Evaluation of durability of concrete substituted heavyweight waste glass as fine aggregate Il Sun Kim a,1 , So Yeong Choi a , Eun Ik Yang a,?article info Article history: Received 12 January 2018 Received in revised form 8 June 2018 Accepted 27 June 2018 Keywords: Heavyweight waste glass Durability Water absorption Freezing and thawing resistance Sulfate attack Chloride ion penetration abstract Concrete is the most widely used construction material, and huge amounts of natural resources are required to manufacture it. With relatively recent rapid industrial development as well as the improve- ment of people's living standards, the volume of domestic and industrial waste is increasing, and much of this waste is not recycled.Construction and Building Materials 184 (2018) 269–277 Contents lists available at ScienceDirect Construction and Building Materials journal homepage: www.elsevier.com/locate/conbuildmat In particular, since 2012, when analog TV broadcasting ended, and systems converted to digital TV broadcasting in South Korea, a large volume of cathode ray tube (CRT) TVs and monitors were discarded and replaced with LCD panels.Just as notable is that most of the old CRT TVs and monitors are not recy- cled despite the fact that parts, including the CRTs, can be. CRT glass products are classified into panels and funnels, wherein the panels may be reused as glass after washing, but the funnels, con- taining a large number of heavy metals such as iron and lead, are difficult to treat using conventional recycling technology.Referring to the electrical accelerated migration test suggested by Tang and Nilsson (ASTM C 1202 (2012)) [39], a chloride ion penetration test was performed by applying a voltage of 30 V for eight hours with a 0.3 M NaOH solution as a pos- itive electrode (+) and a 3% NaCl solution as a negative electrode ( ).Conditions Variables W/B (%) 35, 45, 55 Heavyweight waste glass substitution ratio (%) 0, 50, 100 Specimen size (mm) O100 200 (Compressive strength) O100 200 (Water absorption ratio) O100 200 (Sulfate attack) O100 50 (Chloride ion penetration) 100 100 400 (Flexural strength) 100 100 400 (Freeze–thaw resistance) Curing condition Water curing (20 +– 3 C) Curing days 7, 28, 91 Table 4 Mix proportion of concrete.The results also showed that the diffusion coefficient greatly decreased as the waste glass substitution ratio increased, espe- cially at a high W/B ratio, indicating that the chloride ion penetra- tion resistance was effectively improved.aDepartment of Civil Engineering, Gangneung–Wonju National University, 7, Jukheon–gil, Gangneung–si, Gangwon–do 25457, Republic of Korea highlights Cathode ray tube (CRT) waste glass was recycled as fine aggregate of concrete.Waste CRT glass containing heavy metals was recycled as fine aggregate for concrete; the durability of the concrete was investigated by performing freeze–thaw resistance, sulfate attack, and chloride ion penetration measurement.In addition to heavyweight aggregate, many researchers have studied the properties and radiation shielding performance of concrete mixed with lead mine waste, waste marble, recycled aggregate, electric arc furnace slag, ferrochromium slag, barite, and minerals [22–30].Chemical composition (%) SiO2 Al2O3 Fe2O3 Cao MgO SO3 LOI 21.36 5.03 3.31 63.18 2.89 2.30 1.40 Physical properties Specific gravity Blaine (cm2 /g) Initial setting time (min) Final setting time (h) Compressive strength (MPa) 3 Days 7 Days 28 days 3.15 3750 255 6:30 34 43 53 Table 2 Material properties of aggregate.[24] W. Gallala, Y. Hayouni, M.E. Gaied, M. Fusco, J. Alsaied, K. Bailey, M. Bourham, Mechanical and radiation shielding properties of mortars with additive fine aggregate mine waste, Ann.The specimens for the test of the freezing and thawing resistance and flexural strength were prepared as rectangular columns with a size of 100 100

400 (mm), while those for the sulfate attack test, the chloride ion penetration test, compressive strength, and water absorption ratio were prepared as cylinders with a size of O100 200 (mm).[25] D.H. Han, W.J. Kim, S.K. Lee, H.Y. Kim, P. Romero, Assessment of gamma radiation shielding properties of concrete containers containing recycled coarse aggregates, Constr.[26] M. Maslehuddin, A.A. Naqvi, M. Ibrahim, Z. Kalakada, Radiation shielding properties of concrete with electric arc furnace slag aggregates and steel shots, Ann. Durability of concrete containing CRT glass was investigated.Materials 2.1.1.1.?1.1.2.2.1.2.2.1.3.2.3.4.2.1.4.2.1.5.2.2.2.2.2.2.2.3.2.3.4.5.6.3.3.2.7.8.3.3.9.10.11.12.11.12.3.4.3.5.13.14.3.6.4.15.16.17.