

P2

DRAFT REPORT

Shared Mobility


Design a safe last mile sharing vehicle for the rural India

Under the guidance of
Prof. Nishant Sharma

Abhishek Ayush

206390003

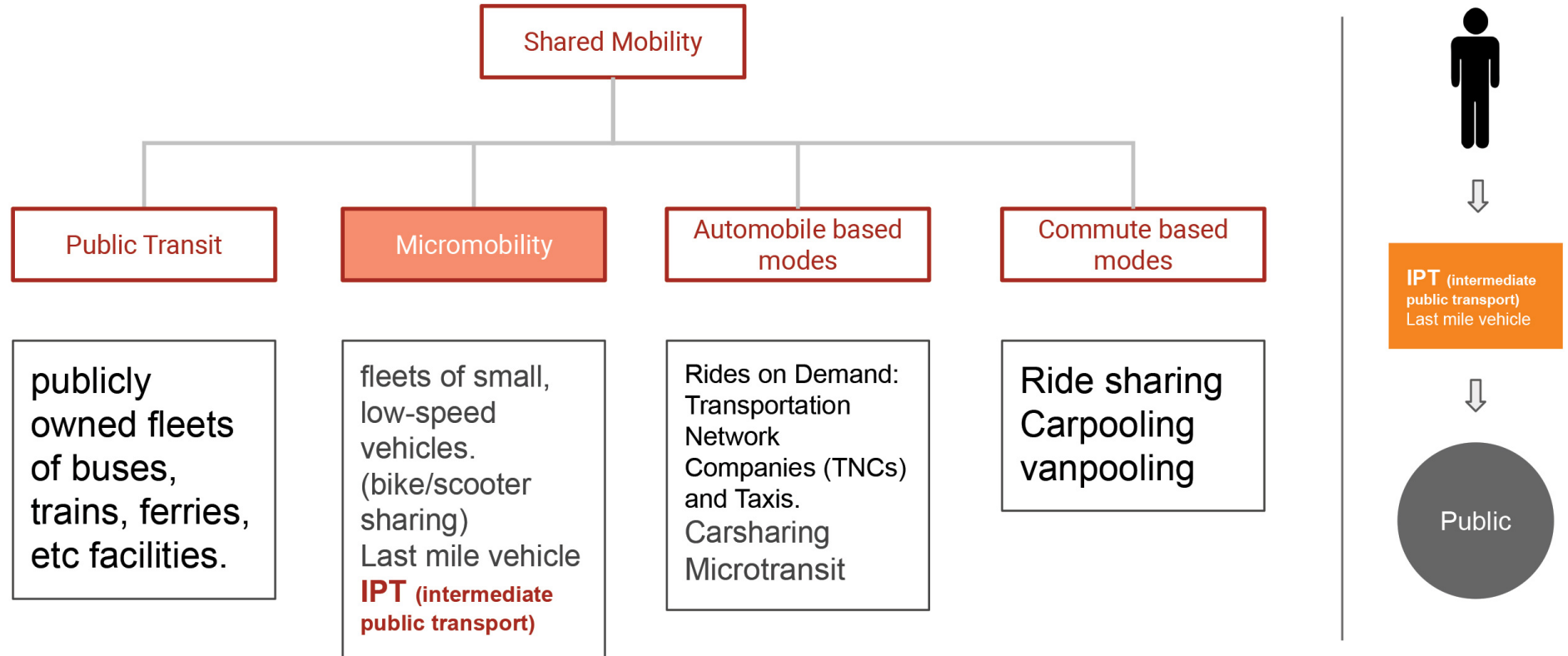
Mobility and Vehicle Design
IDC, IIT Bombay



Definition:

We broadly define shared mobility as transportation services and resources that are shared among users, either concurrently or one after another. This includes public transit; micromobility (bikesharing, scooter sharing); automobile-based modes (carsharing, rides on demand, and microtransit); and commute-based modes or ridesharing (carpooling and vanpooling).

<https://sharedusemobilitycenter.org/what-is-shared-mobility/>



MOTIVATION



SHARED MOBILITY

Mobility in urban india



SHARED MOBILITY

Mobility in rural india



The second most reported means of transport in India is Auto Rickshaw

about 38% rural households and about 47% urban households use auto rickshaw for commuting

http://timesofindia.indiatimes.com/articleshow/52971518.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cpps

VULNERABILITIES

Current scenario

Front passenger leg outside auto, is extremely dangerous for the passenger, due to this the hand driving posture is extremely compromised and it also restrict the hand movement of the driver, which risk the safety of all the passengers. Also luggage is hanged outside the auto which adds risk to passers by too



Overloaded auto-rickshaws pose threat to schoolchildren

The death of a nine-year-old school student, Sakshi, after falling off from an auto-rickshaw on Monday, has raised a serious concern over the overloading of passengers on auto-rickshaws, especially the ones ferrying school children.

As per government orders, a maximum of five children up to the age of 14 years could be accommodated in an auto-rickshaw. However, more than 15 kids could be seen jostling for space inside these jam-packed autos ferrying them to schools.



<https://www.tribuneindia.com/news/archive/jalandhar/overloaded-auto-rickshaws-pose-threat-to-schoolchildren-820516>

Overloaded auto-rickshaw overturns in Nithari, crushes 10-year-old passenger

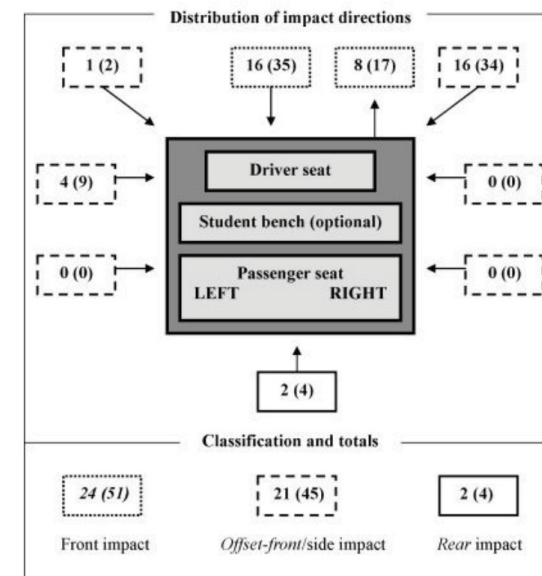
According to police, the auto-rickshaw was taking students home from school when the accident took place.

“The driver was speeding and due to the excess weight, the auto-rickshaw overturned. Of the 11 students, three were injured seriously and a 10-year-old died,” a senior police officer said.

<https://indianexpress.com/article/cities/delhi/overloaded-auto-rickshaw-overturns-in-nithari-crushes-10-year-old-passenger/>

Overloading with more than three passengers was found in 25 cases (50% of cases in which passengers were carried). Four to six passengers were on board in 18 (36%) cases and 7–15 passengers in 7 (14%) cases. The number of injured or dead passengers (irrespective of inclusion in this study, because not all the injured/dead in each crash were brought to the hospitals participating in the study) was found to be significantly higher in motorised rickshaws with more than three passengers (mean 4.5 injured or dead per case, standard deviation (SD) 3.5) than in those with three or less passengers (mean 1.8, SD 1.0; $p < 0.001$)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3020288/>





MARKET
RESEARCH

Apé Auto+ DSL BS VI: Technical Specifications

Engine	Diesel
Type	Water Cooled Engine
Displacement	599 cc
Max Power	7 kW (9.39 hp) @ 3600 rpm
Max Torque	23.5 Nm @ 2200 rpm
Transmission	
Clutch Type	Multi Disc Wet Type
Gear Box	Constant Mesh
Gears	5 Forward, 1 Reverse
Suspension	
Front	Hydraulic Telescopic Shock Absorber With Helical Compression Spring with Damper
Rear	Hydraulic Telescopic Shock Absorber With Rubber Compression Spring with Damper
Steering	
Steering	Handle Bar Type
Brake & Tyre	
Brake	Drum Brake Hydraulically Actuated Internal Expanding Shoe Type
Tyre	4.50 - 10, 8 PR
Electrical System	
System Voltage	12V DC
Battery Rating	50 Ah
Dimensions	
Wheelbase	2100 mm
Overall Width	1465 mm
Overall Length	3140 mm
Overall Height	1950 mm
Minimum Ground Clearance	240 mm
Weight	
GVW	974 kg
Kerb Weight	524 kg
Seating Capacity	Driver + 5
Performance	
Maximum Gradeability	23.80%
Fuel Tank Capacity	10 Ltrs
Max Speed	60 km/h

Ape Auto + ***

₹2.99 lakh* [View On Road Price**](#)

*Ex-showroom Price in BIHARSHARIF

**Based on location and Insurance, prices may vary.

***Permit as per local regulations is responsibility of customer

[Book Online & Save ₹ 2,000 Additional](#)

***For exact offer, please connect with the dealer.

EMI Starts @ ₹ 9,791* [Calculate EMI](#)

Color

Presenting **Ape** PERFORMANCE RANGE **BS VI**

INDIA'S SUPER 5 SEATER

— BADI SAWARI BADI KAMA! —

42 MONTH WARRANTY

- Powerful Engine
- 5+1 Gear Box Smooth Driving Experience
- Long Life Aluminium Clutch 30,000 kms
- Higher Power & Gradeability

5+1 Seater

COMFORT +
Increased Hood height to suit rear seat passengers

SEATING CAPACITY +
for accommodating 2 extra passengers

SAFETY +
Grab handles for easy access

CONVENIENCE +
Entry steps at the rear



Apé Auto DXL BS VI: Technical Specifications

Engine	Diesel
Type	Water Cooled Engine
Displacement	599 cc
Max Power	7 kW (9.39 hp) @ 3600 rpm
Max Torque	23.5 Nm @ 2200 rpm
Transmission	
Clutch Type	Multi Disc Wet Type
Gear Box	Constant Mesh
Gears	5 Forward, 1 Reverse
Suspension	
Front	Hydraulic Telescopic Shock Absorber With Helical Compression Spring with Dampener
Rear	Hydraulic Telescopic Shock Absorber With Rubber Compression Spring with Dampener
Steering	
Steering	Handle Bar Type
Brake & Tyre	
Brake	Drum Brake Hydraulically Actuated Internal Expanding Shoe Type
Tyre	4.50 - 10, 8 PR
Electrical System	
System Voltage	12V DC
Battery Rating	50 Ah
Dimensions	
Wheelbase	2100 mm
Overall Width	1465 mm
Overall Length	3140 mm
Overall Height	1950 mm
Minimum Ground Clearance	240 mm
Weight	
GVW	806 kg
Kerb Weight	506 kg
Seating Capacity	Driver + 3
Performance	
Maximum Gradeability	23.80%
Fuel Tank Capacity	10 ltrs
Max Speed	60 km/h

Presenting
Apé PERFORMANCE RANGE
BSVI

XXL SAWARI XXL KAMAI XXL PEHCHAAN



Apé Auto DXL ***

₹2.96 lakh* [View On Road Price**](#)

*Ex-showroom Price in BIHARSHARIF
 **Based on location and Insurance, prices may vary.
 ***Permit as per local regulations is responsibility of cust

[Book Online & Save ₹2,000 Additional](#)

***For exact offer, please connect with the dealer.

EMI Starts @ ₹9,707* [Calculate EMI](#)

Color

Specifications and Features [View All](#)

[Book a Test Drive](#)

[Book](#)

Specifications are subject to improvements / changes. | * Conditions Apply

Authorised Dealer:

Apè Auto DX BS VI (Diesel): Technical Specifications

Engine	
Type	Single Cylinder, Naturally Aspirated, Water Cooled, Direct Injection, Electronic Fuel Injection Engine
Displacement	599 cc
Max Power	7 kW (9.39 hp) @ 3600 rpm
Max Torque	23.5 Nm @ 2200 rpm
Transmission	
Clutch Type	Multi Disc Wet Type
Gear Box	Constant Mesh
Gears	5 Forward, 1 Reverse
Suspension	
Front	Hydraulic Telescopic Shock Absorber with Helical Compression Spring with Damper
Rear	Hydraulic Telescopic Shock Absorber with Rubber Compression Spring with Damper
Steering	
Steering	Handle Bar Type
Brake & Tyre	
Brake	Drum Brake Hydraulically Actuated Internal Expanding Shoe Type
Tyre	4.50 - 10, 8 PR
Electrical System	
System Voltage	12V DC
Battery Rating	50 Ah
Dimensions	
Wheelbase	1920 mm
Overall Width	1465 mm
Overall Length	2940 mm
Overall Height	1770 mm
Minimum Ground Clearance	245 mm
Weight	
GVW	780 kg
Kerb Weight	480 kg
Seating Capacity	Driver + 3
Performance	
Max Gradeability	22.20%
Fuel Tank Capacity	10.5 Ltrs
Max Speed	60 km/h



Presenting
Apè PERFORMANCE RANGE
BSVI

BADI SAWARI BADI KAMAI

Increased Headroom



Powerful Engine



5+1 Gear Box
Smooth Driving Experience



Higher Power & Torque

Apè Auto DX



Long-Life Aluminium Clutch
30,000 kms



Low Maintenance



Apè Auto DX ***

Diesel

₹2.87 lakh* View On Road Price**



Mahindra alfa

Vehicle Dimesnions (mm)

Wheel Base (mm)	2005
Wheel Track (mm)	1250
Turning Raidus (mm)	3500
Min Ground Clearance (mm)	175
Overall Width (mm)	1452
Overall Height (mm)	1866
Overall Length (mm)	2978

Weight

Max. GVW (kg)	780
Kerb Weight (kg)	460
Seating Capacity	Driver + 3 Passenger / Driver + 5 Passenger

Engine

Engine Type	4-stroke, Single - Cylinder, air cooled diesel engine
Displacement	436 cc
Maximum Power (KW)	7.5BHP @3600 rpm
Maximun Torque (NM)	18 Nm @ 2000-2400 rpm
Clutch Type	Multi Plate Wet Clutch
Transmission	Constant Mesh, 4 Forward + 1 Reverse

CHAMPION PASSENGER (6+1) CARRIER

Weight

Gross Vehicle Weight	1350 Kgs
Kerb Weight	685 Kgs
Seating Capacity	6+1
Min. Ground Clearance	160 mm

Dimensions

Wheel Base	2050 mm
Overall Width	1520 mm
Overall Length	3400 mm
Rear Wheel Track	1360 mm
Min. Ground Clearance	160 mm

Engine

Engine Type	Single cylinder water cooled, 4S, DI
Engine Power	7.5 kW @ 3000 rpm (10.2 bhp)
Engine Max. Torque mkg@rpm	2.6 @1800-2400
Engine Capacity CC	510

Mahindra Alfa [Change Truck](#)

★★★★☆ 5 Reviews

[Rate Now >](#)

From ₹ 2.75 Lakh*

*Ex-showroom Price in [New Delhi](#)



USER

RESEARCH

Questionnaire (drivers)

Introduction(name, age, family member(details), since when in this occupation, which vehicle do they own?)

Trip information- How long one trip is and how many trips? Avg daily income? How many passengers do they take on one trip?

How do you accommodate so many passengers?

Why did u consider Auto over toto (e-rickshaw) or minivan?

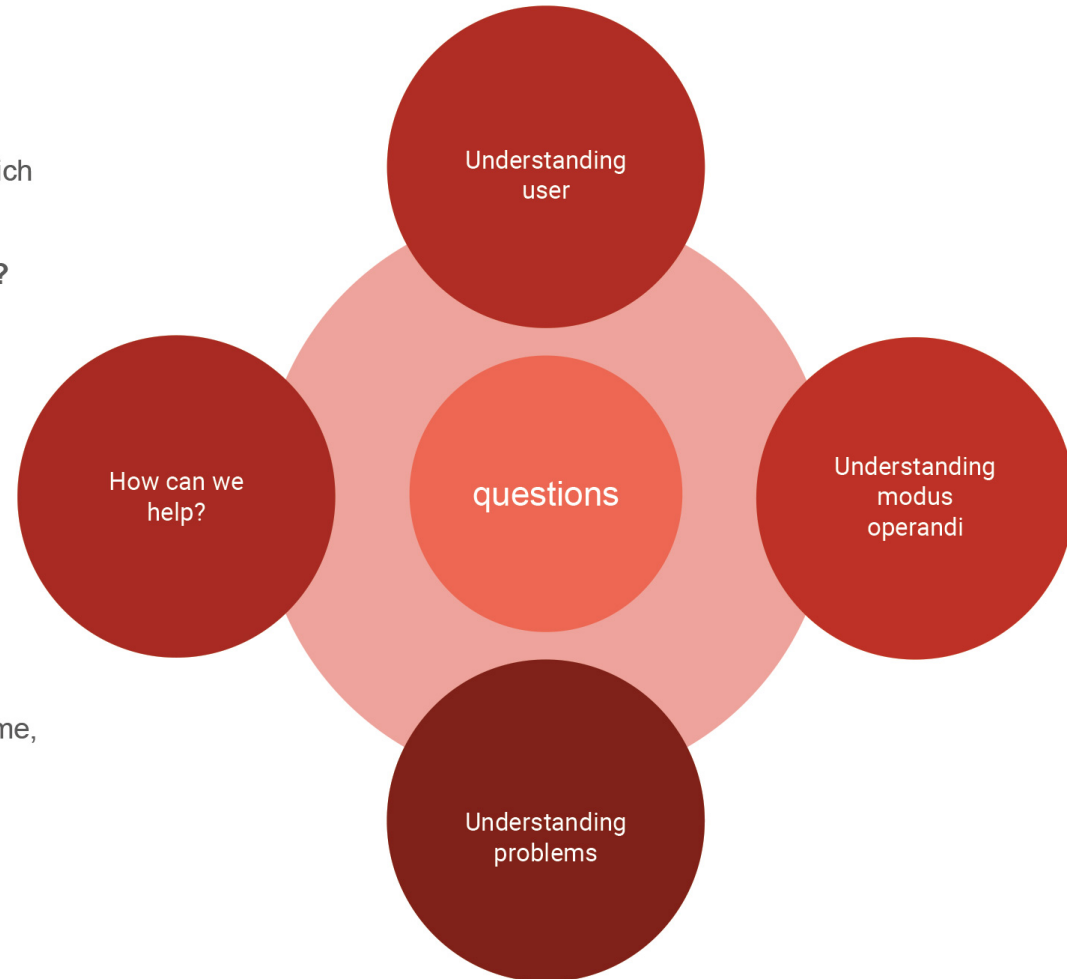
Did u make any modifications to the vehicle after the purchase?

Did you take loan for vehicle ?

Do you have any other problem with running vehicle on road?

If we reduce the price of petrol for you, but fare for each passengers remain the same, then how many passengers would you take now?

Do you have access to electricity?





Binod Manjha
Jharkhand

User 1

He is driving a Piaggio auto, since 5-6 years he is into this profession. He carries 7-8 passengers in a trip and make trips of roughly 15-20 km.

His earnings is variable also does farming, and on avg earns 300-500 per day by driving auto rickshaw. He spent 20k on interior modification like (seats and body work)

He at times overload, intention behind is earning more, he gives discount on fare if someone stand on footboard or rear bumper to travel. He took auto rickshaw because he didn't knew about it when he got his rickshaw. He says e- rickshaw became popular 1-2 years back. Given government schemes he is willing to get an e rickshaw because he already finds running rickshaw less feasible economically and depends more on farming.



Blocked wrong side entry and egress, for safety reasons, but still not adequate

2+2 seating at rear

Middle seat moved forward to accommodate 2 extra passengers at rear. Compromised leg room

Driver seat made widest to accommodate passengers and also because any further modification will need to chance chassis



Elevated platform to accommodate engine, uncomfortable and crouched sitting posture

J 240



Hand support given for overloading passengers



Oversized seat to accommodate more people, Compromised ingress, egress and driving posture

User 2

Subodh Kumar
Bihar

He drives a bajaj RE. Since he has a small auto he takes upto 6 passengers maximum and does trip upto 40 km on one direction, he roughly runs 100-130 km daily. He consider 6 passengers to not be overloaded and don't take any more passenger because there is no space. He modified the front seat to accommodate more passengers. He preferred auto over toto because it is more comfortable and can go long distance too.

He says people prefer his auto over big auto due to comfort and also that it fills faster with just 6 passengers whereas big auto run with at least 10 passengers. He says toto have become popular since past 1-2 years, and is giving him a tough competition in the market although its running cost is very less but his friends who got it need to replace its battery in 1-2 year running that cost 30-40k. He like his auto due to premiumness and comfort and also use it as his personal vehicle

User 3

Awdhesh Singh (43)
Bihar

He owns an Atul auto and is into this business since past 10-12 years. Earlier used to own Bajaj, Mahindra auto as well. He runs in sequence from the market place in the village. He modified his rickshaw (seat and bodywork). and He takes 10 (2+4+4) passengers and makes 3 to 4 trip of 16 -17 km daily. He consider 1+4+4 to be normal seating and does overload to make it feasible due to the rising fuel prices. The problem he face is low income due to fuel price, and people don't wish to seat only in the centre seat so to fill the auto to 10 passengers is difficult. He also says passengers don't agree to raised fare since they have also suffered due to pandemic, and simply give up travelling with price surge. He gives an example, earlier before pandemic the fare was 10, during pandemic it was 20, and now 15 due to fuel price, but still people argue for fare that was before pandemic.

He didn't got toto because he had no experience in it, but he say given government schemes, he will be interested in getting one as he runs small trips. He says he will keep both auto and toto, and will use auto for reserved and long routes like during election campaigns (300 km). He has access to electricity.





User 4

Rahul Kumar (26)
MRF, Bihar

He says this market segment is the most price conscious segment, even a 100 rupee difference can affect the buying decisions. We struggle the most to sell the tyre of this particular segment since is most competitive. Quality comes as a second priority for most, “tatkal chala do, baad ka baad me dekhla jayega”. He also says that in order to earn more they will overload the vehicle even if this affects the longevity of the vehicle as well as its components including tyres. For usage pattern he says minivans run in are used in flood affected areas and where trips are usually more than 35 kms. In flood affected areas the three wheelers often turn turtle so people avoid using it. He travels around bihar and visits many different villages, he says there is a decent coverage of roads, however few areas still lack but there is some level of connectivity established.

Electricity is not an issue in bihar , as per his findings the less performance and quality of e rickshaw (speed, carrying capacity, after sales service and inability to go long distance) limits its expansion, and that is the reason why still we have so many autos running on roads and it will be the same in near future too.

Questionnaire (Users)

Introduction(name, age, family member(details), occupation.

How often do you use auto for travel? Reasons for using auto?

What do you think about safety in current generation of auto rickshaws?

Have you ever witnessed any close calls or accidents involving auto?

What as per you is an overloaded auto? Would u still take one? If yes why?

Do you travel with luggage? If yes how do You manage it during ride?

Do you face any problem, related to safety or any other thing as such when you travel.

What as per you can be done to make the ride experience better?



User 5

Babloo Kumar
Railway Employee
Bihar

He lives in a very remote village (Champapur), there is no proper connectivity of roads. He takes an auto to go to his office, which is the railway halt. He takes an auto because it's the most common mode and other modes include a rickshaw (which he sometimes uses too) and other informal modes. Where he lives, he doesn't get a running auto and the auto takes at least 8 passengers before starting. He has no other option than taking the crowded auto because it's the same case with all autos. He thinks that safety is greatly compromised in autos and it is more due to overloading and bad road conditions of roads in villages. He himself once fell from an auto and broke his arm after the auto got into a pothole.

He travels with a small bag and when going to relatives or outstation, he carries more luggage. Usually, small luggage he holds in hand, but big luggage he keeps in a carrier. It makes it really hard for him during rainy season to travel in an auto. Also, he thinks that autos are not comfortable and with extra passengers, it is even worse. Sitting in a compromised position at the rear hurts his legs and back too. He prefers a middle row seat and only takes a rear seat in an urgent situation. He never takes a front seat again after an accident.





User 6

Rakesh Murmu
Lab Assistant
Jharkhand

He works as a lab assistant in a government polytechnic college. The college itself is located in remote area but there is availability of basic market and healthcare. He uses a motorbike but for longer trips, or trips with his family he uses auto rickshaw. Where he live the main city is 35 kms far so only available mode of transport is auto and taker. He prefers auto because it's fairly newer than taker and airy. He too faces the same issue of not getting running auto and a minimum of 6 passengers is needed to start the commute. He is not much aware about overloading and consider 8 to be the normal carrying capacity. He strictly wants the middle seat to travel as he is not comfortable in front and rear seat, due to his age and body physic. He says his stomach interfere with drivers hand while driving.

He travel with luggage at time, either he hold it in hand or keep it in the carrier at top. He wants the auto to be more comfortable. He like the small auto which according to him is swift, and comfortable. He says there is a lot of jerking and the rides should be smoother to make the experience better.



User 7

Aditya Das
Primary School Teacher
Jharkhand

He lives in a very remote village of jharkhand called “godda”.. He recently started working as a govt. Teacher. He doesn’t own a vehicle and rely on public transport for his transportation need. Available options to him are magic taker auto and fitter gaadi. He prefers magic and autos the most. But he says for small rides magic is not available. He prefers the middle seat but is ok with any seat offered. He takes overloaded because its is the normal case for him all autos in his place run with 8-10 passengers in general. He doesn’t thinks that autos are safe because it’s open but he still takes it because it’s better than fitter gaadi which don’t even have proper seats.

He have once hurt his head with the bolts holding the canopy when the auto jerked in a pothole. He thinks that 3 wheelers are not safe because it can topple easily due to bad road. He keeps his luggage on his lap while travelling and if it’s big he keeps it on carrier overhead

He don’t face any problem as such and find it convenient, but for suggestion he wishes autos to have doors, for safety and whether protection.

Insights drivers

All autos are retrofitted with aftermarket seating and interiors which is done with the sole purpose of accommodating more passengers. However the triangular platform itself is not the ideal one for low footprint and effective packaging inside the vehicle.

Overloading is a necessity and with the recent increase in fuel prices COR is increased, thus, leading to further overloading of passengers.

The space inside the auto is fully exploited to accommodate double the passengers than the permissible limit, and, any space given will be again used to accommodate passengers.

There is no realisation of running an overloaded auto as it has normalised. Thus, even just making the COR more economical won't bring down the overloading pattern.

The current chassis structure is vulnerable to be modified and compromise on safety. Even, the handlebar adds to the vulnerability because it gives freedom to the driver to operate it at extreme posture.

There is a trade-off between comfort to passengers or profit being made and mostly the latter is chosen by totally overlooking the former. But, comfort has an edge, as it is the desired experience by the user.

