

# [The practice of concrete repair health and social care essay](https://assignbuster.com/the-practice-of-concrete-repair-health-and-social-care-essay/)

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Concrete fix can be defined as the act of regenerating, reconstructing, or replacing of any concrete or concrete surfaces after initial arrangement ( Smoak et al, 2002 ) . In general, the demand for concrete fix can originate from different causes which may change from minor concrete holes or cracks- such as ensuing from minor imperfectnesss due to snap-tie holes or she-bolt holes, to major amendss ensuing from external factors or structural failures. In pattern, it is found that the bulk of the defects can be repaired or made good, while in some instances it is frequently found that the rebuilding of the single member or construction is frequently economical ( Allen et al, 2005 ) .

It is agreed in general that the protection and the fix of the concretes are complex undertakings which requires particular attending and incorporate cognition of different specializer Fieldss. Due to the explosive growing of economic systems around the universe and due to the increased investing in substructures ( particularly in footings of care, Restoration and fix ) in the recent old ages, the fix and protection of concrete constructions has become a major subject of both scientific and economic involvement. As a consequence, the building industry has faced many challenges and demands. Underneath these demands lies the fact that the concrete construction deteriorate over clip at unbearable rates. As such, it is extremely necessary to develop the ways by which the life of the concrete constructions can be increased.

There is besides a demand for appropriate tools and techniques to transport out the undertaking of fix and care of the concrete constructions within the limited budgets available. It is besides of import to see the importance of environmental conditions to which the concrete constructions are exposed while sing the tools and techniques employed for the fix of the constructions.

The field of concrete fix calls for the integrated cognition ( expertness ) of different scientific Fieldss. The basic thought behind this fact is that the edifices or the concretes are confronting different environmental or external conditions and around the universes, the field pose many challenges to both the academe and the practicians likewise. Added to this, the fact that many edifices have their ain history and nature, it becomes necessary to develop and implement single schemes and solutions for the protection, fix and care of concretes. As a consequence of these complications, different basic schemes and solutions has been developed of the fix of the concrete constructions ( Raupach, cited in Alexander et Al, 2009 ) . This highlights the fact that this country requires knowledge from different Fieldss and that the sphere of the topic is more of interdisciplinary in nature.

## 2. 2. 1 The pattern of concrete Repair:

There are different criterions to which the pattern of fix of the concrete should be carried out. EN 1504 provides 43 methods to mend and protect the concrete constructions which are based on 11 different rules. However, it is by and large recommended that the interior decorator can take the appropriate solution depending on different conditions like the economical and proficient considerations ( Alexander et al, 2009 ) . It has besides been recommended in the old surveies that while choosing the optimum methods for different state of affairss, the interior decorator should look into in item the particular inquiries such as the needed degree of care, lastingness, and the sustainability ( ibid ) .

Many writers have based their plants on the subject of concrete fixs ( Wall and Shrive, 1998 ; Kuhlmann, 1990 ; Plum, 1990, etc ) . Though there are many methods or criterions sing the concrete fixs, it can besides be noted that there is no standard design specification for the fix of the concretes. It can be argued from an beginning that a proper apprehension of why the spots fail could perchance cut down the figure of failures. However, due to the absence of standard design process for the fix of the concretes and the deficiency of apprehension, many research workers have now concentrated their attempts towards understanding the lastingness of fix spots.

## 2. 3 Adhesion between the concretes:

In the field of concrete research, the adhesion between the concrete is one among the largely researched subjects. This has been argued to be an of import facet that influences the lastingness and the dependability of the spot up or the fix works ( Czarnecki et al, 2007 ) .

In general, adhesion which can be considered as a basic issue in the fix of the concretes can be defined as the attachment of two stuffs in contact ( Czarnecki, cited in Alexander, M. G. , et Al, 2009 ) .

The EN 1504-10 criterions ( European Standards ) used the term 'bond ' to bespeak the adhesion that takes topographic point between the old concrete and the new concrete. As such, it is an of import factor that can besides find the effectivity of the fix. Fiebrich ( 1994 ) divided the adhesion mechanisms into three types ; mechanical interaction, chemical bonding and thermodynamic mechanisms.

