OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

''RAPID WALL TECHNOLOGY''

(CONTRUCTION USING GFRG WALL PANELS)

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Project Guide

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Abstract: ***The demand for conventional building materials used in the housing sector such as burnt clay bricks, cement and steel is growing every year. Reduction in the use of these energy intensive construction materials and speedy delivery of housing units at affordable cost are the key challenges faced in the mass housing sector today. Buildings using Glass Fibre Reinforced Gypsum (GFRG) panels (infilled with reinforced concrete) hold promise as a rapid, affordable and sustainable mass housing solution. GFRG panels were introduced in Australia in 1990 and are now manufactured in India, making reuse of waste gypsum from the fertiliser industry. The panels are made of calcined gypsum, reinforced with glass fibres. They are prefabricated to a size of 12 m length, 3 m height and 124 mm overall thickness (with cavities), and are relatively light-weight (44 kg/m2). Figure 1 shows typical details of the GFRG panels. Some of the advantages of the GFRG system over conventional buildings are: high speed of construction involving less labour, increased carpet area for the same built-up area, reduction in the use of cement, sand, steel and water, excellent finish of the panels with no need for plastering, lesser building weight contributing to reduction in earthquake forces, etc. Buildings constructed of GFRG also have the advantages of cost effectiveness and energy efficiency, in terms of reduced use of energy intensive building materials, and recycled use of industrial waste. Tests have established that the panels have the required resistance to water and fire.***

INTRODUCTION

The threat of climate change caused by the increasing concentration of greenhouse gases in the atmosphere is pushing the whole world into a catastrophic crisis situation with universal concern. The need of the 21st century is for energy efficient and eco-friendly products. The building industry accounts for 40% of CO2 emissions. Building construction causes CO2 emissions as a result of embodied energy consumed in the production of energy intensive building materials and also the recurring energy consumption for cooling and heating of indoor environment. Rapidwall, also called gypcrete panel is an energy efficient green building material with huge potential for use as load bearing and non-load bearing wall panels. Rapidwall is a large load bearing panel with modular cavities suitable for both external and internal walls. It can also be used as intermediary floor slab/roof slab in combination with RCC as a composite material. Since the advent of innovative Rapidwall panel in 1990 in Australia, it has been used for buildings ranging from single storey to medium - high rise buildings. Light weighted Rapidwall has high compressive strength, shearing strength, flexural strength and ductility. It has very high level of resistance to fire, heat, water, termites, rot and corrosion. Concrete infill with vertical reinforcement rods enhances its vertical and lateral load capabilities. Rapidwall buildings are resistant to earthquakes, cyclones and fire.

Scope of the Project Building with Rapidwall in India "

