QUARTERLY PROGRESS REPORT

January, 1 2011 to March, 31 2011

In this reporting period we received additional 30K form Michigan and 15K form Georgia for the project. The total funding received for the TPF-5(164) study so far is $270,000.

The following tasks were performed in accordance with the proposed statement of work/time schedule:

Task #1 Developed a test matrix based on the test schedule in the original test proposal (refer to table 3 quarterly progress report October 1, 2010 to December 31, 2010).

Task #2 A annular corrugated pipe was obtained from CONTECH Co. with the following technical specifications; Note that c/k is cycle pitch to depth ratio which for this case is 3.

Table 1: Handling Weights for CSP[1] with 3"x1" adopted from CONTECH Construction Products Inc. Safety Instructions for Unloading and Handling CONTECH Corrugated Metal Pipe

Weight (Pounds/Linear Foot)			
Inside Diameter (inches)	Gage	Specified Thickness (inches)	Galvanized and Aluminized[2]
36	16	0.064	33

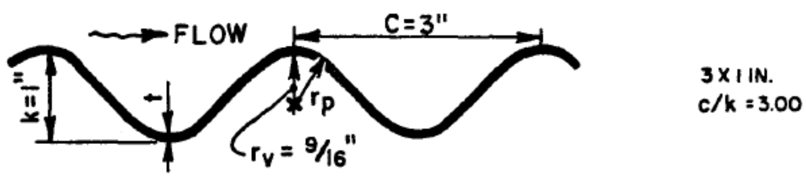

Figure 1: Annular Corrugated Metal Pipe (CMP) Shape

Figure 2 - 4 depicts the different view of the corrugated pipe before any change. According to the factory suggestion, the manning rughness coefficient for this pipe is n=0.012.

[1] Helical lock-seam pipe only. Annular riveted pipe weights will be higher.
[2] Weights for TRENCHCOAT® polymer-coated pipe are 1%-4% higher, varying by gage.

Figure 2: CMP Lateral Cross Section View

Figure 3: CMP Isometric View

Figure 4: CMP Longitudinal View

Figure 5 : CMP Side View

Task # 3 Pipe sections were designed in AutoCAD 2010 with further precision. Figure 6 is the 1st CMP section including placement angle and the arc length.

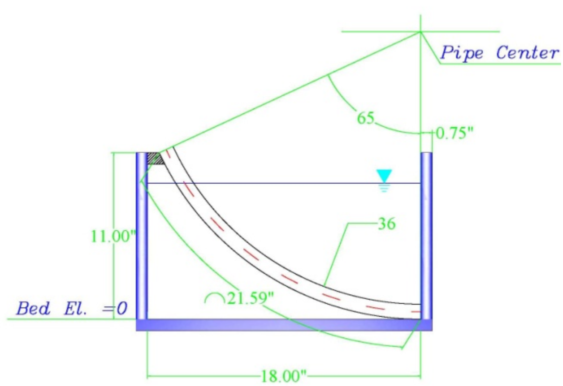

Figure 6: CMP 1st Section with Bed Elevation corresponding to 0.00"

Figure 7 is the 2nd CMP section including placement angle and the arc length. Note that the bed elevation is equal to 0.15 times the diameter of the pipe.

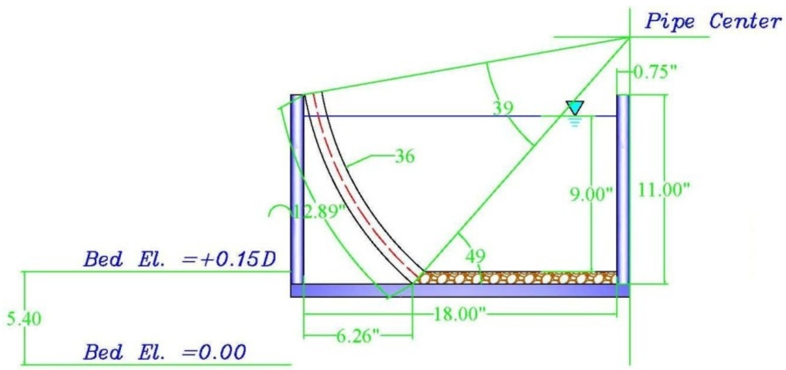

Figure 7 CMP 2nd Section with Bed Elevation corresponding to +0.15D"

Figure 8 is the 3rd CMP section including placement angle and the arc length. Note that the bed elevation is equal to 0.25 times the diameter of the pipe.

