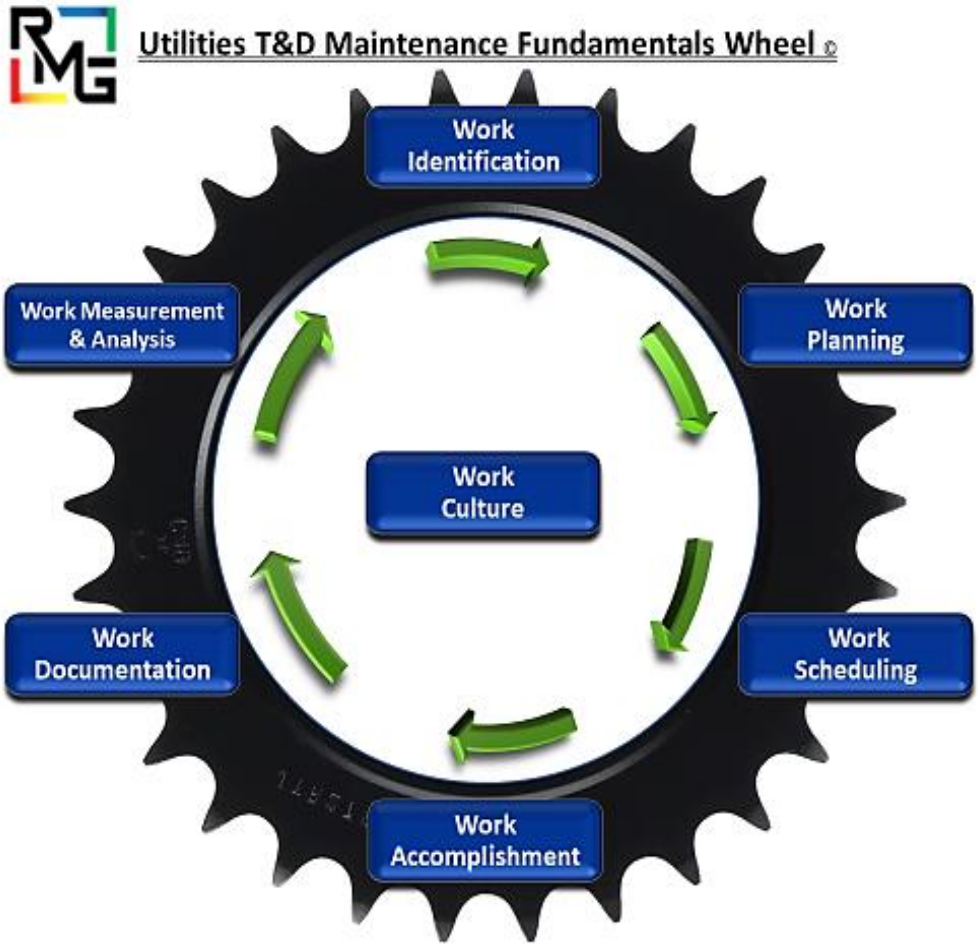
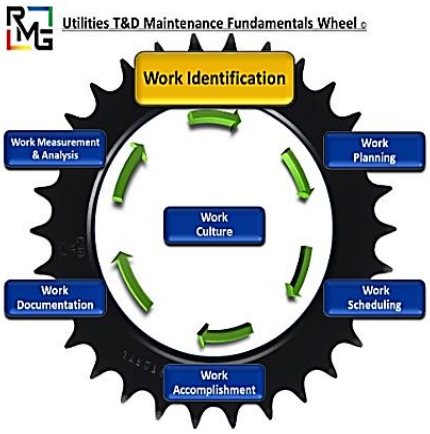
As part of our social distancing consulting services, RMG will be embarking on a LinkedIn seven-part series to help organizations identify key improvement opportunities around their Utility Transmission & Distribution maintenance work process. Following the seven steps of RMG's Utility Transmission & Distribution (T&D) Maintenance Fundamentals Wheel©, we will provide insights that are helpful to ensure a successful Process. The T&D Maintenance Fundamentals Wheel© was modeled on the Plan-Do-Check-Action concept. RMG has taken this concept and customized and expanded it to specifically apply to work processes like maintenance, operations, materials, outages/turnarounds, safety/compliance, capital projects and programs.

RMG's UTILITIES T&D MAINTENANCE FUNDAMENTALS WHEEL©





Work Identification:

In Utility Transmission & Distribution, when identifying work, the first thing that comes to mind for the initiator is "When will the work get done?" The priority assigned to work, along with what programs are planned or in flight, become the primary drivers for planning & scheduling work. While there may be other unique considerations to each utility and operation, there are fundamentals that need to be considered for effective work identification in the Utility Transmission & Distribution operating environment.

