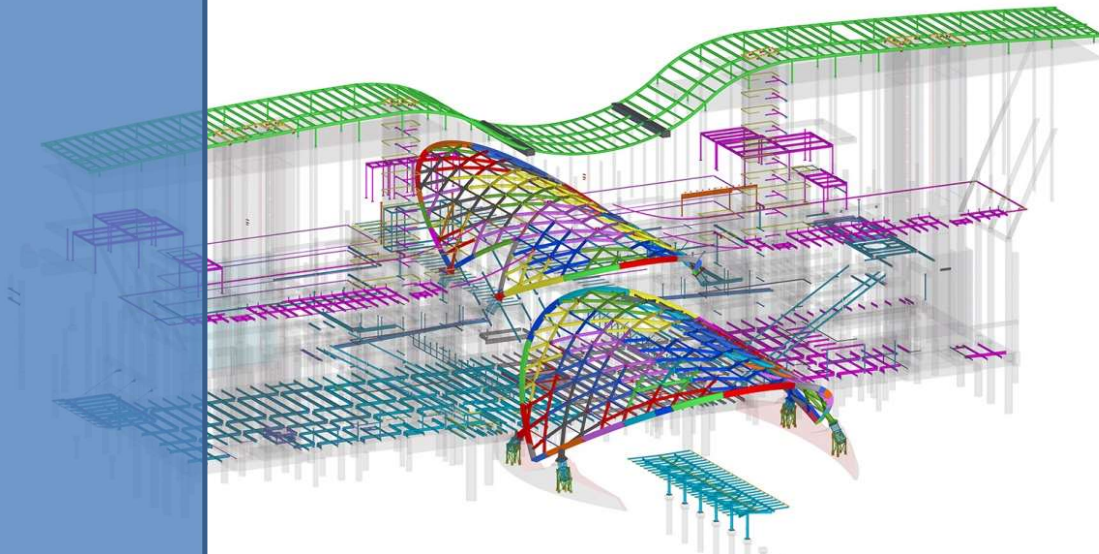


Informative Brochure

THE DESIGN - DETAILING PROCESS



March 2019



Accelerate Project Schedules

Lower Project Costs

Smoother Construction Process

1. OVERVIEW OF THE DESIGN-DETAILING PROCESS

The design-detailing process is a detailing method developed by Anatomic Iron Steel Detailing under which the engineer for the project holds the steel detailing contract as well as the steel design contract.

The steel detailing is commenced when the design is at only 40% complete and the detailer develops the steel model concurrently as the design is developed. During this collaboration period the detailer and the engineer continually swap models and updated structural drawings and the detailer provides information to the engineer regarding items that typically would become RFI's during the construction process such as steel conflicts, erectability concerns, or missing dimensions. In this fashion these issues are resolved during the design stage which is significantly more efficient than via addenda during the construction stage.

Using a model approval process rather than a shop drawing approval process the final steel model can be approved at the same time that the 100% complete issued for construction design set is released. This means that the engineer has an approved set of for-fabrication shop drawings ready to be issued to the fabricator within a week of the fabricator being awarded the steel project.

