ELECTRIFICATION OF THE SEAFORD LINE – THE MANY CHALLENGES

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SUMMARY
This paper outlines the complex scope of the project to electrify the Seaford Line, the passenger rail line to Adelaide’s growing southern suburbs, and highlight the many challenges faced by the Department of Planning, Transport and Infrastructure (DPTI) in delivering this iconic, once in a generation rail upgrade. This paper discusses the various aspects of the Electrification project, namely the Electrification Major Works (masts and overhead wires) and Traction Power elements of the Rail Revitalisation Program, which was first announced in mid 2007.

The scope of the various elements of the Electrification project is outlined in the paper with technical aspects highlighted. Reference is also made to a number of other elements that make up the Rail Revitalisation Program as they provided a significant number of the interfaces requiring close management. The challenges associated with the delivery of the project, including those of a non-technical nature, namely closures of the line for passenger services, the community engagement/involvement processes, the approach to nightworks and the management of vegetation and installation of a significant length of corridor fencing are also addressed.

Safety was always the highest priority during the construction work and the approach to the delivery of the rail infrastructure addressed the on-going operational and maintenance requirements of Public Transport Services, a division of DPTI and the requirements of the National Rail Regulator.

INTRODUCTION
The key objective of the Rail Revitalisation Program was to transform the ageing Adelaide Metropolitan Passenger Rail Network (AMPRN) into a modern, sustainable system providing faster, more frequent and efficient services for commuters.

Initial funding of $2 billion was announced in mid 2007. The program scope was multi-dimensional and evolved as planning progressed and funding became available based on both Australian and South Australian Governments’ priorities. This provided many challenges to the then Department for Transport, Energy and Infrastructure (DTEI – now DPTI) and TransAdelaide (now Public Transport Services, a division of DPTI) to develop standards, guidelines and procedures for the new infrastructure and operating environment (especially associated with Electrification). In addition it was necessary to source the highly specialised expertise and program the works to meet the demanding program timeframes (completion by early 2014).

Initial works in the program included replacing all the sleepers and refurbishing the rail on the Belair, Outer Harbor and Gawler Lines and the construction of several new stations and the installation of some 300 masts, as part of an early works package on the Gawler Line. A new railcar depot was also constructed at Dry Creek, replacing the outdated facility adjacent to the Adelaide Railway Station (ARS) on North Terrace, Adelaide.

To operate on the electrified network, 66 new electric multiple units (EMUs) were purchased from Bombardier Transportation Australia in Dandenong.

This paper concentrates on the Electrification of the Seaford (formerly Noarlunga) and Tonsley Lines which were the focus of works after a scope and budget review in mid 2012.

The key elements of the Rail Revitalisation work on the Seaford Line included:

- The Australian Government funded Seaford Rail Extension ($291.2 million), incorporating a railcar depot for 42 railcars and two new stations (Seaford and Seaford Meadows);
- Electrification of 36 kilometres of track;
• Construction of a 25kV substation at Lonsdale, to convert 66kV electricity to 25kV;
• The Goodwood Junction Grade Separation project which lowered the Seaford Line below the ARTC freight line and Belair Line;
• A new station at Wayville (named the Adelaide Showgrounds Station) and the associated demolition of the nearby Keswick Station;
• Demolition of the dated pedestrian overpass at Marion Station and its replacement with new pedestrian underpass; and
• Upgrading of the out-dated relay signalling system to a Computer Based Interlocking (CBI) system.

DPTI had a significant task to manage the design and construction interfaces and site possession. There were six or more different contractors working within the rail corridor, all with tight timeframes and their own resources, programs, safety systems, issues and risks to manage and site possession priorities.

In addition to these specific rail interfaces, there were significant vegetation removal and pruning activities required throughout six different Local Government areas and the rail corridor required fencing on public, council and private land boundaries.

The rail project related work was undertaken in an environment which included, at various times, extended line closures, weekend closures and nightworks. The requirements of third parties such as Australian Rail Track Corporation (ARTC), Local Government, service authorities and in particular SA Power Networks (SAPN) all needed to be addressed, co-ordinated and closely monitored. The activities of PTS Rail Operations and Engineering and Maintenance including driver training and the testing and commissioning of the new EMUs were also critical to the project’s success.

