IDC School of Design
अभिकल्प विद्यालय

Design Project 3

Designing an Urban Commercial Vehicle

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M.Des Mobility and Vehicle Design

IDC School of Design, IIT Bombay

Guided by:

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DECLARATION

I declare that this written submission represents my ideas in my own words and where others 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 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 also 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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Mobility and Vehicle Design
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APPROVAL SHEET

This Mobility & Vehicle Design P3 Titled "Urban Commercial Vehicle" by Aditya Mahamuni is approved in partial fulfillment of the requirements for Master of Design Degree in Mobility & Vehicle Design, IDC IIT Bombay.

Project Guide: Prof. Sugandh Malhotra

Chairperson:

Internal Examiner:

External Examiner

ACKNOWLEDGMENT

My project Design of Urban Commercial Vehicle has been a great experience overall. It has taught me, Contribution of designers to provide better experiences to the user, How to look at the problems faced by users and how to design for the people. All these wouldn't be possible without proper guidance so I would like to sincerely thank my guide, Prof. Sugandh Malhotra for his valuable guidance throughout this project.

A big thank you to all the people who contributed to my project. Finally a huge thanks to all my classmates for the valuable inputs and feedback throughout the project.

ABSTRACT

In Mumbai's wholesale market, we've looked at different types of commercial vehicles, from big trucks to smaller ones like mini trucks and vans. One big problem we found is that these vehicles are often too big and hard to maneuver, causing traffic jams and making life difficult for everyone around – residents, drivers, workers, and customers.

As we explored the market, we saw all sorts of problems caused by these bulky vehicles and this mini commercial Vehicles are also used for personal uses of traveling. There is potential to design a new kind of commercial vehicle specifically for the busy streets of Indian wholesale markets. That Vehicle increases the goods and passenger transportation efficiency. Which over all improves the flow of wholesale markets

My project is all about mini trucks and vans because we realized that one vehicle could do the job of both. This makes life easier for the people using them, and it gives them more options to serve their customers better. The vehicle we've come up with is a mix of modern looks, practical features, and eco-friendly ideas. It's small enough to fit through tight spaces and can carry different types of goods, making it perfect for the busy streets of Mumbai's wholesale market. With this vehicle, we aim to improve efficiency and make life a little easier for everyone involved.

CONTENT

1. INTRODUCTION

1.1 Commercial Transportation in India

Commercial transportation is the process of moving people or goods from one location to another so an individual or business makes a profit.

The most common commercial transport vehicles include heavy trucks, buses, pickups, and coaches. These must meet federal and state regulations, such as having a maximum gross vehicle weight limitation or a specific number of passengers if they are to be used commercially.

Types Of Commercial Transportation

- Air Transportation

- Water Transportation

- Road Transportation

- Rail Transportation

Mainly Road Transportation is used in Urban areas for middle mile deliveries and Last mile deliveries.

The Indian commercial vehicle market plays a pivotal role in supporting the nation's urban logistics and transportation needs. With rapid urbanization and the expansion of cities, the demand for efficient, versatile, and reliable urban commercial vehicles has surged.

Urban Logistics and Transportation Needs

With increasing urbanization, there is a growing need for commercial vehicles that can navigate narrow city streets, handle frequent stops, and operate efficiently in high-traffic areas. Urban commercial vehicles are essential for last-mile delivery, public transportation, and municipal services, addressing the logistical challenges of densely populated areas.

Commercial Vehicle Types and Configurations:

Small Utility Vehicles

Compact and agile, ideal for urban environments. Examples include Tata Ace, Mahindra Jeeto, and Maruti Suzuki Super Carry.

Medium Commercial Vehicles (MCVs)

Suitable for moderate loads and urban delivery services. Examples include Tata 407 and Ashok Leyland Dost.

Heavy Commercial Vehicles (HCVs)

Used for bulk transportation within cities, including large goods carriers and passenger buses.

Emphasizing fuel efficiency, Indian urban commercial vehicles are increasingly equipped with fuel-efficient engines and alternative fuel options like CNG and electric power-trains, aiming to reduce operational costs and environmental impact. These vehicles boast compact designs with smaller turning radii and optimized dimensions, enabling them to navigate congested urban roads with ease. Furthermore, modern commercial vehicles are equipped with advanced safety features, ergonomic designs, and enhanced comfort, ensuring a safer and more comfortable experience for both drivers and passengers.

1.2 Stages of Delivery in logistics

In logistics and supply chain management, the journey of a product from its origin to the final destination often involves multiple stages, each with its unique challenges and requirements.

First Mile Delivery

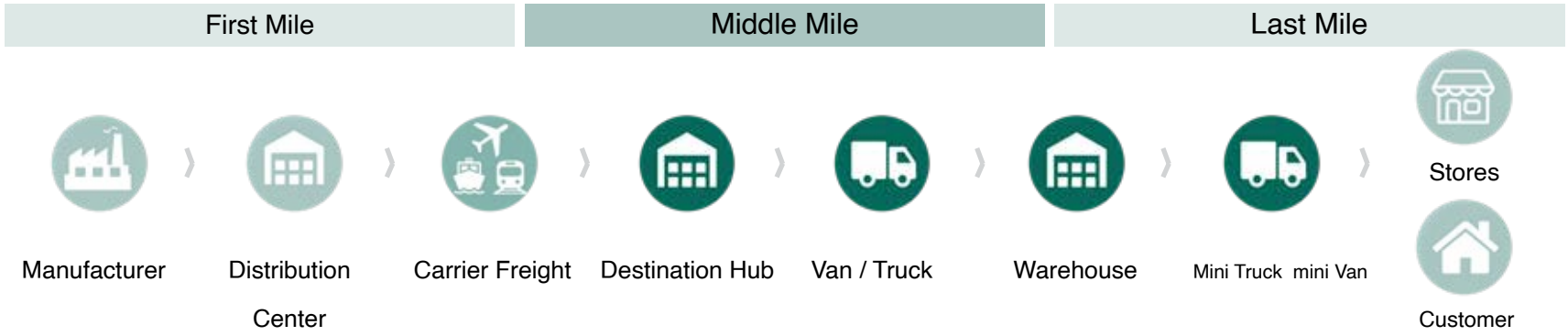
In India, the First Mile often involves the movement of goods from manufacturing facilities, agricultural centers, or warehouses to transportation hubs or intermediary points.

Middle Mile Delivery

The Middle Mile in India encompasses the transportation of goods from Regional distribution centers or hubs to various urban and rural Destinations across the country. This stage requires efficient logistics planning to navigate diverse terrain, optimize transport routes.

Last Mile Delivery

Last Mile Delivery in India is characterized by the final leg of the journey, where goods are transported from regional hubs or retail outlets to individual customer's homes or businesses. This stage presents unique challenges in densely populated urban areas, including traffic congestion, narrow streets, and address complexities, as well as in remote rural areas with limited access to transportation infrastructure.



1.3 Chosen context of wholesale market

Abdul Rehman Road in Mumbai, India, is a bustling commercial artery known for it's diverse array of shops, markets, and eateries, contributing to the vibrant local economy

Challenges and Opportunities

Like many urban commercial areas, Abdul Rehman Street faces challenges such as congestion, infrastructure deficiencies, and regulatory issues. However, it also presents opportunities for revitalization, modernization, and sustainable development, leveraging its rich heritage and strategic location to attract investment and promote inclusive growth.

Historical Significance

Abdul Rehman Street has a significant historical legacy, dating back to the colonial era when Mumbai, then known as Bombay, was a prominent trading center under British rule. Over the years, the street has evolved into a major commercial hub, attracting traders, merchants, and shoppers from across the city and beyond.

Commercial Hub

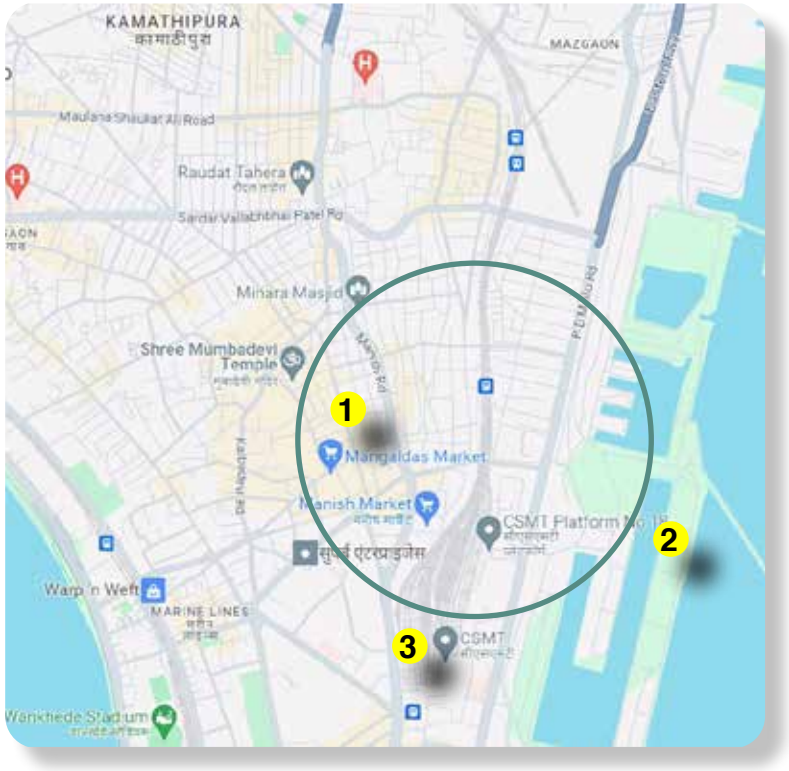
Today, Abdul Rehman Street is synonymous with commerce and trade, housing a diverse array of shops, markets, and businesses. From textiles and garments to electronics, hardware, and stationery, the street offers a wide variety of products catering to different consumer needs. It is particularly known for its wholesale markets, where retailers and traders procure goods in bulk at competitive prices.

Economic Importance

As a key commercial artery, Abdul Rehman Street plays a vital role in Mumbai's economy, generating employment, fostering entrepreneurship, and driving economic growth. It serves as a vital link in the city supply chain, facilitating the movement of goods and services across various sectors.

2. BACKGROUND RESEARCH

2.1 Wholesale Market (Abdul Rehman street)



South Bombay (New Doc, CSMT Railway Station)

This wholesale market represents other wholesale market challenges due to same reason for study Abdul Rehman street is chosen Geographical location of market.

1 - Wholesale Market (Abdul Rehman street)

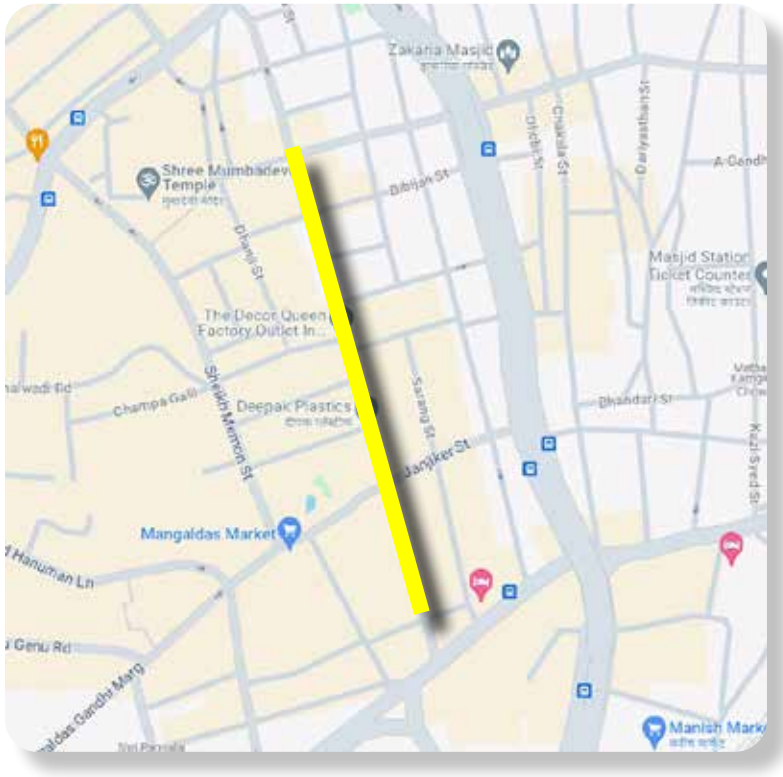
2 - Indira Doc (New Doc)

3 - CSMT (Railway station.)

In a 2 km diameter area there is much more flow of goods as water Transportation, Rail Transportation and Road Transportation facilities are nearby.

Import - Export of goods going on daily inside this area. The wholesale facilities and their warehouses are surrounded by the same area. Because of overflow of goods this area became congested and these narrow streets can not bear this overflow of commercial vehicles.

Normal Day at Wholesale Market



Abdul Rehman Road

The problem of traffic congestion can be seen in all wholesale markets of India.

Abdul Rehman Street is a one-way road. We can also observe the users, Drivers, customers, and wholesalers. Every wholesale market has similar type of problems To define a problem Abdul Rehaman street is chosen. This single street can represent all wholesale markets of India

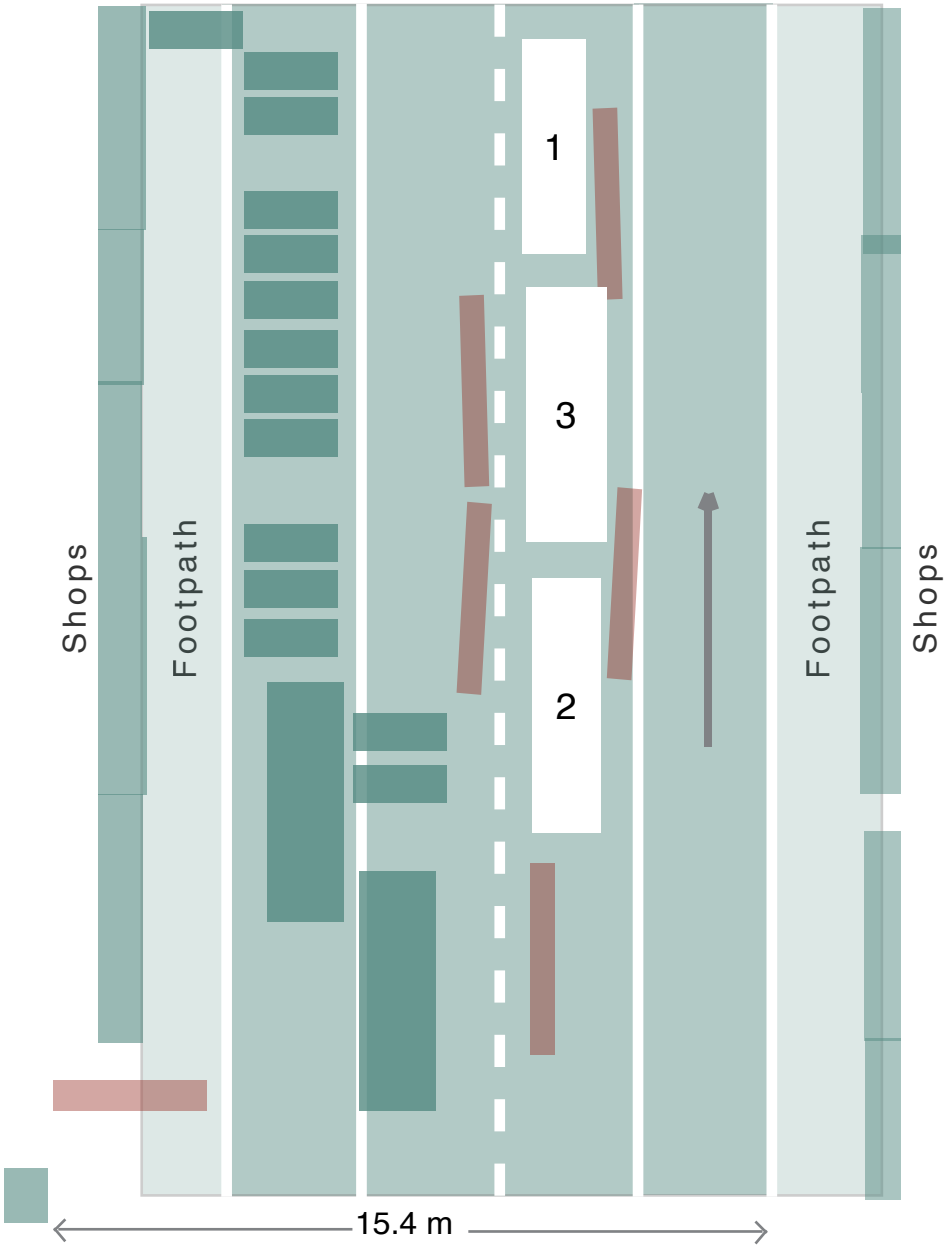
The image quickly shows the current scenario of Abdul Rahman Street

Drivers have difficulty finding parking spots in this area to unload their payloads. They search for available spaces on the road that are close enough to the wholesale shops on the same street. When parking spots are not directly adjacent to the shops, drivers transport the payloads from the vehicle to the shops using handcarts.

2.2 Current Scenario

Different types of mobility solutions are on the street of wholesale market. To understand the space and dimensions of congested space graphic diagram is shown

All wholesale Shops are on both side of the road. Between them the whole mobility solutions are running the system efficiently for all stakeholder.



2 & 4 Wheeler vehicles

3 Commercial Vehicles

Hand Karts

As shown in the reference image, Three lanes out of four lane of roads are always full of vehicles including two wheelers, passenger four wheelers and commercial vehicles which are parked in rest available spaces of road to unload goods. Along with that Hand karts are the small veins of this system which delivers the packages to the final destination example wholesaler and warehouses of market.

That only single lane is available to move vehicles in and out from market. In more than few cases it is observed that last right hand side lane is also used to load cargo into vehicle and it causes congestion. Also inefficient loading and unloading of cargo into vehicle increases the presence of vehicle in the market. Which exponentially increases the number of vehicles in market.

Reference Image

2.3 Delivery Vehicles

Maruti Suzuki eeco

Tata Ace

Tata carry

Tata Ultra truck

Eicher pro 1114 XP

Ashok Leyland Dost

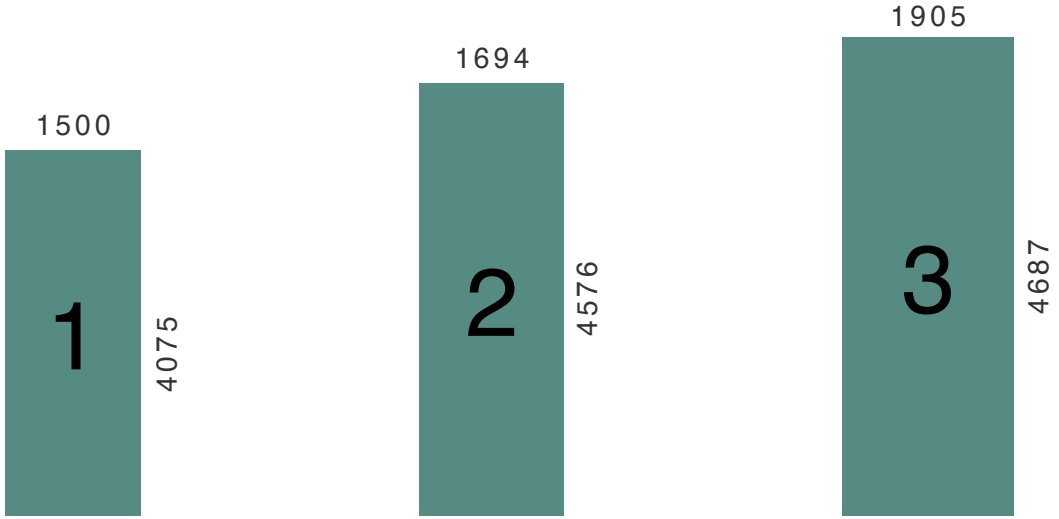
Tata intra v30

Mahindra supro mini truck

Mahindra Bolero Pickup

Suzuki tour v

Tata 704



TATA Ace

TATA Intra

TATA 704

TATA Ace ev

Average Different Sizes

TATA Ultra T.7 ev

2.4 Different categories of Commercial Vehicle

Factors Defining Commercial Vehicle Categories

1. **Gross Vehicle Weight (GVW)**

   The total weight of the vehicle including its maximum load.

   Determines the vehicle's classification as light, medium, or heavy.

2. **Intended Use**

   The primary function of the vehicle, such as goods transport, passenger transport, or special services.

   Vehicles are designed and categorized based on whether they carry cargo, passengers, or perform specific tasks.

3. **Design and Features**

   Specific design elements and equipment tailored to the vehicle's intended function.

   Special purpose vehicles have unique features, such as refrigeration units in refrigerated trucks or medical equipment in ambulances

4. **Regulations and Standards:**

   Legal and regulatory frameworks that define vehicle categories based on weight limits, safety standards, and operational requirements.

   Standards vary by region and influence vehicle design and categorization

5. **Capacity:**

   The load capacity for cargo vehicles or passenger capacity for buses.

   Helps to further refine categories based on how much the vehicle can carry or transport.

Here's how these categories are typically defined:

1. Light Commercial Vehicles (LCVs)
2. Medium Commercial Vehicles (MCVs)
3. Heavy Commercial Vehicles (HCVs)
4. Passenger Commercial Vehicles

2.5 Comparison & specifications of Commercial Vehicle

Comparing the specifications of commercial vehicles is crucial for businesses to ensure operational efficiency, cost management, and performance suitability. It helps in selecting vehicles that maximize fuel efficiency, reduce operational costs, and meet specific transportation needs.

