

GROUP LEADER'S INTRODUCTION



TEAM PROFILE

This is the thirtieth newsletter for Hatch's Structural Assets Group. The Group focuses on service life extension, prevention of structural failures and structural design solutions for the mining, metallurgical and associated enterprises. Such businesses are typically capital intensive with large investments in structural assets such as industrial buildings, storage bins and silos, wharves, process vessels, cranes and material handling equipment. Economic pressures dictate the extraction of maximum value from existing assets, hence the pressure is on companies to extend the service life of these assets to the maximum extent possible rather than replacing them at the end of the original design service life. I am pleased to publish an article outlining the Structural Assets Group's technical capability in this edition of the newsletter.

I take the opportunity to introduce one of our emerging graduate structural engineers, Reuben Richardson, in this publication. I am also delighted to announce that Charles Li has recently achieved the Institution of Engineers Australia's Chartered Professional Engineer (C.P.Eng.) status. This has facilitated him in obtaining his registration as a Registered Professional Engineer of Queensland (RPEQ) which will allow him to practice independently and supervise and teach young engineers working on a number of projects in our business practice.

One of our long serving members Greg Gabb has finally decided to retire from his career as a technical consultant which he enjoyed passionately over the past five decades, of which 20 years was with HATCH and BHP Engineering. Greg is an excellent technical consultant and enjoyed working with the younger engineers undertaking a mentoring and teaching role from a practical point of view such as workshop processes and constructability. Greg has been a great colleague and friend, always happy to lend a hand. It has been an honour and a privilege to work with him for the past two decades.

I would also like to personally thank each member of our group for their dedication, determination and hard work in providing assistance to our clients with many challenging tasks over the past 12 months.

On behalf of the Structural Assets Group in Australia, I would like to take this opportunity to wish everyone a safe and enjoyable festive season and I am looking forward to another busy year in our business in 2012.

"The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn." - Alvin Toffler

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Reuben Richardson



Reuben is a structural engineer with Hatch's Structural Assets Group. He graduated from the University of Queensland with a Bachelor of Civil Engineering (Honours) in 2008.

Reuben spent two years working for the Structural Assets Group as a vacation engineering student on a part time basis prior to his graduation at which time he obtained experience in valuable fundamental structural engineering principles from his colleagues within the group. Since graduation he has been involved in a number of projects working under the guidance of senior engineers within the group. He was then seconded for 10 months to Queensland Nickel in Townsville where he gained practical on-site experience in structural condition assessments and an understanding of structural systems in an ageing industrial plant. This also gave him an opportunity to meet new people, improve his client engagement skills and experience life in far-north Queensland.

Since returning from QNI Reuben has been involved in a variety of projects ranging from independent structural design reviews of conveyors and ship loaders, structural analysis and strengthening of large capacity product bins to failure investigations and service life extension of bulk materials handling machines. Reuben is currently designing the supporting steelwork for large diameter waste gas ducts. This project has severe space constraints and required non-conventional methods to integrate with the existing facility.

With the knowledge he has gained over the past years Reuben enjoys mentoring the graduate engineers. He is currently the Presentation Co-ordinator of the Hatch Ambassadors Group where he is involved in hosting and organising presentation sessions. These sessions are designed to improve young engineers and designers presentation skills while broadening the knowledge of peers. Reuben is also working towards achieving Chartered Professional Engineer (C.P.Eng.) status with the Institution of Engineers Australia and Registered Professional Engineer of Queensland (RPEQ) status by next year.

Reuben is married and he and his wife Cassandra are expecting their first child. They are involved in music, mentoring and leading youth at their local church. In his spare time Reuben enjoys playing piano, ballroom dancing and a wide variety of sports including snowboarding, touch footy, wake-boarding and kite surfing. He tries to stay fit by cycling to work and enjoys riding his motorcycle whenever possible.