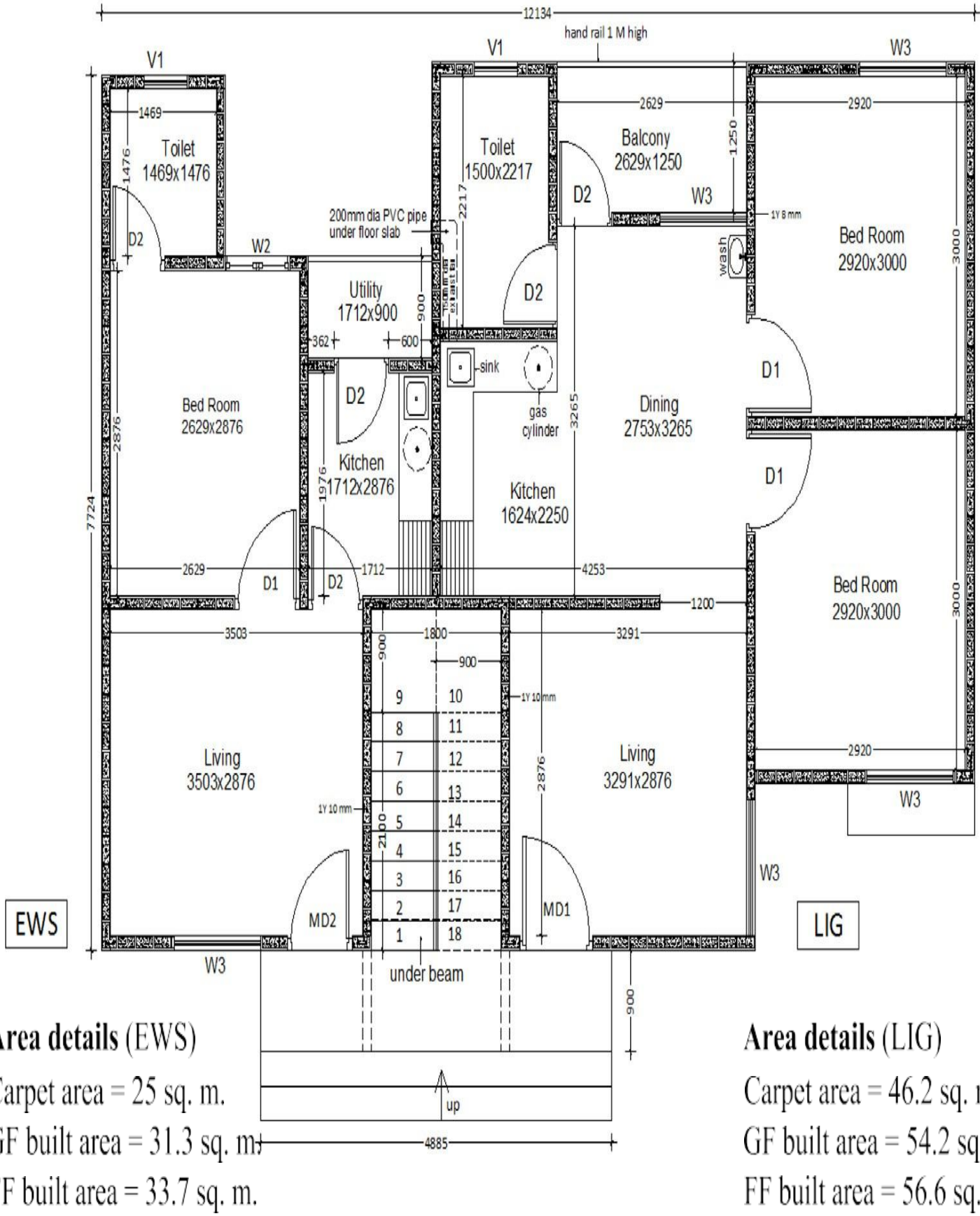
It is just not possible to continue to build with traditional materials and achieve sustainable development." In order to overcome the huge housing shortage is an urgent need for alternative building materials. Building materials that: Are energy efficient Have little or no CO2 emissions Are strong & durable Can be constructed quickly Are resistant to natural disasters like earthquakes, cyclones and fire Can be produced at a cost to meet needs of masses and Have the ability to be recycled Sustainable development also means we need to have an eye on environmental considerations. Conventional walling materials such as fired clay bricks, solid and hollow concrete blocks, tilt-up concrete panels; timber frame, external steel cladding and steel frames have a detrimental effect on the environment. They are high energy users; deplete valuable agricultural land, cause environmental pollution, deplete forests and water and cause high CO2 emissions. Even though these conventional materials will be around for a very long time there are now serious questions being asked by every government about the impact these products have on the environment and on climate change. And it's not a question of whether we personally believe in climate change or not; most people do agree that reducing carbon emissions will have a beneficial effect on the environment. In India, clay brick production accounts for 27% of total national energy consumption. For every million bricks produced 0.8 of a hectare of agricultural land is destroyed; 5.6 megawatts of energy is used and 310 tonnes of CO2 is emitted. Scarce water resources and sands and minerals are depleted and the atmosphere is polluted. Within just a few years cement production in India has increased from 100 million tonnes per year to the current level of 160 million tonnes and steel production from 30 million to 60 million tonnes. Presently 200 billion bricks are produced annually and demand is growing exponentially. With traditional building materials degrading the landscape and adding significantly to CO2 emissions, building from environmentally friendly Rapidwall has become even more attractive. India produces significant amounts of fertilizer for worldwide use but in doing so creates phospho-gypsum as a by-product in the order of millions of tonnes annually. Presently there is 31 million tonnes of excess phospho gypsum stockpiled and this is added to annually by 2.5 million tonnes. By utilising Rapid Building Systems Rapidflow calcination plant the phospho gypsum can be turned into plaster and subsequently into Rapidwall, thereby cleaning up the environment. Rashtriya Chemicals Fertilizer (RCF) in Mumbai and India's oldest fertilizer company, Fertilisers and Chemicals Travancore (FACT) in Cochin, are both in the process of building new plants to turn their waste phospho gypsum into Rapidwall homes and this shows great foresight and planning. This stockpiled Gyspum is enough to build 5 million 30m2 Rapidwall homes. By comparison to traditional building materials, Rapidwall is a low energy user, has little CO2 emission, helps to clean up the environment, is 100% recyclable and is cheaper to produce.

