# 1975 PRODUCTIVITY PROGRAM

## STATE OF NEW JERSEY, DEPARTMENT OF TRANSPORTATION

ALAN SAGNER
COMMISSIONER

STATE OF NEW JERSEY
DEPARTMENT OF TRANSPORTATION
1035 PARKWAY AVENUE
TRENTON, N.J. 08625

March 17, 1975

Dear Commissioner Sagner:

As you directed, I am transmitting herewith a Productivity Program for the Department of Transportation projected to save $5 million over the course of the current calendar year. I am submitting it to you somewhat behind our original schedule due to a review of the impact of the Governor's recommended budget on the feasibility of attaining the projections made.

It must be made clear that the savings projected here have been taken into account in the formulation and modification of our budget. We can still accomplish what is described herein but if substantial further cuts are made in our budget, many of the proposed savings will be jeopardized.

The Program outlined is an ambitious one. Indeed, like any sound management program, it may require slightly more than the Department can, in fact, deliver. However, it is entirely consistent with this Department's history to be the type of "can do" organization for which impossible tasks merely take a little bit longer to accomplish.

Respectfully,

Manuel Carballo

Manuel Carballo
Deputy Commissioner

DEPARTMENT OF TRANSPORTATION
PRODUCTIVITY PROGRAM

# PRODUCTIVITY PROGRAM

The Department of Transportation will embark on a program to save a minimum of $5 million during calendar 1975 through a productivity program. Over $4 million in savings are identified at this time. The additional $1 million will be identified by July 1. The ground work for such a program has been laid by preceeding administrations, going back to the creation of the Highway Department. The current fiscal situation, plus the obvious desirability of increasing efficiency of state government operations, have caused this administration to place a renewed emphasis on the area of productivity. Developing such a Department-wide productivity program requires setting forth some definitions and identifying specific target areas for concentration. Before outlining the program, it is therefore appropriate to discuss broadly what attempts at raising productivity have been made before and to consider the constraints which are inherent in government efforts to improve productivity.

## A. Introduction

Defining productivity in the public sector is difficult in all areas and impossible in some. The private sector provides an easy measure of efficiency. A business either succeeds or fails purely in terms of one criterion: dollars. Thus, the types of considerations which enter into public sector decisions tend not to influence the private sector measure of efficiency. For instance, no private business is currently required to conduct a public hearing, prepare a relocation plan, an environmental impact statement and a detailed public justification of what its actions are if it decides to acquire a new site for a plant.

If, on the other hand, the Transportation Department were to determine that it could increase the efficiency of its crews by relocating a highway maintenance yard or facility from one location to another, all of these constraints would apply. This is not meant to imply that government or the private sector should not take careful account of the social, economic, and environmental impact of its actions. It is only meant to make clear that government might succeed in being efficient in its location of maintenance facilities on a measure which took dollars into account simply as one among many indicia of success. If it failed to meet its own environmental, relocation, and public disclosure criteria, it may have built a maintenance yard, but it would have failed as a government.

The problem is further complicated by the fact that measures of efficiency are more or less quantifiable depending on the area of public sector activity. It is a relatively simple task to measure how many lane miles of highway have been resurfaced at what cost. It is a far more complex task to try to provide a measure of the effectiveness of a teacher in a school system. Again, the point is not that measurement is impossible, but that it at least is more exact in some areas than in others. This productivity program, for instance, does not address the full scope of the Department of Transportation's activities. The analogue to the difficulty inherent in measuring the productivity of a teacher would be an effort to measure the productivity of a transportation planner. The factors defining success or failure in planning are so varied, interrelated and often independent of the control of the planner that, at best, only a crude and probably misleading index could be developed. What indices are possible, then?

This program addresses the highway maintenance functions of the Department of Transportation. It is merely fortuitous that in the case of the Department of Transportation the area which absorbs the greatest resources in manpower and salaries is also the area which lends itself to reasonably accurate

measurement of success or failure. At the outset, however, a distinction must be made between what might be termed effectiveness and what is properly termed efficiency. This distinction is essential to the understanding of what a productivity program in fact represents.

To take a hypothetical example, if based on reasonable standards of production, it takes two men to properly maintain 10 lanes of highway, but if only one man is available (due to budget or other restrictions), theoretically, two things may occur. The first is that only 5 of the 10 miles can be effectively maintained. In other words, only 50% of what needs to be done is done. That one man, however, may maintain his 5 miles of road with 100% efficiency. That is, he does all of his assigned tasks necessary to maintain his 5 miles of road within the eight hours a day he is expected to work. In practice the one man will probably be asked to maintain the full 10 miles. Since he cannot do that, both effectiveness and efficiency suffer. He must spend more time travelling, for instance, than he should. We may, therefore, have -- and in fact the public sector has frequently had -- a situation in which efficiency may be high but effectiveness, due to lack of resources, is low.

Perhaps an example from an industrial context could help. If on an assembly line which produces automobiles, two workers mount the wheels on the car, then the assembly line can produce, let us say, 10 cars an hour. If the plant, in order to save money, eliminates one of the workers, the single remaining worker will have to cross over from one side of the car to the other to mount the wheels. He is, therefore, only able to produce 5 cars an hour. Production, read "effectiveness," is therefore down 50% although the remaining worker is operating -- in this very hypothetical case -- at full efficiency. Efficiency would suffer here, too. Production would have to be less than half the former rate due to the "inefficiency"

of time loss moving from one side of the line to the other.

Returning to the public context, the citizen lightly scoffs at claims of improved efficiency, especially in this era of limited credibility for government, when he sees diminishing effectiveness. It is, therefore, very important to make clear that productivity (efficiency) only increases what one gets for any dollar of investment -- it does not increase the dollars invested. If increased effectiveness among government agencies is required, increased resources are also often required.

This productivity program will, therefore, also use the term productivity in a context somewhat broader than what might properly be the measure of productivity in the private sector. The classic measure of productivity is reflected in the formula that compares units of output to man-hours of labor. Thus, a plant which requires 10 man-hours to produce 100 light bulbs is more productive than a plant which requires 20 man-hours to produce 100 light bulbs. Our productivity program will include a very substantial element of exactly this type of measure of efficiency. For example, based on studies by industrial engineers, we know how long it takes to permanently repair a pothole. Any given crew is allowed just so many man-hours to make the repair. If they do it within the allowed man-hours, they are efficient; if they take more man-hours than allowed to make the repair, to that degree they are inefficient. There is provided as an appendix to this report a brief description of how standards of efficiency are developed.

Two other areas of productivity lend themselves to analysis in the case of the Department of Transportation. The first lies in the area of maximizing the use of Federal funds instead of State appropriations. The closest private sector analogue is called "leveraging," as when a corporation with a 10% investment of its own funds is able to reap the benefits of an investment of funds in excess of that

10% by borrowing through mortgages, bonds, or sales of stocks. The analogue is not quite exact since Federal dollars are also in part dollars coming from the same taxpayer, i.e., the New Jersey resident who pays both local and Federal taxes. However, unless the State maximizes its use of Federal funds, New Jersey's fair share of Federal programs goes to other jurisdictions and the New Jersey residents get no "return on their investment." For that reason, targets are set in our productivity program for funding with Federal dollars activities which heretofore have been paid for only with state dollars.

The final application of the concept of productivity to the Department of Transportation stems from the improved use of technology. Research and development is as essential in the public sector as it is in the private sector, although this essentiality is frequently not reflected in public sector budgets. If, however, through research and development new technology has capital or labor-saving results, its impact can be dramatic. If the man on the assembly line in the example given above had a machine which allowed him to operate from one side of the vehicle in a way to put wheels on both sides of the car, his productivity could be doubled. Obviously, the machine must cost less to install than the man it replaced. Equally obviously, research and development is, by its nature, speculative. Perhaps the hardest concept to explain to the public is a public investment intended to develop some useful bit of technology which fails. By definition, some research and demonstration projects must have a negative outcome. Good management tries to reduce the number of negative results, but if they are ever totally eliminated, that is a sure sign that no research or development of any great worth is going on. This Department will, as part of its productivity program, try new technology. Some of these investments will be productive; others will fail completely. If the savings generated by those that succeed exceed the cost of those that fail, the effort will have been a success despite the failures.