The middle seat is the most comfortable and is preferred by passengers. The seating hierarchy makes it difficult for the drivers to get rides.

There is an eye for recent emerging e-vehicles due to economical cost of running but lack of options and debt of ownership halts the process of adaptation. However, government schemes may accelerate the process.

The owners would feel proud to use the vehicle as their personal vehicle to but have to compromise and make it a commercial vehicle first.

Insights users

Open structure makes the space less claustrophobic but is extremely dangerous with overloaded passengers. Vomiting and suffocation is experienced too in long trips as it is not very comfortable.

Auto are a safe vehicle within permissible limits but open structure gives current chassis configuration allows a lot of opportunities to tweak it and overload it, which risks the safety.

Aftermarket seats are not desirable and cause fatigue to person using them due to compromised sitting posture. Also, it interferes with the working space needed to the driver.

There is a social acceptance for overloading auto, and people chose it because of lack of better options.

Overall satisfaction level in consumer regarding safety and comfort was low and they wish for a more comfortable ride. Also, in rainy season people find it difficult to take a trip in auto.

Luggage being carried is either held in hand or kept outside the envelope of the vehicle, mostly on the top.

Design Brief

How may we design an all weather, 9 seater(8+D) electric low footprint open vehicle for the rural India with non discriminating seating, which prevents overloading of passengers and enhance safety for both driver and passengers **without compromising on loading capacity**.



All passengers and their belongings should be well contained inside the envelope of the vehicle,

There should be uniform and comfortable seating with adequate legroom

The vehicle should provide protection in all weather conditions.

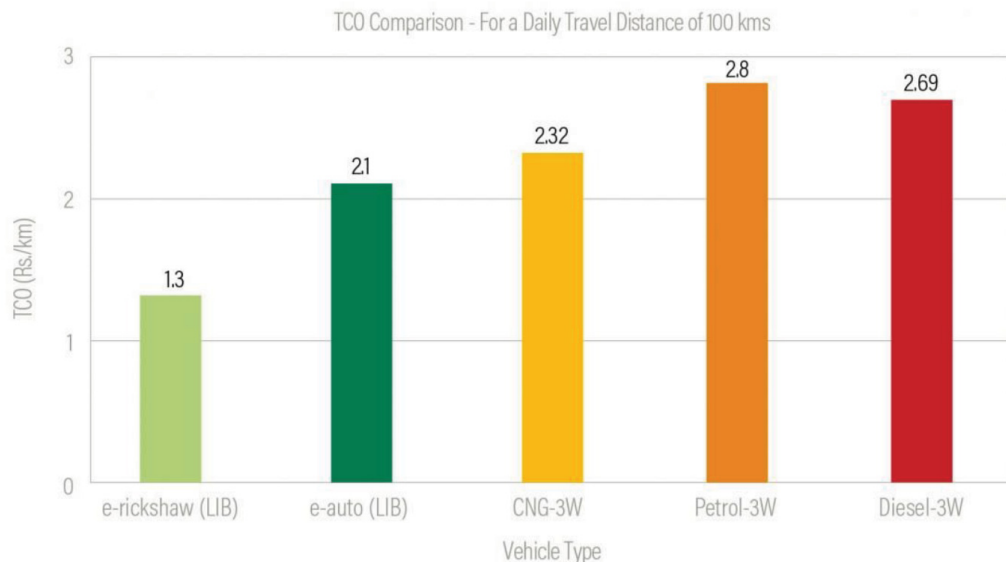
The chassis should be foolproofing it from any further illegal modifications that compromise the safety of users.

Blurring the line between a passenger and a commercial vehicle



BACKGROUND
RESEARCH

Comparison of TCO per km of e-rickshaw (Without subsidy) and e-auto (Without subsidy) with CNG-3W, Petrol-3W and Diesel-3W at average daily travel distance of 100km



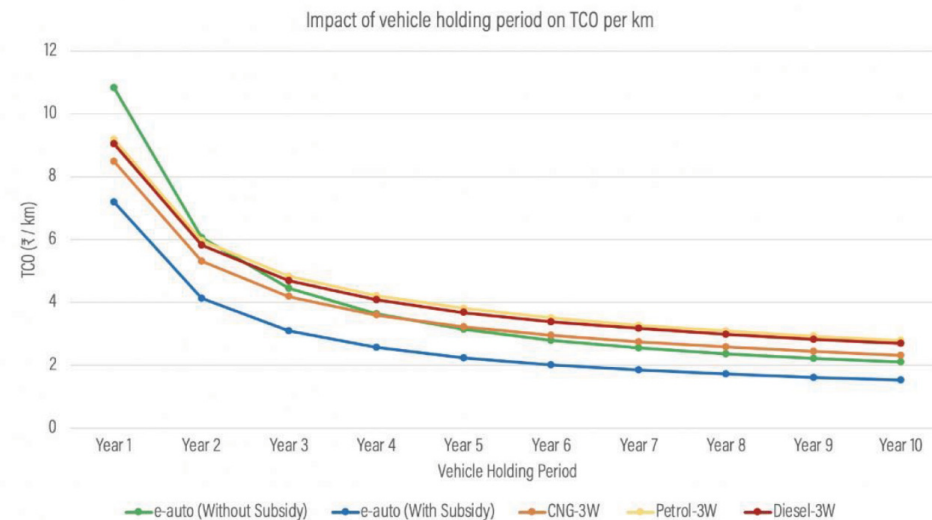
Source: WRI India Analysis



Figure 2: Comparison of TCO per kilometer of e-rickshaw (without subsidy) and e-auto (without subsidy) with CNG-3W, Petrol-3W and Diesel-3W at average daily travel distance of 100 km. Here, the purchase cost of e-rickshaw (LIB) and e-auto (LIB) is INR 2,02,552 and INR 3,66,906 respectively. The cost of CNG-3W, Petrol-3W and Diesel-3W is INR 2,40,000. Some major inputs and assumptions used to calculate the annual operating cost include cost of electricity INR 6/ kWh, cost of petrol INR 72/liter, cost of CNG INR 46/kg, cost of Diesel INR 67/liter, resale value 10%, discount rate 10% and vehicle holding period of 10 years. The mileage of e-rickshaw, e-auto, CNG-3W, Petrol-3W and Diesel-3W are 13 km/kWh, 17 km/kWh, 30 km/kg and 30km/liter respectively.

<https://wri-india.org/blog/busting-cost-barrier-why-electric-three-wheelers-make-business-sense>
https://fame2.heavindustry.gov.in/content/english/13_1_brief.aspx

Comparison of year-wise TCO per km of e-autos (with and without subsidy) against its ICE variant with different fuel options at an average daily travel distance of 100 kms



Source: WRI India Analysis



Comparison of year-wise TCO per km of e-autos (with and without subsidy) against its ICE variant with different fuel options at an average daily travel distance of 100 km.



Government has approved Phase-II of FAME Scheme with an outlay of **Rs. 10,000 Crore** for a period of 3 years commencing from 1st April 2019. Out of total budgetary support, about 86 percent of fund has been allocated for Demand Incentive so as to create demand for Electric Vehicles (xEVs) in the country. This phase aims to generate demand by way of supporting **7000 Electric Buses (e-bus)**, **5 lakh Electric Three Wheelers (e-3W)**, **55000 Electric Four Wheeler Passenger Cars** (including Strong Hybrid) (e-4W) and **10 lakh Electric Two Wheelers (e-2W)**.

Technical benchmarking

50 paise/km



Higher Savings

Low running cost of only 50 paise per km, leading to savings of up to ₹ 45 000.00 every year in fuel cost*.

BATTERY	
Battery Type, Voltage	Lithium-ion, 48V
Battery Capacity (Installed) - kWh	7.37
Charging Time 0-100% @Standard Conditions	3 h 50 min

DRIVETRAIN	
Peak Power - kW	8
Peak Torque - Nm	42
Transmission Type	Direct Drive



Mahindra Treo

★★★★☆ 22 Reviews Ra

₹ 1.69 - ₹ 2.79 Lakh*



Ape E-City FX ***

₹2.82 lakh**

*On Road Price is as applicable.

**Based on location and Insurance, prices may vary.

***Permit as per local regulations is responsibility of customer.

***For Kerala state, exclusive of Kerala Flood Cess

***For exact offer, please connect with the dealer.

EMI Starts @ ₹ 7,776* [Calculate EMI](#)

Color

Specifications and Features [View All](#)

[Book a Test Drive](#)

[Book Now](#)

Vehicle Category	: L5M – Auto
Seating Capacity	: D + 3 Seater Seating Capacity
Battery Type, Voltage	: Lithium Ion, 48V
Battery Capacity	: Rated : 7.5 kWh
Peak Power	: 5.44 kW @ 3500
Peak Torque	: 29Nm

Product positioning



E-rickshaw

- Low cost (0.9- 1.15 lakhs)
- Lead acetate battery- low life cycle
- Less performance- 24 kmph top speed, used for short trips
- More comfortable (noiseless)

Auto

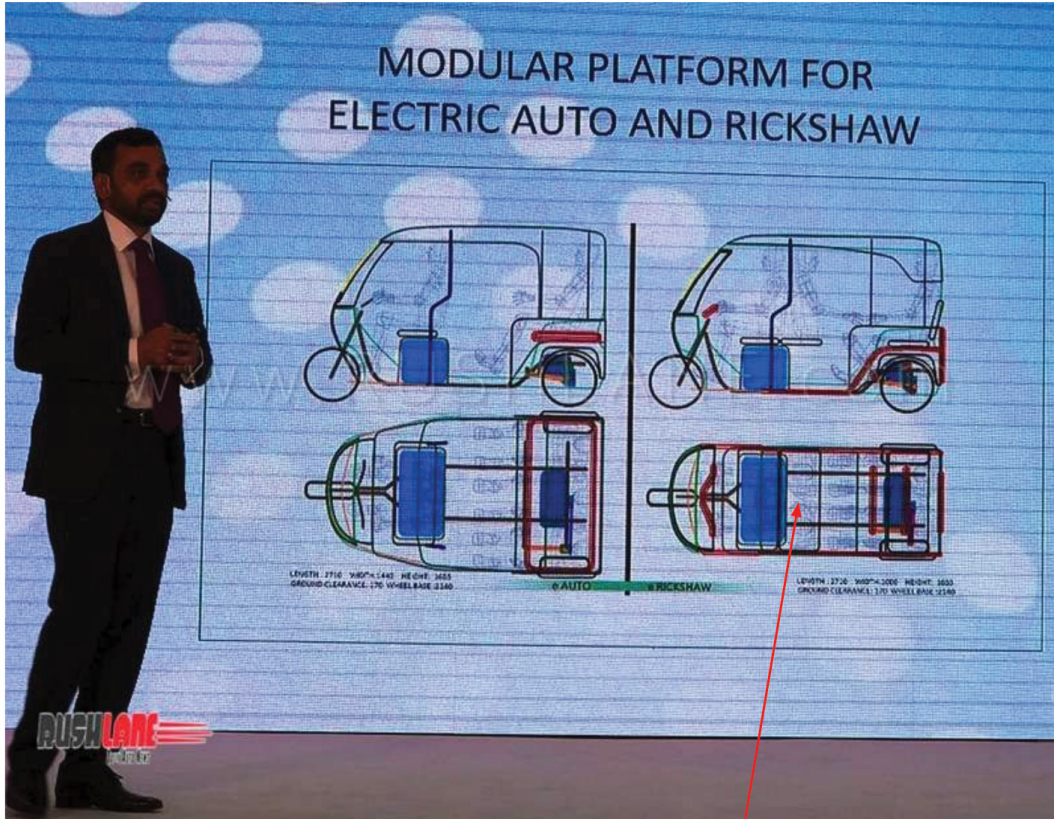
- Low cost (2.5-3 lakhs)
- High COR (diesel powered)
- Good performance: used for trips ranging upto 35 kms
- Not comfortable

4W Auto

- Low cost (3-3.5 lakhs)
- Low COR (Li-ion)
- Good performance: used for trips ranging upto 35 kms
- More comfortable

Mini Van

- High cost (over 6 lakhs)
- High COR (diesel powered)
- Good performance: used for trips ranging more than 35 kms
- More comfortable



Shared legroom

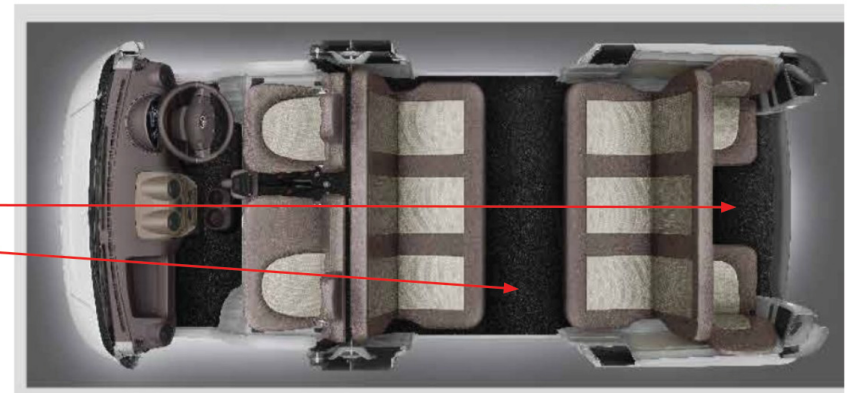


Mahindra Supro

From ₹ 6.4 Lakh* Onwards

Seating : 9+D

Dimensions	Over all vehicle Dimension L X W X H in mm	3798 x 1540 x 1922 mm
	Cargo Box Dimension L X W X H in mm	N.A
	Wheel Base in mm	1950 mm
	Min Ground Clearance in mm	173 mm



Other countries

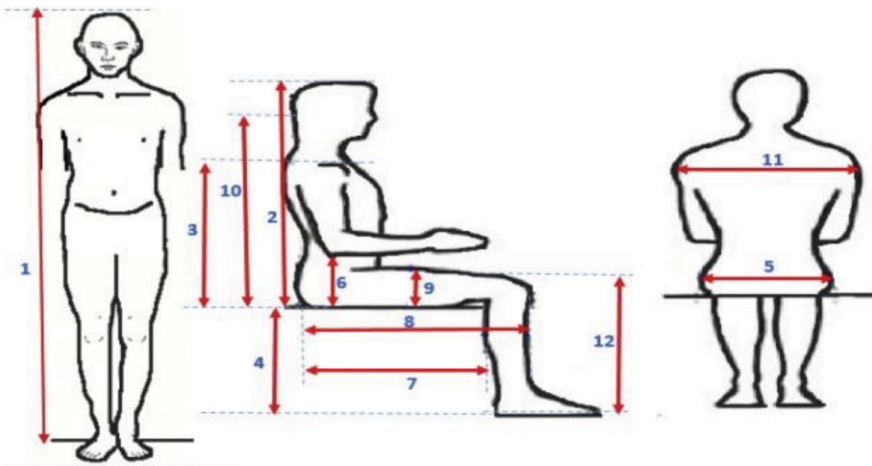


Tuk-tuk in Hat Yai, Songkhla province, Thailand



Asian taxis are called tuk-tuks in Pattaya, Thailand

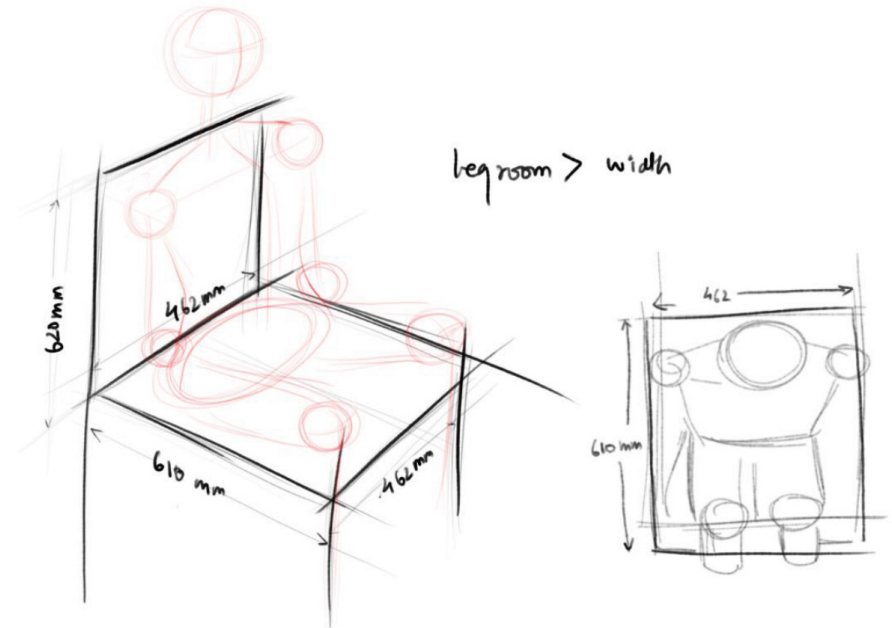
https://commons.wikimedia.org/wiki/File:Tuk-tuk_in_Hat_Yai_08.jpg
https://www.123rf.com/photo_44538270_thailand-pattaya-march-26-2015-asian-taxis-are-called-tuk-tuks-in-pattaya-thailand.html

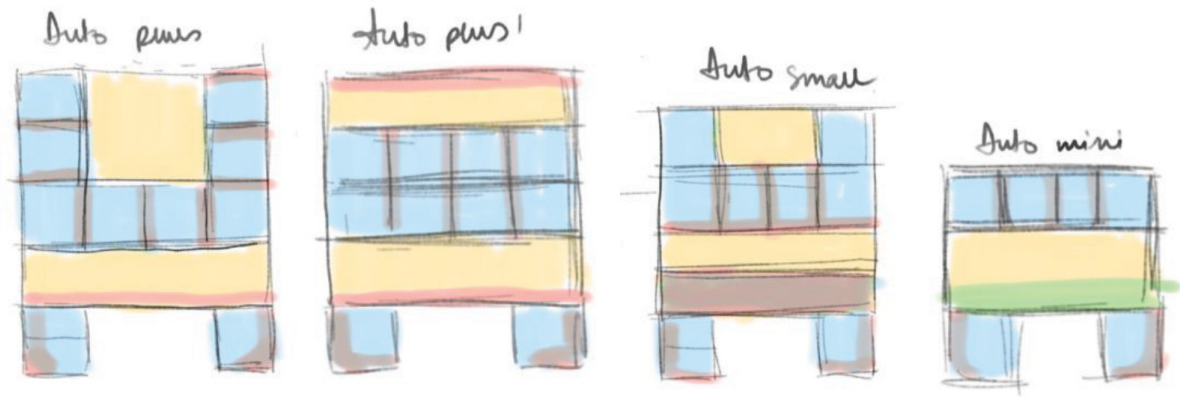


S/No.	Body dimensions	Min	Max	Male percentile			Mean	SD
				5th	50th	95th		
1	Stature (body height) (mm)	1520	1890	1600	1710	1810	1712	62
2	Sitting height (erect) (mm)	680	920	730	805	880	805	43
3	Shoulder height, sitting (mm)	470	650	520	570	620	569	33
4	Lower leg length (popliteal height) (mm)	390	510	410	450	487	450	23
5	Hip breadth, sitting (mm)	260	425	270	320	380	319	30
6	Elbow height, sitting (mm)	130	310	160	200	245	200	28
7	Buttock–popliteal length (seat depth) (mm)	360	540	390	450	520	453	38
8	Buttock–knee length (mm)	460	640	496	560	610	556	35
9	Thigh clearance (mm)	80	200	100	140	185	139	25
10	Eye height, sitting (mm)	600	810	630	710	780	708	43
11	Shoulder (bideltoid) breadth (mm)	350	480	380	420	462	423	24
12	Knee height (mm)	460	600	490	530	570	532	27
13	Body mass (weight) (kg)	400	1100	476	635	915	653	131

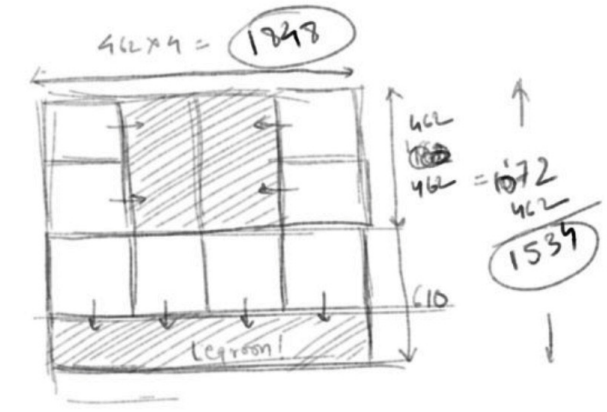
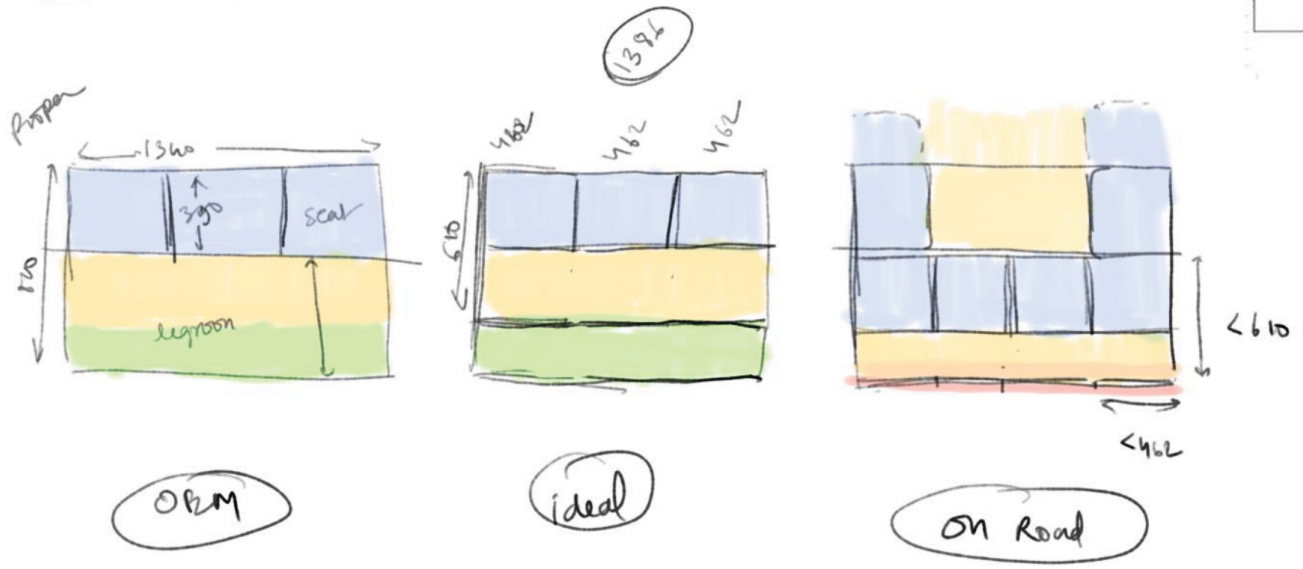
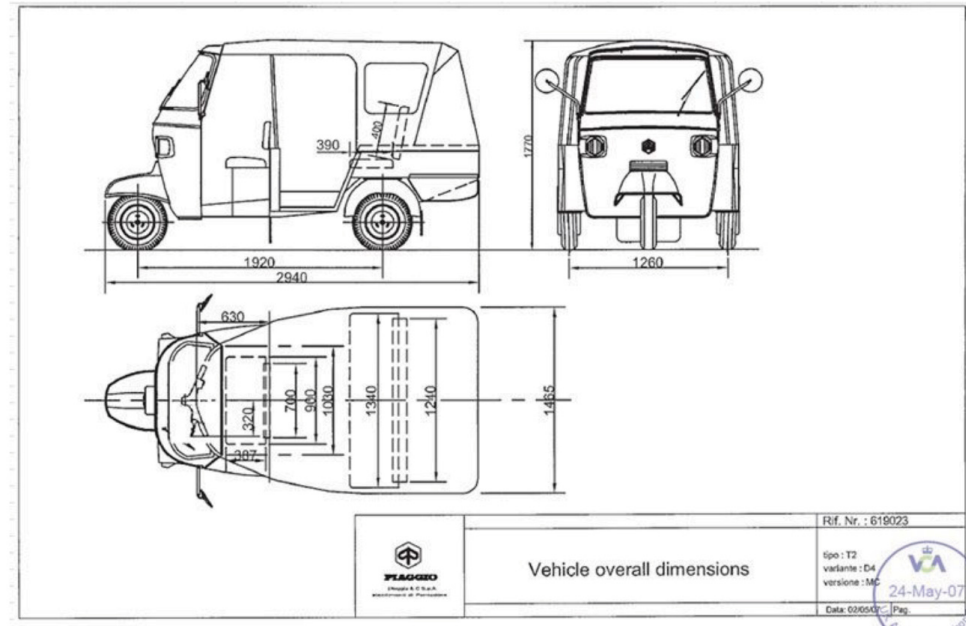
4.3 In the meeting held on 10.7.2012, with the permission of the Committee, a presentation on the safety features of a new category of vehicles proposed for inclusion in CMVRs, namely quadricycle, was also organized. The Committee was informed that this particular vehicle proposed to be brought out under the category of 'Quadricycle' had almost all the safety features of the 3-wheeler auto rickshaw and, in addition, some safety features over and above auto rickshaw. This vehicle had a close body structure with lockable doors which would prevent overloading; it had a hard top and safety belt for driver as well as for other occupants, both in the front seat as well as in the rear seats; two headlamps to enhance front visibility; proper signaling devices and wiper; closed luggage space incapable of being misused to accommodate passengers. Since it is a 4-wheeled vehicle, it may have higher stability as compared to 3-wheeled vehicle. Most importantly, while there are currently no crash standards for 3-wheeler auto rickshaws, the vehicle

https://morth.nic.in/sites/default/files/Report_of_the_Committee_to_consider_safety.pdf





