

# DIONA DELIVERS ON MAJOR INFRASTRUCTURE DESIGN AND CONSTRUCT



MAIN CONTRACTOR : Diona in consortium with J-Power Systems  
PROJECT END VALUE : \$126 million  
COMPLETION : October 2013  
SURVEYOR : Geosurv  
CABLE LENGTH : 14km



The Transgrid Underground Cabling Project covers the manufacture, design, supply, and installation of 330kV XLPE underground cable.

In a joint venture with the Japanese company J-Power Systems, civil engineering company Diona Pty Ltd hold the main contractor position for the Holroyd to Rookwood and Sydney Park to Haymarket 330kV high-voltage cable installation infrastructure project from TransGrid in Sydney. With over 30 years experience, Diona have an exemplary record of successful project delivery and ability to provide expertise for large scale utility projects.

As the principle contractor, Diona were responsible for the design of the route from Sydney Park to Haymarket and from Holroyd to Rookwood, the 330kV cable-laying together with the design and construction of a number of civil structures required along the way. Divided in separate construction phases, the TransGrid project is Diona's largest project to date, with employees on the job numbering over 100 on-site and in the office.

One of the first challenges of this scale of work was dealing with numerous public authorities in order to obtain approvals for construction work. On-going throughout the project, Diona liaised with five different local governments and further to that were in consultation with utilities bodies such as Sydney Water, Rail-Corp and ARTC. The cable installation involved both a below and above ground route design, and required interfacing with a number of live rail crossings and other services, necessitating involvement of the utilities corporations.

The now completed first section of the project had a unique set of complexities, defined mostly by the matter of working within a 3.5km existing TransGrid tunnel. With the cable installation predominately occurring inside the tunnel, Project Manager Steven Ross commented that the very restricted space and the fact they were pulling in lengths

of cables at 1.3km in length required a particular set of logistics. A secondary difficulty was managing the cable tension that occurred with the 1.3km length and a cable coming in at around 35kg per metre. For this issue, the importation of motorised rollers from Japan through the cable supplier J-Power Systems permitted a more manageable cable tension during installation.

Another level of problem solving with working in the tunnel was the material and methodology for the required backfilling. Once the cables had been pulled in, the space around them had to be backfilled with TSB, or thermal concrete. The difficulty at this stage was the fact that the cables effectively block access within the tunnel and the required filler is not traditionally an easy mix to pump. Diona conducted a number of trials with both the pumping contractor and concrete supplier, and were able to develop a thermal concrete mix that was then successfully pumped into the depths of tunnel.

The civil works element of the project encompasses scope from the trench alignment to directional drill and case boring details,

cabling bridge design, along with the design of an access road that goes over the top of the route. With the second section being a route approximately 16km in distance, travelling between the new substations at Holroyd and Rookwood Rd, other logistics were required to be problem solved. While the majority of the cabling installation is installed underground, the route also crosses above ground pipelines or live rail tracks. Diona worked in consultation with RailCorp and ARTC in managing the construction phase of the three cable bridges that cross over live railways, effectively requiring construction during track possessions or between trains.

With offices in QLD, SA and NSW, Diona is able to manage mid-level to large-scale utilities jobs across a wide region of Australia. Some current projects include transmission jobs for Endeavour Energy in the eastern states, along with high-pressure gas projects in SA.

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## GEOSURV SERVICING HIGH PRECISION PROJECTS

Infrastructure surveying is one area of specialisation for Geosurv, the company contracted by Diona for the current Transgrid pipeline project. Covering projects across NSW, ACT and into SA, Geosurv work in the industries of construction, government and infrastructure and commercial and residential property as consultant surveyors, engineers and planners, with a commitment and efficiency demonstrated in every project.

As part of the Holroyd to Rookwood 330kV Cable project, Sydney Water required that Transgrid, and in turn, Diona and Geosurv monitor any deflection in 7.5km of the heritage listed Sydney Water Pipeline which fell along the route of the new cable. This part of the project from Transgrid required a contractor with expertise in high precision monitoring for deflection of the existing pipes. Geosurv were brought in at the design stage, consulting with Diona on various methodologies in how to tackle the challenges presented in terms of scale, site limitations and precision. It was a number of months of consultation before the final procedure was defined, and work could get underway. Geosurv's commitment to the project included the purchase of new specialty equipment, namely a half-second Total Station, delivering monitoring data within +/- 1mm.

This project extended Geosurv's normal limitations, with the need for a job-specific bracket to be designed specifically for the pipes in order



to maintain the strict tolerances allowed. This aspect of the project was managed in-house, with Geosurv's engineers designing the bracket, obtaining certification, sourcing manufacture and then managing a construction team of 6 workers to install over 5000 brackets across the pipeline. A final step in this project was the design of site-specific computer programs that reduced all data from the monitoring stations which could then be sent to the client for their appraisal.

