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DESIGN AND ANALYSIS OF CURVED BEAM WITH DIFFERENT OPENINGS

SHUBHA K U[1], MAHESH SAJJAN[2]

[1]PG Scholar, Department of Civil Engineering, RYMEC, Ballari
[2]Assistant Professor, Department of Civil Engineering, RYMEC, Ballari

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Abstract - *There are various openings in reinforced concrete that are necessary for the proper operation of services like telephone lines, air conditioning, and ventilation ducts. due to this variation in the beams' structure, particularly when taking into account their curvature. When compared to other structural areas, the load distribution is more concentrated at the centre and at the corners. Therefore, in order for the structure to withstand this load, it must be designed so that the weight can be distributed evenly across the curved beam. The nature of the curved beam's existence and how it functions in all potential areas where additional support is required must be studied by taking into account some of the key load distribution factors that are taken into account in finite element modelling. The product can be designed in Catia, and it has been assumed that only Catia software will be used to develop all models. The models are then imported into Ansys to be studied for the structure's proper behaviour. By conducting the initial research for this project, we learned that adding appropriate holes of various sizes and shapes can lessen the load distribution over curve-shaped beams. In order to study the stress strain and total deformation, various holes with models have been designed and imported into ansys. The reinforced concrete beam is thought to have been well analysed in ansys when compared to the real-time model, where we must check the design repeatedly by building following repeated testing, without the need for such additional costs and economic conditions while we can design multiple attempts and in order to attend the best possible analysis outcome.*

1. INTRODUCTION

The seismic load is nature's most awful and ephemeral miracle because of how much damage it causes on a broad scale. This makes it a natural disaster. When seismic forces shake a building, human lives are not directly lost; rather, they are lost as a result of the building's collapse, which in turn places the lives of the building's inhabitants and the value of their assets in jeopardy. In other words, human lives are lost indirectly. There is not a direct risk to human life associated with the shaking of a building caused by seismic activity. When forces associated with earthquakes or seismic activity are applied, all structures are at risk of being damaged. However, the chance of damage increases considerably when the earthquake takes place on a tilted area, such as on slopes, which is at some propensity to the ground. This is because the ground is more likely to move during the earthquake. To put it another way, the possibility of damage greatly increases when the earthquake takes place on a sloped working surface. Working on slopes is an effort that should be avoided at all costs because to the inherent dangers. This occurs as a result of higher horizontal powers on short segments on the tough side, which, in turn, encourages the installation of plastic pivots as a solution to the problem. In other words, the problem is caused by higher horizontal powers. Buildings that are positioned on slopes have a greater degree of both horizontal and vertical variation when compared to their counterparts that are placed on level ground. This is true for both the building's interior and outside environments.

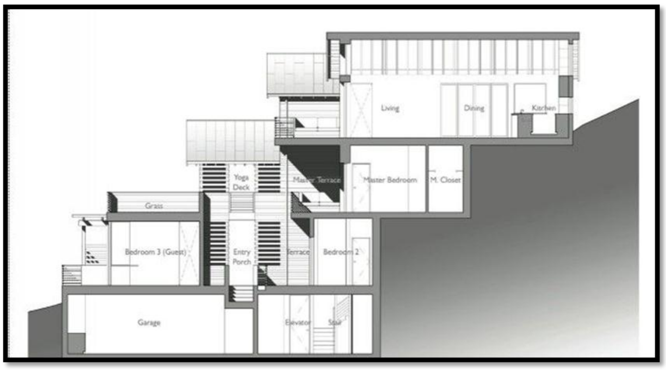


Fig -1: Building on Sloping Ground

1.1 Dampers

Using multiple types of dampers simultaneously can reduce the severity of damage caused by earthquakes. Based on how well they perform, these dampers are divided into different types. Dampers are used because of their ability to absorb a lot of energy, be easily replaced, have a straightforward installation process, and work well with other parts of the building's framework.

1.2 Fluid Viscous Dampers

Fluid viscous dampers are velocity-dependent systems, and the first fluid viscous damper devices were created for use in military applications. The fluid viscous damper consists of an opening through which some fluid is flowing, and the phenomena that is exploited for the operation of the fluid viscous damper is described below. There are a number of chambers through which silicone oil is continuously flowing. This oil is employed because of the reason that it is consistent over a long period of time, it does not waver, and it is inert. Additionally, it is not toxic or hazardous, and it does not easily catch fire. The difference in potential is produced by the two separate chambers. Because of this discrepancy, the pressure is adjusted so that the oil may flow via the designated channel. The energy from the earthquake is transformed into heat energy throughout this phase, and the resulting heat causes the atmosphere to cool.

