ELECTROMAGNETIC PULSE RESISTANCE OF CONCRETE SHIELDS

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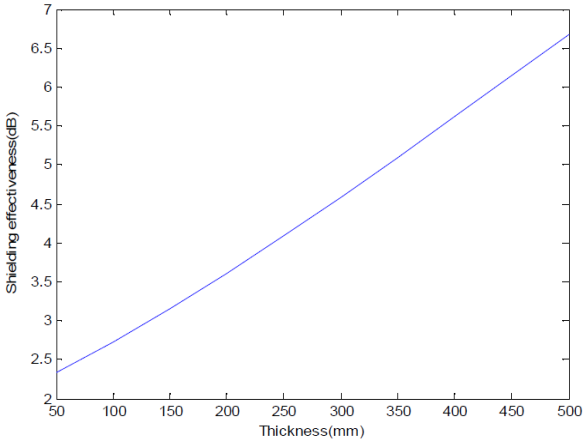
Abstract– In many years it was required to improve the mechanical and radiation shielding properties of concrete. we found that the mechanical properties, including hardness, tensile strength of these radiation shielding blocks were reduced with increasing of the amount of radiation shielding.in this studies we use conductive material in the shielding of concrete against radiation of EMP such as (Steel slag, steel mesh, basalt, and steel fibres) to study tier effect on the shielding against radiation of electromagnetic pulse (EMP).
Keywords: electromagnetic pulse; shielding effect

I. INTRODUCTION

For many years the electromagnetic pulse (EMP) causes a big problem for the humanity. Electromagnetic pulse (EMP) typically refers to high power electromagnetic (HPEM) waves ranging from 100 kHz–100 MHz which damages the building structures and military equipment Depending on its source, EMP can be classified into three categories, i.e., nuclear EMP (NEMP) caused by a nuclear explosion, non-nuclear EMP (NNEMP), or international electromagnetic interference (IEMI) in which electromagnetic waves are directly generated by electromagnetic bombs or high power electromagnetic generators, and lightning EMP (LEMP) caused by natural phenomena such as lightning and huge current flow . EMPs have been investigated primarily in developed countries for applications including EMP bombs and other specific purposes. EMPs that exceed the control range have the potential to neutralize the telecommunication, IT-based infrastructures, and may cause secondary injury and causalities in a population.
The mechanism behind the damage caused by an EMP is that when an EMP arrives at a device, it creates a very strong induced current that enters electronic circuits and destroys them. Electromagnetic (EM) shielding is a growing concern as technology progresses. Increased use of EM-sensitive equipment has led to interest in more affordable and scalable shielding materials. By mixing in several simple materials, basic concrete can be enhanced to offer protection against EM wave penetration into the structures. Some material has been used in shielding such as Concrete with Graphite Fine Powder. Shielding Performance of Carbon Black Mixed Concrete with Zn–Al Metal Thermal Spray Coating. Normal Weight Concrete by Incorporating Iron Cutting Waste (ICW). Electrically conductive concrete using different fillers. Composite Walls of Concrete and Carbon Filaments. Ferrite-Graphite Composite Media for Microwave Shields. Carbon Microfiber Material., Carbon Powder. We will use other materials (steel slag, steel mesh, and basalt as a replacement of aggregate and steel fibres). we will study the mechanical properties (compressive strengths and tensile strength and sustained impact energy test) of the concrete (cubes and slaps) when we use this material in the mix design.

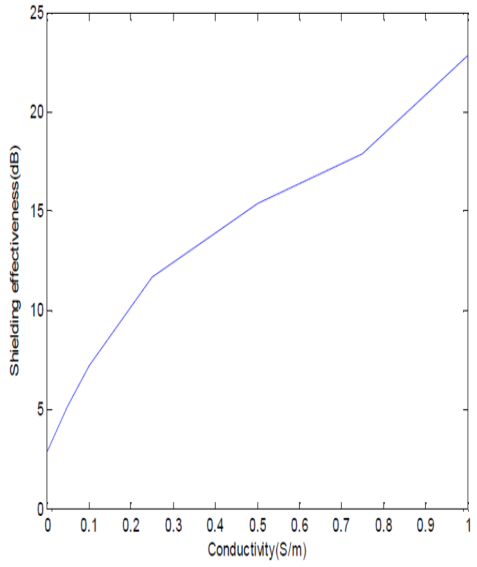
Factor affecting in EMP SHIELDING:

- **Thickness of concrete**



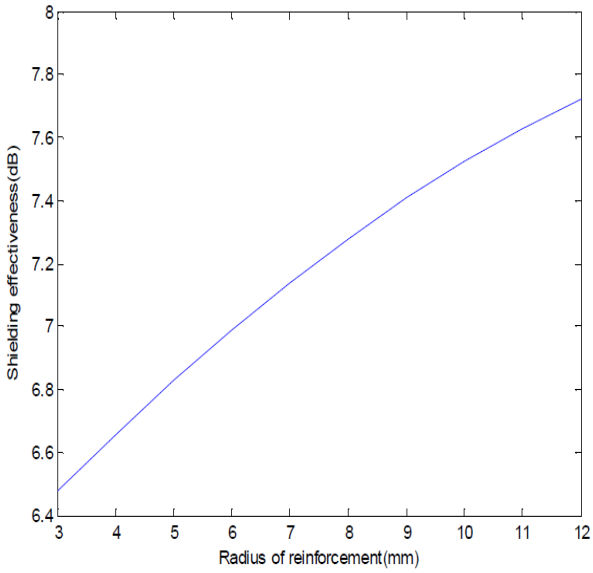
when the thickness of concrete increase the shielding effectiveness of concrete will also increase.

- **Conductivity**



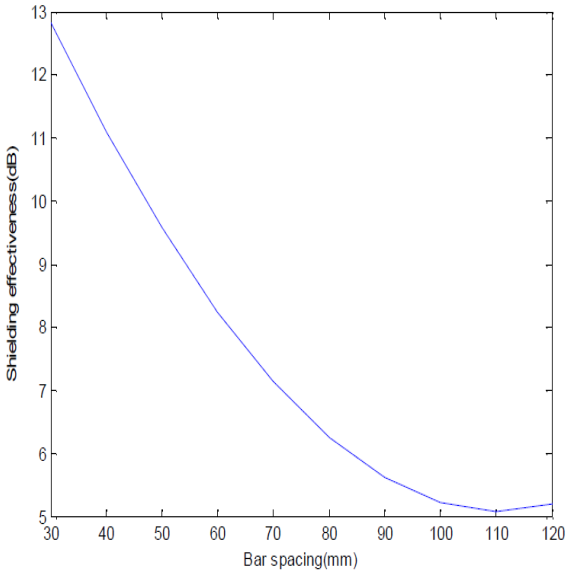
The shielding effectiveness also increase by increasing of the conductivity of concrete so we use a good conductive material in the mix of concrete.

- **Radius of reinforcement**



by increasing the radius of reinforcement, the shielding effectiveness increase.

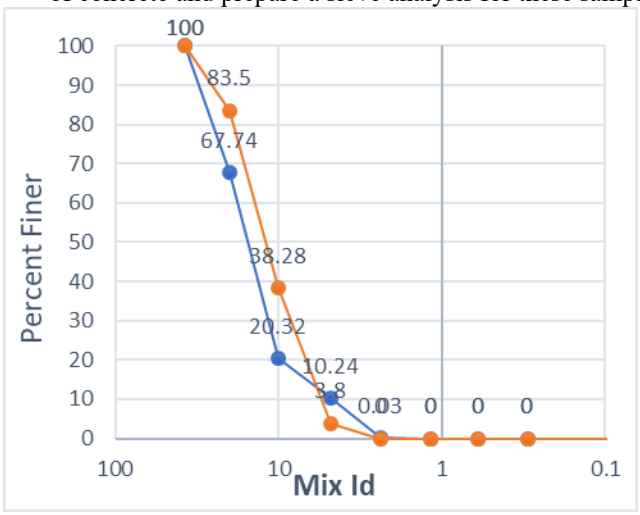
- **Bar spacing**



The shielding effectiveness decrease by increasing of spacing between bars in reinforcement.

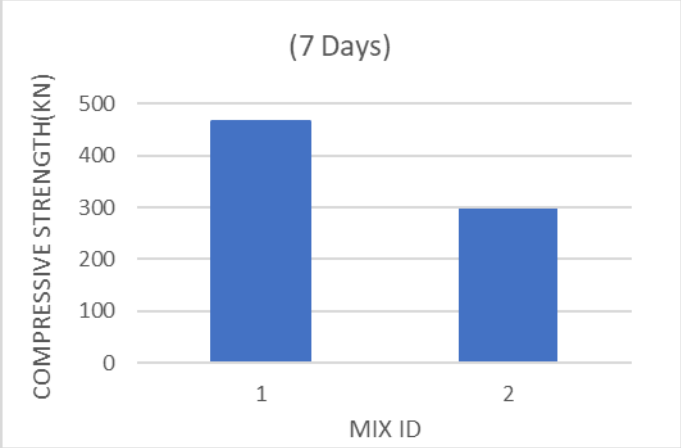
2. Experimental work.

we use two sample of steel slag and basalt in the mixture of concrete and prepare a sieve analysis for these samples.

