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IPD: A Lean and BIM approach with BIM 360

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Learning Objectives

- Explain the key differences between a traditional siloed data project and a BIM 360 project.
- Determine the necessary BIM 360 modules for a successful IPD project.
- Establish the project's BIM 360 roles and workflows for each phase.
- Identify the project's delays and potential risks through BIM 360 Insight dashboards.

Description

One of our industry's greatest challenge is sharing timely information between pre-construction, and construction teams. Translating common communication deficiencies into an IPD approach makes the challenge even greater. Dealing with different teams outside your company, their unique workflows and varied project management tools can be overwhelming. It requires the adoption of a common data environment and established workflows between the owner and the rest of the IPD partners. Engaging into a Lean- BIM mindset attendees will identify the key elements to make the most out of the BIM 360 Docs, and Project Management workflows. We will go through the project's framework and bridge the gap of a traditional siloed data management with BIM 360. We have streamlined the stakeholder's communication by reducing up to 35% of response and approval times regarding RFI's, submittals and decrease up to 25% of the on-site design changes due design coordination process and field checklists.

Speaker(s)

Daniela is a Lean Construction and BIM oriented Architect who currently works at Hermosillo, one of the biggest general contractors in Mexico with over 55 years of experience in construction projects all over the country. In her current VDC Manager role, Daniela is responsible for developing, implementing, and reinforcing VDC strategies and technologies within the design and construction teams of the company. Along with her teammates and through Forge developments for data connections, she is currently working on leveraging the company's workflows and the BIM standards they have developed for the past 5 years. She constantly supports people, collaboration, and the transformation process.

IPD, where do we start?

This industry talk will portray the story of Hermosillo’s first IPD managed with BIM 360. Achieving a high-level of collaboration, this project seeks to become a reference for the Owner, Architect, Construction Manager and trade partners.

From the Construction Manager’s perspective, we will provide insights into how BIM 360 has been the best solution for managing IPD workflows for the first time, as well as promoting collaboration between team members. We will go through the IPD’s framework, team organization, main aspects on the platform’s decision-making, BIM 360 modules and lessons learned.

IPD framework vs traditional project delivery

Throughout the last century traditional construction delivery methods have started to integrate collaboration into its framework. The reason behind this is that owners are demanding better outcomes for the project’s profitability and operation. They are aware of the problems regarding time, cost and quality construction projects repeatedly have. Even though traditional delivery methods cannot be completely changed, Owners can influence on the degree of collaboration the projects will have to achieve their objectives. Many design and construction companies have opted to integrate collaboration into their workflows as part of their own Lean - BIM implementation, resulting in great collaboration efforts and better project outcomes.

The following table illustrates the main differences between traditional project delivery and IPD approach.

Traditional Project Delivery		Integrated Project Delivery
Teams are created by a hierarchical system. Management is top-down and teams work as individual entities.	Teams	Teams are integrated for collaboration. IPD partners are bound as equals and work for a common goal.
Design and construction phases are planned separately. Design deliverables are not considered while planning the execution.	Planning	Planning takes place into early stages of the project. Design and construction deliverables are tied to the project goals.
Design and construction processes are worked separately. Information is shared as required and teams do not communicate constantly.	Process	Design and construction processes are integrated and rely on the early involvement of the key stakeholders.
Projects are mostly 2D based and 3D models are not used for coordination and construction. Information is not standardized.	Technology	Projects are BIM based and 3D models are used for coordination and construction. Information is standardized through a CDE.
Unilateral decision-making. Risk is transferred between each team.	Agreements	Multi-lateral decision making. Risk is shared between partners.

Traditional Project Delivery vs IPD

Collaboration is the goal

IPD as a delivery method has become the representation of the highest level of collaboration in our industry. Not just in the behavioral aspect, but as the main risk/reward sharing environment a contract agreement can have. According to the AGC of America, there are three levels of collaboration to consider while choosing a delivery method.

- Collaboration level one: Collaboration is not contractually required.
- Collaboration level two: Some contractual collaboration requirements.
- Collaboration level three: Collaboration is required by a multi-party contract.

	Level One "Typical" Collaboration	Level Two "Enhanced" Collaboration	Level Three "Required" Collaboration
<i>Level of Collaboration</i>	lower ←————→ higher		
<i>Philosophy or delivery method?</i>	IPD as a Philosophy	IPD as a Philosophy	IPD as a Delivery Method
<i>Also known as...</i>	N/A	IPD-ish; IPD Lite; Non Multi-party IPD; Technology Enhanced Collaboration; Hybrid IPD; Integrated Practice	Multi-Party Contracting; "Pure" IPD; Relational Contracting; Alliancing; Lean Project Delivery System™
<i>Delivery Approaches</i>	CM at-Risk or Design-Build	CM at-Risk or Design-Build	Integrated Project Delivery

Levels of Collaboration vs Delivery Approaches

IPD falls into level three, collaboration is required contractually and the owner expects the IPD partners to comply with the project's collaboration strategy.

