Tall Building Database

web-based water pressure software tool for tall buildings

by

Nick Kelly & Richard Ingham

Improving the way water pressure is controlled through mains and pipes has been an integral part of Thames Water's commitment to managing water resources more sustainable and delivering a more reliable service to its customers. As part of AMP4, the regulated water company has been implementing its Network Improvement Programme - an ongoing programme which focuses on both zonal reconfiguration and pressure management activities, with pressure reduction highlighted as one method for reducing leakage. However, assessing the impact of pressure reduction on tall buildings can become a time-consuming and costly process. As part of its Network Improvement Programme, Thames Water devised a new data collection tool for its surveyors to use while carrying out building assessments.

Tall Buildings - TBD is improving efficiency with which pressure reduction is controlled by Thames Water across London's tall buildings *courtesy Mouchel Parkman plc*

The standardised format allowed subjective information to be quantified in a more consistent manner by using questionnaires that primarily focused on the assessment of building heights; this data provided a more consistent format for reporting. To aid the data collection, a new website was created which could be updated by any person with a user name and password and access to the internet. When the data was collated, the website provided a single, centralised set of results.

This early web based application provided a number of immediate benefits to Thames Water during its pressures management activities, where adjusting water pressure in the vicinity of tall buildings that have not been identified in the early stages of a modelling project can cause significant delays to the delivery time of leakage-saving activities. At the same time, Thames Water realised that the tool had the potential to provide a much more comprehensive service for its conceptual designers, provided the appropriate time and resources were given to the project.

Develop the tool

To help develop the web-based desktop analysis tool – **called the Tall Building Database (TBD) –** Thames Water brought in water consultant *Mouchel Parkman.* Following a process review and scoping exercise, *Mouchel Parkman* set about sourcing the number of other parameters to complement the building height data, part of a five month development process. This included ground height and topographic address data, in addition to the more traditional postal address data.

To provide the topographical data a LiDAR (light detection and ranging) survey was commissioned for the Thames Water region. The remote sensing technique uses optical remote sensing technology to measure the time delay between the transmission of a pulse and the detection of a reflected light signal; this determines the distance between a source and a surface. The initial survey of eight zones in central London – carried out using GPS satellites. GPS base stations and a light aircraft, and later expanded to include every zone inside the M25 motorway – created a data set that could be used to generate a detailed digital terrain model DTM. The DTM provided a value for every square metre of the surveyed area that was accurate to within 100 millimetres. This information was then integrated with Thames Water's existing geographic information system (GIS) data. The initial eight zone data set alone produced more than three gigabytes of information.

Ordnance Survey data was also used to provide map and address point information and accurately represent topographic heights and reference points, as well as the boundary locations for all district meter areas (DMA's) and supply zones. When the initial parameters had been incorporated, *Mouchel Parkman* set about programming the software with the help of GIS consultant *GIS4Business,* which provided technical support. When completed, the final TBD tool comprised four separate modules - **project management, analysis, survey** and **reporting** - which could be used in a systematic way to estimate the impact of pressure reduction on tall buildings.

Project management module
The opening module of TBD - relating to project management - allows the user to store outline information for each project, such as title, aims and other factors, including cost codes, general descriptions and contributor contact details.

However, the module's core function is to permit the user to define the project's area, flow and pressure parameters, as well as costing information for each DMA, from which engineering based decisions can be subsequently made. These parameter values include leakage values, number of inlets and critical minimum and maximum pressure points.

Assigning zonal costs is a vital element of TBD as such details will

TBD is particularly useful in central London, where there is a large number of tall buildings


Utilising TBD is complementing Thames Water's existing leakage detection activities

Utilising TBD is complementing Thames Water's existing leakage detection activities

Utilising TBD is complementing Thames Water's existing leakage detection activities

ultimately influence all cost-benefit decisions related to pressure reduction and the ability to remove tall buildings from a given DMA. Typical cost data relates to building surveys, estimates for the percentage of buildings that need technical solutions, such as a booster, and total leakage reduction savings, which can be substantial for every megalitre of water saved. The module also permits the user to set target dates against which the project can be measured, such as deadlines for building surveys, customer reports, installing boosters and project completion.

