

APPA Effective and Innovative Practices Award 2015

## BIM FOR SKILLED TRADES



WESTERN MICHIGAN  
UNIVERSITY



### BIM FOR SKILLED TRADES

**“FACILITATING CAMPUS MAINTENANCE  
UTILIZING BIM 3D MODELS ON MOBILE  
DEVICES”**

*WMU's approach to building and using a BIM database for an entire campus including all buildings dating from its first built in 1905 to the buildings being built now and ones being planned for the future*



WMU Main Campus

### BIM benefits

**SAVINGS!** Reduction of time spent by skilled trades and support staff for seeking data

**EFFICIENCY!** Skilled trades can do more work orders!

**INNOVATION!** Change in skilled trades culture, moving from paper-based to tablet-based process

**PORTABILITY!** Any university can adopt this process and technology inexpensively

**EFFECTIVE!** All skilled trades can quickly and easily retrieve building information

Reduced time spent on work orders by 15%

Labor efficiency improved by \$524,000

# Overview of Western Michigan University and FM Department



**Western Michigan University** is a national research university enrolling nearly 25,000 students from across the United States and more than 100 other countries. Founded in 1903, it is a learner-centered, discovery-driven, and globally engaged public university that stands out among America's more than 5,000 higher education institutions.

## The Facilities Management Department

The **Facilities Management Department** is a unit of the Office of Business and Finance. FM provides all facility services to campus customers in a professional manner that exemplifies positive customer service and stewardship. These services are delivered in five divisions.

### FM Fast Facts

- ✓ 50,000 work orders in 2013
- ✓ 20,000 PM maintenance orders
- ✓ 8 million square feet of University space
- ✓ 1,200 acres
- ✓ 49 miles of utilities
- ✓ 39 miles of sidewalk and 26.5 lane miles of roadway
- ✓ Annual dispatch of 72 million KWh of electricity and 510 million pounds of steam

## Facilities Management vision

Excellent service to the University community

Excellence in stewardship of the campus environment

Professional and effective communication

High standards for professional and personal accountability

Practicing sustainable development and management of campus resources

## Five divisions, 439 employees

### Planning

Project programming, schematic design, space management, and master planning.

### Projects and Construction

Construction, renovation, and remodeling of university facilities.

### Engineering

Managing, planning, and designing infrastructure and utilities.

### Operations

Management and maintenance of buildings, landscaping and vehicles.

### Administration

Central support for business operations and information technology.

## The Operation Division: Maintenance Services

The Operation Division is divided in five different areas: Maintenance, Landscaping, Custodial, Power Plant and Transportation. Maintenance operates and maintains University buildings and infrastructures. The division has 110 skilled trades divided in nine shops, each of them with a specific area of campus assigned. Most of the challenges faced by the division are the **preventive maintenance** and the **service calls**.

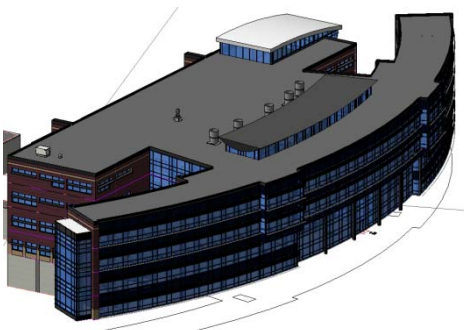
**Bronco Fix-It**, part of Maintenance Services in the WMU Facilities Management Department, is the primary source for serving the building and facility needs at Western Michigan University. Bronco Fix-It quickly communicates building issues and service requests to the professional staff at Maintenance Services sending the **work orders directly to the skilled trades iPads**.

## Technology Background at FM Management

The Facilities Management Department is organized and prepared to adapt to the changing environment in higher education facilities. The FM department has to address challenges in accountability, demographic changes, sustainability, and lifecycle cost management. The department challenges itself to continually improve the organization to **better support the customers** and the **mission of Western Michigan University**.

In the early 1990s the department moved from paper to **2D CAD** based files for "Simple Floor Plans," replacing hand drawn operational drawings. In 1997 the department started using a new **Computer Management Maintenance System (CMMS)** for the maintenance operations. Then in 2005 skilled trades operated with the aid of **barcode scanners**. Each piece of equipment has a unique barcode that gives real-time information through mobile pads. In 2014, 110 skilled trades in nine shops started using **mini iPads** to manage work orders and retrieve database information through a **file-finding** software.

