AUSTRALIAN STEEL INSTITUTE

Mincom Axis

Australian Steel Institute Technology Integration Report

October 2006

Mincom

The People. The Experience. The Vision.

Executive Summary

Project Overview

The Australian steel industry is in danger of losing market share to more efficient overseas competitors and the use of alternative materials to steel such as concrete. To help identify the areas where Australia is less efficient and therefore higher cost than overseas, the Australian Steel Institute commissioned a project to review the potential for data integration. The project investigated the following areas:

- Current understanding of the capabilities for producing and using CNC data
- Generalised view of how significant data integration is in the industry
- Business process improvements to be gained from data integration
- Challenges to the widespread adoption of data integration
- Other opportunities for improvement to the industry as a whole

The approach involved discussion workshops in most Australian States, with participants from all steel industry sub-groups across the steel supply chain, namely Fabricators, Detailers, Merchants and Distributors, Processors and Roll-Formers. The workshops were found to be beneficial not only for the project but also for the participants as they created an environment where business process discussions highlighted the lack of understanding between the different organisation types as to their capabilities, challenges and opportunities for improvements in collaboration.

Key Findings

The following points are the key findings from the workshops and analysis conducted throughout the project. While the main focus was on data integration, a number of related findings have been captured:

- The Australian steel industry is very fragmented with little recognition of the benefits that can be achieved by creating alliances that share costs and benefits while improving the overall efficiency of the supply chain.
- Any change process requires commitment and motivation from its participants, which will be a challenge in the current market in Australia where steel is very profitable and the need for cost reduction to improve competitiveness is not so pressing.
- As more fabrication and processing organisations invest in hi-tech equipment that uses CNC Data, this will become a minimum requirement from detailers
- There has been a steady increase in the demand for CNC data over the past 6 to 12 months, but it is still not sufficient to cause widespread change
- Training and skills retention is a key issue that needs to be addressed

- The challenges for data integration are more commercial than technical, in particular:
    - Who is responsible for errors and rework in the event that the data model is incorrect
    - How are cost savings by processors passed on to other participants in the supply chain
    - The higher cost of producing the data models increases the initial detailing costs and little value is placed on this by the end customer
- Fabricators have a pivotal role to play in the promotion and acceptance of data integration throughout the industry.
- All participants recognised the need for improvements within the industry to remain competitive, but without a critical mass or compelling motivation, lack the ability to effect change
- Quantifying the cost savings and return on investment is difficult as the input data from case studies is not available. The savings identified are more qualitative than bringing direct returns to the bottom line.
- The investment required for some organisations, particularly smaller organisations may be prohibitive and force those organisations to service a niche market
- For many organisations the workshops were the first opportunity they had to discuss business processes with their steel industry partners, and this in itself was beneficial for all participants.
- Overseas trends show that software vendors have a key role to play in the adoption and establishment of industry applications that support the use of CNC data.
- Software vendors that partnered with equipment manufacturers and steel industry participants are now the dominant companies in their target markets.
- A downturn in steel usage in the 1980's forced overseas markets to review their processes and reduce costs through better data integration. These markets are now reaping the rewards of their investments and pose a threat to the Australian industry.

Recommendations

The following recommendations are identified as delivering the greatest benefits. Other recommendations and opportunities have been included within the report where appropriate.

- Establish a working party to develop a proof of concept to showcase data integration and its benefits. The working party should also be tasked with identifying ways to overcome the non-technical issues. A focus area of the working party should be to quantify cost savings.
- Develop a simple cost/benefit calculator to assist steel organisations in identifying where they can expect cost savings from data integration.

- Use the ASI's influence to help address the training requirements for detailers through working with software vendors, TAFE's, detailers and fabricators to establish appropriate training courses and certification. This was an area of particular enthusiasm from all participants
- Communicate within the steel industry, the capabilities of the software applications, equipment and detailing organisations, for example by publishing and maintaining an ASI sponsored internet based information portal containing this type of information.
- Facilitate regular discussion forums with defined agendas and outcomes that include all steel industry sub-groups.
- Establish a panel of certified vendors that are prepared to support the adoption of 3D modelling applications by offering customised applications that target the Design and Fabrication segment of the Steel industry.
- Leverage the investment already made in the Steel Online by expanding its focus to include CNC data integration. The use of active standards bodies has been demonstrated both in Australia and overseas as a practical means to assist organisations with data integration.

Next Steps

1. The ASI project identified a separate activity to communicate the findings of this report to the industry. A communication plan will be developed and the information disseminated through seminars, Internet and documentation.
2. Prioritise and implement the recommendations

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1 Introduction

1.1 Project Overview

1.1.1 Background

The Australian Steel Institute (ASI) has for some time recognised that the steel industry within Australia needs to become more efficient from both a cost and quality perspective to maintain market share against alternative products and international suppliers. To this end, the ASI has identified data integration as a potential weakness in the Australian industry and an opportunity for improved efficiency and cost reduction across all industry participants.

A series of workshops were initially conducted in Queensland with each of the different steel industry sub-groups. This was deemed a valuable exercise and resulted in the ASI engaging Mincom to conduct similar workshops in each state with a significant steel industry sector. The workshops focussed on the following key areas:

- Business processes after RFQ has been awarded
- Comparison of practices used across Australia
- Comparison of practices used overseas
- Data Integration opportunities from the detailing phase through to delivery of product
- Barriers to achieving data integration
- Proven benefits achieved demonstrated through case studies of existing projects

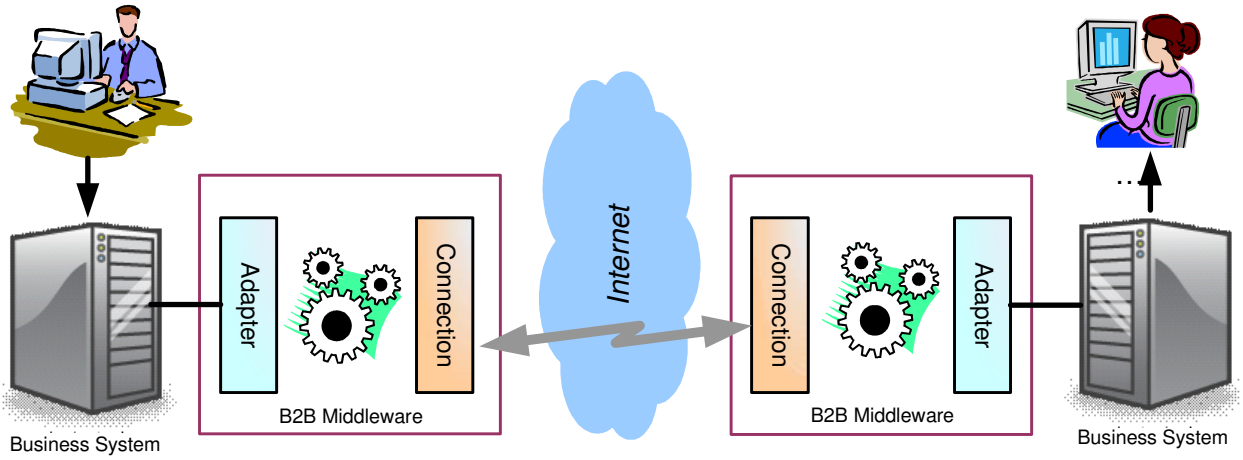
It is recognised that there are other activities that occur such as development of the engineering drawings, which could be improved, however these were outside of the scope of the review.

1.1.2 Data Integration

Data Integration refers to the automated generation of data from a source system or application and subsequent automated input into a target system or application of the same data in either its original form or a manipulated form as required by the target system.

The types of data that can be integrated is not limited to particular business functions, applications or needs, it can however be technically constrained by the capabilities of the systems involved.

The following diagram shows the concepts of data integration across different organisations:



Each organisation is required to have a B2B integration capability, which can perform the following functions:

- Security Management
- Transformation
- Trading Partner Management
- Error and Exception handling
- Document routing
- Business Process Management
- Connection management
- Document logging and tracking

Each organisation will typically have their own requirements for both the data formant and technical connection. Data and connection standards help to alleviate the differences by normalising data, but as the business systems vary there are usually changes required in either format or content to achieve fully automated integration.

Software vendors that provide applications that import and export data are critical to determining industry wide standards and facilitating the adoption of these standards. The data is produced by the software application and as such it is the application itself that must be capable of producing the required data.

1.1.3 Project Objective

The goal of the Technology Integration Project was to determine areas for improvement of efficiency and increased cost effectiveness in the extended steel industry supply chain, particularly through the use of data integration. The project was also aimed at bringing together the various organisations that participate in the steel industry supply chain to understand integration issues, identify of the real business benefits and gauge the readiness and need for integration of between the organisations.

1.2 Approach Used

The following activities were performed to gain the required information:

1.2.1 Workshops

A workshop was conducted in each state to review the business process and provide a comprehensive picture of the practices in use across Australia. The workshops included representatives from the steel industry sub-groups involved in the steel process value chain, from RFQ to Delivery, namely:

- Detailers
- Fabricators
- Merchants
- Roll Formers

The results of each workshop were published to participants and are included in this report as Appendices.

The first workshops conducted were those in Queensland, which involved separate workshops for each sub-group, and then a combined workshop for all parties where the results and observations were presented. All other states had a single workshop for all organisation types.

The Queensland workshops were used to set the foundation business process descriptions and discussion points for the latter workshops conducted throughout Australia, for this reason the workshop summaries link back to the Queensland information as the baseline.

1.2.2 Case Studies

One or more case studies were requested from each state. The purpose of the case studies is to provide evidence of the following:

- Benefits achieved from using data integration between different organisations
- Competitive advantage achieved
- Challenges and how they were overcome, specifically with respect to the data integration. They should consider:
- Additional costs for each/any party because of the extra information required for CNC data
- Data conversion issues for the different machines used
- Error/Exception rates as compared with not using CNC data

Each ASI state manager was asked to nominate 2 recent projects that fit the criteria for a case study:

- All activities carried out within the state
- Occurred within the last 2 years

- If possible, where there was competition from an international player
- Information that can be shared without compromising the client or any of the parties involved

1.2.3 Research

Mincom also researched the practices in use overseas in the United Kingdom, USA and New Zealand.

1.2.4 OneSteel Pilot project

The objectives of the pilot project were to:

- Demonstrate connectivity and mapping of business documents between different types of steel industry partners, particularly across organisations with varying technical capabilities:
  - OneSteel (tier 1) to RPG (tier 2)
  - OneSteel (tier 1) to ARW (tier 3)
- Document any issues identified during the course of the pilot.

The OneSteel pilot was part of a wider ASI project including other organisations; these activities are outside the scope of this report.

A summary of the pilot report is provided in this document.

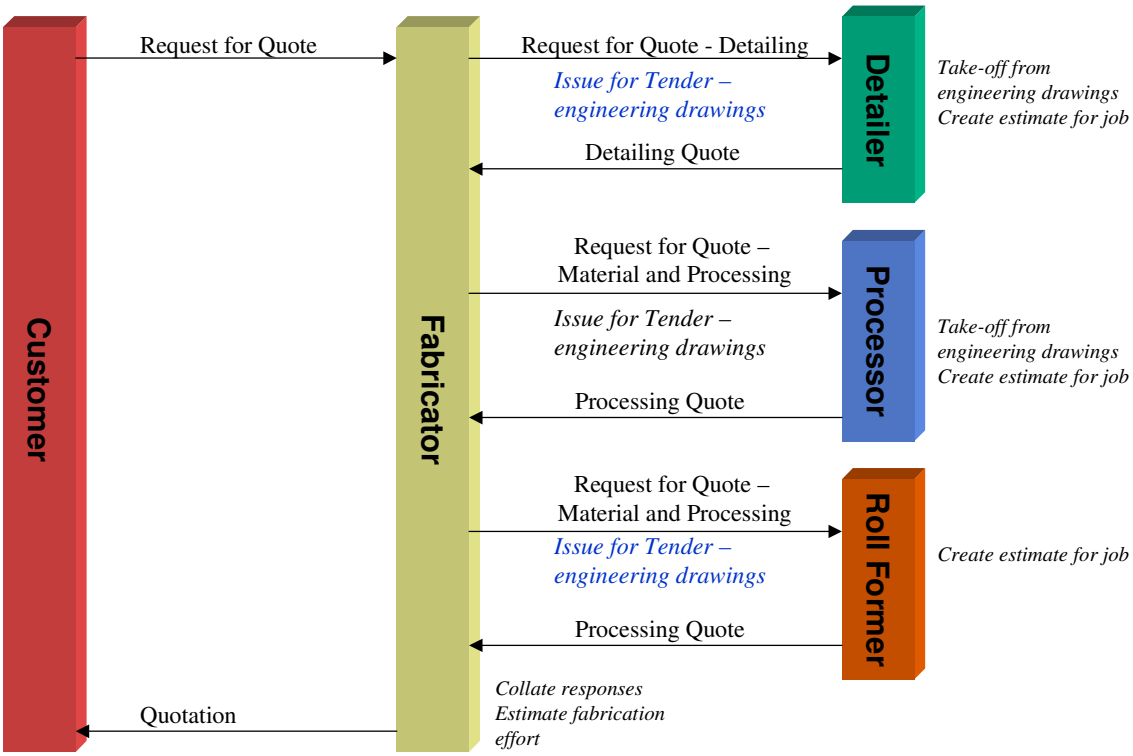
2 Request for Quote Business Process

2.1 Process Overview

While the main focus of the business process reviews was the process following the RFQ being awarded, that is the actual supply of the steel, the RFQ process is included for reference.

