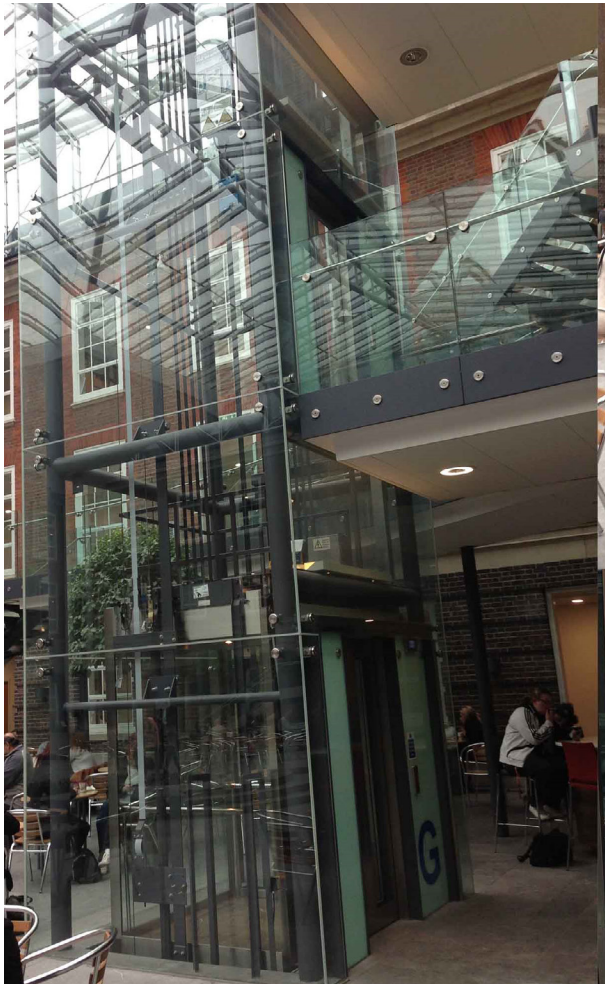
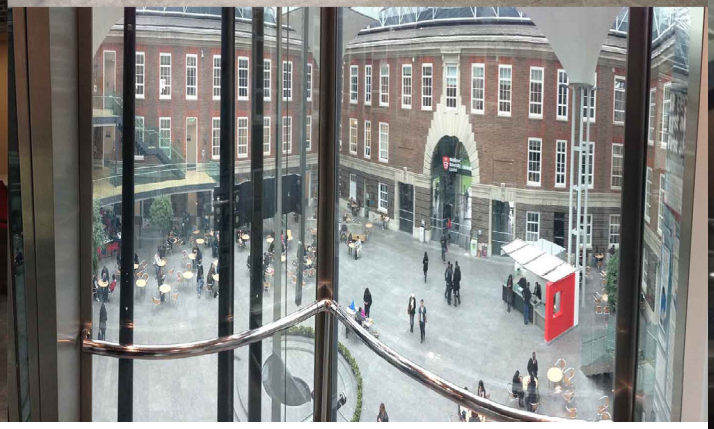
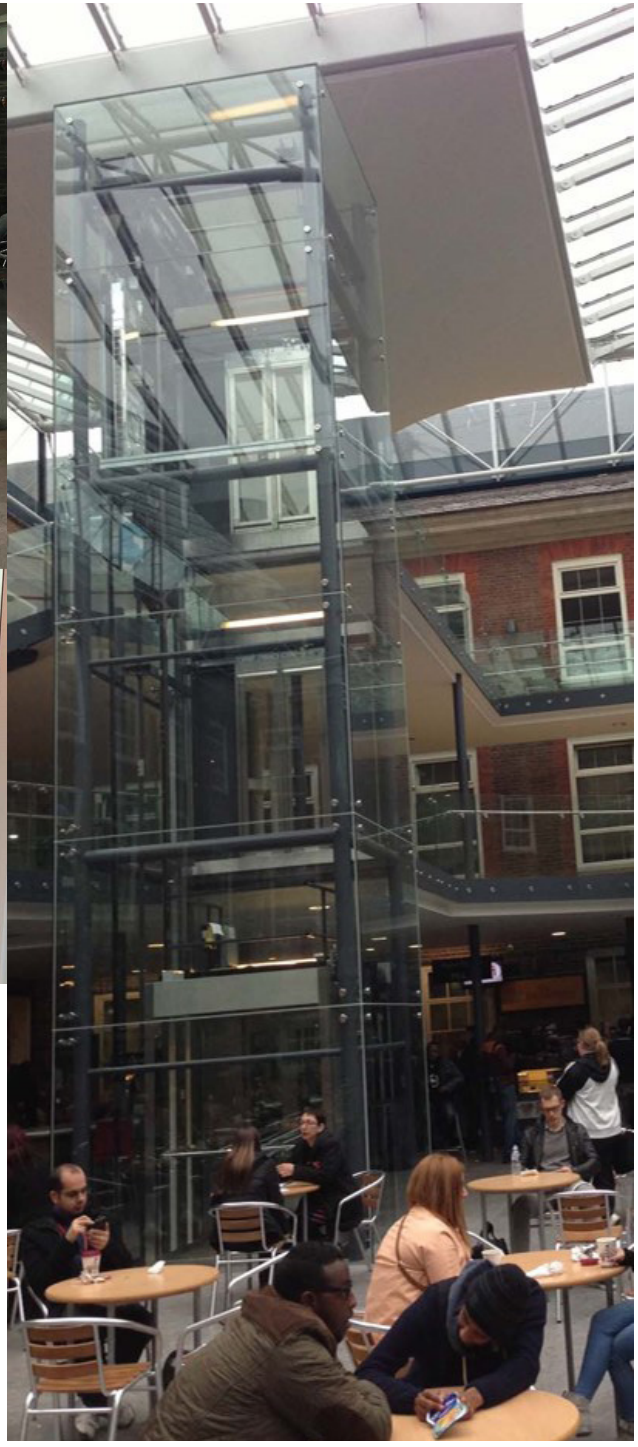
REDESIGN OF GLASS ELEVATOR







The project intends to redesign the glass door elevator present in the quadrangle of the Middlesex University and also focus on the various constraints involved, with the solution to those constraints. The Question of redesigning the quadrangle elevator aroused after analysing the short comes of the existing structure. The Existing elevator system present in the quadrangle of Middlesex university is Gen 2 comfort. It is machine room less type elevator designed for 13 people with a weight capacity of 1000kg. The elevator is powered by compact gearless machine which is a gearless drive with sealed bearings and maintenance free brake disc. The car of the current elevator has sheet metal work done with different welds and joints and glass panels which are connected to other parts with use of silicone based adhesive and sealants. The overhanging mechanism is 2:1 and the rated speed of the motor is 1m/s.

