Salt Stabilization on Ohio's Secondary System

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● OHIO'S state road system consists of about 18,000 miles of various types of highways. The most expensive maintenance costs are incurred on those roads which carry the least amount of traffic, the farm-to-market portion of our highway net. The annual maintenance cost of the poorest of this mileage has averaged about $1,000 per mile over the last ten years and some 1,500 miles are in critical need of repairs at this time.

This secondary mileage, generally carrying from 100 to 300 vehicles per day, is of trafficbound or trafficbound surface-treated type. These roads have been gradually built up over the years by the occasional addition of aggregate, application of dust control materials, and routine surface and ditch maintenance; some have been surface treated, with resultant winter and spring failures and increased maintenance costs. It was considered essential to strengthen bases and remedy deficiencies permanently by incorporating additional aggregate in varying quantities and adding a stabilizing agent, and experimental work was undertaken to develop a low cost construction method to accomplish this purpose.

Different materials have been used to stabilize surfaces and shoulders on selected sections with varying degrees of success. Some 25 miles of trafficbound surfaces were rebuilt in 1955 by state forces with rock salt as an additive, and results conclusively indicated the desirability of utilizing this type of construction to improve existing unsatisfactory surfaces.

Several factors were considered in setting up the program. Limited funds made it imperative to keep the cost down, and a brief general specification was prepared to permit maximum job control under experienced field supervision. Required operations could be done prior to the regular surface treating season, thus giving a large group of regular bituminous contractors the opportunity to perform early work at a probable cost advantage to the state. Existing roadway materials were used in the work, and aggregate was added as required. Existing intermediate satisfactory road sections were undisturbed, and contracts were set up to cover only weak and unstable portions. Detour routes were generally unavailable, and all work was accomplished under traffic.

Specifications were prepared and 28 projects varying from a single section 3 miles long to a group totaling 21 miles in length were sold in March 1956 as purchase order contracts to complete about 260 miles of contract stabilization work on secondary surfaces in five highway divisions, with headquarters at Ashland, Newark, Chillicothe, Marietta, and New Philadelphia. Completed work averaged about $3,500 per mile, and all jobs were finished by June 30.

The purchase order contracts covered furnishing all services, labor, materials, and equipment to recondition existing base and surface in conformance with modified stabilized base course specifications at designated locations by scarifying, pulverizing, incorporating sodium chloride (furnished by the state f.o.b. state storage), additional aggregate, and water, mixing, compacting, reshaping and adjusting to uniform grade and cross-section, and applying a bituminous prime with cover chips.

Contracts listed a minimum number of individual pay items to complete the work. These items consisted of (a) cubic yards of aggregate to be furnished, hauled, and tailgate spread at a stipulated rate per mile; (b) square yards of surface reconditioned in conformance with base course specifications, including addition of sodium chloride at a prescribed rate per square yard per inch; (c) thousands of gallons of water, furnished and applied as directed; (d) gallons of bituminous material furnished and applied at a stipulated rate per square yard; (e) cubic yards of aggregate furnished, hauled and spread at a stipulated rate per square yard as cover; (f) lump sum premium on industrial insurance; and (g) lump sum for lights, signs, and barricades.

Operations started by scarifying existing surfaces to a depth sufficient to eliminate all surface irregularities and provide sufficient soil binder to consolidate finished mixture; specifications provided a minimum scarification depth of 4 in., but it was generally necessary to go deeper to obtain desired results. This material was then broken

Figure 1. Typical surface condition prior to stabilization.

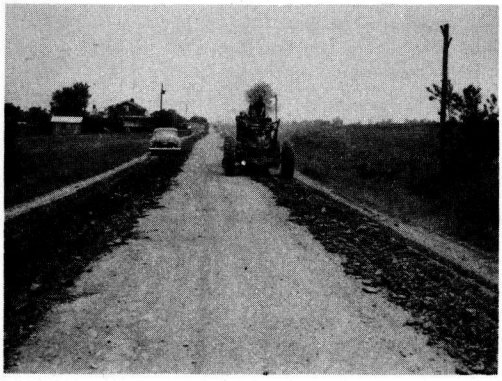

Figure 2. Scarifying existing surface.

Figure 3. Pulverizing existing base material.

Figure 4. Existing base material windrowed to sides.

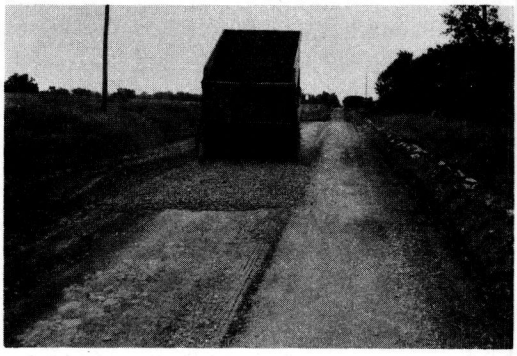

Figure 5. Spreading aggregate.

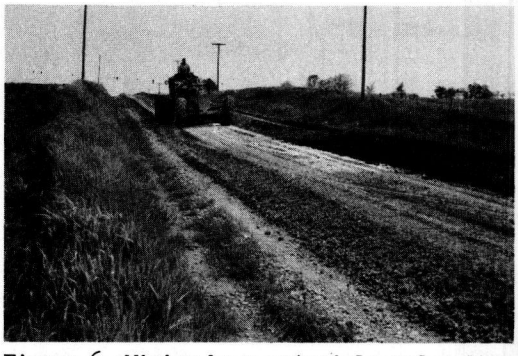

Figure 6. Mixing base materials and sodium chloride.

up and reduced to a uniform condition, with a maximum particle size of 2 in. Power driven rotary pulverizers were used for this work by most contractors with good results.