Other projects currently being undertaken by Geosurv include the surveying of the Scenic Railway in the Blue Mountains, the world steepest and requiring an upgrade. With the purchase of the half-second Total Station and the new MS50 with laser scanning capabilities and being one of a few companies in Australia to own such equipment, Geosurv are in a position to take on challenging projects of all scales and successfully deliver clients requirements.



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## WESTKON PRECAST CONCRETE FOR INFRASTRUCTURE

Westkon is one of a number of companies involved in the Transgrid project underway in Sydney's West. Contracted to supply the pre-cast components for the project, Westkon's skill in consulting design and fabrication have contributed to a successful build of this important infrastructural project.

Based in Victoria since 1985, Westkon have built their reputation on servicing projects across the South Eastern region of Australia, from Melbourne through to Sydney and across regional areas. With 135 persons in the company in total, Westkon maintain two yards for the fabrication of pre-cast components.

Westkon were contracted to supply pre-cast, pre-stressed beams for five bridge crossings for Transgrid. Pre-cast components included headstocks, piers, transition beams and wingwalls. For around 18 months prior to being awarded the contract, Westkon worked in consultation with head contractor Diona and designers Taylor Civil, with the final workable design evolving as one-off, custom designed units. Particular challenges faced on this project included the high voltage nature of cabling running through the

concrete units. Westkon worked in consultation on the development of the design, in particular, regarding the detail of the shear reinforcement in the beams. This challenge concerned the removal of any chance of the beams themselves becoming transformers for the electrical conduit, which may have occurred had any of the pre-stressed reinforcing had any closed loops.

A further challenge for this project involved the co-ordination of sending the 33 to 34 metre long beams from Melbourne to Sydney, ensuring they arrived on site in a well-timed manner.

Other current projects include extensive work for regional rail in Melbourne in all areas of design and fabrication.

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## A STRONG REPUTATION

With over 9 years experience, Earthing Solutions are recognised as having the expertise to handle large infrastructure projects, such as the current high-voltage electrical cabling project from Transgrid. With the equipment and know-how to manage the most challenging of jobs, Earthing Solutions are able to service the earthing and lightning protection for electrical utility projects across the state.

Building upon a record of successful collaboration with main contractor Diona, Earthing Solutions were awarded a supply and install contract for the cabling installation from Holroyd to Rookwood in Western Sydney. The job required each joint bay of the pipeline to be earthed, effectively connecting the high-voltage cables to the main earth bar in the jointing pit. While the company mostly work on sub-station installations and upgrades, this project offered a further challenge to the scale and scope of their project experience.

The Transgrid project posed a number of challenges including the size of the cable itself at 300sqmm, the cable required cadwelded joints for a successful earthing installation. Another difficult aspect was the confined space of each of the pits, necessitating the use of the small Hydraulic Drill to work in the small space available and around the already installed items. A top hammer drill, equipment used on the majority of other projects, was also used, however it was only required on one pit. A further challenge for this project was the procurement of materials, in this case the moulds and weld shots which had to be sourced and imported from the US.

Earthing Solutions are also currently working on the substation at which is attached to the Transgrid project, as well as installing the earthing at Haymarket and Sydney Park. A number of projects are also currently underway working with Endeavour Energy.

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## PROFESSIONAL APPROACH

Laying the groundwork for the Transgrid project in Western Sydney is pre-cast and drainage company Capital Precast. Located in Queanbeyan in NSW, Capital Precast is one of a number of subcontractors involved in the development of this electrical infrastructure project.

In operation for around 10 years, Capital Precast have been servicing subdivisions and roads and other infrastructural projects across regional areas from Wagga Wagga and Albury, across Goulburn, and down to Ulladulla, Cooma and Jindabyne. Electrical works such as the Transgrid project are a new area for Capital Precast, and this was a first time contract with their client Diona, the civil engineering company and main contractor. The first stage of working with the new client involved creating a mould as specified in the concept design received from Diona. A sample cast of the job-specific design was then sent to the client, which once approval was given, Capital Precast were able to go into production, manufacturing in total an approximate of 10,000 precast components.

For this project, Capital Precast specifically made the concrete plinths that are used as a weight to hold down the electrical cables to be

installed. Once the plinths are placed in the underground trench at around 4-5 metre spacing, the electrical cables are able to be run along the track, and tied down securely to each plinth. The tying down of the cables ensure there is limited movement once they are later encased within their concrete housing.

For the standard plinths used in this project, there were approximately 4000 to 5000 components produced. Secondly to these main plinths, three smaller plinths were produced 3-4000 in number of one type, 2-3000 of another and around 800 or so of the third component. The standard plinths weighed around 300kg each.

This was a fairly large project not only in terms of a financial but also in the number of items produced. Capital Precast currently have other roads and subdivisions projects underway, including the production of the Mildura Parkway, the largest road project in Canberra.

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