AUTODESK UNIVERSITY 2013

Improving Your Deliverables with Revit Structure and SDS/2 Connect

Doug Evans – Design Data
Steven Vasquez – Chavez-Grieves Consulting Engineers

Code SE2311

Learning Objectives

At the end of this class, you will be able to:

- Understand a real-life workflow for model transfers sent from engineers to the manufacturers via the Revit Structure model.
- Learn how connection design can incorporate erection clash avoidance into the design phase with your Revit Structure model.
- Gain knowledge from a real-life user, how using SDS/2 Connect with Revit Structure has improved their delivery process.
- Hear three case studies about the implementation process of SDS/2 Connect model transfers and connection design in Revit.

About the Speaker

Doug Evans is vice president of sales for Design Data and has been with the company over 20 years. Throughout his two decades in the steel fabrication industry, Evans has been a part of many technology initiatives and panels. He was involved with the design and delivery of some of the first CNC interfaces between CAD systems and fabrication equipment in the early 1990s. Evans also has served on the Intergraph Structural Committee and continues to serve on many AISC advisory boards that are involved in maintaining industry file transfer standards and presenting industry awards. He has helped concept many products for Design Data over the years, with the latest being the rebranding efforts you see today from Design Data. Before joining Design Data, Evans spent five years as director of marketing for the Gallup organization. He has a bachelor of arts in business administration from Nebraska Wesleyan University, with a minor in computer science.

doug@sds2.com

Steven Vasquez has been with Chavez-Grieves since 2002 and holds a Bachelor of Science in Civil Engineering degree from New Mexico State University. Vasquez's focus has been primarily on structural engineering of fast track design-build projects, and he heads Chavez-Grieves primary design-build team. His ability to manage client risk while providing under the pressure cooker of large scale, fast track projects has been key to his success. Vasquez's project portfolio is extensive, with projects throughout the southwest, and includes many high-profile healthcare facilities, casinos, resorts and business complexes. Steven's repeat clients, both architects and contractors, are some of the largest, and most respected in their fields.

svasquez@cg-engrs.com

Understanding SDS/2 Connect

SDS/2 Connect is an add-in for Autodesk® Revit® Structure that incorporates the power of code-based connection design into the engineer's Revit Structure model. It also includes the ability to streamline the transfer of a Revit model downstream to the manufacturing level. Developed by Design Data, SDS/2 Connect is an incredibly powerful tool that can help design more efficient and cost-effective structures.

Code-Based Connection Design

The primary function of SDS/2 Connect is to provide engineers and designers with the tools to design connections within their Revit Structure model. To automate the connection design process as much as possible, SDS/2 Connect includes country-based connection design codes. Currently, SDS/2 Connect accommodates the United States, Canadian and Australian connection design specifications. Programming of European connection design code is underway and is expected to be released with the 2015 version of SDS/2 Connect.

There are five main factors that contribute to the process of how SDS/2 Connect designs connections: automatic connections, loads, connection adjustments, constructability and user connections. Understanding these areas will aid in your ability to apply connections more efficiently in your Revit Structure model and also help you understand how to manipulate those connections. Each section has a link to a YouTube video that will be shown during the Autodesk University presentation to help illustrate these factors.

Automatic Connections

SDS/2 Connect is capable of designing connections automatically based on user-definable preferences for what the system calls Auto Standard Connections. Auto Standard Connections are connections that can automatically be applied and will “self-determine” the connection type applied, based on set up and the framing condition in the model.

With the available set-up options, the user can automate the connection design process even further, allowing the system to do much of the work for them on simple connections. There is full control over the type of connection that can be selected for numerous framing conditions. In the image on the following page, you will see the default set up for wide flange beams framing perpendicularly into the web of a wide flange column. A bolted, double clip angle connection is the default, but can be changed to many other configurations.

Using Auto Standard Connections, companies can mold SDS/2 Connect to automatically create preferred standard connections for a project, and can significantly impact the time spent designing connections, then manually applying them again in another model.

Click here for YouTube video demonstrating framing conditions and auto standard connections.

Loads

SDS/2 Connect can design connections for a specific end reaction. Loads for designing connections are either input at each node or automatically set by the Automatic Design Load in the Design Criteria section of Set-Up. The default is set for 50% uniform allowable load or maximum web sheer, but can be changed to suit the user's needs.