2. LITERATURE REVIEW

Yogeendra Holebsgilu, R., and Manjunath, P. On a 3D monitor with 10 layers, the Y axis will show movement along four bayous and six straights, while the X axis will show movement along all 10 layers. There is a possibility that the slope of the land is either zero degrees, fifteen degrees downward, or twenty-five degrees upward. The model is deconstructed and planned for using the ETABS 2015 software, taking into account seismic zone V and a variety of soil types. They reasoned that if the foundation of the building were tilted up at a higher angle, the seismic strain on the building would be lessened, and the building's stability would rise. Analyzing the seismic behavior of RC buildings on both flat and sloping surfaces required Sandip Doijad and Surekha Bhalchandra (2015) to apply a number of different shear divider configurations. This research was published in 2015. The G+8 narrative RCC team, which was in charge of the investigation, was taken into consideration. The study looked at sites with slopes of 9, 18, and 27 degrees, as well as areas that were completely flat. The inspection was carried out with the assistance of SAP2000 software that had been modified for Zone II and medium soil.

Birajdar and Nalawade (2004) did study on the seismic behavior of buildings located on sloped terrain, and their focus was on how these structures reacted to earthquakes. The lean of 27 degrees was discovered in 24 different RC frame buildings. In terms of their architectural style, the buildings were either step-back, step-back set-back, or set-back. Buildings in seismic zone III that ranged in height from four to eleven stories (15.75 to 40.25 meters) and had a total of four bays, three of which were oriented perpendicular to the slope and one of which was positioned perpendicular to the slope, were examined. They carried out the three-dimensional study with the help of the Response spectrum approach, taking into consideration the influence of torsion.

3. OBJECTIVES

The purpose of this research is to examine and evaluate the differences and similarities between the seismic responses of buildings that are and are not fitted with fluid viscous dampers.

• To determine the various displacements and variations in the structure both when a fluid viscous damper is present and when it is not present by comparing the two states in which the damper is present.

• Using fluid viscous damping in RC buildings in order to analyze base shear oscillations in the structure so that a determination can be made about what to do about them.

• To investigate further aspects, such as shear, displacement, and tale drift, and make comparisons between them

• Examining the data side by side, making comparisons and analyses of them, and then drawing conclusions about the impact that the viscous damper has on the sloping building.

4.METHODOLOGY

Material Properties

Grade of concrete:M45

Grade of steel: Fe550

Beam:700×500mm

Column:700×700mm.

