HOW TO AVOID GROUNDHOG DAY . . . AGAIN!

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INTRODUCTION

Albert Einstein is credited with saying, ***"Insanity: doing the same thing over and over again and expecting different results."*** *Then in the 1980s, we watched as poor Bill Murray kept waking up to the very same day, very same activities, and same exact results in the comedy "Groundhog Day". We challenge you to look at the process of design, delivery, and operations for our buildings. Are we all stuck in "insanity" or "Groundhog Day?" We keep doing things the same way and expecting different results. This article explores how the utilization of facility data from design to operations can not only break the paradigm of "insanity," it can make our facilities more efficient and sustainable to construct and operate. Our basic premise is that if you do not have accurate "data" about your facility it will be very difficult, if not impossible, to operate your facility effectively.*

KEYWORDS

facility data, BIM and data management, improved facility operations and energy management, managing data for building life cycle, operating a sustainable building

CURRENT STATE OF THE INDUSTRY

Having been involved with the design and construction industry for over thirty years, it is amazing to me how so much has changed. Yet in the same breath, I feel that so much is still the same in how we deliver and operate our buildings. There are a variety of reports that have been published discussing the inefficiencies in the multi-billion dollar industry that delivers thousands of buildings every year. In fact, the construction industry is the only industry that has lost productivity over the last few decades. The percentages and statistics vary from one report to the other, but the fact is the delivery of our buildings is less efficient today than it was in the 1960s! Shocking is the only thing that can be said about this situation. If we are interested in sustainability and improving how our buildings impact our environment, our building construction and operations processes must be reviewed and revised. In this article, we will explore how the management of facilities data is in fact a critical piece in improving the process of building and operating a sustainable building.

To positively impact change, we must look not at the end result, which is the building getting turned over to us to operate; but at the entire process that brought the building to us. The majority of projects that are delivered today are using a century-old process. An owner selects a designer and shares a wealth of knowledge with the design team. The design team

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FIGURE 1. Good luck finding what you need in a mess like this!

interprets the information (data) and summarizes it into a series of documents (plans and specifications). This data is then given to bidders who must interpret the data and "give it the best guess" for a bid. Then the data gets passed off to a series of trades persons who have to once again interpret the data. This interpretation often includes selecting between three or four "equal" products listed in the specification. As we all know, however, there are very few "equal" products out there. Each product has differing characteristics of performance. When the project gets completed, the critical data that the owner had delivered to the design team has now gone through a series of "interpretations" and upon the opening of the facility the owner is now dealing with piles of new data—sometimes organized, sometimes stuffed into cardboard boxes. The maintenance/operations staff has to interpret the data once again. As children, we used to play a game where ten people sat in a row and the first person told the second person in the row a story. The story then passed to each person in the row in whispers. By the time the story got to the tenth person the facts had changed and in some cases the results of the story were totally lost. Aren't we really doing the same thing with this process?

When Computer Aided Drafting (CAD) came to the industry in the 1980s, we thought we had fixed the problem, but in fact we had only changed our delivery tools. The process had not changed. When Building Information Modeling (BIM) emerged, again, we thought this was the fix. But again, when the fundamental process of collecting data is broken, even the best tool cannot do what it is capable of doing. BIM is a very powerful tool and we will talk

about how it can become the source of data collection and management. But it is only a tool, and a tool used in the same broken process will not bring a new result!

Why is data so critical to sustainability? In the simplest terms, the most efficiently designed building with the most sophisticated environmentally-designed systems will not save energy if it is not operated correctly. If the building operator does not have the proper data about his facility, there is no way it can perform as designed. In fact, some recent studies have found that these more sophisticated systems, when not properly maintained and adjusted, can be less energy efficient than buildings designed years ago. As our buildings have become more complex, the management of the data about these buildings has become even more important. But even more than just the collection of the proper data (information), we need to address access of data. Several years ago, contractors started to deliver project "turn over" data on portable hard drives as opposed to stacks of three-ring binders. I will admit that my initial reaction was, "Great! Think about how much paper we are saving! This is great for the environment!" These savings were real, but what we had not done was make the data more accessible. We had simply taken the data that was in cardboard boxes and three-ring binders, changed it into PDFs and put it on a hard drive—not easily searchable, not easily referenced, and not associated with the building's actual components. So again, we had a solution that was not really getting to the bigger issue. We need facility data that is accurate, manageable, and accessible to the people that run our buildings if we are going to be operating truly sustainable facilities.

