

Styling of Front and Rear ends of a City Bus

-Guide

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-Submitted by

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Certification

This dissertation entitled **Styling of Front and Rear ends of a City Bus** by **Harsh Vardhan Tripathi** is approved as Summer Internship Training (Project 1) for the degree M.Des (Mobility & Vehicle Design).

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I declare that this written submission represents my ideas in my own words and where other's ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Design Brief

To style the front and rear ends of a low floor city bus. The bus is an aluminium concept bus under the “Litebus” project for an indigenous aluminium bus. The basic frame and body are to be made out of aluminium solely, and the front and the rear ends are to be attached onto it. These are to be made of fiberglass, and painted differently than the metallic body, to emphasize the use of aluminium. The frame is to be made of trusses which make the frame stronger and lighter. These trusses are to be left exposed, and so are a part of the aesthetics of the bus itself. Hence, the front and rear ends must complement the form of the frame. The ends should also not be too similar to the frame, so as to merge into the form and distract from the frame itself.

The basic frame ideations were already done. So, the different frames need to be modelled in 3D software, before the styling of the front and rear ends. These frames then also need to be paired with different panels and glass elements to ideate on the shape of the greenhouse area. All this will go in as input to the design of the front and the rear ends.

Litebus Project

Introduction

The Litebus project is aimed at creating a lightweight indigenous bus made out of aluminium. A lightweight bus made of Aluminium has many advantages, as outlined below:

“The advantages of using aluminium in the bus industry are manifold. Aluminium can be extruded into complex shapes, allowing for intricate design and integrally strong structures. Modern buses with aluminium bodies are several hundred kilograms lighter than those built using conventional methods of construction. This increases the number of people that can be transported for a given maximum permitted weight and reduces running costs...” (world-aluminium.org, 2013)

The body is to be made of an aluminium Spaceframe attached to sub-frames made of steel at the front and rear which carry powertrain and other subassemblies like powertrain, etc. The aluminium Spaceframe needs to be as light as possible for there to be a meaningful overall weight reduction. One way to do this is to have the frame to be stronger so that it needs less material.

