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Comparative Study of Trenchless Technology around the globe

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ABSTRACT

With 138 crore people (and expanding quickly) in its population in 2020, India is rapidly urbanising, and it needs to provide appropriate services and infrastructure to support its expansion. Not to mention the need to repair the infrastructure that is already there but is in poor condition. There is a tonne of room in this context for trenchless technology at a provider of solutions for India's sustainable growth. It is obvious given India's rapid urbanisation.
The need for trenchless technologies is also increasing. Many projects have been successfully completed using trenchless technology, demonstrating the advantages of this ecologically friendly method for underground utility installation, repair, and maintenance. Trenchless technology is a subfield of construction engineering that deals with methods and associated machinery for creating, maintaining, and renewing underground utility networks without continuously digging trenches. State-of-the-art continuous cabled and piped networks are designed, managed, and renewed using this branch of applied engineering for the conveyance of fluids and communications, respectively. Over the past fifty years, various techniques and technologies have been developed for the rehabilitation and renovation of sewerage and gutter networks. The most advancement is being made in trenchless technologies. They are marketed as being environmentally friendly because they don't limit the amount of space at the renovation site and they go into effect quickly. The project focuses on particular materials as the foundation for the application of trenchless techniques. Trenchless techniques do not cause pipeline waste to be produced. Either a new pipeline pushes the old profile into the vicinity, or additional pipes are added to the current pipeline. The traditional methodology of result control and product performance verification, however, cannot be used with the new pipeline. It is challenging to identify representative data, in particular for Cured-in-Place-Pipe (CIPP) procedures. quantities for key features such as the thickness of the sanitary insets (sleeves) after curing, and it follows from practice that the measurements should be performed with a special spike gauge. CIPP products achieve all the final properties through the installation process in the existing pipeline

Keyword - Repair, Rehabilitation, Sustainable Growth, Trenchless Technology, Underground Utility, Urban Growth, Advantages, limitation, Environmental effect, Cost effectiveness.

I. INTRODUCTION

As we live in 21st century. There so many techniques are introduced in advance version of their traditional techniques. Hence, advance techniques are more beneficial than tradition techniques. So out of which trenchless techniques is one of best techniques introduce in pipeline work sector.

Trenchless technology is techniques of repaired work, installation work, renewing underground pipes, cables and duct which reduce excavation work. This technique affects fewer environments and decrease environmental damage, and also reduces cost. this technique has negative impact on local surrounding, traffic as well as local buildings. Therefore, trenchless technology is better alternative of open cut method for repair and rehabilitation work of pipeline.

The maintenance and provision of safe and efficient utility services needs more environment friendly technologies and approaches to ensure public positive support. Then, trenchless technology has one more advantage of old existing pipe line materials and can reduce waste generated due to excavation of pavement and earthwork. This technique is more useful when there is want for pipeline rehabilitation in middle of busy intersection point, technology permit repair of pipeline without disturbing road surface.

This technique not only does elimination of traffic problem but also it reduces cost of work. then repair work also deducted which happens due to dig up of road when we adopt traditional method. This technology is also to reduce environmental damage and to deduct the cost linked with underground work. Basically, trenchless technology is techniques of making tunnel below ground surface and installation of service line like pipelines for water, gas, or electric and telecommunication cables etc. without any disturbance to the public.

II.Objectives

- To reduces the impact on the environment.
- To reduces damages of valuable surface.

- To saves underground space (pipe busting). It reduces the danger of improperly compacted excavations
- To saves resources.
- Without disturbing the traffic and life on the surface, the lines can be laid below ground in a much shorter time by using this technology.
- To make it accident free.
- To avoids traffic jam.
- To provides the hassle-free road surface.

III. Case studies related to trenchless techniques in different countries

Comparison of Emitted Emissions between Trenchless pipe replacement and Open cut construction

City: - Los Lunas, New Mexico
• Work: - Pipe replacement
• Depth: - 2.1 m
• Length: - 106 m
By using open cut construction method: -
Equipment involved during construction:

Equipment's	Total working time
Excavator	25 hrs.
Water Pump	2 hrs
Paver	90 mins
Asphalt Compactor	1 hr.