Again, our premise is this: for us to improve how we operate our facilities, we need to develop a process (not just a software) that improves how we collect, manage, and access data from the building owner to the design team to the contractor to the operations staff. In other words, we need to manage data for the life cycle of our building.

Let's explore some concepts and processes for addressing these issues.

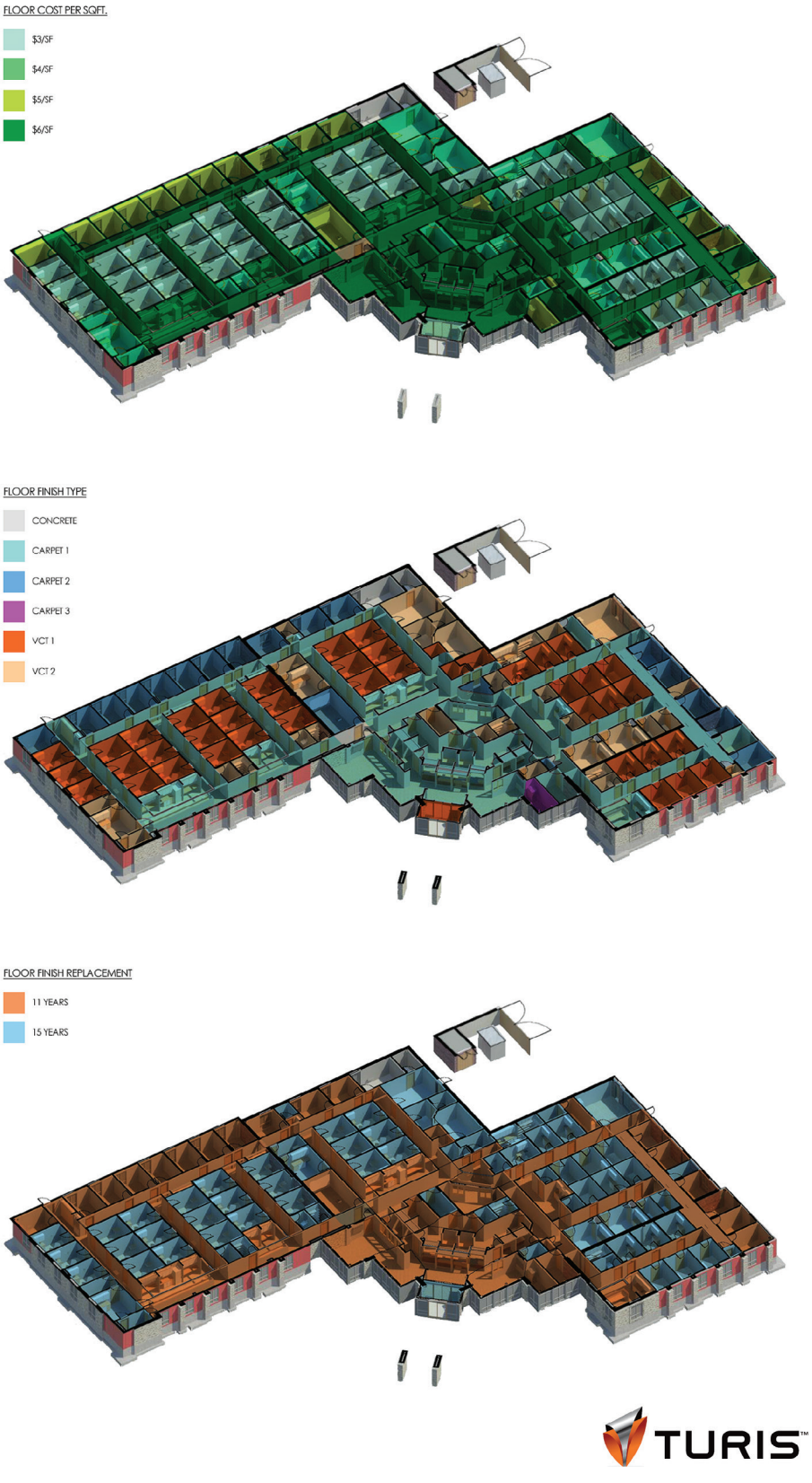
BIM AND DATA MANAGEMENT

Over the last few years, most of us have heard of the software applications that are referred to as Building Information Modeling (BIM), so we are not going to spend a lot of words here describing it in detail. Fundamentally, this software application is available from a variety of manufacturers, but they all have similar characteristics. In a BIM, the project is represented by a series of objects. Each object has height, length, thickness, etc., and the object is a 3D representation. This is in contrast to a CAD plan that represented elements with lines and circles in a "flat" 2D world. The other major characteristic of a BIM is the database that is associated with each object. This database is the key to data management going forward. So now, not only do we have a 3D visualization of our project, we also have the ability to store all of the facility data in a sharable, accessible database.

