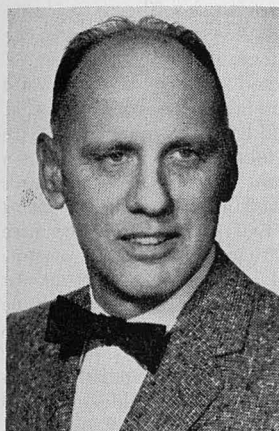


MAINTENANCE OF CALCIUM CHLORIDE TREATED SURFACES AND SHOULDERS

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This is your Fourteenth Annual Highway Conference, and with that record of meetings, it is evident that you consider them worthwhile and of benefit to all



segments of the highway industry in Kentucky. We have similar conferences in Virginia and last October held our Fifteenth Annual Highway Conference. These conferences, we feel, are beneficial to those on the program and those in attendance, not only from the formal presentations, but equally from the informal discussions and individual "get togethers" between meetings and a nights to talk over each other's mutual problems. This thought is most effectively expressed on the fact of your invitation and program which reads—"The purpose of this conference is to bring together state, county and city engineers, various officials, highway contractors and others interested in the design, construction and maintenance of roads and streets, to hear discussions and interchange ideas on matters of general or special interest to those in attendance".

My presentation here is not going to bring you any startling innovations in surface maintenance procedures or any panacea for surface and shoulder maintenance ills caused by inadequate strength or inferior materials. In our opinion calcium chloride is just one maintenance material of many which can be used with success under a proper set of working conditions, all of which must be thoroughly analyzed in advance.

I am a bit dubious about talking to you on this subject because it is probably the case of the student trying to tell something to the teacher. It is my understanding that you had a program in 1959 whereby 750 miles of roads were treated with calcium chloride. We have never had such a large program and I hope that the results of your program will be commented upon during the discussion period.

Since my remarks are predicated on experiences in Virginia, I should first give you a brief sketch of the Virginia highway setup. The Virginia Department of Highways was organized in 1906 and was responsible for the construction and maintenance of a Primary System which grew to some 9,000 miles by 1932. In 1932 the "Byrd Road Act" was passed by the Virginia legislature and in that year the Department of Highways assumed the responsibility for the construction and maintenance of 35,900 miles of county roads in 97 of the 100 counties then existing. This system consisted of 2,000 miles of hard surfaced roads, 8,000 miles of lightly surfaced roads and more than 25,000 miles of unimproved roads. In 1962 approximately 125 miles of interstate highways, 8,000 miles of primary routes and 42,000 miles of secondary routes are being maintained by the Department of Highways. Of the 42,000 miles of secondary roads approximately 22,000

miles are hard surfaced and 20,000 miles are surfaced with stone or local material and provide all weather service except in brief periods of extreme weather such as a sudden spring thaw following extended freezing. I believe you will agree that we have made progress and also that we yet have much to accomplish. What is our plan for improvement and what is our goal? It is our present goal, which has not changed for many years, that we will provide a bituminous surface, or its equivalent, on all roads carrying more than 50 vehicles per day, provide an all weather stone, gravel or soil surface, on all roads carrying from 10 to 50 vehicles per day, and provide a light surface on all roads carrying less than 10 vehicles per day. To advance toward this ultimate goal requires maximum utilization of the engineers ingenuities, the proper selection and application of available materials, and a continuing consciousness of the absolute need for securing the greatest public service from each available highway dollar.

With this background information, I will endeavor to describe to you some specific operations whereby calcium chloride is used as one of many maintenance materials and will comment first on shoulder maintenance.

On the interstate system, all presently constructed projects have provided bituminous paved shoulders, so to date shoulder maintenance has been negligible.

On the primary system, present plans call for shoulders constructed with some type of stabilized aggregate, either commercial or local, and in some cases a calcium chloride treatment applied at the time of construction. On these dense graded aggregates, excellent results have been obtained and shoulder machining has been reduced to a minimum. On one project two years old, it has been necessary to machine these shoulders not more than twice a year. The opposite to this may be found where the shoulder consisted of sand or other granular material with no binder. In this case applications of one pound of calcium chloride per square yard quickly leached out with the result that the benefits derived were short lived, lasting sometimes only one or two months. While the initial result was excellent the need for frequent reapplications negated the results obtained. It was found to be more economical to maintain the shoulder untreated with frequent machining or apply a bituminous treatment.

