The Impact of the implementation mistakes on the construction design in the Arab region, and the ability of the reinforced concrete buildings to resist the applied service loads after the implementation (Libya as a Case Study)

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Abstract:

As a result of congestion construction market in the Arab Union by incompetent engineers and who are lack of engineering knowledge and proper engineering expertise; as well as, in some cases, the absence of control over some construction companies leads to prompting them to dispense with the services of engineers and rely on untrained labor to construct reinforced concrete structures. All this led to commit mistakes during the construction operation and that have a negative impact on resistant buildings for the applied loads and environmental conditions. The mistakes could be simple and cause some structural problems in the long term or could be major mistakes. This study conducted a comprehensive survey on construction sites in Libya and try to limit these mistakes and study their impact on the service of the reinforced concrete structures according to rigorous scientific analysis. The study divided the work into four main categories. The first category, the impact of committing mistakes on (Fc') during the implementation of mix design in the field.
Secondly, ignoring the implementation of reinforcement details accurately at the site and its negative impact on the resistance to shear forces, bending moment, and torsion. Third, negligence the dimensions, distances, and places of structural sections accurately during the construction. The last category, the risk of committing errors during the process of casting or implementing concrete.

Key Words: engineering knowledge, proper engineering expertise, shear forces, bending moment

Introduction

From the available properties of concrete, one of the best is compressive strength. It is so because the structural design

has the great dependence on it. Compressive strength is one of significant properties of solidified cement, and it mirrors the quality and legitimacy of cement.

Compressive strength is the principal opposition for built-up concrete, where that most properties and different resistors, for example, elastic and bowing and shear connection among steel and cement are get improved by expanding Fc'. The nature of substantial creations should be controlled at the task site, and that ought to be finished by testing the substantial parts and the degree of consistency with the details, I.e., the control of blending and relieving rates subsequent to projecting interaction to guarantee the completion of chemical reaction Cement. Work should be able to get a decent concrete with high level of resistance at the site. Based on the study outcomes it can be determined that the local market is crowded by untrained labors and lack of engineers with sufficient experience and good knowledge in the field of construction. All that led to mistakes which have a negative impact on the compressive strength. It has been identified these mistakes in this research and study the risk that can be from exiting these mistakes in the field through laboratory tests.

The field common mistakes for mixture materials

The substantial blends which are utilized in the Libyan fields are made in lab as per American or British norms which means utilizing suitable materials which match the determinations under lab handling conditions. The out of specificity materials have never been utilized in the lab for the plan of substantial blends. Moreover, field materials

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which ought to be utilized in similar substantial combinations, which were made in the lab, are not the same as the materials that were utilized in the lab, which is the primary explanation that was been carried out in our exploration.

1 **- Coarse aggregate:**

- Mostly the aggregate that is being used by the sites is not in accordance with the specification. The main reason behind it is the prevailing cheap prices.
- The standard being set for coarse is 1.5. It is considered for the open concrete works (for example, raft foundation) without paying attention to the gradient (one aggregate size can't get good gradient for most aggregate type in Libya).
- Considering the limited dimension for the case of concrete work, the maximum size for coarse is 1 (for example, columns, beams, and Tie-beams) paying attention to the gradient (one aggregate size can't get good gradient for most aggregate type in Libya).
- Both the amounts are mixed well with 50% ratio.
- Mismatching the maximum size in the local marketing (the maximum size that call on the aggregate in the market is different from its real maximum size in the specifications, it's always given smaller in the lab).

2 **- Fine aggregate:**

Other type of fine aggregates that can match the finest level in British standards contains big amount of the clay. The fine aggregate in Libya is thinking about in the finniest level in British detail, which is Zliten total in the west coast region anyway the most of fields don't utilize this sort of total, due to the excessive cost.

3 **Water:**

Another important consideration in this regard is the use of local water as the combination of certain mixtures.

Field mistakes during the implementations for concrete mixtures:

The study has been collecting various samples from different construction sites and sources sell these materials for more substances known and widely used in Libya. The above-said considerations provide the basis to identify and deal with the mistakes that are identified by the laboratory experiments.

