

## **Introduction**

Asset Basic Care programs use operations, maintenance and/or lubrication staff to physically inspect and verify the operating condition of work areas, processes, and fixed / mobile assets. Some of the topics that will be covered in this paper include:

- **What is Asset Basic Care?**
- **How can Asset Basic Care programs be implemented?**
- **Automated Asset Basic Care programs – an alternative to paper-based inspection methods.**
- **Tools and technology for automated Asset Basic Care.**
- **Review the key elements to ensure a successful Asset Basic Care implementation.**

The goal of this paper is to show that an asset basic care program can be an effective foundation to preventive and predictive maintenance program. Asset basic care can also make a profound contribution to any organization implementing a Six Sigma quality strategy. Most importantly, basic care can have a significant positive effect on asset availability, as well as reduce operations and maintenance expenditures in the achievement of increased asset reliability.

## **What Is Asset Basic Care?**

Asset Basic Care is a commitment by the operations and maintenance staff within a plant to ensure that assets maintain their expected level of quality and volume for output, while reaching their expected lifespan within the plant.

Asset Basic Care attempts to greatly reduce or eliminate reactive maintenance by implementing procedures to ensure that assets are

- Properly configured with all specified guards, safety devices and environmental protection
- Checked that they are within proper operating parameters (i.e. acceptable temperature / pressure / flow rate etc)
- Protected from dirt, water and other sources of contamination,
- Checked for seals operating properly (no leaks of lubricant or process fluids),
- Scheduled so that the correct type and amount of lubricant is used.

These checks are all carried out in a thorough asset care regimen. The investigative part of this regimen also attempts to catch incipient problems by monitoring assets for both visual (qualitative) and measurable (quantitative) indications of change.

Along with the inspection processes of the program, an Asset Basic Care process focuses on education of the operators, the lubrication staff and the maintenance/reliability staff. Asset Basic Care puts high emphasis on both operator managed inspection programs and lubrication management efforts.

Asset Basic Care forms the foundation layer of an overall integrated Total Plant Reliability strategy and can also be a key component in the development of a sustainable Six Sigma approach to maintenance.

## **Origins of Asset Basic Care**

Inspection rounds have always been a part of the maintenance process. Having operations and/or maintenance staff go onto the plant floor, the garage or the engine room and check belts, fittings, seals, fluid levels etc. in an informal manner has been carried out since the Industrial Revolution.

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The more structured approach of scheduled, defined and documented inspection rounds was one of the fundamental concepts that came to be known as “Planned Maintenance”. Developed during the years of the Second World War, planned maintenance methods were applied as a means of assuring high levels of machinery availability. Over the rest of the 20<sup>th</sup> century, planned maintenance and its numerous offshoots have been applied in all industry types in Europe and North America.

At the same time, Japanese industry, faced with considerable challenges, developed a variant of planned maintenance now known as Total Productive Maintenance (TPM). As with planned maintenance, frequent inspections are a fundamental tenet of the TPM process, with a heavy emphasis on the involvement of the equipment operators in the inspection process. Asset Basic Care is derived from several of the concepts (“pillars”) of Total Productive Maintenance (TPM). Some of these concepts are:

- 5S Program, making problems visible by organizing the work area.
- Autonomous Maintenance, which involves both operations and maintenance in caring for assets at the source.
- Continuous Improvement Programs.
- Safety, Health and Environmental Inspection and Improvement.
- Team Based Approach to Identifying and Resolving Issues Concerning Asset Availability.

The following quote from Kunio Shirose, a conceptual TPM author, focuses on the element of TPM that is the basis for the Asset Basic Care approach:

“A very important aspect of TPM is the establishment of autonomous maintenance. The purpose of autonomous maintenance is to teach operators how to maintain their equipment by performing:

- Daily checks
- Lubrication
- Replacement of parts
- Repairs
- Precision checks
- Early detection of abnormal conditions

As <with> most of the Lean Manufacturing techniques and tools, autonomous maintenance is based on education and training. It is about raising awareness of the operators on the knowledge and understanding the operation principles of their machines.” **Kunio Shirose, TPM Consultant**

Inspection processes can therefore be operations-driven or maintenance-driven; often they are a combination of both departments. The management of an inspection program is just as likely to be under the control of operations / production as maintenance.