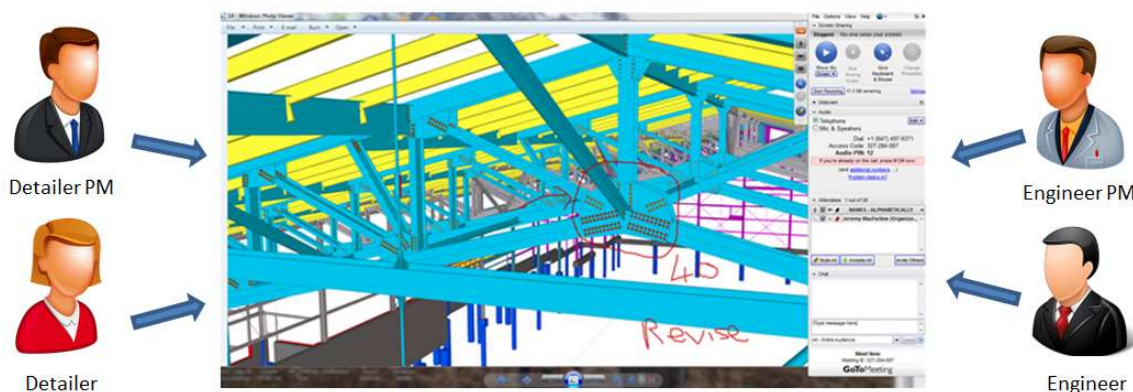
As a result the fabrication starts much earlier, and the construction process is both smoother and significantly shorter due to the fact that RFI's during construction are almost entirely eliminated. This results in a significant improvement to the overall project schedule and a reduction to the total project cost.

2. DESIGN COLLABORATION AND THE RFI PROCESS

The key element of the design-detailing process is the collaboration between the engineer and the detailer during the design stage. At this stage of the project there are no other trades involved so the engineer and detailer are free to work together without the stress of the fabricator and general contractor urgently requesting answers to RFI's.

We commence the detailing process when the design is only 40% complete, and communicate extensively with the engineer as the design evolves. As we build and update the model with revised structural drawings and revit models received from the engineer we advise of the traditional issues that the detailer comes across such as steel conflicts, erectability difficulties, missing dimensions, or required elevations. These RFI's are delivered and answered by the engineer in three ways.

Online Gotomeeting RFI review & model collaboration



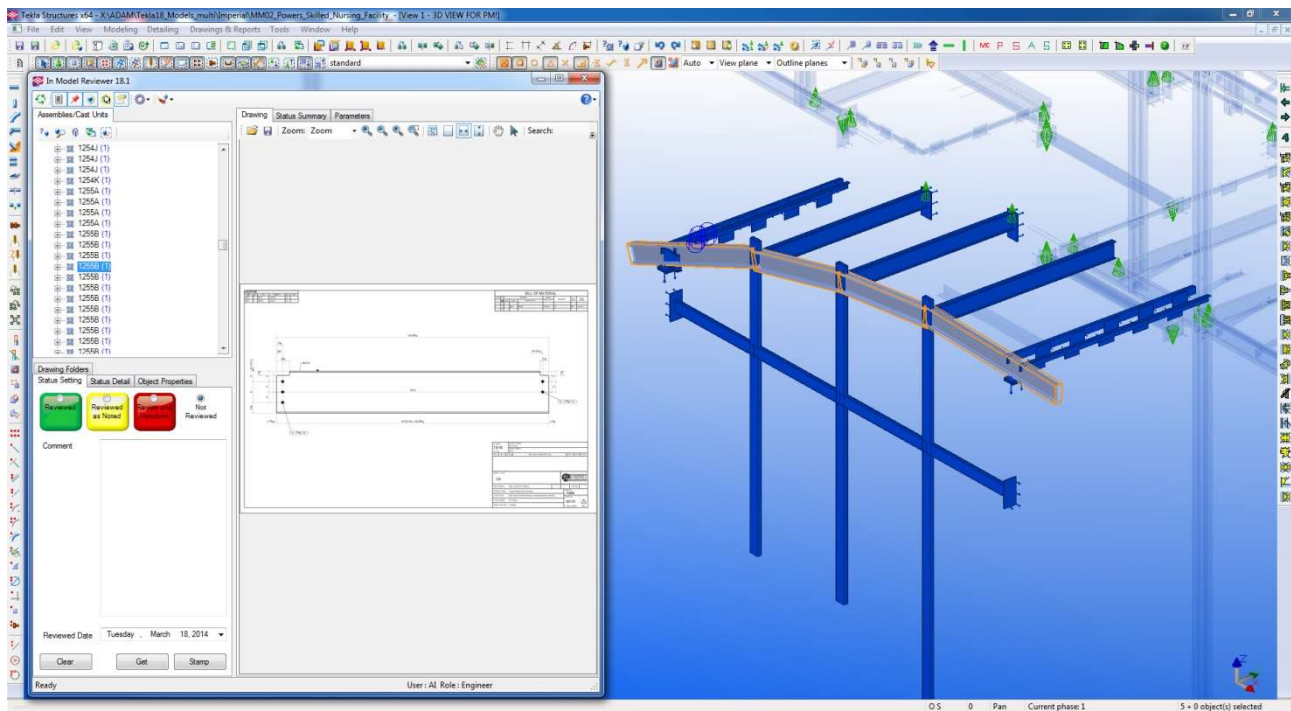
Firstly we can put them right inside the model that we submit to the engineer with comments attached to a specific element or as a note to an area. The engineer is using a Tekla engineering license and can answer these questions right inside the model and these models are simply swapped back and forth as the design develops. Secondly we can hold live online model review meetings once or twice a week. In this case we create a list of questions or problems, and answer this list in real time during the model review session which is very efficient. Thirdly we can generate traditional RFI's and submit them electronically via email to the engineer, whom answers them right on the RFI and submits them back to us via email.