The value of collaboration

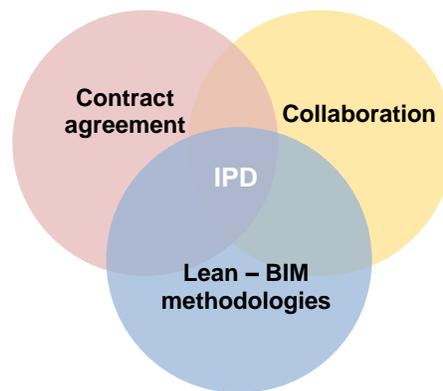
IPD seeks to leverage the contract development, goal alignment, design development, and Lean - BIM methodologies into the early stages of the project. As design and construction experts we have been driven to accelerate this work transformation to address the industry's waste of resources, low productivity, and technology innovation, as well as the owner's demand for value. We are being asked for added value projects in shorter time, so the need to capitalize knowledge and capabilities through technology is increasing exponentially.

Among the main IPD collaboration advantages we can find high quality design, schedule optimization, shared savings, reduced liabilities, coordination and enhanced relationships among teams.

Key IPD collaboration principles

There are many sources of information that will define IPD as a collaborative process corresponding to a contractual risk/ reward sharing scenario. That is essentially true, but for an IPD to be successful it has to cover the following characteristics:

- It has to be contractual**
 Stakeholders are partnered as equals, so shared financial risks/ rewards are based on the project's outcome.
- It involves behavioral changes**
 Partners willingness to collaborate, mutual respect between all parties, constant planning, coordination, and informed decision-making are essential.
- It requires the presence of catalyst**
 The management strategy focuses on Lean - BIM methodologies implementation throughout the project's lifecycle.



Collaboration Principles

Engaging into a Lean – BIM mindset

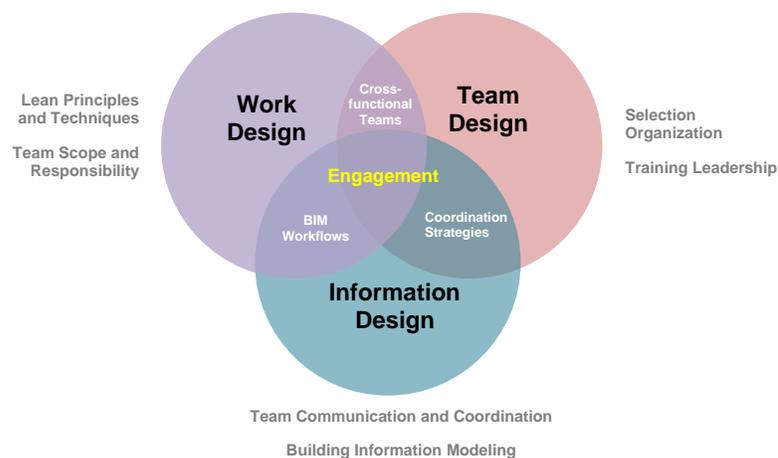
Now that the framework and key principles have been covered, we are going to concentrate on how Lean - BIM methodologies enhance the management strategy from the early stages of the project. According to the IGLC, IPD requires the creation of structures and work processes to efficiently execute the project.

Structuring your IPD strategy

With traditional delivery methods, every team works with their own standards, workflows, team organization and work strategy at their own risk. This has resulted in broken communication between the Owner, Architect, Construction Manager and the on-site teams, in addition to delays, cost overruns and adversarial relationships.

Therefore, IPD seeks to integrate the project parts into a whole and establish a clear strategy between all the partners to address the following:

- Work Design**
 It refers to the project's scope. How the activities are going to be divided, organized and executed. This includes the techniques, shared knowledge and the collaboration strategy.
- Team Design**
 Structuring the IPD teams will either make or break the collaboration strategy. It aims to capitalize the teams capabilities to reach the project's goals. Along with work design, this process balances the interests and responsibilities of all the partners.
- Information Design**
 This section leads us to the main topic of this industry talk. It focuses on the project's information management system. How data is going to be created, communicated, and exchanged throughout the project's lifecycle.



IPD Strategy Structure

While creating the project's information design, the BIM Execution Plan needs to be completed by the IPD partners to establish the project's milestones, level of development, coordination strategy and the information management system.

BIM Execution Plan

The BEP plays an important role on an IPD, in traditional delivery methods design development and construction documentation are not always aligned to the project goals. Information is untraceable, design expectations are unclear and milestones are unfulfilled.

The purpose of the BEP is to have transparency during all phases of the project regarding BIM deliverables. It is important to mention that the BEP is a live document, so follow-up meetings are required as contract development and planning progress.

