Review on Design And Reinforcement of 4-Wheeler Rocker Panel

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Abstract- *Vehicle side crash is a critical crash event where the vehicle is crashed by a movable car or vehicle may hit a tree or pole. Minimising the intrusion into the occupant space is important to protect the occupant. Inside pole crash, vehicle rocker (sill) plays an important role in resisting the load due to the crash. The objective is to study the functional performance and potential mass reduction in the vehicle sill/rocker area by use of carbon fibre reinforced polymer (CFRP) tubes.*

In this project investigates the behaviour of CFRP square section tubes in a three-point quasi-static bending in comparison to conventional steel structure using finite element method. By keeping the resistance force offered by a steel section as the baseline resistance value, different combination of CFRP tubes and metal holding brackets are evaluated and compared with the baseline. Design and analysis of existing Rocker Panel specimen will be done using CATIA R5V20 and ANSYS 19 software. new design & weight optimization of rocker panel specimen will be done using CFRP Experimental investigation will be done by three-point bending test on UTM.

Keywords- *Rocker Panel, Design Optimization, UTM*

I ntroduction- In the 21st century, individuals are additionally headed toward vehicles with higher fuel economy and reduced emission levels. At constant time, because of a rise in awareness on safety and rigorous crash check rules, the automotive makers are heading towards a smarter, a better, a wiser design of the inhabitant space by use of high strength materials for better crashworthiness.

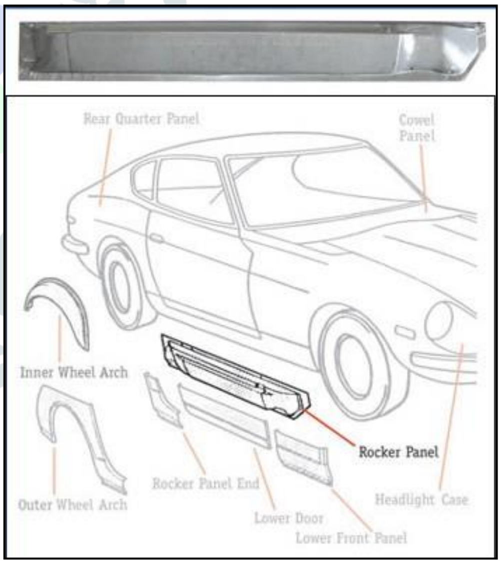
The term crashworthiness

signifies the power of the structure to guard the inhabitant in a crash situation. Crash performance necessities are centred on inhabitant injury parameters and structural deformation measurements like intrusion, acceleration and speed of the deforming structure. Protecting individuals within a crash is difficult as a result of the edges of vehicles having comparatively very little space to soak up energy and defend occupants, in contrast to the front and rear, that have substantial crumple zones.

What is rocker panel?

Rocker panels are stamped pieces of strong metal that form part of the structural body of the car. They are an integral part that runs along the side of your car between the front and rear wheel wells. In other words, rocker panels keep the back of your car from separating from the front of your car. The rocker panel is the lowest body panel on the side of the car located between the two wheel wells. In most cars, only the edge of the rocker panel is visible when the doors are closed since it supports the bottom of the door.

Other than the roof supports, they are the only part of the structural body that connects the front and the back of your car.



Rocker Panel

LITERATURE REVIEW

1. **"Design and weight optimization of 4-Wheeler rocker panel using fea and Three-point bending test",** By Khomane Haridip

Vehicle aspect crash could be a crucial crash event wherever the vehicle is crashed by a movable automobile or vehicle could hit a tree or pole. Minimizing the intrusion into the inhabitant area is vital to guard the inhabitant. In an aspect pole crash, vehicle rocker still plays a crucial role in resisting the load because of the crash. The target is to review the useful performance and potential mass reduction within the vehicle sill/rocker space by use of Glass fiber reinforced polymer (GFRP). This project investigates the behaviour of GFRP square section rocker panel in a three-point quasi-static bending as compared to traditional rocker panel finite element methodology. Design and analysis of existing Rocker Panel specimens are going to be done by victimization CATIA R5V20 and ANSYS nineteen software. new design & weight optimization of rocker panel specimens are going to be done victimization GFRP. Experimental investigations are going to be done by three-point bending check on UTM.(1)