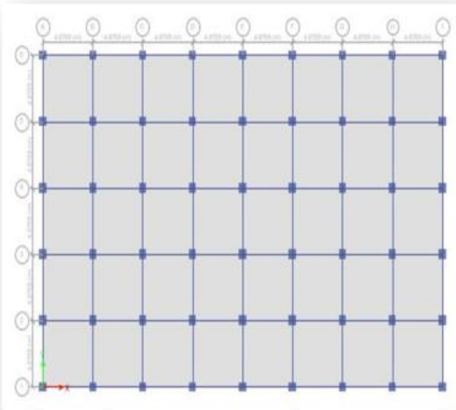
One way slab:200mm

Story Height: 3m

Seismic Loads

Z=V, I=1, R=5 and Soil Type is Medium

4.1 Layout of Buildings



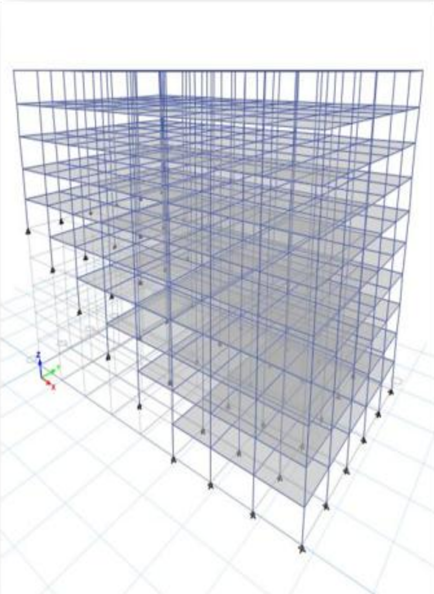


Fig -2: Plan and3D Model of Conventional RC Structure

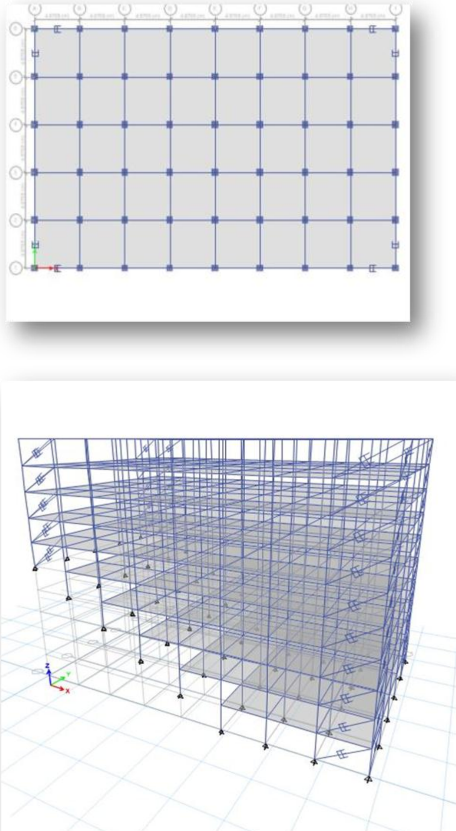


Fig -3: Plan and3D Model of Conventional RC Structure with FVD

5. RESULTS AND DISCUSSIONS

5.1Conventional RC Structure

Displacement

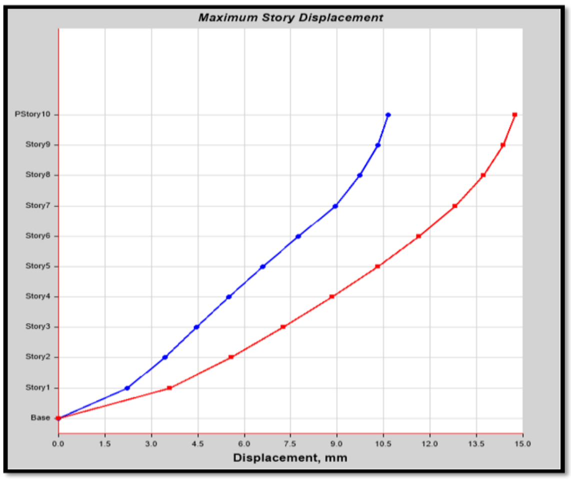


Chart -1: Displacement for EQX Load

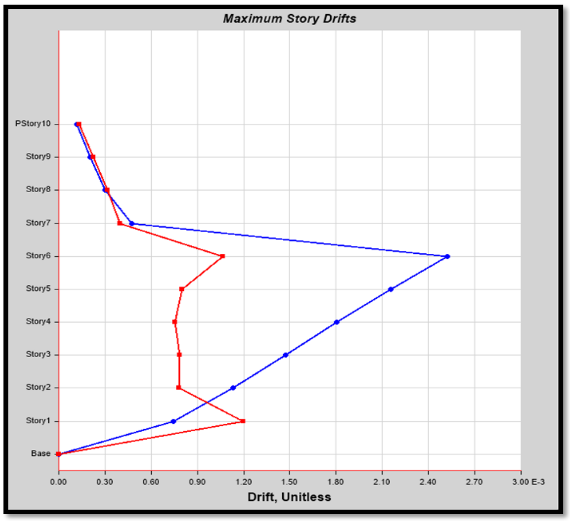


Chart -2: Story Drift for EQX Load

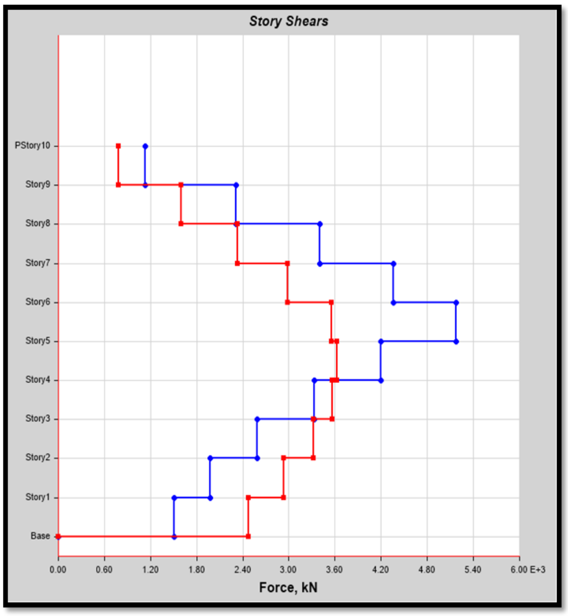


Chart -3: Story Shears for EQX Load

Dynamic Analysis

1. Response Spectrum Scale Factor=9185

2. Mass Ratio Achieved=90%

3. Base Reaction Safe for 84.5%

5.2 Conventional RC Structure with Fluid Viscous Damper

Displacement

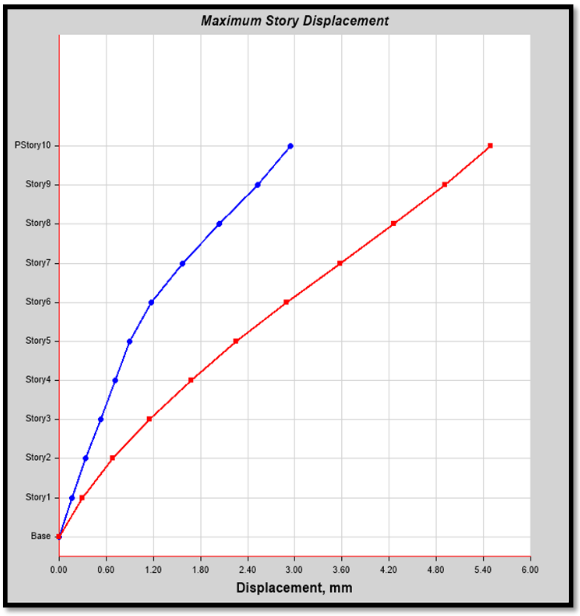


Chart -4: Displacement for EQX Load

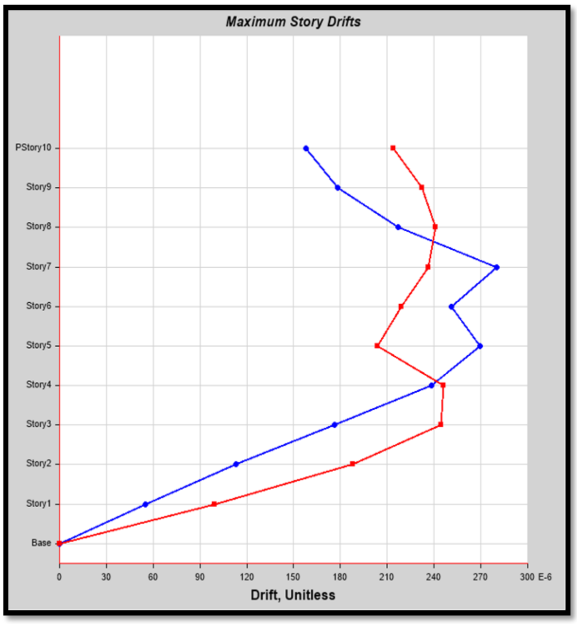


Chart -5: Story Drift for EQX Load