2.1.1 Key activities and participants

The process flow below shows at a high level the steps and activities that occur during the RFQ process for steel construction.



2.1.2 Organisation Roles

Throughout the business processes examined, there are typically four key types of organisations involved in the process. These organisations and the roles they play are described below.

2.1.2.1 Customer

The customer in this case is the organisation requiring the construction/project to be completed. The customer may be a mining company, retailer, building constructor etc.

2.1.2.2 Fabricators

Fabricators are the pivotal organisations through which the entire process is controlled. The fabricator typically receives the initial request for quote/proposal and then invites the other organisations to bid in the response.

Fabricators are normally the only organisations that interact and negotiate directly with the customer, all other organisations negotiate only with the fabricator during the RFQ process. Fabricators determine which detailers, merchants, processors and roll formers will be involved in the project. For some larger projects it is becoming more common for detailers to be engaged directly by the customer under a separate RFQ process.

2.1.2.3 Detailers

Detailers provide the drafting, specification and detailed design for the project. In the RFQ stage, detailers provide the fabricators with a quote to detail the work. In some cases the detailers may be contracted by the customer directly to provide the detailed designs before the work being let to the fabricators.

2.1.2.4 Processors/Distributors/Roll Formers

Processors, distributors and roll formers provide the steel for fabrication. In the RFQ process the processors typically provide cost estimates for the provision of steel based on manual take-offs from the engineering drawings.

2.1.3 Process Description

The RFQ process was not considered the key business process for improvements because of the nature of the process itself. The project is not defined sufficiently during the RFQ process to support the use of 3D-Modelling or generation of CNC data.

For the steel processors, distributors and roll formers, it would be beneficial to have material lists available electronically to facilitate creation of Quotes. The quoting process can be time consuming and often repetitive as the same RFQ's can be received from each fabricator bidding on the same job.

2.2 Business Process Variations

The only variation noted for the RFQ process is the point at which the detailers are brought in. In a few cases the detailers complete the drawings before the RFQ for construction is made available. This process may result in a more accurate quotation but is not always practical.

In general the same process is followed by all states, with variations stemming from the types of jobs rather than a different way of working. Detailers will provide quotes based on the level of detail they know the fabricators can support, thus for fabricators with CNC machine capability, detailers will typically quote based on providing this information.

Importantly, almost all detailing work performed for overseas projects must be quoted as providing 3D models and CNC data as this is considered a minimum requirement.

2.3 Improvement Opportunities

2.3.1 Data Integration

2.3.1.1 Material Take Off

The ability to have the material lists provided in electronic form would facilitate steel merchants providing quotes. The process is currently manual and can result in different lists being used by different organisations and potentially misquoting the project.

The inefficiency in the current process stems from all organisations performing the same activity where it could be done once and more accurately.

Priority: Low

Justification: The material lists vary between the RFQ and Production phase and there may not be sufficient detail to provide a detailed quote at the time of RFQ, particularly with the varying level of detail and accuracy provided in the engineering Issue for Tender drawings.

2.3.2 Business Process

2.3.2.1 Detailing specification levels

Identify and define a number of specification levels for detailing as different costs are involved in producing different types of outputs from the detailing process. For example, during the RFQ stage, one detailer may provide a quote that includes a 3D Model and CNC data as well as the drawing and be compared to another offer that provides only the drawing. By specifying different levels of detailing standards, the fabricator can use this to specify the minimum requirement as well as ensuring the detailers' quotes are equitably compared.

The Queensland Institute of Steel Detailers (QISD) has completed the recommended standards and corresponding definitions (Technology Benchmark Categories) which are available at www.qisd.org.au.

Priority: Medium

Justification: The work has been completed by one state only and to provide benefit to the industry as a whole must be adopted across Australia.

2.3.2.2 Preparation of Tender Documents

For certain types of projects, having the detailing activity performed as a first step of the RFQ process or at least involving the detailers directly in the preparation of the tender documents would improve the accuracy of documents issued for tender. This process is already being used within Victoria and NSW for around 30% of detailing, whereas it is not so common in other states.

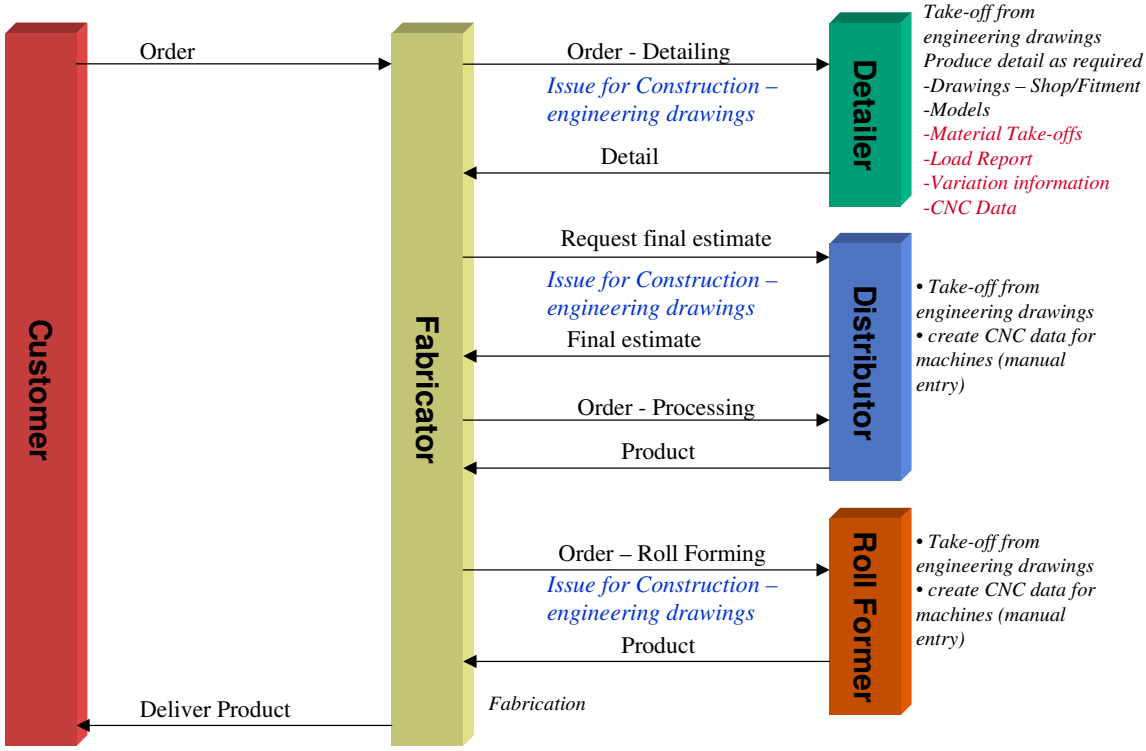
Priority: Low

Justification: Requires significant change management to introduce as well as co-operation from the end customers to adopt this approach. It is however a practice that can be promoted by the steel industry as a whole for those projects where it has merit.

3 Order/Production Business Process

3.1 Process Overview

The process flow below shows at a high level the steps and activities that occur during the Ordering and Production process for steel construction, once the contract has been awarded.



3.1.1 Organisation Roles

As with the RFQ process, there are typically four key types of organisations involved in the process. These organisations and the roles they play are described below.

3.1.1.1 Customer

The customer in this case is the organisation requiring the construction/project to be completed.

3.1.1.2 Fabricators

Similar to that of the RFQ process, the fabricators are the pivotal organisations around which the entire construction process revolves. The fabricators work directly with the customer and the other organisations to complete the project.

It varies by organisation as to whether the fabricators have the capability for steel processing or rely on the merchants and processors to perform all these activities. This will also determine whether the fabricators require CNC data or 3D models. Fabricators will typically only request this level of detailing if their own organisation has this capability, regardless of the capabilities of the processors.

As the customers do not attribute any value to using data integration for their project, it is rarely requested by the customer and is seen as an additional cost. This is a contributing factor to the fabricators not requesting 3D Models and CNC data as standard from detailers.

3.1.1.3 Detailers

Detailers provide the drafting, specification and detailed design for the project. In the production process, the detailers provide the fabricators with the detailed specification of the construction required and at this point may also provide 3D models, CNC data and other electronic forms of information that can streamline the process.

Detailers will typically only provide electronic data if the fabricator requests it, as it is more costly to produce the 3D Models and CNC data than the drawings alone.

3.1.1.4 Processors/Distributors

Processors, distributors and roll formers provide the steel for fabrication. The extent of the processing and machining performed depends on the nature of the project and the capability of the fabricator. The majority of Processors and Roll Formers have invested in equipment that can take CNC data as input but normally need to create the data manually from detailed drawings provided by the fabricator.

3.1.2 Process Description

3.1.2.1 Current Integration

The Ordering and Production process was seen as a key process for improvement through use of electronic data integration. To this end the focus of the workshops was around the production process and the existing or planned capabilities of the detailers with respect to 3D Modelling and CNC data provision.

There is very little data exchange or communication between organisations other than via the fabricator.

3.1.2.2 Drawings

Regardless of whether data integration is used or not, the hard-copy drawings will always be required to be produced. It is not the intention to replace the hard-copies or remove them from the process, instead data integration proposes to make better use of the specifications captured within the drawings by using it to drive the equipment producing the steel.

3.1.2.3 Variations

One of the notable issues identified throughout all workshops was that of managing variations. Nearly every project has a number of variations that cause increased costs, waste and other non-productive activities. This was not an area targeted by the project as it is not directly related to data integration, but does represent an area that warrants further investigation to reduce costs across the industry as a whole.

3.2 Added Costs/Inefficiencies

There are a number of costs in the process that could be reduced:

- Investments made in CNC capable machines are not leveraged because of the manual processes required to produce the data, leading to
  - Longer lead times
  - Increased number of variations and post production changes caused by inaccurate interpretations of the detailed drawings
- Lack of skilled detailers leads to more errors in detailed drawings and potentially incorrect CNC data which can result in even more cost
- Differences in equipment requirements and software capabilities as well as available training for both. Different equipment will have different data formats which may not be supported by the software packages and so customisations, add-ons and other work-arounds are required to get the data in the required format
- Variations to designs and requirements cause overheads to identify the changes made to the drawings and the impact of those changes. It is often unclear as to what has actually changed when a variation is received.

3.3 Business Process Variations

There are some variations in the way the process is implemented across the different states most notably is that between WA and the rest of Australia. In WA detailers and fabricators work much more closely together than in the other states. There is also a much higher usage of 3D models and CNC data in WA than other states.

The overall business process itself is generally the same across all states, however there are cases where variations occur to meet the needs of a specific customer or project.

3.4 Improvement Opportunities

3.4.1 Data Integration

3.4.1.1 NC Data

This was the focus area of the project and as expected is an area where significant benefit can be gained. There is definitely potentially to streamline processes by removing manual steps and having the detailers provide the data in a form that can either be manipulated or processed directly into the equipment.

The reduction in errors, speed of execution and reduced lead time are all benefits achieved from using CNC data integration.