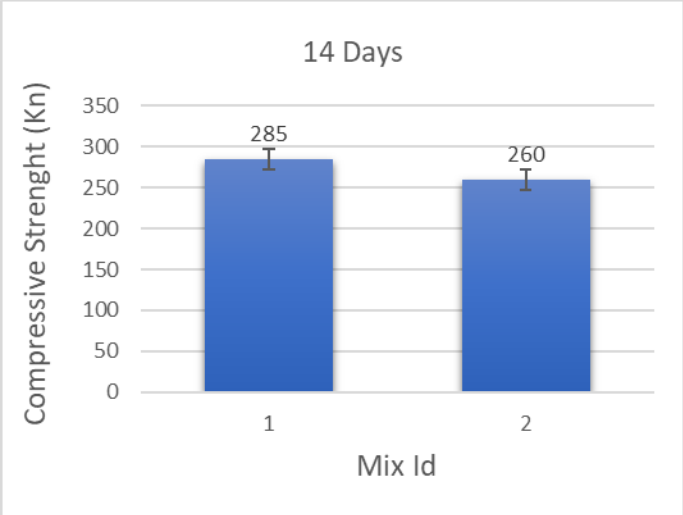


Then we calculate the compressive strength and the tensile strength and the sustained impact energy for this sample besides other sample such as (Uni-Axial Geogrid, Bi-Axial Geogrid, Steel Extended Mesh Tri-Axial Geogrid and Fiber Glass)

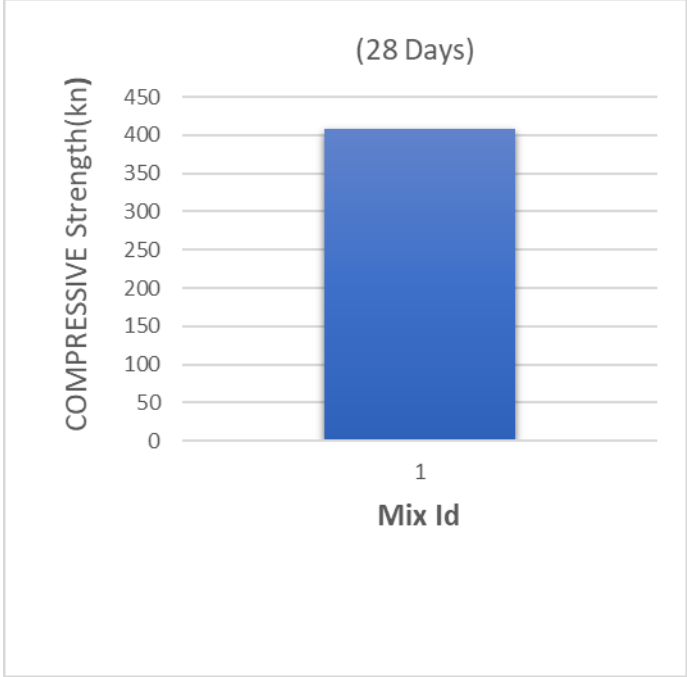
2.1 Compressive Strength Test:



Sample (2) Is Steel Slag Sample Tested After 7 Days (C.S) Sample (1) In Normal Concrete Sample and Its 55.85% More Than the C.S.

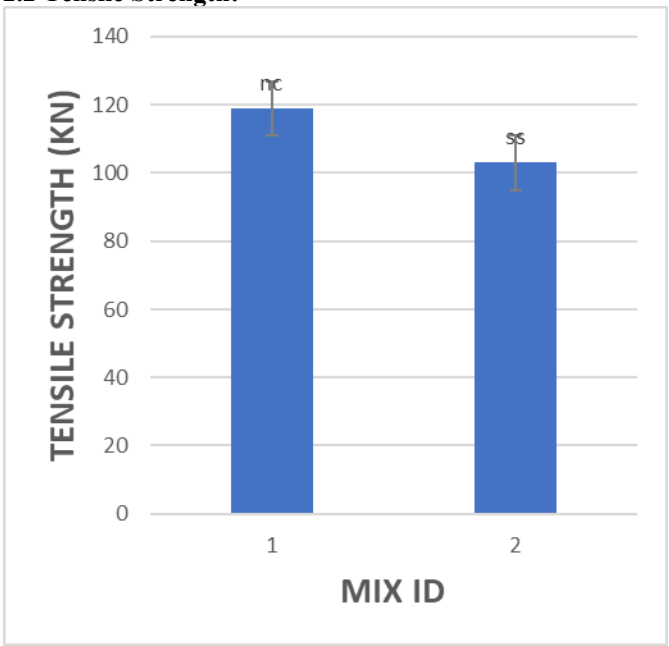


Sample 1 : Normal Concrer Sample And Its 4.9% Less Than (C.S) ,Sample 2 Is Fino Sample And Its 13% Less Than The (C.S)



