FIELD PROBLEMS ON CONSTRUCTION OF GRADE AND DRAIN

D. C. Woodward, Ass't Dist. Engineer of Construction

When informed that this paper was to be prepared, it was mentioned that the paper should be limited to not more than ten (10) minutes. Therefore, I wish to thank you in advance for ten (10), more or less, dull minutes.

I was further informed that the paper would be presented to Resident Engineers. I must digress from the subject for a few seconds to mention that, in my opinion, Resident Engineers are the backbone of the Department of Highways. On the Resident Engineers' shoulders rests the full responsibility of obtaining good construction. A Resident Engineer has been promoted in the eyes of the public since the first contracts were let for construction work in this state.

A few of you well remember when a Resident Engineer was sent out from the Central Office to supervise the construction of grade and drain projects that he was referred to as a "damn stob driver". This was the only title that he held for several years. Later in the eyes of the public, he was promoted to a surveyor; but now, without exception, when you refer to the man who supervises the construction of any project, he is known as the Engineer.

Coming back to my subject – the problems on grade and drain construction are numerous and you Resident Engineers are more aware of the problems than I; but a few points are going to be mentioned.

First, it is very important that the centerline of new construction be properly referenced in order that the centerline can be re-established along the original line. Many of you, no doubt, have worked for days trying to re-establish a centerline that was poorly referenced. The up-to-date method on some projects is to use the original cross-sections recorded and plotted by the Location Division. However, if cross-sections are taken, they should be extended far enough on either side of the centerline to take care of emergencies. Then, of course, the slope stakes should be set accurately; if not, much confusion arises. You well know that if slope stakes are not properly set there will be friction between the engineers and the contractor's forces. An old question relating to the setting of slope stakes is to what slope is to be used in setting the slope stakes where there is a question of solid rock. In such cases, the slope stakes should be set either at the back of the ditch or on a ¼-1 slope; then after the earth has been removed, another slope stake should be set providing the proper slope for the

earth section. Enough for the preliminary work – let's get into the actual construction.

A few years back, optimum-moisture and rolling of embankments were unheard of; but as each of you readily appreciate, they are of major importance today. It is not uncommon to traverse a newly completed road on which it is apparent that work was performed satisfactorily and to hear the remark "who was the contractor on this job?" But, in case fills have settled, the grade is wavy and irregular, the question is "who was the Engineer on this job?" Therefore, it behooves each of us to exercise the rights of our position to make certain that fills are properly compacted in order to avoid undue settlement.

Coming to the finished grade, it is believed that enough importance is not being given to the matter of establishing blue tops. The "Machine Age" under which we are working does make it difficult to furnish all the stakes required, but it is believed that the matter of establishing blue tops on grade and drain projects should not be overlooked and the necessary inspection should be furnished to make certain that the grade is constructed to the blue tops.

Since plans are no longer prepared on major projects of grade and drain construction with the idea in mind of following the line of least resistance, it is believed that the Resident Engineers are not paying enough attention to possible grade revisions. It can be readily appreciated when plans indicate waste here and waste there that a little more waste does not seem important. On recent inspections it has been observed that grade changes could have been made without lowering the standard of the construction in regard to sight distance, et cetera. Therefore, please keep in mind the matter of making grade revisions and make them where possible in order to reduce the cost of grading. By doing such, you are substantiating the definition that you commonly hear for an Engineer, which is – "An Engineer is a person who can take a dollar and make it do the work that a Layman would require two dollars to do."

Getting to the drainage end of the subject, it is believed that Resident Engineers too often accept the size of a drainage structure indicated on the plans without giving the matter too much thought. If, in your opinion, you think a structure should be smaller or larger than indicated on the plans, a drainage survey should be made and if you find that the opening required does not agree with the plans, a recommendation should be made with supporting data. In such cases, you should advise the contractor not to order pipe or steel until it has been concluded what size structure will be installed.

When staking a structure, please be sure that the inlet elevation is low enough to suffice. This is being mentioned as it is not unusual for a complaint to be registered with the Department of Highways that a pipe, or a culvert, was constructed too high to provide for the proper drainage; and, of course, anything done to correct such conditions is expensive. There is another point to consider while preparing to stake a structure, that is to be certain all data are computed correctly for a structure located on a curve. Then follow up the staking to ascertain whether or not the angles have been turned properly by the one using the transit. As you can readily appreciate, it could be embarrassing to find a structure looking at you from all angles after completed.

Another drainage problem is the matter of side ditches. A road cannot be properly maintained without the proper side drainage. It is needless to mention this, but as you know, it is not uncommon to find side ditches on newly completed grade and drain projects that are not constructed properly. A lot of times in rock cuts, the ditches are either too high or too low. I wil ask you a question – "Which is worse of the two evils?"

In regard to ditches, it is believed that in large cuts a lot of times slides could have been avoided if proper drainage were constructed along the top of the cuts. As you know, such work is generally referred to as "special ditches." If, on projects under your supervision, you believe that such a ditch would avoid a slide, let your opinion be known. If your superior does not concur in your opinion, you have at least impressed him that you are on the job and trying to do the work to the best advantage of all.

In closing, I wish to mention that the day has come when an inspector on a grade and drain project has as much responsibility as the concrete inspector had twenty (20) years ago. Therefore, please see that the grade and drain construction under your supervision gets the necessary inspection.