International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-10, August 2019

# Effect of Various Coarse Aggregate Sizes and Different Marble Chips Proportions on Properties of Pervious Concrete

**Rahul Kumar Jadon, Nakul Gupta**

***Abstract*: With the increase in modernization. It has been found that their no more uncovered area left for serving the purpose of infiltration and further there is huge amount of depletion been noticed in the underground reservoirs as well. This problem could be resolved my using pervious concrete or environment friendly concrete or we can call it green concrete as well. So the experimental tests were performed on cube specimens of size 150*150*150 mm the cylinders of size 150mm diameter and 300mm height and .This paper shows the effect of various kinds of aggregates & marble chips on the pervious concrete. And study of 7, 28 days is conducted to determine the compressive strength and the split tensile strength of the specimen. The experiments are performed with a constant water cement ratio of (.40) & Aggregate ratio. And result resembles that strength of the concrete is proportional to its permeability but which could be further modified by introducing the different proportions or marble chips.***

***Keywords: Pervious Concrete, Permeability, Compressive Strength.***

## I. INTRODUCTION

The twentieth century is seeing 'the quick urbanization of the total population'. The worldwide extent of urban population climbed drastically from 13% (220 million) in 1900, to 29% (732 million) in 1950, furthermore, to 49% (3.2 billion) in 2005. A similar report ventures that around 60 percent (4.9 billion) of the worldwide populace is relied upon to live in urban communities by 2030 (see Figure 1).

In 1950, there were just two super urban areas with 10 million or more DECEMBER 2008 The Indian Concrete Journal 17 Report occupants. The quantity of urban communities expanded to 5 in 1975 and 20 in 2005(1), and is required increment to 22 in 2015. Creating nations will have 17 of these 22 urban communities in 2015. In India itself the level of urban populace expanded from 18.0 in 1961 to 27.8 in 2001. It is anticipated that Asia and Africa will have more urban occupants than some other landmass of the world; also, Asia will contain 54 percent of the world's urban populace by 2030.

Populace development combined with urbanization results in critical effects on nature and other issues, which incorporate (Subramanian, 2007): (2) expanded encompassing temperature, (3) diminished air quality, (4) expanded water run-off, (5)

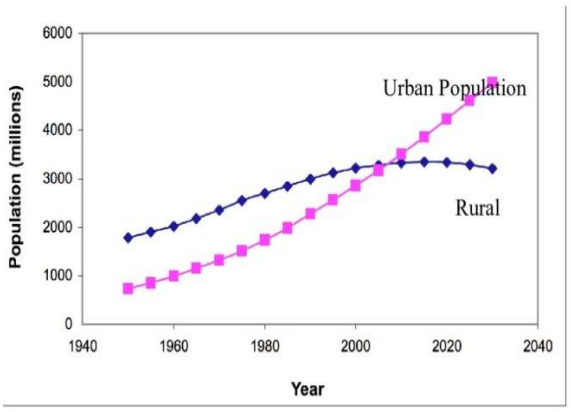



**Figure1.**

diminished nature of run-off water, (6) adjusted climate designs, (7) misfortune of stylish magnificence/character of the network, (8) decrease in homestead lands and resulting nourishment lack, what's more, (9) (Deforestation is happening at a fast rate, with 0.8 hectares of downpour woods vanishing consistently. Deforestation is connected to negative ecological results, for example, bio-decent variety misfortune, a worldwide temperature alteration, soil disintegration and desertification). We will focus on one of the issues, for example water shortage and decrease of expanded run-off in this paper.[1]

### *A. Pervious concrete*

Pervious concrete is the concrete consisting of low or no fines. It could overcome the current environment problems or could help in resolving some of the major environmental issue such as problem regarding the ground water depletion and could help in lowering the amount of $co_2$ emission caused due to air conditions as it absorbs the lower amount of Ultra violet emissions of sun as compared to that of ordinary concrete so it remains comparatively cooler.

Pervious concrete pavement is highly effective technique to serve the current environmental demands. Allows the rainwater runoff to infiltrate into the downward soil and therefore it is the most effective technique according to the EPA and various other agencies aloud the whole world as it helps in recharging the aquifers and decreases the requirement of the retention ponds and various other devices used for the management of the storm.

### *B. Objective of research*

The objective of this research is to provide the pervious concrete with higher strength so that it could be successfully used to fulfill the various environmental demands.

**Manuscript published on 30 August 2019.**
*Correspondence Author(s)
**Rahul Kumar Jadon,** Dept. of Civil Engineering, GLA University, Mathura (India).
**Dr. Nakul Gupta,** Dept. of Civil Engineering, GLA University, Mathura (India).

By using it in construction roadways, parking lots, foot paths and at various other places to met the current demand of infiltration of water to avoid it runoff. On other hand utilizing the marble waste produced during its manufacturing process of in the regions nearby.