This occurred at a time when the program timeframes and budgets were tight and the public scrutiny intense.

PROJECT SCOPE

The scope of the Electrification project consisted of the following elements on the Seaford Line:

1. Major Works (Laing O’Rourke)
   • Fabrication of concrete masts;
   • Installation of masts, portals and twin track cantilevers, small part steel, etc;
   • Stringing of overhead wires (OHW);
   • Earthing and bonding; and
   • Testing and commissioning of the completed infrastructure - section proving, short circuit testing, etc.

In addition, as a variation to the contract scope, Laing O’Rourke Australia Construction (LORAC), the Design and Construct (D&C) contractor, was requested to undertake:
• Electrification of (and all other associated works along) the Tonsley Line;
• Installation of electrification safety screens;
• Vegetation removal and pruning; and
• Fencing of the rail corridor.

2. Traction Power (Siemens John Holland)
   • Provision of a 25kV substation at Lonsdale;
   • Provision of a Track Sectioning Cabin (TSC) at Ascot Park;
   • Provision of a Track Coupling Unit at the Seaford Railcar Depot; and
   • Testing and commissioning.

3. Communications and Community Involvement (both DPTI and Contractors)
   • Liaising with six Local Government Authorities and their Elected Members and senior staff;
   • Informing and engaging in excess of 3,000 “neighbours” that have a property boundary adjacent the rail corridor;
   • Interested stakeholders (i.e. commuters) numbering in the tens of thousands;
   • Managing a dynamic website providing information on all components of the Rail Revitalisation Program; and
   • Staffing a 24 hour, seven day a week information line.

MILESTONES FOR DELIVERY

The key timing objective of the Rail Revitalisation Program was to have electrified services running into the ARS from Seaford in early 2014. There were many other milestones along the way and contract completion dates for all elements were established to integrate the various contracts, activities and interfaces.

Changes of scope and the impact of both the Australian and South Australian Governments’ budget adjustments caused several reviews of the intermediate milestones and overall program scope.

The critical milestones included:
• Completion of works on the Seaford Rail Extension by December 2012;
• Closure of ARS and suspension of all passenger services from 2 January 2013 until 4 February 2013 for installation of portals, replacement of the Nairne Junction and signalling immunisation;
• Closure of the Belair Line to passenger services from 2 January 2013 until 20 July 2013;
• Closure of the Noarlunga Line to passenger services from 2 January 2013 until 1 December 2013;
• Arrival of the first EMU at Seaford Railcar Depot on 19 July 2013, with the first three-car set operational on the test track by 4 September 2013;
• Energisation of Lonsdale Substation on 21 May 2013;
• Energisation and completion of short circuit testing from Seaford to Lonsdale on 24 July 2013;
• Energisation and completion of short circuit testing from Lonsdale to Brighton on 10 November 2013; and
• Energisation and completion of short circuit testing from Brighton to ARS on 3 February 2014, including energisation of Ascot Park TSC on 31 January 2014.

ELECTRIFICATION MAJOR WORKS

1. Construction and Design Interfaces

The Electrification Major Works element was provided under a D&C contract, awarded to LORAC. The scope and contract requirements were established using a collaborative Early Contractor Involvement (ECI) process prior to entering into a fixed price D&C contract in October 2012.

In similar timeframes to the electrification of the existing Noarlunga Line, the line was extended to Seaford, new electric rollingstock (EMUs) procured, the signalling system replaced, the Adelaide Convention Centre (in North Terrace) extended and the existing track underwent a major upgrade of replacing the old timber sleepers with concrete and refurbishing or replacing the rail.

There were obviously significant design interfaces between these associated projects, all of which were approved and funded at different times. For example, the Seaford Rail Extension contractor (Thiess MacDow Joint Venture) was responsible for the design of the Onkaparinga Valley Bridge, the construction of which incorporates the hold down bolts for the electrification masts. The spacing, loading and installation of these masts were the responsibility of LORAC.

Similarly, on the Seaford Rail Extension, the location of access tracks, corridor drainage, pit and conduit runs and other corridor infrastructure needed to be co-ordinated to avoid clashes with the proposed electrification structures and signalling works.

It was very important that early collaboration in the electrification design process allowed sufficient preliminary information to be provided to the Seaford designers in order to reduce impacts on the interfacing elements.