Priority: High

Justification: Investment has been made by processors in equipment that uses CNC data, but the returns are not being realised because there number of projects providing CNC data are minimal outside of WA. The use of CNC data represents an improvement across the entire industry rather than for a single organisation

3.4.1.2 Material Take Off

The ability to have the material lists provided in electronic form would facilitate nesting and calculation of costs. It would also improve the accuracy and speed with which the work can be completed, even with manual checks for consistency.

Priority: Medium

Justification: The material lists do not deliver as much benefit across the entire industry as that of CNC data integration.

3.4.1.3 Other opportunities

The benefits of data integration are not limited to that of CNC data, as gains can be achieved through use of exchanging data for forward planning, delivery schedules, ordering, invoicing, status updates, approvals and milestone payments. The scope of the data integration review project was primarily to review the CNC data integration aspects; as such the additional data integration opportunities have been noted for future reference. These opportunities include the use of Electronic Data Interchange (EDI) for the exchange of a range of data types as identified in the international Research section of this report as well as the OneSteel/Steel Online Pilot Study as outlined in this report.

Priority: Not Applicable

3.4.2 Business Processes

3.4.2.1 Preparation of Issue for Construction drawings

For certain types of projects, having the detailers work with the engineers in the preparation of the engineering drawings can significantly improve the speed, accuracy and understanding of the work required. This process has been used with a number of isolated projects.

Priority: Low

Justification: Requires significant change management to introduce as well as co-operation from the end customers to adopt this approach. It is however a practice that can be promoted by the steel industry as a whole for those projects where it has merit.

3.4.2.2 Management of Variations

The management of variations was raised as an issue in every workshop. It is clearly a pain point for all organisations involved. As this was outside of the scope of the data integration review project, it has been noted for reference but would require further investigation and definition to determine the issues and resolutions.

Priority: Medium

Justification: Has a high cost, is a cause of frustration for many organisations.

4 Challenges and Opportunities

4.1 CAD applications

4.1.1 3D Modelling capabilities

Challenge

Not all detailing companies have made the investment required in the appropriate software to produce 3-D Models and/or CNC data. There is also a definite lack of understanding on the part of the fabricators as to the capabilities of the various detailers outside of the detailing fraternity. This lack of understanding contributes in part to the fabricators not requesting the data in a form that could be used for automation. In fact many detailers have invested in the more feature rich detailing applications that have these capabilities but only use them if requested.

The detailing applications can represent a significant investment, especially for smaller detailing firms, and is difficult to justify without the level of demand necessary to create a return on investment. A vicious circle occurs where data is not requested because it is not available and it is not available because there is a lack of demand.

Opportunity

A central internet-based web site with a register of the detailers and their capabilities would help dispel any concerns regarding the ability of the steel industry detailers to provide the data required. Often an assumption was made that the detailers did not generally have the capability to provide 3D models, CNC Data or other electronic information to facilitate steel production.

4.1.2 Data Compatibility

Challenge

The perception is that different detailing organisations use different software packages, some of which may not produce data in a form that is compatible with the equipment being used by the fabricator or processor. There are data standards that have been in use for some time such as DSTV and DFX files which can either be post-processed into the required format or imported directly into the CNC machines.

There is definitely a lack of understanding as to the capabilities of the software packages and equipment as well as ways to work around any data incompatibilities. The view from most software product providers is that this should not be an issue and can usually be resolved through equipment specific data interpretation.

An added complexity is that the data must be produced in a form that is appropriate for the specifications of the machine and the way the steel is processed, for example just having the lengths defined is insufficient. It is also important to know whether the steel should be angle-cut.

Opportunity

Software vendors that can solve these problems will have an application with greater applicability across the industry. There are only a small number of different applications in use across Australia, which should simplify any collaboration effort. The majority of detailers are using one of AutoCAD, ProSteel, X-Steel or StruCAD. The latter three all produce 3D models, CNC data and Material lists, but not always in a re-usable format. An opportunity exists for the software vendors to work with the steel industry in defining requirements and standards that can simplify the integration across organisations. This approach was found to be highly effective in the UK steel industry and one of the key drivers for success in the adoption of CNC data. See International Findings in Section Six of this report.

4.1.3 Training

Challenge

The investment in the software itself is only one aspect of the overall investment in the CAD applications. Organisations must also develop expertise in using the application and applying it to construction projects in order to gain the most benefits. Often training is provided at the time of purchase without any follow-up or expert sessions.

Opportunity

Co-ordinated training courses provided by the software vendors and the steel industry as a group would develop specialist skills in using the applications within the steel industry. Such courses should also include overviews for fabricators and processors that receive the outputs from the applications to increase their understanding of what is available and how they can better use the data themselves.

4.2 Commercial Benefits

4.2.1 Sharing the Prize

Challenge

While it is widely recognised that data integration can reduce the manual effort, because of the way the industry is currently structured it is possible for different organisations to bear the cost of producing the CNC data to those that reap the benefits. As organisations are commercial entities there must be sharing of the benefit as well as the cost.

This was a common theme across all workshops and is indicative of the fragmented nature of the steel industry within Australia. Research of the UK and USA indicate that this problem has been overcome.

Opportunity

The opportunity here is to improve the industry as a whole, by first having a small number of organisations working together to achieve cost reductions/higher margins across all participants. It is expected that change of this nature needs to be undertaken by committed and motivated organisations that also have the capacity to put in the extra effort required initially.

While the Australian industry remains fragmented it creates an opportunity for foreign competitors who operate more efficiently to offer lower prices for the same quality and shorter lead times, gradually eroding the market share and commercial viability of the industry.

5 Workshop Findings

5.1 Summary for each State

The workshop summaries from WA, SA, VIC and NSW are included in the appendices. The QLD workshop was a different format to the other states with the summary and findings captured in a presentation.

5.2 Key Issues

This section highlights the common issues identified across all states with respect to improving processes through the use of data integration:

5.2.1 Training and Expertise

This was seen as a critical issue by all workshop participants across all organisation types; impacting the quality of work and ability to deliver to required deadlines. Specifically

- Available training courses for detailers and software applications
- Skills and expertise within the detailing industry
    - Aging population
    - Skills available in 2D rather than 3D
    - Cost of training and keeping good resources

5.2.2 Cost vs Benefit

The cost of providing CNC Data and who pays for it compared with the benefit from using the data. This applies not only to the data itself but also the investment required in the software applications, resources and equipment to utilise the CNC data

5.2.3 Liability

When CNC data is created by a third party it introduces the question of who is liable should the data be incorrect and this is not identified until the steel is cut or processed. Most steel processors would prefer not to put this to the test and so are reluctant to use the CNC data without manually checking or reproducing first.

This is indicative of the lack of trusted partnerships and alliances between the various organisations involved in the steel supply chain. The exception to this is the industry in WA where many fabricators have developed close alliances with detailers and would now prefer to rely on the accuracy of the detailers information rather than manually checking the drawings.

5.2.4 Variations

Variations raised considerable discussion in all of the workshops, in particular the following points were raised:

- Revisions and variations add cost to all parties
- The need to clearly identify what has changed from the previous version (3D models normally regenerate the full model for a variation)
- Ensuring when a previous version is referenced that it has been issued
- Generation of CNC data for variations is complex as it may be that only the change needs to have the CNC data and not the whole model
- Difficulty in quoting and estimating when the design is not finalised
- Cost of rework

5.2.5 Industry competitiveness

It is generally perceived that the steel industry in Australia is going backwards with respect to the use of innovative technology solutions to overcome business process inefficiencies. Not only does the industry face competition from international organisations but also from other materials, such as concrete, being used in preference to steel.

Data integration is one way to improve integration and remove some of the costs from within the overall steel supply chain but requires the collaboration of all participants to effect an industry-wide change.

A trend is starting to occur whereby detailing is being taken off-shore either to reduce costs or meet deadlines. This does not necessarily save any time in the overall project as the management of changes is complicated by using remote organisations. However, as evidenced in the software industry, countries such as India, Indonesia, South America and China have a significant capacity to improve the quality and speed within which they can deliver and for a lower cost.

Australia is somewhat protected from international competition for steel because of its geographical position and the cost of freight to deliver steel from overseas into the country. This may change as freight costs decrease or steel costs decrease overseas. Considering only international competition does not recognise the increased competition through the use of alternative materials, as such it is a narrow view of the potential competition.

5.2.6 Engineering drawings

Another unanimous issue was that of the poor quality of the engineering drawings being provided for tender and construction. At these points in the overall process, the drawings are often inaccurate and/or not well defined.

The engineering aspects of the process are seen to be outside of the influence of the steel industry other than to be able to provide standards recommendations to engineering organisations.

5.2.7 Mining vs Architectural projects

The industry needs to consider that mining projects are different to those require a high degree of architectural work, in particular:

- Architectural work has many more variations
- Mining projects are generally well defined up front and have fewer variations
- Architectural work is more complex than Mining projects

This makes CNC data integration more complex for architectural projects than mining projects. It also helps to explain the difference approach used in WA where the majority of large projects are mining related.

5.3 Data Integration Status

5.3.1 Current usage

Other than in WA, there is very little data integration occurring in the steel industry in Australia today. The situation in WA is somewhat unique in that the majority of work is mining work and the organisations have had to work closely together and develop alliances over the years to remain competitive. The fabricators in WA have also invested in equipment that uses CNC data and now simply expect that this will be provided for any jobs.

An increasing number of fabricators and processors are investing in CNC capable equipment particularly in South Australia where there has been a notable increase over the past 6 months. As more CNC equipment is in use, the demand for CNC data will increase and eventually create sufficient need that the detailers will either have to upgrade their skills and capabilities or scale back to work on the smaller projects.

All detailing for overseas projects must be provided with 3D models and CNC data.

5.3.2 Equipment

All new processing and fabrication equipment has CNC data capability, and most will support the DSTV format as a standard. This has been the case for quite a few years now, although it is only starting to be seen in Australia amongst the larger organisations.

5.4 General Observations

5.4.1 Discussion forums

Feedback from every workshop supported the benefits a forum whereby all industry participants could be involved in an open discussion to understand the challenges each organisation faces, identify areas of cost/inefficiencies and brainstorm solutions. The forums need to be empowered to achieve something other than simply documenting good ideas. The ASI is in a strong position to facilitate these forums, provide guidance from an industry best practice point of view and facilitate projects to prove the value of collaboration between the different parties.

Many of the challenges to improving the processes through data integration and other means stem from the fragmentation that exists within the industry. These challenges cannot be overcome by any one organisation, instead it will take a group of like-minded companies working together to come up with a workable solution. This is particularly true of the issues relating to cost vs benefits and liability.

Recommendation:

The ASI initiate a special interest group to both prove the benefits of data integration and recommend solutions/approaches to the issues of equitably distributing both the costs and the benefits.

5.4.2 Technology benchmarks

The work completed by the QISD with respect to nominating standards for detailing allows a comparison point to be set for all RFQ responses and detailing work. To be effective, this initiative needs to be adopted by the detailing organisations outside of QLD to become a nationwide standard. While this was not a specific objective of the workshops held, it is one of the outcomes that could be achieved in a relatively short time.

Recommendation:

Ensure that the standards are used throughout QLD and promoted in other states. The value of using the standards needs to be articulated through the use of case studies and documented benefits to justify the investment required.

5.4.3 CAD Software packages and vendors

There appears to be somewhat of a disconnect between the software applications available and the requirements of the detailers, fabricators and steel producers. This may be due to the different versions in use, or lack of understanding of the capabilities of the products, however either cause indicates that the products are not being used to their fullest advantage.

Various customisations, add-ons and changes have been made by some organisations to modify the applications to produce the data required and provide the level of detail needed to better run their businesses. Most software vendors have a process whereby their customers can request changes or provide input into new releases.

Recommendation:

Software vendors need to better understand the requirements of their customers and their customers end-users, in this case detailers and fabricators or processors. The applications need to provide for both the detailing and the data requirements of the equipment that produce the steel.

Training in the product capabilities, import/export features are needed on an ongoing basis to ensure users are up to date with features. The ASI can help with this by working with the software vendors to create courses targeted at the steel industry, and in particular that support the defined best practice processes including data integration. In many cases it is simply a lack of knowledge that prevents some of the time-saving features of products from being used.

5.4.4 Lack of short-term need

The steel industry has been in a boom for the past few years, most organisations cannot keep up with the work they have committed and in their pipelines. Thus there is enough business available that all participants can profit without having to improve efficiencies or look too closely for cost reductions. This has been a contributing factor in the slow adoption of data integration.

