Despite many construction challenges, including the impacts of the devastating January 2011 floods, the upgrade of a section of Australia’s Ipswich Motorway was officially commissioned, under budget and six months ahead of schedule, in May 2012.

The Ipswich Motorway Upgrade: Dinmore to Goodna (D2G) Project—a $2 billion (U.S.) infrastructure initiative funded by the Australian federal government to provide a safer, more reliable and sustainable transport solution for the Western Corridor as well as South East Queensland’s wider transport network—was one of the most complex and challenging road infrastructure projects ever built in South East Queensland.

South East Queensland is Australia’s fastest-growing region, attracting on average 55,000 new residents each year. It also is gaining national and international recognition as a major economic hub. The Ipswich Motorway forms a vital link in the freight route between Sydney, Melbourne, Brisbane and Darwin.

It also supports South East Queensland’s economy by providing connections to the port of Brisbane and major freight terminals.

The official commissioning of the D2G Project followed three years of construction by Origin Alliance, which comprised the Queensland’s Department of Transport and Main Roads (DTMR), Abigroup Contractors, SMEC Australia, Seymour Whyte, Fulton Hogan and Parsons Brinckerhoff. At its peak, the D2G Project employed more than 1,000 people and was the largest road alliance project in Australia.

A local angle

The D2G Project involved widening 4.97 miles of the Ipswich Motorway to a minimum of six lanes (three lanes in each direction, with room for four in the future) as well as building an extensive network of new service roads designed to improve local access. It also included construction of 15.5 miles of shared pedestrian and cyclist facilities, 26 new bridges (five of which are new shared pedestrian/cyclist facilities to make crossing the motorway easy and safe as well as provide improved access for the wider community) and upgraded interchanges at the Cunningham and Warrego highways as well as at Redbank.
The combination of additional motorway lanes; separation of local from motorway traffic; and longer, more evenly spaced entry and exit ramps will provide greater safety, more reliable traffic flows and reduced congestion.

The project was built in a very constrained, busy corridor, which is used by more than 90,000 vehicles every day, of which 13% are heavy vehicles. Maintaining the safety of the traveling public and road workers was of utmost importance. Detailed traffic modeling and ongoing consultation with stakeholders ensured traffic detours and temporary closures were successful thanks to complex staging arrangements, which not only accommodated all of the motorway traffic but also helped minimize property impacts.

Parsons Brinckerhoff, as part of the Origin Alliance design team, integrated noise-mitigation treatments seamlessly into the overall project design. In some locations this required consideration for noise from both road and rail traffic, which necessitated the development of unique, project-specific assessment criteria as well as a design that benefited all key stakeholders.

Pedestrian and road bridges were designed to integrate with the local surroundings and existing infrastructure while also meeting all relevant safety and design technical standards. The project team’s extensive planning also ensured motorway traffic flow while the project’s 26 new bridges were being built.

For example, large precast girders, deck units and bridge parapets were transported, lifted and installed at night when traffic volumes were much lower. This approach not only minimized peak-hour disruptions for motorway users and the local community but also helped speed up construction times. Careful staging of construction over a 51-month period also helped maintain travel-time reliability.

### By the numbers

To construct the required bridges for this project, the project team used:

- 714 bridge girders or beams. Some of them are 114.6 ft long and weigh 90 tons;
- 52 precast driven concrete piles and 323 bored concrete piles set to a maximum depth of 124.5 ft; and
- 215,000 sq ft of precast concrete and reinforced earth wall panels.

### Some color and fill

Many of the pedestrian bridges that were built or rebuilt have their own distinctive color scheme, such as the mauve bridge in Goodna, which reflects the local jacaranda trees that many people associate with the area. Another good example is the orange bridge at Law Street, which reflects the distinctive color of the soil along the banks of the nearby river. These specifically colored bridges act as “journey markers” by helping remind motorists where to enter or exit the Ipswich Motorway.

