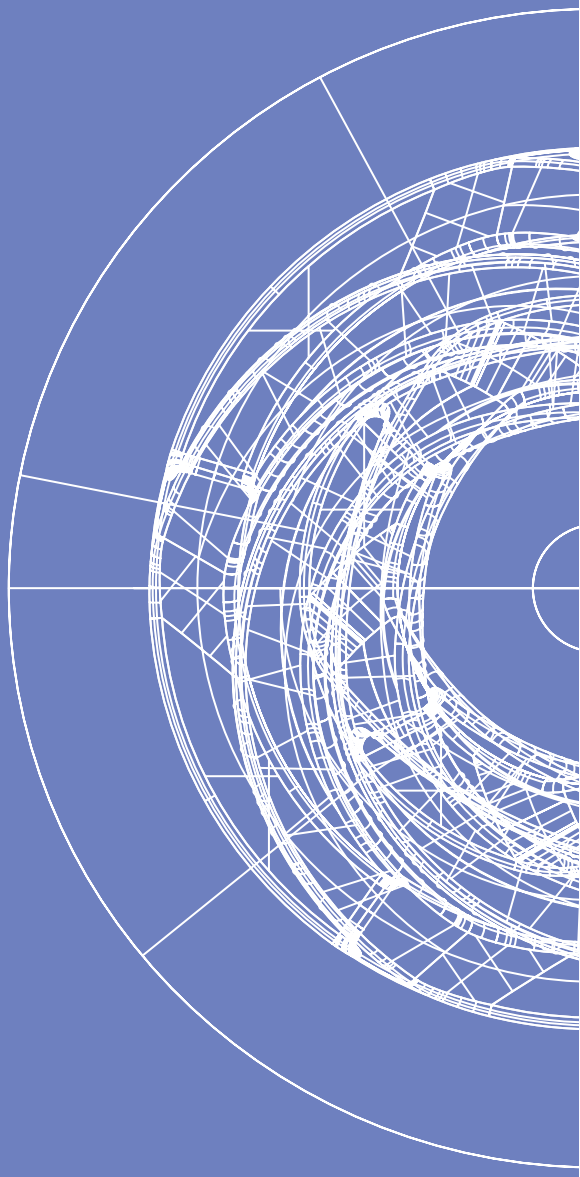
APM Project of the Year Award

Finalists 2014



Innovation in projects


Finalists
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Introduction

The APM Project Management Awards have been recognising excellence in project management for the past 22 years.

Awards finalists are judged to excel in three key areas: project management, results, and innovation and lessons learned.

In this special report we focus on innovation, or more specifically, innovations in projects.

Overall winner Network Rail went to extraordinary lengths to repair storm-damaged track near Dawlish in Devon, deploying water cannons to dislodge debris and drones to assess its impact.

The other finalists – Thales UK and London Underground, United Utilities, 4Delivery Ltd – used specially-equipped monitoring trains, mock tunnels and a 'buddy system' between designers and engineers to achieve the desired outcome.

APM believes that these (and other) solutions should be showcased and shared, so that the lessons learned can continue to inspire the next generation of project innovators.

Association for Project Management

Project: **Dawlish Sea Wall emergency works**

Company: **Network Rail Infrastructure Ltd**

Emergency repairs at Dawlish presented many challenges for Network Rail, including the need to stabilise a massive sea cliff after failure caused by the intense rainfall in the storm conditions. The project team's innovative solution – deliberately initiating a landslide – was crucial in getting the line open again, as well as earning the team the APM's Project of the Year award.

On 4 February severe storms swept the UK, resulting in damage to a 4.5-mile length of sea wall and railway between Dawlish Warren and Teignmouth, Devon. Most famously the train track was left swinging along a 100-metre section of the line.

Rebuilding the washed away railway to re-connect the route was critical to communities and business in the West Country, drawing government, political and media attention.

It was therefore imperative for Network Rail to get the line reopened as quickly as possible – in fact, they set themselves an ambitious two-month timescale.

Among the tasks faced and successfully completed by Network Rail and its contractors during this project were the rebuilding and fortifying of the sea wall with more than 6,000 tonnes of concrete and 150 tonnes of steel, the restoration of Dawlish station, the installation of more than 13 miles of new cables and the renewal of more than 700m of railway track.

As project manager Tom Kirkham emphasises, this was a huge undertaking, with Network Rail and its contractors working around the clock, against a background of continuing bad weather.

