Bangladesh University of Engineering and Technology

Department of Biomedical Engineering

BME 202: Biomechanics Sessional

Lab 01: STATIC HELMET ROLL OFF TESTING DEVICE

Objective: To comprehend how the helmet roll off testing apparatus works and how it contributes to the assessment of helmet safety.

Theory: Helmets are a crucial part of personal protective equipment because they shield the head from harm during collisions. Yet, if a helmet is removed during a collision, the user is not protected. The purpose of the helmet roll off testing apparatus is to measure a helmet's resistance to rolling off a surface during an impact.

The helmet roll off testing equipment drops a weighted headform onto the helmet to imitate a real-world collision. To simulate the weight and shape of a head, a headform that resembles a human head is employed. It is fastened on a platform that is mobile and may turn in any direction. With a chin strap or equivalent device, the helmet is fastened to the headform.

The helmet must resist sliding off the headform and stay firmly fastened to it during the collision. The apparatus gauges the platform's rotational speed and keeps track of the impact's maximum force. During the test, the helmet is said to have failed if it rolls off the headform.

The helmet roll off testing apparatus measures how well the helmet can withstand rolling off from various angles and orientations. As a result, the test is run several times with various impact angles and placements.

To ascertain if the helmet satisfies the safety requirements established by oversight bodies, the testing data are examined. The helmet is regarded safe for use if it complies with the requirements; otherwise, it may need to be altered or modified to increase safety.

The helmet roll off testing equipment is an essential tool for assessing helmet safety and making sure the wearer is adequately protected. It examines the helmet's capacity to stay firmly fastened to the headform and avoid rolling off the surface while simulating a real-world collision. The tool ensures that helmets offer wearers appropriate protection by being a crucial part of the helmet safety testing process.

Required Materials:

Helmet, Device, Measuring Tape, Weight Plates.

Instrumental setup:

