Discover how London Underground produce 10 Year Asset Management Plans using Enterprise Decision Analytics

London Underground (LU) carries more than one billion passengers a year, as many as the entire UK National Rail network. With around three and a half million journeys made each day, on 11 lines serving 270 stations, LU run more services than ever before on a network that is over 150 years old.
Initial Project Overview

LU had developed a Track Asset Investment Prioritisation tool using spreadsheets but were reaching the limit of what this enabled them to do. At this point in 2009 they contacted SEAMS to discuss how Enterprise Decision Analytics (EDA) could help them improve their asset investment planning.

The first track model delivered by SEAMS used a rule based engineering approach triggered by remaining asset life and was successful with helping LU plan their future track investments. Questions such as, ‘What are our renewal volumes and costs?’ or ‘If we need to sweat the assets rather than replace, what will the impact be on maintenance costs?’ can now be answered.

Optimised Modelling Approach

In late 2012, LU wanted to grow the model into a full Whole Life Cost calculation and look at how implementing SEAMS’ Optimisation engine could help LU improve decision making further. It was essential to LU that the software was able to hit performance benchmarks, including concurrent optimisation across a number of asset types, and the ability to produce optimisations and calculations within a predefined time.

Railways generally operate within rigid funding envelopes. The requirement for budget to renew a specific asset on the railway generally has to compete with the requirements of other railway assets, major improvement schemes (aimed at improving passenger carrying capacity), and works aimed at improving customer experience or service. Therefore it’s important to be able to assess the impact of asset management decisions relative to other changes such as the introduction of new Rolling Stock so that the railway can decide how to apportion a constrained budget to leverage the best possible increase in value.
EDA is deployed across the Track Strategic Asset Management team and is used by LU to:

- Run scenarios to calculate the expected impact of potential cuts to the investment budget and communicate this with the LU Board during the business planning round.
- Capture the total cost of ownership for track assets incorporating performance and maintenance benefit for each renewal option.
- Quantify the impact of future timetable changes associated with providing services for the ever increasing population of London to allow accurate forecasting of budgets.
- Calculate the design life for each asset depending on the asset type, curvature, installation year and type of rolling stock.
- Using condition information collected by the maintainer, add a measured life overlay to normalise for areas which are performing differently to the forecast or where poor asset information exists.
- Understand the ownership liability of building new lines in terms of maintenance, renewals and risk.
- Model the impact of future rolling stock technology changes and understand the impact on track.
- Produce an annual ACR (Asset Condition Report) by exporting an asset condition forecast by remaining asset life.
- Output a detailed list of what works are required, where and when to achieve the LU Business Plan which is given to the works delivery teams.
Key Benefits to LU of SEAMS Enterprise Decision Analytics

The optimal timing for asset replacements can be identified using the best value interventions, ensuring key objectives such as safety, minimal service disruption and cost savings are met.

The model gives greater flexibility and ensures they can run multiple ‘what if’ scenarios - quickly.

EDA has enabled London Underground to successfully defend budgets and demonstrate how changes in investments will affect operational costs and network health.

London Underground has been able to deliver its strategy of focussed investment in its track infrastructure to drive lower ongoing costs through reduce maintenance requirement, improve asset reliability and safety and enable higher speed train operations to increase fare revenue and meet the demands of an ever growing London.

A 52% reduction in life expired assets (backlog removed)

61% reduction in passenger delays due to track failures

Reduction in total cost of track assets of circa £80m p.a.

Since EDA implementation
- 52% reduction in life expired assets (backlog removed)
- 61% reduction in passenger delays due to track failures
- Reduction in total cost of track assets of circa £80m p.a.
- Track assets supporting faster speeds and increased passenger numbers

*Results correct as of August 2017*
EDA has provided LU with a secure and stable platform from which to calculate the expected cost, risk and performance profiles associated with the ownership of our track assets. This is invaluable when producing the 10 year Asset Management Plan along with optioneering during the Business Planning round. The ease of adding new lookup tables for accumulated tonnage forecasts, renewals costs and measured life has helped us to use our time more efficiently and is central to our role as Asset Managers.

Elizabeth Lasserre, Track Asset Manager, Transport for London
What lessons have been learnt from the SEAMS EDA solution?

The London Underground Track Model has been developed progressively over the last five years, gaining in both capability and complexity as it is continuously improved to support Asset Management maturity. It now sits at the heart of Track Asset Management decision making within London Underground.

As London Underground has been through the process of developing and implementing the Track Model a number of important lessons have been learned:

1) The development of such models is not a discrete activity. As models develop and are implemented within the business, they act as a catalyst for Asset Management thinking. The fact that they provide an ability to answer the ‘what if’ questions generally leads to more questions. Similarly as an Asset Management team becomes increasingly adept at answering such questions, the wider business tends to ask more.

2) Because of the developing understanding, the nature of the question and the requirements on the answer change with time. Therefore, the requirements on a model also change which requires that the models are re-visited and changed to suit.

3) Asset models will always grow organically. This means that trying to deliver such models within fixed set of requirements can lead to a model being out of date at point of delivery (as the asset management thinking has evolved through the development, but the requirements have not).

4) All models require significant volumes of data. Unfortunately, data accuracy is often an issue. Models must therefore be constructed in such a way as to be resilient to poor asset information.