2. **"Evaluation of the survivability of CFRP honeycomb-cored panels in compression after impact tests" By** Oleg A. Staroverov, Elena M. Strungar, Valery E. Wildemann

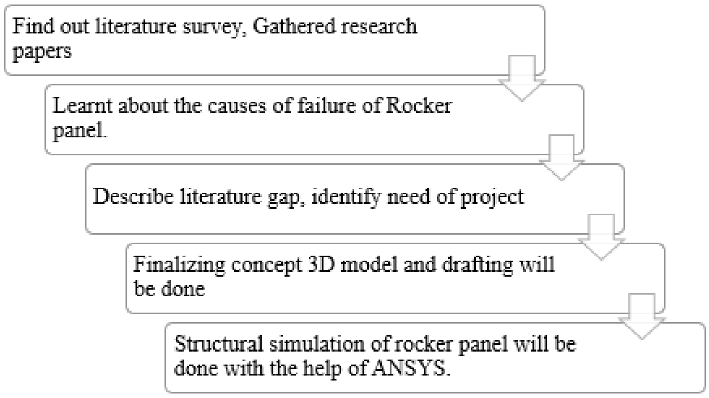
This paper is oriented to the experimental research of the mechanics of the CFRP sandwich plates, glass and carbon fiber sample panels with a large-cell honeycomb core. The method for testing polymer composite sample plates in compression after impact (CAI) tests with joint use of a testing machine and a video system for deformation field registration was tested. Analysis of the experimental data obtained highlighted the impactive sensitivity zone for the test specimens. A quantitative assessment of the loadbearing capacity of glass and carbon fiber sample panels in CAI tests with the different levels of the drop weight impact energy was performed. Photos of samples after impact have been provided. Vic-3D non-contact three-dimensional digital optical system was used to register the displacement and deformation fields on the surface of the samples. The video system was used to evaluate various damage mechanisms, including matrix cracking, delamination's, and rupture of the damaged fibres. The paper studied the evolution of non-homogeneous deformation fields on the surface of the composite samples during the post-impact compression tests and analysed the configuration of non-homogeneous deformation fields.(2)

PROBLEM DESCRIPTION:

To meet the challenges of making a stronger vehicle to achieve more strength and good structure in crashworthiness, use of the Composite materials can be one of the solutions

OBJECTIVES

- To study and perform static analysis on 4-wheeler rocker panel specimen under loading condition.
- To propose an optimized model this will have better or same performance and reduced weight.
- CAD modelling of 4-wheeler rocker panel specimen in Catia V5R20 software.
- To perform static structural Analysis of reinforced 4-wheeler rocker panel specimen in ANSYS 19 workbench.
- Experimental investigation of Reinforced rocker panel specimen will be done by three-point bending test on UTM.
- Comparative Analysis between Existing material results and Reinforced Material results.