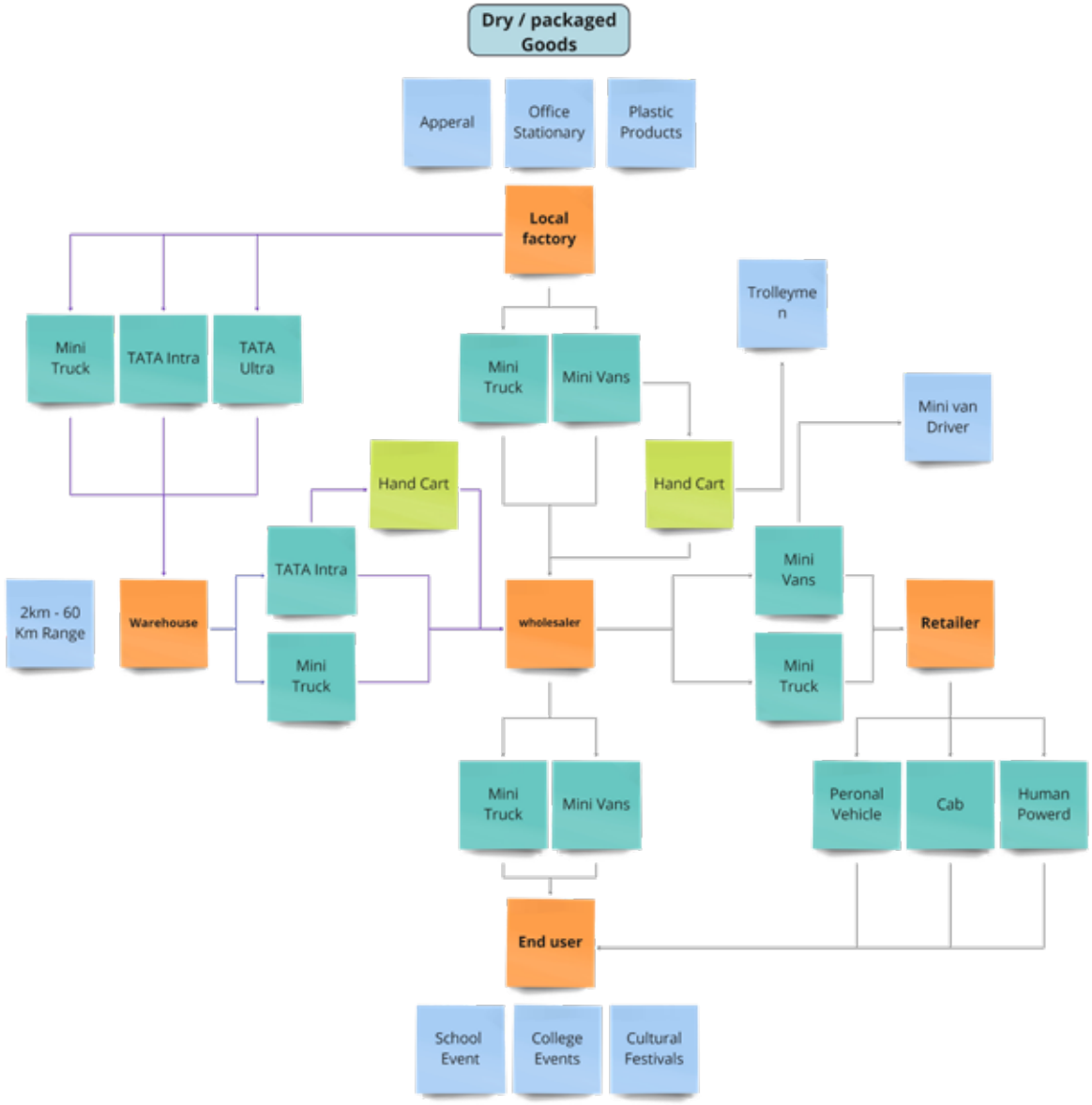
Model	Seating	Price	Payload	Gross W (Kg)	Wheel Base	Full lenght (mm)	width (mm)	height (mm)	Grond clearance (mm)	Turning radius (m)	Milage (km/l)	Cargo Capacity (mm)
Maruti Suzuki eeco	D+4	5.47 L	575	1030	2350	3675	1475	1930	160	4.5	19	
Tata Ace Gold CNG	D+1	5.5 L - 6.5 L	700	1630	2250	4075	1500	1840	160	4.3		2450 * 1430 * 300
Suzuki carry	D+1	5.5 L - 6.5 L	740	1600	2110	3800	1562	1883	160	4.3	18	
Mahindra supro mini truck	Day cab	5.5 - 6.58 L	900	1802	1950	3530	1512	1900	170	5.2	23	2280 * 1315 * 425
Suzuki tour v	D+5	6 L			2350	2350	1475	1825	180	4.5	20	-
EECO Cargo	D+1	5.47 L	920	1540	2350	3675	1475	1825	160	4.5		
Ashok Leyland Dost	D+1	8-10 L	1500	2805	2510	4630		1930	190		17	2645 * 1620 * 380
Mahindra Bolero Pickup	D+1	12 L	1245 - 1700	2940	3260	5215	1700	1865	190	6.5	12	2765 * 1700 * 650
Tata intra v50 / V70	Day cab	8-10 L	1700	2940	2600	4734	1694	2013	193	6	12.5	2960 * 1620 * 400
Tata 704	D+2	13-14	2267 kg	4650	2955	4687	1905	2260	209	11		
Eicher pro 1114 XP			10 ton	15360	4255		2250		240			5810 * 6108 * 2250
Electric											**Range (Km)**	
TATA Ace EV	D+1	9.5 L	750	1840	2110	3825	1512	1997	160	4.3	154	2068 x 1397 x 350
TATA Ultra T.7	D+2	25 - 30 L	8750	16000	4215	5625	2320	1800	230	6.95	161	
Mahindra Dost+ EV												
ASHOK LEYLAND BOSS 1218HB EV		19 L	5000	12000	3360	5620	2200	2990	230	6.95	350	4200 * 2200 * 1800
EICHER PRO 2049 EV		13 L	3500	4995							150	
TATA ULTRA E.9			4050	9000							150	
OSM M1KA 3.0			2500	5500							180	
Kia PV7					3390	5270	2065	2120				

2.6 Movement of Goods

In Indian wholesale markets, the general product flow is shown in the flowchart.

Products are transported to the wholesale markets by trucks and mini trucks. But it has been observed that both vendors and consumers of wholesale marketplaces transport their goods in minivans as well as themselves.

Wholesalers warehouses may or may not be in the same area of the city.



2.7 Nature of Payload

1. Office Stationaries
2. White Goods
3. Furnitures
4. Apparel
5. Plastic Household Products / Toys
6. Bags and Luggage
7. Kitchenware
8. Tableware
9. Packaging Supplies
10. More

All types of

DRY GOODS
PACKAGED ITEMS
E- COMMERCE

1. Office Stationaries

Description : Includes items like paper, pens, notebooks, folders, staplers, and printers.
Average Size : Small to medium, often packed in boxes.
Average Weight : Lightweight to moderate; a box of paper can weigh around 9-14 kg.
Bulk Transport Considerations : Ensure items are well-packaged to avoid damage. Keep paper dry to prevent warping. Use pallets for large quantities to facilitate handling.

2. White Goods

Description : Large household appliances such as refrigerators, washing machines, and ovens.
Average Size : Large; dimensions vary but can be roughly 150-180 cm tall and 76-89 cm wide.
Average Weight : Heavy; typically between 68-113 kg each.
Bulk Transport Considerations : Require careful handling to avoid damage. Securely strap appliances and use padded materials. Ensure upright transport to avoid damage to internal components.

3. Furniture

Description : Includes chairs, tables, sofas, and cabinets.
Average Size : Varies widely; from small chairs to large sofas and dining tables.
Average Weight : Can range from 9 kg for a chair to over 90 kg for a large sofa.
Bulk Transport Considerations : Protect corners and surfaces to avoid scratches and dents. Disassemble larger pieces if possible to save space. Use blankets and padding for protection.

4. Apparel

Description : Clothing items like shirts, pants, dresses, and shoes.
Average Size : Small to medium; often packed in boxes or garment bags.
Average Weight : Light; a box of clothes can weigh around 5-23 kg.
Bulk Transport Considerations : Keep in dry conditions to avoid moisture damage. Use garment racks for hanging items. Stack boxes carefully to prevent crushing.

5. Plastic Household Products / Toys

Description: Includes items like storage containers, kitchen utensils, and children's toys.
Average Size: Varies; from small utensils to larger toy sets.
Average Weight: Generally light to moderate.
Bulk Transport Considerations: Ensure items are well-packaged to avoid breakage. Use padding for fragile items. Stackable and often come in nesting designs to save space.

6. Bags and Luggage

Description: Includes backpacks, suitcases, and handbags.
Average Size: Medium to large; dimensions vary.
Average Weight: Light to moderate; can range from 0.5-7 kg each.
Bulk Transport Considerations: Avoid over stacking to prevent crushing. Use dividers to maintain shape. Ensure zippers and handles are protected from damage

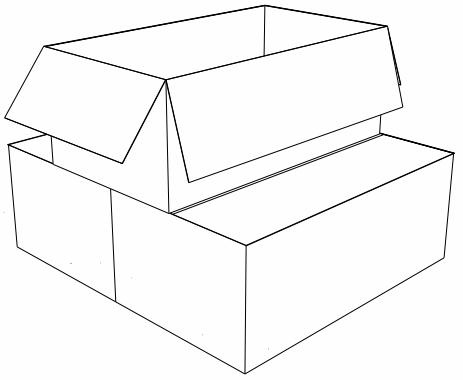
7. Packaging Supplies

Description: Includes items like boxes, tape, bubble wrap, and packing peanuts. Plastic and Rubber Sheet and Matting.
Average Size: Varies; often comes in bulk packs.
Average Weight: Light to moderate; a bulk pack of boxes can weigh 4.5-18 kg.
Bulk Transport Considerations: Keep in dry conditions to maintain the integrity of packaging materials. Stackable and lightweight, making it easy to transport in bulk.

Standard Sizes of Packages.

Corrugated boxes used for packaging.

18x18x18 inches,
20x20x20 inches,
24x24x24 inches



Maximum size
3 X 3 X 3 Feet

2.8 Critical Dimensions for Payload

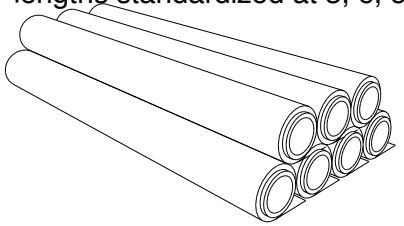
Shape and size of Payload both have equal value for transportation, Some examples of them are listed down here to understand the required critical size and volume of payload. Mainly two shapes can be seen in nature of payload

1. Cylindrical shape
2. Rectangular shape
3. Odd shape

Cylindrical Shapes packaging

Drums and Barrels : Used for transporting liquids like paints and beverages. Pipes : Utilized in construction, plumbing, and industrial applications.

To find critical dimension. Pipes are the best examples due to availability in different lengths.
Standard Sizes of pipe: lengths standardized at 3, 6, or 12 meters.



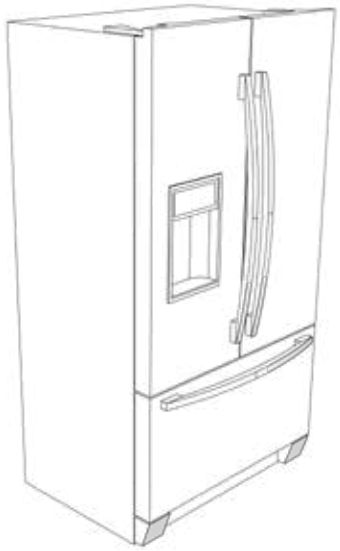
Rectangular shapes of packaging

In rectangular shape package are horizontally and vertically more longer. To find critical dimension for cargo area we need to find both maximum directions.

Boxes and Cartons : Used for a wide range of goods from electronics to food items.
Crates : For transporting fragile or heavy items like machinery or glass.
Palletized Goods : Items stacked and secured on pallets, forming a rectangular shape.

Washing machine

Household Fridge



Product dimension : 76.5 * 81.7 * 177 (cm)

Capacity : 550 liter

Weight : 97 kg

Critical Height for the cargo space can be 180 cm

Odd Shape of Packaging

Odd shape is the combination of basic shape but in the world of packaging these shapes may be difficult to transport in bulk. Transportation can be inefficient in terms of usability of cargo area.

Transport Considerations for Both Shapes:

Space Utilization : Rectangular shapes generally offer better space utilization in vehicles due to easy stacking and fitting.

Stability : Cylindrical items require more securing measures to prevent rolling and shifting.

Accessibility : Ensure items are easily accessible for loading and unloading, especially in urban environments where space is limited.

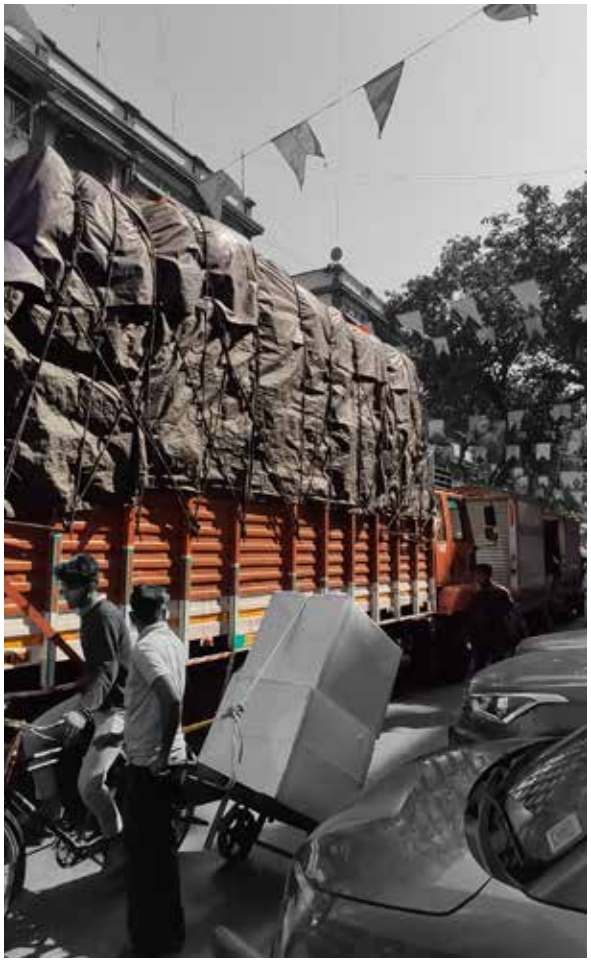
Weight Distribution : Properly distribute the weight to maintain vehicle stability and comply with axle load limits.

Critical Dimensions

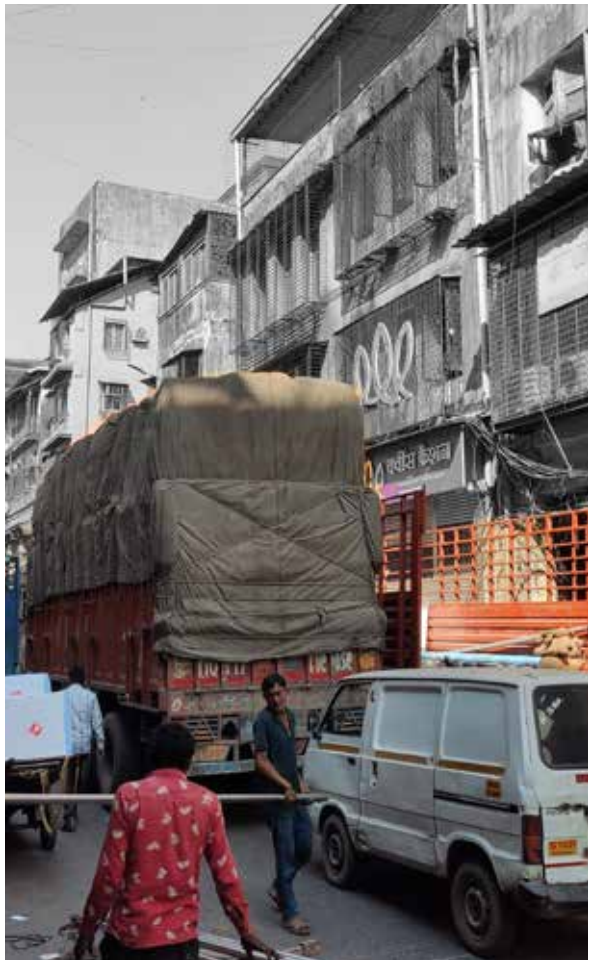
Length - 3 - 5 m (Payload such as PVC pipes need the space around)
Height - 184 cm (Refrigerators can't be transport by changing orientation)
Width - 150 cm (to maneuver though narrow streets of India.)

3. PRIMARY RESEARCH

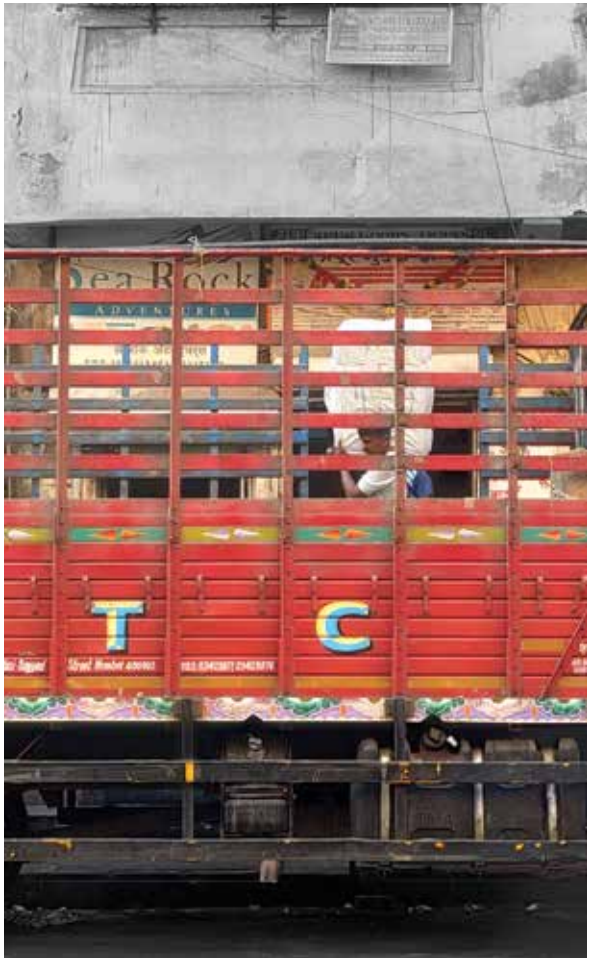
3.1 Observations



Traffic Congestion in Wholesale Market due to large sizes of vehicles



Inefficient flow of cargo in market.



Cargo Loading from side of the truck,

Activities that are observed

In first images; Cargo unloading is happing simultaneously. From running vehicle on Hand kart. Possible reasons behind can be unavailability of parking spaces. Long queue to reach destination or limited time for delivery.

Example Unloading payload from Blue-white Tata Intra

Conclusion from this activities due to the delay in the current shipment driver is in early for his next shipment

Unloading of payload on a running truck in a traffic is Jugaad for them to tackle the delay of shipment or save the time.

Second Image - there is no dedicated space for long cargo

Activities that are observed

In both images residents can be seen in wholesale market. Unfortunately they suffer from delay in their schedule due to congestion

Inefficient system causing residents suffer. (Turning Radius of truck)

Payload access from rear side is difficult in some situation.

Higher level of cargo bed - Difficulty for loading and Unloading as well as Unsafe for pedestrians and workers.

Illegal and Unsafe traveling

Tight spaces between two parked vehicle

Documentation and Sequence of unloading

3.1.1 Interior of TATA Ace.

Thickness of door is approximately 10 cm to occupy the maximum space for user,

Spaces between two seat is modified for extra seating, Seating is very upright and less ergonomic.

Window cut is made for extra vision for driving.

3.1.2 Interior of Suzuki Eeco





Engine is placed under the driver seat to utilize the spaces.

Seats are placed little inside from the door due to wheel well causing difficulty for leg room of Driver and Passenger.

Grill Partition between passenger and cargo area.

3.1.3 Mini Commercial Vehicles in IITB campus






Lack of safety

Modification according to users need.

Utilization of each cm for cargo transportation .

3.2 Interviews

Interviews are taken in the market in their vehicle to empathize users closely. There are many challenges they face everyday; those details are in Interview compilations.

Compilation of Interview. (Daily routine)

Interviewee : Juber Sheikh
Age :42 year

He started driving at the age of 16 in Mumbai. He was a driver for a long time on different vehicles. He was saving money in his life to buy his own vehicle. He bought Suzuki Eeco in 2016 on partial loan and cleared the loan two years ago.

He wakes up at 6:00 - 6:30 am. He drops his younger son and daughter to the school which is around 5 km from his house

He leaves home around 8:30 a.m. With his vehicle. Firstly he goes to the local factories or Street vendors those are around his area to pick-up his first order of the day. As it is previously booked by customers . He drops first delivery in Crawford market of South Bombay which is Abdul Rahman Street.

He starts waiting for his customer in the market. If he is lucky to receive an order within an hour after a second shipment he starts waiting at Spent time eating tiffin brought from home or vada-pav, cut chai of Rs - 5, kanda bhaji with their community people. They eat while sharing stories from here and there. He daily completes 2 big orders and some smaller. He daily earns (Rs 1200 - 1600).

He thinks his job is not respectful to the community and He don't want his children to be drivers. He made it his goal to educate his children and see them as doctors and engineers.

He has a Smartphone. He bought it due to his children's force. He asks his children about doubts about smartphones and he is comfortable now with Smartphones. As he is confident that he can handle new technology in vehicles. New Design and new technology is for rich people. But his aspiration is to use it, if it is affordable.

He always cares about maintenance of his vehicle that causes him a lot to spend. Design and new technology is for rich people. But his aspiration is to use it.

3.2.1 Mini Van User

Juber Sheikh

Occupation - Driver (Owner)

Age - 42 year

Address - Sion, Mumbai

Family - Mother, Wife, 2 sons & Daughter

Use of Vehicle

- To Drop the his children to the school
- Home to Wholesale market (1st)
- 2 Deliveries inside Mumbai
- 120 to 140 km daily Run

Pain Points

- Ideal Time for Vehicle is High
- Less cargo capacity for wide range of Customers.
- Maintenance cost
- Driving is less respected profession
- Illegally carry more payload.