The final and perhaps the most difficult concept to establish is that in some cases a savings will only represent a reduction in the rate at which costs are increasing. To return to the example of the car on the assembly line, if the machine hypothesized were installed and if, as a result of that installation, only half the man-hours previously used are necessary to produce the car in question, that does not mean that the car will necessarily be cheaper. For instance, the cost of materials for the car could be increasing at a rate faster than the savings in labor costs. The machine might have saved $100 in labor costs but in the meantime the price of the wheels the worker is installing on the car could have gone up $200. There is, therefore, a saving of $100 although the costs of the end product have gone up $100. Obviously, this does not mean that one should not invest in the machine that saves $100 because otherwise the price would have gone up $200. In our productivity program, some of the savings which will be identified will be of this nature. In other words, even after we save, if we succeed, $5 million during this calendar year, it may well still cost us more to maintain the State Highway System.

Finally, it is not inappropriate to note that productivity in the Department of Transportation has been increasing over many years. It increased last year and will increase this year. This increase in productivity contradicts the common belief that government is inefficient particularly in comparison with the most recent Federal statistics for the private sector. Those figures indicate that last year, for the first time since the statistics have been kept, productivity in America's private sector declined by 2.7%. Productivity in the New Jersey Department of Transportation has increased.

B. Historical Trends

Some gross measures of these increases in productivity will be provided by the following statistics.

1. Lane Miles -- The number of lane miles for which the Department of Transportation is responsible has increased by 44% over the last ten years. (Table I) The ratio of highway maintenance employees to the physical inventory maintained has decreased by 44% in the last ten years. The ratio of employees per lane mile has in fact decreased to below the level of effectiveness although clearly, productivity has increased. (Table II)

2. Landscaped Areas -- The number of acres of landscaped areas for which the Department of Transportation is responsible has increased by 18% over the last five years. The ratio of highway landscape employees to acreage maintained has decreased by 7.1% in the last five years. The ratio of employees per acre has in fact decreased to below the level of effectiveness although clearly, productivity has increased. (Table III)

3. Equipment -- The number of pieces of equipment for which the Department of Transportation is responsible has increased by 25% over the last 10 years. The number of mechanics engaged in maintaining that physical inventory has increased by 48% in the last 10 years. Even though the percent increase in mechanics has been greater than that of the increase in fleet, we still cannot maintain the fleet at the required level of service effectiveness, although clearly productivity has increased. This is due to the fact that the newer equipment purchased over the ensuing years has become increasingly more complicated due to the technological advances made within the industry. As an example, the dump truck used for road maintenance 10 years ago was a unit which consisted of a basic cab and chassis, dump body and hydraulic hoist mechanism, a tow type mechanical materials spreader, and a front mounted snow plow. This unit required two people for operation during

the material spreading function, a driver and a shovel man located in the back of the dump body shoveling and/or regulating the flow of material being spread. Our current truck for this type of service is made up of a cab and chassis (in some cases, a 6-man crew cab) with a centralized front engine crank shaft driven hydraulic system operating a snow plow lift cylinder, dump body hoist, and an automatic hydraulically operated material spreader. The new unit requires only the driver of the truck, eliminating one man, and provides very closely controlled material spread rates for conservation of material and increased lane coverage. Of course, the new units require a much greater level of technical competence when repairs are required, and usually a longer time period to perform the repairs, due to more complicated equipment being utilized. (Table IV)

4. Electrical Fixtures -- The number of electrical devices for which the Department of Transportation is responsible has also increased over the last ten years; highway lighting units by 206%, traffic signals by 41% and illuminated signs by 52%. In this time period a 90% increase in equipment knockdowns was experienced. There are 143 employees engaged in maintaining this physical inventory - up 39% from ten years ago. The ratio of employees per electrical system, however, has decreased to below the level of effectiveness although clearly, productivity has increased. (Table V)

The above are gross measures of efficiency but persuasive nonetheless.

C. Constraints on Efficiency

The public sector suffers from a number of constraints on efficiency which are not to be found in the private sector. Very frequently, well-intentioned programs designed either to eliminate patronage or corruption have the result of making honest management very difficult. The Civil Service system, for instance, was developed to insure that merit prevailed in the appointments of employees. It was also designed at a time when public employees were not unionized to protect the employees from arbitrary and capricious action by management. With the growth and unionization of the public sector, however, there is an increasing duplication of effort. The interrelationship of collective bargaining agreements and Civil

Service regulations is sufficient to challenge the most exact mentality. A private sector employer familiar with the restraints on management imposed on some collective bargaining agreements relating to promotion, seniority, transfers and similar matters, could only be shocked to find that in addition to the terms spelled out in his collectively bargained agreement, an independent set of rules and procedures ran parallel within the same organization.

Perhaps one of the most telling examples of inefficiency caused by the public distrust of government officials appears in the area of equipment. Public bidding is required for any purchase in excess of $2,500. The amount of $2,500 was picked in 1958 and its current actual purchasing power would be more in the order of $3,650. Failure to increase the dollar amount for which purchases can be made without bid means that at any time in which a part or piece of equipment is needed which costs in excess of $2,500, several months must be lost to the process of advertisement, receipt and evaluation of bids. Thus, if a mechanical sweeper breaks down, a major part must be ordered. If only two are assigned to a given highway region, then either the road is not swept, or it is swept by hand, a grossly inefficient operation, while procurement of the sweeper parts moves through "channels."[1]

Another impact of the bidding statutes is an incredible diversity of equipment. In the private sector, a corporation will make a decision based on variables such as cost, ease of maintenance, projected useful life, etc., and procure a fleet of equipment generally from one manufacturer. This has several advantages: uniformity of equipment allows the corporation's mechanics to become skilled in repairing that piece of equipment; uniformity of equipment allows maintenance of a stock of spare parts consistent with the needs of that single type of equipment; and the vendor of the equipment, recognizing a large and good customer, generally will tend to provide better service.

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[1]Bids may be waived in the case of emergency. In the ordinary case, mere economy does not constitute an emergency within the meaning of the statute.

This may be contrasted with the present situation in the Department of Transportation. All equipment, of course, must be competitively bid and awarded to the lowest qualified bidder. Consequently, the Table VI example indicates we have an inordinate number of brands of equipment. We have 201 different types of equipment, such as: dump truck: 2 ton; mower: rotary, walk-behind, etc., of which there are a total of 229 different brands making up a total fleet of cars, trucks, and road equipment of 4,278 which does not include 1,536 snow plows or 2,000 items of shop equipment. Our mechanics, therefore, must know how to repair several types of equipment. Parts inventory control is complicated by the need to have different ratios of frequency of repair and replacement for each different type of equipment, often resulting in an oversized or undersized inventory. Vendors, already leary of the red tape involved in government procurement processes, have little incentive to stock parts or accelerate repairs for a customer who buys a limited amount of equipment, infrequently, and furthermore has no choice but to deal with him if he is the low bidder.

There are many other examples. False "economies" abound. Frequently, accounts are knowingly underbudgeted so that, for instance, despite enormous increases in the price of gasoline, antifreeze and oil, an agency will be given the same amount as the previous year. Budgeting for replacement parts frequently does not reflect cost escalation in that area. Budgets will recognize the need for an increased number of mechanics but not for a number of storeclerks to provide the necessary parts. In times of tight budgetary constraints, an intelligent replacement cycle of equipment is "easily" deferred so that each year in order to bring equipment on to a proper replacement cycle, a greater and greater investment is required so that finally no one can afford to replace the entire fleet. While these problems also occur in the private sector -- with far greater frequency than the public knows or cares to acknowledge -- they tend to occur all too often in the public sector.

Again, these constraints are not intended to serve as excuses but to set a realistic context against which public sector employees must labor.

