AN EXPERIMENTAL STUDY OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT BY HYPO SLUDGE

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION OF PROJECT WORK

Paper waste (hypo sludge) is a waste from paper and board industry. It is estimated that in India, 0.7% of total urban waste generated comprises of paper waste. Paper sludge is a major economic and environmental problem for the paper industry. Paper sludge are varies with strong and weak fibres. Strong fibres of waste are taken for the recycling process to make recycled paper and the weak fibres are taken to the disposal site. Due to this disposal, it causes a severe problem of air pollution, water pollution and soil pollution. To reduce the disposal problem, paper sludge are replaced with cement where paper waste behaves like cement because of silica and magnesium properties which improves the setting time of cement.

Hypo sludge was originally introduce as artificial pozzolana in which it consists of minimum amount of silica, magnesium, considerable amount of lime which is the main property of cement. Hypo sludge is used as a replacement in producing mortar and was investigated on its mechanical, physical and chemical properties. Substitution of waste materials will conserve resources and will avoid environmental and ecological damages caused by quarrying and exploitation of raw materials for making cement. There is an increasing demand for concrete worldwide at low cost, by producing this concrete it will reduces the demand of concrete and reduces the emissions of CO2 from cement industry. This project concisely explains the technical and environmental benefits of supplementary cementitious materials use and study the deign parameters of concrete on inclusion of paper waste as partial replacement of cement

Benefits of Hypo sludge

*Environmental friendly Hypo sludge improves the settingof concrete due to presence ofsilica and magnesium.
*Hypo sludge is a light weightcompare to conventional concrete.
*Hypo sludge improves theproperties of fresh and hardenconcrete.

1.2 PROBLEM STATEMENT

Hypo sludge produced in a large amount as by product of paper industry and is usually used in concrete production as partial replacement of cement. It contains low calcium and minimum amount of silica and due to presence of silica and magnesium properties , that it behaves like cement. Use of hypo sludge in concrete can save the paper industry disposal costs and also produces a sustainable concrete for construction**.**

1.3 OBJECTIVE

- The present research work is focused with following objective
- To study the suitability of supplementary cementitious materials (SCMs) like hypo sludge.
- To find out the optimum percentage of hypo sludge in concrete in the place of cement.
- To compare the compressive strength of conventional concrete with hypo sludge concrete.
- To compare the cost of conventional concrete with hypo sludge concrete**.**

1.4 SCOPE OF THE PROJECT

The process of formation of paper from pulp includes the following processes during whichthe Hypo sludge is f ormed as waste byproduct is purely a chemical wastes and do not contain any biodegradable element. Most of th e mills are using only woody raw material (bamboo, eucalyptus, casuarinas, poplar and other hardwood spe cies), but some other mills are using bagasse in substantial quantity as raw material. Most of the paper mill s in India prepare bleach liquor (calcium hypochlorite) using lime and elemental chlorine. Six mills among eig ht mills are using ClO2 as bleaching agent either as partial substitution of elemental chlorine or in final st age of bleaching to attain desired brightness level. These mills are producing ClO2 with environmental frien dly process. Three mills among eight mills are still using calcium hypo chlorite in final stage for bleaching. Sol id wastes generated during calcium hypo chlorite generation are called hypo sludge.

- To control the environmental pollution.
- To produce low cost concrete.
- Economical and profitable substitute to landfills, incinerator.
- To produce sustainable concrete.

1.5 WHAT IS HYPO SLUDGE?

Hypo sludge is a waste material collected from the paper industry. Hypo sludge behaves like cement because of silica and magnesium properties.It is a good binding chain material for the concrete.The chains also pack regularly in places to form hard, stable crystalline region that gives the bundle chains even more stability and strength. Hypo sludge is used in concrete with the replacement of cement of10%, 15%, 20%, 25% and 30%. The compressive strength and spilt tensile strength was also determined in 7 days and 28 days.

