Setting high standards in sharing technologies

ASI steel detailer member, PDC was recently appointed to deliver shop detailing for ASI steel fabricator Civmec and in a separate engagement, also appointed BIM management consultants to support Brookfield Multiplex for the Perth Stadium and Sports Precinct being developed by the Western Australian Government.

The global group was recently named winner of the Information and Communication Technology Export Award category at the WA Industry and Export Awards. Some of the innovations and novel approaches contributing to this success were applied to the Perth Stadium steel detailing and contributed to a more efficient solution.

The 60,000 seat stadium is expected to be completed in time for the start of the 2018 Australian Football League (AFL) season and will have the third-biggest capacity in Australia with 60,000 seats and the potential to increase to 70,000. The standard of the stadium including its functionality, services, finishes and fitout will ensure that it is a world-class venue.

The stadium and sports precinct is the centrepiece of the Burswood Peninsula redevelopment located next to the Swan River and will be capable of attracting national and international events to Perth catering for AFL, rugby, soccer, cricket and entertainment.

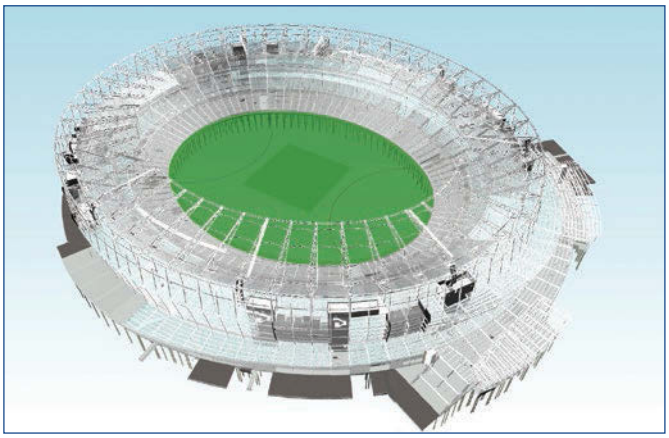
In mid-2014 the Westadium Consortium, consisting of Brookfield Multiplex, John Laing, Brookfield Financial and Brookfield Global Integrated Solutions was contracted to design, build, partially finance and maintain the facility for 25 years.

PDC's engagement with the project was extended by being appointed BIM management consultants to support Brookfield Multiplex's delivery of a LOD500 'as built' model for the ongoing service and maintenance of the facility. LOD500 is the most detailed of the 'Level of Development' frameworks.

PDC's innovative end-to-end strategy for the Perth Stadium project has ensured that systems, relationships and forums are used to comprehensively develop the Management Plan in collaboration with the State Government, the yet to be appointed stadium operator, the Facilities Manager and the D&C Team, including key subcontractors, suppliers, consultants and key stakeholders.

Throughout the project, PDC helped Tekla beta test its newest iteration, Version 21 which has allowed multiple offices to pool work on one overall model in the cloud and eliminated some common interface issues (due to the requirements to subdivide models).

Third party software capabilities were enhanced by using PDC's own award winning proprietary technology software, iConstruct for Autodesk Navisworks which enables 3D elements from all areas of the project to be imported, integrated and standardised into a single, data-rich 3D model. This tool works with other 3D modelling software and acts as a project knowledge hub for all stakeholders, including internal workforces and outside contractors, saving time and money on resource intensive projects. It integrates with CAFM/CMMS and documentation systems to provide a seamless and enterprise wide configuration.



"This could not have been done offshore" PDC Project Manager, Detailing, **Shayne Edwards** said.

"The in-house design/detail modelling required for the first few months of the project helped establish the strong, open relationship with all the key players.

"Our use of the latest version of Tekla and the application of 'smarts' into the models so they better integrated with BIM have also been critical to the success of the project to date.

"The interface between Brookfield Multiplex, Hassell/Cox, ARUP, Civmec and ourselves has enabled us to work through challenges well in advance of them becoming potential issues."

The fully collaborative approach involving architects, designers, fabricators and detailing was overseen by Brookfield Multiplex. Multiple face-to-face meetings to resolve issues kept the project on track.

iConstruct was used for clear reporting of progress status, outstanding items, technical queries and design holds. PDC also provided custom reporting to aid Civmec with fabrication where required and worked with the design team to resolve design issues, helping to meet tight schedules and mitigate further delays.