BIM Kickoff meeting

During the BIM kickoff meeting the Owner, Architect, Construction Manager and trade partners have to identify and review the key sections and information regarding the project's development. In this meeting partners' engagement and understanding of the design and construction information take place.

On IPD agreements the BIM Execution Plan has to include at least the following sections for the project's BIM implementation to be a success:

- **General information**
This section documents the project's description, location, involved companies, key roles, and contacts.
- **Goals and uses**
It documents the project's BIM Management strategy regarding clash detection, 4D, 5D, FM, and the potential BIM uses of the model to achieve the established goals during each phase.
- **Process**
It establishes the workflows to integrate the model uses along with the information exchange goals.
- **Information Exchange**
Define the content for each information exchange, component models, LOD, plans, and sections among others.
- **Infrastructure**
Information exchange systems, software, templates, connectivity, bandwidth, and technology requirements.



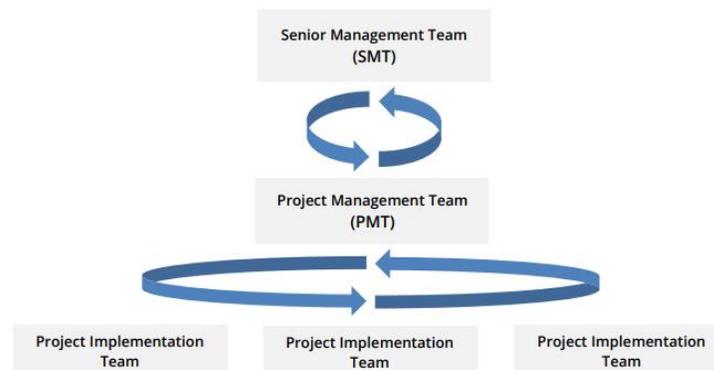
BIM Execution plan uses

Structuring the IPD teams

A multi-party agreement changes the dynamic of traditional management and teamwork. Therefore, team structuring is crucial for the project at both the project management and development level. The Owner, Architect, Construction Manager and trade partners are part of the core team involved in the consensus-based decisions to increase project efficiency and results.

The teams and responsibilities on an IPD have to be established as follows:

- Senior Management Team (SMT)**
 Comprised by one representative of each IPD partner. It typically involves project executives to conduct contract negotiations, changes and solve major disputes.
- Project Management Team (PMT)**
 Also known as the core team, it consists of one representative of each IPD partner. It is responsible of meeting the budget target and construction schedule, as well as conducting collaborative decision-making between partners. If disputes are not solved unanimously, the SMT will be involved as required.
- Project Implementation Team (PIT)**
 Responsible for work being done on-site. It is comprised by all the team members and consultants, as well as the subcontractors participating in the project. It is typically represented by the leader of each team.



IPD Team Structure

The current situation

IPD challenges traditional delivery methods and require stakeholders full engagement to the project’s framework and collaboration strategy. In this project, most of the partners had experience with collaboration level two and Lean - BIM practices. The owner was the only partner that had full experience with IPD agreements, which meant their influence and support was key for the partners commitment to the agreement.

The main challenges

As our first IPD, trade partners worked through many issues, drawbacks, and risks of abandoning the project. Some of the challenges we experienced involved the following:

- Core team members unexperienced with IPD
- Industry’s uneven Lean adoption
- Team members unexperienced with BIM management

- Comfort with true collaboration
- Team alignment around goals
- A single information management system

The need for a cloud-based solution

Once the IPD teams have been structured, the information management system had to be defined and stated in the contract agreement. For the Owner, it was crucial to mitigate the traditional project collaboration issues, such as siloed data between teams, outdated information, untraceability and unfinished workflows. Hence, a cloud-based solution throughout the whole project’s lifecycle was a must.

The solution requirements

The IPD framework states that information management system has to achieve the project’s collaboration and communication goals. For this reason, the solution had to comply with the next aspects:

- Access for all team members
- Workflow optimization and traceability
- Open and transparent communication
- Standardized information for all partners
- Propriate information being pulled
- Capitalize Building Information Modeling
- Storage security within the cloud

A common data environment

The essence of the CDE is to integrate the project into a single source of truth. Making data available to all team members with seamless information sharing reduces the need of time wasting retrieving information from different systems, repositories, and emails, as well as promoting collaboration between stakeholders.



BIM 360 Common Data Environment

Why BIM 360 is the best solution?

The next step was to determine which solution was the best fit for the project. Each partner was already using a solution for their own company and workflows, but we had to define which one would help us achieve the project objectives as a team. One thing was clear, the solution had to ease documentation management, overcome limitations of BIM, and enhance collaboration during design and construction phases.

Data makes IPD possible

With BIM 360, the Owner, Architect, Construction Manager, and trade partners were able to upload, review, and retrieve information from any location with a standardized system. Capitalizing the benefits of a model and the preestablished design and construction workflows, BIM 360 optimized project management through the whole lifecycle.

