GERALDTON SOUTHERN TRANSPORT CORRIDOR:

SETTING NEW BENCHMARKS IN REGIONAL INFRASTRUCTURE CONSTRUCTION

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EXECUTIVE SUMMARY

The Geraldton Southern Transport Corridor Stage 1 was a $78 million design and construct project completed by Thiess six months ahead of schedule, in October 2005.

In delivering this project Thiess is credited by joint clients Main Roads WA and the Public Transport Authority of Western Australia as setting new benchmarks for project delivery in community relations, local content and environmental management. The project was located in the centre of Geraldton, a city of 35,000 people.

Apart from direct infrastructure, the project left a range of legacies in Geraldton and the Mid West region, including:

- Enhanced community amenity – such as additional pedestrian crossings and high-wide load facilities.
- Benefit to Mid West business and economy – through a high-level of local business involvement and local employment, as well as training for apprentices and trainees, and upskilling of local employees
- New industry benchmarks – in community relations, local content and environmental management.
- High level of community ownership and pride in the completed project.

Defining features of the Geraldton Southern Transport Corridor Stage 1:

- Diverse contract requirements – including 5.3km arterial road, 13km rail, and a coastal works program placing 420,000m^3 of material on city beaches.
- Environmental conditions – particularly Geraldton's hot, dry and windy summers.
- Innovation for client benefit - Thiess' innovations created millions of dollars in savings for the client.
- Diverse stakeholder relationships – from local government authorities and Aboriginal representative groups to beach goers, resident groups, local businesses and port users.

Overall, the success of the project was a result of effective, focused project management. A culture of innovation was created, backed up by robust planning, smart logistics programming at a time when the sector was starting to boom, effective environmental management, comprehensive community relations and stakeholder relations programs, and forward consideration to minimise community and business impacts.

1. OVERVIEW: GERALDTON SOUTHERN TRANSPORT CORRIDOR

Construction of a road and rail transport corridor in the City of Geraldton and Shire of Greenough

Client: Main Roads WA and Public Transport Authority WA

Main contractor: Thiess Pty Ltd

Client budget: $92 million; Design and construct contract for Thiess: $78 million

Contract award: September 2003
Contractual practical completion date: April 2006
Practical completion: October 2005

Design consultants:

BGE	SMEC	Golders
Lincolne Scott	Maunsell	EPCAD
GHD	Lloyd Acoustics	Arup
ETC	Interactive Design	MP Rogers & Associates
ATA Environmental		

2. PROJECT STATISTICS

Project requirements

- construction of 5.3km roads**,** mostly arterial, while maintaining through traffic
- construction of a new 12km rail alignment, partly through residential areas
- 1km rail refurbishment at the Geraldton Port, without interrupting export operations
- 1.4 million m^3 balanced cut to fill, which included a sensitive coastal works program involving placement of 420,000m^3 of sand on city beaches as the catalyst for a project to redevelop Geraldton's CBD foreshore

Construction requirements

- four bridges
- two tunnels
- relocation of 97 services
- 1.4 million m^3 cut to fill

Bulk earthworks

- Total 1.4 million m3 balance cut to fill including:

- Placement of 900,000m^3 within project alignment
- Carting of 420,000m^3 of sand for City's Foreshore Redevelopment project
- Carting of 80,000m^3 to fill eastern breakwater at Geraldton Port

- 51,000 limestone blocks in 3200m noise/screen walls and 960m retaining walls
- 97 services to relocate or protect

Pavements

- 5.3km new roads
- 186,000m^2 pavement
- 150mm sub-base: crushed metamorphic rock
150mm basecourse: screened laterite gravel
- Seal and asphalt
- Roads generally kerbed
- 4900m guardrail

Rail

- 12km new rail
- 1km rail refurbishment at Port of Geraldton
- Narrow gauge: 1067mm
- 13,000 concrete sleepers
- 4 road level crossings
- 5 pedestrian level crossings

