

ROAD MAINTENANCE EQUIPMENT

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I intend to address my remarks chiefly to public officials, keeping in mind that a goodly number of equipment men are present, of whom each and every one, in his own mind—sells the best equipment on earth, bar none.

First, I take up a question of vital importance especially to those public officials present who are executives, the matter of buying equipment.

The public official having the power to decide the purchase of equipment must be honest. He must also frequently, and with definite finality, be able to use that little word of two letters pronounced "No!"

The third prerequisite to successful purchase of equipment is accurate knowledge of what is best to do the job planned. This is chiefly a problem of fact finding—facts about the job and facts about the equipment.

My own decisions have been based chiefly on interviews with contractors, superintendents and other men who have actually used the equipment in question.

The ideal way to buy materials or equipment on public work is first to draw up detailed specifications, and then receive sealed bids from those able to furnish.

Take the case of materials such as stone, gravel, tar and asphalt. We have specifications in great detail on these. We can take bids and make awards on the low price. It is easy to make tests and see that specifications are met in all particulars.

In the matter of equipment, however, we have no specifications even for small tools that will permit us to take bids and buy on price. And when we come to large equipment the problem is still more complex.

Take the matter of motor trucks for example. Suppose you want to buy a two-ton truck. About the best you can do is to make a few general requirements as to power, capacity, body, tires, etc., and ask for bids requesting that detailed specifications be submitted with each bid. You can get a score of truck manufacturers to quote you a price and each will claim his is the best buy at the price. No two trucks will be exactly alike and there is much ground for difference of opinion as to the best "buy." It is obvious that under these conditions low price can not be the controlling factor, because the price

each quotes is for a different article. But the public official has to satisfy himself which offer best fits his needs.

This is the big difficulty in the purchase of equipment. The greatest help is a thorough knowledge, not only of the equipment, but of the job it is going to be called upon to do.

It pays to take good care of equipment. Too much equipment is left out in the open, exposed to the weather, and at the mercy of every thief. Adequate storage should be provided during the winter months. Frequent inspections should be made during the working season and complete overhauling should be done during the winter season. It costs a lot to have a machine break down during the working season, and no money is better spent than in the forestalling of breakdowns.

Standardization of Equipment

There are many reasons for standardizing equipment. With but one make of truck in a district the truck drivers and mechanics learn how best to operate and repair it. Better service can be given because less repair parts need be carried to take care of all needs. I must say, however, that this is an ideal hard to realize on public work, especially if you have several firms manufacturing the same kind of equipment in your state.

Recommendations on Equipment

It is with great hesitancy that I take up the matter of making detailed recommendations on equipment. The thing that makes road work fascinating is its variety. Because topography and climate varies everywhere so do road problems differ in their character and the nature of the equipment best adapted to their solution.

In many of the things I am about to say you may not agree with me, because you have in mind one set of conditions and I another. I therefore, would ask that caution be used in following out the recommendations I am about to make.

I do not intend to give free advertising any more than I can help. Therefore, although I am perfectly willing to answer any questions you may ask, I must place this condition—that I will not here publicly indicate a preference between particular machines by name. If any of you care to talk with me privately I will express my views frankly, giving the reasons for my opinion.

Grading Equipment

Many states are carrying on a program of stage construction which is closely allied to maintenance work. In Ohio we completed 823 miles of this sort of work in 1925, and it has

met with great popular approval. This operation has been carried out in outlying districts and the poorer counties where travel is not heavy. If such communities had to wait for \$40,000 per mile roads they would be in the mud for 25 years hence. We have given them an all year road at an average cost of \$3,000 per mile. The old road has been widened out and minor relocations made. Repairs have been made to bridges and culverts. The old road metal has been salvaged and local materials used wherever possible. On account of a large program outlined we have found it economical to purchase heavy equipment. This stage construction grading merges into gravel or traffic bound macadam maintenance. For grading operations we have found the following combinations of equipment most satisfactory.

1. In hilly country, 10-ton crawler type tractors worked in pairs, one with a twelve-foot blade and the other immediately following with a ten-foot blade grader. On this sort of an operation we prefer the leaning wheel type of grader because it is free from side slipping, it moves the earth higher and is more easily and quickly pulled out of the ditch. We prefer the track laying type of tractor in all cases because it is not so apt to tear up the road surface or get mired in bad places.

Under certain conditions in hilly country we are using gasoline shovels with $\frac{3}{4}$ cubic yard buckets on crawler type running gear. I look upon the gasoline shovel as one of the recent outstanding developments in road building equipment for rural highways. There are several good shovels of this type on the market. It is far better than the old time steam shovel for light shovel work because of its lower operating costs. Where frequent moves are necessary there is no bother with the water lines or fuel transport problems. In coal mining communities and oil well districts there is no trouble with bad water as with the steam boiler on a steam shovel.

