Six Elements of a Successful Maintenance Management System

Part Six - Implementation

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Perhaps the best way to demonstrate the implementation of an MMS (Maintenance Management System) is to tell the story of one such attempt. If the readers have been following this series in previous IMSA Journal editions they may have noticed that the author's title has changed from "City of Norfolk, Superintendent of Traffic Operations" to the title used on the current byline. Since 1991 the author was employed either by the city's DOT (Division of Transportation) or as a contractor managing, supervising or acting as a traffic signal maintenance technician.

Before-A History

May 1st 2001 is a good starting point to begin a history of Norfolk's MMS implementation. On that date, the City of Norfolk accepted new infrastructure and a reorganizing of operations functions as part of the ATMS (Advanced Traffic Management System) phase II Project. ATMS phase II was the implementation phase of Norfolk's vision for an ITS (Intelligent Transportation System). While many elements of MMS programs had been adopted over proceeding years (including a CMMS [Computerized Maintenance Management System] in 1993 that was abandoned little more than three years later), the increases in the scale and scope of infrastructure, equipment, and related maintenance without a corresponding increase in resources demanded a new commitment to MMS principles.

Prior to 2001, DOT's maintenance was almost wholly reactive. A single three-technician PM (Preventive Maintenance) team spent the entire year together completing aerial and ground PM checks to schedule. Only one-half of the city's signalized intersections were inspected per year. This meant that conflict monitors and other critical control equipment were tested every other year. Only signalized intersections where included as assets. School lights, beacons, warning signs etc., were not on any PM list. These assets were in many cases not even inventoried. This PM program was the first PM program implemented (in recorded memory) by DOT and it had only been implemented since 1995. PM did not rate very high as a priority for management at this time. Technicians were frequently pulled from the PM team to respond to reactive maintenance needs.

While the addition of the ATMS and its additional staff did release the signal maintenance technicians from much of their controller programming duties, the additional infrastructure and the unfamiliarity with the new system far outweighed any time savings. The communications-interconnect upgrade to fiber optic cable accomplished by the ATMS project is an example of a false maintenance gain in that the earlier copper interconnect had been abandoned and so required no maintenance. Installing the new cable was as an increase in maintenance responsibilities for DOT.

With the ATMS many new ITS assets like CCTV (Closed Circuit TV) and DMS (Dynamic Message Signs) were added. These devices increased reactive maintenance. CCTV, DMS and communications assets were not included in the formal PM structure. School Zone signs, warning and hazard beacons along with pedestrian crossing assets are not scheduled either.

After-The response

To meet this challenge DOT began using a CMMS-*Work Management System* already being utilized by the Public Utilities and the Public Works department's Streets and Bridges division. After completing a detailed inventory of the entire traffic signal system infrastructure the division entered the information into the system, developed codes and documented processes. Field administrative staff captured all requests for maintenance service through electronic service requests forms. Managers and supervisors reviewed the requests, prioritized them and created and assigned work orders to service teams to complete in the field. The planning and scheduling step that the service request documents created enabled supervisors to eliminate duplicate requests, group requests based on location and answer the most critical requests first. Reactive calls decreased by15% within two years of full implementation.

Preventive maintenance was incorporated into the CMMS as well. PM checks were created for all the assets inventoried based on manufacturer recommendations, technical standards and best practice. Scheduling and automated generation of work orders for the PM checks made following the proscribed periodicity much easier to manage and supervise. Norfolk began scheduling checks for non-signalized traffic control devices like school zone flashers last year. PM goals include the addition of ITS devices and locations. While current staffing levels project failure to meet periodicity of the new PMs, funding is being sought to outsource many PM services, making use of a pending PM IDQ contract.

The *stock and parts* inventories from the field warehouse were entered and managed from the CMMS. The parts and materials used could now be directly added to work orders so that costs could be more accurately tracked and inventories automatically updated. Overtime the automated process reduced the size of the warehouse inventory considerably. Though not commonly accounted for by governmental agencies, the related reduction of carrying costs for maintenance materials is certainly positive.

Approximately two years ago, DOT launched a career ladder - *workforce development* program. This program was instituted to act as motivation for a largely in-house program of technical training, OJT (On-the-Job Training) and skills cross-training with the object of getting its workforce up to speed on the new skills being required and broadening the skill-levels of all technicians. The program allowed for automatic advancement of technicians (with pay) who met the programs requirements. To be advanced the technician must a) achieve an above average evaluation for the year, b) have a least a year's experience in the previous level (paygrade), c) become IMSA certified to a required level, and d) have all the skills

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required in an OJT booklet mastered and signed-off by a designated "skilled-expert."