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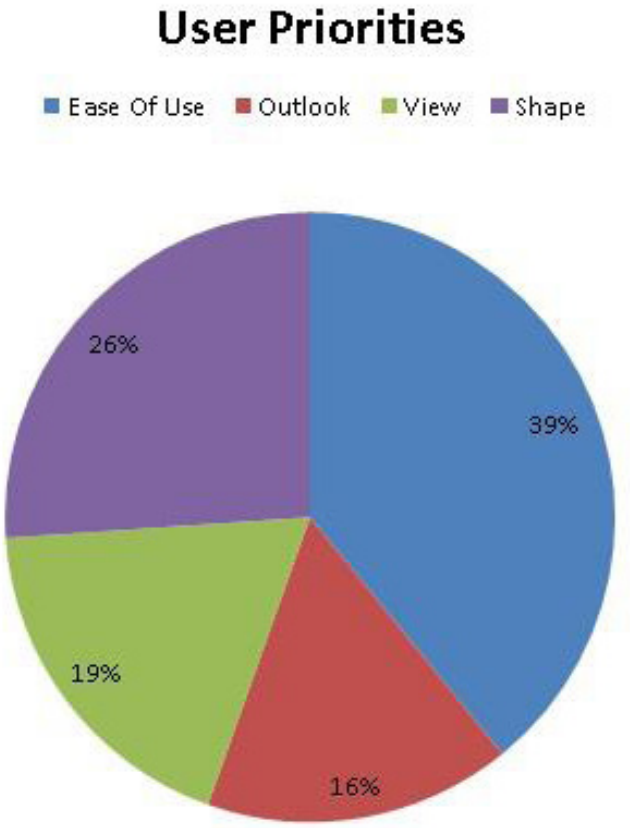

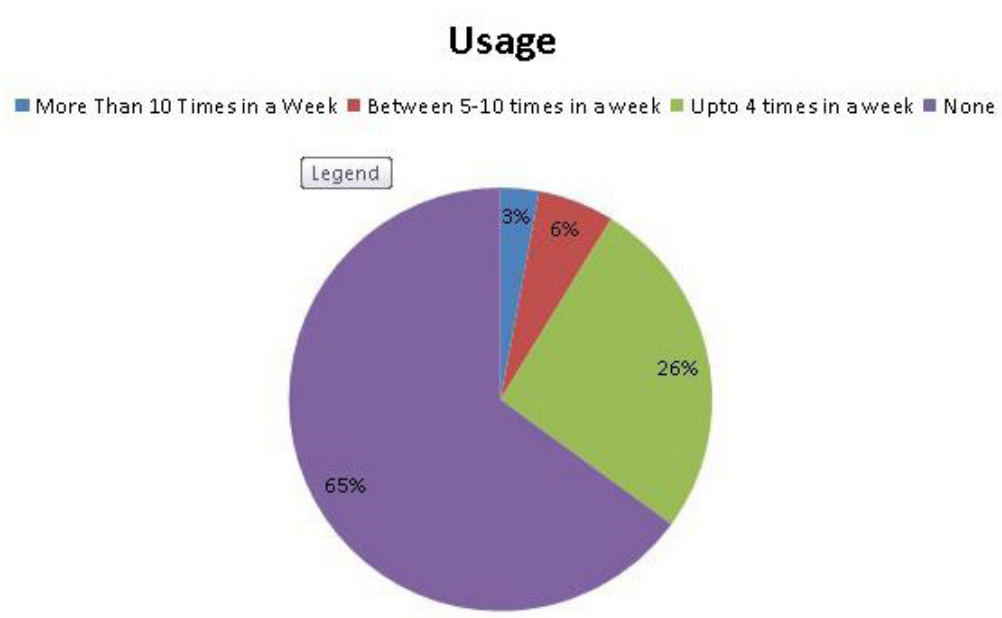

The mood board represents the main consideration for design that is the view from the elevator, the green design, light weight and environment friendly design. Flow charts outlay the statistics based on survey samples taken from the users.

The results provide the justification to the concept of redesigning the current elevator and guide the factors invoved in the creation of new design.