Among the main benefits of the platform, we can mention the following:

- User friendly interface
- Seat assignment flexibility
- Unlimited storage
- Interactive visualization
- Modules for each project phase
- Reporting and risk monitoring
- Integration with other information systems
- Continuous platform improvements

Delivering value with BIM 360

IPD partners rely on participation and clear communication, leading to positive outcomes such as true collaboration for design and construction, efficient submittals workflows, and reduced number of RFI's during the construction phase. With the different BIM 360 modules, the current "lonely BIM" issues present on traditional delivery methods were reduced.

Traditional Project Management		BIM 360 Project Management
Data is collected, stored, and retrieved by several participants without a standardized system.	Information management system	Data is collected, processed, stored, and retrieved by established roles and a standardized system.
The Owner, CM and trade partners are involved in the project until the design development phase is completed.	Collaboration	The Owner, CM and trade partners are involved from early stages of the project.
Coordination and clash detection processes are partially done. Construction teams are not involved.	Coordination	Coordination and clash detection are done during pre-construction phase and IPD partners are involved for their input.

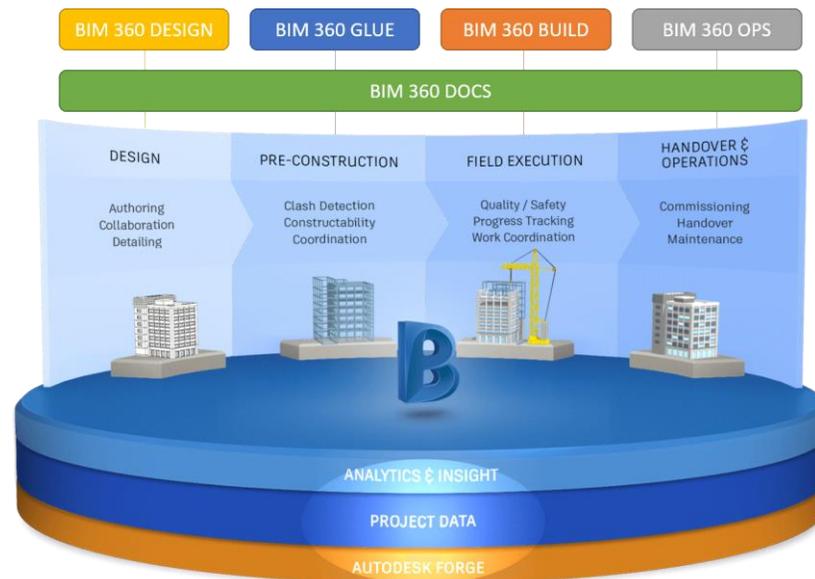
RFI's between parties are done by email and commonly do not have a standardized format.	RFI workflows	RFI's are managed through the pre-established workflows. They are role-based and require standardized information always.
Submittals are managed by email with no connection to the project's specifications and approvals do not have a standardized process.	Submittal workflows	Submittals are linked to the project's specifications and require a standardized approval process.
Quality and safety checklists depend on several formats, printed papers and a filing system.	Quality and safety management	Quality and safety checklists are standardized through templates and a cloud-based system.

Traditional Siloed Data Project vs BIM 360 Project

BIM 360 Modules

Aligned to the project's goals and the mitigation strategy for the traditional siloed data project issues aforementioned, the IPD partners carefully studied the workflows and functionalities of each BIM 360 module and determined the use of the following:

- BIM 360 Docs**
The repository of all the project's information. All the modules of the BIM 360 family connect with Docs to retrieve and create information.
- BIM 360 Design**
This module works with Revit Cloud Worksharing. It allows design teams to synchronize models on the cloud and easily share and coordinate information across teams for collaboration.
- BIM 360 Model Coordination**
This module provides a coordination space to upload, review and detect clashes between component models.
- BIM 360 Project Management**
This module works for submittals and RFI's workflows throughout the project's lifecycle.
- BIM 360 Field**
This module connects with the site team for quality assurance, safety management and issue tracking through checklists.



BIM 360 Design and Construction Data Integration

BIM 360 – IPD Management

One of the main benefits of IPD is the core team’s early involvement during early stages of the project. This influences the design process, workflows optimization and the overall outcomes. It is a great opportunity to employ lean methodology and BIM technology to promote information being pulled from the design, construction and control phases of the project. During each phase, BIM 360 modules streamlined information management between partners.

Design Management

Design and construction processes are very different, yet they have to be integrated and planned simultaneously. The design process requires several iterations and reliability towards design development and deliverables. Design management on IPD improves collaboration and removes waste regarding overdeveloping a model while changes and decisions are still being made.

During the design phase BIM 360 Docs, BIM 360 Design and BIM 360 Model Coordination allowed us to track design work across the project, keep key stakeholders involved and reduce the number of on going clashes, RFI’s and submittals during the construction phase.