The European Standards, EN 1504 provides two ways of look of the formulated bond degree consequences of the adhesion ( Czarnecki, cited in Alexander, M. G. , et Al, 2009 ) .

Threshold value in MPa ; towards structural fix ( EN 1504-3 ) : & gt ; 2, 0MPa ( Class R4 ) , & gt ; 1, 5 MPa ( Class R3 ) ;

Pass/fail standards towards structural bonding ( EN1504-4 ) e. g. hardened concrete-to-hardened concrete or fresh concrete-to-hardened concrete: the trial shall ensue in break in the concrete.

Once the bond is formed between the concretes, the bond can so be said to be effectual merely if the freshly formed bond ensures an even distribution of the emphasiss and an effectual transportation of burden withoutfailure.

Specifically, it has been found that the addition in adhesion, consequences in higher tolerance on non-compatibility belongings of both the old concrete and the new covering stuff ( Czarnecki et al, 2007 ) .

## 2. 4 Factors impacting Adhesion:

There are many basic theories on adhesion that describe the mechanisms of the attachment between the old concrete and the new sheathing stuff. The chief theories pointed by different writers on the subject are the soaking up theories and the mechanical blocking theories ( Emmons et Al, 1994 ; Santos et Al, 2007 ; Maerz et Al, 2001 ) . Briefly, in the first theory associating to the thermodynamic surface assimilation the intermolecular forces or the Van der waal forces, the chemical linkage through the interface and the H affair increases the bond between the old and the new concrete. The 2nd theory of mechanical blocking can be broken down at two degrees foremost macroscopic in which the raggedness of surface creates mechanical blockings between sheathing and concrete and secondly at microscopic degree, the surface porousness at the interface substrate, comparable to a micro-roughness, facilitates grounding by tangle of hydrates, Bouksani et Al ( 2010 ) .

Czarnecki ( 2009 ) in his research about the adhesive facets of the concrete bonds gave a important decision. He concluded that there are many factors impacting the adhesive strengths. These included:

The belongingss of the fix stuffs: this included, viscousness, shrinking during puting, surface tenseness, weirdo, etc.

Old concrete ( concrete substrate ) : strength of the stuff, presence of drosss, clefts present on the surface and the micro clefts, porousness of the stuff, the raggedness of the surface, etc, .

The consequence of theenvironment: the degree of temperature- the alteration and the rate of alteration, presence of moisture- humidness degree and the alteration of humidness degree, the phenomenon of transportation- suction due to capillary consequence, the loading-mechanical burden, ageing, consequence of corrosion etc, .

All these factors mentioned supra could act upon the bond between the concretes. Many of the factors could increase the bonds between the concretes but, in most of the instances, these grounds cause devastation in concrete bonds. Due to these grounds, it is obvious there is still a demand for the High Adhesive Repair Materials to be used in the fix patterns in order to turn to these issues.

It has been identified that adhesion will depend on many factors. These are chiefly due to the phenomena that take topographic point at the interface country of the concretes ( Slater, 2001 ) . The chief phenomena includes, raggedness of the stuff surface, presence of wet on the surface, the humidness degrees of the external environment, external burden, wetability of the surface, the belongingss or the influence of the linear stuffs, etc, .

The importance of surface raggedness, wet status and bring arounding status is frequently highlighted in many researches. It has been said that the first measure in fix or the care of the concrete after taking the method is to fix the surface of the bing concrete on to which the concrete is to be laid. This may include the remotion of the bing deteriorated concrete bed so that this can be replaced by the new stuff. The strength will depend on the grade of attachment of the new stuff on to the bing stuff. However, the influence of the raggedness and the wet of the surface besides contribute to the overall bond between the old and the new concrete. Therefore, it is really of import to guarantee that the wet and the roughness quality of the surface is achieved to the needed degree before the new concrete is laid on to the bing concrete ( Courard, 2000 ) .

