

WHITEPAPER

Building a Business Case for Mobile: Managing Mobile Work Orders



PROMETHEUS GROUP



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Introduction

Digital transformation is a term used to describe a variety of technology initiatives within the asset management community and beyond. Many elements of digital transformation projects are not new, rather for the first time these elements are being integrated to create a holistic view of asset management activities and real-time conditions. Larger volumes of higher quality data, acquired faster, allow maintenance teams to plan and react more quickly and effectively, at a lower cost.

Unfortunately, continued reliance on slow, labor intensive, and error prone work execution systems, such as paper-based work orders, threaten to obstruct or negate the benefits from digital transformation initiatives. This paper explores the benefits of mobile work order solutions and provide some key points supporting the business case for maintenance mobility.

Why Should Maintenance Teams Go Mobile?

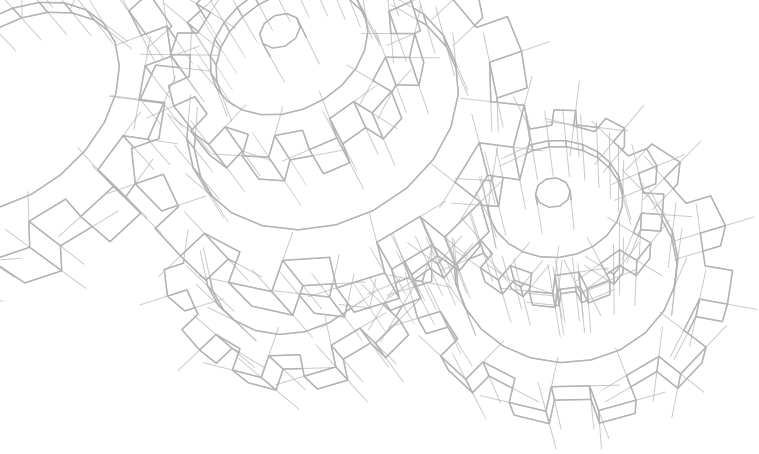
Mobile work solutions are usually implemented to address common work process ailments. However, these solutions deliver positive benefits far beyond the elimination of paper, increases in labor productivity, and streamlining of work process. The speed and accuracy of maintenance/repair data may be crucial to the success of predictive maintenance, reliability, or total productive maintenance programs. Improvement requires measurement, and measurement requires high quality data to assess the process and make positive

adjustments. There are also additional benefits not discussed in this paper. These include inventory reduction, project management (shutdowns & overhauls), right sizing of maintenance work (over or under maintaining) and other advantages.

Maintenance Work Documented on Paper or Executed on Mobile

The delivery of maintenance and repair work has changed as technology has advanced and business demands have driven maintenance organizations to strive for operational improvements. Work can still be assigned through a variety of methods including face to face meetings, telephone, radio, pager, text and email communications, paper work orders, and electronic dispatch (mobile) work orders. However, complex tasks require comprehensive supporting information that goes beyond a simple work order. These include job plans, repair/maintenance history, safety information, recent readings and measurements, diagrams, and other key information. Mobile solutions offer the best method for quick and efficient delivery of all information required for maintenance and repair work.

The highest possible value from work execution is only obtained when the result data is accurately entered in the CMMS/EAM/ERP system as soon as possible. Until this information is entered the entire organization is blind to the completed work results, asset availability, and accurate inventory levels. It is this operational data requirement which forms one basis of the argument of paper vs. mobile work orders.



Mobile Work Order Benefits

Verbal, email, text notifications, and paper may be acceptable for assigning work, but work process completion requires accurate data to be collected and entered into the system of record as soon as possible. The trend in most progressive maintenance organizations is to implement mobile work orders to achieve the following benefits. The percentages of improvement are taken from general maintenance and repair industry figures, averaged across multiple industries.

Operational Improvements



Reduce overall asset maintenance and repair costs (21 to 49 percent) – Speed, accuracy, and quality of mobile work all contribute to better running assets and reduced costs.