Table No;1 Emissions Generated by the Equipment

	HC	CO	NO	PM	CO2	SO
Excavator	2.41	16.2	23.36	2.86	1.3	5.25
Water Pump	0.36	2.85	2.2	0.27	0.14	0.53
Loader	0.37	1.42	5.59	0.42	0.28	1.12
Soil Compactor	0.58	3.87	5.64	0.65	0.31	1.27
Paver	0.19	0.71	2.82	0.2	0.14	0.56
Asphalt Compactor	0.14	0.55	2.1	0.18	0.10	0.42

Table No:2 Emission of different gases by equipment

Equipment's used in construction work: Emissions Generated By them:

Equipment	Total Working time
Hydroguide winch	15 mins
Air compressor	35 mins
Backhoe	90 mins
Paver	15 mins
Soil compactor	45 mins
Asphalt Compactor	15 mins

Table No:3 Emissions Generated by the equipment

	HC	CO	NO	PM	CO2	SO
Hydri guide winch	0.02	0.07	0.06	0.01	0	0.01
Air compressor	0.07	0.28	0.23	0.06	0.06	0.26
Backhoe	0.66	4.82	4	0.41	0.27	1.08
Soil compactor	0.07	0.48	0.71	0.08	0.04	0.16
Paver	0.03	0.12	0.47	0.03	0.02	0.09
Asphalt Compactor	0.04	0.14	0.52	0.04	0.03	0.10

Table No:4 Emission of different gases by equipment.

By comparing all the factors between open cut and trench less method, trench less construction method can reduce up to 80% of emissions.

. **Case study 2:** Evaluation of the Construction and investment process of a High-Pressure Gas pipeline with use of trench-less method and open excavation method.

By Open excavation method: -

• Excavation and filling operation required
• Removal or cutting of trees
• By Trenchless method: -
• No disruption on banks or vegetation
• Away from shore line
• No disturbance in flow of water

Cost Evaluation at different stage: -

In Trenchless Method-

1. Installation of pipes
2. Restoring sites

In Open excavation method-

1. Installation of pipes
2. Restoring sites
3. Use of earth works
4. Drainage

Economic Cost

It includes cost of expenditure on materials and works not directly connected with the construction.

1. Cost of damage to private property
2. Cost of damage and wear of road surface.
3. Increased expenditure on road maintenance.
4. Cost of environmental supervision.

Economic cost of trenchless method will be more than the open excavation method.

Social cost

The cost incurred by the local community during construction period. It includes,

1. Traffic organizations problems
2. Safety issue
3. Human factors

Environmental cost

For analysis purpose this factor is divided into five criteria: - Air, soil, water, physical factors and natural factors.

Case study 3: Trenchless Rehabilitation of 60-Inch Residuals Transfer Main at East Side Water Treatment Plant.

City: - Dallas, Texas

Work: - Replacing main in the main existing alignment. Type of pipe: - Reinforced concrete pipe

Length: - 3.54 km Diameter: - 60 inch

Capacity: - 540 million gallon per day

Problems in existing pipeline:

• Longitudinal cracks in pipe.
• Leakage at various points.
• Foundation failure may occur.
• Pooling inside the pipe

Alternation of this work

Alternative 01: - Open and cut at same place. Alternative 02: - Open and cut at different place.

Alternative 03: - Cured in place pipe method

It involves insertion of fully saturated resin fabric tube into existing pipe-line by use of water inversion or winching. Material can be polyester, fiber glass reinforced. Water of air pressure used for inversion process and hot water, stream, up light curing.

Alternative 04: -

Slip lining: - Small diameter pipe inserted in existing pipe.

As we see author gives 4 alternatives option for
rehabilitation work and out of which options give choice to adopted most beneficial option out of this alternative.

Case study 4:

Limitation of post-Earthquake on trenchless technology.

- The application of trenchless techniques is limited in urban areas. The open-cut method should consider.
- After the 2010 and 2011 earthquakes, some streets and roads were completely blocked due to intensive pavement damage.
- Application of trenchless techniques for new installation or rehabilitation of the damaged pipeline after an earthquake has some restrictions.
- Christchurch is the first major city in New Zealand to be affected by intensive earthquake shocks. Intensively wastewater pipes could be affected and damaged by earthquakes in New Zealand. According to the Christchurch GIS database (Christchurch City Council 2010),
- About 40% of wastewater and stormwater pipelines were surveyed by June 2011.
- Some trenchless techniques like pipe bursting, cured-in-place pipe, point repair methods cannot be applied to renovation and rehabilitation of damaged underground pipelines in some particular types of damage caused by earthquakes.

Figure : Broken pipes in earthenware laterals and difficulty of applying open-cut method. (Images by author of paper

IV CONCLUSION

From Study it is conclude that the trenchless techniques more advance technique as compared to traditional techniques in market.

Rehabilitation: In rehabilitation work trenchless technology is more beneficial as compare to traditional method as we know there is need to take care and maintained is required to pipeline Hench this technique is beneficial for this segment.

- Then trenchless fewer techniques provide antileakage quality and life extension property to existing pipeline in rehabilitation work.
- Also, this plays important role in corrosion resistance and abrasion ability. Then trenchless technology reduces traffic disturbance and maintain environmental balance.
- This technique includes cost effectiveness in rehabilitation work. In trenchless method for Sewer rehabilitation techniques provide nonstructural as well as semi structural ability to existing sewer pipe lines. Generally, concrete sewer pipes with degraded condition, the cured sleeve shows a better diversity of thickness than in the case with remanufactured steel pipes without high corrosion.

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