The difference in the consequence of the researches carried out by different research workers could be observed on ; the status under which the hardening is carried out ; the humidness status ; the bonding agents used in the experiment ; the temperature at which the trial is carried out ; the age of the specimen ; the type of the trial employed ; the design/setup of the specimen, etc. To this point, Julio et Al ( 2004 ) argued the importance of different trial parametric quantities to be considered while comparing the consequences. They noted that these differences produced contradictory consequences and as such, there is no consensus in the findings. Therefore it is by and large agreed that the comparing of findings appear to be hard. But, to acquire an overview of the current cognition and substantial findings some of the major factors that affect the adhesion between concretes are discussed below.

## 2. 4. 1 A individual survey sing assorted factors:

Wall et Al ( 1988 ) investigated the factors impacting the bond between the old and the new concrete in concrete fixs. The experiment was carried out to research the effects on the bonds based on different parametric quantities. These parametric quantities included the thickness of the bed of the bonds, the ratio of the cement and H2O used in fixing the howitzer, the influence of different conditions under which the hardening procedure was carried out, the influence of wetting the surface of the old concrete onto which the new concrete is laid, the influence of the hold between blending the copolymer PVA bonding agent and its application to the old concrete.

The major difference that can be noted from the survey carried out by Wall et Al ( 1988 ) and other researches is the difference in the bonding strength of the specimens incorporating the Portland cement to the specimens that contained Copolymer PVA agents. It was observed in their survey that the specimens that contained Portland cement howitzer were stronger than the PVA agent 1s.

Major differences were besides found in the trials associating to the thickness of the new concrete bed or the repair stuff applied to the older concretes. It was found that the strength increased when the thickness reduced ( 1/8 in and 3/16 in proved stronger than the 1/4 in bed ) . However, the writers do non give farther account sing this phenomenon. Notably, the research did non supply clear account about the affect of cement to H2O ratio. The compressive strengths for different H2O to cement ratios were found to be different. Ultimate compressive emphasis for a H2O cement ratio of 0. 32 was found to be lower ( 1870 pounds per square inch lower ) than the one which had a H2O cement ratio of 0. 40 by thisobservation, Wall et Al ( 1988 ) concluded that the bond strength between the two concretes decreased as the H2O cement ratio besides decreased.

One another determination was about the surface status of the substrate concrete before the application of the new bed. It was found that the pre-wetting of the substrate before the application of the new bed resulted in bettering the strength of the bond. In instances when the PVA bonding agents dried before the application of the fix stuff to the surface, it was found that the compressive strength of the bonds decreased by 10 % . However, it was besides found that the howitzers with PVA modified cements produced higher bond strength.

One other of import facet found was the influence of the bring arounding status on the strength of the bonds. Different specimens were cured under different hardening conditions. It was found to impact the ultimate strength. Though it was found that the specimens that were cured under high humidness conditions ( 100 % ) had greater strengths than the 1s cured in less humid conditions, the differences were non considerable. Hence it was concluded that the grade of influence was little when sing other parametric quantities.

## 2. 3. 2 Influence of Material for the Repair:

Though there are many methods that can be followed while mending the concretes, it is advised that proper attention should besides be taken while sing the fix stuff. Once these have been selected, the following of import measure is to clearly understand the conditions that the concrete will see over its life. Some of the cardinal factors are the conditions conditions, chemical exposures, the scope of temperature, the magnitude of the burden and the continuance to which the concrete is exposed to the burden, the nature of the spot ( aesthetic or structural ) , etc. It is of import to see these facts because different researches in to the field of the concretes have shown that the public presentation of the spot stuff varies under different conditions. It can be argued that proper attention should be taken while choosing the spot stuffs by giving proper consideration to the stuff belongingss of the substrate concrete and the old concrete and the conditions to which the concrete will be exposed over its life. It could be recommended that the stuffs with different belongingss could be selected merely if the bond strengths are non affected and further it does non do any lastingness jobs ( Wipf et al, 2004 ) . However, it is critical to guarantee that the internal emphasiss do non transcend the tensile emphasiss of the substrate ( Wipf et al, 2004 ) .