All the data collected by the CMMS was put to good use in *statistical analysis*. Reports were prepared using work order data linked to signalized intersections that clearly indicated sub-standard performance of a specific incandescent lamp product. The information was used to recoup partial costs of replacement lamps. Actual rather than the projected data usually used for *performance measures* became available for resource evaluation reports, asset lifecycle reports and parts and material usage.

Some key themes and programs in Norfolk's efforts to meet the challenge are listed below. These themes and programs will be seen acting in many of the MMS elements.

Standardization

The standardization of traffic control assets of a given type aided in smoothing the stock inventory process and many of the other elements as well. Using standard parts at a standardized asset does not necessarily imply that each part is from a particular manufacturer or vendor.

Norfolk has avoided a proprietary equipment scenario as much as possible by specifying control equipment, parts and pieces that are interchangeable but not manufacturer specific. Norfolk follows Caltran's specification suite for control equipment as much as possible. It arguably provides the most detailed specification set in the industry while ensuring a large pool of manufacturers and vendors because of the California's large market for equipment. Other innovations instituted in Norfolk include only maintaining a single color (black); type (LED); and two mounting types (rigid and disconnect) of signal heads in stock. To ease the labor shortage in the signal maintenance shop, new specifications and orders for completely assembled traffic signal heads, control cabinets, etc. has been implemented. Removing time spent in the shop assembling and constructing devices frees time previously used by technicians and allows for the transfer of that time to provide increased maintenance time in the field.

Standardization also reduces the scope of maintenance skills necessary for the maintenance group to train and maintain for. Buying pre-assembled signal heads reduces the need to train workers to manufacture signal heads. Technicians can concentrate on replacing heads not creating them. DOT's choice to buy traffic controller equipment with the same user-interface saves the time and material necessary to train and document workers to program controllers using multiple methods. Ten years ago, it was necessary for DOT's technicians to be able to program various controllers using more than nine separate interfaces with almost as many conflict monitor interfaces. Today only two programming interfaces need be learned, soon to be reduced to one.

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Standardization is a process that must be followed throughout the lifecycle of the asset. It starts with the design and installation of the equipment. Standardization for maintenance purposes must be considered as part of the design process. "Ease-of-maintenance" and equipment reliability should also be considered during the design and installation process.

Indefinite Quantities (IDQ) Contract

To ensure standardization and eliminate creation of dual standards, the same specifications are used for Norfolk's contracted signal maintenance Indefinite Quantities Contract (IDQ). This important instrument provides an unlimited resource to supplement the finite in-house resource. Tasks from setting up a basic work zone through the complete construction of a signalized intersection are broken down into line item costs. Since the IDQ is awarded through a competitive bid process, it also serves as the benchmark during competitive studies for in-house vs. contracted costs. Norfolk has included "install-only" line items in this contract that allow its stock system to supply the contractor at lower cost and with tighter scrutiny of function and specification.

Price Agreements

Norfolk has also made judicious use of purchasing price agreements. For high cost, scarce or frequently used items, it makes sense to identify and advertise these items for competitive bid in purchasing price agreements. Norfolk's Finance Department allows traffic operations to skip normal purchasing procedures for items on a price agreement. The store keeper may order parts and material directly from the vendor. Price Agreements make ordering, receiving, testing equipment for new installations and upgrades for installation by contractors easier and more thorough.

Lessons learned

DOT's experience has been that changing the institutional culture is the hardest task of all. How do you move from a reactive-focused to a reliability-focused organization? Some key concepts to successfully transition from a traditional, repair-focused organizational culture, to a proactive, reliability-focused culture are outlined below.

Maintain a Long-Term Strategic Focus

It's easy to bend to political pressure and drop long-term plans for short-term gains. Being the voice of restraint, when a designer has council excited with expansion plans, the latest equipment can be a risky position for a maintenance manager. The maintenance manager will remember however that there is a real price to pay for expansions without a compensating increase in resources.

Aligning Reward Systems with Strategic Goals

Time should be taken to explain to technicians the reason for the switch from an "if it isn't broke don't fix it" attitude to a "fix it before it breaks" attitude. Managers and supervisors must make the rewards of preventative maintenance greater than the rewards for "heroic" reactive maintenance.

Strong Committed Leadership

The importance of receiving the support of management from the top down is vital. Faith and trust in the local supervisors by upper management is important to allow supervisors rather than upper managers to determine what requests can be scheduled maintenance and what requests need be reactive. Support must be given to supervisors in the difficult transition moving from reacting to planning.