Using Modern Systems for Online Replacement of Pipelines in Crisis Management and Critical Passive Defense Arteries

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CASE REPORT

Using Modern Systems for Online Replacement of Pipelines in Crisis Management and Critical Passive Defense Arteries

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Abstract

Sometimes roads and streets in the cities and villages of the country are witnessing numerous excavations by institutions and municipal and service organizations, including municipalities, power departments, telecommunications, and more. These drills are new for various reasons, such as the establishment of pipelines for water transport, sewerage, gas, and even the transfer and distribution of petroleum fuels, including crude oil, and in fact for the construction and installation of winding and cable laying, or because of damaged pipes and cables under the soil, drilling, excavating, changing and repairing the grid is done.

Keywords: Crisis Management; Passive Defense; Critical Arteries

Introduction

Critical substructure has obtained much consideration in the article, policy, and political debates in latest years, following concern over exposure of infrastructure to fanatic assault, infraction through catastrophes, raising awareness of the interdependent nature of infrastructure in new urban systems, and alters in the possession of and authority for infrastructure properties. We claim that a finer comprehension of what is crucial about urban infrastructure is not just identification of their vulnerability and interconnectedness, but also of the clue linkages between critical infrastructure and man-made and environmental system totality and fairness within the context of investor urbanization. Infrastructure is routinely framed in current urban diplomacy as a transport to grow the economy through the development of works [1,2]. In terms of the economic downturn and when going on fiscal hesitancy ensues, governments may look to the building and preservation of social and public infrastructures such as public residences and public transport [3]. Cities and groups that have encountered infrastructure shortfalls in the past may become the beneficiaries of adjusted national and state-level policy to protect economic profitability through suitable infrastructure performance plans [4,5]. Abrupt pipe breaks happen in water conduction pipelines and dispensation mains. An abrupt pipe fracture makes a negative pressure wave that travels in both directions away from the breakpoint and is reflected at the pipeline boundaries. Due to our country's location on the earthquake line, we have been witnessed a painful catastrophe that causes the deaths and injuries of many compatriots and causing heavy losses to the country's economy [6]. Similar events in the other countries, especially the advanced ones, should lead us to believe that the earthquake should not be considered an indescribable phenomenon; otherwise, the casualties and losses associated with it are irreplaceable. But it has to be resolved and like the other countries we have to deal with it seriously. With emerging advances in science and technology took important steps in the direction of innovation, production and construction, and improving the economic conditions in the country. Fortunately, a prerequisite for a serious move has been made in this regard, and there would be no longer excuses for accepting continued damage in the country.

Case Studies

Generally, there are some reasons to repair pipelines including inappropriate estimation, design and implementation of the pipe network or cable, in particular the lack of forecasting and the lack of interference with the population growth rate that makes use of these facilities in designing these networks; therefore, pipelines do not have the capacity to meet the needs of the population. Also, no geopolitical and geoscientific, scientific, technical and engineering studies has done to find out the number, material, density, and other features of the soil layer in order to know the destructive effects of the soil and waste materials (which, in the end, would cause destruction the pipes' and cables' network) [7].

Inappropriate trench run, inadequate subbase density of ducted channels for pipe deployment and inappropriate and non-technical substructure which is both functionally inappropriate (inappropriate tilt of the pipe and disturbance in the process of conducting materials inside the pipes, in particular sewage) and structural (loading of the pipe and additional pressure on the pipe due to the emptiness of space below the pipe that in fact plays the role of a small bridge to a closed packet for material transfer)will bring many serious problems.

Low-grade tubes and cables used in the construction of underground transmission and distribution networks, requiring repair or replacement after a short period of time. Low capacity (transmission capacity) of pipes make it unable to meet the needs of all residents, and as a result of the necessity of increasing their size every few times, the lack of sufficient resistance in the pipes to withstand the pressure of the upper layer of the soil layers, resulting in the fracture and destruction of the pipes, thus the discontinuation of the transfer process [8]. On the other hand, impose the costs of re-drilling, repair and replacement damaged tubes are one of these problems. In this case, it is better to use a new method called micro tunneling which is described in the present article.