Increase first-time work completion rates (11 to 21 percent) – By following a better work process, and with all the information needed at their fingertips, crafts and trades can quickly and accurately complete jobs with higher first-time fix rates. This increases overall craft service quality, and more importantly, decreases asset downtime.



Increase productive work (wrench time) (9 to 17 percent) – Save the meeting time used to assign and distribute work, travel time from meeting to the job, travel time to return completed paperwork, time spent searching for job information details, and the time spent to enter completed work orders by techs or admin personnel. This leaves more time for productive work.



Increase asset availability, reduce unplanned downtime (13 to 24 percent) – Properly conducted maintenance, accurately captured, is available immediately for reporting and trending. The current state of the workload, and the assets, is reflected

in the CMMS, ERP, or EAM.

Work reassignment – Work can be returned to the



scheduling office for electronic reassignment without waiting for the paper to catch up. This ensures that important work is not delayed, or worse, falls through the cracks with status unknown.

Drive improved practices by enforcing standard work



procedures – Mobile doesn't force technicians to perform work a certain way. However, work process flows are standardised, and job steps are displayed as needed to complete work correctly and safely. This also aids workers who may be unfamiliar with an asset or a given maintenance/repair procedure.

Emergency work – Emergency work is electronically assigned to the right resource, with a high priority, in



the right location, containing all the required information, who can address and correct the condition. Assignment delays are minimized,

and repairs are completed quickly, resulting in less asset downtime.

Electronically record meter reading, photos, inspection results – Additional information is easily gathered



without the need to physically attach records or make entries into separate systems, which leads to higher user adoption, more and richer data sets, and improved maintenance performance.

Access to data – Mobile solutions can access asset maintenance/repair history, inspection records, past



readings, check availability of parts in inventory, and much more.

Capture additional work – Techs may be approached by operators with a work request, or a technician may



observe a condition which results in a new work request or work order. In a paper environment, this work is often completed

yet goes unrecorded, or the work is delayed while the documents are prepared and printed. By using a mobile solution that integrates with your ERP, EAM, or CMMS, this work can be completed and recorded immediately, or a work request can be entered with the observations noted and assigned electronically to the right person or crew.



Accurately record work execution time and location, parts/supplies used, and results –

Standard times for maintenance tasks can be adjusted since accurate job completion time history data is available. This directly effects the number of future jobs which may be scheduled. Parts and supply items used are relieved from inventory or returned to stock unused. Immediate updates help maintain inventory accuracy. Workers can record job problem, cause, and resolution codes for trending and root cause analysis. Nested drop-down lists guide the tech through the process of selecting the right codes to accurately describe the failure they found and corrected.



Eliminate printing costs – Reduces or eliminates the preparation time, paper, and printer expenses required to print work order packets.

This isn't just paper and ink or toner. At the very least, you'll save on admin and IT support, as well electricity costs. Everything a technician could need, including the job plan, bill of materials, tool requirements, safety information, manuals, and asset history can all be contained electronically within the mobile work order application.



Reduce errors – Handwritten notes, check marks, and other annotations are open to interpretation by data entry personnel. Mobile work applications support the use of pick lists, check boxes, barcodes, and field-level edit rules to ensure data integrity. Errors can be costly to locate and correct.

Data Quality and Timeliness Value

Update systems and asset availability in real time – Completed work results are available immediately in your system of record, along with current asset availability. No need to phone, email, or meet to notify operations of asset availability. Supervisors can easily see what work is completed and what is still open.

Measurement (data analytics) – Timely and accurate data allows maintenance supervisors and managers to “Dashboard” key metrics, spot trouble, and apply resources as needed to decrease downtime. Accurate and complete work data supports root cause analysis, labor utilization improvements, adjustment of maintenance plans, and overall work process improvements.

Additional Benefits

Recover warranty parts and labor – Mobile supports the management of manufacturer warranty claims for parts and labor recovery. Work orders can be flagged with special instructions so that claim procedures are followed, and warranty expiration dates are observed.