On locations where resurfacing requires shoulder build-up, we have frequently found calcium chloride to be a help in reducing dust nuisance, expediting consolidation and minimizing machining. Here again the results are dependent upon the type of material used to build the shoulder back to grade. Where open graded aggregate only is used, sufficient binder material is seldom available to provide maximum benefit from calcium chloride treatments, likewise if ditches are pulled to secure additional material excessive clay may be prevalent with resultant muddy conditions in times of extended wet weather. A proper combination of aggregate and binder material can result in an excellent wearing and low maintenance shoulder. While I may sound as if good results are obtained only with an exact combination of aggregate and binder, in reality a little judgment in the choice of shoulder material will suffice to secure a good job. What I do want to stress is the fact that some planning should go into the selection of shoulder materials and particularly where you intend to use calcium chloride, if the greatest benefit is to be obtained.

In the selection of materials for surface stabilization with calcium chloride, even more care and planning is necessary. Before going into this phase of stabilization, I believe a few words on our secondary system improvement policies will assist you in understanding our use of calcium chloride treated surfaces on these roads.

Virginia, although many changes are taking place, is at present basically a rural state having large expanses of territory with a small population per square mile. This is further borne out by the fact that approximately 90 percent of the secondary mileage has a traffic count of less than 400 vehicles per day. As

previously stated there are some 20,000 miles of stabilized but non-hard surfaced roads. It is this mileage that produces our greatest number of complaints and requests for improvement. In order to provide the greatest service to the largest number of citizens, we must use every means available to improve the most miles with the least number of dollars.

We make every effort to use local materials, where available, for base construction to keep costs to a minimum. When satisfactory local materials are not available commercial aggregate is used. We have been quite successful in the use of both local and commercial aggregates, but we also have come to realize that there is nothing like time and traffic to consolidate this surfacing material and also to develop weak spots. The necessity for designing minimum base thicknesses, to extend new construction mileage as far as economically possible, followed by the application of relatively thin bituminous surface treatments, resulted in spot surface failures during the first winter following construction. It was, therefore, decided that on any roads which have a traffic count of 400 vehicles per day or less, that we would attempt the construction in a stage process. This stage process is to construct the road, apply the base material and let traffic use the road through one or two winters, following which the final bituminous surface treatment is applied. The thinking behind this stage construction is that any weak spots in the base or surface would develop and could be corrected prior to application of the bituminous surface treatment, with the final result being a long wearing, patch free and low maintenance cost surface.

While this plan has excellent reasons from the highway engineer's standpoint, the residents along the road and the motorists were not so well pleased. The same old dust problem was with them and with the dust went the binder from the roadway surface. We have, therefore, set up a policy of using a surface application of calcium chloride in the first stage and continued maintenance as a calcium chloride treated road to alleviate the dust problem and to retain the base material so that at the end of one or two winters we can apply the bituminous surface treatment without the need for additional surfacing material.

Specifications for incorporating the calcium chloride into the roadway material read as follows: "Base Stabilization—Just prior to the rotor or other type of mixing, as specified in section 310, calcium chloride shall be applied at the rate of one half ($\frac{1}{2}$) pound per square yard per inch of depth, not to exceed six (6) inches, after which the mixing, shaping and compaction shall be completed in accordance with section 310. An additional application of three-fourths ($\frac{3}{4}$) pound per square yard shall be spread on the surface and when directed, water shall be added."

"Surface Application—Upon the completion of the rotor or other type of mixing, as specified in section 310, one (1) pound of calcium chloride per square yard shall be applied uniformly, after which shaping and compacting shall be completed in accordance with section 310, additional water being applied if necessary. Upon the completion of the shaping and compacting, three-fourths ($\frac{3}{4}$) pound of calcium chloride per square yard shall be applied to the surface and, when directed, water shall be added."

The surface method is the type utilized in secondary construction and maintenance, the base stabilization method being normally confined to base construction on heavy duty primary roads. Base stabilization projects of this type are not being generally set up at the present time.