## Influence of Adulthood:

The bond between the substrate and the new concrete has besides been linked with the adulthood of the sheathing. This was pointed by Delatte et Al ( 2000 ) . To lucubrate over this subject, they linked the adulthood of the sheathing to the bond strength, which in bend was related to the overall strength of the stuff ( interface ) . It was concluded in their research that the early- age strength of the concrete had important consequence on the bond strength and the tensile strength of the stuff. These groups of researches have besides highlighted that sheathing or the interface as one of the major zones of the break. Therefore, harmonizing to Beushausen and Alexander ( 2008 ) , mechanisms of bond failures in relation to the parametric quantities of stuff and the location of failure will necessitate farther research.

## 2. 3. 3 Influence of Test Method:

It has been argued in the old diaries that the quality of the bond strength can be influenced by a scope of parametric quantities associating to the stuff and the conditions of the environment ( Alexander and Beushausen, 2008 ) . Another of import factor is the trial method used. There are assorted test methods proposed to measure bond belongingss and public presentation of fix stuffs in general. They include the tensile bond, slant-shear, twist-off, flexural and patch trial etc. , However each trial is influenced by different combinations of factors and can non give entirely a full image ( Austin et al, 1999 ) . For case, Momayez et Al ( 2005 ) reported in their survey that in few instances bond strength from some trials were upto eight times higher than those obtained from other type of trials.

Additionally, it is of import to observe that the mechanical adhesion in tenseness varies well from that in shear ( Alexander and Beushausen, 2008 ) . Therefore, it can be argued that the positions of different writers ' will besides depend on the pick of the methods used in finding the bond strength.

## 2. 3. 4 Condition of the surface of the interface:

The bond strength besides depends on the general status of the surface like cleanliness. There is besides particular industry criterions to which the cleansing and preparing of the concrete surface should be carried out before the fix is carried out ( Charles and Scott, 1997 ) . In add-ons to these criterions, there are besides many standard recommendations provided by different makers of the fix material merchandises. The more normally known industry criterions are: ASTM D 4258 Surface Cleaning Concrete for Coating ; ASTM D 4259 Abrading Concrete ; ASTM Standards for Cleaning, Surface Preparation, and Testing ; ASTM D 4285 Indicating Oil of Water in Compressed Air, etc.

One of the major points to be considered while cleaning the surface is the presence of the surface contaminations. This can be in the signifier of liquids or solids. There is a possible menace that these contaminations could jobs for the application of the stuff, hardening, adhesion or other things which are critical for organizing the bond between the two concrete beds ( Wipf et al, 2004 ) . It is noted that the presence of dust and unsound concretes are besides a major barrier for organizing a strong bond between concretes. It is recommended that the usage of the doodly-squat cock be avoided when covering with the damaged concretes. Alternatively, the usage of the chisel and cock can guarantee that the structural belongingss of the concretes are non affected ( Ibid ) .

## 2. 3. 5 Influence of Roughness:

The influence of the raggedness to the bond strength between the concretes has been argued by many writers. It has been argued in the old surveies that the add-on of the ordinary concrete on to the interface that is unsmooth green goods better consequences than the 1 that was laid on to the smooth interface ( Garbacz et al, 2006 ) . These findings are similar to the 1s investigated by other writers excessively. Matana et Al ( 2005 ) identified in their research that the bonds between the concretes provided good bond strength when the stuff had unsmooth interface. Similar consequences were besides given by Courard ( 2006 ) . Roughness of the substrate surface is frequently presented as the most of import factor to accomplish a good bond. This betterment is chiefly assigned to the addition of the contact surface ( Talbot et al 94, Santos et al 07 ) .

On the other manus through the survey done by Perez et Al ( 2009 ) , while analyzing about the correlativity between the raggedness of substrate surface and debonding hazard, they interpreted by their consequences that increasing of raggedness does non heighten the bond strength.

