CASE STUDY

BP Pipeline Cost Reduction Project

At the IPLOCA 2000 Convention in Dubai, Dr Norman Sanderson offered to prepare articles for the IPLOCA Newsletter, describing aspects of the BP Pipeline Cost Reduction Project for the IPLOCA membership. The BP Pipeline Cost Reduction agenda includes activities in design, materials, welding, construction practices/equipment, operational aspects and project execution. This is the third of these articles and describes BP's activities on Pipeline Delivery & Construction Logistics Modelling.

The modelling approach outlined above was initially developed for research and development parametric studies but rapidly became recognised by the BP project groups as a powerful project logistics optimisation tool.

Background

In support of BP's Pipeline Cost Reduction initiative it was identified that a tool was needed to quantify the benefit of any proposed technology development improvement to the construction of onshore pipeline. With this aim in mind, BP embarked on developing a computer based simulation model of the onshore pipeline construction process, with the ability to incorporate proposed technology improvements to quantify the cost benefit.

As the onshore pipeline construction process comprises a series of discrete operations or events with probabilistic durations the logical approach was to employ a commercially available general-purpose discrete event simulation package to model the process.

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Company	BP
Industry	Oil & Gas
Application	Delivery & Construction Logistics
Benefit	Modelling Pipeline Cost Reductions

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The software selected to model the process was WITNESS from Lanner Group. WITNESS is a discrete event simulator that has graphical animation with the capability to model both discrete and continuous process, and has been applied extensively within BP.

Model Description

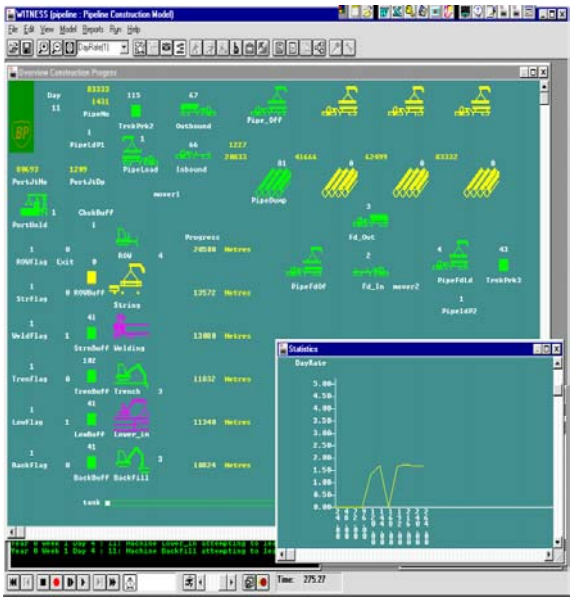
Onshore pipeline Construction (from spread mobilisation, camp construction and pipe transportation through to welding, inspection, coating and testing) accounts for approximately 50% of the overall cost of a project. As the pace of a project is increased, for example by the inclusion of multiple pipe-laying spreads, so the complexity of managing the project increases substantially. Using computer simulation tools to predict overall construction performance can be a powerful means to manage this complexity, to identify construction bottlenecks and to test what impact engineering changes or technical improvements might have on the project as a whole.

The pipeline Delivery & Construction Logistics Model (screen display shown opposite) represents a generic onshore pipeline construction process of a single definable pipe diameter and length. The user of the model defines high level parameters of the process, i.e. the diameter of the pipe (in inches), the length of pipeline to be constructed (in kilometres), the average joint length (in metres), the number of pipe dumps, and distances from a receipt port, the number of trucks available for transporting pipe from the port to pipe dumps and from pipe dumps to stringing and their average speed. This data is entered via configured Excel worksheets that are a convenient way of data entry and saving scenarios.

Specific logistic and construction process data is also entered via the Excel Workbook, for example the number of joints welded per hour, the number of pipes bent per hour, the length of ditch that can be cut per hour, etc. The model includes options of multi-jointing at the port area or at the pipe dumps, with any number of joints welded. It is also possible to deselect activities, for example ditching, lower and lay if the pipeline is not to be buried.

The model includes the ability to define construction shift patterns and terrain factors that alter the process rate of certain construction process, e.g. ROW, trenching, etc. while in the defined terrain section.

WITNESS has graphical animation capabilities and it is possible to view the simulation process and progress to understand the issues. The activity icons continuously indicate their state i.e. yellow represents idle, green is busy, red is broken down, magenta means the process is blocked (constrained), etc. As the simulation runs the utilisation of each process is tracked together with progress rate and costs. The model also tracks the number of joints at each location and the number of trucks in use throughout the simulation period.



Project Application

BP has used this approach to plan and support the construction of the In Salah Gas Export Pipeline Project in Algeria and is currently developing a model for Shah Deniz Gas Export Pipeline Project in Azerbaijan. The In Salah model considers only the logistics of pipe

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supply from three separate pipe mills to stringing activity to track stock levels and shortages, truck utilisation, determine trigger points for contingency actions, etc. It is possible to define the pipe quantities and production rates for the three separate mills for the three sizes of pipe required, together with options for coating local to the pipe mill or coating 'out of country' and associated batched shipping operations. The model includes trucking of pipe from port of entry or in-country mills to a multi-jointing yard for campaign jointing of the three different pipe diameters and three different manufactures takes place.

The modelling approach outlined above was initially developed for research and development parametric studies but rapidly became recognised by the BP project groups as a powerful project logistics optimisation tool. For each application, the model is modified to reflect the actual characteristics of the planned construction process.

References

BP's Pipeline Cost Reduction Initiative
Steve Burchell
Onshore Pipeline Conference, Istanbul, November 1999

For further details on logistics modelling contact Steve Burchell, BP, Sunbury, UK (email:burchell@bp.com)

For general information on the Pipeline Cost Reduction Project, contact Norman Sanderson, BP, Sunbury, UK (email:sanderson@bp.com)

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