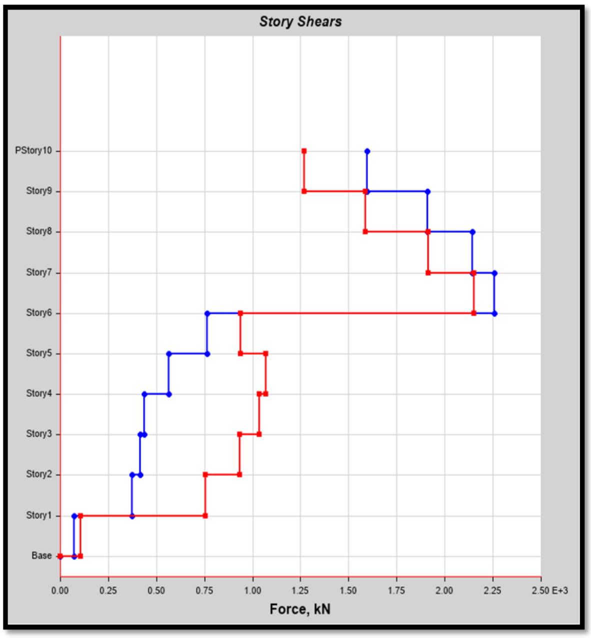


Chart -6: Story Shears for EQX Load

Dynamic Analysis

1. Response Spectrum Scale Factor=9185

2. Mass Ratio Achieved=90%

3. Base Reaction Safe for 84.5%

5.3 Comparison of Conventional RC Structure and Conventional RC Structure with Fluid Viscous Damper

5.3.1 In X-Direction

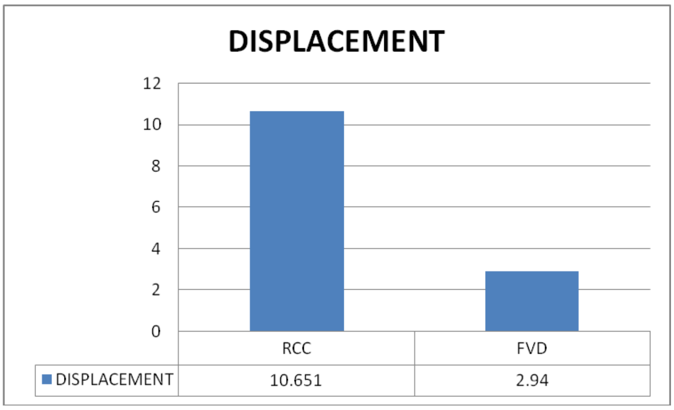


Chart -7: Displacement(mm) for EQX Load

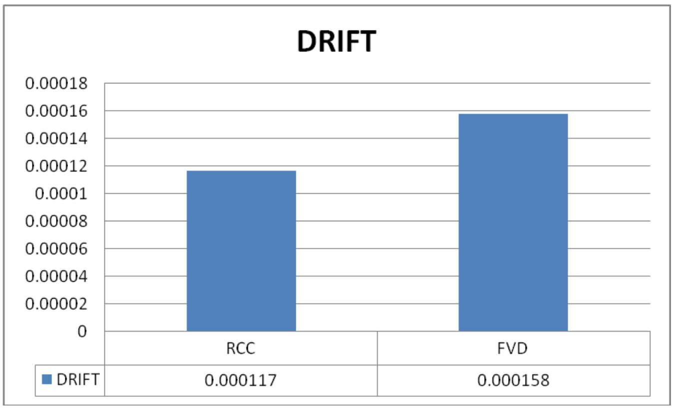


Chart -8: Story Drift for EQX Load

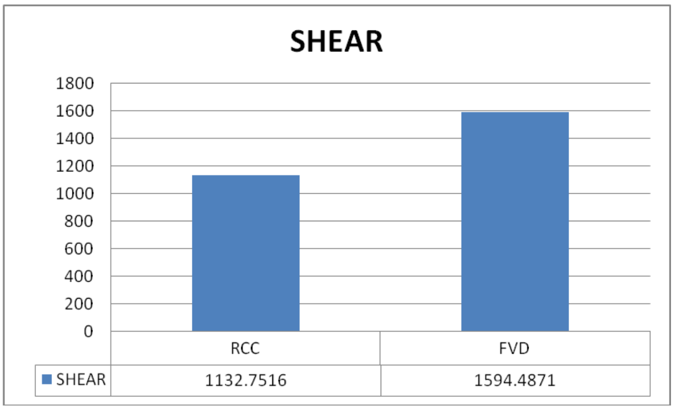


Chart -9: Story Shears(kN) for EQX Load

1. There is 72.4% decrease in the story displacement as shown in the chart 7 by providing the viscous dampers.

2. There is 25.94% increase in the story drift as shown in the chart 8 by providing the viscous dampers.

3. There is 28.95% increase in the story shears as shown in the chart 9 by providing the viscous dampers.

5.3.1 In Y-Direction

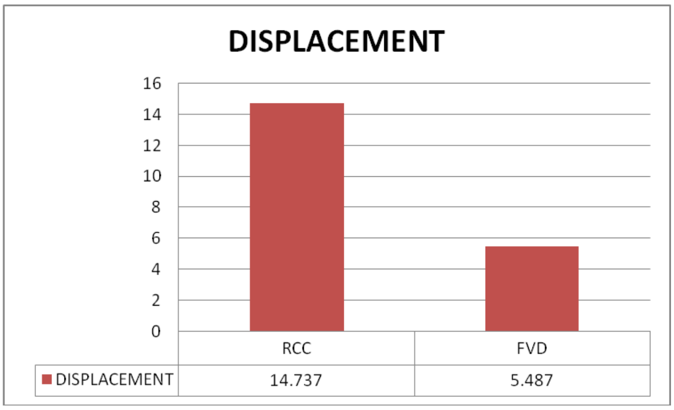


Chart -10: Displacement(mm) for EQX Load

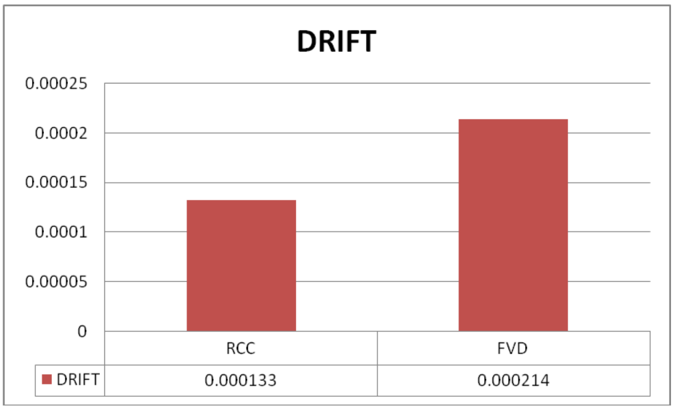


Chart -11: Story Drift for EQX Load

