High Accuracy Flow Profiling in Large WWTP Inlet Pipe

Biberach an der Riβ, Germany

TELEDYNE ISCO
A Teledyne Technologies Company

Expertise in Flow

Case Study

Benefits of ADFM Pro20:

- 1-2% flow rate measurement accuracy
- Accurate velocity measurement in difficult hydraulic conditions
  - Turbulence
  - Near zero/ zero velocity
  - Peak velocity shifting from side to side in channel
  - High velocity (±9m/s)
- Large flow measuring span (0.2 - 6m level)
- 4 Pulsed Doppler velocity sensors in multiple points (bins) and pointing in different directions of the flow
- Measures velocity even if 1 or 2 sensors are covered
- Generates a true flow profile
- Calibration-free technology with zero drift of ultrasonic level

ADFM Pro20 Sensor

"The Future of Flow!"™

The ADFM Pro20 Pulsed Doppler flow meter from Teledyne Isco, Inc. brings unparalleled flow rate measurement to a traditionally difficult measurement environment: large pipes and channels. In a test supported by University of Applied Sciences Biberach in Germany, the ADFM Pro20 demonstrates its unique flow measuring capabilities in a wastewater treatment plant (WWTP) inlet.

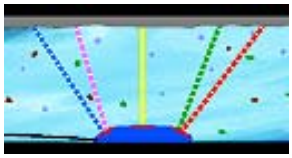
Figure 1: WWTP inlet channel Peak velocities visible on left side of pipe (red arrow).

WWTP Inlets

Accurate flow measurement at a WWTP inlet is a key element for achieving optimal efficiency in any wastewater treatment plant. Treatment processes are often designed for specific flow rates, and process adjustments are often controlled directly by flow measurements. The inlet measuring point represents one of the most difficult flow applications in a WWTP. This is due to high solids content, large channel sizes, and difficult hydraulic conditions.

Site Challenge

Difficult hydraulic conditions are the challenge of a shared WWTP inlet at Biberach an der Riß, Germany. The large inlet pipe (1.8 m) is constructed with an S-curved bend to bring the inlet water from one side of a river channel to the other side. A valve leading to a stormwater tank is located after the S-curve and a short distance upstream of the inlet measuring point. This valve protrudes into the pipe itself, causing strong turbulence. Peak velocities shift in the pipe according to variations in flow rate. An inlet screening for large particles is located a short distance downstream of the inlet measuring point, potentially obstructing free flow conditions at higher flow rates. Standard types of area velocity Doppler sensors have previously been tested at the site and have been found to give inaccurate measurements.



ADFMPro20 sensor operation

System Options:

- Stationary or portable
- Communication:
  - Data logging (32MB)
  - Analog (4-20mA)
  - Digital (MODBUS/ Ethernet)
  - Relay Alarms
  - GSM/GPRS
- Flowlink 5.1 software:
  - Data Analysis
  - Diagnostics
  - Graphs/Tables
  - Editing

ADFM Pro20 with canister or box electronics

accQcomm Interface Module

ADFM Pro20 solution

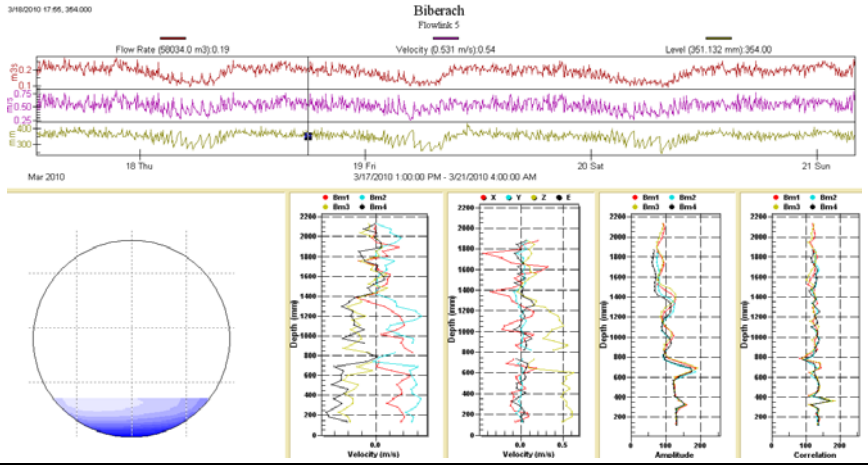
Teledyne Isco's dealers in Germany, Deinlein & Lunz Umwelttechnik GbR, cooperated with University of Applied Sciences Biberach in testing the ADFM Pro20 Velocity Profiler at this WWTP inlet site with difficult hydraulic conditions. The ADFM Pro20 Pulsed-Doppler technology accurately measures flow rate in large channels and pipes with depths up to 6 meters. Four (4) piezoelectric ceramic sensors emit short pulses along narrow acoustic beams pointing in different directions in the flow.

Figure 2: ADFM Pro20 sensor installed at site
Velocity beams indicated with arrows

Each sensor precisely measures velocity at multiple level points (bins). The measurements are then used to determine the flow pattern over the entire flow cross-section, creating a true velocity profile. Since the flow pattern and measured velocity distribution are dependent on each other, the ADFM Pro20's advanced flow algorithms automatically adapt to changing hydraulic conditions. It removes the need for in-situ calibration and ensures accurate flow rate measurement even in difficult flow conditions with turbulence, non-uniform flow, backwater, high velocity, near zero or zero velocity and reverse flow. The four independent sensors ensure redundant flow measurement, and ensure that the system will continue to measure velocity even if 1 or 2 sensors are covered.

Measurement results and feedback from Hochschule Biberach

The ADFM Pro20 showed consistent and accurate measurement results, even in the challenging conditions. Dipl. Ing. P. Hennig from Institute of Hydraulic Engineering at University of Applied Sciences Biberach was impressed by the performance of the ADFM Pro20 flow meter: *"When we see the flow profile with the velocities shifting from side to side in pipe, we can really understand why other Doppler flow meters are not able to measure correctly at the site. With the advantages demonstrated, I can see a potential for this flow meter in large pipe/ channel applications in Germany."*



Measurement results displayed in Flowlink 5.1 software, with flow profile and velocity diagnostics. Lower velocities in profile shown in darker color.

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