



WHITE PAPER

Determining the Optimum Staffing Levels for a Maintenance and Reliability Department





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INTRODUCTION

Managing a maintenance budget can be a challenge for new managers, and those managers with a fluctuating demand schedule. Often it feels like there is more work than the people on your staff can complete. Yet on other days it may seem like planners are scrambling to find work for all of the manpower available. Determining the right manning level for your maintenance and reliability department is an important step in maintaining control of your costs and their drivers. There will always be unique circumstances, depending on the overall duties of the department. However, a few simple calculations can help you understand, relatively, if you have both the right manning level and the correct skill sets in your department.

First, these calculations will go through determining the ideal crew size based on known repetitive workload. After determining the ideal crew size, we will use the recommended organization staffing structure to calculate the staff skills and levels needed for the calculated crew size.

These calculations come with a range of underlying assumptions as seen in Figure 1. Adjust these assumptions based on your actual operation.

CALCULATING THE APPROPRIATE STAFFING LEVELS

STEP 1: DETERMINE REPETITIVE WORKLOAD

To begin, determine the expected yearly repetitive workload for the crew. Most Computerized Maintenance Management Systems (CMMS) can report the load hours for repetitive work. This repetitive workload includes qualitative inspections, such as filters, fluid levels, contamination, or visual condition; quantitative inspections like vibration analysis, wear measurements, or infrared inspections; and time-based replacements, including oil changes and equipment swap outs.

Repetitive workload is often labeled as Preventive Maintenance (PM) work in a CMMS.

STEP 2: DETERMINE DESIRED PERCENT OF WORK THAT IS REPETITIVE

Next, determine from your vision or goal statement what percentage of work from the overall workload constitutes this repetitive work. Best-in-class organizations are defined as having 80% of their workload come from repetitive work, and the planned repair work derived from this repetitive workload. Ideally, 30% of the workload is from repetitive work, 50% from the planned work derived from repetitive work, 10% of work is continuous improvement work determined from Root Cause Analysis (RCA) or other continuous improvement activities, and the last 10% (or less) of the workload is from emergency or break-in work. For this example, we used 30 %, as shown in the assumptions in Figure 1.

Figure 1. Assumptions

- A. Repetitive workload is known
 - Inspections, time-based replacements, condition based routes
 - Yearly workload of repetitive work has little variation
- B. Skill sets are defined and analysis of headcount crew is performed by skill set
 - For example, unless machine repairmen and electricians are interchangeable in your organization, determine the headcount for each skill set independently
- C. The vision of what percent of work should be repetitive
 - 30% is used in this calculation
- D. Work hours available for a man-year assumes these facts:
 - 8-hour shift
 - 2 weeks of vacation
 - 10 holidays per year
 - 2 weeks of safety and technical training per year
 - 1 hour of safety training and team meetings per week
 - 1 hour of instruction/paperwork/break time per day
 - 30 minutes of wasted time (travel, interruption, etc.)

Table 1. Electrical Resource Repetitive Workload Example		
RESOURCE (TEXT)	QUANTITY	UNIT
Electrical	4,760.50	Hours
Electrical	7,220.00	Hours
Electrical	6,980.50	Hours
Electrical	5,933.00	Hours
Electrical	32,008.00	Hours
Total	56,902.00	Hours

STEP 3: DETERMINE HOURS AVAILABLE IN A MAN-YEAR

Determine how many hours of work you can reasonably expect from each crew member. Shift schedule, training, meetings, vacation, and breaks are all variables. For this exercise, we will use the assumptions listed in Figure 1.

STEP 4: CALCULATE IDEAL MANPOWER LEVEL

To begin, calculate the total hours of work with the following equation:

$$\frac{\text{Hours Repetitive Work}}{\text{Percent Total Workload That Is Repetitive}} = \text{Total Hours}$$

Therefore, using the electrical resource repetitive workload example from Table 2, the total hours are:

$$\frac{189,673}{1462.5} = 130$$

Next, you will use the total hours of work to calculate the level of manpower needed:

$$\frac{\text{Total Hours}}{\text{Hours Per Man-Year}} = \text{Manpower Level}$$

So, pulling the total hours previously calculated and the available man-hours from Table 3, the level of Electrician manpower for this example is:

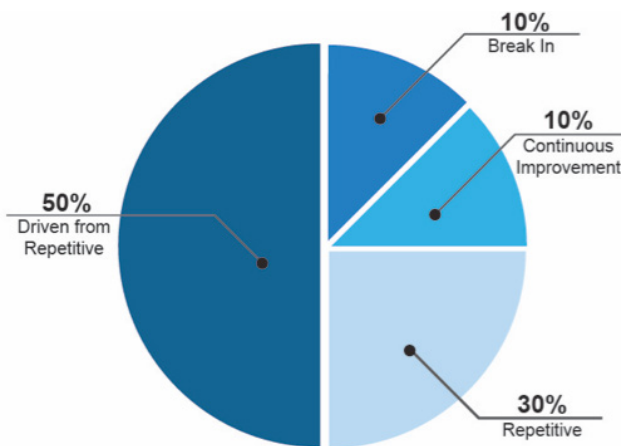
$$\frac{56,902}{30\%} = 189,673$$

By understanding that 130 Electricians is the ideal manning level for this organization, it is easier to make budgeting and actual head count decisions.

In order to make the ideal workload balance (Figure 2) work on a consistent and predictable basis, the 130 Electricians must be supported by a right-sized reliability management team.