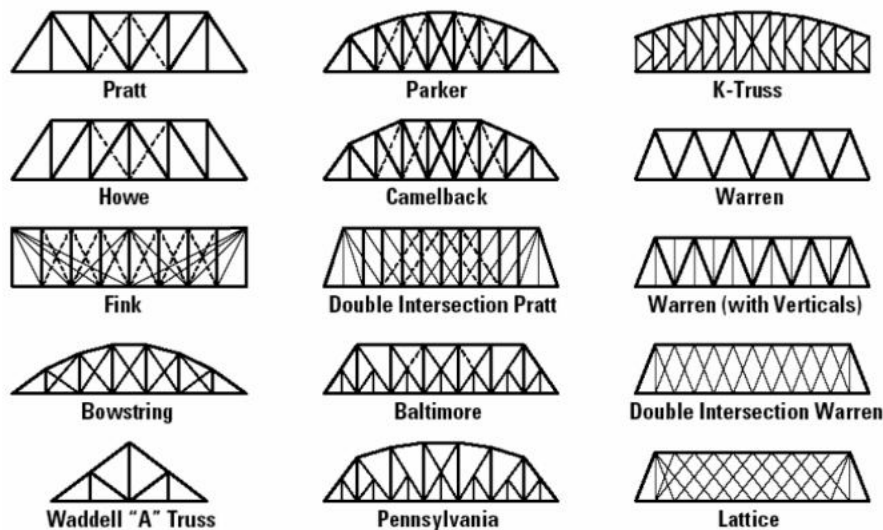


Aluminium

Frame Design

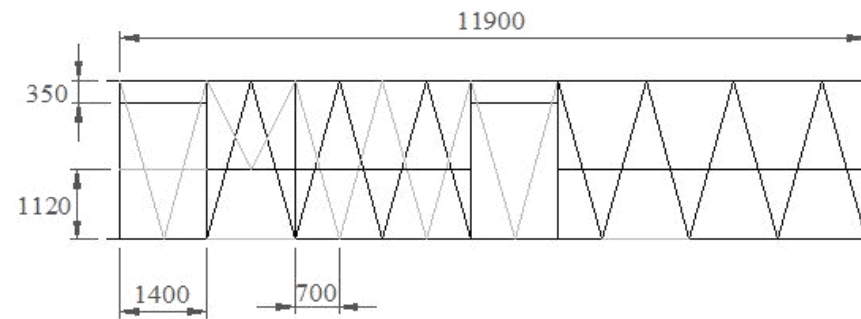
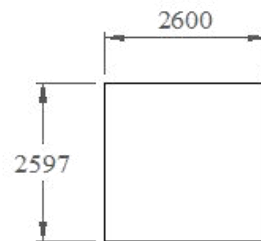
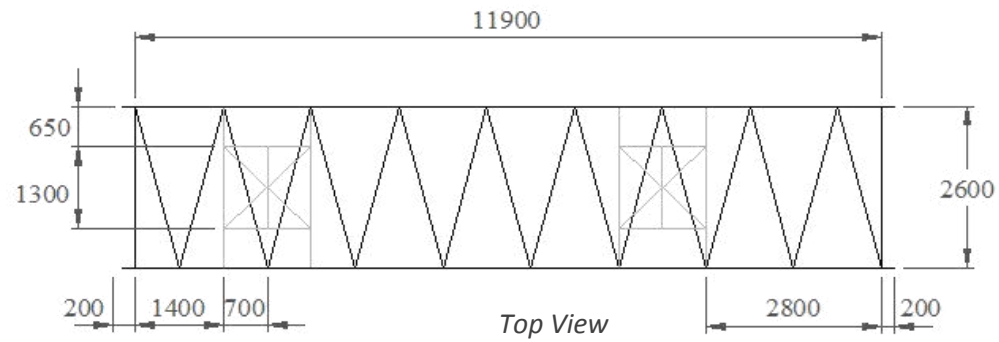
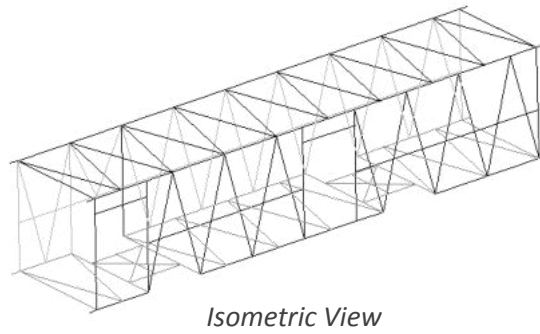
This higher strength can be achieved by using trusses, creating a network of criss-crossing members. These members are then covered by aluminium panels, glass, or left exposed, achieving a different aesthetic than conventional buses. Also, leaving this part in its aluminium finish gives emphasis to the usage of aluminium in the frame. As this makes the frame a focal point of the aesthetics of the bus, its form is to be considered. Inspiration was taken from architectural structures like bridges and support frames. (2013)

Frame ideations were already done and their shape was fine tuned to degree by Finite Element Analysis. The frames were then to be modelled in 3D software, and then covered in body panels and glass elements to ideate the shape of the greenhouse of the body. Dummy front and rear ends were used at this point to indicate the aesthetics being aimed at.



Space frame example

(Spaceframe D)



