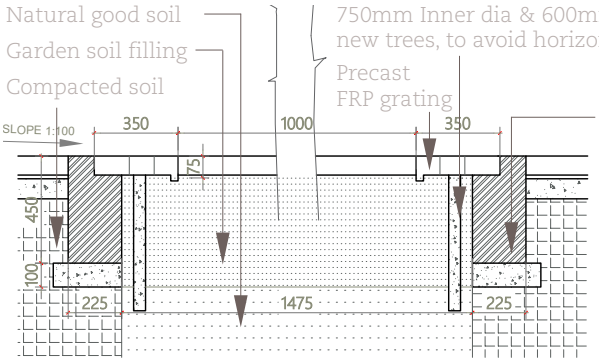
Street fixtures like bus shelters, utility boxes, seating, bollards, public toilets, bins, etc. are installed prior to the paving.

Bus shelters

Footing of the bus shelter unit should be fixed before the PCC work of the adjacent footpath.

A safe temporary waiting space should be provided for commuters until work is complete along that stretch.

Trees and landscape



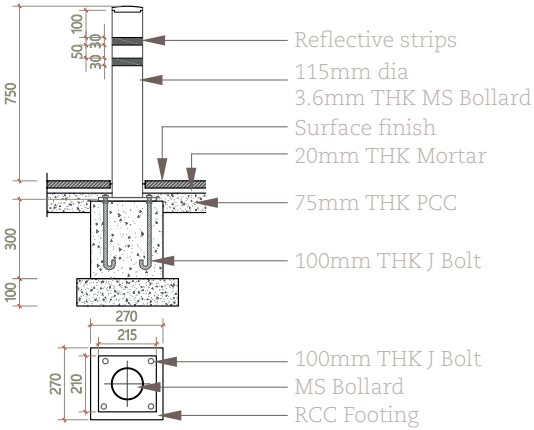
This stage involves filling of tree pits with manure & clay, planting of trees, providing protective mesh & grating around trees etc.

Sprinkler system

Tree plantation in pit

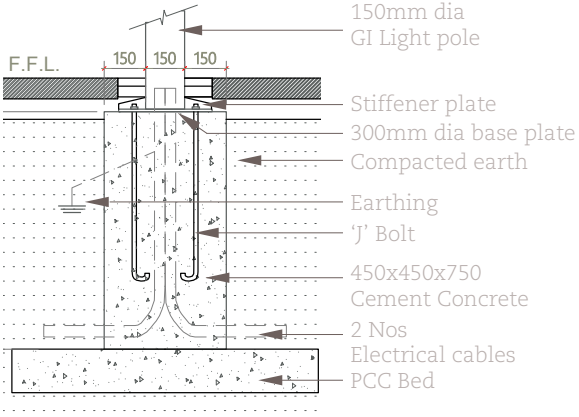
Tree grating

Bollards



Footing & installation of posts

Elements on the footpath that have a footing are installed while concreting, along with electrical connections if necessary (for streetlights, surveillance units, etc.).



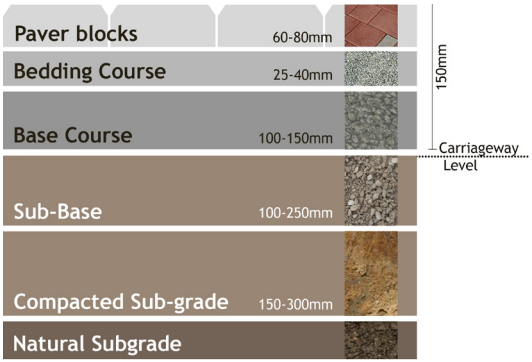
The footing for the post is constructed before providing the PCC base for the footpath.

The lamp post units are erected on the baseplates provided on the footings.

16 Surface finish

Footpath

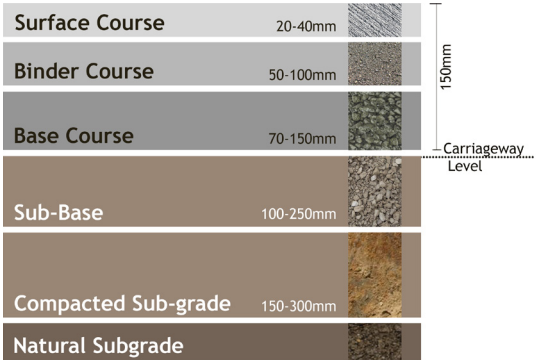
The footpath can be finished with paver blocks or PCC. The finished surface should match with the level of manhole covers and kerb stones at 150mm. Different textures can be used to mark different usages on the footpath.