The data in a BIM is stored in a database embedded within the BIM. What was not acted upon until recently was the ability to share the data in the BIM with other software platforms. There are a variety of ways to share this data with the most basic being, to "push" the data from the BIM to a spreadsheet. Even this most basic of formats for sharing data can be hugely important to a large facility.

Since every room within a BIM can be considered an object, that object can retain information about itself. At the most basic level, a room can accurately record and share the room size, the cubic volume of the room, the designation of the air handler that services that room, and much more basic information. Sharing this basic data with the operations staff can be

FIGURE 2. Not only can we tell you what the floor finish is in each room, but also let you know the cost and estimated date for replacement.



essential to improved facility operations and energy management. On a recent college campus where we converted the entire facility to a BIM, the staff found that over 16% of their room and facility square footages (SF) were wrong! Inaccurate data on things like room sizes and cubic volumes leads to improper metrics. The question becomes, are you doing as well as you think you are on energy savings if you have bad data to start with?

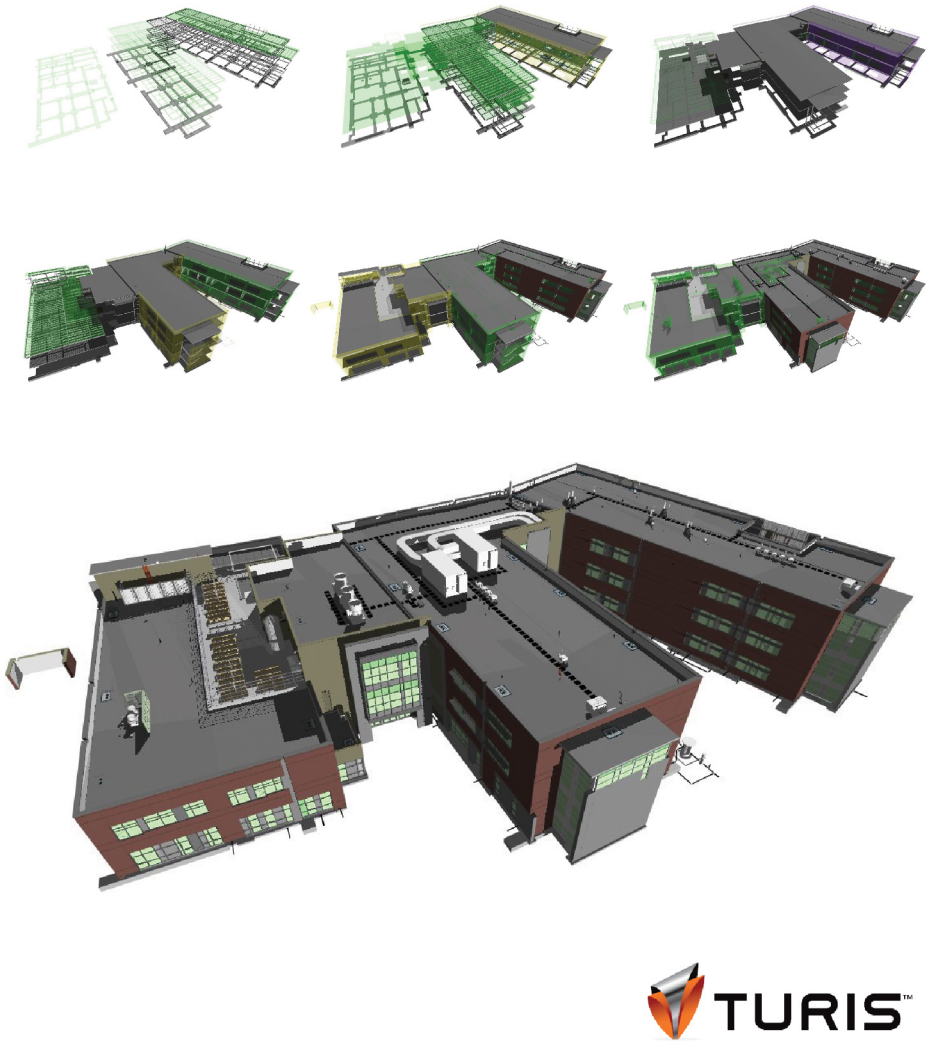
The basics of pushing BIM data to a spreadsheet provide a wealth of opportunities for improving your metrics and your facility understanding. The real power of the BIM database is when you can push it to your operations management software. In recent testing on the ability to push data between multiple software formats, it was found to be much more manageable than first perceived. Not only can multiple software formats share this data, the data can be pushed both ways. By this we mean it is possible to change the room utilization or description in one software and then push that change back to the BIM. Conversely, if we change a room size in the BIM, that size change can automatically push to the operations software. Now we have a means of keeping our data accurate.