D. Productivity Program

As indicated above, this Department's program will consist of three major elements. These three elements are: Maximization of the use of Federal funds; increased output per man-hour; and increased utilization of cost-effective technology. What follows below is the Department's program under each of these headings along with an estimated time frame for implementation and completion

1. Increased Federal Aid -- A number of activities undertaken by the Department have either never been programmed for Federal aid or have only recently been made eligible for Federal assistance. It is now apparent that a number of activities previously financed 100% with State funds can be now financed using a minimum 70% Federal participation (if the improvement is on the Interstate System, the Federal participation is 90%.) In other words, in the case of the following items, the State can have a "saving" of at least 70% in State dollars.

a. Roadway and Bridge Improvements -- Under this program the Department of Transportation rehabilitates the older roads in the State highway system and restores the quality of highways for greater safety and lower maintenance costs through reconstruction; resurfacing and shoulder improvements, erection of guard rail, fencing, and bridge safety fencing, extends the useful life and safety of bridge decks and structures. These "betterments" are capital in nature although directed toward the preservation of existing improvements. The fiscal 1975 budget appropriated $8,856,647 for this purpose. The fiscal 1976 budget recommends $6,851,295 for this purpose. Since some of the proposed improvements are on the Federal-aid Highway System, an effort will be made

to program $3 million of improvements during the current calendar year for Federal aid. This will represent a minimum saving of $2.1 million in State funds or approximately the amount by which the current year's recommended appropriation was reduced. Progress in programming this amount will be reported quarterly with the saving to be fully attained during the current calendar year.

$2,100,000

b. Electrical and Traffic Improvements -- Under this program of electrical control, directional and illuminating facilities required for the safe and efficient flow of vehicular and pedestrian traffic on the State highway system is provided. The fiscal 1975 budget appropriated $1,209,671 for this purpose. The fiscal 1976 budget recommends $1,235,982. This increase in appropriated amounts recognizes the incredible inflation in parts and equipment in this area. Table VII provides some examples of this inflation. The recommended amount is below the Department's request by about $500,000. The Department will seek to program for Federal aid $1 million worth of traffic and electrical betterments during this calendar year. This will result in a minimum saving of $700,000 or approximately the amount needed to cover projected inflation and to maintain the existing level of activities. Progress toward implementing this program will be reported quarterly with the savings to be fully realized within the current calendar year.

$ 700,000

c. Manpower - The Department's maintenance activities are currently budgeted for 1,548 positions. The fiscal 1976 budget, recognizing the increase in lane miles and facilities to be maintained, adds 85 positions. Notwithstanding this increase in maintenance positions, the number needed to properly maintain the State's highway system at 100% effectiveness is not met. The Department will, therefore, seek to add new positions to be Federally funded through the Comprehensive Employment and Training Act (CETA). If 100 additional positions can be secured under CETA, the State will have avoided the need to budget for these 100 additional positions. Projected savings are therefore $684,700. These savings will be reported quarterly and are expected to be realized during the current calendar year.

$684,700

d. Training -- Although training is relatively a low-cost item, it is essential to efficient operations. As the Department's equipment becomes more complex and its role expands to meet current needs, the ability of the Department to make the best of its current resources is, in large part, determined by our ability to train our current manpower. The fiscal 1975 budget for training was $50,000. During the previous fiscal year, training funds were not matched with Federal-aid dollars. By initiating this year a matched program for training, we have been able to expand our training capabilities to a program level of $120,789 during the current fiscal year. We have, therefore, been able to buy more for the same amount of money, which

constitutes a saving of ~~$77,173~~ #70,789. These savings will be realized by the end of the current fiscal year and will be reported at the end of the second quarter of this calendar year.

Subtotal - Federal-aid Savings ~~$247,962~~ 70,789 ~~$3,484,700~~ 3,555,489

2. Output per Man-hour -- The Department has a highly sophisticated computerized management reporting system which measures the productivity of its field crews against standards developed by its industrial engineering staff. For purposes of this program the principal work activities of our field crews have been isolated and made the subject of a special report. These activities represent some areas in which field forces spend the greatest number of man-hours. In some of these areas productivity exceeds 100% of the industrial engineering standard. In other areas, it is well below 50%. During the current year, the Department will seek to bring those areas in which productivity is below 85% to the 85% mark.

It should be noted that in the private sector 85% productivity is considered good. Generally speaking, work standards exceed by a small amount what may be realistically expected of a crew since working conditions are never either perfect or average. For instance, the accepted work standard may require a crew of 8 to perform a task. On any given day, one of the 8 employees may be out ill, reducing the crew to 7, or necessary equipment may be broken or delayed in arriving at the work site. Since work standards assume almost perfect efficiency and they are based on an "average crew" working against those standards, deviations from 100% productivity are recognized from a general acceptance of 85% productivity as more or less standard.

These selected activities are listed on Table VIII along with the performance statewide of all crews on the reporting date ending January 3, 1975.

Two factors should be stressed at the outset. First, the figures reported here are statewide. The averages conceal disparities among the State's four highway regions and among the crews within the regions. Line management has available to it more specific reports which allow a closer focus on a crew-by-crew basis. For purposes of this report, however, with this caveat, a statewide average is presented.

Second, the Department maintains constant scrutiny over those areas in which performance is reported to be in great excess of work standards. Exceeding production norms can reflect several things:

-- That the work standard, which is a statewide work standard, is more easily met in one region than in others and the performance in that one region disproportionately raises the level of production statewide;

-- Some crews have found a more efficient way of performing their assignment than reflected in the work standard, in which case the work standard should be revised to incorporate this more efficient means of production;

-- There are errors in the reporting system.

All of the above conditions are carefully monitored by the Department through a maintenance field audit performed by the Bureau of Maintenance, in conjunction with the Division of Industrial Engineering, where needed. In addition, a newly created Office of Internal Auditing has general overview responsibilities of the integrity of the Department's reporting systems and performance. On a random, unannounced basis, it can and does provide for spot checks on performance.

Increasing productivity in those areas below the 85% standard means that the Department will receive 38,759 hours additional work for the same level of salary expenditures. Valuing those hours at $4.36 per hour, the Department will, therefore, save $169,000 in the current calendar year. These savings will be reported upon quarterly. It is expected that the savings will be generated in small amounts during the first quarter, gradually increasing toward the end of the year. The full amount may not be realized during the current calendar year.

$ 169,000

a. Increased Permanent Repairs -- During winter months, potholes are generally repaired by using a cold asphaltic material, sometimes called "cold patch." While if properly done, cold patch can last for several months, it is by nature a temporary repair and must be redone as soon as possible with hot asphaltic materials for a "permanent patch." Cold patch is used basically for two reasons. The first of these is that under certain climatic conditions, hot asphaltic is not appropriate, e.g., during heavy rain or extreme cold. Cold patch will have to continue to be used in such cases. In the great majority of cases, however, the second reason prevails. That is, during winter months when construction activity is limited, many of the State's suppliers of hot asphaltic materials close their plants. Hot asphalt is, therefore, unavailable unless the Department produces its own.

Since a permanent patch is preferable to a temporary repair, in that it will not have to be redone and therefore one whole operation is saved, the Department is moving to increase its capacity to produce limited quantities of hot asphalt during winter months. Through use of centrally located pug-mills, the Department can increase the number of

permanent repairs it makes during winter months. Its capacity to make such repairs can be increased still further through the acquisition of heated and insulated trailers which allow the hot asphalt to be transported over large distances without cooling off. The first phase of the program, initiated within this calendar year, has been the expanded utilization of the pug-mills and of permanent repairs. Statistics in both these areas will be monitored.

The second phase involves the acquisition of new equipment. Since the purchase of equipment is such an extended process, it is expected that the savings from such equipment will not accrue during this calendar year, but will begin to appear toward the end of the next winter season.

If through the first phase efforts of the Department, the number of temporary repairs made are reduced by 10% and the number of permanent repairs is held constant, then the Department will have saved $81,794 in labor and materials. This potential savings will be monitored only during the first and second quarters of the year, since the program is seasonal in nature.

