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Visualize real-time steel production status in Advance Steel model & in A360

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Learning Objectives
• Understanding the cloud services included with Autodesk subscription
• Access critical data to make informed decisions from the field
• Visualize the production status of your projects in Advance Steel
• Deliver unique high-value low costs service to your client with real time access to his project production status

Description
Get ready to access real-time production-rich data ‘graphically’ from the field, on the move, or from your drawing office with a connected cloud-based BIM workflow. This class will show how to take advantage of Autodesk Advance Steel, A360/cloud and GRAITEC Advance Workshop to not only gain access to intelligent digital BIM data related to actual production and delivery (at LOD 500) live from the field but also how this can improve delivery coordination, reduce change order requests and minimize errors. Autodesk cloud changes the way live production information is accessed whilst on the move and the bi-directional link between Advance Steel and Advance Workshop takes full advantage of this to deliver production status information graphically in real-time anywhere any time. Working in a live and connected BIM workflow at the sharp end of the project also enables time and costs savings to be achieved across the whole construction phase.
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Your AU Experts

Carl Spalding

Starting his career as a structural draughtsman for a prominent engineering company in Southern Africa, Carl quickly worked his way up to DO Manager, and then Director of his own design company; developing practical skills born of real-world experience and a refined passion of adopting technology to eliminate repetitive tasks. Since moving to the UK in 2000, Carl has established a prosperous career within the Autodesk channel working with, and supporting both SME and major UK firms in the AEC and Infrastructure industry and gaining a wealth of industry knowledge and understanding of Autodesk’s extensive portfolio in the process. This knowledge combined with his strong structural background and his passion for innovation and ambition to succeed, has resulted in quick succession through GRAITEC ranks and is now Graitec Product Strategy Director where he is using his skills to influence the future of construction technology to come.

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Joseph is a structural engineer with more than 15 years of experience in the industry. Joseph is Product Line Manager for structural analysis and design products at GRAITEC INNOVATION SAS and also provides dynamic analysis and reinforced concrete consultancy to highly skilled GRAITEC customers. Joseph has also taught dynamic analysis and reinforced concrete design for more than 10 years at the French university, Conservatoire National des Arts et Métiers (CNAM).

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Introduction
The need to do more with less whilst working to minimal margins under extreme time constraints is an ever present reality in the construction industry. This magnifies as you move closer to the sharp edge of construction phase putting immense pressure on subcontractors who are working to even tighter margins, and with less time to spare for sharing digital information.

In this day and age we have access to platforms that enable, encourage in fact, the habit of sharing vast amount of data - email, social media, cloud services etc. As BIM data starts to filter across the entire design cycle the need to share data related to your involvement in the project with stakeholders is fast becoming a key criteria of your participation in the first place. Sure data drops typically managed by the GC will be in place where you will need to save your project files (typically drawings or pdf’s, but not limited to of course) in accordance with your project plan or BEP.

In this class however we’re talking about going one step further and proactively sharing digital data not typically associated with a drawing or model. To avoid any confusion and to be crystal clear from the start in this class we are referring specifically to the Structural Model.

The idea is to take collaboration to a whole new level of connectivity by sharing information-rich production data ‘graphically’, in real-time with your client (or GC) or indeed with the wider network of stakeholders to improve decision making process.

Offering your GC the possibility to have access to live production information which he can see in an actual BIM project model that updates as parts are actually being fabricated introduces a whole new meaning to a ‘connected BIM workflow’.

In this class will try to help you understand how you can start to take your project connectivity to the next level, making it possible for multiple sources to remain connected simultaneously throughout the project cycle and have access real-time digital fabrication status information, in the corresponding Structural BIM model, from the office or from the construction site, via a PC or even from your mobile or tablet device.
Understanding the cloud services included with Autodesk subscription

Cloud Services
The cloud is the easiest way to share data that is replicated in multiple sources simultaneously. There are multiple cloud based services available from a wide variety of sources from Google to Microsoft to Dropbox, all vying for business in a very competitive space.

The cloud (simply explained as data saved on a secure server accessed online or synced to your computer and mobile devices) enables data to be easily shared with others. A folder can be shared with others and as a file is added or amended it is immediately synchronised updating all other instances (when connected to the internet). This ensures everyone has access to the very latest data. In reality the cloud has been around since the beginning of the World Wide Web under different names but recently reinvented, and seriously simplified.

All cloud services offer free storage space and the ability to securely share data, however the biggest challenge with storing multiple file types is the ability to view them. This is particularly true of CAD and related BIM model formats which tend to be application specific.

