

Abstract for Poster Presentation

## **Emerging Technologies for Inspecting Underground Infrastructure**

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Obtaining quantitative data which allows for objective assessment of pipes is of increasing interest to engineers, contractors, and municipalities. It has been shown that conventional closed-circuit television inspection technologies cannot adequately meet this need due to the subjective and imprecise nature of the assessment process. Laser profiling is an emerging technology that has been shown to provide precise measurements of pipe parameters such as ovality, unobstructed cross-sectional area, pipe deformations, lateral size, offset joints, and flow levels. Some laser profiling systems currently on the market account for the laser profiler's position and orientation relative to a global coordinate system using gyroscopes or accelerometers, however, none have demonstrated the capability to account for the profiler's position and orientation relative to the pipe being inspected. This poster demonstrates how this problem can cause current laser profiling techniques to generate inaccurate pipe profiles, while remaining precise. This poster also presents an analytical study which quantifies the errors produced by laser profilers including erroneous ovality and 3D wireframe distortion. Several options for solving this problem will also be discussed.

Several pipe inspection systems are currently being produced commercially which retrieve three-dimensional profiles of the inner walls of underground pipes via optical triangulation (e.g. Clearline and Colmatec). While successful in their purposes, (Logan and Anderson, 2004; Ouellet, 2004) the drawback of these systems is the partial occlusion of the pipe by the front mounted laser units. A family of systems has been suggested by a research group at Louisiana Tech University wherein a laser unit is mounted behind the view of the camera (Hegab, 2004). The laser light projects forward in a conical shape onto the pipe wall in the camera's view. In this poster, the potential for accuracy of these kinds of systems is evaluated theoretically as well as that of the existing systems. Error propagation analysis is used to compare existing systems' potential for accuracy versus the conical projection systems. Partial derivatives are taken of each of the critical parameters in each triangulation formula to establish the relative effect of that parameter. Conclusions are drawn on the likelihood of adoption of the conical systems versus existing systems based on how well each of the triangulation systems responds to changes in the desired parameters.