With these options, the overall RFI process is very efficient due to the direct communication environment created by the detailer working directly under contract to the engineer. Furthermore, since the design is evolving during this process the solutions to these issues can easily be incorporated into the design. This is far more efficient than trying to incorporate these solutions after the drawings have been issued for construction and all of the other sub trades are involved.

3. MODEL APPROVAL AND FOR FABRICATION DRAWINGS

Using the design-detailing process we approve the steel model rather than the steel fabrication shop drawings. To achieve this we use Tekla's "In-Model Review" platform which is a collaborative model swapping and shop drawing approval platform. This software was developed by Tekla for the approval of electronic pdf shop drawings in a 3D model setting, but a convenient function of this platform is that it also approves the model element as well as the related shop drawing. This means that we can generate unedited basic Tekla shop drawings without any fabricator settings from the model and submit this model for approval to the engineer for review.

The engineer can then use this platform to review and approve these elements within a 3D model environment where the steel and the associated elements can be seen and element properties can easily be enquired since the model contains all the information. The elements are then notated by the engineer using the easy to use colored interface stipulating whether each element is reviewed, reviewed as noted, revise and resubmit, or not reviewed. They can also add comments to the element and stipulate what needs to change if revise and resubmit is selected. In this manner the EOR approves the elements within the steel model, before we generate the fabricator's customized shop drawings.



Screen Shot of Tekla's "In-Model Reviewer" platform

The reason for this is because an integral part of the design-detailing process is that the detailing is completed before the steel fabricator is selected. As a result, we do not know what the fabricators shop floor settings are and so cannot generate those customized shop drawings at the time the engineer approves the steel. By approving the steel model first we then only need to program Tekla with the fabricators settings once the fabricator has been selected. Once this is done, which typically only takes a few days, we can then generate the for-fabrication drawings immediately and these drawings will meet the fabricators shop settings whatever they may be. These drawings are then provided to the EOR since he holds the detailing contract, and since he has already approved the steel model he can simply stamp them, issue them to the architect for quick review and approval, and then deliver this approved for-fabrication set of drawings directly to the fabricator to commence construction.

4. PROJECT SCHEDULE ACCELERATION

There are two primary drivers that result in the significant acceleration of the overall project schedule.

Firstly due to the fact that the detailing process starts so much earlier on the project. In the traditional detailing model, the detailer works for the steel fabricator and thus will not be released to start the steel detailing process until after the fabricator has been awarded the project. Under the design detailing approach however we work for the engineer of record directly, whom has the detailing contract from the outset of the project. As a result, we can commence the detailing process when the design is only 40% complete. This head start results in significant time savings to the project, since the for-fabrication drawings can be delivered to the fabricator almost immediately after they are awarded the fabrication contract.