Concrete: precast yard

Fabrication of 42 precast trough beams

- Lengths 12.5m – 25m
- Weight 22T – 63T
- 800m^3 of concrete
- 200T of reinforcing steel
- Post-tensioned stressing
- 3 moulds – max 2 beams/mould/week

Concrete: insitu works

- 4200m^3 concrete
- 500T reinforcing steel
- 156 precast arch segments
- 5750m^2 MSE walls

Four bridges

- Waverley 2 x 21m spans (7.0m height)
- Brand over road 2 x 21m spans (5.8m height)

- Brand over rail 12m span (6.1m height)
- Highbury 2 x 25m spans, 1 x 20m span (6.6m height)

Bridge construction:

- Piers cast insitu
- abutments adjacent to rail were cast insitu for impact loading
- all other abutments were reinforced earth walls
- precast bridge beams were installed and covered with approximately 150mm cast insitu deck slab

Two tunnels

- Waverley 27.6m length (14.6m width, 7.5m height)
- Willcock 150.7m length (14.6m width, 7.5m height)

Tunnel construction:

- Cast insitu footings
- Precast tunnel aches installed
- Precast tunnel arches were tied together with a cast insitu beam across the top of arch sections

Landscaping

- 200kg of seed collected: 95,000 tubestock, 100kg for direct seeding
- Brand interchange entry statement
- Remainder coastal vegetation

3. COMPLEXITY AND DIFFICULTY OF THE CONSTRUCTION TASK

Special requirements of the site and location, including access and logistical problems.

The Geraldton Southern Transport Corridor (GSTC) was constructed to improve rail and heavy vehicle access to the Port of Geraldton, while separating heavy vehicles and local traffic. The GSTC also included the placement of 420,000m^3 of sand on four city beaches as the catalyst for the City of Geraldton's Foreshore Redevelopment Program.

On the doorstep of Geraldton's CBD, a large part of the project transformed major arterial roads. These works were carefully planned and managed to minimise disruption to the community from traffic disruption, sand carryover, dust, vibration and noise.

One of the biggest constraints for the project was the need to keep traffic flowing, particularly on the Brand Highway as a major arterial road for north/south through traffic, heavy haulage trucks heading to the Port through Geraldton and local residents and tourists.

Traffic planning and management was a major priority. Due to innovative construction planning and altering the sequence of works, the Brand interchange was constructed without having to close the busy Brand Highway. And the interchange was completed in time for peak grain carting season when an additional 1200 trucks a day travel to the port. This was an outstanding achievement.

Haulage program

More than 54,000 truck movements were required through city streets to transport a total of 780,000m^3 of sand for the coastal works program, the eastern breakwater fill and fill at the Willcock tunnel. This was the equivalent of more than one truck leaving site every two minutes. Due to thorough traffic and dust management, not one accident resulted. Measures taken included wetting down loads, vigilant street sweeping and dedicating a senior engineer to manage effective traffic sequencing.

Coastal works

The coastal works program presented other areas of complexity:

- Turbidity restrictions were in place to ensure reclamation works did not affect sea grass species in Champion Bay.
- Specifications for the grade of material to be placed on beaches meant the best sand needed to be sourced for coastal works. Colour, using a Munsell colour chart, and particle size distribution were monitored. The working areas of trucks and loaders were moved to get the best material to the beaches, meaning transport of material to build the Brand interchange had to work around this activity and traffic management within the cutting had to be carefully supervised.
- Transport of material to the beach sites involving an extensive haulage campaign to the central CBD required careful traffic and dust management initiatives.
- The requirement for effective environmental management procedures to ensure no hydrocarbon spillage in coastal areas.

Dust

Geraldton's extreme climate posed challenges to the construction team. Geraldton is known for strong summer winds and low summer rainfalls. Extreme winds of up to 75km/hour during January 2005 together with lower than average rainfall created difficult conditions.

This challenge was intensified at the site of the Willcock rail tunnel, where 280,000m^3 of earth was being placed over the tunnel structure in an area adjacent to businesses at the Fishermen's Wharf, an area exposed to the prevailing strong southerly winds.

