UTILIZATION OF PLASTIC WASTE AS ALTERNATIVE CONSTRUTION MATERIAL

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I. INTRODUCTION

GENERALINTRODUCTION

Plasticisthegeneraltermforawiderangeofsyntheticorsemisyntheticpolymerization products. They are composed of organic condensation or addition polymersand may contain other substances to improve performance or economics. There are fewnaturalpolymersgenerallyconsideredtobe"plastics".Thesepolymersarebrokeninpresence of suitable catalyst, into monomers such as ethylene, propylene, vinyl, styrene andbenzene.Thesemonomersarethenchemicallypolymerizedintodifferentcategoriesofplastics.

Plastic products have become an integral part of our daily life as a basic need. It isproduced on a massive scale worldwide andits production crosses the 150 million ton peryear globally. In India approximately 8 Millionton plastic products are consumed every year(2008). Its broad range of application lies in films, wrapping materials, shopping and garbagebags,fluidcontainers,clothing,toys,householdandindustrialproducts,andbuildingmaterials. It is a fact that plastics will never degrade and remains on landscape for severalyears. Mostly, plastics are recyclable butrecycled products can again be recycledbut thelitter left over in earth system and water systems are more hazardous to the environment. Therecycling of a virgin plastic material can be done many times, but after every recycling, theplasticmaterialisdeterioratedduetothermalpressure.Considering,70%ofplasticconsumption is converted as waste over time, approximately 5.6 million tons per annum(TPA)plastic wasteisgeneratedincountry,whichequalsto15342tonsperday.

Plastics ConsumptioninIndia:

Nationalplasticwastemanagementtaskforcein1997projectedthepolymersdemand in the country. Polymers Demands in India (Million Ton) documents the demand ofdifferent polymers in India during years 1995-96, 2001-02 and 2006-07. The comparison ofdemand and consumption from more than one fourth of the consumption in India is that ofPVC which is being phased out in many countries. Poly bags and other plastic items exceptPET in particular have been a focus, because it has contributed to host of problems in Indiasuchas chokedsewers,animaldeaths andcloggedsoils.

II. OBJECTIVES:

- To investigate the actual supply chain network of plastic waste from households tocommercialunits alongwiththeotherrecyclables.
- To identify and propose a sustainable plastic waste management by installing WasteExchange centers and bins for collection of recyclables with all the plastic waste and aWasteProcessingUnitforprimarilynon-recyclable plasticswaste.
- Preparation of a Project Report, system design, sourcing of equipment, and necessarymodalitiesforimplementationandmonitoring.
- ToEmphasizethereduceduseof"**Plasticwaste**".
- Efficienttransformationofplasticwaste into"**ConstructionMaterials".**

- Controllingtheimpactofplasticwasteontheenvironment,makingourenvironmentan“**EcoFriendlyZone”.**
- Growthecontributionofthewastesector to**GDP.**
- Ensurethedesignandmanufactureofproductsthatavoidorminimizewastegeneration.
- Stabilisequantityofwastedisposedtolandfillthenreducethevolumeofplasticwaste.

III. PROCESS:

The raw materials used are Recycled Plastic waste, Cement of OPC 53 grade, M-sand, Seasand, 20mm down size coarse aggregate, standard concrete mould of 15cm cube and**I shape**castironmouldforthepaverblocks.Thedifferentcategoriesofplasticsarespecifiedbelow

CATEGORIESOFPLASTICS

- ✓ PolyethyleneTerephthalate(PETEorPET)
- ✓ High-DensityPolyethylene(HDPE)
- ✓ PolyvinylChloride(PVC)
- ✓ Low-DensityPolyethylene(LDPE)
- ✓ Polypropylene(PP)
- ✓ PolystyreneorStyrofoam(PS)
- ✓ Polystyrene
- ✓ Other (likeCD,Toysand etc.