To maintain these calcium chloride treated roads in a satisfactory condition normally requires the addition of one-half ($\frac{1}{2}$) pound to one (1) pound per square yard of calcium chloride twice a year, once in the spring and again in late summer. This is, of course, largely dependent on the season and the amount of rainfall occurring in the area. In extended periods of dry weather an application of water may be sufficient to bring the calcium chloride back to the surface and thereby materially extend its useful life. It is desirable to hold the number of

surface bladings to a minimum consistent with the maintenance of a smooth surface. Excessive machinings tend to break the surface bond, increase ravelling and thereby shorten the period of time between necessary reapplication of calcium chloride. Maintenance employees in the habit of machining non-hard surfaced roads after each rain must be cautioned to machine these treated roads only on the basis of need which will normally be much less frequent than for untreated roads.

I have found in my own field experience, as Resident Engineer, that in the preparation of a surface for bituminous surface treatment, calcium chloride can be a time and money saving material. Preparation of the surface requires moisture to secure compaction and continuous water application during the conditioning procedure and while awaiting arrival of the bituminous surface treatment outfit can be an expensive item. It is also difficult at times to maintain uniform moisture content, the surface is first too wet and next dusty. The application of one (1) pound per square yard or less of calcium chloride provides the necessary moisture to take care of all needs during this period. In this operation where long term benefits were not important the operation was most successful in sandy soils or granular surfacing material. The only trouble with this procedure was in the case of surfacing material containing enough clay to cause a glazed surface under traffic. Under these conditions scaling of the bituminous surface treatment occurred during freezing and thawing cycles. Similar difficulties have been encountered with micaceous granite and other moisture sensitive materials. Conversely, where bituminous surface treatment is not contemplated, moderate clay content is beneficial. You can see that the use of this material must be tailored to the desired results.

On the many thousands of miles of roads with traffic of less than 50 vehicles per day and no immediate hope of securing major improvement in the form of a bituminous surface, the motorist and residents alike feel that some relief from their dust problems is justified.

We have for many years maintained a policy of applying calcium chloride in front of dairies, stores, churches and schools as a dust palliative and at one period in front of dwellings within 200 feet of the road. This latter policy dealing with dwellings has now been revised due to fund shortages, whereby the property owner pays the cost of the calcium chloride and the Department of Highways takes care of delivery and application. These programs have been most successful insofar as dust relief and public response has been concerned, however, there have been some repercussions from the winter road conditions following the first summer of application. This again was the result of the wrong combination of calcium chloride and surfacing material. Many of the roads on which the calcium chloride was applied had only light applications of surfacing and were high in clay content. The resultant combination caused an excessively muddy condition and some improperly biased opinions about the use of calcium chloride under any conditions.

I think it might be worth-while to describe to you briefly some methods of applying these spot treatments. You all realize that it is quite expensive to send a truck and crew to apply a 200-foot section in front of a church in one location today and another truck and crew for a similar application at a dairy in another location tomorrow. Economies in this operation can be realized by preparing a schedule of application requiring a full day and then sending out the crew to be preceded by a water wagon to expedite entrance of the chemical into the surface. Even greater economy can be effected by performing the application immediately following a rainfall, thereby eliminating the cost of the water wagon. Chemical spreaders normally used in snow removal operations can be used to insure economical and uniform coverage.

One other maintenance use of calcium chloride is in winter patching of bituminous surfaces and shoulders when weather conditions are unsuitable for

bituminous patching. Calcium chloride can be added to crusher run aggregate and this material used to fill pot holes in surface treated roads. The calcium chloride will provide sufficient moisture to decrease ravelling and displacement until such time as a permanent bituminous patch can be placed.

These are some normal present day uses of this material, but what may be expected in the future? I have been told that in areas adjacent to plants where calcium chloride is manufactured, it is possible to secure in liquid form a weak solution which can be applied with a bituminous distributor providing very economical dust proofing. Possibly there is a chance of expanding this operation with a resultant economic dustproofing and stabilizing effect on appropriate surfacing materials.

With our 20,000 miles of non-hard surfaced secondary roads, our secondary roads engineer and maintenance engineer are looking for new materials and new methods to provide better service to the citizens of Virginia. Maybe a "magic material" will be produced and we all hope so, but until that is developed we must make the best possible use of available materials. We know that among these available materials for specific needs is calcium chloride. I believe the report of one of our engineers on the results obtained in the use of calcium chloride summed up the efficient utilization of this material for highway maintenance purposes when he said "Calcium chloride has to be employed through a definite program to be effective and cannot be spread about haphazardly with the idea of a cure-all for every highway ailment". Used as a part of such a planned program, calcium chloride can be a valuable maintenance material.