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A COST-EFFECTIVE TOOL OF UTILITY MANAGEMENT IN MUMBAI

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Abstract : Mumbai is a Metropolitan City and Financial Capital of India. Due to job opportunities and rapid urbanization, more population is diverted to urban city like Mumbai. By virtue of increase in population and living standard, the demand for services has increased tremendously and citizens expect quality and prompt services from the Municipal Corporation and all other service providers. Further, in this competitive world, to match consumer's needs, rates, quality and standards, a greater number of service providers are participating for each individual services. Utilities mainly comprises of water supply, drainage, electric supply, telecommunication, internet, gas lines, etc. Almost all of these utility service providers lay their cables below the road surface. Trenches are being excavated on roads for laying new utilities or for repairing faults of existing utilities. Due to high land rates and buildings being constructed at a very less distance from the edges of the roads, there is hardly any space to widen the existing roads, thereby putting limitation on availability of space below roads for laying new utilities. These services have caused great congestion below the road surface, thereby laying of new pipelines or cables has become difficult and occurrence of faults, leads to repeated excavation for carrying out repairs. Utility services deteriorate with their age. It is difficult to trace underground utilities since the visual inspection of these utilities is not possible. It is hard to determine and to estimate when to rehabilitate or replace these utilities. There are problems concerning underground utilities due to uncertainty of the location of the utilities. This problem is leading to delays, extra work orders, change orders, construction claims, contingency bidding, loss of service, property damage, etc.

In order to overcome the above cited problems, a ducting system along the newly constructed roads is proposed in the paper. Cost – Benefit analysis of proposed ducting system is carried out by considering a reference stretch of 1000m road and then compared with the existing system of laying utilities.

Key Words – Utilities, Services, Ducting, Trenching, BMC, etc.

1) INTRODUCTION

Mumbai City has nearly 2000 Km of road length, out of which 1950 Km is maintained by BMC and 50 Km by State Highway Authority. All the roads in the city are surfaced, with about 18% Concretized and the rest Black Topped. The details are shown below in table no.1.1.

The structural condition of the roads is very good, though the riding surface deteriorates monsoon as witnessed during the past. BMC carries routine pre-monsoon works to reduce the damage due to rains. A key issue though is the digging of roads by utility agencies/ companies for laying utility lines throughout the year, which after road restoration leaves the road in bad condition.

Road Length in Mumbai

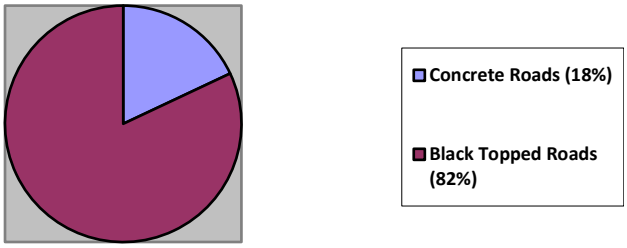

Table 1.1 : – Road Length in Mumbai

Sr. No.	Type of Road Surface	Island City (Km)	Western Suburbs (Km)	Eastern Suburbs (Km)	Total (Km)
1	Concrete	115.75	127.66	107.41	350.82
2	Black Topped	390.72	799.99	399.64	1590.35
	Total	506.47	927.65	507.05	1941.17

Source - (www.mumbaidp24seven.in)

In Mumbai, number of utility service providers are increasing with time and have passed more than 30[1], highest in any Indian City. These utility companies dig up roads to lay cables, as a result, 20 – 25% of roads in Mumbai[1], mainly in rapidly developing areas, are constantly in a state of disrepair. All utilities in Mumbai are running below road crust in zigzag manner. Roads are often dug for making new provisions and maintenance of existing utility services, causing damage to the road crust, which further leads to many problems related to road maintenance. Agencies are charged a hefty amount when they ask for permission to dig up a road, ranging from ₹5,000 to ₹21,000 a meter depending on the type of road surface[1]. Despite such heavy charges, some companies do not show any responsibility while filling back the trench, sometimes even leaving it unattended for several days. Lack of co-ordination is also observed among various utility providers.

Since most of these underground utilities are emergency services and, in many cases, the agencies dig up the newly constructed/ repaired roads, which leads to settlement of the road surfaces. The reinstatement of trenches done by these agencies is not as good as the original work. Later, such surfaces develop potholes and uneven patches. Ultimately civic body is often criticized for bad roads and potholes, especially in monsoon.