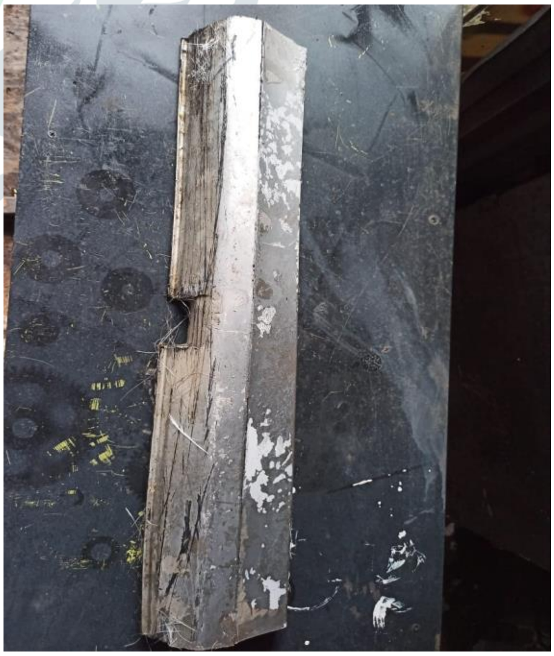


Process Flow

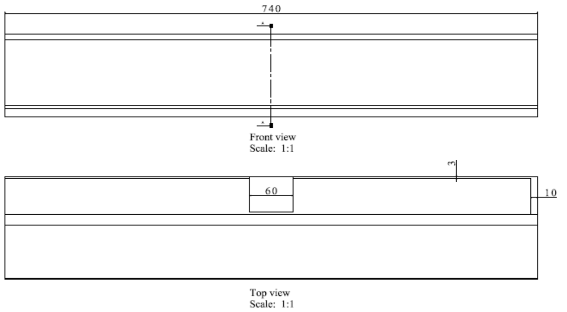
DESIGN AND PARAMETERS MEASUREMENT

Reverse Engineering

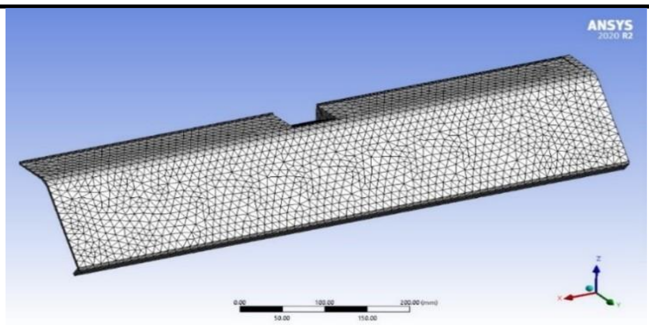
Reverse engineering (also known as backwards engineering or back engineering) is a process or method through the application of which one attempts to understand through deductive reasoning how a device, process, system, or piece of software accomplishes a task with very little (if any) insight into exactly how it does so. Reverse engineering is applicable in the fields of computer engineering mechanical engineering, design, chemical engineering, and systems biology



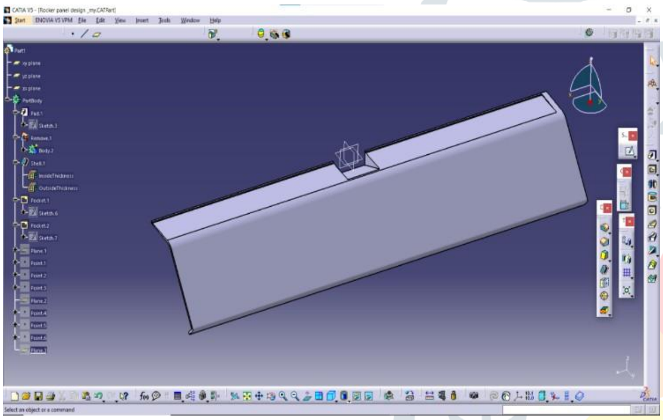
Rocker Panel(Bolero)



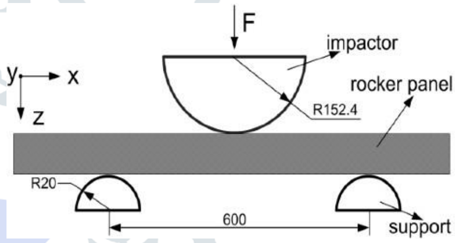
Drafting Of Existing Rocker



Product Model After application Of Meshing



3D Catia Model

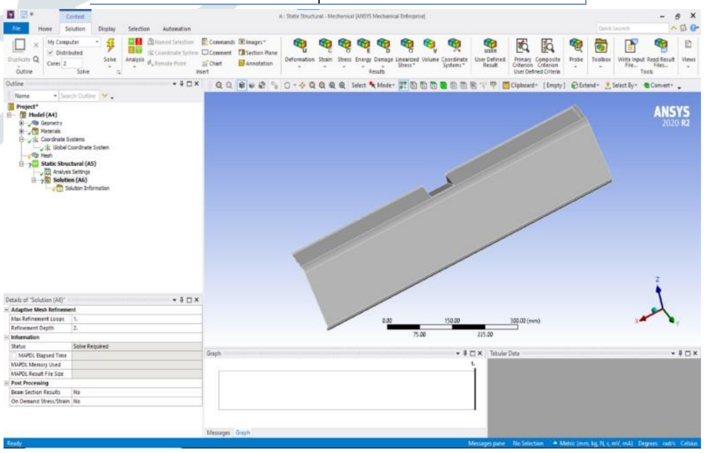


Boundary Conditions on Rocker Panel

Display	
Display Style	Use Geometry Setting
Defaults	
Physics Preference	Mechanical
Element Order	Linear
Element Size	10.0 mm
Sizing	
Use Adaptive Sizi...	No
Growth Rate	1.0
Max Size	10.0 mm
Mesh Defeaturing	Yes
Defeature Size	0.18 mm
Capture Curvature	No
Capture Proximity	No
Bounding Box Di...	764.3 mm
Average Surface ...	11673 mm^2
Minimum Edge L...	2.0 mm