Mobile fosters collaboration – There are typically a number of people in the organization who must stay informed about maintenance issues and schedules. With a mobile work solution, all important parties can access the files and information at once, all from their own devices. Mobile maintenance software keeps everyone on the same page and aids in collaboration.



Flexibility – Maintenance operations often require a good deal of flexibility. For example, there may be several projects scheduled for a given day, but if a breakdown occurs, the current project(s) must be suspended to deal with the breakdown. This requires flexibility and quick communication with multiple resources and departments. Mobile work solutions allow you to communicate the changes and rearrange your crew’s work schedule on the spot, thus supporting your crew to be both flexible and more productive.

The Ever-Increasing Value of Work History Data

Physical work on assets has obvious value to the organization, but the data collected can provide value as well. Work history data is of great benefit, but only when it is complete, accurate, and timely. Mobility achieves this on a level that a paper-based system cannot match.

The operational value of this historical data includes, but is not limited to:

- Reporting asset availability in real time
- Adjusting and updating work schedules
- Measuring work completion against the schedule
- Adjusting standard job task times (planning and scheduling)
- Evaluating inventory levels and stocking requirements

- Measuring individual performance and training requirements
- Flagging safety hazards
- Measuring overall maintenance effectiveness
- High quality data supports reliability-centered maintenance initiatives

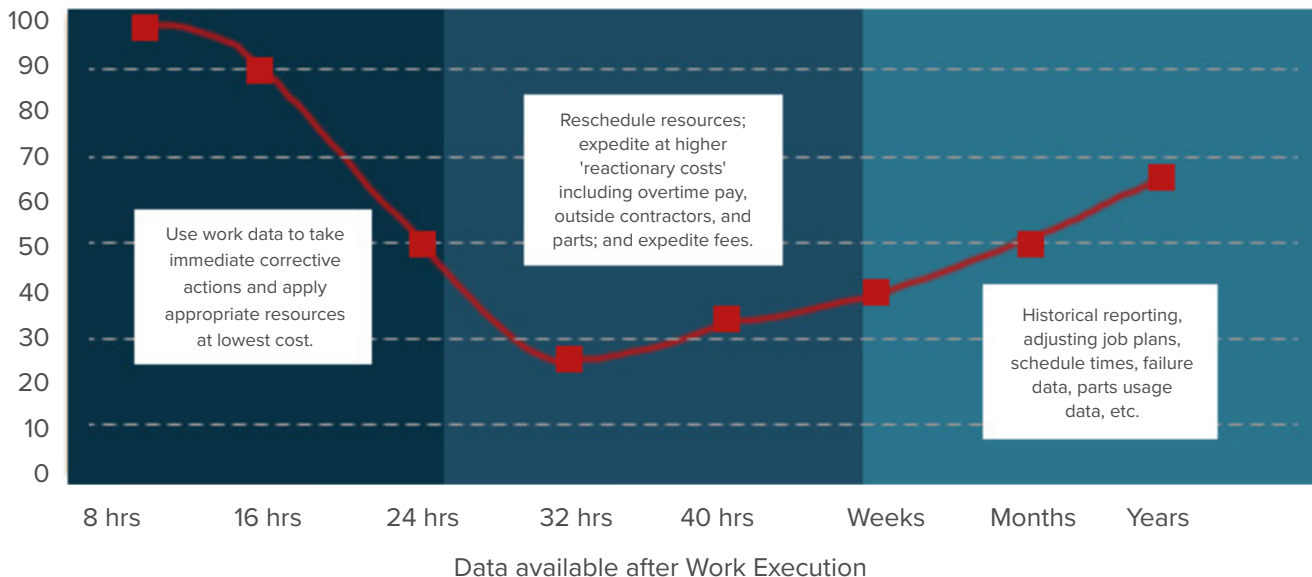
As Brian Baldwin, CMRP, states in "How Failure Data Contributes to the Success of Your Reliability Program," measuring maintenance strategy effectiveness is one key benefit that comes from documenting failure data. He says, "Accurate failure event documentation within your CMMS provides the foundation necessary for accurate analysis of mean time between failures (MTBF), mean time to repair (MTTR) and the total cost of failure when lost production is also accounted for."