If loads are present in the model from analysis done by an engineering software product, SDS/2 Connect can import that information to supersede the automatic design load. SDS/2 Connect has direct integration with CSC Fastrak to import designed loads and apply them accordingly to streamline the connection design process. SDS/2 Connect is also capable of reading loads from Bentley RAM and RISA Technologies RISA-3D once they have been brought into Revit Structure using their respective Revit add-ins.

Whether manually changing loads or importing loads, SDS/2 Connect quickly shows results of these changes in the newly designed connection based on the specific load. It may cause increases in bolt diameters, weld sizes, plate thicknesses and the number of rows of bolts.

High loads can also cause SDS/2 Connect to fail, or not design a connection. Filters can be created in Revit Structure to highlight these instances, and SDS/2 Connect also provides a search tool to help identify connections that may have failed during design. All connections that do fail during design provide a warning banner on the edit screen that helps to explain the point of failure.

Click here for YouTube video demonstrating the effect of loads in SDS/2 Connect.

Connection Adjustments

SDS/2 Connect users can make connection adjustments inside Revit Structure through the connection specifications fields. These areas allow you to make common adjustments to the connections, such as selecting steel near side or far side for a shear plate, changing setbacks, or adding moment to the connection.

Click here for YouTube video demonstrating changes in connection specifications.

Constructability

SDS/2 Connect considers the entire framing situation when designing a connection. That means that during the connection design process, it takes into account opposing members, fit up and constructability in addition to the load. The best example is shown in this video.

Click here for YouTube video showing constructability checks done in SDS/2 Connect.

Framing conditions also play into the constructability considerations that are a part of SDS/2 Connect. To speed up your connection design process, this add-in will analyze concerning framing conditions and it can change the connection automatically. Whether

it is the rotation of a column as seen in the video or interference from other members, the system can automatically choose another connection that will work, if your chosen connection fails.

Going even further, connections that require consideration for the erector, like copes for bolt clearances or equipment, are automatically incorporated in the design. The ability to include this kind of manufacturing knowledge in the connection design process results in better information and fewer RFIs or change orders later in the project.

The constructability checks that are built into SDS/2 Connect help designers and engineers identify potential clashes that could happen in the field much earlier. This can be incredibly valuable as early identification of clashes allows them to design their structure to avoid such problems before their reach the manufacturing and construction stage.

User Connections

User connections allow users to override the system-designed connection and manipulate the connection to meet specific requirements. For each Connection Edit screen, there is a check box that, when checked, allows you full editing capabilities over the connection settings. Whether changing plate or angle sizes, numbers of bolts, or materials used, the user has full control over the connection.

An additional feature of this modification is the cross dependency of each field. As you enter into a field, for example to increase the number of rows of bolts, SDS/2 Connect will show arrows indicated other fields you need to verify, length of plate, etc.

Click here for YouTube video showing user connections in SDS/2 Connect.

Model Transfer Options with SDS/2 Connect

While some companies focus on the connection design benefits SDS/2 Connect offers, others utilize the add-in for its model transfer capabilities. **SDS/2 Connect's model transfer capabilities can be used for free**, even if the SDS/2 Connect add-in has not been purchased. All the user needs to do is install the free 30-day trial and they will continue to have access to the export and import tools after the trial expires.

The model transfer of SDS/2 Connect is done through direct API development between Design Data and Autodesk, rather than through a translator language like IFC or CIS/2. The benefit to this is that the model is not limited by the capabilities of those standards. For instance, CIS/2 does not include rolled material information, so rolled beams do not come across as such with any CIS/2 file, whereas this information can be communicated directly through the SDS/2 Connect interface. There are a few options that users have in how they choose to handle the model transfers; we will briefly outline the most commonly used options.

SDS/2 Connect Export from Revit Structure to SDS/2 Detailing

Many users choose this as the preferred method for sending a Revit Structure design model to the detailer or fabricator. The model is exported from Revit Structure using SDS/2 Connect's model export tool, which creates an XML file that is small enough to easily be emailed to the detailer or fabricator. The XML file contains model information for all structural steel members in the Revit model. If connections are present, they will be transferred as well; however, users do not need to have applied any connections in order for the transfer to work. Because the detailers and fabricators are more easily able to start working from this model immediately, this process works well as an option for a one-time transfer to get the design model down to the manufacturing level in a more efficient format than IFC or CIS/2.