Fig:1 Categories of Plastic

METHODOLOGY:

ToprepareSea-sand&M-sandpaverasperproportion(1:2,1:3, 1:4).

1)Plasticwastecollection,

dstorage

2)Shreddingplasticwasteintosegregationan requiredsize

Fig:2 Plastic waste Collection

Fig:3 Plastic Shredding

3)Providetheheattothe Plasticwasteuntilit melts

4)Mixthemeltedplasticinto thesandasperproportion

Fig:4 Heating of Plastic

Fig:5 Mixing

5)Addedmixtureintomould

6)Demouldedplasticpaver

Fig:6 Addedmixtureintomould

Fig:7 Demouldedplasticpaver

Methodology:

ToprepareSea-sand&M-sandblockas perproportion(1:1.5:3).

1)Mixtureofsandplasticgrains asandcementaspermixproportion

Fig:8 Mixing

2) adding the water permixproportion

Fig:9 Adding of weter

3)addedmixtureintothemould .

Fig:10 Addedmixtureintothemould

4)demouldedconcrete block

Fig:11Demoulding of Blocks

Mixdesigns :

MixProportionsofPlasticPavers:

Themixproportionofpaversareobtainedfromthestandardresultsthemixproportionsweadopted fro the manifacturingof pavers is (1:2,1:3,1:4). The mix proportion 1:2 indicatesthattheone proportionofplasticandtwoproportionoffine aggregate

TheVolumeofaPavermould orBlock(v)=AreaxHeight

=27500x60

$=1653000mm^3$

$=1.653x10^{-3}m^3$

Considering25%ExtraVolume

$=1.653x10^{-3}x1.25$

TotalVolume (V) $=2.06625x10^{-3}m^3$

Table:1MixProportionsofPlasticPavers

Mixproportion	Volume ofplasticinm3	Weightofplasticinkg	Weight offineaggtegatein kg
1:2	$4.130x10^{-4}$	0.570	2.28
1:3	$5.16563x10^{-4}$	0.7128	2.138
1:4	$6.8875x10^{-4}$	0.9504	3.80

MixProportionsofConcreteBlock:

1. MixproportionforaconcreteblockusingRecycledplasticwasteasthepartialreplacementofM-sand

Table:2MixProportionsofConcreteBlock

WaterCementRatio (kg/m3)	Cement(kg/m3)	FineAggregate(kg/m3)	Coarse Aggregate(kg/ m3)
186	383.16	685.58	1178.13
0.5	1	1.789	3.074

Table:3MixProportionsofConcreteBlock

Mix	**Replacement(%)**	**Mass offineaggregate(kg)**	**Massofplasticreplacedby fineaggregate(Kg)**	**Watercementratio**	**Mass ofcement(Kg)**	**Mass ofcoarseaggregate(Kg)**
M0	0	3.5	0	0.5	1.94	6.2
M1	10	3.15	0.35	0.5	1.94	6.2
M2	15	2.975	0.525	0.5	1.94	6.2
M3	20	2.8	0.70	0.5	1.94	6.2

2. MixproportionforaconcreteblockusingRecycledplasticwasteasthepartialreplacementofSeasand

Table:4MixProportionsofConcreteBlock

WaterCementRatio (kg/m3)	Cement(kg/m3)	FineAggregate(kg/m3)	Coarse Aggregate(kg/ m3)
186	383.16	666.8	1216.14
0.5	1	1.74	3.174

Table:5MixProportionsofConcreteBlock

Mix	**Replacement(%)**	**Mass offineaggregate (kg)**	**Massofplasticreplacedbyfine aggregate(Kg)**	**Watercementratio**	**Mass ofcement(Kg)**	**Mass ofcoarseaggregate (Kg)**
M0	0	3.4	0	0.5	1.94	6.2
M1	10	3.06	0.34	0.5	1.94	6.2
M2	15	2.89	0.51	0.5	1.94	6.2
M3	20	2.72	0.68	0.5	1.94	6.2

IV.RESULTSAND DISCUSSIONS:

TestsonCement:

The different tests conducted on cement are “specific gravity test, Normalconsistency test, Initial setting time and final setting time test” and its values arelistedinbelowtable.

