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Functional Dashboards for Project Management Using Forge

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Learning Objectives

- Learn how to create information layouts for better decision-making using BIM 360 data
- Learn how to combine Forge modules to link visual reference with project data
- Learn how to use the information in BIM 360 Docs for risk analysis
- Learn how to track BIM 360 project performance on a daily basis

Description

The amount of information collected in BIM 360 software can be overwhelming. Besides, finding connections between data that can lead to project insight is not always easy. However, thanks to the flexibility of the Forge API and its seamless communication with BIM 360, it's now possible to connect information systems that highlight important data and enable better-informed decisions. Attendees will start by understanding the basic setup of a functional Forge-powered information dashboard. We'll then go through some of the main opportunities to connect information and discuss how to make the most out of the outcomes. We'll work using practical examples that provide tangible benefits to the project. In the end, we'll review how to find the required information in BIM 360, what it means, and where to start connecting it using the Forge platform's Data Management API.

Speakers

Camila is a technology-oriented architect with 5 years of experience in innovation focusing on coordination, visualization, and analysis of AEC projects. The current VDC Manager at Hermosillo, one of the biggest general contractors in Mexico with over 55 years of experience in projects all over the country. Camila led the implementation of the BIM program in Hermosillo and established a companywide culture of collaboration which follows the CM-BIM guidelines set by the AGC. In collaboration with key business partners and college institutions, Camila is also working towards expanding the adoption of BIM on a national scale. Some of the projects that have been successfully developed as part of Hermosillo's VDC program are, standardizing BIM aligned workflows, working on Forge development for data connections, developing VR workflows for coordination, and the development of an innovation lab where new technologies are tested for design/construction applications.

Julio is software developer and instructor with over 5 years of experience in the development of tools for the AEC industry. Currently working in Hermosillo where he is the manager of the developing team focused on BIM/VDC integrations. He works closely with the estimators, project managers, construction managers and other key roles in the company trying to understand their needs and optimize their workflows. His main task is to gather business needs and apply software solutions to improve efficiency. Simultaneously, he develops custom integrations for the construction industry using front-end and back-end tools.

Behind the need for a dashboard

It is common to hear that we are in the information age, the shift from the industrial revolution to the rapid growth of information technologies has shaped our lives in pretty much every way we thought possible. However, some changes came faster than others, and while some industries have embraced the idea of informed data shifting every decision; construction and the overall AEC industry have proven to be less inclined to look to what the information we produce may indicate about the future.

This document will address the need for a proper information shift in the construction industry by providing the knowledge required to create a project management dashboard. This dashboard will be used to record project information pulled from BIM 360 and visualize it in an effective way for decision making.

Learn how to create information layouts for better decision-making using BIM 360 data

The first thing to review when creating a dashboard is how it is going to be used to assess and structure project information for effective decision-making. BIM 360 is a powerful tool and an incredible source of data, however, the amount of information stored within a BIM 360 project can be overwhelming at first, making it harder to clearly organize. Therefore, a proper analysis of uses, requirements and objectives of the project is necessary to get a clear path of action. Then you will be able to harness the currently available data into an efficient visual format that will aid our users in managing the project.

In this section we will review the basics of information and dashboard design. We will also discuss the best way to start working with the available data in BIM 360 to come up with a functional layout, and workflow for the final project dashboard. From design elements to data management principles, a functional dashboard takes the available information, connects it, and presents the results in a meaningful way that will give our final user all they need to know, truly, in a dash.

Information design, basic concepts to consider.

The first step on creating any kind of data visualization is to define the objective of the project. This will set the parameters that need to be met and give a better idea on which is the best way to fulfill them. In the case of a dashboard, there are several aspects regarding information design that need to be considered so the data can be presented in a clear and easy to grasp way.

At its core, information design is “the practice of presenting information in a way that makes it most accessible and easily understood by users.” (SEGD 2019). It looks to create data visualization that will foster an efficient and effective understanding of it. The importance of information design derives from the need of the dashboard to be functional. If we only focus on the technical side of the visualization of information, we end up alienating our user and lacking acceptance when it comes to the daily tasks of operation. This is something to consider when designing the final dashboard to ensure its success.

As a good rule of thumb, the way to apply information design principles to our dashboard or any kind of data visualization, is to create and portray information to create a story (of the current status of the project) that is:

- ❖ **Engaging**
 - Present information that is relevant for the project and that will come in handy when making decisions.

- ❖ **Explanatory**
 - The way the project data is represented needs to be clear and properly give an all-around panorama of the status of every task to be overlooked.

- ❖ **Easily Absorbed**

- The final users need to be able to get all the information they need in a limited amount of time. Every second saved when trying to find the status of something will count towards the overall efficiency of every workflow.

❖ Accurate

- The quality of the final product of any information design project is directly related with the quality of the source data. Make sure your information is up to the date and it is being portrayed in the correct scale and graphic system. In the construction industry this is even more critical since the project's status can change in a matter of seconds.

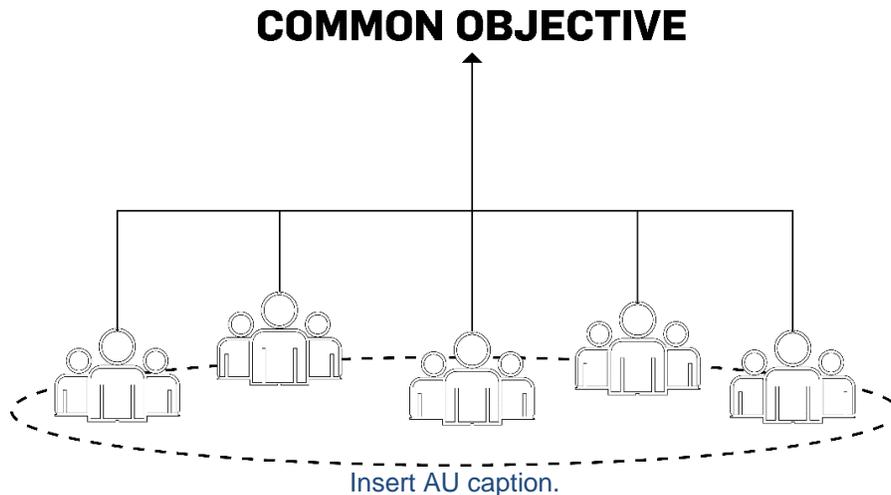
Once we have a clear idea on how information design principles seek to create a better user experience when interacting with the project, we can look into the way these are applied into the creation of an information layout that will be used as a way of monitoring a construction project. The overall workflow that we will follow for this goes as follows:

1. Defining objectives of the project.
2. Defining the audience.
3. Identifying the data available and required.
4. Understanding BIM 360's role.

These steps will set the foundations of the final dashboard that will be used by the team members on site. Having a strong information design framework will ensure the best possible outcome when it comes to the accessibility and acceptance of the final project.

