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ABSTRACT

Part of the series "Managing Highway Maintenance," the unit deals with management by objectives--its definition, how it works, and necessary steps for application. It is designed for maintenance supervisors who are familiar with maintenance management systems. The format is a programed, self-instructional approach in which questions are asked in progressive steps. (EA)

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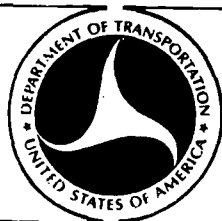
# MANAGING HIGHWAY MAINTENANCE

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# MAINTENANCE MANAGEMENT-- BY OBJECTIVES

*Management by Objectives Series*



UNIT 10

LEVEL 2

FEDERAL HIGHWAY ADMINISTRATION  
Offices of Research and Development  
January 1973



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This book is part of the series "Managing Highway Maintenance," prepared for the Implementation Division, Office of Development, Federal Highway Administration, under contract FH-11-7600. The series as a whole is described in the *Training Guide and Catalog* volume.

The contents of this book reflect the views of the contractor, Roy Jorgensen Associates, Inc. The contents do not necessarily reflect the official views or policy of the Department of Transportation.

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Implementation Division  
Offices of Research and  
Development

Washington, D.C.  
January 1973

## INTRODUCTION

What is "management by objectives"? How does it work and what steps are needed to use management by objectives? This unit of training answers all of these questions and shows how the concept is related to any systematic approach to managing maintenance. It is designed for maintenance supervisors who know something about maintenance management systems -- and the parts that make up a system.

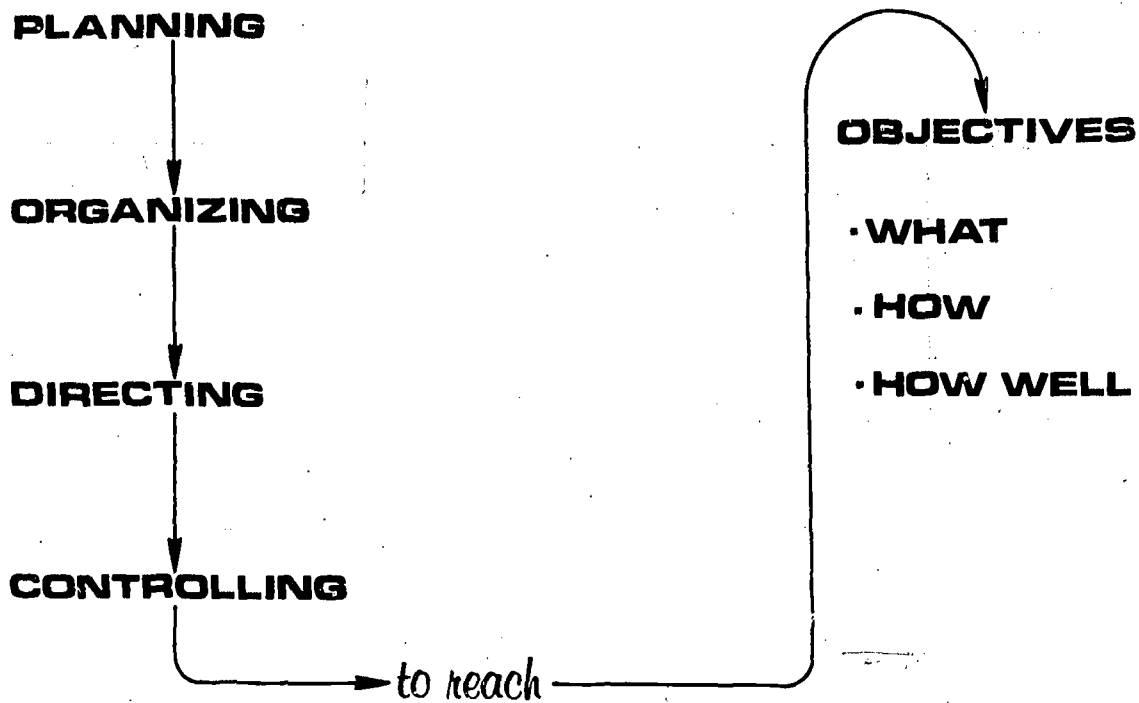
## TRAINING TECHNIQUE

The information in this unit is taught in a series of steps. Each step teaches by asking questions. You must answer each question before going on to the next step. Place your answers in this booklet. Check your answers with the ones shown below the dashed lines.

This course is self-instructional.

- + YOU CAN WORK ALONE.
- + YOU CAN CORRECT YOUR MISTAKES.
- + YOU CAN FINISH THE TRAINING AT YOUR OWN SPEED.

Turn the page and begin.



Section One

WHAT IS MANAGEMENT BY OBJECTIVES?

Management is the process of planning, organizing, directing and controlling work. It is something you do every day. Management is four things. It's:

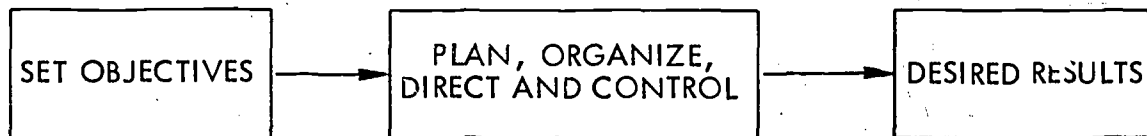
1. Deciding what work needs to be done and how to go about doing it;
2. Gathering and organizing manpower, equipment and materials to get the job done;
3. Supervising the work being done; and
4. Checking to see that the work is done as you planned in the first place.

Objectives are goals or targets -- something to work toward. Objectives indicate what the results of work should be -- what work should be done, how much of it should be done, how well it should be done, and how much it should cost.

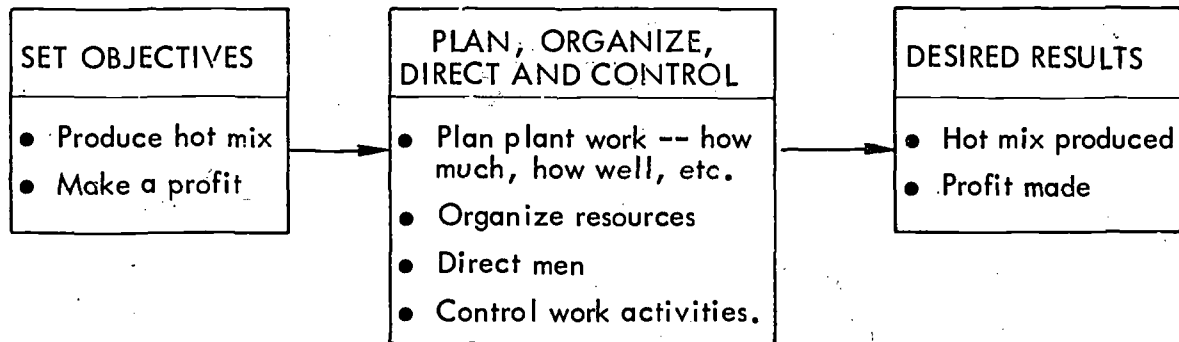
## MANAGEMENT BY OBJECTIVES

Management by objectives is the process of setting objectives, and then working toward those objectives. It is deciding what the results of work should be, and then planning, organizing, directing and controlling work so that the objectives are reached.

A diagram of the management-by-objectives process might look like this:



This process can be used by any supervisor in any organization. The diagram of the process for the local hot mix plant would look like this:



Notice that objectives have to be set first. This is what the diagram shows.

Objectives provide a basis for managing -- for making all of the decisions and undertaking all of the tasks needed to reach the desired results. And it's probably obvious that everyone in an organization has to work toward the desired results. In the hot mix plant, top management has to set objectives, make certain decisions and perform certain tasks. So do the day shift supervisor and the plant inspector and everyone else.

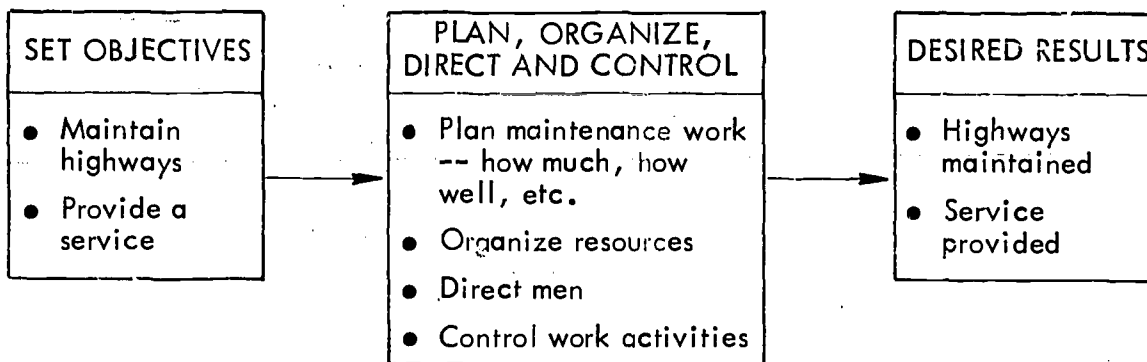
### MAINTENANCE MANAGEMENT BY OBJECTIVES

The same process applies to supervisors in highway maintenance. In the space below, draw a diagram of management by objectives for your maintenance agency. (Use the diagram on page 2 as a guide.)

When you have completed your diagram, compare it with the one on the next page.

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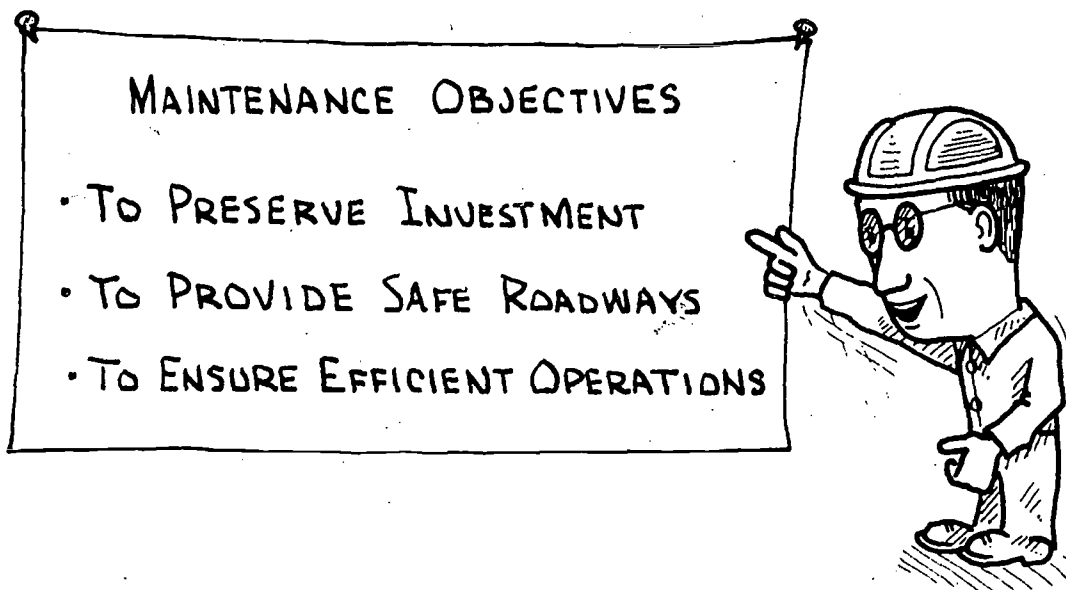
The diagram you prepared should look about like this:



Your diagram does not have to have the same wording, but the process should be in the same order and your wording should mean about the same as the one above. The Department is "in business" to maintain its facilities or to provide a service to the traveling public.

#### TRADITIONAL MAINTENANCE OBJECTIVES

Most maintenance departments set the same kinds of objectives.





The traditional objective of one department is "to maintain the roads and rights-of-way in originally constructed condition and to provide satisfactory, safe and aesthetically pleasing travelways."

Another department puts its objectives this way: "The highways will be maintained in such a manner that:

- "1. The investment in roads, bridges and rights-of-way is protected;
- "2. Comfort, convenience, economies and safety are afforded the traveling public; and
- "3. The expenditure of resources is accomplished with continuing emphasis on economical operations."

And the officials of still another department say that their objective -- or purpose -- is "to maintain the Department's road system in a way that ensures the safety of the motorist and preserves roadway facilities in an economical manner."

The wording of each objective is different, but they all mean about the same thing. And all of them are supposed to provide a basis for managing work. They are supposed to help engineers, supervisors and foremen do their jobs.

But how much help are these objectives -- on a day-to-day basis? Let's use these objectives in actual situations.

## CASE ONE

Stan Smith is a maintenance supervisor. He knows that one of his department's objectives is "to provide satisfactory, safe and aesthetically pleasing travelways." So, among other things, Stan starts mowing in the spring and does not shut down the mowers until late fall. His roadsides are aesthetically pleasing. As a matter of fact, the grass never gets more than seven inches high.

John Harris has the same objective, but unlike Stan, he lets the grass reach 12 to 14 inches before mowing. As far as John is concerned, his roadsides are aesthetically pleasing.