College of Health and Human Services (3D Model), Western Michigan university



*Bronco Fix-It is the  
online tool for  
service requests in  
campus*

Bronco Fix-It service request



## FM Initiative: BIM for skilled trades

### Statement of program/practice and its results

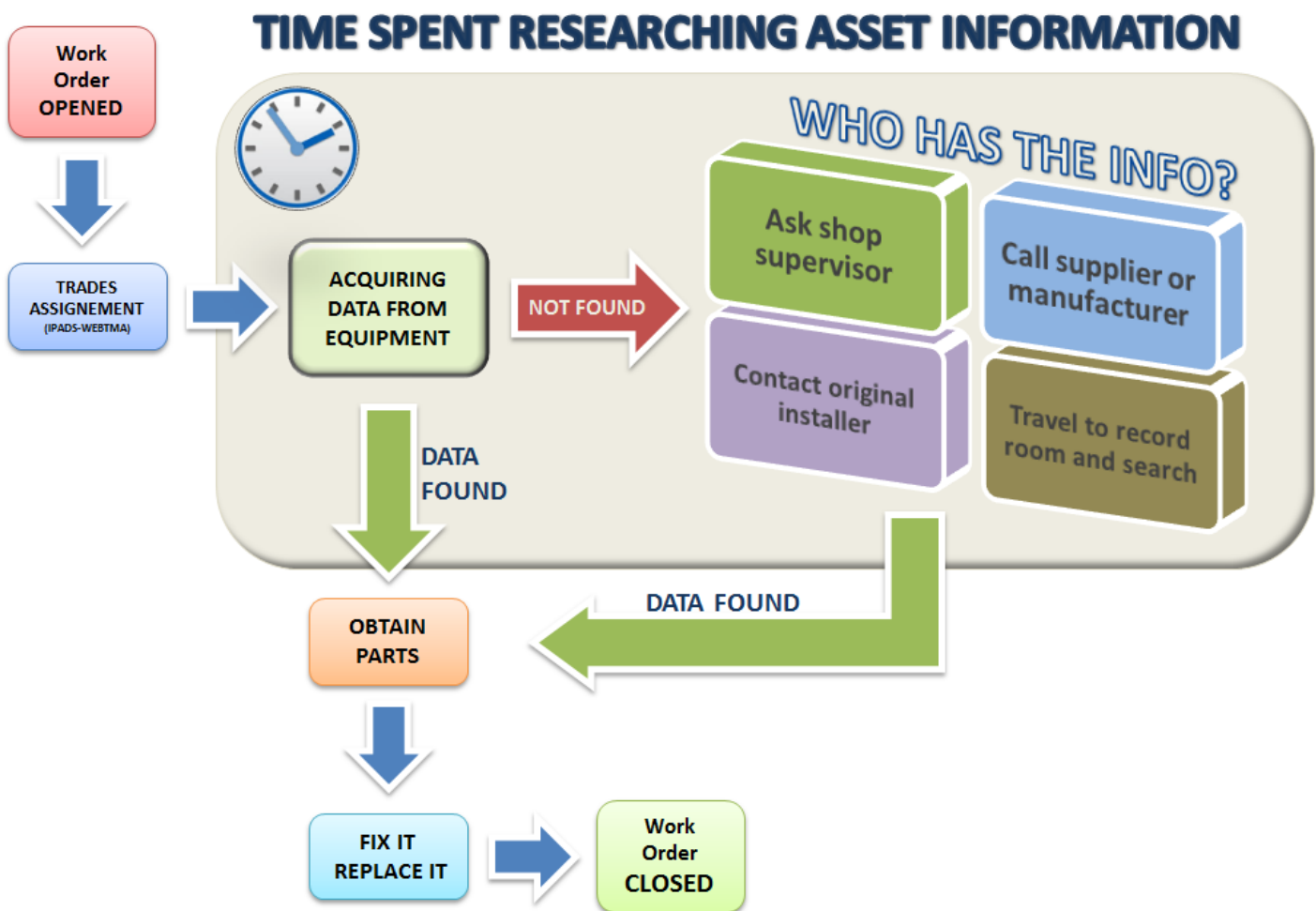
The **BIM for skilled trades** initiative strives to enable skilled trades to have mobile, data-rich BIM models allowing them to better access information. With the information at their fingertips, they can maintain mechanical equipment throughout the campus in a more efficient manner. Part of this goal has been accomplished by equipping technicians with iPads that allow them to manage work orders and obtain CMMS data. The objective is to enhance the mobile data availability and the mobile viewing of BIM models that have been populated with data from the CMMS system using a synchronizing tool that has been developed to connect the CMMS and BIM databases.