Fig-1. Hypo sludge

Fig-2.Hypo sludge Concrete

Fig-3. Formation of Hypo sludge concrete

Table-1. Physical properties of Raw Hypo sludge

S.no	Property	Result
1.	Specific gravity	1.42

Table-2. Chemical properties of hypo sludge

Sr.no	**Constituent**	**Present in hypo sludge (%)**
1.	Moisture	56.8
2.	Magnesium oxide (MgO)	4.5
3.	Calcium oxide (CaO)	46.1
4.	Loss on ignescent	27
5.	Acid insoluble	12.12
6.	Silica(Sio2)	4.0
7.	R2O3	3.6

1.6 LIMITATION

- Availability of hypo sludge
- Handling problem

CHAPTER 2

LITRATURE REVIEW

INTERNATIONAL RESEARCH PAPER

Jayeshkumar Pitroda, et al.,[1](2013) Concluded that based on the following experimental investigation concerning the water absorption and sorptivity of concrete, the following observations are made regarding the resistance of partially replaced Paper Industry Waste (Hypo Sludge) for M25 and M40 grade concrete:The water absorption and sorptivity of Paper Industry Waste (Hypo Sludge) concrete shows lower water absorption and sorptivity at 10% replacement with Paper Industry Waste (Hypo Sludge) for M25 and M40 grade concrete. There after the water absorption and sorptivity shows an increasing trend. For 90 days, where percentage decreases in water absorption is found to be 1.13% for M25 and 1.53% for M40 and sorptivity is found to be 2.32 mm/min0.5 for M25 and 4.65mm/min0.5 for M40 with respect to reference mix. The water absorption and sorptivity of Paper Industry Waste (Hypo Sludge) concrete shows lower water ab-sorption and sorptivity at a replacement level of 10% with Paper Industry Waste (Hypo Sludge) for M25 and M40 grade concrete. The water absorption and sorptivity of Paper Industry Waste (Hypo Sludge) concrete shows higher water ab-sorption and sorptivity than traditional concrete. The water absorption and sorptivity of M25 Paper Industry Waste (Hypo Sludge) concrete is higher than water absorption and sorptivity M40 grade concrete. The Paper Industry Waste (Hypo Sludge) can be innovative supplementary cementitious Construction Material but judicious decisions are to be taken by engineers.

Table-3. Sorptivity at 90 days for M25 & M40

Concrete gread	Concrete Type	Dry wt in grams (W1)	Wet wt in grams (W2)	Sorptivity value in 10-5 mm/min0.5
	A1-M25	979.00	980.00	2.32
	C1-M25	1012.50	1013.50	2.32
M25	C2-M25	917.50	919.50	4.65
	C3-M25	884.00	890.00	13.95
	C4-M25	866.50	873.50	16.28
	A2-M40	979.00	979.50	1.16

M41	C5-M40	959.00	961.00	4.65
	C6-M40	928.50	931.00	5.81
	C7-M40	920.50	927.00	15.11
	C8-M40	769.50	780.00	24.42

R .Balamurugan & R .Karthickraja [2] (2014) Prosposed that, Over a 300 Million of Industrial Waste are being Produce Per Annum by Chemical & Agricultural Process In India.This Material Possess Problems Of Disposal & Health Hazard.The Waste Like Phospho gypsum, Fluro gypsum & Red mud contain Obnoxius Impurities Which Adversally Affect the Strength & Other Properties of Building Material based On Alternative to Land Fill Disposal. The Cement Has Been Replaced By Waste Paper Sludge Accordingly i=In The Range Of 5% to 20% bt Weight For M20 & M30 Mix.By Using Adequate Amount Of The Waste Paper Pulp & Water, Concrete Mixture Waste Produced & Compared In Terms Of Slump & Strength With The Convential Concrete.

JayrajVinodsinh & Jayeshkumar [3] (2013) Stated that**,** In this author check the flexural strength of beam by partial replacement of cement with hypo sludg & fly ash in concrete. The following observations are made regarding the resistance of partially replaced fly ash and hypo sludge. Flexural strength of the concrete increases when the 20% replacement of cement by fly ash is increased up to 11.08 %. Flexural strength of the concrete increases when the 10% replacement of cement by hypo sludge is increased up to 8.91%. Environmental effects from wastes and residual amount of cement manufacturing can be reduced through this project. A better measure by a New Construction Materials formed through this project.

