



Technical Bulletin 技术布告栏

Methods for proper concrete curing

ACN / 071808

主题：混凝土正确的养护方式

NOTE: The discussion below pertains only to the curing of non-colored concrete for normal applications. For colored, architectural or any exceptional types of concrete, special curing procedures are required. In such cases it is advisable to contact the material manufacturer. For detailed information on recommended practices for curing concrete, refer to "Standard Practice for Curing Concrete" (ACI-308).

备注：下列讨论仅限于常规混凝土在一般应用的情况,对于那些加色,建筑装饰用或特殊的混凝土养护,应征询材料生产厂商的建议. 本文所建议的方式及细节请参考 ACI-308 "混凝土养护标准规范"

Why Curing is So Important

Improper curing can easily cut the strength of even the best concrete by 50 percent. Curing simply means keeping the water in the concrete where it can do its job of chemically combining with the cement to change the cement into a tough "glue" that will help develop strong, durable concrete. Good curing means keeping the concrete damp and above 50 °F (10 °C) until the concrete is strong enough to do its job. Recommended practice calls for a minimum of seven days curing (except for high early strength concrete) or the time necessary to attain 70 percent of the specified compressive or flexural strength, whichever period is less.

为什么养护如此重要

缺乏正确养护的混凝土其强度可能折损高达 50%，养护简单的说就是保持混凝土中的水份，让水与水泥藉由化学反应形成坚固的“胶结”生成足够强度及耐久性的混凝土，好的养护指的是保持混凝土在强度发展初期够湿及温度维持在 50 °F (10 °C) 以上直到混凝土发展到一定的强度,常规作法是至少浇筑后的前 7 天(早强混凝土除外),或是强度发展达 70% 以上所需的时间,取两者较短的时间来做必要养护

All concrete must be cured to attain maximum strength. Correctly cured concrete is best from every standpoint: It shrinks less, cracks less and dusts less. It is stronger, is more durable and is more wear resistant.

所有的混凝土都需要养护方能达到最高强度，养护不仅仅关乎其强度更对混凝土的收缩,开裂，表面起砂的都有影响,正确的养护会让混凝土更耐久,更耐候

Start curing the concrete as soon as possible after it has hardened. Early drying – especially in hot, windy

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weather – must be prevented or the concrete will not attain its full potential quality. Refer to ACI Committee 305, "Report on Hot Weather Concreting."

混凝土浇筑硬化后应尽快进行养护, 混凝土过快干燥应极力避免, 尤其是高温风大情况下更应注意养护- ACI "高温气候下的混凝土"

Methods of Curing

• **Membrane Curing Compounds** are the preferred (most practical and widely used) method of sealing moisture in the concrete. Easy to spray, roll or brush on and low in cost, these curing compounds generally require only one application. These method is effective for slabs, vertical walls or irregular surfaces. For flatwork, cover the dried curing compound with scuff-proof building paper or polyethylene tarp to protect the surface from marring by other trades until the curing is complete. If a membrane curing compound is used, make sure it meets the moisture retention requirements of ASTM C-309 at the coverage rate specified.

养护方式

养护剂(成膜)的使用最为广泛及有效用以保持混凝土中的湿度, 养护剂使用花费小, 使用方便可以是喷涂, 滚涂或漆刷的方式涂覆于混凝土表面, 且一遍涂覆基本上就足够了. 养护剂的使用无论是地面, 墙面或不规则形体都适用, 地面使用养护剂后在养护期内应以适当的塑料薄膜覆盖保护避免其它工种的施工污染, 养护剂的使用应符合ASTM C-309的湿度保持性规定, 耗用量应按厂家建议施工

Water Spray is a good curing method but **only** if the concrete is kept continually damp. Allowing the concrete surface to dry between sprinklings can cause crazing of the surface and cracking of slabs.

洒水养护不失为一种好方法, 但如何一直保持混凝土所需要的湿度是问题, 在洒水间隔期间, 混凝土忽干忽湿, 可能造成表面的裂纹及楼板的开裂

Waterproof Curing Paper holds moisture in the concrete by preventing evaporation. Water is sprayed on the concrete surface and covered with a non-staining, waterproof paper. Edges are overlapped and sealed with waterproof tape. This method is acceptable for slabs but not practical for walls, irregular surfaces or colored floors.