Propertiesof Cement:

Table:6Propertiesof Cement

S.No.	Properties	Valuesobtained	Standardvalues
1.	Specificgravity	3.114	3.15
2.	Normalconsistency	30%	30%
3.	Initiala nd Finalsettingtime	30 minand 580min	Not less than 30 minsNotgreaterthan10hrs

TestsonFineAggregates:

1. TestsonM-sand:

ThedifferenttestsconductedonM-sandarespecificgravitytestandparticlesize distribution test are conducted on M-sand and the values are listed on abelowtable

Propertiesoffineaggregates(M–sand):

Table:7TestsonM-sand

Properties	Valuesobtained
Specificgravity	2.63
FinenessModulus	3.67

2. TestsonSeasand:

ThedifferenttestsconductedonSeasandarespecificgravitytestandparticlesize distribution test are conducted on Sea sand and the values are listed on abelowtable

Propertiesoffineaggregates(Seasand):

Table:8TestsonSeasand

Properties	Valuesobtained
Specificgravity	2.702
FinenessModulus	2.42

Testsoncoarseaggregates(20mmdownsizeaggregate)

Thetestconductedoncoarseaggregateisspecificgravitytestandthevalueislistedinbelowtable.

Propertiesofcoarseaggregates

Table:9Propertiesofcoarseaggregates

Properties	Valuesobtained
Average Specific gravityofcoarse aggregate	2.77

PropertiesofLowDensityPoly Ethylene(LDPE):

Table:10PropertiesofLowDensityPoly Ethylene(LDPE)

Properties	Values
PhysicalState	Solid
Appearance	Granules
Grainsize	5-7 mm
Density	.930g/cm^3
Heat Resistance	80^{o}C

COMPRESSIONTESTSONPAVERSANDBLOCKS:

I. ResultsofCompressionTestonPavers:

1. TestonM-Sand Paver:

Compressionstrengthonpaversofratio(1:2)

Table:11TestonM-Sand Paver

Slno	Area(mm^2)	Load(kN)	Compressive strength(N /mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	27500	685.0	24.92	25.16
2	27500	690.0	25.12	
3	27500	700.0	25.45	

Compressionstrengthofpaversofratio(1:3)

Table:12TestonM-Sand Paver

Slno	Area(mm^2)	Load(kN)	Compressive strength(N /mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	27500	650.0	23.63	23.66
2	27500	635.0	23.10	
3	27500	670.0	24.24	

Compressionstrengthofpaversofratio(1:4)

Table:13TestonM-Sand Paver

Slno	Area(mm^2)	Load(kN)	Compressivestrength (N/mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	27500	625.0	22.78	23.57
2	27500	645.0	23.45	
3	27500	675.0	24.55	

