

# “MOBILE APPLICATION DEVELOPMENT ON MIX DESIGN OF CONCRETE”

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**Abstract:** Mobile Application Development on mix design of concrete is a development of app built using Android Studio which makes the lengthy process of calculations very simple by just selecting the desirable properties of elements. Concrete mix design comprises of five majorelements in different proportion: cement, water, coarse aggregate, fine aggregate (sand), and air. Some elements such as admixture and pozzolonicmaterials can be included to give it certain desirable properties. Design of concrete mix is done by using IS code tables and calculationprovided in the standard. Every grade of concretehas a unique properties and design process. Usingxml code, mix design for various grades of concrete and combinations of additional materials can be implemented with ease. Thework also states the use of mineral admixtures with partial replacement of basic ingredients of concrete. In our research, we prepared anextensive database of concrete recipes with the according destructive laboratory tests to get the desired strength and required durability. The mobile app aims to simplify the process of mix design, which typically involves complex calculations and considerations of various factors such as strength, workability, durability, and environmental conditions.

**Keywords:** Concrete Mix Design, Android Studio, Mobile app, IS code.

## I. INTRODUCTION

Concrete is an amalgamated substance producedartificially by hardened blend of cement, fineaggregate (sand), coarse aggregate and water in fixed ratios. It is authentically the backbone of construction industry due to its ability to set in any architecture in raw state and on consolidation it becomes sturdy rock-solid structure, attaining desired workability, durability and strength requirements. The properties of concrete in its fresh and hardened state depends on the performance of its constituents, so it becomes very important to find relevant relationship among its ingredients. Concrete mix design is thetechnique of determining the proportions of exquisite natured ingredients of concrete to accomplish satisfactory workability in fresh state,durability and strength in hardened state most thriftily. This lengthy procedure of Concrete mix design is made simple by Conmix App which was developed using Android Studio.

### 1.1 USE OF ANDROID STUDIO FOR THE APPLICATION DEVELOPMENT

Android Studio was created to speed up application development. This makes it easier to create the best applications possible for each Android device. According to IntelliJ IDEA, Android Studio provides the quickest coding and operational process turn around for app developers.

A developer of an app can also update resources and publish code to an active app without having to restart it thanks to its Apply Changes feature. In order to allow for the development of apps using both files, the Android Studio project construction is divided into two files: Java and XML. Using Java and XML to create applications is supported by the Android app development framework. In the process of creating Android apps, XML and Java files play distinct roles. When one wants the app to perform a task, a Java file is used in Android Studio because of the app's behavior. An independent context for action will be provided by a Java file to an android app.

The Main Objective of our project is to develop a mobile application using android studio, where the code is written in Java using eclipse software, and the UI design and screen elements is done using XML code. This mobile application will thus provide an easy access to achieve the desired gradation of aggregates with the desired strength, workability etc., approximately accurate as per the Indian Standard Code.

## 1.2 CONCRETE MIX DESIGN

The step-by-step procedure listed in IS code for the design of high strength concrete mix is presented below which is the basis for the development of code.

1. Target strength for Mix proportioning.
2. Selection of W/C ratio.
3. Estimation of percentage of air content.
4. Selection of water and admixture contents.
5. Calculation of cement/cementitious materials.
6. Estimation of fine aggregate and coarse aggregate.
7. Obtaining mix proportions for 1 m<sup>3</sup> of concrete.

Manual mix design requires tests on cement, aggregates and admixtures. Following are the test results conducted on cement:

NO.	TESTS	IS CODE REFERENCES	RESULTS	REQUIREMENT AS PER IS CODES
1	Normal Consistency	IS:4031(Part 4)-1988 Reaffirmed 2005	31%	
2	Initial setting time & Final setting time	IS:4031(Part 5)-1988 Reaffirmed 2005	165min 200min	Min 30 minutes Max 600 minutes
3	Soundness	Per IS:4031(Part 3)-1988 Reaffirmed 2005	2mm	<10mm
4	Specific gravity	IS:4031 Reaffirmed 2005	3.053	3 to 4
5	Fineness of cement	Per IS:4031 Reaffirmed 2005	2.24%	Residue should not exceed 10%

Following are the test results on Coarse Aggregates:

NO.	TESTS	IS CODE REFERENCES	RESULTS	REQUIREMENT AS PER IS CODES
1.	Specific gravity	IS:2386(Part 3)-1963 Reaffirmed 2002	2.67	2.5 to 2.7
2.	Water absorption	IS:2386(Part 3)-1963 Reaffirmed 2002	0.305%	0.6%
3.	Shape test Flakiness index Elongation index	IS:2386(Part 4)-1963 Reaffirmed 2002	19.70% 17.56%	< 30% < 30%
4.	Crushing Strength	IS:2386(Part 4)-1963 Reaffirmed 2002	24.26%	< 45%

Following are the test results conducted on Fine Aggregates:

NO.	TESTS	IS CODE REFERENCES	RESULTS	REQUIREMENT AS PER IS CODES
1.	Specific gravity	IS:2386(Part 3) Reaffirmed 2002	2.66	2.3 to 3
2.	Fineness modulus	IS:2386(Part 1) Reaffirmed 2002	2.727	2.3-3.5
3.	Water absorption	IS:2386(Part 3) Reaffirmed 2002	2.73%	

Casting of cubes were done followed by the manual calculations of design from the IS Code. These cubes were then tested for 3days, 7days and 21 days to achieve the desired strength along with the desired combinations of materials required for the mix.

Therefore to ease the procedure of concrete mix design we have henceforth came up with the solution of developing a mobile application.

## II. METHODOLOGY

In the experiment a typical concrete mix analysis was carried out using of manual approach. We first did the literature review from the previous studies, then comes the collection of data and study of the data is carried out. Using android studio, mobile application is being built by easy drag and drop process. Front end is developed using XML and backend programming code is done using JAVA and the app is ready to use. Followed by this, the comparison of results of manual mix design and that of the app results is done.

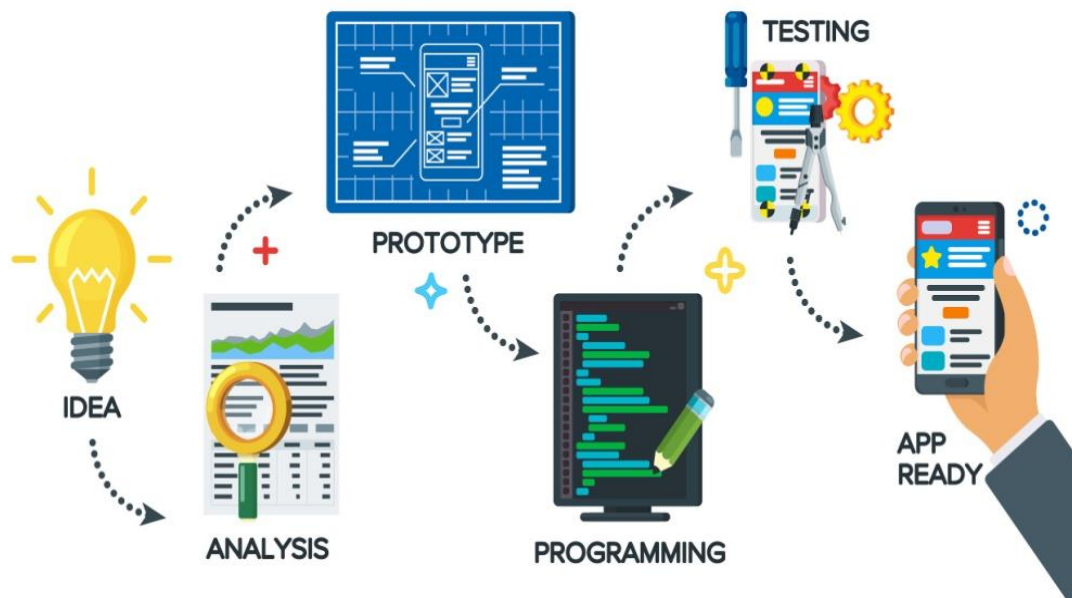


Fig 1: Methodology

1. **Idea:** As we know that concrete, to be built at a desired strength requires more strategy of mixing the sand, aggregate and cement with a knowable quantity which is decided after the calculation process. The calculation process is different for various grades of concrete. The calculations, which is the important part of mix design is done by the application which is developed using Android studio that makes it easier to achieve the desirable quantity of mix.