Quick, efficient, and accurate collection of failure data is a direct appreciable benefit of a mobile work order process.

If the data is not entered and available within a reasonable time then actions will be taken without benefit of the data, so its value degrades.

Sometimes maintenance or repair work completed is not effective. Either the asset goes down shortly after maintenance work, or repair work fails, and the asset is out of service again. In either case, information on that

The Value of Work Order Data ... Over Time



recent work activity is crucial to quickly restoring the asset to operating condition. This requires that the work activity be completely and accurately recorded in the CMMS, immediately. Work event data is valuable only if it is complete, accurate, and timely.

Transcribing data from paper to the system of record increases the risk that critical details may be lost, incorrectly entered, or misinterpreted. This is especially true if the entry is not made by the person who accomplished the work. If the data is of high quality, then report results can be trusted and critical business decisions made.

Over an extended period, this historical data becomes more valuable as a source for failure trends, asset assessment, and job planning and scheduling, and may be used to support future maintenance budgets.

Paper vs. Mobile Work Orders

There are pros and cons to any approach. Let's take a rational look at the benefits — and disadvantages — of both paper and mobile work execution.

Paper Work Orders — Pros

There are several pros to a paper work order process. Paper work order processes can be easily implemented. Organizations need to simply design their form, based upon CMMS/EAM work order field requirements, determine the paper distribution flow, and decide who will perform the entries. They then train their team on the process, print, and execute. Similarly, changes to

the process, and the forms, are easy to incorporate when required. Paper work orders and work packets are printed, assembled, distributed, and may contain many of the same components as mobile work orders. It is acknowledged as an inexpensive process to execute and maintain because the true costs are hidden as lost productivity.

Paper Work Orders — Cons

Paper work order processes have multiple disadvantages that prevent an organization from optimizing maintenance execution. Paper processes have direct costs for paper, toner, ink, electricity, and labor to collate and deliver job packets, as well as costs of craft and trade persons and supervisors time, spent in meetings to assign and distribute work.

Additional time costs include craft and trade time searching lengthy work packets for information needed, recording work results on paper, then transcribing the work results into the CMMS and timekeeping systems. In some organizations, the data entry task falls upon supervisors, schedulers, planners, or admin personnel. This can create additional issues of data integrity as handwriting may be difficult to read, requiring interpretation at best or guessing at worst. Information may be missing altogether. Some of this critical data is likely known to the technician who performed the work but is not available to the person entering the data. Inventory accuracy suffers as correct part numbers and quantities used are not recorded on all work orders. Additional inventory accuracy issues may result from work order entry lag time.





RCM programs may suffer because of inaccurate or missing failure, cause, and resolution codes, as well as lag time from work completion to entry in the EAM, ERP, or CMMS. We call this the asset availability information gap. Workers may use default codes, rather than look them up in a reference source, to meet system entry requirements regardless of whether these codes reflect the true nature of the maintenance or repair performed.

