

Evaluation of Concrete Paving Blocks with partial replacement of waste tea ash

Devendra Kumar Sharma¹, Uttam Verma²

¹Assistant Professor, Department of Civil Engineering, Sobhasaria Group of Institutions, Sikar

²Student, Department of Civil Engineering, Sobhasaria Group of Institutions, Sikar

Abstract—Agricultural waste is a feasible material which used as alternate of cement replacement and reduce CO₂ emission from production of cement. Waste tea ash use as place of cement 5%, 10%, 15%, 20% and 25% in paver blocks. Some tests include like workability, and strength tests like compressive and tensile strength of concrete or paver block. All test results shows that waste tea ash reduce the properties of paver blocks. When we increase quantity of waste tea ash then paver blocks decreased strength. As result waste tea ash provide sustainable, ecofriendly and low cost paver block at low strength.

Index Terms—Workability, strength, waste tea ash, sustainable

I. INTRODUCTION

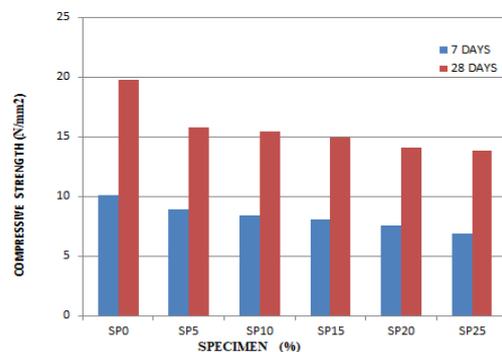
The paver blocks generally used for parking areas, streets, sidewalks which made by cement, water, aggregates and some other adhesive materials. At present time paver blocks demand more in construction so cement consumption more for manufacturing of paver blocks. For reducing amount of cement production many materials like fly ash, tea waste ash, silica fume, rice husk ash, and other many agricultural waste used as replacement of cement in concrete and blocks[1-7]. Many studies shows that many researchers focused on waste materials used in concrete as aggregate replacement like rubber tyre waste, brick waste aggregates, recycled waste of demolition etc[8-12]. The cement klin dust at amount of 40% suitable for heavy traffic application and provide ecofriendly blocks[13]. Marble dust used 0-40% and suitable results provide at 20% amount used in paver blocks [14]. 25% granite powder also enhance suitable properties of paver blocks [15]. All previous studies shows that waste materials replacement of cement as suitable amounts enhance the properties of concrete and paver blocks. At present time aim of this study is use of agricultural waste in paver blocks and effect of agricultural waste on properties of concrete and paver blocks.

II. WORAKBILITY OF PAVER BLOCK

The workability depends on the water mixing in fresh concrete for prevent sag in concrete and paver block. As result waste tea ash increase then W/c ratio increase and 25% waste tea ash replacement of cement increased w/c ratio from 0.2- 1.3.

III. COMPRESSIVE STRENGTH OF PAVER BLOCK

The compressive strength is most important property of concrete which provide durability to concrete. The compressive strength enhance when curing time of paver blocks increased but amount of tea waste ash increase then compressive strength reduced. The compressive strength of paver blocks SP0, SP5, SP10, SP15, SP20 and SP 25 contain waste tea ash 10.1, 8.9, 8.42, 8.1, 7.60 and 6.9MPa at 7days and 19.8, 15.8, 15.44, 14.9, 14.10 and 13.8 MPa at 28days respectively. Hence as result replacement of Waste tea ash place of cement reduce the compressive strength of concrete or paver block but increase at 28 days as compare to 7days test results.



IV. FLEXURAL STRENGTH OF PAVER BLOCK

The flexural strength is most important property of concrete. The flexural strength enhance when curing time of paver blocks increased but amount of tea waste ash increase then flexural strength reduced. The flexural strength of paver block SP5, SP10, SP15, SP20 and SP 25 contain waste tea ash 4.9%, 5.1%, 11.3%, 17.9%, and 24.4%MPa at 28days

respectively reduced as compared to SP0 . Hence as result replacement of Waste tea ash place of cement reduce the flexural strength of concrete or paver block at 28 days as compare to without use of waste tea ash.