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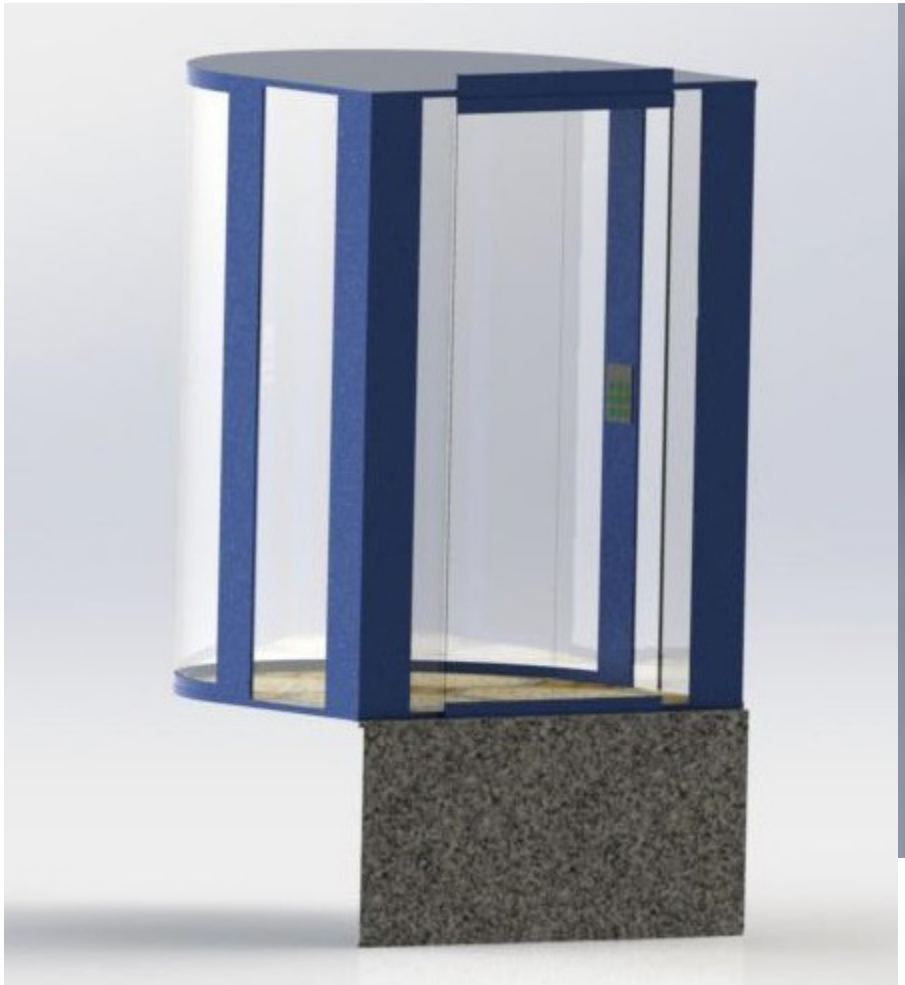
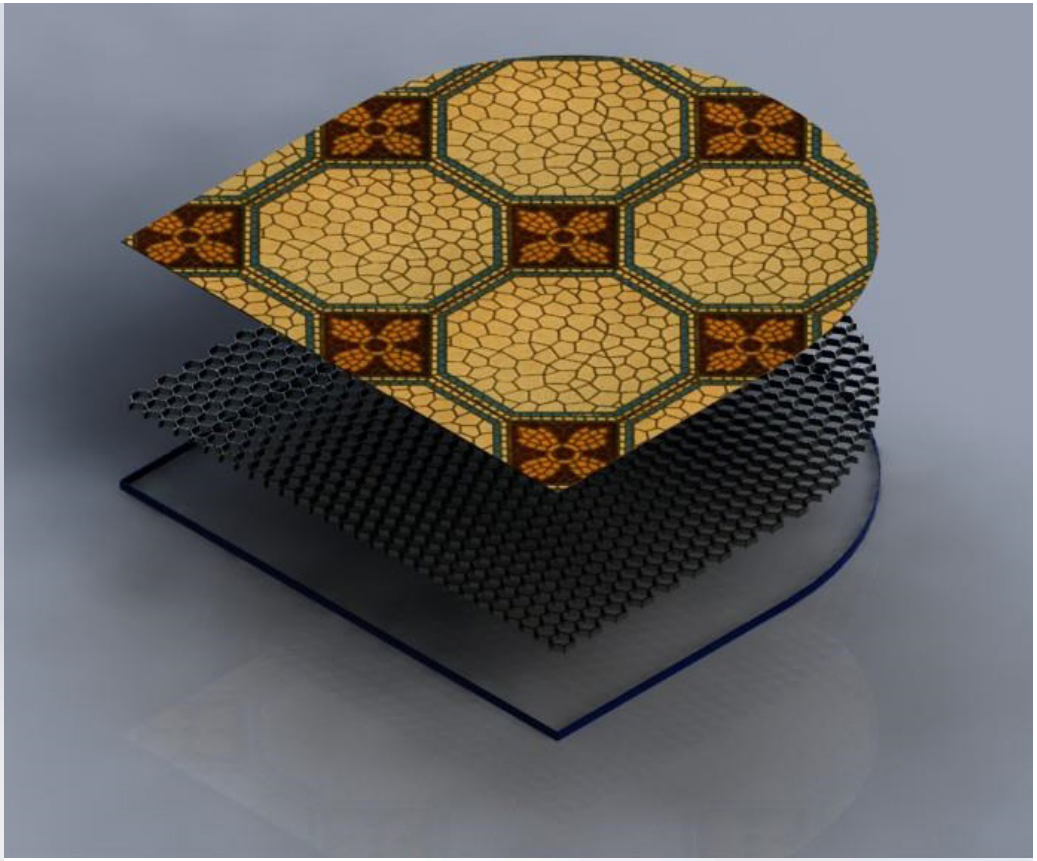
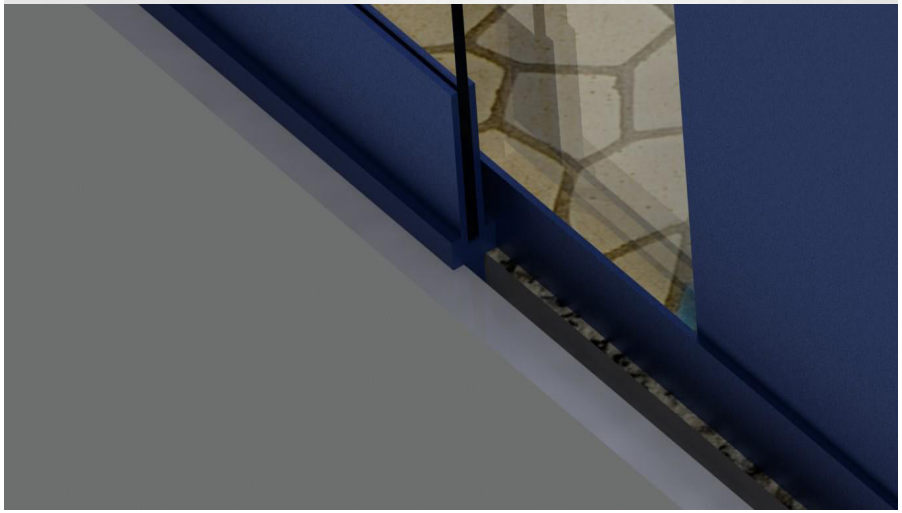
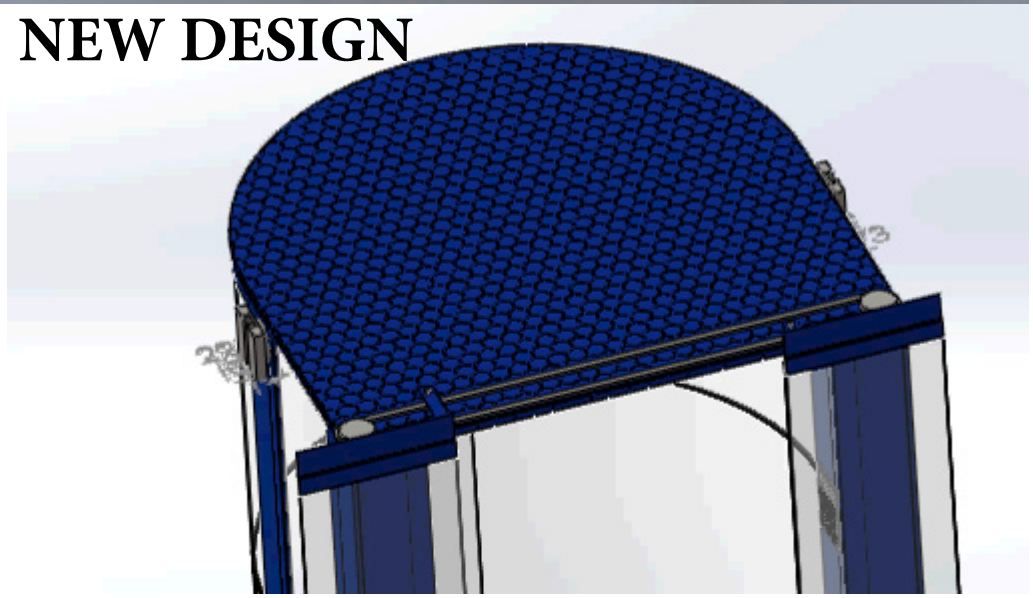






