
Hilton Surfers Paradise

Australian Construction Achievement Awards

2012 Technical Paper



ABSTRACT

The Hilton Surfers Paradise not only epitomises Brookfield Multiplex's capacity to construct iconic buildings but more importantly emphasises the company's innate capacity to provide solutions that are innovative, provide value for money, are quality driven and ensure delivery to stated objectives.

When the Raptis Group ran into financial difficulties on the Gold Coast in 2008, Brookfield Multiplex began discussions with ANZ to see if the project could be saved. As part of the negotiations, Brookfield Multiplex proposed the introduction of a new 5 Star hotel, differentiating the plan from the original two-tower residential development, with commercial office levels and a large retail component.

An independent study, commissioned by Brookfield Multiplex to understand the value the addition of a 5 Star hotel would bring to the development, concluded that given the vital importance of tourism to the Gold Coast economy, and the dependence of employment in Surfers Paradise on tourism and tourism related activities, the *"proposed Hilton developmenthas been calculated to offer a significant level of economic advantage above that of the previously approved DA....and will generate a considerable amount of expenditure and create a sizeable number of jobs, particularly at a time when unemployment is on the rise."*

Following negotiations, the project restarted in May 2009, fully funded by ANZ with design, construction and development delivered and managed by Brookfield Multiplex.

GLOSSARY – KEY WORDS

BM – Brookfield Multiplex

Hilton – Hilton Hotels

HSPR – Hilton Surfers Paradise

Top Down – Construction method that facilitates basement and tower construction at the same time

Orchid Tower – East Tower

Boulevard Tower – West Tower

EMS – Environmental Management System

DA – Development Application

CWs – Construction Workers

Elan – Elan Boulevard Pty Ltd

BCA – Building Code of Australia

GFC – Global Financial Crisis

EWP – Elevated Work Platform

Introduction

Hilton Surfers Paradise is a 5 Star hotel, residential and retail complex. The development, with a total site area of 7,240m², is characterised by two striking and architecturally distinctive high rise towers, the Boulevard Tower and Orchid Tower, each rising from a three level podium and presiding over five levels of basement car parking for residential, hotel, retail and Hilton Hotel back-of-house facilities.

The 32 level Boulevard Tower has 186 residential apartments while the 57 level Orchid Tower consists of 169 Hilton Hotel guest rooms on L3 to L15, and 224 residential apartments.

The podium at street level includes: Hilton Hotel front-of-house, premier fashion, retail and public art centres, a café and restaurant strip. Additional retail is located on L1 and a landscaped podium with lap pool, children's pool, plunge pools, water features, day spa, gym, spa and sauna and bar pavilions is situated on L2.

The core contractual arrangements between the various parties included:

- A **D&C Agreement** between Brookfield Multiplex Constructions Pty Ltd and the Raptis landowning entities (in administration) for the construction of the two towers, retail component and basement carparks.
- A **Development Management Agreement** between a Brookfield Multiplex development entity, the Raptis landowning entities (in administration) and ANZ, to manage the development of the building including the marketing, sales and leasing of the project.
- A **Development Side Deed** between ANZ, the Raptis entities and the Brookfield Multiplex entities.
- An **Independent Certifiers Deed**.

In addition to the core contracts above, agreements were put in place for: Hilton International Management LLC to operate and manage the hotel and serviced apartments in the completed development on a long term basis and for Brookfield Multiplex to be granted the option to acquire the hotel component of the development. Brookfield Multiplex has since exercised this option and is now the owner of the Hilton Hotel Surfers Paradise.