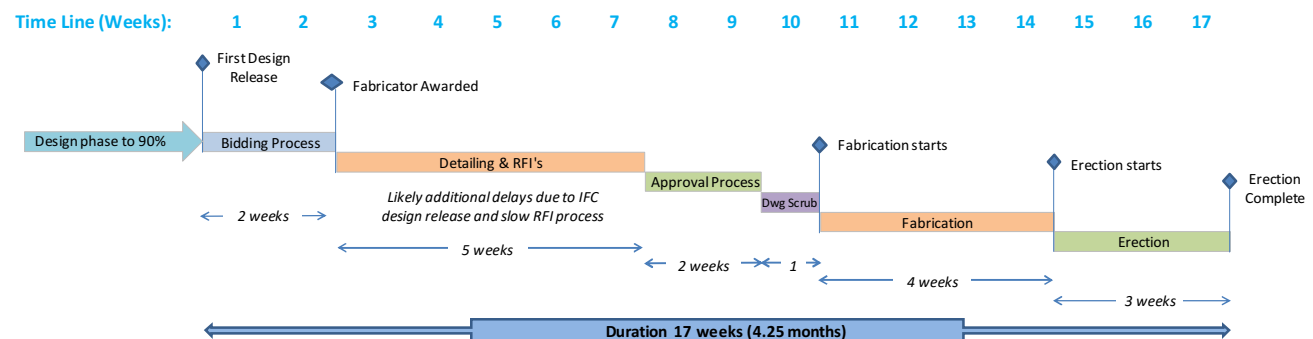
Secondly due to the fact that the majority of the RFI's traditionally generated by the detailer during the construction process are instead generated and resolved during the design phase privately between the detailer and the engineer. We completely avoid the slow and cumbersome traditional RFI process started after the fabricator is awarded the project. This traditional method with RFI's generated and sent through the communication path of detailer – fabricator - general contractor - engineer and back consistently derails a project schedule. Furthermore we completely eliminate situations where unanswered RFI's hold up the fabrication of the project, and we avoid the time consuming and costly conference calls and online meetings which must include managers from all steel trades including the detailer, fabricator, general contractor, and design team to go through the outstanding RFI's.

The following two gantt charts compare a typical schedule for a 400 ton project using the traditional detailing method vs the design-detailing method. As can be seen the project schedule can be improved by seven weeks:

Traditional Detailing Approach

400 ton Project

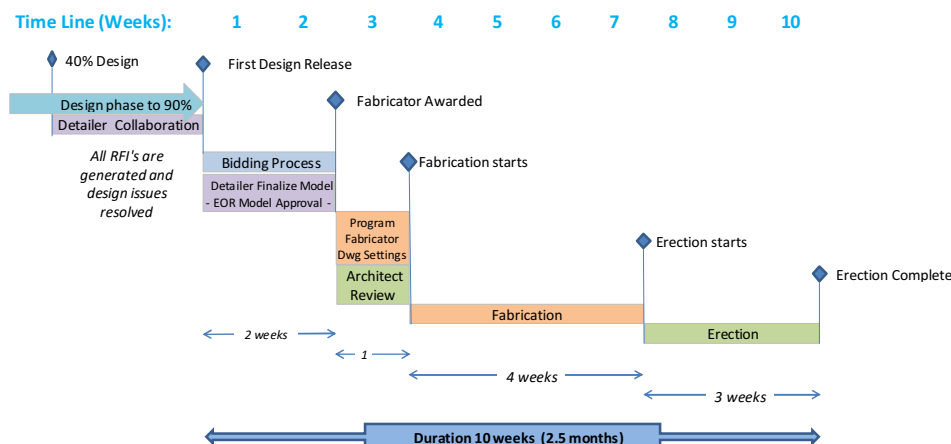
Typical schedule for a 400 ton project using the traditional detailing and fabrication approach:



Design Detailing Approach

400 ton Project

A typical schedule for a 400 ton project using the design detailing approach:



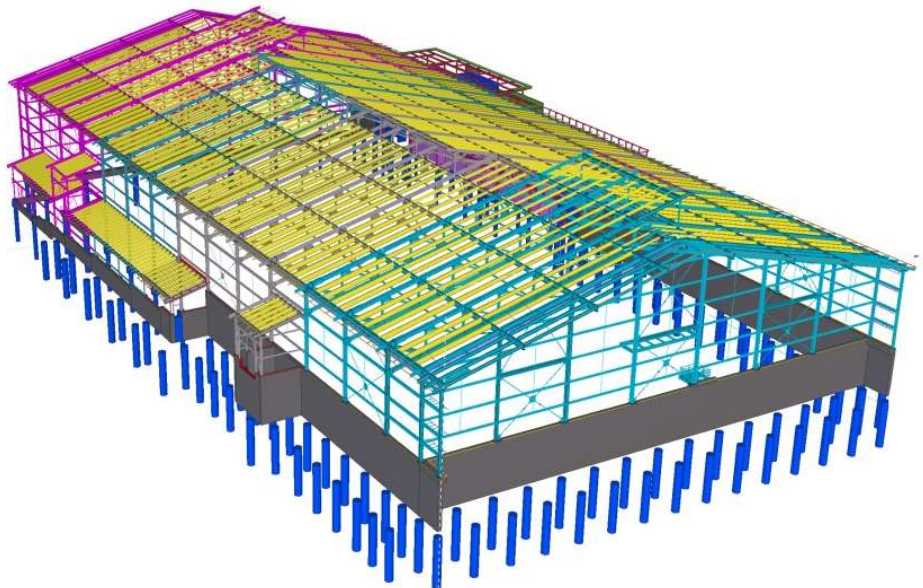
5. CONTRACTING RELATIONSHIPS AND PROJECT COST REDUCTION

Under the traditional detailing model the steel fabricator holds the detailing contract, but they don't get a great deal of benefit from it. There is a lot of overhead with the management of the detailing, as RFI's need to be reviewed and forwarded and coordinated back and forth. Furthermore there is a lot of communication with the detailer regarding scheduling, outstanding items, connection questions and otherwise, most of the answer of which come from the engineer or another party. It is true that the fabricator can bill for the detailing, and likely places a small margin on it but in our opinion this margin likely does not compensate the fabricator sufficiently for the management required.

Under the design-detailing process the engineer holds the detailing contract, but for that they obtain the benefit of the design consulting. This allows all the RFI's from the detailer to be addressed during the design phase rather than during the rush of construction. There are no more stressful calls from the GC to answer RFI's that are holding up construction, and no longer design addenda that are released during the construction process as a result of RFI's. The engineer is also no longer required to hold inefficient conference calls during the construction process to deal with RFI's that must be answered immediately in order to keep the project schedule on track.

To benefit the owner, costs for the project as a whole are reduced as well using the design-detailing process. This is due to three main factors;

First of all, extra costs from all trades are greatly reduced because the design is not revised during the construction process as a result of RFI's brought forward by the detailer or the fabricator. This is the greatest source of extra charges on a traditional project, since all steel trades are working off the issued for construction set. When the design must be revised to accommodate RFI's, the detailer and the fabricator both charge extra costs for these changes. By eliminating these changes during the construction process, we thus eliminate these extra charges. Thus the only extras that the owner should receive are for actual owner driven changes due to a design revision made per his instruction.



Denver Broncos detailed under the new contracting relationship for Martin / Martin Consulting Engineers

Secondly, project bids are a lot more competitive because the steel fabricators as well as the other trades have access to a completed steel model at the time of bid. The general contractor can provide bidders with a full bill of materials for the project which takes the guesswork out of estimates for both the fabricator and the erector, which leads to lower risk premiums.