It is expected that as with most booms it will not last forever. In order for Australia to remain competitive, process improvements need to be identified now so they are in place when required. Process improvements can also lead to increased profits and throughput further sustaining the industry as a whole.

5.4.5 Fragmented Industry

The steel industry in Australia is quite fragmented with little collaboration between the different seel industry sub-groups. There are existing forums through the ASI and other such institutions for groups of organisations to work together, but these are typically restricted to a particular type of organisations such as detailers or fabricators. Australia is also a relatively small market with fewer participants compared with the UK or USA, this should make it easier to collaborate but also reduces the need for more formal partnerships to be established.

6 International Findings

United Kingdom (UK)

6.1 Key Issues

This section highlights the common issues identified within the UK steel industry in relation to improving processes through the use of data integration:

6.1.1 Training and Expertise

The UK steel industry has standardised predominantly on two software packages for the development of 3D models and the output of CNC data for fabrication. The early adoption of these packages has limited the risk of skill shortage as many of those entering the steel industry have acquired at least a limited knowledge of both applications through college courses they have attended.

6.1.2 Cost vs Benefit

As the UK steel industry is more integrated than the Australian industry and is more mature in the adoption of the use of CNC data as output by designers, most fabricators and customers accept the benefits of this data and acknowledge that the costs to generate the data is acceptable. That said it should be understood that most design and drawing capabilities exist within the fabricators company and as a more tightly integrated process have built a reliance on the use of CNC data for fabrication production.

6.1.3 Liability

UK fabricators accept that for most part they bare the risk of using CNC data and accept this as a part of doing business in the steel industry. Given the improved processes and overall reduction in costs associated with the use of CNC data in the UK, market fabricators are more prepared to bare the liability of CNC data as they are reaping the benefits.

6.1.4 Industry Competitiveness

In the UK the steel industry's market share of building construction compared to other media has risen significantly since around 1980 and is now amongst the highest in the world. At that time steel's market share of framed single story buildings was 65% and is now over 95% and of multi-story buildings was 30% and is now over 70%. The key driver for the massive increase in market share has been the improvements in productivity and efficiency. (Steel Buildings, Pope, Dr Roger, BCSA)

The following barriers to the early adoption of CNC data in the UK steel industry have been identified:

- The lack of trust between engineers and fabricators in terms of who should bear the risk for the use of CNC data
- No obvious leadership shown from 3D modelling application vendors
- An unwillingness from industry members to improve business processes in order to become more competitive

However as the industry matured during the 1980's and early 90's the push for improved efficiencies came from within the larger fabricators. The software vendors targeted new releases that addressed specific functionality adding value to the CNC automation process, with two vendors Tekla and AceCAD evolving to become a duopoly in the UK steel industry, for 3D applications.

6.1.5 Managing Change

A number of participants in the Australian steel industry workshops on data integration raised concerns that the 3D modelling process and subsequent output of CNC data is cumbersome when handling changes in the drawings. While this has been experienced in the UK steel industry the market perception is that the 3D modelling applications used accommodate the changes effectively.

One aspect of the design process, which eats into the engineer's fee is accommodating change. For example, it is reasonably easy for an architect to reposition a column in a building – but this can have huge implications for the structural engineer. Such changes can result in a major redesign, of supported beams, transfer beams, columns, base-plates and foundations. In addition to the design change material take-off, and the associated steel work drawings require amendment. Therefore a simple change by the architect resulted in hours of work for the engineer. However by using 3D modelling systems the engineer simply has to change the model and the subsequent engineering information is regenerated. The resulting CNC data output is re-run ensuring all changes to the drawings are consistent at the time of output.

6.2 Data Integration Status

6.2.1 Current usage

Steel construction has increasingly become more competitive with concrete throughout the world, and the use of 3D modelling to detail projects has significantly contributed to its competitiveness. In the UK steel industry Tekla and AceCAD have the lion's share of the steel industry market for 3D modelling applications and both report high productivity for fabricators and designers who have implemented 3D modelling. For example the use of AceCad's 3D steel detailing system StruCad saves considerable time, effort and cost for steel fabricators.

The StruCad models contain all the necessary data to control the CNC machinery used in project fabrication. The StruCam module allowes the CNC data to be produced and downloaded directly to the CNC machines helping to achieve the required accuracy and to eliminate fabrication shop and erection site errors.

6.2.2 Observations

The UK steel industry is more tightly integrated than the Australian market. The benefit of this integration is fabricators are able to compete more effectively within the region and throughout Europe.

It appears the driver for improved efficiencies came from within the industry. Once the larger fabricators bit the bullet they drove the change process including support for the 3D modelling vendors. This in turn evolved to the two vendors becoming the adopted standard.

The current trend is towards worlds best practise. Having tackled the data integration, the UK steel industry has targeted the transferring of data between participating project groups. Currently Electronic Data Interchange (EDI) is growing in importance throughout the industry. While the UK steel industry sees itself a slow adopter of technology it has moved at a faster pace than the industry in Australia and is now reaping the rewards.

Unashamedly industry pundits say they are targeting world best practise as the next milestone in their evolution. A step towards this ideal goal is the introduction of EDI as a means of transferring data between the design shop, steel processing and fabrication. EDI is the generic term used for the transfer of data between one software package and another. Software is now capable of assisting in the communication between engineers, technicians, and steel contractors through EDI. The UK steel industry is further developing the information flow between design packages, detailing packages and management information systems through the use of EDI as a means of increasing competitiveness.

6.3 Key Issues

This section highlights the common issues identified within the USA steel industry in relation to improving processes through the use of data integration:

6.3.1 Training and Expertise

As the North American steel industry continues to enjoy strong growth the steel supply chain is still impacted by inefficiencies due to shortages of skilled labour. This market is similar to that of the UK in that the use of CNC data as output from 3D Modelling applications is commonplace. However the industry is looking for ways of retaining quality staff, acquiring new staff and automated processes in a highly competitive market. Strategies to minimise the risk of skills shortage, which are being adopted by the steel industry in the US, include:

- Looking for ways to leverage the industry's best practices and solutions by using tools that have an availability of established training processes in the market.
- Identifying new ways of compressing operating schedules by adopting newer technologies where possible. Faster shop-floor equipment can get individual processing tasks done sooner. Electronic data exchange — such as transferring job data from detailing packages into fabrication management software automatically — can save time every time the process is run. It should overcome costly errors, and get jobs into production sooner.
- Establishing proper Quality Assurance procedures that are built into the process, not just inspections after the fact, and supporting this with effective staff training. These are key to getting things right the first time. The industry is implementing good procedures, or even automated tools, for ensuring the proper drawing revisions are distributed and followed through the use of applications such as 3D modelling and integration of CNC data.

6.3.2 Cost vs Benefit

A whole range of fabricators in the steel industry in the USA are adopting the use of 3D modelling applications and integrating the CNC data into their manufacturing systems in an effort to improve their competitive advantage. Once this technology was for the large fabricators alone however increasingly small and medium size fabricators are developing a more integrated approach to the use of CNC Data.

The American Institute of Steel Construction (AISC) has identified a large proportion of members who use Fabtrol for design modeling. Even though many Fabricators use external Detailers unlike the UK industry, it appears that the high adoption of applications such as Fabtrol is powering a growth in the use of equipment that accepts CNC data, which in turn is driving efficiency gains across the industry.

Fabtrol has identified the following four benefits that potential users of CNC data could expect to receive.

- **Shorter project schedules.** Instead of spending hours or days entering data by hand, industry members can transfer it electronically in a matter of minutes. The time saved can be trimmed right out of the project schedule enabling staff to start fabrication sooner, accelerate drawing approvals, react to changes faster, and deliver on or ahead of schedule.

- **Reduce costs.** Importing data directly saves the data entry labor required for manual entry. Staff can also reduce the time and resource required for checking and correcting information, since most entry errors have been eliminated. Best of all, the more robust data exchange mechanisms provide automated revision control, so you can quickly see what's changed in the latest revision without having to laboriously review the drawings.

- **Improve your quality and reputation.** Smooth data exchange enables Fabricators to eliminate entry errors, identify changes more quickly, and avoid costly and time-consuming rework. These factors all translate into high product quality and a better reputation with clients.

- **Increased revenues.** The end result of shorter project schedules is the creation of spare capacity in the shop. That means you may have the ability to take on more projects to increase your revenues. Also, as your delivered quality and reputation increases, clients will be more willing to pay your price for the extra reliability, even if you are not the lowest bidder.

6.3.3 Industry competitiveness

Demand for structural steel on construction projects in the United States will continue to grow in 2007, according to industry forecasts. The American Institute of Steel Construction (AISC) projects a growth in tonnage demand for structural steel of 2% in 2007. Members of the structural steel industry at every level of the supply chain are taking steps to ensure that supply continues to meet the expanding needs of the construction industry. The domestic production capacity of structural steel will increase by 10% in 2007 as a result of mill expansions currently under construction.

Roger Ferch, president of AISC, commented, “Structural steel continues to be the material of choice on building projects throughout North America. With continued growth in demand projected for 2007, members of the industry—from mills and service centers to fabricators and erectors—are making sure that structural steel remains readily available for every type of project.”

This market is a mature user of 3D modelling applications such as Tekla and Fabtrol with Fabtrol controlling over 50% of the market.

6.4 Data Integration Status

6.4.1 Current usage

The use of CNC data in the steel industry of the USA has become common practise. And while it is expected that large Fabrication shops would invest heavily in CNC machinery the current trend sees small to medium operators entering into this automated practise. There appears to be several reasons for this adoption.

Small to medium Fabricators are targeting a reduction in operating costs and an improvement in efficiencies. These efficiencies include reduced timelines for work schedules, greater use of staff effort as the keying in of data is eliminated and an increase of quality output as changes to drawings are handled through the version control 3D models. Overall, if these Fabricators are able to reproduce quality processes in an efficient and cost effective manner they will earn their competitive advantage.

New Zealand

6.5 Observations

The New Zealand (NZ) market is similar to the Australian steel market in as much as it is not tightly integrated. However the New Zealand steel market differs from the Australian steel value chain in the relationship they have with the steel merchants. Unlike Australia, which generally speaking receives the steel already processed from the merchants, the NZ steel industry orders cut lengths of steel and works from a stock on hand basis. They then do their own cutting and drilling. The larger Fabricators such as SSE develop their own shop drawings in-house for most projects. As part of this process they output CNC data that is integrated directly into their Beamline machines. The mid to large Fabricators have developed an in-house detailing facility and only sub-let work to external detailers when demand outstrips their own facilities.

With a strong customer focus and technical expertise, SSE Fabrication offer a one-stop-shop for a wide range of structural engineering requirements. Their facilities and experience enable them to meet demanding schedules and undertake complex projects. Stevensons Structural Engineers was founded in 1960 by R. Stevenson. They are leaders in the supply, fabrication, surface treatment and erection of structural steel. SSE operates Profile Cutters with CNC Controllers.

7 Case Studies

7.1 Queensland

7.1.1 Steelcad Drafting

7.1.1.1 Woolworths Project

Steelcad Drafting Pty Ltd were engaged by Woolworths to prepare the steel detail drawings prior to a builder being appointed. Watpac came on board nearly 8 weeks after we had commenced detailing.

Woolworths had prior experience with a recent and similar project in Western Australia. This gave them the confidence to prefer a detailer that utilised a 3D detailing system. Steelcad also had the capacity to take on the whole project which minimised the project management required for this activity.

Being engaged early in the program allowed Steelcad to provide input to the construction planning and maximise drawing office efficiencies by working closely with design consultants. Robert Bird attended weekly detailing meetings held in our office which greatly reduced the impact of design finalisation on our drafting program. Close ties with the consultants also reduced the turn-around time of detailing RFI's and clarifications. Robert Birds should be commended for this "project friendly" approach.

Information delivered by Steelcad Drafting

- Hard copy marking plans, assembly detail drawings, fitting drawings
- Data based transmittal documents
- Construction sequence material lists, assembly parts lists and pick lists
- Field bolt lists and order summaries
- NC data transfer for member shaft processing
- NC data and bundling reports for purlins, girts, bridging and fasteners
- DXF data transfer for plates and flats processing

With all this information at their finger tips and delivered in a timely and user friendly manner, Brisbane Steel Fabrications were able to maximise their control of the steel supply chain. From tender and procurement to processing and JIT delivery to either the site of their Hemmant workshop.