SDS/2 Connect Export from SDS/2 Detailing to Revit Structure

The upstream direction for this type of transfer is less commonly used, but is a good way to get a manufacturer's model upstream to the engineer *if they want to view the connection information in their native Revit Structure model.* More commonly, engineers might import an IFC or DWG reference model for collaboration purposes, though those models are not capable of including connection design calculations. The need to see connection information in the Revit Structure model would be the driving force behind choosing this method of import.

Round-Tripping Multiple Communications Between Revit Structure and SDS/2 Detailing

This method of transfer allows for the updating of information between Revit Structure and SDS/2 Detailing. The process behind this would assume that the designer or engineer created their Revit Structure model (with OR without connections) and when ready, sent it out via SDS/2 Connect to the manufacturer for detailing. The detailer/fabricator would then go to work on the model, adding connections (if necessary) and can create a file that once imported to Revit via SDS/2 Connect can update the design model with additional manufacturing information. This process then can be repeated as necessary.

The SDS/2 Connect add-in's transfer capabilities currently only extend to structural steel and connection materials. This is something to keep in mind when transferring models. To send additional manufacturing information like handrails or ladders back to Revit from SDS/2, a DWG reference model with the miscellaneous steel information is the best way to transfer that sort of model information.

Case Studies

Many companies are finding SDS/2 Connect to be a useful tool, whether they are using it for connection design, model transfers or a combination of the two. It really comes down to the individual company's needs and choice on how to incorporate it into their current workflow that determines exactly how SDS/2 Connect is used on a project.

In the following three case studies, you will read about how three very different companies utilized SDS/2 Connect to help them accomplish their goals on their unique projects.

Case Study One: Clash Avoidance During Connection Design

The Portland, Oregon, office of KPFF Consulting Engineers was one of the first companies to implement SDS/2 Connect in the design of a structure. The Oregon Military Depot project was a Level of Detail (LOD) 400 pilot project for the military and required a higher level of detail from KPFF's Autodesk Revit Structure model than they were accustomed to providing. KPFF's engineers found that the connection design functionality that SDS/2 Connect adds to the Revit Structure model was the most efficient way for their designers to include detailed connection information within the Revit Structure model.

As a traditional design-bid-build project, the detailer and fabricator were not involved early on in the project. In their application of SDS/2 Connect, KPFF used the add-in solely for its connection design capabilities in order to include connection materials in the Revit model.

Meeting Project Requirements

After exploring the possibilities of creating their own families to handle connections and the offerings available to the market, KPFF chose to use SDS/2 Connect to help them take their deliverables to the LOD 400 level. Level of development is a framework that helps those involved in the building process to describe the precision level of the Building Information Model as it moves from concept to design to manufacturing and construction. The LOD specification recently released by the BIMForum in September 2013 has clarified definitions for LOD, incorporating the American Institute of Architects' LOD definitions as well. This specification document can be found at www.bimforum.org.

To meet the LOD 400 requirements at the time this project was completed in 2012, KPFF basically had to provide the connection materials within their Revit Structure model. Those connection materials had to be present in order for KPFF to show their general locations, sizes, etc. The LOD specifications have since been altered and provide a little more clarity than they did at the time this project was done.

SDS/2 Connect enabled KPFF to reach their primary goal—to quickly and efficiently apply and control connection materials in the Revit Structure model. Connection materials like shear plates, clip angles, gussets and bolts were part of an automated connection design process rather than a manual application. This automated process enabled KPFF to not only add connection materials rapidly, but to efficiently generate connection sketches from their Revit Structure model as well. Simply by adding the connection material, SDS/2 Connect enabled KPFF to meet the LOD 400 requirements at the time.

Connection Design and Clash Prevention

While adding simple connection material to the Revit Structure model was the primary goal for utilizing SDS/2 Connect on the Oregon Military Depot, KPFF found added benefits to the tool: connection design and clash prevention.

In order to provide connection materials in the model, KPFF had to design connections. The LOD specification doesn't particularly care exactly how the connection gets designed, only that

the material is there. That being said, the main feature of SDS/2 Connect *is* its connection design. The automated process that allowed KPFF to apply connections within Revit Structure has code-based connection design embedded in that process. Simply put, if SDS/2 Connect adds a connection in your Revit Structure model, then it has been designed and has calculations to back up that design.

