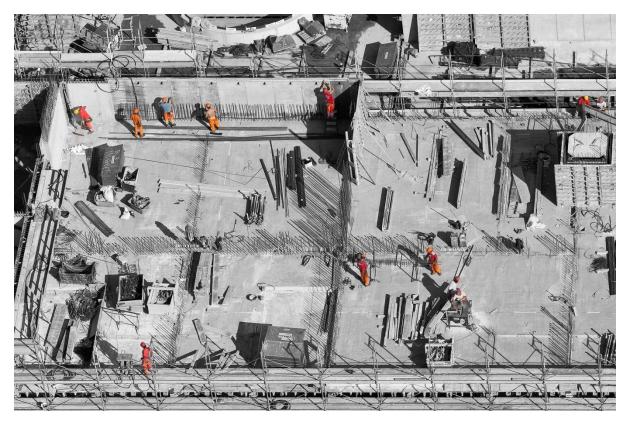**Determining the Concrete Compressive Strength**

The Compressive Strength of Concrete determines the quality of Concrete. This is generally determined by a standard crushing test on a concrete cylinder. This requires engineers to build small concrete cylinders with different combinations of raw materials and test these cylinders for strength variations with a change in each raw material. The recommended wait time for testing the cylinder is 28 days to ensure correct results. This consumes a lot of time and requires a lot of labour to prepare different prototypes and test them.

Also, this method is prone to human error and one small mistake can cause the wait time to drastically increase. One way of reducing the wait time and reducing the number of combinations to try is to make use of digital simulations, where we can provide information to the computer about what we know and the computer tries different combinations to predict the compressive strength. This way we can reduce the number of combinations we can try physically and reduce the amount of time for experimentation.

Dataset:

Table 2-1. *Data Dictionary for the Concrete Compressive Strength Dataset*

Feature name	Description
Cement (kg in a m3 mixture)	Amount of cement used in a m3 mixture (unit: kg)
Blast furnace slag (kg in a m3 mixture)	Amount of blast furnace slag used in a m3 mixture (unit: kg)
Fly ash (kg in a m3 mixture)	Amount of blast fly ash usedin a m3 mixture (unit: kg)
Water (kg in a m3 mixture)	Amount of water used in a m3 mixture (unit:kg)
Superplasticizer (kg in a m3 mixture)	Amount of superplasticizer used in a m3 mixture (unit: kg)
Coarse aggregate (kg in a m3 mixture)	Amount of coarse aggregate used in a m3 mixture (unit: kg)
Fine aggregate (kg in a m3 mixture)	Amount of fine aggregate used in a m3 mixture (unit: kg)
Age (days)	Age of concrete (unit: days)
Concrete compressive strength	Concrete compressive strength which is measured in MegaPascal (MPa). This is the unit for pressure or stress and is the common unit to determine compressive strength of concrete.

Objective:

Concrete is the most important material in civil engineering. The concrete compressive strength (CCS) is a function of age and ingredients. These ingredients include cement, blast furnace slag, fly ash, water, superplasticizer, coarse aggregate, and fine aggregate. Find the relation between CCS and the independent features using statistical models and use the same for prediction.

Final Output:

1. Univariate and Multivariate Analysis in Python or Excel
2. End to End Model in Python
    a. Data Pre-processing
    b. Feature Engineering (if necessary)

   c. Visualisations

   d. Model Iterations

     i. Feature Selection

     ii. Hyperparameter Tuning

3. PowerPoint Presentation with all the analysis and Model information (Models Used and Iterations, Performance, Assumptions if any etc.)