Experimental Study on Fiber Reinforced Self Compacting Concrete by Replacement of Fine Aggregate with Robo Sand

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ABSTRACT-Self-compacting concrete can encompass even the most crowded support using nothing more than its own weight and without vibrating. It is a highly flowable, non-isolating solid. It can also fill formwork. While keeping or enhancing all of concretes traditional mechanical and strength capabilities, it offers these alluring advantages. Thanks to adjustments in compliance with traditional blend designs and the usage of superplasticizers, this strong may also fulfill move execution requirements. Self-compacting concrete has a floor this is especially higher than regular concrete, making it suitable for utilization in formwork this is problematic and can be hard to solid in sure ways, in significantly bolstered areas, or in conditions in which vibrators aren't to be had for compaction. Self-compacting concrete, on occasion called self-solidifying concrete, may also waft via the formwork and integrate below its personal weight whilst being definitely deaerated. It can persist lengthy sufficient to fill areasof virtually any length or form with out setting apart or going extinct. As a result, SCC is in particular useful in situations in which placement is hard, together with in strong folks who are well-armed or in complicated paintings environments.

This research focuses on the feasibility of employing self-compacting concrete in M30 grade self-compacting concrete (SCC) with superplasticizer and viscosity modifying agent additions. In laboratory studies, the fresh and hardened characteristics, as well as the durability of SCC (M30), are investigated. The prospect of using robo sand, which is one of the most common agro-wastes in South India, as a partial substitute for fine aggregate in specific concretes like SCC in structural components is investigated and explored.

Key words: robo sand, steel fibres, superplasticizers, self-compacting concrete, split tensile strength, flexural strength, and durability.

INTRODUCTION

Because it plays a major role in the functional lifespan of structures, concretes durability is one of its most important components. The structures must likely resist the mechanical actions, the physical attacks, and the artificial hostilities to which they are subjected over their typical operational lifetime. In this sense, breaking plays a significant role in the durability of solid structures. Due to this reality, it is crucial to develop strategies to keep cracks at a minimum and denote a minimal risk to the durability of auxiliary components. In this particular situation, steel filaments are presented as a solution to this problem since fibre support systems allow for an overall improvement in the solid pliability and post-splitting blockage.Although a lot of study has been done to identify, delve into, and grasp the mechanical characteristics of steel fibre reinforced concrete (SFRC), very little of it has concentrated on the vehicular properties of this material. The stability and uprightness of a building can be affected by the material vehicle qualities, especially penetrability. Due to the emergence and growth of splits, solids are becoming more porous, allowing water, chlorides, and other damaging agents to enter and promote crumbling.

Research on the durability of SFRSCC is still lacking, especially in the area of consumption obstruction, which is addressed in an early structure. As a result, it is unclear, for example, whether or not filament deterioration could potentially lead to breaking and subsequent spalling of the surrounding concrete. As a result, there is still a lack of knowledge regarding the durability of SFRC, making the requirement to collect strength indicators crucial for the widespread acceptance of this composite material.

Fiber reinforced self compacting concrete

When durability (limited break widths) or health considerations are design objectives, fibre reinforced concrete becomes an option. By bridging breaks, conveying concern over a break, and neutralising the split growth, they enhance the presentation (strength and durability) of weak bond based materials. The steel fibre is the fibre type that is most well-known in the construction industry; carbon, glass, and plastic strands make up a smaller portion of the market.There are many extraordinary varieties of metallic filaments, along with wave cut, quit large metallic fibre, twisted sheet, and additionally snared quit metallic fibre. The concrete enterprise has lots to advantage from this process, which incorporates fusing metallic filaments with SCC to create metallic fiber-fortified self-compacting concrete (SFSCC).

SFSCC is a brand-new form of strong that mixes the advantages and expands the capacity consequences of each metallic fibre strengthened strong and SCC. The usefulness of SCC may be appreciably impacted through the sort and makeup of the strands. Steel strands had been used into conventional solids to update bar support, lower wreck width, enhance post-splitting behaviour, and improve elastic and flexural energy. Steel fibre fortification has an effect on how cracks broaden in concrete and might cause advanced fracture boom blocking, multiplied floor roughness, and a better chance of crack stretching and different wreck formation.

