

tion and the date of work. The adjusted prices are to cover protection costs as well as all others.

Indiana: Less than 10% of Indiana's highway program is performed between December 1 and April 1. Concrete work and bituminous paving are considered to be unfeasible after initial freeze-up. Work accomplished on existing highways in winter months does not justify the cost of providing necessary detours. Clearing, structural concrete, peat treatment and rock excavation can usually be performed in the winter. Because of the efficiency loss, rock excavation probably costs 10% more, whereas structural concrete may go 30% higher. One major problem for the contractors is keeping equipment in first class mechanical condition so starting and efficient operation are possible.

Iowa: Though its winter period is considered to be from December 1 to March 15, paving work is usually closed down by November 10. Grading is usually stopped between November 15 and December 1. Substructural bridge work is performed the year through, but decking is banned from December 15 to March 15. Concrete costs in cold weather are increased approximately 15% with the major difficulty encountered being that of protection of structures and personnel.

Kansas: Only 5% of the year's production is performed by Kansas between December 15 and March 15. Protection of concrete, frost on grade jobs, and operating temperatures on hot mix asphalt work appear to be the principal limitations to cold weather operations. Concrete work is normally shut down by contractors because it costs approximately 10% more than under more temperate conditions.

Kentucky: Though 13% of fiscal 1966 work was accomplished between November 1 and March 31, it is felt that 10% of the year's highway work is a more realistic annual estimate. Limitations are spelled out in specifications by item. No bituminous concrete can be laid between November 15 and April 1. Bituminous surfacing and seal coat treatment are not permitted between October 31 and May 1. Winter work is predominately limited to rock excavation, constructing rock embankments, stockpiling materials, construction of bridges and drainage structures, and clearing grubbing.

Winter work is estimated to cost from 15 to 25% more. Some contractors proceed in winter to keep permanent payroll men working. Major problem encountered involves the protection and processing of concrete materials both during and after incorporation into structures.

Louisiana: The winter months in Louisiana are considered to be December through February. Work on placing asphaltics and painting of structures are the principal items affected by low temperature. Hot bituminous concretes are restricted by a minimum specification temperature that is not often reached in Louisiana's climate. Earthwork is often shut down during these months because of the rain and wet conditions. It is estimated that it would cost from 10 to 20% if work were required in winter months rather than at the option of the contractor.

Maryland: Between December 1 and March 1, Maryland performs approximately 10% of its highway work, which consists primarily of bridge and drainage structures and some rock excavation. Paving work is not permitted from mid-November until March except by special authorization. Comparative costs for winter work are not available. Major difficulties encountered consist of protection of concrete to insure proper hydration, consolidation of soil because of high moisture content and the loss of personnel efficiency.

Massachusetts: January 1 through March 31 is considered to be a period during which outside construction cannot reasonably proceed. Between 2 and 3% of the year's highway work is completed during these three months. Controlled and protected concrete work is allowed, along with some clearing and grubbing. Excavation of peat, unsatisfactory material and some rock is undertaken if weather conditions permit. Breakdown of equipment working at low temperatures, protection of structures and loss of labor efficiency account for added costs ranging from 20 to 50% more.

Michigan: From November through May less than 5% of the concrete paving is performed. Ten per cent of the substructure work is completed, and only a bare minimum of concrete superstructure construction attempted. Below grade concrete work is permitted when the temperature is above 0 degrees F.; and substructure concrete can be placed when air temperature is above 15 degrees F. Box culvert construction is performed when it can be completely enclosed.

Concrete pavement costs approximately 25¢ per square yard for protections; 3¢ S. Y. for paper curing; from 2 to 3¢ S. Y. for calcium chloride; and 3¢ S. Y.