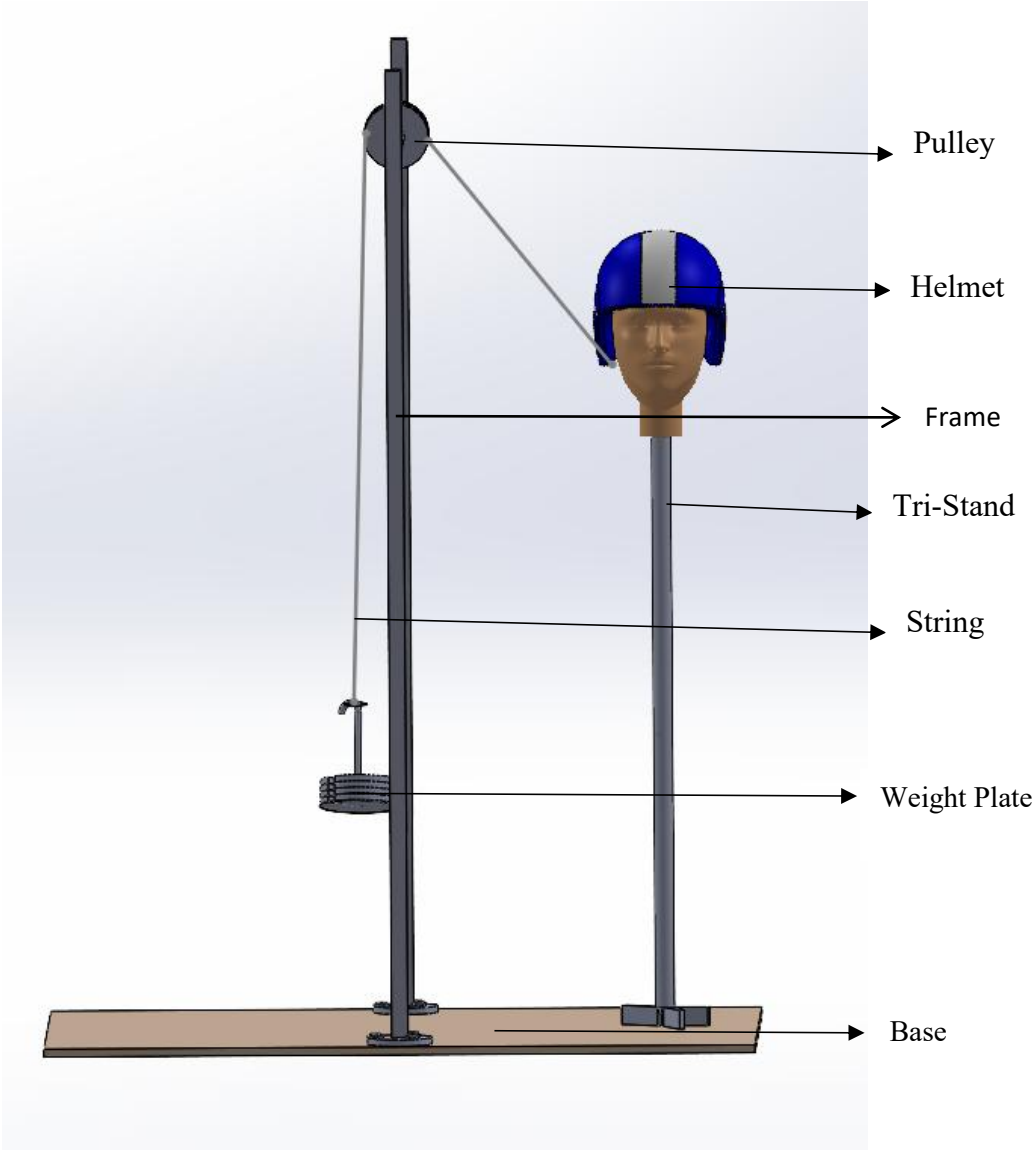

Fig-1: Static Helmet Roll Off Testing Device

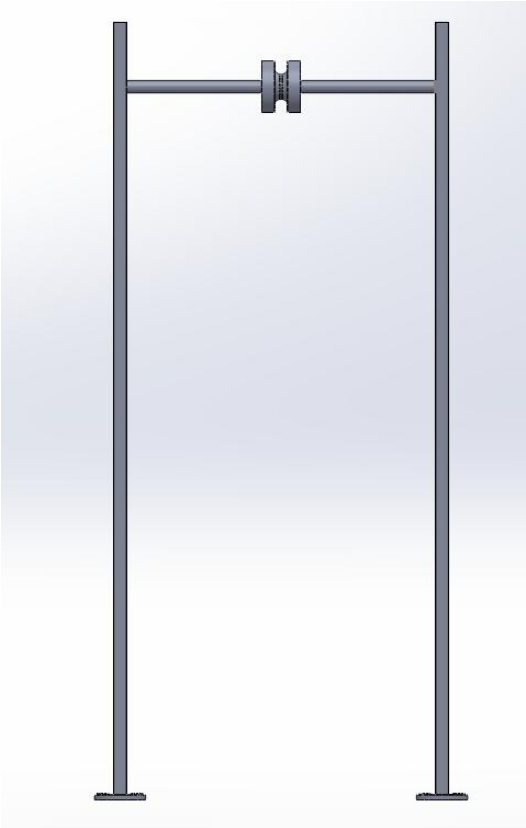

Fig-2: Stand with Pulley

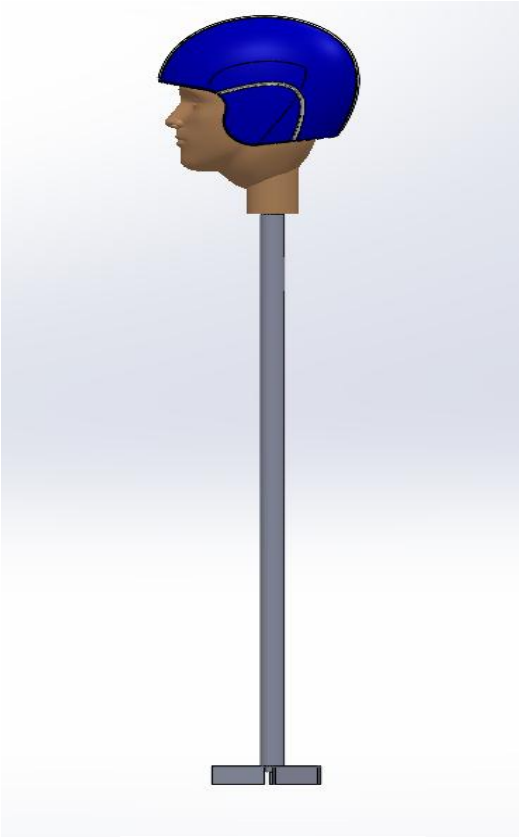

Fig-3: Helmet Stand

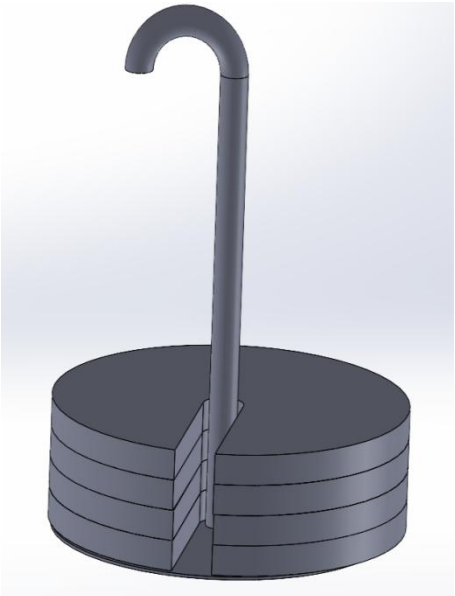

Fig-4: Weight Plate

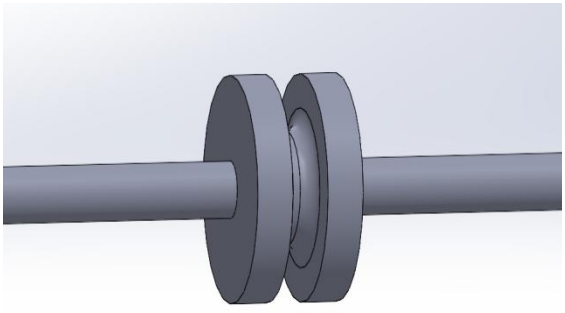

Fig-5: Pulley

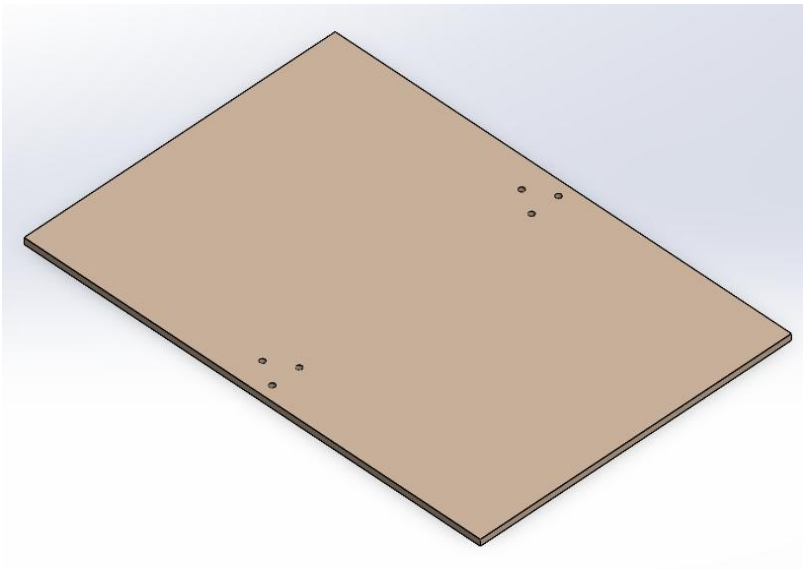

Fig-6: Base

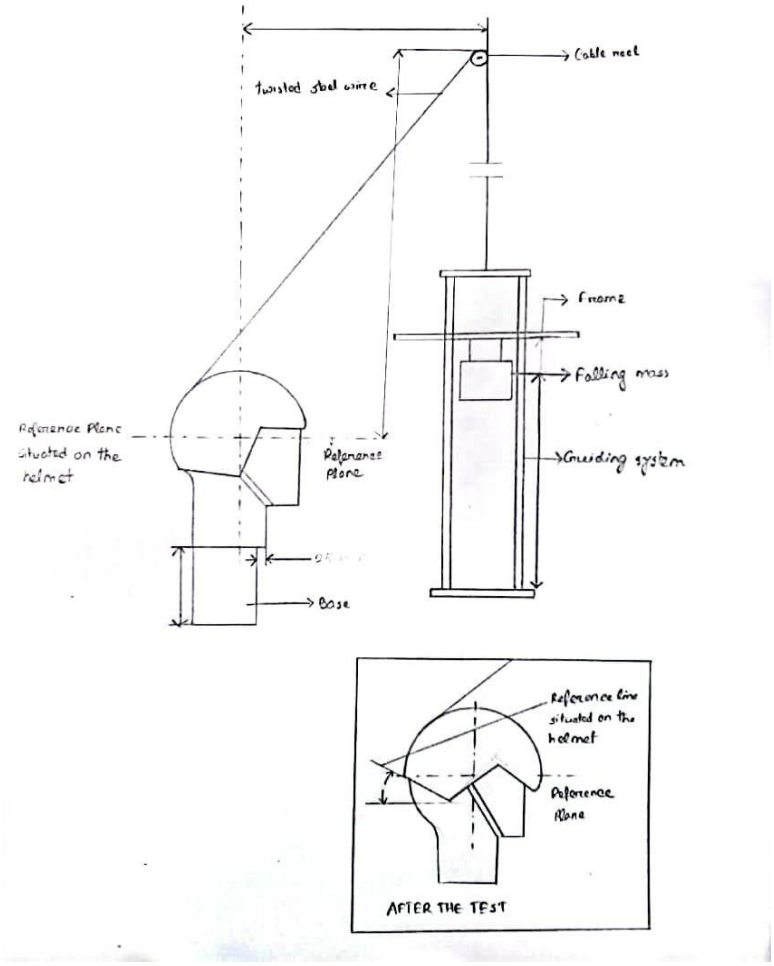

Fig-07: Simplified View of the Setup

Procedure:

1. Appropriately attach the rope to the pulley.
2. The rope has a hook attached to one end.
   At the opposite end of the rope, secure the weight plate holder.
3. Put the mannequin in a certain position. Place the helmet on the mannequin's head and secure the strap.
4. At this point, attach the hook at the helmet's front side.
5. Measure the vertical and horizontal distance with a T-scale or a measuring tape.