PDG - STRUCTURAL ASSETS GROUP

The Structural Assets Group is a team of innovative structural engineers and technicians committed to assisting our clients in extending the life of their assets, prevention of structural failures and reducing the risk associated with the operation of those assets and developing design solutions tailored to suit their individual specific needs. The group provides engineering consulting services for all types of structures, with specific expertise offered in the mining and heavy industry sectors, to clients in Australia and in many other countries around the world.

Structural Assets Group Primary Practice Areas

The type of industrial structures that the Structural Assets Group has expertise with are:-

- a) Mobile bulk materials handling machines (stackers, stacker / reclaimers, shiploaders) and other materials processing equipment such as crushers, dump hoppers, tipplers;
- b) Storage bins, tanks, silos, bunkers and process vessels such as integrated calciners;
- c) Large diameter ducts, blast furnaces, stacks and other heavy plate structures;
- d) Coal and iron ore rail wagons;
- e) Workshops and other mining and heavy industrial infrastructure facilities;
- f) Seismic assessment of industrial buildings; and
- g) Dynamic analysis and vibration assessment of foundation structures for crushers and rotary mills and other industrial structures.



The group has undertaken numerous investigations into existing structures (in particular bulk materials handling machines) to assist our clients in understanding the risks associated with their operation, to reduce maintenance costs, and in many instances to extend the service life of these structures in order to assist in delaying the high capital costs associated with decommissioning and replacement. There are a number of different areas of practice that the group specialises in providing structural engineering services to the mining and heavy industrial sectors. These are set out below:-

- a) Innovative design solutions (for both new and remediation work);
- b) Independent third party design reviews of newly designed structures, particularly as required by Australian Standards and other Statutory

Authorities for mobile bulk materials handling machines;

- c) Condition assessments and structural integrity analysis of existing structures;
- d) Failure investigations;
- e) Investigation and structural remediation design for extending the service life of assets.