## **Asset Basic Care and Six Sigma Programs**

A Six Sigma systemic quality program provides businesses with the tools to improve the capability of their business processes. Six Sigma can be defined as a disciplined, data-driven approach and methodology for eliminating defects in a wide variety of processes, which includes all forms of manufacturing and process industries. A key element of Six Sigma programs is “kaizen”, the Japanese process of continuous improvement using a variety of problem-solving and analysis techniques.

One of the fundamentals of the Six Sigma approach is the requirement for data. Data sets are used to determine the original state of a process, the current state of that process, the rate of improvement and the proximity of the process to the desired quality levels. Asset Basic Care, with its emphasis on frequent and rigorously scheduled inspections, produces a steady stream of both quantified and qualified evaluations of assets, systems and processes. The data collected by these inspections, plus the data generated to measure the compliance to the Asset Basic Care inspection

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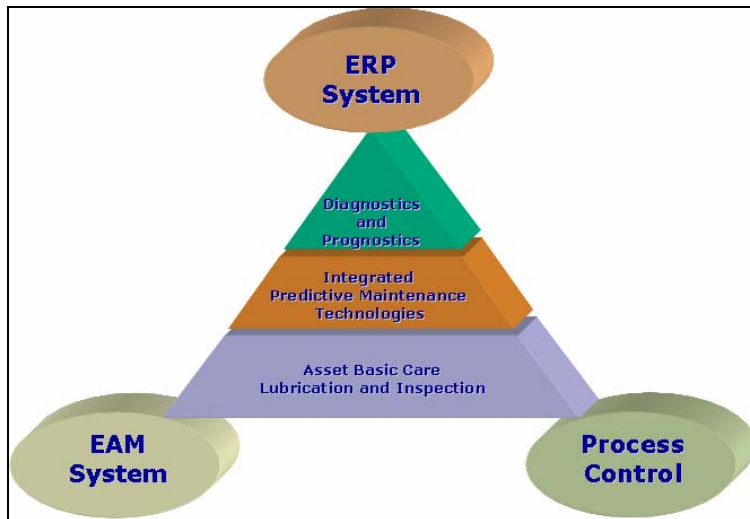
schedule itself, can be used effectively to generate metrics for any Six Sigma program. A well-run Asset Basic Care program is not only a catalyst for improvement in and of itself; it can also be one of the primary data-gathering tools to evaluate the effectiveness of all continuous improvement procedures within the plant.

## **Asset Basic Care in the Overall Reliability Strategy**

Asset Basic Care fits in as a foundational element of a plant’s Total Plant Reliability strategy. A Total Plant Reliability strategy details the availability and contribution of a plant’s resources to be used in asset inspection, condition monitoring, planning and scheduling and logistics for the creation of a reliability program. The strategy provides for optimal use of organizational resources with sufficient asset availability to meet the organization’s output requirements.

A Total Plant Reliability effort uses the skill sets available within the organization (and through the **judicious** use of external expertise) to generate improvements in the following areas:

- Improve planning and scheduling by increasing the effectiveness of the EAM/ERP systems for maintenance management.
- Reduce or eliminate reactive maintenance by optimizing use of early warning technologies such as asset inspections and predictive maintenance technologies.
- Enable the organization to develop and achieve a targeted mix of run-to-failure / preventive / predictive maintenance work orders.
- Fine tune work execution, by ensuring that job plan estimates are accurate and complete, and match actual work order resource expenditures with a minimum of variance. Optimize spare parts inventory management



### ***Overall Reliability Strategy***

Successful Total Plant Reliability programs are built upon the foundation of **Asset Basic Care**. The use of tools such as predictive maintenance, diagnostic systems and reliability centered maintenance / maintenance optimization can all be made more effective when they are used on assets that are clean, properly sealed, operated within correct operating parameters, properly lubricated and frequently monitored for visual changes.

**Integrated Predictive Maintenance Technologies** - brings multiple technological disciplines together to evaluate asset health. Vibration analysis, lubricant analysis, thermography, and ultrasonic analysis are all powerful technologies whose results can be made more effective when used in conjunction with an Asset Basic Care program.

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Early indications of failure using predictive maintenance tools are much more evident in assets that are clean, well operated and properly lubricated. Also, the elimination of evident problems through Asset Basic Care makes predictive maintenance processes more attuned to detection of less evident faults.

**Diagnostics / Knowledge Retention** - can utilize all of your basic care, predictive maintenance, reliability audit and maintenance cost data together to help automate diagnostic evaluation about the condition of assets. Asset Basic Care programs are a prime source of operator and maintainer knowledge that can be embedded in a diagnostic system.