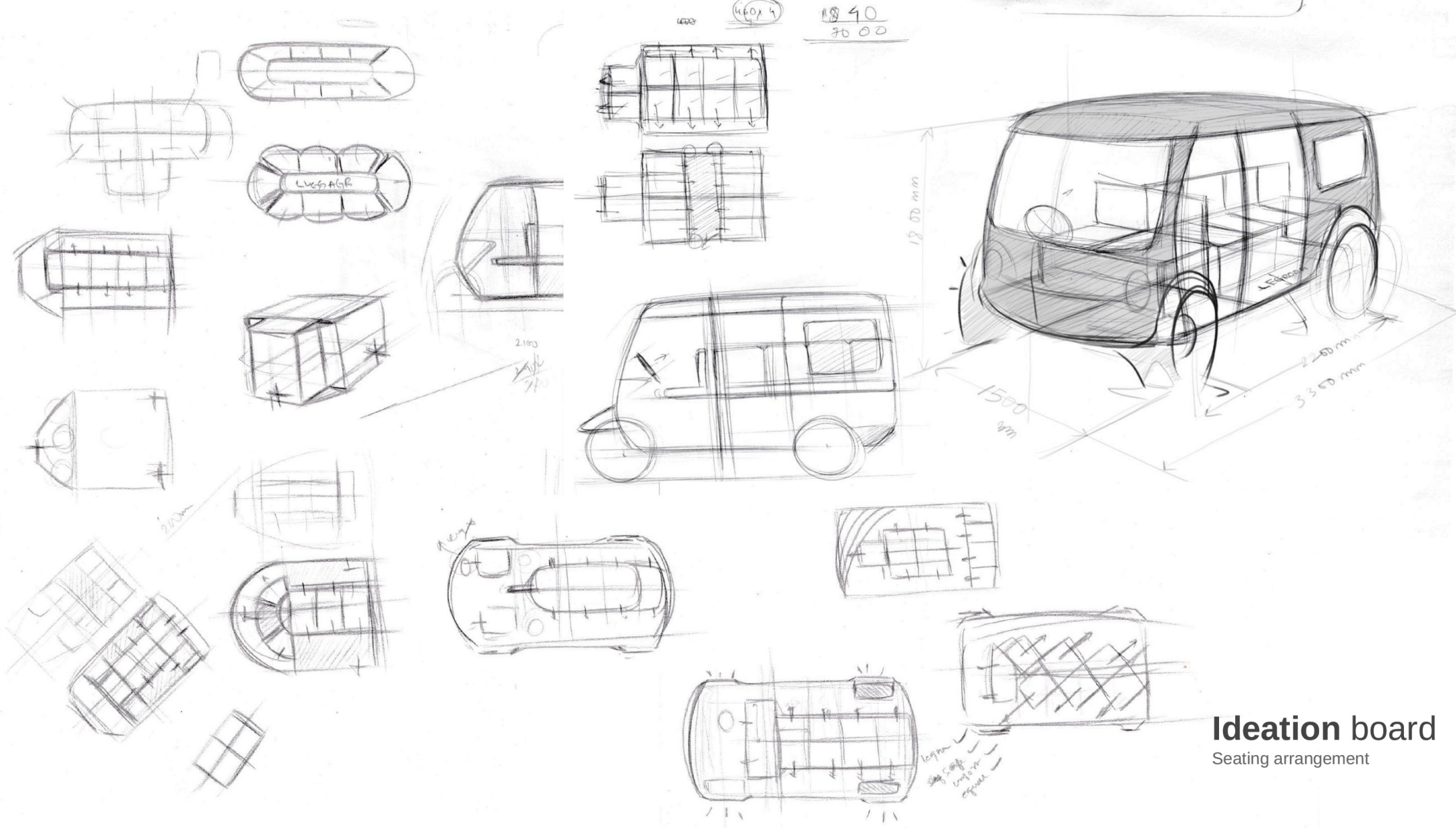
- seats
- legroom
- uncomfortable zone



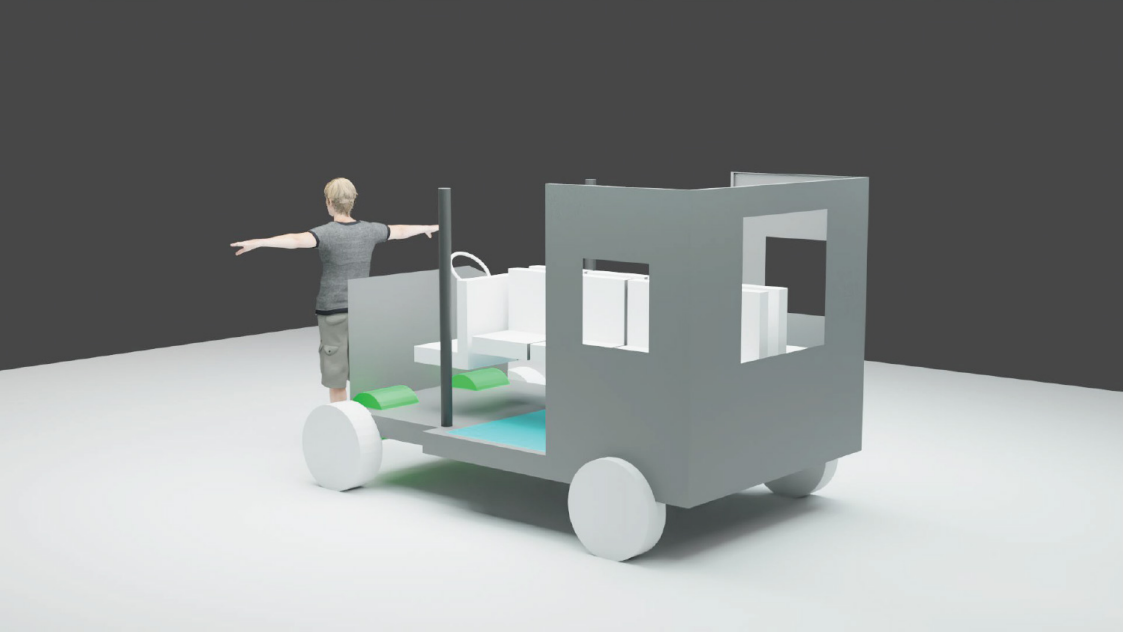
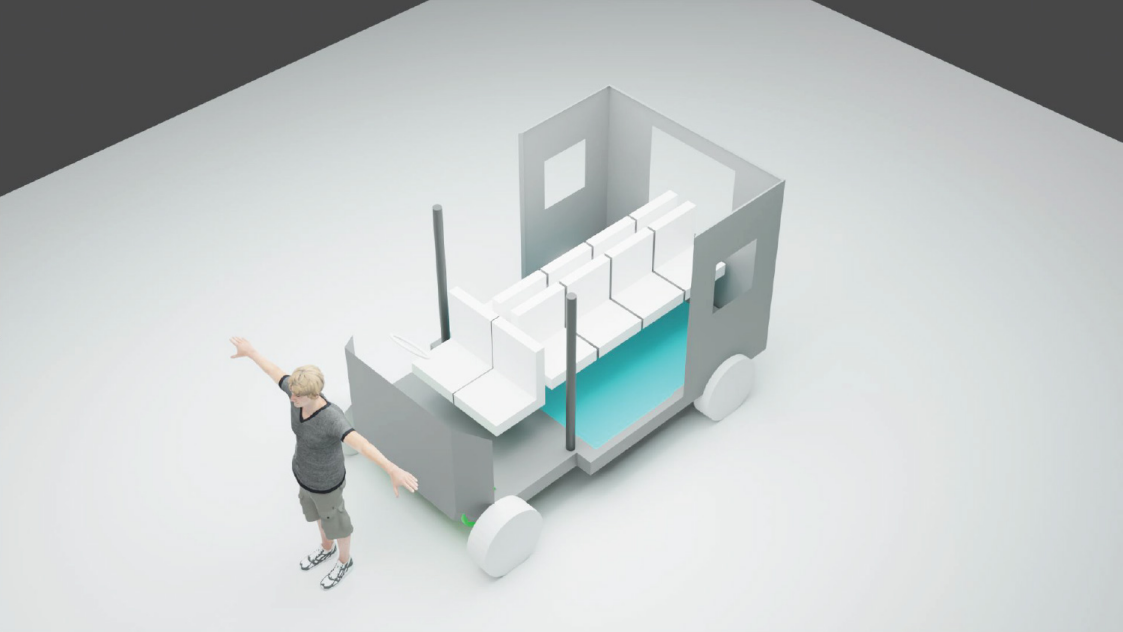
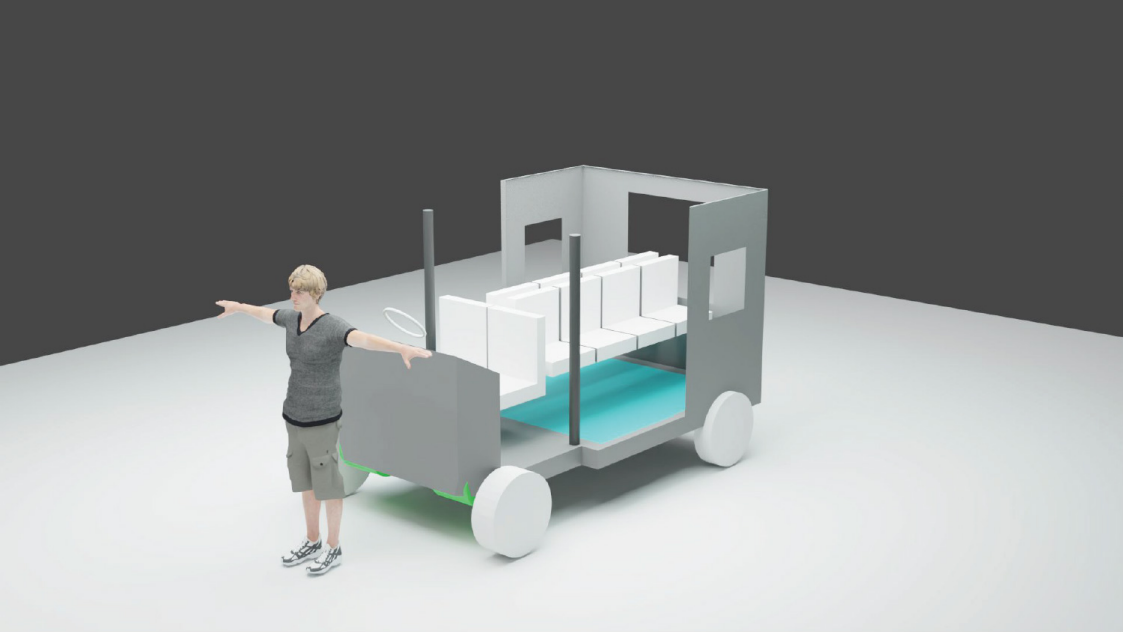
Inspiration board

Public seating
Silkworm cocoon
Turtle shell



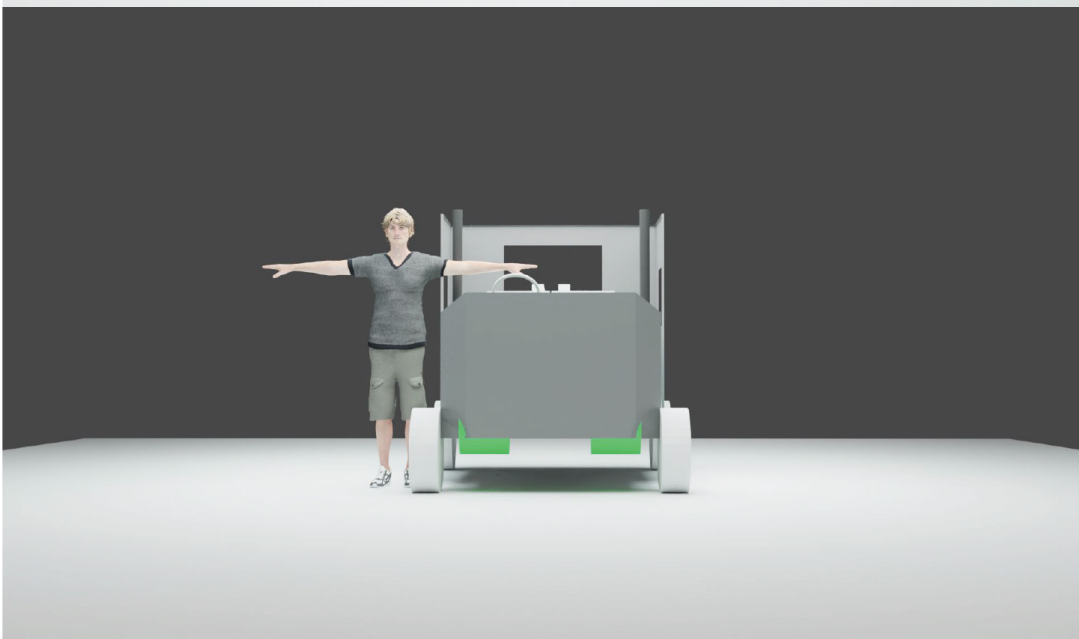
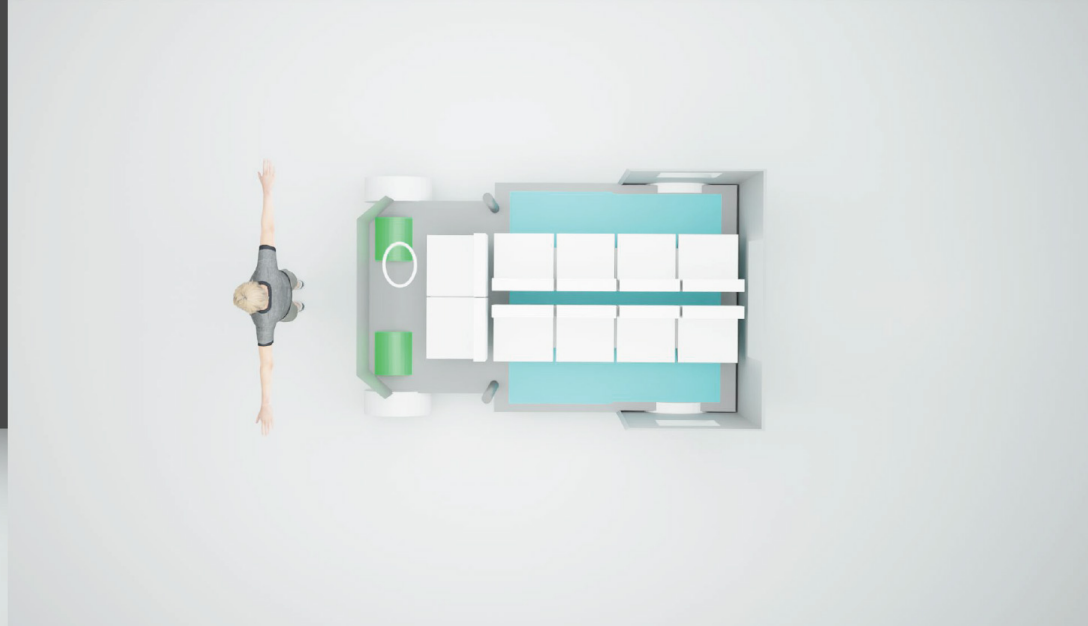


Ideation board
Seating arrangement

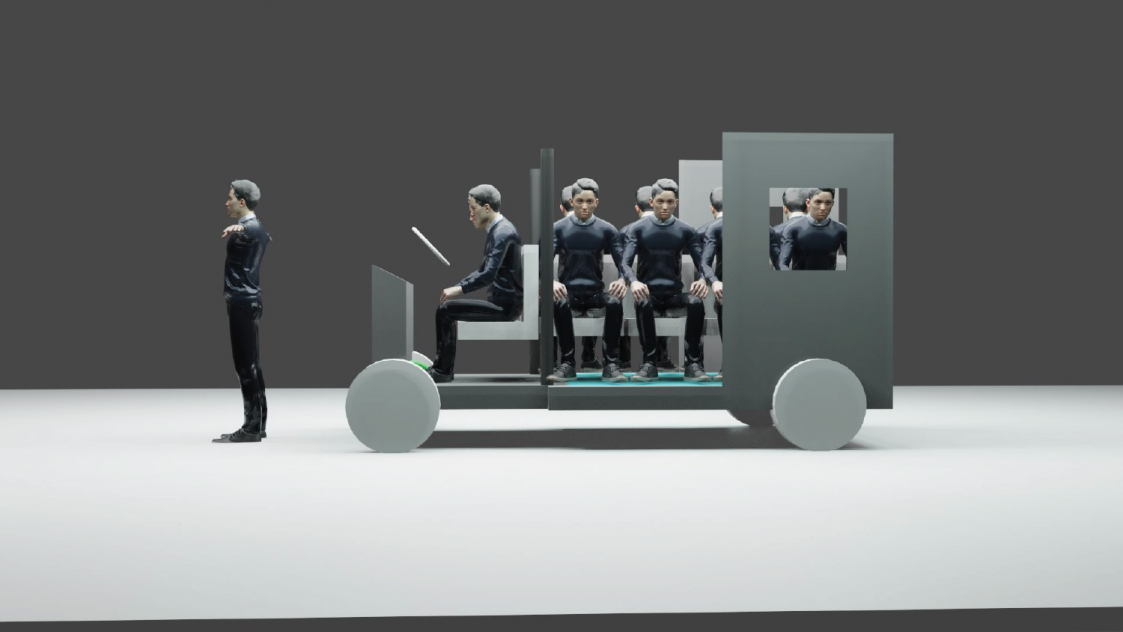
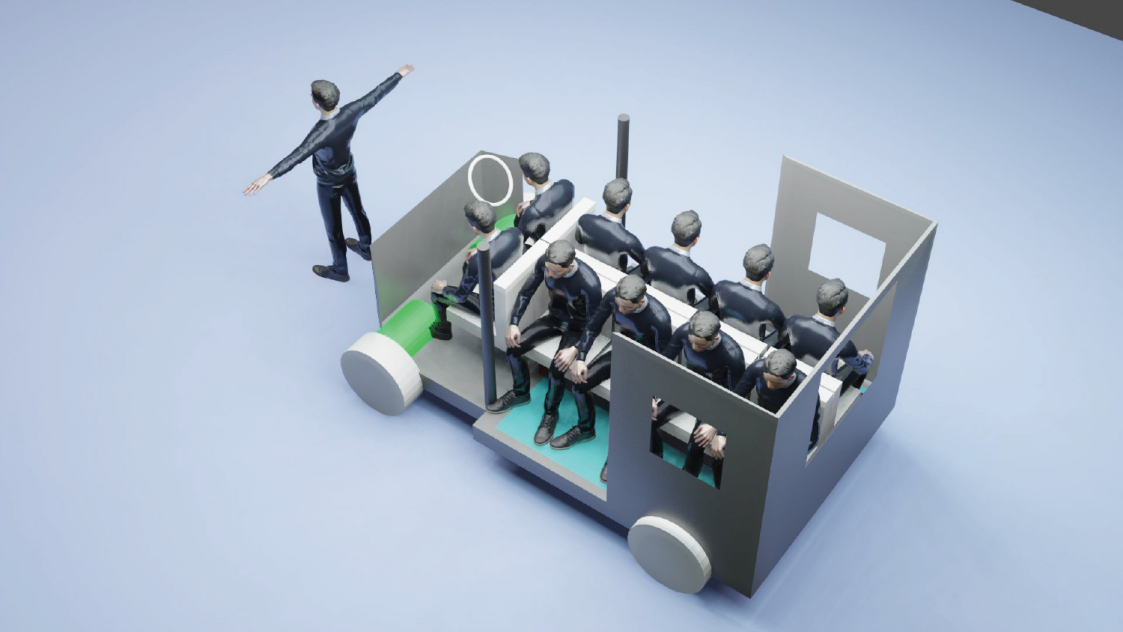
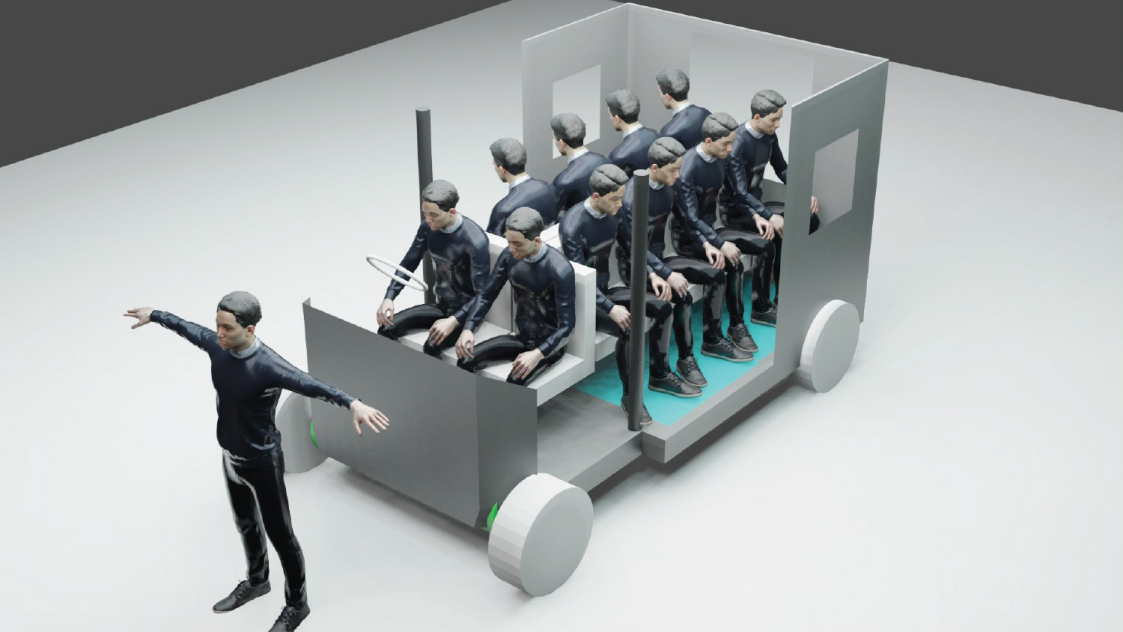


Technical specs	
motor	8 kw (4 + 4)
battery	8KWh

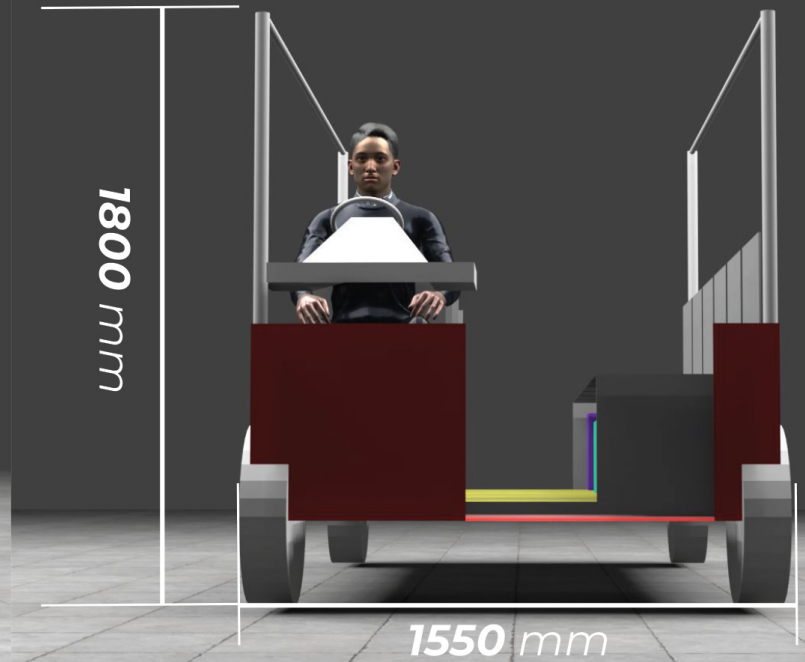
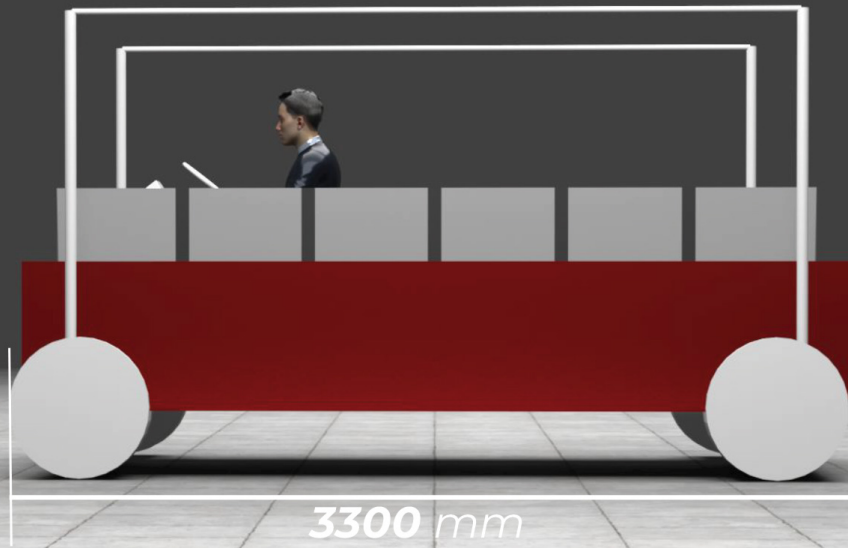
Layout **1**



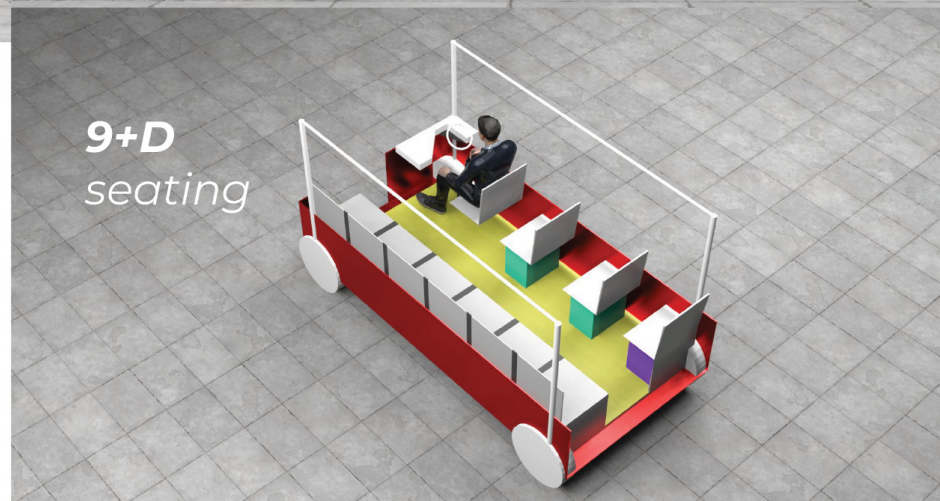
dimensions	
length	3100 mm
width	1600 mm
height	1900 mm
Ground clearance	240 mm



