Scientific Journal of Impact Factor (SJIF): 4.72

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 4, Issue 8, August -2017

Sustainability Of Microtunneling In Developed Urban Areas

(A Case Study Of Vadodara City)

[1]Suresh C Jain
[2]Aaryak M Mehta, [3]Anuj A Agrawal, [4]Harsh R Gupta

[1]*Associate Professor, Department Of Civil Engineering, ITM Universe, Vadodara*
[2,3,4] *U.G students, Department Of Civil Engineering, ITM Universe, Vadodara.*

Abstract: *The development of trenchless technology has been rising in India since 10-15 years. It is the most efficient method for various types of underground works such as sewer line, water supply line, cable ways etc. This technology is known as Microtunneling and it is highly accepted now-a-days due its efficient work technology. It is also cost efficient which is an important prospect in any construction project. In Vadodara city the main drainage line project has been under taken by ITD CEMENTATION INDIA which is a renowned construction company in box pushing and micro tunneling*

Keywords- *Micro tunneling, Drive shaft, Receiving shaft, Pipe Jacking, Tunnel Boring Machine, Trenchless Technology*

I. INTRODUCTION

Mircotunneling is trenchless construction used to install pipes under roads, railways, environmentally sensitive areas or where the pipe driving is required at a significant depth. The American Society of Civil Engineers' (ASCE) Standard Construction Guidelines for Microtunneling defines microtunneling as "a remotely-controlled, guided pipe jacking technique that provides continuous support to the excavation face and does not require personnel entry in the tunnel." Microtunneling can be used for various purposes such as drainage line, water supply line, cable lines, etc. It is developed within the water industry for the accurate installation of gravity sewer and the storm water pipes. It often utilizes laser guidance system to maintain the line and level of installation, though with the larger pipe jacking installation, both laser guidance and survey techniques can be used. This system is available for both main line and branch line. It is the best pipe jacking method for wet and unstable ground conditions or contaminated soils. Most micro tunneling drives are straight between driver shaft and receiver shaft. (There are some special methods for curve drives where the straight line-of-sight is not possible between the shaft due to curvature.)

1.1 Applications

Applications of microtunneling are crossings under existing utilities, busy highways, railroads, levees, waterways and sensitive wetlands or shaft-to-shaft pipeline installation.

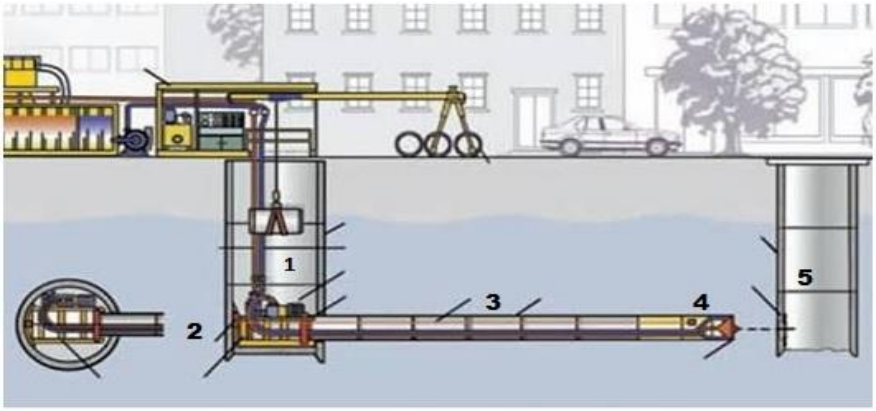

Fig. 1 Schematic diagram of Microtunneling Process

1.2 Essentiality of micro tunneling in Vadodara

In Vadodara, the roads are very congested and its next to impossible to excavate the roads to carry out the underground process. Also, traffic is one of the major issue in urban cities like Vadodara. The population of Vadodara city is about 2.388 million. The width of the roads where the sewer pipes has to be laid are very small, for eg: R.C Dutt Road, Alkapuri (12m). So, it is much necessary to use trenchless technology-Micro tunneling in such dense areas of the city.