All loose material was then windrowed to the sides in preparation for spreading additional aggregate to specified widths. The base was sprinkled, if necessary, and aggregate was tail-gate spread at rates varying from 500 to 750 tons per mile; additional aggregate was usually crusher run or pit run stone, air cooled slag, or gravel, with a top size of 1 in. Some graded sizes were specified, but uniform and dense mixes were obtained with crusher or pit run. About one-half of the windrowed material was bladed on top of the new aggregate, and sodium chloride was applied at the rate of one-half pound per square inch of thickness of conditioned material. The remainder of the

windrow was placed over the sodium chloride, sprinkling was started, and materials on the base were mixed together. Power driven rotary type mixing machines, travel plants, or motor graders were permitted in the specifications; most of the mixing was done with graders, with materials being handled a minimum of three times on the mold board.

The addition of water was a critical job item, and good judgment on the part of the engineer was imperative. Specifications stipulated that the mixture should have "proper moisture content" for maximum compaction, and permitted the engineer to add water as required. Extreme caution was exercised by the contractors in controlling water content, because a "too wet" mix required

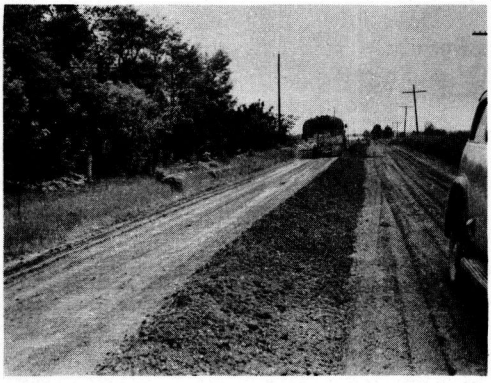

Figure 7. Applying water.

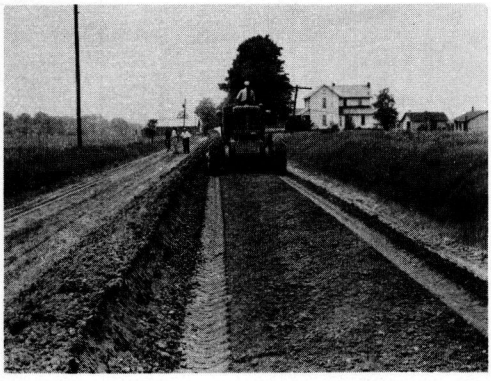

Figure 8. Mixing base material.

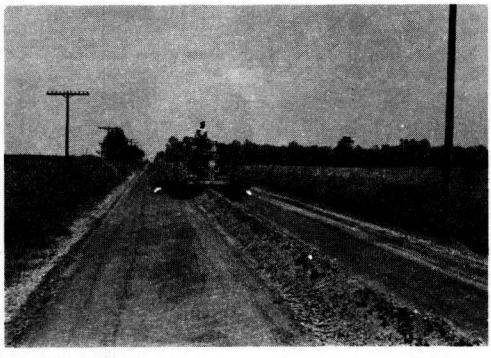

Figure 9. Spreading top course.

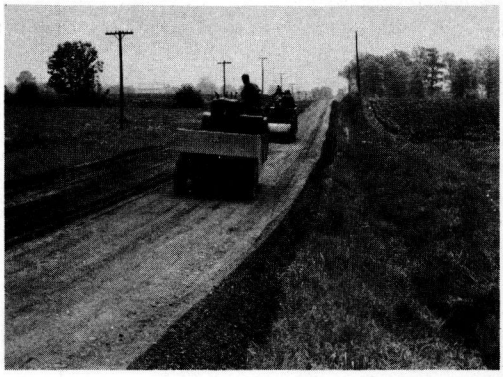

Figure 10. Rolling with tandem and pneumatic tired rollers.

Figure 11. Applying bituminous prime and cover chips.

Figure 12. Finished surface.

drying out with resultant mixing delays. Material was windrowed and manipulated to permit continued traffic movement, and placed in uniform layers of about 3-in. depth, loose measurement. Each layer was compacted with tamping or pneumatic tired rollers, with final compaction obtained with a ten ton flat wheeled roller. The top layer was finished to a smooth contour and a crown of one-half inch per foot.

The road surface was lightly bladed and kept in repair until placement of the bituminous prime coat, which was specified not less than seven days after completion of reconditioning work. The prime coat consisted of an application of about one-third of a gallon per square yard of light viscous bituminous material and approximately ten pounds ½-in. top size chip cover. This completed the contractor's obligation and state forces assumed maintenance responsibility until bituminous seal treatments were placed.

Bituminous seals were sold as separate contracts, and applied as soon as possible after completion of the stabilization projects. Minor raveling occurred on these jobs, and some spot priming was required; traffic and weather located a few pockets of unsatisfactory material, and these were patched out prior to seal placement. Bituminous seals consisted of application of about three-tenths of a gallon per square yard of heavy viscous bituminous material, and 20 to 25 lb of cover aggregate at an average cost of $900 per mile.

Recent inspections indicate that all projects are in good condition. Mixes are well consolidated and stable, and surfaces are tight and reasonably waterproof. The specifications covering this type of work, which permitted maximum field control, appear to be adequate, and the program, completed as it was prior to summer surface treatment operations, obtained good results at reasonable cost. Reconditioning existing surfaces by the addition of aggregate and sodium chloride, with a preservative bituminous prime and seal, has successfully stabilized 260 miles of the secondary system, and is believed to be a satisfactory low cost method of reducing maintenance costs and furnishing better traffic service to Ohio's rural highway user.