Undesirable effects of soil environmental conditions, especially frost and freezing, and successive melting of wet soils around the pipes, providing pipes and cables new technologies to the tube market with more efficiency and efficiency, of course Lower maintenance cost and longer durability, finally, replacement of worn-out networks with these new systems will be more efficient. But the main problem begins when the preliminary drilling, excavation and trench operations that begins after the preliminary studies. Problems such as spending a lot of financial expenses on the entities responsible for building and maintaining these networks, the possibility of damage to the unharmed parts of the network during drilling and excavation operations for repairing damaged parts of the network, destroying the pavement surfaces of the street, interrupting or creating obstacles in the ordinary course of traffic of citizens cause expensive financial and time waste to repair and rehabilitate these passages and the network that also make urban landscape unpleasant [9].

Due to the problems and troubles mentioned above in the field of drilling and trenching for the construction or restoration of underground pipes or underground cables that are considered to be the vital arteries of cities, and on the other hand, given the increasing population growth; therefore, the need for more modern and efficient services to people in the field of infrastructure of city, it is absolutely necessary to use modern methods based on the latest technology in the world for the institutions and services of urban services.

Appropriate Solutions

In recent years, many countries, especially in countries such as England, Germany and many other European countries have been made significant progress in the construction, repair and reconstruction of transmission and distribution networks for water, sewage, gas and electricity. The European system has been implemented in Asian countries like Thailand. Completely scientific and technical methods that if the conditions for their implementation are available they can be a very suitable alternative method from perspectives such as environmental, economic, network characteristics and the soil materials of the region because direct drilling methods requiring a high volume of excavation operations (cut and fill) and other financial costs and surly take time. Among the most important new methods known as On-Line Replacement Systems, the following can be mentioned: Pipe Jack in, Clear Line Expanding, Micro Tunneling, Pipe Bursting, Pipe Reaming and several other methods. The use of such systems without drilling was in 1890 in England to transport water and sewage from intubation without drilling or excavation, or, for example, in the Bangkok Water and Wastewater System of the Thai capital with high population that needs large-scale urban services, the Pipe jacking method has been used [10]. This city is ideal for using Pipe jacking due to its location on the Chao Phraya River, which has a relatively hot enough surface to cross the pipes or push the hydraulic and pneumatic jacks. In fact, city officials achieved the undesirable result from construction and replacement of underground transmission and distribution networks. The pipe jacking system used in the city of Bangkok brings about 26 million cubic meters of wastewater per day, of which about 25 percent are sewage from industrial sewage to some extent into septic tanks for purification and reuse. Of course, the vast majority of this wastewater, like many cities in the world, including our own country is poured into rivers through the channels. Each of these systems, regarding the tectonic condition of the area, the place of operation, also, considering the type of network and the purpose of its creation have special applications. For example, the bursting pipe method used by Vermeer porta burst to replace pipes that are not very large, with diameters of 8 to 30 cm and a maximum length of 30 cm. Or the clear line expands it system, which is used for a hydraulic system, is specifically designed to replace gravity pipelines. In most of these systems, we only need a very small amount of drilling to install the devices. For example, in ways such as pipe bursting, which uses the force of hydraulic jacks to deploy tubes, after deploying the equipment and doing some excavation to the depth required for sleeping the tubes, they are arranged in the hydraulic jaw in order, thus the pipe will be press into the intended permanent place by hydraulic jaw machine [11]. Of course, before doing this operation, the drill head is thrown into the soil and then crushed and discarded by opening the teeth on the drill head of the previous pipe, then, new tubes that are usually made of polyethylene are replaced by hydraulic pressure. In some cases, practitioners have to use drill heads of special or high resistance to seize steel and cast-iron pipes. Of course, in the case of steel and cast-iron pipes, it is important that the renovation and repair of these pipes with the help of cleaners or repairers. Their complete replacement is preferable. The pipe bursting system was first developed by the British Gas Company and D.J. Ryan Company. This method is also known pipe cracking. In addition to the two companies mentioned above, Clampburster, MCEroysBulet, Consplit, ESSIG Germany and Tracto Technic are among the most important companies that offer bursting services in which the pipe is broken and replaced by a new tube in fully scientific and technical way. As for the Tracto Technic Company, it is worth mentioning that the company uses two methods for cracking piping and crushing pipelines to repair or rebuild water and gas pipe networks. Chenille methods are suitable for pipes of cementitious, plastic and cementitious viscosity. The company offers the replacement of a pipe with a diameter of up to 102 meters. But German ESSIG uses Windmill windmills to replace concrete pipelines, clay and cementitious materials up to a diameter of 500 mm. The company has a history of 120 meters long intrusions during a single stage of intubation operations, without drilling and auxiliary trenches drilling. In modern methods of intubation, to propel new tubes and locate them locally, or from a system of hydraulic jacks, belters and drill bits are used on a hydraulic jack alone. The combined system with belt and drill head is much more suitable, since the deviation from the crushing path and eventually the new tube reaches the minimum, and the replacement of the tubes is done in a desirable way. The use of hydraulic jacks alone requires special conditions. The fact is that the soil should not be too rigid, such as clay and sandy soils, and, on the other hand, the main factor is determining the hydraulic pressure of the hydraulic jack. applying the pressure data measured at one place along the pipeline, the timing of the primary and inverted transient waves induced by the break determines the location of the break. The size of the transient wave enables a survey of the fracture size. The ongoing monitoring technique applies an improved two-sided cumulative sum algorithm to detect abrupt break-induced alters in the pressure data. The adaptive tuning of congested sum parameters is performed to discover breaks of differing sizes and opening times. The ongoing monitoring method is confirmed by applying consequences from both laboratory and field experiences and displays potential for finding and determining abrupt fractures in real pipelines. Embedded hard real-time processes require valid warranties for the consent of their timing limitations. A pipeline can be detected through a diversity of procedures and means. If the pipeline loss is straightly connected to security problems, an urgent requirement to continuously monitor the pipeline exists. For such ongoing monitoring, a wireless sensor network has lately been considered as a solution [11]. However, existing materiel expends a large amount of energy; it is therefore very difficult in exercise to apply sensor nodes that have finite energy resources. Pipeline monitoring device depends on piezoelectric sensors to sub the available high-power-consuming sensing system [12]. The system includes wireless impedance nodes that are worked with energy-aware software methods. The experiences directed in a real pipeline testbed display that the suggested system, in fact, discovers pipeline structural metamorphose and also operates the monitoring system continuously with a guaranteed operation time.