Due to the proximity of the city centre, and the proportion of works in sandy coastal areas, strict dust mitigation measures were employed. The suppression of dust blown from the back of trucks driving through city streets is an example of best practice in this area. An automated sprinkler was set up at the exit of the loading site, activated by driving past an electronic sensor. Other measures included dust suppression by water carts (including non-

work days), silt fencing, alteration to work practices, early topsoil replacement and mulch covering, planting of sterile ryegrass, hydromulching, full-time street sweeping and cessation of work during extreme winds.

Noise

Because of the proximity to residents and businesses, noise management formed an important part of the construction planning process. Work hours were limited to 7am-7pm, 6 days per week, and residents were advised in advance when works were required outside of these times. Resident and council approval was sought for specific activities which would have added to noise levels in residential areas.

Vibration

Significant quantities of very hard limestone rock were removed from the rail alignment, requiring Thiess to employ a range of excavation methods depending on the locality. Low peak particle velocity blasting was undertaken in sections more than 1.5km distant from suburban areas. Closer to suburbs, although blasting would have proved faster and Thiess was confident a low-impact program would have been cost-effective and not caused damage to property, community sensitivity to blasting required alternative methods to be used. Rock breakers and 165 tonne Komatsu 575 dozers were used, increasing the length of time by more than three months.

There was additional vibration from compacting rollers during roadworks. Information was provided to reassure residents by describing vibration levels in context with other activities.

Maintaining port traffic flow

The Geraldton Port is Australia's second largest grain export terminal, and also exports increasing volumes of iron ore as well as a range of other mineral resources including mineral sands, copper, zinc, garnet and talc. This is an active port, and rail delays in the port precinct would have significant commercial ramifications.

Thiess worked closely with the Geraldton Port Authority and port users to design a rail refurbishment sequence to minimise disruption to rail users and give all parties an understanding of each other's requirements. This liaison commenced six months ahead of rail works, and culminated in a 30-hour shut down agreed to by all users to enable four rail tie-ins to occur simultaneously and an immediate switch to the new rail.

Brownfields construction site

The fact the GSTC was a brownfields construction site added to the complexity to the project. During construction, this required:

- Construction programs designed to reduce length of time of inconvenience to the community.
- Sensitive traffic management to minimise disruption to the community.

- Suitable rock breaking methods near suburban areas.
- Extended liaison with port users to develop a staging program for port access during rail works at the GPA, with the aim of minimising disruption to port rail traffic.
- Relocation and protection of 97 services, including above and below ground power, telecommunications, gas, sewer and water. A number of previously unmarked services were also located during construction.
- A comprehensive community relations program to manage community expectations about construction impacts, provide forward information about traffic management and other developments, and respond to concerns.
- Deliberate work sequencing for Geraldton's hot, dry and windy summer.
- Extreme winds in January 2005, well above average, required Thiess to step up the project's dust management program to meet commitments to minimise disruption to the community and fulfil Department of Environment requirements. Total average daily winds for January, provided by the Bureau of Meteorology, are 566km/day. In January 2005, the average daily wind for Geraldton was 649km/day – or more than 2500km wind above average for the month.

Willcock tunnel

Works at the Willcock tunnel provided another area of technical challenge, with the construction of a 151 metre rail tunnel in a location where the groundwater was less than 1 metre below ground level. Geotechnical investigations revealed a loose sand layer four metres below the surface, which needed to be compacted prior to tunnel foundations being installed. With the loose sand layer below groundwater level, it was not possible to achieve the desired result using compacting machinery.

Above ground compaction was achieved by surcharging the area for four months with material excavated from the rail cutting. A cut-and-cover concrete arch tunnel was then assembled at ground level, and covered with 280,000m^3 of sand from the rail alignment to allow construction of associated road structures. For the months while construction was underway, effective road access to the Fishermen's Wharf was maintained for vehicles associated with Geraldton's fishing industry.