3.2.2 Mini Truck User

Kiran Kadam

Occupation - Driver

Age - 28 year

Address - Virar, Mumbai

Family - Father, Mother, Brother (Lives in village)

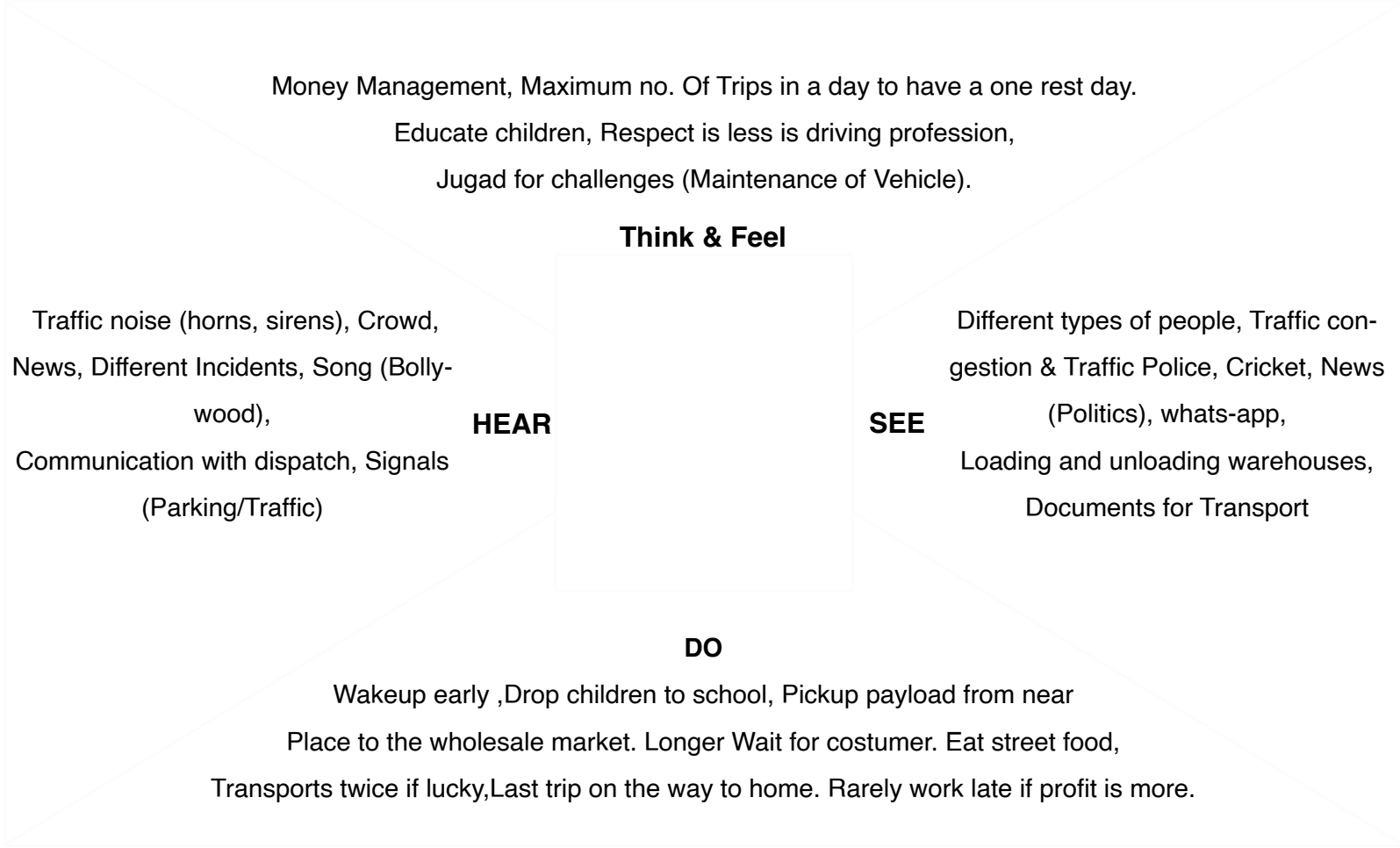
Use of Vehicle

- Local Factory to Wholesale Market
- Warehouse to Wholesale Market
- 2 Deliveries inside Mumbai
- Few times wholesale market to retailer
- 150 km Daily Run

Pain Points

- Returns Empty from market.
- Difficulties in unloading the payload in wholesale market congested areas.
- Parking in congested area
- Rainy Season causes difficult

3.3 Empathy Map

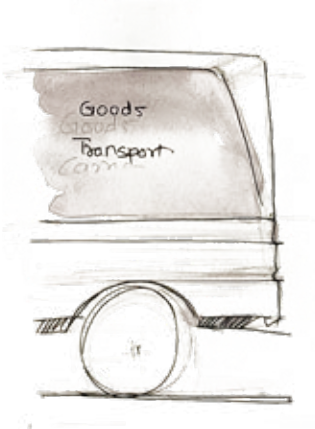


4. SCENARIO BUILDING

Various scenarios were sketched out to visualize the problems faced by the user in the commercial transportation and key insights were derived from them.

Scenario 1 (Customer)

- Couple went to wholesale market to buy household products.
- They selected their amazing house hold products.
- After buying everything started booking Cab.
- Cab drivers are not accepting orders. This become frustrating for them as they are tired already
- They need to book on porter mini truck for going back
- They traveled in septate vehicle.

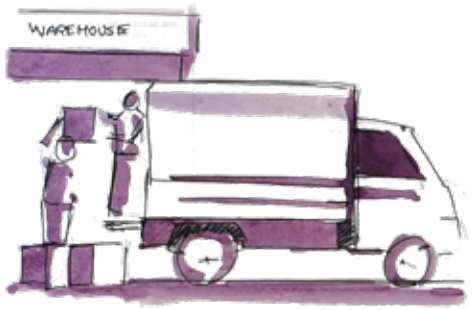


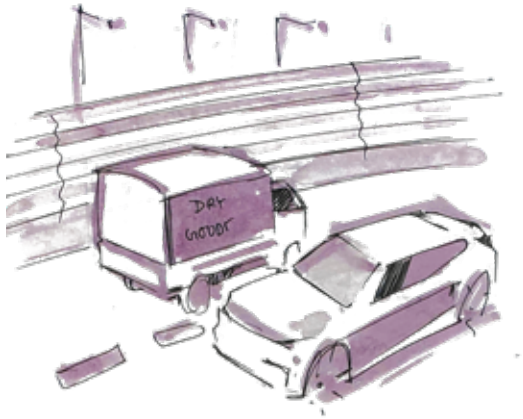
Wholesale Market - Retailer / End User

Scenario 2 (Mini Van)

- A person buying a item from market
- Mini van driver waiting for customer
- Both talk about delivery for those items
- Payload is has large volume than permitted cargo
- Forcefully both user and driver carrying goods illegally

Warehouse / Local Factory - Wholesale

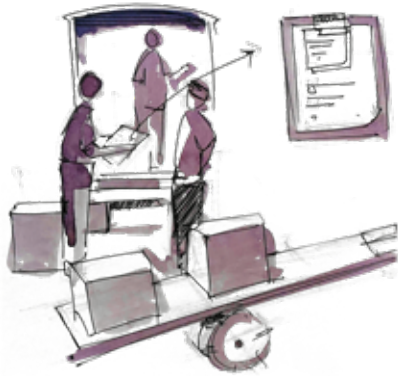




Scenario 3a (MINI truck)

- Goods are loading at warehouse/ Local factory
- Transportation through city road
- Reaching to the destination from small streets of wholesale market
- Difficult to park vehicle for unloading
- Through that narrow space they start to unload,

Warehouse / Local Factory - Wholesale (b)



Scenario 3b

- Distribution of goods is complex as single vehicle has goods of different wholesaler.
- This goods are reaches to the door step using handcarts.
- Empty mini truck wait for some time for customer but those are very few,

5. INSIGHTS

5.1 Interview and Observation Key Points

Illegal and Unsafe Practices:

The practice of customers traveling illegally in the cargo area points to a serious safety concern. This could be mitigated by designing safer, more regulated ways for passengers to accompany their goods if necessary.

Alternative Uses in Social Contexts:

The use of mini trucks for travel to events suggests a cultural aspect to vehicle usage that could be better accommodated with more comfortable and adaptable vehicle interiors.

Underutilization of Cargo Space:

Mini trucks often return empty from wholesale markets, indicating a mismatch between the vehicle capacity and customer demand. Inefficiency suggests the potential for flexible cargo space solutions that can be adjusted based on the cargo volume, thus optimizing operational costs and fuel efficiency.

Accessibility Challenges:

The difficulty in accessing the cargo area from the rear side of the vehicle in congested marketplaces suggests a need for alternative designs. This could include side-loading capabilities or adaptable rear entry designs to facilitate easier loading and unloading in tight spaces.

Seating Capacity Limitations:

The current design of mini trucks, with limited seating, forces customers to find alternate transportation methods. Integrating flexible seating solutions that can convert between cargo and passenger configurations could address this issue, potentially increasing the utility and appeal of min trucks.

Loading and Unloading Difficulties:

The height of the cargo bed presents challenges in loading and unloading heavy items, typically requiring additional manpower. Lowering mechanisms or built-in lifts could reduce the physical strain and risk of injury, improving efficiency and safety.

Maneuverability in Urban Areas:

5.2 Key Insights

- Tight clearances between parked vehicles creating difficulties with cargo handling.

- Need arises for customers to find septate transportation for them or some customers travel in Cargo spaces while transporting cargo.

- Dual use of commercial vehicle, as passenger and cargo transportation without permit

- Commercial vehicle is used for family travel needs.

- Minivan cargo capacity limits complete order fulfillment for some customer

- Illegal and Unsafe Practices

- Need to show driving as respected work sector

- Need arises to carry extra cargo illegally

- Daily travel of commercial vehicle in urban areas 160 Km

- Cylindrical items require more securing measures to prevent rolling and shifting.

- The high bed height creates challenges when loading and unloading heavy items.

- Large turning radius of vehicles contribute to traffic congestion, espe cially in tight spaces.

- Width and Position of 2nd row door opening making difficulty to access the cargo in mini vans

6. BENCHMARKING

- In absences of B pillar

  Increase the accessibility of cargo from side of the vehicle.

- Modular / Fold-able seating

  According to need of seating capacity and required space for cargo, Modular seating allowing the efficient use of interior space of vehicle.

- KIA PBV (Platform beyond vehicle)

  Designed to accommodate various body configurations on top of a standardized chassis. This type of design is common in purpose-built vehicles (PBVs), which are part of the broader trend toward adaptable and modular transportation solutions.

Chassis Cab	High Roof
Length 4,275mm	Length 4,645mm
Width 1,900mm	Width 1,900mm
Height 1,900mm	Height 2,200mm
Wheelbase 2,995mm	Wheelbase 2,995mm
Payload capacity of 750 Kg,	

  Reduces turning radius of vehicle.

- Body frame.

  (Dynamic Hybrid) weld-less body structure. This design uses high-strength tubular steel and engineered polymers, reducing the typical number of parts by about 55% without sacrificing rigidity.

- An integrated rail system on the vehicle's ceiling, floor, and side panels, as well as on the exterior, enables effortless customization of the vehicle to meet individual customer needs.

7 DESIGN BRIEF

Design an electric Urban Commercial Vehicle (UCV) that serves as a versatile solution for urban commercial transportation needs, specifically bridging the gap between mini trucks and mini vans. Also catering towards personal use. This UCV targets urban environments, particularly wholesale markets, where narrow streets and tight parking spaces are common. The vehicle prioritizes a spacious cargo area while accommodating a driver and up to three passengers.

Features

Access to the payload is available from the side of the vehicle, enabling efficient loading and unloading in specific situations of wholesale market.

Modular Seating: The vehicle features modular seating for passengers, and in the absence of passengers, the space is efficiently utilized for cargo.

Lower level of cargo bed for easy and efficient loading and Unloading of Payload

Symmetrical Design components for reducing Manufacturing cost (Example Head lights, Tail Lights)

Platform Beyond Vehicle as modular chassis.

Technical Specifications

Approximate Dimension : 3900 X 1500 X 2337 mm

Ground Clearance : 200 mm

Cargo Capacity : 2156 X 1367 X 1831 mm

Payload : 1 Ton

Maximum Range : 165 km

Battery : 21.3 kWh (Lithium iron phosphate 160 kW/kg)

Battery Dimensions : 1000* 400*100

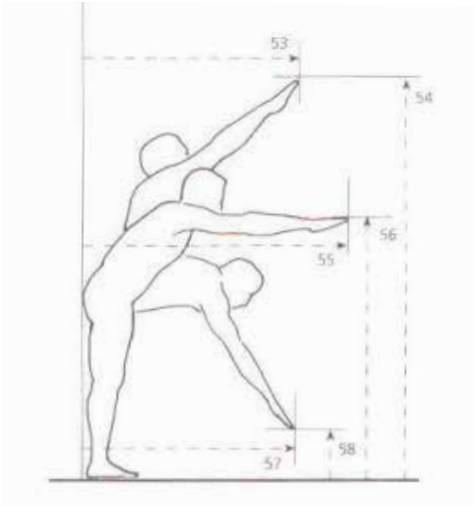
SRM Motor 27 kW (dia 200 * 250 mm)

Mass / Volume = 0.162 g/cm3

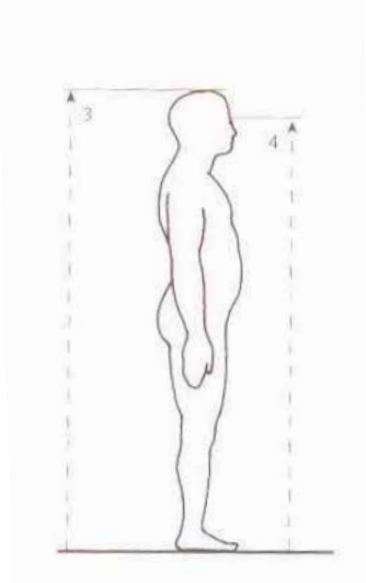
8. PACKAGING

8.1 Indian Anthropometric Data

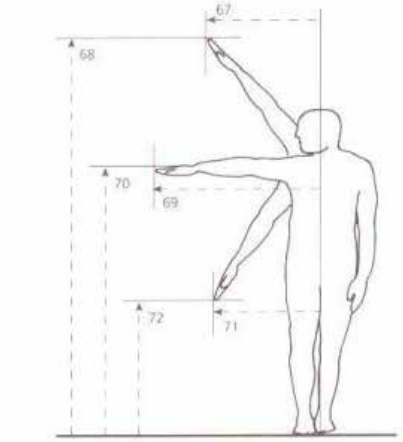
Units are in mm



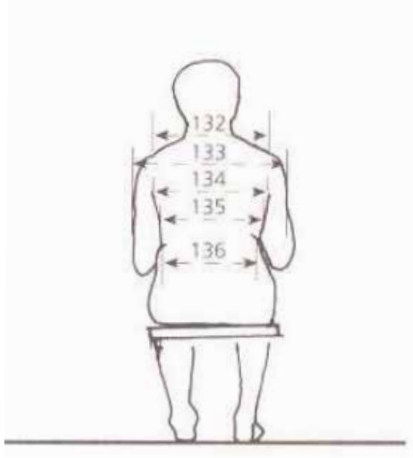
55	- Forward arm Reach	954
56	- Mid Position Height	1399
57	- Lower Position Length	719
58	- Lower Position Height	1139



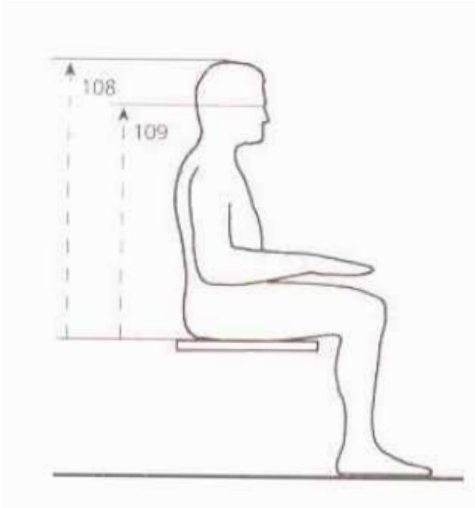
3 -	Height of body	1754
4 -	Eye Height	1645



69 -	Mid Position Length	739
70 -	Mid Position Height	1499
71 -	Lower Position Length	409
72 -	Lower Position Height	959

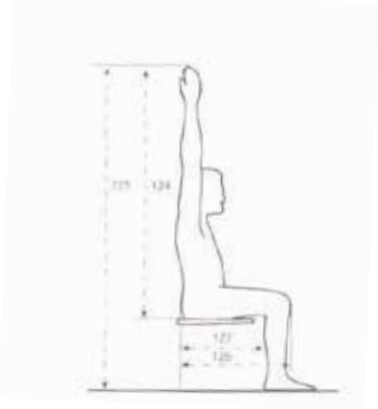


133 -	Bi-deltoid	482
135 -	Eye Height	164
136 -	Waist	317
137 -	Hip	405

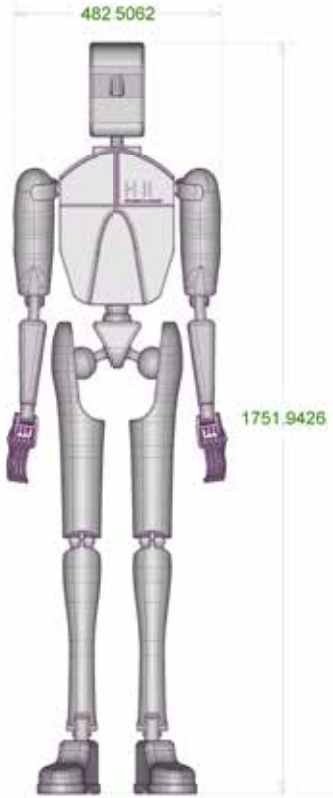


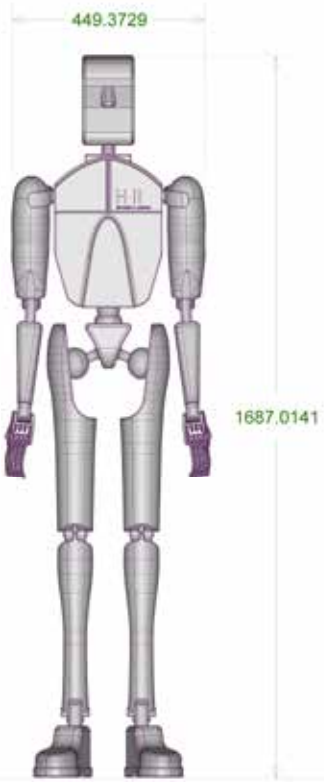
108 - Normal Sitting	893
109 - Eye (25th)	709

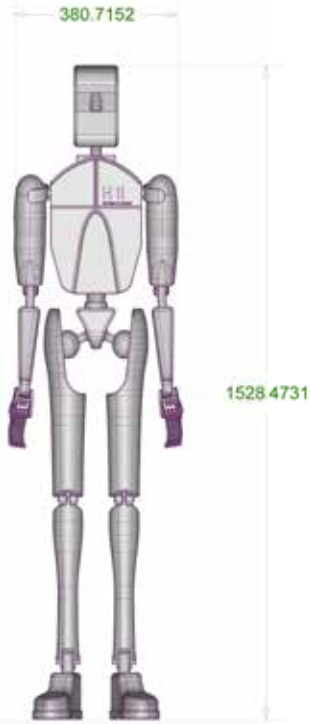
128 - length Normal Sitting	779
131 - Buttock to leg length	1209
-	