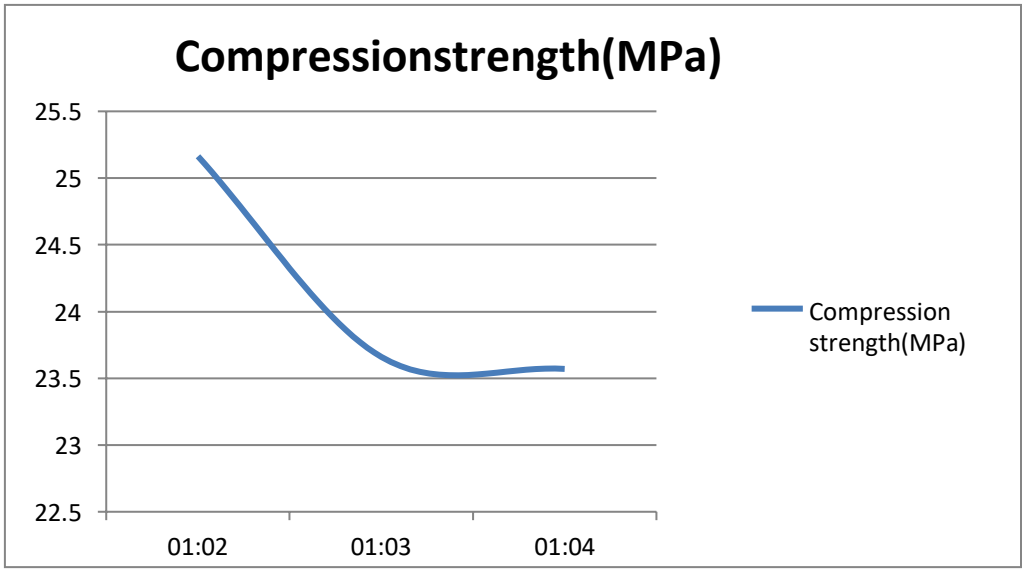

Fig:12Compressionstrength

2. TestonSeasandPaver:

Compressionstrengthonpaversofratio(1:2)

Table:14TestonSeasandPaver

Slno	Area(mm^2)	Load(kN)	Compressivestrength (N/mm^2)	Avg.compressionstrength(N/mm^2) orMPa
1	27500	595.0	21.63	22.17
2	27500	630.0	22.90	
3	27500	605.3	22.00	

Compressionstrengthofpaversofratio(1:3)

Table:15TestonSeasandPaver

Slno	Area(mm^2)	Load(kN)	Compressivestrength (N/mm^2)	Avg.compressionstrength (N/mm^2)orMPa
1	27500	710.0	25.82	25.91
2	27500	680.0	25.73	
3	27500	720.0	26.19	

Compressionstrengthofpaversofratio(1:4)

Table:16TestonSeasandPaver

Slno	Area(mm^2)	Load(kN)	Compressive strength(N /mm^2)	Avg.compression strength(N/mm^2)or MPa
1	27500	685.0	24.90	24.78
2	27500	675.0	24.55	
3	27500	685.0	24.9	

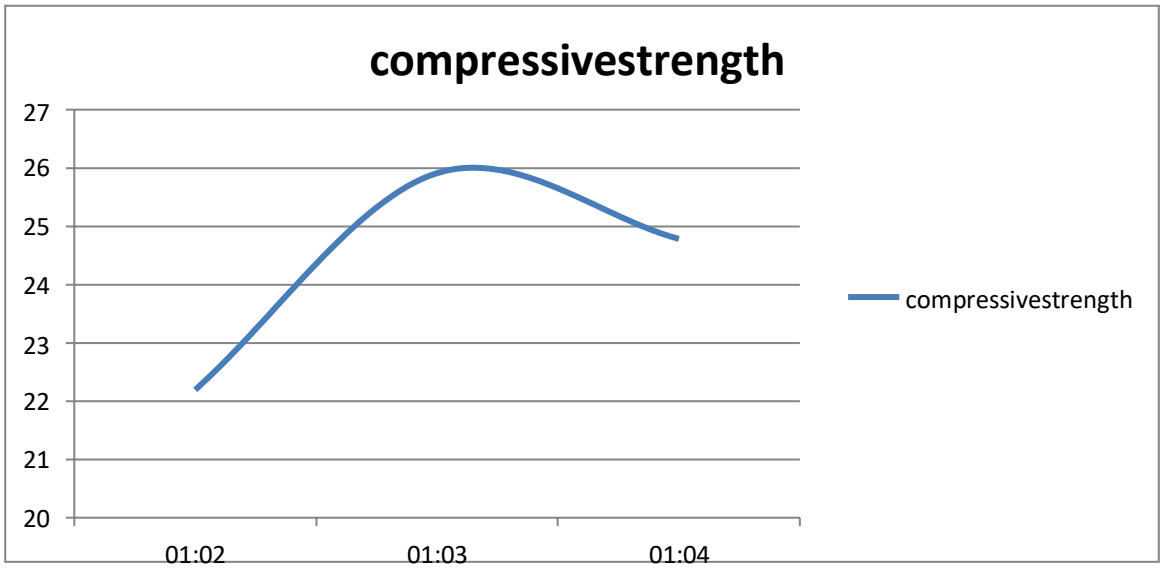

Fig:13 Compressive strength

II. ResultsofCompressionTest onBlocks:

1.TestonM-Sand Block:

Compression strength of block (15 mm x 15 mmx 15 mm)for 0% (zero) replacement ofPlasticbysand

Table:17TestonM-Sand Block

Slno	Area(mm^2)	Load(kN)	Compressive strength(kN /mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	22500	565.1	24.94	25.280
2	22500	576.8	25.64	
3	22500	568.4	25.26	

Compressionstrengthofblock(15mmX15mmX15mm)10%replacementofPlasticbysand

Table:18TestonM-Sand Block

Slno	Area(mm^2)	Load(kN)	Compressive strength(kN /mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	22500	619.3	27.53	27.97
2	22500	647.8	28.79	
3	22500	620.8	27.6	

Compressionstrengthofblock(15mmx15mm x15mm) 15%replacementofPlasticbysand

Table:19TestonM-Sand Block

Slno	Area(mm^2)	Load(kN)	Compressivestrength (kN/mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	22500	632.7	28.12	27.89
2	22500	610.9	27.15	
3	22500	639.2	28.41	

Compressionstrengthofblock(15mmx15mm x15mm) 20%replacementofPlasticbysand

Table:20TestonM-Sand Block

Slno	Area(mm^2)	Load(kN)	Compressive strength(kN /mm^2)	Avgcompressionstrength(N/mm^2) orMpa
1	22500	591.5	26.29	27.85
2	22500	568.7	25.28	
3	22500	584.6	25.98	