## II. MATERIALS

### 1. Cement

Ordinary Portland cement 43 grade As per IS: 12269:2013.

***Table1.Properties***

| Tests | Results | Standard |
|---|---|---|
| **Initial setting** | 92 minutes | Not less than 30 min |
| **Final setting** | 282 minutes | Not more than 600 min |
| **Fineness** | 4.812 % | <10 |
| **Soundness(mm)** | 3.2mm | 10mm |

### 2. Coarse aggregates

Coarse aggregates of size ranging between 10mm to 20mm.

***Table2. Coarse aggregate properties***

| Tests performed | Obtained results | Standard |
|---|---|---|
| **Aggregate crushing value** | 9.3% | **<10% Exceptionally strong** |
| **Impact test** | 14.12% | **30%** |
| **Los angles test** | 22% | **40% max** |
| **Specific gravity** | 2.73gm/cc | **2.5-2.9** |
| **Water absorption** | 0.23 | **0.1-2%** |

**Marble chips**

Granite chips 95% retaining on 6.3 mm sieve.

***Properties***

- Highly resistant to acid attack. My acids got neutralized when came in contact with marble.
- Usually the marbles are light in color.
- Due to its calcium carbonate composition it shows hardness of three on Mohr's hardness Scale.

**Figure2.**

### 3. Water

Water to cement ratios ranging from 0.27 to 0.30 is used routinely with proper inclusion of chemical admixtures, and those as high as 0.34 and 0.40 have been used successfully. The relation between strength and water to cementitious materials ratio is not clear for pervious concrete because unlike conventional concrete, the total amount of paste in case or pervious concrete is more than the amount of void in it. And it is not clear that making stronger paste may not always lead to the stronger overall strength.

## III. MIX PROPORTION

***Table3.Mix proportion***

| MIX | AGGREGATE CEMENT RATIO | WATER CEMENT RATIO |
|---|---|---|
| **FINES (0%)** | 1:4.4 | 0.40 |

## IV. RESULT.

### *1. Compressive strength tests*

Basically the pervious concrete is the mixture cement coarse aggregates and water its compressive strength is comparatively less than that of the conventional plain concrete. Testing of the cube specimen is performed at the UTM for determination of it compressive strength at way ages after 7, 28 days of cure in a under the controlled environment.


**Figure3.**

***Table1.1 Compressive strength of 10mm size aggregate pervious concrete***

| Aggregate size(mm) | Curing period(days) | Strength(N/mm$^2$) |
|---|---|---|
| 10 | 7 | 8.4 |
| | 28 | 10.5 |

*Retrieval Number: J89140881019/19©BEIESP*
*DOI: 10.35940/ijitee.J8914.0881019*
*Journal Website: www.ijitee.org*



*Published By:*
*Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)*

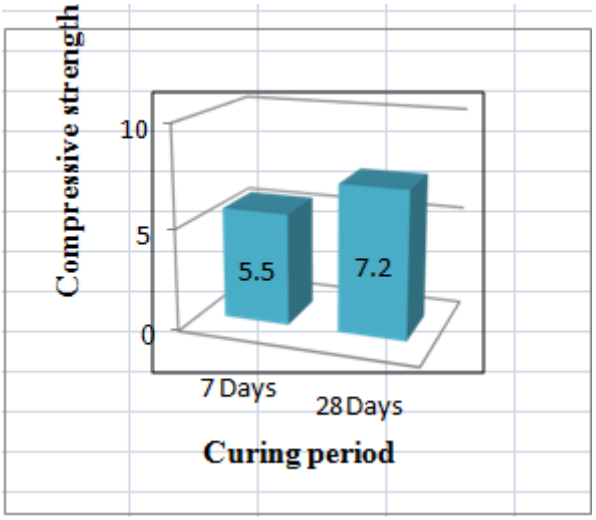
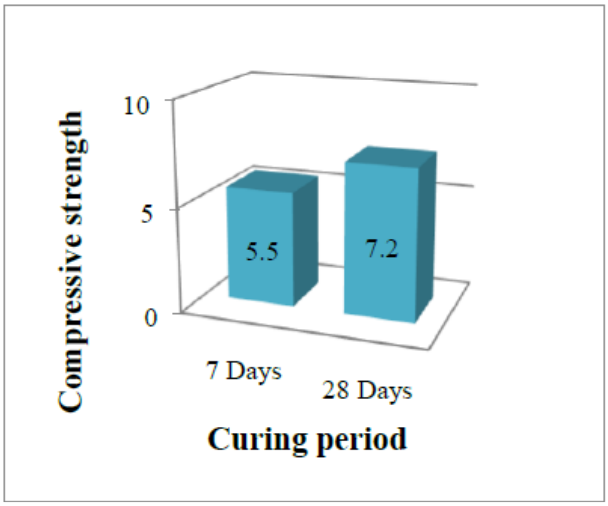



