

Performance Budgeting for Maintenance: A Budget Based on Quality, Quantity, and Productivity Standards

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•TRADITIONALLY, highway maintenance in Utah, as in other state highway departments, has been budgeted on the basis of miles or lane-miles of highway and past experience, and allocations are made under the traditional budget to districts and sub-districts (in Utah, these are called stations) in terms of money for the resources of labor, equipment, materials, and contractual services. Allocations under the performance budget are made in a similar manner both in terms of the kinds of resources and the districts and subdistricts.

The difference comes in how we measure the needs for resources. Under performance budgeting, we now define the maintenance requirements in terms of activities, not just maintenance. It is now a conglomerate of pothole patching, roadside mowing, blading shoulders, plowing snow, and other activities.

We determine how much of each of these activities will have to be performed in each maintenance station. We determine how much resources—labor, equipment, and materials—will be required for each of these activities. And, the performance budget becomes the total of the resources required for all of the activities in each station, in each district, and in the state as a whole. So, the big difference is that the performance budget is built up activity by activity. Further, in administering or controlling the budget, we now can provide managers with activity-related measures and not just fiscal measures. We budget performance of work activities and exercise management control over maintenance activities.

ESTABLISHING A PERFORMANCE BUDGETING SYSTEM

The introduction of a performance budgeting system in Utah was started in April, 1967. The basic foundation for the system was provided by the establishment of maintenance policies for a long-range plan, maintenance programs, maintenance performance standards, and a maintenance reporting system. These were formally approved by the Utah State Road Commission (see Appendix). A target date for introduction of the performance budgeting system was set for July 1, 1969. With the recognition of a possible need for advance decisions by the road commission, a schedule was established for an interim report to the road commission in December 1968. This report has been made and the commission is now considering alternative actions directed toward implementation of the system.

The principal steps that have been taken by the Utah Department of Highways in development of the system can be summarized as follows:

1. Work activities—the definition of maintenance work activities, establishment of units for work measurement, and definition of types of roads for classification by maintenance characteristic.
2. Maintenance feature inventory—the conduct and compilation of an inventory of the maintenance features or characteristics on the highway system that relate to amounts of maintenance work required.

3. Standards—the development of standards for each road type (a) defining level of service, (b) defining average annual quantities of work needed, (c) establishing standard methods and procedures for work performance, and (d) establishing expected rates of accomplishment.

4. Reporting—the development of a work-reporting system that permits compilation of valid data on resources used and accomplishment attained and provides meaningful summaries of information to management.

5. Maintenance program—the development of an annual maintenance program showing planned work and resource requirements for individual management units, based on established standards and current road inventory.

6. Scheduling and control—the development of procedures for work planning, scheduling, and controlling by district and operating-level supervisors.

Those elements in the development of a maintenance performance budget that appear particularly significant are discussed in the following sections.

DEVELOPING STANDARDS

The performance budget system requires that we set several kinds of standards. First, we need a level of service or quality standard so that there is uniformity throughout the state and that there is an adequate level of maintenance. Second, we need to convert the quality standard into meaningful quantities of work activities. These are called quantity standards. Third, we need productivity standards. These define how work is to be done, the staffing required to do it, and the productivity rate that should be attained.

The standards in Utah have been established by a standards panel assisted by the maintenance project staff. We think that the work of the standards panel has been a prime contribution to the system. The panel has met for a two-day work session each month, and has reviewed, evaluated, and revised standards for more than 30 activities.

Because of the importance of the standards, an example is presented to illustrate what the standards do. The complete standard for the semiannual-annual mowing activity, shown in Figure 1, is broken down into the following elements: responsibility, definition, quality and workmanship, scheduling considerations, methods and procedures, crew arrangements, and expected performance. The mowing standard illustrates how guidance is provided to the foreman—what, when, and how much mowing—and also how quantity values are provided for development of the budget.