Technical Data

Boulevard Tower	
Floor Levels	32
Apartment No.	186 residential
Orchid Tower	
Floor Levels	57
Hotel Rooms	169
Apartment No.	224
Podium	
Levels	3
Basement	
East Levels	5
West Levels	6
General	
Total Site Area	7240m ²
Project Cost	\$270m
Project Completed Cost	\$281m
Commencement Date	11 th May, 2009
Completion Date	29 th August, 2011
Total Duration of Project	28 months
Construction Method	Top Down for basement levels, in-situ and precast concrete podium and high rise structures
Manpower Peak	410/day on site
Total Project Manpower	11,070
Excavation – Sand	200,000m ³
Concrete	65,000m ³
Reinforcement	10,000t
Glass	35,000m ²
Plasterboard Partitions	200,000m ²
Floor Finishes	
Tiles	16,000m ²
Carpet	60,000m ²
Stone	3,500m ²
Structural Steel	120t
Masonry	10,000m ²
Balustrade	11,000m

Outcomes

Safety

The key Health and Safety targets on the project were to ensure:

- No time lost due to unresolved Health and Safety Issues
- The safety culture onsite was changed
- All activities outlined in project OH&S status chart were undertaken.

Brookfield Multiplex recognised that the success of our management initiatives, aimed at further improving safety performance, would largely depend upon identifying and changing the behaviour that pervades our industry. The objective was to target workplace behaviour to change the underlying industry attitudes which make up the workplace culture on our project sites.

A strategic decision was made to deliver a strong and disciplined proactive safety culture in which hazards/risks were identified, addressed on the spot and reported. Underpinning the strategy was an understanding of the value of collaborative effort and the knowledge that to achieve excellent health and safety performance, required empowering site personnel to drive and maintaining a culture of safety excellence. Brookfield Multiplex recognised that we must target the root causes of human behaviour, as people's attitudes have been built up over a long period of time and are very resistant to change.

A behavioural Psychologist was employed to help the management team design a two-stage blueprint to deliver the Brookfield Multiplex "Safety Excellence Culture". The program launch commenced with a signed letter from Brookfield Multiplex site management addressed to all site personnel and their families explaining the intent of the Safety Excellence Program.

A combination of both lag and lead indicators was employed to identify, monitor and implement workplace health and safety strategies and institute corrective action strategies to further improve safety performance. Analysis of incidents from December 2009 through to June 2011 using the three-month rolling average method, revealed a significant and sustained reduction in incidents immediately after the Safety Excellence Program was introduced and that incidents continued to decline during our peak operations.

Environment and Sustainability

Brookfield Multiplex implemented its robust Environmental Management System (EMS) on the Hilton project which involved a full environmental site audit, environmental risk analysis, a register of controls and targets, and allocation of responsibilities. The EMS was implemented by EMS co-coordinators, our site managers, supervisors and labourers. Every subcontractor was required to submit its own EMS prior to commencement onsite, and these were reviewed, monitored and audited by the EMS co-coordinators. Specific targets included:

- Reduction of sediment load to local waterways by recycling 80% of all construction waste generated onsite
- Reduction in the use of PVC
- Reduction in operational water usage
- Increase in use of recycled materials

A summary of environmental achievements include:

- Reduction in sediment load to local waterways of 96% compared to industry standards

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- In excess 85% of construction waste diverted from landfill
 - Over 20% reduction in the use of PVC
 - 25% cement replacement with recycled materials
 - An average of 72% of recycled content in the steel reinforcement
 - 20% reduction in operational water usage
 - No environmental incidents
 - Use of a sustainable timber source

The key environmental innovation with the Hilton Surfers Paradise Hotel and Residences project was the selection of the Top Down construction process that resulted in significantly lower water quality impacts to the surrounding local Surfers Paradise waterways, lower management costs and higher authority compliance.

Quality

In line with the successes of innovations in safety, acceleration of construction and cost control, the project team achieved the following impressive results for quality:

- Only 59 non-conformance reports during the 121 week construction period – all effectively closed out.
- On average, approximately 10 customer relationship management defects per apartment, all successfully addressed within the agreed period.