You are familiar with wheel and slip scrapers, the latter for short hauls on small jobs and the former for longer end hauls. The wheel scraper, however, is not well adapted to stage construction operations because there is rarely room in the ditch for it to load, except on relocations.

2. In rolling or flat country other types of equipment have proven efficient. Where cuts are long and frequent turns are not necessary we have found the small model of elevating grader most valuable. With a sufficient number of trucks, Fords with gravity dumps are good, it will move an enormous amount of material at a small cost. Under certain conditions I have never seen anything quite so efficient as a small elevating grader for cleaning ditches.

Roadbed Maintenance Equipment

Here again the type of equipment depends upon the topography. In Ohio we have everything from the flat plains, a century ago the black swamp of northwestern Ohio, to the hills of southeastern Ohio which are as rugged as some so-called mountainous districts in the eastern states.

In southern and southeastern Ohio we are bothered with slips and slides. The road may slide away or a hill may slip down on the road. It is too expensive to move in a shovel for this sort of small work, and it is agonizing to watch a gang of men shoveling this earth into trucks by hand.

No piece of equipment has proven more valuable for this sort of work than a small crane with clam shell bucket mounted on a truck. We own a number of these in Ohio, and while we have some of the half circle swing type and some with the full circle swing type, we much prefer the latter for moving slips and slides. Our principal reason for this is that we work with the road open to traffic and the road need not be blocked with the full circle swing.

A small ditcher originally designed for cleaning farm ditches which will do light ditch cleaning has appealed to me as a good tool, inexpensive and valuable for back slipping and other operations where the superintendent or engineer gets gray haired watching laborers waste their time.

The one-man motor patrol grader is a valuable piece of equipment for shaping up shoulders.

Cutting Weeds, Etc.

The best job of grass and weed cutting is done with a farm mower having a six-foot cutting bar that will cut at any angle between 45 degrees above or 45 degrees below horizontal. A machine of this kind pulled by a good team driven by the owner who lives along the road is the best combination for a good, clean, economical job of weed cutting that has ever come to my attention. The trouble is, however, that few farmers have such a type mower and also they may be busy at other work when you want your weeds cut.

We have used several types of cutter bars attached directly to Fordson tractors. We believe, however, that the special highway mowers, preferably with cutter bar that can be raised or lowered 45 degrees from the horizontal pulled by a team or tractor and operated by a separate man, gets the best job. A team will get into places a tractor can not, thus reducing to a minimum the work which must be done with scythes by hand.

Gravel and Traffic Bound Macadam Maintenance Equipment

I refer here to gravel or stone roads maintained by dragging. There are two problems to be solved in this operation: (1) keeping the surface smooth and (2) replacing surfacing material blown away.

In the matter of keeping the surface smooth there are many ideas. Here again this may be caused by varied conditions such as different gravels and stone, and also difference in the volume of traffic. I do not know of any one piece of equipment that will keep a gravel or traffic bound macadam road smooth. If a thin layer of gravel or stone can be maintained over the surface much will have been accomplished. High speed rubber tired traffic rapidly throws the material to the sides of the road, leaving the center bare and in condition to go into pot holes. The loose material should be kept constantly thrown back on the center of the road. The best tool I have ever seen for this purpose is the spring grader blade mounted on springs and turned to the road surface as a razor blade is to a hone. We used to mount this type of blade on trucks received from the government, and still have many so utilized, but the trucks are rapidly wearing out and we are now using the same kind of blade in place of the stiff grader blade on the one-man motor grader. This spring blade carried along the road at 10 to 12 miles per hour will do a very good job of throwing back to the center of the road and covering the surface with a uniform layer of loose material.

But this sort of an operation is not enough. The large sled drag is indispensable if you are to get a smooth riding surface. As compared with the grader blade it is the same as the carpenter's plane compared to a draw knife. These sled drags should be used every few weeks and when the surface is in proper condition to do the most good. With proper equipment and correct manipulation of materials a gravel road can be made as smooth for riding as any hard surfaced pavement ever built, and much smoother than the average built in the past.

Now let us consider the matter of replacing surfacing material. This problem may be handled in three ways.

- a. It may be shipped by railroad from commercial plants.
- b. Gravel may be obtained from gravel pits or stream deposits.
- c. A local stone quarry may be used to supply stone.