$ 81,794

b. Nonproductive Hours -- In the equipment repair area, mechanics are sometimes left with nonproductive hours due to faulty scheduling or unavailability of parts. Although these nonproductive hours are limited in quantity, they should be closer to zero than they presently are. The January equipment report identified 935 hours in this nonproductive category. Efforts will be to reduce the number of such hours by 75% over the calendar year, resulting in savings of $96,000.

$ 96,000

Subtotal - Output per man-hour $ 177,794

3. Improved Technology -- Through its Research and Development efforts, the Department has been able to identify a number of areas where the use of improved technology should result in significant savings.

a. Reduced Mowing -- Through a research and development contract financed jointly with the Federal Highway Administration and undertaken by the Rutgers University School of Agriculture, the Department has succeeded in developing a strain of grass which grows more slowly than the grass currently in place on the State's highways. Current standards require mowing the 14,630 acres of landscaped right of way six times a year. Use of this new grass will require mowing only four times a year, a 33% saving in the man-hours assigned to this task. The potential for savings is substantial. Due to lack of manpower, the Department is not currently meeting the standard frequency for mowings, mowing four times a year rather than the required six. The use of the newly developed strain will make our present level of activity meet a new standard. This will effect a savings by reducing the amount of work required. A six-times a year mowing cycle would require 329,173 man-hours; a four-times a year mowing cycle requires 219,450 man-hours. The difference of 109,725 man-hours represents a way for the Department to meets its obligation of proper maintenance, i.e., to be "effective" in its role, without an increase in manpower. If this strain of grass could be instantaneously planted throughout the State highway system, the potential savings, computed on the preceeding basis, would be 109,725 manhours or $478,500. Obviously, the entire State cannot be reseeded overnight. A pilot program will be instituted during the current calendar year to try the new seed over a large expanse of the State highway system. If the results are favorable,

based on such a large scale test, the Department will initiate a fast program for reseeding the entire system. The savings identified, therefore, will not accrue during the current calendar year, but progress toward laying the groundwork for future savings will be reported on a quarterly basis.

Savings - 0

b. Lighting -- The Department currently has over 16,000 State maintained lighting fixtures throughout the State. These lights provide safety for the public at intersections, curves, and ramps where lighting is beneficial. Many of these lights, however, are of the older incandescent variety. Such lamps use considerably more electricity per lumen than more modern sodium vapor or mercury vapor luminaires. The current inefficient use of electricity is undesirable both from the point of view of energy conservation and cost. During fiscal 1975 the costs of electricity for metered lighting to the Department was approximately $840,000. Redoing the entire system with Federal-aid so as to replace the current incandescent bulbs with new mercury vapor luminaires would reduce our utilization of electricity and our electric bill by $33,500. The Department expects to award contracts toward the end of this calendar year to implement this new policy. Savings, however, will not accrue until the new lights are in place, which is to say during calendar 1976. Progress toward attaining these savings in 1976, however, will be reported during the current calendar year.

Savings - 0

c. Resurfacing -- Currently when a roadway surface becomes rutted, dried out or worn, either it is ripped out and replaced with

a new surface or an overlay of bituminous concrete is placed on the existing roadway. Resurfacing of this type is expensive both in man-hours and materials. New equipment is available, however, which allows, in a limited number of cases, the recycling of the old asphalt by various processes on the roadway itself. One of these machines was recently tested on Route 1 with some success and a new test is contemplated on Route 130. A decision will be made by the Department as to the desirability of regularly using this type of "milling" maching instead of resurfacing.

The savings that we accumulated on the Route 1 project amounted to approximately $30,000. Each and every subsequent project will be different due to the nature of the mill thickness, the lane width, the shoulder type and other highway characteristics.

The milling can be used in areas where there is pavement rutting or other pavement-type displacement as well as areas where vertical clearance is a problem, such as under bridges. Subsequent savings can be realized in each and every case; however, there is no standard measurement due to the fact that each job is significantly different.

There is a potential savings of hundreds of thousands of dollars each year if full use of this process is implemented. However, at this time no estimate of savings can be made due to the experimental nature of the operation and the potential use of the machine. A better estimate of its use and possible inclusions of project savings may be possible in the second quarter report.

Savings - 0

Subtotal - Research and Development - 0

E. Other Areas of Savings

As indicated above, this productivity program focuses on the maintenance responsibilities of the Department of Transportation. There are other areas, however, in which savings are possible. It must be stressed that such savings can only be considered to be real savings if they can be provided without a reduction in the levels of service afforded to the public. During this calendar year, the Department will save considerable amounts in these other areas in this manner.

1. Reduction in Force -- As a result of a review of the projected right of way acquisition and construction work load for the Department for the coming year, it was determined that a reduction in force was appropriate. As a result, this Department took a step highly unusual for a government agency, to terminate 200 employees in the areas of right of way acquisition and construction inspection. During the current fiscal year, this reduction in force will result in savings of $600,000, as of February, 1975. The saving during the first six months of fiscal 1976 will be $900,000 for a total calendar year savings of $1,500,000. Fortunately, the Department has been able to place some of these employees in other areas which were undermanned or in which employee turnover required replacements of persons who had retired or left the Department for other reasons. Still other employees were placed in other agencies of State government. As a result, a real saving was attained while substantially protecting the interests of the Department's employees.

Savings $1,500,000

2. Engineering Manpower -- A review of the engineering manpower requirements of the Department was initiated in the fall of last year. The results of this review are expected during the current quarter. While it is not expected that the review will indicate an excess of engineering

manpower for the Department as a whole, it is expected that the review will result in a reallocation of engineering manpower in a manner most conducive to effectiveness and efficiency. Thus, those units of the Department which have had an increased work load, e.g., engineering required for the rapidly growing Federal Urban Systems program, will be able to meet their personnel needs without new hires by the transfer of employees in areas with a reduced level of activity, e.g., State-aid road systems.

Savings - 0

3. Mileage Reimbursement -- Since by the nature of the Department's work, construction contracts are awarded throughout the State, Department employees are frequently required to travel long distances to reach their temporary work station. In the past, the employee was afforded the option of driving directly to the work station rather than reporting to his regional office and driving to the temporary work site from there. The theory was that this would result in less travel overall. However, since employees had the right to have mileage while on official business reimbursed, a formula had to be established to determine how much of the total mileage from home to work site was to be allocated for "official business" and how much was to be allocated to the journey to work trip, which is nonreimbursable. An analysis of the formula adopted some years ago indicates that it should be modified. These modifications will be discussed with employee representatives and if, as part of the collective bargaining process, a revised formula along lines to be proposed by the Department is acceptable, savings of $200,000 is possible. Since this saving is contingent on negotiation, it is not currently included as a savings for purposes of this program.

Savings - 0

4. Accident Report Processing -- A substantial saving which does not

accrue to the Department at all but instead accrues to the citizens of the State generally is inherent in a new procedure adopted by the Department jointly with the Division of Motor Vehicles for the processing of accident reports. By use of a more simplified reporting format, 45,000 policy man-hours throughout the State are expected to be saved annually. This procedure was implemented on January 1 and is going through its "shakedown" period now. The number of man-hours saved is the equivalent of adding 23 additional policemen to the public safety agencies of the State, counties and municipalities.

Saving - 0

F. Conclusion

This productivity program represents this Department's best efforts to outline a program to effect savings and efficiency. Reports on the progress of the program will be issued on April 1, July 1 and October 1.

# APPENDIX

## DEVELOPMENT OF A WORK STANDARD

Throughout the Department's Productivity Program, reference is made to work standards. It is important to understand how such standards are developed and what they mean. Industrial engineering as a discipline was developed shortly after the turn of the century in the United States. It involves the application of engineering analysis to human performance. In greatly oversimplified fashion, the following indicates roughly how such an analysis proceeds.