Mobile Work Orders — Pros

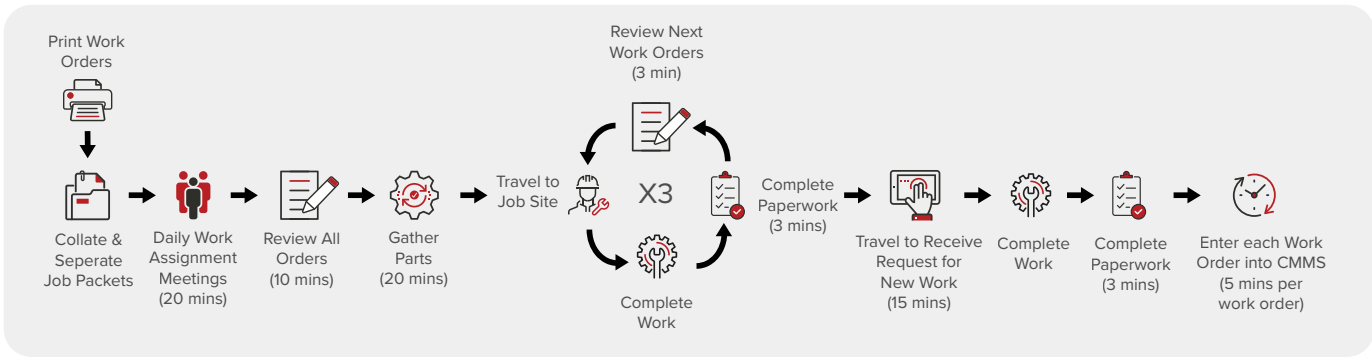
Mobile work orders have started to see widespread adoption by progressive maintenance organizations. This is because the mobile work order process has multiple advantages related to time savings, process improvements, and data availability. Mobile work order processes eliminate the need to print, collate, assemble, and distribute work packets. Mobile work orders can also include advanced details that paper work orders can't, such as repair history, photos, reading, diagrams, manuals, safety information, and more. Work assignments can be made to individuals or crews electronically which reduces or eliminates daily assignment meetings.

Mobile work order solutions improve data integrity with accurate recording of time to complete work, as well as easy entry of precise problem, cause, and resolution codes. Accurate data collected allows for accurate measurement and continuous improvement

of maintenance and repair processes. Additional work, and work requests, can be captured at the asset for immediate remedy or future assignment. Observations can be recorded and automatically attached to the work request or work order (photos, readings, measurements, observations, notes etc.) and all work activity history data is directly tied to the asset upon work order completion. Operator signatures can also be recorded for asset release back to production status. Supervisors can see work progress of their team throughout the shift, and final completions when entered. Bills of materials on the devices aid in selecting and adding parts used to the work order.

Mobile Work Orders — Cons

The disadvantages of a mobile work process are minimal. Mobile work order processes require time, planning, and higher upfront cost to implement. Maintenance process changes may require modifications to the mobile application. Lastly, mobile work processes require resources and financial commitment from the organization to deploy, support, and maintain the system. However, the savings that are realized from implementing the right mobile solution more than make up for this.



Comparing the Process Flow for Mobile vs Paper Work Orders

In the paper process diagram above, time and resources are often wasted on various tasks including:

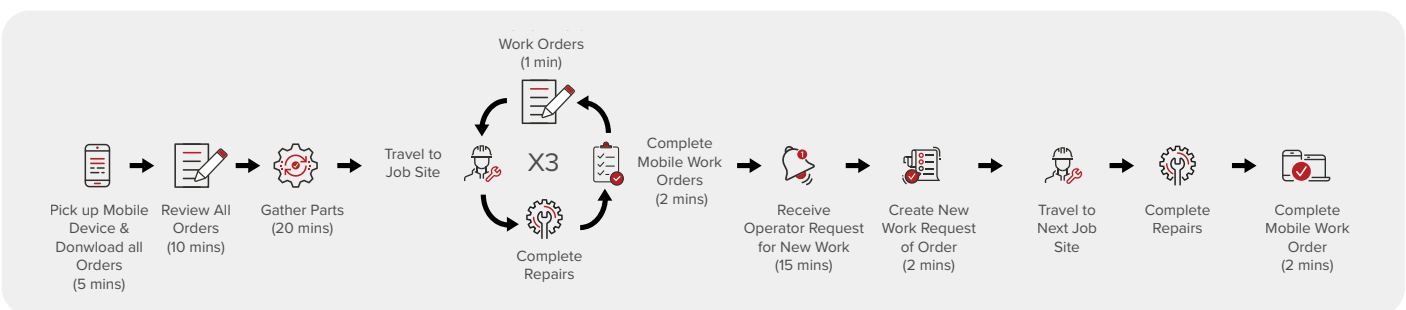
- Printing & collating (different for each company).
- Assignment meeting, work pack distribution (average 20 minutes).
- Time lost trying to find critical information in the packet (average 2 minutes).
- Paper work completion (average 3 minutes per order).
- Time to handle new work request (average 15 minutes per order).
- Work order entry & document filing (average 6 minutes per order).
- Work result data is not available until the order has been entered (hours or days, which effects asset availability, schedules, parts accuracy, etc).
- Maintenance management has to contact technicians to determine what work has been completed, then notify operations of work/asset status.
- Information collected may be incomplete, inaccurate, or not available for hours or days after completion.
- Additional information can be gathered but must be manually entered or imported to the system