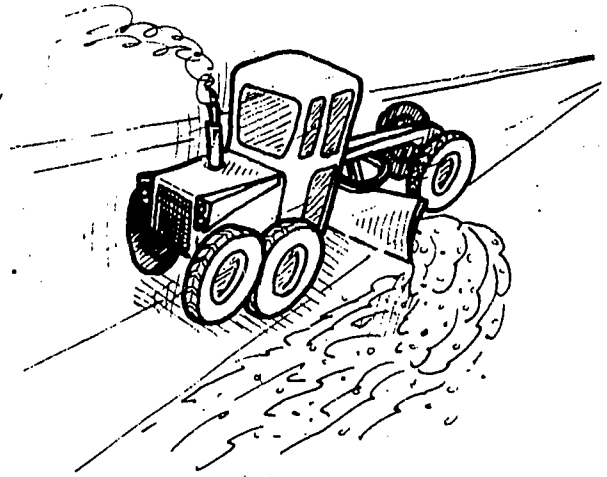
## CASE TWO

Bill Johnston is another supervisor. On his office bulletin board is posted the department's objectives. Part of the objectives state that "the expenditure of resources is to be accomplished with continuing emphasis on economical operations." Bill's boss says that this means that speed in getting work done is important. So Bill gets the word to his foremen: "The more work we can get done -- faster -- the better it will be." And Bill's crews do work fast -- so fast that frequently the work has to be redone. And the head office has been getting complaints about poor workmanship.



### CASE THREE

Don Dolan also is a maintenance supervisor. He has been told several times that his job is "to ensure the safety of the motorist and preserve roadway facilities in an economical manner." So Don blades his roadway shoulders at least four times a year -- to prevent shoulder rutting next to the pavement. But the shoulders are bladed so often that they no longer hold the fines. Additional materials are needed to replace the fines. And shoulder maintenance costs in his area are higher than in most areas.



### QUIZ

These three cases say something about maintenance objectives.

By placing check marks below, indicate which statements are true and which are false.

True

False

1. Traditional maintenance objectives usually mean about the same thing to most supervisors.

2. The supervisors in these cases have not been trained.

3. Traditional maintenance objectives are needed. But they are useful to supervisors only as general guidelines.

4. Traditional maintenance objectives must be translated into terms that are familiar to all supervisors.

Check your answers with those on the next page.

## ANSWERS

True

False

1. Traditional maintenance objectives usually mean about the same thing to most supervisors. **False!** Because traditional objectives are so general, they can be interpreted in many ways.

2. The supervisors in these cases have not been trained. This statement is false -- nothing has been said to indicate whether or not they have been trained.

3. Traditional maintenance objectives are needed. But they are useful to supervisors only as general guidelines. Yes, and we will talk about this in a minute.

4. Traditional maintenance objectives must be translated into terms that are familiar to all supervisors. Probably so.

If you missed any of these statements, go back and correct your answers.

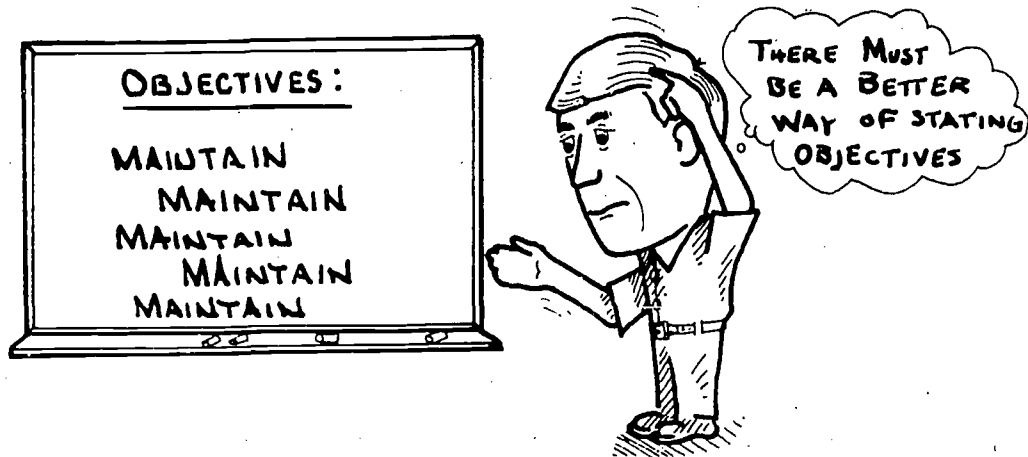
### USING TRADITIONAL MAINTENANCE OBJECTIVES

Traditional objectives are needed and they must be used. To reach the desired results, they provide guidance to all levels of management. But it's clear that the typical, traditional objectives as they stand are not too useful on a day-to-day basis.

- + Traditional maintenance objectives meant one thing to Stan Smith (keep the grass mowed to seven inches) and something else to John Harris (mow the grass when it reaches 12 to 14 inches.)

- + Bill Johnston sacrificed workmanship for speed -- not because he had not been trained, but because his boss did not understand the objectives either.
- + Training in work methods might have prevented Don's problem, but wouldn't it be easier to tell him how many times a year shoulders should be reshaped?

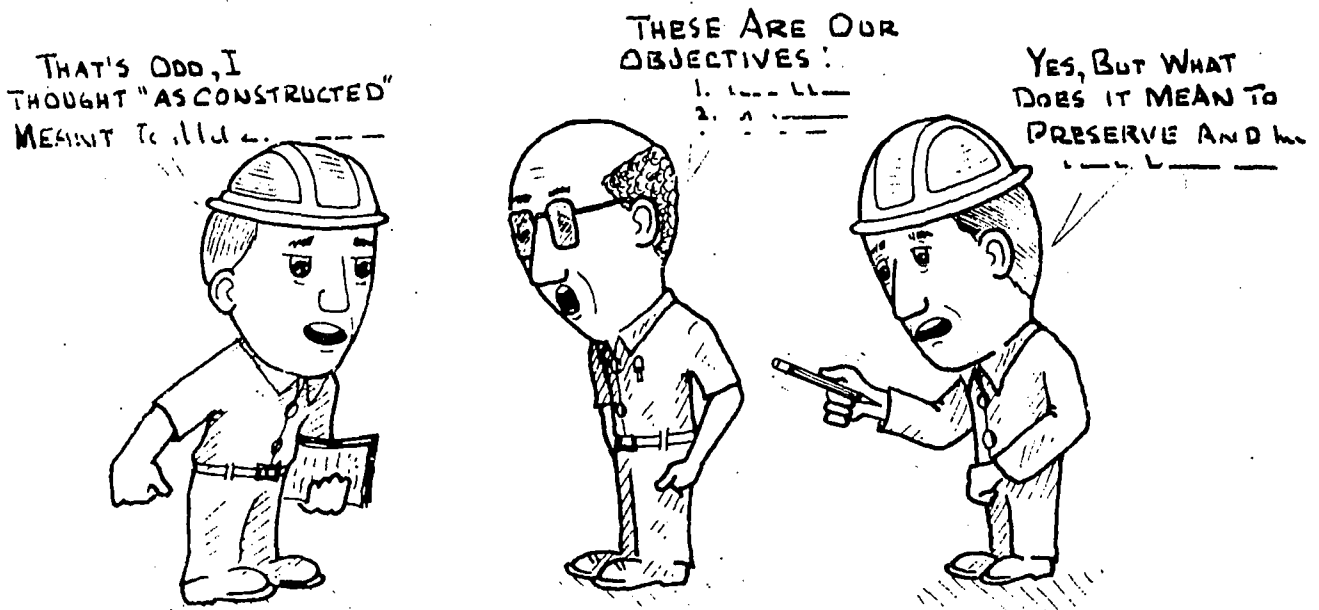
Unfortunately, these cases are not isolated examples. Nor are they exaggerated.



Suppose the Department's traditional maintenance objective were "to maintain the roads and rights-of-way as nearly as practical to an 'as constructed' condition, with due regard for the safety and comfort of the traveling public and with continuing concern for efficient and economical operations." Based on this traditional objective, how often would you perform the following activities?

<u>Activity</u>	<u>Times Per Year</u>
Mowing	_____
Reshaping shoulders	_____
Cleaning culverts	_____
Cleaning and reshaping ditches	_____

How many times per year should each of the activities be performed? Few people would agree on any number -- mainly because this objective can be interpreted in many ways. It's too general. What does it mean to maintain "as nearly as practical to an 'as constructed' condition"?



The typical, traditional objectives are needed -- but only to provide general guidelines for managing maintenance.

To be really useful, traditional maintenance objectives must be translated into terms that are specific and familiar. And none of the traditional objectives described so far meet this rule. It's no wonder that Stan, Bill and Don are having a problem.

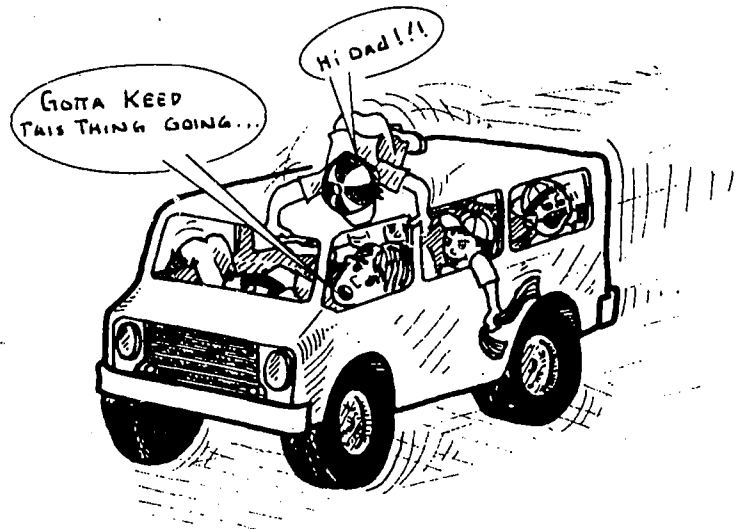
What would you do to solve their problem?

- 1. Do away with traditional objectives and use something else.
- 2. Break down traditional objectives into specifics that can be put to practical use.
- 3. Conduct a series of meetings to explain the traditional objectives.
- 4. Provide training in how to interpret traditional objectives.

If you checked the first, third or fourth choice, go back and change it. The second is the best.

Traditional objectives must be translated into more specific objectives -- ones that can be put to practical use.

## OBJECTIVE : *To MAINTAIN THE FAMILY CAR*



Suppose that you have just bought a new family car, and it has to last for at least four years. Your budget demands that the car is maintained so that it doesn't fall apart after two or three years. So you set the following general objective:

OBJECTIVE
To maintain the family car in such a way that it provides safe, economical transportation for a period of at least four years.

Notice that your main objective is to maintain the car. But this doesn't say much, does it? It gives no clues as to what should be done to reach your objective. It has to be translated into something more useful.

In the box below, rewrite your objective. State what you have to do to make sure the car lasts four years.

NEW OBJECTIVE: WHAT HAS TO BE DONE

Check your plans (new objectives) with the ones below.

---

Several things could be included. Here are a few of them:

- + Have 500 mile checkup performed.
- + Change oil and check grease fittings around 1,000 miles.
- + Rotate tires, change oil and lubricate at 5,000 miles.
- + Argue with car dealer about leaky windshield and faulty heater -- somewhere between 500 and 5,000 miles.
- + Have 10,000 mile checkup performed and change oil and lubricate.



The details of your plan are not important. And if you're lucky you may not have a leaky windshield or faulty heater. The important thing is that you have translated something that's general into something concrete. You have set specific objectives.

### QUIZ

True      False

1. The management by objectives concept can be applied to any kind of traditional objective.

2. When traditional objectives are translated, they are much easier to understand.

3. Traditional highway maintenance objectives probably can be translated in the same way as the "maintaining your car" objective.

Check your answers with those on the next page.

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## ANSWERS

True



False



1. The management by objectives concept can be applied to any kind of traditional objective.



2. When traditional objectives are translated, they are much easier to understand.



3. Traditional highway maintenance objectives probably can be translated in the same way as the "maintaining your car" objective.

It's probably clear. All of these statements are true. But how are highway maintenance objectives translated?

### TRANSLATING TRADITIONAL HIGHWAY MAINTENANCE OBJECTIVES

A typical traditional objective is "to maintain rights-of-way in a manner that is aesthetically pleasing." How can this be translated so that anyone can understand it?

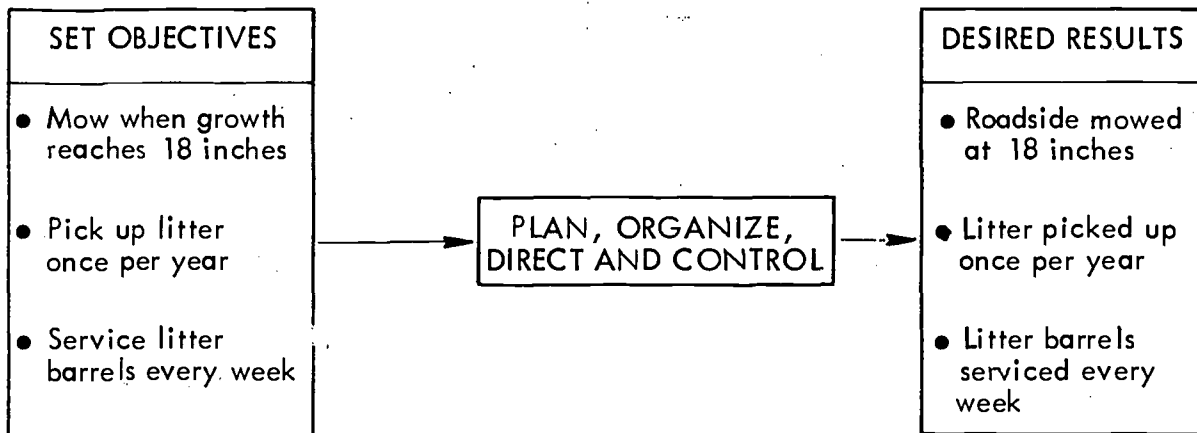
Here are a couple of possibilities:

- + Grass and weeds should be mowed when overall growth reaches 18 inches; or
- + Roadside mowing should be done four times per season on the Interstate System and three times per season on primary and secondary routes.