Let us assume that the task to be analyzed is the permanent repair of a pothole. The first step taken by the Industrial Engineer is to observe in the field many repeated instances of a permanent repair of a pothole being made. As a result of these observations, the time and motion needed to perform the task are recorded. For instance, the crew takes a certain amount of time to arrive at the site, set up its safety equipment such as cones or barriers, unload its tools, clear and cut out the hole, apply binder or tack coat, fill the hole with asphalt, properly tamp or compress the asphalt, clean up the work site and leave. The Industrial Engineer will note whether there are enough men and equipment to efficiently do the job. Too many men get in each other's way; too few men result in inefficiency.

As a result of these numerous observations during which allowances are calculated for delays due to personal time off and fatigue, the industrial engineer develops jointly with technical input from civil engineers what the correct procedures and methods for the repair should be, and some standards for a crew's performance. The industrial engineer will state that if a crew has available to it a truck, small roller, a compressor and jack hammer, and other needed implements,

it should take, on average, 4 men x number of minutes to repair a "standard"-sized hole.

That standard is then tested by being measured against actual performance. If the great majority of the crews greatly exceed this standard, then the standard is too low and it should be adjusted upward. The opposite is also true. Eventually, a sufficient history of performance and observations is accummulated to develop a uniform work standard for the function to be performed.

It is this work standard which provides the grist for any intelligent analysis of efficiency and in turn also provides the basis for sound budgeting. It is on the basis of such standards, for instance, that the Department can compute how many men it needs to maintain a given number of lane miles of highway. The Department's budget request is based on these calculations.

The Department's work standards in some areas are based on those used in the private sector. In the area of equipment, for instance, standards are available for how long it takes to repair a certain type of truck or equipment. Whenever such private standards are available, the Department's standards are made to be generally comparable with such "outside" standards. Generally speaking, however, the Department's standards are unique since most of the functions it performs are not performed by anything other than government agencies.

The text of the "typical" work standard we have identified, that is, the permanent repair of a pothole, follows.

SAMPLE WORK STANDARD

APPENDIX II

NEW JERSEY DEPARTMENT OF TRANSPORTATION

| MAINTENANCE & CONSTRUCTION | BUREAU OF MAINTENANCE |
|---|---|
| DATE: December 23, 1974 | |

FREQUENCY STANDARD: As required: Permanent roadway patching is that patching which is done with hot mix bituminous concrete, using: a compressor to square the hole, tack coat to paint the patch area, and a roller or mechanical tamper to compact the patch

| BASIC CREW | EQUIPMENT |
|---|---|
| 4 Workers | 2 small dump trucks<br>1 compressor<br>1 roller or mechanical tamper<br>1 concrete saw (Optional) |

| TOOLS REQUIRED | MATERIAL |
|---|---|
| Brooms<br>Tamper<br>Lute<br>Rakes<br>Shovels<br>Pavement Breakers<br>Picks and miscellaneous hand tools | Bituminous concrete, maintenance patch<br><br>1. Top mix (FABC)<br>2. Bottom mix (Binder)<br>3. Tack Oil |

PROCEDURE

1. Set up safety.
2. Send truck for material, if not obtained before leaving yard.
3. Square out deteriorated area with pavement breaker and/or concrete saw.
4. Clean area (blow clean with compressor)
5. Apply tack coat (.10 gal./s.y.). Care should be given to see that the perimeter of hole is completely coated with tack oil.
6. Apply bituminous material in a maximum of 2" lifts (compact each lift) consolidate edges.
7. Compact with a roller or mechanical tamper (rollers should always be used on a patch requiring 1/2 ton or more of bituminous concrete).
8. Tamp where required to consolidate edges.
9. Finished patch should match the grade of the adjacent pavement.
10. Seal and sand patched area to impede entrance of water. (Optional)
11. Travel to next location and continue procedure.
12. Clean and load tools back onto truck.
13. Pick up safety.

NOTE 1: Includes time for: travel, clean-up and secure equipment.
NOTE 2: Safety practices in accordance with approved Safety Manual.

| BASIC CREW | UNIT | WORK FACTOR | UNITS PER HOUR |
|---|---|---|---|
| 4.00 | Ton | 1.25 | 0.80 |

| FUNCTION CODE | FUNCTION DESCRIPTION | WORK STD. CODE |
|---|---|---|
| 4501 | Roadway Patching - Permanent | 001 |