Likewise, the electrification design was closely related to the final track position. As the track design was being undertaken concurrently with the electrification design it was important that alignments (both horizontal and vertical) were determined early in the process and that any subsequent changes to track design were communicated effectively to the Electrification team. As not all sections of track had undergone an upgrade, the existing track data also had to be verified. Compounding this challenge was the fact that there were few existing infrastructure records available.

EMUs were being procured at the same time as the electrification design was being finalised. It was essential that the parameters around the performance criteria of the new railcars be established early in the project, thus ensuring that the Traction Power supply would be adequate. This then influenced the EMU procurement process and ensured that that any new railcars proposed would meet the criteria.

The Convention Centre Extension in North Terrace, Adelaide, was another major design interface, with the requirements for the mounting of electrification infrastructure from the beams of the new building needing consideration as well as an assessment of Electromagnetic Interference to the operations in the centre.

All designs have complied with European Standards for emissions. This has also been an important consideration for the new Royal Adelaide Hospital and the existing ARS operations. Live testing was undertaken along the platforms in the ARS prior to construction to validate that there would be no detrimental effect to existing operations in the surrounding buildings.

Notwithstanding that a new CBI signalling system was being installed, it was equally important that the electrification infrastructure allowed the existing signalling system to be maintained. Masts needed to be designed to avoid both the old and new cable systems in the corridor. This was a major challenge in itself, with every mast
location being hydrovacced prior to drilling in order to minimise damage to buried services.

2. Electrification Design Standards

Although Adelaide has a 600V DC tram system operating between Glenelg and the Adelaide Entertainment Centre, 25kV AC electrification is new to South Australia. This means that new standards and specifications had to be developed as part of the Electrification project. Engineering Authority for this process was allocated to the Major Works and Traction Power D&C Contractors (LORAC and Siemens John Holland). DPTI ensured the competency of their design staff through the implementation of a competency assessment process and independent verification and peer review of their outputs.

This task was a challenge for the Electrification team as the development of standards, design briefs and contract requirements were being undertaken in parallel with the design and construction work. There were limited in-house resources with the specialist expertise required to manage or review these documents. T-and their time was generally allocated to project work or in the case of PTS staff on-going operations and maintenance work.

On completion of the Electrification project these standards and specifications were adopted as part of the PTS Engineering Management System, so that future electrification projects are able to implement these standards.

3. Design Challenges

One design challenge of note was the complexity of the track layout in the Adelaide Yard. Significant portal structures were required to span the length of multiple tracks as there was very little space available to install electrification portal legs (see Photo 2).

Mounting electrification infrastructure within the older part of ARS above the platforms necessitated penetration of the plenum (a steel ceiling chamber mounted to the ceiling to facilitate airflow) in order to attach wrap-around brackets to the station columns. This work had to be undertaken very carefully in order to maintain the integrity of the diesel extraction system within the station, whilst allowing the OHW cantilever arms to move as required and maintain electrical clearances.

The Seaford Line runs adjacent to the ARTC track between Goodwood and the Gaol Loop and there was a significant design interface with ARTC to ensure that the construction of the Electrification project and subsequent operation did not impact upon their train operations. The electrification work has included structures spanning the ARTC tracks, where there is insufficient space between the two railways and the isolation or bonding of ARTC infrastructure to remove touch potential issues between the two networks.

ARTC was also concerned with interference to its signalling systems from the electrification infrastructure, what the requirements are for maintenance work adjacent to the electrified environment and how emergencies will be managed to limit risk of disruptions to the freight network. A Joint Co-ordination Committee was formed and met regularly and various information sessions, risk workshops and design reviews were held to resolve the interface issues.

There was a complex process undertaken with SAPN regarding ARS earthing. Typically the power Supplies to the railway stations have been reconnected through isolation transformers in order to separate the SAPN earth from the traction earth. This was physically impossible in ARS due to the sheer scale and complexity of services throughout the building. Therefore it was proposed to connect the earthing systems together. Power modelling was undertaken to validate this proposal, which subsequently received SAPN approval.

The evolving scope of the Rail Revitalisation Program since mid 2007, particularly with additions of the Goodwood Junction Grade Separation, the Marion Pedestrian Underpass and the new Wayville Station in 2013, proved additional challenges as they occurred at a time when the Electrification design work was well advanced. These areas all required re-design of the electrification OHW system.