The responsibility statement indicates who is responsible for decision with regard to this activity. In this instance, it is the station foreman's (first-line supervisor) job to decide when and where this activity is to be performed. The decision is controlled, however, by subsequent requirements of the standard. For some activities, the responsibility for decision may be placed on the district maintenance supervisor. The definition gives a description of the activity and provides guidance as to the general scope and purpose of the activity. Quality and workmanship define, in this case, what is considered adequate performance in terms of mowing frequency, mowing width, and vegetation height. Scheduling guidance is provided to the foreman in terms of which months and on what road classes the semiannual-annual mowing activity is to be performed.

Method and procedure indicate specified ways of performing this mowing operation. Relevant comments here pertain to the effective use of bat-wing and single-swath mowing units. Crew arrangement gives the typical numbers and types of men and equipment to be used for the particular work. Expected performance indicates what the foreman should expect in the way of daily production and productivity under normal circumstances with the use of the specified method and procedure. These kinds of standards set the quantities for the principal work activities on which the performance budget is based.

USING FIXED ACTIVITIES TO DETERMINE MANPOWER FOR BUDGET

In the development of the maintenance work program and the budget, activities are classified as either fixed, semifixed, or variable. Fixed maintenance work activities

PERFORMANCE STANDARD
 UTAH STATE DEPARTMENT OF HIGHWAYS
 OFFICE OF MAINTENANCE
 SEPTEMBER 1, 1968

ACTIVITY 141-100

SEMI-ANNUAL/ANNUAL MOWING

RESPONSIBILITY - Station Foreman

DEFINITION - The specifically planned, scheduled and controlled Semi-Annual or Annual mowing that extends as far towards the right-of-way lines as required for purposes of controlling weeds, eliminating a snow drift line, reducing the likelihood of concealing animals and maintaining roadside appearance.

QUALITY AND WORKMANSHIP - This mowing activity is performed in accordance with the following guidelines:

- The Semi-Annual/Annual mowing will:
 1. Extend a minimum of 20 feet from the pavement edge, where a mowable right-of-way occurs; and
 2. Extend beyond 20 feet only where required to control weeds, eliminate a snow drift line or reduce the likelihood of concealing animals.
- Vegetation is not to be mowed closer than 5".
- This mowing activity is to represent the first and the last mowings (Semi-Annual) of the season on all roads except Low, Gravel or Unimproved (Classes 5, 6 or 7) which receive only one mowing (Annual) per season.

SCHEDULING CONSIDERATIONS - Semi-Annual/Annual Mowing is performed in accordance with the "X" in the schedule below without regard to a vegetation height requirement.

	INTERSTATE	HIGH CLASS	INTERMEDIATE CLASS	LOW CLASS, GRAVEL AND UNIMPROVED
JUNE	X	X	X	
JULY				
AUGUST				X
SEPTEMBER				
OCTOBER	X	X	X	

The June (Semi-Annual) mowing is intended to coincide with the end of the rapid spring growth cycle in order to cut undesirable vegetation prior to the seed stage and to improve summer roadside appearance. Adjustments are to be made when unusually wet or dry years make adherence to the June scheduled cut impractical.

Figure 1. Performance standard for semi-annual/annual mowing.

are ones that must be performed during specific times or periods of the year because of temperature (such as seal coating), seasonal (such as mowing), or functional (such as supervision) considerations. Semifixed activities are those that must be performed during a certain period of the year, but that can be shifted within the months as required for workload leveling. Activities in this category include grading roads, grading shoulders, and semiannual drainage maintenance. Variable activities are those that can be performed virtually anytime during the year because there are no general constraints. Included in this group are activities such as fence repair, annual litter pick-up, and brush cutting.

PERFORMANCE STANDARD
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 SEPTEMBER 1, 1968

ACTIVITY 141-100

SEMI-ANNUAL/ANNUAL MOWING
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The October (Semi-Annual) mowing is intended to eliminate snow drift lines and improve winter-spring roadside appearance.

The August (Annual) mowing, the only mowing provided Low Class, Gravel and Unimproved roads, is intended to eliminate snow drift lines and improve Winter-Spring roadside appearance.