Quality work request – This first step is a key success factor to efficiently moving work through to completion. Clearly and timely communicating the urgency, current condition, specific location/equipment, and type of work for documentation and, planning efficiency and effectiveness

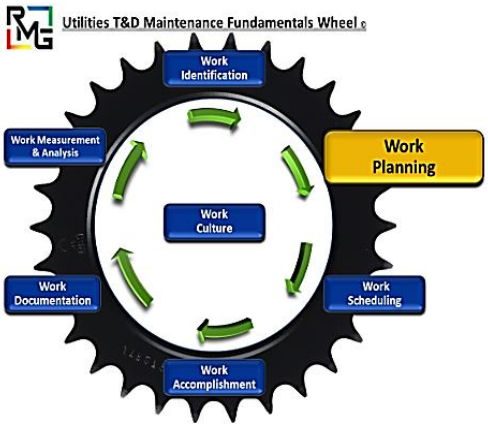
Customer representation – Ensuring service to meet customer's expectations, customer's needs and coordination for work needs to be clearly described and documented to enable a good customer experience.

Equipment hierarchy & labeling – Complete, accurate and up to date equipment type, class, location in system hierarchy, physically labeled to accurately locate and perform and close out work is important for asset management and to support reliability initiatives.

Critical equipment list – Know and document the criticality of the specific equipment and assets identified to help prioritize when the work will be planned, scheduled, and executed. Critical equipment is equipment that can cause an HSE event or condition, or interrupt service.

EAM/CMMS functionality – A system to manage and document, and status work as it moves through your Work Management System to close-out. The EAM/CMMS need to align with preferred work processes and function as the tool to capture and document all work elements: plans, drawings, parts, materials, human resources, and cost.

Adjust operating plan – Accommodate critical work that needs to be executed but will interrupt your operating plan



Work Planning:

Work Planning requires an understanding of equipment, materials/parts, safety, regulatory compliance, crafts and standard job plans and procedures. These planning requirements which may be built into a EAM/CMMS, ensures a high level of standardization and consistancy.

Monthly Resource Planning Directives & Planning Resource Allocation – Integrating project, program and corrective work that accommodates the complete work portfolio and budgets will position you to effectively plan and allocate resources appropriately.

Formal planning process – A systematic method, approach and procedures to create work plans that are consistently applied, and can be managed within your work management system

Field job scoping – planners to visit new or unique work sites to identify and understand appropriate physical conditions and considerations to produce a safe and effective work plan. A defined level of Field Job Scoping needs to be established to ensure:

1. In the field, eyes on, analysis of equipment problem confirming operations diagnosis
2. Clear understanding of clearance & safety issues
3. Understanding of the physical environment to ensure the proper job site is properly prepared
4. A clear understanding of tools, crafts & parts/materials required
5. An overlooked element of Field Job Scoping is the interaction it promotes between the planner and operations, crafts, and supervision.
6.

Field Job Scoping is an essential component of the planning function.

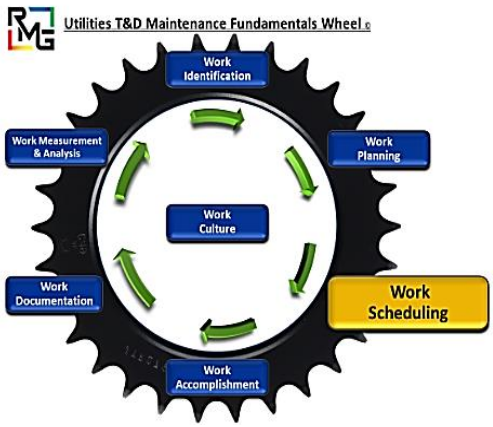
Quality Job Package & Standard Job Plans – To enable the crafts to complete work effectively and efficiently, the elements of a Quality Job Package must be present. All jobs should have a quality job package, except for emergency work. Emergency work by its nature is unplanned, however a planning library may still be consulted for past job packages even on emergency work. At a minimum, a Quality Job Package and Standard Job Plans must have parts/materials, specialty tools, LOTO requirements, craft requirements, work procedures and safety requirements. Standard job plans may be developed over time and entered the planning library of the CMMS. Recurring work like preventive and predictive maintenance may be planned in detail once and then modified as needed. Even corrective work may be developed and entered the CMMS with all the elements of a Quality Job Package or Standard Job Plans. The planner can readily reference these and modify them according to the specific job requirement rather than starting from scratch each time. This also provides the organization with a much greater level of consistency, efficiency, and quality.