BIM 360 Design Collaboration

The Architect was able to employ Revit cloud worksharing as the authoring tool for design development. Virtually co-locating multidisciplinary teams, the core team coordinated deliverables and tracked milestones meeting the requirements

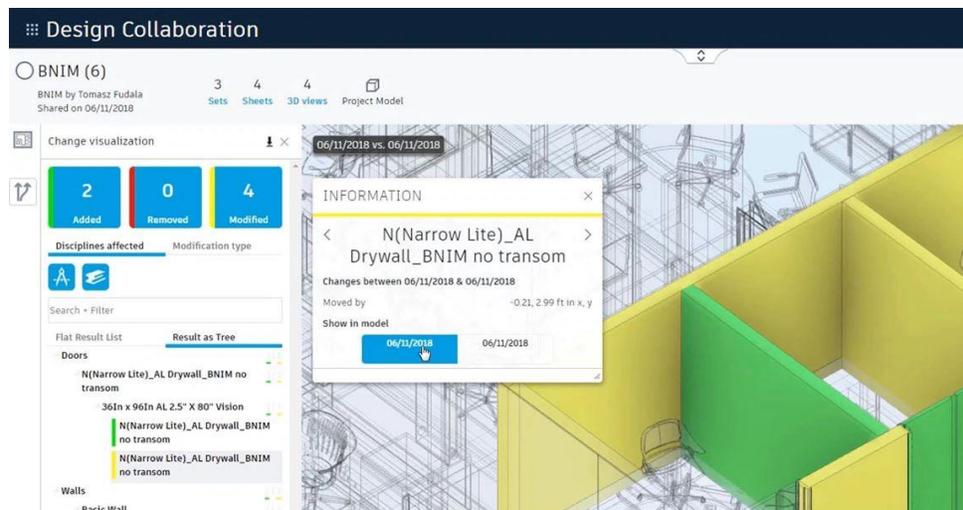
of the BEP. This way, trade partners could rely on the design phase timeline to plan the project's execution.

Because of the platform's friendly interface, design reviews took place directly on the Design Collaboration module. It allowed trade partners expertise contribution, as well as the resolution of coordination and design issues.

The available tools of this module gave place to reduced documentation time during the construction phase, along with the standardization of issue management throughout the project's life cycle.

Collaboration tools

- Revit sets deliverables
- Up to date models
- Master model and hypermodel features
- Component models visualization
- Issue management for design reviews



BIM 360 Design Collaboration

BIM 360 Model Coordination

During this process, multidisciplinary teams and BIM Managers realized clash detection on the cloud involving trade partners to provide their input. Due the module's connection to document management, we were able to maximize the simultaneous work done in Design Collaboration, no duplicate information was generated and all teams worked with up to date information. With BIM 360 coordination issues and role assignment we streamlined the traditional Navisworks coordination process and focused on the hard clashes that could impact the execution.

Coordination tools

- Coordination space linked to document management
- Federated model on the cloud
- Automated clash detection
- Issue management for coordination
- Version control



BIM 360 Model Coordination

Construction Management

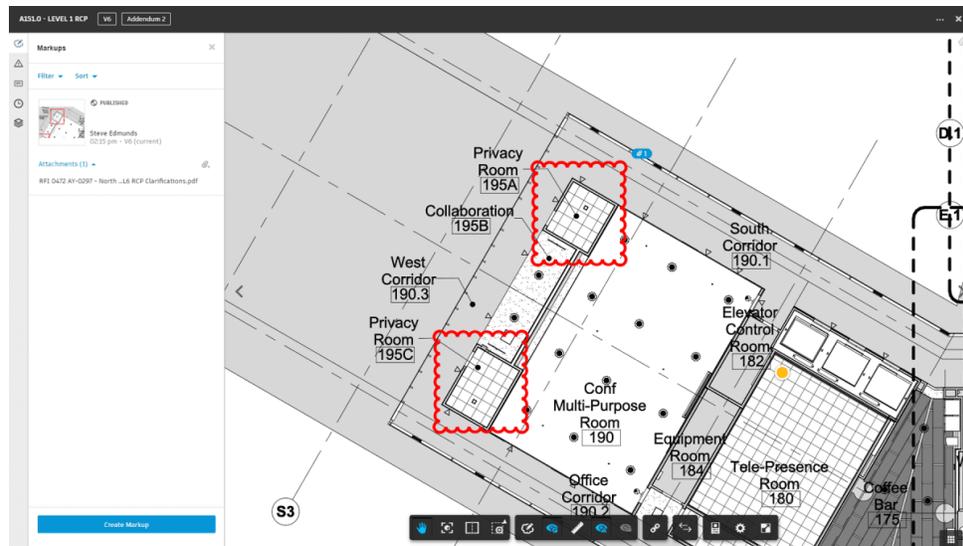
Construction management on IPD requires the continuous collaboration effort invested in design management. The goal is to document, share and communicate coordinated and validated building systems to the on-site teams. In traditional projects, information is unstandardized and depend on several sources of information. Impelmenting a model-based project with BIM 360, we were able to streamline the construction administration workflows. Trade partners coordinated their activities and tracked deliveries against milestones.