METHOD AND PROCEDURE - Mowing is machine paced, and therefore, the most efficient operations are those which depend on each mower working independently. Bat-wing mowers are most effectively used to mow wide swaths and make a minimum of turning and movements. Five foot single unit mowers should be used with bat-wing when required for clean-up.

CREW ARRANGEMENT - Crew arrangements should vary depending upon whether the operation includes the use of a bat-wing mower or not.

<u>OPERATIONS WITH BAT-WING AND SINGLE UNIT MOWER</u>		<u>OPERATIONS WITH SINGLE UNIT MOWER ONLY</u>	
2 Men		1 Man	
1 Mower	38-01	1 Mower	38-01
1 Mower	38-02	1 Tractor	04-05
2 Tractors	04-05		

EXPECTED PERFORMANCE - The following performance can be expected under normal circumstances:

Daily Production:

Single Unit Mower	6.3 - 9.3 acres
Bat-Wing and Single Unit Mower	25.0 - 37.4 acres

Productivity:

Single Unit Mower	0.9 - 1.3 man hours/acre
Bat-Wing and Single Unit Mower	0.4 - 0.6 man hours/acre

Figure 1. (continued).

By distributing the man-hours associated with the fixed, semifixed, and variable activities in accordance with the respective constraints and with an objective of building as level a work load as possible, we determined manpower requirements. Figures 2 and 3 show for two of Utah's districts the resulting manpower requirements as determined by the accumulation of needs for fixed, semifixed, and variable activities. The northern district has 2,307 lane-miles, with approximately 50 percent of the lane mileage at higher elevations, contains the metropolitan area of Ogden, and has an annual precipitation of 16 to 18 in. Analysis of this district's work load indicated a peak fixed activity staffing requirement of 87 for July. The addition of the semifixed and variable requirements during off-peak months resulted in a level need for 87 men for the period from April through November. Because of our ability to level out the work load in all but four winter months, we did not need to hire temporary summer workers.

The southwestern district has 2,358 lane-miles, with approximately 10 percent of the lane mileage at higher elevations, has no large metropolitan areas, and has an

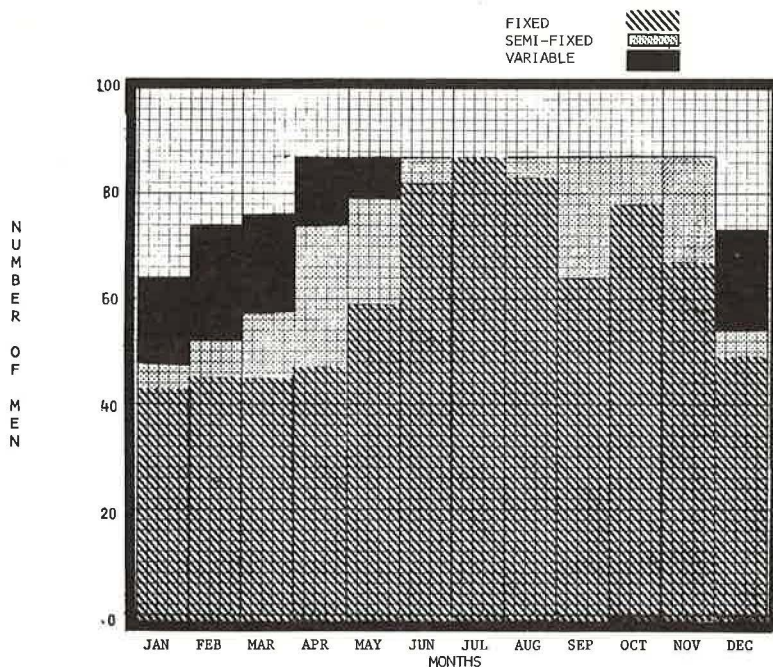


Figure 2. Manpower requirements for maintenance in a northern district.

