

Open-cut vs. Trenchless Technology Bursting Tradition at the Bagley Industrial Park

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The City of West Jordan is one of Utah's fastest growing cities, and currently ranks as the sixth largest city in Utah with a population of roughly 100,000. Both industrial and residential growth has continued at a high rate for several years and shows little indication of slowing at the present time. The City of West Jordan is one of the few communities in Salt Lake County that has significant amounts of undeveloped ground between the city and the mountains, which is available for future development. Within this rapidly expanding city, there are several industrial parks, including the Bagley Industrial Park, which boasts tenants such as Dannon Yogurt, Interstate Brick, and Kraftmade, with new industrial tenants arriving every year. These growth conditions, along with dated infrastructure, have required recent upgrades to accommodate the needs of current and future users.

One such circumstance, initiated by David Murphy, P.E. with the City's Engineering Capital Projects Division, was the expansion of the sewer outfall from the Bagley Industrial Park. While planning for the rapid growth within the industrial park and anticipating full build-out conditions by 2030, the City of West Jordan identified the upsizing of the outfall as a priority project. In order to mitigate the challenges associated with the proposed improvements, Project Engineering Consultants, Ltd., (PEC), was retained to provide planning, design, and construction management for the Bagley Industrial Park sewer pipeline project.

At initiation of the project, PEC collected video and logs of the system, compiled flow data, evaluated the main sewer lines servicing the industrial park, and revised the City's sewer master plan. The existing outfall for the industrial park consisted of 4,000 LF of 10-inch I.D. concrete pipe in the Old Bingham Highway. Preliminary engineering analysis demonstrated that this outfall was undersized, approaching capacity during peak flows, and would require upsizing to 18 inches O.D. in order to accommodate recent growth and future demands.

The initial concept for this project was to commence with conventional cut-and-cover methods, either by installing a parallel line or replacing the pipeline within the existing trench. Upon additional investigation however, it was discovered that the project corridor was extremely constrained by existing travel lanes and access to the industrial park, right-of-way, landscaping including walkways, decorative concrete, and stone/concrete fencing, as well as an overabundance of underground and overhead utilities including communication lines, fiber optics, high voltage power,



Looking westward along Old Bingham Highway (project site).

intermediate and high pressure gas lines. Additionally, the introduction of new tenants to the industrial park required immediate upgrades to the system that would require construction during the harsh winter months, and budget constraints threatened to limit the extent of the improvements. Due to these restrictions, typical excavation alternatives became less attractive, and trenchless methods were considered.

As part of the preliminary engineering, PEC prepared a design alternative analysis comparing conventional trenching with pipe bursting. Preliminary geotechnical analysis established that the soil conditions along the proposed alignment were variable, and consisted of silty to clayey gravel, gravelly clay and clayey to silty sand and silt. The laboratory densities of the soils proved to be generally moderate and did not appear to represent very high densities. This was a critical factor in determining the feasibility of pipe bursting, particularly since backfill that is dense or highly compacted is likely to result in heave at the ground surface, or transmit the bursting stresses to the adjacent utilities.

Conversely, poorly compacted or moderately dense or loose backfill is more readily able to accommodate the volume change resulting from the pipe bursting operations, and less likely to cause heave or stress on adjacent utilities. Highly granular backfill is also less likely to accommodate volume change, while cohesive backfill is more likely to accommodate the volume change that occurs around the burst pipe. Therefore, soil conditions proved to be within the intermediate ranges concerning difficulty for pipe bursting. Some concerns remained regarding stress to adjacent utilities, particularly with the 6-inch high-pressure gas



TT Technologies Grundoburst® with a day's HDPE attached.

High Density Polyethylene Pipe (HDPE) was selected for the pipe bursting project. DR-17 HDPE was specified because of its ability to meet the pressures and strains that would be exhibited during this unconventional triple upsize burst. HDPE provided the contractor the ability to weld a full-day's pull together, approximately 400 LF, prior to beginning each day's operation and string it inside the construction path during the pipe bursting operation.