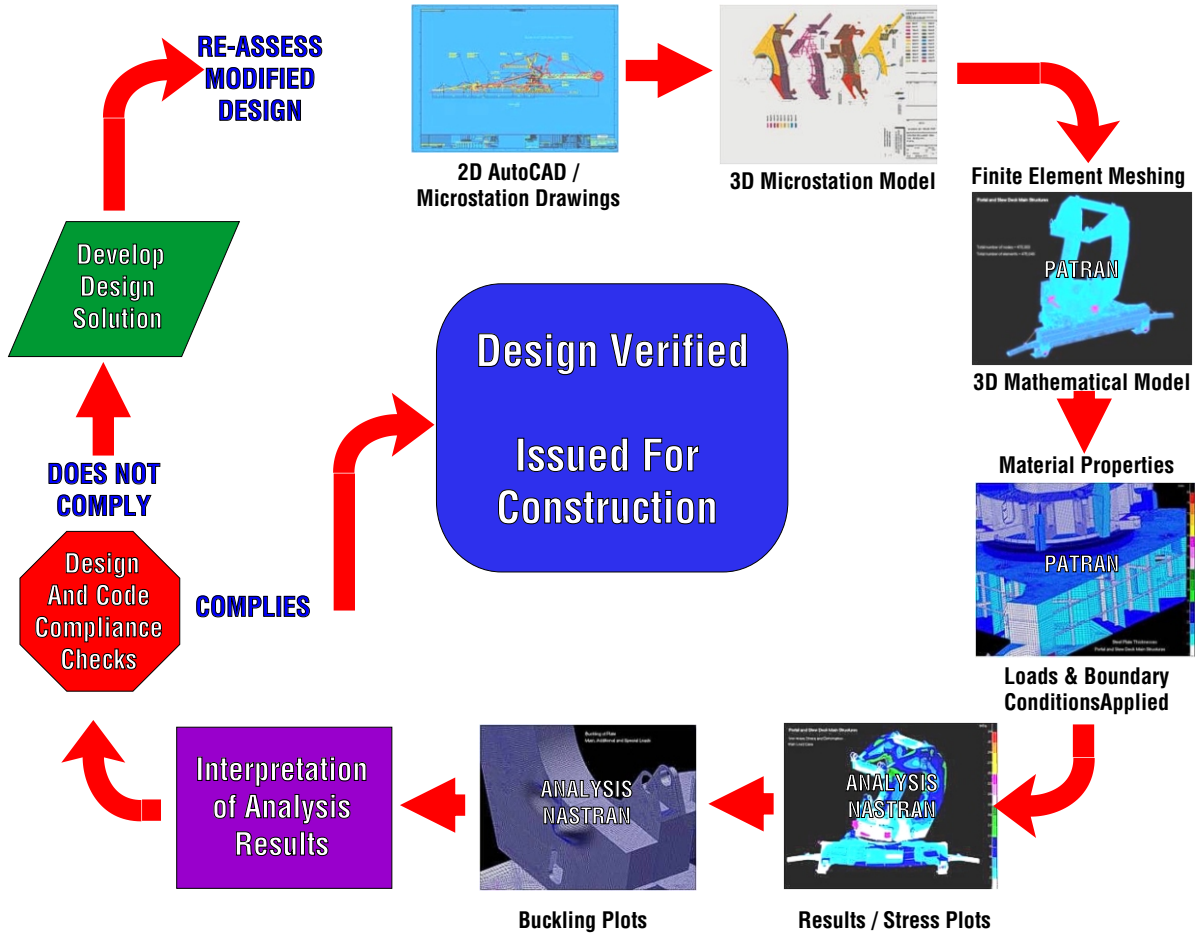


The Structural Assets Group provides world-class expertise in assisting our clients in managing their assets in a cost-effective manner and with an acceptable level of risk. Investigations are usually divided into four stages, on-site inspection, preliminary structural analysis (desk top study), and advanced structural analysis possibly utilising finite element techniques depending on the degree of associated risk and remedial design for service life extension or upgrade of the structures capacity, if required.



All advanced computing, finite element modelling and design reviews are carried out in-house on dedicated workstations. Current licences are maintained for MSC.FEA ('MSC.Patran' finite element modelling pre- & post-processing software and 'MSC.Nastran' advanced structural analysis solver) as well as other advanced engineering applications. All assessments are carried out by experienced and dedicated staff engineers and technologists.





Design Review Process Using Finite Element Techniques

Should you wish further information please contact Dr. Sabaratnam Loganathan at lloganathan@hatch.com.au

Eccentric Connections In Light Bracing

Eccentric bracing cleat connections are a simple, low capacity and low cost connection and are widely used for vertical wind bracing for small to medium size steel structures. However, care must be taken to ensure that the capacity is not over estimated, or the design loads under estimated, during the detailed design.

Buckling of an eccentric gusset plate connection occurred recently in a vertical K brace connection during commissioning of a new materials handling facility. As a result the client engaged Hatch's Structural Assets Group to carry out an independent design review of a number of the conveyor structures. The review identified a number of structural issues which were rectified on site and discussed in detail below.



Buckled Light Bracing Due To Eccentric Connection

FIGURE 4

Firstly, it is important to ensure that all design loads have been considered and that the load path has been

understood correctly when designing a structure. The load path for the bracing arrangement shown in figure 1 is dependant on the ratio of stiffness between the beam in bending and the bracing in compression. That is, if the beam is stiffer than the bracing, the beam will carry the majority of the vertical load in bending and shear and hence less load transfers through the bracing arrangement. For this configuration, the vertical bracing was stiffer in compression than the beam in major axis bending. This would potentially overload the strut and the eccentric cleat would buckle.