PROJECT TEAM

Builder: Brookfield Multiplex

Architects: Hassell/Cox

Engineering Design: ARUP

ASI Steel Fabricator: Civmec

Steelwork Erection: Civmec

Shop Detailing: PDC

BIM Management Consultants: PDC BIM

Closing the in-shop/onsite gap

By adopting an end-to-end digital workflow system, Queensland-based ASI steel fabricator Watkins Steel has significantly increased accuracy, reduced rework and delivers more to clients.

A family-owned business delivering steel fabrication and metalwork services to south-east Queensland since 1968, Watkins Steel has a significant focus on refurbishments which generally involve two people having to be onsite for three to four hours and then revisiting two or three times just to get the initial site measurement correct. Often this work needs to be done outside of normal business hours so as not to disturb operations or create hazards for customers. The process is highly inefficient and puts increased pressure on those measuring up and working onsite.

Frustrated with losing margin because of guesswork and rework, Watkins Steel Director **Des Watkins** and two other members of his management team attended a design-led innovation workshop in 2015 run by **Professor Sam Bucolo** from the University of Technology Sydney.

Watkins Steel has been using a Tekla Structures software package for structural detailing since 2009 and began looking at robotic steel fabrication that would work directly from the Tekla models.

Watkins then invested in four new pieces of technology that would work with the software:

- A Trimble laser scanner and RealWorks software for site measurement.
- A Voortman V808 coping machine for automated steel fabrication.
- Trimble Robotic Total Station and Field Link software for onsite steel installation.
- Trimble Connect for sharing models with clients in the cloud.

Right first, every time

The investment in technology has delivered some impressive outcomes, with close to 100 percent accuracy in site measurements from a laser scan taking just five to eight minutes. Meanwhile the automated coping machine allows the company to perform fabrication to plus or minus one millimetre over 12 metres saving Watkins Steel 500-800 crew hours per month in steel fabrication.

In the recent refurbishment of an historic train station, the technology really came into its own. Traditionally this would have been an incredibly challenging project. However with the new technology, work was carried out without disturbing the public with no need for onsite fabrication of steel.

They are also using the new technology to do existing work more efficiently, so rather than having to develop a market for it, they are already using it on every single job that comes through the door. The improvements they have seen through the entire workflow have been significant.

"We've gone from so much rework and projects taking far longer than anticipated, to being able to guarantee parts of our workflow 100 percent first time," Des said. "For me it's all about eliminating the human error so we can deliver a better result to our clients.

"The first step is the laser scanner, which guarantees our site measurements with 100 percent accuracy. We can guarantee our shop drawings and because the software feeds the coping and flatbed plasma machines, you're getting close to guaranteeing 100 percent accuracy on the steel."

Communicating with the client throughout the process has also become far easier. Now, when Watkins Steel responds to a Request for Information (RFI), rather than a paper plan, they share the existing model with the Tekla plans overlaid via the cloud-based platform. This means that the client can see exactly what they are going to get and any clashes are evident right from the beginning.

With the business for 20 years, Estimator and Business Development Manager **Tony Dickinson** said: "Now when I go to site, instead of spending hours worrying about whether we've got all of the right measurements, it only takes a few minutes to do the scan in which time I can be talking to the client or the site foreman, developing my relationship with them and talking about what we are doing."

This is an abridged version of an article from BuildingPoint Australia and New Zealand. For the full version, visit: http://www.buildingpoint.com.au/tech-savvy-steel-fabricator-eliminates-rework/

Project Manager, **Ben Yu** reviews point clouds in RealWorks.

Savvy coordination conquers complex steelwork

The interoperability of modern design software especially comes into its own when tackling complex steel design as IKERD Consulting's recent experience working out constructability of a monumental twisted staircase for a new technology center in the US attests.

IKERD Consulting is a Dallas-based structural engineering firm that provides consulting services for building owners, contractors and designers with a focus on integrated projects utilising Virtual Design and Construction (VDC) and Building Information Modelling (BIM).

One of IKERD's recent projects was a new three-storey 27,870sqm technology center for telecommunications company, CenturyLink in Monroe, Louisiana. IKERD provided overall BIM coordination services on the project as well as modelling services for a variety of trades.

One of these virtual models was the building's million-dollar 'monumental' staircase prominently located in the building's atrium. The staircase spirals up three storeys around an oval pillar which hides structural steel columns surrounded by a cold-formed metal frame.