V. HELPFUL HINTS

The result of this work shows that

- Waste tea ash increase then W/c ratio increase and 25% waste tea ash replacement of cement increased w/c ratio from 0.2- 1.3.
- Replacement of Waste tea ash place of cement reduce the compressive strength of concrete or paver block but increase at 28 days as compare to 7days test results.
- Replacement of Waste tea ash place of cement reduce the flexural strength of concrete or paver block at 28 days as compare to without use of waste tea ash.

REFERENCES

- [1] J. Yu, C. Lu, C.K.Y. Leung, G. Li, Mechanical properties of green structural concrete with ultrahigh-volume fly ash, *Constr. Build. Mater.* 147 (2017) 510– 518.
- [2] A. Mohan, K.M. Mini, Strength and durability studies of SCC incorporating silica fume and ultra-fine GGBS, *Constr. Build. Mater.* 171 (2018) 919–928.
- [3] A.S. El-Dieb, D.M. Kanaan, Ceramic waste powder an alternative cement replacement – characterization and evaluation, *Sustain. Mater. Technol.* 17 (2018).
- [4] A.R. Djamaluddin, M.A. Caronge, M.W. Tjaronge, I.R. Rahim, N. Md. Noor, Abrasion resistance and compressive strength of unprocessed rice husk ash concrete, *Asian J. Civ. Eng.* 19 (2018) 867–876.
- [5] V. Sata, C. Jaturapitakkul, K. Kiattikomol, Utilization of palm oil fuel ash in high-strength concrete, *J. Mater. Civ. Eng.* 16 (2004) 623–628.
- [6] E.M.R. Fairbairn, B.B. Americano, G.C. Cordeiro, T.P. Paula, R.D.T. Filho, M.M. Silvano, Cement replacement by sugar cane bagasse ash: CO₂ emissions reduction and potential for carbon credits, *J. Environ. Manage.* 91 (2010) 1864–1871.
- [7] N. Holmes, H. O'Malley, P. Cribbin, H. Mullen, G. Keane, Performance of masonry blocks containing different proportion of incinerator bottom ash, *Sustain. Mater. Technol.* 8 (2016) 14–19.
- [8] C.S. Poon, D. Chan, Paving blocks made with recycled concrete aggregate and crush clay brick, *Constr. Build. Mater.* 8 (2006) 569–577.
- [9] K. Jankovic, D. Nikolic, D. Bojovic, Concrete paving blocks and flags made with crushed brick as aggregate, *Constr. Build. Mater.* 28 (2012) 659–663.
- [10] T. Ling, Effects of compaction method and rubber content on the properties of concrete paving blocks, *Constr. Build. Mater.* 28 (2012) 164–175.
- [11] T. Ling, C. Poon, Use of recycled CRT funnel glass as fine aggregate in dry-mixed concrete paving blocks, *J. Clean. Prod.* 68 (2014) 209–215.
- [12] D.M. Sadek, H.A. El Nouhy, Properties of paving units incorporating crushed ceramic, *HBRC J.* 10 (2014) 198–205.
- [13] D.M. Sadek, M.M. El-Attar, A.M. Ali, Physico-mechanical and durability characteristics of concrete paving blocks incorporating cement kiln dust, *Constr. Build. Mater.* 157 (2017) 300–312.
- [14] A.O. Mashaly, B.A. El-Kaliouby, B.N. Shalaby, A.M. El-Gohary, M.A. Rashwan, Effects of marble sludge incorporating on the properties of cement composites and concrete paving blocks, *J. Clean. Prod.* 112 (2016) 731–741.
- [15] J. Jegan, B. Sriram, Replacement of cement by granite powder in paver blocks, *Int. Res. J. Eng. Sci. Technol. Innov.* 5 (2018) 1680–1683.