Layout 2



dimensions	
length	3300 mm
width	1550 mm
height	1800 mm
Ground clearance	240 mm



2769 x 995 x 1854

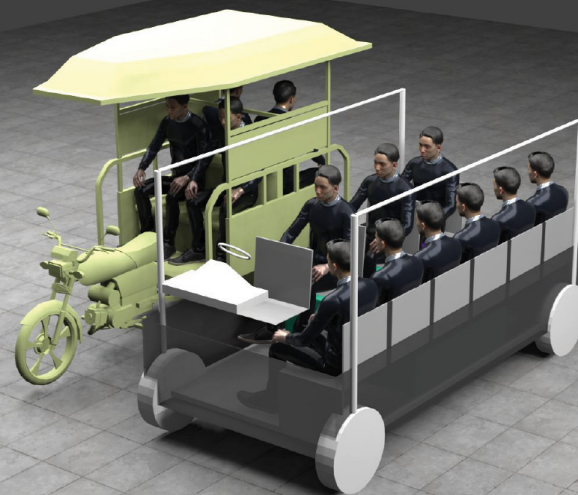
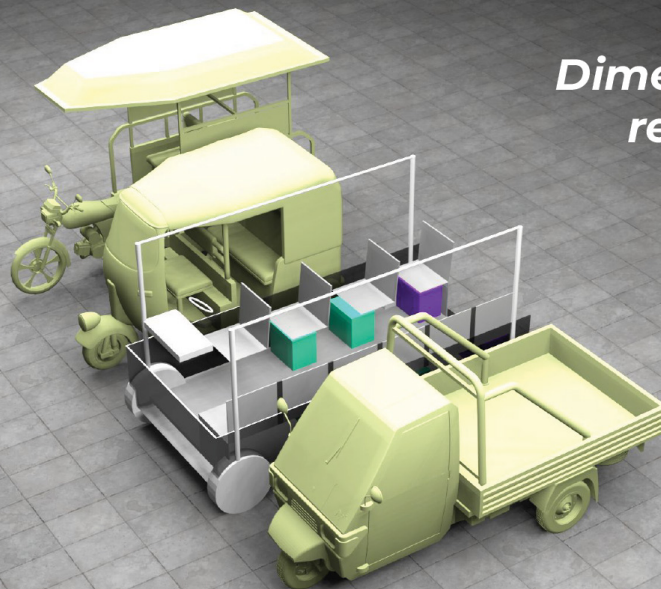
2769 x 1350 x 1750

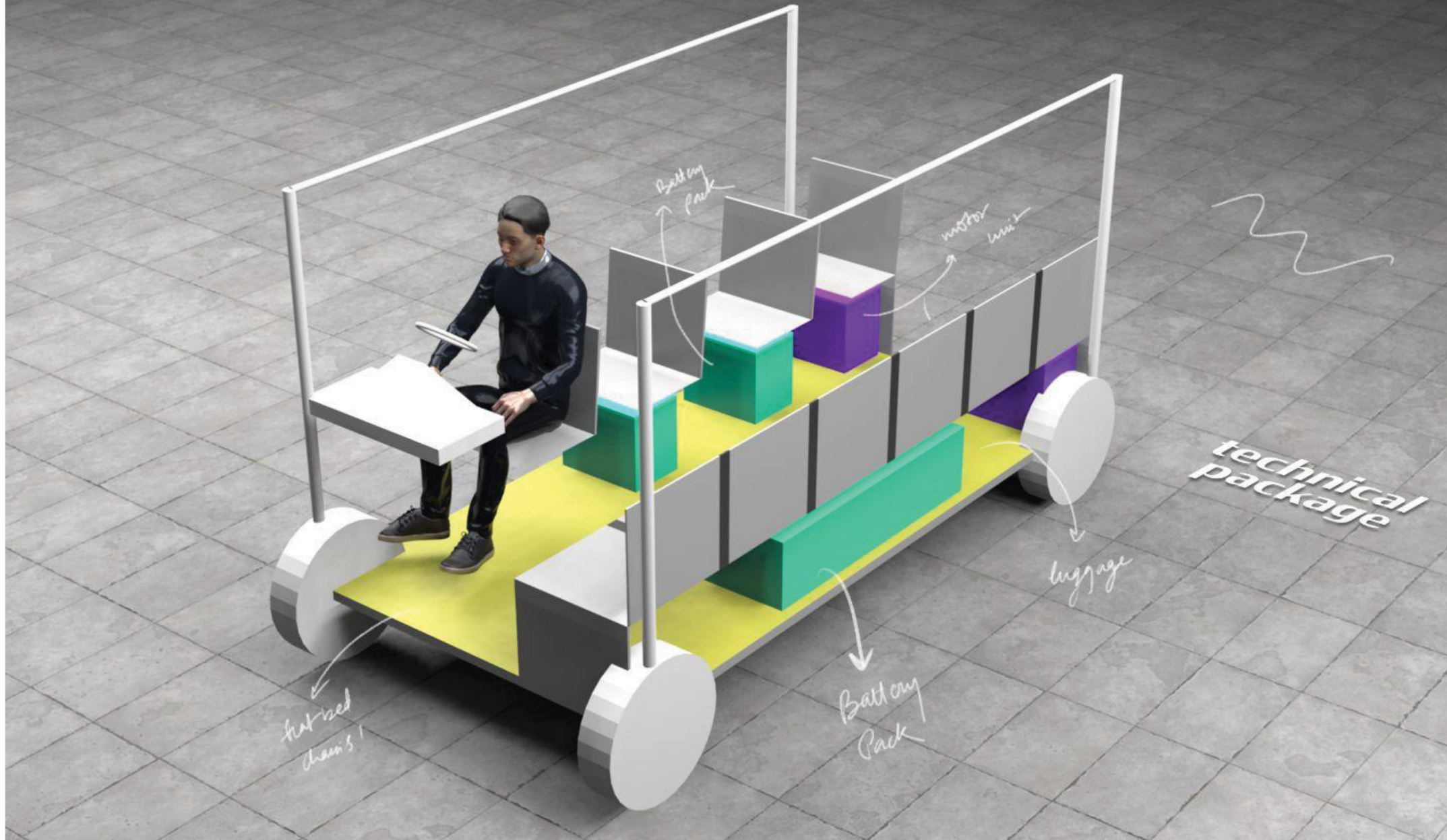
3295 x 1490 x 1770

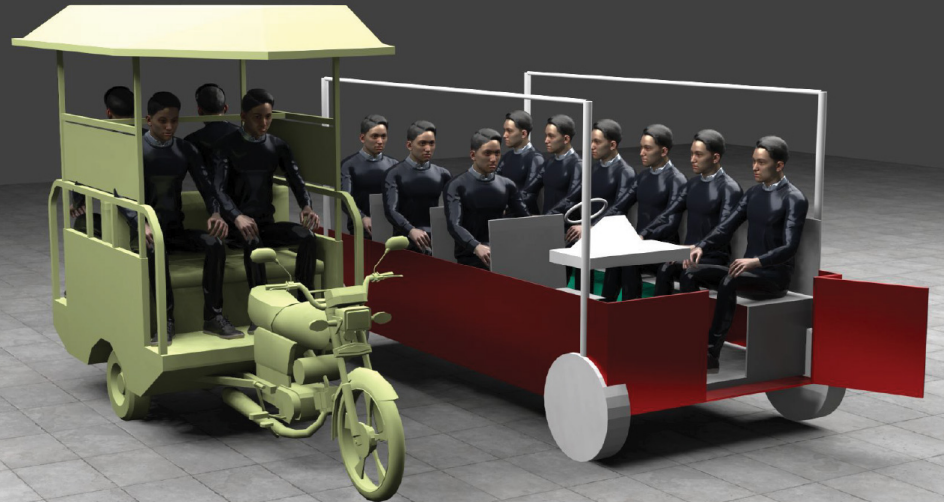
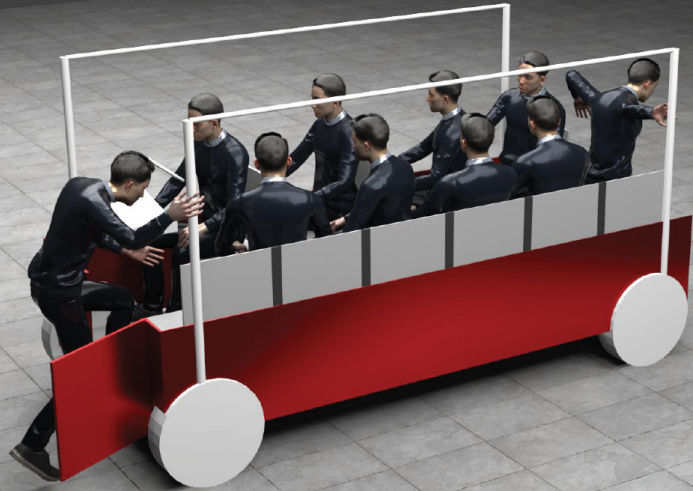
3300 x 1550 x 1800



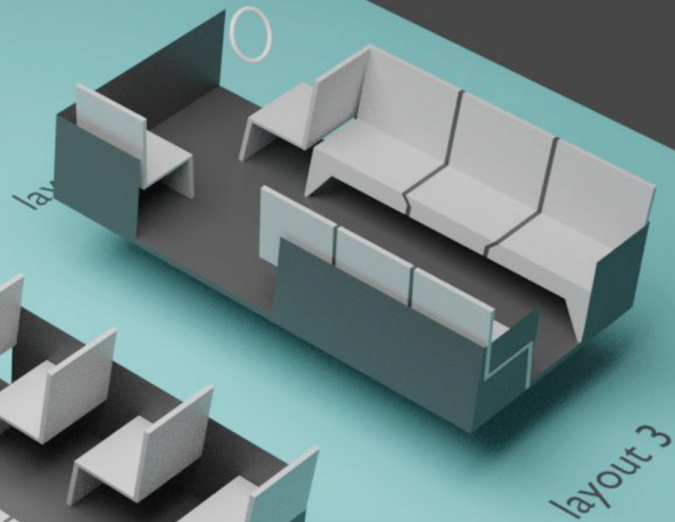
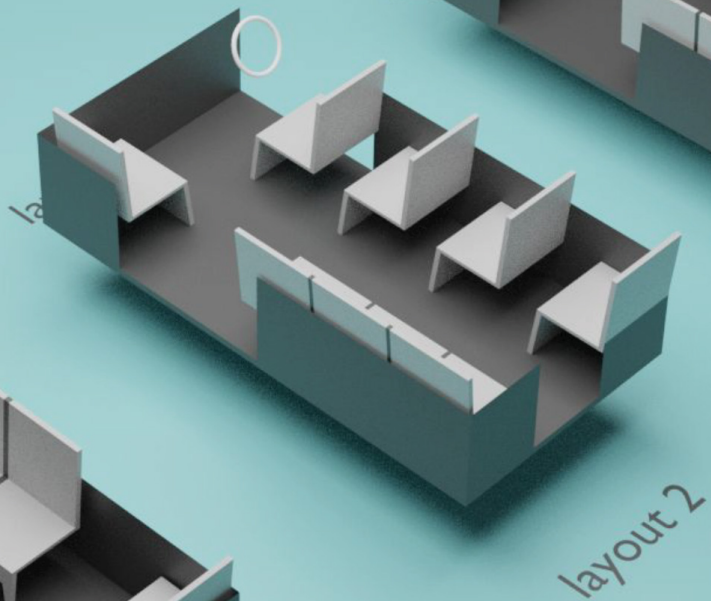
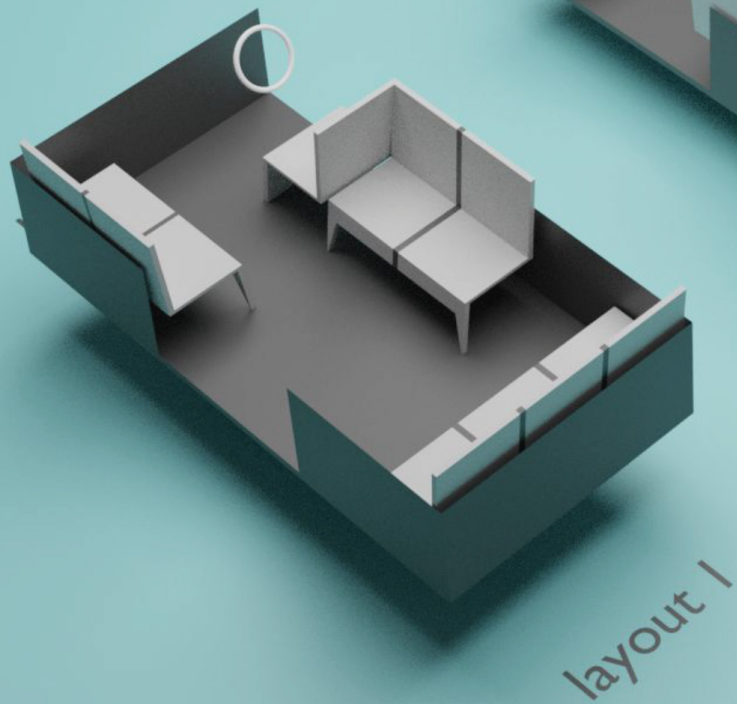
*Dimensional
reference*

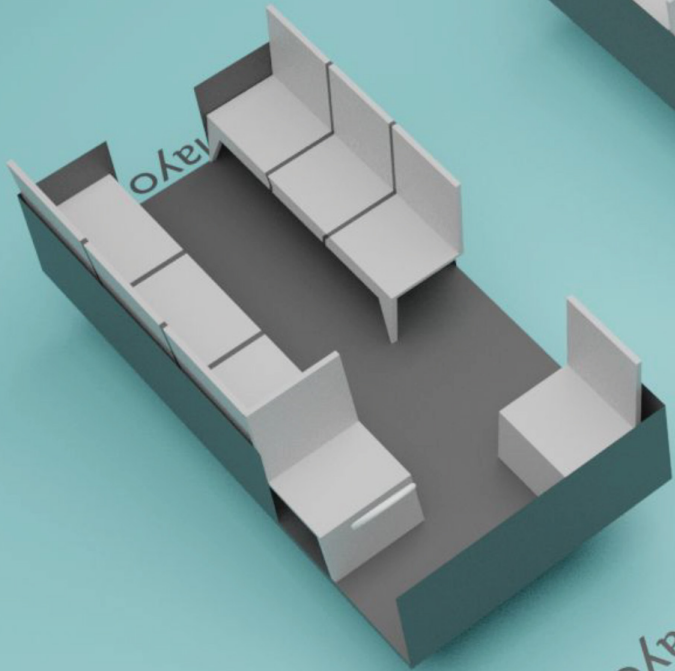




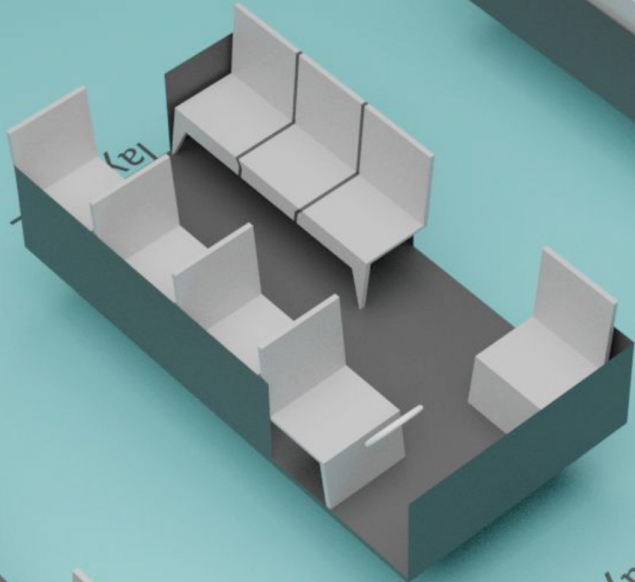


Layout 3



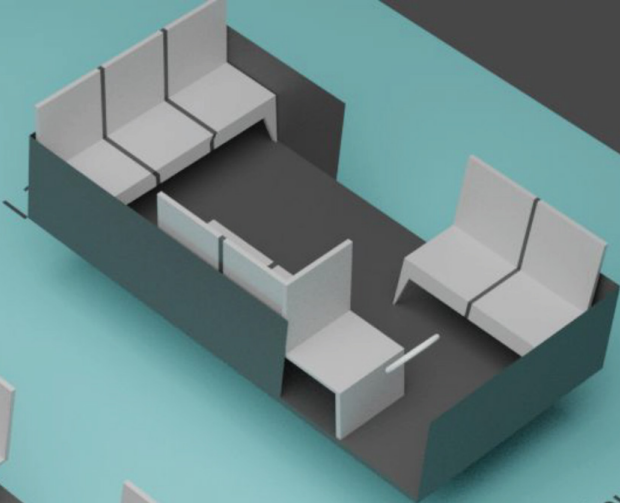


layout 3



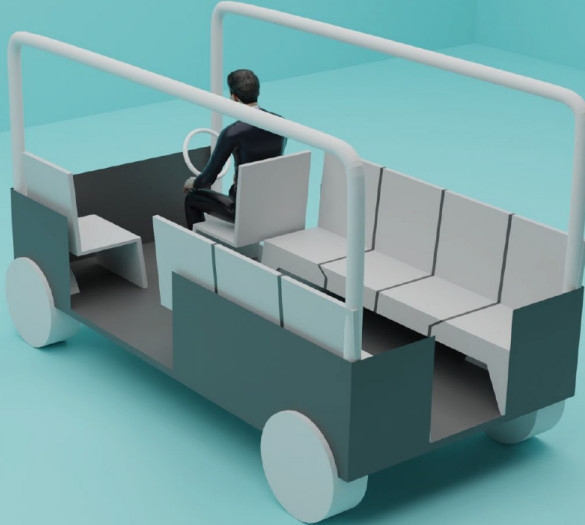
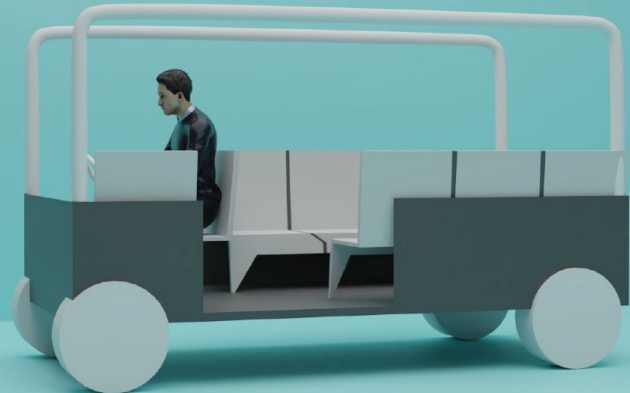
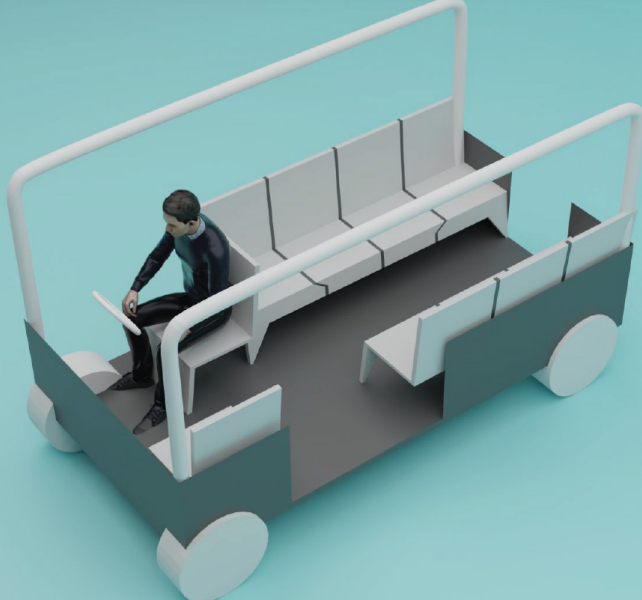
layout 2

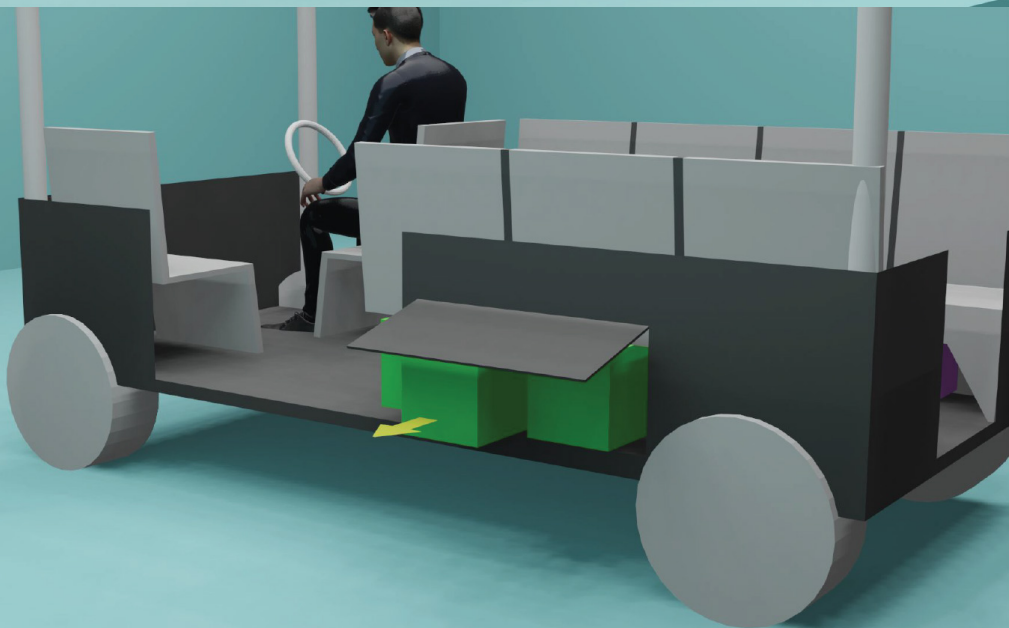
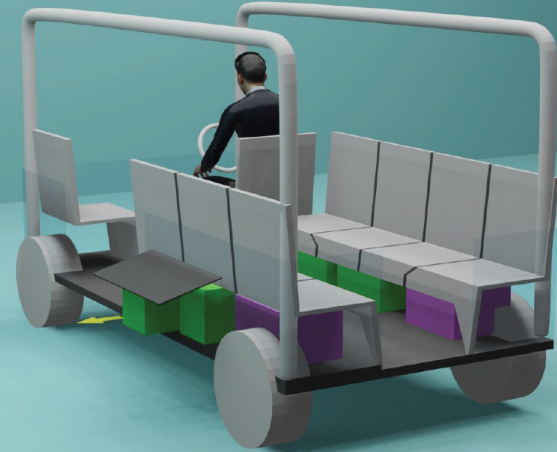
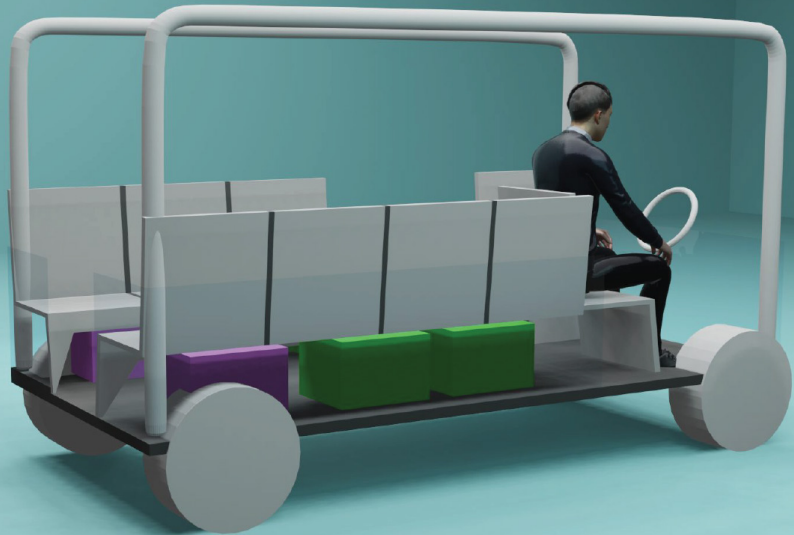
layout 2



layout 1

Final Layout

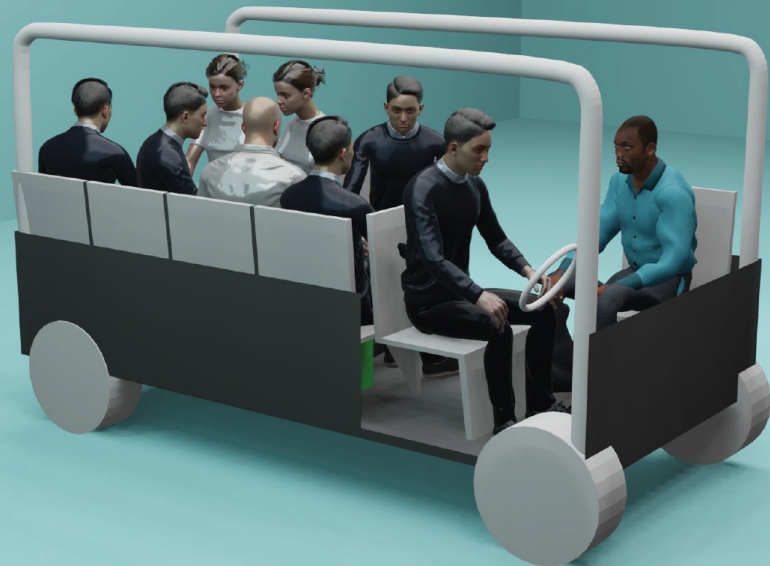




dimensions	
length	3300 mm
width	1550 mm
height	1800 mm
Ground clearance	240 mm

 Replaceable batteries

 motors



Low cost vehicle manufacturing



₹ 1.43 Lakh [Get Latest Price](#)


Brand	Mayuri
Statewise Approvals Available	Bihar
Vehicle Capacity	6 Seater
Seating Capacity	6
Minimum Order Quantity	1

[View Complete Details](#)



4 Stroke Bajaj Auto Rikshaw Bs6, Model:

₹ 2.05 Lakh [Get Latest Price](#)

 [Product Brochure](#)

Brand	BAJAJ
Model	Compact 4S
Fuel Type	PETROL/LPG/CNG
Seating Capacity	3
Engine Type	4 Stroke
Vehicle Model	COMPACT