For the mistakes that are being defined by field surveys, there exits certain basis to consider in this regard as given below:

- Using coarse aggregate out of gradient.
- Using fine aggregate out of gradient (very fine).
- Increasing the amount of fine aggregate use in the mixture.
- Decreasing the amount of coarse aggregate use in the mixture.
- Increasing the amount of water use in the mixture.
- Exaggerating or lacking the mixing time in some sites.
- Using coarse aggregates mixing with clay.
- Using fine aggregates mixing with organic impurities.

Mixture Design

It has utilized two reference blends in this examination. The primary blend was taken from the field and this is the fundamental blend which was focused on. The other blend was planned in the lab; additionally, this blend is utilized in the most key blenders in Libya. The explanation for picking two blends that there are a few mix-ups can't be distinguished by the principal blend which was taking from the field, additionally, proposals give distinctive show for combinations that have less compressive strength structure as compared to the primary blend. So we needed to make one more blend with less compressive solidarity to quantify the issues that couldn't be tested in the primary blend. These concerns and blunders will be noted during communicating the outcomes.

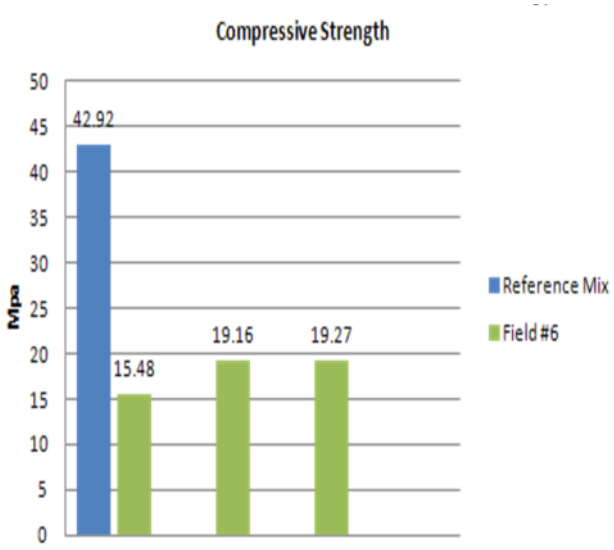
Reason of using two reference mixtures designs in this research:

For the main reference blend, it was seen from the outcomes, which were obtained from combinations that have out of inclination coarse totals, in excess of compressive strength. The justification behind that the primary reference combination has high compressive strength (Fc' = 42.9Mpa) which implies the resistance of the glue (concrete + fine totals) to applied pressure is more noteworthy than the opposition of coarse totals to the applied pressure.

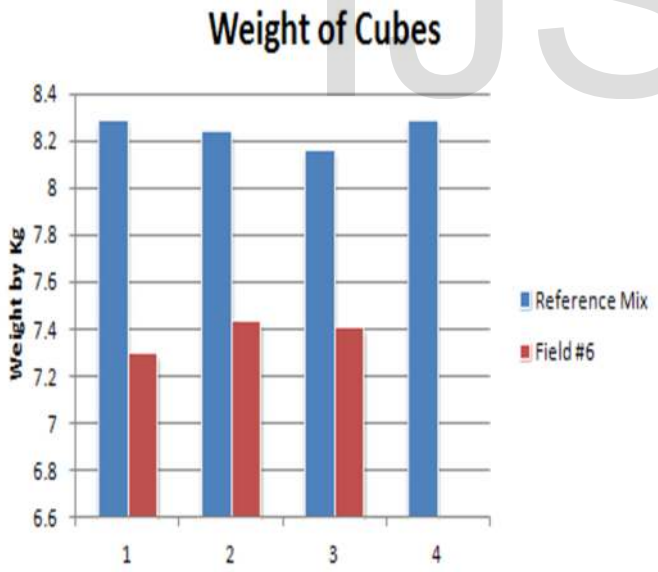
In addition, when the applied pressure surpasses the allowable stress that would happen while stacking the substantial, the loss would be occurred in the coarse total since it is the most vulnerable point in the substantial consideration.

The measure of out of gradient coarse totals in the substantial is not exactly acceptable slope and that would prompt the increment of the volume of voids in the substantial mass and providing the insight about the increment of the measure of glue. The justification for that is expanding the spaces between the prevailing aggregates which permit adding more glue to occupy these spaces (expanding the glue and diminishing the coarse totals). At the point when the glue is expanded (glue has higher compressive pressure) and coarse totals diminished (the shortcoming point) in the substantial, the compressive pressure would also be expanded.