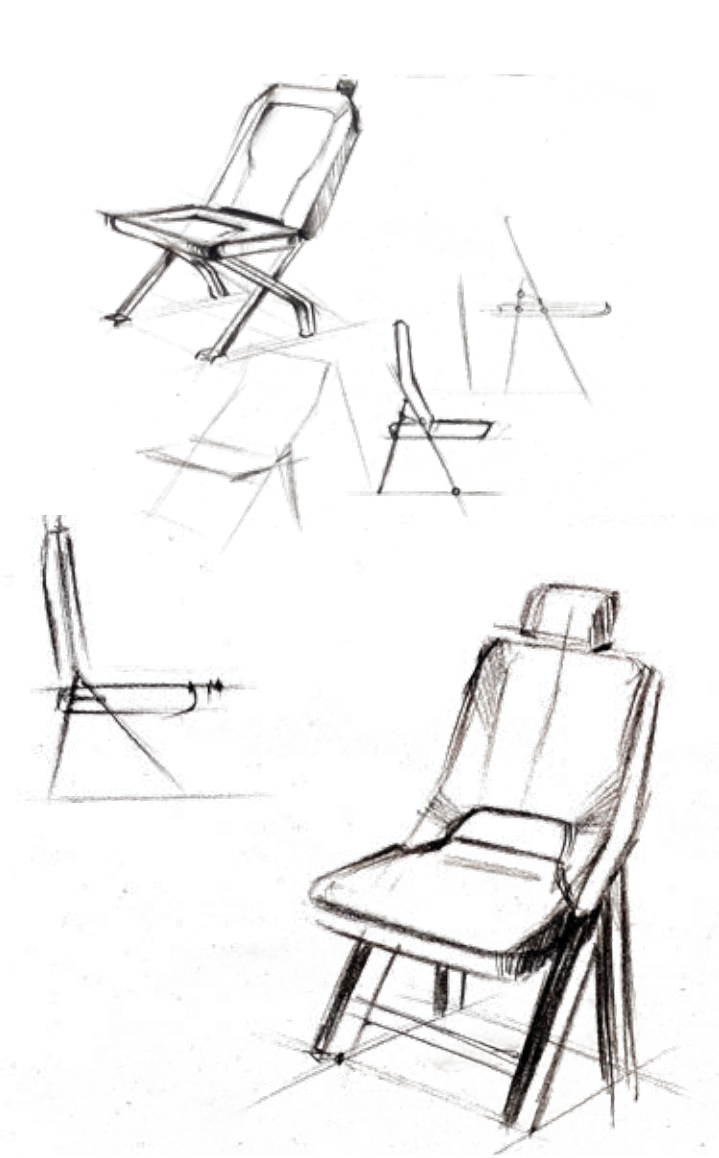
125 - Vertical arm reach.	1821

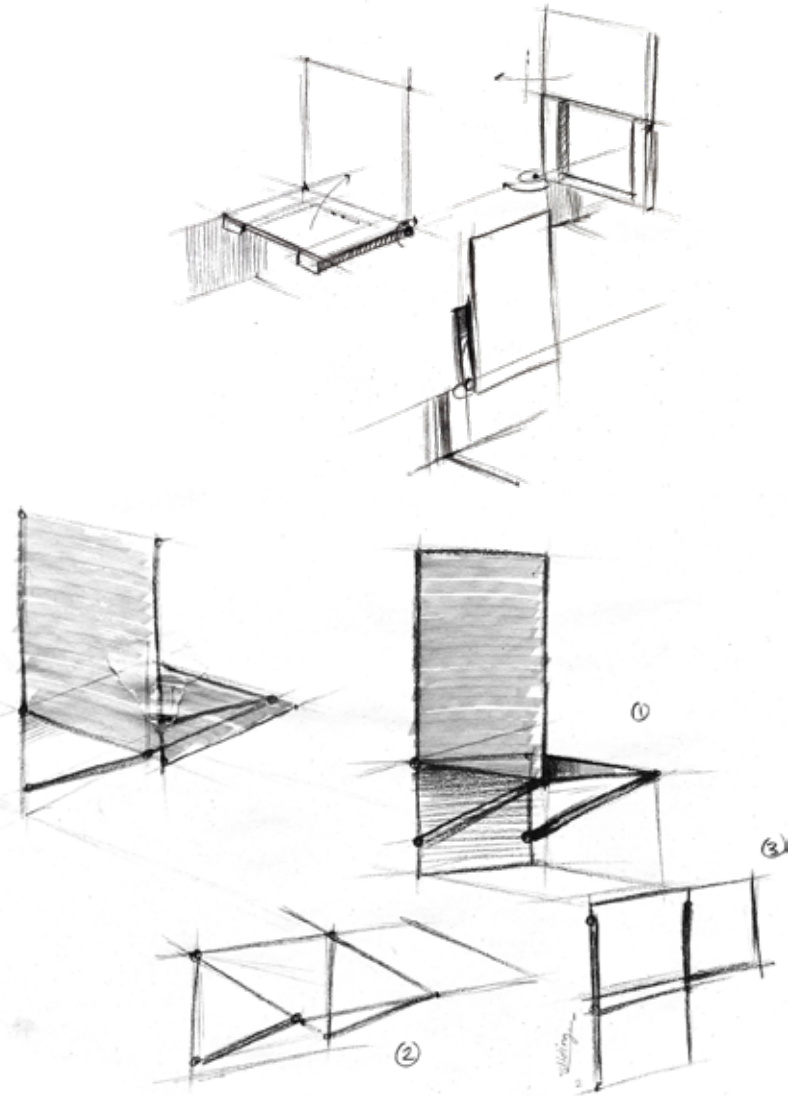




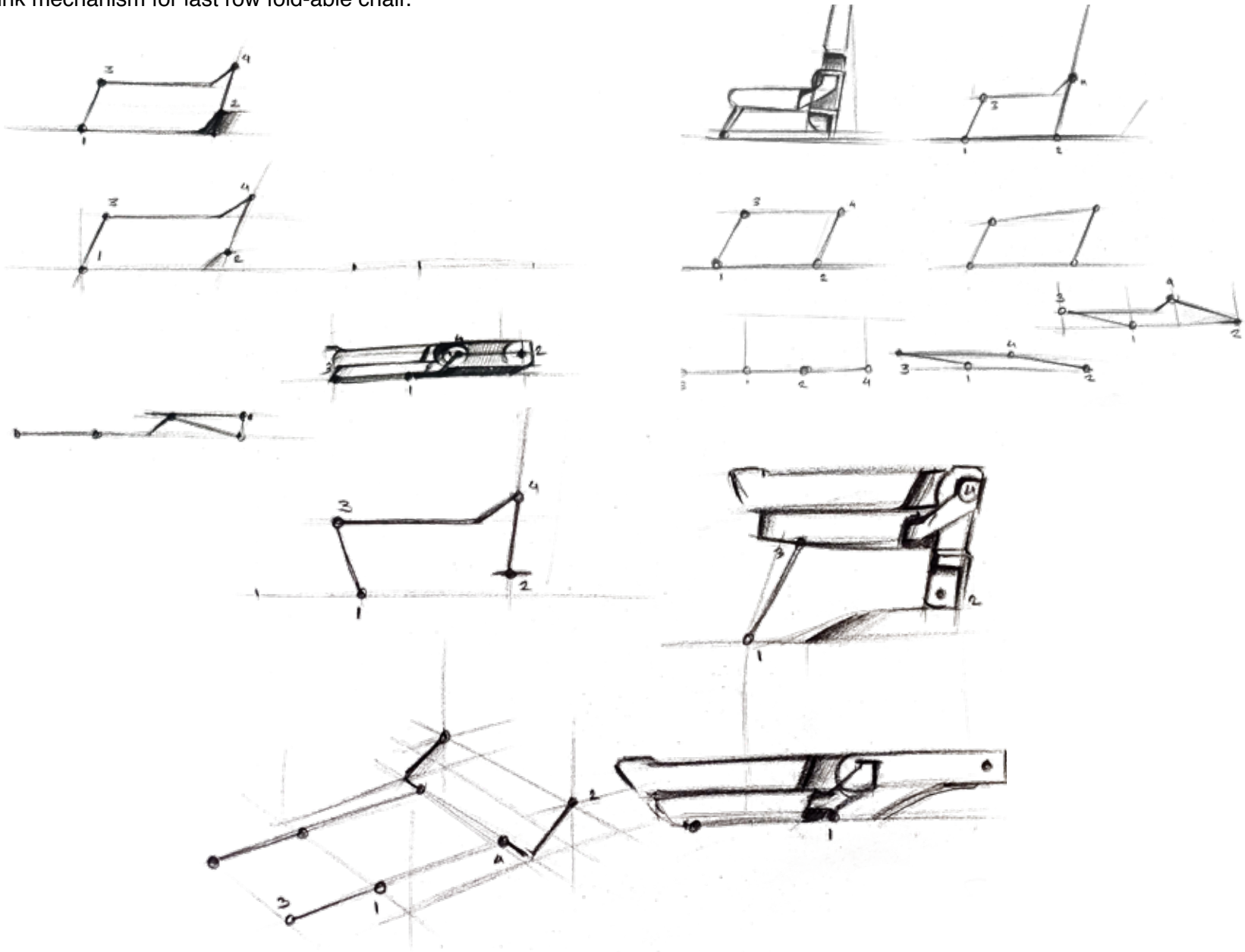


8.2 Fold-able Seat Mechanism

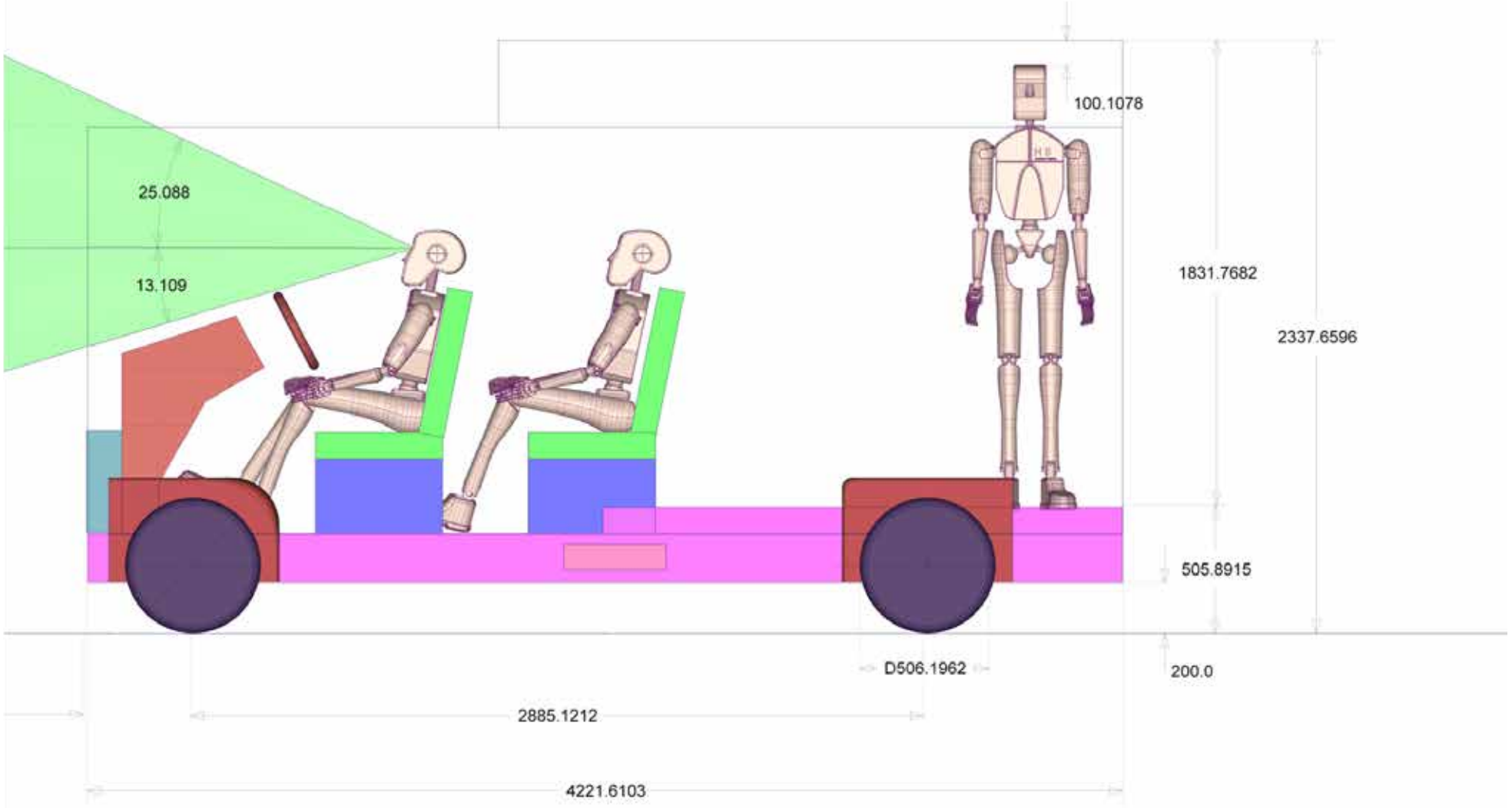




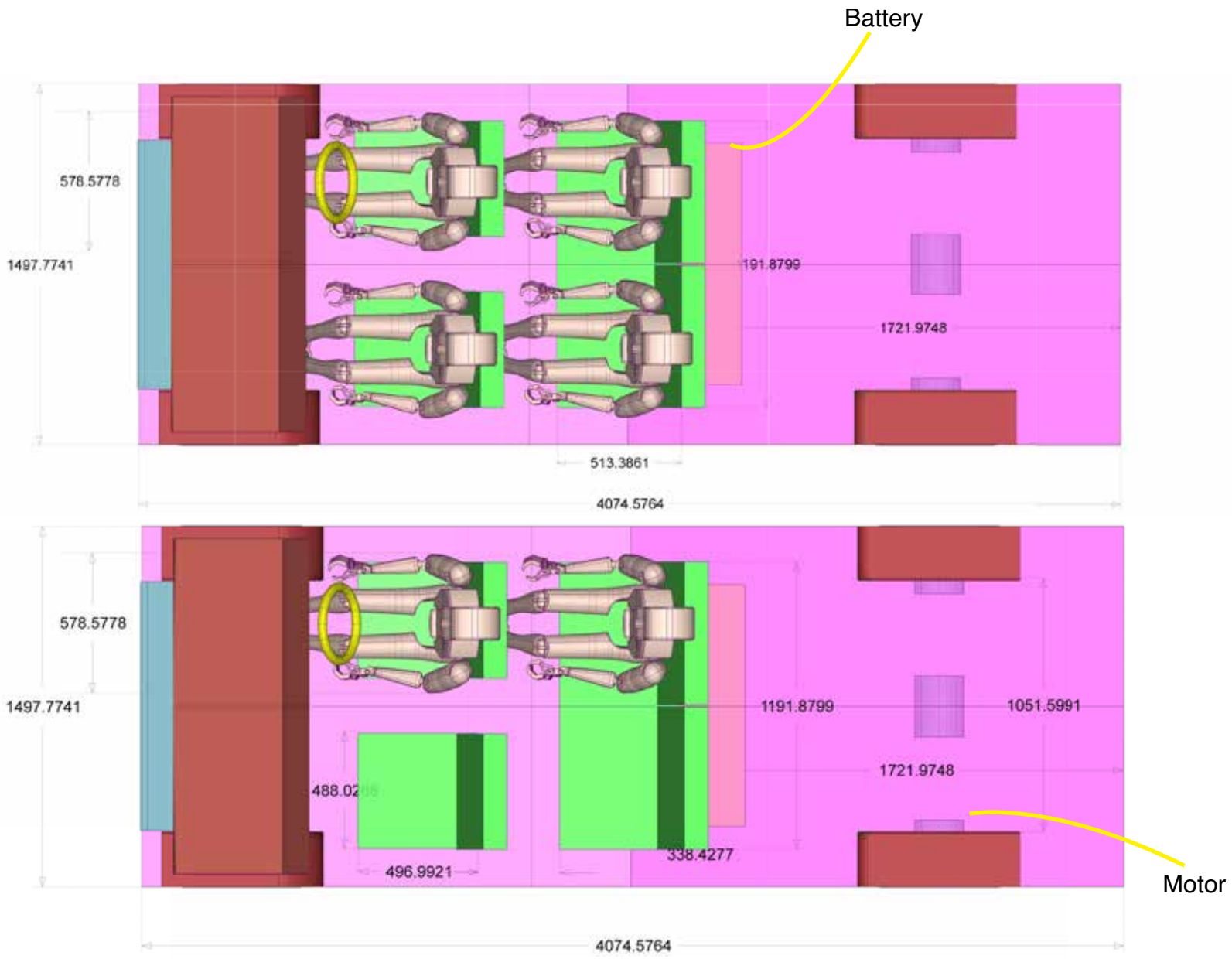
Selected 4 link mechanism for last row fold-able chair.



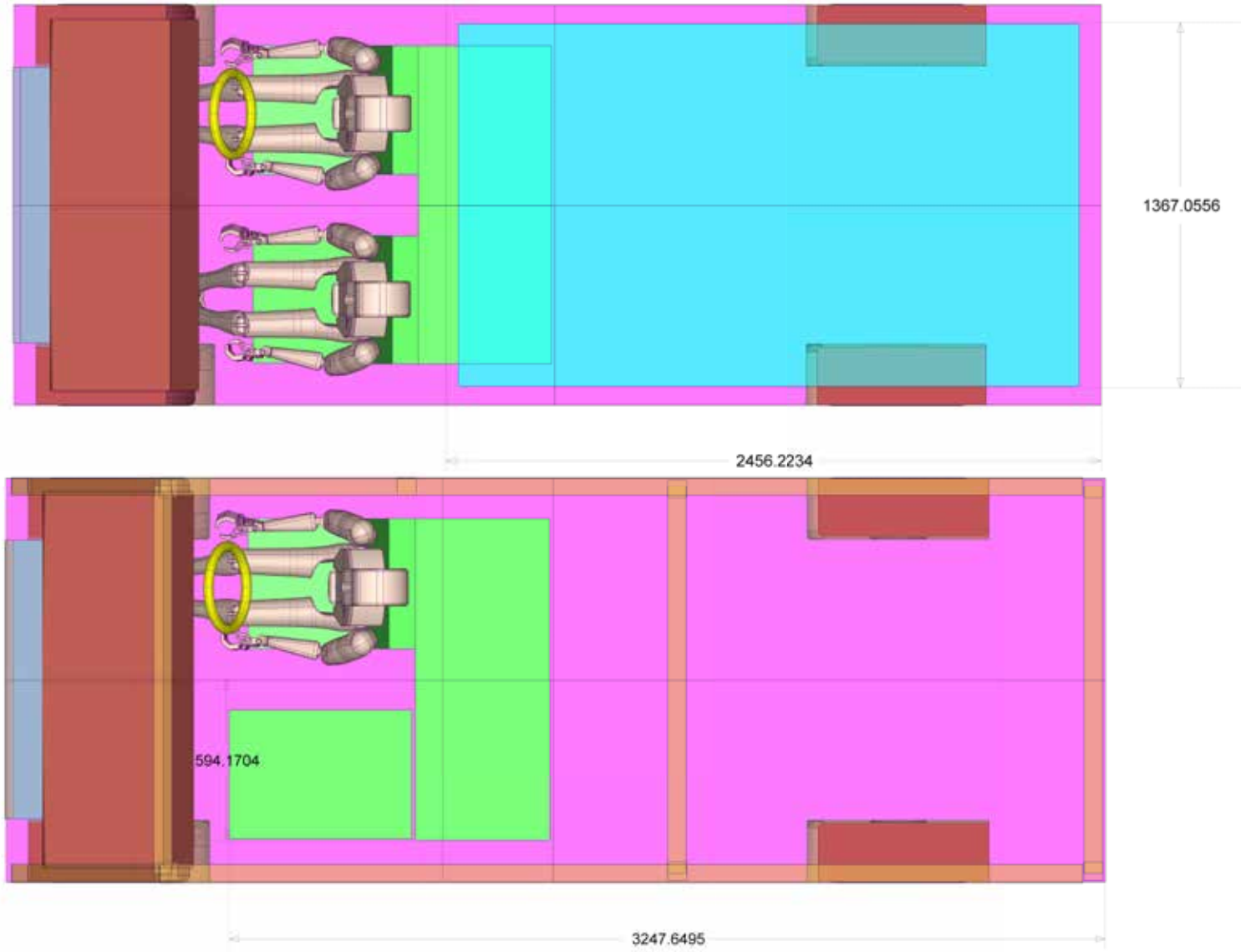
8.3 Occupant Packaging 1



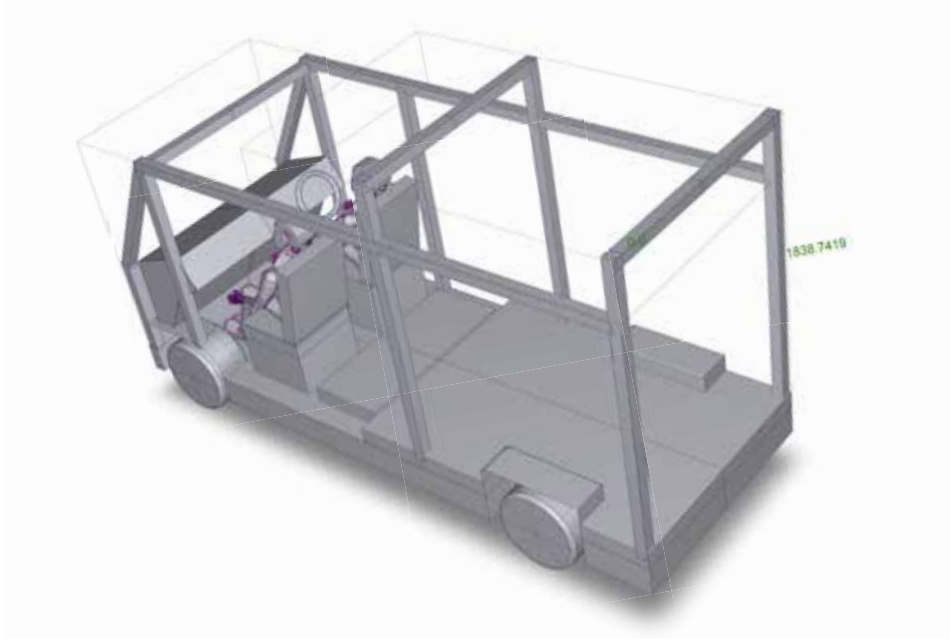
Packaging 1

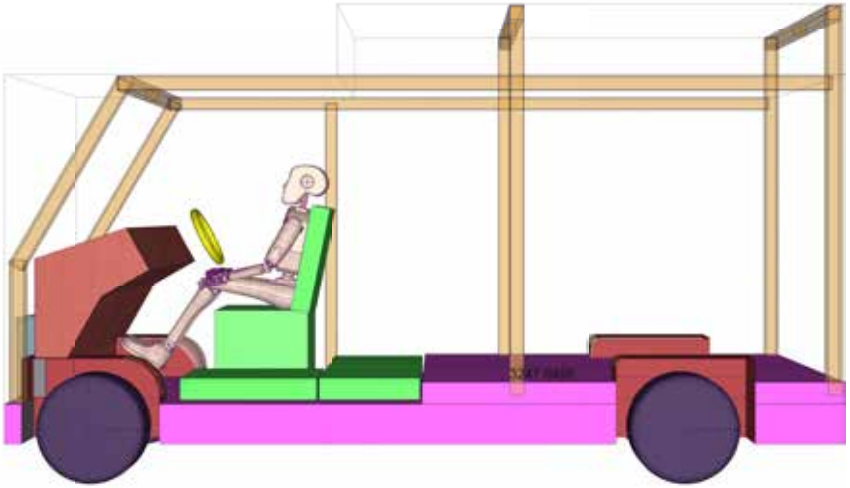

Battery
578.5778
1497.7741
191.8799
1721.9748
513.3861
4074.5764
578.5778
1497.7741
1191.8799
1051.5991
1721.9748
488.02
496.9921
338.4277
Motor
4074.5764