- Analysis:** This project has been decided to overcome the problem of wasting time and energy. This also helps in saving various materials incurred in trial mixes. Results obtained in this system can be accurate and may have the percentage error less than 0.2
- Prototype:** A Prototype is an interactive mockup of a mobile app which contains key user interfaces, screens and simulated functions without any working code which is done very easily with the help of XML in the Android studio.
- Programming:** Programming in android studio is done using the 'Xml' for frontend and 'Java' for the backend part of calculations of concrete mix design.

Following are the snapshots of code and the making of app:

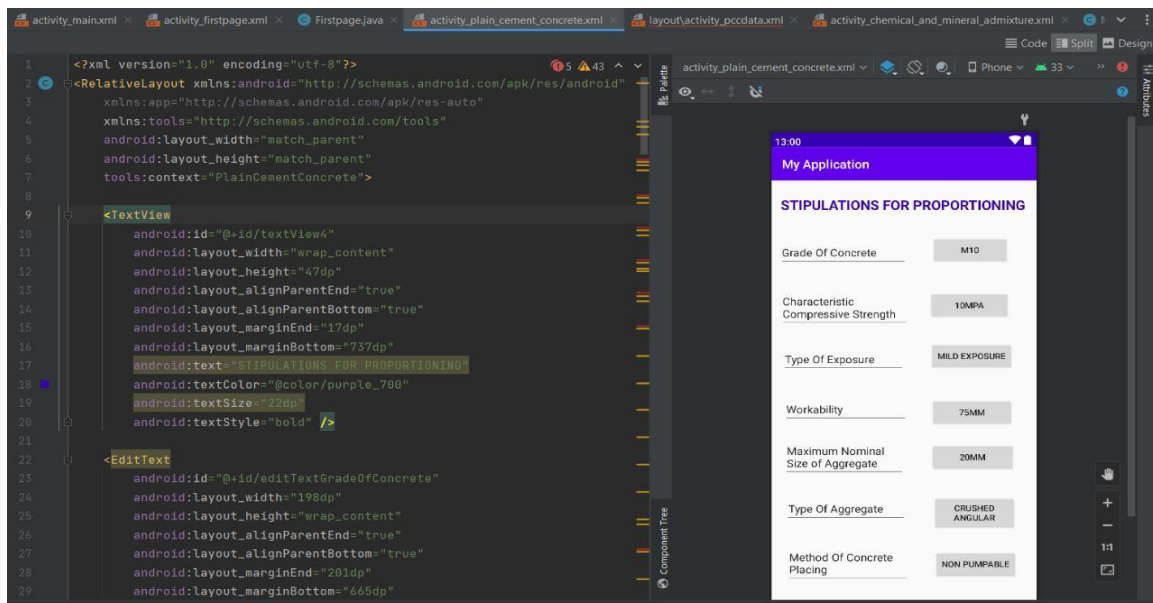


Fig 2: Snapshot of code and making of app