Accurate data must be based upon accurate documentation. For years facility managers and owners have struggled to maintain accurate documentation, especially large campuses such as healthcare and higher education. These facilities have been in a constant state of change ever since occupying their buildings. Let us look at a scenario that we see on almost every campus we visit. At the end of construction, the campus maintenance personnel get their building plans from the contractor. Then the campus starts making small changes requested by staff out of necessity; in-house staff often complete these small changes. The issue we see is that the space managers are working off of the floor plans and these small changes never get documented in a master drawing set. They may have all of the information scattered among hand mark-ups and sketches but this information tends to be compartmentalized within the facility. The carpenter may have good documentation of the changes made over the past five years, but the only documentation of these changes exists in their filing drawer, not accessible by other staff. In most cases, other departments do not even know that this information exists. Beyond minor changes, there are renovations that require an architect, engineer and outside contractor. These remodels are documented but in documents that are just for that project. This does not appear to be a big deal at first because if I need information from that area I can just go to the remodeling plans. The problem we find at the facilities we visit is that this has gone on for 40 years or in some cases over 100 years. This means that remodels have overlapped throughout the years and it is no longer clear what has been done and what documents are correct. A BIM process, when fully embraced, has the ability to fix this issue. Facility managers and owners need to put the same emphasis on the virtual building and maintain it as they do to the physical space.

When we treat the virtual building as you would the physical one the result begins to change the paradigm. To be successful in this effort, a new process needs to be put in place and must be followed. If you would not leave a wall unpainted when you are done taping and mudding, you should see it as equally ludicrous not to update the information in your BIM. Just look at the example of making small internal building modifications. The process can work in many ways but I will give you two examples. Both are equally effective when properly implemented and executed.

The first process will focus on plan-driven changes. In this example, a central planning group is responsible for managing the facility documentation with an in-house modeling staff. There is a request for the demolition of two walls to make three offices into a new meeting

FIGURE 3. Although BIM models themselves are useful, it is the process which creates and updates the BIM that determines its success in maintaining a building efficiently.



room. The planning department approves the change and funding. The next step is for the internal team to create drawings showing how the work shall be completed. These drawings are then given to the appropriate trades to complete the work in the field. A small change is planned and documented prior to the change taking place. The central document and data has been updated and is accurate. When this process is implemented and executed consistently, the facility data will always be correct.

Let us now look at the flip side of this process, again equally as valid. In this case, there are no resources to have an internal document management team and BIM modelers. The planning department receives the same request to demolish two walls; however, in this scenario it is field-coordinated by the trades. No design was done so no drawings exist to show them what to do. They use their experience to make the appropriate changes. The trades in this scenario must document either by hand sketch or digital markup of existing drawings. How is this different than what we showed earlier that leads to our industry issues? The difference is that we add a step to this. In lieu of the carpenter putting the markups in the drawer,

we make them scan it or just take a picture and post the digital file in a folder of pending document changes. Since internal modeling is not an option in this case, a service contract can be used to source out document updates in regular intervals that can be determined based upon the size and regularity of facility changes.