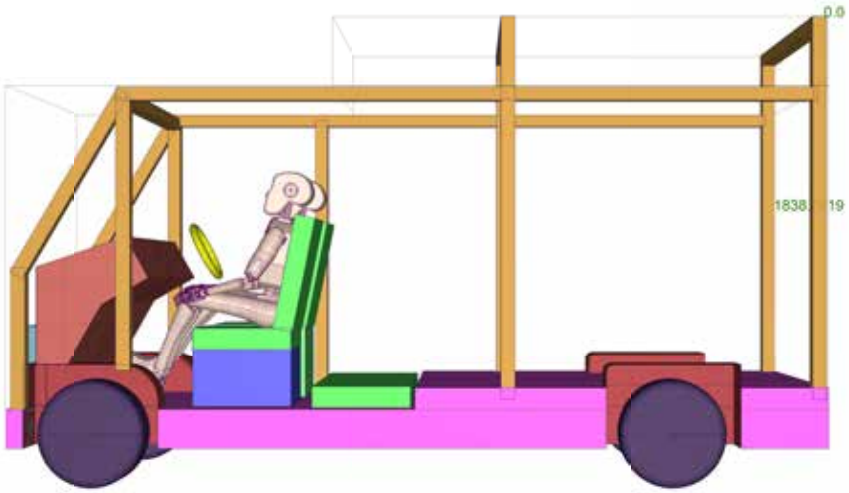
Packaging 1



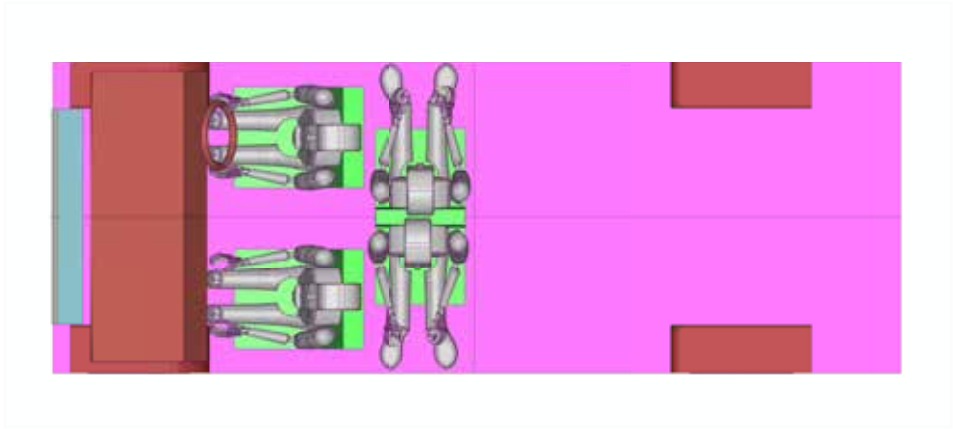
Packaging 1

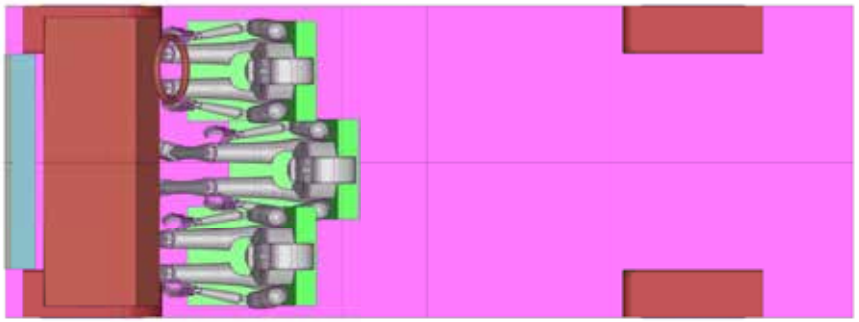


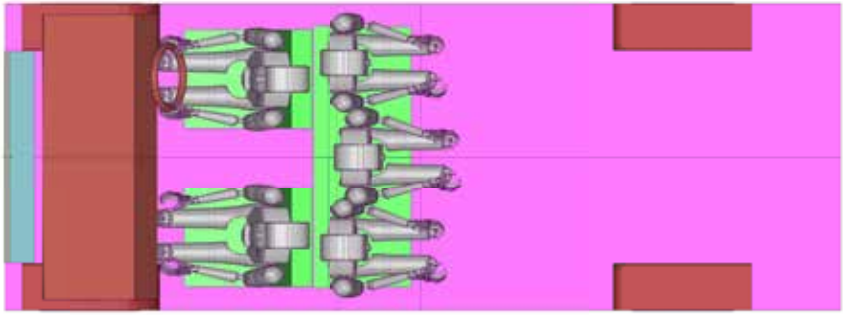


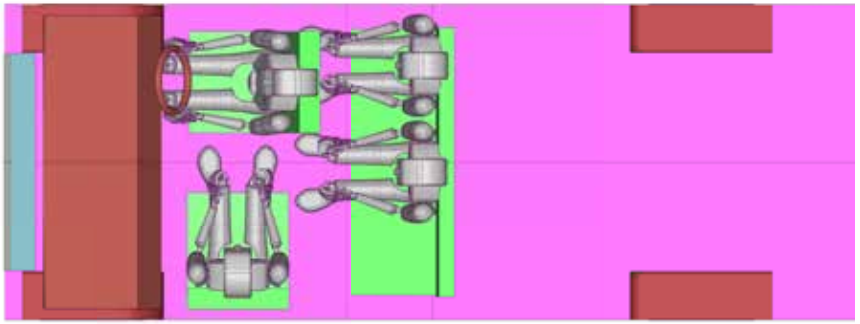


8.4 Exploration of seating configuration.









8.5 Indianness for seating configuration

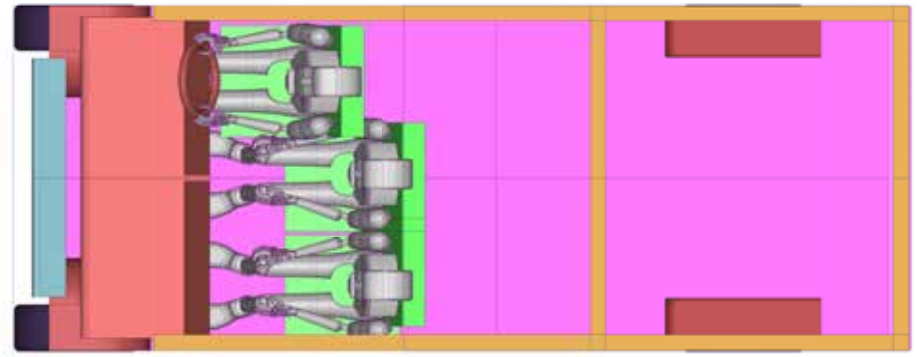
Auto Rik-Shaw : (Width 1.3 m)

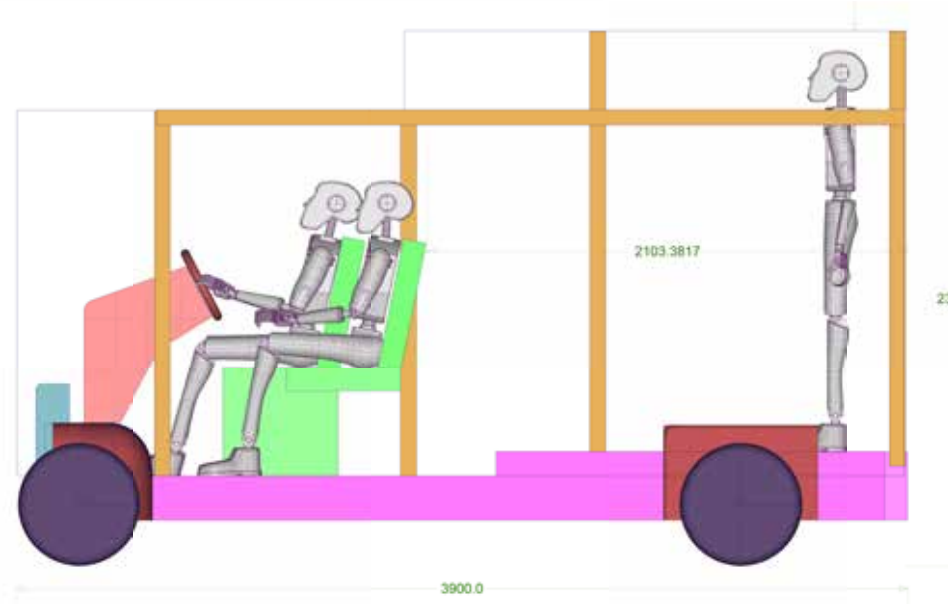
Even though it is too small mobility. Indians have cracked the way to carry more people in it. As shown in the image that middle row of seating is an interesting way to utilizing the space.

Suzuki Jimmy : (Width : 1.6 m)

As shown in pictures that usually how Indians seat in last row. This is inspiration for making new seating configuration.

8.6 Occupant Packaging 2





3 Seats in first row of vehicle. There is limitation for width of vehicle as TATA Ace is compact vehicle in commercial segment, Which has set a benchmark in India to cater the narrow streets of India. Making space for 3 people with the limitation on width of vehicle. Possible seating arrangement shown in images.

Advantages

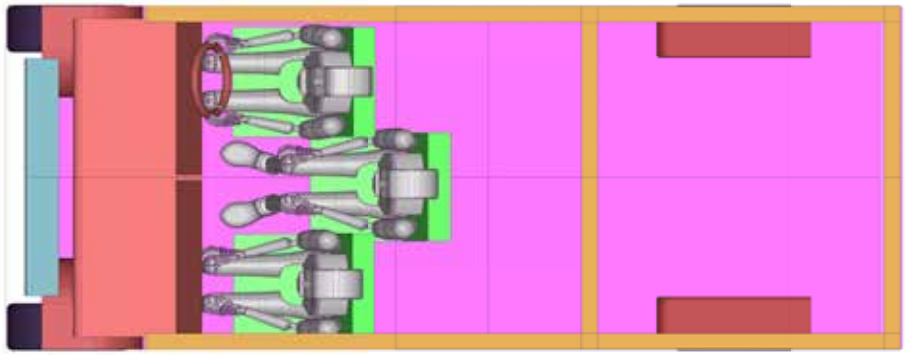
- Maximum space is utilized for cargo area while carrying one extra human. Which

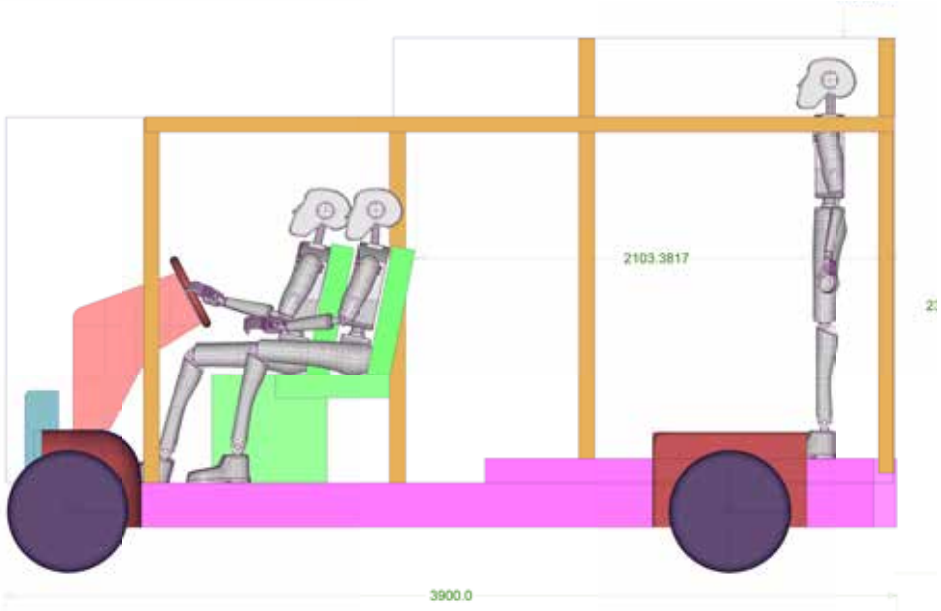
will improve the consumers satisfaction.

Disadvantages of configurations

- Seating comfort for driver and passengers. Comfort for passenger can be compromises in Indian context. But driver should have better space for driving.
- Front right wheel fender is abstraction for driver's leg space.
- Only one side shoulder space is utilized in first row of seating.

8.7 Occupant Packaging 3





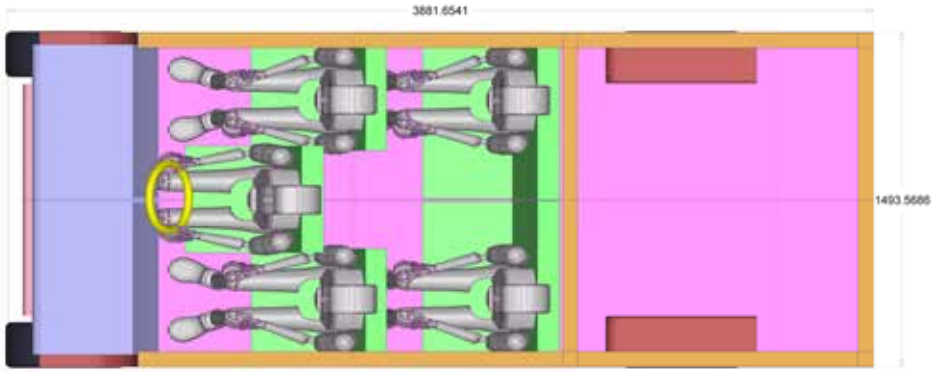
Advantages

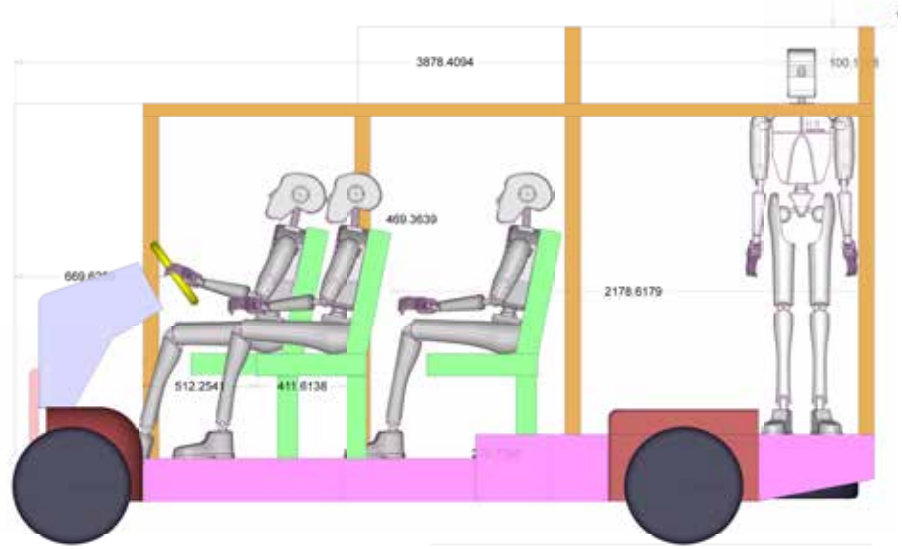
- Maximum space is utilized for cargo area while carrying one extra human. Which will improve the consumers satisfaction.
- Double shoulder space is utilized in first row of seating.

Disadvantages of configurations

- Seating comfort for passengers. Which can be compromise in Indian context.
- Front wheel arches are abstraction for driver's leg space and for most left passenger..
- Ingress and Egress of middle passenger.

8.8 Selected Packaging





Center seat driving has potential to solve many disadvantages of previous packagings.

Advantages

- Maximum space is utilized for cargo area while carrying one extra human. Which

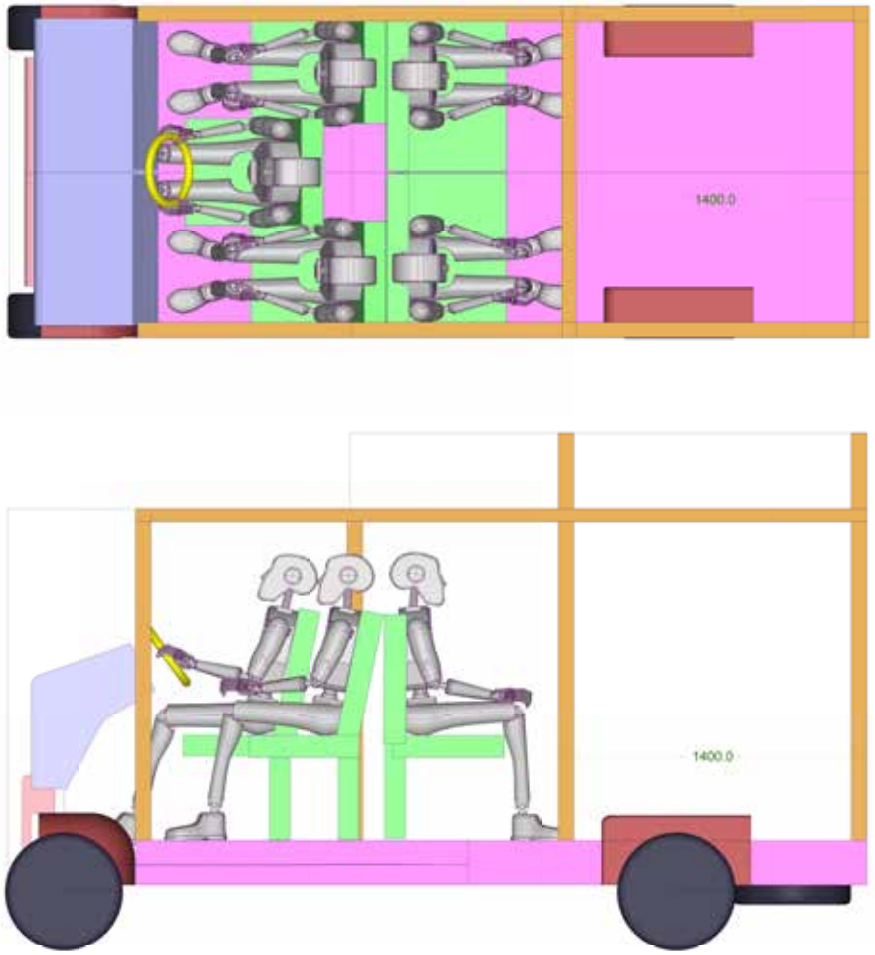
will improve the consumers satisfaction.

- Double shoulder space is utilized in first row of seating.
- Driver has comfortable space for driving.
- Better Visibility for driver while driving as co-passengers are little behind his shoulder.
- Front Wheel arches are not abstraction any more for both side traveler as co-passengers are little backward.
- Driver seat shifted forward to utilizes the central front space.

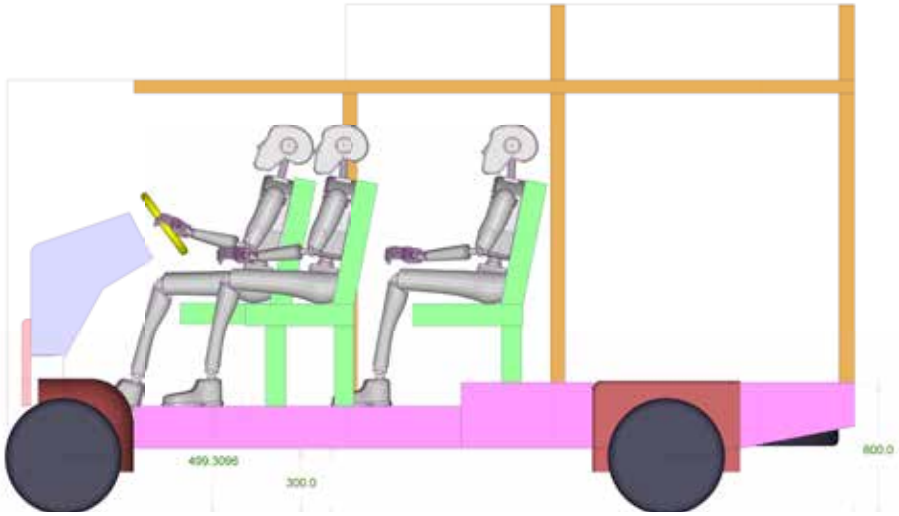
Disadvantages of configurations

- Ingress and egress for driver is difficult in a scenario of maximum passenger and maximum cargo being carried.

Some Explorations of Final packaging



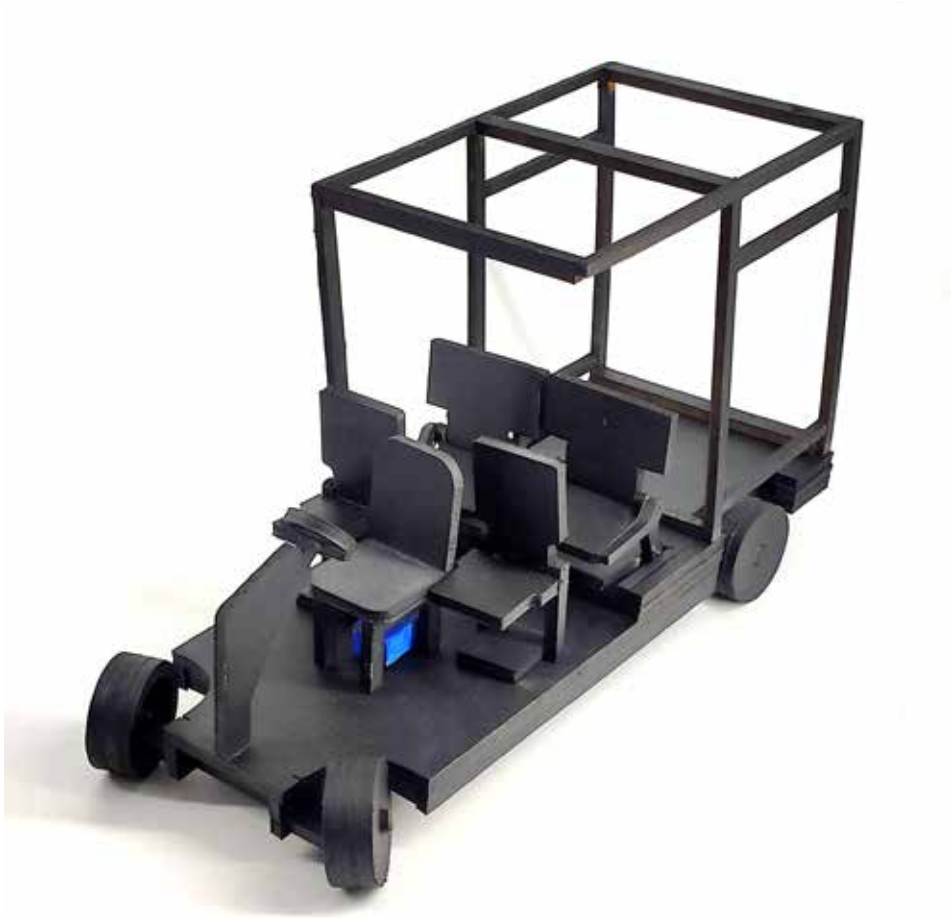
Flat bed for cargo area is beneficial for loading more cargo space. To make flat bed, height of handling payload increases. As shown in below image.

