Study of Illuminating the Future Exploring the Possibilities of Extra Underground Tunnel

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Abstract : IN this era of construction , roads and tunnel are the major things to be constructed . A tunnel is an essentially horizontal, artificial underground opening, with a generally regular cross section and a length that greatly exceeds its other dimensions. Tunnels are used for a wide variety of purposes. They provide urban rapid transit systems. Urban water supply and distribution, sewage collection and disposal, gas pipe lins water lines wifi and DTH cable and mining require extensive tunneling.

In this project extra tunneling system is provided on opposite site of gutter or sewage lines to avoid demolition/smash down the roads after construction This project comes under the smart city by NMC Cost effective solution for ensuring the seamless delivery of ulitilities and necessities The underground tunnel project is a transformative initiative aimed at creating an integrated underground conduit for the transportation of essential utilities, including LPG gas, water pipelines, wifi cable, and DTH cable. With a comprehensive focus on sustainability, safety, and efficiency, the project exemplifies a forward looking approach to urban infrastructure development, positioning it as a pivotal step toward resource optimization and future-oriented urban planning.

Key words :- Extra tunneling system , Cost effective solution.

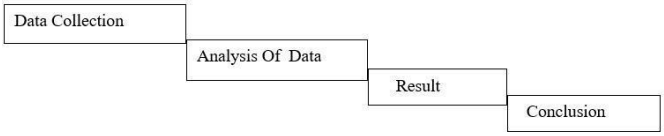
1. Introduction

Extra Underground tunnels play a crucial role in modern infrastructure, enabling the efficient installation and maintenance of essential services like pipelines, gas pipes, DTH, and wifi cables. They are a cost-effective solution for ensuring the seamless delivery of utilities.

When we construct the road,then we construct the sewage tunnel or gutter at the same with that we can construct the extra tunnel on opposite site of it . It provide the door to doors

• A tunnel is an underground or undersea passageway. It is dug through surrounding soil, earth or rock, or laid under water, and is enclosed except for the portals, commonly at each end. A pipeline is not a tunnel, though some recent tunnels have used immersed tube construction techniques rather than traditional tunnel boring methods.
• Extra underground tunnel plays an crucial role in modern infrastructure , enabling the efficient installation and maintenance of essential services like pipelines , gas lines ,DTH and wifi cables . They are coat efficient solution for ensuring the seamless delivery of utilities .
• When we construct the road , with that we construct the sewage tunnel or gutter at the same time with that we can construct the extra tunnel on opposite site of the road.
• It provides the door to door supply of LPG gas , WIFI cables , DTH cables , electric cables ,water pipelines , etc .
• additional increases in surface construction have further aggravated the problem. At the same time, the low volume of underground construction has provided insufficient incentive for the development of innovative . • Minimizes environmental impact while supporting future city expansion and population growth. • Utilizes existing underground space, maximizing land usage without altering the cityscape.
• Engage with urban planners, architects, engineers, and local communities to ensure comprehensive planning.

Methodology



Urban utilities are overcrowding underground space. Therefore, future sustainable underground strategies will consist of the ability to reduce the use of traditional trenching. During the last century, there was an increasing interest in utility tunnels for urban areas as a problem-solving technique to avoid congestion of the street road excavation to subsurface. Utility tunnels or utilidors are joint-use underground facilities that may contain multiple utilities such as water pipelines, sewerage pipe, gas pipe line, DTH cable, WI-FI cables , electrical power, telephone, and central heating in various combinations or in some cases all together.

➢ The methodology involved in the implementation of an underground gas pipeline tunnel encompasses comprehensive research, feasibility studies, engineering designs, regulatory compliance, construction supervision, safety protocols, environmental assessments, and ongoing management. Each phase is critical to the successful and sustainable operation of the infrastructure.

➢ Design Considerations for Underground Tunnels

1.Structural Integrity. Ensuring the tunnel's structural stability under various ground conditions and stress scenarios is vital.

2.Flow Optimization. Designing to maintain efficient flow and access for routine maintenance and emergency responses.

3.Utility Integration. Accommodating multiple services within the tunnel, optimizing spatial efficiency and accessibility.

4.Excavation The process begins with careful excavation
to create the tunnel path underground, avoiding any interference with existing infrastructure.

5.Reinforcement Reinforcing the tunnel walls and ceilings is crucial to ensure structural integrity and protect against natural elements.

