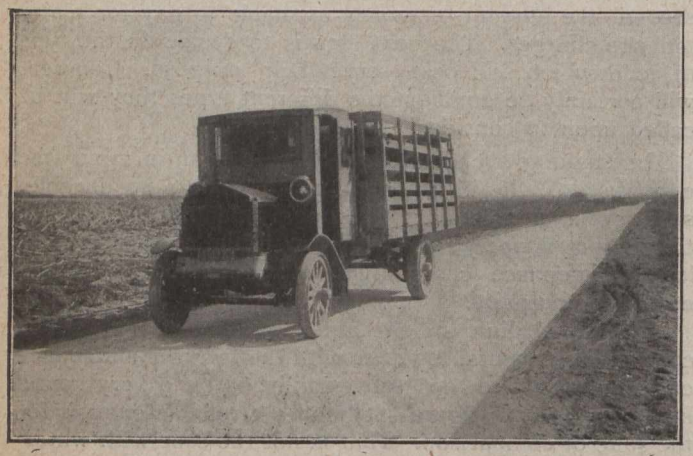
anyone who may doubt their durability. They offer very little resistance to traffic; they produce practically no dust and may be easily cleaned; they are not too slippery; and they are thoroughly adapted to motor traffic if well maintained. They can be constructed at a reasonable cost; as a matter of fact, I think they are the cheapest of all hard surface roads. It may also be noted



Livestock is Transported by Motor Truck Over Concrete Roads

that when considerably worn down by traffic they may be used as a very sound base for asphaltic concrete, sheet asphalt, brick or wood blocks pavement. They can be maintained at very small cost.

On the other hand, they are quite noisy, but this disadvantage should not be taken into account in the case of rural roads.

There is no method, to my knowledge, to prevent wear in the vicinity of joints. Cracks may appear even in places where joints are well constructed. Regarding difficulty in repairing, this objection is a valid one, but, sooner or later, will be found an easy method of making a first-class patch. Until then it would not be advisable to construct concrete pavements in a rapidly growing community if numerous street cuts are to be made in the surface.

There have been many pavements constructed with inferior materials, which accounts for a good deal of defective concrete pavement in Canada as well as in the United States. Only concrete materials of first-class quality for paving purposes should be used. The possible sources of supply of these materials are not quite developed and data regarding same are most generally not available. The investigations and reports made under the supervision of L. Reinecke, of the Geological Survey, will be of great help to road-builders in this country.

Any successful road requires a good deal of care as to details, and this is more true of concrete pavements than of any other. Cement is a wonderful material, but it has to be used properly. After a specification is adopted and the contract made, its terms and requirements should be followed rigidly. Some of these requirements may seem exaggerated to those paving contractors who do not understand their own interest. Often the engineer's or inspector's views are then overruled and the result is inferior construction. The inspectors should be very familiar with the specifications used and must look upon them as their reference library.

The specification of the Canadian Society of Civil Engineers for cement is commonly used. Good care should be taken that cement be stored in a dry shed where water will not leak through the roof or the walls.

Sand should be carefully chosen on account of being the controlling factor in the wearing properties of the surface. It should be free from clay, loam and vegetable matter. Careful instructions should be given to laborers shovelling same into wheelbarrows, that they do not shovel part of the soil on which the sand is deposited. Sand, the grains of which have natural coatings of limonite or other foreign matter, make a very friable mortar. So far as possible only washed sand ought to be used.

The coarse aggregate being called upon to take the wear and tear of the road, it should be hard, tough and durable. Its hardness should be at least equal to that of the mortar used. It must also be remembered that it has to sustain the shattering effects of the steel-shod traffic. So all soft stones, slates, shales and some limestones, etc., should be rejected. It should, of course, be clear of lumps of clay, pieces of wood and scales from uncleaned wheelbarrows. The presence of such matter will, sooner or later, produce local pitting and an increased wear on the surface. Long, flat stones should be picked up, first, because they produce scaling, and also they are very likely to come out, sooner or later, and leave a bad hole.

It is not a good policy to use crusher-run stone or pit-run gravel. These materials will not give to the concrete pavement the required uniformity of texture and hardness of surface. The dust which they contain in quite a large quantity will retard the hardening of the cement. These materials should be screened and separated into fine and coarse aggregates, even if it adds a certain amount to the cost of the work.

When building a two-course pavement the bottom course aggregate may be softer than in the one-course construction, but, on the other hand, the wearing, or top course, must be richer in cement than the one-course. The maximum size of aggregate should be smaller than the one-course, and also harder. To quote Messrs. Agg and McCulloch in their "Investigation on Concrete Roadways" for the Iowa State Commission:—

The Construction of Concrete Roads Brings New Business to the Truck Salesmen

"The life of a concrete pavement depends to a large degree, on the correctness and uniformity in the proportioning of the materials. Emphasis should be laid on the fact that the present methods of field proportioning are exceedingly crude. The development of the bituminous pavement surface has been characterized by the adoption of accurate methods of proportioning and grading the materials. Concrete as a surfacing material will never be used at its highest efficiency until the proportions are specified by weight, and these pro-