Paver blocks/Tiles

Eg: Concrete paver blocks, perforated blocks, cobblestones

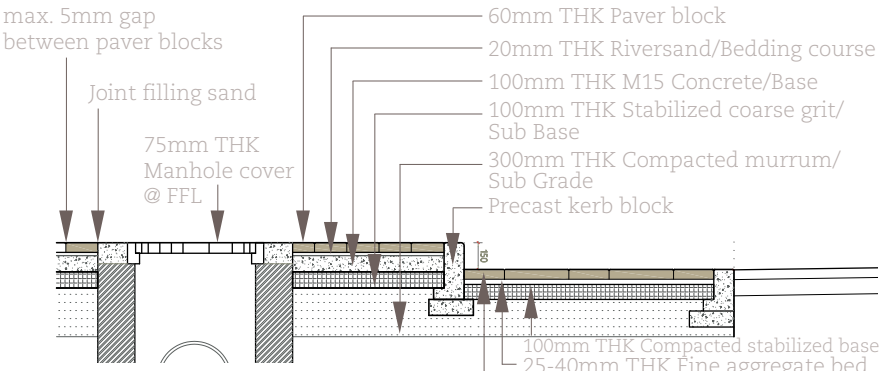
A 20-40mm thick bedding course of fine aggregate should be laid prior to pavers; this will compact slightly to create a firm & flexible base for pavers.



PCC finish

Eg: Textured, pigmented, stamped

A binder course of 50-100mm should be laid on the base course, over which the final surface course of 20-40mm can be laid. The Stamped/ pigmented concrete work should be sufficiently cured.



Detailed section across paver blocks

Cycle tracks should have asphalt/concrete surface finish. For even finish, paver blocks must be avoided on cycle tracks.

Dislocation of paver blocks due to poorly laid edge restraint i.e kerbs

Stamped concrete Tactile paver Pigmented Concrete

Tiles on pilot stretch

Parking spaces

Parking spaces can be finished with concrete (pigmented/textured/stamped) or paver blocks - aligned with, and visually distinct from, the carriageway. Pavers can help in water percolation and are easy to dismantle in case of future repairs. The slope should be maintained to allow water to drain.

The sub-base should be firmly compacted to avoid uneven levelling over a period of time.

In case of soft soil, it is preferable to have a PCC slab (preferably perforated concrete) to avoid uneven levelling of paver blocks.

Other street elements

Other street elements like cycle rack, benches, children's play equipment, advertising boards, signages and beautification elements can be added after paving.

Letter-box

Cycle rack

Utility box enclosed in attractive casing

17 Lane-marking

As the final step after all installations and finishes, lanes should be marked with either water-based or thermo-plastic paints as per Clause 803 of MoRT&H specifications.

The cycle track, pedestrian crossing, etc. should have clear markings as per standards.

Lane marking on cycle tracks should be painted every 6 months for better visibility.

Consultation & supervision

involves coordination among multiple stakeholders and supervision during implementation

Coordination network

The coordination network during execution should include:

- Government Authorities- City Municipal Corporation, Traffic Police, Smart City Authority etc.
- Utility Agencies- Telecom, Electricity, Water, Gas, (both public and private agencies)
- Non-governmental authorities- Non-profit organisations working for Safer streets, Horticulturist
- Architects, Engineers and Designers
- Contractors- Private contractor or appointed by Government
- Project Management Consultant- should be responsible for arranging the coordination meetings, managing exchange of information and ensuring quality control.

An **Apex Committee** comprising all department heads/decision makers from agencies like electricity board, telecom operators, gas & other utilities, should be established solely for management of utilities. Such a committee helps to speed up the design process as the committee acts as a single point of contact.

A **Review Committee** comprising experts representing organizations like City Corporation, transport, traffic, environmental, other non-organisational authorities etc as appointed by the Corporation would supervise & review the entire design and execution process.

Supervision during implementation

The design consultant should support in project monitoring and evaluation with periodic on-site visits during execution. The project monitoring team should ensure that the work being executed and the quality of construction are in accordance with the proposed design. Continuous review of the work on-site is critical for the success of a footpath design project.

Proposed timeline per km

to serve as a checklist of works.

Stage 1 Underground

✔	Activity	Timeline (in days)				
		0-4	4-8	8-12	12-16	16-20
	Demolition & debris clearance					
	Excavation					
	Base preparation/compaction					
	Laying of ducts & utilities					
	Manholes & catchpits					
	Sand filling & levelling					

Stage 2 Aboveground

✔	Activity	Timeline (in days)				
		20-28	28-36	36-44	44-52	52-60
	Laying kerb stones					
	Preparation of base for all finishes					
	Installation of street fixtures					
	Surface finishes					
	Installation of other street elements and beautifcation					
	Lane-marking					

Reference documents

IRC:98-1997	Guidelines on accommodation of utility services on roads in urban areas
IRC:SP 50- 2013	Guidelines On Urban Drainage
IRC:103 - 2012	Guidelines For Pedestrian Facilities
IRC:37-2001	Guidelines for the Design of Flexible Pavements
MORT&H clause 803.4	Specifications for Road & Bridge Works- Traffic Signs and Appurtenances
ITDP-EPC, 2011	Better streets, better cities: A guide to street design in urban India
ITDP, 2013	Footpath Design Guidelines
Tender S.U.R.E., 2011	A new approach for city roads

Abbreviations

HDPE	High Density Polyethylene
PVC	Polyvinyl Chloride
DWC	Double wall corrugated
RCC NP3	Reinforced cement concrete - non-pressurised class 3
BoQ	Bill of quanitities
MEP	Mechanical, Electrical and Plumbing
DIP	Ductile Iron Pipes