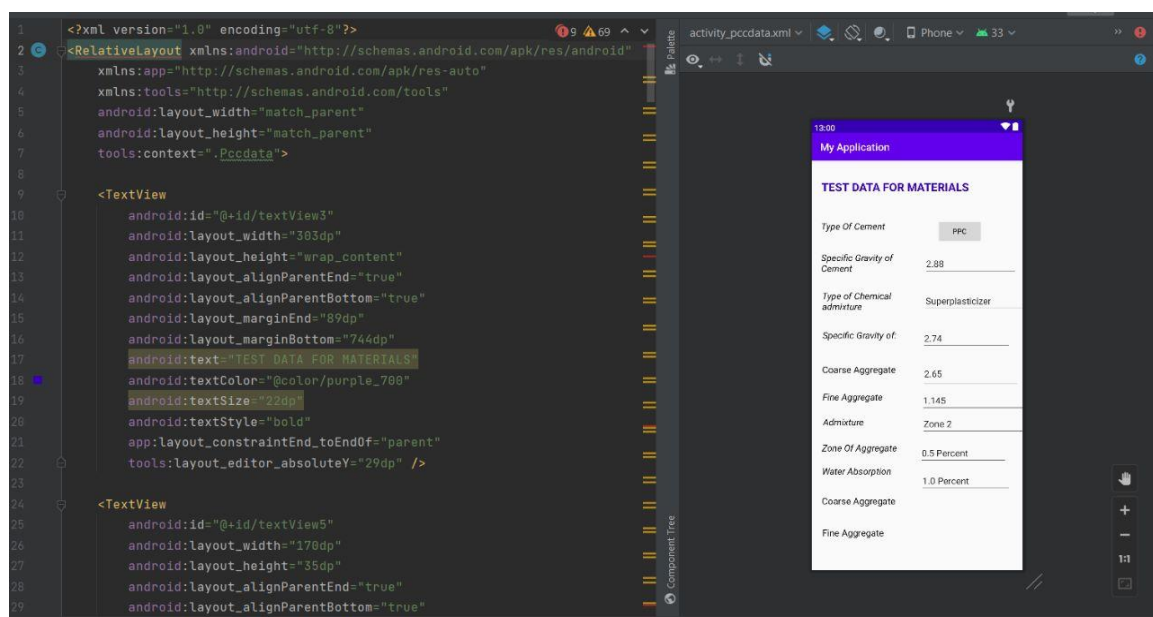


Fig 3: Snapshot of code and making of app

5. **Testing:** App was tested for the smooth running without any bugs for the approximately accurate results of the IS Code. Results were then compared with the manual calculations to test.

<b>Cement</b>	296	Kg/m <sup>3</sup>
<b>Water</b>	148	Kg/m <sup>3</sup>
<b>W/C Ratio</b>	0.5	Kg/m <sup>3</sup>
<b>Super plasticizers</b>	0.0012	Kg/m <sup>3</sup>
<b>Coarse Aggregates(SSD)</b>	1296.52	Kg/m <sup>3</sup>
<b>Fine Aggregates (SSD)</b>	705.06	Kg/m <sup>3</sup>

Fig 4: Manual Results for M20 Grade

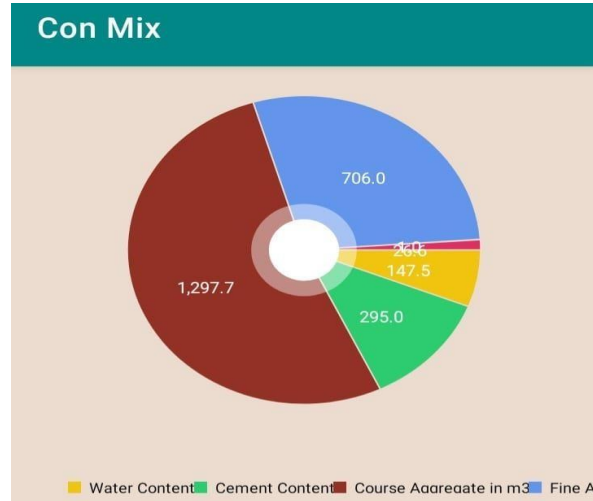


Fig 5: App Results for M20 Grade

6. **App Ready:** App is hence ready to use after all the above followed methodology to achieve the desired gradations with their properties.