Correct Tariff Application – It is critical to have a standard process in place to ensure complete, accurate and timely submission of applications. Having to rework and resubmit applications can delay work start and completion. This can add cost and expose the operation to risk of not meeting regulator commitments.

Parts/Materials Assurance – Before scheduling work, you must ensure that parts and materials are available to be assigned and staged for scheduled work. Scheduling work with parts or materials available can interfere with work in progress and delay starting work as planned. Costs can multiply by having crews scheduled to work without parts and materials available.

Clean, Organized Backlog – It is impossible to effectively plan work when your work backlog is incomplete or incorrect. You need to make sure completed work is closed out, work orders for obsolete equipment needs to be purged and estimates for valid work orders need to include complete and accurate estimates.

EAM/CMMS functionality – A system to manage and document, and status work as it moves through your Work Management System to close-out. The EAM/CMMS need to align with preferred work processes and function as the tool to capture and document all work elements: plans, drawings, parts, materials, human resources, and cost.



Work Scheduling

Work Scheduling requires the most coordination within and between departments of any of the work process steps. Discipline in the scheduling process is essential. Equipment, crafts, materials, tools, and safety requirements all need to come together to perform a job effectively and safely. Work Scheduling matches craft resources with production and equipment needs to make sure the right work is completed at the right time. The process outlined below provides a guideline for a typical efficient scheduling process. The process may vary based on the needs of the organization.

Monthly resource planning directives & planning resource allocation – Integrating project, program and corrective work that will accommodates the complete work portfolio and budgets will position you to effectively schedule and allocate resources appropriately.

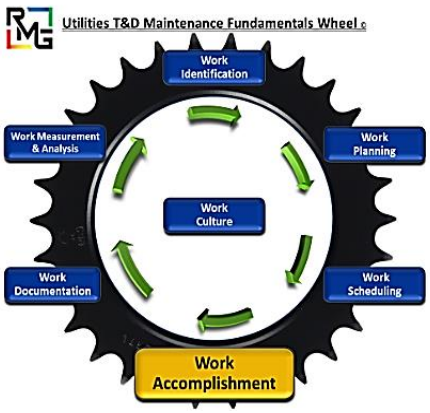
Monthly and Weekly Scheduling – This will position the organization to anticipate resource constraints and consider supplemental contractors to get work done. This also positions the organization to coordinate portfolio, project, and program resource requirements.

Customer representation – Ensuring service to meet customer's expectations, customer's needs and coordination for work needs to be clearly described and documented to enable a good customer experience.

Daily scheduling – Daily Scheduling uses Monthly and Weekly Schedule as a guide for work to be scheduled the next day. Daily scheduling meetings are held to confirm all resources that are required to staff the work one day prior to Work Accomplishment. Operations and HSE personnel attend these meetings to help set priorities and began site preparation. The daily schedule is distributed to the Operations and HSE departments to ensure that job requirements like LOTO, equipment shutdown, confined space permitting, and other items are coordinated. Carryover work from the previous day may be added to the schedule based on craft availability.

Fast flow procedure – Occasionally work surfaces that needs to be addressed immediately. Without compromising HSE and compliance, is critical to have in place a process with appropriate checks and balances to fast-track work. This procedure may include specific individuals, with appropriate decision-making authority to review and approve fast track work. As fast track work is completed, you should revert to the standard work management documentation and close out process to make sure you capture the work and asset history for future planning and analysis.

Parts staging & delivery – One key to efficiency and productivity is to make sure your workforce is prepared to execute work as planned and scheduled. Staging parts the shift before the work is scheduled to be done will ensure your crews can minimize yard-time and get to the worksite as efficiently as possible. For parts that require special handling, specifically scheduling the delivery of these parts (JIT) directly to the worksite will minimize work delay. It is helpful to assure the shift before, that the delivery will be executed as planned.



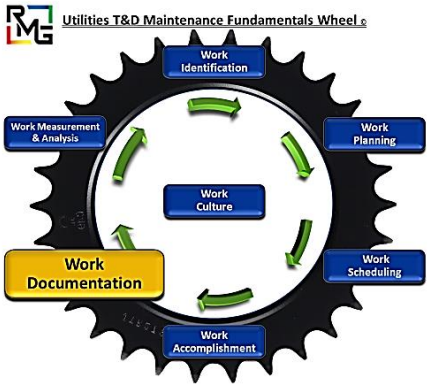
Work Accomplishment:

When Work Planning & Work Scheduling are successful, completing the work in the field should be a well-orchestrated routine. However, unexpected, and unforeseen issues often occur and a 100% compliance rate to the schedule is not always possible. Tracking schedule compliance is important and identifying the reasons work is taken off the schedule is the single most telling metric to identify and remove barriers to an effective work schedule.