Details Of Meshing Used

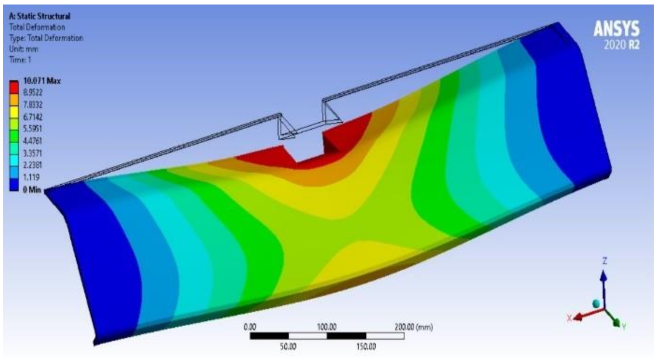
Statistics	
Nodes	3699
Elements	10521



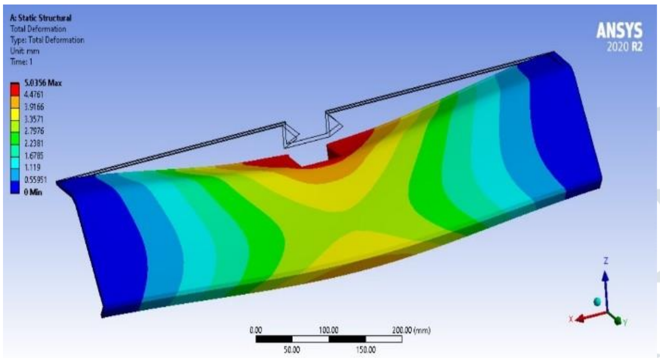
Catia File In Ansys Workbench

MATERIAL APPLICATION

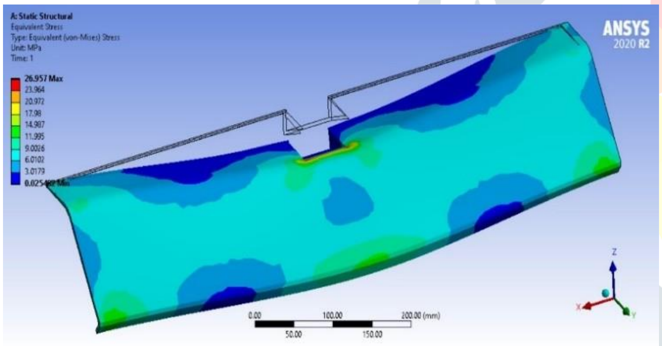
Polyethylene



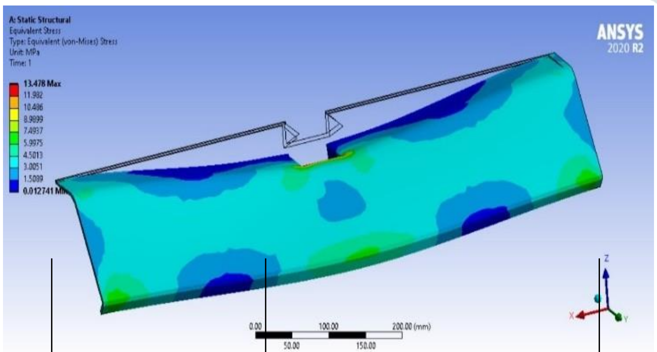
Total Deformation



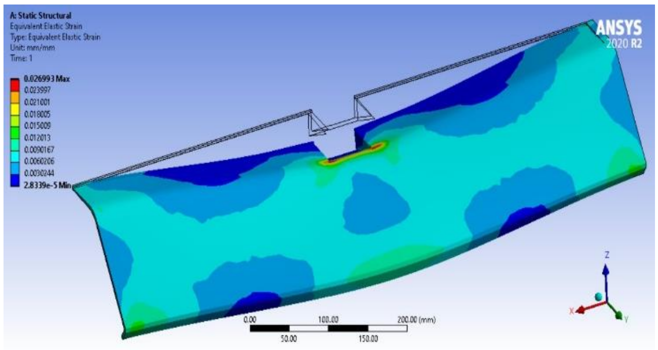
Total Deformation

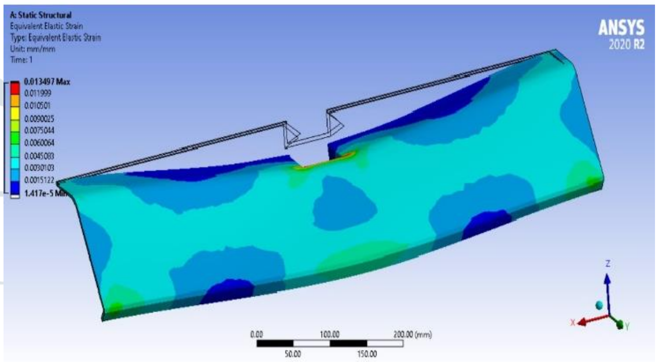


