HYDRAULICS IN CIVIL ENGINEERING

Shaping our world
Hydraulic analyses are a significant component of water resources studies and the design of hydraulic engineering works. They serve to assess and optimise flow phenomena and their interaction with structures, and are also required to determine the dimensions of structures such as dams, weirs, waterways, and stilling basins as well as for the design of pumps and turbines. They define pressures and other required loads for stability analysis of the structures.

Tractebel has been active in applying a broad spectrum of hydraulics in civil engineering, to meet the diverse requirements of planning hydropower plants, navigation systems, water supply, and irrigation projects.

In addition to hydraulic calculations, covering the entire range of challenges from water surface profiles to waterhammer analyses in pipe networks, further important activities include the hydraulic design of structures, the specification and supervision of physical model tests, as well as the development of operation rules and the training of personnel.

Specialists with extensive international experience are available to tackle the diverse and complex challenges. The wide experience in applied hydraulics is augmented by the development of comprehensive mathematical models together with practical experience in physical model studies and field investigations.

A large library of computer programmes is an integral tool to answer hydraulic questions. This library comprises both commercial and internally developed software, thus ensuring that it fully meets the client’s requirements, and can be readily adapted to specific challenges of each project.
Free Surface Flow

Water Surface Profiles
• Calculation of the water surface profile in order to determine water depths and velocities for steady state flow conditions in a river or canal

Open Channel Transient Flow
• Simulation of transient flow in open channels, e.g. upon load rejection by turbines, pumps or by operation of a navigation lock, to determine extreme water levels and velocities

Flood and Dam Break Waves
• Simulation of flow conditions during a flood or following a dam break, and derivation of the discharge and water level hydrographs; definition of flood warning measures

Closed Conduit Flow

Head Losses
• Calculation of head losses in pipe and tunnel systems, and plotting of the energy and pressure head profiles

Surge Tank Oscillations
• Simulation of mass oscillations in pipe and tunnel systems in order to optimise dimensions of the waterways and the surge tank

Waterhammer Analyses
• Simulation of pressure oscillations in pipe or tunnel networks including the effects of inertia, compressibility, and determination of the minimum and maximum pressure heads and discharges
Fields of Application

Hydropower Plants
- Solution of all hydraulic challenges in the design, construction, and operation of hydropower plants

Two-Dimensional Flow and Dispersion Models
- Simulation of flow and dispersion processes for thermal plumes, salt or pollutants in rivers and coastal waters with two-dimensional mathematical models

Sediment Transport
- Sediment transport studies using mathematical models to calculate flow parameters and sediment transport processes, e.g. for the simulation of reservoir sedimentation or degradation of rivers
- Design of settling basins in order to achieve an optimum retention of sediment
- Simulation of hydraulic flushing of reservoirs and settling basins

Water Supply, Wastewater Treatment, Irrigation
- Hydraulic calculations for pumping stations, pipelines, and canal systems

River Training
- Hydraulic calculations, morphological studies, design of measures for river training and flood protection, renaturalisation of streams

Coastal Engineering and Navigation
- Hydraulic calculations and design of coastal protection works, harbour facilities, intake and outlet structures, locks, canals, outer basins, bank and bottom protection
Hydraulic Model Studies and Field Investigations

Hydraulic Model Studies
Hydraulic model studies are necessary for the detailed investigation of complex flow phenomena. Flow patterns and their effect on structures are investigated and measured in physical scale models.

Tractebel prepares technical specifications, negotiates contracts with hydraulic laboratories, and supervises testing. The types of models which have been investigated to date include:

- Moveable bed river models
- Models of intake structures
- Models of bottom outlets
- Spillway models
- Tidal models
- Wave models
- Distorted models

Field Investigations
Tractebel provides all services involved in obtaining and evaluating field data, including specification, organisation, and performance or supervision of hydrographic and oceanographic survey programmes. Field campaigns undertaken to date have served to provide diverse data:

- Water levels and velocities
- Water depths by sounding
- Wave heights, wind velocities
- Sediment concentrations
- Salt concentrations

Operation Rules and Training
For the operation of hydropower plants Tractebel develops the operation rules necessary for safe and efficient operation of the following components:

- Weir and intake structure
- Spillways
- Bottom outlets
- Settling basins
We are Tractebel now

Tractebel provides a full range of engineering and consulting services throughout the life cycle of its clients’ projects, including design and project management. As one of the world’s largest engineering consultancy companies and with more than 150 years of experience, it’s our mission to actively shape the world of tomorrow. With about 5,000 experts and offices in 33 countries, we are able to offer our customers multidisciplinary solutions in energy, water and infrastructure.

Since December 2014, Tractebel Engineering GmbH (former Lahmeyer International) belongs to Tractebel and thus is part of the international ENGIE group headquartered in Paris. Tractebel (Brussels, Belgium) and Tractebel Engineering GmbH (Bad Vilbel near Frankfurt, Germany) cooperate on numerous international projects as one company.

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