This initiative strives to achieve a new information gathering process that will be more efficient than the previously existing procedure and, therefore, **save on resources** that can then be reallocated and repurposed, ultimately achieving **increased efficiency** across the Operation Division.

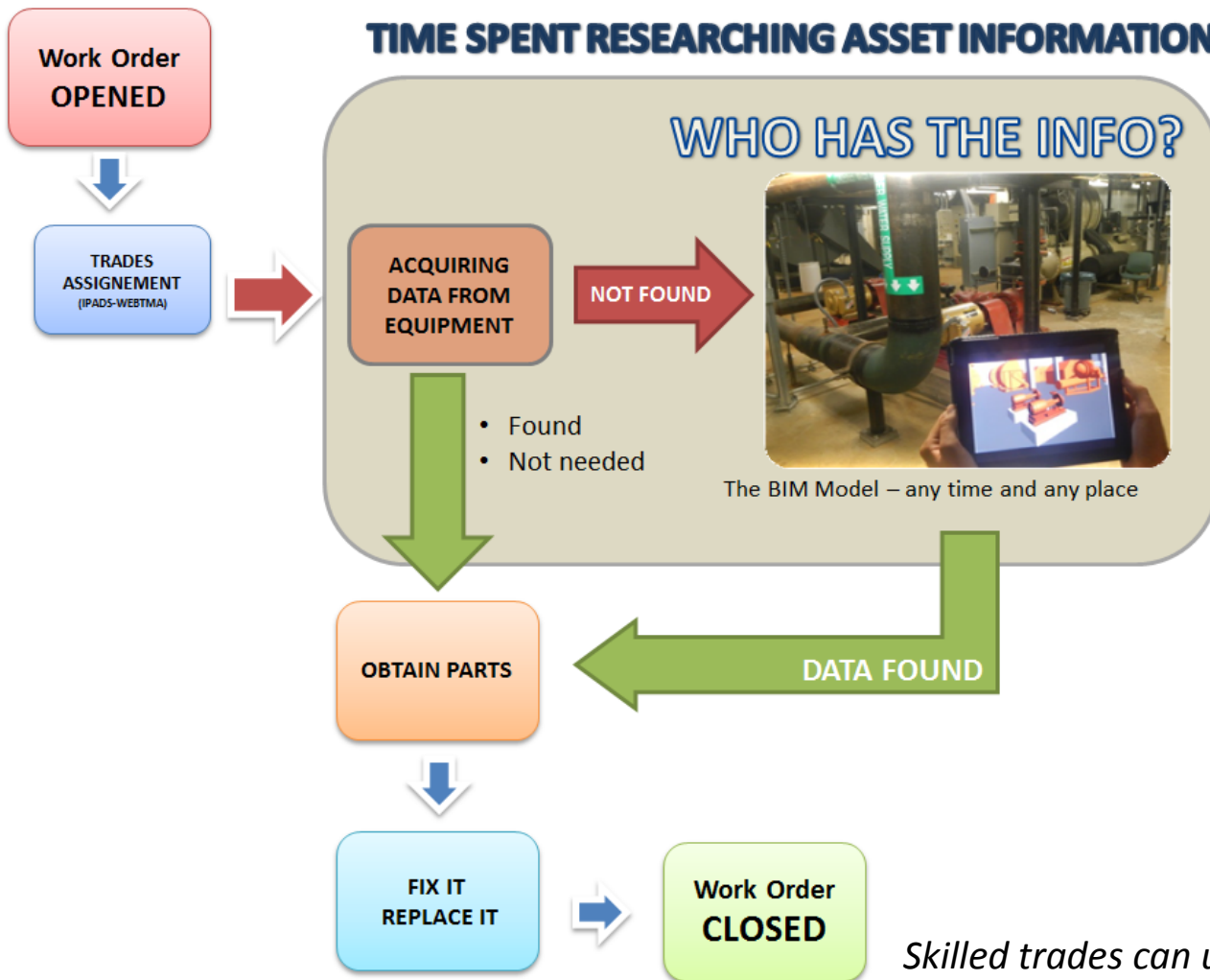


## Previous Work Order Flowchart

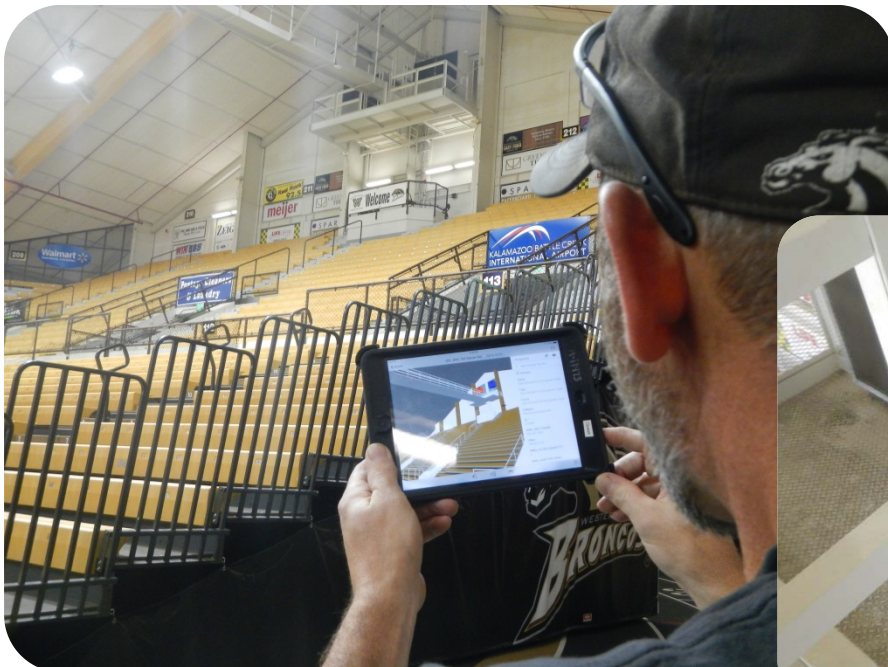
*“The focus of this initiative is to review the **time spent researching** facility asset information.”*



# New Work Order Flowchart



*Skilled trades can use iPads for their PM operations. The BIM model can be easily utilized to retrieve data from equipment located in areas not easy to access.*



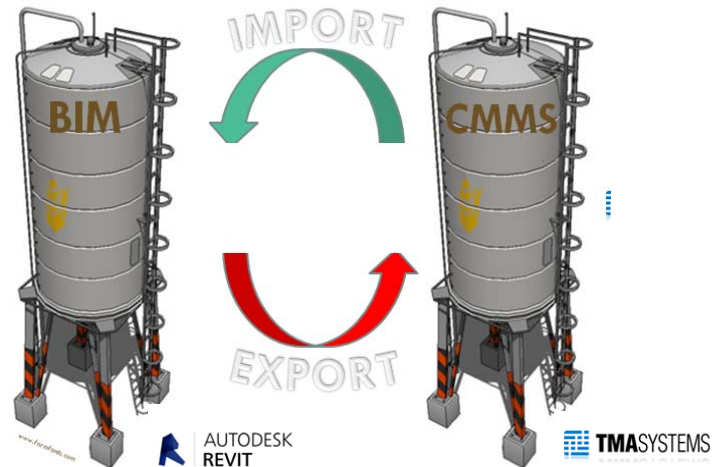
# 1. Institutional benefits

As technology continues to advance, processes must be modernized as well as finding the most efficient way to accomplish a task. This new process for accessing information will provide a reduction in the resources used in comparison to the past process, saving resources what would essentially be wasted. This new technologically-based process is also a step in preparing the work environment to suit a more **technologically inclined work force** that is to be expected in the future.

To serve our existing transitional workforce, the system remains **intuitive and visual for ease of access** to the information. With the ability to synchronize data from both the CMMS and BIM data bases, the **time taken** to update the databases is **reduced significantly** and the chance for error is reduced.

Previously populated CMMS data for existing buildings can be pushed into the BIM with the press of a button. Similarly, new **capital projects** that are accompanied with a data-rich BIM can have this **data pushed into the CMMS**. The ability to make changes and updates to the information is present in both databases, meaning updates can be made in either system and then synchronized with the other.