Curved LED acrylic panels cover the frame and illuminate the staircase area. The staircase is supported by a series of steel beams that protrude from the oval pillar. The treads of the stairs are spaced away from the pillar creating the illusion of the staircase floating up this pillar of light.

"The geometry of the building is very complicated with a lot of slopes and curves and very expensive finishes," said **Will Ikerd**, a principal at IKERD Consulting. "The use of highly detailed 3D models that accurately reflected planned and in-process construction was essential for project coordination."

To facilitate that coordination, IKERD was also hired independently by several project subcontractors to develop these 'construction-grade' models of their building trades, including the manufacturer of the staircase. And all of the discipline-specific models had to work seamlessly within the Navisworks software environment used by IKERD for project coordination and clash detection.

IKERD used Autodesk's 3D model-based software solution for steel detailing, Advance Steel to create a virtual model of the central staircase that would match the constructed staircase. This model was used to coordinate the staircase with the adjoining structural support beams, cold-formed metal frame and acrylic panels.

"The geometry of this staircase is very complicated," explained project coordinator for IKERD, **Trevor Koller**.

"The overall form mirrors the oval-shaped central pillar as the stairs spiral upwards and every tread of the staircase is a unique quadrangle. The central structure included numerous acrylic panels that were manufactured remotely and the majority of the staircase's million-dollar price tag.

"Needless to say, coordination between the staircase and these panels was very important."

The team began by using the architect's Revit model to develop a structural model of the staircase and surrounding steel and supports. These models were then used for clash detection and clearance checking.

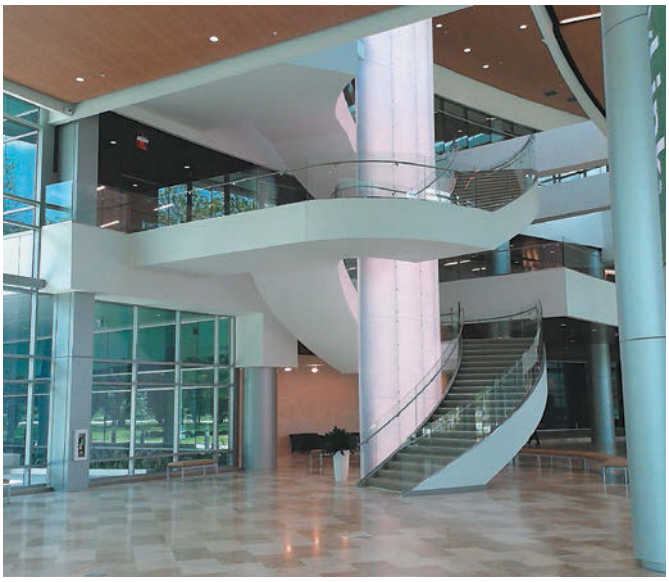


Image courtesy: IKERD Consulting

"But design models can be both highly precise and horribly inaccurate at the same time," said Ikerd.

He pointed out that the level of detail and tolerances of design models are sometimes insufficient for construction-grade spatial coordination, especially on a project like this with such tight clearances and complicated geometry.

"We decided that we needed to model every little detail of the staircase and supporting structure down to the connection level," Koller said. "The parametric modelling flexibility of the steel detailing software and its specialised tools and wizards for stairs made it easy for us to develop the model, helping us figure out the tread size and spacing of the stairs as they curved around the central oval."

"Moreover, the level of detail in the model helped us study the constructability of the staircase," said Ikerd. "For example, would the fireproofing material on the main steel create interferences, was there enough room to fit up the staircase connections, and so on."

In addition to creating a construction-grade model of the staircase, IKERD also used a laser scanner to capture the as-built conditions of the central pillar's core and metal frame.

"It was important to know exactly where steel beams would penetrate the metal frame and these acrylic panels," he said.

ReCap software was used to process the data and create a point cloud of the as-built structural beams and metal framing. That data and the detailing model were imported into Navisworks to validate the position of the new construction and coordinate it against the planned staircase ultimately reducing the number of requests for information (RFI) during the construction phase.

"A designer's drawings and models represent design intent," said Koller. "But, as the saying goes, the devil is in the details."

Adapted from an article by Industry Marketing Manager, Structural Engineering at Autodesk, ***Christian Erickson****.*