Computational Fluid Dynamic Analysis
Of An ADA Compliant Grate
Progress Report for April – June, 2014

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When urban roads are resurfaced with concurrent repair and/or replacement of sections of curb and sidewalks, Americans with Disabilities Act (ADA) compliant pedestrian ramps at crosswalks may be required. Storm drains are often located near crosswalks, and may be in the crosswalk. In that case, an ADA compliant replacement grate would be required. Minnesota Department of Transportation (MnDOT) ADA Operations Unit identified a foundry with an available grate that meets ADA requirements, but no information on the hydraulic capacity of the grate for on-grade conditions is available.

Argonne National Laboratory's Transportation Research and Analysis Computing Center (TRACC) began this project in January, 2014. The project is using Computational Fluid Dynamics (CFD) analysis to determine the hydraulic performance of the ADA compliant grate, R-3210-Q from the Neenah grate catalog in comparison to a traditional vane grate, R-3210 from the Neenah grate catalog. This report covers progress for the period from April through June, 2014.

In the previous reporting period, the model geometry, physics model definitions, boundary, and initial conditions were created for most of the 42 cases, 21 for each of the ADA compliant grate and the vane grate, and approximately one third of the cases were run on TRACC's Zephyr high performance computer cluster.

During the current reporting period, the remainder of the case model geometries were built, and the analysis runs for the cases were completed using the Zephyr cluster. A problem in achieving solution convergence was encountered for one of the higher flow rate cases, which likely would have affected others if it had not been solved. It was isolated to the mesh in the catch basin under the grate and solved by remeshing the catch basin with a slightly finer mesh.

The result data for all cases was collected in an Excel spread sheet and plotted to show the performance of both the ADA compliant grate and the vane grate as a function of longitudinal street slope for the sets of subcases with varying longitudinal street slope. A PowerPoint presentation of the study was prepared and presented to MnDOT and FHWA via a web conference on May 28, 2014. After the web meeting a few more cases were run to verify the performance trends. Correlation equations were also sought for the fraction of flow captured by the grates, the fraction of the total flow entering over the grates from the side, and the fraction of flow directly over the grates that is captured. All 21 case results were correlated for each of the grates with the upstream Reynolds number or the Froude number at the upstream curb depth. These correlations were added to the presentation and included in additional notes with equations defining the Reynolds and Froude numbers and discussion. The notes, updated presentation, and a spread sheet with case and result tables were sent to MnDOT and FHWA on June 27, 2014.

Work on the final report was begun in mid-July 2014, and is continuing.