The next scenario that needs to be understood is the larger remodel projects that require design documents. For this example, we are going to use a large hospital complex. This hospital is organized by area and floor in the building documents. At this hospital, it is not uncommon to have multiple architects designing remodels for different parts of the hospital at the same time. This can potentially be a stumbling point if the original BIM is not thoughtfully organized and built. For this specific hospital we built their model and organized it not as one single large model but as a series of pieces that, when combined, represented the entire hospital complex. We realized early on that this was necessary to allow them to streamline the process. When an architect was hired to remodel the sixth floor operating rooms and another architect was hired to remodel the cafeteria and dining space, we were able to simply extract those pieces of the model or "check it out" to give to the architect for the basis of design. This method has several advantages. The first being that the architect has good documentation to base the design on and therefore does not need to field-verify the plans. The second advantage we found was that this allowed the contractor at the completion of construction to insert the updated model (as-built conditions) back into the master model. The owner never needs to deal with updating a master set based upon remodel drawings.

Keeping room information is important, but for us to have a larger impact on operations of a sustainable building we need much more. The management of equipment data is the key to having a significant impact on operations. As we mentioned, in the BIM every object has an association to a database. This means that every piece of equipment that is in your building can now store a wealth of information. But first we have to get the right data loaded. A lot of people assume that the responsibility of loading data into a BIM should fall to the design professional. We actually discourage that! If you recall, the design professional often must list multiple products in the specifications. If they do that, which data do they load since they do not know which product may be installed? And if we follow the basic principles of "Lean," we should not do a task knowing that there is strong likelihood that it may need to be done over. If not the design professional, then who should it be? We suggest the responsibility for the loading of data associated with equipment be the responsibility of the contractor installing the equipment. They know which piece of equipment was actually installed and should have access to all of the manufacturer's or supplier's data. Remember the box full of equipment operations materials? We can now use the database in the BIM to not only eliminate the box of paper but also to provide means to access it. We have in fact now provided an accurate means to load the correct data and provided a tool to access the data.

But if your facility staff does not have BIM software what is the means to access this data? There are several opportunities to provide access without using a BIM software. The first of these is to utilize a QR code (Quick Reference) located on the piece of equipment. The QR code on the piece of equipment can be linked (via the web) back to the operations and maintenance data stored in the BIM. The operations staff can simply use a tablet, or even a smartphone, to read the QR code and they have instant access to all of the equipment information. The impact of this type of access is sustainable for a variety of reasons. First, to keep our systems of today operating correctly our staff needs the correct data; with this, they have it. Secondly, if we can provide the correct data to our operations staff prior to servicing a piece

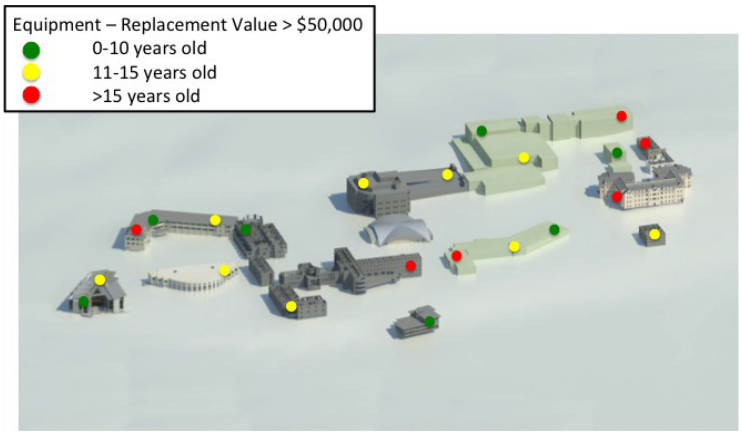


FIGURE 4. The power of data can be applied in numerous ways, such as the age and type of equipment/parts within a building to illustrate when a certain piece needs to be replaced.

of equipment, they can arrive at the job with the proper tools and parts. This saves multiple trips across campus making our staff more efficient and, in effect, saving energy.

Now, let us start to really think about the power of the data in a BIM. On a recent college campus, we used the BIM to store age data of all major pieces of equipment. If a piece of equipment was over 12 years old, it turned yellow in the BIM. If the equipment was over 18 years old, it turned red. Newer pieces showed up as green elements. When all of the buildings on the campus were shown in one overview and the pieces of equipment were applied, a visual map of a major capital improvement was brought to light! Multiple red elements in a single plan deeply concerned the operations staff. They then used this map to talk to their capital budgeting staff and very quickly got "buy in" for accelerating the need for major equipment upgrades.

These discoveries point out that a BIM, when properly implemented on your facilities, can be the tool to hold and visualize your facility data. It can be shared with other operations software and it can be designed to be very accessible and maintainable. But it is all also much more about process than a piece of software. Let us look more closely at the data and how to make this happen on both new and existing facilities.