Tubular steel frame



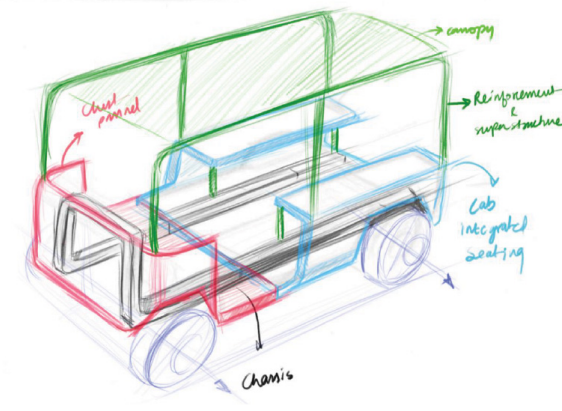
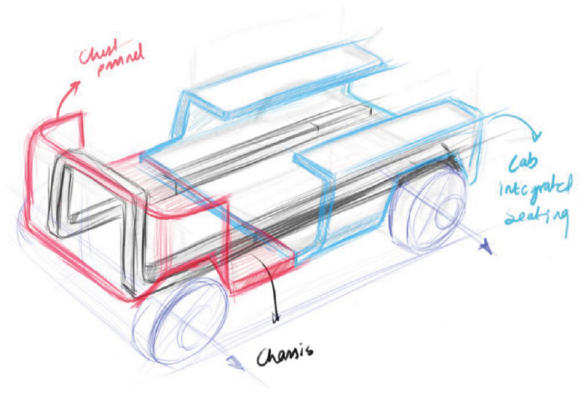
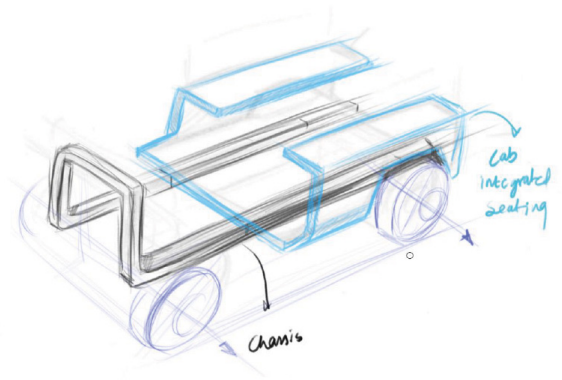
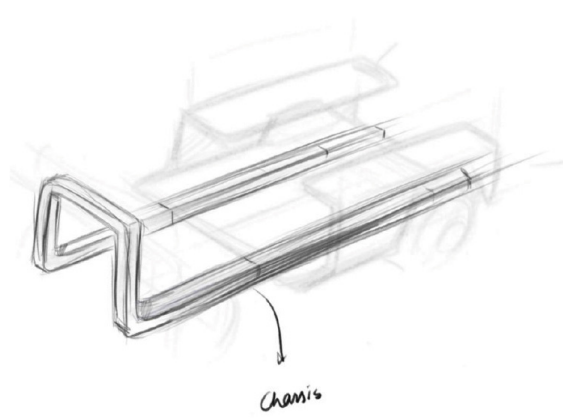
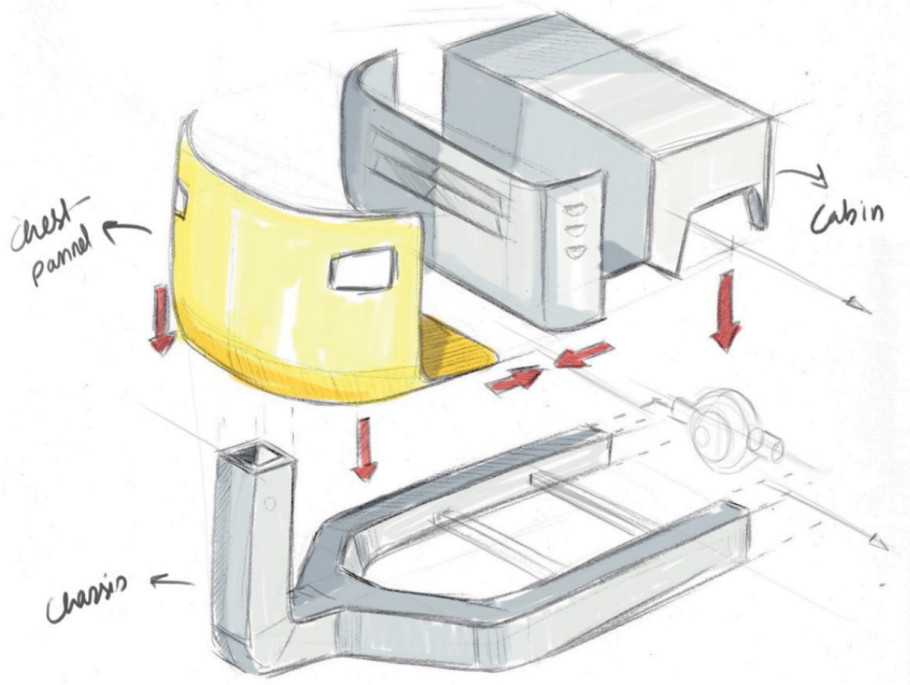
Drivetrain assembly



Body assembly
(Body on frame)

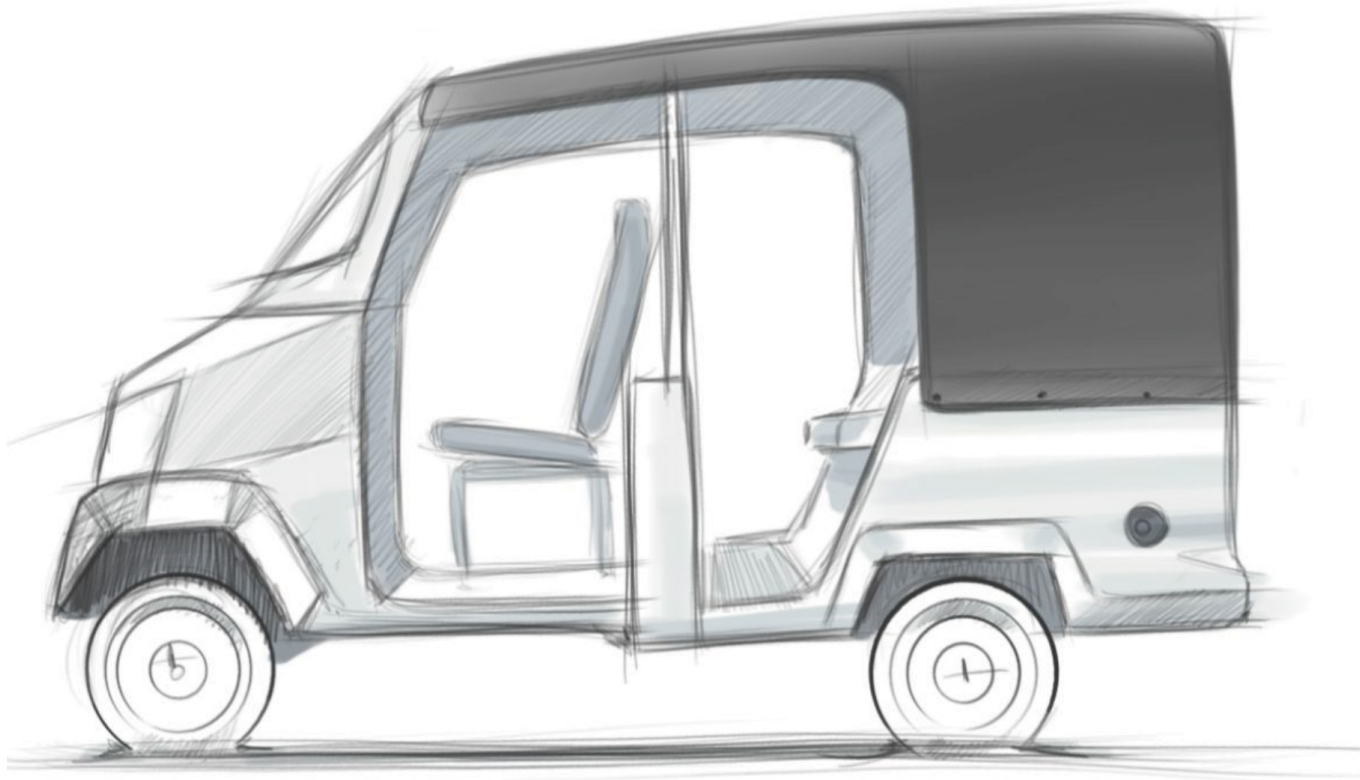


Final assembly and inspection



Reinforcement & superstructure

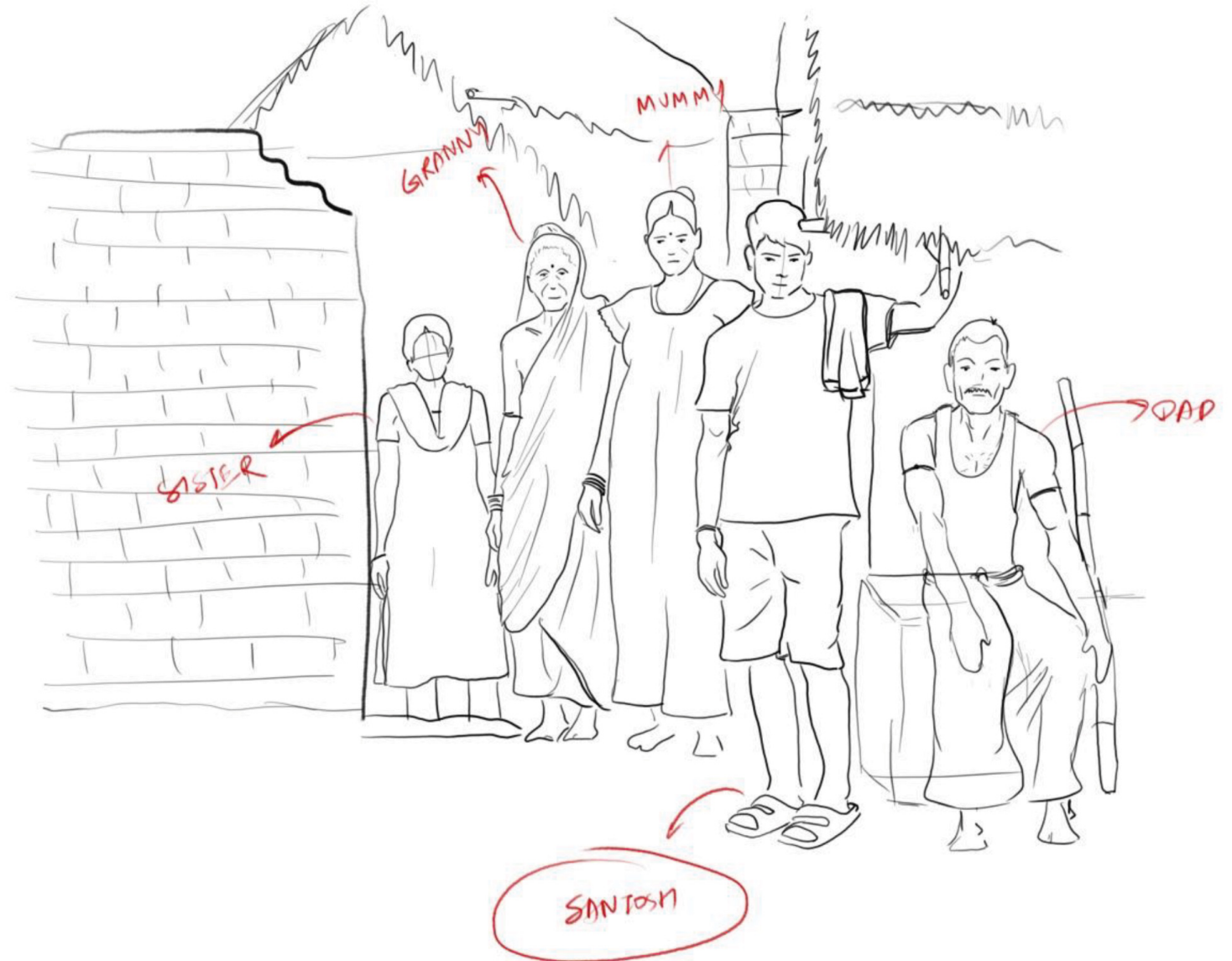
Reference vehicle



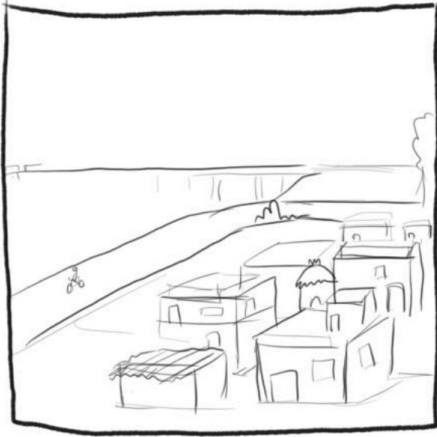


Storyboard

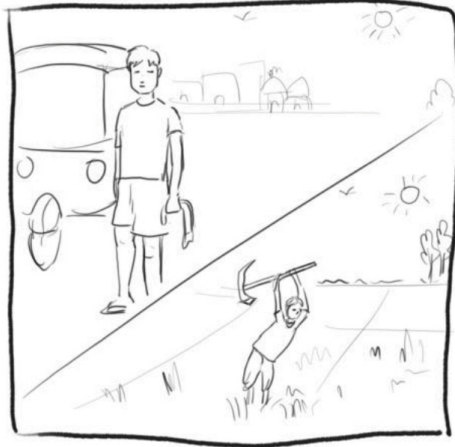
सपने : किसके पहले ?



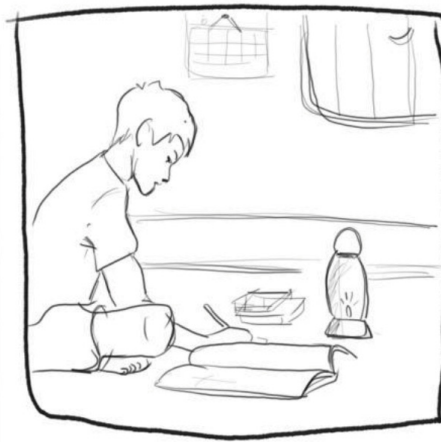
Santosh lives by the bank of river ganga in the village of champapur



To manage the family, santosh contributes by driving auto rickshaw and his father does farming.



Santosh wishes to get a govt. Job so he manages to study at night and drive auto in morning



Santosh uses his auto to go to his coaching and then for picking passengers. His mother comes to see him off like everyday



After his classes Santosh comes to the auto stand in the nearby marketplace to get passengers.



He sees a well dressed person and makes space for him in the front seat, the person refuses at first but santosh convince him



Santosh is excited to find that the person is going for the interview of same exam he wishes to appear for and ask him for some tips.



Since he was busy talking he misses the bad road and hits a pothole. The auto loses its balance.

The auto maintains its balance somehow but the suited man falls from the auto.
Santosh: sir!!! Watch it!



Santosh: sir I'm really sorry, are you ok? Please let me take you to a nearby clothes store, your interview dress got all dirty!
Passenger: I told you I don't want to sit here. Now just leave me alone.
Santosh: But Sirrrr!!!

My interview is ruined now, wish I didn't listen to this foolish driver.

Second auto incoming: upar baith k chaliyega bhaiya?? Paanch rupaiya Kam bhanda dijiyega.



Santosh felt very sad about the incident and it got him thinking

Santosh: I ruined the interview, he would have worked so hard for this day. Should I not overload? But how will I manage my studies my family then?
I feel helpless!!

User persona

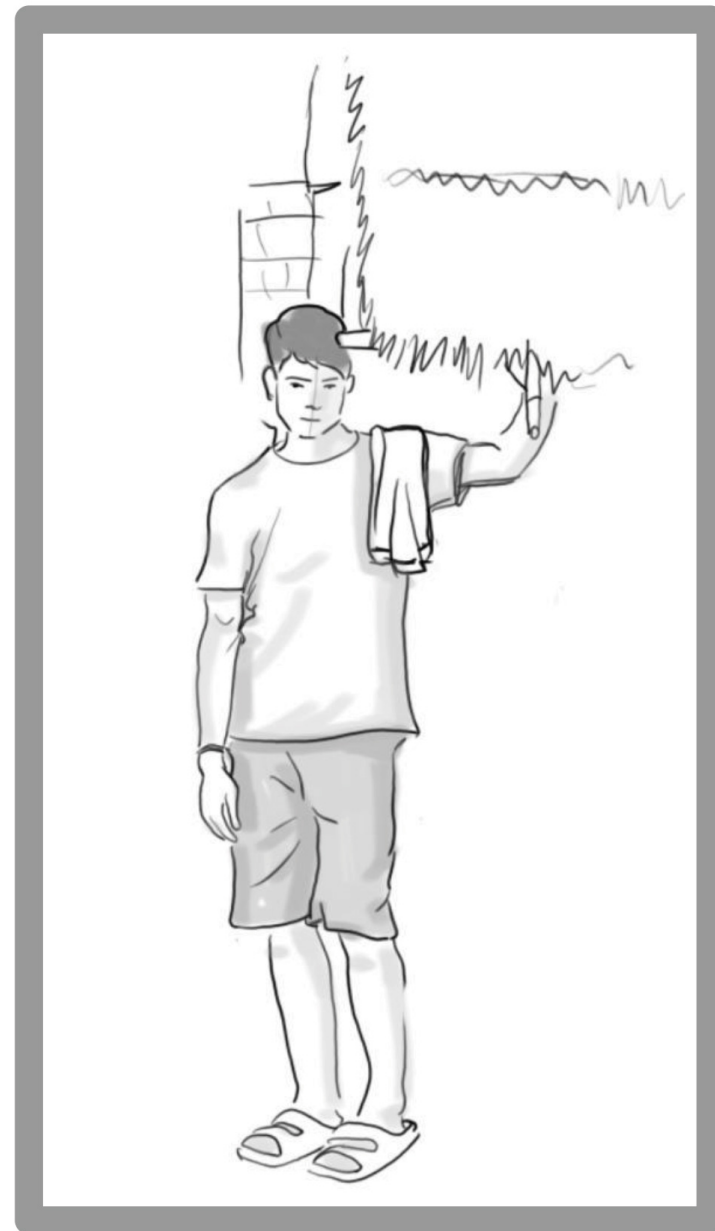
Name - Santosh Kumar

Age - 27 (Male)

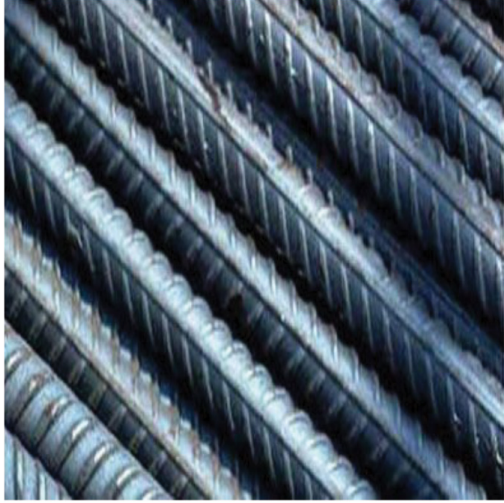
Profession - Student and part time auto-rickshaw driver

Vehicle owned - Piaggio Ape

Aspirations - To make a decent living out of his part time occupation and support his family and his education.



moodboard

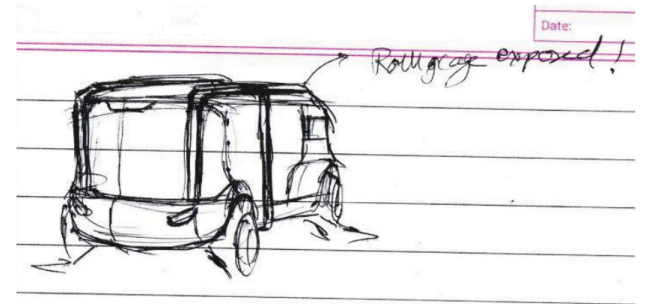
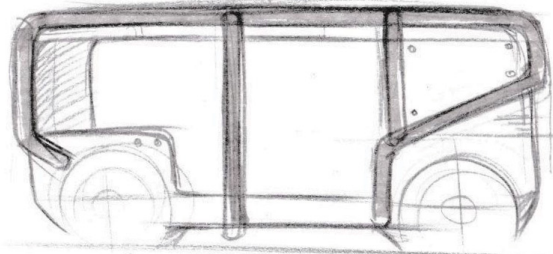
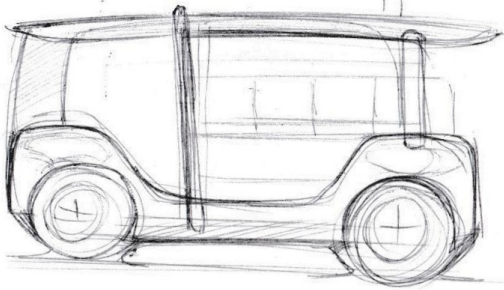
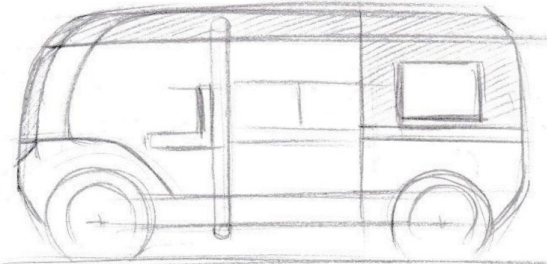
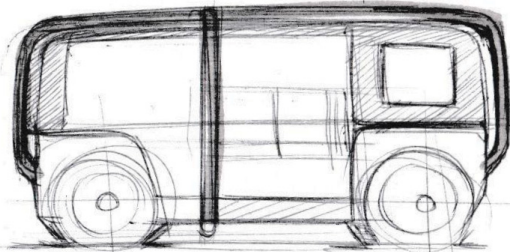
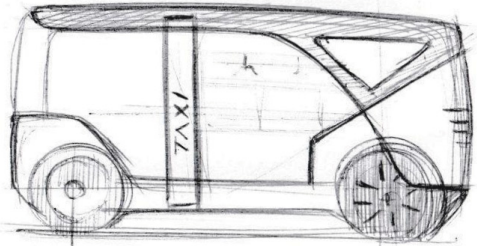
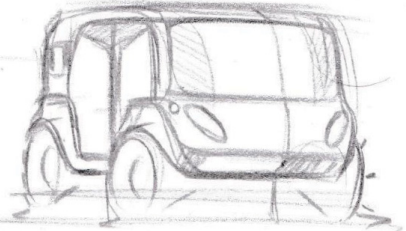
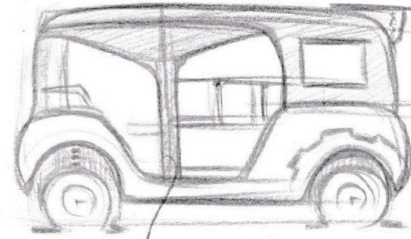
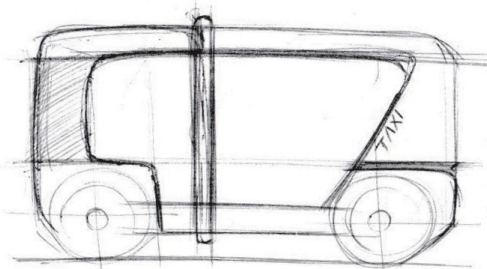
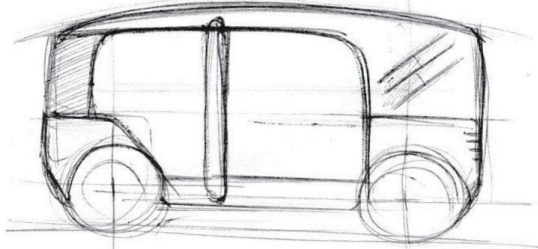


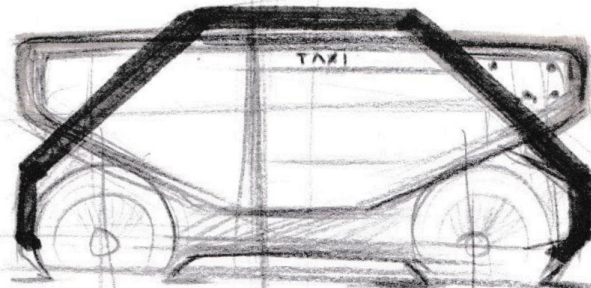
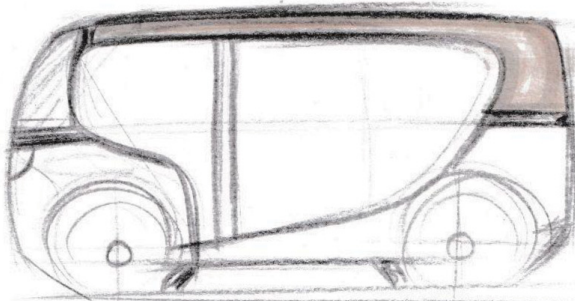
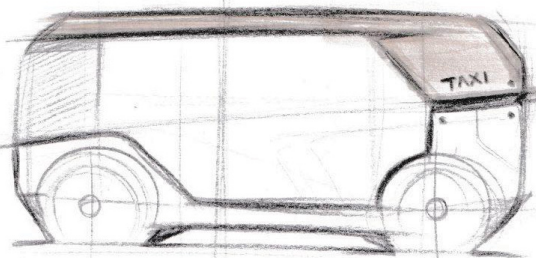
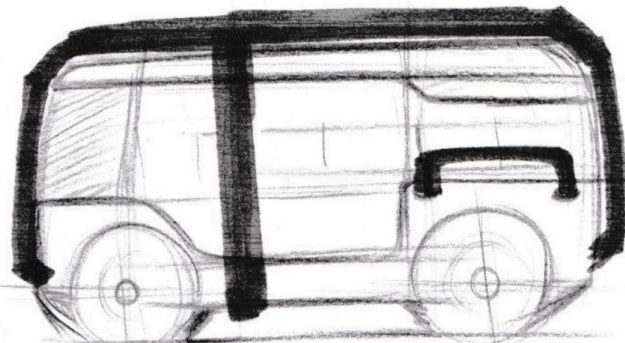
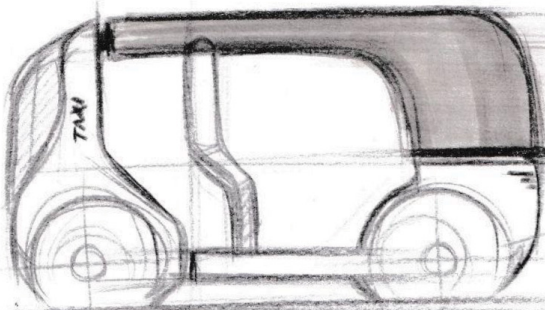
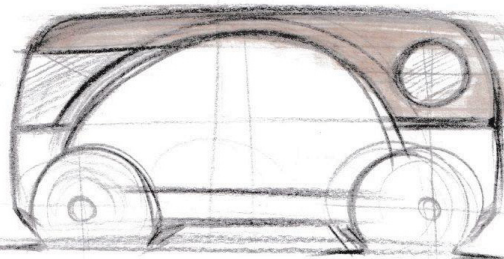
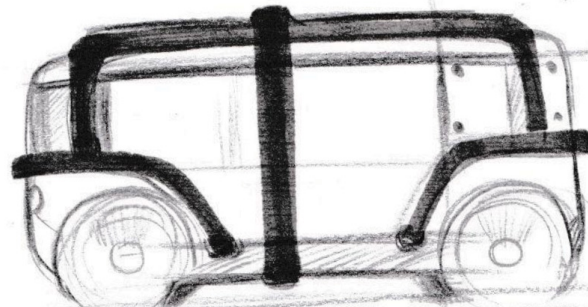
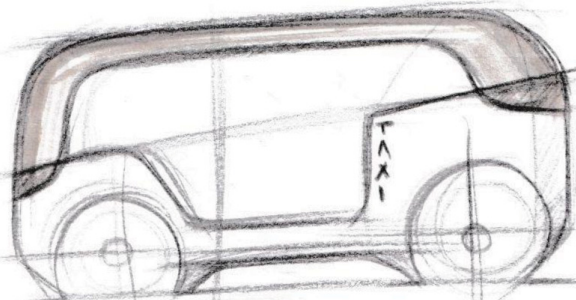
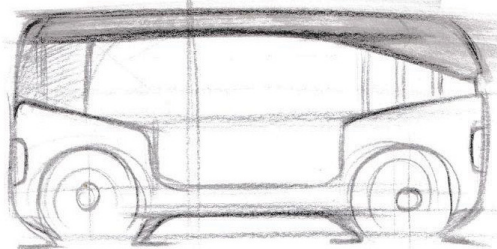
**बरियार
और
ढाल**