The argument over the influence of raggedness is still an on-going issue and as such, the consequence of the raggedness of the concrete surface over adhesion procedure is non really clear ( Austin et al, 1995 ; Czarnecki, et Al, 2003 ) . Some research workers have argued that there is influence of surface sums on the degree of adhesion that take topographic point at the interface. A seeable sum of ratios between 30 to forty per centums provided better consequences ( Fiebrich, 1994 ) . Fukuzawa et Al ( 2001 ) , argued the being of correlativity between roughness parametric quantities of the material surface and the adhesion strength. Though the raggedness of the stuff is an of import factor, some writers ( Silfwerbrand, 1990 ) have besides pointed the affect of micro clefts that are produced on the surface of the concrete when the surface is treated by different methods to accomplish the raggedness. These sorts of micro clefts are found to deteriorate the quality of the bonds that is formed between the concretes ( Garbacz et al, 2005 ) .

## 2. 3. 6 Influence of wet:

With respects to the presence of wet, recent surveies provide a better apprehension to the subject of influence of the wet on the strength of the bond. Bouksani et Al ( 2010 ) , in their survey on the influence of the raggedness and wet of the substrate surface on the bond between the old and the new concrete, suggest that the incursion of the sheathing stuff into the substrate concrete is chiefly dependent on quality readying of the substrate surface.

They besides suggested that the surface of the substrate should be saturated with dry surface- which means that the surface of the substrate is non stagnated with H2O, so that it ensures that a good micro raggedness and a better thermodynamic surface assimilation is achieved. They suggest that the stagnancy of the H2O on the substrate surface can forestall the pores from absorbing the sheathing stuff which can ensue in a weak adhesion procedure. The overall consequence of over stagnancy is that, it will stand as a barrier in the interface zone cut downing the attachment procedure.

On the other manus if the substrate stuff surface is dry with really low wet or no wet, this will ensue in the interface absorbing more H2O from the freshly laid stuff. Such a procedure will besides cut down the overall adhesion procedure as this could ensue in higher opportunity of uncomplete hydration of the cement. Therefore, it can be concluded that the wet needs to be present merely to a optimal degree. Excessively much wet or excessively small presence of wet will ensue in a weak adhesion procedure.

Similarly, Xu ( 1999 ) besides studied bond strength utilizing oven dry, air dry and concentrated surface dry status of substrate. He reported that prewetting the surface of concrete substrate reduced the bond strength of the specimens used in his experiment from 0. 64 to 0. 12 MPa

However, Saucier and Pigeon ( 1991 ) did n't happen any noteworthy difference between the bond strength of lab dried surface and pre-wetted surfaces in slant shear trial. In another survey, Austin et Al. ( 1995 ) did work on happening bond strength utilizing substrates with concentrated surface prohibitionist, saturated surface moisture and air dry wet conditions. They besides reported no important difference in bond strengths ( about 2. 77 to 2. 98 MPa ) due to the different wet status of substrate.

## 2. 3. 7 Influence of Bring arounding Condition:

There are a few researches carried out refering the affect of bring arounding status on the shear bond strength. Yee and Ibrahim ( 2010 ) in their survey on shear capacity of precast slabs investigated the difference in consequences for H2O cured samples and air cured samples.

The consequences they got were changing with similar raggedness feature of surface but different bring arounding status. For case, a unsmooth surface produced higher shear capacity than a smooth one in air cured status whereas a smooth surface produced 16 to 18 % higher shear capacity in H2O cured conditions. Another noteworthy point was the influence of bring arounding status on the interface strength which was highly variable, as such it decreased by 30 % in smooth and unsmooth surface in H2O cured status where as for the air cured status it increased by 40 % between smooth and unsmooth surface.