Cloud services that enable viewing of 3D CAD and BIM models opens up new possibilities to share digital BIM data in real-time from and with multiple sources. This level of interaction with project partners starts to introduce new ways to visualize and represent digital information together with the working BIM model. But let’s not get ahead of ourselves. First we must adopt a cloud services from which we can capitalise on the viewing of BIM project models ... in this case Autodesk A360.
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Autodesk Cloud Services
There are multiple cloud based services available from Autodesk with many more services planned. The base of which is A360 included with all Autodesk product subscription contracts and accessed using your Autodesk Account. [https://a360.autodesk.com/](https://a360.autodesk.com/)

Autodesk Account / ID
Your Autodesk Account (also known as Autodesk ID) is a single sign in account that enables you to use the same user ID and password to access multiple Autodesk websites. This simplified sign in process makes remembering and managing your account information easier.

Sites Accessible with Autodesk ID:
- Alias Design Community
- AutoCAD Exchange
- **Autodesk 360**
- Autodesk Discussion Groups
- Autodesk Green Building Studio(*)
- Autodesk Labs
- Autodesk Learning Central
- Education Community
- International Communities
- Manufacturing Community
- Registration & Activation

(*) Access to this website requires a current Autodesk® Subscription contract.

Your Autodesk Account also provides access to your profile and all the products and services you have purchased or for which you have a subscription contract - however the levels of services available will depend on the types of products you have on subscription.
A360 Drive Folder on your PC
When you install an Autodesk product an A360 Drive folder will also be created on your local PC. Any data saved here will automatically be synced with your online A360 Drive folder.

To be able to use this folder you must first sign into your account from your Autodesk product tool bar:

Now you are ready to start to use A360 Drive to create folders and save data that you can share with others (even if they don’t have an A360 account).
Simply right click on any of the folders (from your PC or online) and select share, then can add the email addresses of your collaborators and set their access rights.

They will receive an email notifying them of the shared folder and a link to access it. When they login they will see all existing files and, depending on their rights, will be able to save files here too.
Any data saved in one of your shared folders by a 3rd party will instantly sync with your PC giving you real-time access to their data. If you select the Notify me option, you will receive an email notification when new content is added.

Access critical data to make informed decisions from the field

Defining exactly what critical data is?
Data is relative to who needs it and often mostly irrelevant until of course it is needed. At this point it becomes critical data. For me data becomes critical if it can help to make more informed decisions, if it draws attention to safety issue that may arise, if it enables bottlenecks to be predicted and eradicated, if it prevents delays occurring, or helps processes (businesses for that matter) to be streamlined and optimized. Generally any information that can aid the start to end process in a way that ensures efficiency and safety.

Displaying Data
So we know that data is critical but it’s not just having the data that counts. Importantly it’s how the data is presented or displayed that makes the biggest difference. This is why we take heaps of data, like figures in a spreadsheet or DB and create charts to clearly represent the data so that we can quickly identify key factors, differences or areas that need attention.
The same will be true of a real BIM workflow in the longer term. Right now we are only really interested in the basics like geometric information related to the element itself and its understanding of its relationship with other elements it is in direct contact with.

A window in a wall for example understands that it sits within the confines of a wall’s depth and removes a proportion of volume from the wall enabling it to behave accordingly when placed in a model. It may also contain information about its manufacturer, cost, and fire rating but these are optional and will only become visible when added to a drawing when the appropriate label is added or a corresponding list generated.

In the future however we may need to:

- Track the window’s progress through production
- Know the original source of all the materials to meet sustainability regulations
- Know and measure its entire carbon footprint from source to manufacture
- Know how long it takes to install so we can start to predict (simulate) more accurately the entire construction phase from the BIM model taking different choices to reduce delivery time or optimize resources before construction even begins

The list goes on... but this is where LOD 500 (Non-graphic information attached to the Model Elements) starts to offer additional benefits.

**Access to data from anywhere**

We live in a digital era, in the time of the Internet of Things where more and more things are, or are quickly becoming, connected. Digital data can be streamed or at least accessed from mobile devices almost everywhere. Being connected encourages (not guarantees) more efficiency as important information can potentially be at our finger tips. But again it’s not simply having the data but how we visualize it and what we choose do with it that counts.
In construction, making important decisions earlier in the design phase is only possible when relevant data can be visualized in a way that makes key factors more obvious. If for example something does not turn up on site when it is needed for installation this creates a reactive situation often with a knock-on affect in other areas. Whereas if it was known the day before, the site manager could take a decision and plan accordingly.