Time constraints

The project successfully overcame a number of time constraints, including:

- Undertaking coastal works only during winter to avoid hot dry windy summer conditions
- Completing sand placement activities at Town Beach by 1 October 2004 in time for the Sunshine Festival dragon boat races.
- Completing the east/west movement of the Brand interchange before the peak grain carting season in November 2004 when an additional 1200 trucks a day travel to the port.
- Completion of the north/south movement of the Brand interchange prior to Christmas 2004, when vehicle volumes dramatically increase for the school holiday period.
- Opening the new train line in September 2005 before the grain season, and increasing iron ore delivery schedules for the final quarter 2005.

Changing construction sequencing

The original scope of works required Thiess to complete the Waverley Bridge prior to construction of the Brand interchange. To complete the Waverley Bridge first, the Brand interchange would not have been completed until the second half of 2005, and would have been constructed in two phases (involving a cessation of work over the windy summer months), involving longer-term deviations for local and heavy haulage traffic to the port. Thiess developed an alternative construction program in which the Brand interchange was completed first. Extensive planning and research was undertaken before the City of Geraldton and Shire of Greenough were consulted, and agreed to the changes.

- Constructing the Brand interchange first meant more disruption in the form of traffic deviations, but for a significantly shorter time.
- Thiess targeted the completion of the east-west route of the Brand interchange prior to the peak grain carting season in November 2004, when up to 1200 additional trucks per day are channelled through the area to the port precinct. This route was opened on 6 November, relieving the potential for traffic congestion and traffic safety issues during the grain carting season.
- The change also enabled the majority of earthworks to be completed over one winter rather than two – again causing less disruption to the community and enabling landscaping to commence one year earlier.
- An extensive information campaign – including television and newspaper advertising, media stories, briefings to community groups, newsletters, and letters to residents – ensured the community was warned well in advance to expect disruptions and to take care while construction activities were underway.

The original program planned sand placement on city beaches to be undertaken over two winters. As a result of the changed construction sequencing, and following consultation with beach user groups, a revised program targeted to complete sand placement activities over one winter. Completing the earthworks over only one winter enabled all beaches to be handed back to the community one year early, reducing the time the beach sites were closed to the community, and limiting haulage disruption to the community to only four months.

Systems complexity and systems efficiency in the delivery and operation

A systematic approach was used to manage the delivery and operation of the project. The team developed project-specific plans and procedures based on Thiess Management System guidelines. In addition, specific quality management measures included the use of TPMS7, a Thiess electronic project management document control system. TPMS7 stores drawings, specifications and all external and internal correspondence.

Community constraints

If poorly handled, community relations for this project would have caused delays and obstructions to the construction program as well as unnecessary aggravation in the community. Recognising the pivotal role community relations would play in the successful delivery of the GSTC, Thiess employed an experienced community relations professional with local knowledge. This enabled a tailored and comprehensive community relations

program to be developed which, while deviating from the program specified in the contract scope of works, meant the most effective communications, consultation and involvement activities were implemented for the Geraldton community.

The GSTC project set the following goals and objectives:

- To create a supportive environment for the GSTC to proceed within, to minimise barriers to construction progress.
- To generate community interest, pride and ownership in the GSTC.

Leadership from the Project Manager

The Project Manager personally became involved early in several key issues to assure the community Thiess was taking matters seriously. Examples include:

- Negotiations with Aboriginal groups to monitor vegetation clearing, topsoil removal and excavation activities. Construction could not begin until arrangements were in place for monitoring activities, to ensure protection of Aboriginal heritage during construction.

- Working through issues with businesses to find practical and constructive solutions to traffic and dust management issues during construction of the Willcock rail tunnel.

- Discussions with the Geraldton Rotary Club, over sensitivities about Norfolk Island pines planted by club members in 1992 removed during construction of the Brand interchange.

- Responsibility for the environment and community relations was also extended to engineers, superintendents and supervisors. This ensured a culture did not develop where construction-related community issues were not passed on for "someone else to fix".