Start with the end in mind, defining objectives.

Even though some idea of an objective is present at the beginning of the project, it is important to clearly define what is and what is not part of the final result, as well as how you are going to measure the success of the development. The main mistake companies do when starting information related initiatives is to start spending resources on gathering data without a plan. This usually ends up in a system that is not structured to meet the project needs and that misses the true advantages to be gained with the proper use of information.



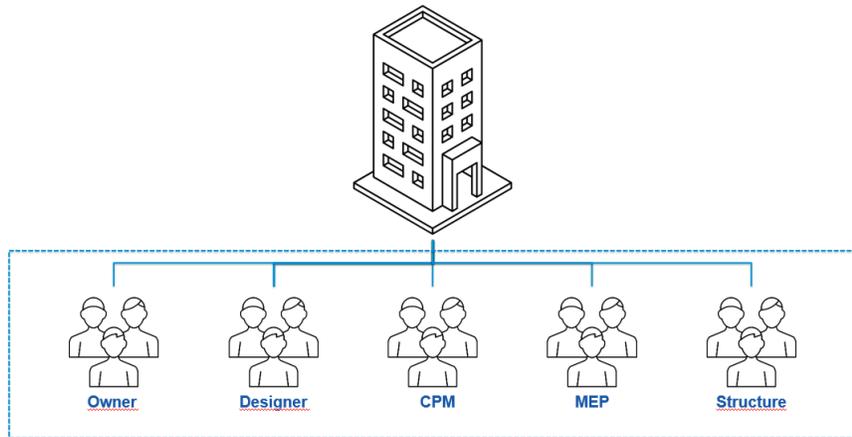
Defining your audience and their needs.

After defining what you want to achieve with the project, it is time to determine how the final user is going to interact with the final product. The construction industry is characterized by their interdisciplinary aspect, and the variety of people with different backgrounds that need to collaborate in a common environment. This makes it harder to set a specific audience profile to work with and requires more flexibility.

The best way to approach the audience definition of a construction tool is to go beyond the individual background of the user and understand their motivations, responsibilities and tasks on the site. Some of the principles to remember when defining the audience can be summarized with the concept of Designing for Humans, an element that is easily overlooked when going too deep into the technical aspect of the final product. At its core designing for humans means to define the final user by the means of:

- Plan for how they think
- Design for how they see
- Write for how they read
- Create for how they feel

Understanding the process and context in which the tool will be used provide excellent insight on what to focus on, and what pieces of information are more valuable than other. Which are required to be handled with special interest.



Interdisciplinary effort

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Identifying your data

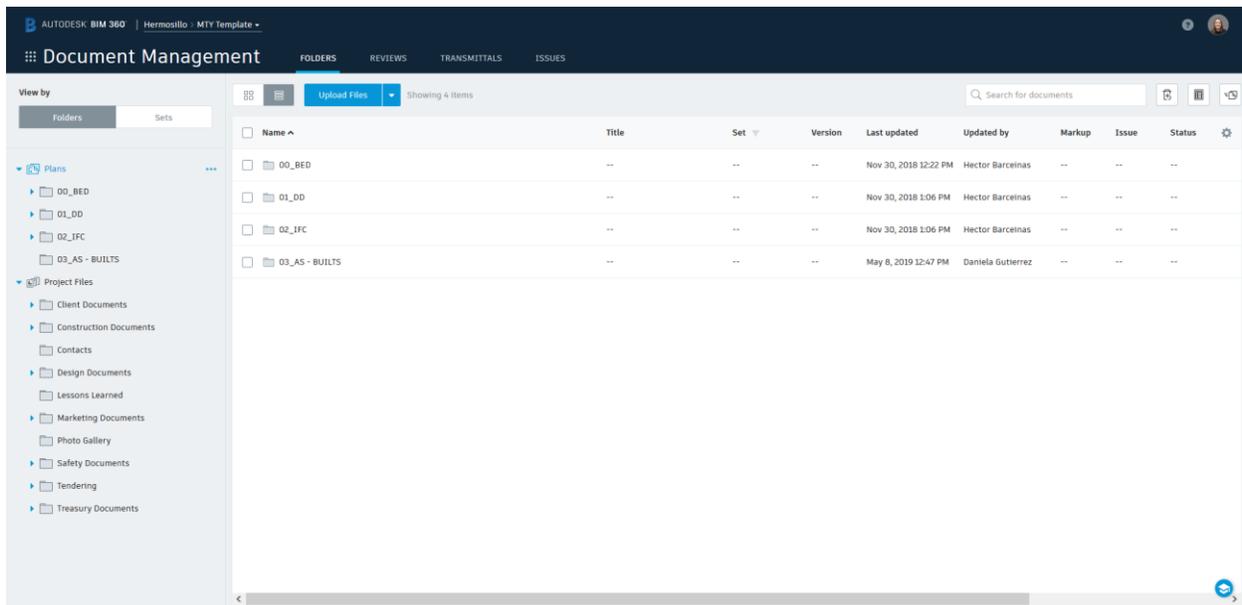
We will go through the process of identifying the type of data to work with, as well as the best way to map the information to be used. We will also review how to set up a standardize process to both track data and properly visualize it at a later stage. Before we start however, it is important to keep in mind some of the main elements to consider when identifying the data to be used which consist of:

- The dynamic nature of the information.
 - Some pieces of information will be set at the beginning of the project and will be used as reference information for project management, others however, will be constantly changing and should be updated on a regular basis. Keeping track of the nature of all the information will let you know how to properly rely on your data.
- Basic kinds of data.
 - Quantitative information can be objectively measured.
 - Qualitative data comes from predetermined parameters beyond a numerical value.
- Defining information providers
 - Determine the ways the users will be uploading information and if there are any data preparation elements to be considered.
- Raw data vs processed data
 - Some information can be used as it was collected without any extra processing to be performed with it. However, to provide the best and optimal way of analyzing the information most of the data collected needs to be processed and transformed into its final visualization form.

Where BIM 360 comes into play

BIM 360 is the source of all the information that will be used in the dashboard. As the common data environment of a construction project, and thanks to its flexibility and connectivity among systems, it can provide information on different levels and in an easy way for every project stakeholder to understand it. Among the basic things to consider about the use of BIM 360 in the project are:

- The use of a standard structure
- Definition of roles, their permissions and restrictions.
- Different sections of the project Plans vs Project Files
- Communication tools within BIM 360:
 - Reviews
 - Checklists
 - RFIs
 - Issues
 - Submittals
 - Markups
- Connectivity, feed information to the project regardless of your location.
- Standards, All the information gathered within BIM 360 needs to be consistent in both its structure and format. That is the only way you are going to be able to automate the process of gathering data to feed the final product.



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Now that we have covered the basics of information design it is easier to go deeper into the dashboard layout design of the project with the proper framework.