Thirdly, since the schedule is so much faster overall costs are reduced on the project. The fabricator starts fabricating sooner with less management overhead. The GC has a faster project schedule and thus lower site management costs. All the trades have access to the steel model, so the BIM process is also less costly since there are less clashes as all trades can build their models in accordance with the steel model which is already done. All of these savings can then pass on to the owner, provided it is established that the project is a design-detailing project at the time of bid.

6. BENEFIT SCHEDULE FOR THE DESIGN-DETAILING PROCESS

The following table presents a summary benefit schedule for the various groups involved in the construction project from using the design-detailing process:

Benefits to Owner	Benefits to Engineer	Benefits to GC	Benefits to Fabricator
Project schedule significantly enhanced	RFI's through fabricator & GC eliminated	No steel RFI's thus far less overhead cost	No RFI's thus far less overhead cost
Building occupancy sooner thus investment revenue sooner	More efficient communication with detailer	Construction path shorter lowering field operating costs	More competitive quotes due to accurate material reports
More competitive quotes due to accurate material reports	Steel RFIs resolved during design stage rather than construction	More competitive quotes due to accurate material reports	Significantly enhanced project schedule improves profitability
Less delays and problems and less overall investment risk	No pressure from the GC to resolve RFI's during construction	Less field problems due to less revised steel	Fabrication can commence within one week of project award
Less extra cost claims from the steel trades	Control of the detailing contract	Less extra cost claims from the steel trades	Less delays and project problems
Owners rep spends less time on RFI issues during construction	Design drawings QC'd by detailer for conflicts and constructability issues	BIM process simplified as models built to the existing steel model	For fabrication drawings conform to shop standards

7. OUR PROJECT HISTORY USING THE DESIGN-DETAILING PROCESS

We began developing this method in 2010 and have since completed ten projects using this process. We have found that in each case there are fewer problems in the field, since the design is not revised during the fabrication period as is often the case using the traditional detailing approach. The following is a list of the projects we have completed using this process:

Project	Location	Client	Tonnage
1. Denver International Airport	Denver, CO	SA Miro, Inc	2,300
2. Denver Bronco's Training	Denver, CO	Martin/Martin, Inc	1,350
3. Health & Wellness Center	Denver, CO	SA Miro, Inc	610
4. Half Acre Building	Laramie, WY	Martin/Martin, Inc	580
5. Bioscience Two	Aurora, CO	Martin/Martin, Inc	500
6. CCD Sleb	Denver, CO	SA Miro, Inc	360
7. Powers Skilled Nursing Facility	Colorado Springs	Martin/Martin, Inc	260
8. Indian Peaks Medical	Frederick, CO	SA Miro, Inc	185
9. Red Tail Camp	Eagle County, CO	SA Miro, Inc	55
10. ADC Salon	Greenwood, CO	SA Miro, Inc	50

Of the above, the most complex project was certainly the Denver International Airport. The following section provides an overview of this project, as well as some model views.

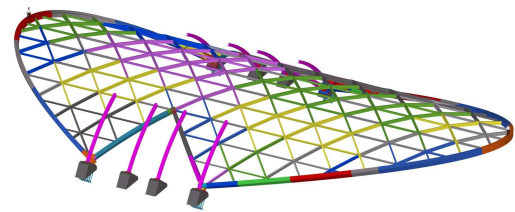
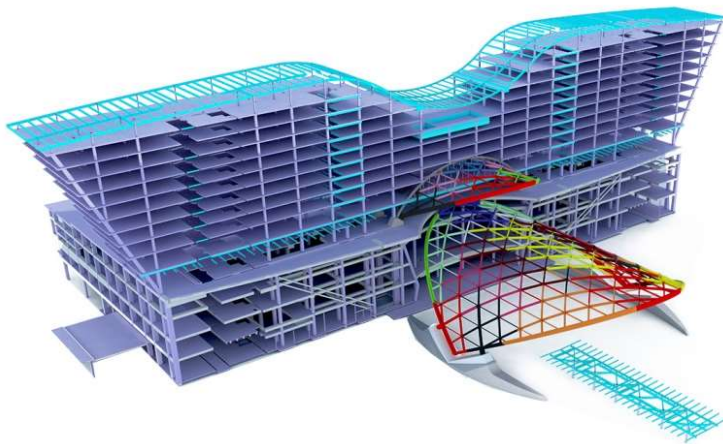
8. DENVER INTERNATIONAL AIRPORT