So now we know we can all benefit from access to more data, and we know that we could need to access this data from anywhere, and we know that we would also need to be able to make sense of the data in a way that enables informed decisions to be taken... so how do we go about it?

**Back to the Cloud**

No point adding an overhead to your workflow without a benefit right. So we’ve seen how to set up and implement A360 and shared project folders with our supply chain. Ok so what next? What are you going to ask them to save here? Perhaps you just want a simple way of sharing large files like DWG’s or Revit models (ave’s a bit of hassle with emailing large files of course) but is that it?

Nah we want more, so much more... We want access to the model and much more information and from anywhere. More we want it on the move and at any time!

- We want to check the status of production from our phone when at a site meeting.
- We want a visual representation of what has been fabricated.
- We want to see in my model what is due to be delivered today.
- We want to see in my model what was delivered last Thursday.
- We want to see in my model what is due in production tomorrow.
- We want to see in my model [add your preferences here]
- In short, we want the moon on a stick! 

**The Moon on a stick**

Enabling project related data to be stored on the A360 and shared with stakeholders opens up new possibilities. OK A360 alone is not yet ready to replace dedicated project collaboration services or BIM data drop services (although this workflow can be applied to any BIM ready construction centric collaboration service) but this will change with Alexandria project coming soon. In the meantime A360 is certainly ideal for enabling real-time sharing of work-in-progress project models and related data.

Like many cloud based service A360 enables any type of file to be stored however where A360 differs is that it enables online viewing and marking of DWF and 3DDWF.
More importantly there is an app for A360 so it can be installed on your mobile/tablet and these model files can be viewed directly on your mobile device. Combining BIM models with real-time production status information makes A360 a really great tool for key stakeholders (or anyone you choose) to access and visualize intelligent data from the field or anywhere.

**Visualize the production status of your projects in Advance Steel**

**Structural BIM workflow: FEM Software to Revit to Advance Steel to Advance Workshop**

Before we get to visualizing production status in Advance Steel we must first send the project to production, and in order to send the project to production we must first understand the BIM workflow that takes place in order for workable digital data to make the round trip back to Advance Steel.

**Note:** This class considers a GRAITEC and Autodesk product workflow (there are other software packages available of course) and assumes the model has been developed by the Architect in Revit and passed to the Structural Engineer. Thereafter the BIM model will continue to evolve in Revit and transferred to and from their FEM software for the design, eventually arriving in Advance Steel to add connections, secondary steel work etc. Once at fabrication-detail level the BIM model will move to Advance Workshop to manage production and as parts are produced data will finally arrive in Advance Steel to be visualized.
An example of this workflow can be seen in the image above and further explained in AU 2015 Class AEC10342.

**Connected BIM workflows**

We’ll pick up the workflow from Advance Steel using an array of BIM tools dedicated to collaboration either using industry recognized Import and Export formats or a connected workflow with Autodesk primary platforms such as Revit.

With the need to have a connected BIM workflows, Advance Steel is fast becoming the system of choice for steel detailing not only for its versatility but because it supports synchronized file sharing with multiple platforms including Autodesk Revit and Graitec Advance Design.

Technically this means a working model could be progressed simultaneously by different parties in independent systems and all changes synchronized between them. Current BIM workflows are not quite at this level of collaboration, or expected to be, but it is encouraging to know the possibility already exists for when BIM moves on.

For now we will assume the structural elements were isolated in Revit and shared with Advance Steel using the Advance Steel Extension in Revit.
Fabrication details with Advance Steel
Once transferred to Advance Steel and fabrication details, such as connections, secondary steel work etc. added and fabrication documentation created (based on localized preferences, templates and standards), the model is ready to be issued to the workshop for production.

Traditionally drawings, material lists, cutting list, etc. are used in workshops around the world for managing and planning production, ordering stock and setting task lists for different workshop personnel. Considerable resource, time and careful planning is needed to filter and sort through this documentation and its efficiency is prone to vary depending on the experience of those involved.

In this digital age there are many other options available for sending instructions to the workshop, such as NC files. An NC file is a simple text file that describes all the conditions of the finished individual part.

Other NC type formats such as NC-DXF, WISCON, XML, SXML, NC-IFC, etc. can also either describe parts, or the whole assembly, or the entire structure, or a combination or, in some cases, even include the fixtures and fittings.