Then in early March the team faced a further challenge. Around 25,000 tonnes of material sheared away from the cliff face and onto the track at Woodlands Avenue, Teignmouth. Knowing they were already committed to reopening the railway in less than a month, the team quickly brought in a range of experts to help them find a way of clearing away the debris and making the site safe, while dealing with the specific access challenges of a site with houses above and the sea below.

"We knew we had to act quickly and we turned that into a strength, getting a whole range of expert

> **"We used drones to take aerial photos so we could ensure our water cannons were at the right pressure to remove the material without under-mining the whole area"**

advisers to the site, including geo-technicians, military specialists and consultants from the quarrying industry.

"They all had a look and we gathered their suggestions on what could be done within the timescale. Because of the specific access issues – a row of houses at the top and the sea at the bottom, we couldn't just bring machinery on to the site and take the material away – we knew we had to loosen and release it. We held a series of discussions where we encouraged everyone to make suggestions – at this stage, there was no such thing as a bad idea.

"We looked at a range of options, from using explosives to working with the fire service to dump water on the debris from helicopters. As it turned out, neither of these would have been effective in clearing away the weathered rock and clay – it would just have made more of a mess.

"In the end, the solution came from Cornwall's china clay industry, which uses high-pressure water cannons. We used these to create a controlled landslip, turning the red earth into slurry that could run off into the sea, while minimising damage to the infrastructure below."

Project team members Rosie Majer and Tom Kirkham

Below: Walkway repairs to damaged sections of the track

Bottom: Prime Minister David Cameron celebrates with the team

As the project progressed, the team had to continue to think on their feet – the jets from the original water cannons turned out not to be big enough. The team sourced larger versions from Middlesbrough, and these had the additional benefit that they could be operated by remote control, minimising risk to the workforce.

"We also had to go on assessing the site, so we used drones to take aerial photos so we could ensure our water cannons were at the right pressure to remove the material without undermining the whole area," said Tom.

All such innovations helped the team bring the project to a safe and successful conclusion, with the reopening of the line to the original deadline on 4 April, just two months after the closure. And in recognition of that success story, APM named the Dawlish sea wall emergency works its 2014 Project of the Year.

Project: **Jubilee and Northern Line Upgrade (JNUP)**

Company: **Thales UK and London Underground**

Finalist

The need to test a new signalling system while maintaining normal rail services led to some innovative thinking by this team – including the use of trolleys and passengerless trains so they could try out the technology without affecting safety.

In 2004, Thales won the contract to install a tailored version of its computer-based signalling system, SelTrac, on two lines of the London Underground. The Jubilee and Northern Line Upgrade (JNUP) is part of an extensive modernisation programme for London's Tube network.

As you might expect, the changeover from traditional signalling systems based on red and green lights to a state-of-the art, Transmission-Based Train Control (TBTC) system was a huge project that brought many challenges.

Both parts of the project had specific time constraints. In the case of the Jubilee Line upgrade, the work needed to be completed in time for the London 2012 Olympics. For the Northern Line, the goal was to provide an additional 20 per cent capacity by December 2014.

But with the necessity to continue operating normal train services, most of the upgrade work had to be done during the four-hour window while the railway was closed to passengers. Understandably, the team looked for ways to maximise and extend those 'engineering hours'.

JUBILEE LINE GOAL 18% ADDITIONAL CAPACITY BY 2012

NORTHERN LINE GOAL 20% ADDITIONAL CAPACITY BY DECEMBER 2014

As Thales programme director Andy Bell explains, this was particularly relevant when it came to testing the new system. "At the start of 'engineering hours' we needed to switch off the current operating system, work on the SelTrac integration, then switch back to the old system without compromising on safety or running times."

To help meet the challenge, the team developed an innovative testing application specifically for the JNUP programme that allowed the engineering team to run a compliance test at the end of engineering hours and ensure seamless transition between the two signalling systems. This was a large investment of resources – effectively its own design, test and integration project – but was essential to the smooth running of the whole upgrade, increasing safety for both workforce and

passengers, and significantly reducing the time taken to switch over and test the systems.