Where materials are unloaded from railroad cars, car unloaders and trucks are necessary equipment. In Ohio we contract with trucking companies for this sort of work. Bids are taken for material per ton spread on the road.

The working of local gravel deposits is so involved in local conditions that each location is a problem in itself. One very satisfactory piece of equipment for this sort of a job is a certain one unit gravel crushing, screening and loading plant. Material is delivered to a belt conveyor usually by a drag line. It is then elevated to screens and oversize material turned into the crusher. It is finally delivered to the waiting truck by means of a belt conveyor. No other piece of equipment equals it in performance, compactness and portability.

Recently developed equipment valuable in gravel pits include belt conveyors, bucket loaders and truck mounted clam shell cranes. Drag line outfits can be used in many places to good advantage, depending on the depth, area covered and over-burden of the gravel deposit being worked.

In some districts where there is no gravel it is possible to crush and screen local limestone. For a small operation an air compressor operating drills is very handy. For larger operations a well drill should be used for blasting holes. The best quarry arrangement is where the crusher can be placed much lower than the quarry floor. The stone may then be chuted to the crusher platform into the crusher and then elevated to the storage bin. I have seen cars with small gauge track and Fords with gravity dumps used to good advantage on local limestone quarries, depending on conditions. We prefer the gyratory type of crusher generally because it produces a more uniform size and has low up-keep.

Bridge and Culvert Maintenance

Bridge and culvert maintenance is sometimes sadly neglected, particularly the repainting of steel bridges. I have heard arguments pro and con on the use of sand blast for cleaning and the air brush for painting steel bridges, as against hand methods. I believe there is a place for both. Inaccessible places are best taken care of by the sand blast and air brush. On the other hand a better job is obtained with the paint brush on accessible surfaces. Much depends on the personal skill of the operator. The paint spray frequently causes damage to the finish of passing motor vehicles. Both methods are being used with success.

In each division in Ohio we are employing one, and in some divisions several gangs as part of our maintenance organization, exclusively on the extension of small culverts and the rebuilding of small bridges. Concrete bridge work requires experience and skill. We use concrete mixers mounted on rubber tired trailers, easily portable, and other equipment necessary on this sort of an operation.

We have found the cement gun a valuable unit for economical repair of certain kinds of masonry abutments. Bridge and culvert maintenance is so different from other road work that I believe it deserves special attention by experienced men with adequate equipment.

Macadam Maintenance

The largest piece of equipment used on macadam maintenance is the motor truck distributor for applying bituminous surface treatments. There are several good distributors on the market that will handle materials, both for cold and hot application. The tendency has been to simpler design, less pipes, etc. A recent development is the use of a separate motor for pump operation. This is especially valuable on penetration work and in hilly sections.

For cleaning the road surface a good Fordson sweeper is on the market, built stronger than the old horse-drawn sweeper. This design has the broom back of the operator which is a distinct advantage.

The biggest part of macadam road patching today is with bituminous materials. Tilting drum type mixers with skip are preferred for mixing stone and bitumen because they clean easier.

I have found the small Fordson type roller, of which there are several makes on the market, a labor saver in places where there is extensive patching. It can be easily loaded into a truck and cheaply transported from job to job.

Heating kettles of two-barrel capacity are well adapted for macadam maintenance. We buy them in all cases equipped with oil burners. This feature is well worth the extra cost as it eliminates much loafing waiting for the kettle to heat up. There have been some accidents due to exploding gas from heaters, but this can be avoided with proper care.

Equipment for Repair of Concrete, Brick, Etc.

The air compressor with paving breaker is the most recent development for concrete road repair where replacements are necessary. This applies to all concrete base pavements.

The same recommendation for heating kettles as mentioned under macadam applies to concrete and brick pavement repairs.

A special air hammer mounted on wheels is the best tool we have seen for taking down high spots or raised points on concrete pavements. We have seen an attachment for the Fordson tractor with revolving grinding wheel, but this is not nearly so fast as the air hammer recently developed.

On account of limited time I omit here the discussion of several classes of equipment such as those for snow removal, proper machinery and tools for garages, etc.

The Motor Truck on Road Repair

There is the Ford truck. It is low in first cost. In many places it could replace some of the war time junk, still called trucks, at a fraction of the operating cost. On hauls up to 3 miles it is the most economical. Over that it fails. On hills and in hard going the cooling system fails. In Ohio we equip all new Ford trucks with auxiliary transmissions. There is no use overlooking the low cost of repair parts and the ease of handling Ford trucks.