The power of NC data
Typically NC files only ever seem to be used when the fabricator’s workshop is equipped with a CAM machine for processing the part (such as for cutting, drilling, scribing etc.). In these cases the NC file is sent to the machine and depending on the machines capability - for example it could be a cut and drill line - then it will filter through the NC file for these parameters and ignore the rest of the information that does not describe a process it manages – like coating, scribing, welding etc.
Here is a simple example of an NC file:

If you consider that the NC file contains all the information about a part – literally everything from the project number and part number to its assembly number, section size, grade, material, hole sizes and locations, coating type, end-cut definitions, cope (notch) location, part number scribing location, quantity, etc. – or other similar formats that contain the entire project including bolts, you have to ask… wouldn’t it be better to use these formats, and gain much more automation, instead of manually reviewing and managing drawings and lists?

The move towards BIM suggests huge savings to be made through the reuse of available information to drive or automate downstream processes – imagine the potential time savings and automation possibilities for steel fabricators...

Managing steel fabrication processes
Every aspect of a workshop’s facility, from the stock yard to the stores to cutting to drilling to welding is simply a stage of the fabrication process that a steel ‘part’ will either visit (or skip) on its journey to being fabricated. This is irrespective of if it is being made by a machine or by a person, or even if more than one task is required at each stage (such as cutting and drilling) or if the process requires both machine and human interaction across the whole process. There will also be a natural flow to the path or route each part takes as it travels through the different stages of the workshop.

For the purpose of simplicity we will refer to each of these stages as Work Centers.
distributing tasks to the appropriate Work Centers - remember a Work Center could be a stock yard manager, a painter, a welder, a chap on a press drill, a CNC Machine or even a 3rd Party specialist or galvanizing shop down the road.

One of the challenges that the PM faces is being able to predict every eventuality that comes with each project. Sure there are common elements but often there are several special requirements, such as thick plates or tube profiles that need to be subcontracted, or perhaps a section size which has an extremely long delivery cycle, or working out the amount of welding - or types of welding for that matter - and evenly distributing this among the appropriate personnel, all of this is not immediately obvious when the project gets issued to production when drawings and lists are used.

Without spelling it out one can easily see how much of an overhead this process can be. By contrary a good MIS system, like Advance Workshop, takes the NC data for the entire project and does this sorting and allocating in seconds.

Assemblies and Parts automatically assigned to Work Center’s based on a predefined workflow.

Capabilities associated with a Work Center (in this case a welder).
Managing steel fabrication with Advance Workshop MIS
So a good MIS system will be able to check every single part in seconds and identify exactly what each part needs done to it, in what order and, not only allocate these tasks to each Work Center but do it in a way that optimizes the workflow (or path) it takes in order to be made in the most efficient way.

Advance Workshop can distribute workloads evenly or based on varying capacity or even skill level and even take into account processes that need can’t be done in-house and need to be outsourced. This is just the tip of the iceberg... with intelligent material nesting algorithms reducing wastage, barcoding systems tracking parts and time sheets, and advanced analytics giving instant access to minute by minute production performance for the whole business or by each Work Center.

The demand for faster turnaround times, higher quality, better safety standards, complete traceability, reduced wastage, increased capacity and the need to generally reduce errors (cost), not to mention the influence of the next Industrial revolution (Industry 4.0) and the fact that CNC machines are becoming more effective and more affordable are stimulating investment at the sharp end of the construction cycle.

Other benefits of a good MIS system are material optimization, stock management, resource planning, production performance analysis, daily reports, etc.
Steel fabrication MIS software like Advance Workshop is not just for forward thinking steel fabricators looking to gain a competitive advantage but should be considered by all as essential business-centric system for managing and optimizing every aspect of their production.

Advance Workshop constantly collects feedback from each stage of production or Work Center developing intelligent performance data which is used for analyzing and optimizing production but it is also this data that can be delivered back to Advance Steel to visualize production status.

**Tracking Production Progress**

When a project goes live and is issued to the workshop each Work Center receives a works order for the work it needs to carry out. Depending on your process the works order could be a hardcopy printout (with or without barcodes), an electronic list delivered to a PC terminal in the workshop, delivered to a mobile device, or delivered directly to a CNC Machine — or a combination.