BIM 360 Document Management

Bridging the gap between design and construction phases with BIM 360 Docs, the core team and third parties were able to upload, retrieve and review information for multiple purposes such as permits management, reporting, risk monitoring, specifications and lean planning. Co-location throughout the project enhanced the collaboration process during the construction phase. Moreover, documentation administration was optimized with set assignments, transmittals, customized review processes such as design reviews and redlines, as well as issue management through all the phases.

Construction administration tools

- Revit model and sheets visualization
- Review workflows for drafting and consistency documentation
- Project files administration
- Transmittals
- Issue management



BIM 360 Document Management

BIM 360 Project Management

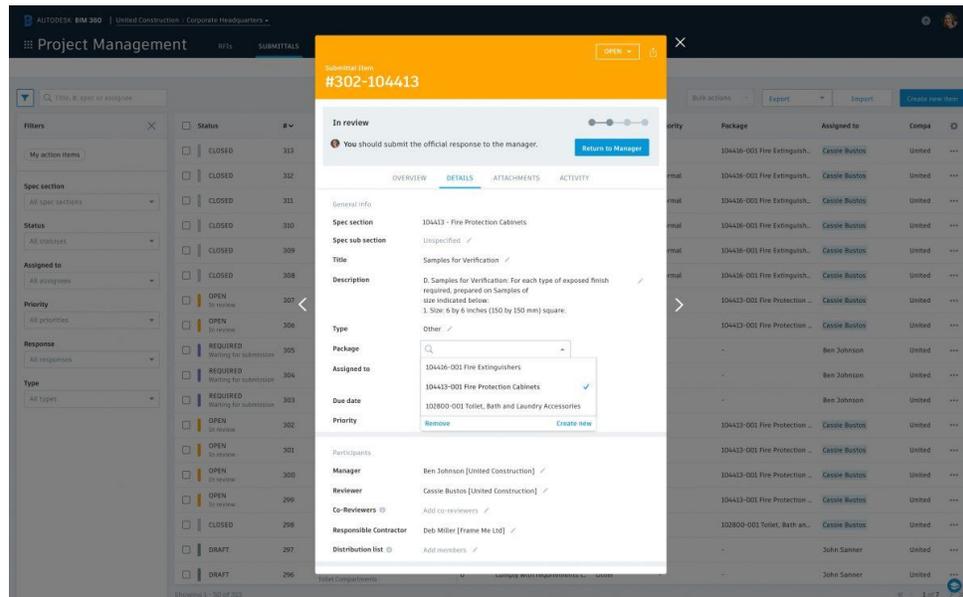
With this module we streamlined the traditional RFI and submittal workflows for participants that were not involved into early stages of the project. Traditionally, submittals and RFI workflows involve multiple participants, steps and information management systems before sharing them to the construction teams. Participants spent time wasting searching for plans, specifications and submittals, which translates into delays communicating information to key stakeholders.

Working with BIM 360 pre-established workflows, the RFI and submittal processes were automated and less construction administration was required. Establishing key roles such as creator, manager and reviewer, trade partners committed to the workflow and improved response times, as well as pending items resolution. With information integrated between modules, RFI's were linked and referenced to meeting minutes, document management issues and Insight dashboards.