NEW DESIGN



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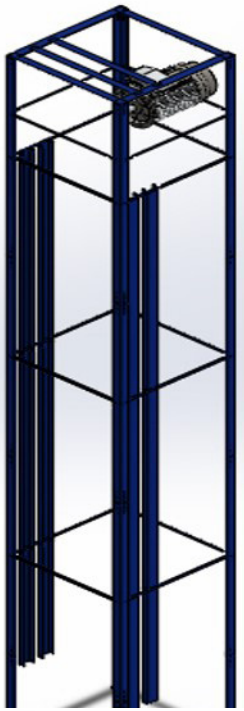

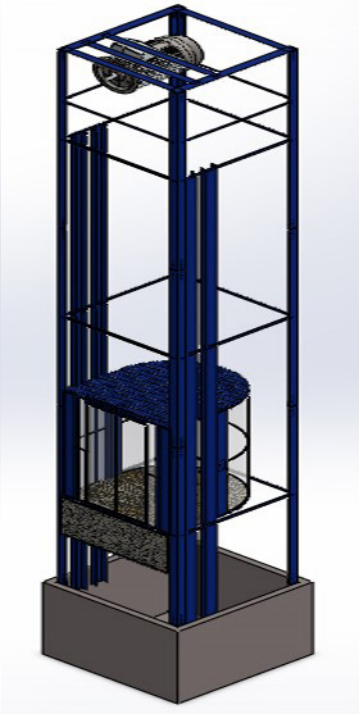

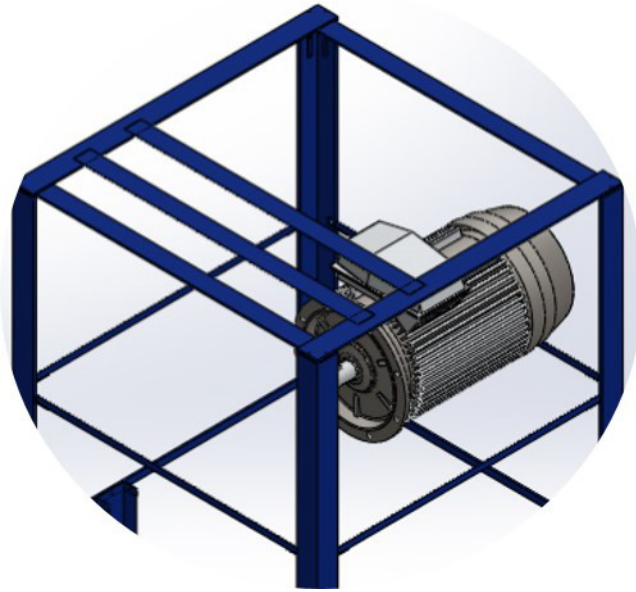

The introduction of semi-circular arc in front of the elevator car provides a 180 degree view. It promotes the use of glass fibres which are recyclable and contribute less to carbon footprint. Honeycomb structure at base facilitates the weight reduction while increasing its strength.
Regenerative type of drive is used to run the elevator in order to conserve power. Electric power is generated when car is either in upward motion or in downward motion. By help of regenerative drive, the energy generated can be used for other loads connected to same network.

The overhead mounting used in the redesign is similar to the earlier installation as because there is no need for larger pit area. Additionally, overhead system require lesser number of pulley which ultimately reduces the intermediate loss of power due to pulleys. The 2:1 suspension system helps to reduce the torque requirement of the machine by factor of two which in turn helps to reduce size, weight of the machine and makes the elevator machine more compact.