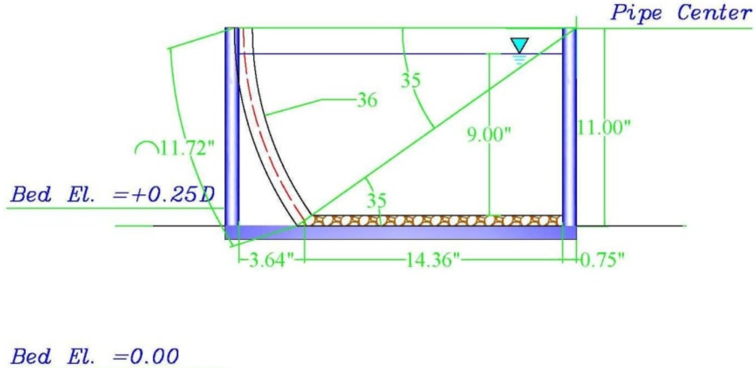

Figure 8 CMP 3rd Section with Bed Elevation corresponding to +0.25D"

Task # 4 Particle Image Velocimetry (PIV) and Acoustic Doppler Velocimetry (ADV) setup

- <u>PIV Set-up</u>

The main objective of the PIV tests is to achieve a 3-dimensional high resolved velocity distribution to enable us to compare experimental data and CFD simulations. For this purpose, 2D-3C Stereo PIV is being utilized.

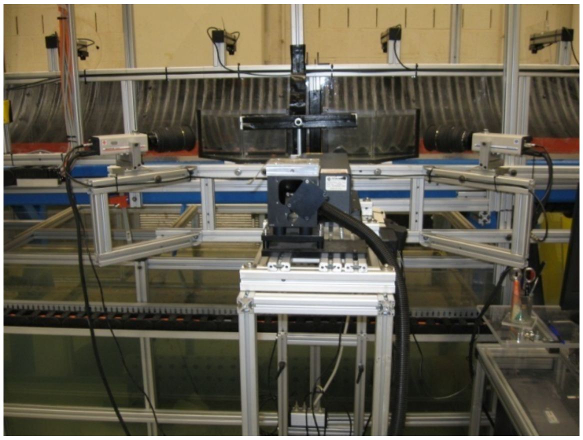

Figure 9 Stereo PIV Front View

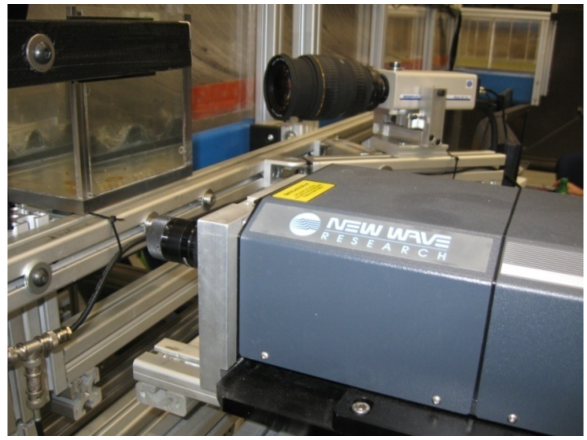

Figure 10 Stereo PIV Side View

The set up includes:

- Two high speed CCD cameras
- ND-YAG laser device
- Two water boxes to lower the errors imposed by the difference in water and air refractive index
- Supporting frame for cameras and Laser
- PC with all required interfaces to operate laser and shut the images
- Image processing software

Figures 9 and 10 well exhibit the place of CCD cameras and the laser along with the carriage that allows us to move the instruments parallel to the flume.

- <u>ADV Setup</u>

A 16 MHz SonTek microADV is mounted and synchronized with a 2-dimensional robot to validate the velocity fields obtained from PIV. Figures 11 and 12 depict the robot as well as a dummy mounted instead of ADV probe.