6. Start placing weight plates one by one and observe carefully
7. After inserting each weight plate, you must visually determine the percentage of exposed area.
8. Repeat the procedure 1-7 now using other sides (back and lateral side) and make two more data table.

Data Collection:

Weight of the helmet=_____ kg

No of obs.	Suspending Mass, m (kg)	Force, F=mg (N)	Horizontal Distance, x (unit)	Vertical Distance, l (unit)	Angle, $\theta = \tan^{-1}\frac{l}{x}$
1					
2					
3					
4					
5					
6					
7					
8					
9					

Data Table No-01

Result Analysis:

1. What is roll of testing device and why do we use it?
2. What are the different types of roll off testing devices available in the market?
3. What are the standards that define roll off testing requirements for helmets?
4. What are the changes in applied force as the angle increases and decreases? Explain.
5. Is the force of different parts of the helmet different? If so, explain why?
6. Compare the force value of different types of helmets and explain whether the force values will be same for all helmet?
7. How much exposure of the occipital side is harmful to a person? And what amount of force does that amount of exposure?
8. How does a roll off testing device simulate the impact of a helmet hitting a surface?
9. How can a roll off testing device help helmet manufacturers improve the safety and design of their products?
10. How often should a helmet be tested using a roll off testing device?
11. How is the data collected from a roll off testing device used to evaluate a helmet's performance?
12. How does the cost of a roll off testing device compare to the potential benefits of using it to improve helmet safety?
13. What are the potential risks associated with not conducting roll off testing for helmets?
14. What are the common types of failures that a roll off testing device can detect in helmets?