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MERITS	DRAWBACKS
Less weight	Increased manufacturing cost
Increased floor area	Complex for assembly
Use of efficient material	
Regenerative drive	
Unrestricted View	

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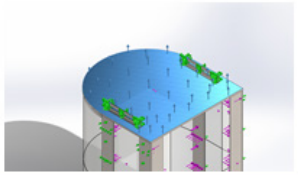
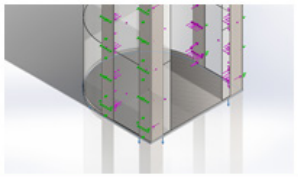
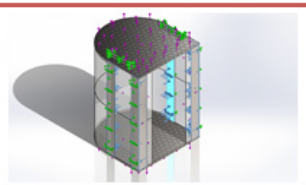
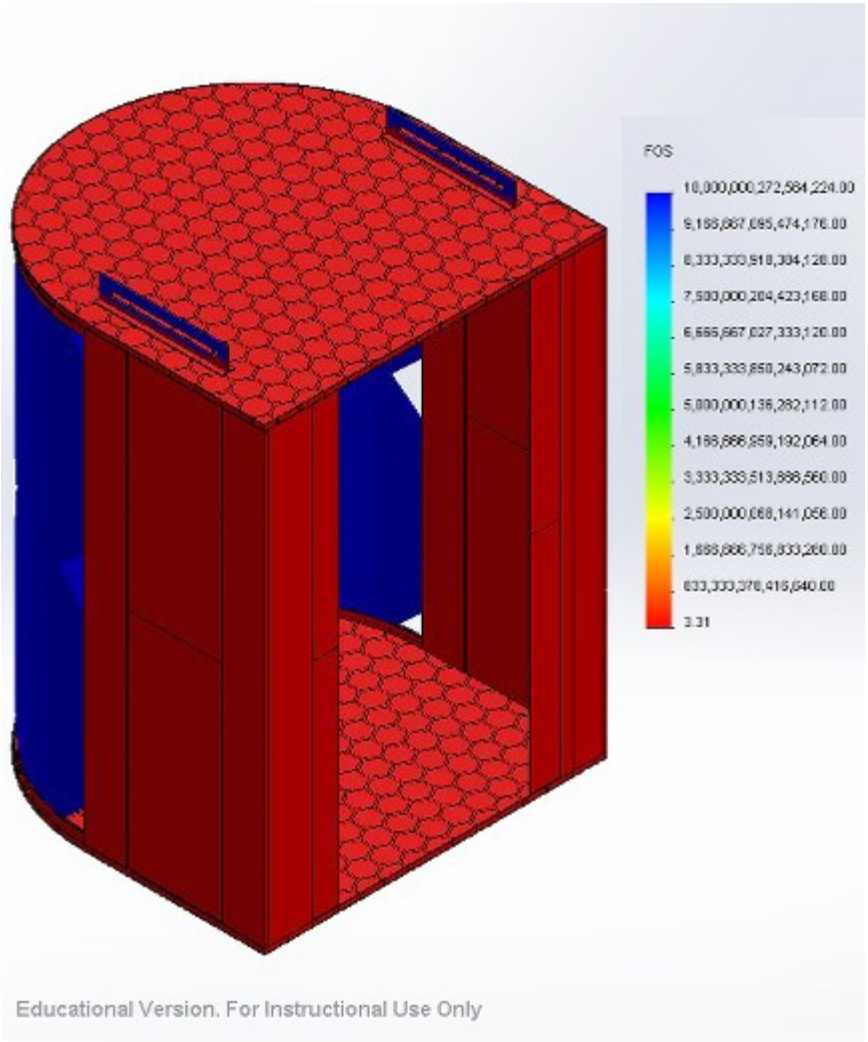
Forces Acting on the car

Load name	Load Image	Load Details
Force-1		Entities: 1 face(s) Type: Apply normal force Value: -21000 N
Force-2		Entities: 1 face(s) Type: Apply normal force Value: -20000 N
Force-3		Entities: 6 face(s) Type: Apply normal force Value: 10000 N



Factor of Safety

The simulation of car was carried out in three different scenarios first being acceleration, second deceleration and the last one being static. The car would behave same under static and uniform velocity condition. Now, as we know the weight of the car along with all other attachments is 1000kg and it is been designed for a load of 1000 kg. Also the car shows sliding contact at the rollers provided which is going to roll in the guiding rails. The car is being hung by two clamps on the top surface of the ceiling of the car; hence they will act as a fixed contact.

Material selection has been based on manufacturability, cost and mechanical and thermal properties of the material.

Note: The results here demonstrate only the condition of acceleration.