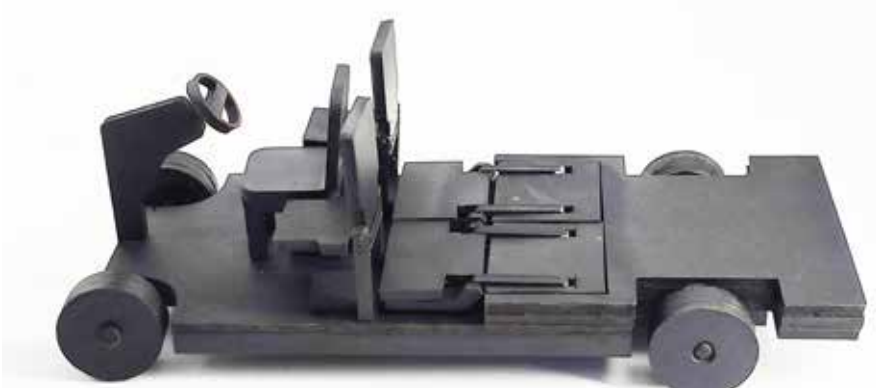


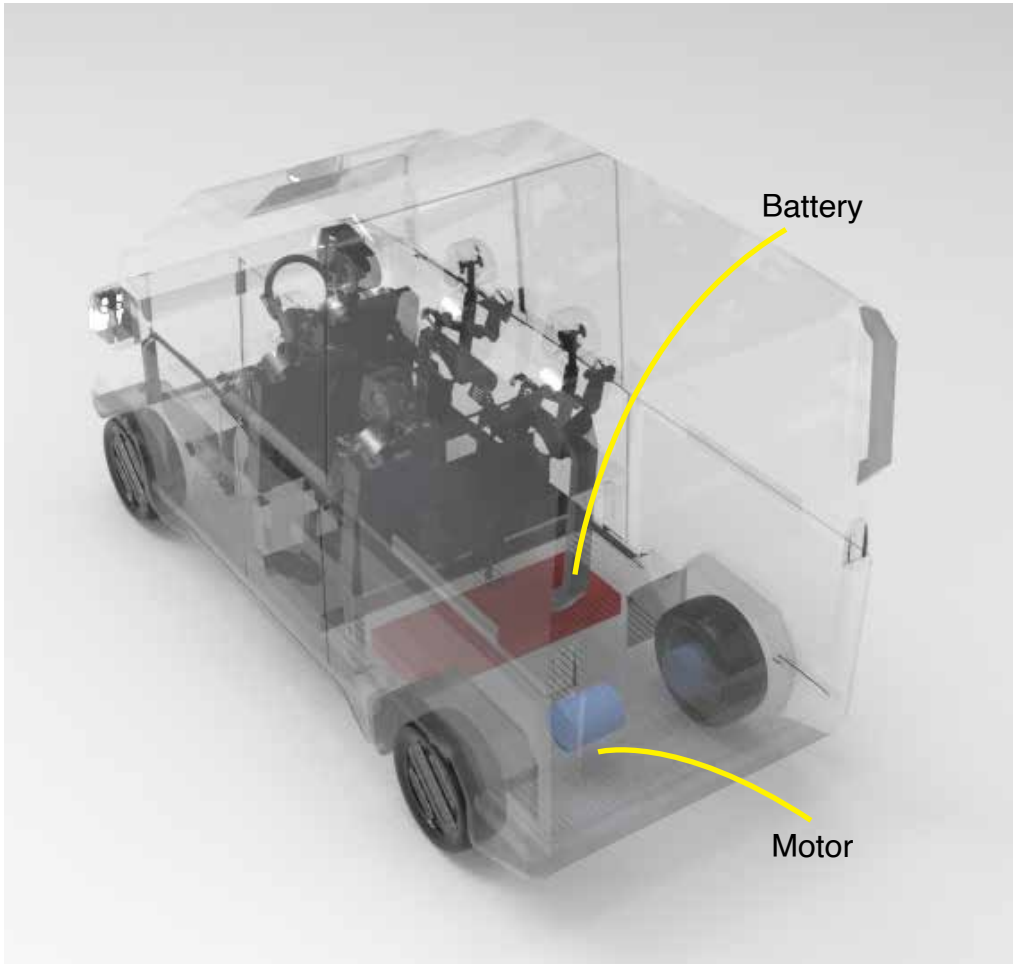
8.9 Technical Packaging Mock-up (Scale 1:14)

To understand the proportion of vehicle and compare with existing commercial vehicles, Mock-up of TATA Ace and Eeco is made along with the final packaging

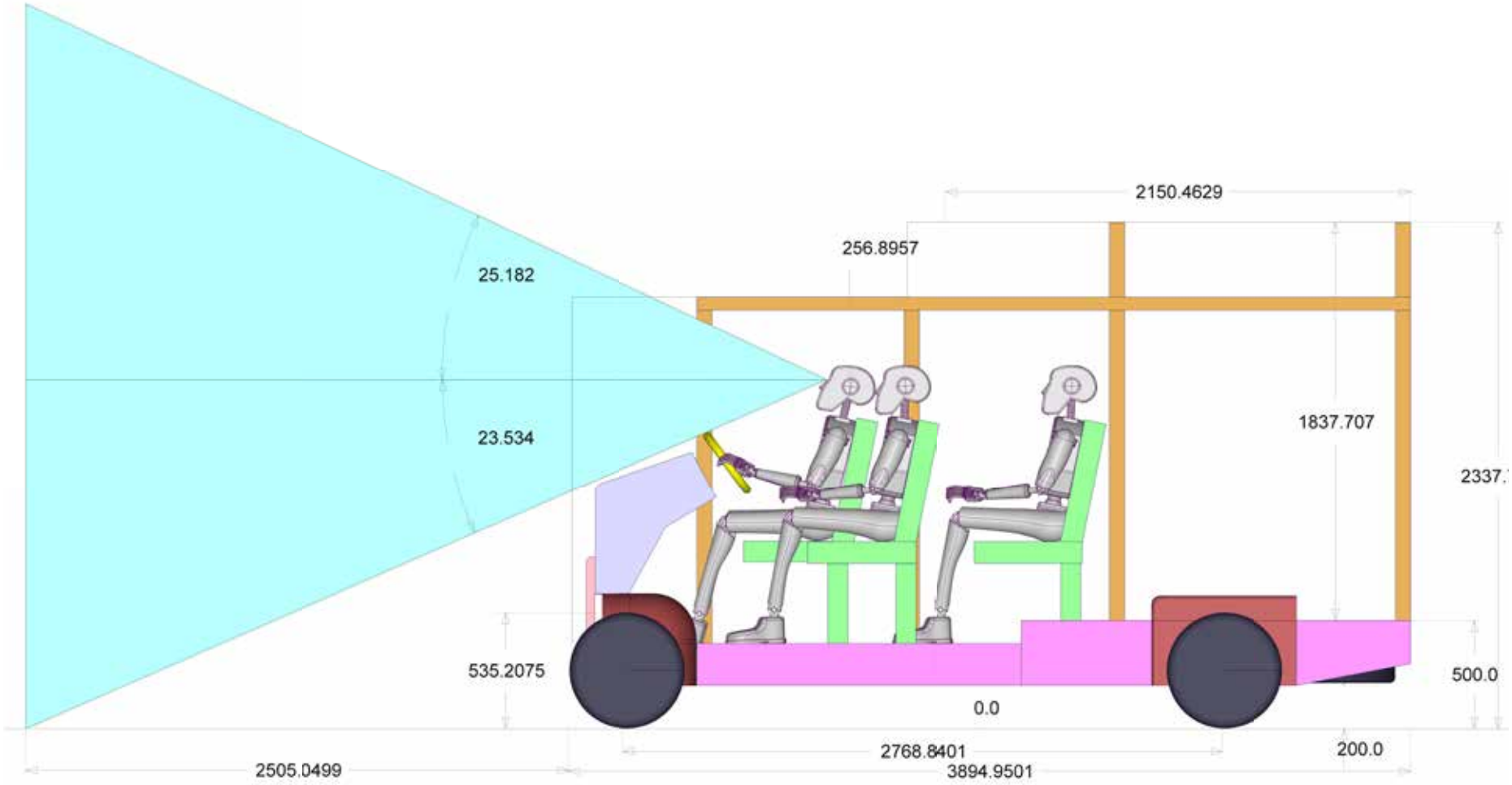
Technical Packaging Mock-up (Scale 1:14)



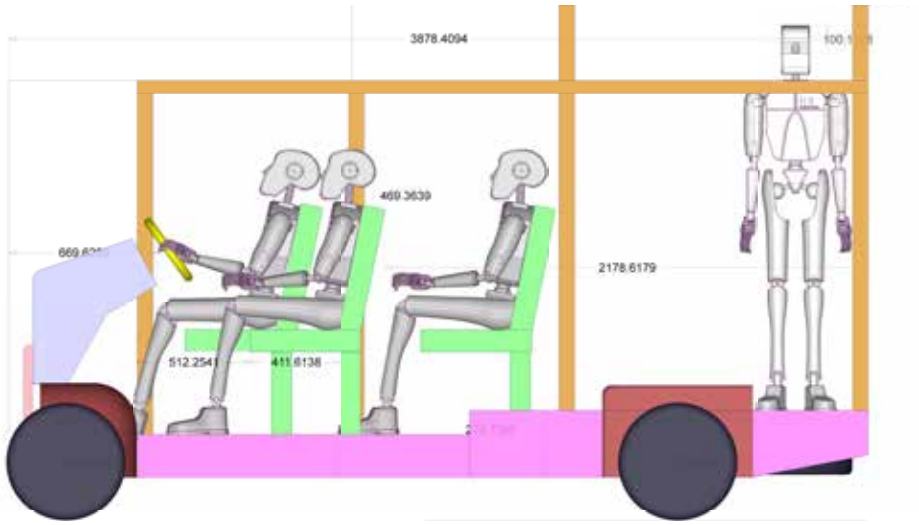


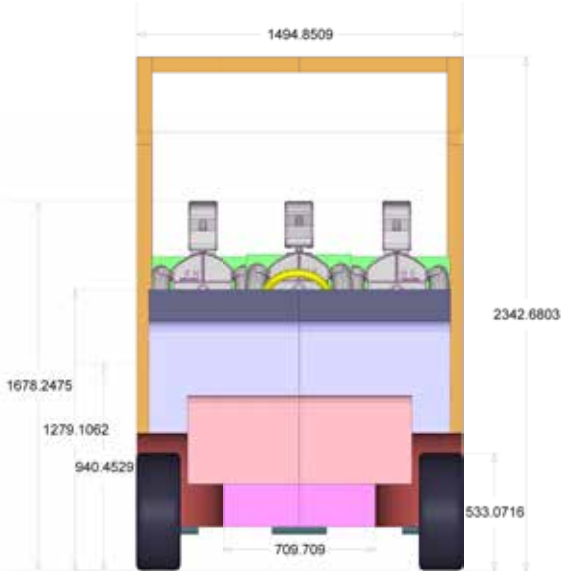

Battery
Motor

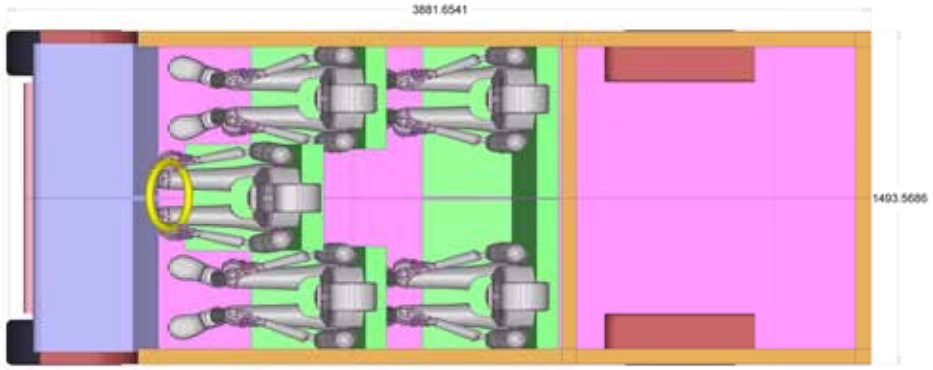
8.10 Final Packaging



Final Packaging







Merits of Concept

It can be used as Mini van and Mini Truck as it provides the same cargo space as mini trucks example TATA ace as similar product

Modular seating configuration benefits the loading of odd shape cargo.

First row provides the seating for two passenger and driver, with driver having comfortable space to drive.

Better vision while turning vehicle for driver as co passengers are little behind is shoulder.

As 2 passengers are in first row. Maximum is used for cargo transportation.

Driver seating is shifted toward front as it is in center of vehicle. Which is restricted in one side driving due to wheel well space occupied in interior.

Access to the cargo from side of the vehicle is efficient due to removal of B pillar from the left side of vehicle.

3 m long space is available to transported long cargo.

Challenges

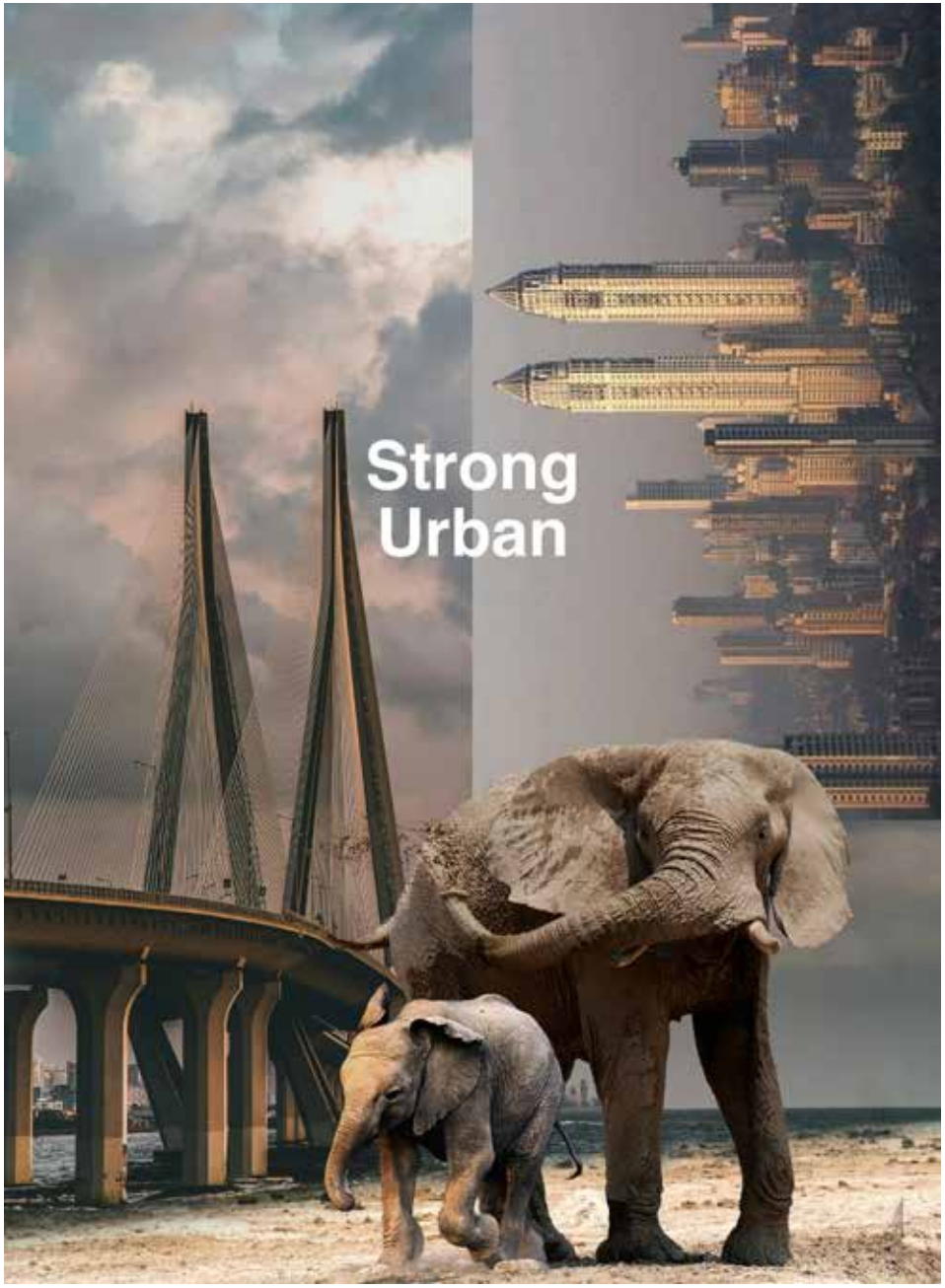
In a scenario of maximum cargo and maximum passenger driver has a difficulty of ingress and Egress.

Additional modular separation is necessary to prevent of falling cargo in front in sudden braking and uncertain situations.

Maintenance of modular seats.

30 to 60 min of traveling of Urban transportation need can cause Congested seating for co - passengers.