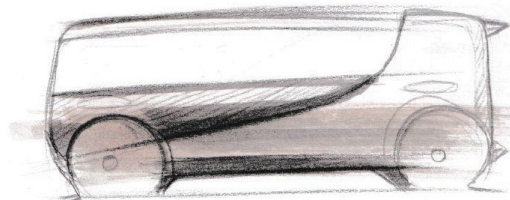
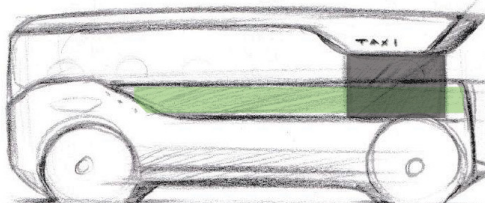
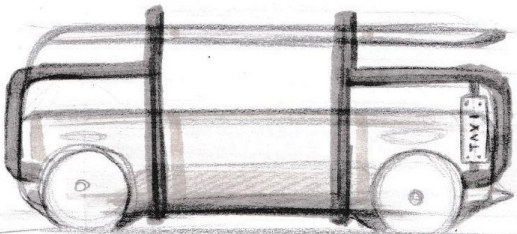
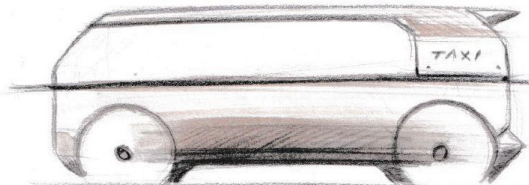
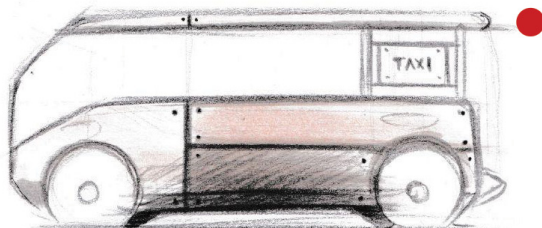
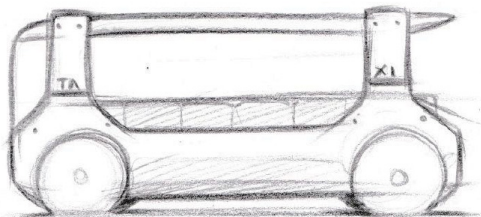
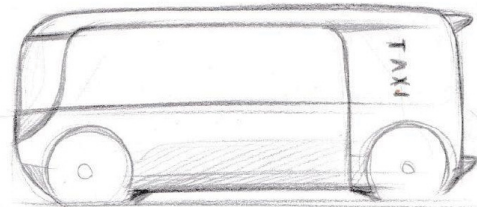
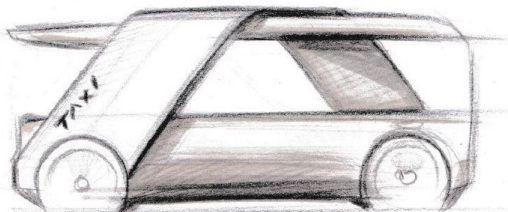
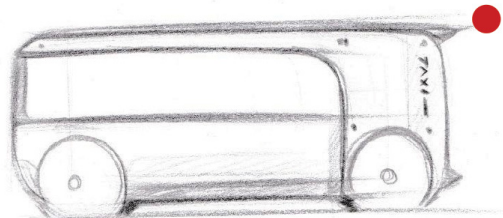
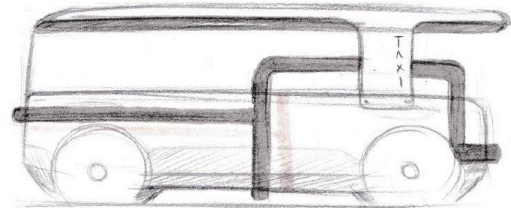
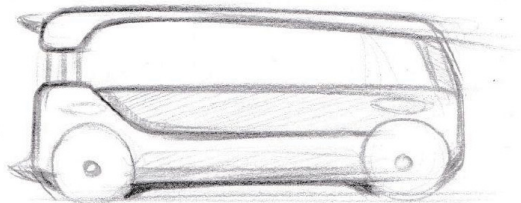
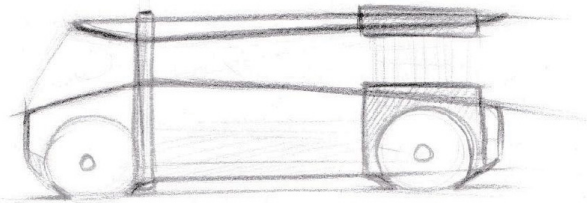
Vernacular for

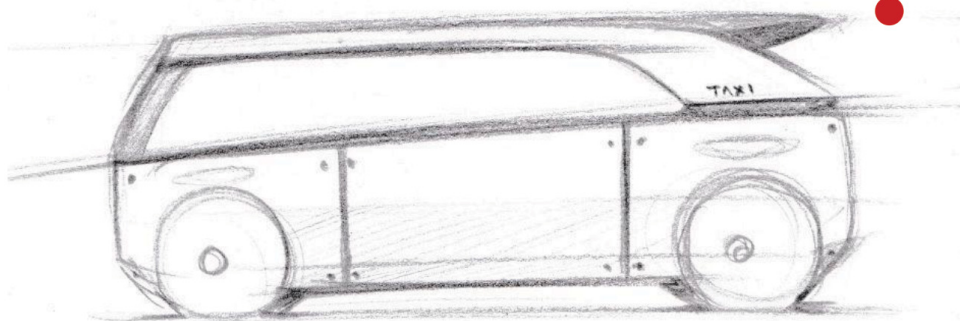
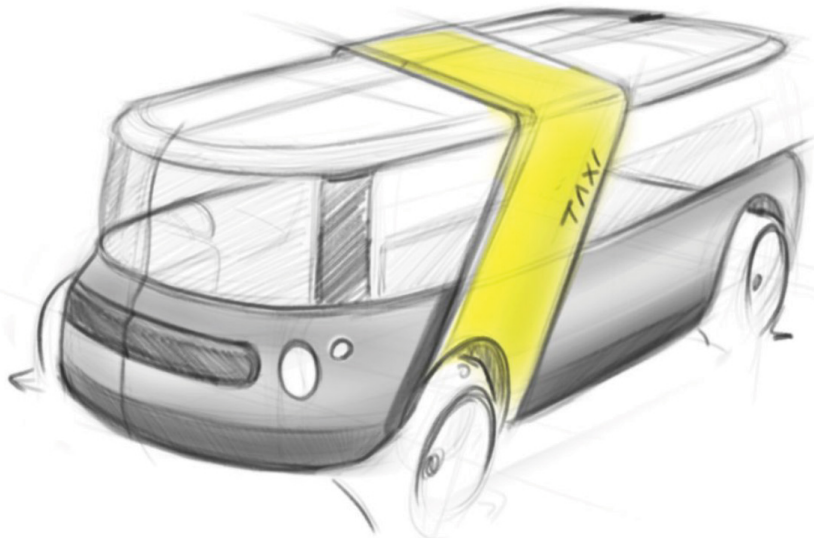
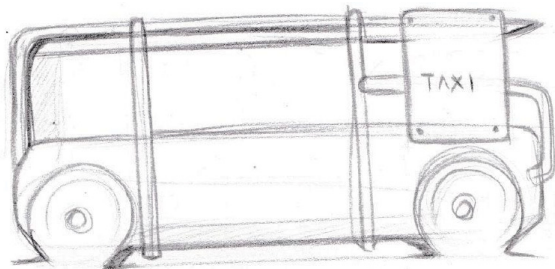
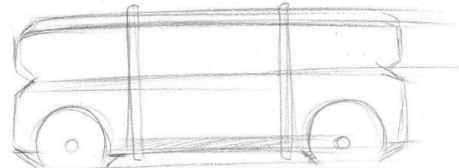
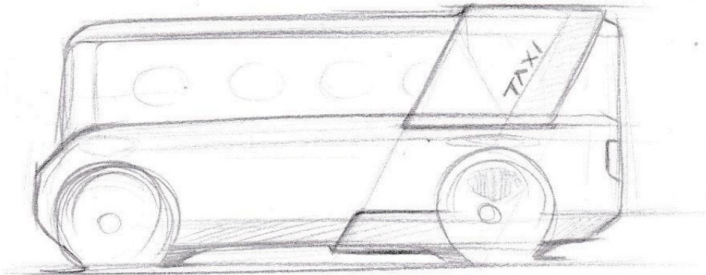
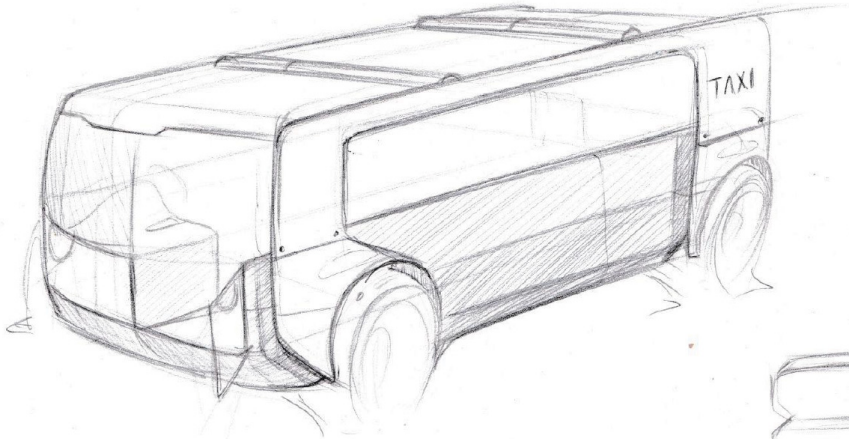
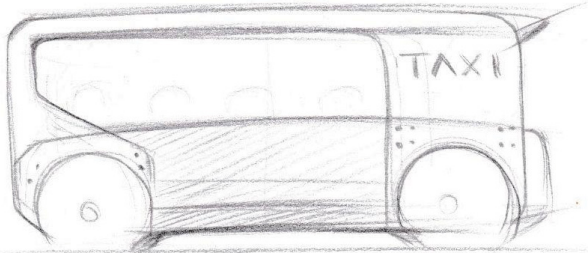
**Tough and
cocooned**

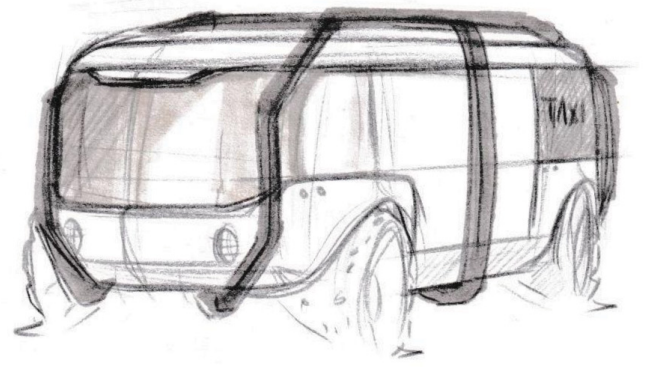
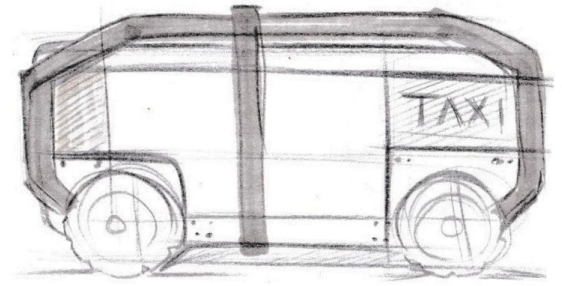
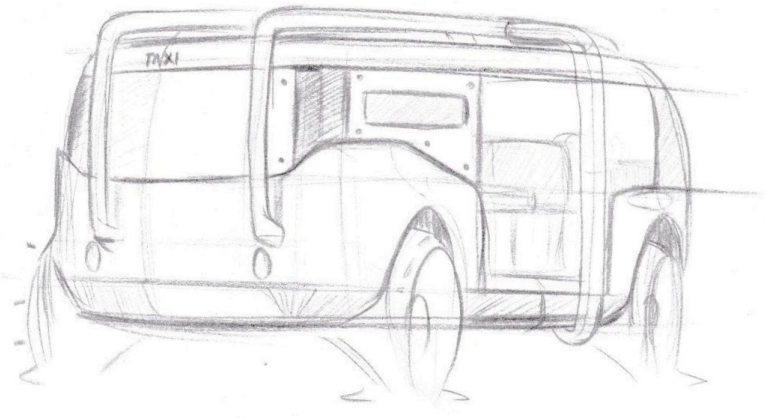
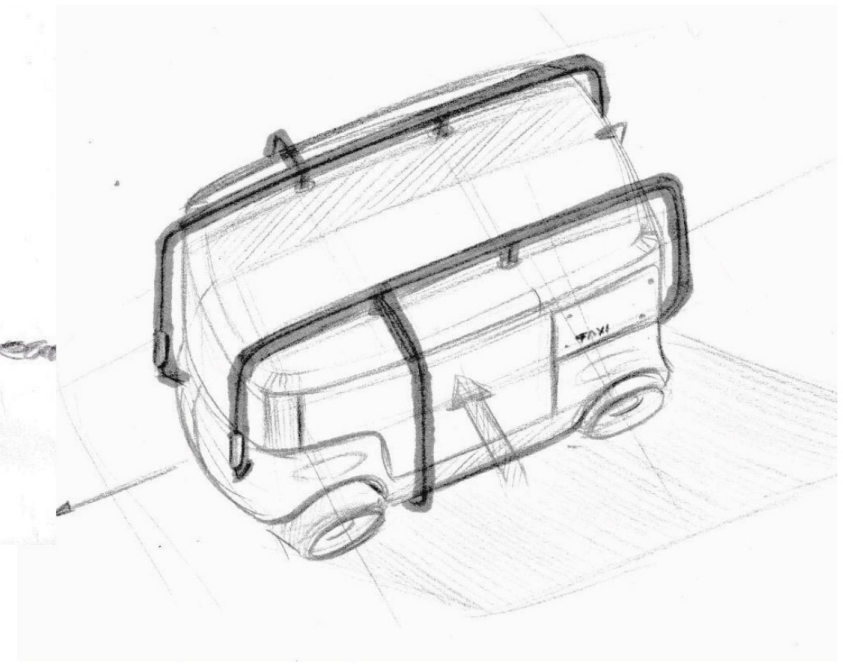
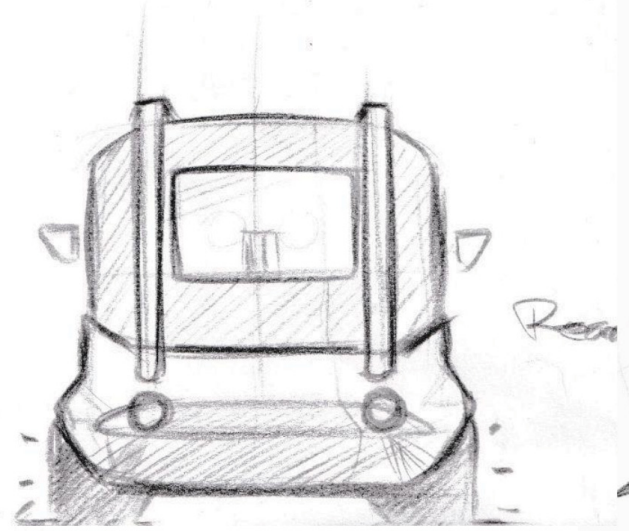
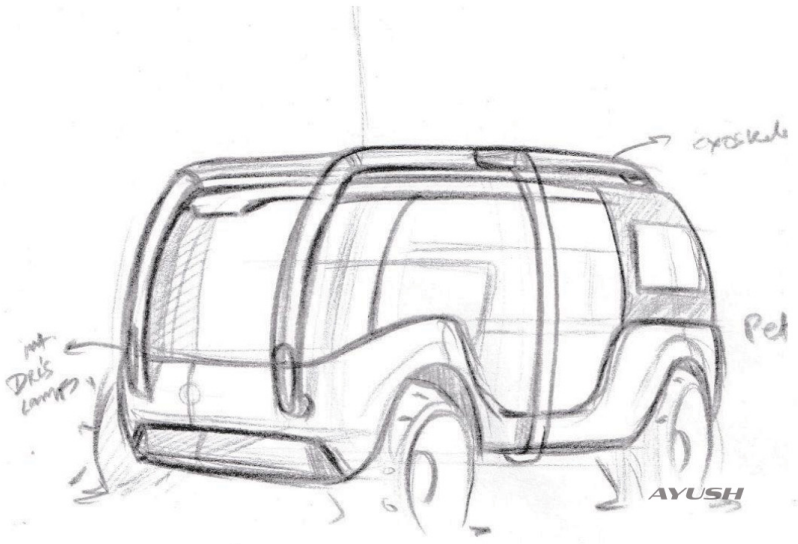
ideations

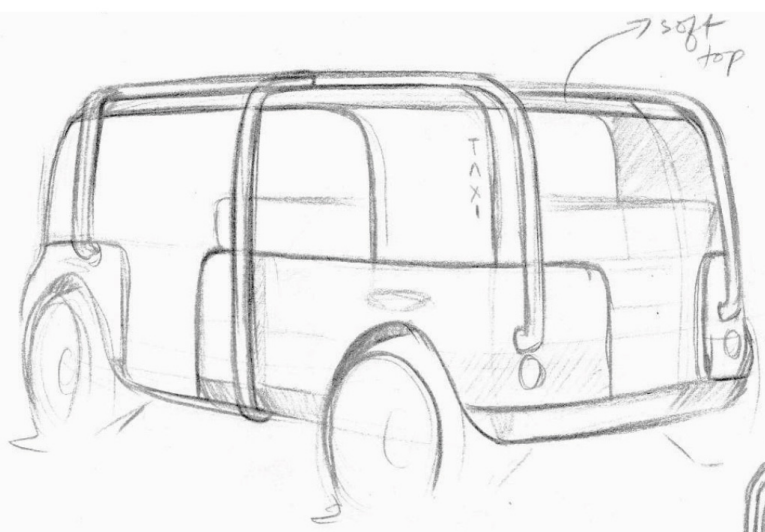
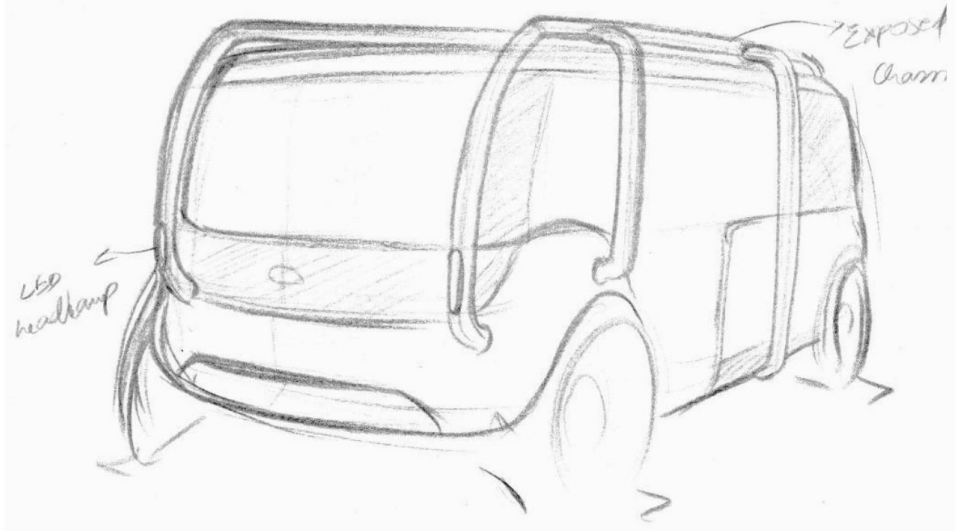




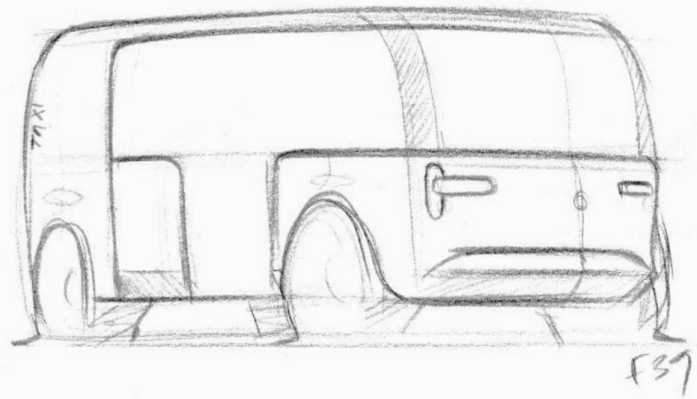
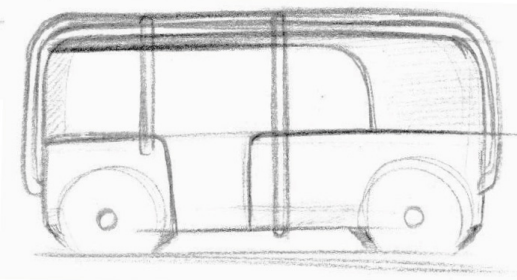




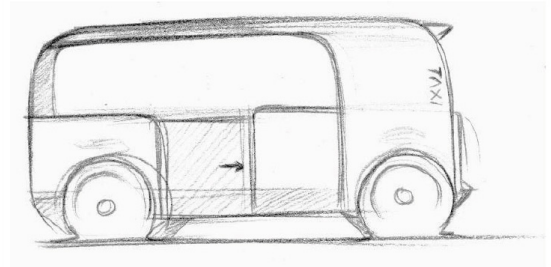
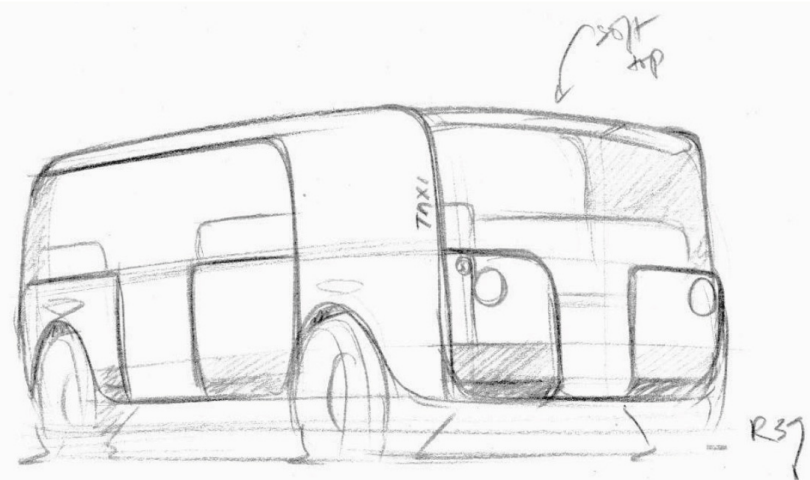


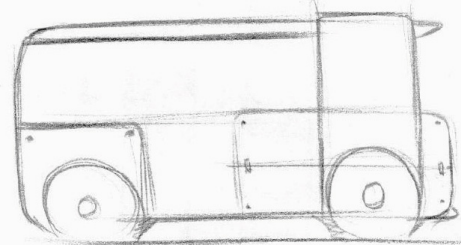
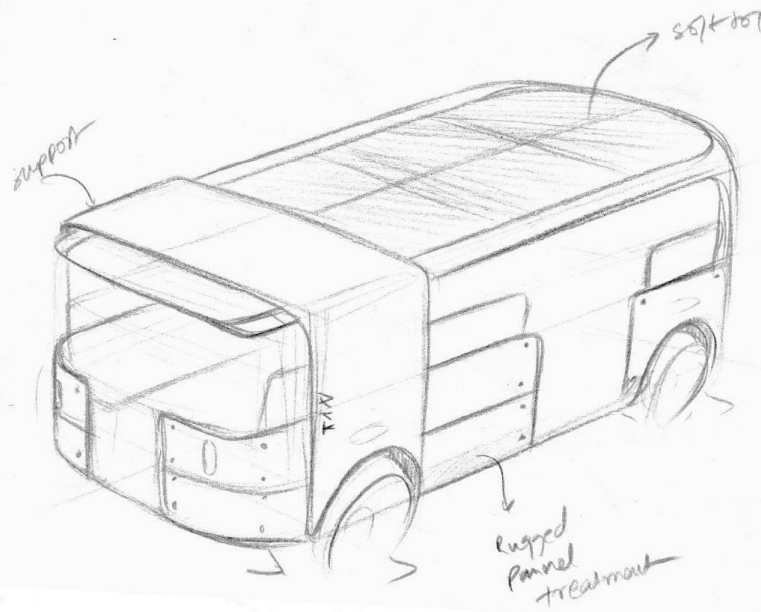
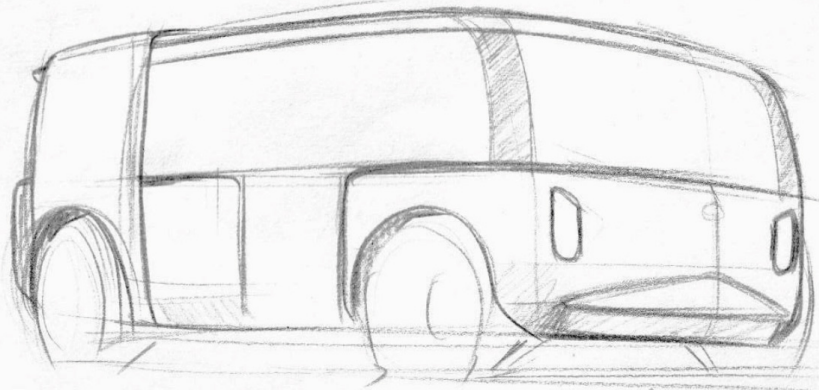