annual precipitation of 8 to 10 in. Here again our analysis indicated a peak staffing requirement of 81 for fixed activities during July. However, because of the more temperate winter months and limited areas where snow cover exists, a substantially greater amount of this district's semifixed and variable work could be planned for performance during the period from December through March. Therefore, the annual work load

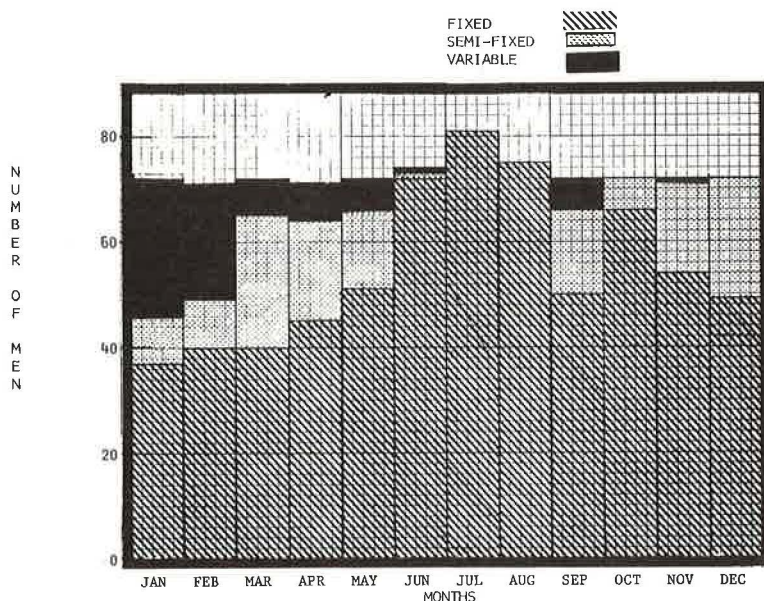


Figure 3. Manpower requirements for maintenance in a southwestern district.

could be handled with level staffing requirements for all but the summer months of June, July, and August, and a permanent staffing level of 73 was established to be supplemented by 8 temporary summer employees.

Analyses of all of the districts revealed that even though the activities performed were the same, each had its own peculiar work load composition and each demanded slightly differing staffing solutions. The analysis also revealed the inadequacy of allocating resources solely on the basis of road or lane-miles. The pursuit of performance budgeting has brought us a long way toward developing an objective approach to staffing requirements. However, alternative staffing solutions that will be examined in the years ahead include the potential reduction of permanent staffing levels through the use of greater amounts of planned overtime, and the reduction of permanent staffing levels by creating an accentuated summer peak that could be performed by temporary employees hired seasonally.

TRANSITION TO FULL IMPLEMENTATION OF THE SYSTEM

We now have a basis for a performance budget on which the maintenance work program can be based for the fiscal year beginning July 1, 1969. We have standards for the principal work activities on which the budget is based and by which field supervisors can schedule work. We have designed a specific work scheduling and reporting system to ensure control in accordance with the budget. We have tested the system extensively. All maintenance stations are currently scheduling and reporting as required by the system.

The critical problem now is to provide adjustments in staffing to fit the manpower resources required for the new system. Figure 4 shows our goal in terms of expenditures for maintenance. Additional funding will be required during the implementation