Brookfield Multiplex understands that one of the major concerns of clients, operators and purchasers is uncertainty regarding the end product, resulted in the instigation of design and construct consultation workshops and presentations, which allowed identification with an agreement by stakeholders to be established regarding space, layout, selection and quality of materials. This provided the stakeholders with the confidence that the process would deliver the required outcomes. To establish a standard for finish quality on the Hilton project, the team constructed full size prototypes of a Hotel suite and a two bedroom apartment type including wet areas, balconies and kitchens etc. This process established the benchmarks to which the client and operator could physically relate, as well as providing a means for 'road testing' FF&E and material selection.

Complexity, Difficulty and Optimisation of the Construction Task

The construction of a grand-scale project in one of Australia’s busiest tourist precincts added complexity to an already ambitious development, making it necessary for the project team to adopt a flexible approach to managing changes in the weather, the activities of adjoining organisations and the high volumes of vehicular and pedestrian traffic generated by major events such as the V8 Super Car Carnival.

Interfaces and Constraints

One of the chief challenges during the construction of Hilton Surfers Paradise was the simultaneous building of the four structural zones housing the Hotel, apartments, recreational facilities, services, vehicular access and stowage.

The four working zones covered:

- **Basement** – over five and a half levels covering 7,000m² per level
- **Podiums** – over three levels
- **West Tower (The Boulevard)** – 32 levels
- **East Tower (The Orchid)** – 57 levels

These zones, which were subjected to a tight programme and specific constraints imposed by the structural engineers, necessitated a detailed construction management plan with a rigorous peer review process in order to provide Brookfield Multiplex with the confidence that all risk factors were considered and addressed. Constraints imposed by the design included the need for the completion of the total basement area slab level before commencement of the next level below. This activity served to ‘brace’ the perimeter walls and columns preventing load forces from acting directly on the unsupported structures that would have created bending moments. Brookfield Multiplex worked hard with the design engineers to develop a system that accelerated this activity whilst still delivering the structural support required for bracing of the perimeter walls and columns.

Another challenge to the team was to complete the basement structure before the east tower reached IL30 - if not completed the tower load would be in excess of the columns and walls not yet exposed and braced. After careful analysis and onsite coordination, Brookfield Multiplex was able to program and construct the entire basement two weeks before the tower reached L30.

Co-ordination between the tower work fronts and podiums was critical to enable a program that flowed and provided continuity for the workforce whilst also maintaining a safe working environment. Monthly, weekly and daily programme reviews and consultations established a regime that benefited from input by all planners and on which the project operated. The materials handling plan provided for the individual areas in a way that enabled all fronts to work as if they were independent yet still a part of the project as a whole. In other words each work face was able to operate at its programmed pace whilst not interrupting the adjoining work face and its commitment to program.

The previous mentioned plan also provided for a high paced tower floor plate construction achieving consistent four (4) day cycles. Plant and equipment sharing between the two towers was critical in establishing and maintaining these cycle times. Routine daily meetings held at the end of the shift between the area managers and materials handling supervisor were vital in delivering the program without disruption to the site and the surrounds as covered in the logistics section above.

Unique Risks

Maintenance of the stability of neighbouring buildings during excavation

The site with a basement excavation depth of approximately 20m is bordered by neighbouring buildings to the north and south and has street frontages to the east and west. The chosen 'top down' construction methodology in itself promoted a high level of security for our neighbours during excavation, with its full slab bracing arrangement to the perimeter diaphragm wall. This method reduced the open cut temporary support to single level depth as opposed to full excavation depth that sees the depth exposed for longer periods when settlement issues can create problems for adjoining neighbours. The maintenance of water table levels is much more controlled with the employment of the D-wall because it enables the recharging of the boundaries with pump out water from the excavation zone. With a consistent water table, top down excavation and a routine surveillance of survey height points surrounding the site Brookfield Multiplex was able to complete the works with minimal interruption.