R. Srinivasan, et.al [4] (2010) Conclude that, The Project Is Concrete With Experimental Investigation On Strength Of Concrete & Optimum Percentage Of The Partial Replacement By Replacing cement Via 10%, 20%, 30%, 40%, 50%, 60%, & 70% Of Hyposludge.Where This Hyposludge Contains Low calcium & Maximum Calcuim Chloride & Minimun Amount Of Silica, Hypo sludge Behave Like cement because Of Cilica & Magnesium Properties.This Silica & Magnesium Improve The Setting Of Concrete.While Producing a Paper The Various Waste are Come Out From The Various Process In Paper Industries, From The Preliminary Waste Names As Hypo sludge.Due To The Cement Production Green House Gasses Are Emitted In the Atmosphere For Producing 4 Million Tons Of Cement, 1 Million Tons Of Green House Gases are Emitted.Due To Sludge To Eliminat the Ozone Layer Depratron.Due To Sludge, Production Of Cement Reduced.

NATIONAL RESEARCH PAPER

Prof. Jayeshkumar Pitroda1,et al.,[5](2013) Stated that, Based on limited experimental investigations concerning the compressive strength, flexural strength and modulus of elasticity test of concrete (M25 Grade) for rigid pavement, the following observations are made in the ray of the objectives of the study:Author discuss about rural road which we have opportunity to do sustainable development in low cost.For that they consist various values & consist vatious test.For a CBR value of 2% and Wheel Load (P) of 30KN; Cost of rigid pavement decreases from Rs. 785.67 per sq.mt. To Rs. 605.17 per sq.mt.For a CBR value of 4%, 6% and Wheel Load (P) of 30KN; Cost of rigid pavement decreasesfrom Rs. 620.27 per sq.mt. To Rs. 605.17 per sq.mt. 10% replacement of cement by hypo sludge in concrete for rural road construction gives Slab Thickness 150mm and low cost of rigid pavement i.e Rs. 590.12 per sq.mt. for a CBR value of 2%, 4%, 6% and Design Wheel Load (P) of 30kN.For a CBR value of 4%, 6% and Wheel Load (P) of 30KN; Relative Cost of Slab decreases 100%. To Rs. 99.95%. At 10% Replacement Cement by Hypo Sludge and Rs. 97.56%. At 40% Replacement Cement by Hypo Sludge.Use of hypo sludge in concrete can save the paper industry disposal costs and produce a 'greener' Concrete for low cost rural roads.This research concludes that hypo sludgecan be an innovative Supplementary Cementitious Material useful for development oflow cost rural roads.India should aggressively identify projects that can use large amounts of hypo sludge in road Construction so that harmonizing environment and ecological sustainability can be developed.Use of hypo sludge in road construction works will result in the less depletion of naturally available stone metal, gravel, sand and soil; and will save cement, which is the costliest ingredient will lead to reduction in construction cost. With adequate knowledge on the performance of hypo sludge based road pavements, a huge demand can be expected from the road sector to use hypo sludge for construction purposes, but judicious decisions are to be taken by engineers, for development of low cost rural roads.This research study concludes that there is a great scope for eco-efficient utilization of hypo sludge for sustainable development of Indian Road Network

Prof. Jayeshkumar Pitroda, et al.,[6](2013) Concluded that**,**Author Explained about innovative use of paper industry waste which is hypo sludge in design mic concrete.In this the use the hypo sludge concrete in the place of conventional concrete.The form a concrete which contain the following material that is cement, course & fine

aggregate, water & hypo sludge. Compressive strength reduces when cement replaced hypo sludge. As hypo sludge percentage increases compressive strength and split strength decreases.Use of hypo sludge in concrete can save the paper industry disposal costs and produces a 'greener' concrete for construction.The cost analysis indicates that percent cement reduction decreases cost of concrete, but at the same time strength also decreases.Environmental effects from wastes and residual amount of cement manufacturing can be reduced through this research.A better measure by an innovative supplementary cementitious Construction Material is formed through this research.This research concludes that hypo sludge can be innovative supplementary cementitious Construction Material but judicious decisions are to be taken by engineers.