2) EXISTING SYSTEM OF LAYING UTILITIES[2]

In Mumbai almost all the utilities are laid below roads by way of Open Excavation. To understand the present scenario with regards to utility management in Mumbai and charges recovered from utility service providers, policy guidelines as followed in Mumbai by municipal corporation for granting of permission to utility and municipal agencies for excavation and reinstatement are elaborated below

2.1 Procedure – For planned work of laying/ replacing utilities, permissions are issued from 1st October to 15th April. For trenches exclusively proposed on footpaths, the permission shall be granted up to 30th April. On receipt of application and recovery of charges, permission is granted subject to following guidelines.

2.2 Charges Recovered - Demand notes are issued by the concerned road engineer, which includes cost of reinstatement and once the charges are paid work order are being issued by specifically mentioning the start and end date.

Table No 2.1 - Charges recovered for laying utilities

Sr. No	Existing Surface	Finished to	Rates per R.M.		
			0.6m X 1m	0.75m X 1.5m	1m X 1.5m
1	Cement Concrete Carriageway	A) 100 mm thick Paver block immediately B) Cement Concrete Pavement in due course	18596	20299	20961
2	Mastic Asphalt	Mastic Asphalt	7502	7978	8771
3	Bituminous Concrete	Bituminous Concrete	6369	6846	7638
4	Paver Blocks	Paver blocks	5000	5394	6651

Source - www.mcgm.gov.in

In order to avoid excavation of newly constructed road, a letter is issued to all the utility service providers at the time of reconstruction of any particular road with following details

a) Start and end point of the road taken for reconstruction
b) Date of excavation of road
c) Person to be contacted for co-ordination

In most of the cases, utility service providers, makes arrangement for laying, replacing, or shifting of their respective cables along with the time schedule fixed for excavation of road. This leads to avoiding immediate excavation of newly constructed roads.

To raise the seriousness among the service providers, charges are enhanced as follows, for the service providers who applies for excavation of trench within 5 years of newly constructed road

Table No. 2.2 - Multiplying Factor for Excavation in Defect Liability Period

Sr. No.	Time Period of Application	Multiplying Factor
1	Excavation during 1st year of DLP	4
2	Excavation during 2nd year of DLP	3
3	Excavation during 3rd year of DLP	2
4	Excavation during 4th year of DLP	1.7
5	Excavation during 5th year of DLP	1.4
	Excavation beyond 5th year	1

Source - www.mcgm.gov.in

2.3 Provisions for Penalties -

While issuing demand note for allowing excavation, a security deposit amounting to 50% of reinstatement charges are recovered, which if required are forfeited in case of any lapses from service provider.

Table 2.3 - Provisions for Penalties

Sr. No.	Description of lapse	Penalty in Rs.	Per
1	Change in alignment	25,000	Lump sum.
2	Change in starting or end point	10,000	Each
3	Not rolling and compacting as per specification	2500	Metre
4	Delay in reinstatement of trench beyond end date	5000	Day
5	Not attending damaged trench during defect liability period	5000	Day

Source - www.mcgm.gov.in

2.4 Methods of Reinstatement of Trenches

After laying service cables/conduits; those shall be covered with sand layer of sufficient thickness to withstand compaction by vibratory roller during reinstatement of the trench.

The reinstatement contractor shall backfill the trench with granular layers. Each layer of granular material shall not be more than 150 mm in thickness. Maximum 5 layers of granular layers shall be operated. In case of more depth of trench, depth below the thickness of maximum five granular layers shall be backfilled by excavated earth first. Sufficient watering and ramming of each layer shall be done with vibratory hammer to avoid settlement of these layers and to achieve effective compaction.
All reinstatement work including asphalting shall be completed prior to 10th May of every year.