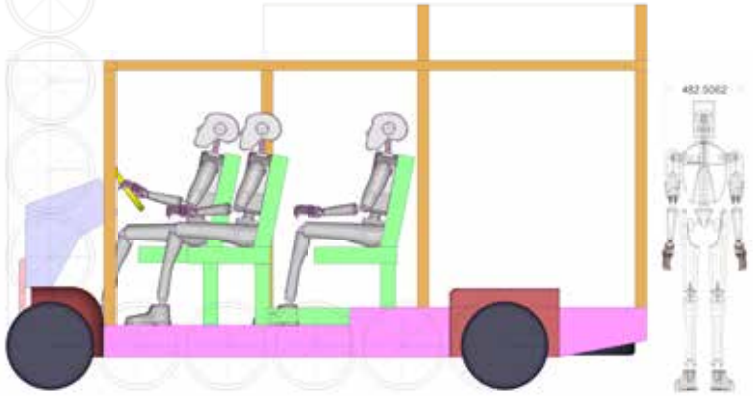
9 MOOD BOARD

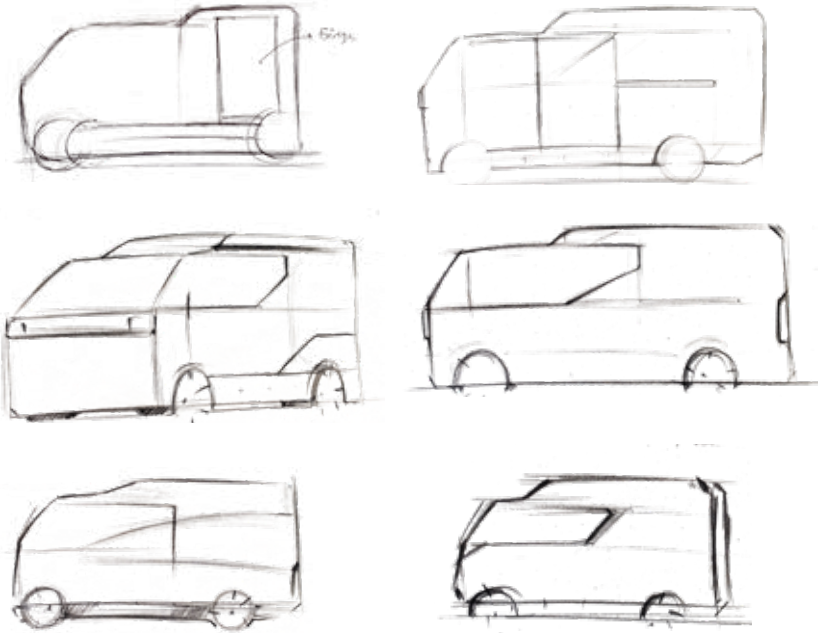


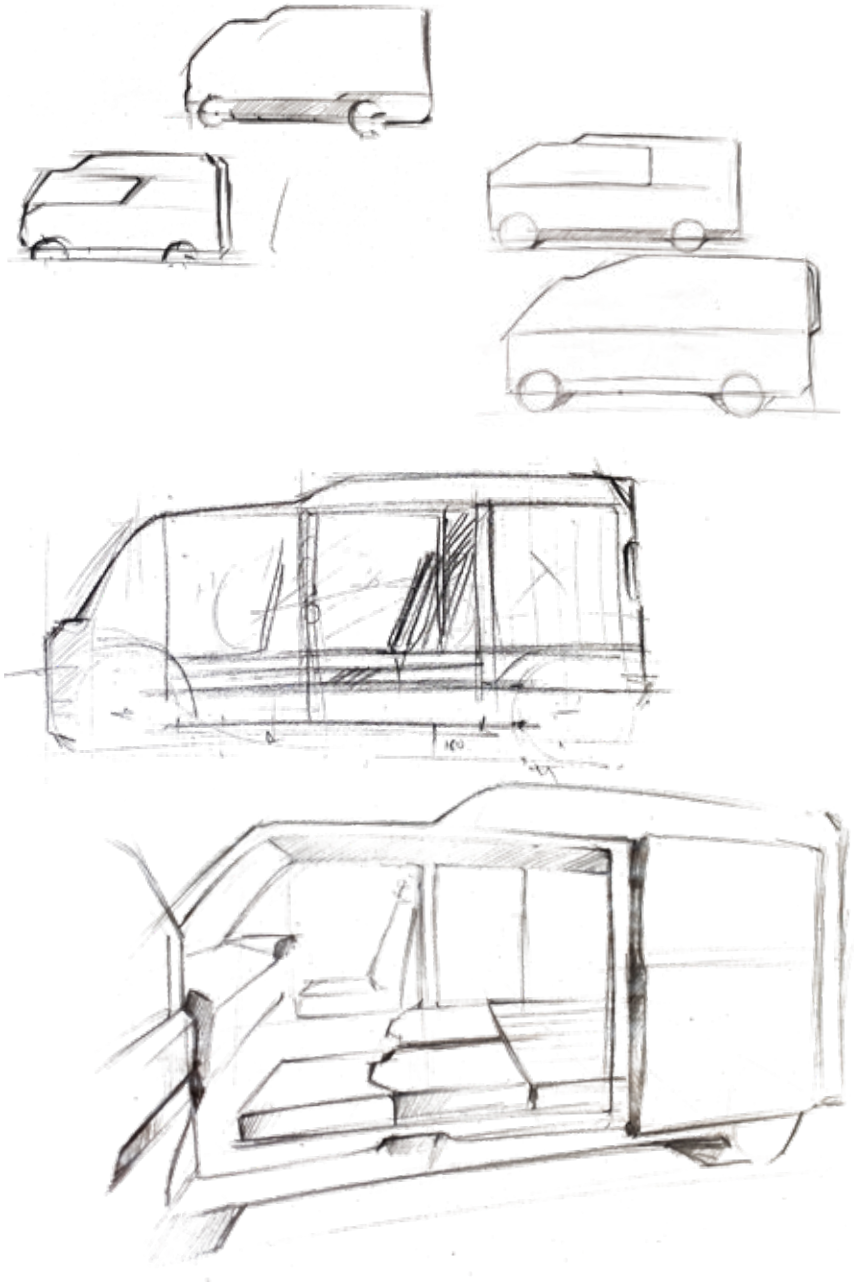
10 THEME BOARD

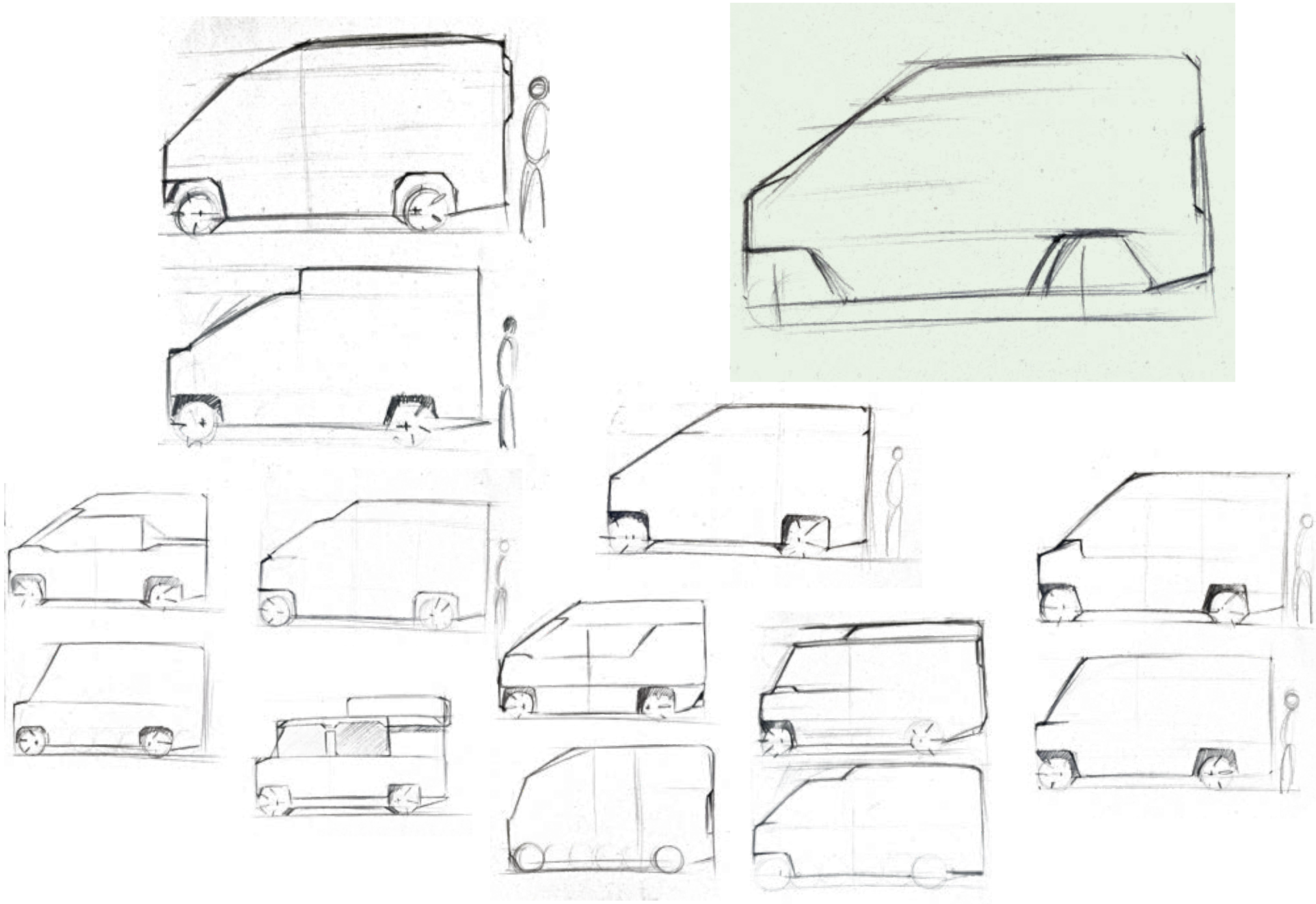
11 IDEATION SKETCHES

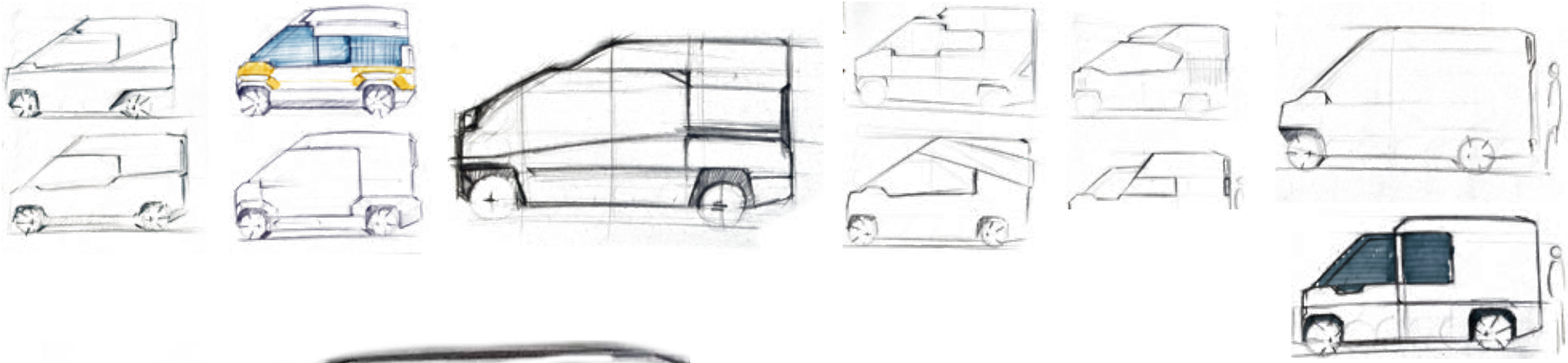
Vehicle Proportions

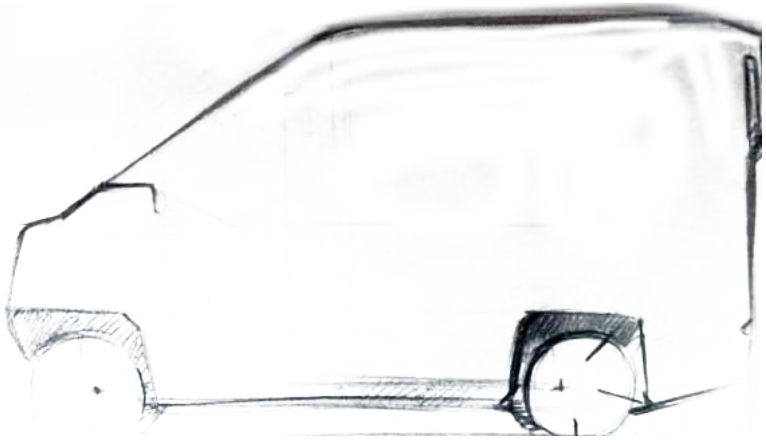




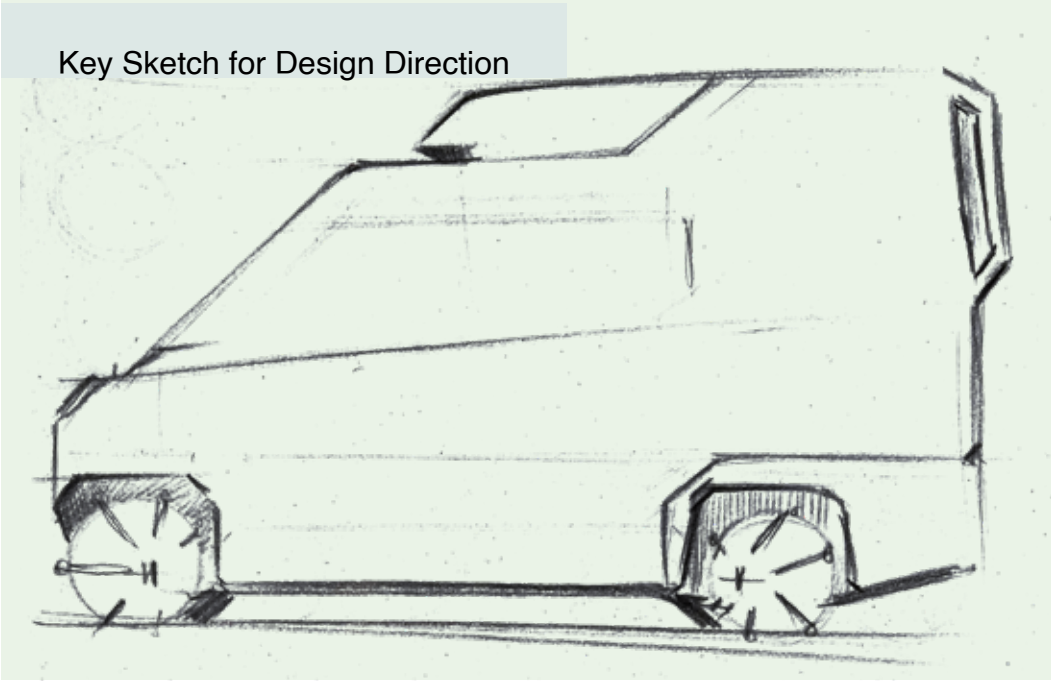


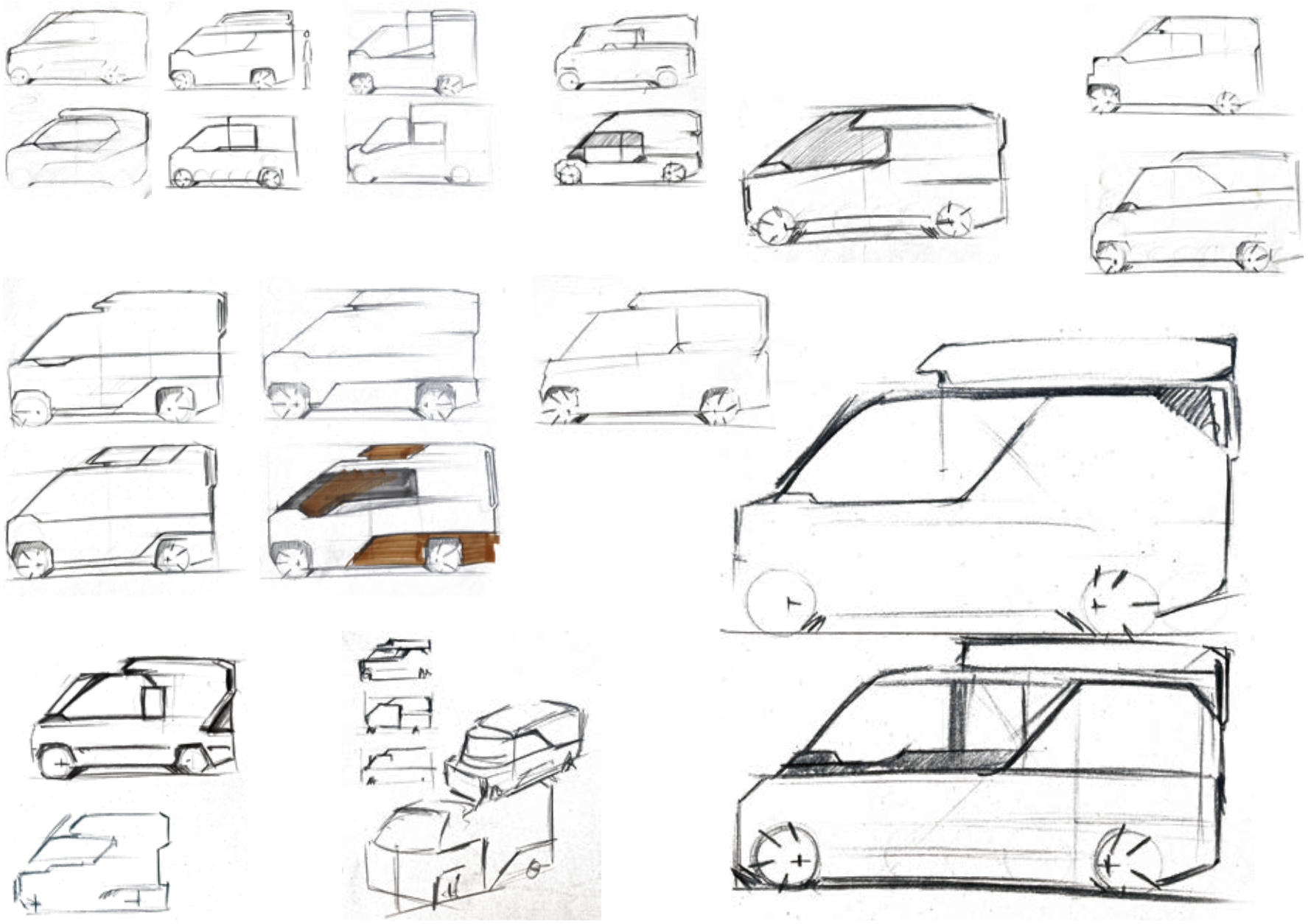


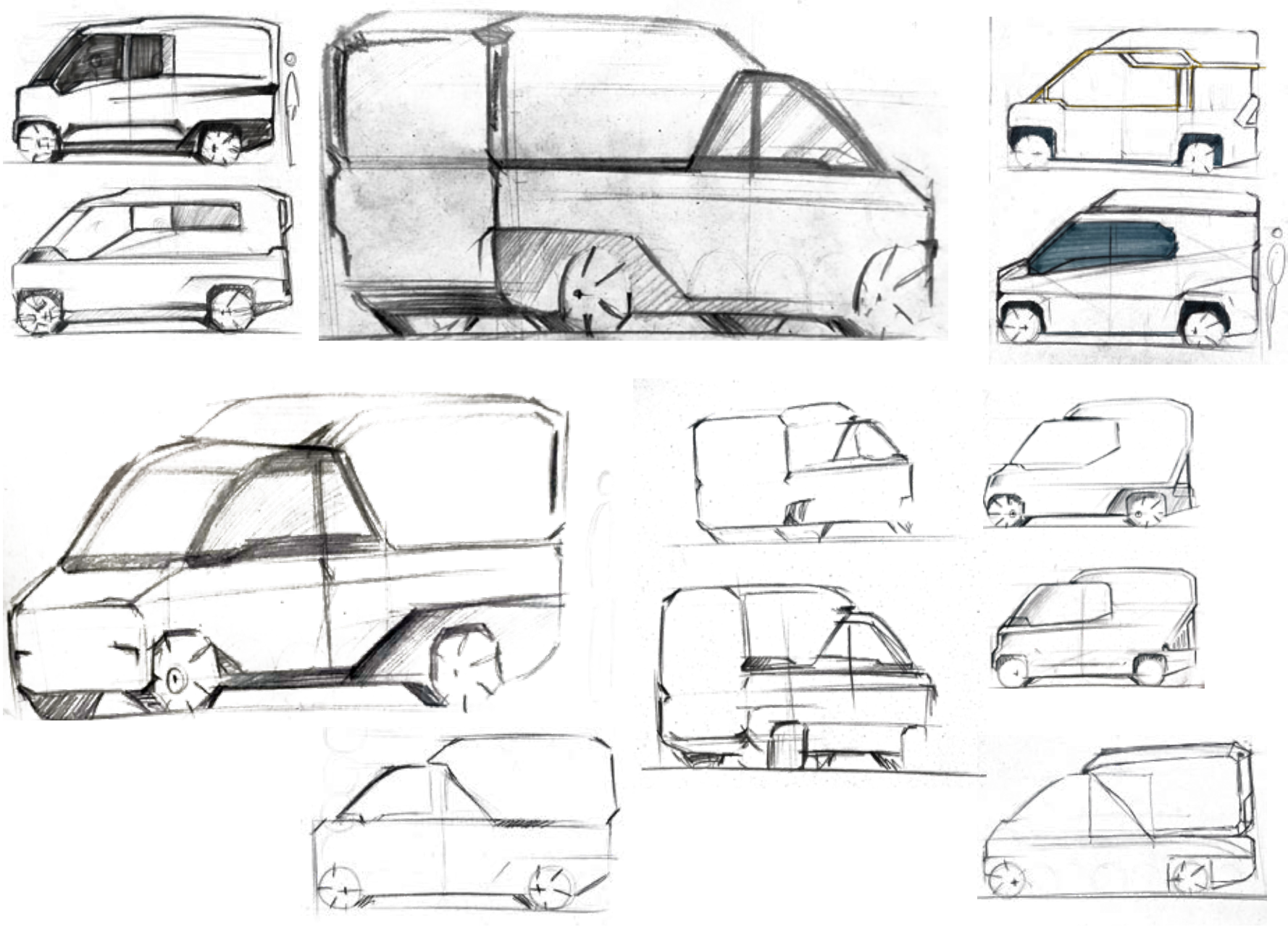


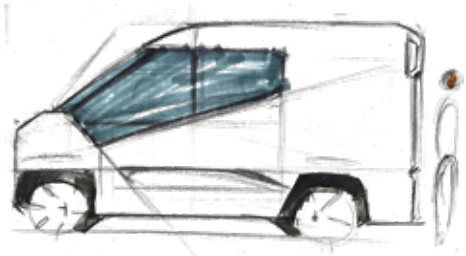


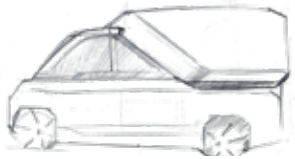
Key Sketch for Design Direction

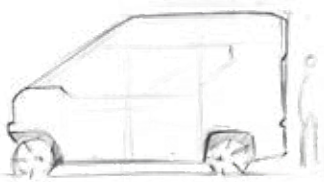


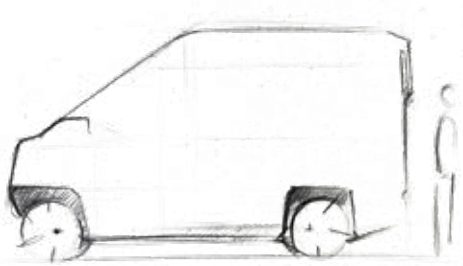


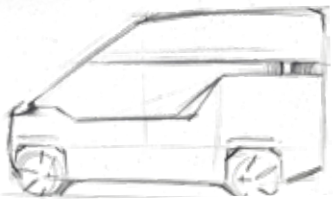


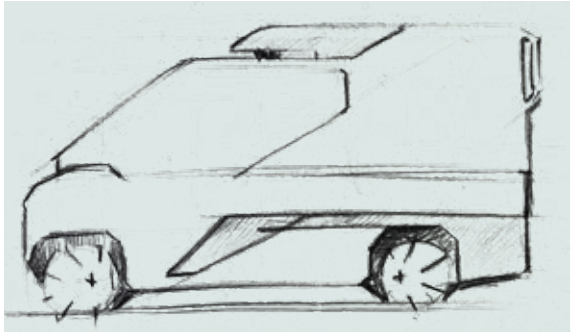




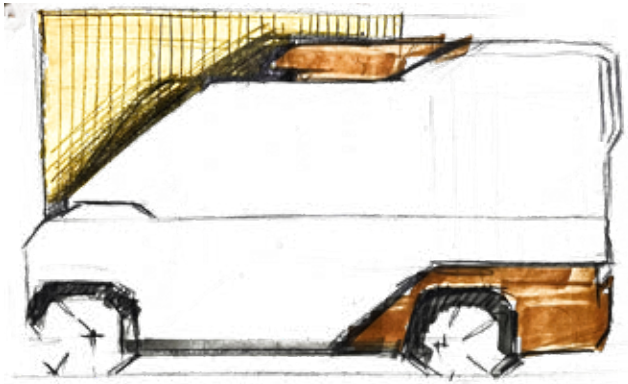


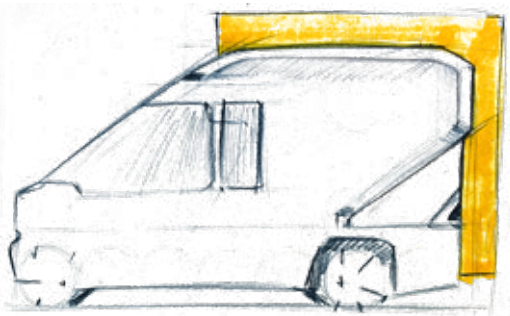


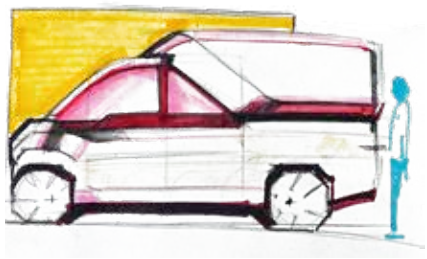