Immediately, KPFF saw the benefits of SDS/2 Connect's connection design process. For each connection that they'd applied in the model, they could instantly view the design calculations that the add-in used to arrive at that connection. Furthermore, they had all the design calculations available to them for documentation as well. The time savings from this alone are valuable in that the connection design and application to the Revit Structure model are part of a single process through a Revit add-in, rather than performing connection design in a table and then going back to Revit to apply the connection materials.

Additionally, SDS/2 Connect designs connections inside Revit Structure with the entire connection node or joint in mind. SDS/2 Connect considers the fit-up and constructability during its design process to reduce the number of erection issues in the field. For instance, if multiple beams are framing into a single column, all the framing conditions are factored into the design of those connections before any connections are applied. This allows the system to detect any issues that could arise from opposing members, ultimately helping to eliminate costly mistakes before they reach the field.

KPFF believed this was a huge benefit to them, as it enabled their designers to see the potential field clashes in their model and design around them. Having that information available so much earlier in the project allowed them to alter their design to better accommodate construction further along in the process. Being able to see the locations of stiffeners and gussets — common causes of fit-up issues — enabled KPFF to adjust their design accordingly. As a result, they were able to create a better designed model, eliminating many opportunities for requests for information (RFIs) to come back to them from the manufacturer.

Through the design-bid-build process for the Oregon Military Depot, KPFF completed their contract documents, utilizing SDS/2 Connect to aid in creating connection materials, sketches and design calculations as a part of the submission of their final deliverable.

Case Study Two: Using Design Models to Fast-track Manufacturing Models

Chavez-Grieves Consulting Engineers, Inc. out of Albuquerque, New Mexico, used SDS/2 Connect as a conduit to improve their model transfer between Autodesk Revit Structure and SDS/2 Detailing. The real story is in how Chavez-Grieves used this functionality to help them leverage the project while it was in question of even being built.

The project, Twin Arrows Phase II, was the second phase of the Twin Arrows Navajo Casino Resort near Flagstaff, Arizona. Chavez-Grieves was working closely with Sicon (the owner's representative) and Hunt Construction out of Phoenix, Arizona, at the beginning phases of the project. During the design phase, funding for the project came into question and Chavez-

Grieves agreed to do the steel detailing "at risk," meaning Chavez-Grieves agreed to produce their shop drawings in parallel with the construction documents, delivering both sets of drawings at the end of their process.

While this is not a common delivery method in the steel industry, it provides a marked advantage when working with critical timelines. Chavez-Grieves was able to handle this in part because they were already the engineer of record on the project when the funding came into question and were already invested in the project. As consulting engineers that provide steel detailing services, Chavez-Grieves has both engineers and detailers in house, which helps them make the delivery of at risk detailing services more achievable.

The ability to provide the construction documents in tandem with the shop drawings made it possible for the Twin Arrows Phase II project to become a reality. The at risk process allowed the timeline for the project to stay in place while giving owners more time for funding to be solidified. This also allowed Hunt Construction to avoid committing to a fabricator until the proper funding was in place. An added benefit of the at risk process was that the owner and GC had better leverage to get more competitive bids on the steel package due to the simultaneous creation of construction documents and shop drawings.

Defining At Risk Detailing

In a typical work process, construction documents are created, and then delivered to the fabricator or detailer for the steel detailing portion of the project. This can significantly draw out the process, because the detailer will re-input the model into their detailing software from the drawing set. Whether it is done manually or through an IFC or CIS/2 import, there is significant time spent vetting the model to be assured that it passed through the model translation well enough to be used as a manufacturing model. Once the model is in and vetted, there will inevitably be many questions that come up for the detailer, requiring multiple sets of requests for information (RFIs) to resolve those questions. Once the questions have been resolved, the model still must be detailed and put on to sheets to be ready for fabrication.

Chavez-Grieves has been able to streamline their delivery (as well as add services to their business) by offering steel detailing at risk on certain projects. The Twin Arrows Phase II was one such project that was fit for, and significantly benefitted from, an at risk steel detailing delivery process.