Contractors on these associated projects were given priority in terms of site access at times to facilitate the completion of their elements in accordance with the overall tight program.
timeframes. Every contractor needed to be very flexible and collaborative.

4. Program Challenges

The objective of the Rail Revitalisation Program to have an electrified passenger service operating into ARS by early 2014 was maintained although there had been significant scope, budget and contractual changes.

Electrification testing and commissioning by necessity was the last task to be completed – e.g. the OHW could not be energised until the Signalling project was completed (the new signalling system being immune to the effects of electrification), electrification overhead components could not be hung from other structures until they were completed (e.g. the Goodwood Junction Grade Separation dive and Wayville Station canopy), electrification structure footings could not be drilled until other major earthworks were completed (Seaford Rail Extension, Marion Pedestrian Underpass and Convention Centre) and the system could not be registered to its final position until all track work and tamping was completed.

The impact of all these other works on the Electrification project was a significant challenge. The original contract completion date was maintained with only minor slippage, despite the issues around scope, site access and interfaces with the other associated projects.

To address the interfaces from all the associated projects from a scheduling perspective, a Program Joint Leadership Team was formed. Up to nine contractors were represented at General Manager or Project Director level to discuss priorities and issues that would impact on timely delivery.

This process worked well, particularly around possession arrangements and sharing the corridor for critical activities, with the safety of all staff being a focus.

5. Resource Challenges

There were many challenges in resourcing the Rail Revitalisation Program and the Electrification element was where the impact was felt the most.

With Electrification being introduced into the Adelaide rail network for the first time, there were few staff within DPTI with the skill set and experience required to design, construct and operate an electrified rail network. There were no standards, guidelines, procedures or contract specifications - these had to be completed as part of the project.

This resource challenge was addressed in a variety of ways. On the personnel side, expertise was contracted in from specialist consulting companies or individuals with appropriate skills or experience were recruited on short to mid term contracts. This approach was successful and supplemented the ongoing DPTI team, providing them with skills and confidence gained from others with experience on 25kV networks in Australia and overseas.

Specialist staff such as Electrical Control Officers were brought in from Perth to capitalise on the most relevant experience for the Adelaide Electrification project.

A major challenge with resources in this area included the retention of staff in a project lasting several years. Many of the specialised team members had relocated to Adelaide, often away from their families. The DPTI Electrification team had staff from Brisbane, Perth, Melbourne, Wellington (NZ) and Hong Kong. LORAC and Siemens John Holland had a similar diversity in staff and even recruited a team from the UK to fast track the overhead wire installation in the lead up to energisation into ARS in early 2014. Out of a cold English winter into some heat wave conditions in Adelaide was a challenge.

Managing fatigue from the long working hours was a factor that needed to be closely monitored. Coupled with this, there was a considerable amount of weekend and night work to capitalise on possessions and retain program pressure. Day shift staff often worked long hours, across disciplines to keep the project on track.

Once passenger services re-commenced in early December 2013 the night shift was subject to strict possession arrangements that placed pressure each night to clear the track well prior to services commencing the following morning.

6. Technical Data – Number of Masts, etc

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Table 1: Electrification Major Works infrastructure delivered

**POSSESSION MANAGEMENT**

The majority of the electrification works were undertaken during the closure of the Noarlunga Line from 2 January 2013 and until the resumption of passenger services on 1 December 2013.

Even without trains running in the corridor, the interface between at least six contractors required a considerable effort to co-ordinate which party was working in a particular area and which safety
system applied, etc. This was a mammoth task in terms of possession management and construction zone interfaces were designed to ensure that works could be undertaken safely and efficiently with so many contractors on site.

The January 2013 closure of the Adelaide Yard saw this process delivered exceptionally well, with 1,000 metres of track installed and 1,300 metres upgraded. The complex replacement of the 'Nairne Junction' track was undertaken in parallel with the erection of significant steel work for electrification (over 100 portal legs and booms) and immunisation of the existing signalling system.

DPTI established a Possession Management Group that assumed responsibility for this task. The high level Program Joint Leadership Team forum mentioned earlier convened on a monthly basis to review individual contractor’s programs and resolve conflicts, priorities and issues based on overall Rail Revitalisation Program objectives.