Concept 1/Frame B.3



Concept 2/Frame C



Concept 3.1/Frame D



Concept 3.2/Frame D



Concept 4/Frame E



Concept 5/Frame F



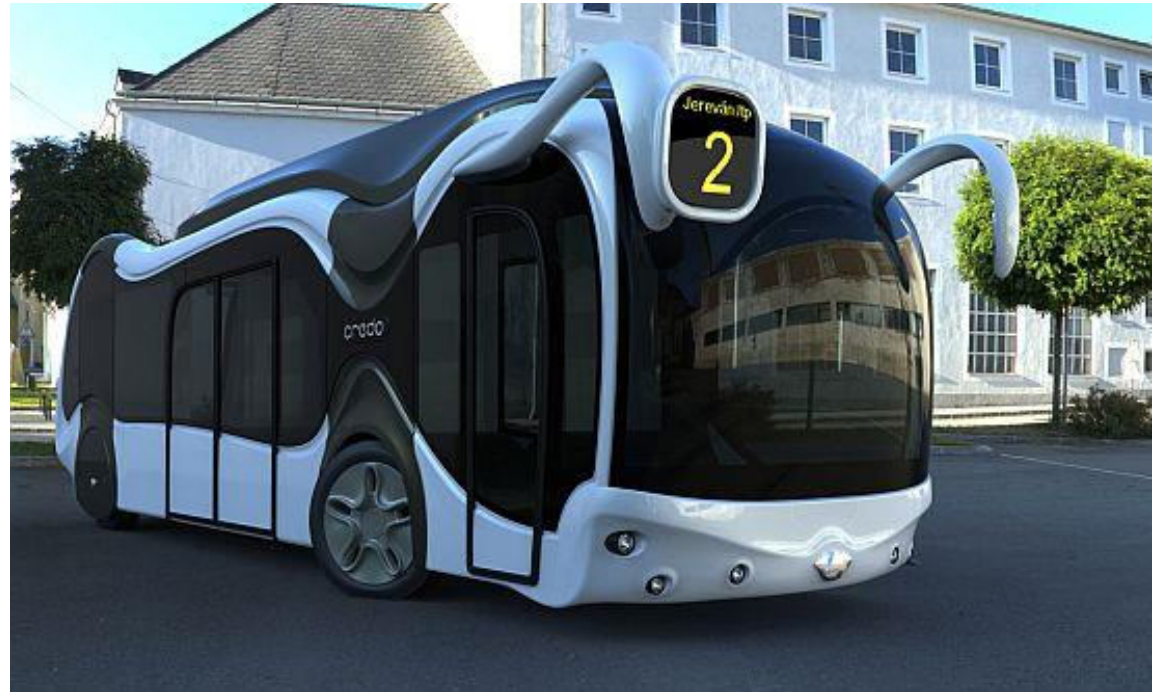
Styling of the ends

Once the body styles were made, the front and rear ends were to be styled. The benchmarks were the current and future buses from around the world. Certain design trends were found by studying the benchmark buses, like:

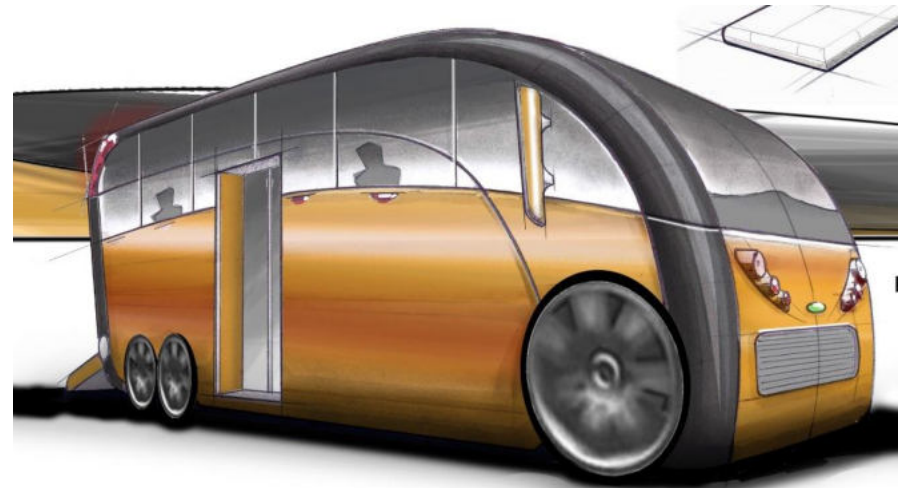
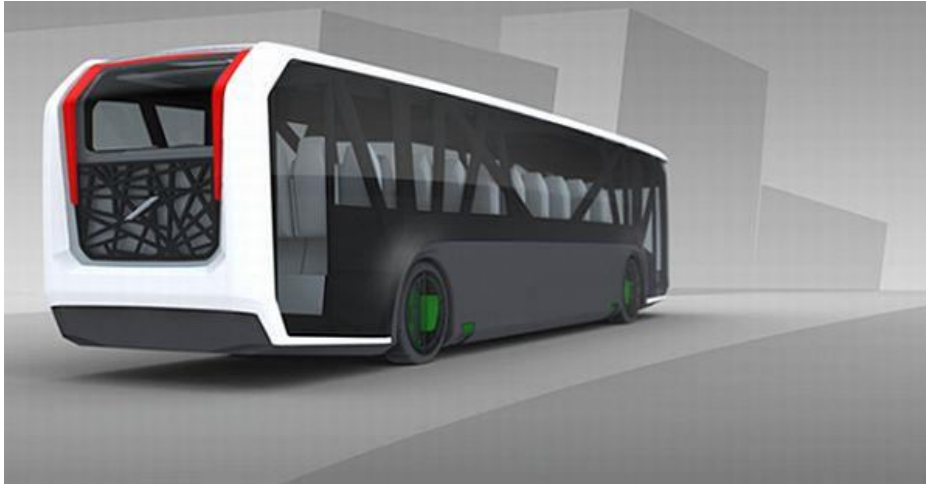
1. Large and continuous Greenhouse areas (2013)