Simultaneous construction of three separate work faces, West Tower, East Tower and Basement

As previously described, a detailed material handling plan and construction programme was developed to cater for the need to have works proceeding simultaneously on the three fronts. Brookfield Multiplex's dedicated managers coordinated on a daily basis at the end of the day's shift to ensure the next day was planned and programmed for equipment movement and supplier delivery. Brookfield Multiplex's engineers continually monitored and reviewed programme performance to identify and address areas of delay or concern. Safety management and supervision consultation was undertaken on the risks involved with works interrelating between zones. Works such as the west tower southern curved wall crown were prefabricated on the central L2 east tower zone, and then lifted to the 34th level west without incident. The sheer volume of traffic – a truck every 7 minutes over a 10 hour shift in construction peak months, moving safely and efficiently through the site and through the heart of the tourist precinct without incident, was a risk well handled.

Operation of machinery at height in a coastal environment prone to strong and ongoing winds

In tackling this issue Brookfield Multiplex drew on its large depth of experience in working in the city of the Gold Coast, where the company has completed many high-rise tower buildings, and therefore has an understanding of the critical nature for selection of plant and equipment within the environment. Similarly at the Hilton, the use of tower crane type and design, with a higher wind speed operation criteria was required. We also took the time to find the optimum location for placement of such plant within the site to lessen the impact on the surrounding environment and avoid issues that nature can throw at us by placing hoists and cranes in areas identified by wind engineering reports, as being 'kinder wind zones'. In addition we relied on self climbing form work and screening systems to lessen the reliance on tower crane support, and the use of form work hoist systems for unimpeded delivery.

Settlement risk on apartments sold prior to the appointment of Brookfield Multiplex

At the time Brookfield Multiplex was appointed to the development, 274 of the 410 apartments had been presold off the original marketing collateral, however documentation of the apartment floors had not been finalised. The potential settlement risk for ANZ as vendor was very real due to possible inconsistencies between marketing floor plans and the final design. To mitigate this issue, the team formulated a risk strategy whereby architectural plans were overlaid with the original marketing plan, area comparison schedules were prepared between the architectural areas and the sales contract areas and all special conditions attached to the sales documents were reviewed.

The risk management process was undertaken at various stages of the project as the design progressed. The ultimate success of the process was highlighted at settlement with no terminations occurring due to inconsistencies of the unit plan.

Top Down Construction

Our innovative use of the Top Down approach was the second demonstration of this method, within this terrain, in Australia and the first of its use in a larger scale environment. The larger site footprint of the Hilton Surfers Paradise at 7,500m² and deeper excavation to 25 m below surface level including the removal of almost 200,000m³ of sand required the implementation of a unique sand excavation method. The new method utilised posi-drive track machines to transport spoil to a central stockpile for removal by excavators passing loads. The overall benefit achieved by implementing the Top Down approach was a total reduction in basement construction time of six months.

The Top Down Construction methodology allowed for construction of the basement and towers at the same time instead of the conventional method to excavate and construct basement levels before commencing on podiums and towers. During the top down construction, the foundation contractor spent several months onsite installing 800mm and 600mm diaphragm walls sections of 6 metres wide by 40 metres deep to construct the perimeter diaphragm wall for the basement.

The diaphragm wall is used as a cut off wall and has been designed to limit ingress of water at no more than 5 litres per second across the whole site. Prior to ground floor slab works, wells were sunk and water was pumped out of the site to below final basement levels. Pumps were then turned off to allow monitoring of inflow of water. This was done by measuring of water levels through piezometer wells inside and outside of the site. The results showed that the ingress of water was well below the allowable rate, proving that the design and construction of the diaphragm wall were successful.

One fascinating part of the project was the installation of concrete filled steel piles, structural steel plunge columns and Barrette foundations for the two towers' main foundation supports. Other foundation supports were precast columns to support the ground slab and basements.

Once these works were completed, the ground floor slab was cast on a blinding layer and the podiums and towers commenced. As the ground floor slabs cured, excavation of the basement commenced with sand removed via a 22m long x 5m wide penetration left in the ground slab. These works were carried out with the use of tracked bob cats to excavate sand and remove blinding layer beneath the ground slab dividing the 7,600m² basements into four sections working in a clockwise direction from the penetration.