Dashboard design basics

Up until this point we covered the principles of information design to be considered when working with any kind of project that requires the creation of a user interface that will be used for decision making. These are the basis of the actual design of the dashboard that will be used using BIM 360 information. The final product will be a compact, at a glance, one source of information.

In this section we will cover the main elements to consider and define when designing the final dashboard. We will determine the audience that will make use of it, the types of dashboards to be used depending on the decision that will be informed by it and the guidelines and tools to use in the final product development.

The audience: The project manager

A functional dashboard is truly useful when it accommodates to the needs of the users in the context of their daily activities. For this specific project we had to accommodate to the needs of the construction project manager in a way that would help the role in making a proper assessment of the status of the project for decision making. This is just an example of how the guidelines for defining the user needs can be applied on any kind of scenario. In order to properly identify all the user requirements, we will need to define the following elements:

- What kind of choices will be taking place on a daily basis?
- What information is required for said choices?
- What are the timeframes that apply to the operations of the role?
- How tech savvy is the average user?
- What is their routine? When during the day will they be using the dashboard?
- How can we simplify their life by providing the information they usually need at a glance?

By answering these questions, it is possible to define not only the profile of the user but the average scenario in which they will be using the dashboard. That way not only the main audience is defined but the context in which they will be using the information can be taken into consideration and accounted for.

The objective: tracking time, quality and cost.

Defining the objective of the dashboard comes in hand with the definition of the audience. Once the main user of the product is defined it is time to determine which of their daily tasks are going to be optimized with the information provided and what is the use of them. In the case of the Construction Project Management the responsibilities of the role determined that their main goal is to ensure the project's proper execution regarding time, cost and quality. As such, all the information to be gathered needs to be distributed into one of those three groups

After the information has been properly sorted into the parameters to be measured, the next step is determining how the display of information will provide a clear picture of the status of the project regarding the selected objectives.

Kinds of dashboard

Dashboards can serve different purposes depending on the kinds of actions or decisions that will be taken with the information they provide. There are three main kinds of dashboards that can be used efficiently in the project, their difference comes in the level of detail and the timeframe of the data they display.

- Operational Dashboards

This kind of dashboard provides information on the daily status of the activities of a project. It goes into reporting the real-time performance metrics of all the tasks at hand in a simple unified solution. It provides immediate information about the project current results and indicators



Example of Operational Dashboard by iDashboards.com

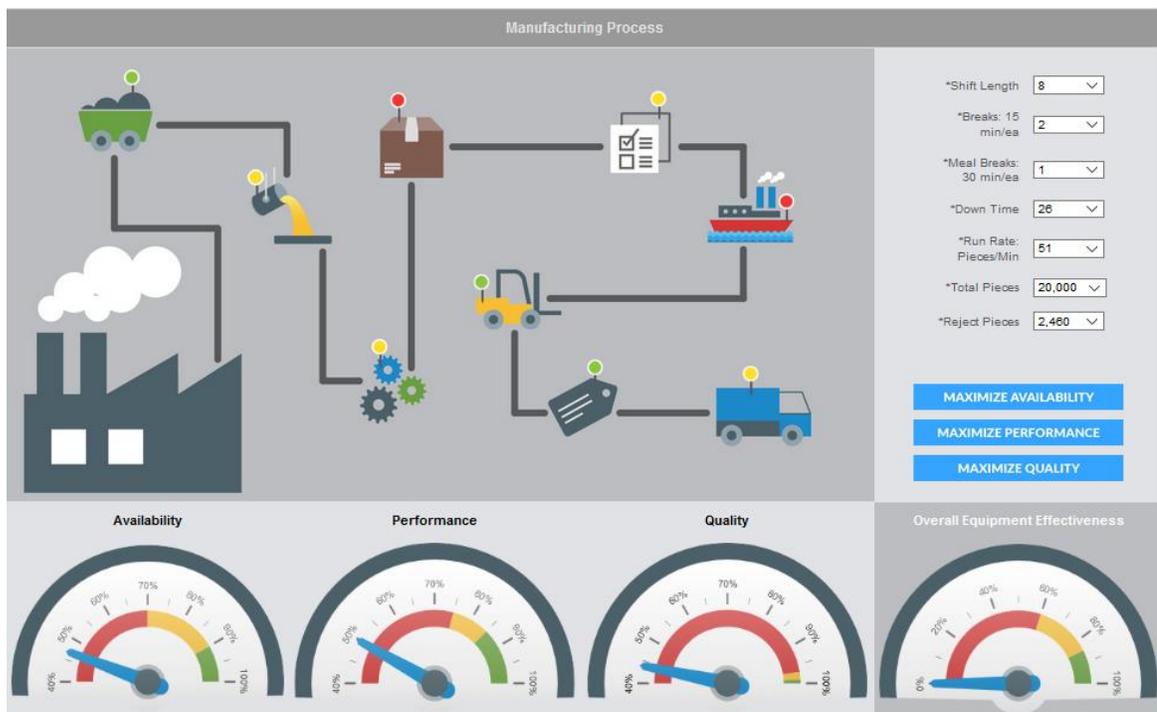
Operation dashboards need to focus on the current status of the project and have a specific scope to give the user the required information at a glance and without further interaction. This kind of dashboard is especially great for informing the whole project team about the status of the current activities, so they can implement any required actions as soon as possible.

- Analytical Dashboards

Opposite of operational dashboards, which focus on the moment, analytical dashboards consider past performance in order to identify trends and get a clear view of the factors

that have contributed to the project’s current status. This dashboard uses iterations and more interaction with the users in order to supply the required information as they are analyzing and reviewing the performance of the project.

Due to its use for identifying trends and cross-referencing information, analytical dashboards require a higher level of understanding of the information. The decisions based on this data come from correlating it to both past and present reference.