Study On Estimation Of Wall Panel System With Conventional Building Works In Construction Industry

The estimation for wall panel system is carried out based on the Material, Labour and size of panels used for construction activity.From the Comparative study on Estimation of wall panel system and conventional building system we can calculate the cost difference for each work of construction activity.

ADVANTAGES OVER CONVENTIONAL BUILDINGS:

- Less built-up area for the same carpet area, the wall panels are only 124mm thick.
- Less embodied energy and carbon footprint: significant reduction in use of cement, sand, steel and water; recycling of industrial waste gypsum.
- Lower cost of structure. Due to that we can save the materials.
- Lower building weight (panels weigh only 43 kg/m2), contributing to savings in foundation and reduction in design for earthquake forces, particularly in multi-storied construction.
- Buildings up to 8-10 storeys' can be designed using this load-bearing system, without the need for beams and columns.
- Excellent finishes of prefabricated GFRG panels – used for all the walls, floors and staircases, with minimal embedded concrete: no need for additional plastering.
- The use of prefabricated light-weight GFRG panels not only implies faster overall construction time but also a safer working environment.
- The structure is Light weight and accurate. The whole construction is Economical.
- The construction using this panel is Load-bearing
- Rapid wall panel is environmentally positive of environment friendly.



Area details (EWS)

Carpet area = 25 sq. m.

GF built area = 31.3 sq. m.

FF built area = 33.7 sq. m.

Area details (LIG)

Carpet area = 46.2 sq. m.

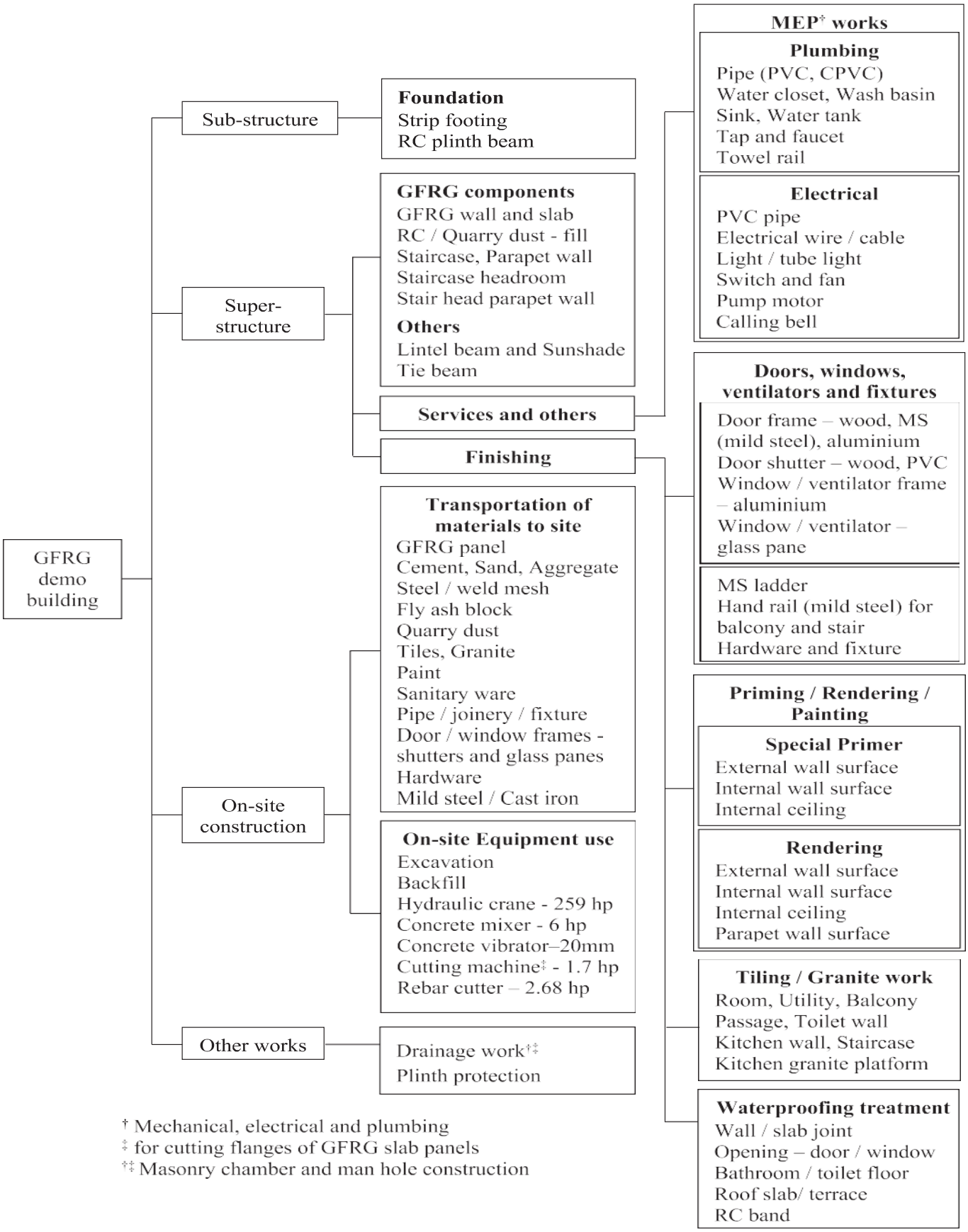
GF built area = 54.2 sq. m.