Sangeeth & B. Ravindra [7] (2016) Stated that, In this project sikacrete admixture is used to improve the strength and reduce the water content in concrete. Optimum percentage of the partial replacement by replacing cement via 5%, 10%, 15%, and 20% of Hypo Sludge and also 50ml added Sikacrete. For phase I the work is concerned with experimental investigation, mix design, Casting of cubes and testing on cubes. The mix design was carried out for M20 grade concrete. Concrete is basically made of cementations materials which have to properly bind themselves together, as well as with other materials to form a solid mass. Concrete or mortar is made up of cement,water and aggregates (Coarse and Fine Aggregate) and sometimes with necessary admixtures. Concrete has attained the status of a major building material in all the branches of modern construction. It is difficult to point out another material of construction which is as variable as concrete. Concrete is the best material of choice where strength, durability, impermeability, fire resistance and absorption resistance are required. Compressive strength is considered as an index to assess the overall quality of concrete and it is generally assumed that an improvement in the compressive strength results in improvement of all other properties. Hence strength investigations are generally centered on compressive strength.

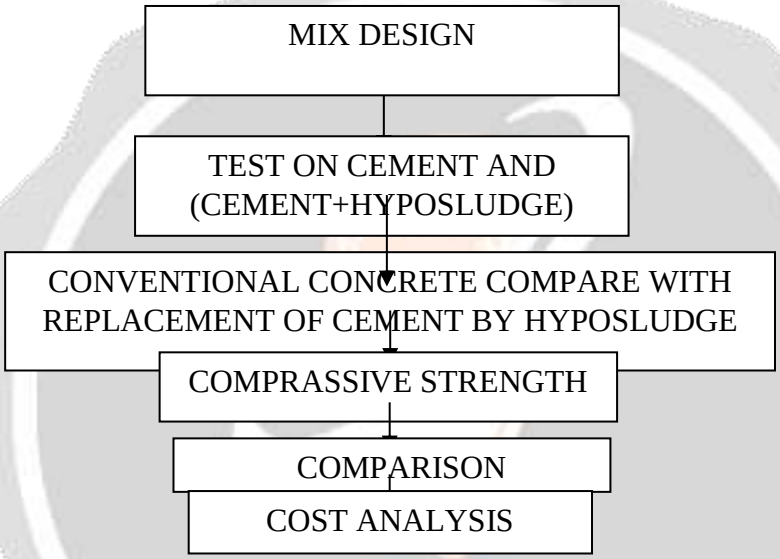
Rushabh & Jayeshkumar [8] (2013) Stated that, The evaluation of Hypo Sludge for use as a supplementary cementitious material (SCM), i.e., as a pozzalona, begins with the mortar testing. Mortar is similar to concrete in that it contains cement, water and aggregate, except that in mortar graded fine aggregate is the only aggregate present. With the control mortar, i.e.10 %, 30% and 50% of the ordinary Portland cement (OPC) confirming IS 269IV is replaced with Hypo Sludge,The data from the Hypo Sludgemortar is compared with data from a "control" mortar without Hypo Sludge. From this study the following conclusion can be drawn: The results presented in this paper, indicate that the incorporation of a HypoSludge in mixed cement is not feasible for making masonry mortars for high strength. Adequate strength developments were not found in mortars made of the mixed cement and Hypo Sludge as cement replacement for 1:3 mortars at 28 days. Hypo Sludge may be used in masonry mortar to improve the long-term bond strength. Partial replacement of the Portland cement with Hypo Sludgedoes not improve the masonry bond strength at early age of 7 days. So it can be used in non-structural elements in the low range compressive strength where strength is not required. Hypo Sludge can be used to prepared low cost temporary structure.