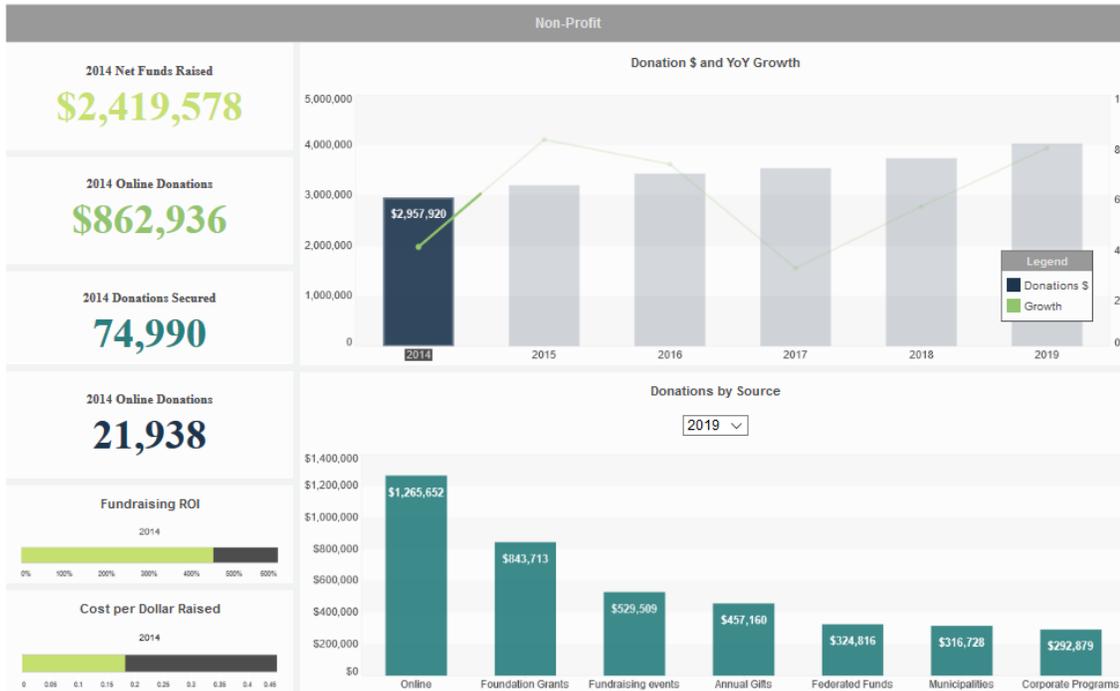


Example of Strategic Dashboard by iDashboards.com

- Strategic Dashboard

Some data requires an extra layer of analysis before it can be insightful regarding the status of a project in its past and future performance. In order to properly get this data, it is important to set KPIs of the different aspects of the project. This will help the users easily find value within the data and set context when reading the information.

Strategic dashboards use predefined KPIs and measures them on both daily information and retrospective records. This kind of dashboard can be really insightful since it indicates risk factors and improvement opportunities easily. However, they also require the most amount of preliminary work, it is only by having clear workflows and setting up parameters for your KPI that an analytical dashboard can be created.



Example of Strategic Dashboard by iDashboards.com

Dashboard construction guidelines

Due to its practical nature, dashboards need to follow a set of guidelines to ensure their functionality while optimizing the user's experience. In general, dashboards need to balance ease of use and user comprehension in a limited amount of space.

In this section we will go through the main guidelines to follow in dashboard design that incorporate what we have reviewed earlier regarding information design, objective and audience definition, and kinds of data.

1. 5 second rule

The 5 second rule refers to the way information should be presented into the layout, so the user doesn't spend more than 5 seconds trying to reach their desired information. This not only refers to displaying the information in a way that can be found in a limited amount of time, it also requires for the information to be clear enough to be processed and remembered after a quick glance.

Achieving the 5 second rule in dashboard design can be tricky once you consider it's not only about finding the information but about understanding it as well. For the information to be setup clearly enough for the users to capture it, it is necessary to set clear reading guidelines so information can be seen in context. Another important aspect to consider is the use of colors and symbols that convey meaning in a logical intuitive way so information can reach the user without the need of reading. Finally, a good way to improve the fast

understanding of information is to simplify it to the point where only the information required to meet the objectives of the dashboard is presented.

2. Inverted pyramid

The inverted pyramid concept is an organizing principle to use when setting up the layout of information-based on their used, function, relation and most importantly, its importance. It categorizes data into three priority tiers, which then can be transformed into visual form by laying information from top to bottom in order of importance.

The three tiers of information according to the inverted pyramid go as follows:

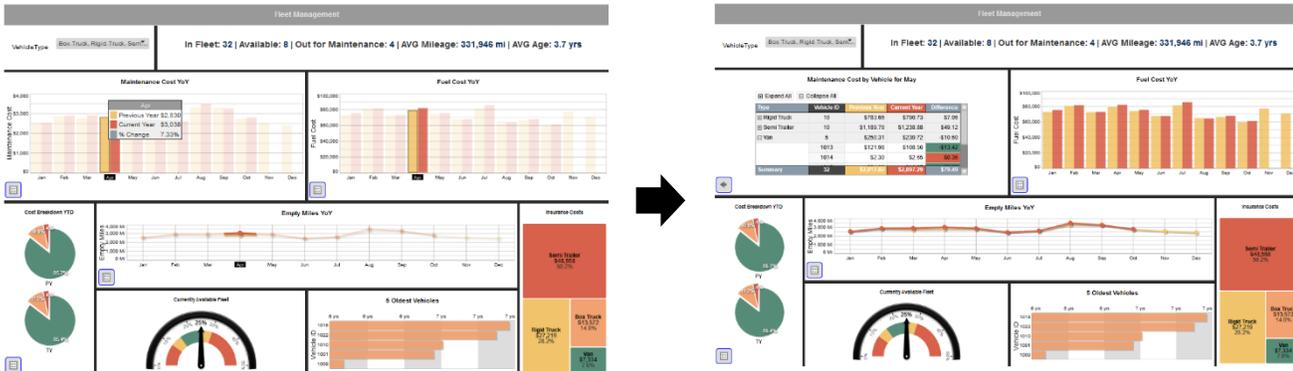


Example of Strategic Dashboard by iDashboards.com

3. Managing iterations

Iterations are the different levels of detailed information presented in the dashboard that are displayed as the user interacts with the product. This is a tool that can come in handy when information is first visualized in its resummed form for easy understanding but may require an extra level of detail if the user requires to fully analyzed it.

A great use of iterations is in analytical or strategic dashboard, where information at first glance gives the overall past and present performance of a project but may fall short of further analysis regarding specific elements or indicators. A clear example of iterations used properly is when a chart shows information that when clicked upon reveal an extra level of information such as in the following example:



Example of Strategic Dashboard by iDashboards.com

When working with iterations in dashboard design it is necessary to find a proper balance between simplicity and available information. Iterations should only be used to provides an extra level of detail when necessary since most of the information required by the user should be easily available at first sight in order to meet the 5 second rule.

4. Customize vs personalize

We are used to having customized elements on our daily lives, from our coffee to our cars, we are constantly surrounded by products that are custom made to our experience. This makes only natural to expect that the information and experience that we will encounter in a dashboard built for the management of our project will also be custom made to our specific needs.

However, when it comes to creating an operational or analytical dashboard that will need to suit the standard characteristics of a construction project while adapting to the individual requirements of each user the key is on doing the tailor experience in two steps, first via personalization (the system automatically sets up a view predetermined to the role) and later on by allowing the cards and widgets to be organized to an extent by the user through customization.

5. Be consistent

Consistency is what ties every section, widget and element of your dashboard together. Creating consistency in a dashboard refers to sticking to a set of visual guidelines, grids and color codes that will be found across the product in a unified form. By being consistent you not only create harmony between the sections of the dashboard, but you also create a language to be followed when reading it.