DATA: WHAT IS IT? WHO NEEDS IT? WHERE DOES IT COME FROM?

What exactly is data? We have learned over the last few years of working with a variety of clients that data varies upon who you are and what your business is. Here are two examples of how data varies:

- A regional bank was interested in gathering data about their 200 branches that could help them bid out service for maintaining the buildings. The data they wanted included the square footage of glass, the square footage of each flooring type, and site information. Their need for data was so they could provide actual square footages to bidders to be able to compare bids more competitively.
- The second example was a private college that needed data to help them better manage their maintenance staff. The data that was required included room square footages, floor finish types, number of fixtures, as well as the frequency of cleaning schedule.

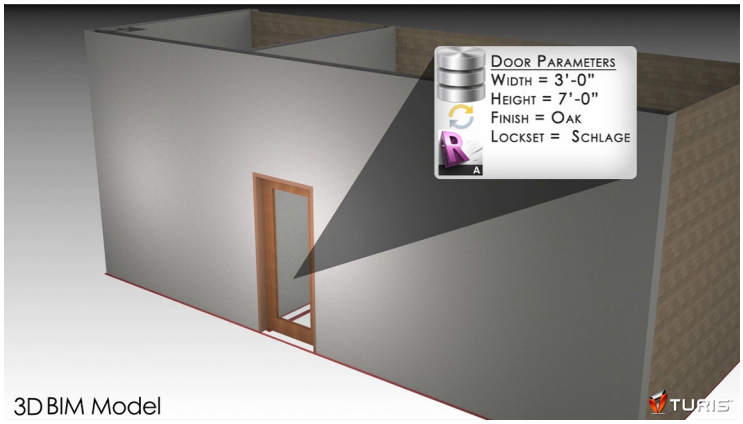


FIGURE 5. Numerous amounts and types of different data may be stored in a BIM file; however, only having the information the client deems critical streamlines the process and results in a viable model for facility managers.

In both of these cases, the owner was gathering the data manually, often spending weeks every year updating their data by measuring off of blueprints or maybe creating a poly-line around a CAD floor plan. Not only was this process time consuming, it often led to conflicting information. Probably the most amazing fact we found about the collection of data was at a hospital. As we talked to multiple groups within the hospital, we discovered that five groups were each collecting the exact same data. Not only did they not know that the other groups were collecting the exact same data, when we compared the data between groups, none had the same data. Wasted time and energy by each of these operations groups is simply inefficient and leads to bad metrics.

What lessons can be learned from these examples? Every owner needs to determine what data they need for their facilities. The best person to determine what data is needed is the user. On our projects we have developed a process of doing what we refer to as "Persona Development." This consists of a series of interviews that we refer to as problem seeking. In other words, we interview the users to see what data they need and how they use it. Does it need to feed into other software? How often do you access this data and how do you collect this data today? What information is needed during an emergency? At the end of this process, we have a series of documents that outline what data is critical to the operations of a facility and how it needs to be delivered.

We have talked to a lot of owners who have said, "Well, the heck with it. Just have them load every piece of data into the BIM." In theory this sounds good, but we caution you that this is trap. A model loaded with every fragment of data has two inherent problems. First is simply the size of the model and management of it going forward. The other issue is if the model is loaded with lots of superfluous data, it will be so difficult for your staff to manage and access data that they will soon become frustrated and quickly discontinue using the data. Also, all data that gets loaded into the model needs to be updated over the life of the building. If you have too much data in your BIM and it is not maintained, it will not be trusted. Once that happens, you will again lose trust and the efforts will be wasted. Our process only allows for data to be loaded into the model that a user has identified as valuable, and the most important part is that the user takes ownership of the information so that they cannot simply place blame at the feet of the larger group when it is not kept up to date. The users that interact with the data that brings them value must take ownership of the data and responsibility for keeping it updated. The concept of ownership of data within an organization is also the

key to preventing duplication of efforts. Once everyone is aware of who is responsible for keeping each data set updated, departments will stop duplicating efforts and begin to go to the correct source for each data set.

HOW DO I STOP "INSANITY" OR "GROUNDHOG DAY?"