The availability of CNC and DXF data to roll formers and processors meant they could utilise all the high end technology that has been built into their systems over recent years assuring maximum possible efficiencies during the ordering, processing and delivery stages.

Without the use of a 3D modeling / detailing software package like X-Steel, StruCAD or BoCAD, none of this technology would have been available to the fabricator and his suppliers. The detailing program would have been extended because our feedback to design consultants during the final stages of design finalisation and co-ordination would not have been as detailed or advanced as it was.

If 2D detailing was used, additional detailing resources would have been necessary to deliver the required drafting program which meant the detailing contract would have been split between two firms. This in turn would have increased the drafting costs and drawn additional project management from the client, the builder and the fabricator.

7.1.1.2 Statistics

Purlins
Quantity - 10,733
Total length - 94,465m

Steelwork
No. Assemblies - 15,149
No. Drawings - 6,259
Mass - 3,830t

Fittings
Quantity - 65,440

Fasteners
Quantity - 130,000

Provided by Clayton Roxburgh, Manager of Steelcad Drafting Proprietary Ltd, Queensland.

7.2 Western Australia

7.2.1 PDC Consultants

7.2.1.1 BHPB Iron Ore RGP3 Area C Expansion

BHB Billiton Iron Ore engaged PDC Consultants to complete the 3D modelling and production of shop detail drawings for the Area C Expansion Mine Site. The expansion of the Area C mine included new crushing and screening facilities, a new stockyard and an 8 kilometre overland conveyor. The engineering, procurement and construction management services were provided by MPDJV (a joint venture between Flour and SKM) with Monadelphous Group (SMP contractor) supplying the structural and mechanical construction services.

Monadelphous subcontracted the fabrication of the steelwork to numerous fabricators around Western Australia and also Thorton Engineering in Melbourne. The scope for Thorton Engineering included the fabrication of the Primary, Secondary and Tertiary Crushing facilities as well as TS210. In total approximately 7,000 tonnes of steelwork, handrail and grating.

The need to automate the detailing process was identified by the client, SMP and the fabricator. The detailing process was automated through PDC utilising their 3D modelling system, as outlined below. PDC's workflow combines Navisworks propriety software with detailing softwares such as Prosteel, Tekla Structures and Strucad to provide the link between design, fabrication and construction.

The main output files included:

- PDF files of drawings
- NC and DXF files for fabrication
- Electronic reports such as material lists and client database reports
- 3D models
- Navisworks models with full intelligence and linked detail drawings

The models were used with MPD for design reviews, for fabrication and construction through planning of lift studies and colour coding for progress. In addition, it was used as a training tool for operations staff for the new facilities.

The overall integration of detailing with the tail end of the detailed engineering design enabled work to be completed in parallel and therefore improve on the overall project schedule. At the initial award stage of the SMP contractor, approximately 4,500T of 7,000T was ready for fabrication. This resulted in fabricators having the required electronic information and commencing fabrication within 1 week of the award of the contract. The advanced ordering of long lead items by MPD also ensured there were no delays in commencing fabrication. Overall, PDC believes that there will be schedule and cost benefits to integrating detailing into engineering and the increased use of the 3D modelling process.

Identified Benefits

Huge efficiencies were gained by linking detailing to all project processes and optimising the electronic information available. PDC produced in excess of 55,000 drawings for the project with an additional 150,000 to 200,000 of electronic files. The transfer of information is fairly seamless through electronic transfer processes.

Earlier involvement in engineering resulted in detailing and fabrication issues being resolved earlier and enabled design changes to increase detailing efficiencies. Further improvements could be achieved by being involved during the feasibility studies phase.

What would the impact have been if software was not used for detailing / fabricating?

PDC Consultants understand that additional risk of manual error would have negatively impacted the project both through the fabrication process and input of CAM data.

Provided by Martin Weir, General Manager of PDC Consultants, Western Australia.

7.3 New South Wales

7.3.1 CADRAW

7.3.1.1 Project Magnet

Original customer: One Steel Whyalla Steelworks

Our customer was the fabricator, Samaras Engineers in S.A.
Detailer: Cadraw Pty Ltd NSW

About 75 tonnes

The detailing process was automated due to the fact that one of the requirements from the fabricator was that CADRAW supply by all documents electronically. All drawings were supplied in PDF and DWG format while all steel parts were sent in DXF and DSTV format for CNC processing.

Identified Benefits

All parties identified a benefit because the data was accurate when exported from the 3D model and was not manually keyed into any other machine for processing. This eliminated the chances of human error. The transfer of information was fairly seamless through the electronic transfer processes.

Provided by Nazareno A Manuele, Director CADRAW

8 OneSteel Pilot Summary

8.1 Introduction

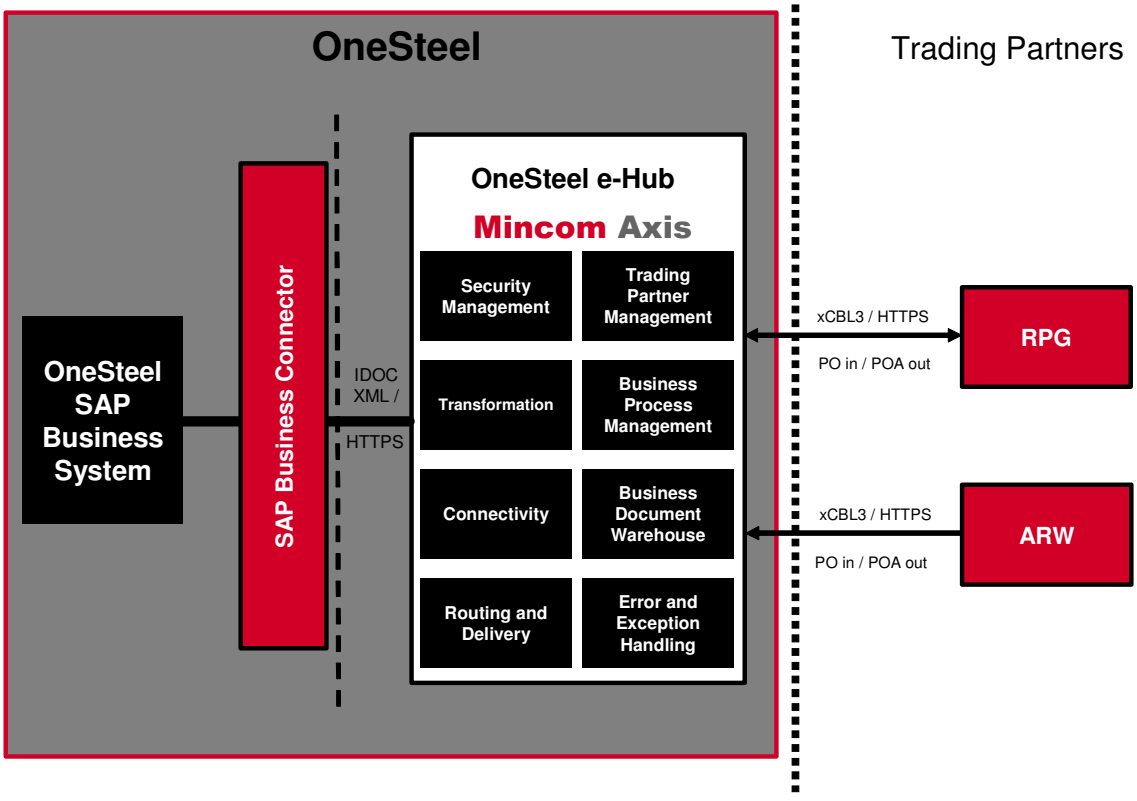
8.1.1 Overview

The Steel Industry in Australia has published electronic document exchange technology specifications for procurement based transactions. The majority of the Tier 1 Steel organisations have adopted electronic trading and are continuing to expand its usage and benefits gained. The goal of the pilot was to identify issues in reaching supply chain members in Tiers 2 and 3 of the steel industry, using existing processes. It is important to note that once the technology is in place it can be used for any type of data exchange including CNC data. The challenge is then on the business to update their processes to take advantage of the technology and by so doing improve industry competitiveness.

OneSteel, BlueScope, RPG and ARW are all members of the Australian Steel Institute and agreed to conduct a pilot project to assess the issues and capabilities associated with implementing B2B connectivity using the steel online standards.

8.1.2 Scope

The scope of the pilot project is illustrated in the following topology diagram:

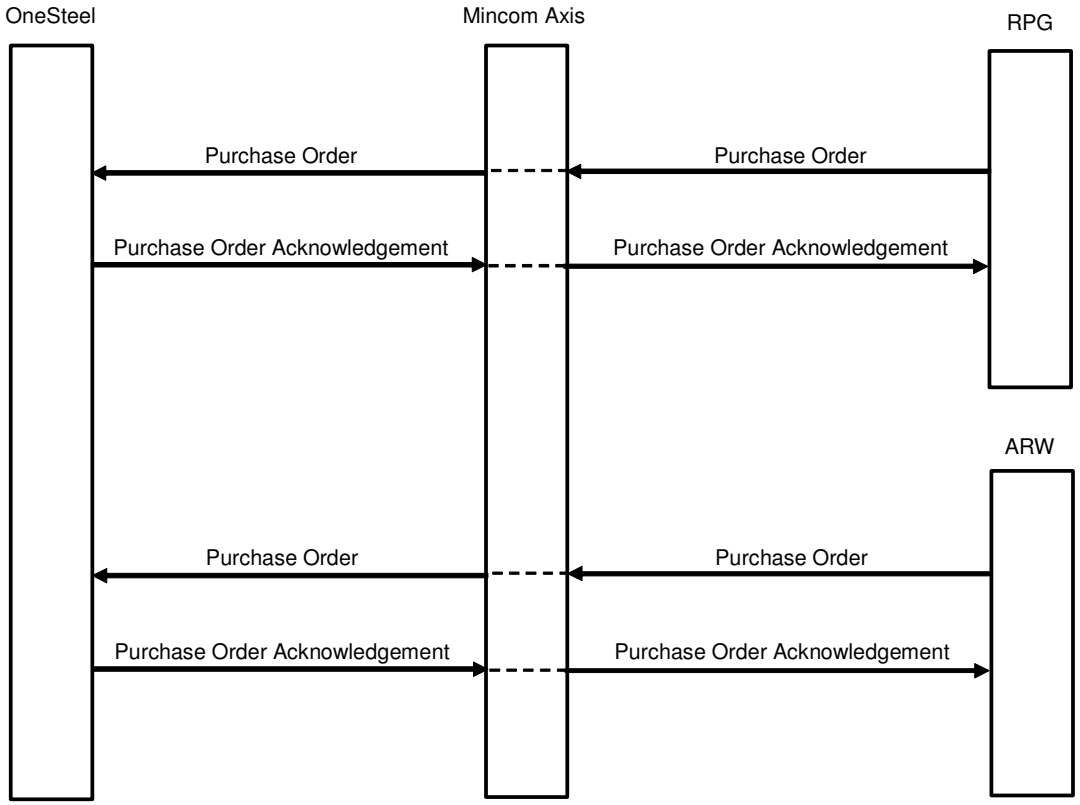


A connection was to be established between RPG and OneSteel, and between ARW and OneSteel. The following business documents were included in the pilot:

- Purchase Orders inbound to OneSteel, using HTTPS and xCBL3 to connect to RPG
- Purchase Order Acknowledgements outbound from OneSteel, using HTTPS and xCBL3 to connect to ARW

8.1.3 Business document flows

The following graphic shows the document choreography for electronic business documents implemented in the ASI pilot project between OneSteel and RPG / ARW:



8.1.4 Process Description

RPG and ARW both place purchase orders on OneSteel. These are transmitted via Mincom Axis to OneSteel.

OneSteel respond with purchase order acknowledgement documents to both RPG and ARW. These documents are also transmitted using Mincom Axis.

For the pilot activity, RPG created a Purchase Order in xCBL3.0 format, which was sent to Mincom Axis and converted into a format suitable for OneSteel. The Purchase order was delivered to OneSteel and loaded into their business system.

8.2 Key Findings

8.2.1 Connectivity

Initial engagement with RPG and ARW identified that smaller tier steel industry partners may not always have capabilities in-house to quickly implement B2B using the steel online standards.

