EFFECT OF CRUMB RUBBER AGGREGATE ON TOUGHNESS AND IMPACT ENERGY OF STEEL FIBER CONCRETE

by

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LIST OF ABBREVIATIONS

ACI	American Concrete Institute
ASTM	American Society for Testing and Materials
BI	Brittleness index
BS	British Standards
C	Cement
C agg.	Coarse aggregate
CMOD	Crack mouth opening displacement
CR	Crumb rubber
CRED	Completely random experimental design
EU	European Union
FEM	Finite element method
FRC	Fiber reinforced concrete
GHGs	Greenhouse gases
HQRR	High quality recycled rubber
I	Industrial steel fiber
ITZ	Interfacial transition zone
LUSAS	London University Stress Analysis System
MS	Malaysian Standards
OPC	Ordinary Portland cement
PC	Plain concrete
PRC	Plain rubberized concrete
R	Recycled steel fiber
RILEM	Reunion Internationale des Laboratoires et Experts des Materiaux, Systemes de Construction et Ouvrages
RHFRC	Rubberized hybrid fiber reinforced concrete
S	Sand

SEM	Scanning electron microscope
SF	Steel fiber
SFC	Steel fiber concrete
SFRRC	Steel fiber-reinforced rubberized concrete
SHPB	Split-Hopkinson pressure bar
SP	Superplasticizer
STC	Shredded tire chips
UPV	Ultrasonic-pulse velocity
w/c	Water to cement ratio

LIST OF SYMBOLS

A	Cross sectional are of concrete section
a	Notch depth
b	Width of beam
β_r	Uniaxial principal stress ratio
D	Cylinder diameter
d	Depth of beam
E	Modulus of elasticity of concrete
E_d	Dynamic modulus of elasticity of concrete
ε	Strain of concrete
ε_o	Strain at effective end of the tensile softening
ε_c	Strain of concrete at ultimate compressive strength
f_{cu}	Uniaxial compressive strength
f_{tu}	Maximum tensile strength
g	Gravitational acceleration
G_f	Fracture energy
G_{IC}	The critical energy release rate
H	Depth of the beam
h	Falling height
J_{IC}	The critical J-integral
K	Flexural stiffness
L	Sample length
l_{ch}	Characteristic length
m	Mass
P_b	Impact bending load
P_c	Compression load
P_f	Flexural load