A Study of Effective Piping Strategies

Siemens Research Competition

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Abstract

A grand number of studies have been reported concerned about the deformation of pipes. Most of them have to deal with the internal pressure that is put on the pipe. Therefore, the purpose of this study is clarifying the deformation; steel pipe with external pressure, bending is analyzed. Effect of external pressure on deformability of pipe is investigated both under compressive or load bending. Stress analysis using Abagus is performed in order to stimulate the large deformations of the pipe. Consequently, this research has focused on the behavior and study of a lab pipe under heavy load upon it.

Executive Summary

Opportunity

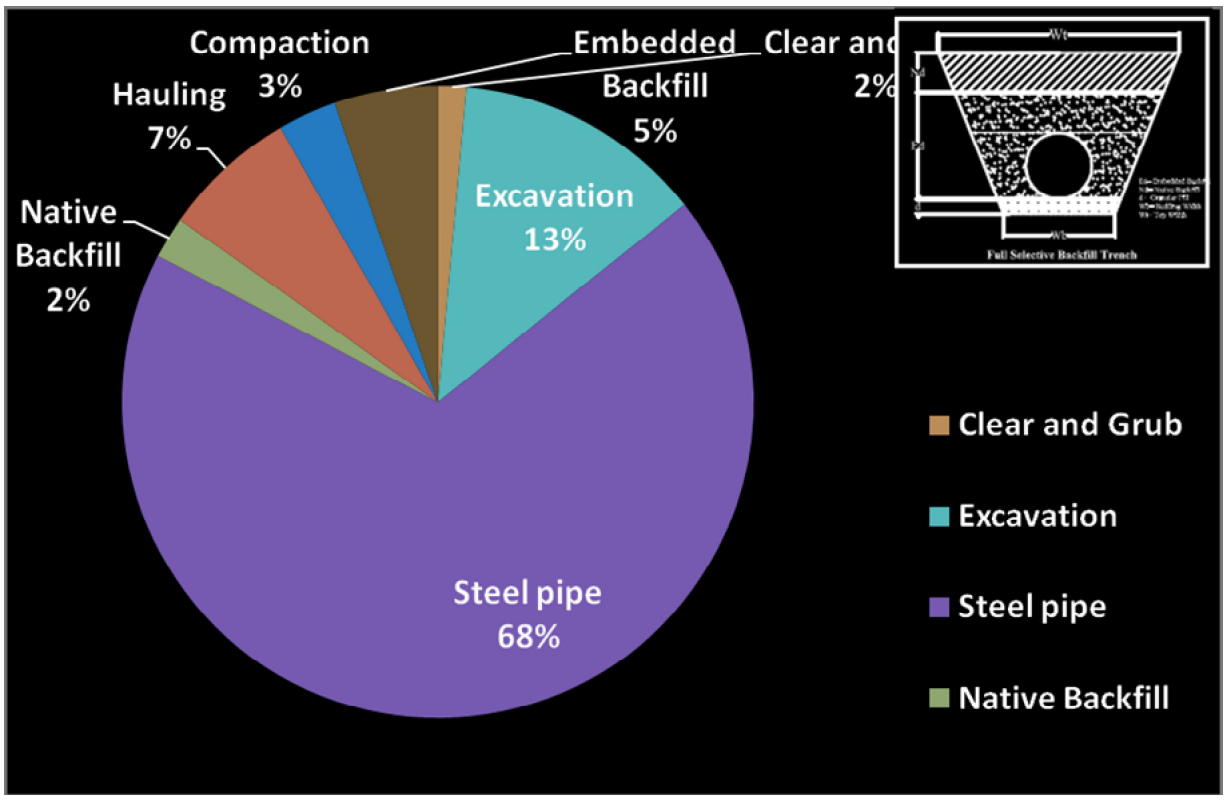
With rising prices the research will be able to solve the different issues relating raising prices in finding a cost-effective way to replace and repair damaged pipes. It is inexpensive to replace damaged pipes and time consuming with several process required before eventually finishing the project. Companies like CUIRE find ways to see the effects due to erosion or pressure on the pipes and find new ways to make the pipes better and more efficient so over extensive replacement is unnecessary.