**Maintenance Program Optimization** – the data collected through an Asset Basic Care program is invaluable when engaged in a maintenance optimization / RCM analysis, especially if the basic care data is paired with failure history data taken from the EAM system. If the EAM system is capable of work order initiation based on condition, basic care findings can be used to enable work scheduling based on assessed asset reliability.

**Systems Integration with other plant systems (process control / CMMS / EAM / ERP)** – basic care data can be delivered to ERP systems and EAM systems for maintenance purposes, but the most common delivery process is to process data historians. Distributing the findings throughout the plant can be very helpful in focusing the attention of all plant personnel onto the reliability, safety and environmental metrics collected by an Asset Basic Care system.

It is therefore evident that Asset Basic Care is a solid foundation for a successful overall reliability program.

- Early indications of failure using predictive maintenance tools are more evident in assets that are clean, well operated and properly lubricated.
- Daily or per shift inspection data is always available to the reliability team for immediate analysis verification.
- Reliability specialists can focus on complex reliability issues rather than simple operation or lubrication conditions – these conditions are detected by operations or lubrication techs.
- Plant-wide distribution of Asset Basic Care system findings can focus attention on the overall reliability of the plant (through the development and use of key performance indicators).

## **Benefits of Asset Basic Care**

Asset Basic Care programs have been implemented in hundreds of organizations, both in process and discrete manufacturing facilities. Benefits of a successfully implemented care regimen include:

- Reduced unplanned downtime / reactive maintenance work.
- Reduced corrective maintenance cost per repair.
- Positive long-term impact on safety and environmental performance.
- Improved employee morale through cooperation between maintenance and operations.

Some benefits that have been documented by organizations that have implemented Asset Basic Care programs include:

**Paper Mill, Florida** - An Asset Basic Care program at a paper mill in Florida resulted in a **70% reduction** in reactive repairs in three years and a reduction in maintenance budget by **one-third**.

**Paper Mill, Virginia** - An Asset Basic Care program at a paper mill in Virginia was credited as a major contributor to a **20% increase** in total mill production – even with the permanent shutdown of one of mill's six paper machines.

**Carbon Black Plant, Louisiana** - An Asset Basic Care program at a plant in Louisiana led to a **32% reduction** in ongoing preventive maintenance work orders, and a **10% reduction** in annual maintenance costs.

## Implementing Asset Basic Care

An Asset Basic Care program can be implemented as a separate program in and of itself, or as part of one or more broader programs. Implementation of basic care programs can differ considerably, depending on the type of organization, industry, and especially on the goals and objectives of the team within the organization who is spearheading the program. The main success factors are clear assignment of roles, effective management support, appreciation of cultural issues, and having a clearly laid out implementation process for all participants to follow.

### Role Assignment / Management Support

During the development and initial roll-out of an Asset Basic Care program, the necessity for upper management support and clear and unambiguous role assignments cannot be overstressed. A successful basic care program requires a high level of cooperation from operations staff and maintenance staff, and this cooperation can best be managed with managerial support from the higher levels of both (or above both, preferably).

Either the individual who has been put in charge of the roll-out of the basic care program should be directly involved with the initial deployment area, or he/she should have a liaison who is directly involved with the area. One strategy that has been utilized is the formation of a “Reliability Group” which is comprised of individuals from both the maintenance and operations staff.

### Cultural Issues

All of the elements of 5S, see below, are appropriate for a basic care program. The most important, and the one that has the most profound effect on the work place, is self-discipline, sometimes referred to as sustain, or sustainability. The concept that all personnel in a plant are responsible for the assets within the plant is as much a cultural change as it is a technical or procedural change.

<b>Sort</b>	Remove unnecessary items from the workplace	“When in doubt, throw it out”
<b>Straighten</b>	Locate everything at the point of use	“A place for everything, and everything in its place”
<b>Sweep</b>	Clean and eliminate the sources of filth	“The best cleaning is to not need cleaning”
<b>Standardize</b>	Make routine tasks standard operating procedure – what to do and when to do it.	“See and recognize what needs to be done”
<b>Self-discipline</b>	<u>Sustain</u> by making 5S second nature	“Understand what needs to be done without being told”

A culture of self-discipline is one of the key factors that will determine if a basic care program will thrive, or simply be seen as another management program *du jour*.