一种不污染混凝土表面的**不透水养护纸**覆盖于混凝土表面, 纸张间相重叠并以防水胶带粘贴固定以防止水份的蒸发, 这种方式仅能使用于地面混凝土, 立面, 彩色混凝土及不规则形状混凝土则无法使用

Damp Burlap is sometimes an effective method of curing. However, the burlap must be washed and free of any

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foreign substances which might stain or harm the concrete. Also wet burlap may be hard to handle for large areas. Once the damp burlap has been spread over the concrete surface, it must be kept continually damp with water spray to replace the water lost through evaporation. It should not be used on colored or metallic floors.

湿粗麻布(袋)覆盖使用也相当有效但粗麻布袋在使用前应经过筛选及清洗避免可能的混凝土表面染色污染,另外就是当大面积以这种方式养护时相当耗费人力,反复的浇水淋湿麻布袋是必要的动作,此方法不建议使用在加色混凝土或含金属材质的地坪

Other Methods include **plastic sheets** which are completely watertight, light in weight and easy to handle. They give good protection during curing. However, care must be taken to ensure that such sheets lie flat against the surface, otherwise mottling of the surface may result. **Damp earth, sand, straw and hay** can also be recommended, but their use should be limited to emergency situations. Earth and sand are messy, and hard to handle and to clean up. Straw and hay dry out quickly, can blow away and can be a fire hazard. None of these methods should be used on colored or metallic floors.

其它的养护方法包括塑料薄膜覆盖,完全不透水,质轻,好操作是其优点,但若是没有摊平覆盖会导致混凝土表面色泽的差异及塑料覆盖时不规则的痕迹,另外还有覆土,覆砂,稻草等的覆盖,但不大建议使用,除非实在找不着其它材料.覆土覆砂第一是脏后续清洁更是麻烦,稻草或干草覆盖干的快且容易四处飞散效果肯定难以控制,以上这些方式都不建议使用在加色混凝土或含金属的地坪混凝土上

Cure Concrete Longer In Low Temperatures

Concrete strength develops more slowly at lower temperatures. Below 50 °F (10 °C) do not expect satisfactory performance from the concrete unless special precautions are taken (See section regarding "Carbonation"). Closely follow job specifications on curing time. In the absence of specifications, concrete should be cured, protected from harmful temperatures and not used until it has developed the required strength. Heaters, if used, must be vented so combustion gases are exhausted outside the enclosure in order to avoid carbonation of the fresh concrete. Refer to ACI Committee 306, "Report on Cold Weather Concreting."

低温时混凝土养护时间得延长

混凝土在温度低的情况下其强度发展势必延缓,在50 °F (10 °C)以下,强度不会太好除非有特别的措施,倘若使用暖炉加温需特别注意可能引起的表面"碳化"反应

Results of Proper Curing

- **More Durable Concrete:** Good concrete, properly cured, has fewer pores and crevices where water can enter, freeze, expand and crack the concrete. Air entrainment helps make more durable concrete, but its use must also be accompanied by proper curing.

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• **More Wear-Resistant Concrete:** Well cured concrete (28 day curing period) will develop a surface twice as wear resistant as a surface that is cured for only three days. Proper curing prevents dusting and means less cracking, crazing and spalling of the concrete. All in all, the better the curing, the better the concrete.

正确养护后的混凝土

更经久耐用的混凝土, 养护正确的混凝土孔隙率降低, 会更密实能较有效的阻挡水份的侵蚀, 进而降低水份在冬季冻结后膨胀导致混凝土的开裂的机会, 混凝土浇筑输气技术应用仍应配合适当的养护

更耐磨耗的混凝土, 养护完整的混凝土达 28 天周期, 较仅养护 3 天的混凝土, 其表面耐磨损程度差异可达 2 倍, 正确养护的混凝土较无机会造成收缩开裂, 表面会更密实不起砂, 强度耐久性, 耐水性都会较好, 总而言之养护愈好混凝土的品质就愈好

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