Steel fibre fortification can be used to effectively lower the strong's penetrability and lift its solidity. The foremost targets of this observe are to research the workability of self-compacting concrete, to research the energy residences of M sand as first-rate aggregates, along with compressive, split, flexural, and sturdiness residences, and to evaluate the residences of self-compacting concrete whilst it's miles clean and whilst it has hardened whilst made with extraordinary proportions of Robo as first-rate aggregates.

MATERIALS USED AND MIX DESIGN

Materials usedCement

The bodily and chemical residences of regular Portland cement of grade fifty three from a close-by marketplace have been tested according with

IS : 4031 - 1988. And discovered to conform numerous conclusions according with May be: 12269-1987.

OPC 53 Grade cement

Fine aggregates

The present experiment uses sand from a nearby market as fine aggregates. According to IS:2386, the physical characteristics of fine aggregate, such as their specific gravity, mass thickness, degree, and fineness modulus, are assessed.

Fine aggregates

Coarse aggregates

For the contemporary experiment, beaten coarse combination with a most adjusted length of 12.5 mm turned into obtained from the close by Robo Silicon pulverising plant in Hyderabad. According to IS 2386, the bodily traits of coarse total, which include express gravity, mass thickness, degree, and fineness modulus, are investigated.

Coarse aggregates

Robo sand

To produce Robo Sand, a fine aggregate, stone, gravel, or slag are crushed. a term used to indicate crushed rock or gravel aggregate material used for construction applications that is less than 4.75 mm in size.Contrary to non-refined surplus from the manufacturing of coarse aggregate, robo sand is a material of excellent strength.

Steel fibers

The SFRC game plan has included the usage of tempered steel wire with a crosswise separation of 0.5 mm. This exploratory effort has made use of a steel fibre that is 40 mm long and 80 mm in diameter. All of the steel strands are contained, imprisoned, and completely undamaged.

Steel fibers

Superplasticizer

The solid blend's powerful plasticizer makes it incredibly beneficial for longer periods of time with much less water. Since it is obvious that using huge amounts of superior material (fine aggregate + bond + fly ash debris) makes the solid much stiffer and needs more water for essential functioning, SP430 is used in the current experiment as a water-decreasing addition.

Mix design of SSC

Mix design is the process of deciding which components are best for concrete and working out how to make concrete that meets a specific minimum standard for strength and durability while being as cost-effective as is practical.

Final Mix of M30 grade concrete = 1:1.07:1.38 at w/c of 0.42

Experimental study

Mixing of concrete

On a solid, impermeable floor, measured amounts of cement, coarse aggregate, and fine aggregate were dispersed. While mixing the solid, steel strands are randomly added. It took 10 to 15 minutes to mix repeatedly until the desired uniformity of shade was achieved.

Casting and curing of test specimens

Concrete mixing

Standard-sized cube specimens (150mm x 150mm x 150mm), prism specimens (100mm x 100mm x 500mm), and cylindrical specimens (150mm diameter x 300mm height) were all cast.

Placing and compacting

To ensure that no water leaked during the filling, form oil was applied to the shape's component parts and a comparable layer was attached between the contact surfaces of the base of the moulds and the base plate. The solid is then properly crushed to fill the layer of the mould at that time.After being fully filled, the moulds are levelled. Slurryis used on the final solid surface to fill the spaces and make it plain. One thing to keep in mind is that concrete should be compacted prior to the commen concrete of the solid starting settling time.

Curing

Sample situation Three-dimensional shapes, crystals, and chambers have been maintained at 27 2C for twenty-four hours and for 12 hours after the season of water enlargement to the dry fixes in a place unfastened from vibration, in maximum air, at 90% relative mugginess, and in maximum relative humidity. The stable three-D forms, crystals, and chambers are then eliminated from the moulds and left for 3, 7, and 28 days for restoration.

Test specimens kept for curing

Tests to be conducted on concrete

Workability Slump flow test

For the assessment of a freshconcrete property, the concrete slump test is used. The test is an accurate test that gauges how well fresh concrete works. It assesses consistency between bunches much more explicitly.

Slump flow test

Compaction factor test

The compaction component check is the concrete functioning check this is completed at a studies facility. The compaction component is the ratio of in part compacted to absolutely compacted concrete loads. It became advanced through the Road Research Laboratory withinside the UK and is used to estimate the cost of concrete.