TABLE I

# LANE MILES OF MAINTAINED STATE HIGHWAYS

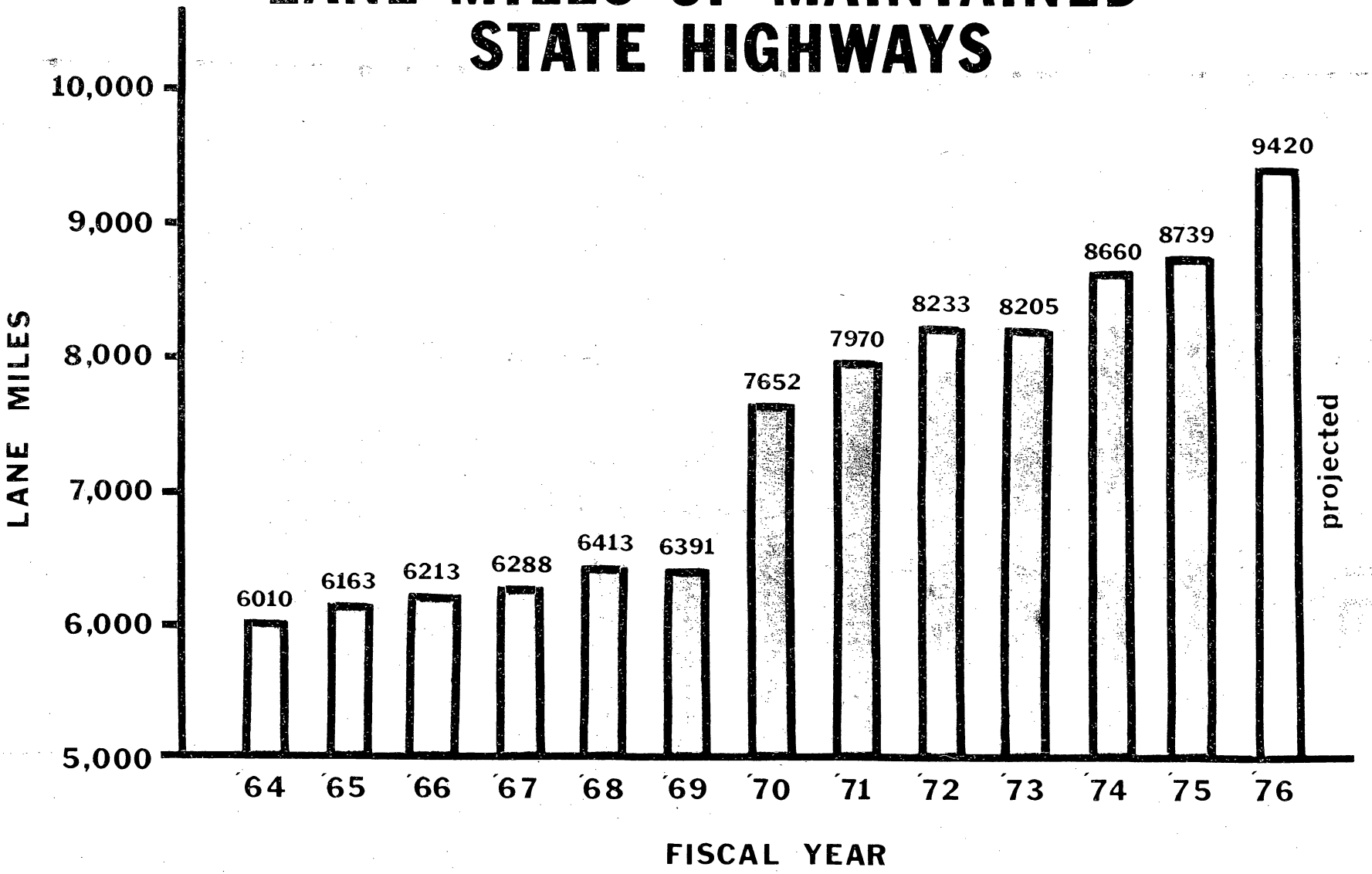
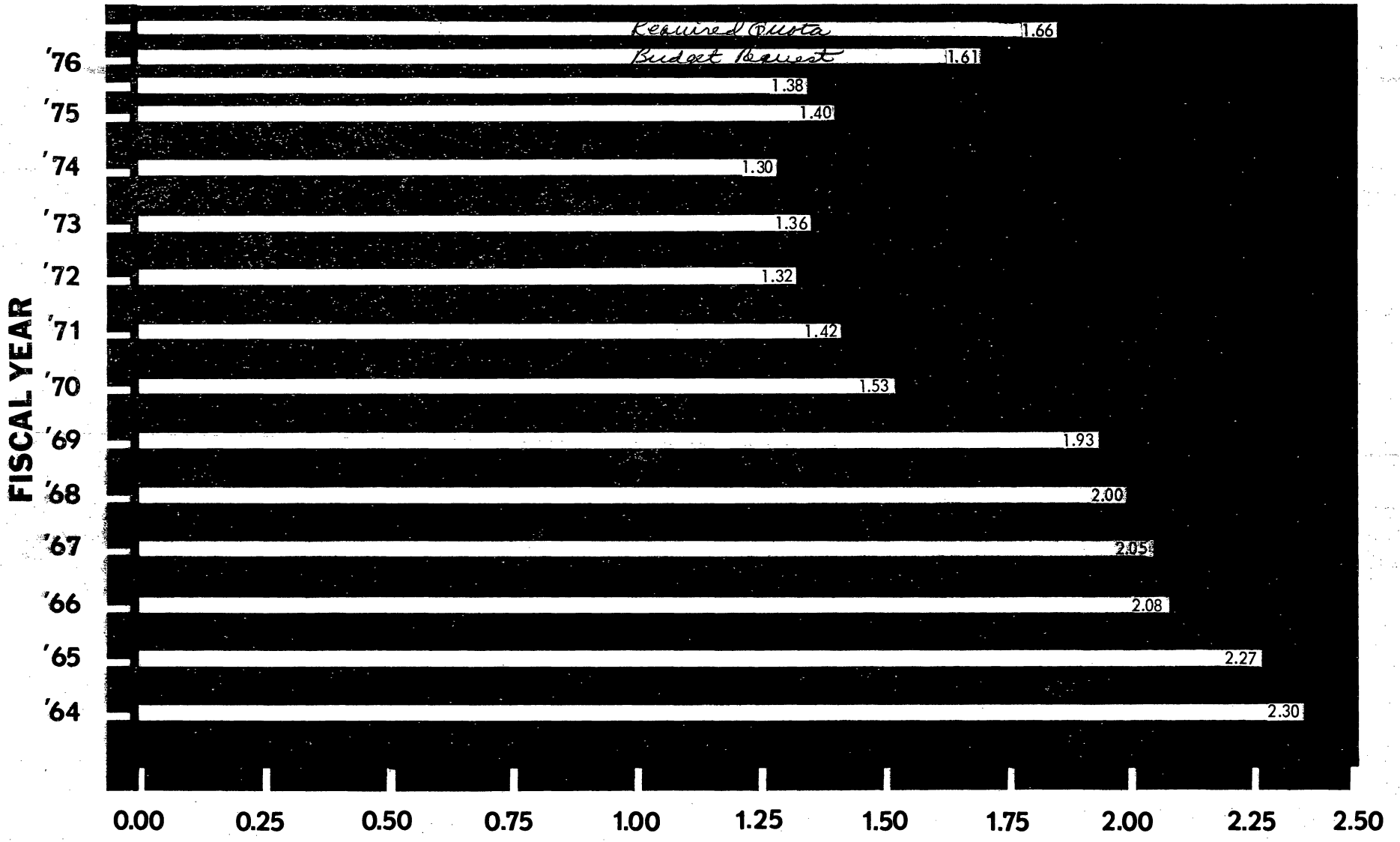