The Concept

CUIRE has found a way using software's such as Abacus to illustrate the effects of the pipe due to heavy dumping. With these special software's, the pressure areas and the areas of high change in radius is visible. This research is useful for companies trying to create easier drilling as well as replacing

all ready damaged pipes. With the ability to determine the pressure points, companies can now find a way to fix these problems and even better efficient ways to keep them from moving or damaging.

Costs



This is the basis of what prices range up to and the difficulty in changing damaged pipes. With the research you can reduce these prices by up to 30%. Based on the research you can estimate the cost of what it is going to be to create better suitable pipes.

Introduction

The goal of the ongoing research is to provide for natural and international research that will enhance cost effectiveness, construction, productivity, environmental improvement and the renewal of the aging underground infrastructures.

There are several ongoing projects in progress at CUIRE, which will be useful in fixing as well as enhancing the piping industry. The lab work that is in progress consists of putting a steel pipe and laying certain amount of weight in order to see how much the pipe changes due to the pressure put on it. Many devices have been used with this experiment that is helpful in identifying the many changes that happens on the pipe. This experiment is useful in identifying the many problems faced with heavy dumping on the pipe as well as easier ways to dig into the soil.

There is a major cost in repairing pipes that have been damaged due to the heavy dumping on the pipes as well as possible movement of the Earth. The problem is that it costs money to excavate the ground, then to backfill the ground, the cost of hauling the soil away and finally to replace the damaged pipe. With this research, it will be easier to determine the damage done on the pipe due to heavy weight on the pipe as well as the correct material that can be used to lessen the damage on the pipe.

In this project, a pipe is put in a ditch and with weight upon it; recording is done to see how much the pipe changes. Using a software, it can be seen how much the pipe changes and exactly the areas that change the most due to the weight. In determining, where the pipe

changes, it can be useful in determining what areas of the pipe have to be reinforced and how much weight can be put on what kind of pipe material. Using the software, you can determine the hotspots of the pipe and the exact load that hurts the pipe the most.

2. Basic Laws

Before considering the effect of tension, pressure and weight on pipe or riser behavior, you must first see the famous Archimedes law. The law can easily just be stated as buoyancy which is the force exerted by a fluid, that opposes an object's weight. In a column of fluid, pressure increases with depth as a result of the weight of the overlying fluid. A column of fluid, or an object submerged in fluid, experiences greater pressure at the bottom of the column then at the top.

This law has its own flaws:

- It can only be applied to pressure fields that are completely closed.
- It says nothing about internal forces.
- It says nothing about stresses.

Seldom mentioned in engineering papers is an important corollary to the law, which is very relevant to pipe problems. Just as the combined effects can produce no resultant movement anywhere in the fluid, the movement induced anywhere in a submerged body, by a closed pressure fluid, is exactly the same as that induced by the distributed distrust.

Construction of the Model

The lab work started off with having to excavate a ditch 120 in by 300 in by 150 in order to fit the pipe into the ground. Using special software called BIM; researches can propose how the finished project will end up looking like. BIM is software that can make a 3-D model of piping infrastructures or building proponents and illustrates how the project would look like even before completion. Bedding was inserted in the ditch about 1 ft in height so that the pipe can lie on top. Once the bedding was completed, a steel pipe (300 in longitudinal, 150 in transverse, 236 heights, and 73.2 diameters) was inserted and then covered with regular compact soil. Once the pipe was covered by the compact soil, another 42 in of soil cover was placed on top. Finally, pea gravel was put on top of the soil cover in order to add more pressure on the pipe. An Earth Pressure Cell (EPC) was installed under the bedding to record the pressure and the changes on the pipe. As the levels of soil were added, pieces of wood were constructed in order to keep the soil in place and reinforced due to the heavy weight of the soil.