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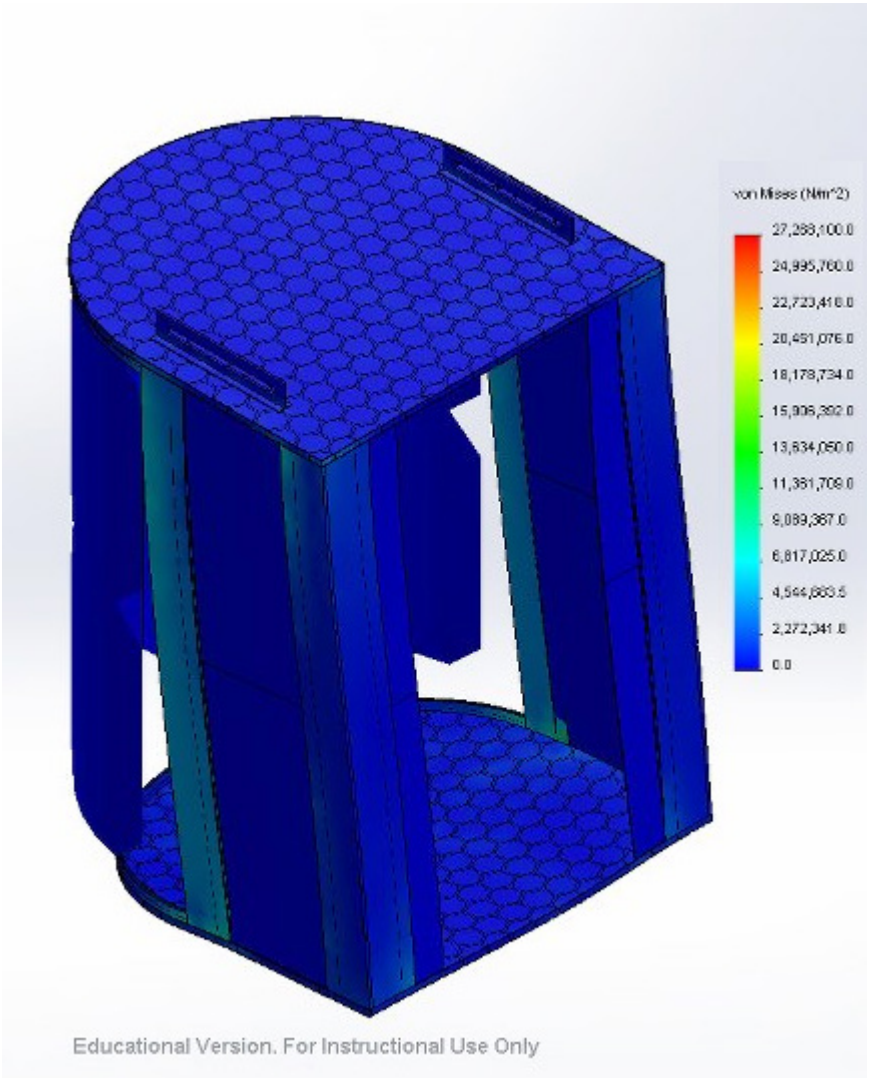
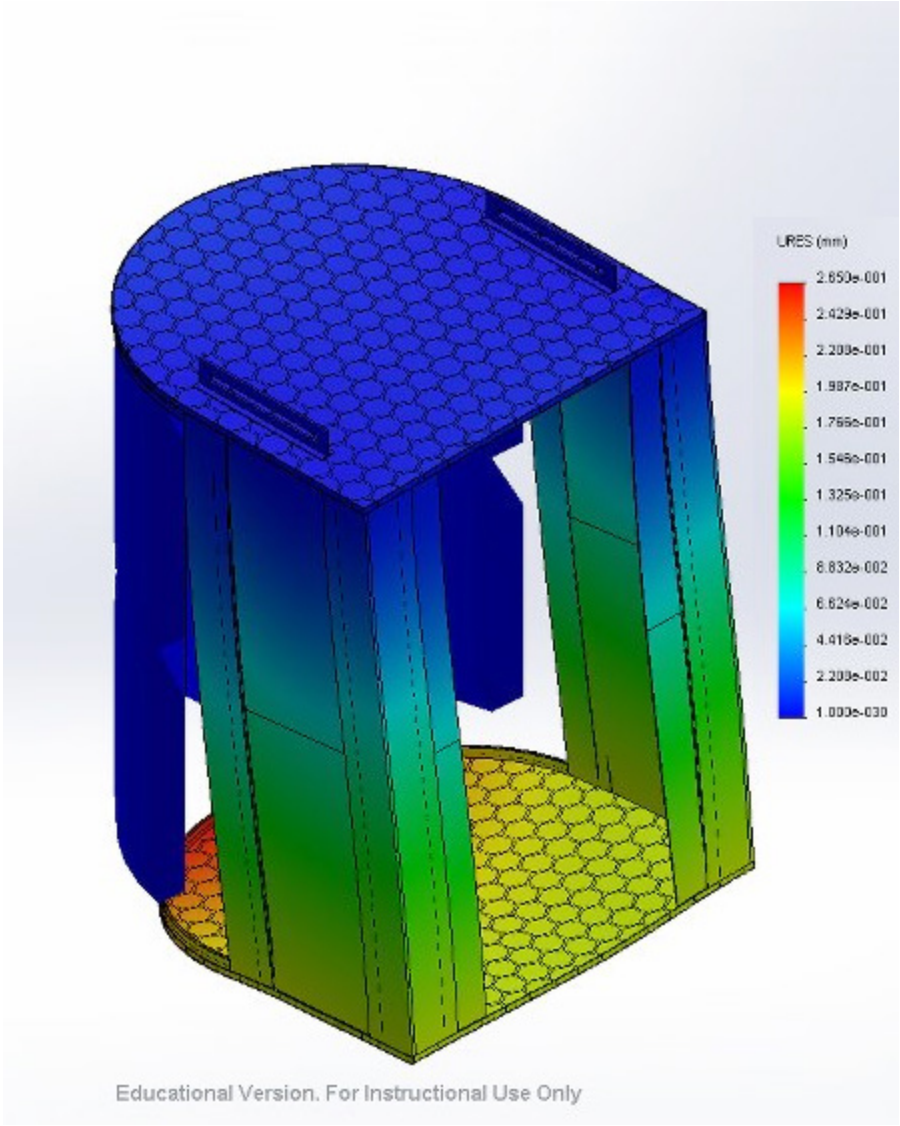