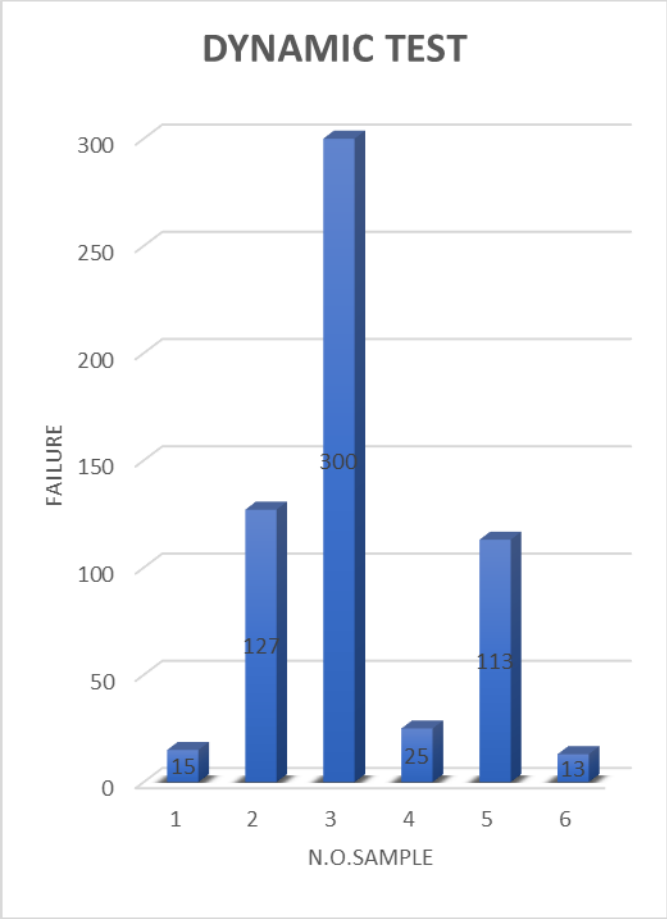
Sample Is Steel Slag Sample After 28 Days And It's The (C.S).

2.2 Tensile Strength:



The Sample 1 Is Normal Concrete = 119 Kn and Its 15.5 % More Than The C.S and Sample 2 Is Steel slag Sample = 103 Kn

2.3 sustained impact energy test:



SAMPLE (1) IS (S.S) AND IT'S THE (C.S)
Sample (2) Is Uni-Axial Geogrid and Its Failure At 127
Sample (3) Is Bi-Axial Geogrid and Its Failure At 300 Sample (4) Is Steel Extended Mesh and Its Failure At 25 Sample (5) Is Tri-Axial Geogrid and Its Failure At 113 Sample (6) Is Fiber Glass (Fg)And Its Failure At 13

3.CONCLUSION

we have studied some concrete cubes with different component then we subject it to some tests. compressive strength test, tensile test and sustained impact energy test the results of these test give us the best component of concrete cubes from these tests we deduce that.

3.1compressive strength:
After 7 days:
steel slag sample tested after 7 days give 299 Kn.
the normal concrete sample after 7 days give 466 kn AND ITS 55.85% MORE THAN THE steel slag which is the control sample.
After 14 days:
A fino sample was tested and the reading was 260 kn
The normal concrete sample was 285 kn
After 28 days:

For steel slag (c.s) the reading of compressive strength is 406 kn.

3.2 tensile strength
A sample of steel slag was tested and the reading was= 103 kn
A sample of normal concrete was tester and the reading were = 119 kn
And its 15.5 % more than the (c.s)

For sustained impact energy test: we have done this test for different component of concrete slaps such as (SS, UNI-AXIAL GEOGRID, BI-AXIAL GEOGRID, STEEL EXTENDED MESH, TRI-AXIAL GEOGRID, FIBER GLASS (FG)) and the dimension of slab was 40*40*10.

3.3 (drop wt. impact)
We found that the best slab was the slab which contained BI-AXIAL GEOGRID as the failure was after 300 and the 1st upper crack was after 19 and the 1st lower crack was after 10 the wt. of shatter parts =2760 gm and the diameter of the ball marks = 5 cm

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