The out-of-angle coarse totals in this first reference blend is a component. So, in view of all that we require to have another reference blend to distinguish the disadvantage of out of angle totals for combinations that have less compressive strength (glue has less obstruction stress than coarse totals).



It is extremely important in the field that you find one misstep during the execution which implies the high compressive strength wouldn't be occur in the field, so we needed to have another blend which has less compressive stretch to ensure that the compressive strength of the glue is equivalent or not exactly the compressive strength in the coarse totals which is obvious and normal for most combinations plans for the normal concrete. The subsequent reference blend has compressive strength Fc' = 8.033Mpa.



Materials used to make the mixtures in the lab:

- It was used coarse aggregate according to ASTM C 33 (the source called Raas Ellafaa)
- It was used fine aggregate according to BS 882 (the source called Zleeten).
- It was used cement Portland type I (42.5N) according to Libyan specifications 2009/304 (AL-Etihaad Al-Arabie)
- The water used was according to ASTM.

Proportions of concrete mixture components:

It was taken accredited and renowned ratios used in the Libyan and some Arab countries market to design the first mixture for concrete and this mixture design was treated according to US specifications and in a laboratory environmental and adoption. This mix called first reference mix. The mixing ratios obtained through site for first reference mix are 350 Kg of cement, 0.4m3 fine aggregates, and 0.8 m3 coarse aggregates. The second reference mix was designed in the lab and the mixing ratios are 343 Kg of cement, 0.85m3 of coarse aggregates, and 0.268 fine aggregates. These two reference mixes are used to compare their compressive strength with other mixtures that contain errors which were committed in the field and find out the effect of these mistakes.

There are two types of mistakes during making the mix design in the field:

- The materials which are using in the mix design at the field don't match the specifications in the type and gradient.
- Mismatch mixing ratios of the components of the mixture that are designed for it.

Methodology of lab work

The research utilized mechanical blender, and computerized scale with the accuracy of 0.05. Placing each of the materials in the blender acknowledge the water and run the blender to ensure that the materials get blended then adding the water to the materials.

The length of time blending is going between two to four minutes then, at that point, taking the droop test by filling the cone with the substantial. Filling the cone in three layers and compacting each layer multiple times. The compaction was for each layer independently and the compaction doesn't surpass another layer. Subsequent to estimating the droop test moving top of the structures (solid shapes 1500×1500×1500) by concrete (examples).

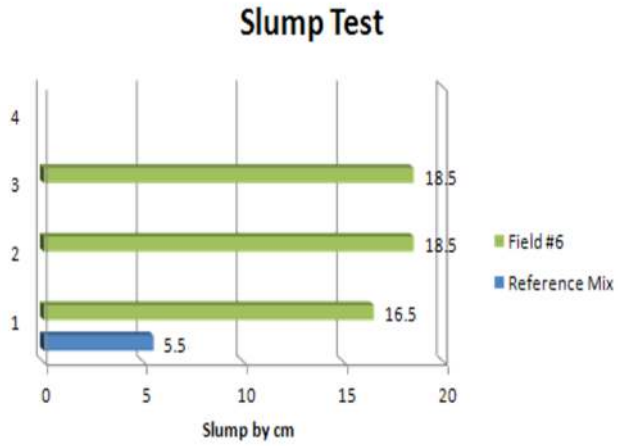
The substantial was filled in the cups in three layers each layer ought to be compacted multiple times. The compacting ought not to surpass the streaming layers which implies the compaction for each layer doesn't interfere with the other layer.

Following 24 hours the blocks move in the water to fix. The restoring time is 27 days then the cubes escape the water and don't remember about them for more than 24 hours prior to testing.

During the test time, the Wight of the cube ought to be taken then put the block in the compressive machine test. The stacking time is between 2 to 3 minutes, then, at that point, composing the outcomes at the specified limit which is Fc'. This is how the tests are performed by considering the specified steps and the limitations which helps to provide with certain specified results.

Coarse totals in the field are dry (during the summer time), then again the coarse totals in the lab are soaked with the dry surface (when the mix design is considered for the development). A portion of the fine totals in the field are soaked and few are to some degree immersed, yet the fine

totals in the lab which are utilized for the combination evaluation are dry. We confronted trouble to appraise the measure of water that can be utilized in the field on account of the changeability of conditional utilization of fine aggregates.