As parts and assemblies are cut, drilled, notched, profiled, welded, painted etc they are ticked off the works order — again either by scanning a barcode, marking it as complete on the PC terminal, ticking a list and handing it back to the PM (who enters this in Advance Workshop at intervals throughout the day), or by receiving feedback directly from the CNC Machine. All of this data is tracked in Advance Workshop and each part is updated accordingly.
**Scheduling Shared Updates**

In Advance Workshop each project is managed as part of a collective and considered with all other active projects for things like material nesting optimization or workload management and so on, but they are also tracked in their own right. This enables Advance Workshop to save project updates at predetermined intervals (hourly/daily/weekly/monthly/etc) set by the user. The location to save the data is also determined by the user.

This brings us full circle back to A360. The Advance Steel user can share their A360 project folder with the Advance Workshop user who can select this as the folder for saving project updates.

**Deliver high-value to your clients with real time access to project production status**

**Bringing things together**

In this section we will bring all the above together to show how we can receive and apply production status information to our Advance Steel model, in a visual way, and then share this on A360 to be viewed on site.

**A360 Drive – steel production progress XML**

In the first part of the class we covered A360 and we shared a folder with our Steel Fabricator who uses Advance Workshop. We requested they save any progress update files here for our project and the steel fabricator scheduled recurring updates to be saved to this folder automatically.

Now we will take one of these files and apply it to the Advance Steel model so we can easily identify the production progress.
Applying Production Status updates to your Advance Steel model

With your project open in Advance Steel click the Check Status icon on the PowerPack Ribbon:

Navigate to your A360 Drive and select one of the files provided by your steel fabricator. The update file is intrinsically linked to your project model and will automatically apply a color style to your project as follows:

- **Red** – Awaiting Production
- **Yellow** – In production
- **Green** – Complete

We can visually see the status of each part as a direct result of where it is in the production cycle. Also by applying the production status to your Advance Steel Model additional fabrication information has been added to each individual element. This includes information like the supplier name, order reference number, the welder ID or name and even important details like the welder’s certificate number, and the key legacy information such as delivery date.
All of this fabrication data can be queried and filtered in the Advance Steel model. This is very powerful way to visualize a variety of conditions directly in your model and showing only the relevant elements. Incidentally searches and queries can be saved to the Project Explorer as part of your template for use on all projects. Doing this will enable you to set up default views based on standard conditions (like delivery date) giving instant access to various types of fabrication data in a graphical format, in a consistent way for each project and simplifying how the data is presented. Here for example we can search by welder:

Or by delivery date:
Or by Phase and Lot:

Or by LOT:

**Publishing a 3D DWF to A360**

So now your model contains fabrication data and you can visualize this in several ways directly in the Advance Steel model, the next step is to publish your drawing to A360 as a 3DDWF with the production status applied. With the appropriate production status applied in your Advance Steel project model type 3DDWF in your command line and save the file to the appropriate folder in your A360 Drive.
Visualize real-time steel production status in Advance Steel model & in A360

This will automatically sync to your online A360 folder and also be available for all collaborators to access (if they have rights to view the folder contents of course).

Remember one of the benefits of A360 was the ability for multiple CAD and BIM formats to be viewed directly online. These include DWG, RVT DWF etc.

Below we can see the 3DDWF we saved to A360 Drive which includes both the fabrication colour code based on its production status as well the additional fabrication information which was automatically added to the individual elements in the Advance Steel model. This is also visible by collaborators.

Please ignore the radical colour effect – Autodesk are working to fix this bug
Real-time access from the field with A360 Mobile App
Now this is where things get interesting. With the A360 mobile app for Apple or Android (mobile or tablet) these model files can easily be viewed directly from your mobile device... from anywhere.

Combining BIM models with real-time production color status information makes A360 a really great tool for key stakeholders (or anyone you choose) to access and visualize a variety of data from the field enabling intelligent planning to take place or informed decision to be taken if needed.

As a side note the workflow between Advance Steel and Advance Workshop, even publishing of files to a specified A360 Drive, can be fully automated.

As Autodesk develops their cloud platform it won’t be long before we will be able to load the main project model cycle through the production update files seeing the results displayed instantaneously.
Conclusion
There are a number of simple ways to easily improve your engagement with your supply chain offering a truly unique service and without adding hefty overheads. The processes described in the Class are relatively simple to adopt and what’s more have the potential to be completely automated.

Inviting your client (GC) to access advanced production information on a daily or at will enables them to make more educated decisions, be more coordinated, plan ahead, and even adopt to a just-in-time work schedule. This type of data has the potential to enable site resources to be optimized, minimized even, reducing health risks and improving site safety standards.

We hope by adopting the process described in the Class enable you to change the rules of engagement, raise the bar to a whole new level and make yourself a first-choice indispensable business partner.

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