Compressive strength of concrete

This study's findings have been affected by ([9] IS516-1959). Standard 150x150x150mm 3-D bureaucracy have been used to degree the compressive energy of concrete. On the CTM bearing floor with a restrict of 200T with out deformation, examples of stacking linked at a regular fee till the dissolution of the 3-D shape have been shown. It was determined which load was the most severe and what compressive strength it had ([21] AS Alnuaimi).

Compressive strength test machine

Tensile strength of concrete

According to IS516-1959, this test was administered. The typical 150mm x 300mm sized chambers were used to evaluate the concrete strength. Examples of a maximum weight of 200T are positioned on the CTM bearing surface without showing signs of flimsiness, and a constant rate of stacking is maintained until chamber dissatisfaction. The greatest load was observed, and the level of excellence was established. Procedure for Split Rigidity Testing from IS5816-1999

Flexural strength of concrete

According to IS516-1959, this test was administered. The typical 150mm x 300mm sized chambers were used to evaluate the concrete strength. Examples of a maximum weight of 200T are positioned on the CTM bearing surface without showing signs of flimsiness, and a constant rate of stacking is maintained until chamber dissatisfaction. The greatest load was observed, and the level of excellence was established. Procedure for Split Rigidity Testing from IS5816-1999

Durability of concrete

Concrete's durability may be defined as its ability to withstand continuous use, compound attack, and surface abrasion while maintaining its optimal structural qualities.

To maintain its optimal construction qualities, concrete must be able to withstand sustained activity, synthetic attack, and scraped area. It frequently refers to the duration or expected lifetime of execution that is trouble-free. Depending on the desired qualities and appearance, different concretes require varying levels of strength. For instance, concrete exposed to tidal seawater will require different conditions than concrete used indoors.

Because of the effect of corrosive and sulphates, solidness of SCC was the focus of the current work.