Result

This article will donate to the critical urban design literature by inspecting how infrastructure prioritization and performance is shaped through a delineation of urgency which deposes the association between urban infrastructure planning, performance and planning process [13]. One of the most significant implementations of temporary simulation is dynamic leakage finding [2]. A permeance discovery model and the solution were suggested depend on the three protection laws in hydromechanics and the state equation, which comprises transient simulation model and volume equivalence model. Dynamic parameters connected with the model such as pressure, flow and temperature can be obtained through Supervisory Control and Data attainment system. By analyzing the elements affecting leakage situation, we came to a deduction that leakage and outlet pressure are more important elements contrasted to the factors of frictional persistence and pipeline diameter. The results of these fractures can be very costly due to the service discontinuity, the expense of renovation, and damage to circumambient assets and infrastructure [14]. The expenses connected with the pipeline fractures can be decreased by reducing the fracture discernment and position time. This article offers a recent ongoing monitoring method for discovering and locating fractures in pipelines.

The most important advantages of such systems are the following:

- No need for excavation and trenching in different regions and causing damage to other underground facilities
- The high speed of installation operations by replacing the pipes and cables in the transportation network and distribution of water, sewage, gas and telephone
- Shorter operating time
- Uninterrupted transit of urban transport
- As well as, preventing damage to passages, streets, asphalt surfaces, buildings and structures that pass through the transmission and distribution networks.

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