2. Low height of the windshield bottom line (2013)

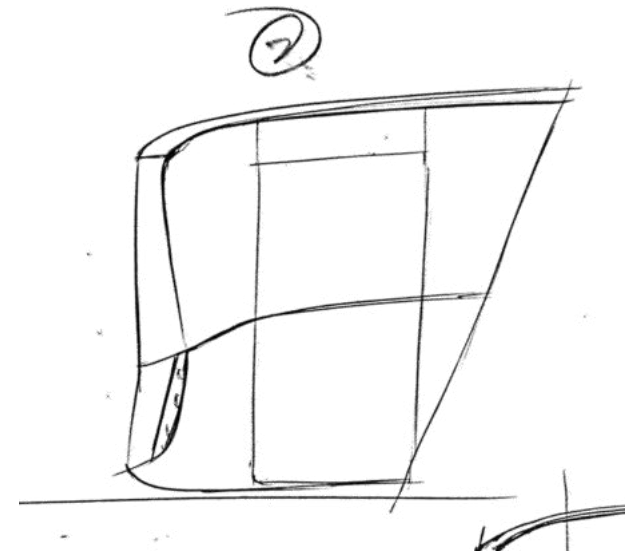


3. Continuous line from top of body along the windshield (2013)



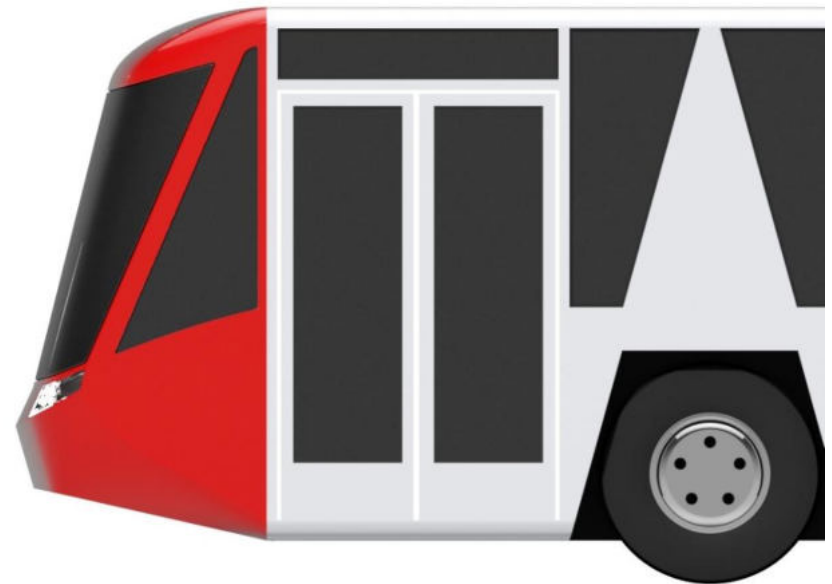
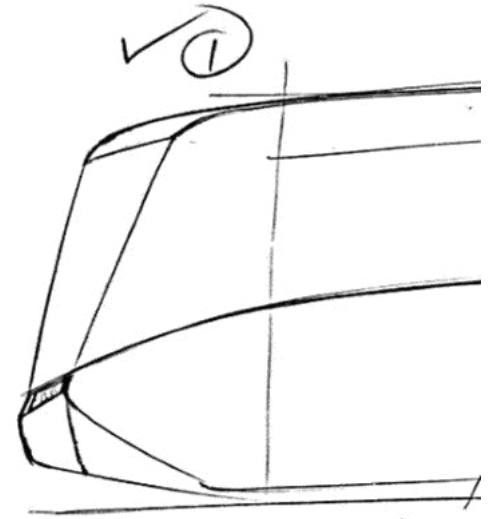
Early Concept 1