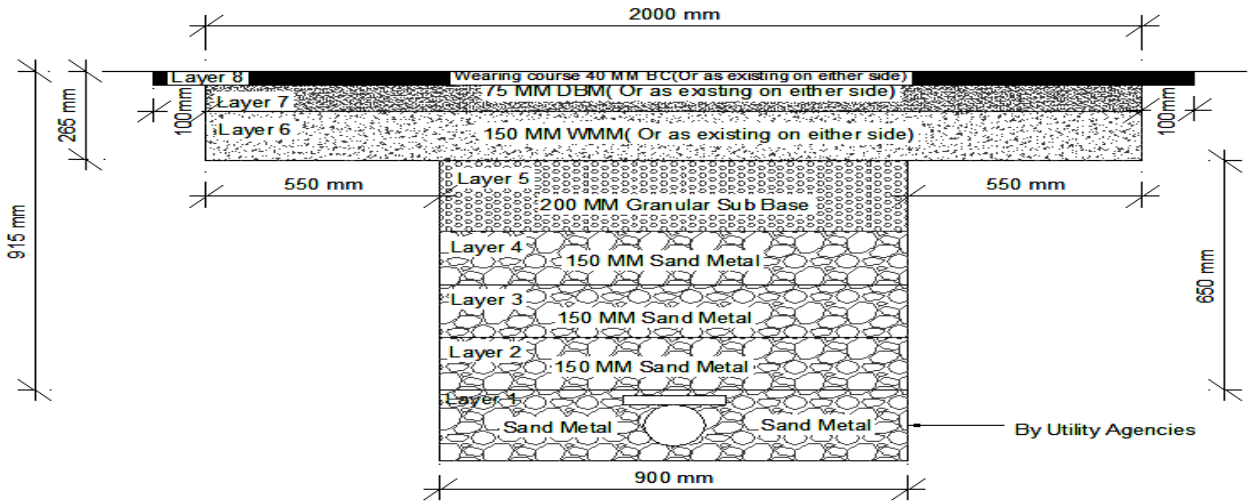

Figure 2.1 - Typical Cross Section of Reinstatement of Trench
Source - www.mcgm.gov.in

3) PROPOSED DUCTING SYSTEM

In order to avoid continuous excavation of road surfaces for laying of utilities, a ducting system is proposed in the thesis. Further, ducts and its components are designed in such a way that, it will be able to accommodate wide range of utilities. On site practical difficulties are also taken into consideration while designing ducts.
Proposed Ducting System is overall 2.9m wide and hence it is proposed only on major roads in Mumbai having road width of 18.3 m or more. As on minor roads, it will be difficult to accommodate ducts along with carriageway for vehicular traffic, footpaths for pedestrian traffic and side strips for laying of other utilities such as water, sewage, etc.

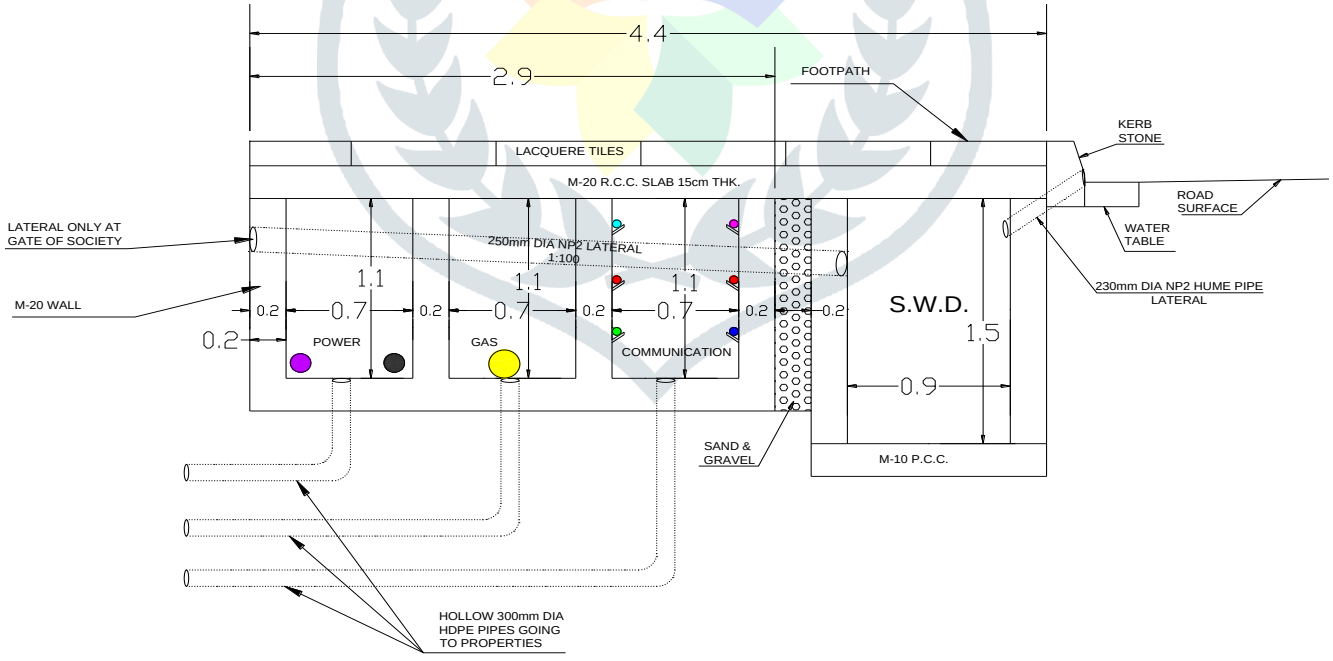

Figure No 3.1 - Cross Section of Duct

4) COST-BENEFIT ANALYSIS OF PROPOSED DUCTING SYSTEM

Cost Benefit Analysis has been carried out in following steps

- Estimate is prepared for the proposed duct (1000m) as shown in figure no. 2.
- Revenue to be generated is forecasted for the design life span of ducts (i.e. 25 years).
- Cost of construction is compared with the revenue generated in order to assess the cost benefit of the proposed ducting system.