At a pulp and paper mill in Louisiana in early 2004, operators initially resisted the implementation of a basic care program. By June 2005, the basic care program was credited with a \$30 per tonne reduction in maintenance costs, this at time when paper mills have been shutting down due to high operating costs and oversupply. Plant personnel achieved this by embracing the basic care concept and the culture of self-discipline that it implies.

## Implementation Steps

The implementation of an Asset Basic Care program involves the following steps:

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1. Design Inspection Forms
2. Operator Training
3. Inspection Scheduling / Optimal Route Length
4. Develop Feedback Mechanisms.
5. Execute Asset Basic Care Cycle.
6. Measure Performance.

### **Step One: Design Inspection Forms**

Properly designed inspection forms have the twin goals of ease-of-interpretation and fast completion.

- **Easy To Read** - Design the inspection forms (or data capture screens) with as simple a language level as possible.
- **Consistent** - Make inspection questions as consistent as possible for each asset type, so the operator can complete the inspection as quickly as possible.
- **Non-Ambiguous** - Design the questions (data entry fields) so that it is clear which exception item is to be selected/entered if a fault is detected.

Inspections can involve anywhere from two to ten points per asset/machine train, depending on the complexity of the inspection item. Typical inspection items include:

- Check lists, single and multiple check-off.
- Operating Hours, Usage Meters.
- Predefined and Ad Hoc Notes.
- Fluid (lubricant, fuel, coolant etc.) levels.
- Process Parameters (pressure, flow, draw ...)
- Temperature / Sound / Ultrasonic levels.
- Vibration (velocity and shock pulse) levels.
- Images / Sketches.

### **Step Two: Operator Training**

Operations staff is the main resource for implementing an Asset Basic Care program. The primary key to success is operator training.

- **Choose Appropriate Inspections** - It is important to train the operators to carry out inspections at an appropriate level of complexity.

From **IDCON** “As a guideline-if an operator can be trained in an inspection method in less than 15 minutes, he or she should be trained to do that inspection.” The corollary to this statement is that if the inspection requires more than 15 minutes to teach an operator, it may not be a suitable candidate for inclusion in a basic care program.

- **Explain WHY as much as WHAT and HOW** - Operator buy-in is essential for a successful inspection program, and a training program should emphasize the reasons why the program is being implemented. It

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has been our experience that there is a direct correlation between the level of effort expended to give the operators understanding about the reasoning behind an inspection process and the level of buy-in.

- **Train The Trainers** - Designate and train one or more employees of the plant staff (reliability, operations, IT) as the program trainer. This is especially important if one-time training of the operators is being carried out by external consultants. The operators will be much more comfortable carrying out the inspection if there is a backup resource readily available.
- **Plant-Floor Training** - All operators should be walked through their inspection rounds at least once, preferably more often, during the initial training program.
- **Tools Training** - If the inspection program is to be implemented using automated tools, then training must be extended to include the software systems and handheld data collection tools. However, it is important not to let the tools training become the primary focus of the training effort – tools are merely the tail, the inspection process itself is the dog.

### **Step Three: Inspection Scheduling / Optimal Route Length**

#### **A) Developing Data Collection Procedures**

Essential to Asset Basic Care are the data collection procedures needed to detect problems and measure improvement. These include:

- Operator Asset Production Check Sheets.
- Operator Area Housekeeping Check Sheets.
- Lubrication Routes.
- Asset Condition Check Routes.
- Safety / Health Protection Inspection Routes.

#### **B) Inspection Rounds**

Determining the best way to execute a program of inspection rounds (either operator-based inspections or lubrication inspections) raises a number of questions, but two questions are always raised.

- **How often should inspections be carried out?** In theory, inspection frequency should be based on the known length of time between a failure indication and the failure event itself - the potential failure to functional failure, or P-F interval.

In reality, we usually don't know these failure intervals. Also, the inspection process is not solely concerned with failure – we are also interested in finding out operating states that are sub-optimal from a performance or even an esthetic perspective. The amount of failure or fault data needed to derive accurate (or at least statistically valid) failure intervals can often be very hard to come by. When we ARE able to derive statistically valid inspection intervals, they are often at odds with the practicalities of the plant operation.

Fortunately, we have found that very good estimates of optimal inspection frequency usually come from the operators and reliability staff within the plant itself. Also fortunately, it is appropriate to derive inspection intervals from established practice.