The windscreen is curved inwards to give the driver a better view of the road ahead. This helps in city driving.



Early Concept 2

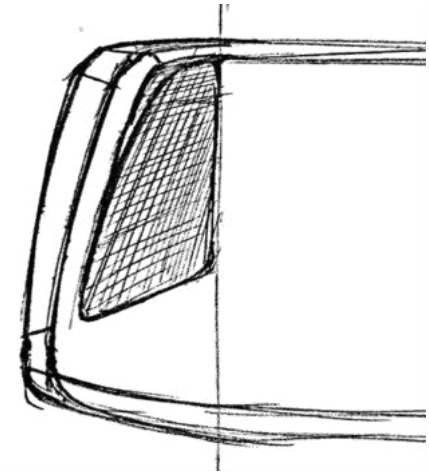
Inspired by trains and metro rails, with slab sides and a beaky front.



Early Concept 3

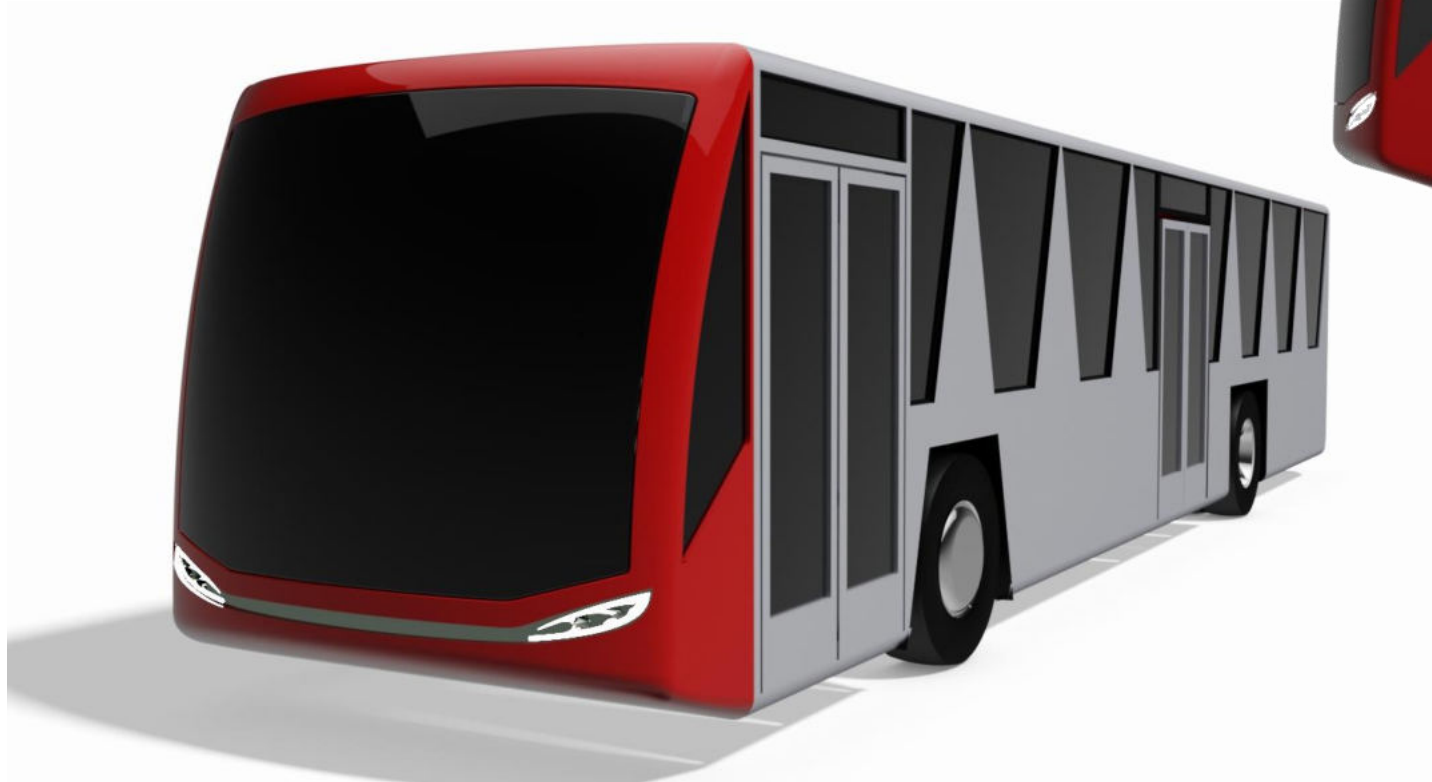
Much more conventional form, with continuous line flowing from the top edge of the body downwards, along the side of the windscreen.