*Table1.2 Compressive strength of 10mm size aggregate pervious concrete*

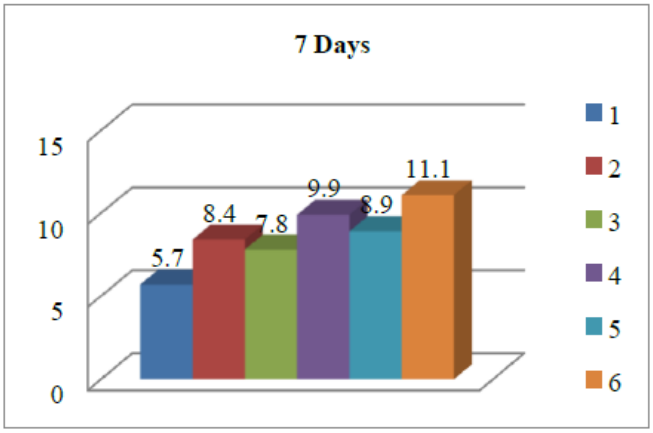
| Aggregate size(mm) | Curing period(days) | Strength(N/mm$^2$) |
|---|---|---|
| 20 | 7 | 5.5 |
| | 28 | 7.2 |



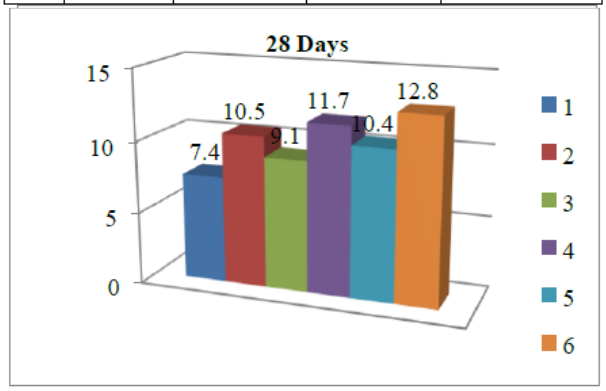

On using the different mix proportions with the dosage of the marble chips the compressive strength results obtained are

**Table1.3. Compressive strength of pervious concrete at various proportions of 10 mm and 20 mm aggregates at 7&28 days.**

| Sr. no. | Marble dosage | 10mm aggregate | 20 mm aggregate | 7days compressive strength (N/mm$^2$) |
|---|---|---|---|---|
| 1 | 10% | 0 | 90 | 5.7 |
| 2 | 0% | 100 | 0 | 8.4 |
| 3 | 30% | 0 | 70 | 7.8 |
| 4 | 30% | 70% | 0 | 9.9 |
| 5 | 20% | 40% | 40% | 8.9 |
| 6 | 50% | 50% | 0 | 11.1 |




| Sr. no. | Marble dosage | 10mm aggregate | 20mm aggregate | 28days compressive strength (N/mm$^2$) |
|---|---|---|---|---|
| 1 | 10% | 0 | 90 | 7.4 |
| 2 | 0% | 100 | 0 | 10.5 |
| 3 | 30% | 0 | 70 | 9.1 |
| 4 | 30% | 70% | 0 | 11.7 |
| 5 | 20% | 40% | 40% | 10.4 |
| 6 | 50% | 50% | 0 | 12.8 |




**2. Split tensile strength**

**Table 2.1** Split tensile strength of 10mm size aggregate pervious concrete

| Aggregate size(mm) | Curing period(days) | Strength(N/mm$^2$) |
|---|---|---|
| 10 | 7 | 0.79 |
| | 28 | 1.1 |

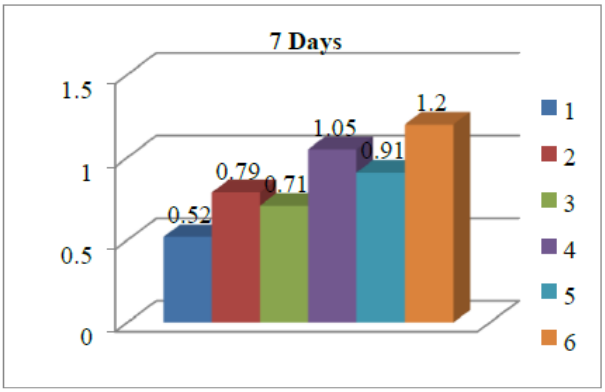
*Retrieval Number: J89140881019/19©BEIESP*
*DOI: 10.35940/ijitee.J8914.0881019*
*Journal Website: www.ijitee.org*