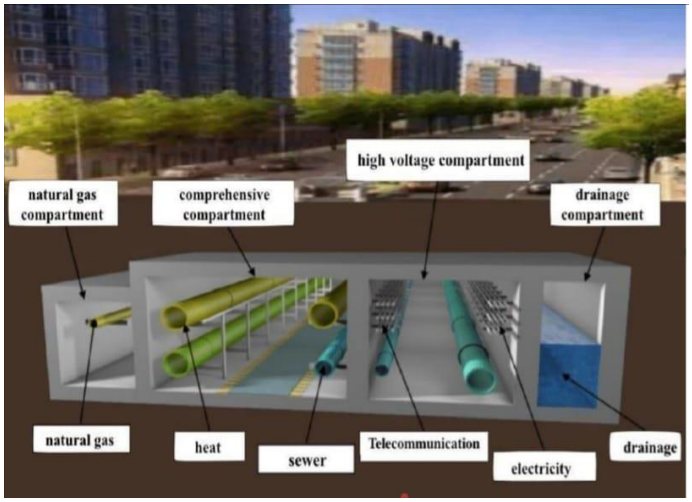


Fig -1: Tunnel

Method :

1.Surveying
Detailed geological and topographical surveys to map the tunnel route and understand subsurface conditions.

2.Excavation
Utilizing appropriate methods such as tunnel boring machines or traditional mining techniques.

3.Lining & Installation
Implementing durable tunnel linings and safely integrating utilities within the structure.

4.Quality Control
Rigorous monitoring and inspection to ensure compliance with design specifications and safety standards

5.Reinforcement
Reinforcing the tunnel walls and ceilings is crucial to ensure structural integrity and protect against natural elements.

6.Installation
Next, the components including LPG gas pipelines, wifi cables, and DTH cables will be installed meticulously, guaranteeing

7.LPG Gas Supply
The tunnel will incorporate a dedicated system for transporting LPG gas from its source to the distribution area.

8.Pipeline & Cables
In addition to LPG gas, the tunnel will house pipelines and cables for carrying wifi and DTH signals, ensuring seamless connectivity.

2.1 Method:

- Surveying

Detailed geological and topographical surveys to map the tunnel route and understand subsurface conditions In small diameter tunnels Wriggle Surveys can also be carried out using conventional Total stations and a target prism mounted on the end of a rod. Dedicated Profilers are also available, which can be used in conjunction with reflectorless EDM to provide rapid profiling with an accuracy of 5-10mm.

- Excavation

Utilizing appropriate methods such as tunnel boring machines or traditional mining techniques. Bottom-up method: A trench is excavated, with ground support as necessary, and the tunnel is constructed in it. The tunnel may be of in situ concrete, precast concrete, precast arches, or corrugated steel arches; in early days brickwork was used. The trench is then carefully back-filled and the surface is reinstated.

■ Lining & Installation

The precast concrete lining is then put into place, expanded against the tunnels exposed ground, and pushed out under pressure. In hard ground, shotcrete is used to line the tunnel. Shotcrete is a wet mixed concrete that is sprayed onto the tunnel surface using a compressed air technique.

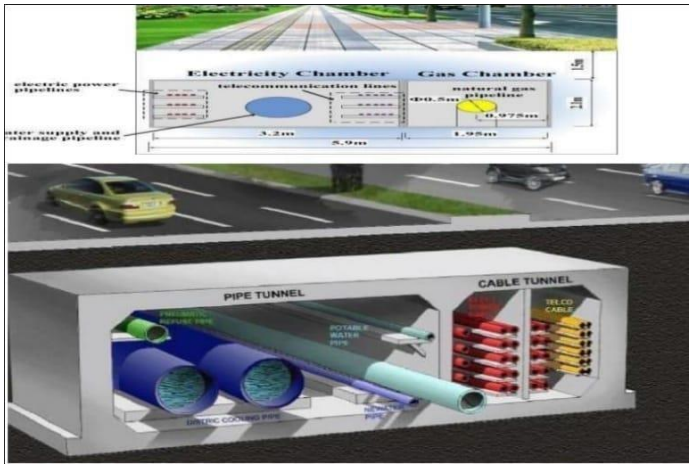


Fig -2 over all view LITERATURE REVIEW

A. The purpose of this literature review is to thoroughly study the similar works of the other researchers and identify the research gap of such studies to pave way to new research findings. In this chapter, the studies conducted by various researchers underground tunnel based composites, and the recent developments and various applications are presented.