Work site readiness – Operations and HSE play important roles in ensuring that the maintenance crafts can be as efficient as possible in performing their work. All safety, environment and regulatory requirements and permits must be in place for the crafts to safely execute the work plan. Operations must ensure that the equipment is prepared and ready for the crafts to start the job in accordance with the schedule. This includes making sure the work site is as clean as possible.

Crew preparation and supervision – A morning tailboard meeting is the first task that must be performed at the start of the workday. The tailboard meeting communicates the schedule, job assignments, tool and materials needs, job packages, coordination needs with operations and between crafts and safety and regulatory requirements to the members of the crew. Even with well executed preparation unexpected circumstances often occur as the work is being performed. It is essential that supervision follow up as frequently as possible with the crafts and jobs to assist the crews in overcoming these unexpected obstacles. Supervision's role in Work Accomplishment includes problem solving, problem identification, problem mitigation and leadership.

Job closure and customer satisfaction – Once the work is completed ~~by the crafts~~, several tasks remain to close out the work. The equipment needs to be tested and Operations must be consulted to ensure the repair has been completed to allow Operations to continue production. Permits must be reviewed and closed. The job site must be cleaned and returned to the condition it was in when the ~~crafts~~ work started ~~the work~~. Parts and materials that were not used must be returned to stores.



Work Documentation:

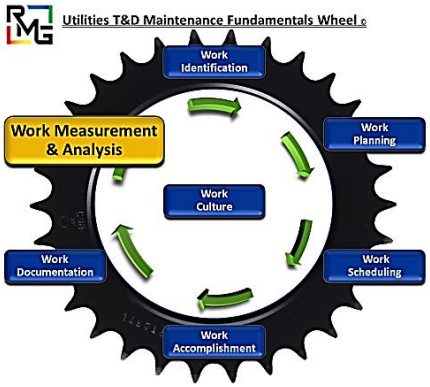
Work Documentation is an important element in the overall work process. The timely and accurate reporting of the work accomplished in the field feeds labor, materials, equipment, job order and costs records and history. The capturing of this data updates backlogs and forms the foundation that permits the organization to analyze and make improvements. The steps outlined this far on the Maintenance Fundamentals Wheel provides the organization with the tools to work off the backlog in the most efficient manner. The next steps in the Wheel provides the organization with the information and data to effectively eliminate much work from entering the backlog at all.

Labor & materials actuals – Capturing and documenting actual labor and material in your work management system will feed and enhance your asset management and reliability analysis capabilities. Knowing the history of work will position you to repeat successful work and adjust improve work that underperformed.

Work history – Collecting costs and activity on Work History provides the basis for an organization to begin identifying where there is opportunity for improvement. The documentation of this history starts with entering the actual parts/materials used, craft hours expended, a description of the work that was performed, as well as other valuable information. Entering this data in detail will also provide the EAM/CMMS with the information to develop and recognize reliability trends.

Prints & drawings – While completing the job and the job package, changes and modifications are frequently made to the equipment. These may be marked up and redlined when closing out the work. This information is invaluable for the next time work must be performed on the equipment. Updating the prints and drawings is frequently done outside the CMMS in a Document Management System. The updated prints and drawings need to feed back into the planning process so that the job packages that are created accurately reflect the equipment that is in the field.

EAM/CMMS input – The timely entry of data in the EAM/CMMS helps the organization in many ways. The closure of work in the EAM/CMMS keeps the backlog clean and facilitates both the planning and scheduling processes. Documenting the actual parts, materials, labor, and work completed feeds both the job order and equipment histories. Additional valuable information that facilitates the next step in the process Work Measurement and Analysis may also be captured. The entry of reason, cause and failure codes can provide the mechanism to help isolate the type of problems that the equipment may be having. An EAM/CMMS also provides the benefit of taking the collection of data from the work completed and easily rolling the data into a metrics package.