For instance, a few fields utilize exceptionally soaked totals and others utilize somewhat immersed , the trouble has increased since certain fields utilize extremely fine totals and others utilize less fine (which implies various perceptions from one type to another) however is still out of the determinations which implies the fine angle is not quite the same as is visible to other, so this type of reasons made our agenda to gauge the right expanded water percent in the field to test it in the lab.

Conclusion

The various pores in coarse total additionally prompted a distinction related to water (which implies various perceptions from one type to another). There is one more main consideration in changing the level of water which is about the control individual who is considered regardless of adding water to the substantial blend. The trouble here is each individual who's responsible for adding distinctive measure of water from one site to another.

It depends on his experience to quantify the functionality of cement. Kind of design has likewise affected the measure of water that is included to the blend. At the point when the components are tight similar to sections or with some thickness with steel, the businesses increment the measure of water to make their work simpler. This load of elements made it so challenging for us to decide the level of adding water to the field blend.

So, we needed to seek after the same way the US specifications (ASTM), which is relying upon the usefulness test (Slump Test) and that found in many destinations that droop going from 15 cm to 26 cm, and we accepted these upsides of droop to test this adding water in the lab. However, for blending proportions of different materials, we had the option to confine their utilization to the given Pots and move the materials for utilization for substantial blender. This is how by performing various tests it is tried to attain the objectives of the current research work so may it can serve as the basis for certain research studies and the linked models of same kind. Also, All mixes were done by some people to minimize any errors during the implementation in the lab (it was the same person for preparing the materials, the same person for using the mixer machine, and the same person for compacting concrete in the cubes and curing these cubes in the water.

Each mistake has significant impact on the compressive strength. Out of gradient coarse aggregates has positive impact in the reference mix#1 and has lightly negative impact on compressive strength in the mix#2. Out of gradient fine aggregates has negative impact due to increasing the water to get the good workability and that cause pores in the concrete. Out of gradient fine aggregates has very low workability which makes it hard or

impossible to implement in the field. Or leave voids during the implementation in the concrete. Increasing water mistake has the biggest impact on the compressive strength. Increasing water has obvious impact on the compressive strength even if the slump stays during the specifications. Slump test is not indicate to bad compressive strength. Segregation leads to lose the bond from the mix by setting it to the bottom or to

the top by bleeding. Increasing the number of fine aggregates has big impact too. Mingling more than one mistake in the mix increase the negative impact on the compressive strength.

Acknowledgment

The years at Rutgers as a Ph.D. student have been an amazing and thrilling part of my life. I have had the privilege and pleasure of being supervised by Dr. Jie Gong. I am deeply grateful for his continuous guidance, support, and encouragement throughout my entire graduate experience at Rutgers. I learned a lot from his professionalism. It is really a great honor for me to have him as my mentor and a friend.

I would like to thank my friends and colleagues starting with Mr. Aravind Reddy Pasham who provided very valuable help for this dissertation. I would also like to thank Mr. Sher Khan, Mr. Kall Dalco for their support throughout my studies. I have felt so blessed to be surrounded by such great friends who made this journey enjoyable.

I would like to extend my appreciation to all my colleagues who provided insightful; discussions, and scientific suggestions to help improve my dissertation.

Mostly, I would like to thank my loving parents and my family members for their immense love, support, and confidence in me

References

1) Neville A. M. and Brooks J.J. (2010) , concrete technology - 2nd ed. London , Pearson.
2) Neville A. M. (2011) , Properties of concrete , 5th ed. London , Pearson.
3) Kosmatka. steven H. ; Kerkhoff , Beatrix , and Panarese William.C. , (2003) , Design and control of concrete mixtures , 14th edition , Skokie , Illinois , USA , Portland cement Association.

4) ACI 305.1-06 (Specification for hot weather concreting).
5) Building Code Requirements for structural concrete (ACI 318M-14) and commentary (ACI 318-14).
6) 3) ASTM C33 aggregate consists of gravel
7) 4) ASTM D2419
8) ASTM C39 determines the compressive strength
9) ASTM C143 slump
10) ASTM C496 determines the splitting tensile strength