They place this material at the penetration for an excavator to pick up and load into trucks. The program required 800m³ of soil to be removed on a daily basis. Due to the confined space environment, all machines were fitted to mining specifications and constant checking of air quality was conducted with CO₂ monitors. Ventilation systems were also installed throughout various locations on the ground slab to help circulate air and ensure air quality was maintained. As each area was excavated, a blinding layer was cast to allow the basement slabs to commence following behind the excavation process and flowing downwards in a cork screw method.

Contribution in the Design Process

In conjunction with and supported by the increasingly collaborative and concerted effort to establish a high performance safety culture, was an equally concerted effort by the site team to review work processes and to identify where hazards/risks could be eliminated through improved design and planning. Many solutions were identified in this process that were subsequently adopted or became a reference point on all Brookfield Multiplex projects – they included:

- Use of elevated work platforms for placement of column boxes, pouring of columns and walls. This enabled manpower and equipment to be positioned correctly and reduced OH&S risk to workers.

- The use of screens to majority of podium area as edge protection for full height of podium provided safer protection to main traffic thoroughfare, minimised large volumes of scaffold material onsite and enabled works to continue without delays.
- The use of 13m high pre-cast boundary walls to podiums areas enabled full edge protection to adjoining buildings and workers alike. Precast walls were also extended to allow for L2 garden bed maintenance without the requirement of engineered harness points.
- The use of hydraulic wall climbers to the curved façade and internal walls minimised our requirement to lift shutters every floor cycle. This reduced the OH&S risk of shutter movement and enabled works to continue even if cranes were affected by inclement weather.
- The design and pre-fabrication of 8m high panels on L2 for the Boulevard Tower façade at roof top level that were craned into position. This eliminated the risk of falling objects and the inclusion of large exclusion zones had a cantilevered scaffold been implemented.
- Incorporated access walkways to Surfers Paradise Boulevard Tower perimeter precast structural steel supports to enable building maintenance via rope access.
- Removal of block work to typical levels of tower by introducing speed panel to fire stair separation wall and mechanical risers. Installation of walls could be done without affecting egress paths, materials could be loaded onto floor and floors were kept cleaner due to no wet trades.
- Trailing deck attached to bottom level of jump form to allow lift rails and doors to progress ahead of finishing trades. This enabled removal of lift door cages out of lobbies and provided clearer access paths.
- Use of precast to construct Orchid Avenue Tower halo, enabled works to be installed off EWP without requiring scaffold, provided a walkway for building maintenance rope access and also reduced requirements to return for defect rectification compared to original concept design.

Design solutions also included:

- Heights of all balcony handrails were increased to exceed BCA requirements.
- All toughened glass was also laminated to mitigate any glass from falling if accidentally broken. This also addressed spontaneous shatter.
- All light fittings on balcony soffits were relocated away from edge of building.
- Slip ratings installed to external areas exceeded BCA requirements.

Construction Phase

In order to quantify the level of success or otherwise of the project, objectives and measurable targets with respect to risk management, design, planning and programming, project administration, site operations, health and safety, quality and environmental management were established at the outset and results periodically reviewed and progress reported to the Brookfield Multiplex Executive Committee.

Site Operations Management

Brookfield Multiplex Constructions was committed to ensuring the site operational risks and opportunities arising from the works were effectively managed and controlled through the implementation of its Site Operational Management System Procedures and Site Operations Management Plan. The Site Operations Management Plan described how the Project Management team implemented and conducted its allocated site management responsibilities during the Construction phase of the project.

A fundamental aim of this Plan was to ensure all construction was properly facilitated, integrated and coordinated so as to deliver certainty to the objectives of the project being constructed on time, safely, within budget and with outstanding quality results. Management Plans were developed to satisfy specific contract requirements with the management system being implemented within the framework of the Project Management Plan that overlays the suite of management plans. The Project Manager was responsible for communicating these to the relevant teams and monitoring their performance.