<u>Forward management of issues</u>

As Geraldton had never before experienced a project on the scale of the GSTC, residents were not well prepared for construction impacts. Thiess instigated a targeted communications program to help the community to adapt to changes. Affected residents were advised in advance of potential impacts, through television and newspaper advertising, newsletters, briefings, displays and letters to specific streets or residents.

- The GSTC website enabled people to access traffic advice, concept drawings and other information.
- Local email networks were tapped into reaching hundreds of people directly.
- Noting the level of interest in construction progress, Thiess erected a purpose-built viewing platform adjacent to the Brand interchange to provide locals with a safe vantage point.

A number of community events were held to raise community awareness and celebrate the completion of major milestones including:

- Completion of the Brand interchange. The GSTC Team collaborated with a local group promoting physical wellbeing, Move Motivate Midwest, to encourage Geraldton residents to inspect the new interchange before it opened to traffic. The December 2004 event attracted more than 1000 residents and generated immeasurable goodwill for the project.
- Progress on Willcock Drive rail tunnel – more than 2000 residents came to inspect Geraldton's first rail tunnel in March 2005 while it was still under construction, again demonstrating the community's support for and interest in the project.
- The official GSTC opening was attended by more than 1000 people on 10 September 2005.

Throughout the project, Thiess maintained a high level of responsiveness to community needs and concerns.

- Liaison with resident group Friends of Beachlands in July and August 2004 resulted in an additional pedestrian/cyclist crossing being included in the final design
- In April/May 2004 Thiess brought together coastal user groups to advise of beach closures during the coastal works program to extend city beaches. As a result of these discussions, Thiess erected a compound to store school equipment to allow students to continue to use the Town Beach area safely without the need to cross the haul road.
- Following discussions with boat builders in September 2004, the GSTC Project Team investigated an option to allow for high-wide loads to travel through the corridor without risk of damage to structures or road furniture.
- Regular port co-ordination meetings were held with port users in the six months leading up to and during rail refurbishment works at the Geraldton Port to ensure disruption at the port was kept to a minimum and port users could plan around the construction schedule.
- Thiess' media relations program resulted in more than 250 stories over 18 months, of which only 14% conveyed a negative slant.

Environmental constraints

Coastal works

Coastal works were not carried out in summer months, due to the potential for dust issues and conflict with coastal users. As previously discussed, Thiess successfully pushed to complete these works within one winter rather than two. Early completion resulted in environmental and social advantages, such as early hand over to the City of Geraldton for development and community use, and reduction in beach closures to the community.

Seagrass in Champion Bay

A further environmental constraint for the coastal works required there be no impact on seagrass in Champion Bay. The contract stipulated the turbid plume should not exceed 300 metres. The construction team altered work practices in response to plume length, to ensure turbidity did not pose a problem to seagrass. Further to requirements, the construction team also reported on light transmission to seagrass. Monitoring showed light transmission did not fall below 100uE/m^2/s for a continuous period of four weeks, demonstrating the coastal

works program was completed with no long-term environmental impacts from turbidity.

Coastal setback

Early in 2004, Thiess completed a survey to confirm a minimum 74m setback from the rail centreline to the shore vegetation had been achieved at Grey's Beach, as required by the project's environmental conditions. A distance ranging from 75m-125m was confirmed.

Environmental Management Plan

A detailed Environmental Management Plan (EMP) was developed to ensure GSTC construction activities met the conditions and commitments set by the Minister for the Environment and Heritage.

The final EMP was prepared by Thiess, with approval from both the DoE and Department of Indigenous Affairs required before construction activities could commence. Several versions were prepared as the EMP was refined, prior to submittal for approval. The benefit of this process included DoE and DIA requirements being better considered in the early design stages of the project, a more thorough understanding by Thiess of specific environmental issues and management processes, and better integration between the EMP, Thiess systems and the construction process.

Solid performance against the EMP was achieved, even for challenging issues such as dust management, vibration, noise management and coastal works.

