CREATING A COMPLETE 3D PICTURE OF THE WORLD ABOVE AND BELOW BY INTEGRATING 3D SUBSURFACE UTILITY ENGINEERING, LIDAR, AND PHOTOGRAMMETRY

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Front end design for infrastructure projects whether at private industrial/commercial sites or military installations historically involved survey information of above ground conditions such as existing features and topographic information. This information generally included little information regarding the existence and routing of existing subsurface utility systems. In the early 2000's the concept of Subsurface Utility Engineering (SUE), developed and formalized by the Federal Highway Administration, proved that mapping underground infrastructure and inclusion of these data into the predesign information matrix resulted in an average cost savings of roughly $5-dollars for every $1-dollar spent on the SUE process. These savings are realized from identification of conflicts between the proposed design with existing utilities and other underground infrastructure long before the final plans are stamped. Avoiding utility relocations with small adjustments to the design directly result in these cost savings which are more often orders of magnitude higher than the original published results.

Advances in technology are further refining this process into the 3D realm as Building Information Modeling (BIM) has in the above ground design space. Instruments such as advanced 3D ground penetrating radar (GPR) imaging arrays, electromagnetics, and Light Detection and Ranging (LiDAR) now make it feasible to merge these data into a comprehensive 3D view of the world above and below ground. This allows, among other things, engineers to use 3D clash detection software to clearly identify potential conflicts, and make smart and well planned redesigns around existing infrastructure.

This paper will discuss some recent developments in 3D GPR array technology, integration of above and below ground 3D imaging technology, and recent case studies.