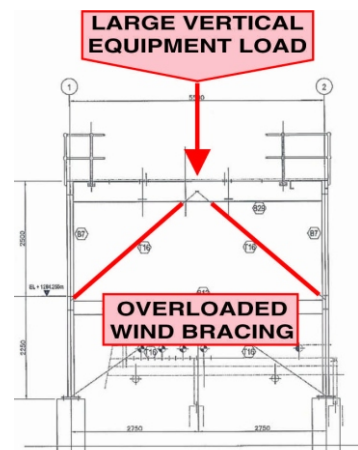


FIGURE 1 - DESIGN ISSUE



There are a number of ways this could be resolved. One option is to increase the depth of the beam or bracing size and/or strengthening the connection detail. Another option is to separate the load path by inverting the K bracing as shown in figure 2, while ensuring the beam is capable of carrying the large vertical load in bending.

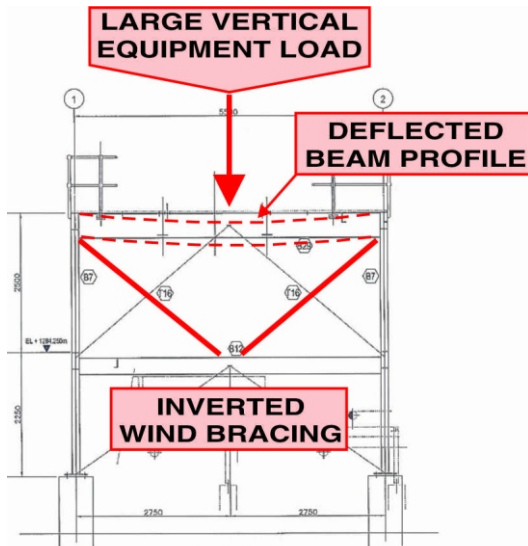


FIGURE 2 - DESIGN SOLUTION

It is also important to include the effect of eccentricity, shown in figure 3, in the detailed design of connections. During the review of the design calculations it was noted that the connections had been designed as a concentric connection and no allowance was made for the cleat plate eccentricity. This led to a substantial overestimation of the connection capacity in compression and consequently visible buckling occurred as shown in figure 4.

In this case, in order to increase the capacity of the connection, adding stiffeners or using a thicker cleat and gusset plate would be required. An excellent design guide on the subject of light eccentric cleats can be found in the March 2010 edition of the Steel Construction Journal of the Australian Steel Institute.

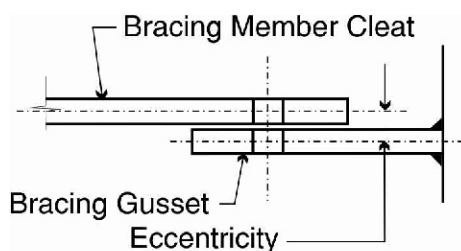


FIGURE 3 - MINOR AXIS BENDING DUE TO ECCENTRICITY

In conclusion, it is important to ensure that the load path corresponds to the design intent followed by adopting suitable connection details which incorporate eccentricity where applicable.

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Should you wish further information on this article please contact Reuben Richardson at the following address r-richardson@hatch.com.au



**A Safe and Merry Christmas to All
May the New Year bring you Happiness
and Prosperity**

POSITION CHANGES

I am pleased to announce that Senior Consultant, Dr. Gongfa Chen, joined the Structural Assets Group in July 2011. He has gained a wealth of experience working in China and in Universities and Research Organisations in Australia prior to joining Hatch. We welcome Dr. Chen to the Hatch family and no doubt he will be looking forward to the new challenges ahead of him.

I am also delighted to announce that graduate Structural Engineers Navdeep Aujla and Brad Luscombe will commence their structural engineering journey with the Structural Assets Group in January 2012. Both have been being working with the group as undergraduate trainee engineers on a part-time basis. We also welcome Navdeep and Brad to the Hatch family and trust that they are looking forward to the challenges ahead of them.

I would like to introduce graduate trainee engineer Boris Cordero Porras who joined the Structural Assets Group in November 2011. We welcome Boris to the Hatch family and have no doubt that his Spanish language skills will assist our business in South America for many years to come.

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CONTACT DETAILS

Enquiries or requests for information can be directed to our Brisbane office.

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