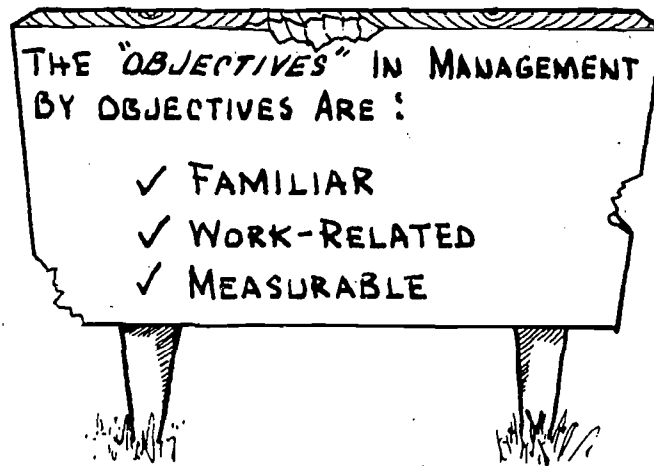
Obviously, both of these objectives are much more specific than "mowing to achieve aesthetically pleasing rights-of-way." Either one makes clear what the head office considers "aesthetically pleasing." In addition, the Department might specify that:

- + Litter should be picked up once per year, and as needed to prevent damage to mowers; and
- + Litter barrels should be serviced every week.

Notice how these translated objectives fit the management-by-objectives diagram:



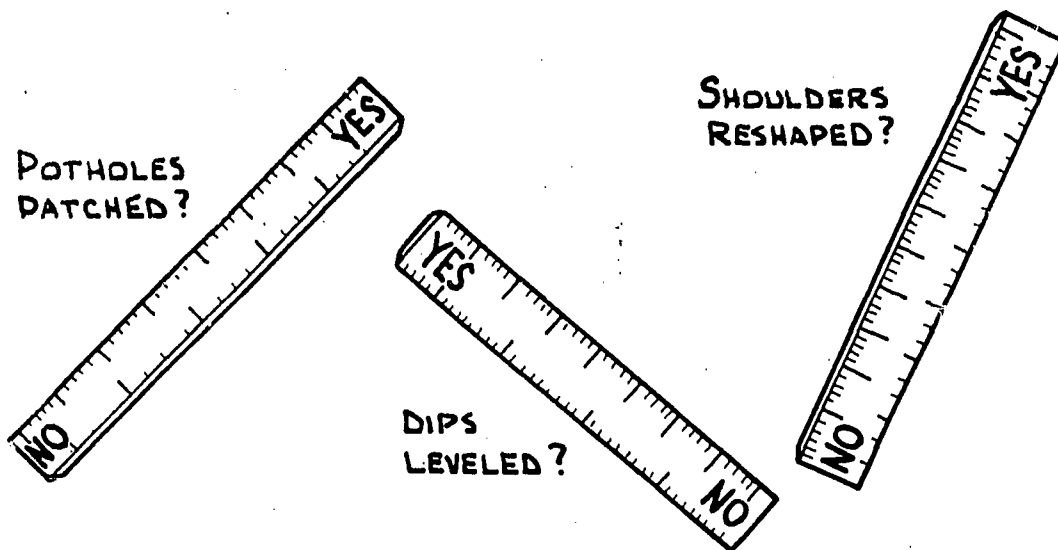
Also notice that the objectives are stated in familiar terms: mowing, picking up litter, and servicing litter barrels. These specific objectives also are measurable -- in terms of acres or swath miles mowed, and truck loads of litter picked up, or barrels serviced.



This last feature is important because it allows you to determine the extent to which the objectives have been accomplished. Suppose that in order to maintain roads in a manner which is "safe to the traveling public" the Department specifies that:

- + Potholes should be patched;
- + Surface dips should be leveled when they exceed one inch in ten feet (measured lengthwise); and
- + Shoulder ruts more than two inches deep should be filled.

These are specific objectives to work toward -- and they are the kinds of objectives which can be measured. Have the potholes been patched? Are dips leveled? And are shoulders patched or reshaped to correct ruts?



The yardsticks used to measure aesthetically pleasing roadways are different from those used to measure safety. But the basic idea is the same: useful objectives are those which are reasonably specific, easy to understand and measurable. And any supervisor can check his progress against measurable objectives.

### QUIZ

Now what can be said about the concept of management by objectives?

True

False



1. Management by objectives is a way of being specific about the kinds and amounts of work needed to meet traditional objectives.



2. Management by objectives encourages uniform levels of maintenance.



3. To manage by objectives, the objectives themselves must be work-related and measurable.



4. The traditional objectives can be translated into terms which are work-related and measurable.



5. Management by objectives sounds like it can be used by any manager.



6. Management by objectives makes sense.

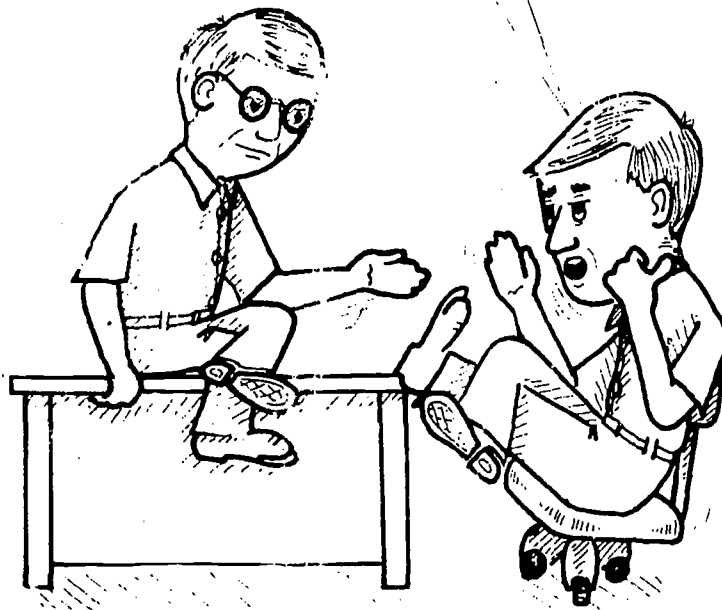
Once again, check your answers -- with those on the next page.

## ANSWERS

- | <u>True</u>                         | <u>False</u>             |  |
|-------------------------------------|--------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 1. Management by objectives is a way of being specific about the kinds and amounts of work needed to meet traditional objectives.                                  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 2. Management by objectives encourages uniform levels of maintenance. Yes. If the objectives are reached, every area will get about the same kinds of maintenance. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 3. To manage by objectives, the objectives themselves must be work-related and measurable.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 4. Objectives can be translated into terms which are work-related and measurable.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 5. Management by objectives can be used by any manager.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | 6. Management by objectives makes sense.   |

Once again, all of these statements are true -- especially the last two. Management by objectives can be used by any manager -- it's universal. And management by objectives makes sense -- mainly because it increases your chances of doing work as the head office wants done.

OK I AM CONVINCED..  
BUT HOW DOES MANAGEMENT  
BY OBJECTIVES AFFECT ME ???



## Section Two

### USING MANAGEMENT BY OBJECTIVES

"Management by objectives" sounds like a good idea -- and it is. Specific, work-related, measurable objectives are set, and every supervisor in the Department works towards those objectives. And "management by objectives" sounds like it should produce the desired results -- and it does. But how?

What steps have to be taken to use the concept? To some supervisors, the answers are obvious:

- + A plan -- or work program -- should be developed;
- + Resource requirements have to be calculated for the program;
- + Efforts should be made to level (or balance) the work load; and
- + A budget must be prepared to support the program.

All of these steps are part of any systematic approach to maintenance management -- and the concept of management by objectives. This Section summarizes the steps and shows how each step contributes to management by objectives.

## WORK PROGRAMS

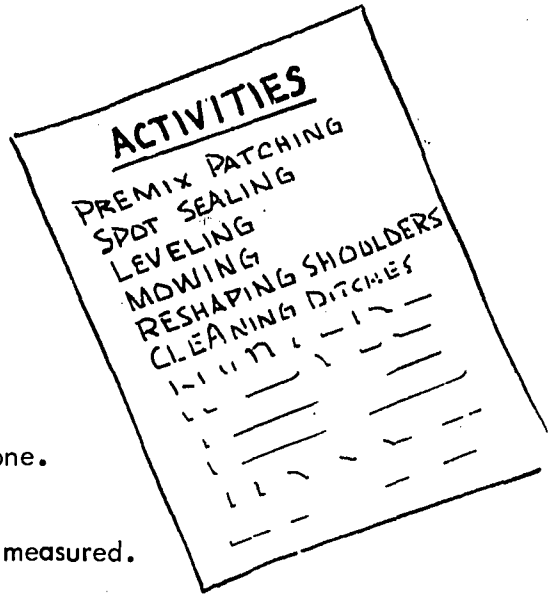
A work program is an estimate of the kinds and amounts of maintenance to be done. To develop a work program:

1. Work must be described and measured;
2. The road system has to be inventoried; and
3. Decisions have to be made about when an activity should or should not be done.



## MAINTENANCE ACTIVITIES

The mowing, litter pickup and patching described in Section One are examples of maintenance activities. They describe your work. An activity describes a specific combination of tasks done to repair, recondition or replace a roadway feature. The name of an activity and its description pretty well define what maintenance is being done. And a work unit, such as ton, cubic yard or acre, is a quantity that is used as a measurement of how much work is planned or actually done.



To develop a work program, work must be described and measured.

Here is an example of one activity:

Activity Name:	Premix Patching
Activity Description:	Hand-tool patching with premix material to correct potholes, edge failures and severe depressions in asphalt surfaces.
Work Unit:	Ton of premix.

## QUIZ

True

False

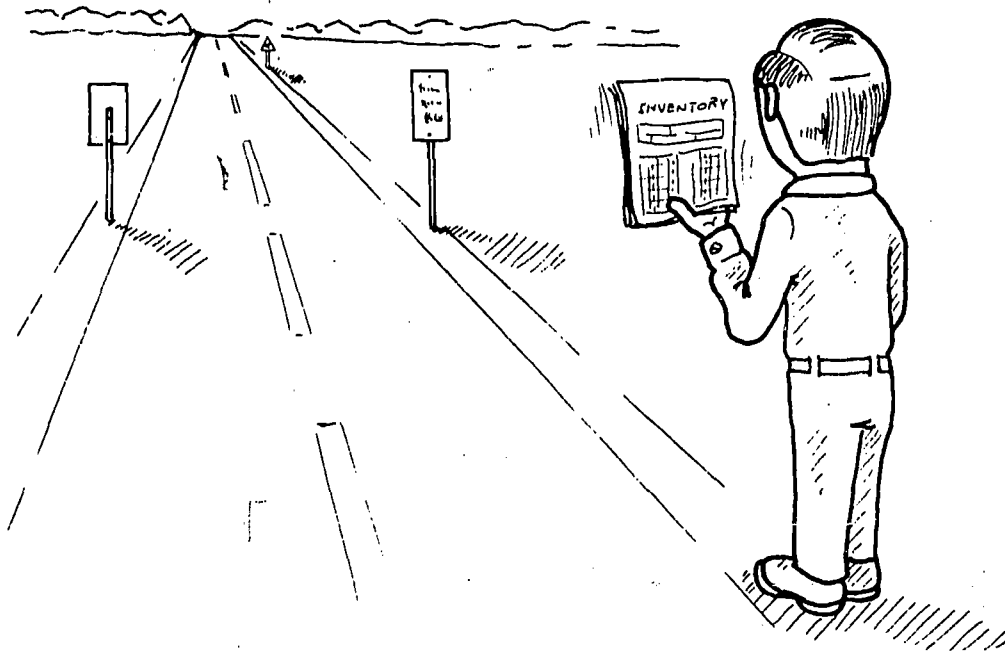
1. Like changing oil and lubricating a car, maintenance activities describe the work to be done.
2. Like changing oil and lubricating a car, the activities cannot be measured accurately.
3. Maintenance activities and work units make management by objectives complete.

## ANSWERS

Only the first statement is true. The second is false. Maintenance activities sometimes are more difficult to measure than quarts of oil or pounds of grease, but they can be measured accurately. The third statement is false because maintenance activities and work units don't make up the whole concept.

Maintenance activities only answer the question: What is being done?

Maintenance feature inventories and quality standards are combined to answer the question: How much of each activity should be done?



