

## Modelling using Discrete Event Simulation in Construction

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### Situation

Construction Companies are facing tougher trading conditions and increasing challenges in pursuit of happiness.

Challenges often include:

- Delivering on client expectations whilst addressing their unique concerns and problems.
- Meeting safety and carbon neutral targets.
- Returning continuous savings on projects.
- Perception by investors as being in the Gartner defined Leader Quadrant.
- Supply Chain Management.
- Logistics.

The capital investment and risks associated with delivering construction plans to time and budget are more often than not high. Mix in the inherent lifecycle of months, if not years, can potentially lead to capital encased for long periods with very little room for contingency. The cumulative effect is very little room for error and even less for trying new ideas.

Senior executives, shareholders and stakeholders, understandably require strong assurances that all factors have been considered to reduce the level of exposure to risk. Given the large sums of money associated with standard contracts, the 'warm comfort feeling' usually means projects with:

- Risk that is 'as low as is reasonably practical/ acceptable'
- Performance targets and milestones, that are achievable within the proposed terms.

"The best laid plans of mice and men often go awry" is a saying that manifests in many a project manager, planner or senior executive's nightmare. Variability and random events seem to be the demon that life constantly excavates and appears as the villain that the hero has to battle. This villain has a clear goal, to throw spanners in the works and steal any potential savings.

Random events such as weather may be the topic of daily discussion in the UK but when it comes to planning, current planning tools may not provide the level of comfort required to reassure the stakeholders, so communicating ideas can be that much harder.

Though experience counts for a lot, quantifying cumulative risk and the permutations from a combination of potential issues, to produce the "the perfect storm", can be very difficult to justify and account for, especially if it's on gut feeling. The fall back solution is often generated by adding in 'float' that relies on this gut feeling and experience, sometimes critical path analysis, but lacking supporting data to back it up. This all adds to the risk with potentially higher costs.

## Opportunity

The Government backed strategy Construction 2025 fundamentally aims to create an environment of sustainable competitiveness. The BIM and lean initiatives that many companies have embarked on go a long way in being able to achieve this but require:

- Vision and governance that ideas and practices deliver 'SMART' solutions.
- An organisation that has continuous improvement in its DNA.

It is commonly expressed within the construction industry that tools and techniques used in industries such as manufacturing may only be applied to repetitive processes, e.g. excavation activity during the earth works phase. However, it doesn't take Einstein to tell us that if we continue to do things the same, there will be no improvement.

## Solution

Discrete Event Simulation (DES) is a computer representation of a physical system operating in time. It comprises of:

- Processes/ Activities
- Input Data
- Constraints/ Controls
- Mechanisms/ Resources

The main purpose of building DES models is to study the causal effects on the system from constraints. Advantages of using this approach include:

- Simultaneously process multiple variables in a reasonable time.
- Handle random events such as weather and journey times.
- Integrate with existing systems through import and export of data.
- Opportunity to challenge the conventional and test new ideas and approaches.
- Support a collaborative environment to enable input from various subject matter experts to be evaluated.
- Provide a powerful dynamic visualisation to foster greater understanding of the proposed plan.
- Leave stakeholders with a comfortable feeling when presented with the final plan.
- Provide a means to mitigate against the 'Perfect Storm'

The results from the DES models provide support to the decision making process. This makes DES applicable to not just repetitive processes such as Earth Works but more about:

- Determining holistic solutions that take account of variables such as overrunning engineering works and equipment breakdowns.
- Understanding the impact change such as journey times may have on the system.
- Assessing causal relationships such as increasing resources in order to increase the output and their sensitivity on the desired outcome.
- Mitigating risk and optimising the final To-Be state to take account of stakeholders concerns and requirements.
- Having a record of what works and why it works for continuous improvements.
- Providing a collaborative environment for the evaluation, communication and sharing of ideas

Loxcius provides a service that exploits the power of DES to deliver strategic, tactical and operational improvements through the building of DES models. Loxcius also provides support and training.

To have a greater understanding on how DES can support your construction projects, or if there are further questions about simulation, then please email [colin.adams@loxcius.com](mailto:colin.adams@loxcius.com) or alternatively call +44 (0)2392 987984.