Fig.2 Comparision with Open Cut Conventional Method

II LITERATURE REVIEW AND STUDY

From the literatures of many researchers it has been found that the use of trenchless technology helps in improving economy. The rapid growth of urban population coupled with the reducing subsurface as well as ground spaces for laying utilities are based on CATALYSTS for the application of Trenchless Techniques in India and other nations of South Asia. Added to this, the deteriorating state of existing physical subsurface infrastructures evolves into a situation where the conventions are giving way to advancements (Trenchless). In India ten years ago, 'trenchless techniques' was a term known only for advancements and automation and the information in the subsurface constructions. Even the knowledge at that time was rather bookish. During the last ten years Indian trenchless markets saw a substantial growth in the population of drilling rigs (the population grew from non-existence to the present value of something above 400 operating units). Water and sewage infrastructure and other utility services represent a significant investment on the part of most municipalities. For well over 100 years, the distribution networks for utility services have been located underground in pipes or ducts that are laid, repaired or replaced by trenching from the surface. In cities and urban areas, these distribution networks are located underneath roads. This often makes access difficult, particularly in areas congested with traffic and buildings. When pipeline infrastructure is not well maintained, inefficiencies occur. For example, in water distribution systems, this can lead to leakage and possible water shortages. In sewage systems, cracked and damaged pipes can cause wastewater seepage, leading to contamination of groundwater. These problems often give rise to related health and environmental impacts. Ground space is vital for the functioning of our modern society. This is where the arteries of our cities and communities are located - with pipelines for utilities and waste disposal, cables and communication networks, and underground transport routes. And the underground space has still more potential to offer. Shifting production facilities, cultural and service centers into the underground space can make room for an ecologically intact environment at the surface. At the same time, this gives economic opportunities markets, with enormous unrecognized and unexplored potentials. As the world moves together more and more rapidly, there is a unique opportunity to tackle these challenges together at the international level, and to make use of the enormous opportunities that arise.
It has been observed that the cost benefits are upto 20% in use of trenchless technologies.

III METHODOLOGY UESD IN TRENCHLESS CONSTRUCTION

3.1 Construction method

Trenchless construction includes such construction methods as tunneling, microtunneling (MTM), horizontal directional drilling (HDD) also known as directional boring, pipe ramming(PR), pipe jacking (PJ), moiling, horizontal auger boring (HAB) and other methods for the installation of pipelines and cables below the ground with minimal excavation. Large diameter tunnels such as those constructed by a tunnel boring machine (TBM), and drilling and blasting techniques are larger versions of subsurface construction. The difference between trenchless and other subsurface construction techniques depends upon the size of the passage under construction.

Fig.3 Laser alignment Process at R.C Dutt Road, Vadodara.

Fig.4 Pipe Jacking (Pipe-42) at R.C Dutt Road, Vadodara.

3.2 Technical Parameters

Size of Drive Shaft & Receiving Shaft: 7m X 7m
Height of Shaft: 9m
Grade of concrete: M 25
Pipe Diameter: 1.8m (internal)
Pipe length: 2.8m
Grade of concrete of pipe: M 50 with internal PVC sheet lining of 4mm.
TBM Speed: 50mm/min (avg)

3.3 Man power & utilities

This technology reduces number of unskilled labours required in open trench construction. Hence skilled persons, supervisors, operators and engineers are needed to execute and inspection of works. This almost eliminates temporary residences and other utilities to be erected on site. This reduces the cost of mobilization and immobilization, which in turn proves trenchless technology as economical.

IV CONCLUSION

It has been concluded during our study and visit of work site at Vadodara city roads that latest technology such as trenchless work by Micro tunneling is highly essential because of growth in population, vehicular traffic and existing road width which cannot be widened. It is also recommended that conventional method becomes more costly because of dumping of excavated stuff far from site. Micro tunneling, thus proves easy and trouble free operation in dense areas of cities like Vadodara.

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