We have described the "insanity." Now how do we stop it? In order to do that, we need to make some fundamental changes:

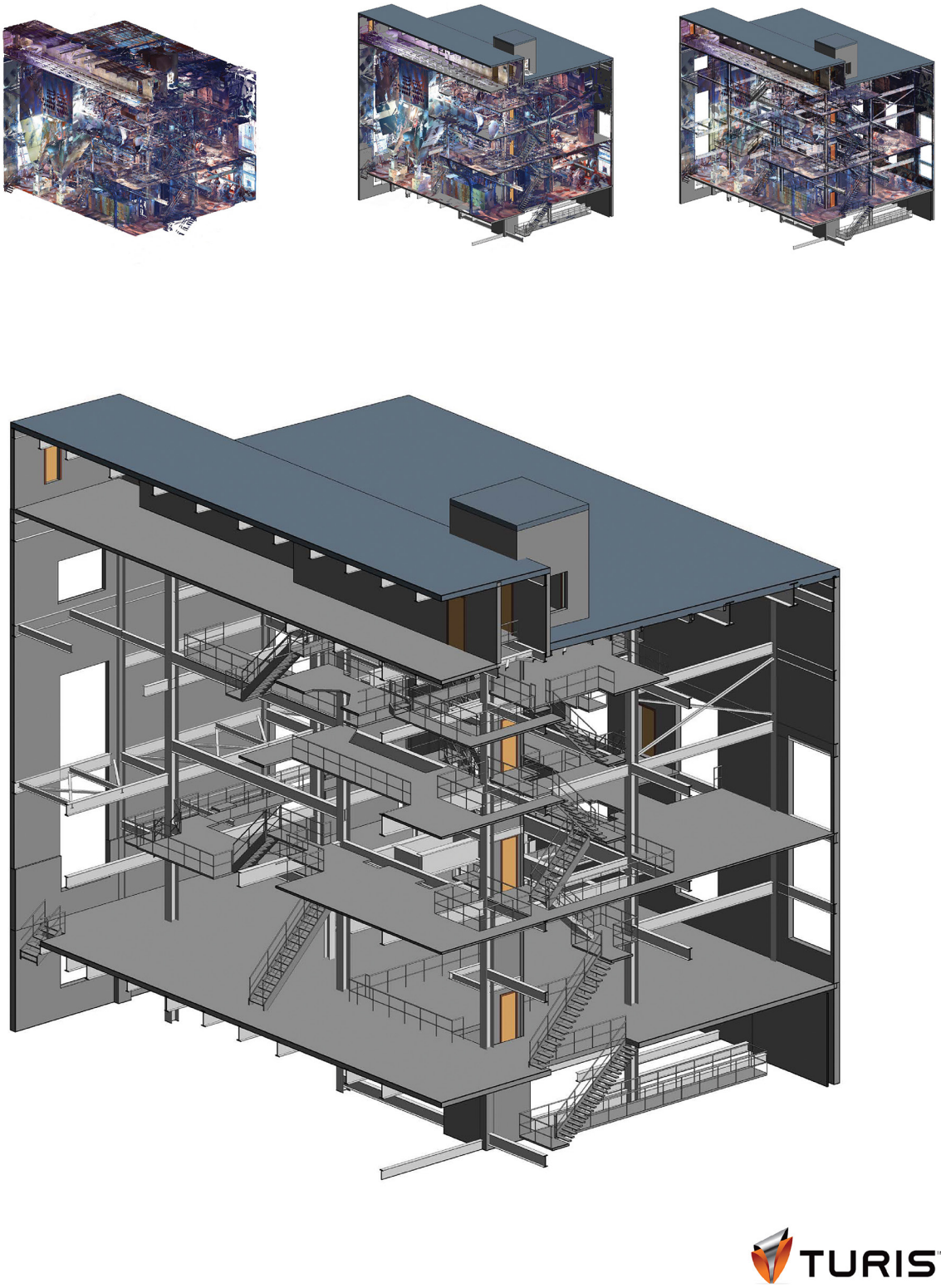
- We need to understand what data is needed, who uses it, and why.
- We need to focus on only the data that provides us true value.
- We need to get the data into one place where it can be shared, maintained, and accessed.

We like to emphasize that this is much more about process than software. Obviously, software is the tool in the background helping us to manage the process, but not the single source solution.