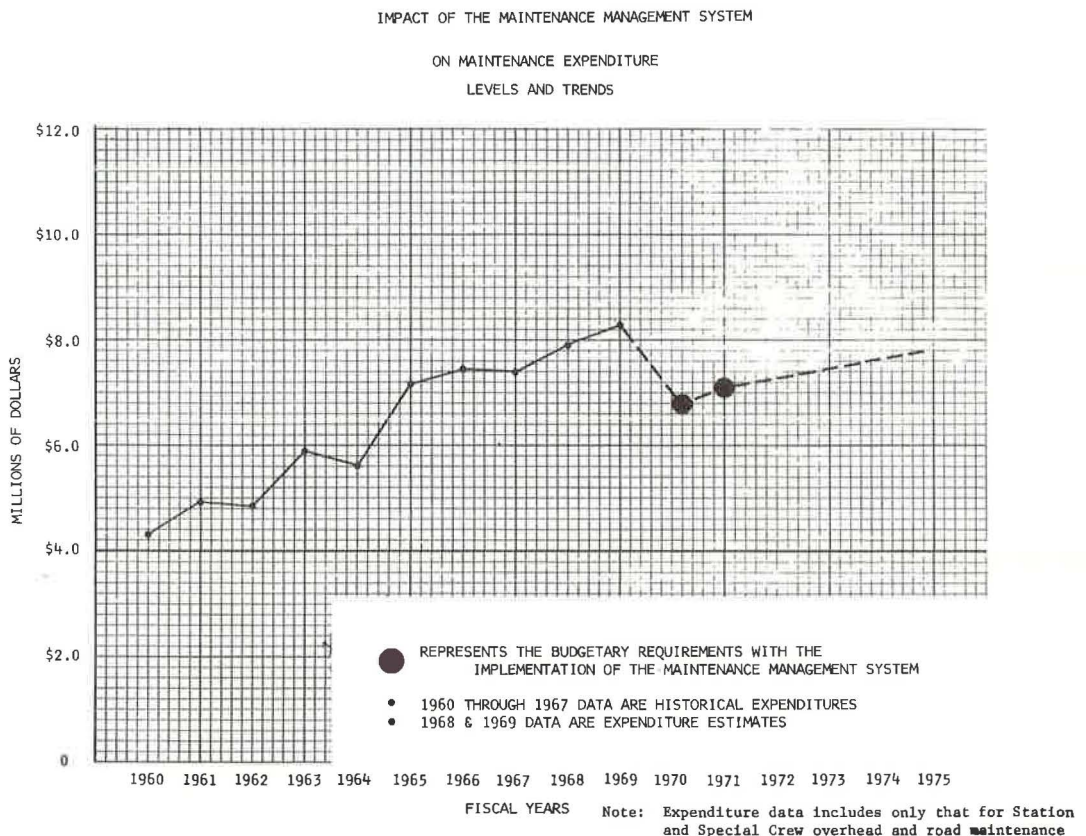


Figure 4. Impact of the maintenance management system on maintenance expenditure levels and trends.

TABLE 1
NUMBER OF MAN-MONTHS, AT CURRENT STAFFING LEVELS, RELEASED
FOR NONMAINTENANCE ACTIVITY—DURING FISCAL YEARS 1970 AND 1971

District	Man-Months Available			Total Man-Months Required for Maintenance Workload		Total Man-Months Released	
	Permanent Employee ^a	Summer Employee ^b	Total	1970	1971	1970	1971
1	1,287	120	1,407	983	1,002	424	405
2	1,836	162	1,998	1,045	1,052	953	946
3	744	102	846	741	741	105	105
4	1,008	105	1,113	727	736	386	377
5	876	39	915	876	876	39	39
6	1,284	60	1,344	1,025	1,027	319	317
Total			7,623	5,397	5,434	2,226	2,189

^aBased on October 1, 1968, staffing levels.

^bBased on the number of temporary employees during the summer of 1968.

TABLE 2
ESTIMATED MONTH AND YEAR OF ALIGNMENT OF AVAILABLE AND REQUIRED
MANPOWER UNDER A POLICY OF ATTRITION WITH NO REPLACEMENTS

District	Current Staff ^a	Annual Attrition Rate (percent)	Staff by Fiscal Year				Month of Alignment
			1969	1970	1971	1972	
1	107	20	97	88			January
2	153	20	138	110	97		March
4	84	10	80	72	65	61	February
6	107	10	100	90	86		December