von Misses Stress Analysis



Static Displacement Analysis

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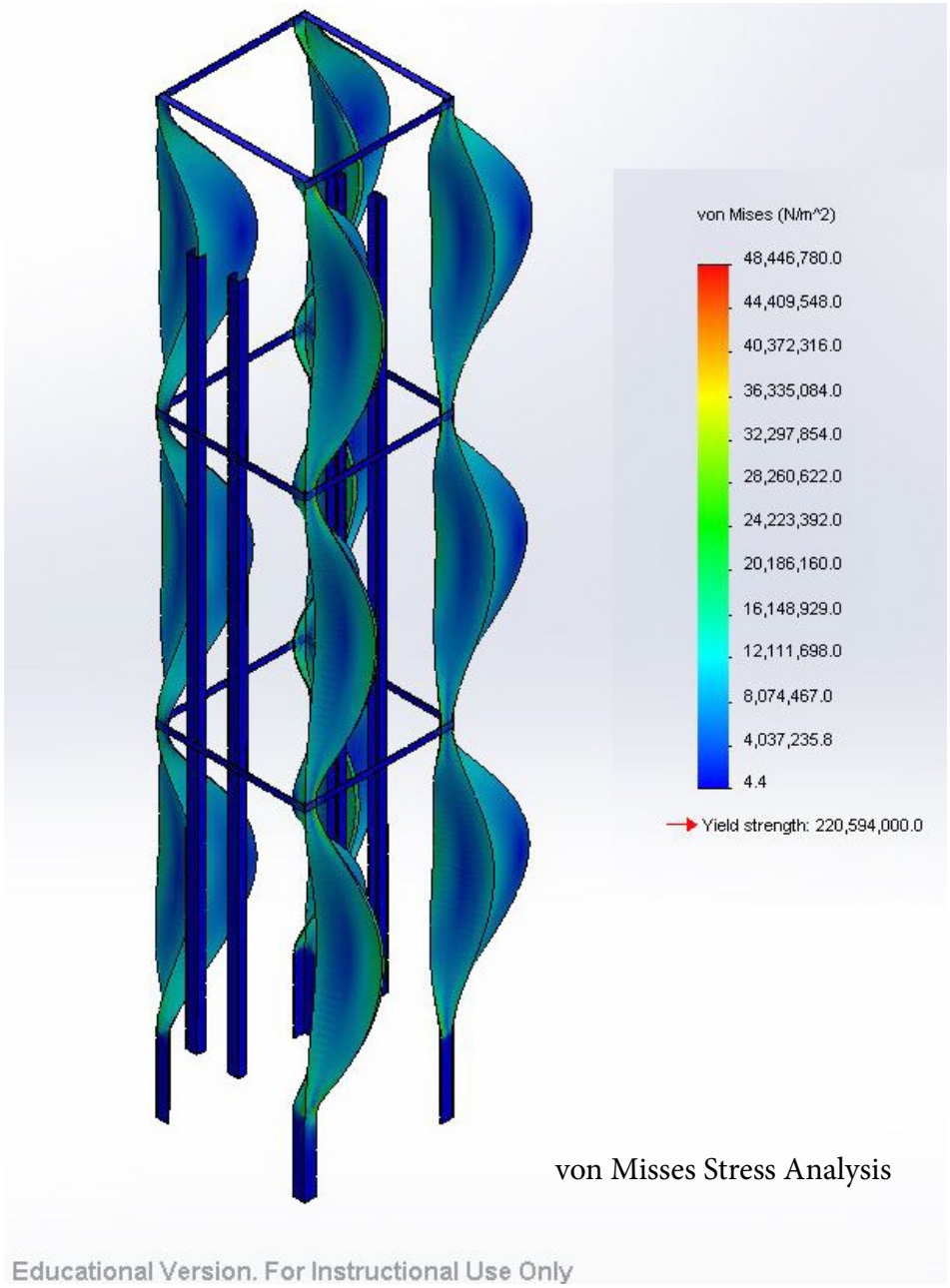
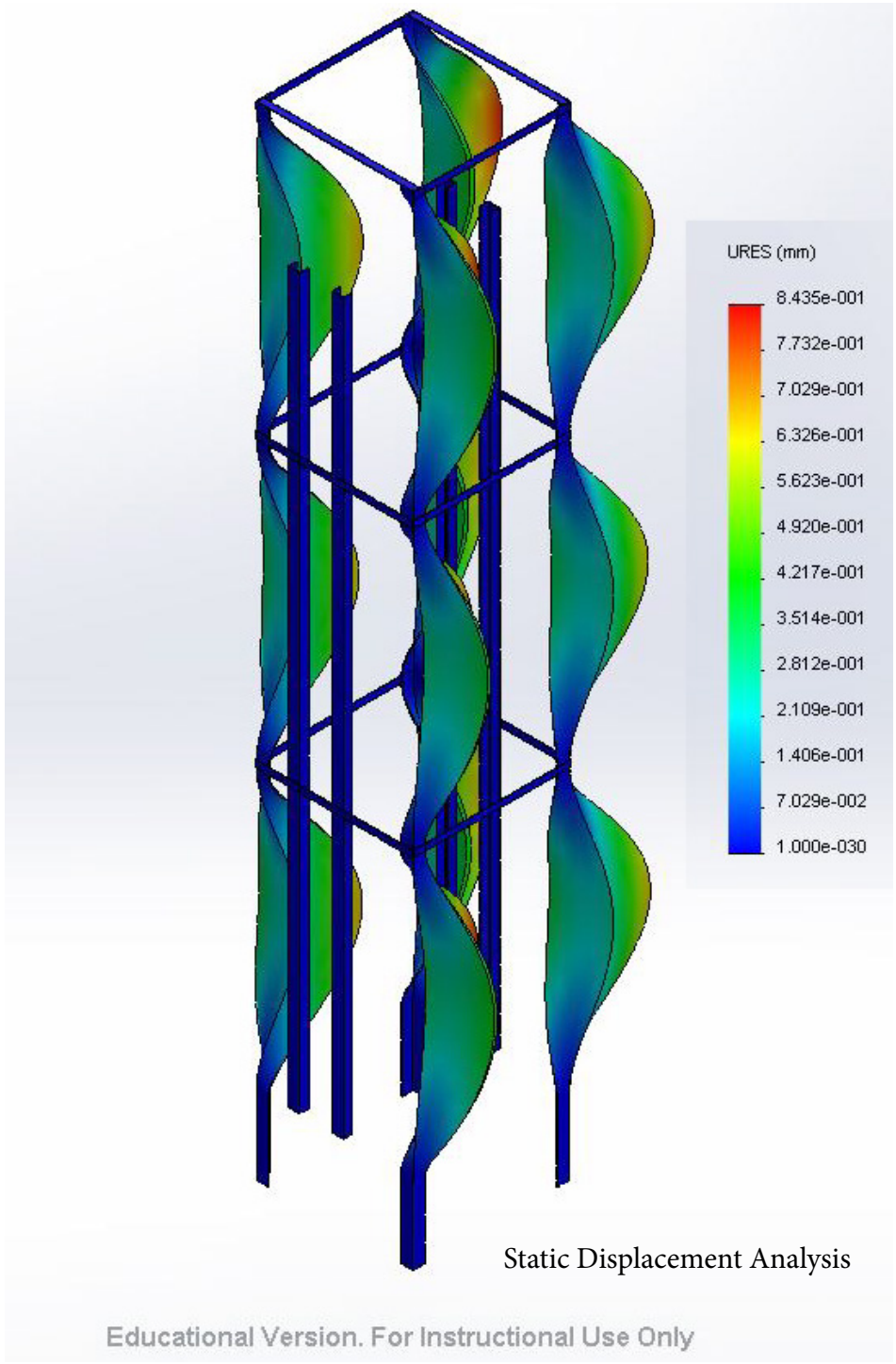