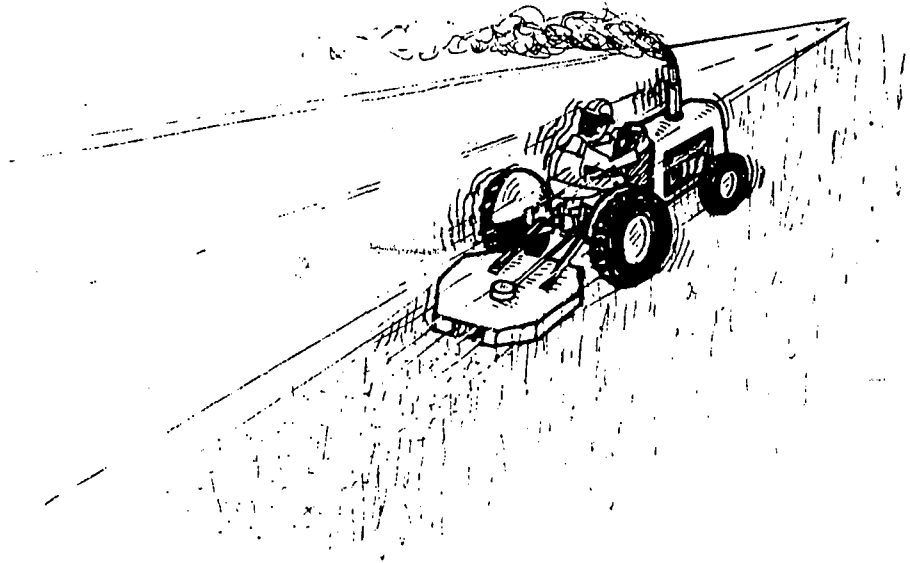
## MAINTENANCE FEATURE INVENTORIES

For most activities there is a physical feature on the road system which helps to determine the amount of maintenance required. For Premix Patching the feature might be "lane miles of asphalt surface." And for Machine Mowing the feature would be "mowable acres" or "mowable swath miles." These are the kinds of features which must be inventoried -- by counting signs, culverts and litter barrels, and measuring lane miles, mowable acres and miles of roadside ditch. The result of the counting and measuring is an up-to-date list -- an inventory -- of everything that needs to be maintained.

In a typical county, the inventory values for Premix Patching and Machine Mowing might be as follows:

<u>Road Class</u>	<u>Inventory Values</u>	
	<u>Lane Miles</u>	<u>Mowable Acres</u>
Interstate	60 (paved shoulders)	375
Primary	120	310
Secondary	200	230
Total	380	915

Similar values, of course, must be determined for every feature being maintained. And the values must be carefully defined. In this example, a lane mile is one mile of asphalt surface or shoulder, 12 feet in width. And the total mowable acres are the number of acres which the county wants to mow -- not necessarily the total right-of-way acreage.



### QUALITY STANDARDS

The mowable acreage in this example is one of many decisions the head office makes about how the road system should be maintained. And for our typical county, someone decided that part of the quality standard for mowing would be:

- + On Interstate roadways, the entire median will be mowed when less than 60 feet in width; and the roadside mowing will extend to the ditch flow line. Mowing on medians greater than 60 feet will extend to the ditch flow line;
- + On Primary roads, mowing will be done from the edge of the shoulder to not more than 20 feet; and
- + On Secondary roads, one 5-foot swath is all that is required to be mowed.

These details are not really important. The important point is that quality standards have been set for mowing. Another part of the same standard might specify that Interstate roadways should be mowed when general growth reaches 14 inches and Primary and Secondary routes will be mowed at 20 inches.

Decisions such as these should sound familiar. They are about the same kinds of decisions you made when you decided what work would be needed to make your car last four years.

### QUIZ

True      False

1. The decisions in the mowing example are the same as the kinds of decisions made to manage by objectives.

2. The decisions made to mow when general growth is 20 inches in height is a specific objective.

3. Quality standards for maintenance activities must be viewed as something to work toward.

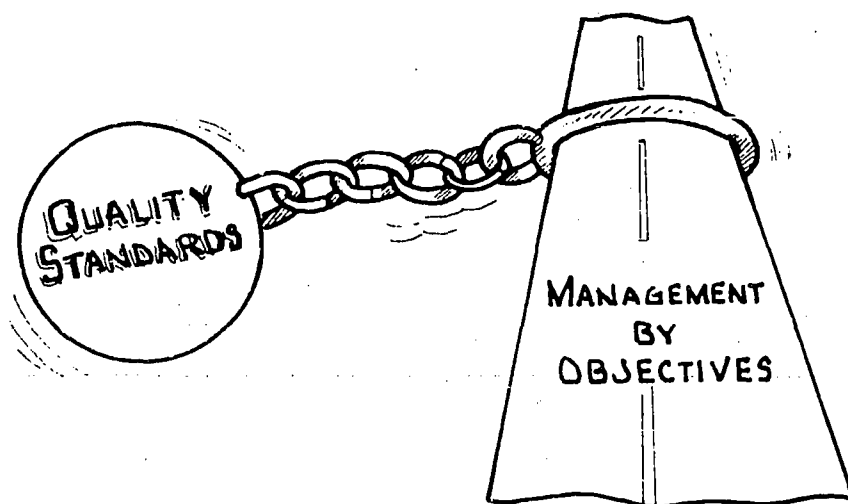
4. There is a definite relationship between quality standards and management by objectives, but to manage by objectives, it's not necessary to describe work and inventory the road system.

5. Technically, work programs are not part of the management-by-objectives concept.

## ANSWERS

The first three statements are true; statements four and five are false. Check your answers, and correct any errors.

The decisions made to set quality standards are identical to those made to manage by objectives. The decisions are related to specific, measurable activities. And to make these decisions, the work being done must be described and the road system must be inventoried.



A work program is the center of managing maintenance -- by objectives. And quality standards are needed to make a work program.

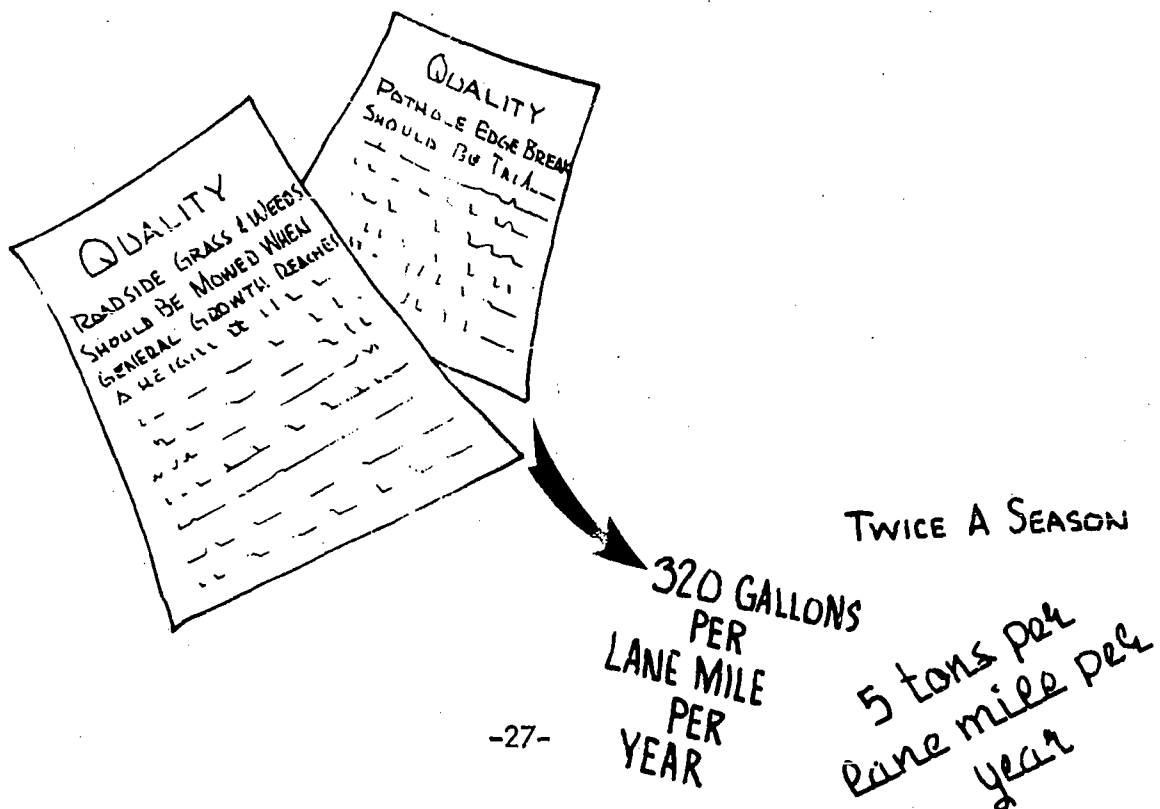
The quality standard for the mowing example has been set. And all supervisors using this standard know the conditions under which Machine Mowing should be performed. The same kind of standard must be set for Premix Patching.

The activity description for Premix Patching said that this work is done "to correct potholes, edge failures and severe depressions in asphalt surfaces." This, by itself, is a quality standard for Premix Patching -- because it describes the conditions under which the activity is needed. Most maintenance agencies will be more specific about the definition of a "severe depression," but for our purposes this description is good enough.

Quality standards for other activities might consist of the following:

Activity	Quality Standard
Joint and Crack Repair	If the crack is wider than $\frac{1}{4}$ inch when the air temperature is between 30° and 50°F, fill the crack. Otherwise, don't do anything.
Premix Leveling	If the pavement has moderate depressions (more than 1 inch in 10 feet), the area should be leveled.
Reshape Gravel Shoulders	If the edge of the pavement drops more than 2 inches to the shoulder, the shoulder should be reshaped.

About the same kinds of decisions have to be made about spot sealing, replacing concrete pavement, picking up litter, replacing signs, cleaning drainage structures and all of the other activities to be done. When taken together, these decisions are quality standards. They say what the head office wants done and what the Department can afford.



## QUANTITY STANDARDS

An important part of the management-by-objectives concept is a maintenance work program. And so far, we have described and measured activities, you have taken an inventory of the road system, and quality standards have been set. But no estimates have been made concerning the kinds and amounts of work needed to reach the quality standards -- or maintenance objectives. Without such estimates, there can be no work program -- and the estimates must specify kinds and amounts of work by maintenance activity.

There are several methods of estimating work quantities. For example, you could make a guess as to how much Premix Patching will be needed in your area for the coming year: 150 tons. Or, you might check purchase orders for the past two years and decide that 165 tons should be included in next year's work program. Both of these methods are estimates and both are okay if they are based on the quality standard for Premix Patching. But to make sure that quality standards are used and to provide a uniform level of maintenance, many departments use quantity standards -- and for some activities, standard frequencies.

Quantity standards are "educated" estimates of the work needed to achieve quality standards. Here is what is meant by "educated" estimates:

### Quantity Standard for Machine Mowing

The quality standard for Machine Mowing on Interstate roadways was set at 14 inches (page 25).

By measuring how fast grass and weeds grow to a height of 14 inches, estimates can be made about the number of times the roadside will have to be mowed during a normal season. If the rate of growth is about an inch per week and if mowing

is done to within 6 inches of the ground, then the growth (8 inches) will have to be cut about once every 8 weeks -- or three times in a six-month growing season. So the standard frequency for Machine Mowing on Interstate roadways is set at "three times per year" or a quantity standard of "three acres per mowable acre."





The quality standard for Machine Mowing of Primary and Secondary routes is 20 inches. Using this standard, a six month season, a growth rate of one inch per week and a cut to six inches:

What is the standard frequency?  
(How many times per year should the grass be mowed?)

\_\_\_\_\_

What is the quantity standard?

\_\_\_\_\_

-----

Standard frequency:

two times per year

Quantity standard:

two acres per mowable acre

Twenty inches cut to six inches is 14 inches. So one cut should be made every 14 weeks ( $3\frac{1}{2}$  months), and the standard would indicate that during the six-month season, the grass should be mowed twice -- or 2 acres per mowable acre.

#### Quantity Standard for Premix Patching

The quantity standard for Machine Mowing is fairly simple to set. And standards for several activities can be set in about the same manner. But Premix Patching is different. It's not usually performed on a frequency basis. So for this work, an "educated guess" is used. But the guess is based on as much evidence as possible. Purchase orders, existing roadway conditions, average quantities of materials used in past years and test (or control section) data qualify as evidence.

PREMIX PATCHING, THIS WILL HAVE TO BE AN EDUCATED GUESS....



For the purpose of our example, the evidence might show that the following quantity standards are okay:

Interstate:	0.1 tons per lane mile per year
Primary:	0.2 tons per lane mile per year
Secondary:	0.3 tons per lane mile per year

These are average values. They do not represent the amount of work required on a particular road in your area -- they apply to all roads in general. And the values are based on as much data as can be gathered -- with a reasonable amount of effort.

#### Quantity Standards for Other Activities

The head office has to go through the process to develop quantity standards for such activities as crack repair, surface replacement and culvert repairs.

For some activities, the quantity standard is set in an arbitrary manner. For example, if the Department feels that to reach the quality standard for cleaning culverts, each culvert should be cleaned once every other year, the quantity standard would be "0.5 culverts per culvert per year." And it's an arbitrary standard because no data are available to indicate that the standard should be different.

For miscellaneous and administrative activities, time sheets and other records can be used to estimate the total number of man-hours to be included in the work program for activities such as annual leave, equipment repairs and materials stockpiling. But these values (such as 1,500 man-hours for annual leave) are not really quantity standards. They are estimates of the total manpower requirements for a given activity.

## QUIZ

This is a good place to review what you know about quality and quantity standards. As usual, check which statements are true and which are false.

True

False

1. Quality standards can be set for some maintenance activities.

2. Quality and quantity standards must be determined before work programs can be developed.

3. Quality and quantity standards make up the ways the head office has translated the Department's traditional objectives.