The access arrangements were a huge challenge for the LORAC and the Electrification team (as they had been for all other contractors). Not only was access to ARS and the Adelaide Yard dependent upon the Convention Centre Extension piling works being completed, but during the course of the project additional associated projects were added to the scope of the overall program. With LORAC undertaking works along the entire corridor, the impact was significant.

TRACTION POWER

The Traction Power element of the Electrification project was delivered under a D&C contract. The scope and contract requirements were established using a collaborative ECI process prior to entering into a fixed price D&C contract in late August 2012 with Siemens John Holland.

The Traction Power design process involved the systems integration of the track, the train service plan and timetable, rollingstock characteristics, signals and communications and the requirements of and the effects on the high voltage (HV) power supply.

Power studies were undertaken simulating the proposed electrified network using input data consolidated by gathering requirements, interfaces and design development from all projects running under the Rail Revitalisation Program. Power studies confirmed the rating of the primary equipment including the traction transformers and HV switchgear. Power quality studies were used in setting up the Network Connection Agreement with SAPN and in the design of the Static Var Compensator equipment which ensures that the effects the rail has on the power supply do not exceed pre-agreed tolerances.

The power supply options available for the Traction Power substation were the Electranet 275kV and the SAPN 66kV. After an extensive cost benefit analysis with all factors taken into consideration, the 66kV supply was chosen. The choice of using the lower HV supply such as 66kV for a 25kV system meant that power quality equipment became a necessity.

The Traction Power substation site at Lonsdale was chosen after considering the available land (both government and privately owned), proposed location of the neutral sections and the most economic cabling distance to SAPN substations with available spare circuit breakers. Land acquisition issues lead to compromises and an awkward triangular site was acquired for the substation site (see Photo 4). This posed a challenge to the designers for the layout of the buildings to house the infrastructure and ensure access for construction and on-going maintainability.

![Photo 4: Overhead shot of Lonsdale Substation](Photo 4: Overhead shot of Lonsdale Substation)

The recruitment and retention of expertise for 25kV Traction Power systems in Adelaide was challenging due the specialised nature of the field.

To maximise reliability, the Traction Power substation was designed with a significant level of redundancy, such as two large 25kV transformers which allow for changing between these if and when required. Also there are several back up low voltage (LV) supplies to ensure that the system functions in the event of loss of the external LV supply.

The Traction Power system also includes a TSC located at Ascot Park. This facility allows for the switching of Traction Power between the tracks from Ascot Park to the ARS and also the Tonsley Line. There is also a Track Coupling Unit at the Seaford Railcar Depot which allows for isolation of the depot from the mainline.

The Lonsdale Substation was energised on 21 May 2013 and handover to PTS for operational control under its Electrical Rules subsequently occurred.

The testing and commissioning of the OHW from Lonsdale to Seaford was completed on 24 July 2013, consistent with the arrival of the first EMU on 19 July 2013 at Seaford Meadows. This milestone allowed for the testing and commissioning of the new EMUs and driver training activities, initially on the section of track...
between Noarlunga and Seaford stations. This commenced on 4 September 2013.

**ASSOCIATED WORKS**

1. **Bridge Screening**

Along the corridor live parts of the electrification infrastructure are close to areas that are accessible to the public. Some examples of these include pipes, service gantries and bridges passing over the rail corridor and adjacent pedestrian/cycle paths.

The Electrification team addressed this risk by applying a hierarchy of controls (elimination, substitution, isolation, engineering and administrative) to mitigate each of these challenges.

In many cases it was possible to eliminate the risk by removal of the access point to the live infrastructure. An example was the removal of the Keswick pedestrian path which passed under the Anzac Highway - Richmond Road bridge.

Pedestrian access across this busy intersection was maintained by adding pedestrian crossings to the signalised intersection. Some challenges in doing this were completing the job in time for the Royal Adelaide Show, constructing around the SAPN HV services that are built into the bridge deck and ensuring that adding pedestrian phases to the intersection operation did not interfere with the vehicular capacity of the intersection.