von Misses Stress Analysis

The load acting on the elevator shaft are calculated on the factors such as acceleration of car, friction during braking operation, vibration and torque to overheard motor, relative motion of counterweight and gravity.
For the sake of simplicity, maximum force resulting from all the factor has been applied. The minimum factor of safety was found to be 3.55



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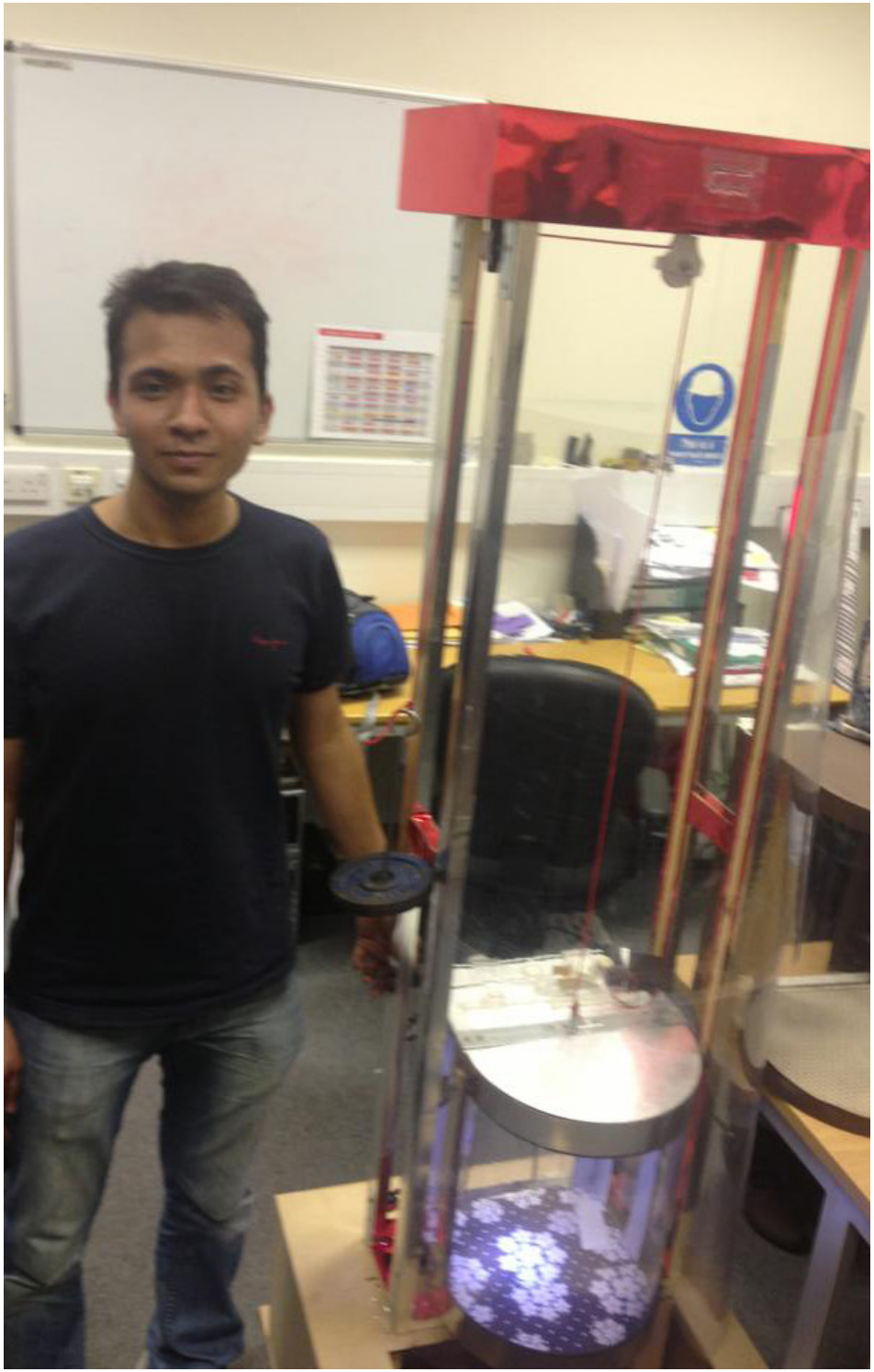

Final Prototype

The prototype development was done in two phases. The prototype was developed in ratio of 1:5. The first prototype and the second prototype had different materials used. The advantage of doing that was to get better result and closeness to the proposed design in the prototype. Also to ensure the problems that will be faced during manufacturing and to see how the proposed system reacts to actualisation of the scenario.

The final prototype included sheet metal work and the glass work in this prototype was done using acrylic which replicates the glass fibres. The complete car was bolted and adhesive were used at required positions. The weight was an important factor during this prototyping as lesser the weight lesser would be the torque required to move the car within the shaft and hence low torque motor can be used which brings down the complete prototype under allowed budget. The final weight of the car in this was found close to 5 kg. the honey comb is not visible in this because of sheet metal work which replicates the actual manufacturing environment. The final prototype is a working model unlike the first prototype.

There are certain changes in the prototype with respect to the actual proposed design. These changes were considered to ease the manufacturing process and to facilitate the manufacturing of prototype in the allocated budget. Among these changes was the construction of only two floors for representation, the use of 1:1 roping system unlike the proposed idea of 2:1 system. Other changes that can be observed was instead of actual belt rope were used to counter the non-availability of belt system in market.

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