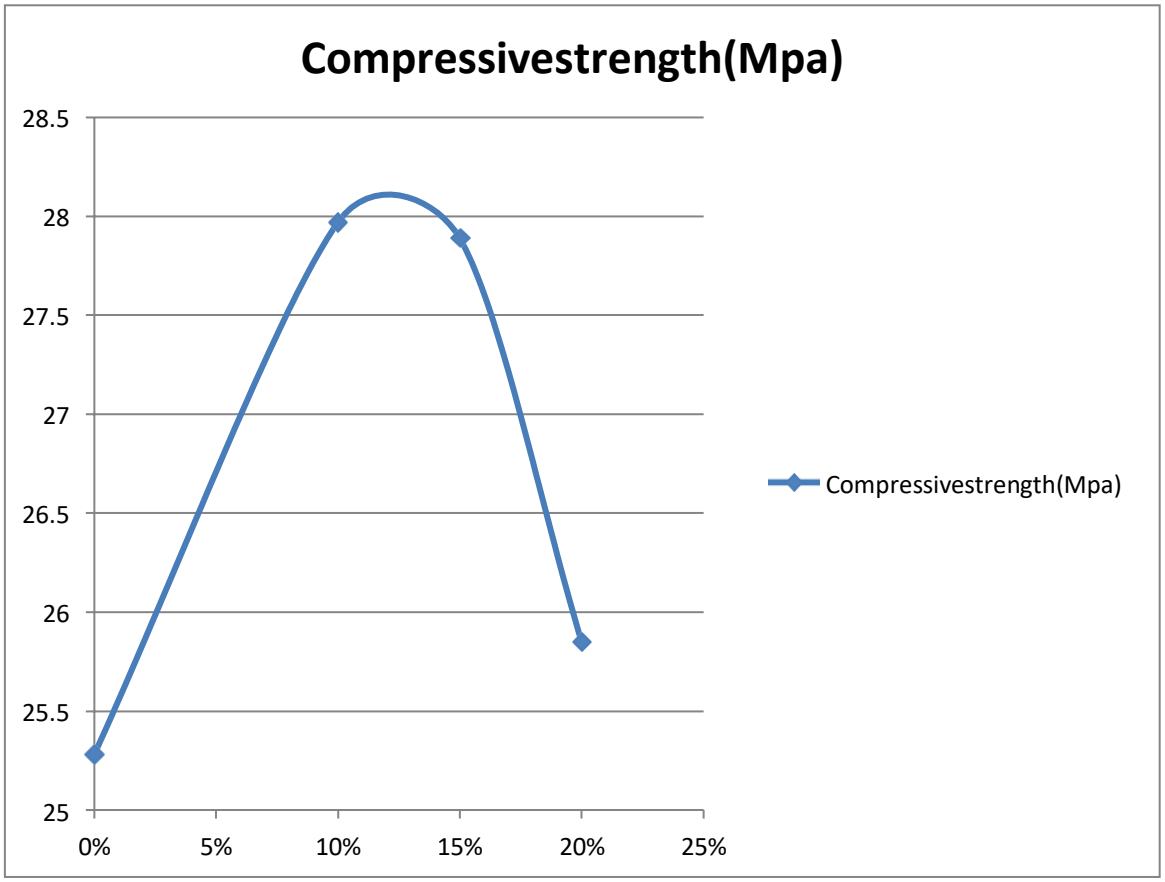

Fig:14 Compressive strength

1. TestonSeaSandBlock:

Compression strength of block (15mmX15mmX15 mm) for 0% (zero) replacement ofPlasticbysand

Table:21TestonSeaSandBlock

Slno	Area(mm^2)	Load(kN)	Compressivestrength(kN/mm^2)	Avg.compressionstrength(N/mm^2) orMpa
1	22500	852.5	37.89	36.34
2	22500	817.8	36.34	
3	22500	783.1	34.80	

Compressionstrengthofblock(15mmX15mmX15mm)10%replacementofPlasticbysand

Table:22TestonSeaSandBlock

Slno	Area(mm^2)	Load(kN)	Compressivestrength (kN/mm^2)	Avg.compressionstrength(N/mm^2) orMpa
1	22500	548.2	25.36	24.36
2	22500	570.7	24.36	
3	22500	525.7	23.36	

Compressionstrengthofblock(15mmX15mmX15mm)15%replacementofPlasticbysand

Table:23TestonSeaSandBlock

Slno	Area(mm^2)	Load(kN)	Compressive strength(kN /mm^2)	Avg.compressionstrength(N/mm^2) orMpa
1	22500	486.4	21.62	20.75
2	22500	447.5	19.89	
3	22500	467.0	20.75	

Compressionstrengthofblock(15mmX15mmX15mm)20%replacementofPlasticbysand

Table:24TestonSeaSandBlock

Slno	Area(mm^2)	Load(kN)	Compressive strength(kN /mm^2)	Avg.compressionstrength(N/mm^2) orMpa
1	22500	442	19.64	18.66
2	22500	420	17.68	
3	22500	420	18.67	