Wherever possible the Electrification team chose to use existing Australian Standards to reduce the risk profile of the project. However selecting an appropriate standard for bridge screens was a challenge as there was no applicable Australian Standard and the International Standards adopted by the various State Railway Authorities were inconsistent. After extensive research and peer review, DPTI adopted European Standard EN50122 for bridge screens.

There were several challenges in this area, including managing staff expectations from various professional disciplines regarding the assessment of the level of risk, the adoption of the European Standard, the type of screens chosen and the focus on aesthetics at the various locations being matters of spirited debate.

Installing screens to existing bridges meant additional dead and wind loadings to the bridges. It was therefore necessary to perform structural calculations to confirm the suitability of adding these loads. These calculations were assisted by DPTI maintaining excellent design and construction records for the various bridges on its asset register, but less detailed information was available for some of the council bridges.

DPTI adopted a screening solution of horizontal style screens for a number of reasons. One of these was to minimise the additional loads imposed on the bridges (see Photo 5). Even so, it was necessary to strengthen several bridges to withstand the loads imposed by the bridge screens.

Removing the dated pedestrian overpass at Marion Station was an example of mitigating the risk by substitution. In this case the pedestrian ramps leading up to the existing overbridge would have been too close to the OHW. It was not possible to install a screen between the public and the OHW to address the risk.

The cost of strengthening the old pedestrian overpass structure to handle the wind loads that would result from attaching vertical screens to the structure made that impractical. Instead, DPTI chose to remove the overpass structure and replace it with a new pedestrian underpass to solve the above problems. The opportunity was taken to enhance the entire station surrounds and improve safety and security due to high number of pedestrians with two adjacent schools.

The fitting of electrification safety screens to the various bridges over the railway line was a further example of the use of engineering controls to reduce the risk of potential electrocution. In most cases it was not realistic or desirable to stop people walking across the various bridges over the rail corridor. Instead the solution to keep people safe from electric shock was to install screens that prevent a person from touching the OHW or attempting to damage the wires.

Incorporating screening into the overall Electrification contract was complicated by the tight timelines around the tender process, the cost of tendering and the availability of information to base the designs on. To fast track the process and decrease the impacts of further interfaces, it was decided to deliver the screens as a provisional sum item in the Electrification Major Works D&C contract to minimise these issues.

2. **Other Protection Measures**

Administrative controls have been implemented which include the erection of signs warning of OHWs at stations and other areas where the public may have access.

The design clearances for the OHW were established consistent with other states and the road network in South Australia. They and were as follows:
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- 4.6 metres mid block along the corridor;  
- 5.7 metres at level crossings; and  
- 7.1 metres for a major over-dimensional vehicle route.

PTS has developed a framework of Electrical Rules and procedures for access into the electrified corridor and working in the corridor through a permit system, especially within 3 metres of the OHW.

PTS Employee Notices were distributed and briefings given to staff to increase the awareness of the new arrangements, the changes in risk profile and operating environment and any work restrictions that must apply.

VEGETATION MANAGEMENT ACTIVITIES

Vegetation management activities along 36 km of dual track have been an emotive issue for the community and a challenging activity for the Electrification team.

DPTI followed the standards and practices adopted by similar rail networks where electrification using a 25kV AC system has been implemented, to assist in developing its own exclusion/clearance zone policy and guidelines.

The vegetation clearance zones required to achieve the electrical clearance requirements have resulted in the removal and/or pruning of trees and screening vegetation. Depending on the size and significance of the vegetation, various approvals of the Development Assessment Commission and/or Local Government and private property owners were required.

The removal of community gardens within the corridor for safety reasons evoked some very emotional responses (see Photo 6).

In total more than 2,000 trees and shrubs were removed (approximately 50 classified as Significant or Regulated) and nearly 2,500 trees and shrubs were pruned. Railway stations that have centre platforms were most impacted and this was often where communities had been involved in planting and maintaining screening or shade trees.

The Electrification team developed a Communications Plan that covered Members of Parliament, councils, the community and local interest groups. DPTI worked to ensure that residents living in close proximity to the railway corridor were actively engaged before construction on vegetation management activities began and provided an opportunity to discuss any concerns. Notification of works were delivered to all properties between O’Sullivan Beach and Keswick three streets back on both sides of the railway corridor – 14,700 properties in total. Twenty three community information sessions were also held over a period of six months to ensure that local communities had the most current information.

