# DESIGN AND DEVELOPMENT OF COLLAPSIBLE PUBLIC TRANSPORT RAMP

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## INTRODUCTION

In this project, an attempt is made by considering the distance between the door of the bogie and the railway platform and by considering the height of the bogie from the platform.

Getting in/out of the Buses and Railway bogies is difficult for aged people and kids, there is a gap and height differences between entry footboards and the ground or platform. Few cases of falling in gap and getting injury were happened if we see the few case studies. As the buses have huge gap from ground it is difficult for aged and kids without any assistance. Even there are many accidents recorded due to height differences. Figure 1.1 shows an accident caused due to the platform gap.

Figure 1 Shows an accident caused due to the platform gap

**Research Survey:**

The ideal platform would be straight and align perfectly with a train or other large vehicle. Even in this case, a small gap between the conveyances and the platform is necessary to allow the vehicles to move freely without rubbing against the platform edge. In 2007, the Long Island Rail Road regarded an 8-inch (20 cm) platform gap as typical on its non-curved platforms.

From survey the dimensions of gap between world's longest platform in Hubli and the train door foot board. Figure 2 shows the schematic sketch of the railway bogie and flat form.

1. Platform 1:
   - Height difference 21 inches
   - Gap 13 inches

2. Platform 2:
   - Height difference 30 inches
   - Gap 15 inches

3. Platform 3:
   - Height difference 27 inches
   - Gap 12 inches

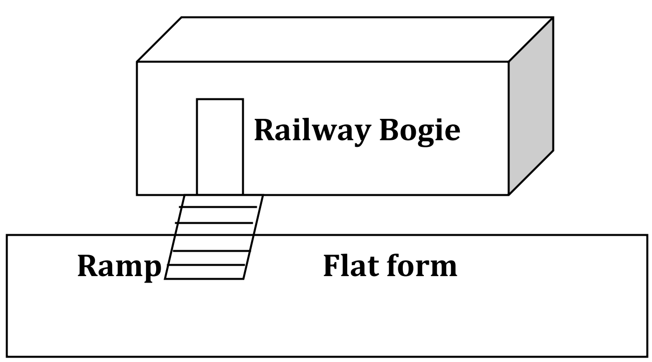



Fig. 2. Schematic image of the Bogie and flat form

**PROBLEM DEFINITION**

To develop a collapsible public transport ramp used for old aged people, kids and disabled people to get into the buses and trains with lesser effort as more effort is needed by them to get into the trains as shown in the figure.1.10. There are many accidents caused because of the gap between platform and the train footboard due to lack of attention or urgency or any other reason. The collapsible ramp provides needful solutions.


Fig 3 Real time images of the problems faced by the general public.

### Proposed solution

Few specified bogies or all bogies as per requirement and buses may be provided for aged people and kids with collapsible ramp facility. In this project an attempt is made by considering the distance between the door of bogie/bus and the railway platform/ground and by considering height differences. This ramp is attached to the door footboard and opened/closed with help of hydraulic system.

### Objectives

- The primary objective of a collapsible ramp is to provide a means of accessibility for individuals with mobility challenges.

- It allows people using wheelchairs, walkers, or other mobility aids to navigate obstacles such as steps, curbs, or uneven surfaces more easily.
- Another objective of collapsible ramps is to ensure they are sturdy, durable, and safe for users. Ramps should be constructed from high-quality materials that can support the weight of users and withstand regular use without compromising their structural integrity.
- Collapsible ramps are designed to be easily foldable or disassembled for convenient transportation and storage.
- The objective of cost-effectiveness involves providing an affordable solution for individuals and organizations requiring accessibility ramps.

**COMPONENTS OF COLLAPSIBLE RAMP**

1. Mild steel square hollow tube
2. Permanent magnet DC motor
3. Lead acid battery
4. M6 Fastners
5. Toggle switch:
6. Capacitor:
7. Controller:

**METHODOLOGY**

The methodology of a collapsible ramp involves designing and constructing a ramp that can be easily folded or collapsed for convenient storage and transportation. Here is a step-by-step outline of the methodology:

**Material selection**

For an intelligent and resourceful design, the designer must clearly know the material which are available and the properties they possess. Selection of material depends on many features such as the intensity and type of stress to which the components are subjected to, whether it is flexible or rigid or it is to experience high temperature or corrosive action and how it leads itself to processes of manufacture, i.e. forging, machine