*The two DATA Silos BIM and CMMS are connected*



*Student auditing CMMS data and collecting mechanical information for BIM Asset*



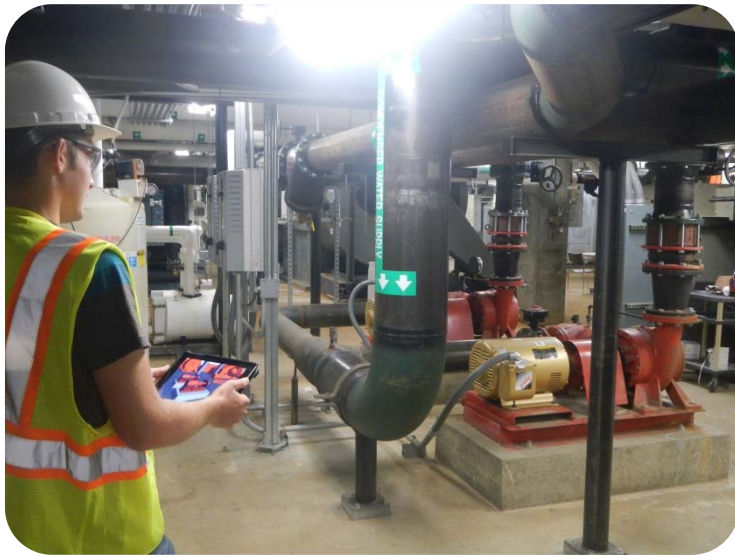
In keeping consistent with the University's vision of adding value to multiple systems at one time, the audit process being utilized in the field adds valuable information to three different systems.

The data currently in the CMMS database is verified while physically visiting each piece of equipment and is then corrected or entered for the first time when discrepancies arise between what has been recorded and what is actually preset. Not only are the mechanical equipment assets added to the building models, architectural details such as floor elevation changes are added for a better visual representation of equipment containing spaces. Finally, this process ensures that our two dimensional operational CAD files and three dimensional Revit models match in floor plans and, thus, that the two representations of the building match in square footage.

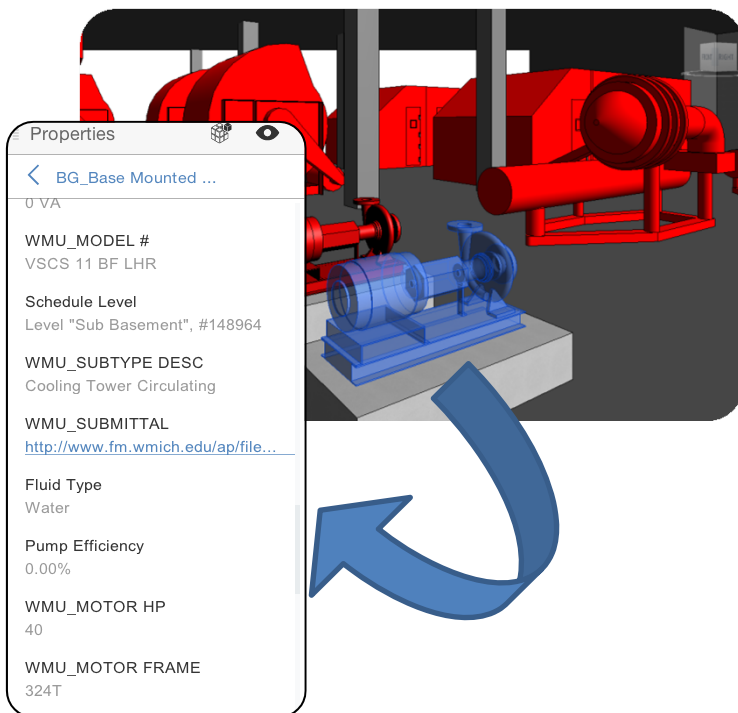


*iPad screenshot navigating a BIM model, the properties box on the right shows the Mechanical Asset of the highlighted pump*





Retrieving asset information in the field using  
BIM on iPad



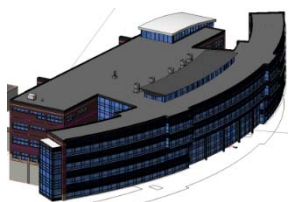
## 2. Characteristics or qualities that make this program innovative

