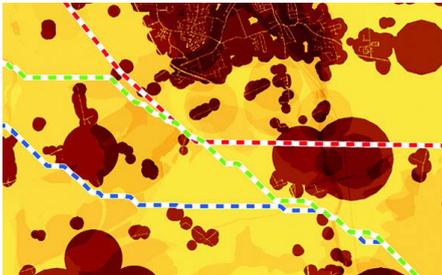


PIPELINE ROUTE OPTIMISATION METHOD (PROM)

PIPELINE ROUTING ANALYSIS IN THE UK



GIS SERVICES

GIS SERVICES - EUROPE PROVIDING ADVANCED GEOSPATIAL AND INFORMATION MANAGEMENT SOLUTIONS

Making smart decisions demands reliable answers to tough questions. Black & Veatch's GIS solutions empower you to cut through the data clutter and see how to improve efficiency, enhance service and streamline your operations. Whatever your function or area of responsibility, GIS solutions from Black & Veatch can help.

PROM QUOTES

- "PROM has saved an estimated £40K during the water resources project"
- "a cost effective mechanism to make better informed, auditable decisions about corridor routing options"
- "every pipeline over 1km should be run through PROM early in its life cycle"
- "the results of the initial trial routes are impressive"

PROM APPLICATIONS

- Infrastructure planning
- Water resource planning
- PR09 planning and optimisation
- Capital maintenance prioritisation



PROM APPLICATIONS

SELECTED PROJECT EXAMPLES

BULKWATER SUPPLY FOR EAST ANGLIA

Anglian Water | 2007-ongoing

Black & Veatch was appointed to undertake a strategic review of environmental and geotechnical considerations, and pipeline engineering requirements, for approximately 500km of proposed large-diameter bulk supply water transmission pipelines. The GIS, decision based PROM was created to provide a cost effective mechanism to make better informed decisions about the various corridor routing options available to AnglianWater. The tool has the capability to automatically provide pipeline routing options given a number of environmental, geo-technical and operational considerations. Mark Chandler, @One Alliance efficiency manager, said of the work *"PROM has saved an estimated £40K during the water resources project"*.

Its use has now widened within AWS, and it is being used on many pipeline infrastructure projects. The tool has brought many benefits, such as significantly reduced costs associated with the route planning process, more efficient routes minimising capex and opex, and automatic profiles and schedules for pipeline management and cost estimation. Guy Gregory, the Enabling Programme Manager for the @One Alliance has stated *"every pipeline over 1km should be run through PROM early in its life cycle"*.

PIPELINE ROUTE INVESTIGATION STUDIES

South East Water | 2008-2010

Black & Veatch were appointed to develop the PROM for South East Water to better support their water resource infrastructure and capital planning part of their water resource planning business activities. The PROM has been developed to cover their whole company area and therefore is capable of generating routes throughout the region. The PROM has recently been used for validating previously defined routes and is being used to support South East Water's PR09 work optimising routes and providing instant asset reporting.

PIPELINE ROUTE INVESTIGATION STUDIES

Bristol Water | 2008-ongoing

Black & Veatch have also recently been asked to develop PROM for Bristol Water Plc as part of their infrastructure planning, development services and PR14 process. Kevin Henderson, Network Planning Manager from Bristol Water stated "the results of the initial trial routes are impressive. The flexibility, turn around time on route generation and the number of constraints that are simultaneously considered whilst generating routes should result in significant route planning cost savings as well as potential reduced operating costs (for example, shorter routes could equate to smaller diameter mains

and less pumping required). We have been recently using it to great effect in quickly producing quantitative environmental and costing information for PR14 routing schemes”.

PROM IN DETAIL

As featured in magazines such as *New Civil Engineer*, and as far a-field as *Water Engineering Australia* the PROM is a new approach to pipeline routing, with the potential to make cost savings during every stage of a pipeline’s lifecycle. The GIS based method reduces expenditure during planning and can generate routes optimised to offer the lowest construction and operational costs. PROM has been developed by Black & Veatch to offer a cost effective mechanism to make better informed, auditable decisions about corridor routing options. Highly flexible, the method can be tailored to generate routes to meet clients’ priorities at the business, program and project level.