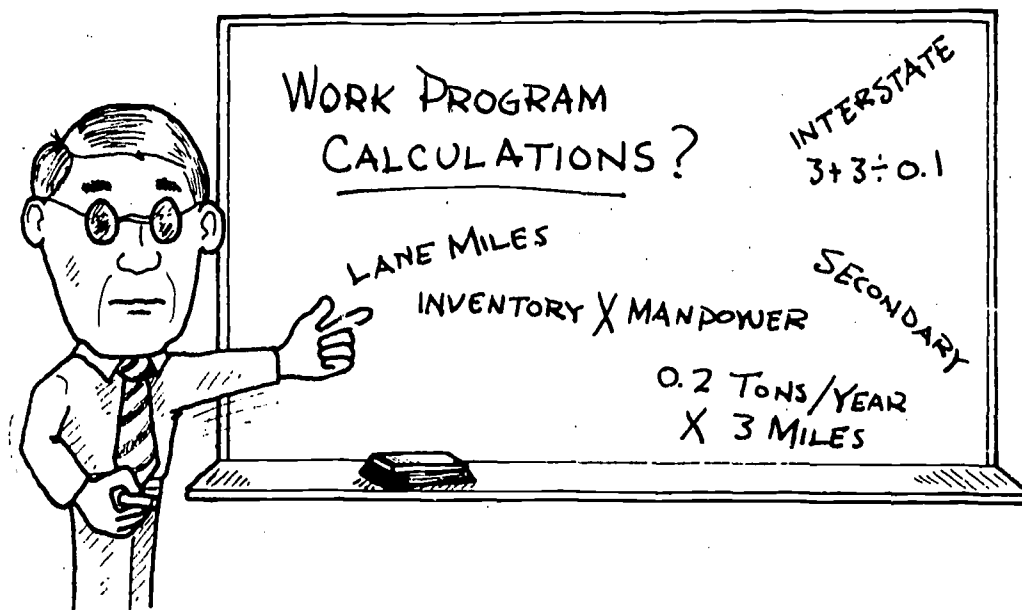
4. The two things that are needed to make up maintenance work programs are roadway feature inventories and quantity standards.

5. It doesn't make much sense to try to manage by objectives without work programs.

## ANSWERS

The first statement is false -- because quality standards must be set for nearly all activities. All of the other statements are true:

- + Quality and quantity standards must be determined before work programs can be developed;
- + Traditional objectives are translated into quality and quantity standards (or standard frequencies);
- + Roadway feature inventories and quantity standards are used to make up work programs; and
- + It sure doesn't make much sense to try to manage by objectives without work programs.



## WORK PROGRAM CALCULATIONS

The really difficult part of developing a work program has been completed:

- + Activities have been described and measured;
- + An inventory has been taken of all of the features you maintain;
- + Decisions have been made about how well the road system should be maintained -- quality standards have been set; and
- + More decisions have been made about the quantities of work needed to reach quality standards.

From here on, the process is simple. The inventory amount times the quantity standard (or standard frequency) equals the amount of work to be included in the program.

For Premix Patching the calculations are:

<u>Road Class</u>	<u>Inventory<sup>1</sup> Amount</u>		<u>Quantity Standard<sup>2</sup></u>	=	<u>Work Program Quantity</u>	
Interstate	60 lane miles	X	0.1 tons/lane mile	=	6 tons	
Primary	120 lane miles	X	0.2 tons/lane mile	=	24 tons	
Secondary	200 lane miles	X	0.3 tons/lane mile	=	<u>60 tons</u>	
Total Work Program Quantity for Premix Patching					=	90 tons

<sup>1</sup> From page 23.

<sup>2</sup> From page 30.

PROBLEM

Use the inventory values for mowable acres -- and the quantity standards on pages 23, 28 and 29 to determine the work program quantity for Machine Mowing.

<u>Road Class</u>	<u>Inventory Amount</u>		<u>Quantity Standard</u>	=	<u>Work Program Quantity</u>	
Interstate	_____		_____		_____	
Primary	_____		_____		_____	
Secondary	_____		_____		_____	
Total Work Program Quantity for Machine Mowing						_____

ANSWER

Here are the correct quantities:

Interstate	1,125 acres
Primary	620 acres
Secondary	<u>460 acres</u>
Total	2,205 acres

They were calculated on the basis of 915 mowable acres and a quantity standard of three times per year (or three acres per mowable acre) for the Interstate System, and two times per year (or two acres per mowable acre) on Primary and Secondary routes.

## A SAMPLE WORK PROGRAM

The 90 tons of Premix Patching and the 2,205 acres of Machine Mowing represent part of a work program -- a part we have been using as an example. A sample work program for the county is shown on the next page. Carefully review this program. Then take the Quiz below.

### QUIZ

True

False

1. The Ryan County Work Program is a complete program. It shows the kinds and amounts of work needed to reach quality standards.
  2. The Ryan County Work Program could be used for other counties (or areas).
  3. The activities listed on the Program could be useful in other maintenance agencies.
  4. The planned quantities on the Program are specific, measurable objectives.
  5. The Program follows the concept of management by objectives.
-



MAINTENANCE WORK PROGRAM  
FOR RYAN COUNTY - 1973

<u>ACTIVITY NUMBER AND NAME</u>	<u>WORK UNIT</u>	<u>PLANNED QUANTITY</u>
<u>Surface and Shoulder</u>		
101	Joint and Crack Filling	Gallon of Sealant 775
102	Remove/Replace Concrete Pavement	Lane Foot 250
103	Premix Patching	Ton of Premix 90
104	Spot Sealing	Lane Mile 45
105	Bituminous Surface Replacement	Ton of Premix 810
111	Patching Base	Cubic Yard of Material 300
112	Spot Patching Shoulders	Cubic Yard of Material 80
113	Reshaping Shoulders	Pass Mile 1,720
119	Other Surface and Shoulder Maintenance	Man-Hour 1,900
<u>Roadside and Drainage</u>		
120	Tree Removal (Burning)	Inch (Diameter) of Tree 1,895
120	Tree Removal (Hauling)	Inch (Diameter) of Tree 950
121	Stump Removal	Each Stump 160
122	Clean Drainage Structures	Each Structure 580
123	Full-Width Litter Pickup	Pass Mile 320
124	Clean and Reshape Ditches	Ditch Mile 14
126	Machine Mowing	Acre 2,205
<u>Traffic Services</u>		
130	Replace Steel Beam Guardrail	Lineal Foot of Guardrail 85
131	Sweeping and Flushing	Mile 125
133	Sign Maintenance <sup>1</sup>	Man-Hour 3,280
134	Signal Maintenance	Man-Hour 810
<u>Maintenance Improvement</u>		
150	General Bridge Maintenance	Man-Hour 605
159	Other General Maintenance <sup>2</sup>	Man-Hour 2,200
<u>Snow and Ice Control</u>		
160	Spreading Salt	Pass Mile 4,010
161	Plowing Snow	Pass Mile 3,250
<u>Administrative and Overhead</u>		
170	Building Maintenance	Man-Hour 420
171	Grounds Maintenance	Man-Hour 800
180	Administrative Overhead	Man-Hour 6,650

<sup>1</sup> Includes 1,050 man-hours required to replace all directional signs.

<sup>2</sup> Includes 900 man-hours estimated to do special shoulder project.

## ANSWERS

Statements one, four and five are true; statements two and three are false. Here is an explanation of each statement:

1. True. The Work Program for Ryan County is complete. It shows all of the activities which have been described and measured. And the quantities are estimates of the kinds and amounts of work needed to reach the quality standard for most activities.
2. False. The Ryan County Work Program is for Ryan County. Because it is geared toward road system features unique to that county, no other county or area can use its planned quantities.
3. Maybe. It depends on what you mean by "useful." Some agencies may want or need to describe and measure work in other ways. For example, the Work Program lists no specific quantities for premix leveling or centerline painting operations. Ryan County managers consider both as miscellaneous or not too important -- and they are included in "Other Surface and Shoulder Maintenance." Some activities and work units probably are useful, but a direct "lift" from Ryan County to another agency wouldn't work.
4. True. These are the same kinds of objectives described in Section One -- they are specific and measurable.
5. True. This is what management by objectives is all about.



## CALCULATING RESOURCE REQUIREMENTS

The first step in using management by objectives is complete. A work program has been developed. The second step is to calculate resource requirements.

Resource requirements consist of the number of man-hours, equipment hours, and the amount of materials needed to accomplish the planned quantity of work for each activity. And to calculate the needed resources, several questions must be answered:

- + How many man-hours or crew days do you need for Premix Patching, Machine Mowing and all of the other activities?
- + What is the best crew size for each activity, and how much equipment is needed for each?
- + What results can you expect in terms of average production and productivity?

Performance standards answer these questions.

## PERFORMANCE STANDARDS

Performance standards describe the best way to do a job. A performance standard lists the crew size, equipment and materials to be used. It also includes an estimate of what can be accomplished when the standard is followed. Here is a typical standard:

### PERFORMANCE STANDARD FOR SPOT SEALING

CREW SIZE: 8

(Add flagman as needed.)

EQUIPMENT:

3 dump trucks  
1 asphalt distributor  
1 roller  
1 chip spreader  
1 power broom

MATERIALS:

Liquid asphalt  
Gravel (31-C)

ACCOMPLISHMENT:

UNIT: Lane mile

DAILY PRODUCTION:

2-3 lane miles

AVERAGE PRODUCTIVITY:

25 man-hours/lane mile

If the Ryan County Work Program calls for 45 lane miles to be sealed, the resource needs for this activity can be calculated in the following manner:

<u>WORK PROGRAM QUANTITY</u>		<u>AVERAGE PRODUCTIVITY</u>	=	<u>TOTAL MAN-HOURS REQUIRED</u>
45 lane miles	X	25 man-hours/lane mile	=	1,125

Equipment needs for this activity would amount to 3,375 hours for 3 dump trucks and 1,125 hours for an asphalt distributor, roller, chip spreader and power broom.

Materials requirements might be 1,500 cubic yards of gravel and 70,000 gallons of asphalt.

When using this method, expected crew performance -- productivity -- is the key to calculating resource requirements. And for any "standardized" activity, the calculations are simple:

<u>ACTIVITY</u>	<u>CREW SIZE</u>	<u>WORK PROGRAM QUANTITY</u>	X	<u>AVERAGE PRODUCTIVITY</u>	=	<u>TOTAL MAN-HOURS REQUIRED</u>
Premix Patching	2	90 tons		5 man-hours/ton		450
Machine Mowing	1	2,205 acres		1 man-hour/acre		2,205

With these data, equipment needs and most materials requirements can be calculated.

A SAMPLE PROGRAM  
WITH MANPOWER REQUIREMENTS

The manpower requirements for Ryan County are shown on the following page. Study this table, then take the quiz below.

QUIZ

- | <u>True</u>              | <u>False</u>             |  |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. The "Total Planned Man-Hours" at the bottom of the table is the total amount of labor required in Ryan County -- for a one-year period.                             |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. So far as "management by objectives" is concerned, it might not be necessary to calculate resource requirements because the planned quantities are objectives.      |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. The expected performance used to calculate resource requirements is, by itself, a specific measurable objective -- a goal to work toward.                           |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. There must be an easier way to manage by objectives. There has to be some way to get around work programs, resource requirements calculations, and everything else. |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. The information needed to calculate resource requirements is found on performance standards.  |
-

MAINTENANCE WORK PROGRAM  
AND MAN-HOUR REQUIREMENTS  
FOR RYAN COUNTY - 1973

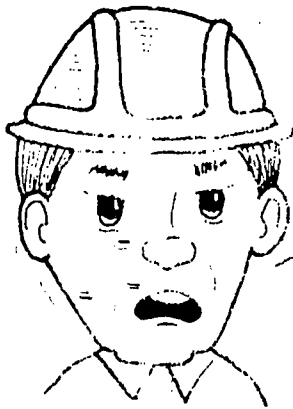
<u>ACTIVITY NUMBER AND NAME</u>	<u>WORK UNIT</u>	<u>PLANNED QUANTITY</u>	<u>MAN-HOUR REQUIREMENTS</u>	
<u>Surface and Shoulder</u>				
101	Joint and Crack Filling	Gallon of Sealont	775	310
102	Remove/Replace Concrete Pavement	Lane Foot	250	750
103	Premix Patching	Ton of Premix	90	450
104	Spot Sealing	Lone Mile	45	1,125
105	Bituminous Surface Replacement	Ton of Premix	810	730
111	Patching Base	Cubic Yard of Material	300	360
112	Spot Patching Shoulders	Cubic Yard of Material	80	360
113	Reshaping Shoulders	Pass Mile	1,720	1,720
119	Other Surface and Shoulder Maintenance	Man-Hour	1,900	1,900
<u>Roadside and Drainage</u>				
120	Tree Removal (Burning)	Inch (Diameter) of Tree	1,895	640
120	Tree Removal (Hauling)	Inch (Diameter) of Tree	950	325
121	Stump Removal	Each Stump	160	480
122	Clean Drainage Structures	Each Structure	580	520
123	Full-Width Litter Pickup	Pass Mile	320	1,280
124	Clean and Reshape Ditches	Ditch Mile	14	2,240
126	Machine Mowing	Acre	2,205	2,205
<u>Traffic Services</u>				
130	Replace Steel Beam Guardrail	Lineal Foot of Guardrail	85	55
131	Sweeping and Flushing	Mile	125	200
133	Sign Maintenance <sup>1</sup>	Mon-Hour	3,280	3,280
134	Signal Maintenance	Man-Hour	810	810
<u>Maintenance Improvement</u>				
150	General Bridge Maintenance	Man-Hour	605	605
159	Other General Maintenance <sup>2</sup>	Mon-Hour	2,200	2,200
<u>Snow and Ice Control</u>				
160	Spreading Salt	Pass Mile	4,010	400
161	Plowing Snow	Pass Mile	3,250	195
<u>Administrative and Overhead</u>				
170	Building Maintenance	Mon-Hour	420	420
171	Ground Maintenance	Mon-Hour	800	800
180	Administrative Overhead	Man-Hour	6,650	6,650
Total Planned Man-Hours				31,010

<sup>1</sup> Includes 1,050 man-hours required to replace all directional signs.