1. Strength
2. Weight
3. Appearance
4. Manufacture
5. Cost of production

These will also determine the variation between success and failure of the machine. We can further classify the above factor into four main classes

a. Service Requirements
b. Construction Requirement
c. Economic Requirement
d. Maintenance Requirement

Service Requirements Before a material is chosen for construction, it must possess some distinct properties which it exhibits when put to play. These properties are generally referred to as the service requirement. Some these properties which should be appreciable while the material is in service are:

a. Strength
b. Toughness
c. Hardness
d. Stiffness
e. Resistance of corrosion

f. Conductivity and heat resistance.

Fabrication Requirement

For fabrication process, a material must possess some distinct properties, these are mainly forge-ability, malleability, ductility and weldability. Materials undergoing forgeability are heated to a temperature close to its melting point then shaped to desired structure. For malleability, it's required that the material should be made into a sheet like form while ductility requires the material to be drawn into a wire form. Finally, weldability which is the ability for the material to be welded. Therefore, the materials must be able to be joined by the process of welding.

Economic Requirement

This is about the most important factor for the material selection because it determines the total cost of production which in turn affects the price of the product or retail cost and consumer choice. It the total cost of production is high, variably the price of the finished product will also be high. When the price of a product is high, consumers will seek for alternative cheap but similar goods. Bearing in mind that the two aims of production is satisfying consumer wants and needs and also to make maximum profit. This will reduce the overhead cost of production therefor making it cheap in respect to other similar materials. Then we can comfortably harmonize the cost of production with the real price. One of the major considerations in engineering design is to design machines that are reliable, cost effective and the ability of the machine solving human problem

**CAD Model**

The component of this Ramp is designed by using Solid works Software. Fig 4 shows the assembled model of collapsible ramp. The design prioritizes an average angle of inclination (as the platforms are not uniform), showcasing simple mechanism of link and slotted for easing retraction and collapse.