For design purposes, Chavez-Grieves authored the model in Revit Structure. Once the model was built and checked for accuracy in Revit, they then used SDS/2 Connect's export capabilities to transfer the model so that detailing could begin immediately. The ability to transfer the design model downstream to the detailer saved Chavez-Grieves over 40 man hours that would typically be spent building the model again in the detailing software.

By getting a jump-start on the model, the detailer was able to check it over and identify areas that may cause issues in the field and notify the engineer sooner. On this project, the roof involved complicated geometry with a radiused perimeter and hip and valley framing for

drainage. On a typical project, for the detailer to manually input this steel using only 2D contract documents, the roof alone would have taken days to work through and would have required significant communication through RFIs to reach the final result.

In contrast, for the Twin Arrows project, the detailer was able to receive the model from Revit Structure directly into SDS/2, thereby starting with a 3D visualization of the model rather than drawings. The benefit of this was that the detailer could easily see the design intent and start by identifying locations that needed adjustment, rather than having to model in the steel and rectify a multitude of RFIs before being able to reach that same point. With the engineer and detailer in the same location, many RFIs were solved by simple conversation, reducing the number of RFIs to zero when it came to design.

The timeline from project start to a deliverable package was about four months. Chavez-Grieves transferred the Revit Structure model to SDS/2 Detailing to start the detailing process (while simultaneously creating construction documents) in September 2012. By November 2012, the design was complete and the shop drawings were at 90%. The last 10% of the shop drawings were finished after the fabricator was selected in December 2012. After the fabricator, Able Steel, Inc., was brought on board, the last 10% of work was completed to adjust naming conventions, sequencing, etc. to meet the shop standards. Steel fabrication then began in January 2013.

The model transfer provided by SDS/2 Connect directly impacted the success of the project by getting a more reliable model from Revit Structure to SDS/2 Detailing sooner, making it possible to deliver a shop drawing package alongside the construction documents—a huge value when there are time constraints for the project. If you consider most projects don't even start detailing until receiving 100% complete contract documents, the ability to deliver shop drawings at the same time can significantly reduce project timelines, or as in this case, keep projects from derailing altogether.

Chavez-Grieves also believes the collaboration between Revit Structure and SDS/2 Detailing helped diminish the risk for all parties of the design team, construction team and most importantly the owners. The ability to transfer the design model quickly and accurately into the manufacturing model helped mitigate change orders and eliminate costly field fixes.

Transferring the Design Model to a Manufacturing Model

The SDS/2 Connect model transfer functionality uses the Revit Structure API to transfer the model, meaning there is no need for an IFC or CIS/2 file. This results in direct communication between Revit Structure and SDS/2 software without translation issues that can occur in standard file types. This feature of SDS/2 Connect does include round-tripping capabilities that allows direct communication of changes to be sent from model to model, complete with the ability to accept or reject changes to the model. The benefit of an API model transfer is in the fact that the communication of the model happens in a way that is the most efficient for both the products to interface, rather than each product reading and writing to a standard determined by a third party.

A model transfer facilitated by SDS/2 Connect allows a model to be transferred from a Revit Structure native model to an SDS/2 native model, resulting in an immediately useable model. For example, a design model that has beams set back outside the flanges of the column requires additional work or translation when it is imported using a standard file type to a manufacturing model. These issues don't exist in the API interface of SDS/2 Connect because of its ability to modify Revit Structure members, bringing it closer to the manufacturing model earlier in the design process. Standard files have their uses, but in this case the greater benefit lies in the ability to transfer a design model to the manufacturing model with a higher level of accuracy.

For the Twin Arrows Phase II project, Chavez-Grieves used SDS/2 Connect as a one-time transfer of the model, from Revit Structure to SDS/2 Detailing. Instead of round-tripping the changes, after the initial transfer, the two models were updated in tandem rather than via SDS/2 Connect.

Model transfer is only one facet of SDS/2 Connect. SDS/2 Connect also provides the ability to design connections within the design model in Revit Structure. Connections can be designed based on various code-based checks for a variety of types of structural members like beams, columns and bracing, and include full documentation of design calculations for those connections. SDS/2 Connect also provides engineers the added benefit of automatically checking for connection interferences, which can help eliminate erection clashes in the field.