FF built area = 56.6 sq. m.

Typical floor plan of GFRG building

(b) Snapshot of completed GFRG building

Typical floor plan and snapshot of GFRG building



3.2 Work break-down structure for Case-1: GFRG building.

Comparison of construction cost of GFRG and conventional building

Sr.no.	Item of work	GFRG construction	conventional
A	FOUNDATION – Including earthwork excavation, pcc (1:4:8), block work ,RCC plinth beam(M25 grade),centering work for plinth beam, reinforcement	408686	423092
B	SUPERSTRUCTURE – Including supplying GFRG panels , brickwork, infill with M20 concrete, infill with quarry dust+cement, GFRG panels for floor/roof slab/staircase , concrete lintel and additional (M25), centering work , reinforcement for load bearing system , reinforcement for lintel and additional , weld mesh (10 gauge)	1315121	1256367
C	Finishing work (rendering and plastering)	87436	467018
D	waterproofing	163544	115796
E	painting	117107	368039
F	Floor /wall tiling	161809	148100
G	Joineries- door/window/ventilator , iron ladder, mild steel handrail for stair	338324	338324
H	Plumbing and electrical work	202375	228175
I	Plinth protection and drainage work	2812702	3363211

*Interest saved due to early completion of work (interest considered @ 14% rate for 4 month of conventional technique = 156950

	Rapidwall construction	**conventional**
Total rs.	**2812702**	**3520160**
Total carpet sqft. Of carpet area (rs.)	**1841**	**2478**
Structural cost per sq ft. of carpet	**1128**	**1582**

Area(rs.)

CONCLUSION

Rapidwall Panel provides a new method of building construction in fast track, fully utilizing the benefits of prefabricated, light weight large panels with modular cavities and time tested, conventional cast-in-situ constructional use of concrete and steel reinforcement. By this process, man power, cost and time of construction is reduced. The use of scarce natural resources like river sand, water and agricultural land is significantly reduced. Rapidwall panels have reduced embodied energy and require less energy for thermo-regulation of interiors.

Rapidwall buildings thereby reduce burdening of the environment and help toreduce global warming. Rapidwall use also protect the lives and properties of people as these buildings will be resistant to natural disasters like earthquakes, cyclone, fire etc. This will also contribute to achieve the goal of much needed social inclusive development due to its various benefits and advantages with affordability for low-income segments also. Fast delivery of mass dwelling/ housing is very critical for reducing huge urban housing shortage in India. Rapidwall panels will help to achieve the above multiple goals. This technology is adopted in Australia, China since 1990. In India IIT madras had prepared Demo building which is two story apartment building of GFRG technology but in India there are no commercial building built based on this technology.

In terms of building materials used, the GFRG building construction results in about 1/4 reduction in cement use, 1/3 reduction in steel reinforcement and close to ½ reduction in sand use compared to a conventional load-bearing brick masonry building. The use of rapid GFRG construction technology results in about ¾ savings in con-

struction duration, ½ savings in terms of total number of man- days required and ¼ saving in construction cost.

REFERENCE

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