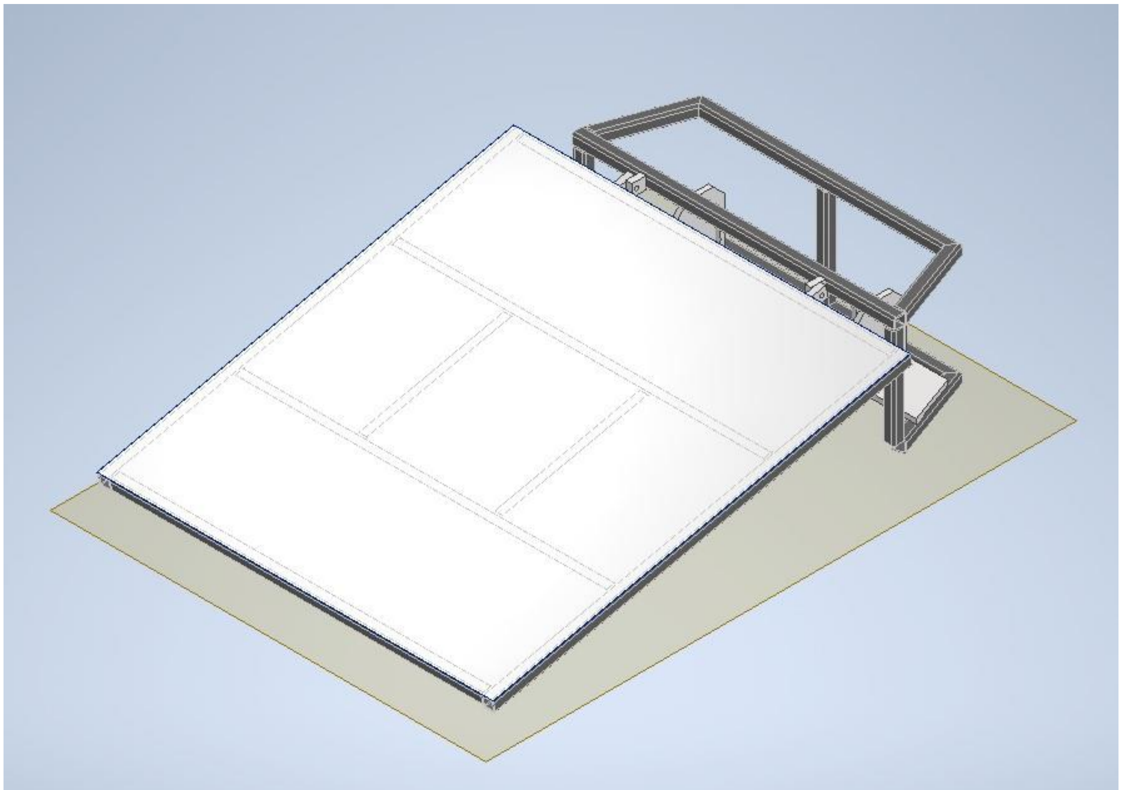


Fig.4: Assembled model of the Ramp

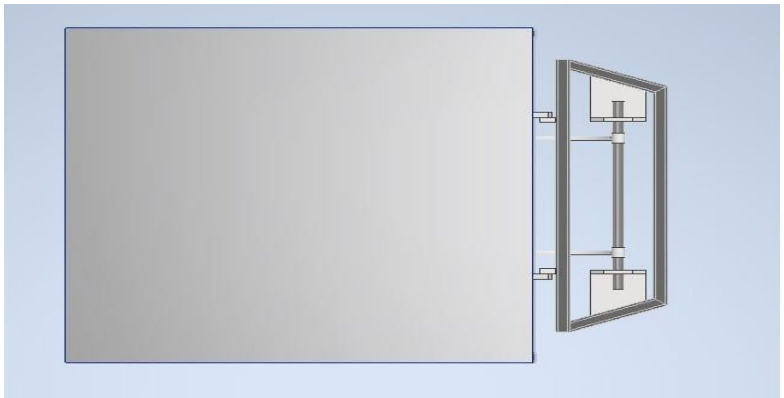


Fig 5: Top view of CAD Model

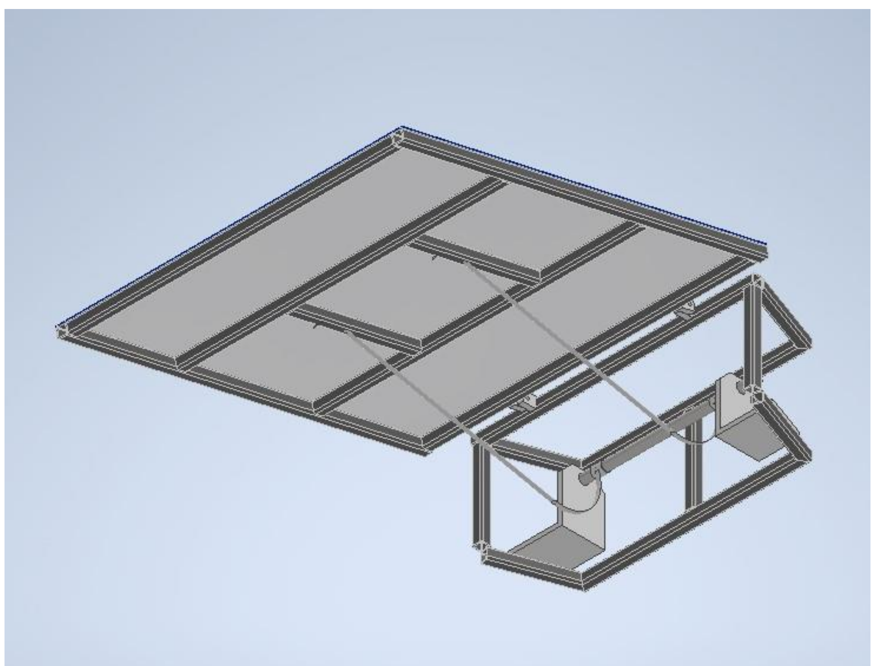


Fig 6: Bottom isometric view

**2 D Model**

The below 2D model (shown in fig 4.4) has the top, front and side view of the ramp with appropriate dimensions of the ramp and the trapezium stand.