Smaller steel industry partners may require assistance to establish connectivity using the steel online messaging standard – ebXML Messaging Standard.

8.2.2 Security

A particular issue was identified regarding the requirement for digital certificates to support HTTPS and the cost of the certificates. The actual cost varies depending on the provider used and can range from $200/year to over $3,000 per year.

One option would be for the ASI to become a certificate authority for the steel industry and provide certificates for a nominal fee to its participants, further facilitating technical connections for smaller organisations.

8.2.3 Data Mapping

Mapping refers to the translation and transformation of business information from the format produced by one system into a format that is acceptable for another system. It is a critical aspect of electronic business document exchange.

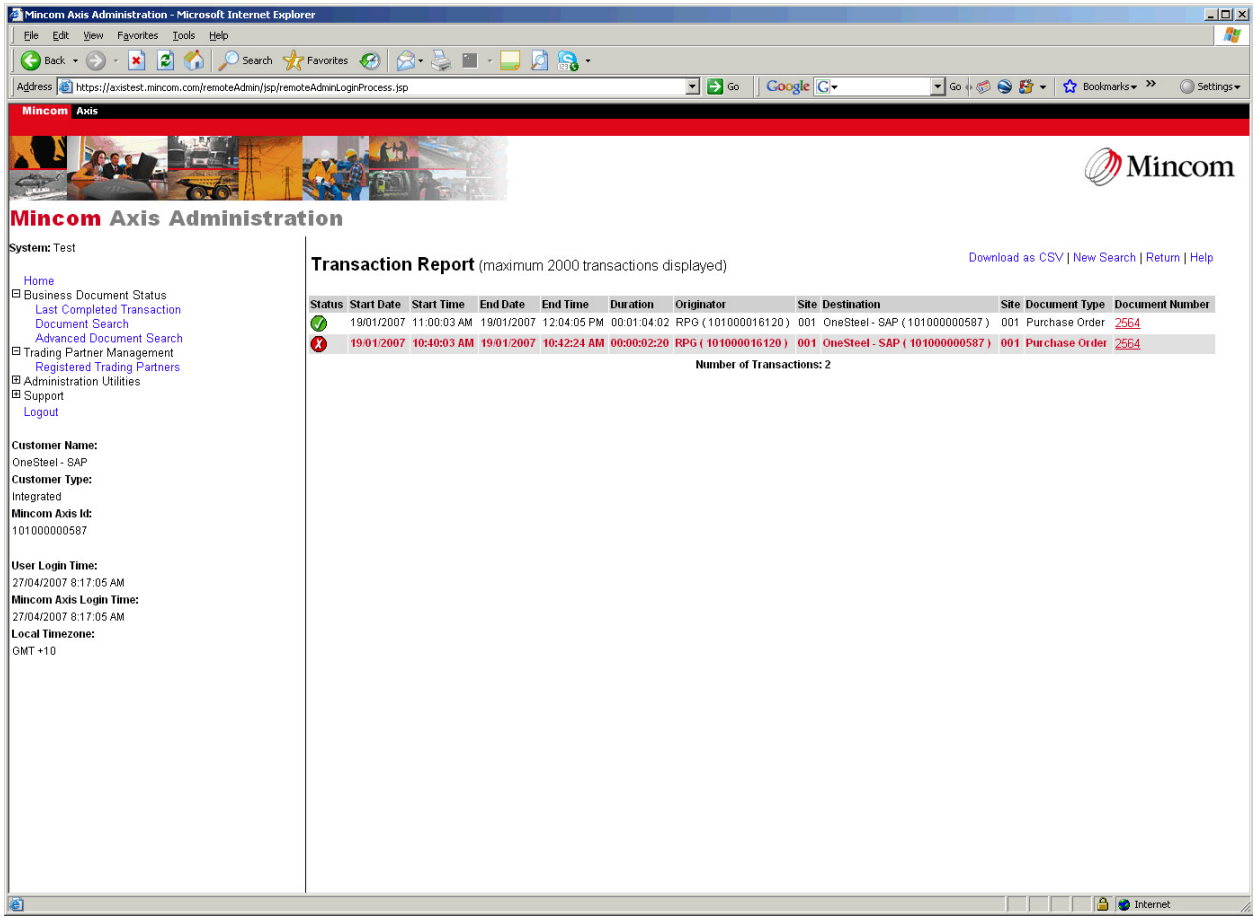
Both RPG and ARW currently utilise the ASI steel online document format standards out of their business systems. For the purposes of the pilot XMLYes provided mapping from the ASI steel online format to xCBL3 which OneSteel support for interfacing with trading partners.

Mincom Axis provided the mapping from xCBL3 into the OneSteel native business system format, IDOC XML.

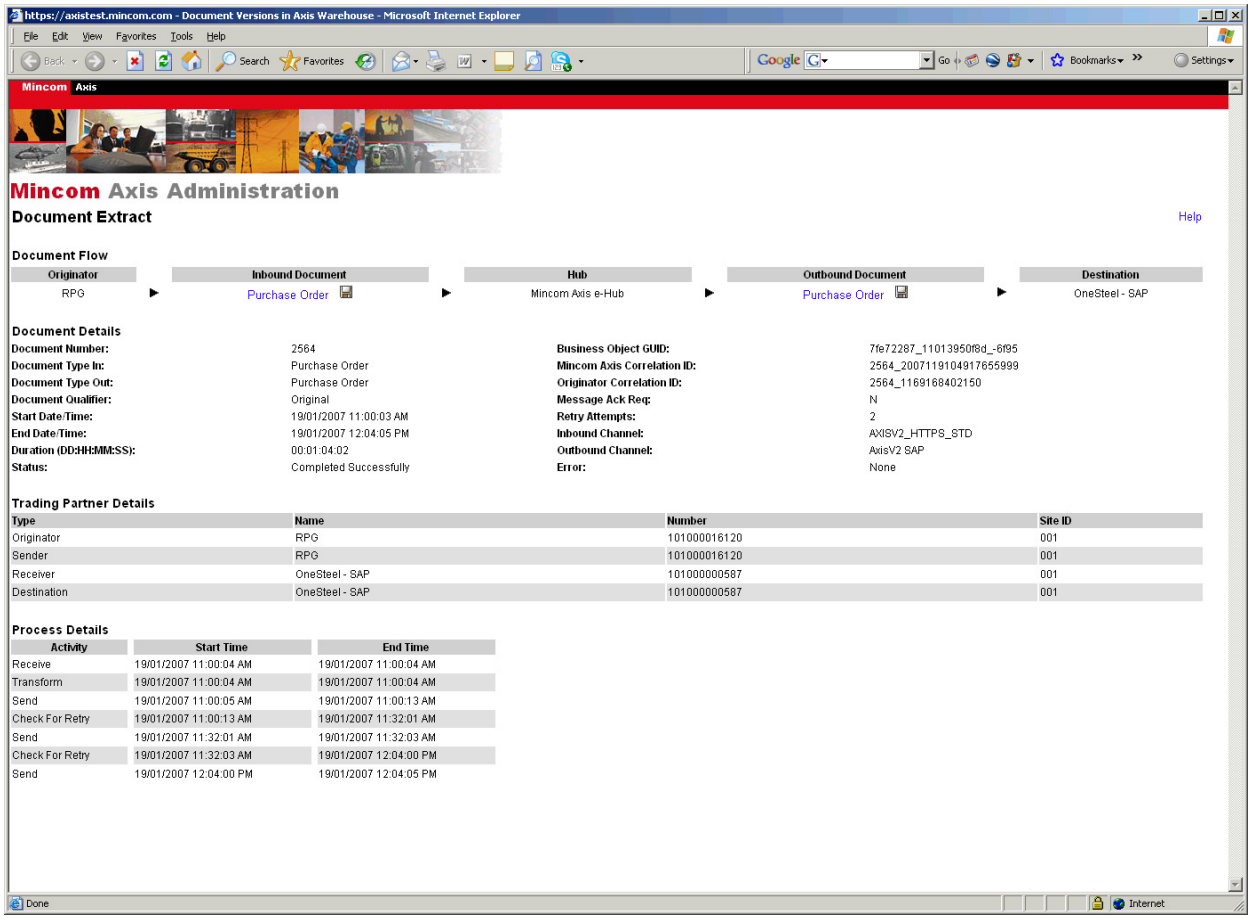
Code translations between trading partners were handled by Mincom Axis for the pilot. It is expected that each party (either sender or receiver) will need to translate codes such as supplier ID, part/material codes in all cases.

8.2.4 Results

The screen shots below are taken from the OneSteel eHub (Mincom Axis) and show a summary and detail view of a document sent by RPG to OneSteel. The summary includes both a successful (green tick) and a failed (red X) transaction. Detecting when a document has failed is at least as important as knowing it has been delivered successfully.



The detail view of a document provides more information on the parties involved in the exchange transaction, the steps it went through to be processed and its current status. The actual data for the document is also available through this view.



8.3 Pilot Summary

The pilot itself used the Purchase Order / Purchase Order Acknowledgement process flow, however the technical connectivity requirements typically do not vary for different document types. The data mapping is specific to the document types and content which can vary from one organisation to another, even when using specified standards. The basic steps for document processing are similar across all documents types.

The pilot showed that automated integration can be achieved by organisations of different sizes and capabilities.

Glossary

The following table defines the acronyms and abbreviations used throughout this document.

Acronym	Definition
3D	Three Dimensional
ASI	Australian Steel Institute
B2B	Business to Business
CAD	Computer Aided Design
CNC	Computer Numerical Control
EDI	Electronic Data Interchange
HTTPS	Hypertext Transfer Protocol using SSL
IDOC	SAP native document format
NSW	New South Wales
PO	Purchase Order
POA	Purchase Order Acknowledgement
QISD	Queensland Institute of Steel Detailers
QLD	Queensland
RFQ	Request for quote
SA	South Australia
UK	United Kingdom
USA	United States of America
VIC	Victoria
WA	Western Australia
xCBL	XML Common Business Language. More information can be found at www.xCBL.org
XML	Extensible Markup Language

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Western Australia

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South Australia

Victoria

New South Wales

Nazareno A Manuele, Director CADRAW

United Kingdom

Dr Richard Pope, The British Constructional Steelworks Association

http://www.acecad.co.uk

http://www.tekla.com

Dr Graham Raven, Senior Manager, Construction Technology, The Steel Construction Institute

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Luke Faulkner, American Institute of Steel Construction

Roger Ferch, American Institute of Steel Construction

Josh Cochrane, FabTrol Systems

New Zealand

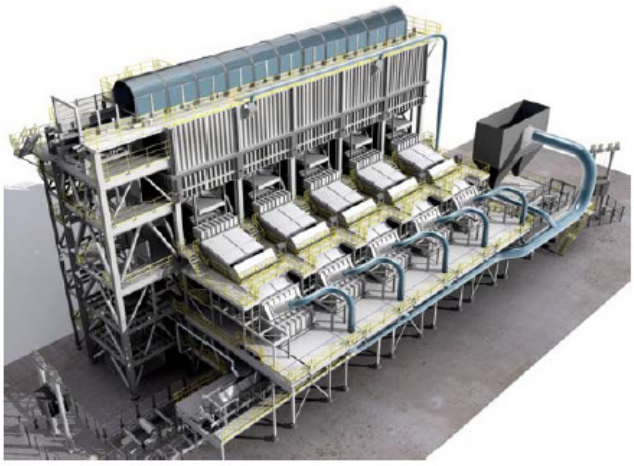
Evan Kroll, Manager Stevensons Structural Engineers,Tokomaru, MANAWATU, New Zealand

Supporting Materials

The following materials were gathered during the research phase of the project.

PDC 3D Modelling Process Design Technology

Since its inception, PDC Consultants has consistently stayed at the forefront of design technology. At the heart of PDC's business is its continued investment in the very latest 3D modelling software.



PDC has developed its own unique modelling software system – the PDC 3D Modelling Process - which combines Navisworks proprietary software and other 3D modelling packages, such as Strucad, Xsteel, Prosteel and Autoplant piping.

The state-of-the-art PDC 3D Modelling Process is a powerful and flexible design and detail tool that has revolutionised the design and drafting process.

This innovative technology provides clients with an amazingly accurate 3D simulation of project structures, to the finest of detail.

Not only does PDC's 3D Modelling Process dramatically cut design and modelling costs, it also ensures that minimal rework is required during the construction phase of a project.