Direction 1

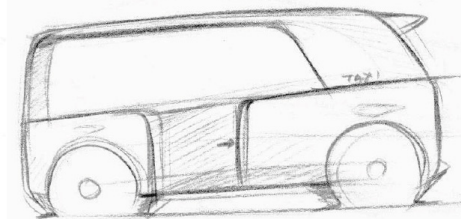
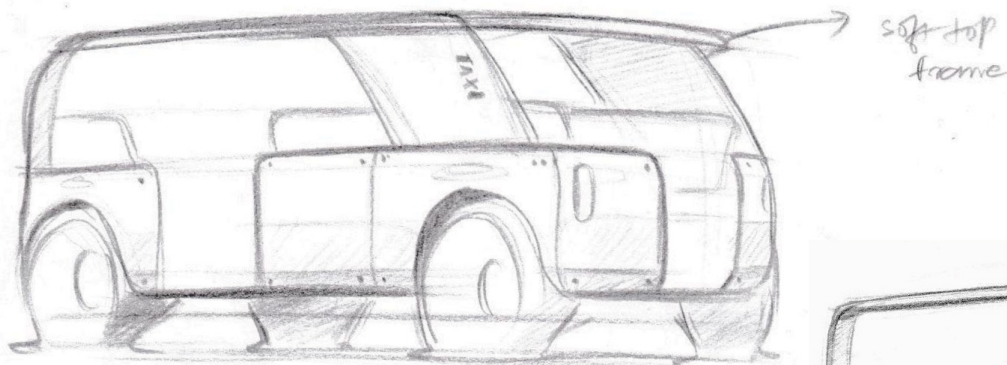
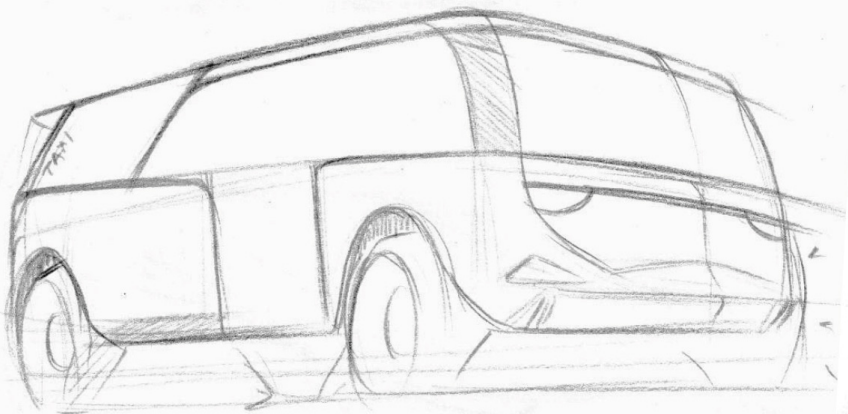


Direction 2

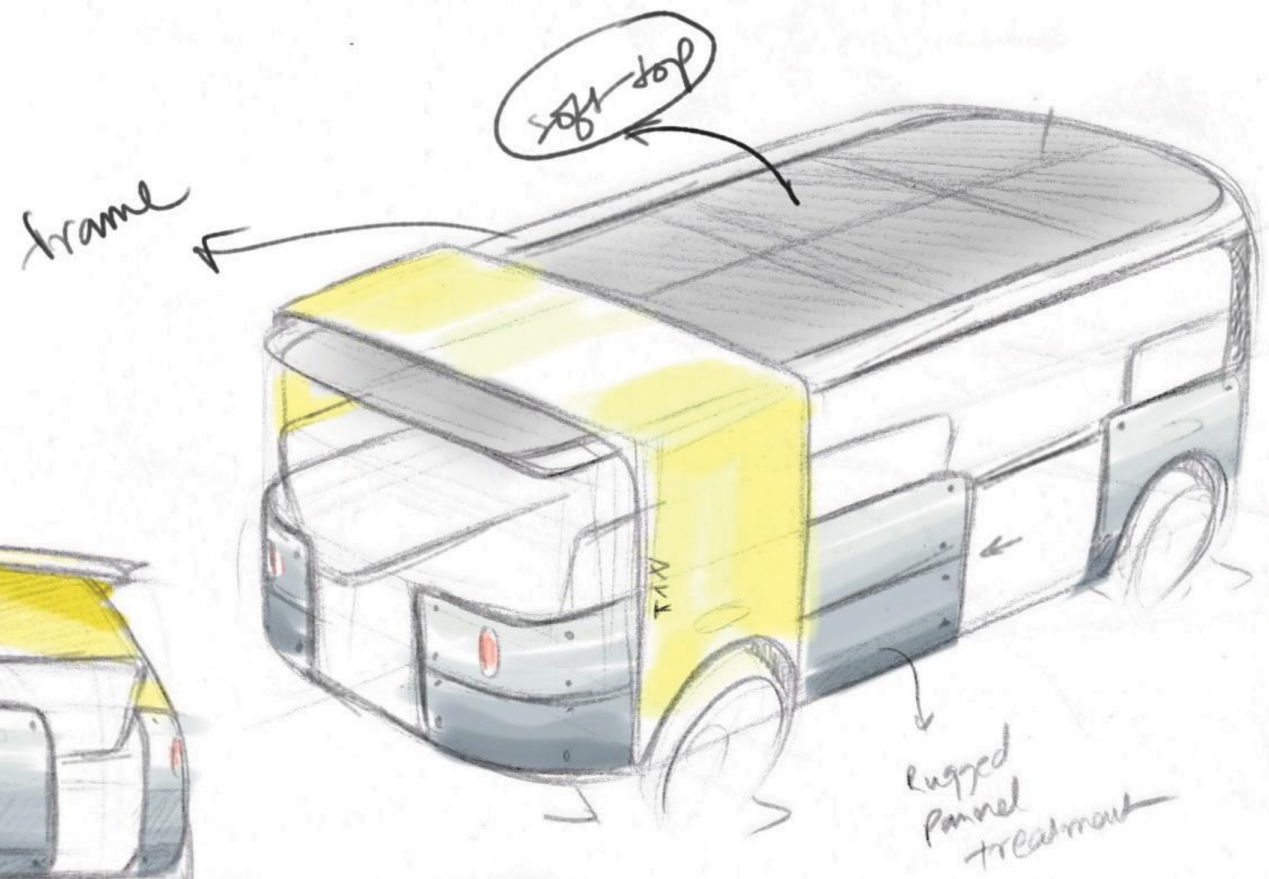
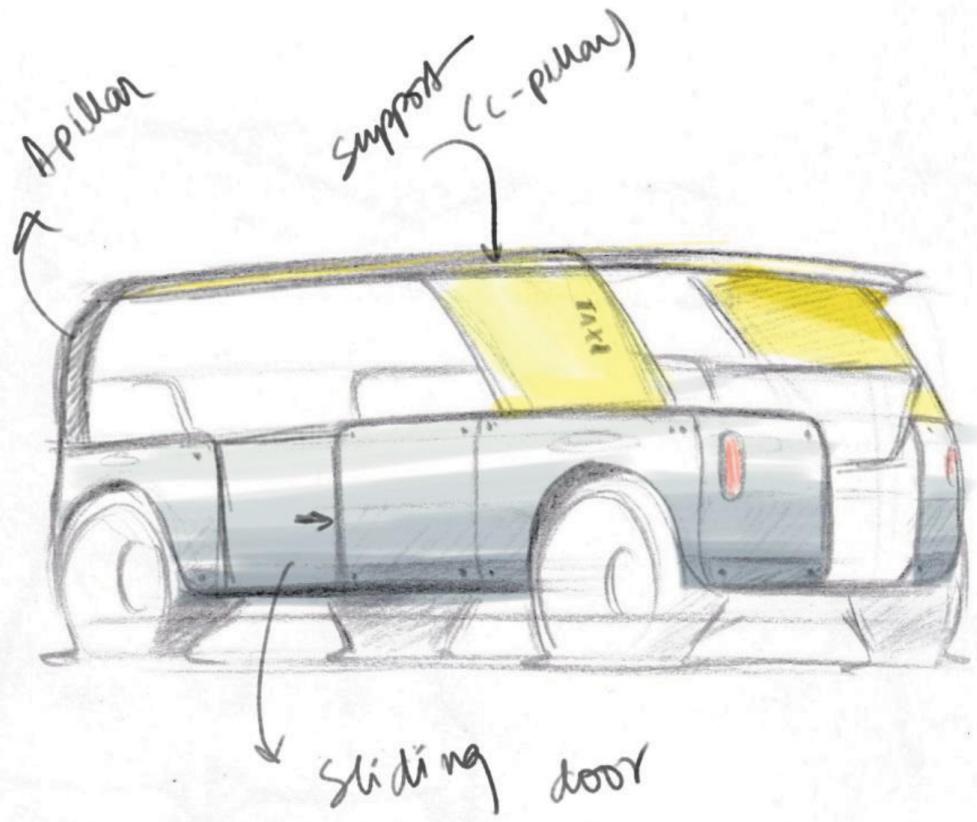


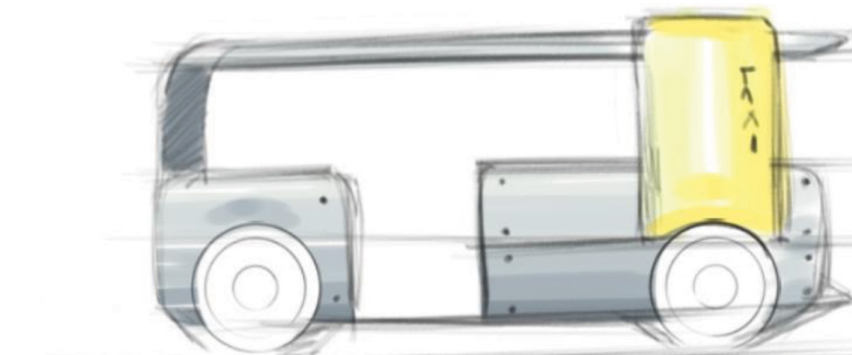
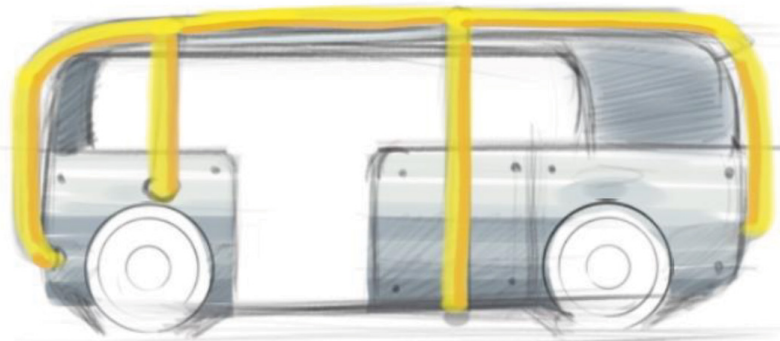
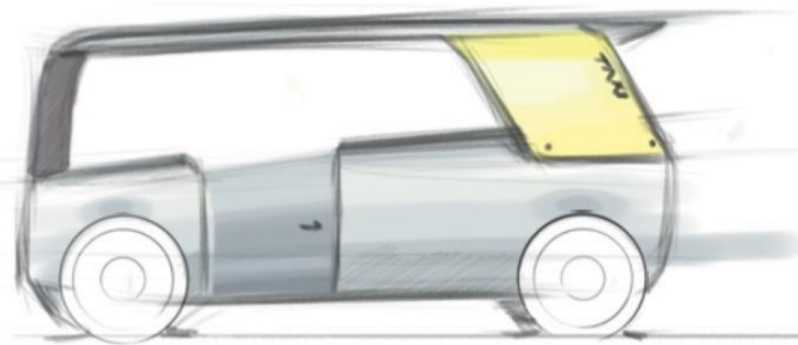
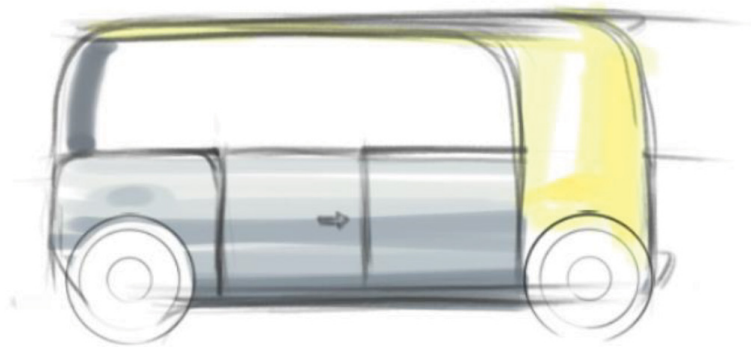


Direction 3



Direction 4

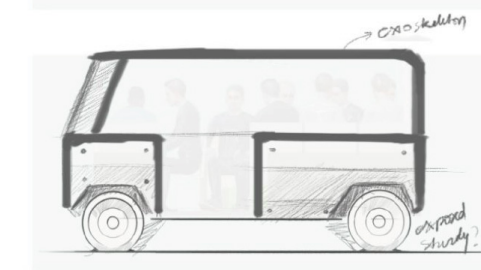
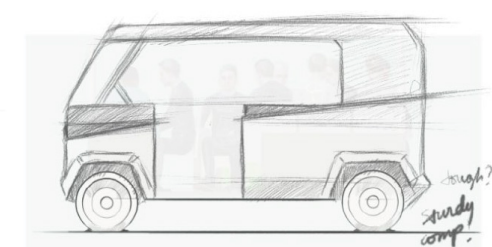
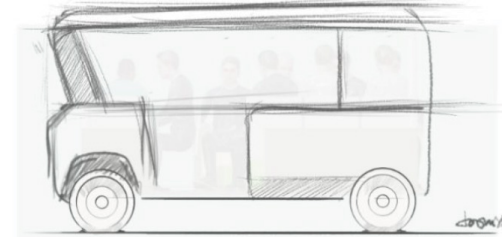
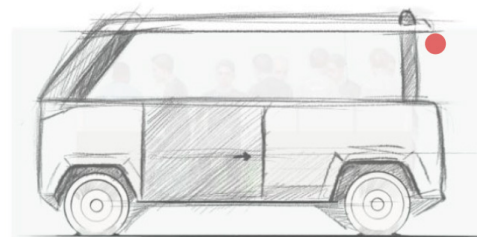
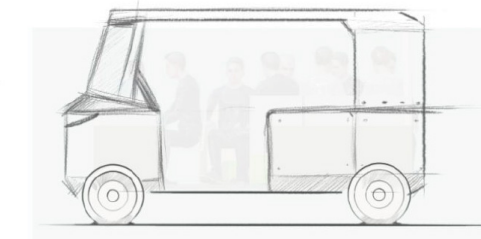
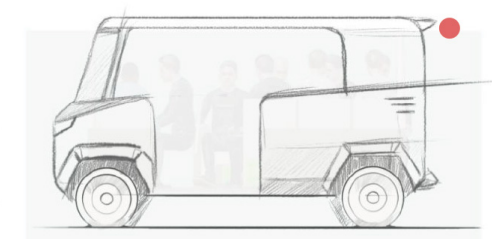
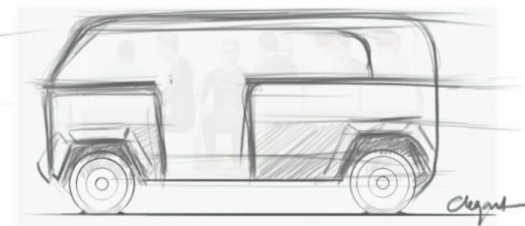
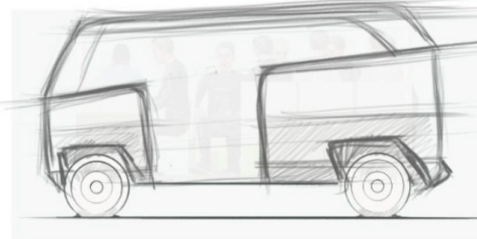
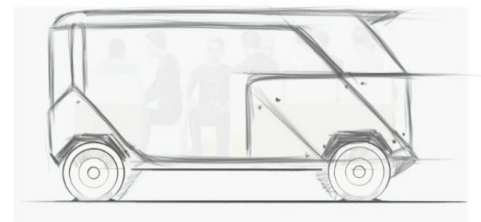
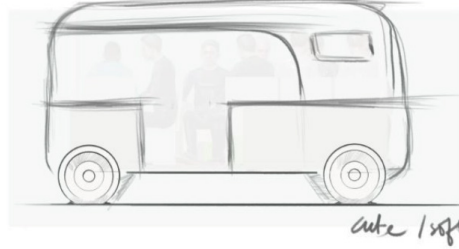
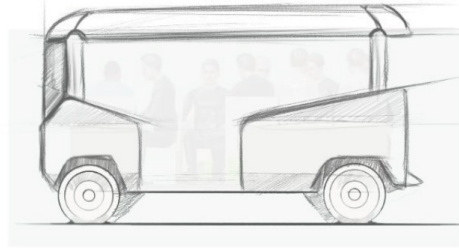
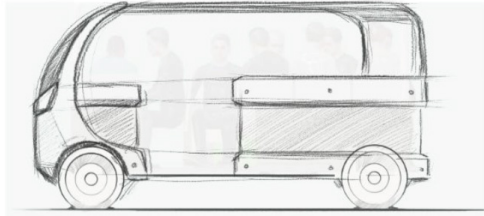
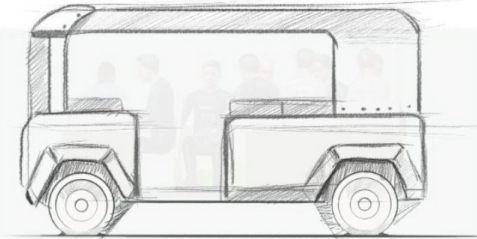
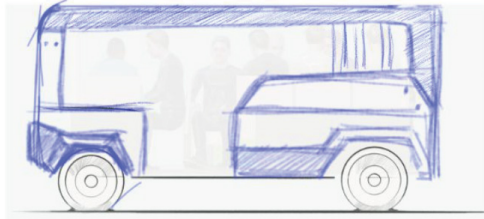




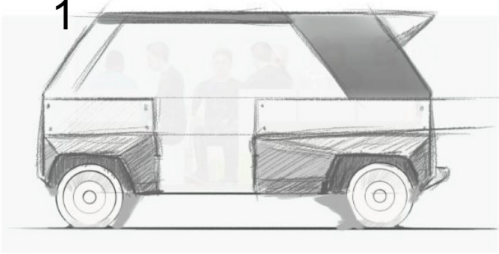
Proportions Proposals



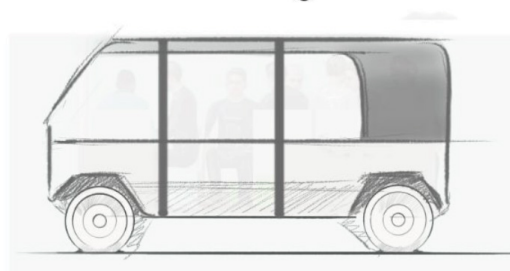
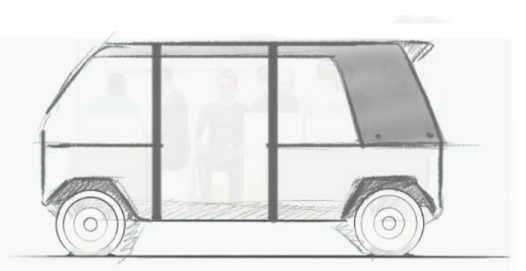
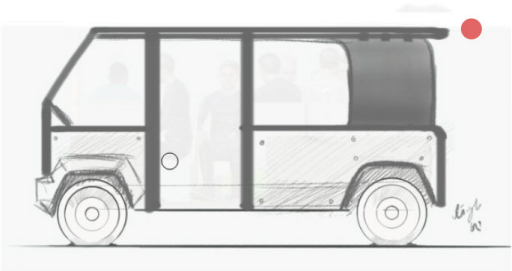
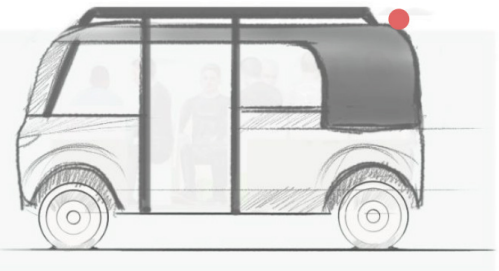
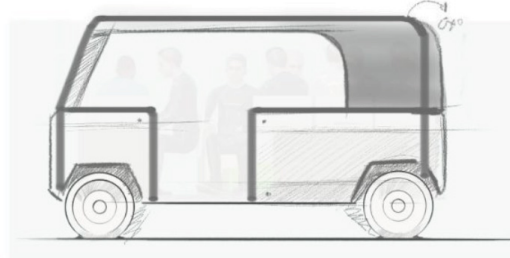
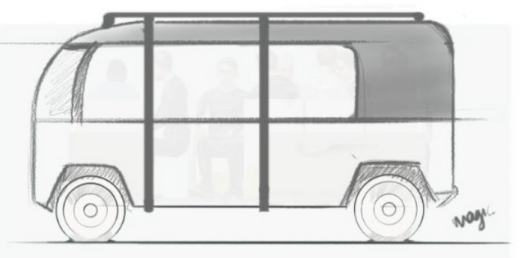
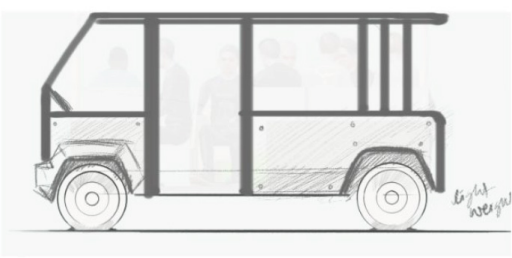
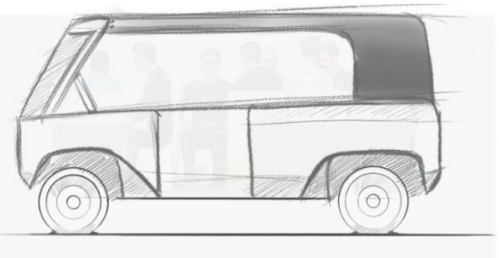
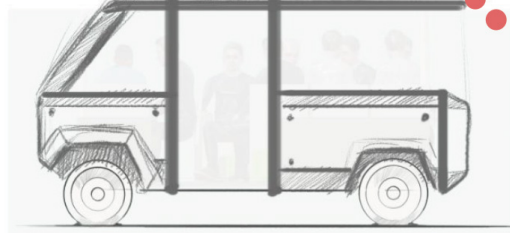
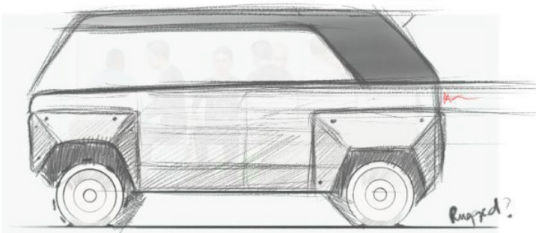
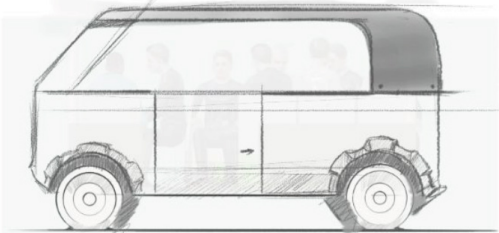
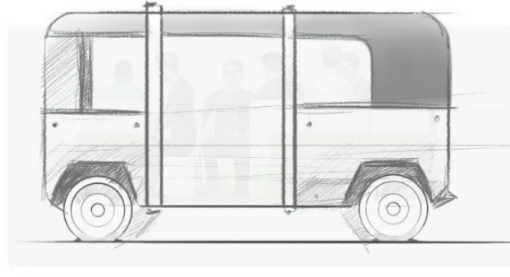
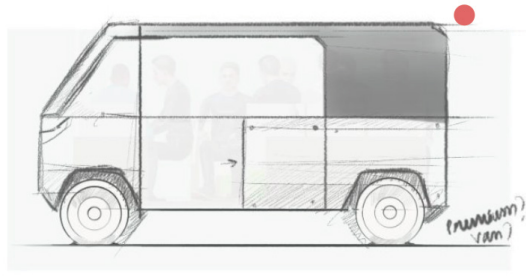
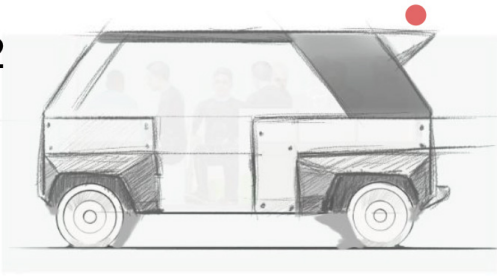
2