To finalize the preliminary engineering, PEC prepared a design study report for the City outlining the benefits and disadvantages of both open-cut and pipe

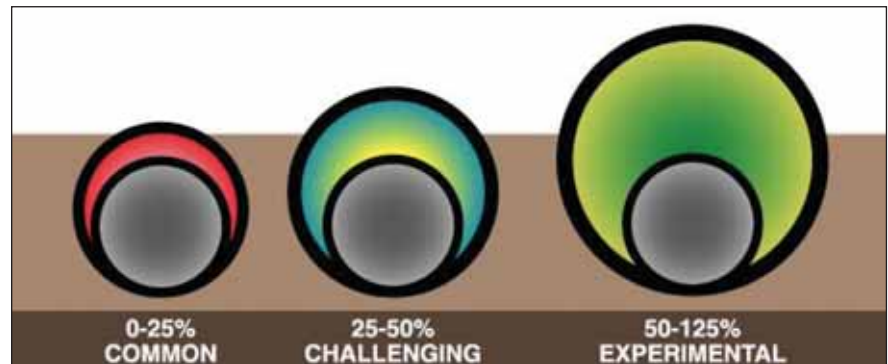
bursting methods. Detailed opinions of probable construction costs were also prepared, along with probable duration for construction. Final recommendations resulted in the majority of the project being designed and constructed utilizing pipe bursting, with a few hundred feet dedicated to open-cut. For the remainder of the project, traditional open-cut methods were utilized in order to avoid complications with service laterals and to adjust the grade of the pipe in order to enhance the flow throughout the system.

Based upon the engineer's estimate, the pipe bursting costs were anticipated to be 20% less per linear foot than the

line located immediately adjacent to the sewer alignment, with only a few feet of horizontal clearance, and vertical separation of roughly 5 feet.

To further complicate the potential for pipe bursting, the 18-inch O.D. would be a triple upsize and would require a 22-inch bursting head. This would constitute a 120% increase in size and would place this burst within experimental ranges. The challenges associate with pipe bursting were calculated and investigated further, the outcome of which provided a conclusion that bursting was feasible on this project.

Pipe bursting challenges for upsizing.



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Welded 18" O.D. HDPE.

open-cut segment. Additionally, the anticipated construction duration was also reduced by an excess of 30% due to elimination of complications with backfill moisture content, bracing of existing utilities, and paving restrictions generated by winter weather conditions. It was apparent at the project bid opening that the contractors concurred with the anticipated benefits of pipe bursting. All of the bids came in under the engineer's estimate, with the successful bid indicating pipe bursting costs were 24% less per linear foot when compared to open-cut costs.

Noland and Sons Construction Co., Inc., a local contractor with pipe bursting experience was the successful contractor. The Project Manager for Noland and Sons was Doug Noland. The equipment Noland chose for this challenging burst was a pneumatic bursting head with a leading edge cutter to split the concrete pipe. The equipment was manufactured by TT Technologies and included a 20-ton Grundowinch and Grundoburst® pneumatic bursting head. The TT Technologies representative was Jim Moore, who provided technical support throughout the project to the contractor and PEC. It was determined that the existing manholes throughout the project would require replacement. This provided Noland the perfect location for their insertion and receiving pits for the bursting operation, and provided them ample spacing for their daily bursting operations with the 400 LF lengths between manholes.

The benefits of pipe bursting continued to be manifested throughout construction, as the contractor was able to maintain



Noland and Sons installing splitter on bursting head.

complete access to the industrial park and maintain full operation of adjacent travel lanes throughout construction. Furthermore, the 10-inch concrete pipe in Old Bingham Highway earmarked for upsizing did not contain any service laterals to contend with during the installation. This provided the additional impetus for pipe bursting over conventional trenching.

Although bentonite lubrication would typically have been used for this type of burst, extremely cold weather prevented its use. Even with bursting rates varying widely throughout the project, sometimes one-half of typical production rates, the contractor was able to maintain an aggressive schedule during the pipe bursting portion of the project. The only delay to the project occurred within the open-cut section as the contractor struggled with the failure of the trench wall and with utility bracing.

In summary, the pipe bursting alternative, through proper



TT Technologies Grundoburst® with PEC Engineer and Noland and Sons.

engineering and cost effective design solutions, planning, and construction, allowed the contractor to avoid lane closures that would restrict heavy truck traffic, eliminated right-of-way constraints and the potential need for construction easements, avoided costly repairs to surface infrastructure, eliminated impacts to the buried and overhead utilities, and avoided additional environmental impacts such as noise, dust, and exhausts. Additionally, the project was completed on an expedited construction schedule during harsh winter conditions.

Pipe bursting has proved once again to be a cost effective trenchless alternative method that can triumph during extreme conditions and provide upsizing ability unparalleled by conventional installation methods. Even during these extreme conditions, pipe bursting provided the shortest construction timetable, with the least amount of impacts to the traveling public, business, existing infrastructure, and other utilities in a much more compact construction footprint.

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