### III. OVERVIEW OF APP

#### SNAPSHOTS of the app:

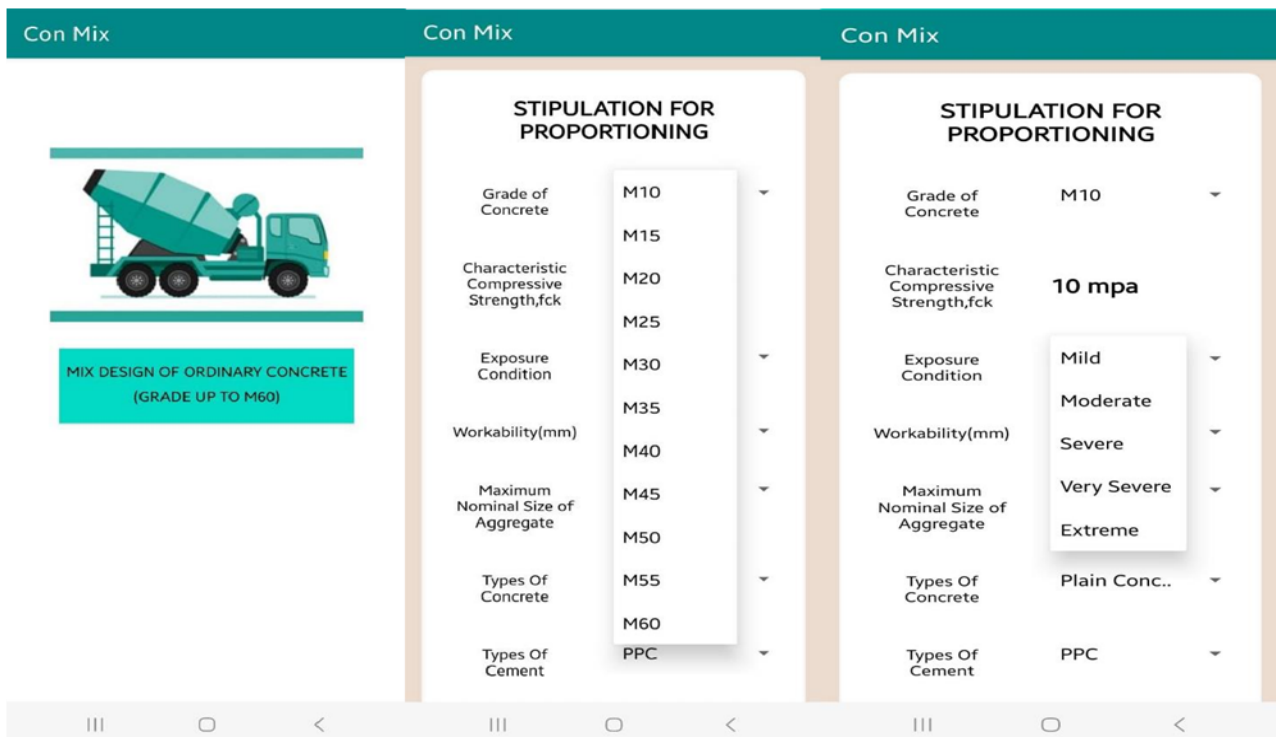


Fig 6: Working images of the App

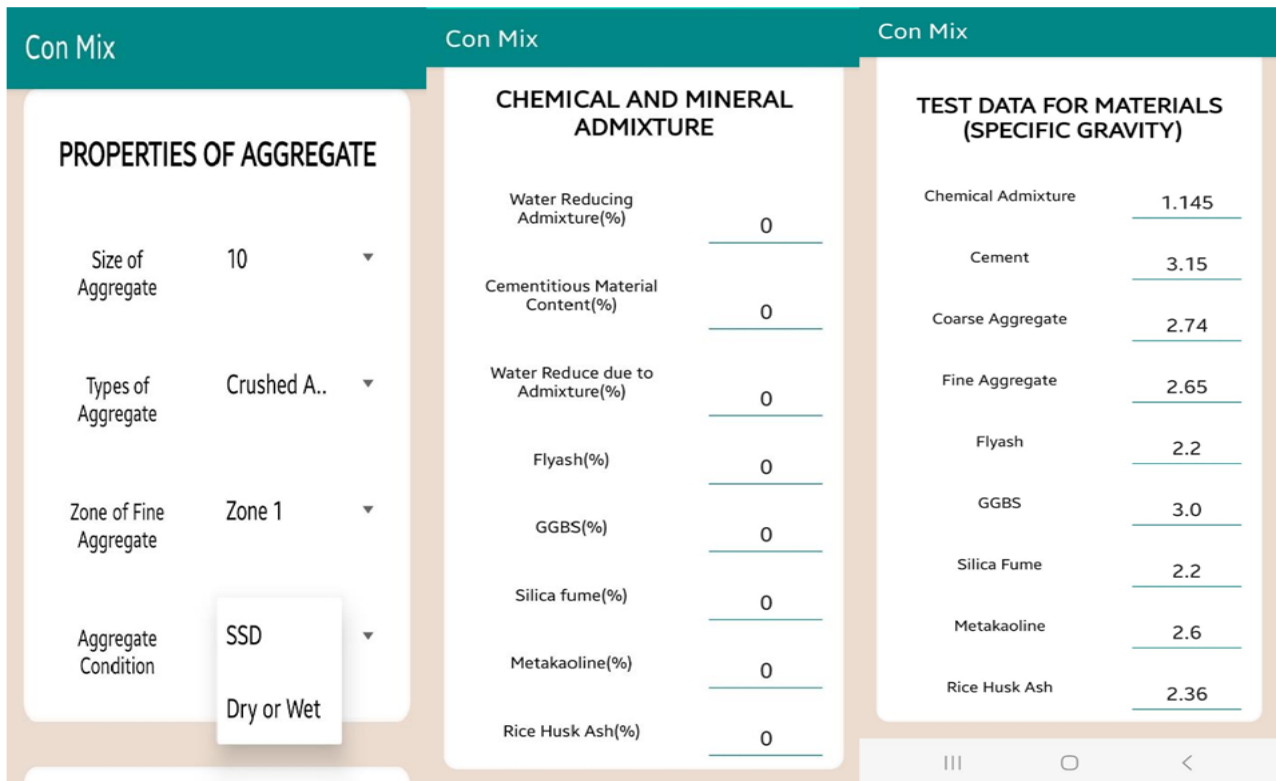


Fig 7: Working images of the App

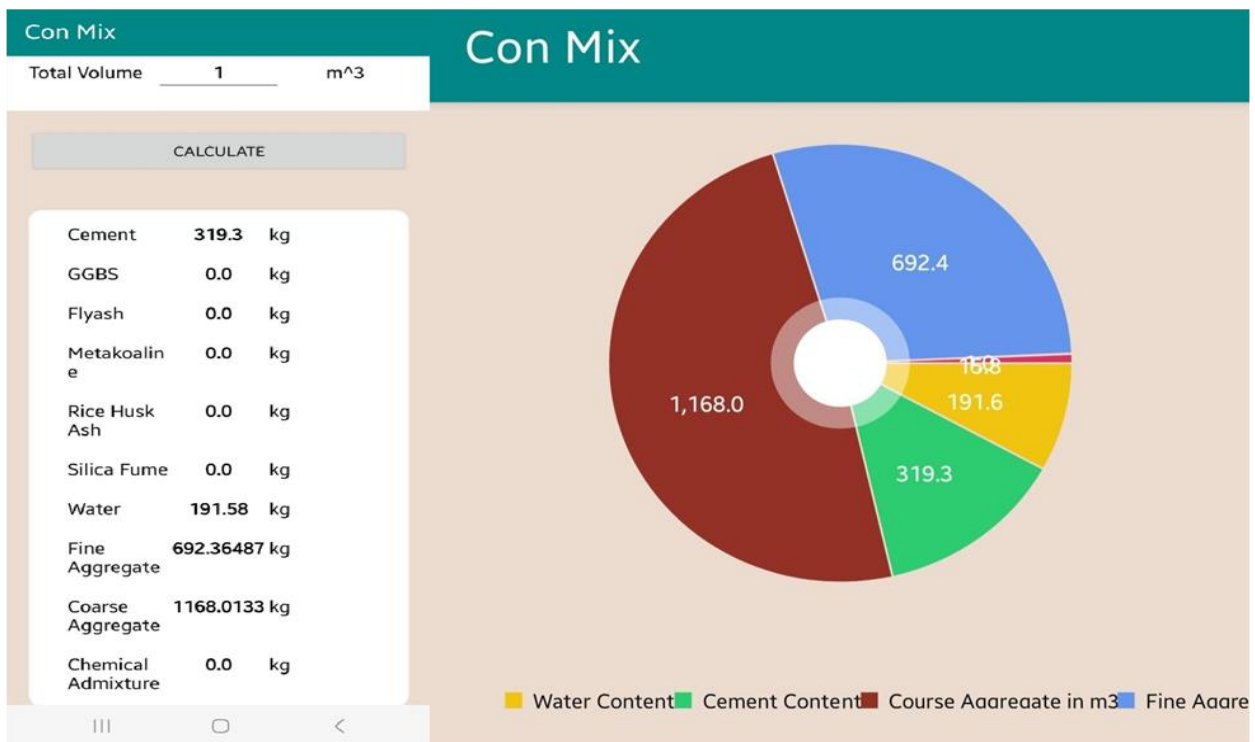


Fig 8: Final Results of the CONMIX app



Fig 9: App Logo of the CONMIX app

#### **IV. CONCLUSION**

Mobile app development on mix design of concrete using android studio revolutionizes the construction industry by providing a portable, accurate, and efficient solution.

1. The mix design packages are user friendly.
2. It saves lot of time, energy and material incurred in trial mixes.
3. Results are very accurate and may have percentage error less than 0.2.
4. It includes all the provisions of IS codes and can design all grades of concrete specified in codes.
5. By providing a digital platform to calculate and optimize concrete mix designs, these apps streamline the process, enhance accuracy, and increase efficiency for construction professionals.

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