For general maintenance work I would buy a two or two and one-half ton truck, pneumatic tires all around, dump body and hydraulic hoist with full cab. On long hauls over good roads bigger trucks may be advisable, but I believe this sort of work is more economically contracted. We can not afford to buy these trucks in Ohio when haulage contractors will do the work for less than our costs. The best truck in this class, bar none, in all-round reliability and freedom from breakdown is the "Class B" Liberty Truck supplied to the states by the federal government.

New Equipment Needed

Road equipment is much better designed than it was a few years ago. Teams formerly were used much more extensively, but they have been largely displaced. Much trouble was experienced awhile back attempting to use tractors to pull machines designed for teams. While we have little of this sort of trouble today, yet there is much room for improvement in other ways.

The chief source of trouble occurs where the manufacturer's engineers do not have the practical knowledge of the work the machine has to do.

Motor truck bituminous distributors need wider tires on penetration macadam work. Better heating facilities, in the way of a burner made of metal of higher heat resisting quality and designed to secure more complete combustion will save much valuable time now lost. Provision should be made in the design to reduce piping to a minimum and to automatically heat all pipes, even the spray bar.

A street sweeper should be provided of more sturdy design than those still being manufactured and never intended to be pulled by tractors or moved at high speed from job to job.

In general a better running gear is necessary on maintenance equipment because it very frequently must be moved and moved in a hurry. This applies to belt car unloaders, tar kettles, concrete mixers and other machines.

We are doing more and more maintenance work in the winter. This is because our roads are used more in the winter than formerly. Note the popularity of the closed car and the increased use of the motor truck in business. This means that we must provide greater protection against cold for the operators of trucks, graders, etc. For the same reason I favor closed cars for all engineers and superintendents who must drive long distances in all kinds of weather.

There is a big field for new equipment on maintenance operation on rural highways.

A central mixing plant lay-out for mixing cold patch bituminous materials would meet a popular demand.

A central mixing plant for concrete road repair would fill a need. It could be designed to set up at the railroad siding, using say a 10-L size mixer on rubber tired trailer, batch boxes and belt conveyor to charge the mixer.

Where the mixer must be placed on the road and half the road kept open to travel on concrete road repair a mixer is needed that can be turned 90 degrees for loading the skip on the pavement.

Half the labor in erecting guard rail is in digging post holes. I would suggest that in view of the many attachments made for use with a Fordson such a post hole digger might be made, using the tractor for power. In fact I know of one now being perfected. Another solution would be to design a post-hole digger to be run off an air compressor. At my suggestion a certain company spent some effort on this problem, but so far without notable success.

Conclusion

Last week in company with an Ohio road contractor I stood on the balcony of the Coliseum at the Road Show in Chicago. We were looking down on a magnificent array of road building equipment, estimated to be worth \$3,000,000. I remarked to him, "What would some of the old 'side-walk' contractors say if they could see this?" The contractor ever with the point of view of his tribe replied, "I am wondering what a man would do who had it on his hands with no work to do." The moral of this story is:

"Don't tie your money up in expensive equipment unless you have work for it to do."

Contractors must obey this rule or go out of business. Public officials must follow it or be kicked out of office.

The justification for buying equipment depends on the economy of what it will do as compared with other methods.

On public work and particularly on highway maintenance work there is another very good reason for the extensive use of labor saving equipment. Most all road repair operations are carried on with the road open to traffic. The work is done under the eye of every passer-by. The farmer, not very prosperous these last few years, is especially critical. Every time a laborer, even for a moment, rests on his shovel handle, several heavy tax-payers see him. And you know what happens. We depend upon public opinion for the support of an adequate highway program. I am, therefore, in favor of keeping the number of public employees on rural highways down to a minimum. Labor saving machinery is the best way to do this.

The volume of road maintenance and repair work on highways is growing by leaps and bounds. It offers a field of opportunity for the road equipment manufacturer and the road contractor.

The greatest loss in connection with equipment generally is the loss when it is not working. The purchaser of equipment, therefore, be he public official or private contractor must know that he has superintendents with ability and finances adequate to make that equipment earn more than it cost. I say this because no equipment can take the place of the man who has good judgment, initiative and energy to do things.

HEAVY GRADING EQUIPMENT

By S. N. Johnson,
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The outstanding cause of bad roads is poor drainage or no drainage at all. Road drainage is just as essential as farm drainage. The success of gravel road maintenance depends largely upon this factor.

Clinton county has 841½ miles of county roads, many of which were constructed more than 25 years ago. Very little attention was given to drainage in their construction.

Late in the year of 1924 we purchased a 10-ton tractor and a 12-foot blade grader, and began opening up side ditches on our gravel roads. About 65 miles were given just one