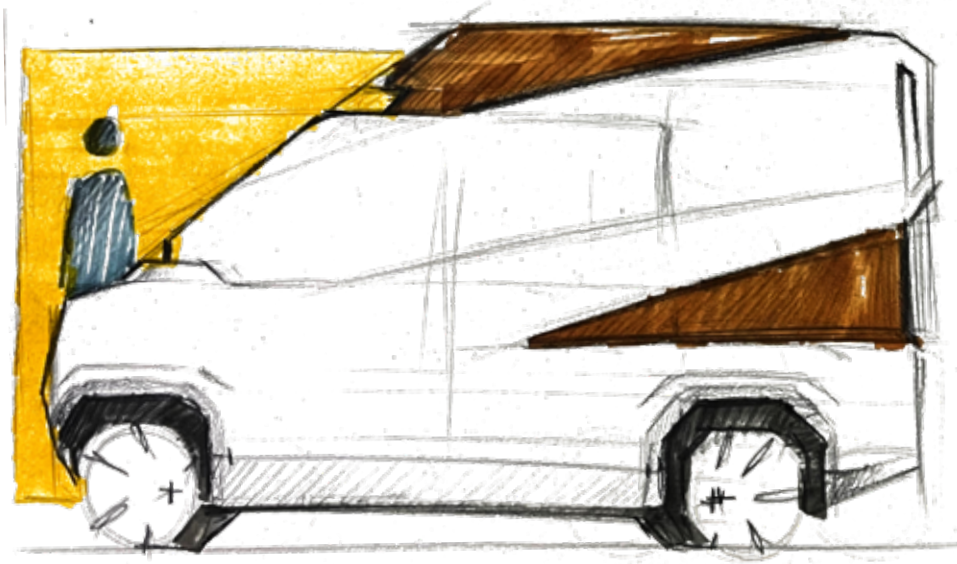


Key Sketch for design direction



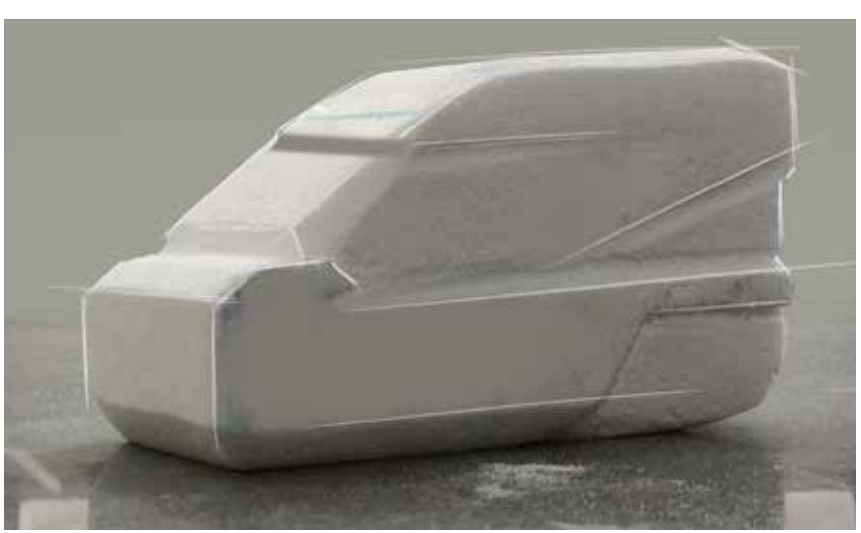


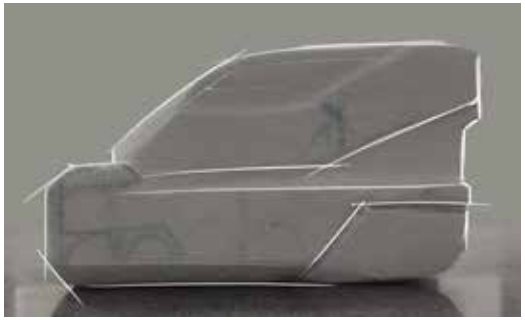


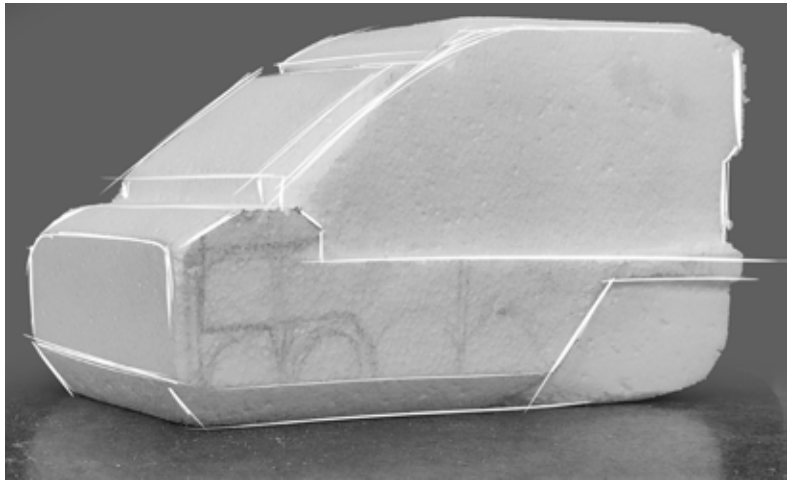


Key Sketch for design direction

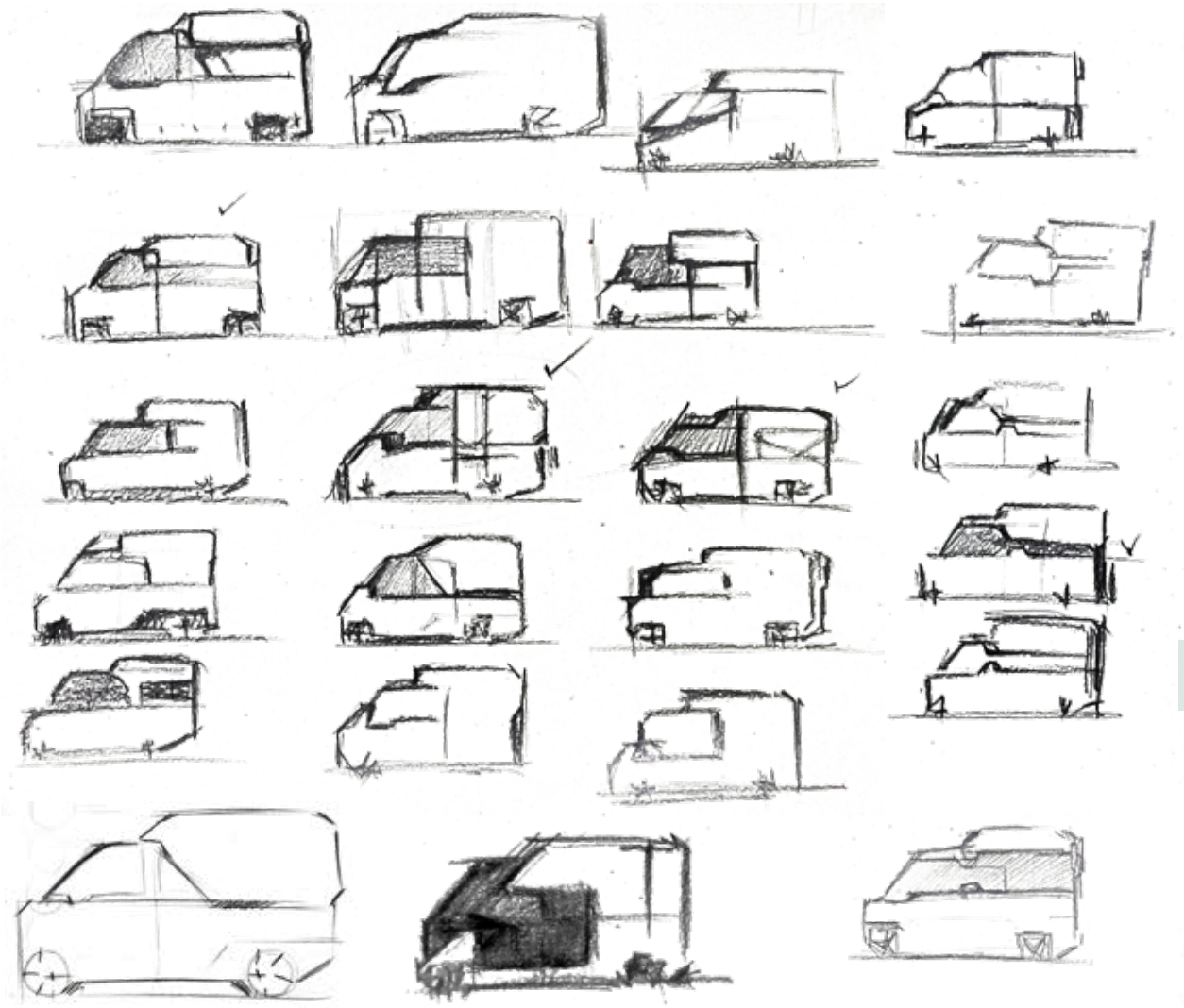
11.2 Form Exploration



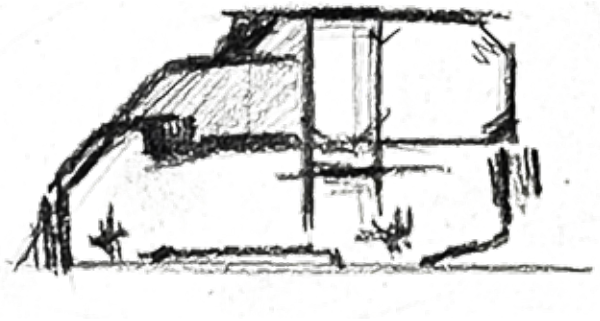




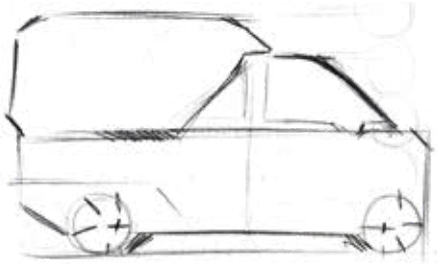
11.3 Sketch Rivison



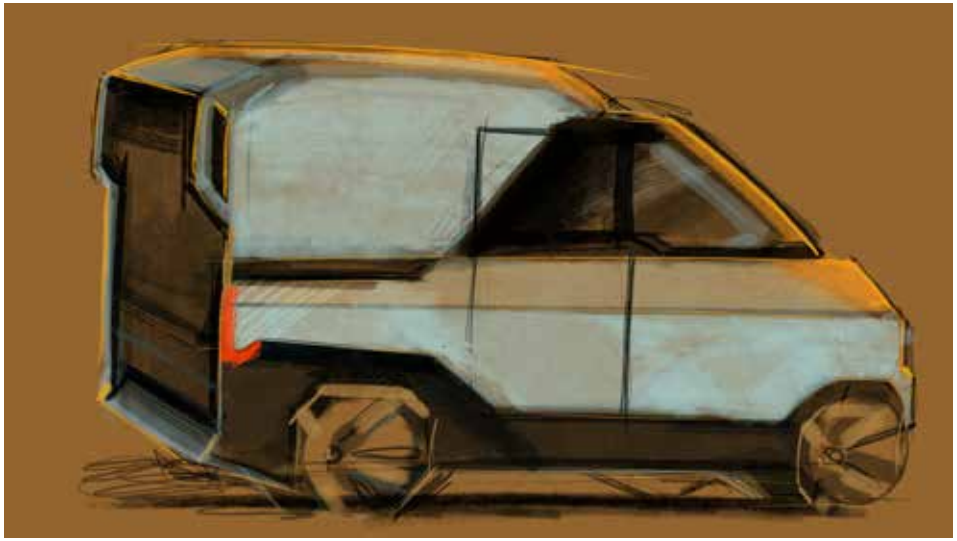
Key Sketch for Design Direction



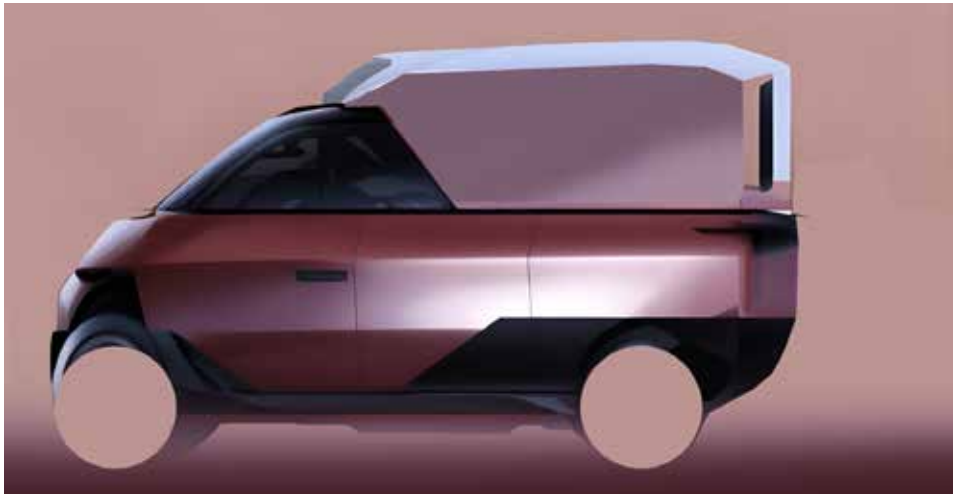
11.4 Concept_1.

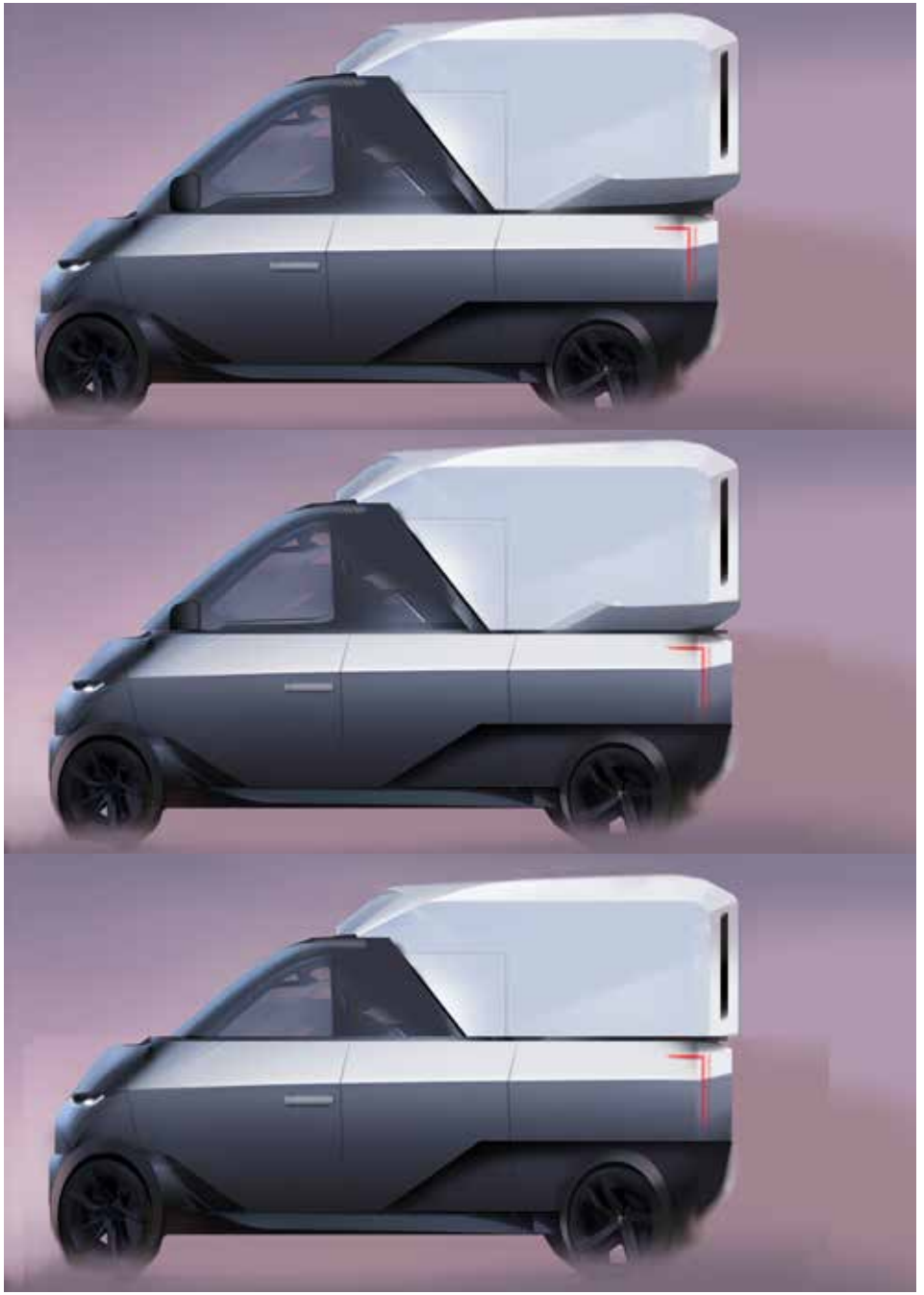


AI Generated Render

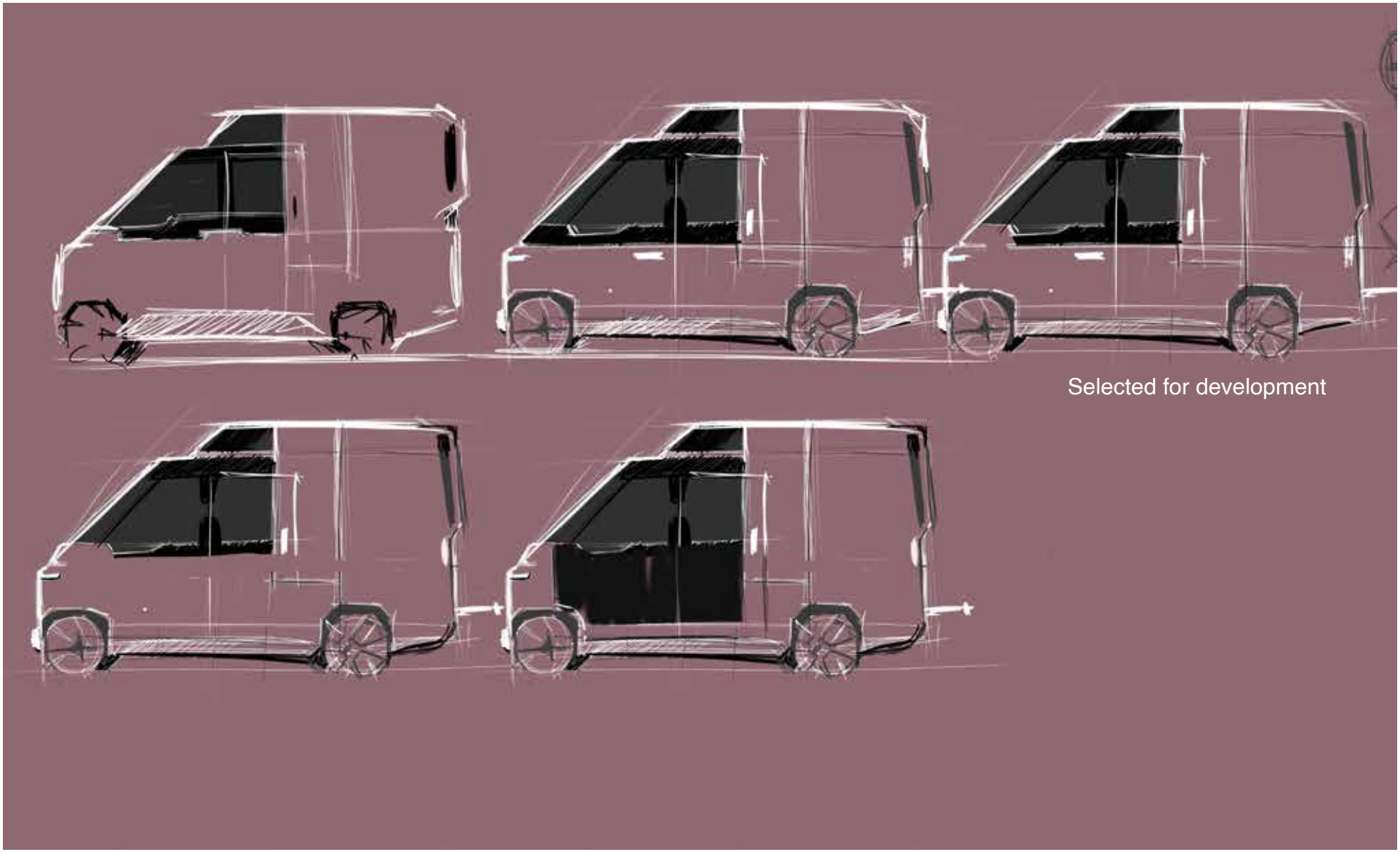


11.5 Exploration concept_1

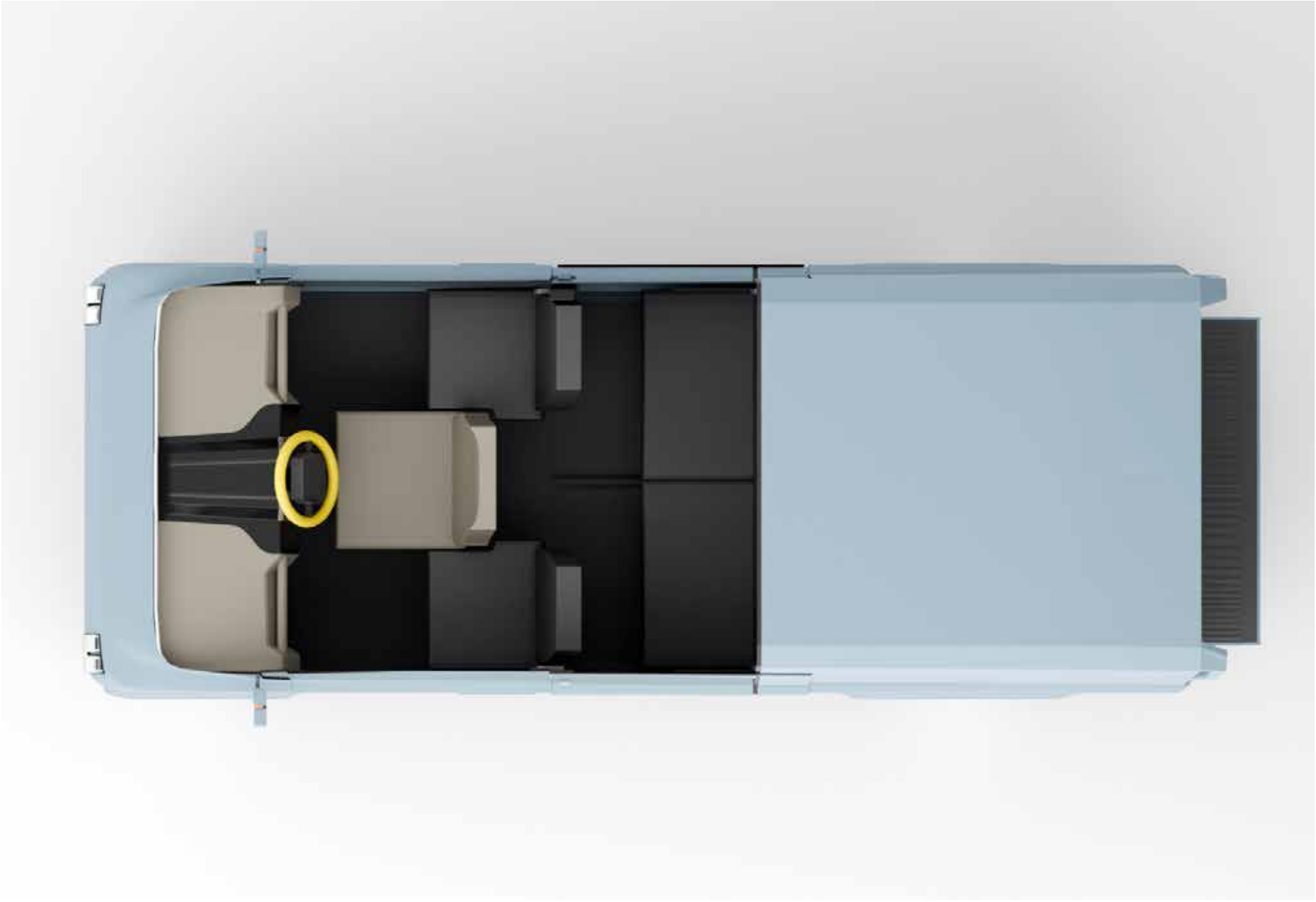




11.6 Concept_2



12 DESIGN



13 POSSIBLE USE CASES

THANK YOU..

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