Through DPTI’s vegetation offset planting funding contribution, the Electrification team worked with local councils, community groups and schools to be innovative in the way it mitigated the loss of vegetation. This included undertaking local landscaping projects, working with schools to build bird and wildlife boxes and placing them in local parks and along the corridor, and providing additional land along the corridor for councils to extend screen planting and walking trails. LORAC in its EPIC (Environment, People, Industry and Community) program was also well received.

This multi-faceted approach was successful and when combined with the provision of cycle paths in specific locations has meant that a positive outcome has resulted from a situation that could have detracted from the overall project benefits.

FENCING THE CORRIDOR

Existing fencing of the corridor along the 30 km of track to Noarlunga had not been to any particular standard. Private property fences varied considerably from basic post and wire to 2.4 metre panel fencing. There were many properties which had unauthorised access gates to allow “shortcuts” to local shops, neighbours, etc.

The higher standards imposed by the Electrification project meant that there was a challenge when considering the “drop zone” in many areas and in installing new fences, with multiple landowner agreements required and interfaces to be managed as the work progressed along the corridor.

There were many instances where residents had encroached into rail property, either utilising the land for landscaping or in several instances building works. This necessitated boundary surveys and transfer of land titles, negotiations with residents to purchase land, or reinstalling fences back on the surveyed property boundary.

A defined standard of fencing was applied along the rail corridor and unauthorised access points removed.

Many private properties border the rail corridor and the timing and organisation of the fence replacement needed to take many factors into consideration. The needs of the residents...
(security, views, amenity value, etc) were considered for with all vegetation removals as well as the safety requirements of the Electrification project. Effective co-ordination and communication between DPTI, LORAC the contractor and the resident was essential to this process. This might not seem a significant issue to manage, but with over 200 private properties requiring new fences along the corridor it became a logistical nightmare with varying demands and restrictions.

Other issues that needed to be considered included were access to the resident’s property for equipment, whether the resident had pets or small children, security of the property during the work while it was being fenced, whether is was a rental property, etc.

The actual alignment of the corridor fence is an interface between many parties. Ideally the services authorities (SA Water, APA Gas, etc) need to be fenced out, while our internal services (signalling, etc) need to be within the corridor. Fence installations were designed to minimise vegetation removal, while allowing enough access space for future maintenance of the line. Proposed developments along the railway were also taken into consideration, including cycle and pedestrian access and paths.

The fencing was one of the last pieces of infrastructure to be installed and so it was installed in a tight time frame. It could not be completed until civil works in the area were completed as it restricted access to the site. However fences needed to be completed shortly after to secure the corridor before electrifying. Therefore the fencing needed to be constantly reprogrammed to avoid all other contractors’ works.

NATIONAL RAIL SAFETY REGULATOR

The Rail Revitalisation Program was initiated in mid 2007 when each state had its own rail safety regulatory regime. In January 2013 the Office of the National Rail Safety Regulator (ONRSR) was formally established, with its head office based in Adelaide. South Australian rail operators were to be overseen within the new ‘Central Branch’ based in Adelaide but also looking after Northern Territory and Tasmania. Previously the South Australian Rail Safety Regulator was part of the internal DPTI organisation and a number of original South Australian regulatory staff had moved over to the new National Office which was helpful in terms of a continuation of relationship.

2013 brought a lot of change in this area with a new ‘national’ regulator’s office, a new CEO from the UK, a new Rail Safety National Law and potentially a new way of doing business now that rail regulation aligned nationally and no longer sat within a state government arrangement.

The Rail Revitalisation Program required a number of variations to the accreditation of the Rail Commissioner in order to allow and deliver the works, thus a more strategic and regular interface needed to be established with the ONRSR to ensure the Rail Revitalisation program was not delayed due to these continual approvals given the Rail Safety National Law gave the Regulator up to six months to determine an individual application for variation.

These variations/approvals related to the extension of the network to Seaford, the introduction of EMUs on the Seaford Line, and energisation of the Seaford Line in three stages from Seaford to the ARS.

The development of the various Systems Assurance Reports/Safety Arguments associated with these changes to the configuration of the rail network to accompany the applications for the variations to accreditation, required specialist systems engineering input and a significant amount of effort which included taking the ONRSR along with us on this journey.