Analysis module

The hub of TBD relates to analysis, where pressure, cost and DTM information is displayed and analysed for trends. Users can create numerous schemes within each project, allowing them to make comparisons and draw conclusions based on presented results. From this data, a user can highlight buildings at risk to pressure changes, and recommend pressure changes and changes to DMA boundaries.

The user can test different scenarios, such as reducing pressure at different head values, and produce line graph representations of DMA total head values that feature available head drop, maximum ground height and the minimum 15-metre head that must be made available in each DMA. An overview graph can also be used to plot predicted costs against predicted savings, allowing the user to visually grasp which pressure change provides the most benefit.

The core section of the analysis module informs the user about how many buildings are potentially at risk from pressure reduction, meter by meter, and recommends minimum and maximum pressure reductions. Mapping software is used to plot each DMA in either map view or satellite view; the map highlights all buildings that are at risk at a given pressure, giving the user an aerial overview of the grouping of buildings at risk. The map contains address, grid reference, topographical reference, roof height and ground height values for every building in a zonal area.

Survey and reporting modules

TBD's final two modules focus on surveys and reporting results. The survey module can create survey forms for each building at risk, which can then be downloaded and distributed to a surveyor, The process can save significant time and effort for the conceptual designer. Additionally, Excel reports can be produced which provide composite data for very building at risk and all projects that include and exclude buildings at risk.

Trial on the network

TBD was first trialed at the end of 2006 in Thames Water's Crouch Hill zone; a zonal area of 30 square kilometres which incorporates 320,000 properties, covering Tottenham down to the City of London. Previous tall building surveys in the re-configuration area involved walking surveys undertaken on a street-by-street basis.. The tall buildings were then identified and scheduled for an internal survey that would establish if the building already had a booster in place, and therefore whether the building was at risk from changes to network pressures.

Initial TBD trials assessed building roof heights, ground levels adjacent to buildings and current and proposed network pressures. The system automatically made allowances for frictional losses in the buildings' internal plumbing system and the amount of useable pressure that might be required by building occupants living on the top floors. Using TBD reduced the number of buildings that required an internal survey by approximately 30 per cent, delivering significant internal survey cost savings. In addition, the trial proved that a considerable amount of time could be saved.

Building on success

By pulling together all the data, enabling the designer to facilitate more accurate forecasting and analysis of project parameters, TBD has reduced the risk of Thames Water's tall buildings being overlooked at the conceptual design stage of projects and enabled conceptual designers to make important decisions within very short time scales. The original concept was to develop a desktop tool for engineering design, allowing conceptual designers to define pressure management boundaries and to identify areas where rapid improvements can be made in locations where tall buildings are not present. However, TBD has shown greater potential for a number of other operational requirements, such as event management and DG monitoring.

At the request of Thames Water, *Mouchel Parkman* - which has taken on the management responsibility for TBD, controlling security requirements, server access, data sets, ongoing maintenance and software licensing - is in the process of developing an updated version of TBD to meet additional operational requirements. Once it has been updated, the new tool will automatically log all customer contacts by recording all history of communication for each building, including storing e-mails. An additional functionality will allow the user to schedule infrastructure events within each DMA and, as a reactive tool, to automatically assess the number of buildings at risk as a result of a DG2 low pressure event. This will all be capped with an advanced reporting engine that can produce reports with full graphics at the click of a button.

Although TBD has not solved the problem that couldn't be remedied before its implementation, it has significantly improved the efficiency with which pressure reduction is controlled.■

Note: T*he Editor & Publishers wish to thank Nick Kelly, Project Manager for Thames Water Utilities Limited and Richard Ingham, Operations Manager for Mouchel Parkman for providing the above article for publication.*