Quantm, Highway 129 and Beyond

By Ron Turcotte, P.Eng.

I was contacted by Maureen Mountjoy to see if I would be interested in writing an article expanding on the Highway 129 Route Planning Project that was published in the Spring 2009 edition of MTO's "Road Talk". I must admit that I was originally nervous about contributing to the Ontario Professional Surveyor magazine. I am not a surveyor. I am not even a writer, but I agreed because I feel strongly about the benefits of using Quantm in planning and preliminary design projects. So if you wanted more information on Quantm, here it goes.

Let us start with what is Quantm? There are two major components to Quantm, the Quantm Integrator and the Quantm Pathfinder processing network. The Quantm Integrator interface is installed on the project team's computers to allow them to input design criteria and constraint information and view the results of the optimisation. The input and output files are relatively small files that can be transmitted via email. The Quantm processing network is essentially an extensive series of large blade servers of which a centralised solution is able to farm out resourcing based on demand requirements. They have multiple facilities to serve clients needs and the site that we used for the Highway 129 project was located in Australia and it provided some timeline advantages. Because of the difference of the time zones between North America and Australia, when the project team sent scenarios to Quantm for optimisation at the end of the day, generally they were run during the evening (their day) and the results were sent back for review the following morning. Figure 1 is a simple schematic diagram of how the optimisation process works.
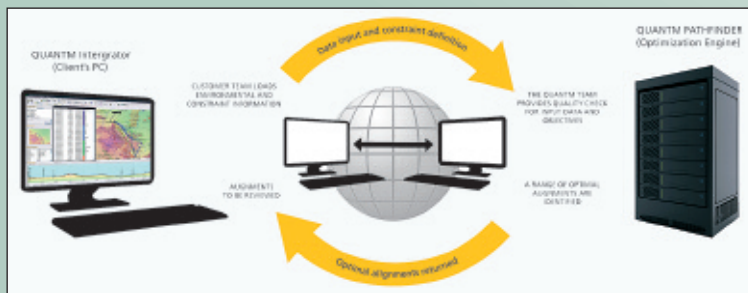

Figure 1. Quantm Schematic.

Now let me give you some background information on the study area. Highway 129 is located in the District of Algoma and runs for about 220 kilometres from Highway 17 (Thessalon) in the South to Highway 101 (Chapleau) in the North. See Figure 2 for a map of the area. The section of Highway 129 in the study area runs adjacent to the Mississagi River and is now part of the Mississagi River Provincial Waterway Park. From the highway you are offered breathtaking views of cliffs, wildlife, and of course

Figure 2. Highway 129 Study Area.

the river. See Figures 3 and 4 for photos of the study area.

This twenty kilometre section of Highway 129 is mainly confined by the Mississagi River on the West side and a steep grade or rock cliffs on the East side. There appeared to be a few opportunities to move to the higher ground on the East of Highway 129 and the Ministry of Transportation also wanted to look at an alternative on the West side of the Mississagi River. The ministry thought that Quantm would provide the best means of searching for possible new routes in the relatively rugged terrain.

Figure 3. Close proximity of the Mississagi River to Highway 129 in the vicinity of Devil's Gap (The area is named for the turn in the river, not the highway).

Figure 4. Vertical rock face on East side of Highway 129 also in the vicinity of Devil's Gap.

I was introduced to Quantm in January 2007 and was trained on version 4.8. They have now deployed version 6.0.1 which offers a number of improvements over version 4.8. The Graphical User Interface (GUI) has changed to resemble a GIS interface. There are now variable priorities for avoidance zones (High, Med, and Low) and waystations facilitate guidance through the study area instead of guide posts. The system can accommodate multiple geometries (not just basic road and rail), e.g. divided highways, super-elevation, separate shoulder and median widths. Improved bridge, tunnel and retaining wall geometry details and location reporting results in greater cost accuracy. You can now import DXF, XYZ and shapefiles directly into Quantm. No conversion is necessary.

The whole Quantm process can be described by the following steps; 1. Prepare terrain model, 2. Training (if required), 3. Input initial cost information and design criteria, 4. Develop environmental and cost constraints, 5. Send scenario to Quantm for initial optimisation, 6. Review results, 7. Refine route(s) design criteria and constraints, repeat steps 5, 6 and 7 until done.

Now the long version.

Step 1 – Prepare the terrain model. This can come from Ontario Base Maps (OBMs), photogrammatic mapping, light detection and ranging models (LiDAR), Digitised Contours (including spot heights and breaklines), triangulated irregular networks (TINs), etc. The Quantm system can readily import almost all forms of terrain data for use

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