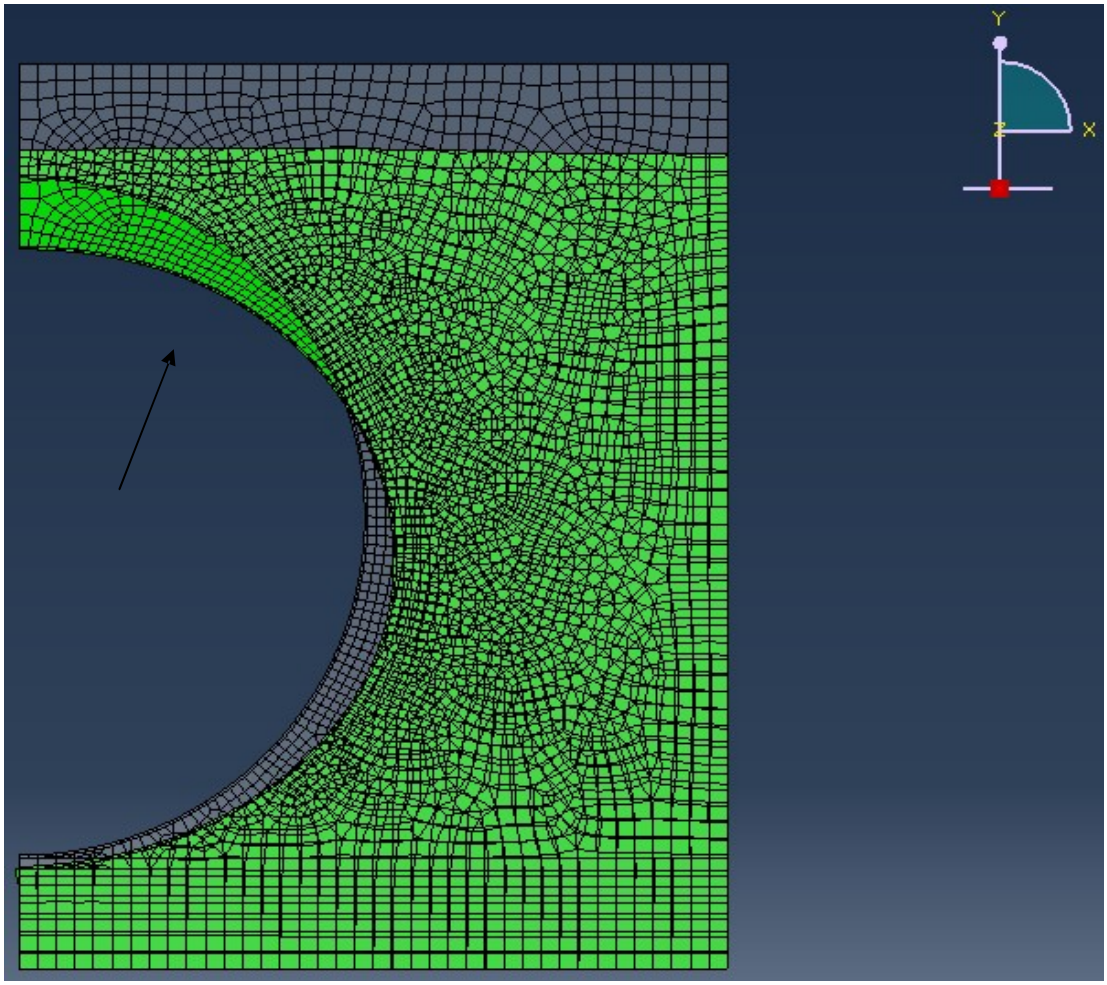
Materials Used

- 20 ft wood
- Abagus(software)
- EPC- Earth Pressure Cell
- BIM(software)
- GeoCom(software)