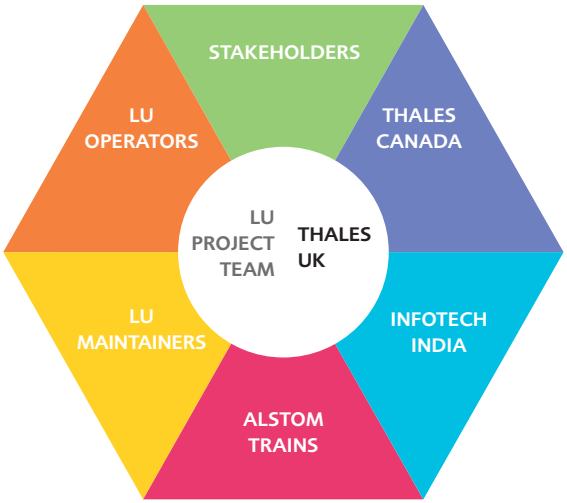
Additionally, says Andy, the team came up with a whole range of innovative testing techniques as the project progressed, and particularly as they took the lessons learned from the Jubilee Line upgrade on to the Northern Line task. "One example is the 'test trolley' we developed that could simulate a train, moving up and down the track and collecting data in the same way as a passenger train would when we went live.

"We also equipped special monitoring trains with all the new communications technology. These were closed to passengers and could run between normal services during off-peak hours, enabling us to check how well the communications between the trains and the signalling system were working without disrupting journeys.

"All these ideas were driven by the need to work efficiently and safely and reduce the impact on the travelling public while work was in progress, but of course they also had major cost benefits," says Andy. "It's also significant that the best ideas came directly from the people working on the project – engineers and testers who had a very clear understanding of the challenges and what was needed," he adds.

The results of JNUP speak for themselves – The Jubilee Line was able to provide the additional 18 per cent capacity needed during the 2012 Games, and continues to deliver strong performance.

And with the final commissioning of the Northern Line completed in June 2014, six months ahead of schedule and significantly under budget, major improvements in capacity, reliability and journey times are now being realised.



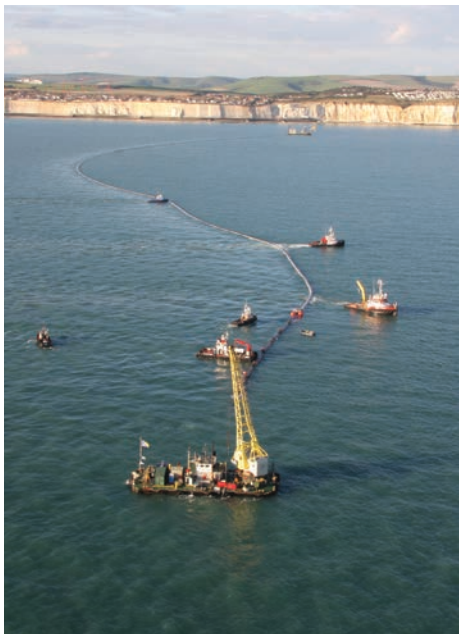
Above: The stakeholder map

Left: Specially-designed 'test trolleys' enabled the team to check the signalling system ahead of launch

Project: **Cleaner seas for Sussex**

Company: **4Delivery Ltd**

Finalist



This high-profile environmental scheme needed a culture of openness and engagement. So it was a perfect testing ground for an innovative 'buddy system', which laid the foundations for great communication between designers and engineers and helped make the project a success.

The £300m 'Cleaner Seas for Sussex' scheme was delivered in 2013 on behalf of Southern Water by 4Delivery Ltd, a joint venture between Veolia Water, Costain and MWH. It was four years in construction and involved building a new wastewater treatment works, plus all the infrastructure associated with it, including one of the largest living green roofs in the Europe.

Required by European legislation but vigorously opposed by local residents, the scheme took 12 years to secure planning approval, including two public enquiries and a judicial review.

So when it finally received the go-ahead, it was clear that the whole process would be very much in the public eye, and that the project team needed to ensure it met all its targets.

In particular, the scheme had to meet a compliance deadline of 31 March 2013, and with penalties for the UK Government if it overran, there was little room for delays or revisions.

The team needed to do everything possible, then, to foster a culture of open engagement and ownership among the wider, multi-company and multi-discipline team. They therefore introduced an innovative 'buddy system', where the designers for particular elements of the scheme were linked with the engineer for that part of the project on site.

Costain's Graham Sugrue, working with 4Delivery Ltd, was the project director who drove this system. He explained: "I'd been working on projects for many years and frequently had to deal with a design team based maybe 70 miles away who had little direct contact with the engineers. They'd send in their drawings and the construction team would just be expected to follow them. But we might well find that what they'd sent us wouldn't work in the real world, and there'd be lots of adjustments back and forth until we got it right.

"I felt there were ways we could work with the design team more efficiently, and started thinking about how we could break up the project into separate components – for example, the 'earthworks' or 'steel work' for each structure, and get the designer responsible for each component to 'buddy up' with an engineer with relevant experience. They'd then work together to create that element of the design."