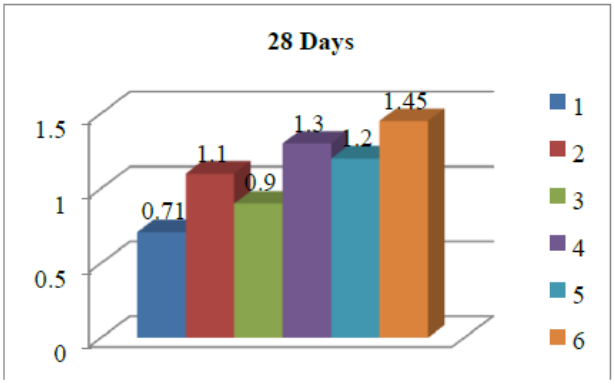
*Published By:*
*Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP)*

**Table 2.2 Split tensile strength for various proportions of 10mm and 20 mm size aggregate pervious concrete at 7&28 days**

| Sr. no. | Marble dosage | 10 mm aggregate | 20 mm aggregate | 7days split tensile strength ( N/mm$^2$) |
|---|---|---|---|---|
| 1 | 10% | 0 | 90 | 0.52 |
| 2 | 0% | 100 | 0 | 0.79 |
| 3 | 30% | 0 | 70 | 0.71 |
| 4 | 30% | 70% | 0 | 1.05 |
| 5 | 20% | 40% | 40% | 0.91 |
| 6 | 50% | 50% | 0 | 1.2 |




| Sr. no. | Marble dosage | 10 mm aggregate | 20 mm aggregate | 28 days split tensile strength (N/mm$^2$) |
|---|---|---|---|---|
| 1 | 10% | 0 | 90 | 0.71 |
| 2 | 0% | 100 | 0 | 1.1 |
| 3 | 30% | 0 | 70 | 0.9 |
| 4 | 30% | 70% | 0 | 1.3 |
| 5 | 20% | 40% | 40% | 1.2 |
| 6 | 50% | 50% | 0 | 1.45 |




## CONCLUSION

Population development and urbanization present noteworthy challenges for water assets the executives all through the world. In urban regions, asphalt of streets, stages, structures and their encompassing regions by impermeable material outcomes in underground water run-off and water contamination. There is a quick need to stop this issue all together to have practical water the board in urban territories. The conventional tempest water gathering systems have a few impediments. Pervious concrete can store extensive amounts of downpour water, enable it to permeate into the hidden soils and in the meantime lessen the passage of toxins in storm water frameworks. Thus they offer the best answer for downpour water overflow and contamination issues in urban territories Guidelines provided in this paper, might be helpful to every one of those living in urban regions. It is trusted that the development of pervious concrete pavements, will give results like those of solid check dams built in dry spell stricken Saurashtra, Kachchh and northern Gujarat regions, which acquired comparisons the essences of ranchers of country zones, by bridling valuable ground water not just for purpose of irrigation in addition to energize ground water as well.

## REFERENCES

1. UN World Urbanization Prospects report (2007)
2. A thirsty world, http://www.unesco.org/courier/2001_10/uk/doss02.htm, retrieved on July 8th 2008.
3. ACI Committee 522, Specifications for pervious concrete pavement (ACI 522.1-08), American Concrete Institute, Farmington Hills, MI, 2008, pp. 7.
4. ACI Committee 522, Pervious Concrete (ACI 522R-06), American concrete Institute, Farmington Hills, MI, 2006, pp. 25.
5. Ashley, E., Using pervious concrete to achieve LEED points, Concrete InFocus, 2008, A Publication of NRMCA.
6. Brown, H.J., Pervious concrete research compilation: Past, present and future, Concrete Industry Management Program, 2008, RMC Research & Education Foundation, Middle Tennessee State University, pp. 34, http://www.rmcfoundation.org/newsite/images/PCRC%20Final%206-08.pdf
7. Chusid, M., and Paris, N., Decorative applications for pervious concrete, Concrete Decor, December-January 2006, Vol. 5, No. 6, pp. 3. http://www. concretedecor.net/All Access/506/CD506-New_Technology.cfm
8. Chusid, M. and Miller, H.S., Controlling runoff beautifully, CE News, July 2008, Vol. 20, No. 6, pp. 33-35.
9. Color and texture in architectural concrete, Portland Cement Association1995, Skokie, IL.
10. EPA 2000.

## AUTHORS PROFILE

**Rahul Kumar Jadon,** M. Tech. student, GLA University, Mathura (India) has earned his B.Tech.(Civil Engg.) from GLA University, Mathura. attended many international Conferences.

**Dr. Nakul Gupta,** Associate Professor, GLA University, Mathura (India) has earned his Ph.D. from Babu Banarsi Das University, Lucknow. He has also published eight papers in International Journals and attended fifteen National & International Conferences.