Project Management tools

- Workflow role assignment
- RFI standardization

- Submittal management
- Specifications and items management
- Meeting minutes



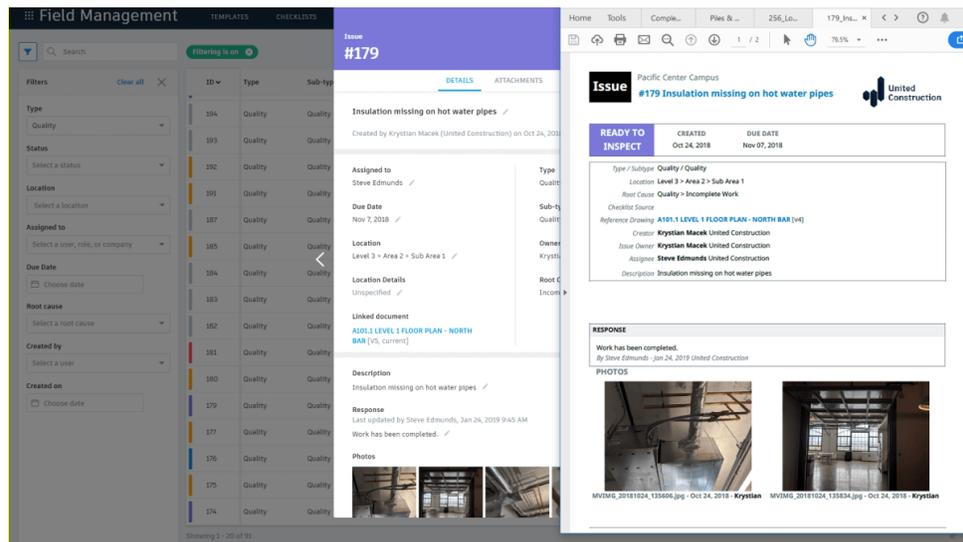
BIM 360 Project Management

BIM 360 Field Management

Trade partners were able to invest effort on studying the quality and safety strategies from the early stages of the project. In traditional projects, quality and safety tasks are usually managed through isolated platforms, formats and depend on a filing and printing system. With BIM 360, we were able to integrate both strategies into the same information management system. Increasing collaboration, trade partners were able to unify checklists templates for each task, determine issue types, keep track of on-site teams productivity and finally integrate them into their daily activities through mobile devices.

Site Management tools

- Checklist templates
- Safety management
- Quality management
- Issue management
- Daily logs



BIM 360 Field Management

IPD – BIM 360 workflows and roles

Working on IPD with BIM 360 requires a strategic definition of roles, responsibilities and workflows. IPD challenges traditional roles and require team members to take on new roles and responsibilities adapted to the project's needs. With BIM 360 custom roles and companies, we unified the core team's roles and established a joint organizational structure for the platform's workflows.

BIM 360 workflows and roles structure

The IPD teams require a high degree of leadership and engagement to the collaboration strategy. Each team manages different levels of information and decisions. Therefore, the team selection and role assignment have to be considered from the early stages of the project.

During design and construction phases, team members have to identify the source of information, amount of information needed, degree of accuracy, and the time needed to communicate this information. With this, we were able to streamline the stakeholder's communication by reducing up to 35% of response and approval times regarding RFI's and submittals, in addition to decreasing up to 25% of the on-site design changes due design coordination process and field checklists.

IPD - BIM 360 Roles

- BIM Manager**
 Responsible of monitoring the BIM strategy of the project. The BIM Manager oversees the established BIM 360 tasks, guarantees the correct use of the tools and workflows, keeps track of the BEP compliance and milestone tracking. Moreover, the BIM Manager is in charge of the project's risk monitoring, reporting, dashboard creation and training new members of the project on the strategy and tools.
- Single point of contact**
 Accountable of receiving and distributing requests to the responsible roles of completing BIM 360 workflows, such as transmittals, RFI's, submittals, review processes and issues. The single point of contact is assigned as RFI and submittal managers to distribute requests to lead architects and engineers.
- Architect – Engineer**
 In control of completing BIM 360 workflows, providing and approving design reviews, design issues, coordination issues, RFI's and submittals during design and construction phases.
- Owner and Project Manager**
 Responsible of consulting and receiving information from all the workflows. They don't necessarily take direct action on official approvals and responses, but may intervene when it is required.
- Superintendent and field engineer**
 In charge of retrieving information on-site for the project's execution. Active role in big room meetings, model and plans reviews, issue management and redlines process.

	Project Defaults								Account Defaults	
	Project Admin	Insight	Document Management	Project Management	Cost Management	Design Collaboration	Model Coordination	Field Management	Account Admin	Insight/Executive Overview
Architect	⊘	⊘	👤	👤	⊘	👤	👤	👤	⊘	⊘
BIM Manager	⚙️	⚙️	⚙️	⊘	⊘	⚙️	⚙️	⚙️	⊘	⊘
Civil Engineer	⊘	⊘	👤	👤	⊘	👤	👤	⊘	⊘	⊘
Executive	⊘	👤	⊘	⊘	⊘	⊘	⊘	⊘	⊘	👤

