# SURCHARGE FILLS

**There** is often considerable uncertainty about the ability of an existing sewer to support additional backfill placed over the top of the original trench. Many variables can impact the effect surcharge fills may have on an existing system. The original ASTM pipe strength, the bedding factor or class of bedding, the width of the original trench and the degree of backfill consolidation are all factors that can influence the analysis. Some of these factors may be found in the plans and specifications used at the time of the original installation. However, uncertainty of the actual installation conditions and the lack of complete records often leave the engineer with little solid information upon which to base the new evaluation. The engineer may choose to involve a geotechnical engineer to assess the soils in the trench to define the current trench conditions. The following suggestions may be useful to those faced with resolving this type of issue. NCPI is available to assist in the analysis of specific projects.

## PRACTICAL CONSIDERATIONS

1. **Recognize that any decision will have an associated risk.** This risk will be site specific and will have to be balanced by the cost benefits involved. Consider what remedial measures may become necessary and include them in the risk assessment. Accessibility for future maintenance and repairs must also be considered.

2. **Establish a baseline of the present integrity of the system.** This may be done using an air test and televised inspection. Newer methods of inspection include laser profiling and sonar evaluations. Early detection of pre-existing conditions will provide a better basis for decisions on future construction. The expected service life of the host material and the historical performance of the pipeline will also contribute to the evaluation.

3. **Estimate the load on the pipeline.** The estimate of the load that the pipe will experience can be considered as the sum of the Marston trench load **on the original construction** and the load generated by the surcharge soil.

   Marston Trench Load – Detailed knowledge of the original construction conditions is crucial at this step of the process. Incomplete information can lead to poor assumptions and an incorrect estimate of original load.

   Surcharge Loading – In the majority of cases, the effect of the surcharge fill on the pipe may be evaluated by considering the additional fill as a uniformly distributed load. This method uses the breadth of the original trench, the distributed load of surcharge soil per square foot and the Uniform Surcharge Load Coefficient to calculate the influence of the surcharge soils. This coefficient takes into account the height of the surcharge fill and the soil characteristics. Specific engineering methods are available to quantify the magnitude of the load.

4. **Include all construction loads occurring during the placement and compaction of the new fill.** Heavy equipment can produce highly concentrated loads due to the vehicle mass and soil conditions at the time of placement. Other dynamic loads may also need to be considered depending on the extent of construction activities occurring above the existing line.

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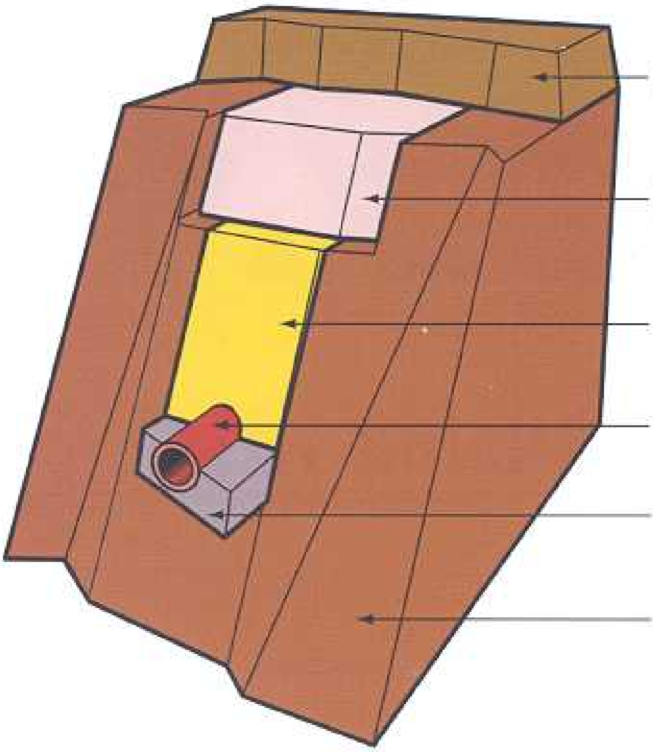
## LOAD REDUCTION AND DISTRIBUTION METHODS

Following an analysis, if the effective load appears to be problematic, one may consider the following mitigation measures to distribute and minimize the effects of the surcharge on the buried pipeline.

1. **Trench Plate the Existing Trench Zone** – Steel plating may be installed across and along the ground surface over the existing pipeline to distribute load during placement of surcharge fills.

2. **The Load Distributing Concrete Slab** – A reinforced concrete slab may be installed across and along the ground surface of the existing trench. This will distribute the surcharge fill over a wider area.[1]

3. **The Compressible Inclusion** – The compressible inclusion approach is capable of neutralizing a significant portion of the trench surcharge load. The Kentucky Transportation Center has conducted research using this approach and reported that the overburden stresses in the rigid structure (pipe) can be reduced by 30-50%[2]. This method utilizes a compressible inclusion placed just below the existing soil surface. The depth of the new trench should be 2 to 4 feet and extend 1 foot on each side of the existing pipe alignment. The trench should be filled with a low density material such as expanded foam or straw. To quantify the specifics of a design or to predict the amount of load reduction is beyond the scope of this document.




4. **Pipebursting with Vitrified Clay Pipe** – This Trenchless method of pipeline rehabilitation may be used if it becomes necessary to replace the line due to concerns over additional load development.

For additional information or to discuss a specific situation, contact the National Clay Pipe Institute.

[1] Portland Cement Association, ST 65 – Vertical Pressure on Culverts under Wheel Loads on Concrete Pavement Slabs

[2] Kentucky Transportation Center, Research Briefs, FY 2001

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