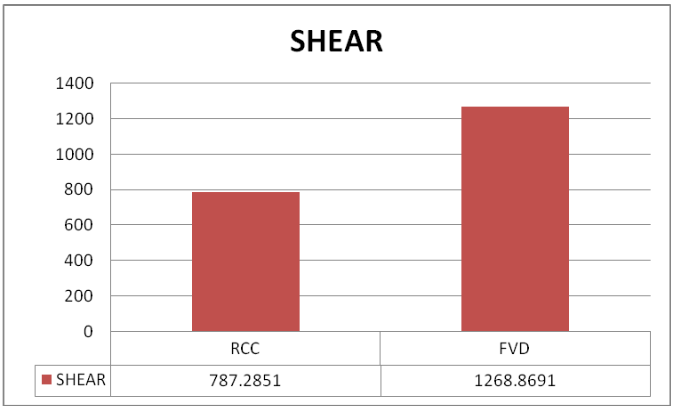


Chart -12: Story Shears(kN) for EQX Load

1. There is 62.76% decrease in the story displacement as shown in the chart 7 by providing the viscous dampers.

2. There is 37.85% increase in the story drift as shown in the chart 8 by providing the viscous dampers.

3. There is 37.95% increase in the story shears as shown in the chart 9 by providing the viscous dampers.

6. CONCLUSION

1. The final values that were produced for the damper model's displacement, drift, and shear reserves were found to be accurate after checking the results of the final comparison for displacement, drift, and shear. 1.

2. After going through all of the tables and graphs, we came to the conclusion that the cement damper and shear wall model performs significantly better than all of the other models, which have less value overall. After going through all of the tables and graphs, this was the conclusion that we came to. Even when taking into account the fact that the damper and shear wall model performs more effectively, this finding is still accurate.

3. The functionality of the model is also improved when drift analysis is performed, which in turn improves the performance of the damper when the values of the forces are taken into consideration.

4. When considering the share forces, it is important to take into account both the RCC model, which is the model of the damper that performs better, and the normal model, which appears to be a better choice; consequently, it is important to take into account the model of the damper that performs well.

5. After taking into account all of the findings, including the displacement drift and story share values, we can finally arrive at the conclusion that the damper model is superior to all of the other models when it comes to the design of slopes that involve several stories. This is the case because the damper model accounts for the interaction between the displacement drift and the story share values. This is indeed the situation.

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