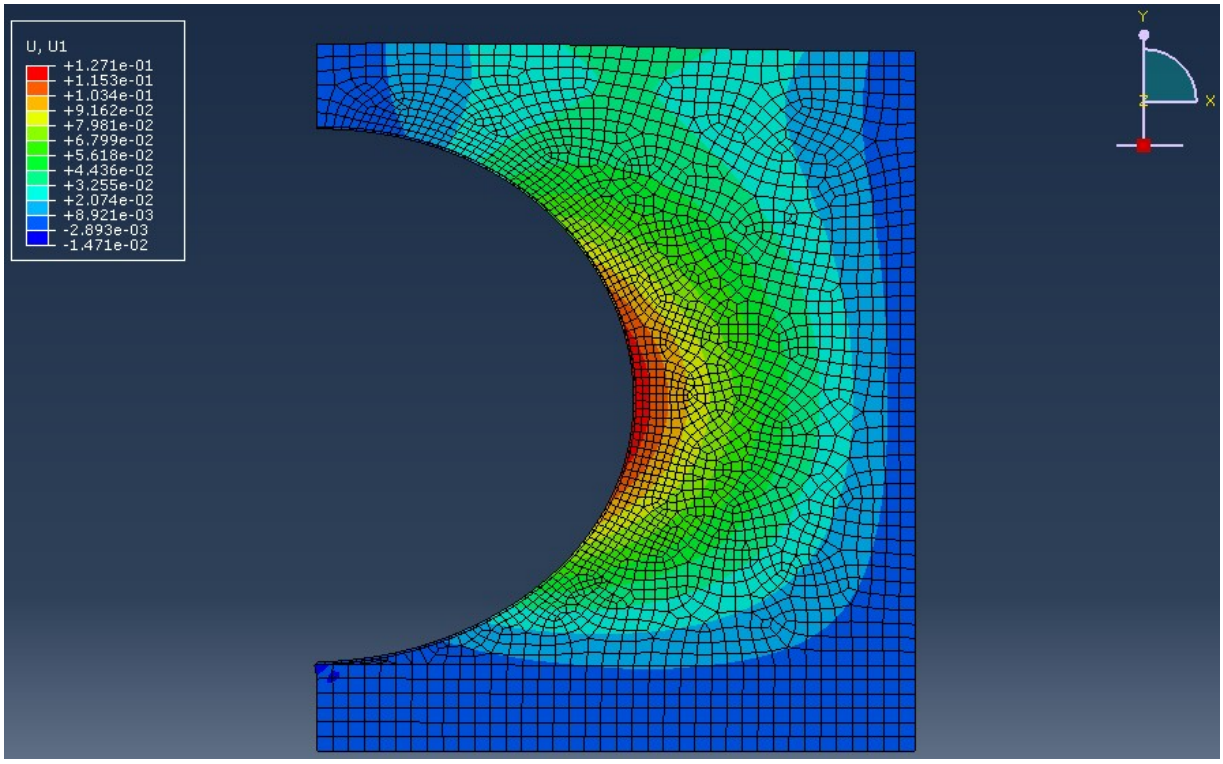
- Soil
    - Pea gravel
    - Sand
- Steel Pipe (300 in longitudinal, 150 in transverse, 236 heights, and 73.2 diameters)

Results and Analysis

The results showed that the pipe changed dramatically due to the pressure put upon it by the heavy load on top of it. Using Abagus, the software showed all the deformation on the pipe as well as areas of heat. The Dark green represents the change of the pipe afterwards and the other outline represents the pipe before.



The software also showed the different heat areas of was pressure was located the most.



Conclusion

The results of this can be useful in determining cheaper ways to dig and cheaper ways in replacing damaged pipes. The work is helpful in identifying all the serious problems identified in piping but as well as the risks of heavy dumping. The research can also be used in determining pressure put upon a pipe when natural disasters such as earthquakes occur. The research successfully identified all the problems with heavy dumping and ways to find cheaper ways in piping.

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