Consistency creates and boosts the intuitive flow of the user experience by allowing the user to use the same rules and parameters to understand every part of the layout, and easily figure out where the information they are looking for will be located.

A unified and consistent dashboard can be achieved with the use of:

- Defined color schemes
- Grids

- Setting up building blocks
- Margins
- Iconography

Setting up the final layout with BIM 360 information

The final step of the way is the actual definition of the dashboard layout using the information design principles and the dashboard tools we have covered. To do this, it is important to determine the way every data connection will be taking place, and to list out all the data processing that will be required to properly visualize the information of the project.

A great way to start in this task is to create a data origin and target matrix. In this document we will define all the information that was determined to be important by the audience and objectives analysis, and the way that they will have to be presented to meet the information and dashboard design principles.

Determining the dashboard characteristics

Once the kinds of data to be used have been set, the objectives of the information defined, the audience has been determined and the kind of dashboard to be developed chosen based on their data capabilities, it is now time to start creating the dashboard for the project.

For this specific task and after reviewing with the users the main information requirements they encountered on daily basis it was settled to create a dashboard with the following characteristics:

Element	Definition
Name	CTQ Control
Description	Control panel to measure and identify risk factors in the project's status regarding the time, cost and quality objectives.
Audience	Construction Project Manager
Audience Description	CPM that will need to monitor the current and past performance of a project in order to capitalize on project
Objective	<p>To be able to gather the current status of a project based on time, cost and quality and evaluate it against the control parameters.</p> <p>To present the past performance of a project regarding time, cost and quality to identify trends.</p> <p>To visualize the future activities to be performed in the project to properly adjust current actions to meet the cost, time and quality objectives.</p>
Kind of dashboard	Analytical – The dashboard will need to show past and present information for planning.
Types of data	

Usage	Daily at the beginning and end of the workday.
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Defining the information required

Once the objective of the dashboard is settled, it is necessary to review the information that will be presented in it to achieve its goal. Since we are going to be measuring different kinds of data with different purposes, the first step to have a clear idea on what should be used from BIM 360 is to list all the pieces of information that our Construction Project Manager (defined audience) needs to get a clear idea of the current and past performance of the construction project (objective).

For this example, we divided the information that was needed into the three main categories to be measured in the project: Time, cost and quality.

Time	Cost	Quality
Contract Substantial Completion	Current Egress	Number of issues
Contract Beneficial Occupancy	Current Ingress	Type of issues
Projected Substantial Completion	Balance	# Open Issues
Projected Beneficial Occupancy	Pending Ingress	# Closed issues
Delay	Pending Egress	Issues in time
Percentage of delay	% Cost completion	Issues with expired deadline
Number of tasks delayed		Checklists completed
Average Delay		Passed checklists
Design Deadlines		Failed checklists
Procurement Deadlines		

Mapping the information in BIM 360

After the data to be displayed in the dashboard has been identified, it is time to map its location from BIM 360 and review its compatibility. This is where a standardized structure for both the format of the information and the location of every file is key. You need a way to be consistent on every project so the dashboard can be applied in the future.

To link the information, a clear matrix mapping the desired data with the file that contains it and with its required location. This analysis should also include the source and target format of the file in order to identify if the information is going to be easily read from the current documents that store it, or if an extra level of processing is going to be required.

Information	Location	Source Format	Target Format	Processing Needed
Time				
Contract Substantial Completion	Project Schedule	.MPP	XML	NO
Contract Beneficial Occupancy	Project Schedule	.MPP	XML	NO
Projected Substantial Completion	Project Schedule	.MPP	XML	NO
Projected Beneficial Occupancy	Project Schedule	.MPP	XML	NO
Delay	Project Schedule	.MPP	XML	NO
Percentage of delay	Project Schedule	.MPP	XML	NO
Number of tasks delayed	Project Schedule	.MPP	XML	NO
Average Delay	Project Schedule	.MPP	XML	NO
Design Deadlines	Design Schedule	.MPP	XML	NO
Completion Percentage	Project Schedule	.MPP	XML	NO
Procurement Deadlines	Procurement Schedule	. XLXS	XML	YES
Cost				
Current Egress	Procurement Schedule	. XLXS	XML	YES
Current Ingress	Balance Account	. XLXS	XML	YES
Balance	Balance Account	. XLXS	XML	YES
Pending Ingress	Balance Account	. XLXS	XML	YES
Pending Egress	Procurement Schedule	. XLXS	XML	YES
% Cost completion	Not available	-	-	-
Quality				
Number of issues	BIM 360 API			NO
Type of issues	BIM 360 API			NO
# Open Issues	BIM 360 API			NO
# Closed issues	BIM 360 API			NO
Issues in time	BIM 360 API			NO
Issues with expired deadline	BIM 360 API			NO
Checklists completed	BIM 360 API			NO
Passed checklists	BIM 360 API			NO
Failed checklists	BIM 360 API			NO

Grouping and visualization of data

The next step after we have all the information required is mapped, is to group it and start defining the data visualization to be used for each element.

BASE LAYOUT

	Information	Visualization
Indicators		
TIME	Contract Substantial Completion	DATE
	Projected S.C.	DATE
	Percentage of delay	%
	#of tasks delayed	Pie Chart
	Average Delay	Figure
COST	Current Egress	Bar chart
	Current Ingress	Bar chart
	Balance	Figure
	Pending Ingress	Bar chart
	Pending Egress	Bar chart
QUALITY	% Completion	Pie Chart
	Number of issues	Figure
	Types of issues	Bar chart
	Open vs Closed issues	Pie Chart
	% expired issues	Pie Chart
	%Pass checklists	Pie Chart

	Information	Visualization
Time Reference		
TIME	Tasks	Gantt Chart
	Start Date	Gantt Chart
	End Date	Gantt Chart
	Duration	Gantt Chart
	Percentage completed	Gantt Chart
Cost	Purchase Order	Gantt Chart
	Purchase Order Date	Gantt Chart
	Purchase Order Amount	Gantt Chart
Design	Design Documents	Gantt Chart

Project Reference		
	Information	Visualization
MODEL	3D Model	BIM 360 API

Indicators		
	Information	Visualization
TIME	Delays over time	line chart
COST	Ingress over time	line chart
	Egress time	line chart
	Payment applications over time	Bar chart
QUALITY	# of issues over time	line chart

Time Reference		
	Information	Visualization
TIME	Delayed Tasks	Gantt Chart

ITERATIONS

This exercise helps define the sections of the base layout and the iterations that will be needed for each piece of data to be presented. It is easy to understand the workflow that will be going behind the curtains with the information whenever the construction project manager needs to have an overview of the project.

Based on this analysis the layout was divided into three main elements:

1. Indicators
Elements based on the parameters set by the users that provide the most requested information of the three monitored categories.
2. Time Referenced Information
The construction schedule is one of the most important factors to keep track on during the execution of a project. A properly created and up to date schedule can provide insight on the status on matter beyond the duration and projected completion of the activities.