<sup>2</sup> Includes 900 man-hours estimated to do special shoulder project.

## ANSWERS

Statements one and three are true; two and four are false. The second and fourth statements should be explained. If there is an easier way to manage by objectives, we don't know about it. Objectives must be specific, measurable goals. And work quantities, average expected production and productivity are specific and measurable. This is why statement four is false.



I'VE GOT SPECIFIC  
OBJECTIVES BUT NOT  
ENOUGH RESOURCES. . . .  
SOMETHING HAS TO GIVE !!

Statement two is false because it doesn't make much sense to prepare a work program -- and hope that you have the resources to get the job done. Planned quantities are objectives, but something must be done to make sure that you have all of the resources you need to reach those objectives.

It should be obvious that statement five is true. If you missed statement five, go back to page 39 and read "Calculating Resource Requirements" again. If you understand how performance standards help to calculate resource requirements, continue reading.

To complete the Ryan County Work Program, 31,010 man-hours are required. Is there enough manpower to complete its Program? How many men are needed? One man on the payroll accounts for about 2,080 man-hours per year (40 hours per week X 52 weeks). And 31,010 divided by 2,080 is about 14.9. The planned work, done according to performance standards, requires at least 15 men.



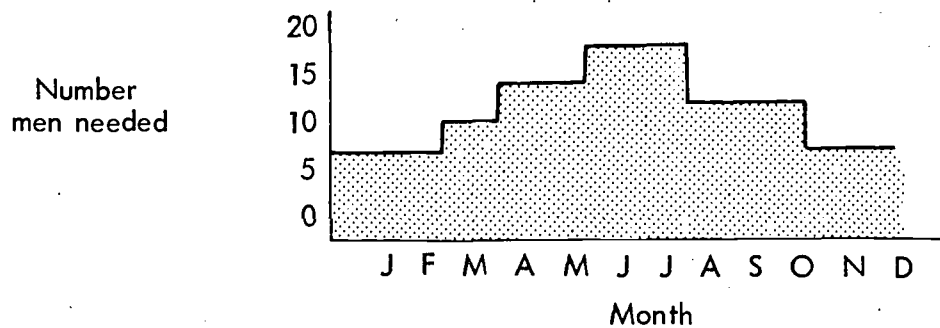


Can the planned work be done by 15 men? Probably not. The work program has built-in provisions for administrative work, sick leave and so on, but no provisions have been made for the seasonal nature of maintenance work. Fifteen men would be enough only if the work load were the same from one month to the next. But it's not! So the next step is to try to level the work load.

LEVELING THE WORK LOAD

If no effort is made to level the work load, the manpower needs in Ryan County will vary from one month to the next:

RYAN COUNTY WORK LOAD  
-- NOT BALANCED --



During the peak season, as many as 20 men may be needed. During the slack months, maybe only nine men are required. But what do you do when 15 men are available and only nine are needed?

### QUESTION

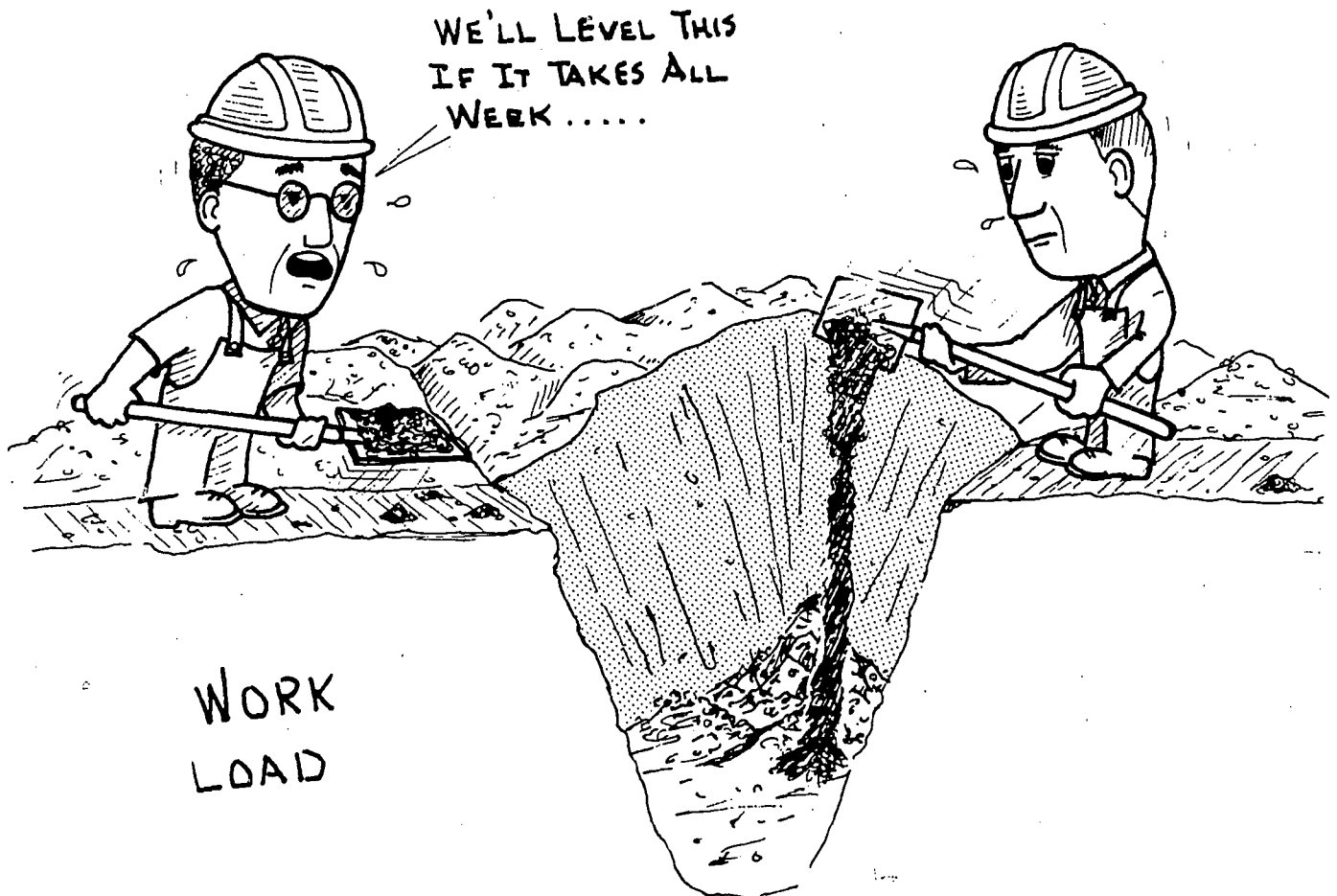
Which of the following methods should the head office use to try to level the work load?

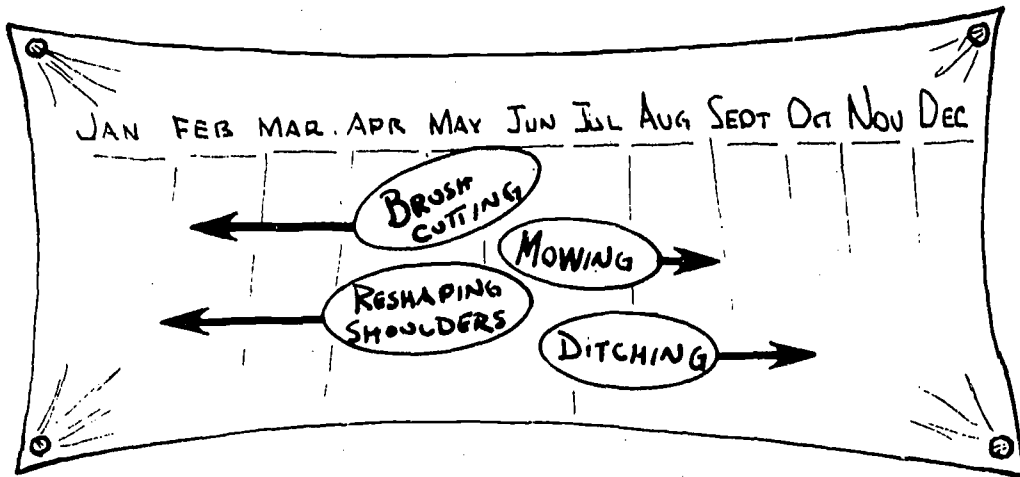
1. Hire temporary employees during the peak months.
  2. Let a contract on some activities.
  3. Neither method (1 or 2) will level the work load.
-

## ANSWER

Number three is correct. Hiring temporary employees or letting contracts will ease the pressure, but it will not actually level the work load.

For most maintenance agencies, it's impossible to level the work completely. But a lot can be done to decrease peak pressures and increase manpower needs during the slack months. Some activities, such as spot sealing and mowing, can be done only during certain months of the year. Other kinds of work can be shifted from one month to the next. Reshaping shoulders and surface replacement are examples. Still other activities can be scheduled at any time of the year -- such as tree removal, brush cutting and employee vacations.



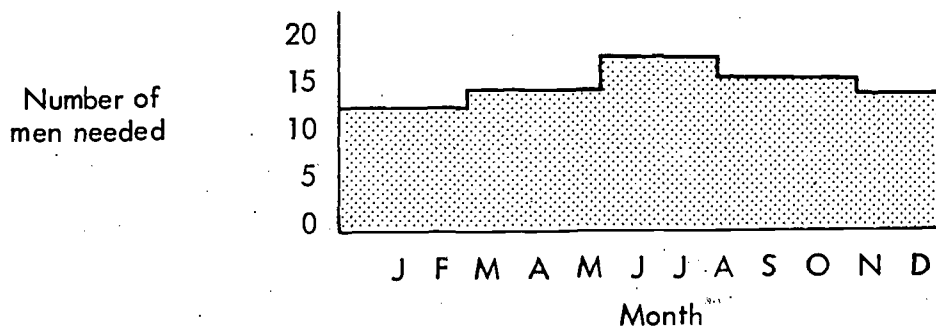


To level the work load, activities which can be "moved" a month or so should be moved. Activities which can be scheduled any time, must be shifted from one season to the next. To level the work load, the head office should specify the months of the year when certain activities should be done. And if you know about some of the basics of balancing work loads, you probably will recognize a scheduling calendar such as the one on the next page.

Scheduling calendars show the months of the year during which work should or should not be done. They take into consideration the need to do work at certain times -- and they balance this requirement with the need to complete the work program with the resources available, including temporary labor and contract work.

The net effect of using a scheduling calendar might look like this:

RYAN COUNTY WORK LOAD  
-- BALANCED --



WORK SCHEDULING CALENDAR

ACTIVITY NUMBER AND NAME      JAN      FEB      MAR      APR      MAY      JUNE      JULY      AUG      SEPT      OCT      NOV      DEC

Surface and Shoulder

101 Joint and Crack Filling	██████████											
102 Remove/Replace Concrete Pavem.												
103 Premix Patching												
104 Spot Sealing												
105 Bituminous Surface Replacement	██████████											
111 Patching Base	██████████											
112 Spot Patching Shoulders	██████████											
113 Reshaping Shoulders	██████████											
119 Other Surface/Shoulder Maintn.												

Roadside and Drainage

120 Tree Removal (Burning)	██████████											
120 Tree Removal (Hauling)	██████████											
121 Stump Removal	██████████											
122 Clean Drainage Structures	██████████											
123 Full-Width Litter Pickup	██████████											
124 Clean and Reshape Ditches	██████████											
126 Machine Mowing												

Traffic Services

130 Replace Steel Beam Guardrail												
131 Sweeping and Flushing												
133 Sign Maintenance	██████████											
134 Signal Maintenance	██████████											

Maintenance Improvement

150 General Bridge Maintenance												
159 Other General Maintenance												

Snow and Ice Control

160 Spreading Salt	██████████											
161 Plowing Snow	██████████											

Administrative and Overhead

170 Building Maintenance	██████████											
171 Grounds Maintenance	██████████											
189 Administrative Overhead												

LEGEND: ██████████ Periods of expected performance.      ||||| Periods of possible performance.      ||||| Periods when the activity usually should not be scheduled.



## QUIZ

True

False

1. A scheduling calendar wouldn't be needed if the work load were not seasonal in the first place.

2. According to the balanced work load diagrammed on page 48, Ryan County probably should be staffed with 15 or 16 full-time employees.

3. Leveling the work load is one way to help make sure you have enough resources.

4. Leveling the work load is one way to help make sure that management by objectives is used.

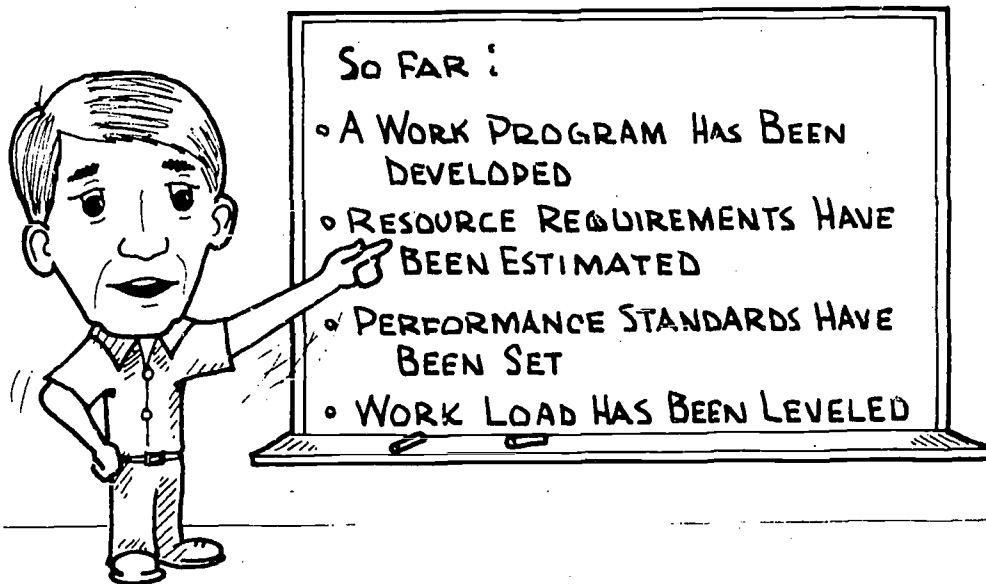
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## ANSWERS

All of these statements are true. The benefits of a scheduling calendar are obvious.