Vinai & Danish [9] (2016) Conclude that**,** Many researchers have used hypo sludge as replacement of cement in cement concrete and chief finding of which are given in this section. The hypo sludge is mostly used along with fly ash, another waste product, and its effect on properties of concrete is evaluated.In a study to evaluation modulus of elasticity of concrete replaced with hypo sludge and fly ash , it was found that modulus of elasticity slightly decreased as amount of replacement increased and hence it was concluded that fly ash and hypo sludge can be used as replacement of cement. The study conducted to find out feasibility of use of hypo sludge in rural roads concluded that cost of pavement construction for different CBR values decrease by 10% to 20% when cement was partially replaced by hypo sludge and hence is an innovative supplementary cementitious material for low cost roads which is also ecofriendly.in the experimental study on hypo sludge replacement concrete concluded that though compressive strength of concrete reduces but the environmental effects are beneficial. Also the total cost is reduced. The study to evaluate flexural strength of concrete beams with fly ash and hypo sludge observed that flexural strength of concrete beams is increase by about 11% for 10% replacement and 9% for 20% replacement. The structural performance of concrete evaluated in concluded that compressive strength of concrete increases up to 10% replacement but starts decreasing with 30% replacement. Similar pattern was found in case of strength. The experimental study of concrete with hypo sludge and fly ash found similar pattern that 10% replacement increase compressive strength but further increase in amount of hypo sludge as replacement results in decrease of compressive strength.

Y.D. Shermale & M.B .Varma [10] (2015) Stated that**,** Some information has been published on uses for hypo sludge. There is a lack of information on the engineering properties of the material. In 2013, Jayraj et al done experimental investigation on strength of concrete and optimum percentage of the partial replacement by preparing a mix M20 grade was designed as per Indian Standard method and the same was used to prepare the test samples. In the test performed, the optimum compressive stress obtained by utilizing paper waste was at

30% replacement. The compared values of cost show gradual decrement in total cost of per cubic meter concrete. When government implement the projects for temporary shelters for who those affected by natural disaster, this material can be used for economic feasibility. In 2013, Jayesh kumar Pitroda et al focused on investigation of strength of concrete and optimum percentage of the partial replacement by replacing cement via 10%, 20%, 30%, and 40% of Hypo Sludge. Keeping all this view, the aim of investigation is the behavior of concrete while adding of waste with different proportions of Hypo sludge in concrete by using tests like compression strength and split strength. In 2013, Rushabh shah and J. Pitroda study the results of the cement mortar of mix proportion 1:3 in which cement is partially replaced with Hypo Sludge as 0%, 10%, 30%and 50% by weight of cement. Test results indicate the decreases in the strength properties of mortar with Hypo Sludge for strength at 7 &28 days as partial replacement with the cement in the cement mortar 1:3. So it can be used in non-structural elements in the low range compressive strength where strength is not required and low cost temporary structure is prepared.

CHAPTER 3
METHODOLOGY



MIX DESIGN

Concrete mix design is the process of finding right proportions of cement, sand and aggregates & Hypo sludge for concrete to achieve target strength in structures. So, concrete mix design can be stated as Concrete Mix = Cement: Sand: Aggregates : Hypo sludge.

The concrete mix design involves various steps, calculations and laboratory testing to find right mix proportions. This process is usually adopted for structures which requires higher grades of concrete such as M25 and above and large construction projects where quantity of concrete consumption is huge.

Benefits of concrete mix design is that it provides the right proportions of materials, thus making the concrete construction economical in achieving required strength of structural members. As, the quantity of concrete required for large constructions are huge, economy in quantity of materials such as cement makes the project construction economical.

A mix M25 grade was designed as per Indian Standard method and the same was used to prepare the test samples. The design mix proportion is done in Table 1.

Table-04. Mix design of Gread M25

M-25 CONCRETE MIX DESIGN	
As per IS 10262-2009 & MORT&H	
A-	**Stipulations for Proportioning**

1		
1	**Grade Designation**	**M25**
2	Type of Cement	OPC 53 grade confirming to IS-12269-1987
3	Maximum Nominal Aggregate Size	20 mm
4	Minimum Cement Content (MORT&H 1700-3 A)	310 kg/m^3
5	Maximum Water Cement Ratio (MORT&H 1700-3 A)	0.45
6	Workability (MORT&H 1700-4)	50-75 mm (Slump)
7	Exposure Condition	Normal
8	Degree of Supervision	Good
9	Type of Aggregate	Crushed Angular Aggregate
10	Maximum Cement Content (MORT&H Cl. 1703.2)	540 kg/m^3
11	Chemical Admixture Type	Superplasticiser Confirming to IS-9103