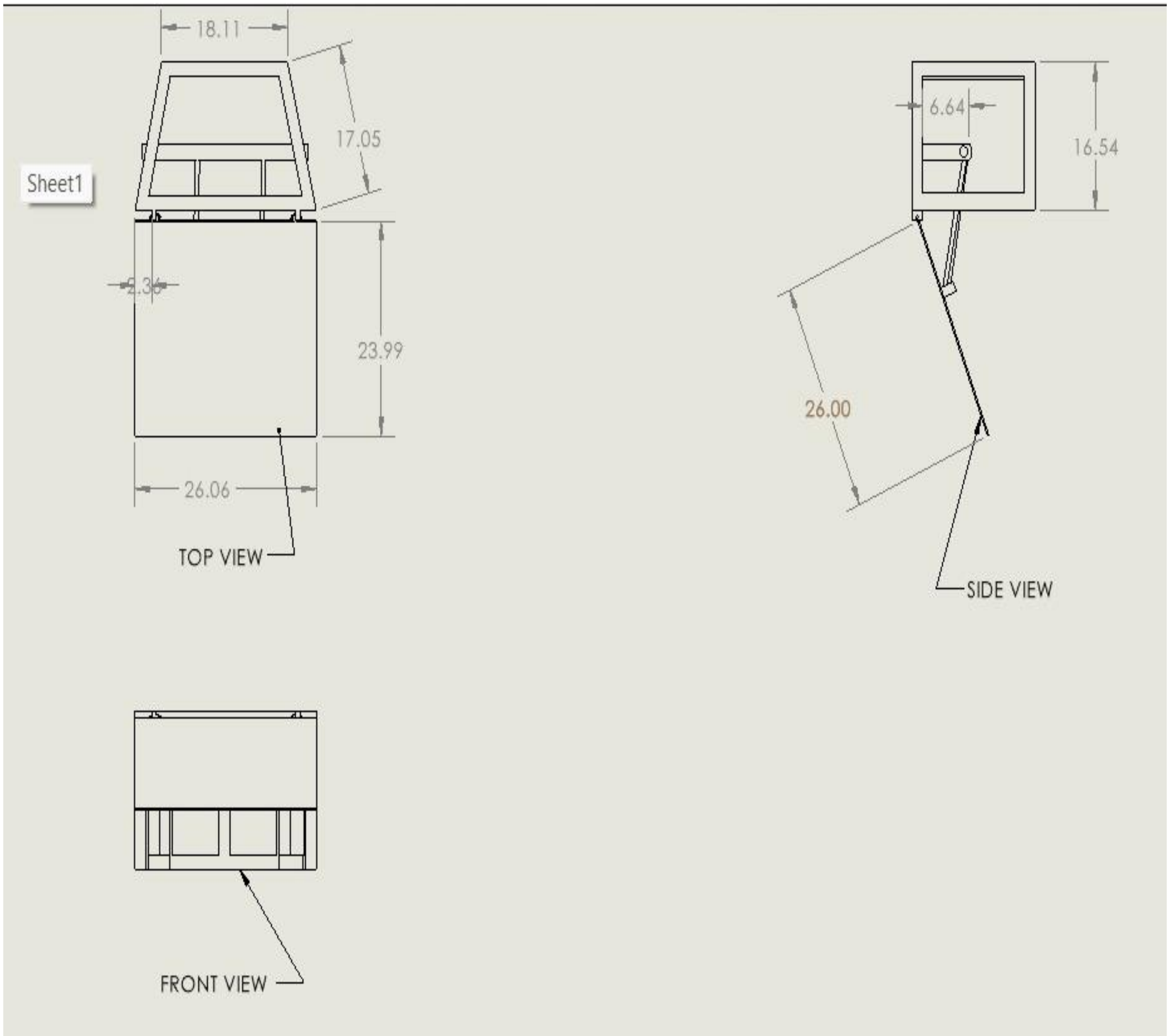


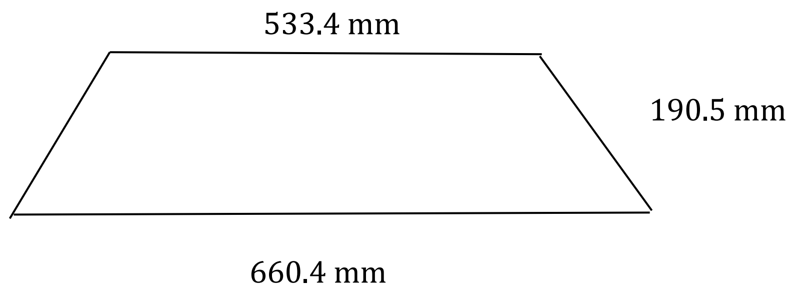

Fig. 7: 2D Model of the ramp.