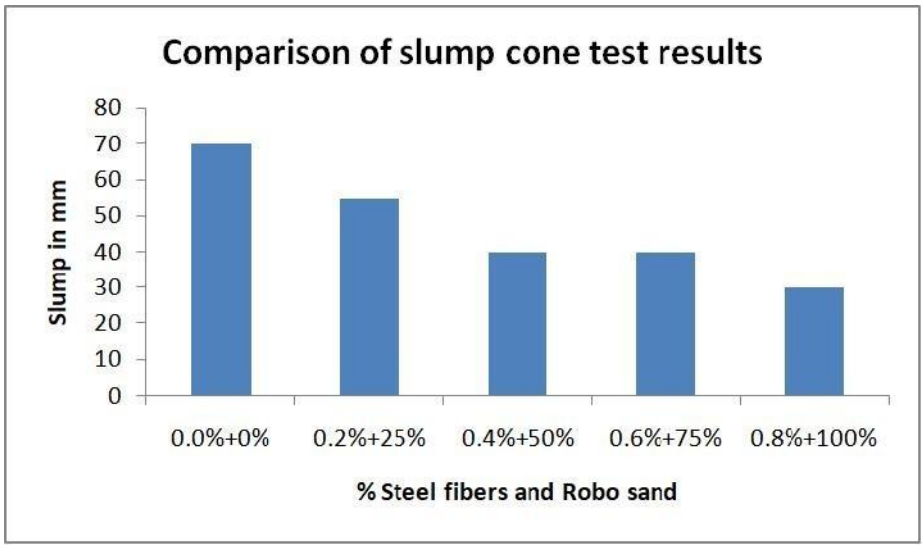
Mixing acid

Specimen tested after acid attack

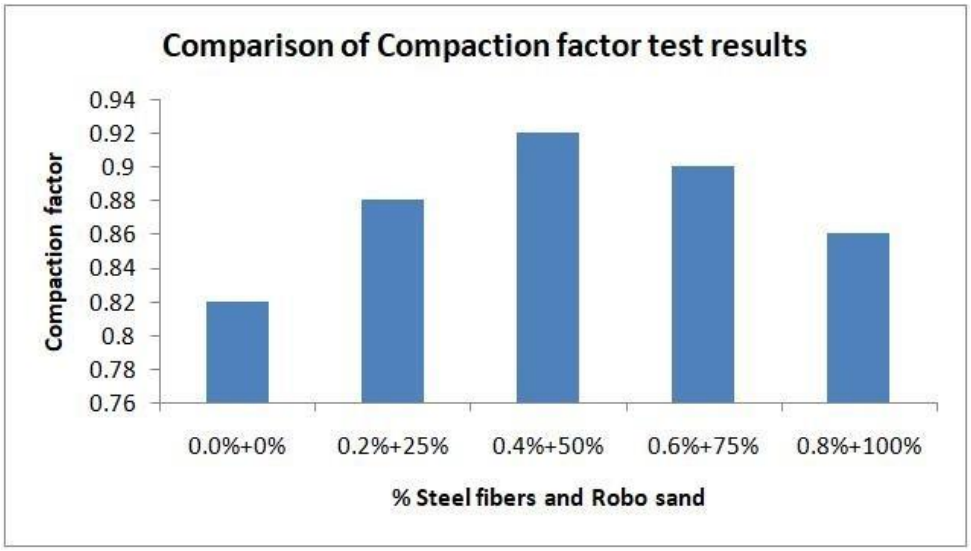
Test specimen after sulphate attack

RESULTS AND ANALYSIS

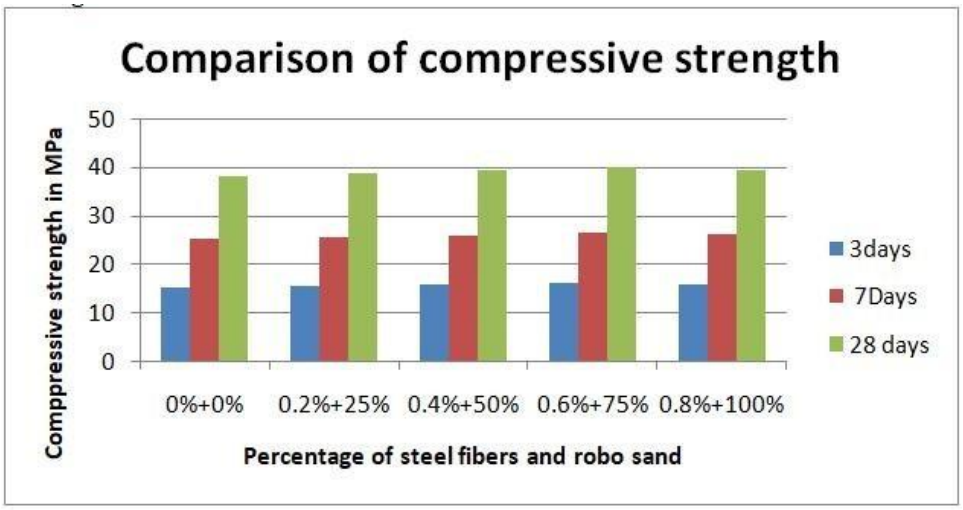
Workability of concreteSlump cone test



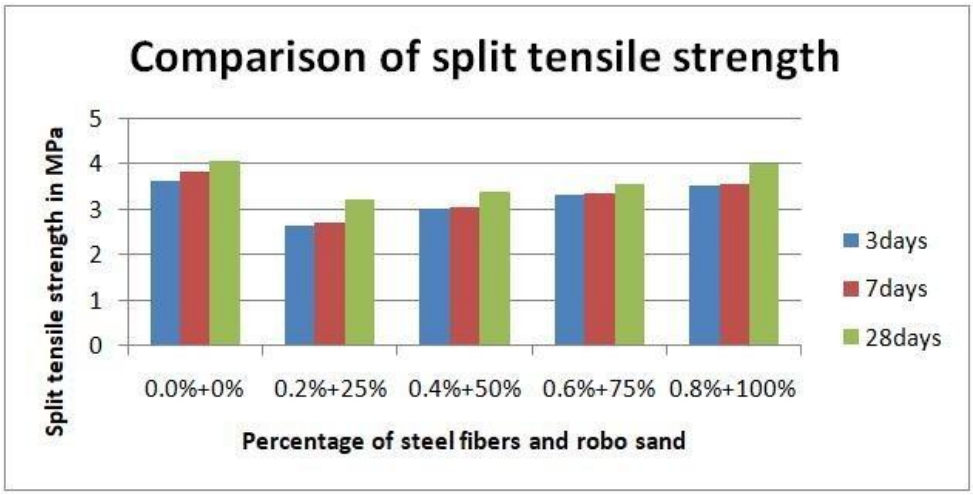
Compaction factor test

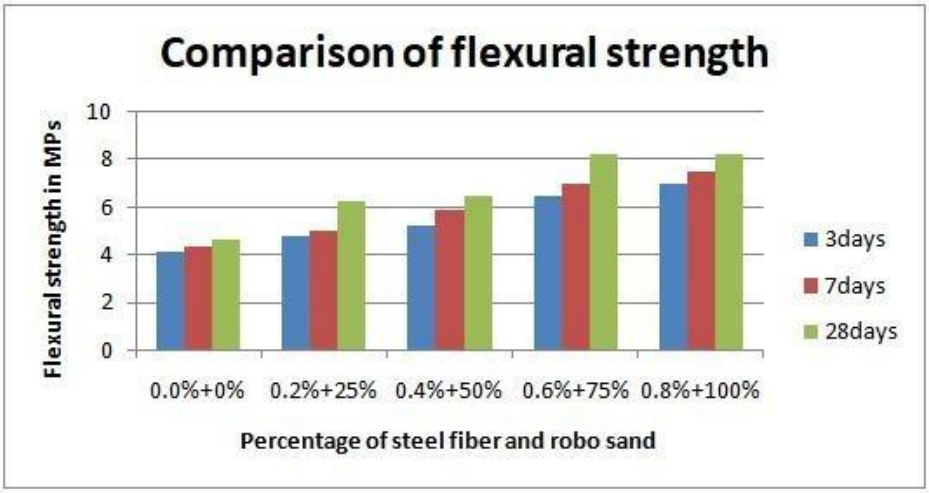


Strength of concrete Compressive strength



Split tensile strength

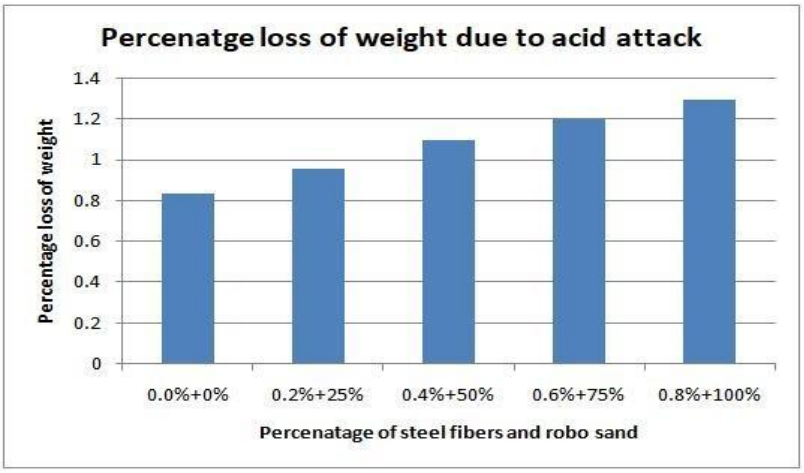




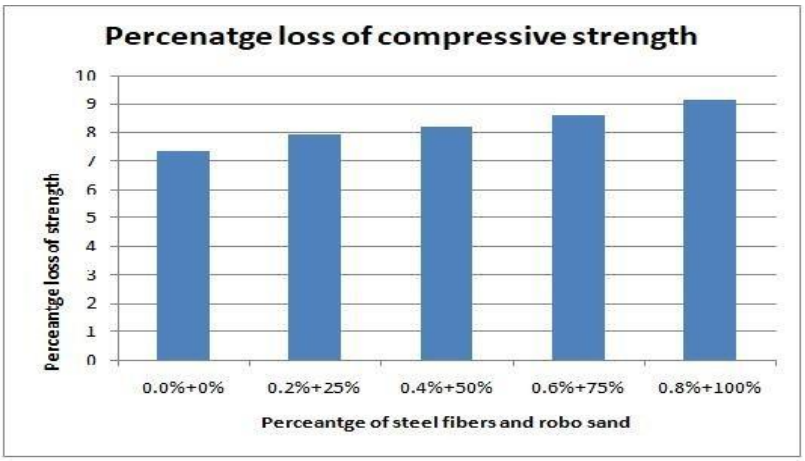
Flexural strength

Durability of concreteAcid attack

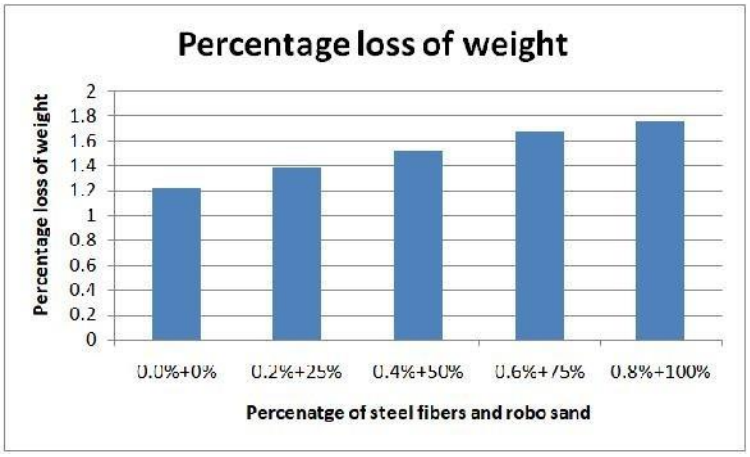
Percentage loss of weight



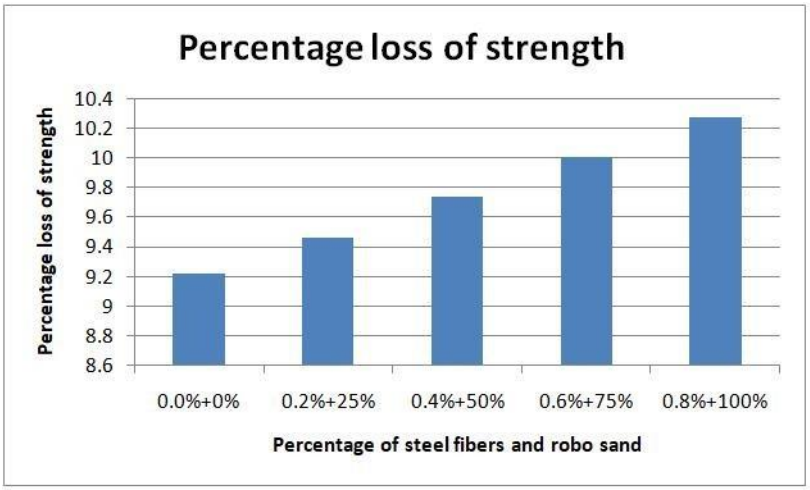
Percentage loss of compressive strength



Sulphate attackAcid attack
Percentage loss of weight



Percentage loss of compressive strength



CONCLUSIONS

The aforementioned experimental investigation led to the following findings.