Overall, the GSTC was subjected to more than 16 external audits for environmental management, occupational health and safety and quality, with all confirming the project's high level of compliance.

Heritage constraints

Aboriginal burial sites or artefacts

Early archaeological reports identified the potential for earthmoving activities to uncover Aboriginal burial sites or artefacts in coastal dunes. Thiess developed a successful relationship with three local Aboriginal groups with responsibility for the area, the Willinyu, Naaguja and Mullewa Wadjari groups. An initial commitment directed monitoring for vegetation clearing and topsoil removal. However, following discussions with the Aboriginal groups monitoring activities were extended to excavation activities.

A nominated representative from each group co-ordinated a roster system involving a total of 20 Aboriginal monitors to observe vegetation clearing, topsoil removal and excavation of undeveloped areas of the corridor alignment from March 2004 to March 2005. No items of significance were discovered.

Heritage buildings adjacent to the site

Another heritage constraint was the need to protect two European heritage buildings located adjacent to the construction activities: the Hermitage, near the Brand interchange, and Gould's cottage near the rail alignment. Pre-condition survey reports were undertaken prior to construction. A blasting program was undertaken within 200 metres of Gould's cottage in 2004, to remove volumes of extremely hard limestone, using a low-peak particle velocity blasting regime. A follow-up property condition survey conducted in December 2004 found no additional deterioration as a result of construction activities, including blasting.

Risk management

Risk management for quality, OH&S and environment was undertaken throughout the project, at various levels.

- A series of risk assessment workshops were conducted throughout the project, commencing late 2003 prior to commencement of on-site works. Potential risks were identified during these sessions, ensuring these risks were considered from the early planning and early design phases. These risk assessments were reviewed and updated regularly to ensure new risks were identified and managed.
- Risk assessments were undertaken for sub-contractors and suppliers prior to individual contract award, to ensure their processes met the requirements of Thiess' systems. If processes were deemed not to be compatible, the sub-contractor was required to follow the Thiess system.
- OH&S and environmental risk management was conducted on a daily basis by engineers, through work activity briefings with supervisors, input into JSEAs, and content delivery at toolbox meetings and other safety briefings.
- Property condition surveys were completed on 420 residences and business within 100m of construction activities, prior to works commencing.

4. LEADERSHIP AND MANAGEMENT OF THE PROJECT DELIVERY

Project team relationships including clients, employees, consultants and subcontractors

A strong partnering approach existed between core project personnel, consultants and subcontractors who worked closely with the clients to deliver the project. This collaborative approach included the team establishing protocols to clarify areas of responsibility and facilitate expedient responses to technical design or community queries. A range of methods were established to ensure effective communication between employees, consultants, subcontractors and suppliers.

Innovation in the development and/or delivery of the project

At all stages of tender, design and construction, Thiess sought to improve the delivery of the project by challenging existing thinking to find ways of doing things better. This created innovations such as:

Cut-to-fill balance

Thiess' innovative tender design raised the rail alignment by approximately 1.5 metres, reducing the amount of spoil generated by about 1 million cubic metres to achieve a cut-to-fill balance. The results included significantly less cost to the client, and less disruption to the community and the environment from transport of spoil material. During contract negotiations, MRWA and PTA asked Thiess to lower the vertical rail alignment at one point to enable loaded trains to leave the port. Thiess reworked the vertical and horizontal curves to maintain a cut-to-fill balance.

Waverley rail tunnel

During the post-tender negotiations, the Waverley Street rail bridge was changed to a tunnel structure, again providing considerable cost-savings to the client.

Staging of works

The scope of works required Thiess to complete the Waverley Bridge before construction of the Brand interchange. Thiess changed the sequencing to construct the Brand interchange first, which minimised disruption to the community and expedited project completion by more than six months.