Program Management

At the outset, and in order to effectively manage time, a detailed and integrated Design, Procurement, Construction and Commissioning program was developed in collaboration with relevant stakeholders. This programme was subsequently managed through regular monitoring, reporting and where necessary, rescheduling in order to meet the required completion date. Driving the overall programme was an understanding of the logic, being those critical interdependencies which must occur in order for the programme 'to work'. Consideration and an understanding of the existing operational constraints and key project milestones were fundamental to this process.

From the overall programme noted above, individual programmes were developed in greater detail for each of the key disciplines of design, procurement and construction. These programmes that evolved to a greater degree of granularity were also broken into both midterm and short term timeframes enabling a superior ability to monitor and report on required outputs by respective parties. These programmes identified milestones appropriate to the discipline, for example for the design programme, specific user group reviews and presentations were highlighted so that the developing design married in with the project requirements thus avoiding the potential for unnecessary rework.

Construction Progress Reporting

Construction progress was reported monthly. Close monitoring of progress allows assessments to be made against the agreed construction programme and to determine if the project objectives were being met. Early reporting of problems either in supply, construction or procedural activities allowed for intervention, and prevented compounding effects.

Use and Development of New Technologies

The mix of residential apartments and hotel pool apartments (those owners who choose Hilton to manage their apartment), with 186 in the Boulevard Tower and 224 in the Orchid Tower, created a total of 410 apartments that needed to be technically configured to operate as either a hotel room or a residential apartment. In addition, the Orchid Tower has 159 Hilton hotel rooms on L3-L15 as well as an executive/club lounge and boardroom on L15.

With both hotel and residential services required on every floor and every room (other than hotel-only services to the actual 159 hotel rooms), it was evident that fibre carriage was required throughout the combined 89 levels of the two towers. The construction of eight specific IT rooms across both buildings and on multiple levels, and with 21 full size equipment racks installed resulted in all services being fibre fed from the greater public network to the Hilton complex, thereby providing one of the highest Internet speed and bandwidth feeds available in Australia.

Conclusion

Stage 1 of the project, the Boulevard Tower (consisting of 186 apartments over 32 levels plus retail shops) was completed on time in October 2010.

Stage 2, the Orchid Tower (consisting of the 169 room Hilton Hotel from L3 to L15 and reception on ground, and 224 apartments from L16 to L57) in August 2011, three months early.

As a result:

- The successful and early delivery saved Elan Boulevard three months of interest on a development cost of approximately \$540m
- All but 18 apartments of the remaining 160 apartments were sold at an average 1.8% discount on their original value, despite these sales occurring during the height of the GFC
- The \$370m project was brought in on budget (with just \$320,000 overspent) on a GMP that was arrived at in only three weeks of intense analysis and testing
- Brookfield Multiplex is now the proud owner of the Hilton Hotel

It is a success story for all involved – Elan Boulevard stands to recoup much of its investment, Brookfield Multiplex rescued an endangered project and at the same time provided much-needed work for its employees in Queensland. Importantly, local subcontractors and suppliers benefited from contracts during the height of the GFC, (preference for local employment being a key plank of the construction strategy) and the Gold Coast has a new and iconic project that is attracting large numbers of national and international visitors to the region.

The Project Team

Peter Bell – Construction Manager, Nick Xenitopoulos – Project Manager, Manos Sartzetakis – Site Manager, Rod Budd – Site Manager, Adam Stante – Design Manager, Michael Sinclair – Project Engineer, Matthew Riding – Contracts Manager, Renie McHugh – Personal Assistant, Mark Stante – Project Director, Kevin Gogolka – Senior Development Manager, Glenn Robinson – Environmental Manager - Geoff Taylor – Contracts Manager - Matthew Riding – Contracts Administrator