of record. Process steps are eliminated in the mobile process diagram above, without compromising the quality of work.

The savings that can be realized from this include:

- No printing or collating – use company printing cost per work order.
- Assignment time reduced to 5 minutes (average 15 minutes saved per tech).
- Time to review order decreased (average 2 minutes saved per order).
- Mobile work order completion (average 7 minutes saved per order).
- Time saved on work request travel (average 15 minutes saved per request).
- Work result data is immediately available for reporting (asset availability).
- Maintenance management checks the CMMS, EAM, or ERP for work progress/completion. Operations can check asset status in the system of record.
- Data is complete, accurate, and available within minutes of work completion.

Note that so far, we've only looked at the time saved. There is also added value from the information that is gathered with completed work: meter readings and inspection results, photos, signatures, notes and observations, work requests, etc.





Building the Business Case for Mobile – ROI

Many of the mobile benefits stated below are subjective and as such difficult to quantify. In addition, many of the proposed benefits are subject to a variety of individual organization conditions. For example, if an organization practices stringent inventory control, with tools such as barcoding or vendor managed inventory, then perhaps they would not benefit as much as an organization with poor controls where inventory adjustments for shrinkage are common. You know your organization best. You should be able to use the figures below to extrapolate the savings that your company would realize with the right mobile solution.

Mobile solutions offer potential savings in several ways. The factors you should look at include minutes saved per work order, first time work order completion rates, work order closure rates, record filing, storage costs, and improved overall workforce utilization. Specifically, organizations should consider the following:

Time and money saved per work order – Measure the time and effort required per job to print, distribute, assign, complete, enter, and file paper work orders. Remember to include the labor and associated costs from collating, distributing, filing, transporting, and storing all that paper.

Increased first time work order completion rates, reduction in rework – measure how often a work order can't be completed due to missing information. Is this due to lack of key information which mobile could provide?

- **Percentage of work orders closed out because there is no associated paper work** – In these cases, default values are entered which may impact asset repair history, RCM programs, craft quality, and measurement of overall maintenance effectiveness.

- **Improved overall workforce utilization** – Calculate how much time is saved via mobile. This can be translated into additional wrench time.
- **Increased asset availability and utilization** – An increase in available wrench time naturally reduces unscheduled downtime.
- **Reduce inventory shrinkage** – Mobility allows for accurate accounting for all parts and supplies at the point of work performance.
- **Capture operator work requests and emergency repair work** – Field generated requests and work orders increase accuracy in these areas.
- **Automate operator rounds and readings** – Receive immediate notification of critical measurements.
- **Increased data accuracy, quality, and depth of information** – Mobile asset management empowers technicians to increase their data collection efforts with less effort. A mobile solution designed for maintenance and asset management makes it so the job cannot proceed without accurate data entry.
- **Reduced data entry effort** – Data is entered into the mobile solution as part of the job, greatly reducing the amount of effort needed.

ROI Model Example: The ROI spreadsheets below detail the calculations for three distinct ROI justification arguments.