First iteration had the front cabin too long, with space wasted in the dashboard. Hence a newer alternative was derived with shorter front overhang. In this case, the FRP part merges with the body at the door centre line, and the front end was given the same finish as the body.



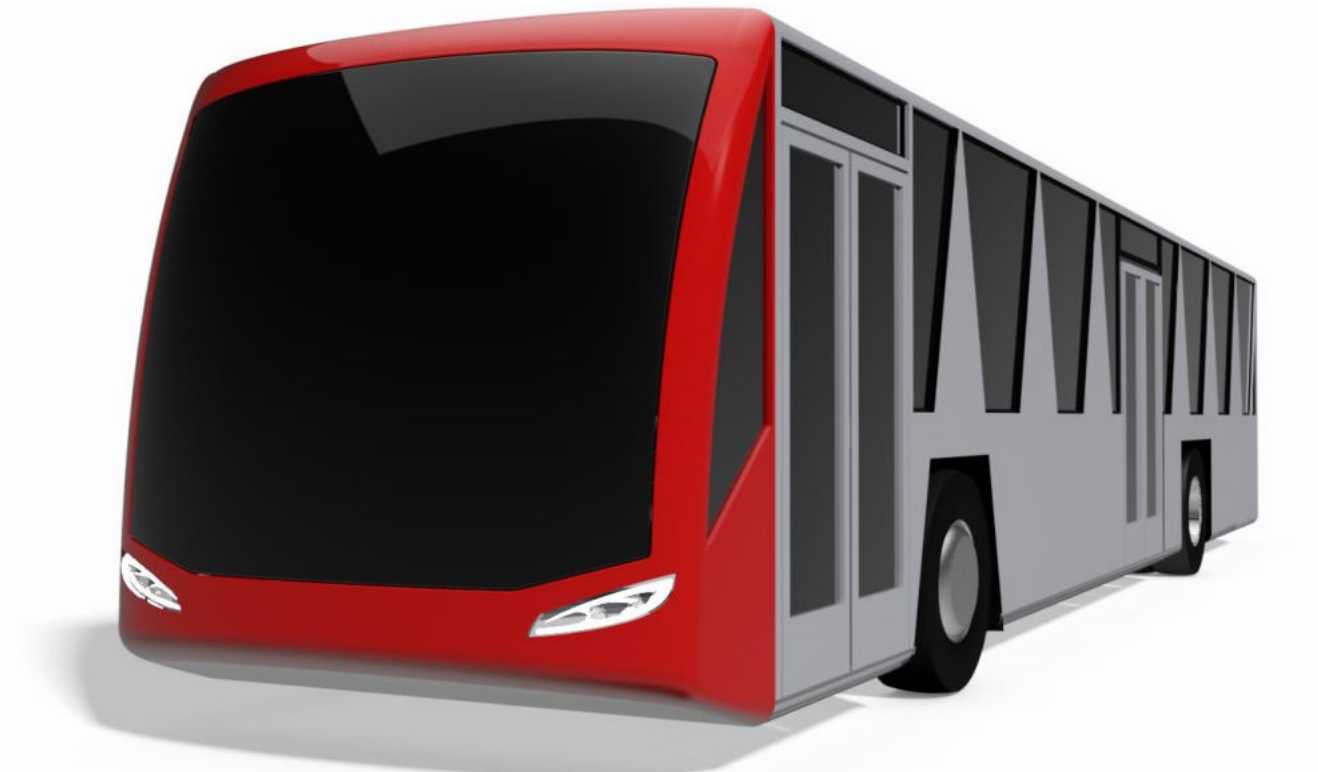
Variation 1

In this variation, the FRP part meets the body ahead of the door frame, giving a much sharper corner at the top. Also, the two front headlamps are joined together by a black plastic strip.



Variation 2

In this variation, the black strip is removed, and the headlamps are two discrete units



Variation 3

In this variation, the FRP part includes the door and meets the frame just behind the door frame.

The door frame itself is chamfered at the top edges to match the aesthetic of the body, and to allow for the leading top corner to be pushed further back, giving a softer corner.



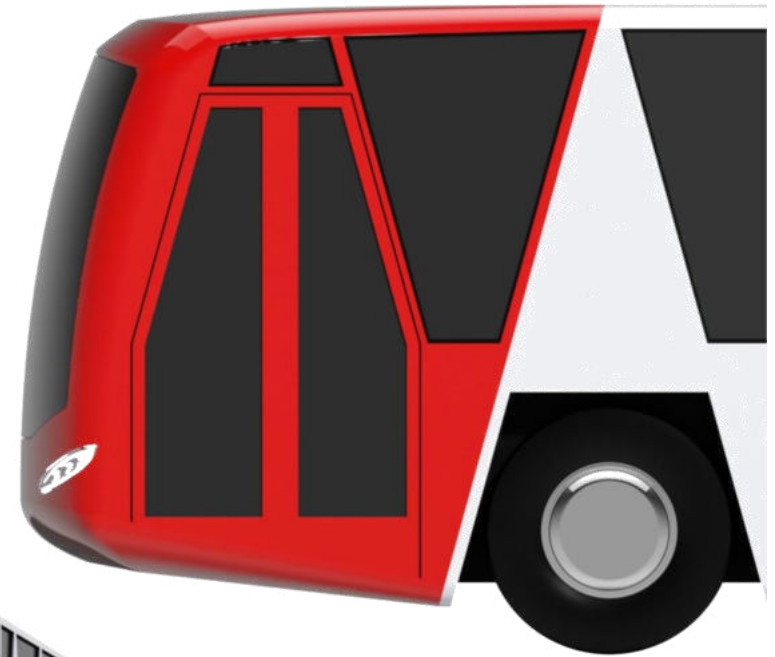
Variation 4

In this Variation, the chamfer length is decreased to visually balance the glass and FRP areas, as well as to allow for a wider opening of the door.



Variation 5

In this variation, the FRP part meets the body behind the door frame, but along an oblique member, thus, encompassing the entire front cab.



Rear Variation 1

The rear iteration is made to match the first variation of the front. The slits for the engine cooling system follow the same lines as the tail amp piece and windscreen bottom.



Rear Variation 2

Just like variation 2, this variation also loses the centre black and chrome strip to form two separate tail lamps. The tail amp detailing can be seen here.



Learnings from the project

The first major learning was the understanding of the aesthetic of buses, which is quite different from that of regular four wheelers. The dimensions and proportions of the vehicle play an important part in deciding the form. Also, the surfaces need to be smooth and simple. Due to the large size of the surfaces, they behave very differently if sculpted to a great degree.

Also, there was the learning that every design cannot be in the same language. And that public transport vehicles need to be visually neutral. They should be designed to be inoffensive to all so as to be welcoming, rather than be disruptive and flashy.

Then again, learning how the frame of a vehicle can be a focal point in its aesthetic. And how to use and exploit this fact to differentiate it from the rest of the buses in the market.

As the project involved a lot of software usage, there was a notable improvement in my Alias, Keyshot, and Showcase skills.

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