Equivalent Stress



Result Table (Polyethylene)

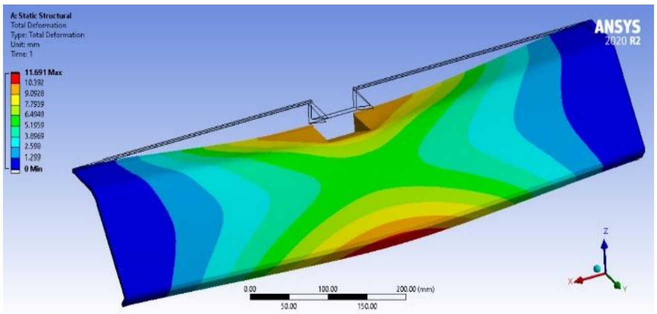


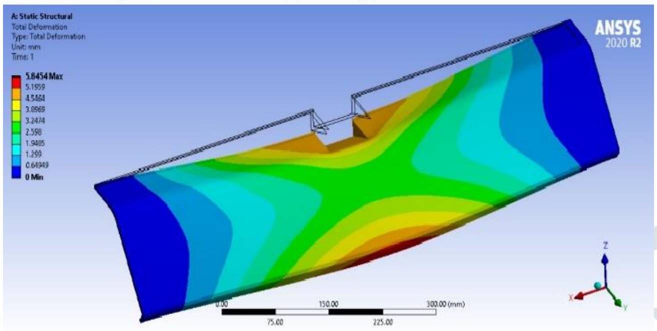


Equivalent Elastic Strain

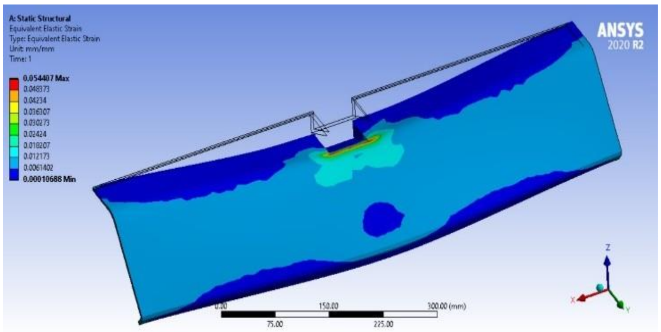
Displacement (mm)	Total Deformation (mm)		Equivalent Stress (MPa)		Equivalent Elastic Strain	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
-10	0.00	10.071	0.0254	26.957	2.833*10^-5	0.0269