In plants where operators are already carrying out once-per-shift or once-per-day inspections, it can save a lot of time to simply review and optimize the existing inspection frequencies. Within 4-6 months of

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implementing a basic care program, there is usually enough data collected to be able to review and alter the inspection frequency. Route frequency review should be built in as part of the Asset Basic Care inspection cycle.

- **How long should an inspection route take?**

Route length can vary considerably from plant to plant.

It is our experience is that expected completion time for routes should be no longer than two hours. For once-per-shift or once-per-day routes, it is usually impractical to have routes that take longer than an hour – the norm for these types of routes is 20-30 minutes..

Longer routes generally have poorer data collection compliance statistics, as they often cannot be completed within a single shift.

#### **Step Four: Feedback**

Proper feedback requires a method (or methods) to deliver usable information to maintenance, operations and management.

- **Reports** - It is important to sit down with the operators while the basic care program is being designed, to understand just what information the operators want to see in their basic care reports.

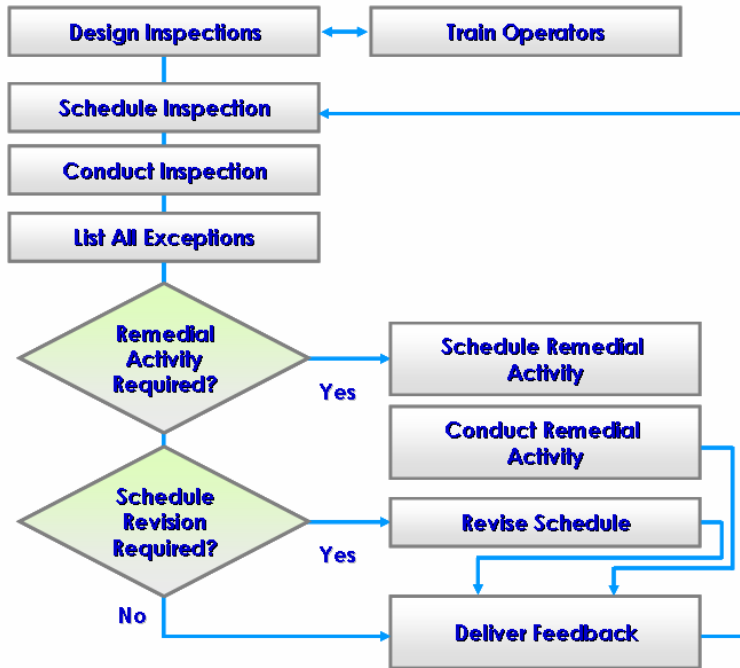
Often, operators want reports that contain the same data as the reports received by maintenance, but formatted and ordered in different ways.

- **Plant Data Display Systems** - If operations is heavily invested in existing data display systems such as Honeywell PHD, OSIsoft PI or AspenTech IP.21, consider delivering inspection data via these systems.

Reporting inspection results to operations through a known system can increase operator acceptance of the process.

- **Compliance Metrics** – compliance reports or KPIs are becoming a standard part of basic care inspection programs. These tools measure how closely the inspection process is matching up to the prescribed schedule. Good compliance metrics enable decision-makers within the plant or organization to use basic care data with confidence, to make effective production or maintenance decisions.

### Step Five & Six: Asset Basic Care Cycle



### *Asset Basic Care Cycle*

The execution of an Asset Basic Care program involves the following steps:

- Schedule the inspections for a time period.
- Carry out the inspections in a timely manner.
- Generate and deliver a list of noted exceptions.
- Notify all participants about any exceptions found during the inspections.
- Schedule and conduct any remedial action needed to eliminate the exceptions.

## Automated Asset Basic Care

### Challenges to Manual Inspection Procedures

There are a number of challenges to manual inspection process. Inspection programs using check sheets are difficult to monitor – many inspection rounds never get carried out, and it's difficult to determine if they haven't been carried out.

The data collected on inspection check sheets is highly prone to error – entries are illegible, different inspectors use their own terms to describe problem conditions, meter values are transcribed incorrectly. This is difficult for the person reviewing the inspection results, and even more difficult if those results are required to be entered into a database or a spreadsheet.

