

Survey Division of the same office, under Walter Starkweather, with R. Longworth in charge of field party. Inspection of construction was by Fred J. Legg, except the steel in the main hangar, which was inspected by the Detroit Testing Laboratories.

At the present time most of the airport managers are pilots. The proportion may continue to be large but not because being a pilot is an essential requirement for the position. The characteristics of the business man and the engineer seem to fit immediate needs better, at least through the development stages.

SOME DEVELOPMENTS IN DESIGN AND CONSTRUCTION OF HIGHWAYS

By Wm. J. Titus, Chief Engineer, Indiana State Highway Commission

Highway design should begin with the first inspections preparatory to making surveys. Speaking broadly, the design is the basis on which the survey studies are to be carried out. As the details are developed by progressive steps from the first surveys to the final plan layout, it becomes increasingly apparent that the design is the foundation of the whole of the work.

We are inclined to rush a survey party into the field and drive stakes, only to find that much of this work must be scrapped and new lines run because the first work could not be fitted to the design so as to fulfil the requirements. The locating engineer must have a full understanding of the operation and maintenance of the road and the ability to picture the completed project.

The trend of highway design is toward a much higher standard of alignment, grades, width, and surface. The public's money is invested in these roads and the public is entitled to the greatest possible use of the roads with safety. This requires the most careful study of the widths, the surface, the grades, and the alignment. The highway funds in Indiana are usually secured from all the users of the roads; so it is no more than fair that the roads should be designed for their benefit rather than the benefit of abutting properties.

It is very desirable that roads be constructed with shoul-

ders of sufficient width to permit parking off the pavement when repairing tires. This is sometimes quite expensive, but not as expensive or dangerous as blockading the pavement slab with parked automobiles. The Indiana Highway Commission is now constructing all its concrete pavement with 8-foot shoulders, with a slope of $\frac{1}{2}$ " per foot toward the side ditch in order to help the drainage. Traffic cannot park on the shoulders when the ground is soft, but fortunately that is not usually the condition when the traffic is the heaviest and the pavement is being used to its maximum.

Another reason for constructing wide shoulders on our highways is the necessity for snow removal. We have within the last few weeks had over half the area of Indiana pointed evidence of that factor. If narrow, cramped shoulders are constructed, on a plea of economy, there is provided no place to which heavy snow from cuts can be either plowed or shovelled from the pavement in order to let the traffic through.

And, within the last few days, we have seen the necessity for pavements to be constructed above the flood water levels. If that can be done at any reasonable cost, the pavements should be made available for use when the need is greatest and often tragic. Many times entire communities would be marooned, so far as automotive traffic is concerned, except for pavements and bridges constructed above the flood waters which are veritable life savers to many hundreds of people. And the pavement slab costs the same, whether constructed above or below the height of the floods.

THE DESIGN OF A LARGE TILE DRAINAGE SYSTEM

By H. C. Morrison, Gibson County Surveyor

In order to understand and properly design a tile system, a certain knowledge of soil physics is essential. Under the classification of soil particles, we might have fine gravel, coarse sand, medium sand, fine sand, very fine sand, coarse silt, medium silt, silt, fine silt, and clay, in which the size of the particles may vary from 1 to 2 millimeters in diameter down to .005 to .0001 millimeter in diameter.

The size and arrangement of the soil particles and of the voids between them plays a very important part in agriculture, since upon them depend the aeration of the soil, the rate