Table-5. Proportion for M25 Gread Concrete

	Water	**Cement**	**Fine Aggregate**	**Course Aggregate**
By weight, [kg]	191.6	547.42	456.96	1255.475
By volume	0.35	1	0.834	2.29

Mix Proportions

Conventional Concrete 1: 0.834 : 2.29
10% replacement 0.9: 0.834 : 2.29
20% replacement 0.80:0.834:2.29
30% replacement 0.70:0.834:2.29
40% replacement 0.60:0.834:2.29
50% replacement 0.50: 0.834: 2.29

- **DESIGN MIX MATERIALS:**

a) **Supplementary Cementitious Material:** Hypo Sludge The hypo sludge is procured from J.K.Papers mill Pvt.Ltd, plant. This plant is located near Songadh in Tappi District in Gujarat State. Hypo sludge contains low calcium and maximum calcium chloride and minimum amount of silica.Hypo sludge behaves like cement because of silica and magnesium properties.This silica and magnesium improve the setting of the concrete.

Fig-4. Hypo sludge

b) Cement: The most common cement used is an Ordinary Portland Cement (OPC). The Ordinary Portland Cement of 53 grade (Hathi OPC) conforming to IS:8112-1989 is used. Many tests were conducted on cement; some of them are specific gravity, consistency tests, setting time tests, compressive strengths, etc.

Fig-5. Hathi Cement (OPC 53 grade)

Table-6.Properties of Hathi Cement (OPC 53 grade)

Sr.no.	Physical properties of cement	Result	Requirements as per IS:8112-1989
1	Specific gravity	3.15	3.10-3.15
2	Standard consistency (%)	28%	30-35
3	Initial setting time (hours, min)	35 min	30 minimum
4	Final setting time (hours, min)	178 min	600 maximum
5	Compressive strength- 7 days	38.49 N/mm^2	43 N/mm^2
6	Compressive strength- 28 days	52.31 N/mm^2	53 N/mm^2

c) Coarse Aggregate: The fractions from 20 mm to 4.75 mm are used as coarse aggregate. The Coarse Aggregates from crushed Basalt rock, conforming to IS: 383 are used. The Flakiness Index and Elongation Index were maintained well below 15%.

Fig-6. Coarse aggregate

d) Fine aggregate: Those fractions from 4.75 mm to 150 micron are termed as fine aggregate. The river sand and crushed sand is used in combination as fine aggregate conforming to the requirements of IS: 383. The river sand is washed and screened, to eliminate deleterious materials and over size particles.fig.-3 and 4 coarse aggregate and fine aggregate. Table-2 gives the properties of aggregates.

Fig-7. Fine aggregate

Table-7. Properties of Fine Aggregate, Course Aggregate

Property	Fine Aggregate	Coarse Aggregate	
		20 mm down	10 mm down (Grit)
Fineness modulus	3.35	7.54	3.19
Specific Gravity	2.38	2.76	2.69
Bulk Density (gm/cc)	1753	1741	1711

e) Water: Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to from the strength giving cement gel, the quantity and quality of water is required to be looked into very carefully. Water cement ratio used is 0.40 for M25 and 0.30 for M40 concretes.

TEST ON CEMENT AND (CEMENT+HYPOSLUDGE)

Details of the Experimental Study

- **Compressive Strength Test**

Comressive strength test can be obtain by casting a 150 mm × 150 mm × 150 mm concrete cubes using M25 grade of conventional concrete & hyposludge concrete. Specimens with ordinary Portland cement (OPC) and OPC replaced with hypo sludge at 10%, 20%, 30%, 40% levels will cast. During casting the cubes will mechanically vibrated by using a table vibrator. After 24 h the specimens will removed from the mould and subjected to water curing for 14 and 28 days. After curing, the specimens will tested for compressive strength

using a calibrated compression testing machine of 2,000 kN capacity.A mix M25 grade was designed as per IS 10262:2009 and the same was used to prepare the test samples.