For your new projects, the process is actually quite simple. The preparation of Data Management Protocol, sometimes referred to in some circles as a BIM Protocol Manual, is an essential document. This document is a narrative that gets added to your next project Request for Proposal (RFP) for your design and construction partners. In this document you clearly delineate the flow and capture of your key facility data. The data that is needed based on your internal data evaluation process is outlined. This document defines who is responsible for gathering this data during the construction of the project and who is responsible for adding it to your data visualization or BIM. This document, when properly prepared, becomes a huge asset to your design and construction partners by clearly defining roles, responsibilities, and expectations. Our experience has also shown that when this document can be discussed with your partners at the beginning of the project it will result in no additional cost to the project because of the delineation of responsibilities, as opposed to the unknown of "Provide a BIM at the end of the project."

As we all know, the majority of the facilities that we have to deal with are not new projects, they are the existing buildings in our portfolio or campus. How do we gather data on the vast majority of our buildings? The first step is to develop a BIM of your existing facility. For many campuses, this is the first stumbling block. They do not have a million dollars to go back and model their existing buildings. In fact the big issue here is that most people take the wrong approach to even modeling their facilities. They have heard that to have a data rich model one needs a very elaborate model that will cost several dollars a square foot. This is inaccurate! In fact, a very basic model, the equivalent of a space model of your entire campus, can be delivered for under five cents a square foot, in most cases. This model is not a beautiful model that will provide renderings or fly through animations, this is a data model. Although basic in appearance, this model can be data rich. Behind every object in this model is the full database. All of the information you need—from room size to pump specifications—can be added to this model. This database can then be linked to your other facility management software. In effect, this model becomes the source of all facility information for your other operations software. The hidden secret is that once this data exists, it is possible to change a piece of data in a software and push it to the BIM, or conversely, push the new BIM data to other software. Frequently, there is no need for double entry. It is literally a "push" between software platforms.

FIGURE 6. Field verifying existing conditions is made easier thanks to the advent of point-cloud laser scanners.



Some of you may be reading this thinking to yourselves this is great but you have millions of SF at your facility and in order to make the paradigm shift you need to spend a lot of money to get started. A recent project proved the opposite. We were able to create a base model for over 60 buildings and 5 million SF in a matter of weeks, not months or years. We were also able to deliver it cost effectively for pennies a SF, not dollars. So what did they get?

- They received space models for over 60 buildings and 5 million SF.
- They received field verified data including floor type, ceiling type, wall finish, space type, and department.
- The field verification process also included updates to their existing documentation when plan discrepancies were discovered in the field.
- The end deliverable was accurate as-built data loaded documentation for over 5 million SF!

SUMMARY

When we talk about sustainability, we so often look for the direct savings such as recycling and reduced energy consumption elements. By all means these are very important characteristics of sustainability. Going forward, looking at the life cycle of the building data, data capture management and access are the most critical components to the realization of energy savings and sustainability for our buildings.

A variety of articles over the last few years have documented the flaws with the age-old system of design-bid-build. In fact, the construction process is less efficient today than it was in 1964! There are inefficiencies at every level of the process. There is duplication of services and documentation. All generated waste and inefficiency. There is a loss of knowledge at every hand-off that leaves the operations team with limited, inaccurate, and often inaccessible data. Without this data, it is virtually impossible to operate a system or a building at its designed efficiency. We need to analyze how the delivery of our new projects can be improved. In this article, we have outlined some of those approaches. Regardless of the system you utilize, data capture is critical for your new buildings. Start to develop a data management protocol for your new facilities NOW. Additionally, it is even more critical to capture facility data for existing facilities. A quick and efficient process for capturing existing facility data is the key to maximizing the operations of all your existing campuses. Bad data equates to bad metrics. Do you know how you are really performing if you, like the examples we sited, have seven per cent more square footage than you realize?

Once you have the data, you need to provide access to it that is efficient and easy to update. If your staff has to struggle to find the data, it will not be used. Similarly, if the data is not up to date it will soon be disregarded.

How do you move forward? We believe that the keys come down to the following basic steps:

- Data analysis process: what data do you need, who needs it, and how do they currently access it?
- Where does the data need to flow to and how many groups access the same data?
- Prepare a data management and delivery protocol for your new projects so you get the data you need in the format that you need the first time.

- For your existing facilities, prepare a basic data management visualization plan.
- Create a base level BIM.
- Document the current data. . . .

The train has left the station, it is a fact. Data visualization will bring your staff a minimum of a 20% efficiency improvement in how they access data and the value of the data. It is not too late to catch the train, but you need to move now!