This project consisted of detailing a new hotel and commuter train platform at the Denver International Airport which together comprised of over 2,300 tons of structural steel, and was the largest project we have yet detailed using the design-detailing process.

The highlights of the project were two extremely complex and very large canopies, one freestanding and spanning more than 120 feet above the train platform and the other larger canopy extending under the hotel itself with arches above it to support the hotel. The larger canopy, measuring 205 feet, extends out on the north and south sides of the hotel as well as running continuously under it. The canopies are constructed using moment-welded diagrid technology which transfers the load across the surface of the canopy and down to the massive abutments.

The project schedule was enhanced significantly due to the design-detailing process as the complete joint penetration welding in many of the diagrid joints on the canopy involved multiple different internal stiffeners that needed to be welded at skewed and strange angles, often converging on each other in somewhat impossible ways. We are confident that if those connections had to be coordinated using the traditional RFI process through the fabricator we would still have been working on the first submittal rather than reviewing the erected steel in the field.

Mr Joe Rapp, EOR for the project at S.A. Miro, Inc commented "The project was an exceptional success. Having the 3-D model and collaboration available with the Tekla team working for us was a great asset to the project. The schedule benefitted greatly by having Miro carry the detailing contract."



Denver International Airport model views of the entire structure, as well as the hotel canopy that projects through the building.

9. SUMMARY

We hope that this brochure has provided you with a solid understanding of the design-detailing process and how this new detailing method improves the construction process. We are hopeful that as the use of this process spreads we will create a new collaborative environment where engineers and detailers are working together to reduce costs and schedules on all construction projects.

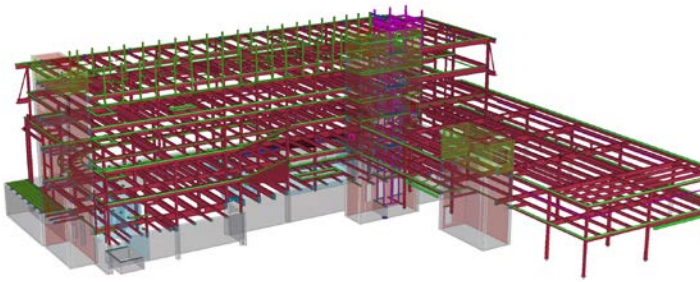
It will take some time for this process to gain market acceptance, but we are confident that as it develops all trades will see the value inherent in this method to each contractor involved in the project.

If you would like further information, or would like us to attend your firm to complete a presentation for your team please call us and we would be happy to accommodate you. Our contact details are on the back of this brochure.

Thank you for your interest in our company and this new detailing process!

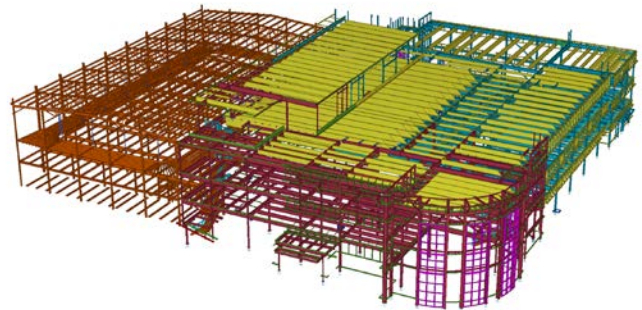


THE DESIGN-DETAILING PROCESS



*Health & Wellness Center – 610 tons
Detailed using the design-detailing process*

*Half Acre Building – 580 tons
Detailed using the design-detailing process*



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