

معالجة وإصلاح بعض العيوب في الخرسانة المتصلبة

" Treatments and Repairs of Defects in
Hardened Concrete "

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Abstract

This research looks for and Studies the trails appointed by the researcher

About the treatments and repairs of defects of the hardened concrete such as segregation, cracks, cold joints, and leakage of water through concrete, unlevelled surfaces ... etc. Also, the research contains conclusions of how to get high quality concrete.

الخلاصة :

يقدم البحث خبرة الباحث في إصلاح بعض عيوب الخرسانة كأماكن التعشيش والنتوات البارزة عن مستوى السطح والفجوات والثقوب والمفاصل الباردة والتشققات التي تؤدي إلى تسرب الماء . كما يتضمن البحث مقترحات وتوصيات حول ضبط الجودة لتجنب حدوث هذه العيوب.

1 - Introduction

Concrete is the construction material results from the mixing of solid particles with different sizes named as aggregates which occupies the large volume of material , joint by cementation and contains a little ratio of pore filled with air and gases.

The wide use of concrete in engineering structures is based on its low expense compared with other construction materials. Furthermore, its Low tensile strength can be treated by the increasing of reinforcement in concrete.

There are wide interests in the subject of concrete defaults and the engineers faced the technical problems in treating the defaults and failures in concrete because of the deficit of local experience and the shortage in the special material needed for treatment of the concrete.

The present research includes the special experience of the researcher to treat the defaults of concrete by using the available local materials based upon simple method which can be used by local labors of construction . However, it is necessary to know the types of defaults and their reasons in order to select the best way for treatment.

There are many reasons for defects in concrete such as the bad works in carrying out, some mistakes in design, using bad raw the materials, and the surrounding climates which are not considered in design.

All reasons can be summarized in table (1) . The present study reveals the common defects of concrete, with suggestions and recommendation of how to control the quality in order to avoid the defects .

2 - Detection of Defects

The detection of defects needs accurate checking and experimental determination based upon the recommendation of American Concrete Institute No. (ACI-201) {3} and (ACI-540) {4}. Furthermore, there are simple equipments which can be used in site for detection of defects .

For examples, the crack meter can be used to measure the cracks width, the Fe- depth meter can be used to measure thickness of concrete cover , and the Half- Cell can be used to measure the potential difference in reinforcement which can be manufactured based upon (ASTM C876) {5}. Also , the surface levelling and vertical alignment can be checked by water balance and vertical alignment equipment .

Table 1 : Defects of Concrete and Their Reasons

Gender reasons	Defects Detected	Description							
		cracks	Water seepage	Surface corrosion	Reinforcement corrosion	extension	Deflection	Fragmentation	Splintering (shattering)
1 – Bad Carrying out	1- Segregation		x						
	2-holes and cavities		x						
	3- cold joints	x	x					x	
	4- non leveling of external surface			x					
	5- non alignment	x							
	6- non color homogeneity								

Gender reasons	Defects Detected	Description							
		cracks	Water seepage	Surface corrosion	Reinforcement corrosion	extension	Deflection	Fragmentation	Splintering (shattering)
2 – Bad raw material	1- Sulphate attack	x	x	x		x	x	x	x
	2- chloride salts attack	x	x		x	x		x	x
	3-alkaline interaction of aggregates	x	x			x	x	x	x
	4-extensible aggregates	x	x	x		x	x	x	x
3 - Wrong design details	1- underneath of reinforcement appointed on maps	x	x					x	
	2- there are of joints of mat. on	x	x						
	3- underneath of concrete cover	x	x			x			x
	4- wrong of form design							x	
4–surrounding environment	1-plastic shrinkage	x	x						
	2- effects of water	x	x		x	x	x	x	x
	3- effects of waves and velocity of water slowing			x					

3- Repairs of Defects:

3-1 Segregation

The reveals of coarse aggregates on surface and isolated from the cement is called segregation . Such phenomenon is caused by the non adequacy of concrete compaction , non uniformity of concrete

mixing ,and isolation of coarse aggregates from the cement during pumping the concrete .

