

BELL SYSTEM PRACTICES
Outside Plant Construction
and Maintenance

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CONCRETE AND MORTAR

CONSTRUCTION DURING LOW

TEMPERATURES

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1. GENERAL

1.01 Concrete construction during cold weather may be carried on satisfactorily provided suitable precautions are observed. Depending on the severity of the temperature conditions, the precautions may include protection of the concrete after it is placed, heating the materials or the use of mixtures and materials suitable for producing the desired quality of concrete under the prevailing conditions.

1.02 In early winter, when freezing temperatures occur only at night, it is necessary merely to protect concrete from freezing after it is placed. As the weather grows colder and freezing temperatures prevail, it may be necessary to heat the mixing water and aggregates in addition to protecting the concrete after it is placed.

1.03 It is not generally advisable to pour concrete when the air temperature is below 20° F. With the approval of the inspector or supervisor, however, concrete work can be carried on during these lower temperatures if, in addition to the above precautions, high early strength cement is substituted for normal cement in the concrete mixture. See G45.140.1 for classes of concrete suitable for use in low temperature construction.

2. PROTECTION OF CONCRETE AGAINST FREEZING

2.01 When concrete begins to set, heat is generated by the chemical action between the water and the cement and this helps to keep the mass of concrete warm. This heat is not dissipated rapidly except at the surface exposed to the cold temperatures.

2.02 In manhole construction the heat is retained within the manhole with the outside surfaces of the walls and floor protected by the surrounding earth, which seldom freezes beyond a depth of two or three feet in most localities. Therefore, the upper surface of the roof is usually the only part of the manhole that requires protection. This protection against loss of heat should consist of a suitable layer of straw or other insulating material covered with tarpaulins. The protection should cover the entire roof including the roof opening and should be allowed to remain for the minimum period indicated in the following table.

Minimum Period During Which Protection Must Be Maintained

<u>Air Temperature</u>	<u>Normal Cement</u>	<u>HES Cement</u>
Low but above freezing	3 days	1 day
Between 32° F. and 20° F.	5 days	2 days
Below 20° F.	*	3 days

* Use high early strength cement if necessary to do concrete work at this temperature.

2.03 The earth surrounding concrete protection for conduit installations also serves to protect the concrete from freezing. Immediately after a conduit installation in cold weather, the trench should be backfilled with material that is not in a frozen state.

2.04 Concrete for pavement replacement should be protected in the manner recommended for manhole roofs.

3. HEATING THE MATERIALS

3.01 For best results, concrete should have a temperature of about 70° F. when it is being poured. Concrete should never be poured when its temperature is below 40° F. or above 100° F. When the prevailing atmospheric temperature is such that the concrete materials will not be within that temperature range as mixed, the mixing water, the aggregates or both shall be heated prior to the mixing. The temperature of the water and aggregates after heating should be at least 75° F. and not more than 150° F.

3.02 Heating the mixing water is generally the most practicable and effective means for producing concrete of a temperature within the desired range. On the job this can be accomplished simply by supporting a metal drum of around 50 gallon capacity in such a manner that a wood fire, blow torch or furnace can be operated under it.

3.03 Aggregates are more difficult to heat properly, but where this is necessary to remove frost and ice or to obtain the desired temperature in the concrete, it can be done on the job by the use of a flue fire in the aggregate pile. Since with this method there is danger of local overheating with generally undesirable effects on the aggregate, it is necessary to turn the aggregate frequently to distribute the heat evenly throughout the mass and prevent any of the material from remaining too long in contact with the hot flue pipe.

3.04 Where equipment is available for generating it, live steam furnishes an efficient and desirable means of heating both the water and the aggregates. This method is particularly adaptable for heating aggregates, as the heat transfer is fast, uniform and thorough.

4. MIXING AND PLACING CONCRETE

4.01 During cold weather, concrete shall be mixed as stiff as possible and yet obtain a mix that will place and finish well.

4.02 The concrete shall be placed immediately after mixing to prevent loss of heat.

4.03 No concrete shall be placed in contact with frozen material. If the ground on which concrete pavement is to be placed is frozen, it shall be thawed out before placing the concrete.

5. FROZEN CONCRETE

5.01 If concrete has been damaged by freezing, the frozen concrete shall be removed and replaced with freshly mixed concrete.