Measurement & Analysis:

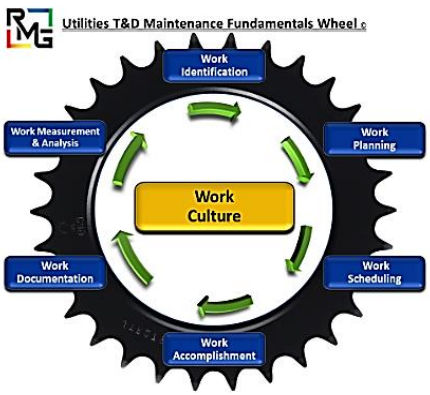
Collecting data in the Work Documentation step allows the organization to turn data into information that facilitates decision making. This is accomplished in the Work Measurement and Analysis step. Activities in this step include Problem Solving, Proactive Maintenance and Indicators.

Key business and work process indicators – The metrics package can provide useful information on not only the health of the work process, but also pinpoint opportunities with the equipment. With the proper discipline around documentation, the data in the CMMS can move an organization from a knowledge-based system to an information-based system. Indicators normally fall into three general categories. These are Work Process, Equipment Reliability and Business Indicators. The three indicators form what RMG calls a Chain of Success©. Effectively operating the work processes will feed this linked set of indicators. The Work Process Indicators measure the health of the work process. This includes such metrics as schedule compliance, PM compliance and backlog. The next set of indicators in this chain are those that highlight Equipment Reliability. These include indicators like MTBF/MTBR and availability. The final set of indicators focus on Business Indicators. These most often translate to costs and throughput. When all these sets of indicators are operating properly a direct linkage should be recognizable. If there appears to be an issue with the linkages, then the reporting of these indicators needs to be examined.

Problem solving – The history collected in the Work Documentation step and entered a CMMS helps organizations identify where its Bad Actors are and stimulates the activity around making beneficial long-term decisions. These decisions may be around deciding what equipment, parts, procedures, and work plans can make the production process most reliable and profitable. Reliability techniques such as FMEA and RCFA may be employed by using the data to identify and eliminate defects. Decisions on life cycle costs may also readily be made by analyzing this information.

Proactive maintenance – The data may also be used to target and update the current preventive and predictive maintenance programs. Keeping your preventive and predictive programs evergreen provides more benefit than simply following the programs by rote. No organizations have all the labor resources to do all the preventive and predictive maintenance that they would like to do or is recommended by the manufacturer. Analyzing the data that is collected will assist and organization in identifying and prioritizing the activities that will provide the greatest benefit.

EAM/CMMS output – The closure of work in the EAM/CMMS keeps the backlog clean and facilitates both the planning and scheduling processes. Documenting parts, materials, labor, and work completed feeds both the work and equipment histories. Additional valuable output facilitates Work Measurement and Analysis. Reason, cause, and failure codes provide the mechanism to help isolate the type of problems that the equipment may be having. A CMMS also provides the benefit of taking the collection of data from the work completed and easily rolling the data into a metrics package.



Work Culture

Many things can influence Work Culture. The work process described in this discussion of the Maintenance Fundamentals Wheel swims in the ocean of an organization's Work Culture. The Work Culture of the organization may facilitate and enhance this swim or force employees to drown in the process. The elements of a well performing Work Culture that RMG looks for include those enhancers highlighted in this section. Volumes of information is available on each of these subjects, so these are discussed at a succinct level,

Teamwork
Effectively executing the maintenance process requires an immense amount of communication and coordination. This is true not only within the maintenance organization, but with all the organizations the maintenance department works with. Having a clear and common vision and set of goals around the maintenance effort helps facilitate this Teamwork.

Clear roles and responsibilities
People and organizations require a clear understanding of what is expected of them. Defining a clear set of roles and responsibilities and training people in these is an important factor in making accountability a positive influence in the organization as opposed to a negative one.

Leadership and actionable direction
An organization needs to clearly demonstrate that they have leaders who assist not only in identifying barriers and opportunities, but also providing direction that is actionable. This encompasses leaders in any position of an organization.

Management by walking around
This is a concept that has tremendous value. Nothing can replace going into the field and seeing first-hand how work is being performed. This demonstrates that leadership is interested in what is happening in the field, care about their co-workers and provides the opportunity to improve the relationship between management and employees.

Formal communications/meetings
Meetings must have a formal, published agenda with clear objectives for the meeting. The agenda must be adhered to. Exceptions may be highlighted and recorded for later future assignment and resolution. The highlights and decisions of the meeting should be published and distributed to everyone to verify that all participants left the meeting with a common understanding. Unorganized meetings can be a huge morale killer and demotivator.

Listening and constructive feedback
It is important to a Work Culture that people see and experience that they are being listened to. People have varying viewpoints, experiences, opinions, and solutions. Listening does not necessarily mean agreement. Feedback needs to be constructive and on subject.