CONVENTIONAL CONCRETE COMPARE WITH REPLACEMENT OF CEMENT BY HYPOSLUDGE

- In the following path we will find the comparison between the conventional & hypo sludge concrete.
- We compare the cost of conventional & hypo sludge.
- We compare the compressive strength of the conventional & hypo sludge concrete.
- We compare various most important parameters of conventional & hypo sludge.

Table-8.Comparison of Cement and Hypo Sludge

Sr. No	Constituent	Cement, [%]	Hypo Sludge, [%]
1.	Lime(CaO)	62	46.2
2.	Silica(SiO2)	2	9
3.	Alumina	5	3.6
4.	Magnesium	1	3.33
5.	Calcium sulphate	4	4.05

COMPRASIVE STRENGTH

Table-9.Compressive Strength and % Change of Strength at 7, 14, 28 days for M25.

Concrete grade	Concrete Type	Average Ultimate Compressive Strength at			% Change in Compressive Strength at		
		7 days [N/mm^2]	14 days [N/mm^2]	28 days [N/mm^2]	7 days	14 days	28 days
M25	A1-M25	28.77	32.00	44.59	0	0	0
	C1-M25	20.15	23.56	29.63	(-) 29.96	(-) 26.37	(-) 33.55
	C2-M25	13.93	13.93	17.78	(-) 51.58	(-) 56.46	(-) 60.12
	C3-M25	5.93	9.04	10.07	(-) 79.38	(-) 71.75	(-) 77.41
	C4-M25	4.44	5.78	8.15	(-) 84.56	(-) 81.93	(-) 81.72

COST ANALYSIS

Cost Impact on concrete the change in cost due to addition of Hypo sludge replacing cement is worked out in table 8. The basic market rates of materials are given table 7. Cost decrease due to reduction in cement.

Table-10. Cost of Materials

Sr. No.	Materials	Rate (Rs/Kg)
1	Cement (HATHI OPC 53 grade)	6.40
2	Hypo sludge	0.60
3	Fine aggregate	0.60
4	Coarse aggregate (20mm Down)	0.65
5	Grit	0.65

Table-11.Materials for designed M25 concrete

Concrete grade	Concrete Type	% Reduction in cement	Materials					Total Cost [m^3]	% Change in Cost
			Cement [kg/m^3]	Fine aggregate [kg/m^3]	Coarse aggregate [kg/m^3]	Grit [kg/m^3]	Hypo sludge [kg/m^3]		
M25	A1-M25	0	479	485.75	718.22	478.81	0	4135.12	0
	C1-M25	10	431.1	485.75	718.22	478.81	47.9	3857.30	(-) 6.71
	C2-M25	20	383.2	485.75	718.22	478.81	95.8	3579.48	(-) 13.43
	C3-M25	30	335.3	485.75	718.22	478.81	143.7	3301.66	(-) 20.15
	C4-M25	40	287.4	485.75	718.22	478.81	191.6	3023.84	(-) 26.87

CHAPTER 4

PLANNING SHEDULE

In order to complete the aim of this project work, An Experimental Study of Concrete with Partial Replacement of Cement by Hypo Sludge was selected.

The project was selected giving consideration to factor such as source of hypo sludge available, compressive strength & cost of the concrete etc.

After selection of Hypo sludge, different test methods will decided. On the basis of literature review, the parameter of analysis & sampling frequency will planed.Then, concrete quality & strength was examined at the selected location over a period of time.Since initial tests is a dominant factor affecting the concrete strength after 7 & 28 days.

For experimental setup, the as per the different percentage of hypo sludge in concrete examined by forming a cubes at 7 & 28 days.The Sequence of Study Planned for the case study of following Project as follows;

Sr.no	Month	Remark
1.	June	Topic &
2.	July	Guide Selection.
3.	August	Topic Study.
4.	September	Research &
5.	October	Analysis.
6.	November	Material finding & Selection of Material.
7.	December	Report & PPT Presentation.
8.	January	Material Collection & Cube Moulding & Casting.
9.	February	Testing
10.	March	Result &
11.	April	Conclusion study.
12.	May	Final Presentation.

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