During route selection the PROM has already yielded savings of between £25,000 and £40,000 on some projects. These savings are achieved by bringing together unlimited sets of data, for the clients operating area, in a single GIS spatial database. Dataset selection can be tailored to reflect clients’ priorities but will typically cover areas including:

- Environmental designations
- Geology
- Archaeology
- Contaminated land
- Infrastructure
- Landuse
- Utility assets

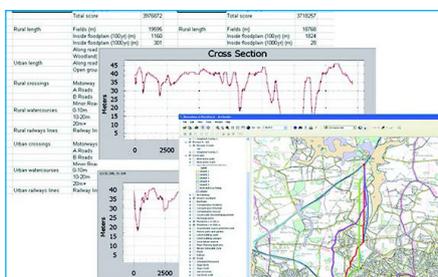
Typically 70+ datasets are collected during a PROMstudy. These provide detailed ‘decisional criteria’ information on a specific areas suitability for inclusion as part of the proposed route. Datasets are collected, compiled and individually ‘weighted’ by Black & Veatch’s environmental and geotechnical experts. This transfer of knowledge from engineer to GIS system enables the PROM to make the complex decisions necessary to produce an optimised pipeline route.

Each of the 70+ weighted datasets is then given an influence based on its level

of importance compared to the other decisional criteria information, and merged into a single ‘least score’ database. This database enables the generation of an optimal route, effectively allowing the GIS to analyse 70+ datasets at once, a task simply not possible using traditional techniques in a very short space of time.

Once the initial set up has been completed PROM can be given any start, mid or end location to provide a route shaped by the knowledge and suitability rules it has captured. As well as single start locations, multiple locations can be added to answer questions such as *“where is the best place to start my route?”* and using linear features determine *“where is the best connection point to join to my existing pipeline?”* Multiple start or end locations can quickly be generated and evaluated to meet a clients requirements to evaluate a set number of options, without spending unnecessary time on non preferential routes.

The PROM automatically generates hydraulic profiles and schedules for pipeline management optimisation and cost assessment. A copy of all the decisional



**DIGITAL DISTRIBUTION
EMPOWERS THE USER**

criteria information is also packaged and distributed along with a license free map viewer. This allows the environmental and geotechnical professionals to quickly and comprehensively validate, and better understand the route options the PROM has produced.

The package reporting not only allows the reviewer better access to information, it also allows the PROM to deliver routes extremely quickly eliminating the need of producing time consuming paper based mapping. Digital distribution also

contributes towards Black & Veatch’s commitment to sustainable engineering by significantly cutting down our paper usage.

The whole premise behind the PROM is to provide a cost effective mechanism to make better informed decisions about corridor routing options. It is a decision based expert system that provides initial pipeline routing options given a number of environmental, geotechnical or commercial considerations. These considerations or expert knowledge have been determined using B&V in-house environmental and geotechnical experts. PROM has proven it can provide the following benefits to clients:

- A significant time and cost saving associated with route optimisation and planning
- Reduced costs associated with capex and opex
- Automates profiles and schedules for pipeline management optimisation and cost assessment (e.g. target cost settings, submissions)
- Better information on GIS generated and other prescribed routes
- A reusable database that can be quickly tailored and reused, and iteratively learns as a project or projects progresses
- The ability to quickly compare the merits of one route with another
- A valuable validation tool that enables previously determined routes to be validated to add extra assurance
- The use of expert resources as verification and not for whole assessment process
- It is flexible enough to accommodate local site specific considerations i.e. exclusions round environmentally sensitive schemes
- Large use of public databases for up to date information and comprehensive evaluation

**For more information contact
Paul Hart**
01737 856568 | hartp@bv.com

BLACK & VEATCH
Building a world of difference.®