**Dimensions**

Rectangular hollow tube: Breadth= 25.4 mm

Depth= 25.4 mm

Trapezium stand: Height: 203.2 mm




Aluminum checkered sheets: Thickness: 2 mm

Width: 762 mm

Length: 863.6 mm

Common shaft for both the motors: Length: 342.9 mm

S-curve rods (2 nos): 10*10 mm

Length: 508mm

**Display of our project**

A Below figure 8 shows the collapsible railway ramp. It is a complete product for usage. This is the product to be fitted at the footboard of the door of the train coach.

Fig 8: Collapsible railway ramp.

## RESULTS

### Calculation of collapsible ramp

4.7.1 To pull the ramp or close it when not in use.

**1.**The weight of ramp(W) = m*g.

(W) = 15*9.81=147.15N.

m – Mass of ramp.

**2.** Force needed to pull the ramp from fully open position.

(F)=1.25*W.

=1.25*(147.15) =183.93N.

(1.25)- Considering 25% greater force required to pull the ramp.

**3.** As we are using two motors to drive, the wheel load on each motor wheel

System (N) = W/2.

(N) = 147.15/2 = 73.57N.

**5.** Co efficient of friction (μ) = 0.6.

(0.6)- (maximum coefficient of friction for cast iron at given weight)

**6.** Frictional force = 0.6*N

= 0.6*73.57 = 44.145N.

**Progress of the project:**

As shown in Fig 9, measuring of the train coach door and study of ramp placement at the foot board of the coach door is an essential step. As we get the proper measurements of the door, we can the proceed in the designing of the ramp based on the measurements.

Fig 9: Railway carriage workshop

As shown Fig 10 We have visited to Railway carriage work shop with our Project Guide S. C. SAJJAN for showing the progress of the project with Workshop Training Institute Prof PRAMOD KALLUR for taking the measurement of coach door. By taking the all safety precautions given by the INDIAN RAILWAYS, Hubbali Division.


Fig 10: Group photo with project guide & WTI professor

As Fig 11 After taking measurement of the coach, the collapsible ramp which is designed is attached to the coach. And tested the working condition of the collapsible ramp with attached motor, battery and controller.

Fig no 11: Ramp frame attached to the footboard of the door.

**CONCLUSION**

Collapsible ramps offer several advantages, such as to access wheel chair, durability. Collapsible ramps are typically made from sturdy materials and can withstand regular outdoor element.

However, there are also some disadvantages to consider. Collapsible ramps may have weight capacity limitations compared to permanently installed ramps, and their narrower width may not be suitable for certain mobility devices or equipment's

Ultimately the decision to use a collapsible ramp depends on individual needs and circumstances. Careful consideration of the advantages and disadvantages will help determine if a collapsible ramp is the right choice for providing accessibility and convenience in a particular situation.

## FUTURE SCOPE

- Automated and Integrated Systems: Railway ramps could incorporate automated mechanisms that deploy and retract the ramp as the train arrives and departs. Integrated sensors and communication systems would enable seamless interaction between the platform, train, and ramp, ensuring precise alignment and minimizing human error.

- Smart Ramp Technology: Future ramps could incorporate smart technologies to enhance usability and safety. These ramps might include features such as built-in sensors to detect obstructions or uneven surfaces, automated leveling mechanisms to adapt to varying train heights, and integrated lighting for enhanced visibility during low-light conditions.

- Lightweight and Durable Materials: Advancements in materials science could lead to the development of lighter yet durable ramp materials. This would make the ramps easier to handle and deploy while maintaining robustness and reliability. Materials like carbon fiber composites or advanced polymers could offer strength, corrosion resistance, and longevity.

- Foldable and Compact Design: Future ramps may feature improved folding mechanisms that allow for more compact storage and transportation. This would make it easier to integrate ramps into existing train infrastructure without requiring extensive modifications. Compact designs would also enable the use of ramps in a wider range of platforms, including those with limited space.

- Integration with Train Designs: As trains evolve, ramp systems could be integrated directly into the train's design. This could involve incorporating retractable ramps or bridge-like structures that extend from the train's footboard, eliminating the need for separate portable ramps all together.