Table 2. Calculation of Available Man-Hours			
WEEKS / YEAR		HOURS / DAY	
52	Calendar	8	Straight time
-4	Average vacation, sick, holiday	-1	Lunch, break, transition
-2	Training	-0.5	Waste
-1	Team meetings		
45	Weeks of work / man	6.5	Available hours / day
MAN-YEAR AVAILIABLE HOURS			
32.5	Hours / week available		
1462.5	Hours / man / year		

Figure 2. Breakdown of Ideal Workload



STEP 5: DETERMINE IDEAL STAFF LEVEL TO SUPPORT CREW

The ideal staff level depends on the crew size. Figures 3 and 4 depict recommended organizational structures for a very large and small plant. There are corresponding organizational charts for various sizes of organizations.

As shown in Table 3, these ideal reliability staff level organization charts can be translated into a mathematical matrix of ideal staff level given a known craftsmen level.



Figure 3. Ideal Reliability Staff Level for a Very Large Plant (>100 Craftsmen)

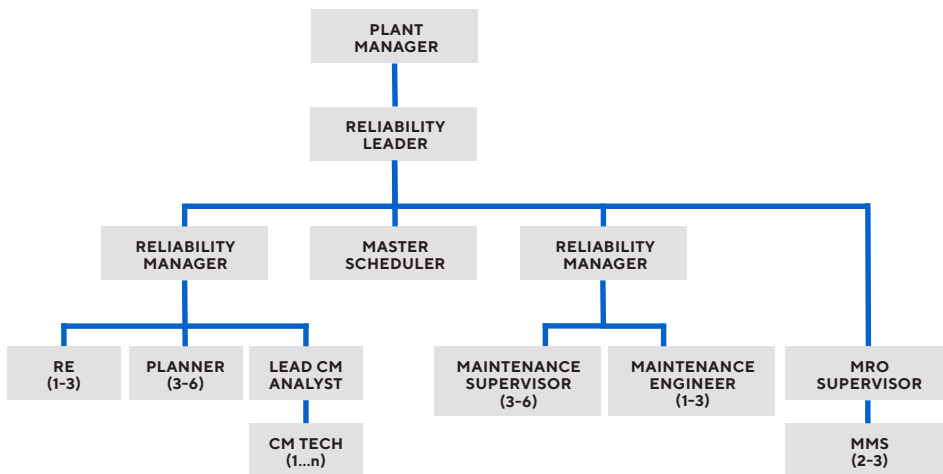


Figure 4. Ideal Reliability Staff Level for a Small Plant (>15 Craftsmen)

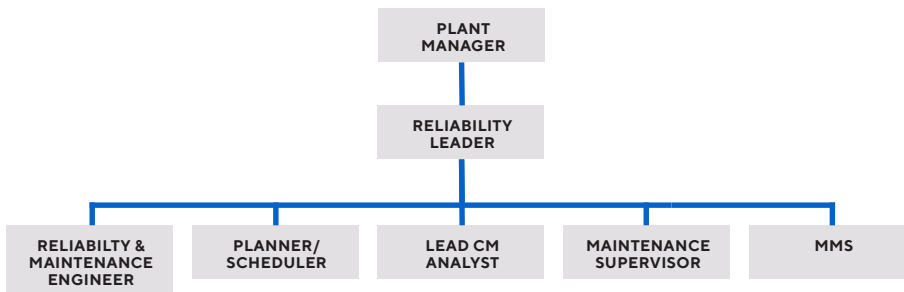


Table 3. Ideal Staff Level by Craftsmen Supported Mix

CREW TO SUPPORT RATIO		YES	> 50	35:1	15:1	> 50	> 50	20:1	35:1	> 15	30:1
Plant Size	Craftsmen to Support	Reliability Leader	Reliability Manager	Reliability Engineer	Planner	Scheduler	Maintenance Manager	Maintenance Supervisor	Maintenance Engineer	MRO Manager/ Supervisor	Material Specialists
Very Large	> 100	1	1	> 3	> 6	1	1	> 5	> 3	1	> 3
Large	50-100	1	1	1-3	3-6	1	1	3-6	1-3	1	2-3
Medium	15-49	1	0	1	1-3	0	0	1-3	1	1	1-3
Small	< 15	1	0	0.5	1	0	0	1	0.5	0	1

Table 4. Ideal Support Structure for 130 Crew Members

Craftsmen to Support	Reliability Leader	Reliability Manager	Reliability Engineer	Planner	Scheduler	Maintenance Manager	Maintenance Supervisor	Maintenance Engineer	MRO Manager/ Supervisor	Material Specialists
130	1	1	3	8	2	1	7	3	1	4

Note that one person can function as more than one skill set. So, it can make sense to have two one-half staff members, as shown in the small plant levels in Table 3. The recommended structure for the small plant suggests having one half of a Reliability Engineer coupled with one half of a Maintenance Engineer. It is necessary to split roles at smaller staffing levels, but not recommended at larger staffing levels. When calculating the support staff for larger organizations, it is recommend to truncate (or round down) to the nearest whole person. As in everything, common sense needs to be used when determining the proper staff and skill set of that staff.

For the final step in our calculations, determine the ideal staff support level for this example by plugging our 130 Electricians from Step 4 into the support matrix (Table 3). These ratio calculations and rounding down to the nearest whole person yields the support organization of 31 people shown in Table 4.

MOVING FORWARD

These calculations need to be balanced with other business constraints; however, they provide a baseline against which to make informed decisions.

The labor portion of most maintenance budgets constitutes half or more of the overall spend. By understanding the ideal labor requirements to support the organization, the budget and management of it can be put into perspective. These calculations can also be used to understand what the base workload is for the organization and what is cyclical or spike load. It is easier to make insourcing, outsourcing, and temporary labor decisions when ideal crew and staff levels have been calculated. Right sizing the organization is a strategic balance of overall vision, ideal manning calculations, common sense, and available budget.

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