Figure 11: ADV Side View

Figure 12: ADV Front View

Task # 5 PIV and ADV Performance Evaluation

Before starting the original testing, some test scenarios were defined to evaluate the efficiency and performance of aforesaid methods. The purpose was to arrive at the velocity fields in a rectangular section in an open channel with an arbitrary discharge. Subsequently, as a calibration grid, a 5 mm by 5 mm doted image was adopted. Figures 13 and 14 show the calibration grid used in the evaluation test. The sliding mechanism in the calibration grid handle made the measuring of the complete flume section possible.

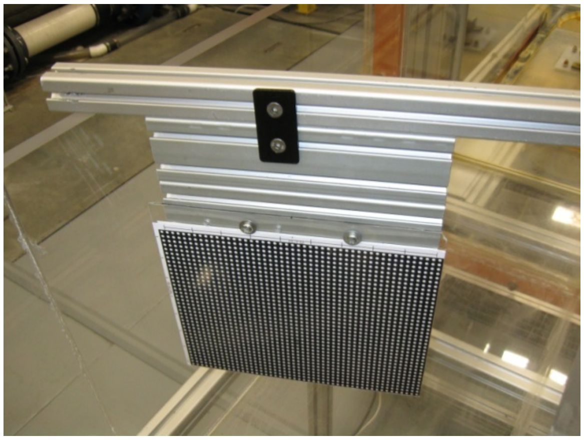

Figure 13: Calibration Grid Front View

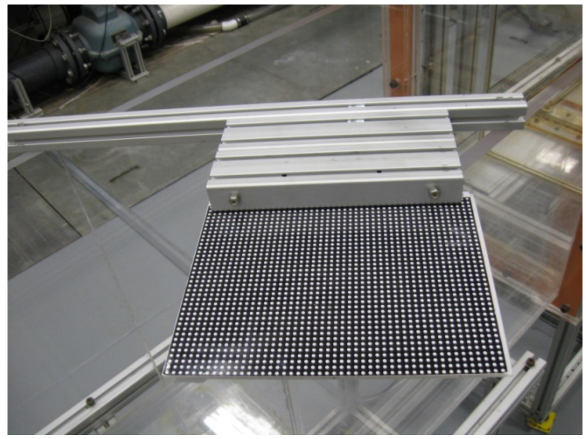

Figure 14: Calibration Grid Back View

Figures 15 and 16 demonstrate velocity vectors profiles and velocity surface profile from PIV test, respectively. ADV results carried out in some random points are in complete agreement with the results from PIV.