## MANAGEMENT BY OBJECTIVES -- SO FAR

So far, management by objectives means that a work program is developed to make specific and measurable what the Department wants done. Quality standards have been translated into work quantities, and performance standards have been set for most activities. And to make sure you have the manpower, equipment and materials needed, resource requirements have been calculated and the head office has tried to level your work load. But is enough money available?



## BUDGETS

How much money do you need to do the planned work? A budget -- one based on expected performance -- can be developed to answer this question. In effect, a price tag can be put on the resources required to complete the work program. And the prices (or costs) of each resource are tied to expected performance, as shown by performance standards.

The performance standard data for Premix Patching and the planned quantity (90 tons) in Ryan County can be used as an example:

CREW SIZE: 2

EQUIPMENT: 1 dump truck (plus small tools)

MATERIALS: premix

AVERAGE DAILY PRODUCTION: 3 tons

AVERAGE PRODUCTIVITY: 5 man-hours/ton

From this information, the following data can be calculated:

Manpower Requirements:	90 tons	X	5 man-hours/ton	=	450 man-hours
Daily Labor:	2 men	X	8 hours	=	16 man-hours
Crew Days:	90 tons	÷	3 tons/day	=	30 crew days
Equipment Days:	1 truck	X	30 days	=	30 truck days

And cost records in Ryan County show that the following rates apply:

Labor:	\$3.20/man-hour (an average)
Dump Truck:	5.07/truck day (a rental rate)
Small Tools:	0.50/crew day (a rough estimate)
Premix:	9.00/ton (purchased from the plant)

So the amount of money needed to do the planned amount of work is:

Labor:	\$3.20/man-hour	X	450 man-hours	=	\$1,440.00
Equipment:	(\$5.07 + 0.50)/day	X	30 days	=	167.10
Materials:	\$9.00	X	90 tons	=	<u>810.00</u>
Total Premix Patching Cost					\$2,417.10

To accomplish the planned amount of Premix Patching about \$2,400 will be needed.



Several points should be made about this method of developing a "performance" budget:

- + The same kinds of calculations can be made for most activities. Other methods would ordinarily be used for non-standardized activities, special work, and snow and ice control.
  
- + The cost figures have been simplified for this example. Average rates have been used. For many activities, the head office is more precise.
  
- + The amount of money to be budgeted for this activity is based on a planned work load and an expected level of performance. If either factor changes, it will be necessary to make adjustments in the amount of funds allocated to this work and other activities.

A summary of the completed budget for Ryan County is shown on the next page.

HIGHWAY MAINTENANCE BUDGET  
FOR RYAN COUNTY - 1973

ACTIVITY NUMBER AND NAME	WORK PROGRAM	WORK UNIT	QUANTITY	MAN-HOURS REQUIRED	SUBJECT OF EXPENDITURE				TOTAL BUDGET
					LABOR	EQUIPMENT	MATERIALS	CONTRACTUAL SERVICES	
					\$	\$	\$	\$	\$
<u>Surface and Shoulder</u>									
101	Joint and Crack Filling	Gallon	775	310	993	361	451		1,805
102	Remove/Replace Concrete Pavement	Lone foot	250	750	2,400	1,200	400		4,000
103	Premix Patching	Ton	90	450	1,440	167	810		2,417
104	Spot Sealing	Lane mile	45	1,125	3,600	1,309	1,636		6,545
105	Bituminous Surface Replacement	Ton	810	730	2,336	685	3,620		6,641
111	Patching Base	Cubic yard	300	360	1,152	442	177		1,772
112	Spot Patching Shoulders	Cubic yard	80	360	1,152	329	165		1,646
113	Reshaping Shoulders	Pass mile	1,720	1,720	6,708	5,522	-		12,230
119	Other Surface and Shoulder Maintenance	Man-hour	1,900	1,900	6,085	1,623	406		8,114
	Sub-Total Surface and Shoulder			7,705	25,866	11,639	7,665		45,170
<u>Roadside and Drainage</u>									
120	Tree Removal (Burning)	Inch	1,895	640	2,069	887	-		2,956
120	Tree Removal (Houling)	Inch	950	325	1,037	559	-		1,596
121	Stump Removal	Each stump	160	480	1,536	228	96		1,920
122	Clean Drainage Structures	Each structure	580	520	1,670	557	-		2,227
123	Full-Width Litter Pickup	Pass mile	320	1,280	4,097	1,366	-		5,463
124	Clean and Reshape Ditches	Ditch mile	14	2,240	7,168	7,168	-		14,336
126	Machine Mowing	Acres	2,205	2,205	7,058	5,775	-		12,833
	Sub-Total Roadside and Drainage			7,690	24,635	16,600	96		41,331
<u>Traffic Services</u>									
130	Replace Steel Beam Guardrail	Lineal foot	85	55	177	39	177		393
131	Sweeping and Flushing	Mile	125	200	640	524	-		1,164
133	Sign Maintenance	Man-hour	3,280	3,280	10,489	4,034	1,614		16,137
134	Signal Maintenance	Man-hour	810	810	2,591	740	370		3,701
	Sub-Total Traffic Services			4,345	13,897	5,337	2,161		21,395
<u>Maintenance Improvement</u>									
150	General Bridge Maintenance	Man-hour	605	605	3,534	1,087	815		5,436
159	Other General Maintenance	Man-hour	2,400	2,200	7,030	2,556	3,196		45,902
	Sub-Total Maintenance Improvement			2,805	10,564	3,643	4,011		33,120
<u>snow and Ice Control</u>									
160	Spreading Salt	Pass mile	4,010	400	1,283	2,566	8,982		12,831
161	Plowing Snow	Pass mile	3,250	195	614	751	-		1,365
	Sub-Total Snow and Ice Control			595	1,897	3,317	8,982		14,196
<u>Administrative and Overhead</u>									
170	Building Maintenance	Man-hour	420	420	1,346	75	75		1,496
171	Grounds Maintenance	Man-hour	800	800	2,563	142	142		2,847
180	Administrative Overhead	Man-hour	6,650	6,650	21,307	1,184	1,184		23,675
	Sub-Total Admin. and Overhead			7,870	25,216	1,401	1,401		28,018
	TOTALS			31,010	102,075	41,937	24,316		201,448

## REVIEW QUIZ

Here are some statements about all of the materials you have read. As usual, check which statements are true and which are false.

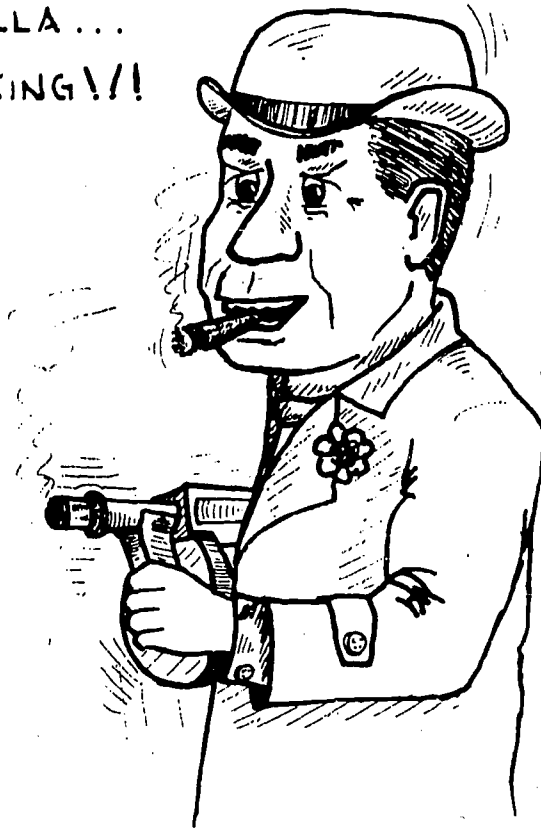
- | <u>True</u>              | <u>False</u>             |   |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | 1. To manage by objectives, the Department has to set specific, measurable objectives. Then everyone has to work toward those objectives.         |
| <input type="checkbox"/> | <input type="checkbox"/> | 2. Management by objectives can be used by any manager; it is universal.  |
| <input type="checkbox"/> | <input type="checkbox"/> | 3. Traditional maintenance objectives usually are specific and measurable.  |
| <input type="checkbox"/> | <input type="checkbox"/> | 4. To manage by objectives, traditional maintenance objectives should be translated into terms that are easy to understand.                       |
| <input type="checkbox"/> | <input type="checkbox"/> | 5. One of the main reasons for converting roadway inventories and quantity standards into work programs is to make objectives easy to understand. |
| <input type="checkbox"/> | <input type="checkbox"/> | 6. Resource needs are calculated to make sure the work load is level.   |
| <input type="checkbox"/> | <input type="checkbox"/> | 7. Resource needs have to be calculated before work programs can be developed.  |
| <input type="checkbox"/> | <input type="checkbox"/> | 8. Resource needs are calculated by using information found on performance standards.   |
| <input type="checkbox"/> | <input type="checkbox"/> | 9. The main reason for leveling the work load is to make the best use of resources -- and to make sure the program can be completed.              |
| <input type="checkbox"/> | <input type="checkbox"/> | 10. Management by objectives is a systematic way of setting objectives and providing enough resources and money to reach those objectives.        |
| <input type="checkbox"/> | <input type="checkbox"/> | 11. When management by objectives is not used, most supervisors will interpret objectives differently.  |

## REVIEW ANSWERS

- | <u>True</u>                         | <u>False</u>                        |   |
|-------------------------------------|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 1. To manage by objectives, the Department has to set specific, measurable objectives. And then everyone has to work toward those objectives.           |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 2. Management by objectives can be used by any manager; it is universal.  |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> | 3. Traditional maintenance objectives usually are not specific and measurable. Traditional objectives are needed, but only to provide general guidance. |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 4. To manage by objectives, traditional maintenance objectives should be translated into terms that are easy to understand.                             |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 5. One of the main reasons for converting roadway inventories and quantity standards into work programs is to make objectives easy to understand.       |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> | 6. Resource needs are not calculated to make sure the work load is level. They are calculated to make sure the work program can be accomplished.        |
| <input type="checkbox"/>            | <input checked="" type="checkbox"/> | 7. Resource needs are not calculated before work programs are developed. Work programs are developed first.   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 8. Performance standards contain the information used to calculate resource needs.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 9. The main reason for leveling the work load is to make the best use of resources -- and to make sure the program can be completed.                    |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 10. Management by objectives is a systematic way of setting objectives and providing enough resources and money to reach those objectives.              |
| <input checked="" type="checkbox"/> | <input type="checkbox"/>            | 11. When management by objectives is not used, most supervisors will interpret the existing traditional objectives differently.                         |

Check to make sure that you marked the right answers, and correct any errors. Then go to page 57.

OK FELLA...  
START TALKING!!!



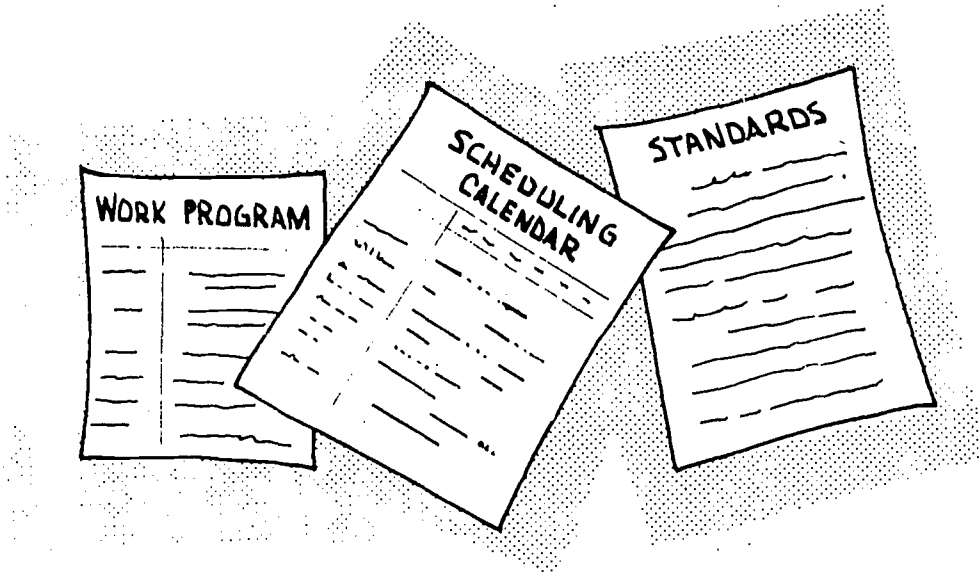
Section Three

COMMUNICATING MANAGEMENT BY OBJECTIVES

The management-by-objectives concept will go down the drain unless it is communicated to everyone who is expected to use it. And the communications must be two-way -- up and down.