Case Study Three: Methods for Combining Connection Design and Model Transfers

Steel fabricator Williams Steel Company of Jackson, Tennessee, found an opportunity to enhance the design process for more than just the structural steel package on the FLS-Ash Grove project in Midlothian, Texas. A heavy industrial project, FLS-Ash Grove is a pre-heat tower for a cement manufacturing plant. With over 3400 tons of steel in the project, the steel structure alone stands at 250 feet; add in the equipment and the stacks on the project, and the structure stands a total of 340 feet tall.

The FLS-Ash Grove structure lives up to its reputation as a heavy industrial project. The supporting center column of the structure is a W14x730, the largest domestically rolled shape sold. Moving up along that column, the W14x730 splices to a W14x665 and so forth as the structure grows in height. Heavier wide flange vertical bracing, with large gusset plates, are also commonplace on this project.

As we examine this project, we will discuss how Williams Steel and their sister company, WDE, Inc., worked together to design and fabricate FLS-Ash Grove, which is still in fabrication at the time this was written.

Enhancing the Design Model

While Williams Steel's main responsibility was the steel structure, they found they could add value for the owner and contractor by showing locations and sizes of the gusset connection in the Autodesk Revit Structure model. SDS/2 Connect helped them get the gusset plates into their Revit model in an as-built state, rather than an estimated reservation of space. The ability to show the structure closer to the way it would be manufactured has been infinitely valuable to Williams Steel. With Revit's live section feature, Williams Steel was able to show the owner and GC how their Revit model would translate to the field and quickly get those views to drawings.

In addition to the value added for the owners, Williams Steel chose to use SDS/2 Connect in Revit Structure to enhance the design process for the mechanical, electrical and plumbing (MEP) subs that were designing the structure in terms of locating large equipment, piping, cable trays, etc. By designing and applying the connections that would be critical to the MEP, the MEP designers were able to plan their models with more efficiency, designing around potential clashes rather than waiting to find them during the coordination phase.

Consider how valuable it is to have for MEP designers to have access to accurate gusset connections as early as possible when trying to design for tight spaces. Knowing the exact clearances that they have can greatly improve the design process and eliminate waste on the project.

In terms of enhancing the design process internally, Williams Steel found the benefit of SDS/2 Connect to be in the automation of connection design calculations. With the engineer of record (EOR) for the FLS-Ash Grove project at their sister company, WDE, Inc., using SDS/2 Connect, they were able to use the design calculations SDS/2 Connect and SDS/2 Detailing produce automatically as part of their documentation. SDS/2 Connect also helped in the generation of connection sketches to match the calculations in their contract documents.

A Unique Work Process

Williams Steel and WDE, Inc. worked jointly on the project, using Revit Structure 2013, SDS/2 Connect 2013 and SDS/2 v7.3. The model originated in Revit Structure, with 100% of the major structural steel input by the engineer.

The engineer took the time to ensure the model was input accurately, since that can affect the results when the model is transferred downstream. When working with SDS/2 Connect, the structural usage of members is important when it comes to transferring the model. In order for vertical braces to accept the connection design, their structural usage must be set to "vertical brace" not "beam" or "other." Similarly, the structural usage for a joist must be set to "joist" for the physical member to transfer downstream correctly.

Once the model input was completed in Revit Structure, the engineer used SDS/2 Connect to perform a one-time model transfer to send the model out from Revit to SDS/2 Detailing. At this point, the model existed in both Revit Structure and SDS/2 Detailing. Because having the

connections in the Revit Structure model was critical to this project, the engineer worked in tandem with the detailer to design the connections critical to the structure together.

At times, the engineer and detailer would work alongside each other in a conference room, moving through the model together to design and apply connections in parallel in both Revit Structure (using SDS/2 Connect) and SDS/2 Detailing. They focused primarily on moment connections and the large column splice and vertical brace connections, as those were the most critical to other parts of the project design. Some of the larger gusset plates measured at approximately 7 feet by 5 feet, so knowing the space they occupied was quite important.

Once the critical connections were applied in both models, the engineer completed the contract documents and was able to provide better visualization for the MEP as well as the owners and GC. The detailer went further into the structure to model less critical connections, as well as secondary and miscellaneous steel in preparation for creating the shop drawings.

The FLS-Ash Grove project is still under construction as of November 2013. All shop drawings and CNC files for fabrication were generated by SDS/2 Detailing. However, the collaboration between the engineer and detailer helped move this project forward smoothly by facilitating clash prevention as a part of design for all parties involved on the project.