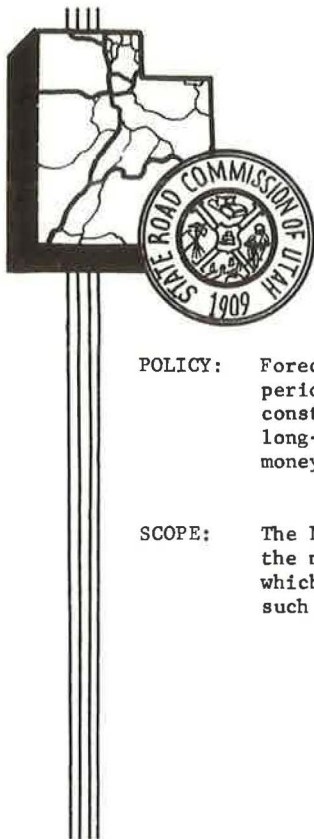
^aNumber of permanent employees as of October 1, 1968, assumes implementation of attrition policy January 1, 1969.

period for training and manpower adjustments. Table 1 gives the manpower adjustments needed to reach the potential of the performance budget. In districts 3 and 5, the adjustment is small and readily attainable. In the other three districts, the adjustment is sizable.

Consideration is naturally given to attrition as a means of attaining adjustment in staffing. Table 2 gives a projection based on current personnel turnover rates within the four districts where adjustments are needed. It will be noted that alignment through attrition alone is not achieved until February 1972. From a practical standpoint some of the positions vacated will require replacement. This would contribute to a delayed alignment. Because of this and our desire to attain alignment as soon as possible, we are considering a combined use of attrition and transfers.

As this is being written, a decision has not been made as to how the transition to the new system will be fully effected. However, we hope that the transition can be accomplished by July 1, 1970.

Appendix



LONG - RANGE MAINTENANCE PLAN

POLICY: Forecasts of maintenance requirements will be projected over a period of years to conform with the long-range plan for highway construction and the financing thereof to provide estimates of long-term requirements for manpower, equipment, materials and money, as well as plant facilities.

SCOPE: The Long-Range Maintenance Plan will constitute the objectives of the maintenance function of the Utah State Department of Highways which are to preserve and operate the State Highway System in such a manner that:

1. the investment in roads, bridges and appurtenances is preserved,
2. comfort, convenience, economies and safety are afforded the motorists and the public, and,
3. the necessary expenditure of resources is accomplished with continuing emphasis on economy.

MAINTENANCE PROGRAMS

POLICY: Annual maintenance work programs will be established for districts and sheds based on the mileages of the different classifications of highways and roads and on the quantity and productivity standards for maintenance work activities.

These annual maintenance programs will be prepared by the Office of Maintenance, reviewed by the State Highway Engineer and the Director of Highways and approved biannually by the Road Commission.

SCOPE: When annual maintenance work programs are approved they will become the basis for allocating resources to the management units responsible for carrying out the work in the field.

M A I N T E N A N C E P E R F O R M A N C E S T A N D A R D S

POLICY: To assure the attainment of the desired level of maintenance; to provide uniformity throughout the State; and to give quantitative bases on which to plan and carry out the maintenance program, performance standards will be established for:

Quality - To set the level of service and a gauge for work requirements for maintenance activities.

Quantity - To reflect the work requirement for different activities in terms of practical and significant measurements, such as tons of patching, acres of mowing, etc.

Productivity - To establish methods of doing work and the productivity to be expected in terms such as: man-hours per ton of patching materials, etc.

SCOPE: Approved maintenance standards will serve as guides in the development and maintenance of the Long-Range Maintenance Plan, Maintenance Programs, budget allocations and the state-wide application of efficient and economical maintenance methods and procedures.

M A I N T E N A N C E R E P O R T I N G S Y S T E M

POLICY: A system of maintenance reporting will be established to provide records of work accomplished in terms directly relatable to work programs. Summarizations of report data will be made available to maintenance management personnel at all levels, from Commission to Shed Foremen, in form best designed to serve their needs.

SCOPE: Reports to field operating personnel will be used as guides to improving performance and for reviewing performance standards.

Reports to top level management will relate performance to planned work for the year by Districts. These reports will be accomplished by Office of Maintenance analysis and a summary of actions taken or to be taken.

Reports to top management will also present trends in performance standard values and other significant statistics demonstrating improvement in performance.