Local skills training

As the first major infrastructure project in WA to have the new Building Skills Policy applied, Thiess was given the daunting target of 31,000 hours of training over the two-year construction period. To reach the target, Thiess changed hiring practices to ensure greater employment of trainees and apprentices, and engaged two group training schemes in Geraldton to assist in the process.

A firm resolution to create opportunities for participation by trainees and apprentices saw the project reach 40,000 hours for trainees and apprentices, 30% above target hours set by the State Government.

Pre-cast yard

Another area of innovation for Thiess was the establishment of a pre-cast yard in Geraldton for the manufacture of 42 trough bridge beams. Thiess set up a pre-cast yard, located opposite the formwork manufacturing sub-contractor, to enable greater control and more efficient construction of beams, reduced transport costs, less risk of damage and ultimately a cheaper cost to the client.

Thiess worked with its formwork design consultant to design formwork in the pre-cast yard with reuse and interchangeability for the manufacture of all beams being the criteria. Rather than having four different types of formwork for four different types of beams, one set of formwork was created for three of the beams.

Post-stressed beams were constructed, rather than pre-stressed. This allowed a simpler set up at the pre-cast yard, as well as faster completion and removal of beams. Beams were designed to maximise the use of formwork.

An experienced Structures Superintendent reviewed all structure designs to provide practical improvements for construction.

Vibration

In mid-2004, a vibration assessment was conducted for compaction machinery used for the GSTC. The assessment indicated distances required to comply with allowable vibration levels, giving operators confidence they were not exceeding specified levels. The results were also provided to community members to provide confidence the vibration levels being experienced were within allowable levels and were unlikely to cause damage to property.

When possible in areas close to residences, operators reduced the amount of vibration used by compaction machinery to minimise the impacts felt by residents. This increased the time of works, but reduced community impact.

Bridge pier construction

Bridge piers were designed to allow one set of formwork to be used throughout the project for in-situ concrete construction. Only minor changes to formwork were required for construction of the bifurcated columns. This enabled a quick turnaround in setting up formwork, pouring and stripping. Ultimately, the faster construction program meant less cost to the client, as well as opening up completed structures earlier to the community.

The Brand interchange, for example, was opened in less than seven months. And the Highbury Bridge, which involved 2 x 25m spans and 1 x 20m span, took only seven weeks from the completion of earthworks to have beams in position.

Planning and control of construction operations

One of the most complex elements of the project was the need to transform major arterial roads on the doorstep of Geraldton's city centre. Planning and controlling the construction operations was essential to achieve the required project outcomes with minimal impact.

Traffic planning was a priority. The project team dedicated a full time senior engineer to focus on traffic staging at the Brand interchange.

Occupational health and safety management

The GSTC achieved an outstanding safety record, with no lost time injuries after more than 500,000 man-hours worked, and less than $2500 in workers' compensation costs incurred for Thiess' direct employees and sub-contractors.

Thiess has accreditation for its Occupational Health and Safety Management System, (AS4801) and environment (ISO14001) and quality assurance (ISO 9001).

While a dedicated safety manager was employed for the GSTC to ensure safety awareness remained high, responsibility for safety was also part of the job description for engineers and supervisors, to ensure a strong safety culture within the project.
Identification and reporting of hazards – with a "no blame, just fix it" attitude – was actively encouraged on the GSTC project.

Industrial relations management

A greenfields site agreement was established prior to construction commencing. Over the 18 month construction period, only one day was lost by 12 employees in the precast yard due to industrial relations.

Use and development of new technologies

A range of new technology and techniques were adopted for the GSTC, including:

GPS technology

A new system was trialled on the project, with feedback provided to the manufacturer for improvements prior to commercial release. The foreman's vehicle was fitted with global positioning system technology linked to a computer within the vehicle. The computer contained the electronic design model data, which allowed the foreman to compare construction progress to the final design, for example to determine the remainder of fill or cut required in a particular location. This system was trialled on the project over two months. The manufacturer reviewed its design to incorporate these practical comments, with the intent of producing a more user friendly, cost-effective system.