The PDC 3D Modelling Process is fully flexible, and is designed to guarantee that all steel connections are consistent, eliminating mistakes that can cause major delays and additional costs during fabrication and construction.

Advantages include dramatic cost savings against 2D design modelling, due to reduced man hours. The PDC 3D Modelling Process allows for savings of up to 50% in the design and detailing phase of a project.

Navisworks with PDC Intelligence Module provides 3D models that are fully intelligent, containing detailed drawings linked to models. Design reviews allow confirmation of design intent and detailed movie files can be produced for client review.

Flexibility is an important factor in drafting design and the PDC 3D Modelling Process provides this function with ease. The system creates composite models that can accommodate structural, mechanical, piping and electrical requirements.

The PDC 3D Modelling Process also offers the following functions:

Clash Checking

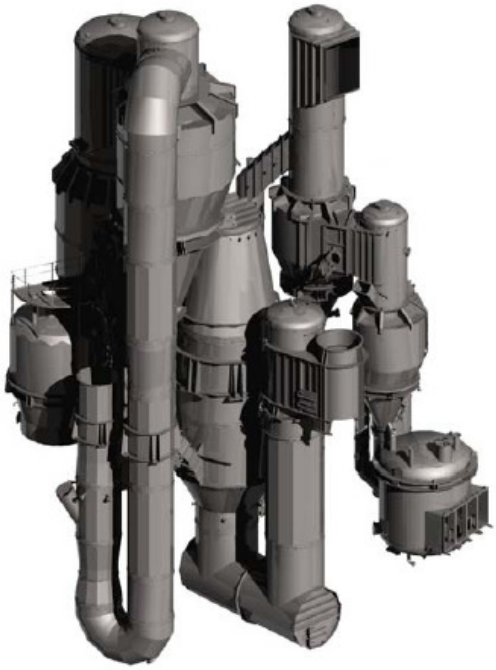
- Whilst clash checking can be completed within each 3D modelling system, Navisworks enables multi disciplined 3D models to be combined and clash checked.
- Separate models able to be checked, as well as other types of 3D solid models
- Clash check reports can be run, as well as information stored, to determine status of clash

Intelligent Viewing System

- Composite model converted to geometry cache for fast loading
- Data from intelligence report displayed quickly in side panel
- Live data from data sources can be viewed based on mark/drawing number
- Members can be quickly located and highlighted using 'find' command

Drawing Viewer

- Drawings linked to members and stored alongside the model in PDF format
- Drawings can be brought up quickly for viewing and printing



Colour Coding Model

- Links to any Access/SQL database
- Will colour code model against database
- Prompts to select query to colour on
- Optionally makes other entities transparent/dim
- Shows status of members

Custom Information

- Custom information can be applied to non-intelligent entities
- Drawings can be manually linked in this way

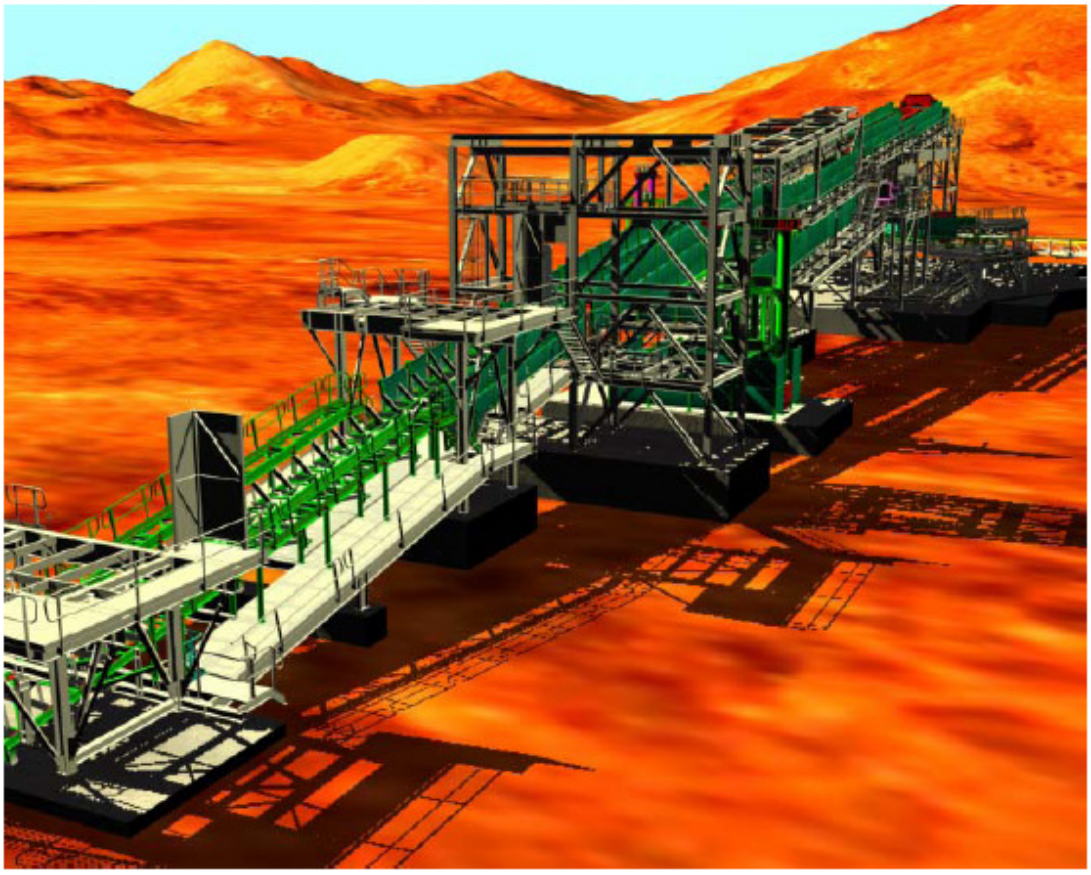
Cross Sections

- Several levels of sectioning can be applied and switched on/off independently
- Unlike some other systems, sections are not lost when model is rotated or zoomed

The PDC 3D Modelling Process Advantage

The PDC 3D Modelling Process offers a range of advantages that significantly reduce design and modelling costs, while ensuring minimal rework is required during construction.

PDC 3D Modelling Process presents a solid model that is reusable for presentation material such as animations and rendered views. With PDC Intelligence Module all models are linked to drawings and live data can be linked to the model for tracking. Most importantly, PDC 3D Modelling Process can be customised to form part of an efficient workflow for any project.



About Mincom

Asset-intensive industries have unique requirements. Mincom has dedicated more than 25 years to developing enterprise solutions and services that ensure these requirements are fulfilled and improved business outcomes are realised. Mincom has a deep understanding of the issues and challenges facing the industries we service. Eight out of ten of the world's top mining organisations rely on Mincom solutions. Mincom delivers custom solutions to asset-intensive industries such as mining, manufacturing, transport, utilities and defence. With a focus on partnership and collaboration, our global community of customers is supported by a team of over 1,100 professionals deployed throughout 18 offices around the world.

As a complete technology integration provider, Mincom delivers a comprehensive range of consulting services including technology integration, supply chain analysis, implementation services, strategic business consulting, eBusiness services, and strategic IT consulting. Mincom has proven experience in successfully completing projects, on time and on budget. Our consulting services are delivered by specialists with an average of 15 years industry experience in mining, manufacturing, defence, transport and information technology. This ensures Mincom ads significant value to our customers' businesses through industry professionals focused on delivering the optimal business outcomes for each organisation.

For the past two years Mincom has been a member of the Australian Steel Institute (ASI) and has supported a number of ASI initiatives such as the Queensland Technology Integration Forum. Mincom provided consulting services through the facilitation of a series of workshops that addressed the integrating of technologies within the steel industry supply chain. The ensuing report identified a number of opportunities that exist in the steel industry to reduce lead times for quoting, ordering and processing, reduce errors and eliminate re-inputting of information.

Appendix A: WA Workshop Summary

The business processes for both Request for Quote and Ordering/Processing follow the same steps as those defined during the Queensland workshops. The main difference is that in WA it is the norm for detailers to provide 3D models and CNC data to Fabricators.

Organisational Summary	
Detailer Landscape	• 2 Major detailing companies in WA • Contract work both domestically (WA and Eastern States) and Internationally • Recognise the need for 'World Class' practices to compete against overseas, lower priced detailers • Typically provide 3D models and CNC data to fabricators • Only recently have East Coast fabricators requested CNC data, whereas the requirement has existed in WA for many years. • End customers may go directly to detailers, although this is not that common
Fabricators	• Work closely with Detailers • Have invested in equipment that utilises CNC data • Different machines with different capabilities will need the data represented specifically to suit that machine (for example a 3 spindle machine operates differently to a 4 spindle machine) • Prefer to rely on accuracy of detailers rather than manually checking the information from drawings • Revisions require rework, especially when only the text and not the 3D model is updated • Identified a lack of technical skills and training of up coming personnel as a potential area of concern • Complex equipment requires trained personnel • Most equipment can process the DSTV files containing CNC data. The equipment will pre-process data into the correct format • At the time of tender, need to work with detailers to ensure they understand what is required. • Do their own Material Take-Offs from the drawings (manual process) • Do own drilling, cutting, nesting etc • One particular example where the Fabricator uses specialised software to interact with the 3D models to provide accurate status reports and monitoring of fabrication process
Processors	• No specific information was received from Processors

Findings	
Commonalities with QLD	• Would prefer to be involved earlier in the process, e.g. during the engineering phase to ensure drawings/models have sufficient information for quoting • Revisions/changes cost all parties and need to be handled carefully • Competition is strong, with many competitors in the international marketplace • Efficiencies can be gained through greater integration, both at the data and the organisation level • Facilitated workshops/discussion forums add value to the industry, however, there needs to be actions resulting from these activities
Differences with QLD	• Detailers and fabricators work closely to ensure the data is presented in a form that is usable by the fabricators • Fabricators recognise the benefits of using CNC data and are prepared to invest in equipment suited for this purpose • Detailers are responsible for the accuracy of the data
General Observations	
Areas for further investigation	• Given the challenges faced in QLD in achieving the same level of data integration as used in WA, the following barriers identified in QLD require further investigation to understand how they were overcome in WA: • Liability in the case of CNC data not being correct • Availability/Capability of detailing firms to provide the required data • Available Training Courses/Education for producing 3D Models and CNC data
Areas of Concern	• View that the industry is going backwards, partly due to a leakage of knowledge and commitment to training • Some models are poor quality, particularly in the case of revisions, the models are not updated

Appendix B: SA Workshop Summary

The business process for Ordering/Processing follows the same steps as those defined during the Queensland workshops. South Australia is similar to QLD in that the detailers do not often provide 3D models or data to the fabricators.

Organisational Summary	
Detailer Landscape	• Variations in the degree of completeness of information produced. • Some can produce CNC data / 3D Models, however this is not the norm and is not required by fabricators • Provision of CNC data requires a high level of trust between the fabricator and detailer, this doesn't always exist • Generally produce the drawings in the format that is known to be accepted by the fabricator. • Quality of engineering drawings can also be improved (standards) • A hard copy of the drawing is always required, not just the data • There is currently a shortage of skilled draftsmen, and many of the best draftsmen are skilled in 2D packages, need to be careful to not lose these skills in favour of 3D models. • Recognised that now that Fabricators have CNC capable equipment, they will start demanding CNC data and go outside of the state to other detailers if SA detailers cannot meet the demand. • NC data is more costly to produce, this cost must be covered by the fabricator.
Fabricators	• Similar relationship with detailers as that observed in QLD, the work relationship is not as close as in WA. • NC data can sometimes be too accurate, or will need to be re-keyed because of the error rate • Responsible for managing the detailers in response to client requirements • Different applications provide different information, for example pro-steel will give lengths but not describe whether it is angle-cut • One fabricator has developed specialised software to get the cutting lists from different software packages (e.g. AutoCAD and Pro-Steel) • NC machines have not be widely used in SA up until 6 months ago, the requirement for CNC data is really only just starting to be seen.
Distributors/Roll-Formers	• Typically distributors will take CNC data and the hard-copy of the drawing • The hard-copy is required for nesting

Findings	
Commonalities with other States	• Training and skill levels are recognised as major inhibitors to using the required applications to produce accurate 3D models and CNC data • General concern at the level of experience of engineers and draftsmen as they graduate, they typically have less practical skills and still require additional training to be productive • Fostering of alliances between detailers and fabricators would help build the level of trust and therefore confidence in the CNC data to be used • Recognised that without CNC data being used, SA will be less productive to other states and so will lose business • Facilitated workshops/discussion forums add value to the industry, however, there needs to be actions resulting from these activities. All attendees found the open workshop discussion valuable.
Differences with other States	• Detailers and fabricators do not work closely together as is done in WA. • WA is mainly mining oriented work and so does not always need architectural work • Fewer CNC machines are in use, reducing the demand for CNC data
General Observations	
Areas for further investigation	• Similar issues as those identified in WA and QLD: • Liability in the case of CNC data not being correct • Availability/Capability of detailing firms to provide the required data • Available Training Courses/Education for producing 3D Models and CNC data • Software providers need to understand the requirements of both the detailer and the fabricator or distributor using the CNC data. • Benchmarks across the industry and consideration of all inputs (production, material etc).
Areas of Concern	• View that the industry is going backwards, partly due to a leakage of knowledge and commitment to training • Some models are poor quality, particularly in the case of revisions, the models are not updated

Appendix C: VIC Workshop Summary

The business process for Ordering/Processing follows the same steps as those defined during the Queensland workshops. Victoria is similar to QLD in that the detailers do not often provide 3D models or data to the fabricators.