1.Name of author :- Salahuddin A. Azad Name of paper :- Locating underground cable faults: A review and guideline for new Development Description of paper :- The power distribution networks in urban area are normally through underground cables due to population density , housing , commercial installation and many other reasons. Although the power network has facilities to back feed through alternate sources , this back feed option reduces as long as the faulty cables cables are not rectified .

2.Name of author :- siti Norafida Jusoh Name of paper :- Tunnel and Microtunnel For Future Smart and Sustainable Infrastructure Solution Description :-Abstract-Underground facilities and tunnels is not a rare discussion anymore. More and more underground explorations were carried out as to fulfil the need of mankind. In this paper, discussion on how to utilise tunnel and underground space knowledge in order to sustain green development thus to provide smart solution for infrastructure facilities (electrical cable, manhole etc) is discussed. Types of tunnel and its excavation methods especially the recent micro-tunnelling method also presented. Affect to the green and sustainable development and case study are also presented.Vijay Laxmi Kalyani,Shailee Joshi,Vidhi Chaudhary(2015)

3.Name of author :- D. J. Spoor, and J. Zhu. Name of paper :-Designing Underground Cable Systems to Withstand Steady State and Transient Voltages & DTH cable and wifi cables Description - Transient over voltages and insulation coordinationare a major design concern for EHV underground cables, as these must be minimised on both the cable sheath and conductor. However, such transients can also impact on the design requirements at medium transmission voltages, especially when overhead to underground transitions are included along the cable circuit. This paper demonstrates some of the main principles when modelling voltage transients in underground cables DTH cable and wifi cables

4.Name of author :- Souythen D. porital. Name of paper :-Utility tunnel for heating pipes between Rigshospitalet and Amagerværket in Copenhagen, Denmark Description - The central portions of a rapid transit network are usually in the tunnel. Some tunnels are used as sewers or aqueducts to supply water for consumption or for hydroelectric stations. Utility tunnels are used for routing steam, chilled water, electrical power or telecommunication cables, as well as connecting buildings for convenient passage of people and equipment.

5.Name of author :-henrry liu. Name of paper :- pipeline Technology Description - line of pipe equipped with pumps and valves and other control devices for moving liquids,gases, and slurries (fine particles suspended in liquid). Pipeline sizes vary from the 2-inch- (5- centimetre-) diameter lines used in oil-well gathering systems to lines 30 feet (9 metres) across in high-volume water and sewage networks. Pipelines usually consist of sections of pipe made of metal (e.g., steel, cast iron, and aluminum), though some are constructed of concrete, clay products, and occasionally plastics. The sections are welded together and, in most cases, laid underground.

6.Name of author :- Hamed Shirazi, Reg Eadie, HR Chen. Name of paper :- A review on current understanding of pipeline circumferential stress corrosion cracking in near-neutral PH environment. Description - In recent years, pipeline failures attributed to circumferential stress corrosion cracking (C-SCC) in near-neutral pH environments were reported.. C-SCC failures remain rare, but they are often unexpected and can create significant pipeline operation and safety hazards

Resources and Consumable required (List of Components with material specification):

Road TUNNELS can be made from various materials, including concrete, stone, and plastic, RCC.

• Concrete: Concrete kerbs are the most popular type of kerbs used in road construction (V Portland cement concrete)

• Stone: Stone kerbs are a popular choice for heritage areas and historic districts.

• Plastic: Plastic kerbs are lightweight and easy to install.

• Aggregate: fine and course.

• Pipelines, gaslines

• Cables ,wires

Benefits of Using Underground Tunnels for Infrastructure

Efficiency

Underground tunnels minimize disruption to the surface environment while providing a secure route for various

Mitigation of Hazards
By placing utilities underground, the risk of damage from natural disasters and human interference is significantly reduced utilities

Economy
Damages/ excavation of roads after construction are reduced.

Cost-Effective Maintenance

* Maintaining traditional road tunneling and other supply can be acostly endeavor. Constant repainting and maintenance requirements add up over time, straining limited budgets. The supply of various things from one tunnel is cost effective . This translates into potential cost savingsfor local authorities, allowing resources to be allocated towards other pressing infrastructure needs
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Challenges on the Path to Implementation

A primary hurdle that engineers face in and during tunnel construction is the geological variability. The Earth's subsurface can be complex, with the soil and rock composition varying drastically in certain spaces. This requires constant adjustments of techniques and methods to suit

Conclusion and Future Prospects of Underground Tunnels for Infrastructure:

Efficiency

Increased Reliability Enhanced dependability of vitalservices with underground infrastructure

Mitigation

Risk Reduction Effective mitigation of environmental and structural risks through underground solutions