Through outstanding leadership, the department has built a flexible foundation for the BIM database to allow for no absolute restriction or definition for the final BIM system's use or content. Undefined parameters and the **LOD** (level of detail) have **not been allowed to paralyze** momentum and progress of the initiative. The department found resources and support to **build the BIM data base**, selling a concept for the future with no defined cost or benefit. Existing staff members did not possess the needed BIM skills and justification for either the dedication of their time or hiring additional staff was not present at this phase. The hiring of professional consultants to build the initial BIM database would cost the University hundreds of thousands of dollars. The solution was to select **University students** with an interest in BIM to join the Facility Document Team in Facilities Management where they have access to construction documents, CAD and 2D information as well as physical access to campus facilities, thus adding to the educational experience while creating the foundation for the University's BIM assets. To our knowledge, we are the **first university** that has implemented this **type of process**. The department worked closely with TMA Systems, our CMMS provider, to develop the required Revit/TMA interface that is used for the synchronization process.

## 3. How this practice can be used by others

This practice of connecting the CMMS and BIM databases **can be utilized by any other FM** management organization to attempt to improve their information-gathering process as well. The critical linking tool is feasible for differing CMMS systems that other institutions may use, allowing for broader system compatibility and, thus, the opportunity for more FM management organizations to use a similar time and resource optimizing system.

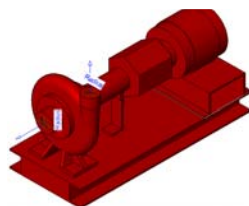
### BIM ASSET AT WMU



All existing buildings in  
campus modeled



CMMS data and pdf  
specifications attached  
to mechanical  
equipment



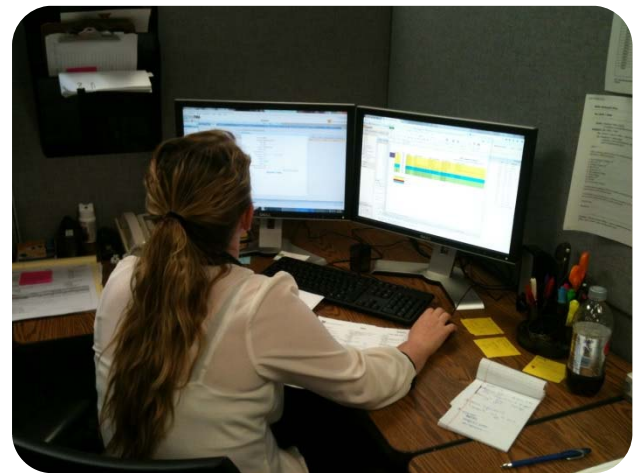
## 4. Management involvement and employee commitment

The management of the department has been involved in the BIM for skilled trades initiative from its conception and continues to be involved and supportive. A new full-time BIM experienced position was created to manage the Document Room and the building models, which provides the student employees a more accessible staff member for when questions or concerns arise, eliminating the need to search for support.

Staff from various other areas such as building **commissioning, information technology, and database management** have been directed to **help support the new process** when needed. These different areas have played an integral part at different stages of the process such as database management providing the initial equipment reports, and information technology providing support for the installation and trouble-shooting of the Revit/TMA interface and providing infrastructural support for the BIM models. One hundred iPads have been purchased and deployed to technicians to increase mobility, access work orders, and provide the ability to utilize the new information accessing process that has been created. **Student employees** provide a **committed knowledge driven base workforce**. The entire team continues to be integral for the continuation of the initiative.



FM Document Room



TMA and IT



Associate Vice President Peter Strazdas presenting the Initiative to MSU and U of M FM staff



Skilled trades





*Tour of the FM Department for the universities hosted at WMU for the BIM presentation*

***“...we are having many discussions with our team on implementing some of your processes.”***



*Students presenting the BIM initiative to other universities at FM Department*

***“...we were all very impressed with the great things you are all doing...”***

## Feedback

### What other universities say about it:

*“Thank you, for a great visit last week! You and your team went above and beyond for us and we truly appreciate the hospitality you extended to us! Kevin and I learned a great deal from your operation and we are having many discussions with our team on implementing some of your processes.”*  
**Corey Ruff, Executive Director Facilities and Campus Management-Abilene Christian University**