Organisational Summary	
Detailer Landscape	• 30% of Detailing is direct with the engineers or as a value adding service rather than through fabricators • Most detailers can provide a 3D model • The majority of off-shore work is to fabricators, who all require CNC data • The CNC data must be the same view as the shop drawings – this is a standard requirement for US fabricators to ensure the process is streamlined. For Australia it is more critical that the data is accurate than the process being streamlined. • A hard copy of the drawing is always required, not just the data • As with the other states, an area of concern is the shortage of skilled people and availability of training programs to resolve this. This is of particular concern to the VISD • A course has been designed but the funding hasn't been available • Lack of skilled resources is becoming a major problem and is an area of concern for all detailers and fabricators. • There has been an increase in the demand for DXF files but the requirement for hard copy drawings will always be there • Changes and Variations can be more of a problem with CNC data, particularly if the changes are not clearly labelled or the components are re-numbered as a result of the change
Fabricators	• There were not many Fabricators represented at the workshop, therefore the majority of the information was provided by the other organisations. • Not only do the CNC files need to be in the correct format/file type, but they must also be in the correct view to match the machine requirements. There needs to be a level of confidence that the data is correct to get any efficiencies • 20-30% of the tonnage of steel could be processed using CNC data today, 6 years ago the percentage would have been zero • There has been an investment in CNC capable machines by both fabricators and processors in recent years • Material lists in advance would help in booking the required steel

	• The process may be more of an issue than the CNC data, detailers need to verify the models and drawings are correct before producing the files. • Changes and variations are also difficult to manage • Engineering drawings do not have 'clouds' to show variations • There is a lack of trust within the industry. A high level of trust is required for fabricators to use CNC data from detailers. • There is more architectural based work in VIC, which is different to the mining type work out of WA. Architectural work often has many more variations at a later stage and is of a more complex nature • Cost implications, both from investment in equipment and cost of errors • The steel industry chain is not easy for customers to work with resulting in a loss of business to other materials.
Distributors/Roll-Formers	• Material lists in a structured form and in advance would be useful to help forecast demand • For distribution there is a cost in getting stock in and holding stock as well as processing. This issue of supply could be reduced by using material lists in advance for planning. • Different machines require different data in different formats and may require different information. Detailers need to know which format is required or the data must be post processed.
Findings	
Commonalities with other States	• Training and skill levels are recognised as major inhibitors to using the required applications to produce accurate 3D models and CNC data • Majority of detailers are capable of producing 3D models or CNC data but don't because it is not requested • General concern at the level of experience of engineers and draftsmen as they graduate, they typically have less practical skills and still require additional training to be productive • Quality of engineering drawings was a concern • Cost of the software and training can be prohibitive to smaller detailing firms • Resistance to change and lack of trust is a barrier to accepting CNC data for automated processing • There is more investment in equipment that can use CNC data and an increasing demand for CNC data as well as drawings. • Facilitated workshops/discussion forums add value to the industry, however, there needs to be actions resulting from

	these activities. All attendees found the open workshop discussion valuable.
Differences with other States	• Steel work is mainly architectural, SA and WA is more mining related and therefore less complex • Slower uptake of CNC machines than WA or SA, so there is no pressure to provide data • There was more emphasis on getting the material lists and the downstream benefits of this.
General Observations	
Areas for further investigation	• Available Training Courses/Education for producing 3D Models and CNC data • Software providers need to understand the requirements of both the detailer and the fabricator or distributor using the CNC data. • Ability to provide material lists • Having detailers involved earlier in the process may improve lead times and quality • Better understanding is required of the capability of fabricators and processors with respect to the data required by machines • Value needs to be defined
Comments	• Forums such as the workshop are seen as very beneficial to the industry in general because all parties can discuss issues and ways to improve processes

Appendix D: NSW Workshop Summary

The business process for Ordering/Processing follows the same steps as those defined during the Queensland workshops. NSW is similar to most other states in that the detailers do not often provide 3D models or data to the fabricators.

Organisational Summary	
Detailer Landscape	• Detailers in NSW often deal directly with the builders rather than fabricators • Can depend on the timing of the project • Quality of the original documents from the engineers is not always very good • Most detailers can provide a 3D model but do not provide the data to the fabricator unless it is asked and paid for. • There needs to be a reward/compensation for providing the CNC data because of the benefits it brings • Changes and variations can be more of a problem with CNC data, particularly if the changes are not clearly labelled or the components are re-numbered as a result of the change • A hard copy of the drawing is always required, not just the data • As with the other states, an area of concern is the shortage of skilled people and availability of training programs to resolve this. • Need detailers who understand steel and not just those who can operate a modelling package • One option is to offer something at the end of the training such as a building certificate but have the trainees perform detailing as they are being trained • Detailers would provide data in the correct format for the merchants if they knew what format was required • The default format for CNC data files is DSTV. • There is better communication, understanding and monetary reward when efficiency gains are made
Fabricators	• Not all machinery can take the type of data that is produced and it may require re-keying anyway • There is one fabricator in Sydney that does notching which is where there is greater benefit from automation • Variations and changes cause problems from renumbering and not having the changes clearly identified • Reduces the benefit of CNC data • Most projects result in left over steel • Source material is based on the initial issue drawings which change over time

	• Not all types of fabrication and processing will gain from automation (e.g. cutting rectangles/low complexity jobs) • 75% of the NSW tonnage of steel is processed from 3D models. • Standards are required to be used for naming conventions and product identifiers • E.g. PFC 200 and 200 PFC mean the same thing but need to be correct according to the requirements of the machine • There are default standards but these are not used across the board • Data standards need to be defined if automation through integration is to be achieved.
Distributors/Roll-Formers	• Take-offs from drawings for quotes can be time consuming and involve a lot of effort from the distributors • Don't charge directly for the effort required to manually key the CNC data into the machines, therefore there is no direct cost reduction if the data is provided, there is however a reduction in lead times because it can take 3 – 4 weeks to do the take-offs and key in all the data • Projects run much smoother when the processors can talk directly to the detailers and fabricators rather than being at arms length

Findings	
Commonalities with other States	• Training and skill levels are recognised as major inhibitors to using the required applications to produce accurate 3D models and CNC data • Majority of detailers are capable of producing 3D models or CNC data but don't because it is not requested • General concern at the level of experience of engineers and draftsmen as they graduate, they typically have less practical skills and still require additional training to be productive • Quality of engineering drawings is a concern • Cost of the software and training can be prohibitive to smaller detailing firms • Resistance to change and lack of trust is a barrier to accepting CNC data for automated processing • Facilitated workshops/discussion forums add value to the industry, however, there needs to be actions resulting from these activities.
Differences with other States	• Steel work is mainly architectural (similar to VIC), SA and WA is more mining related and therefore less complex • Slower uptake of CNC machines than WA or SA, so there is no pressure to provide data

General Observations	
Areas for further investigation	• Available Training Courses/Education for producing 3D Models and CNC data • Software providers need to understand the requirements of both the detailer and the fabricator or distributor using the CNC data. • Better understanding is required of the capability of fabricators and processors with respect to the data required by machines • Equipment owners need to be able to publish their required data standards so detailers can produce the data in the correct format, this could possibly be achieved using a web site.
Comments	• Forums such as the workshop are seen as very beneficial to the industry in general because all parties can discuss issues and ways to improve processes • There were a number of issues raised and discussion points that may be resolved if a smaller group of people worked on a solution rather than having too many people involved.

Appendix E: QLD Workshop Summary

Objective

Identify the benefits to be achieved by reducing inefficiencies associated with moving data between supply chain participants.

Driver

Increasingly, Australian companies are competing with global players. These global players tend to be vertically integrated (i.e. fabricate, process, detail) whereas Australia relies on an extended supply chain. Global players are naturally integrated, as they are a single business whereas Australia is faced with integrating across the supply chain.

Issues

The fundamental issues discussed are similar to most inter-organisational integration projects. That is:

- Differing levels of technical capability across the participants. For example Detailers who use 3D versus those who use 2D and those who still rely on the drawing board
- Costs of achieving a more leveled technical playing field
- The need to better understand the business benefit opportunities
- The need to better understand capabilities/limitations - systems and business process
- Change Management
- Education for industry segment members

Observations

Initial discussions were largely focused upon the exchange of drawing and some supplementary data - largely manufacturing focused. It would appear that substantial opportunities could be accrued if discussion expanded to include integration of the engineering and commercial processes (e.g. tendering, purchasing, invoicing, project management, manufacturing planning)

This could be achieved in a phased approach.

- It would appear that there is an opportunity to extract greater value from data that is being accumulated across the value chain. For example drawings, plus parts lists, plus engineering/maintenance detail associated with the manufactured item could be supplied to the end customer (e.g. building, machine owner) for loading to their asset, maintenance, configuration management systems
- Initial discussions looked at issues between particular links in the supply chain (e.g. fabricator to detailer, fabricator to distributor). It is likely that many of the process issues and opportunities for efficiency gains will be in the crossover between links. ASI needs to ensure they map and critically review the integrated process.

The realities of inter-organisation integration are:

- The systems and processes of each participant are and will always be different (e.g. one participant upgrades their internal system before others)
- Participants have different business drivers, investment capacity, technical skills and levels of interest
- Not all participants require or will be able to provide all of the desired data

- Where a participant integrates with other multiple participants there will be a requirement to deal with multiple data formats;

    - Deal with differences in content (e.g. coded data may mean one thing to one party and something else to another);
    - Deal with different business rules (e.g. unless data item A is provided to partner Z, the file will be rejected).
    - Integration of any systems let alone systems owned by different organisations is a complex and ongoing task.

- However, the benefits are maximised when an organisation can standardise its business processes

Implementation
Therefore if ASI is to achieve its goal of increasing industry efficiency it needs to attract high levels of participation. To do so it needs to develop standards or guidelines that can cater for the wide variations that occur between parties. Rather than only focusing on technical issues such as file types, members should look to clarifying the following:

1. Define process choreographies that can be used by the majority of members (these processes can have options that cater for the more sophisticated organisations)
2. Define what data needs to flow within these processes and identify the base set of data required to provide efficiency improvement
3. Consider how organisations with only the minimum capability can participate. For example if a fabricator, merchant, processor could receive all the data they need in their required format, they shouldn't care if the provider of that data used 2D, 3D or Excel to generate it providing it is enhancing the efficiency

NOTE: Members will undertake the use of a more automated process at varying levels. The aim should be to attract as many participants as possible and as they compete with more automated participants the marketplace should drive them to increase their level of commitment to the automated process in order to compete more effectively.

Interestingly it appeared the majority of organisations relied on email (SMTP) for exchange of data. With increasing concerns over security of transmissions, and the need for reliable delivery, and compliance, it is surprising that there is not pressure to utilise more secure, robust channels.

In terms of benefits the discussion as always focused on process step elimination and associated cost savings. In establishing cost benefit of the integrated approach consideration should be given to indirect factors such as reductions in WIP process inventories, reduced risk of liquidated damages and improved production rates. These often deliver greater dollar returns than simple reductions in administration overhead.