## COMMUNICATION -- DOWNWARD

One of the most common ways of getting management by objectives to field supervisors is to supply copies of the work programs, scheduling calendars and standards.



The Ryan County Work Program, back on page 43, is an example. So is the scheduling calendar on page 49. Quality and performance standards usually are summarized on a simple form. The maintenance standard on the next page is an example. Notice that it contains nearly all of the information needed to plan and control work in ways that help you manage by objectives:

- + The quality standard -- or conditions under which the work will be done;
- + The recommended crew size and equipment for this activity;
- + Procedures for doing the activity; and
- + What objectives have been set -- in terms of average daily production and productivity.

# MAINTENANCE STANDARD

## PATCHING BASE

April 17, 1972

Activity No. 111

<p><b>DESCRIPTION AND PURPOSE:</b>                  Repair of base or subgrade failures under bituminous pavements through the excavation of unsatisfactory material and replacement with concrete, aggregate or other material to correct possible hazards and to preserve the roadway.</p>																	
<p><b>SCHEDULING:</b>                  Schedule primarily during summer.</p>		<p><b>TYPE OF ACTIVITY:</b>                  Routine Maintenance</p>															
<p><b>CREW/EQUIPMENT</b></p> <p><b>Recommended Crew Size:</b> 7                  (Add flagmen as needed.)  <b>Equipment:</b></p> <table border="1"> <thead> <tr> <th>No.</th> <th>Description</th> <th>Group</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>Dump trucks</td> <td>03</td> </tr> <tr> <td>1</td> <td>Pickup truck</td> <td>01</td> </tr> <tr> <td>1</td> <td>Gradall</td> <td>11</td> </tr> <tr> <td>1</td> <td>Rubber-tire roller</td> <td>16</td> </tr> </tbody> </table>		No.	Description	Group	3	Dump trucks	03	1	Pickup truck	01	1	Gradall	11	1	Rubber-tire roller	16	<p><b>ACCOMPLISHMENT</b></p> <p><b>Work Unit:</b> Cubic yard of material  <b>Daily Production:</b> 45-50 cubic yards  <b>Average Productivity:</b> 1.2 man-hours/cubic yard of material</p> <p><b>MATERIAL</b></p> <p>Crushed concrete, pit-run gravel or aggregate</p>
No.	Description	Group															
3	Dump trucks	03															
1	Pickup truck	01															
1	Gradall	11															
1	Rubber-tire roller	16															
<p><b>RECOMMENDED PROCEDURE:</b></p> <ol style="list-style-type: none"> <li>Cut out surface failures with Gradall or other suitable equipment.</li> <li>Remove unsatisfactory base or subgrade material.</li> <li>Load unsatisfactory material into truck, haul away and dispose at predesignated area.</li> <li>If water under the pavement caused failure, build a small trench out to the ditch and fill with coarse granular material before resurfacing.</li> <li>Place new base material in layers in cut-out section.</li> <li>Compact each layer with hand tamps and roller.</li> <li>Compact the final layer until it is level with the surrounding base.</li> <li>Replace surfacing as under Activity No. 105.</li> </ol>																	

All of these things can be put in a convenient binder or management manual, and just about every maintenance supervisor should have one.

### QUIZ

True

False

1. Included in any manual for field supervisors should be the quality and performance standards used to develop each supervisor's work program.

2. It's probably not necessary to include quantity standards and resource requirements in your management manual.

3. Training in management by objectives is needed to make the concept work as it should.

4. The combination of manuals and training programs probably will guarantee the success of the management-by-objectives concept.

---



## ANSWERS

The first three statements generally are true. Quality and performance standards must be communicated. But because quantity standards and resource needs are basically planning values, they usually are not included in field manuals. And some kind of training is necessary to get across what the Department is trying to do and how it is being done.

The fourth statement is false. Usually, no amount of training or manuals will guarantee the success of management by objectives. The reason is simple: training is no good unless it is put into practice. Manuals aren't worth much unless they are used. Training and manuals are tools -- and no one but maintenance supervisors can guarantee that they will be used. But most supervisors know that the boss wants work managed by objectives -- so work programs, scheduling calendars and standards are put to use and the downward communication is complete.

The rest of the communication process must be a "reversed" flow.

## COMMUNICATION -- UPWARD

Is work being done according to the program? Are standards being met, in terms of production and productivity? Is workmanship satisfactory? What steps should be taken to make sure the year's objectives are reached? Many of the questions can be answered by a work reporting system. Work reports, completed by foremen and crew leaders and summarized by supervisors supply information about whether or not objectives are being reached.

### PROBLEM

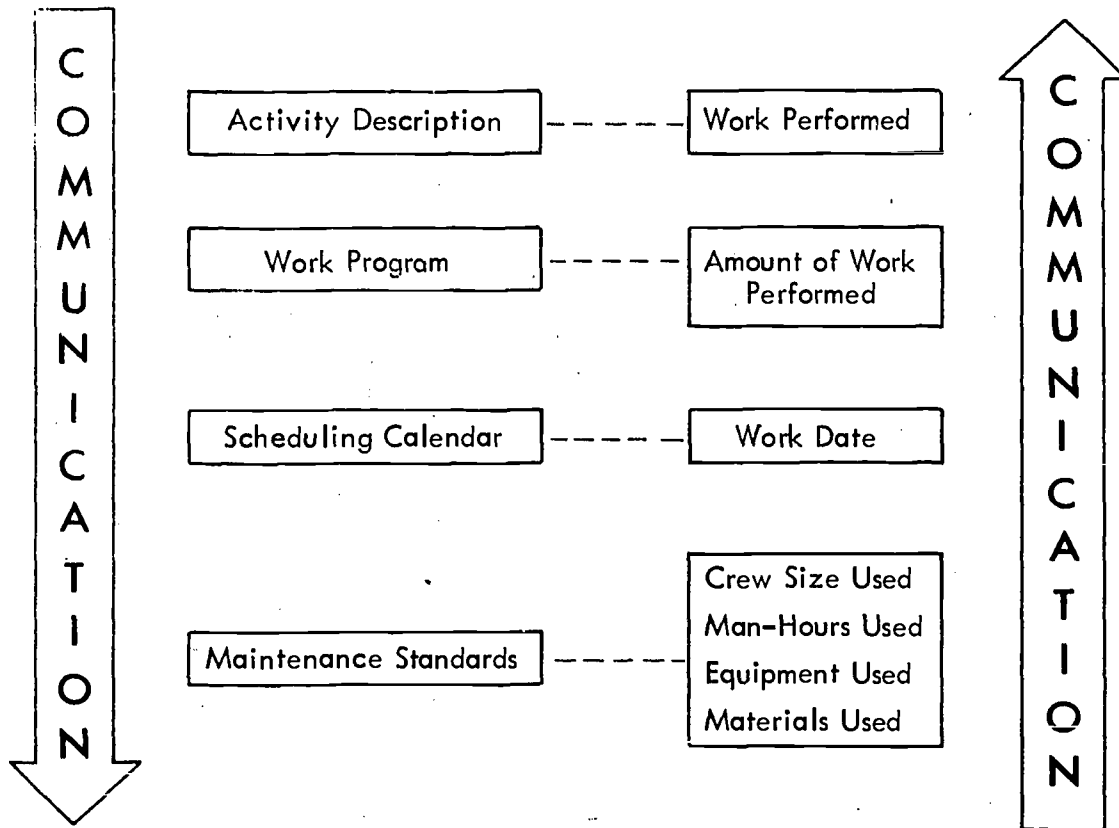
In the list below, check the kinds of information that probably should be reported. As you review this list, keep in mind the parts of the management-by-objectives concept which have been communicated downward.

#### Work Reporting Checklist

- The activity performed
  - The crew size
  - The names of the crew members
  - The amount of work done
  - The date the work was done
  - The number of man-hours used to do the work
  - The number and types of equipment and amount of materials used
  - The specific location of the work performed.
-

ANSWER

All of the items might be checked. But for most purposes, the third item (names of crew members) and the last item (specific work location) are not necessary. The relationship between the downward and the upward flow of information is shown below.



Notice that for each part of the concept communicated downward, there is corresponding information flowing upward.

There are several ways of gathering the information needed to keep everyone informed of the progress toward managing by objectives. In most instances a simple form is all that is needed -- one which contains space for describing what and how much was done and with what resources. A form such as this one is shown on the next page.

MAINTENANCE WORK REPORT			
Activity <b>III PATCHING BASE</b> <b>( 2/10 MILE WEST OF</b> <b>LOCUST RAU)</b>			Crew Size <b>7</b>
Route <b>4</b>		Management Unit <b>007</b>	
Foreman <b>PETE</b>		Date <b>4/28/72</b>	
LABOR		EQUIPMENT	
Employee	Hours	Number	Hours
<b>PETE</b>	<b>8</b>	<b>03 - DUMP TRK</b>	<b>8</b>
<b>BILL</b>	<b>8</b>	<b>03 - " "</b>	<b>8</b>
<b>TERRY</b>	<b>8</b>	<b>03 - " "</b>	<b>8</b>
<b>JIM</b>	<b>8</b>	<b>01 - PICKUP</b>	<b>8</b>
<b>HAROLD</b>	<b>8</b>	<b>11 - GRADALL</b>	<b>8</b>
<b>SAM</b>	<b>8</b>	<b>16 - ROLLER</b>	<b>4</b>
<b>BOB</b>	<b>8</b>		
Total	<b>56</b>	Total	<b>44</b>
MATERIAL			
Description	Amount	Unit	
<b>PIT RUN GRAVEL</b>	<b>84</b>	<b>C.Y.</b>	
ACCOMPLISHMENT <b>84</b> UNIT <b>C.Y.</b>			

Compare the information on this form with the information needed to manage by objectives -- on page 62. Does this form have all the necessary data? The answer, of course, is "Yes." It shows what and how much was done and when. It also indicates what resources were used.

Some departments use a "crew day card" for this purpose. A typical card is shown below.

ACTIVITY NO.	NAME		RD. CLS.	CREW SIZE
111	PATCHING BASE		PRI	7
MOVT. UNIT NO.		PLANNED	REMAIN	MO. PIND.
007		7	3	APR
ASSIGNED TO:		DATE:		
FETE		4/23/72		
LOCATION AND SPECIAL INSTRUCTIONS				
ROUTE 4 - 2/10 MILE WEST OF				
LOCUST BAY				

LABOR			EQUIPMENT		
R.T.	EMPLOYEE	O.T.	UNIT	DESCRIPTION	HRS.
3	FETE		03	DUMP TRUCK	3
3	BILL		03	DUMP TRUCK	3
3	JERRY		03	DUMP TRUCK	3
3	IAN		01	PICKUP TRUCK	3
3	HAROLD		11	GRADALL	3
3	SAM		16	ROLLER	4
3	BOB				
56	TOTAL HOURS				

MATERIALS		
DESCRIPTION	UNIT	AMOUNT
PIT-RUN GRAVEL	C.Y.	34
ACCOMPLISHMENT		
84 C.Y. GRAVEL		
CREW DAY CARD	TYPE OF WORK:	
	LIMITED ROUTINE MAINTENANCE	

Does this card serve other purposes?

- No. Look at the card again.
- Yes. Continue reading.

-----

"Yes" is the right answer.

The card in this example has translated the work program, scheduling calendar and part of the maintenance standard for Patching Base, Activity 111:

- + The work program is put in terms of the estimated number of crew days needed for the activity -- the number planned and the number remaining.
- + The scheduling calendar is described by the month shown on the card -- April; and
- + Part of the performance standard is shown -- the crew size, equipment and materials recommended and the way in which accomplishment (production) is measured.

In effect, such a card serves two purposes: It authorizes work and makes the communication process work -- both down and up.

### QUIZ

True

False

1. The management-by-objectives concept won't get off the ground unless communication channels are open -- both ways.

2. Included in the communication channels should be manuals, training and work reports.

3. Work reports or report summaries provide most of the information needed to show the extent to which Department objectives are being met.

---

### ANSWERS

All of these statements are true.

## SUMMARY

Here is a summary of what management by objectives is all about:

- + Management by objectives is the process of setting specific, measurable objectives, and then working toward those objectives. It's deciding what the results of work should be, and then planning, organizing, directing and controlling work so that the objectives are reached.
  
- + The typical, traditional maintenance objectives are needed, but only to provide general guidelines for performing work.
  
- + Traditional maintenance objectives must be translated into familiar, work-related objectives -- in terms of quality standards. Then the quality standards are used to determine quantity standards.
  
- + Quantity standards and roadway feature inventories are used to develop work programs.
  
- + The concept of management by objectives is in agreement with any systematic approach to maintenance management:
  - Activities are identified, described and measured;
  - The road system is inventoried;
  - Quality standards are developed which indicate the conditions under which work should be done;

- Quantity standards and other values are applied to road system features -- and the result is a work program;
  - Resource requirements are calculated and efforts are made to level the work load;
  - And a budget is developed to support the work program.
- + Expected performance is the key to calculating resource requirements -- and because this is true, performance standards must be set.
- + Resource requirements must be calculated to make sure you have enough resources to accomplish the work program.
- + Activity descriptions, work programs, scheduling calendars and standards must be communicated to everyone -- and the necessary communication can be helped by manuals and training.
- + Finally, work reports must be used to complete the flow of information -- to provide a way of judging the success of your effort to reach Department objectives.



This is management by objectives.

There are only two things missing: the work itself -- the patching, sealing, mowing and everything else;

and

scheduling and controlling work in ways that ensure that management by objectives works.