*“Thank you so much for the wonderful lunch and learn session yesterday. We were all very impressed with the great things you are all doing and are really excited to utilize the information you so graciously shared to develop a BIM program here at MSU.”*  
**Lorena Griffin, Facilities Information Services Manager-Michigan State University**

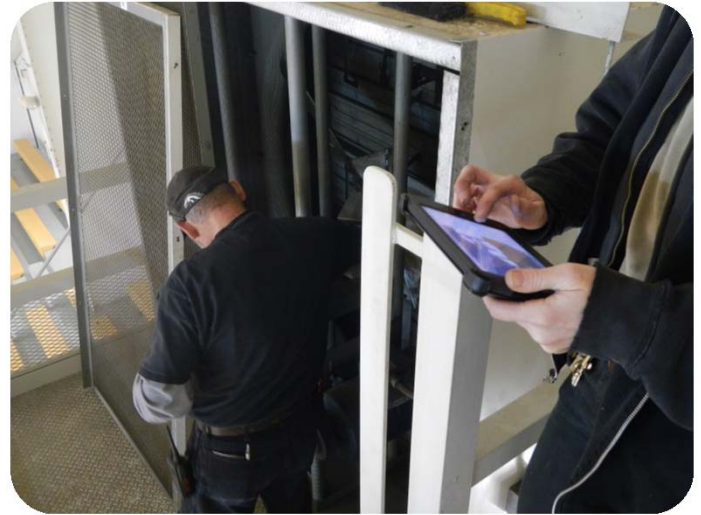
## What skilled trades say about it:

*"This new approach to conceive the maintenance will help our job on a daily basis; I spend a lot of my time answering calls and retrieving information on our system for other trades on the field, some of them they need to drive back to the shop just for data seeking."*

**Steve**  
Shop Supervisor, Shop 5

*"BIM? I don't have any idea of what that is, but having the information we need in the field or even at the shop before leaving it, also in 3D! It's amazing!"*

**Beckie**  
Skilled Trade, Shop 5



Skilled trades using BIM models for a service call

***"...having the information we need in the field or even at the shop before leaving it... It's amazing!"***



Students showing the BIM models to a skilled tradesperson.

***"...will help our job on a daily basis; I spend a lot of my time answering calls and retrieving information..."***

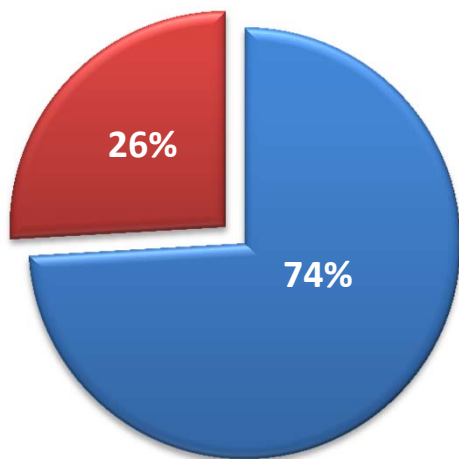
## 5. Documentation of results, analysis and resulting benchmarks

In the fiscal year 2013, the largest source of work orders was preventative maintenance for mechanical equipment, followed by service calls. While the number of **work orders** based on PM exceeds service calls, 74% versus 26%, the total hours spent on service calls is higher (see chart comparison below).

We believe the primary factor for the increased time spent on service calls is due to the fact that the trades **need to find equipment information** by making calls, driving back to the shop or the record room.

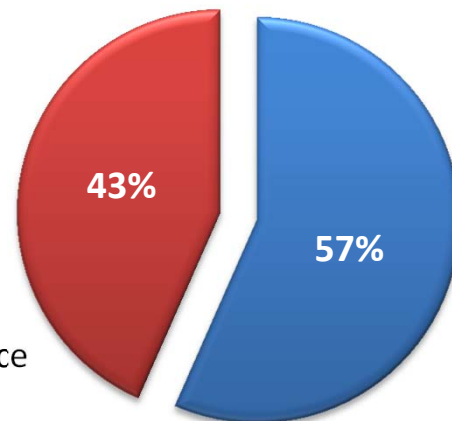
The **BIM initiative** objective is to **provide the trades the information** needed through the building information model shared on their iPads. Information such as warranty, operating and maintenance manuals, specifications will be **attached to the equipment** in the building model and available by clicking on them at the jobsite.