It is necessary to prevent this phenomenon from hydraulic structures face a water velocity greater than 12 m / sec which might cause cavitations. The treatment must be done immediately after removing the forms . In treatment which include removing of coarse aggregates until reveals the correct face of concrete , the depth of drill must not be less than 7 cm with the best .The surface should be cleaned and left for a period not less than 4 hours for drying .Air pressure can be used for during.

The locations which need repairing should be cast first with Epoxy corresponding to American specification (ASTM C881) {6}to join the hardened concrete to fresh which should be cast in strata each of them has a coarse surface. To have the same colour of concrete , white cement is not recommended to apply to the mixes of those strata . The hardened concrete should be cured. for 7 days. The final surface should be grinded and cleaned carefully with water.

3 – 2 Treatment of Separation Location

The separation locations of green concrete results from many reasons such as the earlier opening of forms , non – suitable oil that is used in forms, rough surface of the forms. concrete separation causes large cavities which may be treated by removing the weak concrete and cleaning the cavity ,then adding strata of cement mortar each has a thickness of 10 mm and a rough surface to ensure the homogeneity in colors , Also , a quantity of white cement may be added to the mix. for best bond and to reduce the shrinkage, the mortar mix must to be as dry as possible, the ratio of cement to sand is (1:2) and water to cement (2:4) but not less than (0.4). also, the mortar mix should be compacted with a wood plate. the final surface should be treated and cured for 7days using a wet cover.

3 – 3 The Treatment of Small Cavities on The concrete Surface

Such cavities reveals from the confined air , using steel forms which are closed perfectly and by using pure oils for lubricating the forms without adding the activation agents. the treatment operation is achieved by cleaning the cavities , removing the sediments, drying by pressurized air and filling them with extensible cement mixture .

3 - 4 Water Seepage From Joints

The seepage of water from joints caused by non efficient water stop tape deviated during the pumping operation of concrete , and the expirations of joints materials. The treatment operation includes the pumping of extensible materials to prevent the water seepage for short time , then fixed the sheets of(PCV) by Epoxy.

3 - 5 Treatment of Differential and Roughness of Concrete Surface

The treatment operation of differential and roughness of concrete surface includes the using of a handle or mechanical equipment to remove the edge of high locations and rough the lower locations. The surface should be covered with dry extensible cement mixture in strata of thickness not exceeding 10 mm , compacted well and then covered with wet cloth for 7 days.

3 - 6 Treatment of Cracks

It is necessary to know the type of cracks , its reasons and behavior for specific time, and measure the dimensions to know weather it is stable type or live cracks. The treatment of stable cracks of thickness more than 2 mm should be carried out by filling with Epoxy of low viscosity corresponding to specification

(ASTM C881), American Institute (ACI-503), in tractions of production company, and by using special injectors provided by valve fixed on both side of crack to be fixed by Epoxy (Type II) . The injection carried is out by the valve with a handle or mechanical pump of (0.5 – 1.5) bar pressure until the crack is filled. The external face of crack must be closed by plastic mixture to prevent the seepage.

3 - 7 Treatment of Cold Joints

Such joints are caused by delay of pumping the concrete. They tend to harden partly before pumping and compacting the smooth concrete.

The treatment is achieved by drilling a channel of V-shape a long the cold joint, then filled with Epoxy which is leveling a long and across the concrete surface .In order to ensure the color homogeneity , the external surface is cast with cement mixture contains (PVA) corresponding to the instructions of the production company.

3 - 8 Treatment of Corrosion Points

These points appear on the end of bars of joint the forms . The treatment is carried out by drilling the external surface contacts with bars to a depth of 5 cm , then cut these bars and cleaning by a solution of sodium nitrate with concentration of 20% .Then the hole should be cleaned by water, filled with mixture of cement and sand , and treated by the method of article (3-2).

4 - Conclusions and Recommendations

From the experiments , the following conclusions and recommendations can be adopted :

- 1- It is necessary to survey the defects and their locations , then classified according to general specifications before selecting the method of treatment .

1. The treatment operation required a team of engineers and technical staff to ensure successful treatments.
2. It is necessary to carry out the treatment immediately after detection of defects .
3. The treatment works are often very expensive , it is necessary to control the quality using the best materials and forms to ensure producing concrete without defects.

References:-

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- 6- Standard American Specification For Epoxy Properties , ASTM C881.