Craft/Trade Labor Saving – Mobile Process

1. The first argument is the craft/trade time (labor cost) saved when adopting the mobile work order process. This is obviously the area of greatest cost savings. The amount of unproductive time recovered, in this model, is almost an hour (58 minutes) per person, per day. The argument

will be made that savings are only realized if productive work increases, or the labor force is decreased. We strongly suggest to never attempt to justify any work process improvement initiative with a reduction in the labor force.

You could, in theory, use the increase in wrench time to reduce the labor force...but this will put

you back where you started! Instead, this increase in available wrench time should be used to assign additional daily work orders. Start by reducing any current backlog of work. After that, the additional available hours could be used to selectively reduce overtime and plan/schedule additional maintenance work for key assets.

Craft/Trade Average Time for Work Documentation

	Paper Effort	Mobile Effort
	DATA ENTRY FIELD	
Total number of crafts/trade (all shifts) per site	50	
Highest concurrent head count of crafts/trades for any shift	30	
Will technician's share devices? (Yes/No)	Yes	
Fully loaded burden rate of crafts/trades	\$30 per hour	
Annual work days per craft/trades	242	
Average number of WO's per craft/trade per day	4	
Word orders documented annually	48,400 WO's per Year	
Assignment and work packet distribution meeting vs. mobile process	20.0 Minutes	5.0 Minutes
Review and organization of work packets per order	2.0 Minutes	1.0 Minutes
Manual entry on paper vs. mobile entry per order	3.0 Minutes	1.5 Minutes
Travel time to return for new work orders during the day	15.0 Minutes	0.0 Minutes
Craft/trade enters WOs into SMMS vs. mobile entry per order	4.0 Minutes	0.0 Minutes
Day-end entry of time card vs. mobile process	4.0 Minutes	1.0 Minutes
Total work documentation process time per day	75 Minutes	16 Minutes
Cost per day per craft/trade	\$37.50	\$8.00
Cost per day for all crafts/trades	\$1,875.00	\$400.00
Annual cost for all craft/trades	\$453,750.00	\$96,800.00
Mobile Process - Annual Cost Savings		\$356,950.00

Administrative Labor Savings

2. The second model is the cost of administrative labor support to print, collate, assemble, transport, file, and store the paper work order packets. All preparation labor is eliminated when paper is eliminated. It is critical to make all information available electronically, rather than keep some elements “paper based” as this defeats the purpose of mobile.

Print Cost Savings

3. The third justification is the costs associated with physical printing of the work order packets. Assumptions are listed in the model. Again, all associated printing costs are eliminated with a mobile based work order solution.

Current Paper Process - Admin Support		
Admin prints, collates, and delivers work packets to daily meeting. Supervisor assigns crafts/trades complete work, fill out paper WO's, and enter work order data into the CMMS. <i>Your process may vary so adjust accordingly.</i>		
	DATE ENTRY FIELDS	
Admin work order printing and distribution effort	Effort per WO	Daily Efforts
Fully loaded labor rate of admin person		\$22 per hour
Time to print and collate work order packets, per WO	0.45 minutes	1.5 hours
Time to collect, transport, and file paper work orders, per WO	0.65 minutes	2.2 hours
Total time spent per work order	1.10 minutes	3.7 hours
Work rrdor processed annually	48,000 WO's per yearr	200 WO's per day
Annual Paper Work Order Preparation Labor Costs		\$19,521.33

Work Order Packet Printing Cost Savings	
	DATE ENTRY FIELDS
Number of pages per work order packets	5
Printing cost per page	\$0.10
Pages printed per day	1,000
Printing costs per day	\$100.00
Pages printed annually (0.10 per page is the industry average *)	242,000
<i>*Includes printer, use, paper, ink/toner, electricity, and support</i>	
Annual Paper Work Order Preparation Labor Costs	\$24,400.00

Mobile ROI Summary

4. Total payback is based upon estimated costs for mobile software, annual support/maintenance, implementation, and mobile device costs. The cost figures used are estimates for placeholder purposes only. You should obtain current software, maintenance, and implementation costs, from your Prometheus Group Account Executive, and mobile device costs from your mobile device vendor.