Usually the project construction schedule only displays the information of construction tasks. However, in order to incorporate all the time-related information required, we are also displaying information coming from the procurement schedule, the design schedule and the BIM 360 Issues.

3. Project Location Information

A great way to have a visual reference that connects all the information seen on the dashboard to the actual project is to use the models and the model information to tie all the pieces of data. A visual representation of the 3D model that can respond to what other elements of the board are showing to map that information to its actual location is a great visual aid.

The final Layout

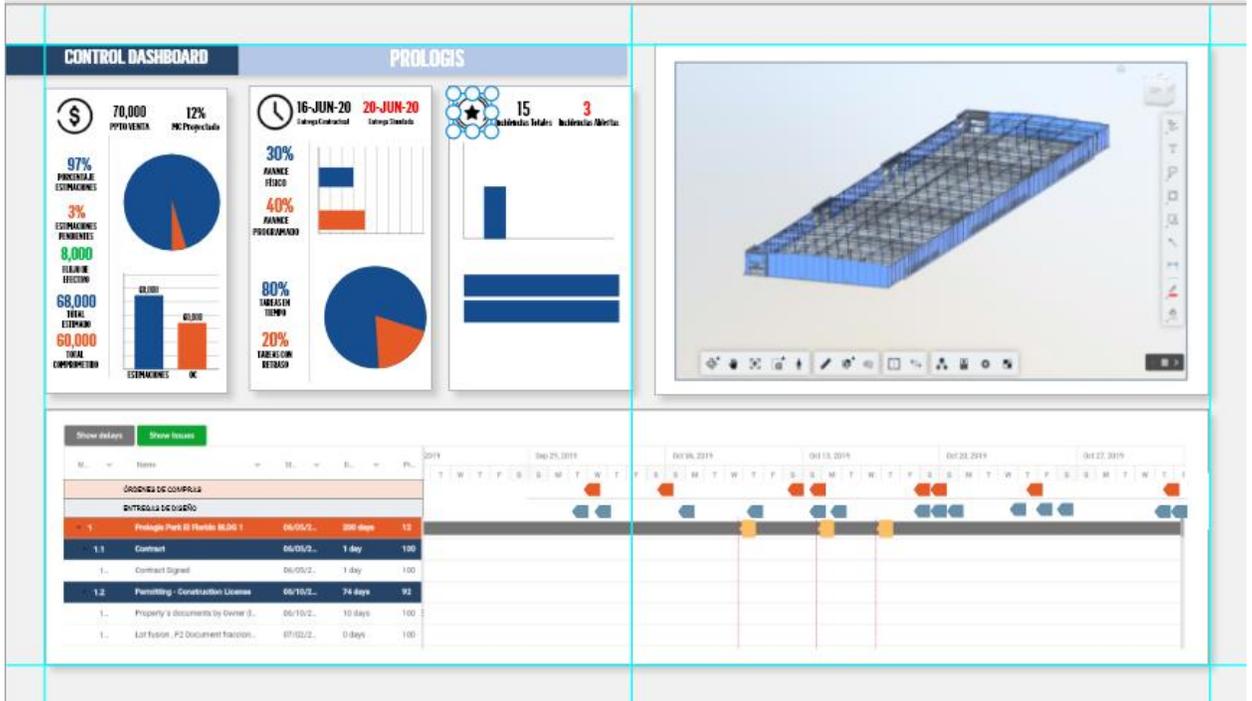
Now that all the pieces and background information of the dashboard have been defined, it is time to apply the dashboard design principles to the collected data to get the final layout. For this particular dashboard we used the sections determined during the grouping of data to create the main three areas where information was going to be presented.

Then, using the inverted pyramid principle it was determined to place the main information (the indicators) on the top right section of the board. Indicators were divided into the three parameters that are being measured in the project: Time, Cost and Quality.

Iterations for the indicators were also located in the same area, each iteration would be presented when the parameter section was selected. This would provide the detail information of a given section when required.

Since the project location reference (the model) needs to be tied to both the indicators and the time reference or Gantt chart, it was located on the top left section of the board so it can be linked easily.

Finally, the Gantt chart that will serve as the time representation required a different proportion in its layout. Following the Lean practices used by the project managers it was determined to have a six-week visualization for all activities. The procurement, design and issues were also incorporated via iteration to avoid oversaturating the limited space available. Delayed activities were also integrated in this matter.



Learn how to combine Forge modules to link visual reference with project data

Just as BIM 360 is the source of information of the whole project, Forge is the key to accessing that information in an efficient way that allows for data to be easily analyzed and presented to the final user. At its core, Forge functions as the toolset that works as the means of connectivity for the project.

In this section we will go through the ins and outs on how to setup a Forge App, connect it to a BIM 360 Hub and access the information through different forge modules to connect and visualized information. We will also look into how each module can come into play when creating the dashboard and what it has to offer.