One of the key challenges for the Origin Alliance team was the long mining history of the area between Dinmore and Goodna. Initial geotechnical investigation found the construction footprint would cross three abandoned underground coal mines dating back to the 1860s. While the motorway’s alignment was adjusted as much as possible within the confines of the constrained corridor, it was not possible to avoid the mine works altogether.

A suballiance team was formed that included specialist mine-filling contractors. In addition, an international expert panel provided guidance on filling the mines. Given that no previous examples of projects of this size and scope had ever been undertaken in Australia, the suballiance delivered some outstanding outcomes in just 28 months (May 2008 to August 2010). A purpose-built concrete mixing plant located near the site offices at Redbank produced the specially designed grout that was used to fill the mines, some of which were more than 262.5 ft deep. The mine-filling works were successfully completed under budget and on time.

### Showing how its done

Innovative technology was used to not only meet the client’s exacting project-quality requirements but also to communicate the design, look and benefits of the motorway to stakeholders and the wider community. A challenge for the design team was how to communicate complex engineering models coherently to the community.

A line-of-sight visual assessment was undertaken to identify design improvements and traffic-management requirements. This data was then used to help develop two drive-through animations—one going east, the other going west—both of which provided a detailed visualization of what the
The drive-throughs were used extensively by the project team at the project’s Visitor Experience Centre, particularly during the early stages of construction, to show stakeholders what was going to be built and the benefits the upgrade would provide once complete.

As the engineering model of the project progressed, the visualization team incorporated realistic 3-D animations and photorealistic textures (shadows, colors and lighting) that accurately portrayed the project and how it impacted the existing terrain as well as the surrounding infrastructure. The 3-D visualization model was integrated into the 3-D engineering design model, which resulted in a comprehensive end product that proved invaluable in

**Fast facts**
- 5 miles of rebuilt motorway (three lanes each way with room for four in the future);
- 4.34 miles of new service roads;
- Remediation of three former abandoned underground coal mines—68,000 acre-ft grout fill volumes;
- 15.5 miles of shared pedestrian paths and cycle ways;
- 19 new bridges, seven shared pedestrian bridges and 13 bridge demolition works;
- Eight sign gantries spanning across the motorway, five variable message sign gantries and 45 static signs;
- 4.22 miles of permanent retaining walls and 1.4 miles of temporary retaining walls;
- Planting of 1 million trees, shrubs and bushes; and
- Employment of more than 1,000 staff (including workforce, temporary labor hire and subcontractors).
educating the community about the project as well as helping various design and construction teams throughout the review and evaluation process.

**Tracking traffic**

A requirement of the D2G Project was for Origin Alliance to track travel time through the area of the motorway upgrade during all of the construction phases, from start to finish. BluTrips travel-time-measurement technology was introduced into the project, a first for Australia. Parsons Brinckerhoff researched, acquired and deployed this prototype technology to replace floating car studies, number plate matching surveys, loop detection and other invasive methods for tracking travel-time reliability.

BluTrips measures traffic flow 24 hours a day. It also provides valuable insights into traffic behavior during construction. For example, it monitors delays during all stages of construction. It also compares travel-time delays before and after the motorway had been upgraded. BluTrips achieves high sample rates and can collect data during all weather and light conditions, thus making it a more cost-effective alternative to conventional travel-survey techniques.

According to Queensland’s DTMR, the project required around 1.35 million acre-ft of earthworks, the laying of around 500,000 tons of asphalt, more concrete than the new Wembley Stadium in London and more reinforcing material than the Eiffel Tower. Ipswich City Mayor Paul Pisasale described the project as "opening a gateway to Ipswich City," as it will be used by more than 90,000 motorists daily.

The success of the D2G Project is best summed up by a recent comment from the local federal member for Oxley, Bernie Ripoll, who said: “In my view, it [D2G] has been the best project in Australia, demonstrating that a consultative approach with the community can be done. In fact, it has been a key part of the success of the overall project.”

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