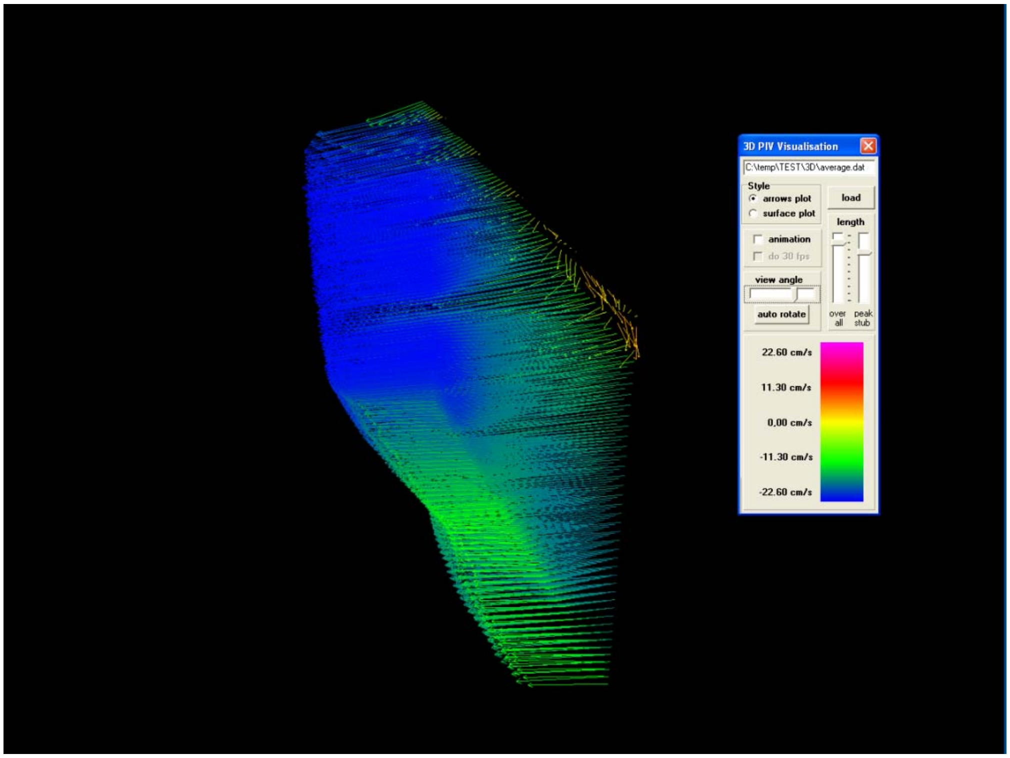

Figure 15: 3D Velocity Vectors Profile

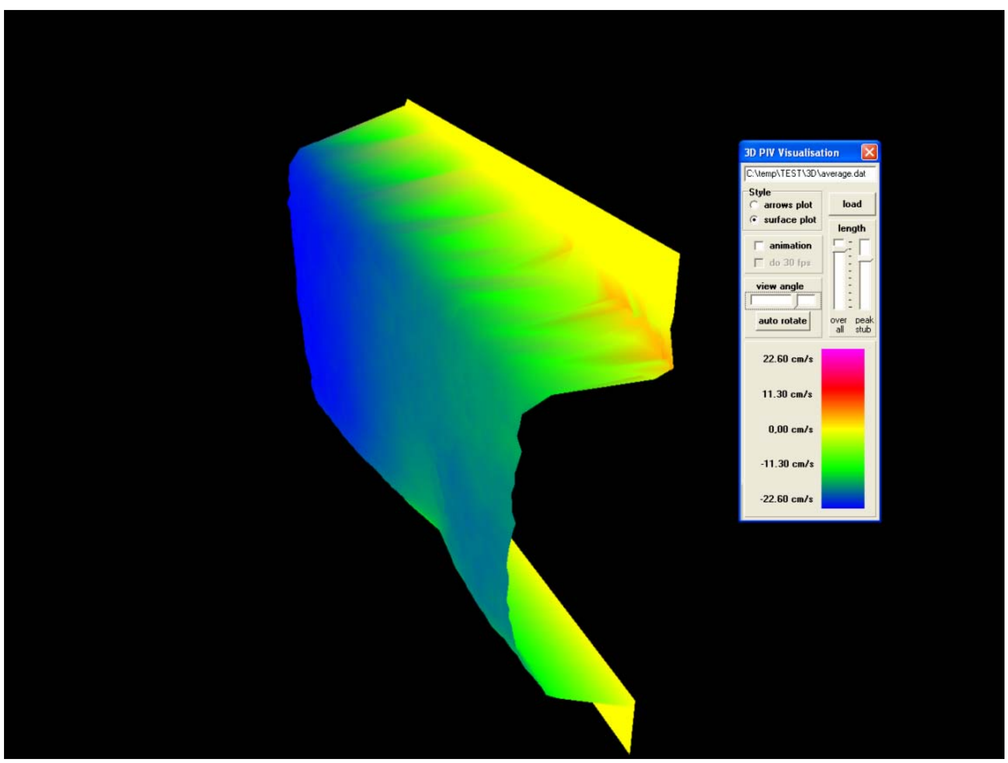

Figure 16: 3D Velocity Surface Profile

The Transportation Research Analysis and Computing Center (TRACC) at the Argonne National Laboratory continued performing computer modeling for the study. The current status of the high performance Computational Fluid Dynamics (CFD) modeling for the fish passage study is presented in the TRACC-CFD quarterly progress report.

In the period from 01-01-11 to 03-31-11 no TPF funds were spent.