At the early stages of the project, the engineers visited the design offices weekly to discuss issues with their counterparts in the design team. Subsequently, meetings took place using Lync technology, enabling video links and screen sharing, improving efficiency while maintaining effectiveness.

As well as helping to eliminate wastage and avoid delays, the collaborative atmosphere generated through the buddy system helped the design and engineering teams turn some very innovative designs into real-world structures.

These included the treatment works itself, which had to meet the planning authority's demand for something that blended into the landscape. This was achieved by creating a green roof for the structure – the size of three football pitches – that replicates the surrounding downland landscape.

Equally imaginative was the creation of a 'signature building' pumping station, as demanded by a different planning authority, that was designed to resemble an eye when viewed from above.

Turning imaginative designs into reality, and meeting the planning authorities' aesthetic expectations, undoubtedly made a major contribution in changing public attitudes to the scheme from vigorous opposition to positive support.

Most significantly, though, the atmosphere of close collaboration generated at an early stage of construction helped the team meet the project objectives in terms of cost, quality and time, with compliance for the works achieved by the March 2013 deadline required by Europe.

Left (top): Inside the wastewater treatment works

Left (bottom): Constructing the 2.5km-long sea outfall

Below: The new pumping station at Marine Drive, near Brighton

Project: **Haweswater Aqueduct – Journey into the unknown**

Company: **United Utilities**

Finalist

The challenges of inspecting a major aqueduct produced some innovative ideas, including the construction of a section of 'mock tunnel' and the development of purpose-designed electric vehicles. But even before they reached that stage, the project team had to apply their best thinking to a massive stakeholder management task.

Left: The Vehicular Access System (VAS), provided safe access to the 8km of tunnel works

The Haweswater Aqueduct is one of the UK's largest treated water aqueducts, conveying up to 570 million litres of drinking water from Cumbria to Manchester every day and supplying around two million people.

In October 2013, after more than a decade of planning and investment, United Utilities (UU) completed one of the biggest challenges it has ever undertaken – producing a detailed structural condition report on the 109-kilometre aqueduct, within a planned two-week window of opportunity, called an outage.

Such a task naturally presented huge challenges, the first of which, as project manager Paul Anderton explains, was to enlist the support of a large number and variety of stakeholders.

"Because this aqueduct plays a key part within UU's regional water supply, we had to engage with regional key stakeholders beyond the immediate aqueduct area – from the border of North Wales to South Cumbria – before we could shut it down and inspect its condition. Primarily, we had to ensure alternative sources of water would be available, with contingency plans, as well as communicating with key customers.

"The company had never done anything on this scale before and to succeed, we also had to ensure our leadership teams across different parts of the business and our operational teams at numerous sites gave this project top priority."

To this end, the project team divided the pre-project planning work into 16 work packages, each with a dedicated 'Focal Leader' who was responsible for obtaining sign-off of the work package on completion, prior to the outage, by a senior leader.

Other key planning activities involved communicating every step of the way with internal and external stakeholders and carrying out all the other necessary pre-project work before the outage could proceed.

"Because of the short timescale, as well as the wide range of stakeholders involved, we ultimately needed these key players to be working together like cogs in a machine – and we as the project team were the 'oil'," Paul added.

The aqueduct could only be taken out of service for two weeks, but even without this constraint, there were huge challenges. The 300-strong workforce had to be able to work safely and efficiently in a cold, wet, slippery tunnel, up to 300 metres underground and up to 4km from an access point, for up to nine hours a day.

During the initial tender period the contractor, Land & Marine, evaluated a number of electric vehicles and proposed one manufactured by a company in Canada. This was then rigorously tested and adapted to ensure it was fit for purpose, using 3D modelling and tunnel testing. As Paul says, the details were of paramount importance, and the team was inspired to be creative and innovative. Ideas were turned into reality such as shaping the vehicles' tyres to drive on a circular surface, the design of a sealed toilet system and a special stretcher that would allow an injured person to be safely carried onto the vehicle.

> *"Everything had to be right – safety was paramount and any incident could have put the whole project at risk of failure"*

A further innovation, the construction of a section of above-ground 'mock tunnel', proved to be a vital resource both for the testing of the specially-adapted vehicles and later for training the 300-strong workforce. Eventually the team expanded the mock tunnel site to include training rooms and a replica of the construction compounds.

"Everything had to be right – safety was paramount and any incident could have put the whole project at risk of failure," Paul said.

In the event, the £30.5 million project was successfully completed within the two-week window, giving UU a much better understanding of the condition of the aqueduct, aiding the company in developing a clear strategy for future refurbishment work, and so helping to ensure a sustainable future supply of drinking water.

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