	0000 - 0800	0800 - 1600	1600 - 2400
MACHINE 1			
FW TEMP IN		143	197
FW TEMP OUT		148	91
OIL PRESS IN		51	80
OIL PRESS OUT		60	199
OIL TEMP IN		180	217
OIL TEMP OUT		185	90
RPM		400	30
AMPS		24	
INITIALS		RBC	
COMMENTS	05/08 HRS: I saw nothing to alarm me!!! 06/16 HRS: I SAW NOTHING TO ALARM ME. 16/24 HRS:		

**An Unfortunate Example of a Paper Check Sheet**

Another source of error is simply that there is often confusion about which machine train is being inspected – especially in process industries where there is lots of identical equipment in operation.

The inspection check sheet offers little additional support to the inspector when he/she discovers what may be a problem – there isn't any way to review previous inspections or query the check sheet for further help.

Often, reporting of immediate problems is done verbally. This can not only lead to inadequate traceability of the problem (its cause, etc.) but the verbal reporting process can cause many problems to be under-reported, as the inspector will inevitably concentrate on the current most serious problems and not report those that are looming, but not currently critical.

Finally, the inspection check sheets need to be reviewed by someone capable of taking the next step – either ordering work to be done or more tests.

**Automating the Inspection Procedures**

There is no question that Asset Basic Care inspection procedures can be carried out using paper check-sheets. However, after having installed automated Asset Basic Care programs in over 100 plants worldwide, we can say with assurance that automating the program offers several advantages.

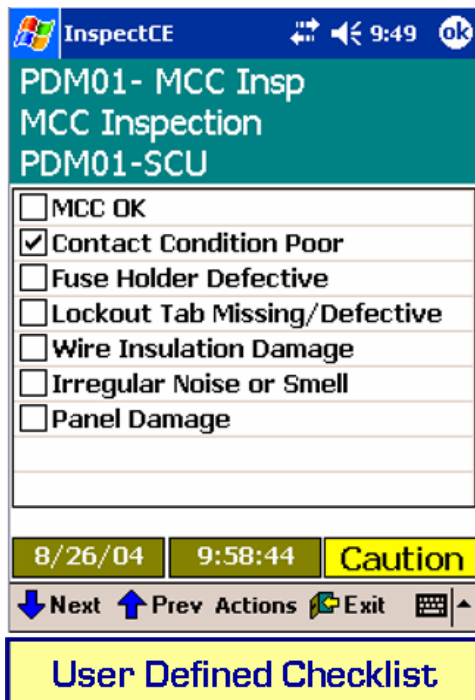
- Implementing Asset Basic Care programs is easier and more efficient
- Increases the accuracy and consistency of collected data.
- Immediate feedback is available to the operators when assessing the asset.
- Exceptions are indicated immediately to maintenance and reliability staff.



### *Tools for Automating the Basic Care Inspection Process*

When the system is electronic, it is easy for an inspector to check on the last reported condition of an asset and check up on any repair carried out since the last inspection. Checking on the integrity of completed repairs adds significantly to the quality of the organization's repair process.

Well-documented and highly compliant data allows an easy comparison of results from one inspection to the next. Machinery and process parameters when logged can be analyzed to establish trends in equipment performance to provide an early indication of the presence of a developing fault condition.



### *Example of Electronic Check Sheet Item on Pocket PC*

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## **Conclusion - Keys to Success**

### **Management elements that need to be addressed to ensure a successful Asset Basic Care program:**

- Role Assignment – assigning responsibility for the program.
- Housekeeping – building a culture of self-discipline in the workplace.
- Training – operators need to fully understand what problems they are to detect and the tools they are expected to use.
- Management Support – both operations and maintenance management must “buy-in” to the program.

### **Technical elements that need to be addressed to ensure a successful Asset Basic Care program:**

- Design of Asset Inspection Methods that clearly define what problems the operators are looking for.
- Developing Route Paths for optimal data collection efficiency and 100% data capture.
- Developing Route Schedules to ensure timely and accurate data collection.
- Measuring Data Collection Compliance – “what gets measured, gets done”

**The keys to a successful Asset Basic Care data collection program can be summarized as – you need to be SURE.**

- **Simplicity**. The process of collecting data must be simple to learn and remember.
- **Understanding**. Operators must understand (be trained) what to look for when carrying out an inspection
- **Reliability**. If the data collection process is unreliable, or causes “paper pile-up”, the system will be considered more trouble than its worth.
- **Effectiveness**. Operators must see positive results from their inspection efforts – feedback at all stages is critical for the program to be considered effective.