4.1 Cost of Constructing a Duct as Proposed in Figure No. 2

Design Parameters Considered for deriving Estimate of Ducting System

1) Duct Length – 1000m.
2) Duct Section - a) Soling Depth – 150mm, b) PCC Depth in M15 Grade – 150mm, c) RCC Raft Depth in M25 Grade – 200mm, d) Duct Depth – 1100mm (With 3 Separate Compartments for Power, Telecommunication and Gas).
3) Maintenance Chambers of 1150 X 1150mm considered at a spacing of 6 to 8m. Society Entrances considered @ 20m.
4) Steel – 90Kg/m^3
5) Ducting System is considered at only One Side of the road. For Consumers on other side of road, utilities are passed through 300mm Día Pipes at society entrances.

Table 4.1 – Estimate for Construction of Duct (1000m)

Sr. No.	Description	No.	Length	Width	Depth	Quantity	Rate	Unit	Amount
1	Excavation	1	1000	2.9	1.8	5220	200	Cu.m.	10,44,000
2	Soling	1	1000	2.9	0.15	435	550	Cu.m.	2,39,250
3	PCC	1	1000	2.9	0.15	435	4500	Cu.m.	19,57,500
4	RCC Raft	1	1000	2.9	0.2	580	4800	Cu.m.	27,84,000
5	RCC Walls	4	1000	0.2	1.1	880	4800	Cu.m.	42,24,000
6	RCC Slab	1	1000	2.9	0.2	580	4800	Cu.m.	27,84,000
7	Steel					182	56000	M.T	1,01,92,000
8	Chambers	150					8600	Each	12,90,000
9	Cross Pipes		4900			4900	1200	R.M.	58,80,000
	Total Cost of Construction								3,03,95,000/-

4.2 Revenue Generated from Utility Service Providers for Utilizing Ducts to Lay Utilities

Revenue will be generated, by charging annual rent to utility service providers for using ducts to lay their respective utilities. For deriving a fair rent, an assumption is made that each utility service provider will have to lay a new cable at least in a span of 25 years from now, due to deterioration/ damage of the existing cables or due to upgradation or change in technology.

In present scenario, an average charge paid by the utility service provider for laying a cable of 1000m is 92,68,000/-[2]. The charges to be paid by utility provider can be distributed equally in a span of 25 years. Therefore, Annually Rent works out to be = 9268000/25 = 370720 per Km and Rs 370 per meter, which can be rounded up to Rs 350 per meter length of utility.

Now, even though Mumbai is having more than 30 nos. of utilities, some of the utilities such as Storm Water Drain, Sewerage, Water Mains, etc. could not be diverted to proposed utility ducts and hence it is considered that at least 15 no. of utilities are being shifted in ducts.

Annual rent collected from nearly 15 no. of utility service providers which have been shifted in ducts works out to be 15 X 1000 X 400 = 52,50,000/-. Revenue collected in 25 years will be 13,12,50,000.

4.3 Cost Benefit Assessment

From the calculations as shown in 4.1 and 4.2 above, it can be concluded that Revenue collected in 25 years will be 13,12,50,000 as against construction cost of 3,19,15,000/-. Hence, the proposed ducting system will be cost beneficial in long term.

5) CONCLUSION

After studying the existing system of laying utilities and comparing it with proposed ducting system, following conclusions can be drawn

- Proposed ducting system generates more revenue as compared to cost of construction in long term.
- As most of the utilities get simultaneously shifted into ducts, chances of road excavation are minimized.
- The proposed ducting system will be widely accepted by utility service providers, due to following reasons

- Time required for laying cables in ducts will be less, as compared to the time required for excavating the road surfaces and then laying the cables.
- Due to inaccurate data regarding the location of the cables, it is often seen that roads are excavated at higher width, which in turn increases the overall cost.
- If cables are laid in ducts, then the operation of laying cables could also be carried out in monsoon season. As of today, planned laying of new cables is not allowed during monsoon season, hence reducing overall efficiency.

- Damage to other utilities, while performing the job will get substantially reduced and hence reduction in compensation claims.
- Faults could be attended in less time.

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