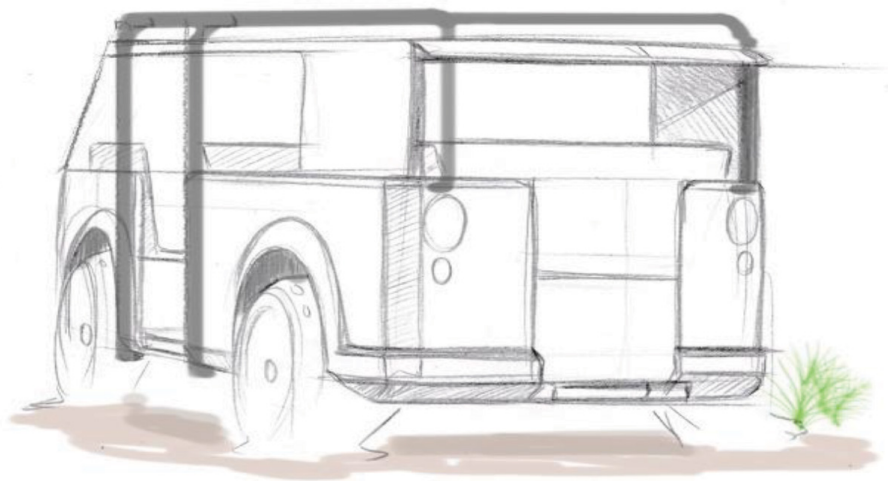
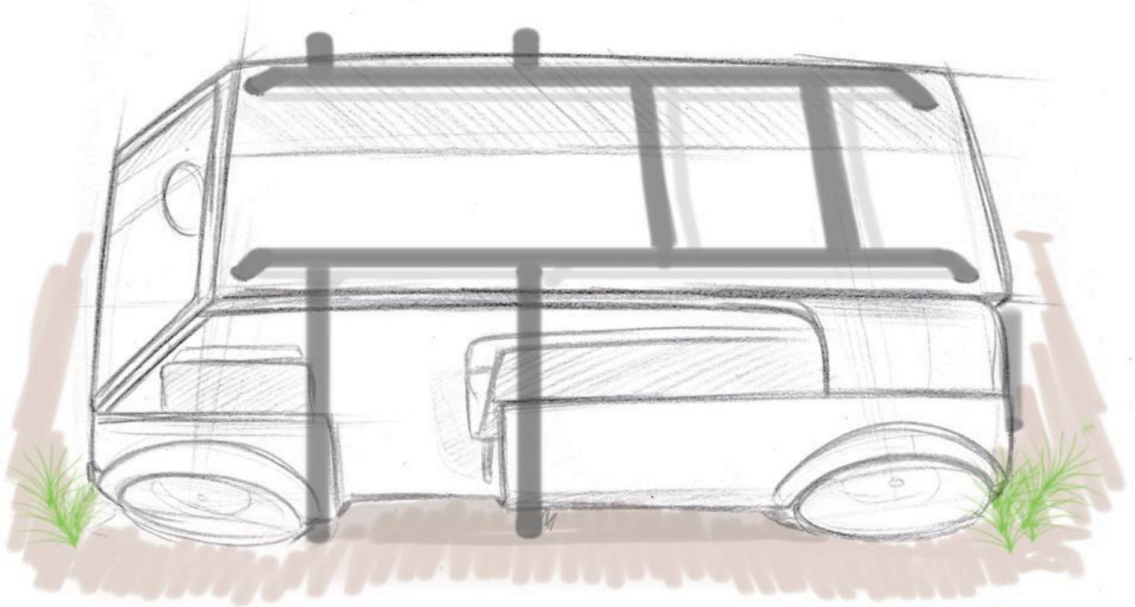
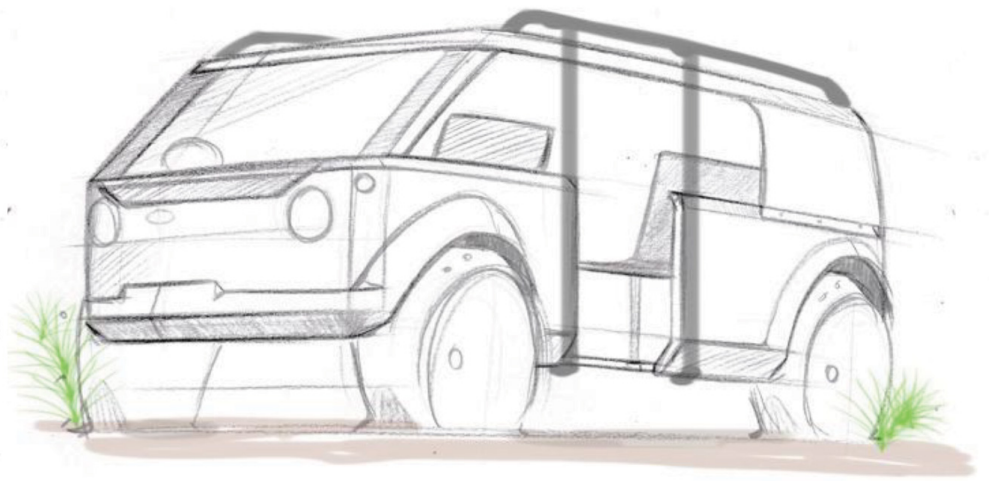
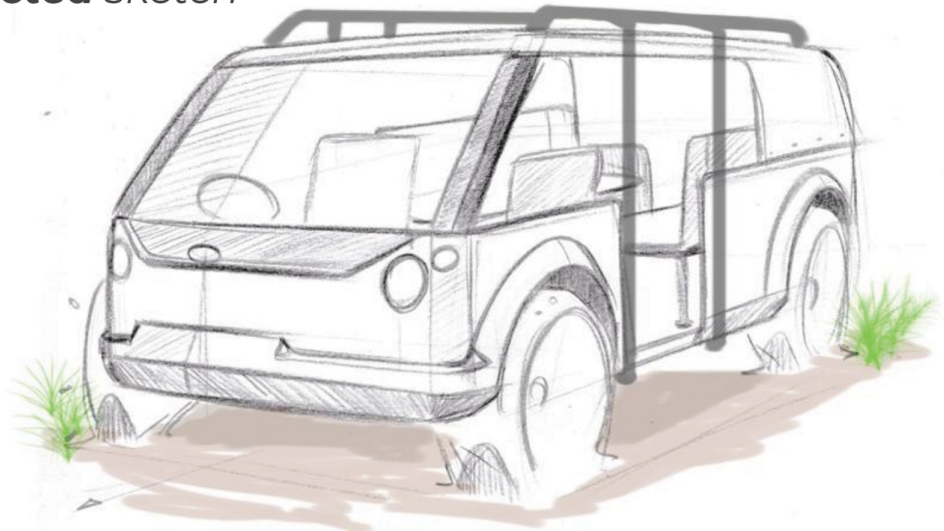
1

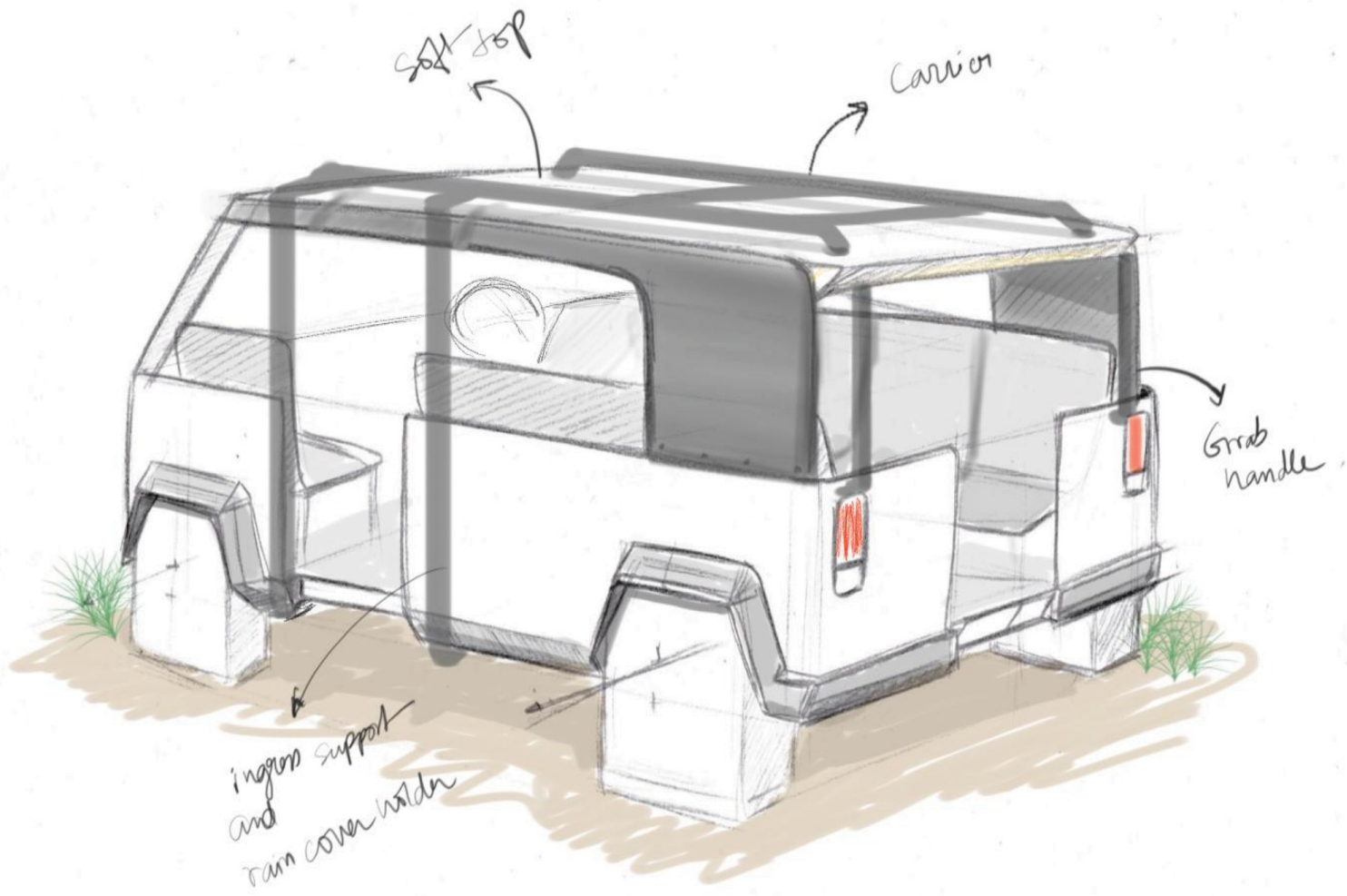


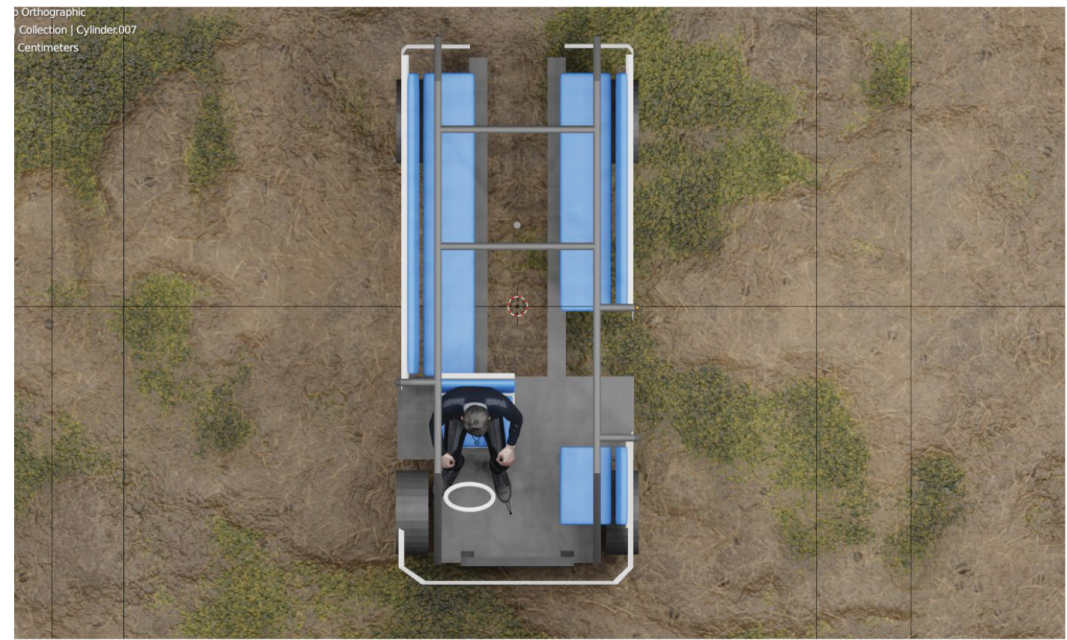
2



Selected sketch



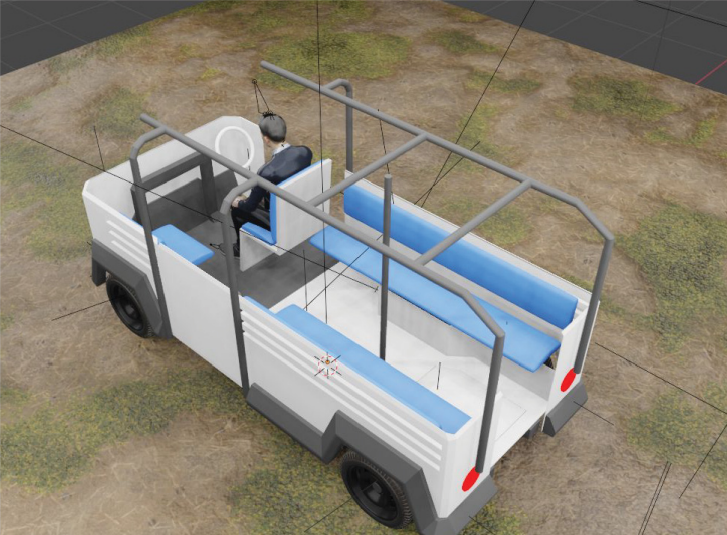
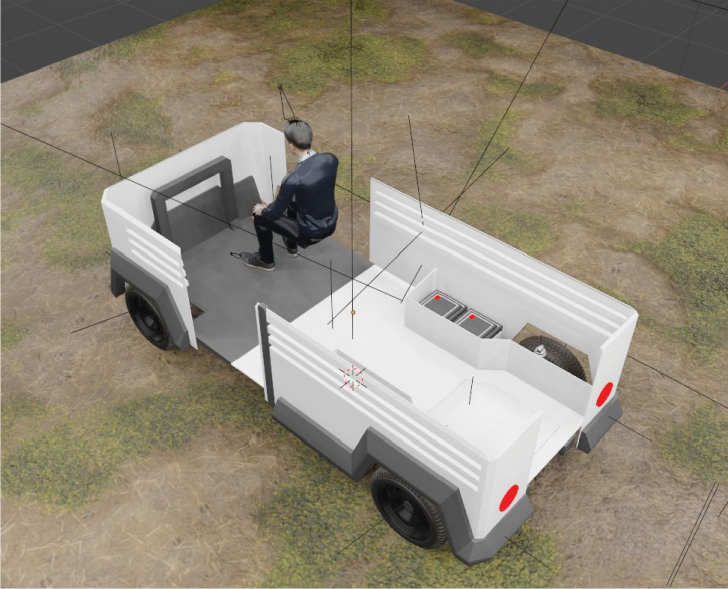
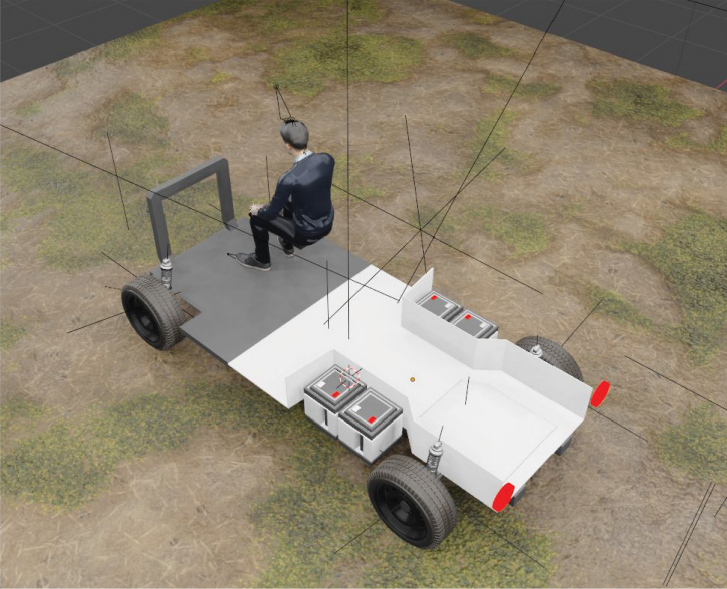
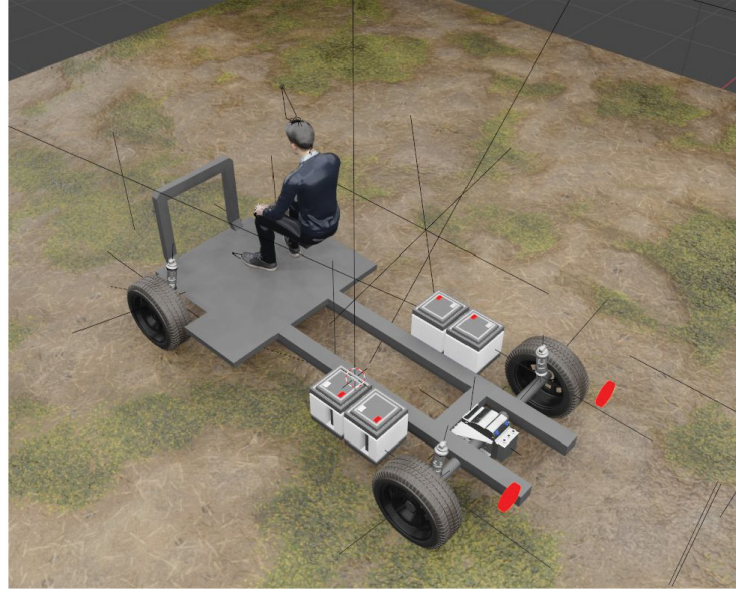




CAD Development

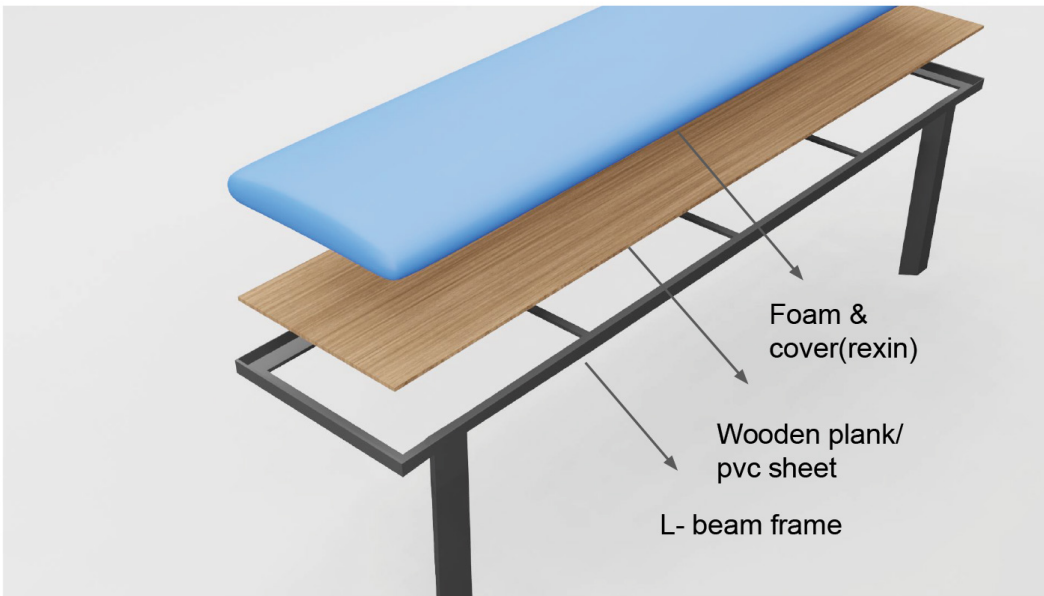


Manufacturing Stages

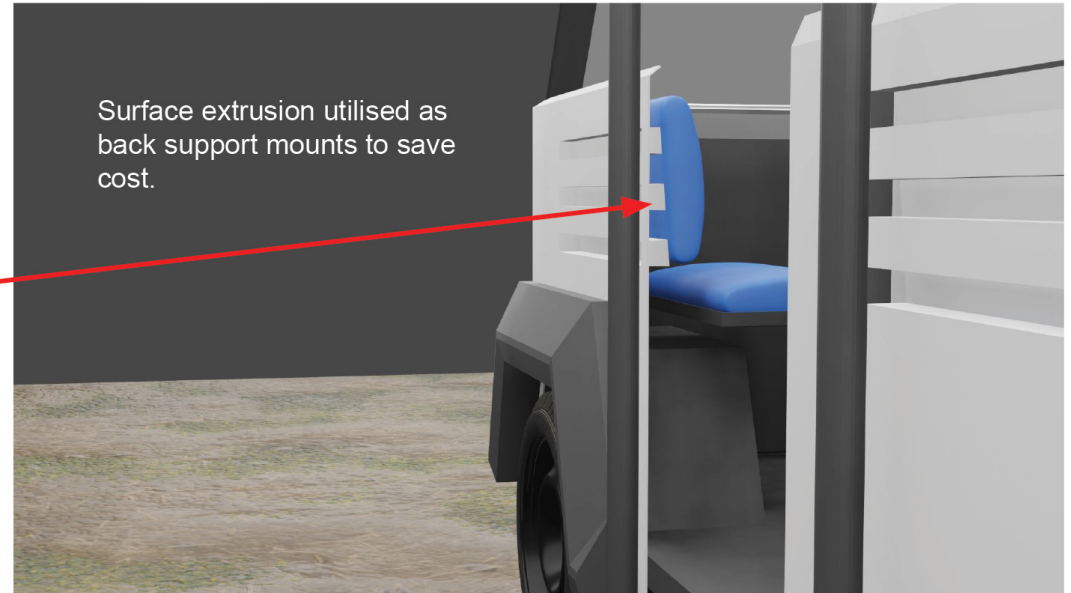
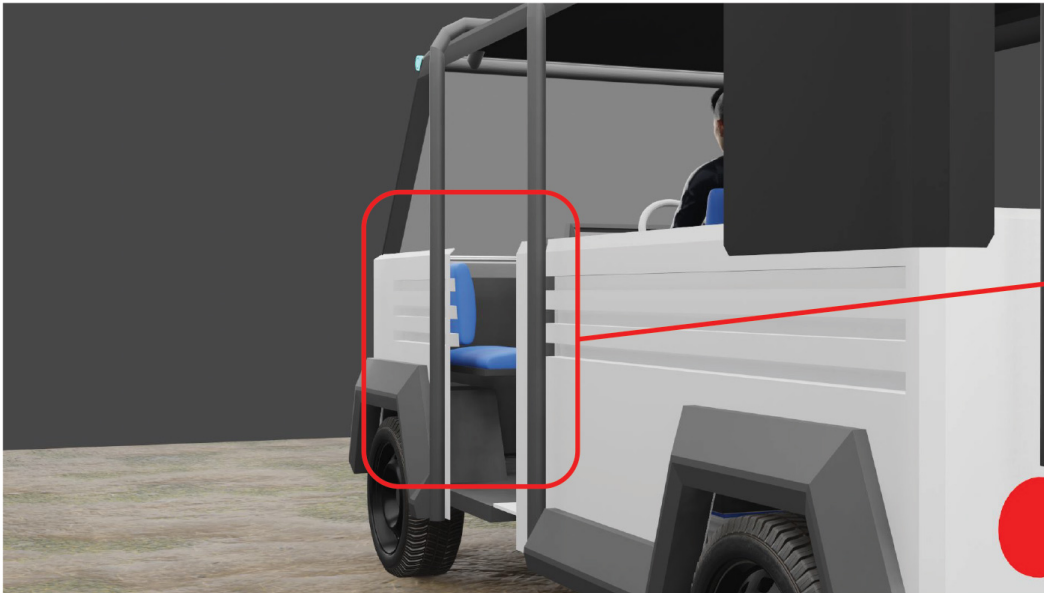


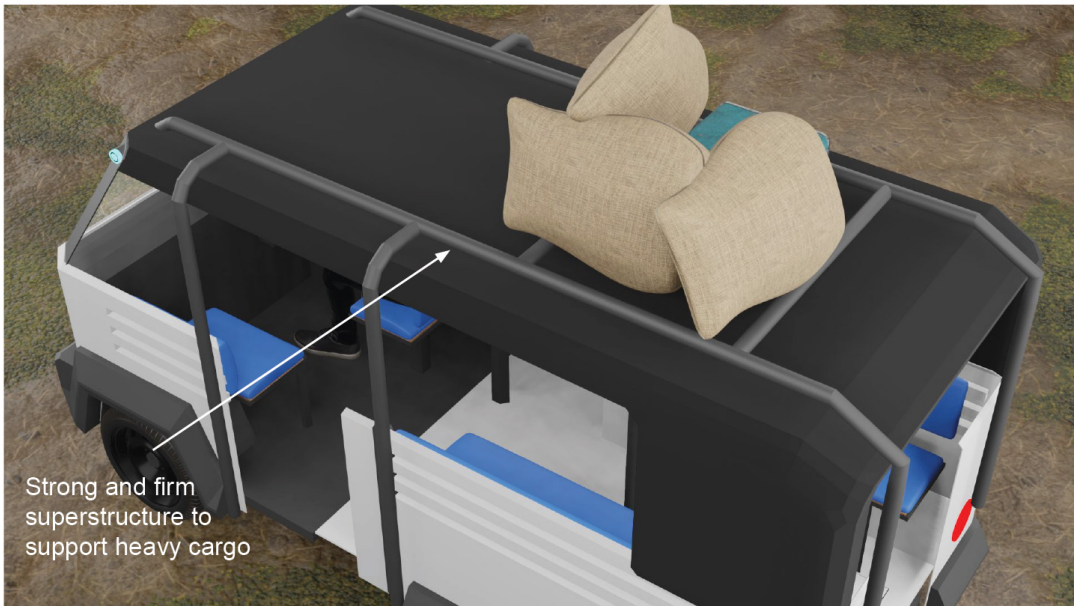
Final CAD model





Low Cost *Interior considerations*





Strong and firm superstructure to support heavy cargo

Luggage & Storage considerations



Small luggage can be hung at rear for pedestrians safety



Bar end drls/ indicator for enhanced road presence

Under seat storage



Easy sliding door
for driver's safety

Driver & Passenger
Safety considerations

THANK

YOU