COMMUNITY ENGAGEMENT

1. The “Stay Switched On” Safety Message

There are many challenges associated with electrifying the Seaford Line, in particular the challenge of educating the general public of the different risks involved in an electrified environment and changes in behaviour required.

A policy was adopted where all OHW within the rail corridor was treated as live from the time of installation (not energisation) and should be treated with the same respect and safety consciousness as power poles.

An intensive school presentation program was offered to schools in the southern suburbs (82 in all). Brochures were distributed to 129 schools regarding rail safety. DPTI staff participated in various public events, such as Christmas pageants, school functions, open days and sporting events to promote the “Stay Switched On” message.

A comprehensive program of briefings and awareness training was provided to Emergency Services, Local Government Elected Members and staff and service authorities to advise of the changed environment that has resulted from the electrification of the network and operation of the EMUs.

2. Website and Info Line

DPTI hosted a dynamic website that provided up to date information on all projects in the Rail Revitalisation Program. It also provided works notifications for further reference. DPTI staffed a free call information line, 24 hours a day, seven days a week responding to residents’ concerns in a timely and efficiently manner.

Conference on Railway Excellence
Adelaide, 5-7 May 2014
3. **Nightworks**

Nightworks were undertaken to meet program targets and minimise the impacts of electrification works on passenger services. When diesel passenger services resumed between Noarlunga and Adelaide, the majority of electrification works were undertaken outside of peak hours (from 9:00pm at night to 5:00am and on weekends).

DPTI worked with LORAC to inform approximately 6,000 residents living adjacent to the rail corridor, and in the surrounding area, in advance of works occurring in their area.

DPTI also continually reinforced to the various contractors the importance of notifying residents about their work and standards of behaviour and good operating practices during nightworks.

The number of complaints received regarding nightworks was not significant and indicated a commitment by all parties to manage a difficult situation well.

4. **Varying Approach by Councils**

Each council has been approached individually to consult on vegetation removals and fence alignments. This has been done through a combination of on and offsite meetings and letters. Decisions with council have centred on vegetation removals and offset (reimbursement) costs for the vegetation removed, how to communicate decisions within their council areas and guidance on what their constituents would agree/not agree to, including hot spot areas where we were likely to encounter resistance. Councils were also engaged on future land use and best areas to revegetate/landscape.

5. **Community Issues**

Beside vegetation management and aesthetics, another community issue raised during delivery of the Electrification project was the perceived impact on television reception by the Electrification project.

Concern was raised by a handful of residents adjacent the rail corridor regarding the potential impact of electrification on television reception. These concerns were localised to houses that are below the horizon and have always had inherently poor reception or antennas that are located inside their roof space.

Adelaide’s Rail Electrification system was designed, installed and tested in compliance with the latest International Standard (IEC 62236) which specifies the maximum interference that the electrical system is allowed to emit.

All new electrified networks throughout the world are installed using 25kV AC systems, as was installed in Adelaide, and there is no known common interference issue reported concerning 25kV railway operation and TV reception.

The system that the South Australian Government has implementing is very similar to the 25kV rail systems that have been installed in both Brisbane and Perth over the last 10 years. DPTI staff and its designers have ensured that we have benefited from the previous work undertaken interstate.

The issues with TV reception have not been experienced interstate and the standards established for the project have ensured that this is the case for the Adelaide electrified rail system.

**CONCLUSION**

The Rail Revitalisation Program and Electrification project in particular was always going to be a challenge for DPTI which had not previously embarked on such a major project on the rail infrastructure.

DPTI, and its Rail Division PTS, faced a steep learning curve to develop a skills base, specific contract, procedural and safety documentation with a comprehensive Systems Engineering framework to enable delivery of a complex series of projects. The scope and timeframes for delivery in a dynamic political environment were always going to be challenging. Funding constraints and changes to scope which impacted on the contracts that were in place increased the interfaces that required close management.

The learnings from the electrification of the Seaford Line are significant and have formed the basis of future rail contract documentation and operational and safety systems being used in the new electrified Seaford Line.

DPTI has developed a skills base within its organisation that places it in a good position to manage future project works on the rail network and manage its operations with the enhanced infrastructure that the Rail Revitalisation Program has delivered.