**Number of work orders**  
[Mechanical Equipment, FY2013]



- PM  
Preventive Maintenance  
Walk throughs
- Service Calls

**Number of worked hours**  
[Mechanical Equipment, FY2013]



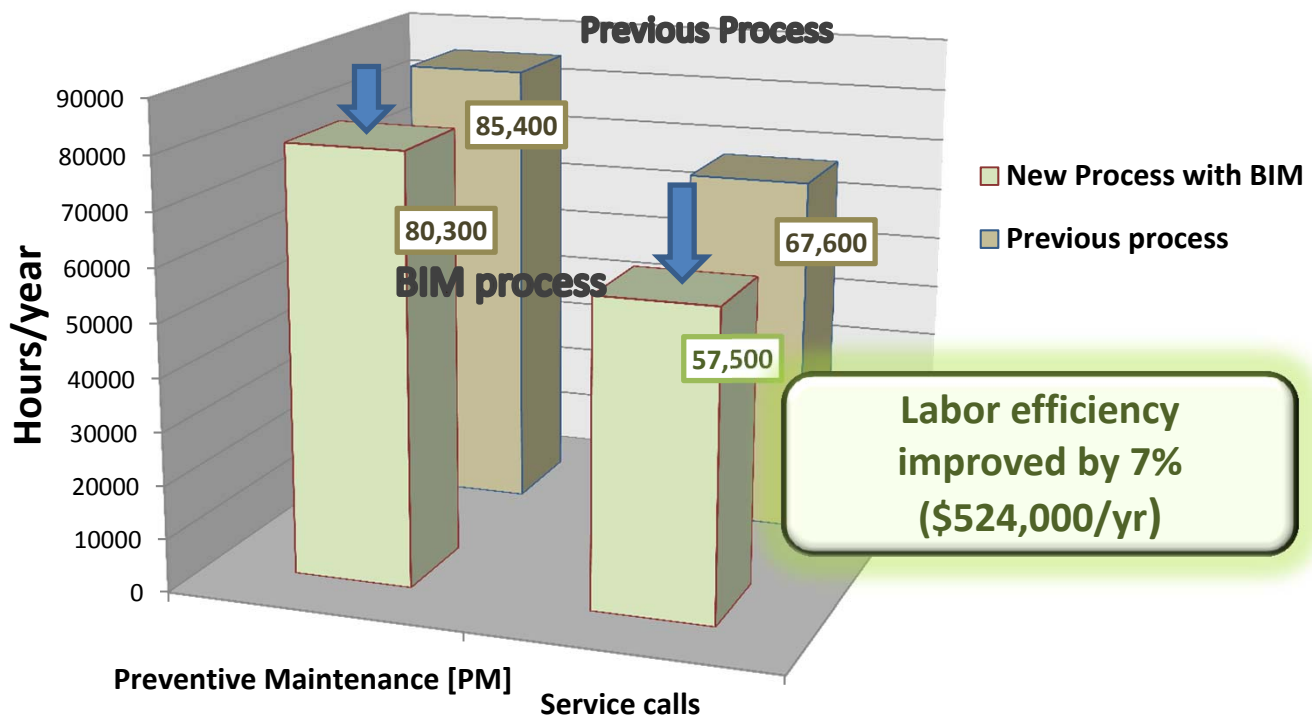


## Efficiency Improvement

A survey has been conducted among the skilled trades that have been using the BIM assets on their iPads. The results of the survey showed that the **reduction of time** for the preventive maintenance and walk through for the mechanical equipment is **between 6% to 9%**, and for the **service calls** for mechanical equipment the reduction is much higher, around **15%**.

The labor efficiency improvement is based on 110 trades within maintenance services and the total hours spent on preventive maintenance and service calls performed within a one year period.

### Efficiency improvement with BIM for skilled trades [Mechanical Equipment]



Comparing the previous process and the BIM the total amount of **hours of efficiency** for the service calls are **10,000 hours** and for the preventive maintenance around **5,000 hours**.

The **average improvement** for the process is **7%** and an estimated labor savings of **\$524,000**.



WESTERN MICHIGAN UNIVERSITY

Facilities Management  
1903 W Michigan Ave  
Kalamazoo MI 49008 -5324 USA  
(269) 387-8556 | (269) 387-8440 Fax  
[www.fm.wmich.edu](http://www.fm.wmich.edu)