Getting started with Forge

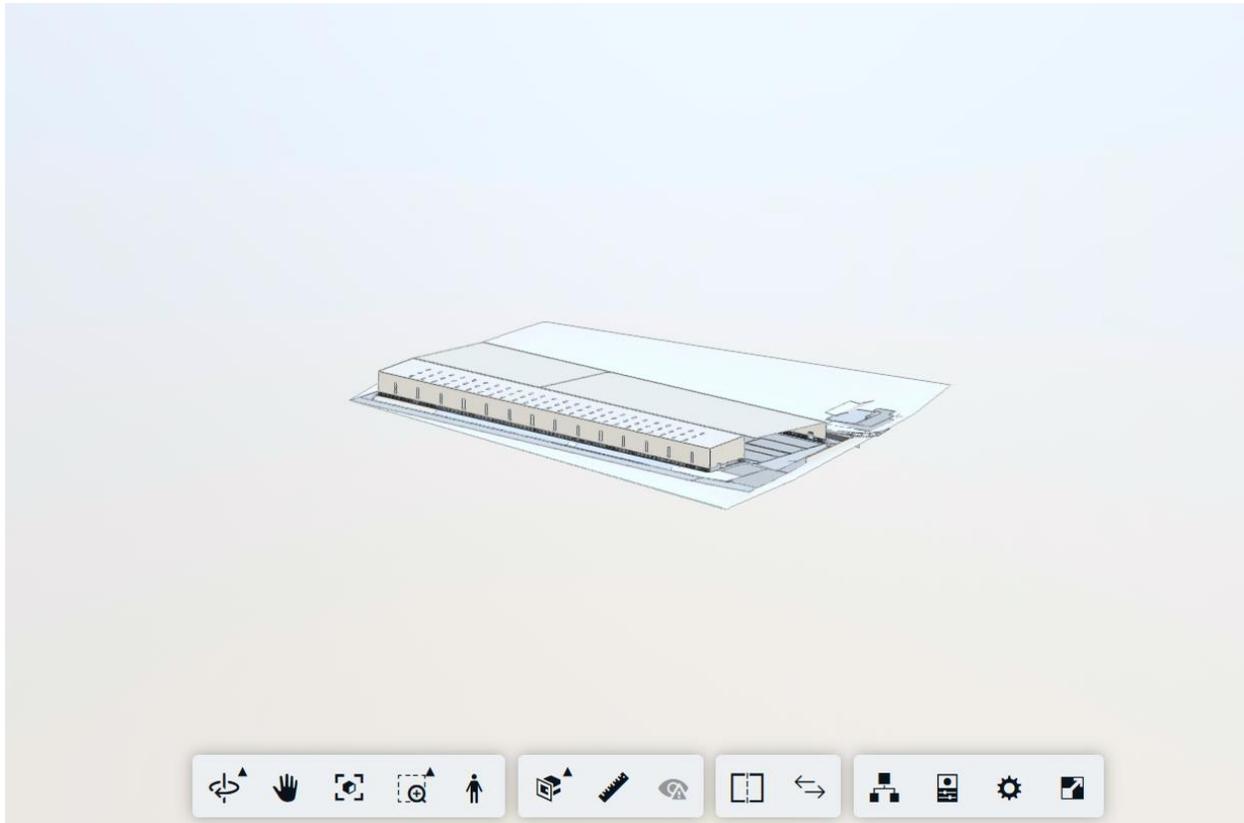
1. The first step in creating an application to connect to BIM 360 using Forge is to get an Autodesk Account which will be used through the Forge Developers website. After creating an Autodesk account, a forge account will be automatically created by login into www.forge.autodesk.com
2. After setting up the account on the Forge website you will be able to use all the Forge services for a limited amount of time. If required it is possible to subscribe to both services and cloud credits required to used them later.
3. The next step is to create an app on the forge website. To register an app the only thing to do is sign into the Forge website, select My Apps from the Profile dropdown and click Create App at the My Apps page.
4. After creating an App, a client secret and a client ID will be assigned. This is the information that will be used to grant access to the app to the forge services. Both client secret and client id can be found on the App Information section.
5. The client ID and client secret are used to generate a token, this token will be attached to every communication between the app and the forge services. This way all communication and requests are tied to the app and account.
6. The final setup step is to add services to the app. To do this you need to go to the details of the app that is going to be modified and, in the APIs, section activate or deactivate the services as required.
7. Do not forget to SAVE after all changes are made.
8. That's it! Now the App is created and ready to be linked to a BIM 360 account.

Forge Modules

Forge is divided into different modules depending on the type of information to be used and the work that needs to be done to it. In order to properly understand the use of each of these tools within the dashboard, we will go over the six main modules that form Forge. We will cover its potential use for connecting information in a way that will provide the final user with the knowledge to make better assessments of the project.

Viewer

The viewer service allows us to visualize the 2D and 3D design documents produced by the design team and interact with them. Using the viewer, it is possible to not only get a clear idea of what the project scope consists of, but to manipulate the model visualization to create more a detailed analysis using sections.



The viewer is a great way to get a visual reference for project elements. By using the proper standards in both the model and other project data it is also possible to connect elements and generate a 3D view that accompanies information such as costs or tasks.

Data Management

The Data Management service is what will allow our dashboard to access and read all the BIM 360 information of the project. This module connects the app to a specific BIM 360 project and allows it to retrieve any version of any document located in any folder. The ability to access the project's documents and read them at ease is truly what makes this dashboard possible.

Model Derivative

The model derivative tool allows you to transform 2D and 3D design information to svl. This will allow the documents to be visualized using the viewer and for their properties to be properly mapped and available for analysis.

It is important to mention that this is only applicable to documents that are NOT currently stored within BIM 360 and that will be uploaded directly to the app. BIM 360 design documents (Both models and 2d drawings) are automatically converted by BIM 360 which allows the app to access their information directly with the viewer.

Reality Capture

Even though we are not going to be using the Reality Capture service within the demo dashboard, this service is an excellent tool for project tracking and can be incredibly useful when used to compare design vs execution.

The Reality Capture service allows users to load their ReCap information for processing and adding geographical data. It is a great way to link the information with GPS data that can later create a great visualization of the captured information.

By incorporating the Reality Capture service with the viewer, it is possible to create a great visual reference of both the design models and the current project. Giving the users an even better assessment of the project.

BIM 360 API

The BIM 360 API allows our App to retrieve admin level information from BIM 360 and automate set up activities which is a great way to standardize the projects. It is also the way to retrieve native BIM 360 information. For this project this service will be used to track the issues and checklists that will be used as quality indicators for the project.

Design Automation

The Design Automation service provides the tools to create and modify design data from both 2D and 3D models created in the main Autodesk Design Authoring tools such as Revit, AutoCAD and Inventor.

Since we are creating or modifying information when using this service, it is not the best match to our project performance tracking dashboard. However, the design automation tools have a huge potential when it comes to exploring action plans by letting you incorporate or generate value engineering ideas, execution sequencing proposals or design changes.

A great example of this potential is the possibility to change the link between Revit elements and the construction schedule to review a different execution process or a schedule update without having to change values in both Revit and MS Project and having to reupload all the information.

Linking everything within the dashboard

Once the connection between your app and BIM 360 has been set into place and the main characteristics of each module have been identified, it is now time build the dashboard by using the layout we have created and populating it with information from the cloud project using the correct tools.

In order to have a clear understanding the connections and sources of the information, we can create a matrix that provides a framework to follow and a structure for the whole product. This is what the structure and connections of the dashboard we have been using looks like:

Section	Element	Visualization	BIM 360 Location	Forge Module	Comments
Indicators	Contract Substantial Completion	DATE	Construction Schedule ProjectName/Project Files/Construction Documents/Reportes de Obra y Avances del Programa	Data Management	Baseline Project End Date
	Projected S.C.	DATE			Project End Date
	Percentage of delay	%			Percentage of delay to be obtained by dividing the difference between the Contract SC and the Projected SC by the project duration.
	#of tasks delayed	Pie Chart			Number of tasks with on of the following: Task Start Date < Current Date + Work % = 0 Task End Date < Current Date + Work % =/0
	Current Egress	Bar chart	Project Client Balance Account ProjectName/Project Files/Construction Documents/Estimaciones y Edos de Cuenta	Data Management	Obtained from XML file
	Current Ingress	Bar chart			
	Balance	Figure			
	Pending Ingress	Bar chart			
	Pending Egress	Bar chart	Procurement Schedule ProjectName/Project Files/Construction Documents/Suministros/Programa de Compras	Data Management	Obtained from XML file. Total Egress - Total Egress Committed
	% Completion	Pie Chart			Obtained from XML file Closed PO/Total PO
	Number of issues	Figure	BIM 360 - Issues	BIM 360 API	Retrieved directly from BIM 360 project.
	Types of issues	Bar chart			
	Open vs Closed issues	Pie Chart			
% expired issues	Pie Chart				
%Pass checklists	Pie Chart				
Time Reference	Tasks	Gantt Chart	Construction Schedule ProjectName/Project Files/Construction Documents/Reportes de Obra y Avances del Programa	Data Management	Obtained from XML file
	Start Date				
	End Date				
	Duration				
	Percentage completed				
	Purchase Order	Gantt Chart	ProjectName/Project Files/Construction Documents/Suministros/Programa de Compras	Data Management	Obtained from XML file
	Purchase Order Date				
Purchase Order Amount					
Design Documents	Gantt Chart	Design Schedule ProjectName/Project Files/Design Documents/04_Design Schedule	Data Management	Obtained from XML file	
Project Reference	3D Model	Viewer	Federated Model ProjectName/Plans/02_IFC/01_Model	Viewer	Retrieved from BIM 360 project and processed through the viewer.
	Delayed elements		Federated Model + Construction Schedule	Viewer + Data Management	Information pulled from construction schedule xml using data management. Viewer filter used for visualization.
	Selected elements in schedule				

Learn how to use the information in BIM 360 Docs for risk analysis.

Now that we have a project performance dashboard that provides information on both the past and present status of a project, it is now time to apply risk management techniques to the design and information displayed. This step will provide small changes to the dashboard to accommodate the information and indicators used in the risk management process so the user can have a better risk framework.

For this section we will go over how the BIM 360 based Dashboard that was created with forge integrates with the risk management process. This will highlight the steps used in its application.

1. Identify the risk

The first step to properly manage risk is to uncover and describe risks as soon as possible. To do this, it is necessary to have a way to easily recognize risks by reading the project information. Followed by understanding which elements are not behaving in the expected way.

In order to have a clear way of identifying risks in the project management dashboard, all the data needs to have a framework that defines the range of values for each parameter that are considered “normal” or “expected”. This range is defined from the start so whenever the data that is pulled from BIM 360 falls outside the normal values it can be identified and tagged (either by a message or notification or by a change in its graphical representation).

2. Analyze the risk

Once a risk has been identified and described, the next step on the risk management process is to analyze the risk. Risk analysis is used to identify the likelihood of a risk and its consequence. A dashboard is a great way to determine the nature of a risk and its potential to affect goals since it gives a picture of all the different aspects of the project in one centralized data source.

By providing trackers for all the information related with the scope, goals and objectives of the project, the dashboard allows the project management to properly assess a risk and identify if it's going to affect any of the key project indicators. The past performance record is also useful since it can highlight the origins of the risk and set the context of how all the current data came to be.

3. Evaluate or rank the risk

Ranking the risk is necessary in order to have all risks in order of magnitude so an action plan can be determined, and risks are addressed based on their relevance.

Magnitude of a risk is generated by combining the likelihood of a risk to happen with its consequences. Both of this element can be assessed using the dashboard by having a clear picture of the project and a way to determine how different project parameters influence the risk.

4. Treat the risk

Treating the risk means ranking the identified risks in order of magnitude and generating action plans to mitigate the effects or minimize the likelihood of each risk.

After a risk has been identified and ranked, the construction project manager needs to gather all the information of how the risk may present itself and affect the project. Then it can create a plan on how to address it. The way the BIM 360 Dashboard ties all the information of the project together helps to map the risks to all its factors, so it is possible to plan ahead knowing current and past performance of the project.

5. Monitor the risk

Tracking the risk after the mitigation plan has been set to action is necessary to evaluate the results of the risk treatment and to ensure that the risk is decreasing in magnitude.

Since the risk was originally identified and analyzed with the use of the information from BIM 360 in the dashboard, it is by the continuous measurement of all the data that the risk's effects and status can be properly tracked. This process can be even more accurate by updating and setting up different control parameters, so when things get outside of the normal range of operation they are quickly identified.

Learn how to track BIM 360 project performance on a daily basis.

Tracking project performance requires two things, definition of project parameters that need to be tracked and a way to feed information from the project regarding those said parameters. BIM 360 provides both things on its own when properly implemented. Take that to the next level with a Dashboard fed with the information from the project that capitalizes on this feature by centralizing the information in a practical way.

The definition of the parameters to track project performance was determined when designing the dashboard. Hence the importance of this first steps regarding information design. However, keeping the project information up to date is not as simple since it requires for all the project team members to be actively updating the platform.

In order to keep all the team on track while using the BIM 360 docs platform on daily basis it is important to make both the recording of data and its retrieval using forge as simple as possible. This can be properly achieved by implementing the following guidelines:

- Set an intuitive standardize structure for all the project information. This structure can be setup as a template within BIM 360. Consistency is one of the key elements for successful workflows.
- Properly use permissions within BIM 360 Docs to personalize the experience of each user and avoid errors. Make the job of each user easier by providing them with only the required information and limiting the room for mistakes.
- Define your parameters clearly and get the key documents to measure them in a compatible and easy to use format.
- Mobility is one of the main advantages of BIM 360, its availability around the world thanks to the cloud and its use through mobile devices allows users to constantly feed updated information to the project. Setup trainings to make the use of all the technologies easier to adapt to and get everyone on track.
- Set routines for dashboard revision by making it part of the daily routine of the user it will be easier to track project performance on a detailed level and identify risks at the early stages
- Trainings are key to successful implementations, get your users to not only grasp the use of the tool but the potential of it too. That way they will continue learning on their own and find new ways to use the software in their daily routine.

Conclusions, how to apply what we've learn into other projects

As we've seen, the construction industry has yet to properly transform itself into the so-called age of information by finally using all the data that is gathered on daily basis on every project. Even though at first it is hard to visualize the way all the project information will be connected in one cohesive platform, it is possible to do so by following a proper structure. Also, having a clear design and development foundation and creating a tool that is accessible to all the users while processing all the project information on a daily basis sets the ground for proper project tracking. In the end, it is possible to create a tool that provides everything the people on site need to know at a glance.

The next step after setting up a dashboard that meets the user's needs and helps to optimize the operations of the project is to set the guidelines to scale the dashboard up. Then its information can be connected, and cross referenced with other projects for top management analysis.

Information is always changing, so a dashboard that answers to the user's needs of today may not do so tomorrow. Having constant feedback from the users is the best way to keep the dashboard functional. Some other elements to consider are to follow up with other kinds of dashboards (operational or strategic) that showcase the information from BIM 360 in a different way such as planning possible actions for risk management.

Forge unleashed the potential of BIM 360 in many ways, and dashboards are just one way to create solutions for the construction industry that finally brings the age of information to our daily lives.

References and further reading

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