TABLE II

# NUMBER OF MAINTENANCE FIELD PERSONNEL PER TEN LANE MILES



# LANDSCAPE MEN PER HUNDRED ACRES

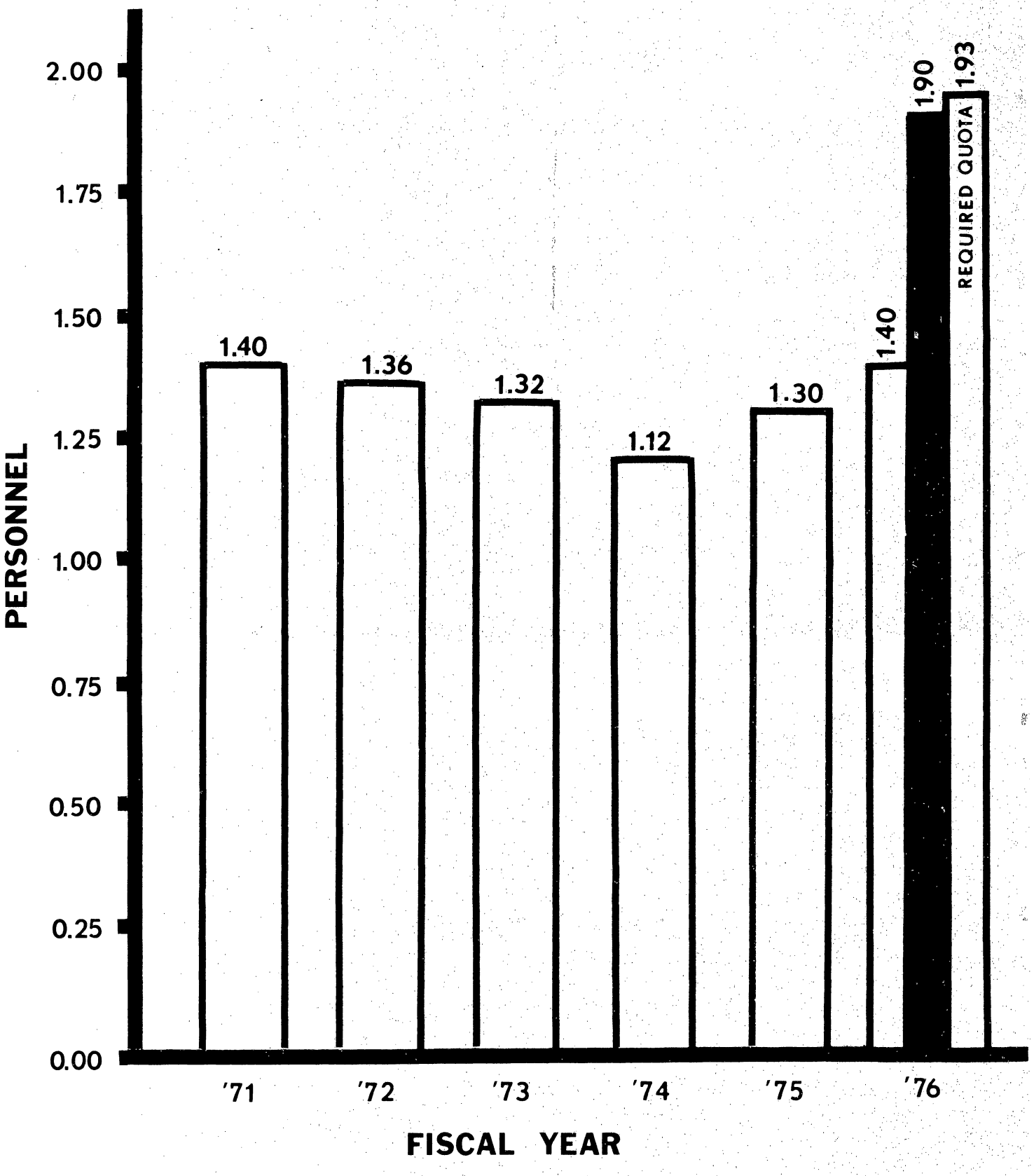



TABLE III

# NUMBER OF MECHANICS PER PIECE OF EQUIPMENT
# 1964 - 1976

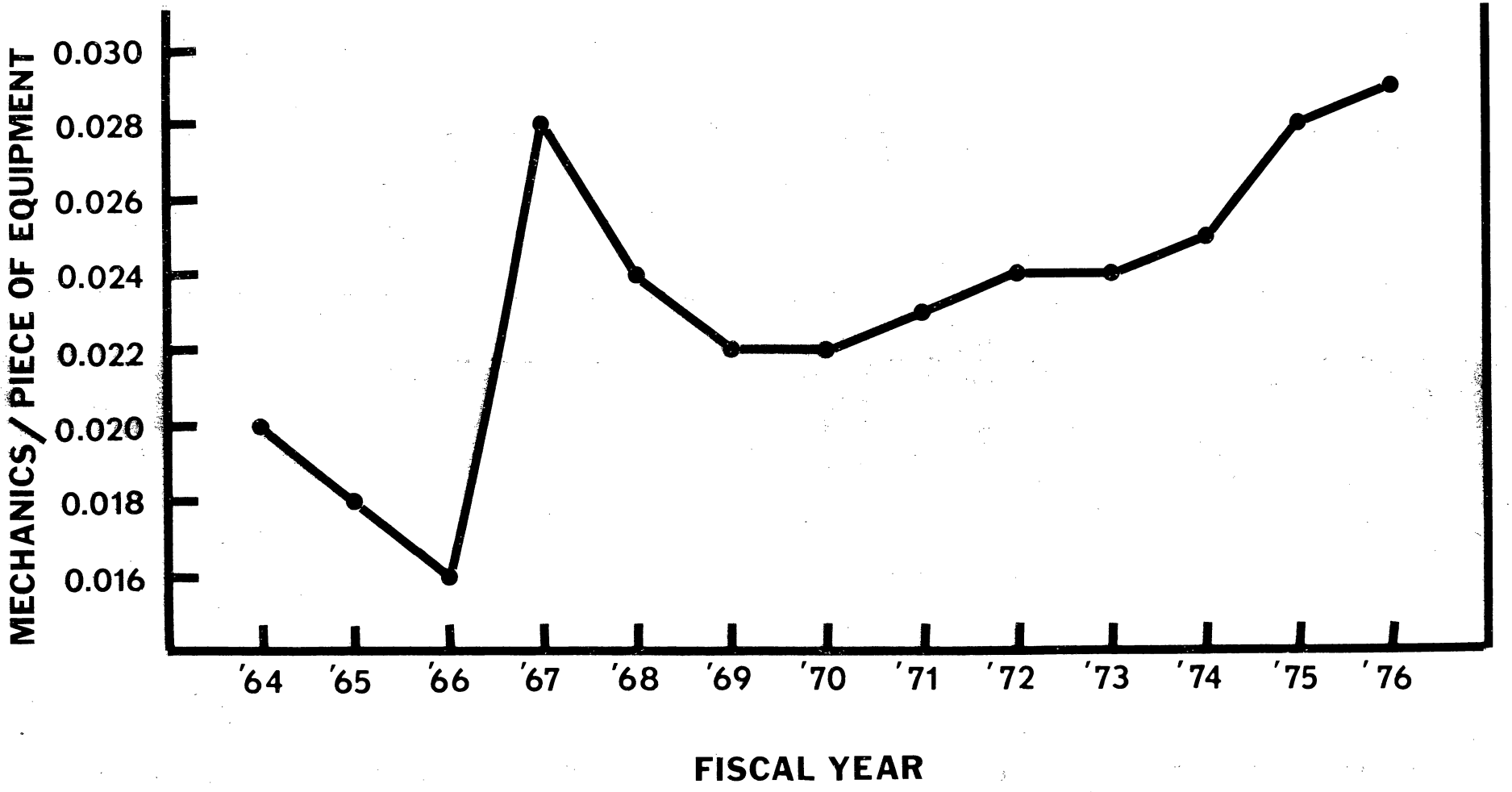



TABLE IV

# GROWTH IN TOTAL ELEC. UNITS MAINTAINED Vs. ELEC. MECHANICS & FOREMAN

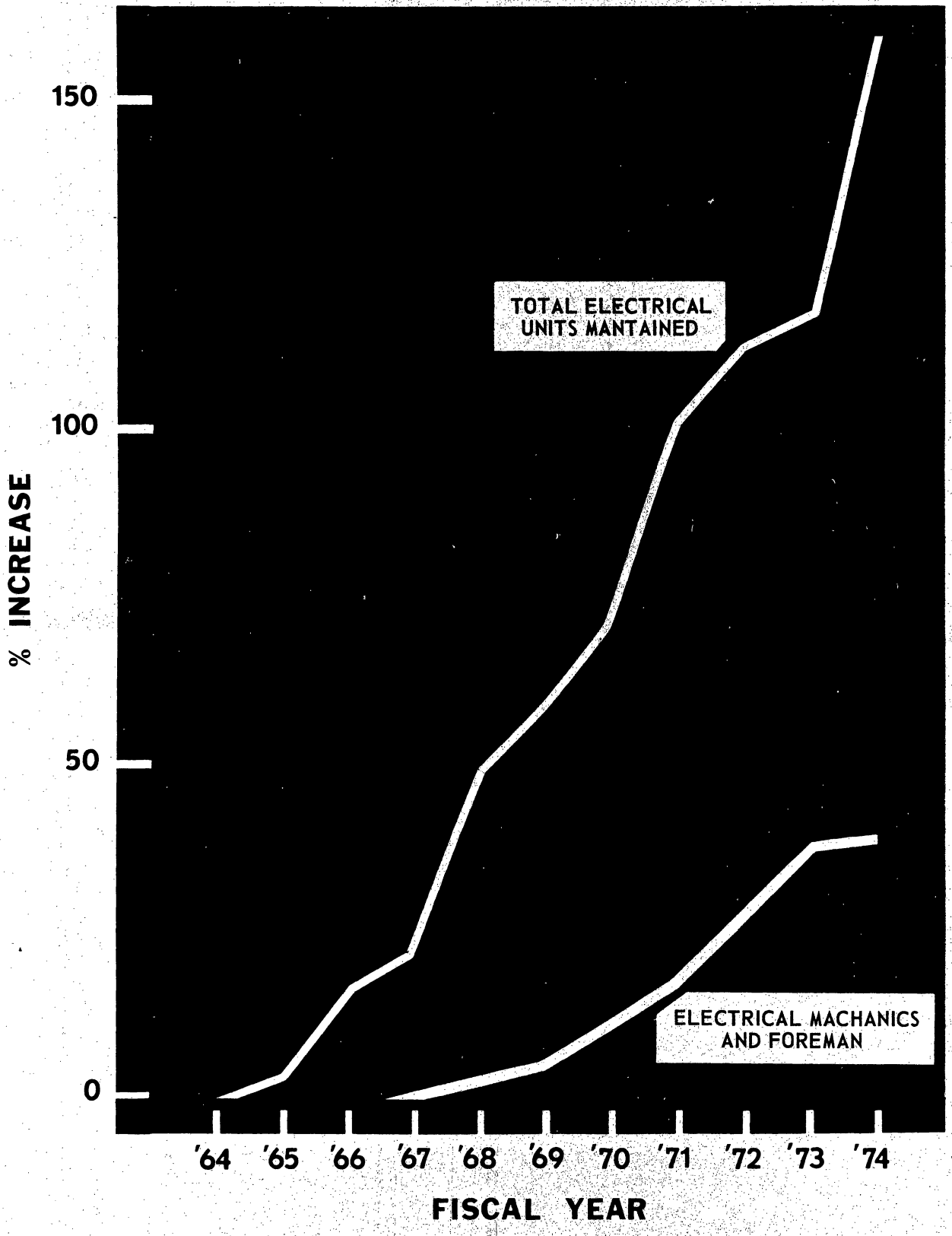



TABLE V

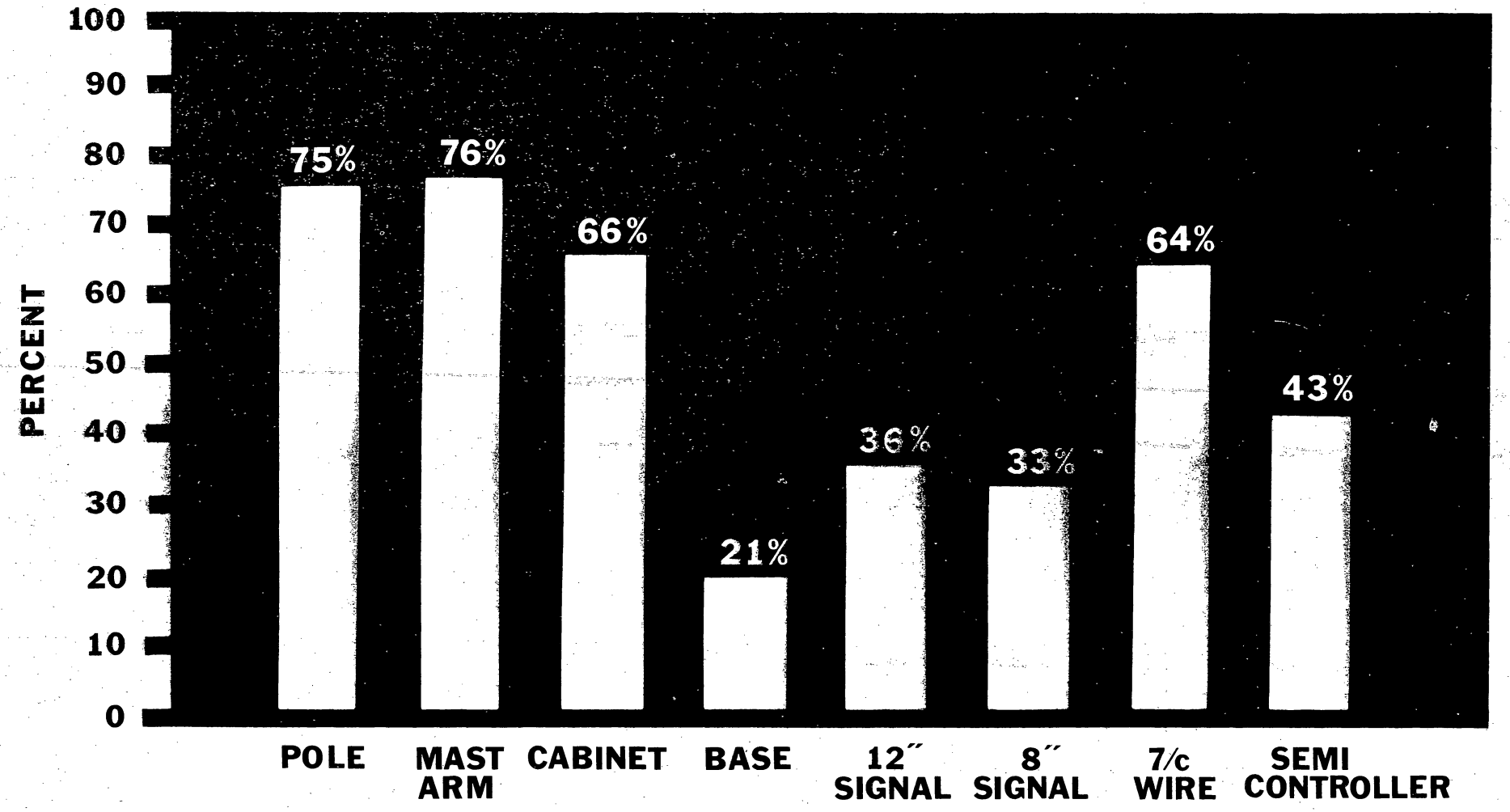
# DIVERSITY OF EQUIPMENT

TABLE VI

| TYPE | NO. OF VEHICLES | NO. OF BRANDS |
|---|---|---|
| Mowers, Rotary (TRC Pulled) | 71 | 6 |
| " Rotary (Walk Behind) | 110 | 6 |
| " Rotary (Built in Sulky) | 43 | 6 |
| " Sickle (Walk Behind) | 17 | 2 |
| " Rotary (TRC Side Mounted) | 5 | 2 |

# PERCENT COST INCREASE PER COMPONENT SINCE 1972

TABLE VII



## Selected Statewide Work Standard Codes

| Code | Description | Unit | Productivity |
|---|---|---|---|
| 501 | Mow Grass* | Acre | 5.1 % |
| 059 | House Keeping | Hours | 97.7 |
| 095 | Litter Patrol | Mile | 74.7 |
| 002 | Random Patch Pavement | Ton | 76.9 |
| 001 | Roadway Patch Permanent | Ton | 72.8 |
| 071 | Plow Snow | Hours | 107.3 |
| 012 | Random Patch Shoulder | Ton | 92.4 |
| 067 | Equipment Repair | Hours | 101.5 |
| 079 | Transfer Material & Supplies | Hours | 102.4 |
| 049 | Hand Sweeping | Mile | 118.0 |
| 075 | Spread Winter Material | Hours | 98.2 |
| 149 | Resurface Exceeding 3/4"* | Ton | 0.0 |
| 097 | Litter Pick Up Walk | Mile | 57.4 |
| 041 | Repair Guard Rail | Linear Feet | 106.7 |
| 011 | Patch Shoulder Permanent | Ton | 66.1 |
| 145 | Storm Damage Extraordinary | Hours | 103.8 |