BIM 360 Roles and Modules

Performance and Risk Monitoring

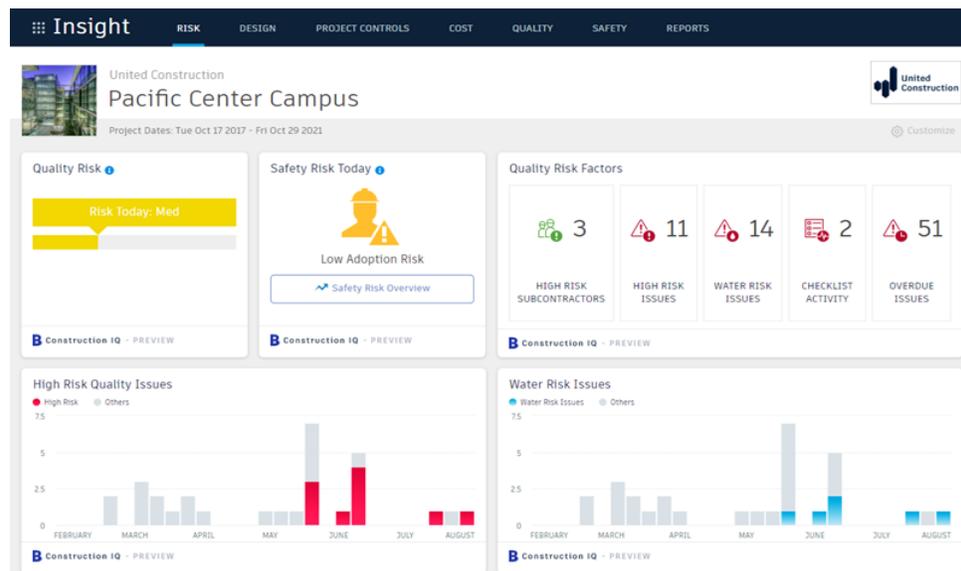
Traditional delivery projects commonly monitor risk through different systems and rely on updated data provided by the responsible roles. As a consequence, risk reports and dashboards become unreliable and mitigation strategies cannot take place correctly. Leveraging IPD risk/reward sharing conditions and the great amount of data collected from BIM 360, we were able to identify possible risks, uncertainties and prioritize them.

BIM 360 Risk Monitoring

With Insight module’s dashboards we were able to establish Lean - BIM key performance indicators tied to the project’s goals and visually track possible risks regarding workflows and planning. Managing a timely risk monitoring strategy, we streamlined data interpretation and communication through BIM 360 dashboards and Power BI’s integration.

BIM 360 key performance indicators

- Overdue issues by type and company
- Overdue RFI’s by company
- Overdue submittals by company
- Overdue review processes by company
- Incomplete checklists by company



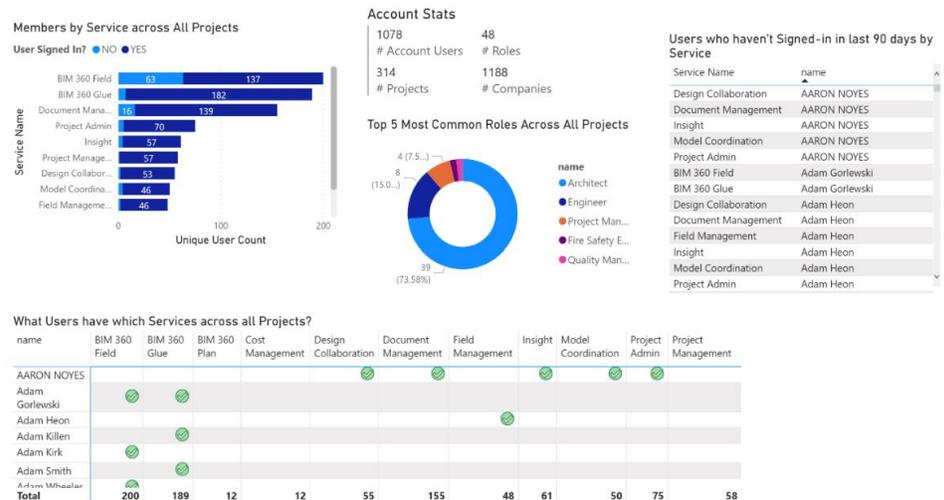
BIM 360 Insight – Construction IQ Dashboard

BIM 360 – Power BI Integration

Through BIM 360’s Power BI integration and Insight module’s reports, we were able to outline the key performance indicators of the overall Lean - BIM strategy of the project. As a result, we provided weekly high functioning dashboards for the core team to address the potential risks of the project.

Customized Power BI risk dashboard indicators

- Last planner indicators
- Project constraints
- Document control overdue items
- Quality and safety checklist conformance



Power BI - BIM 360 Integration

Lessons learned: looking into the future

- The Owner, Architect and Construction Manager will directly influence on the level of collaboration trade partners will have.
- Lean and BIM maturity degree between IPD partners are uneven. Early involvement of key participants will leverage a great percentage of management deficiencies.
- IPD partners have to define an information exchange strategy with BIM 360 from the early stages of the project and document it on the BEP.
- The BEP should to be tied to the project’s goals. Level of development needs to be clear for all IPD partners and be tracked against design deliverables.

- The core team and key participants should be tech savvy and comfortable with 3D model visualization. Co-location plays a big role on IPD as information exchange, visualization and decision making becomes crucial for collaboration.
- BIM 360 project hosting and number of licences must be established during the contract development.
- IPD partners need to consider the BIM Manager role for their organizational charts. BIM 360 workflows and tools require timely and continuous monitoring.
- The project's roles must be standardized along with BIM 360's workflows. The workflows efficiency is proportional to the invested time monitoring them, as well as the participants accountability.
- IPD partners must provide the adequate training, devices and bandwidth connection for the on-site teams.
- The risk management strategy must be tied to BIM 360's key performance indicators.
- The use of mobile devices must be considered for the execution phase and on-site teams.