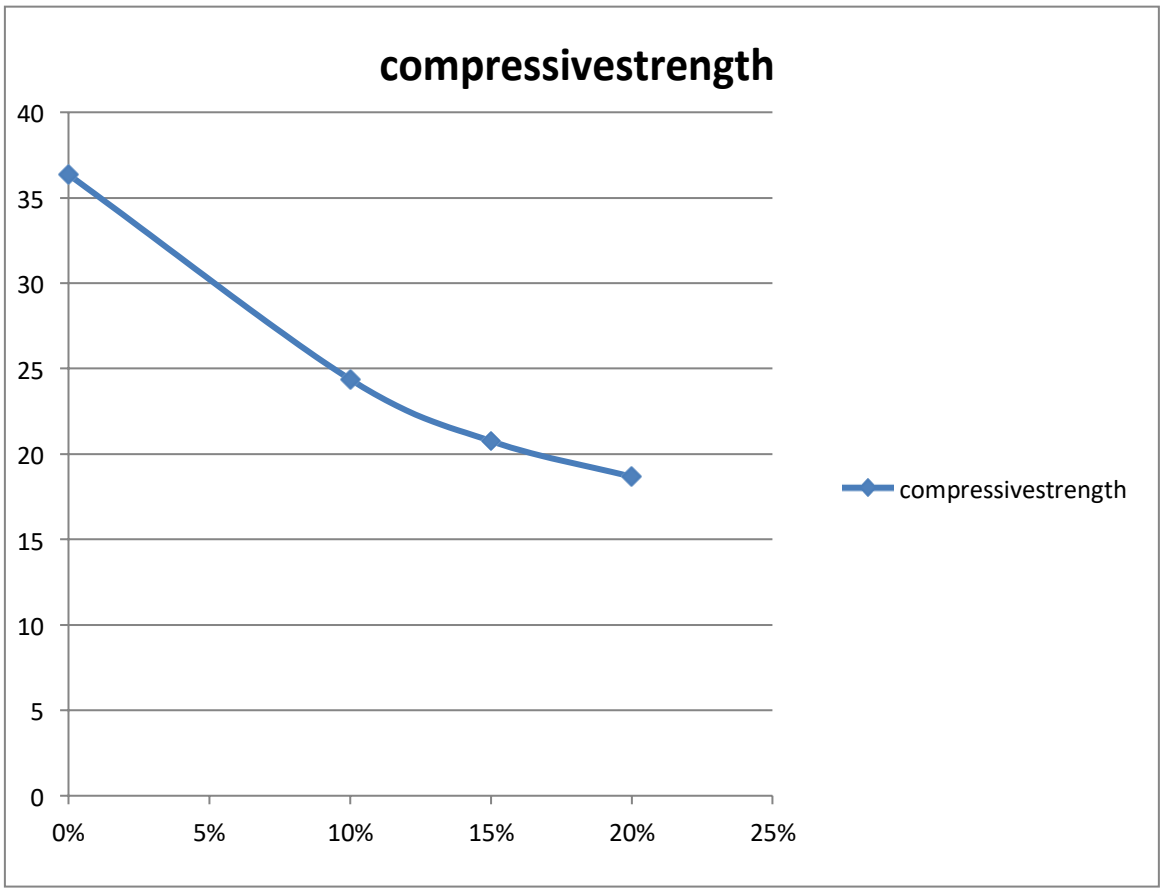

Fig:15 Compressive strength

IV. CONCLUSION

I. ConclusionforPAVERS:

1. Msand

The compressive strength of pavers for the proportion 1:2 will be maximumcomparedto1:3and1:4soitisconcludedthat1:2proportionisgoodforthemanufactureofthe paversitgivesthemaximumstrengthof25.16Mpa.

2. Seasand

Fromthegraphofcompressivestrengthvsdifferentproportion,itconcludedthatthestrength will be increases up to 1:4 then gradually decreases the maximumcompressive strengthwillbe 25.92Mpafor1:4proportion.

II. Conclusionfor Blocks:

1. M-sand

It was noted that the compressive strength of M-sand was increased from 0%replacementto10%ofreplacementofM-sandbytheplasticgrainsafter replacementof 15 & 20% of replacement again it will decrease hence it I concluded that 10% ofreplacementgivesamaximumcompressivestrengthof27.96Mpa.

2. Seasand

The compressive strength of Sea sand it was gradually decreases from 0% to 20% ofreplacement of Sea-sand by the plastic grains for replacement of 0% of replacement0%ofreplacementwegotthemaximumcompressivestrengthof36.34Mpa sowereconcludedthatwecanuse onlysea sandforthe manufactureofblock

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