Noise acoustics software

The design for GSTC noise walls was purposely delayed while the acoustics consultant awaited the latest software from Europe. This software ensured the most effective noise wall designs possible. The noise barriers were subsequently designed to meet the noise level objectives for both the rail and road traffic and maintain quality of life for adjacent residents. In accordance with community preferences, noise treatment used a mix of limestone walls, a bund/wall combination and landscaped bunds, where road reserve area permitted.

5. OVERALL OUTCOMES ACHIEVED

Achievement of time, cost, quality and safety objectives

The GSTC was completed in October 2005, six months ahead of the contract completion date of April 2006. It was built at an overall cost of $92 million, within budget. Thiess' proportion of the overall GSTC budget was $78 million, delivered within budget.

The GSTC project achieved an outstanding safety record with no lost time injuries after more than 500,000 hours worked and less than $2500 in workers' compensation costs incurred. Client quality targets, which were stringently monitored, were met.

Client satisfaction and general success of the project

A high level of client satisfaction was achieved for the GSTC, with Main Roads WA Executive Director of Major Projects, Phil Ladner, crediting Thiess with setting new standards for project delivery for community relations, local content and environmental management.

In a media release prior to the official project opening in September 2005, Premier Geoff Gallop said: "A key to the project's success seems to have been the strong relationships which Thiess was prepared to develop with local government authorities, key stakeholders and the community, at each and every step along the way."

General satisfaction of stakeholder groups

Ultimately, the community was the client for the GSTC and therefore community satisfaction the ultimate performance indicator. Thiess worked to achieve a high level of community interest, ownership and pride in the GSTC, and minimise disruption during construction.

A comprehensive community relations program managed community expectations about construction impacts, provided forward information about traffic management and other developments and responded to concerns. At the same time, Thiess maintained positive and effective working relationships with stakeholders such as local government authories, Midwest Chamber of Commerce and Industry, Department of Environment, Geraldton Port Authority, local Members of Parliament, Aboriginal representative groups and community groups such as Move Motivate Midwest, Active Community Environmentalists, Friends of Beachlands and Rotary Clubs.

Sustainability

In addition to the community and environmental initiatives the project implemented a range of sustainability initiatives. These were primarily centred on helping to cultivate long-term economic, environmental and community development benefits for Geraldton.
Some of the key sustainability initiatives included:

<u>Landscaping program returning all areas to native vegetation</u>

Prior to construction commencing, work had already started for the final landscaping program.

- Seed collection commenced from the corridor alignment and adjacent areas in late spring 2003, and has continued to obtain seed from different seasons. A total of 225kg of seed has been collected for direct seeding and tubestock germination for revegetation. Cleared vegetation was mulched, and stored for later use. Topsoil was also stored, for replacement and covering with mulch. These actions will give the landscaping program its best chance

of success, to create a nurturing environment with localised materials and native seed. Clearing required for the corridor was strictly controlled and restricted to the construction footprint.

- In addition, the project restored 10.3 hectares of degraded adjacent land, which was fenced to protect local flora. Within this area, tracks were rehabilitated and degraded vegetation improved.
- The landscaping program will continue for three years. Not all landscaping could be completed in 2005 due to the timing of completed works outside the winter planting season. In 2005, the program focused on planting 94,000 tubestock and sowing 100kg of seed. In April/May 2006 a further 33,000 tubestock and 35kg of seed will be planted, along with continuing weed management.

Local content

The project team was committed to providing a substantial economic boost to Geraldton. Over $28 million was spent locally, more than double the contractual requirement of $12.7m. Thiess' commitment to local content resulted in 70% of employees being drawn from the local community, although this was not a contract requirement.

Through its strong local content program, the GSTC provided a significant boost to the Mid West economy through use of more than 200 local sub-contractors and suppliers. At the same time, Thiess supported businesses to develop systems and processes to comply with the requirements of such a major infrastructure project. In addition, the project leaves a legacy of substantial training of 46 apprentices and trainees, and upskilling of local employees – skills which are left in the region.