Mobility Case Study: BTP

Brasil Terminal Portuário (BTP) was established in 2007 to build and operate a multi-use terminal for handling shipping containers and liquid cargo. BTP operates in the right bank of the Santos Port in Brazil. It is a joint venture between the Terminal Investment Limited (TIL) and APM Terminals and is the largest port in Latin America.

Mobile Solution Cost	
	DATE ENTRY FIELDS
Cost of a single mobile device	\$900.00
Number of mobile devices deployed	30
Mobile device cost	\$27,000.00
Software license cost	\$120,000.00
Year one support and maintenance	\$27,500.00
Mobile solution implementation cost	\$70,000.00
Mobile Solution Implementation Total 1st Year Cost	\$244,500.00

Mobile ROI Summary	
Mobile solution total 1st year cost	\$244,500.00
Annual craft/trade labor savings - mobile process	\$356,950.00
Annual paper work order preparation labor savings	\$19,521.33
Annual paper WO printing savings	\$24,200.00
Potential Mobile Project Savings	\$400,671.33
Project Payback Period	7.3 months

BTP wanted to improve maintenance process efficiency to better handle its workload, including routine and preventative maintenance of their ship-to-shore and rubber-tired gantry cranes. They established a four-tier improvement project that required a scheduling solution, a mobile solution, a custom interface to bring data into SAP from another system, and reporting capabilities inside of SAP.

Finding a mobile solution was difficult, as the nature of BTP's maintenance work has specific requirements. First, they didn't have the luxury to spend months having functionality and screens developed for all their specific scenarios. Second, their maintenance personnel do most of their work in high elevations and hard to reach spaces, like the top of a crane, where network access and availability could be limited, and the user doesn't have the time or space to fumble through multiple screens.

Prometheus Mobility was the only solution that satisfied these requirements as all the functionality is out-of-the box, everything can be accessed both online and offline, and the simplified screens can be configured to only display the fields absolutely necessary to input in each situation. Prometheus Mobility also allowed them to access the application from any device without complicating their infrastructure with additional hardware or middleware. After implementation and rollout, BTP found it had reduced the maintenance backlog, achieved better preventive maintenance compliance, and reduced scheduling time by 88 percent.

BTP has also improved its notification and equipment asset data by using Prometheus Mobility. This means they are better and more closely tracking breakdowns, malfunction times, repair time, damages, and causes of equipment failure. This data improvement has led to more accurate reliability reports as well as improving their overall preventive maintenance schedule and predictive maintenance strategy, which in the end will reduce downtime and improve overall equipment efficiency.

For more on BTP's process improvements achieved through Prometheus solutions, please see "BTP Improves Maintenance Processes with Prometheus Solutions."

Summary

The business case for mobile should be easy and straight forward. Many maintenance team case studies have revealed the benefits of the process improvements and savings achieved. The process is much the same for any project undertaking. You must review your current procedures, identify all wasted effort, redefine the process with a mobile solution, and move toward best practice. The results should be a more agile work process which delivers efficiency and timely information, with high data accuracy.

The Prometheus Mobility module enables workers to see, record, and update data automatically from the field using their phone, tablet, or computer, improving data accuracy and quality. Mobility sends maintenance data in real time directly to an organization's EAM, ERP, or CMMS system, maintaining it as the single source of truth.

Learn more about how Prometheus Group can help your organization today.

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About Prometheus Group

Prometheus Group is a leading global provider of comprehensive and intuitive enterprise asset management software solutions that work within ERP systems and span the full work management life cycle for both maintenance and operations. Developed jointly with end users, Prometheus software enhances the customer experience for planning, scheduling, and executing work for both routine maintenance and shutdowns and turnarounds, all while protecting the workforce with safety solutions and electronic permit to work. Our straight-forward functionality, graphical visualization, and simple processes enable customers to increase productivity, reduce costs, and improve reporting. For more information, please visit www.prometheusgroup.com.