Experimental Pipe Loss

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Project Description

- *Facilitate Learning to fortify the theory learned in Fluid Dynamic Classes.*
- *Be able to collect real time data using Data Acquisitions.*
- *Use collected data to determine energy loss across different pipe fittings and lengths*
- *Replace old experiment for Me 495*

- *Client:*
  - *Dr. Cornel Ciocanel*

Figure 1 – Initial Construction

Project Updates

- *Majority of design constructed*
- *Sensor system changed from a single sensor to measure pressure to multiple sensors to pressure across the entire system simultaneously*
- *Length of design reduced to 7 ft instead of 10*

Figure 3 – Tank and Pump

Cavitation Analysis

- *Net Positive Suction Head relates the chance of a fluid vaporizing*
- *Reducing energy loss within the reservoir to pump section will reduce the chance of cavitation.*
- *Pump and Tank have different inlet, outlet diameters.*
  - *By utilizing the largest diameter for the majority of the section, total energy is maintained*

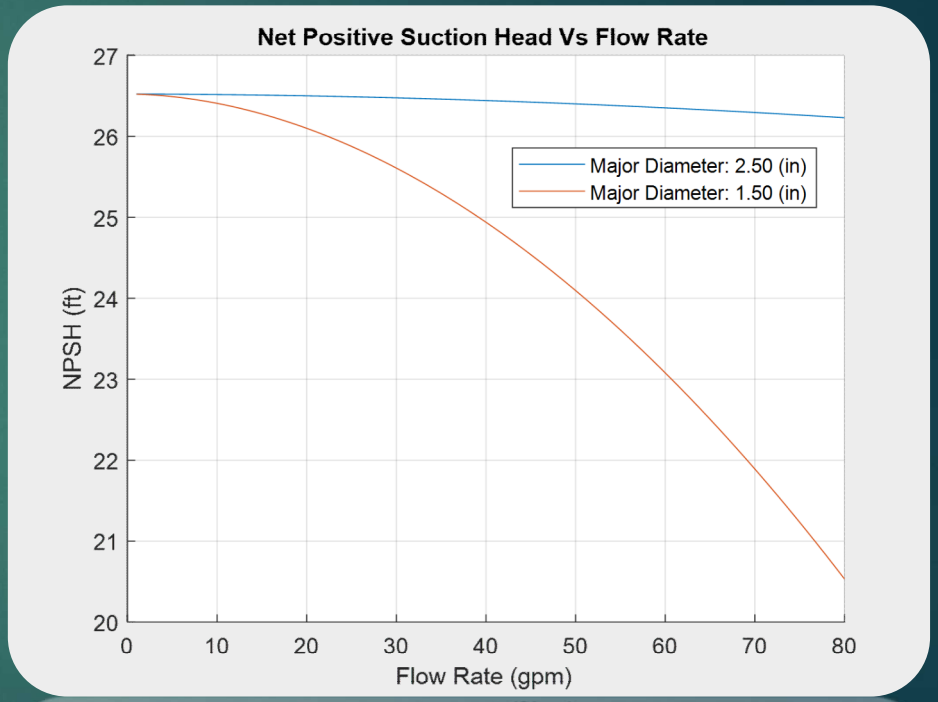

Figure 3 – Cavitation Analysis

Sound Dampening

Sensors

- *Sensor system determined*
- *LabView Integration*
- *Mounts for Sensors changed to direct connections*
  - *No longer using Tee Joints*
- *Pressure Transducers*
  - *100 mV bridge output*
  - *10Vdc Excitation*
  - *Connects with our current DAQ system*
- *Rotameter*
  - *2in PVC Adapter inlet and outlets*
  - *8-80 GPM*
  - *Full scale accuracy +/- .5%*

Figure 4 – Pressure Transducer

Figure 5 - Rotameter

Current Manufacturing Status

- *Upper and lower pipe system mostly completed*
- *Pump partially mounted and connected to tank*
- *System mounted to table top and frame*
- *Flow rate is variable by valve located in segment 1*
- *Missing sensors and rotameter*

Video – Hardware Review

Remaining Manufacturing

- *Attaching the sensors to the pipes*
  - *Either soldering or threaded*
- *Finalization of LabView VI*
  - *Collect all pressures at once*
  - *Save to file*
- *Sealing any leaks once testing begins*
- *Fixing pipes to table top, need rotameter to know correct position*
- *Wiring of pump*

Testing Process

- *Run system at different flow rates*
  - *Flow rates dictated by valve at beginning of system*
    - *100% Open*
    - *50% open*
    - *25 % open*
  - *Record all pressures and flow rate*
  - *Verify the integrity of data file*
    - *All needed measurements are recorded to the data file*
  - *Determine energy loss of measurement points*
    - *Compare to theoretical results*

Schedule

Budget

- *We have purchased nearly all Items except for the Rotameter and the sensors*
- *We are currently over budget*

Table 1 – Budget

Capstone Budget			
Item	Quantity	Price per unit ($)	Price ($)
1 in x 10 ft Copper Pipe	4	35.93	143.72
1/2 in x 10 ft Copper Pipe	1	9.76	9.76
1 in Copper Elbow Joint 90 deg	6	16.47	98.82
1 x 1/2 in Copper Reducer	4	4.51	18.04
1 in Copper Tee Joint	4	19.24	76.96
Hydrolic Reservoir	1	370.5	370.5
Centrifugal Pump	1	1291.15	1291.15
.452in x 48in x 96in Pine Table-top	1	46.25	46.25
NIBCO Ball Valve 1 in copper	5	24.43	122.15
1/2in Sharkbite Ball Valve	1	16.78	16.78
2in Sharkbite Ball Valve	1	88.77	88.77
1in x 3/4in PVC Adapter	1	0.98	0.98
1in Sharkbite PVC Adapter	2	18.97	37.94
1in x 2in PVC Pipe	1	2.34	2.34
4 oz PVC P-68 Primer	1	4.59	4.59
2in x 3ft Copper Pipe	3	44.15	132.45
1in 90 deg PVC Elbow	2	1.14	2.28
2-1/2in x 2in PVC Reucing Coupler	2	4.97	9.94
Total			2751.26
Dr. Ciocanel's Budget			
Item	Quantity	Price per unit ($)	Price ($)
Pressure transducers	11	182	2002
Rotometer	1	654.02	654.02
Total			2656.02

Questions?