Epoxy E-Glass Wet

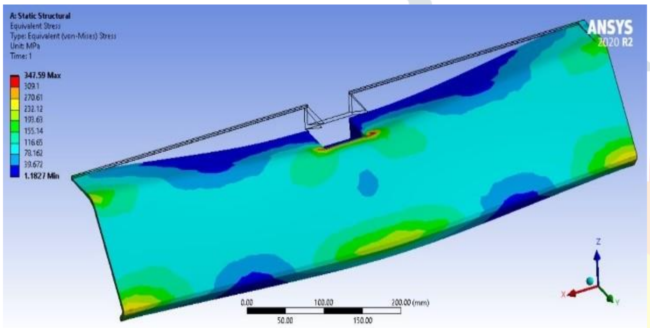


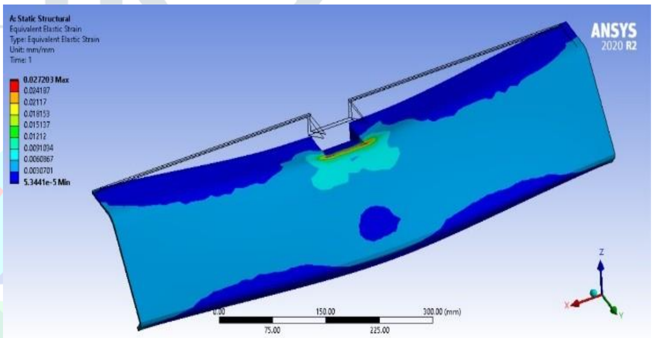


Total Deformation



Equivalent Elastic Strain



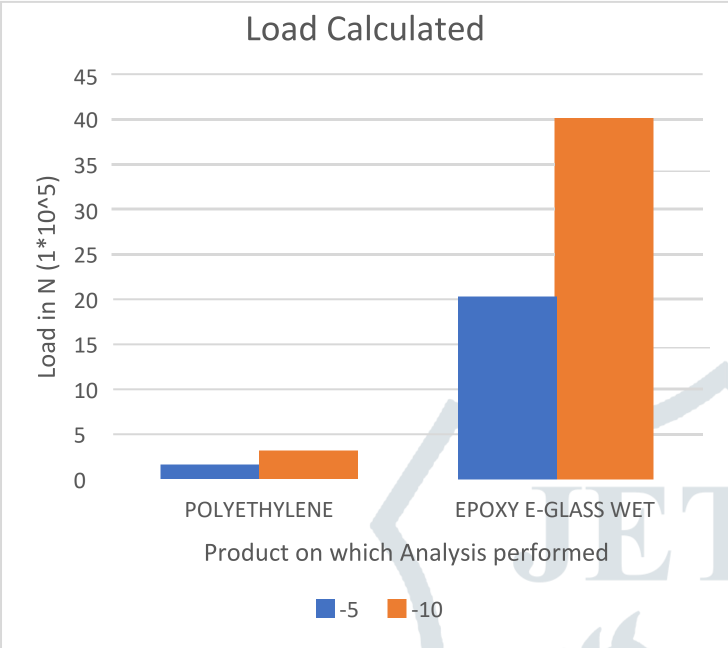


Equivalent Elastic Strain

Result Table: (For Epoxy E-Glass Wet)

Displacement (mm)	Total Deformation (mm)		Equivalent Stress (MPa)		Equivalent Elastic Strain	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
-10	0.00	11.691	1.182	347.59	1.06*10^-4	0.0544
-5	0.00	5.845	0.591	173.8	5.344*10^-5	0.0272

Material Comparison



Load Calculation Histogram

Load Calculated / Displacement Given	Polyethylene (Existing Product)		Epoxy E-Glass Wet (Reinforced Product)	
	Minimum	Maximum	Minimum	Maximum
-10	296.49	3.148*10^5	13.797*10^3	40.574*10^5
-5	148.27	1.573*10^5	6.898*10^3	20.287*10^5

CONCLUSION

The Reinforced rocker panel is also gone through the process of structural analysis and from the plots it is concluded that the reinforced rocker panel has best strength than the original one. As load bear by the Existing rocker panel is 3.148*10^5 and 1.573*10^5 N for -10- and -5-mm Displacement respectively and the Reinforced panel took up 40.574*10^5 and 20.287*10^5 N for -10 and -5 mm Displacement respectively.

From the analysis of both the materials we compare generated values of total deformation, equivalent stress, and the equivalent elastic strain. The chances of the failure of polyethylene material are much higher than Epoxy E-Glass wet material.

The maximum total deformation of Epoxy E-Glass wet is greater than polyethylene material, hence this material sustains more than polyethylene. After considering all the parameters we conclude that Epoxy E-Glass wet is durable, safe and sustain more load than existing polyethylene material of rocker panel. Hence Epoxy E-Glass wet material is better than polyethylene material.

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