| 007 | Cutting Joints | Unit | 138.5 |
| 098 | Litter Miscellaneous | Hours | 100.8 |
| 063 | Gas Attendant | Hours | 99.5 |
| 033 | Mow Grass 5' Wide Machine* | Acre | 0.0 |
| 315 | Reflector Sign Repair | Unit | 64.8 |
| 701 | Bridge Substructure | Hours | 99.8 |
| 533 | Trim Trees | Unit | 85.2 |
| 035 | Remove Weeds From Curb | Mile | 71.2 |
| 076 | Handle Winter Material | Hours | 98.2 |
| 089 | Erect Snow Fence | Unit | 220.3 |
| 069 | Equipment Pick Up & Delivery | Hours | 99.0 |
| 027 | Hand Clean Ditch | Linear Feet | 87.7 |
| 100 | Machine Sweeping | Mile | 40.7 |
| 013 | Regrade Shoulders | Mile | 56.5 |
| 019 | Hand Clean Inlets | Unit | 45.0 |
| 125 | Replace Inlet & Manhold | Unit | 165.2 |
| 503 | Hand Mowing* | Acre | 91.9 |
| 551 | Woodland Clear | Acre | 125.9 |
| 015 | Surface Treatment Shoulder Stone* | Unit | 0.0 |
| 047 | Maintain Rest Area | Unit | 54.1 |
| 121 | Cut, Fill & Wash | Cubic Yard | 52.4 |
| 005 | Pour Cracks Bituminous Concrete | Linear Mile | 51.1 |
| 031 | Mow Grass Small Machine* | Acre | 14.2 |
| 061 | Wash Equipment | Unit | 81.7 |
| 018 | Reconstruct Shoulders | Cubic Yard | 73.9 |
| 320 | Reflector Sign New Installation | Unit | 99.2 |
| 085 | Erect & Remove Inlet Marker | Unit | 183.8 |
| 309 | Paint Stop Line | Yard | 70.0 |
| 703 | Bridge Painting* | Gallon | 26.7 |
| 091 | Remove Snow Fence | Unit | 85.0 |
| 073 | Paint & Repair Plow | Hours | 100.0 |

* seasonal functions - work not normally performed during this period.

Source: Project Management Report - Maintenance Productivity
12-7-74 - 1-03-75

TABLE VIII