## 2. 3. 6 Influence of Bond Coat:

It is common that some external agents are used in the mix to accomplish a higher degree of adhesion. Many writers have different sentiment sing this, chiefly the bond coats like polymer complexs. Some writers ( Silfwerbrand, 1998 ) argue that the bond coats can ensue in creative activity of an excess plane of failing. As a consequence, it has been advised to avoid the bond coats. Further, the bond coats could besides take to the decrease of the meshing consequence ensuing in an overall negative consequence ( Garbacz et al, 2005 ) . On the other manus these statements have been questioned by some other writers. Interestingly, harmonizing to some other writers ( Austin et al, 1995 ; Pretorius and Kruger, 2001 ) , the presence of the bond coats could increase the adhesion procedure between the two concretes.

To this point, Garbacz et Al ( 2005 ) conducted a survey to look into the influence of surface intervention of the concretes on the adhesion mechanism between the concrete beds. Different surface intervention methods were used in order to accomplish different qualities of surface on the concrete stuff surface. Additionally, a fix howitzer with coat was applied to the old concrete and the adhesion was measured. The consequences showed that, in the instance of the sheathings applied without the bond coats, the adhesion procedure was influenced by the raggedness of the concrete substrate.

Form this, it was concluded that the good bond strength belongingss can be achieved from the howitzer ( repair howitzer ) and the bond coat belongingss. It was further concluded that the belongingss of the bond coats and the howitzer helped in bridging the micro clefts and concrete pieces, and besides filled the surface abnormalities. Therefore, it can be concluded on the recent plants on influence of the surface on the adhesion between the surfaces the roughness status of the surface can be regarded as one of the contributing or act uponing factor in the fix of the concretes.

From these treatments on the different factors impacting the bond it can be concluded that the consequences are non ever in consensus and there is still need for surveies to be carried out in this country for deriving farther penetration of the existent behavior of bond with regard to alterations in factors impacting it.

## 2. 4 Surface Roughening Technique:

There are different ways in which the surface of the stuffs can be prepared to accomplish different raggedness conditions. However, the chief purpose of executing the surface intervention on the substrate is to the brand sure that the unwanted beds that might cut down the adhesion procedure are removed before the new beds of concretes are laid on to the surface. In add-on, this besides ensures that the entire country of surface contact is increased to the maximal degree. The forms and feelings achieved on the surface will depend upon the energy applied and chosen techniques.

Roughening Techniques which does non deteriorate the mechanical unity of the substrate stuff must be used. It is of import to see the local status of the concrete under consideration. Consequently, common techniques like chisel and cocks, sandblasting, hydro-jetting, needle gunning, crunching or milling, hammering etc, may be used ( Garbacz et al, 2005 ) .

## 2. 4. 2 Measurement of Roughness:

The raggedness is by and large assessed qualitatively. But, placing the fact that this sort of raggedness rating leads to subjectiveness of consequences, there have been some efforts made to quantify the raggedness. For, case mechanical profilometry was used to distinguish polished and sandblasted concrete surfaces ( Courard 1998, Courard and Nelis 2003 & A ; Courard and Garbacz 2004 ) . Due to some defects of this procedure like viability with lone short surfaces etc. , another method of optical analysis was developed ( Perez et al 2003 ) in order to analyze big surfaces. Subsequently on, these two above mentioned techniques were compared by Courard et Al ( 2006 ) and they concluded that with the combination of these two methods it is possible to acquire a really good description of `` raggedness '' at all graduated tables. They besides pointed out some restrictions of these methods sing the form of stylus which would do it impossible to take measurings on really unsmooth surfaces and other restrictions being really clip devouring etc. ,

In another survey by Courard et Al ( 2004 ) a point which is concluded is that a parametric quantity Xa which is the arithmetic mean of the going of the raggedness profile from the average line is the major discriminating parametric quantity for the comparing of surface readying techniques.

In a new method for measuring the surface raggedness Abu Tair et Al ( 2000 ) , studied five different sorts of raggedness including needle gunning. They used a different attack for quantifying the raggedness by associating the sum of raggedness to Roughness Gradient of the raggedness profile obtained. They concluded that the raggedness gradient parametric quantity can give a proper indicant of the chapped surfaces.

In this survey an effort is made to happen out a similar sort of parametric quantity to which the sum of raggedness can be related and the chapped surfaces can appropriately be categorized.