1. Chemical and mineral admixtures can be used to make self-compacting concrete, which has

higher tensile and compressive strengths for splitting than conventional vibrated concrete.

2. For the SCC formed with steel fibres and robo, the slump flow value decreases when the fraction is raised.
3. At 0.4 percent steel fibres and 50 percent robo, the compaction factor of SCC was found to be at its highest value. After that point, the value of the compaction factor starts to decline.
4. At 0.8 percent steel fibres and 100 percent M sand case, the compressive strength of SCC was found to be at its highest value. As the proportion of robo sand in SCC rises, up to 100 percent, the value of split tensile strengths rises as well.
5. When 0.8 percent steel fibres and a 100 percent robo sand casing were utilised, it was revealed that the split tensile strength of SCC was at its highest level. As the proportion of robo sand in SCC rises, up to 100 percent,so does the value of split tensile strength.
6. When using 2% steel fibres and 100% robo sand casing, it was found that the flexural strength of SCC was at its highest value. Flexural strength ratings can reach 100% with a higher robo sand composition.
7. For both acid attack and alkaline attack cases, the proportion of weight loss and strength loss rises along with the amount of robo sand in SCC.
8. Self-compacting concrete also has two very important advantages. One is the length of time required forconstruction, which is frequently less than when standard concrete is used since vibration compaction doesn't require additional time.
9. The positioning is connected to the second benefit. SCC can be seen as ecologically favourable as long as compaction is not necessary; otherwise, no noise would be produced.

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