



IDC School of Design
अभिकल्प विद्यालय

Design Project II

Designing a vehicle for Bike Taxi services in India

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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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APPROVAL SHEET

This Mobility & Vehicle Design Project II titled 'Designing a vehicle for Bike Taxi services in India' by Mohammed Jaseel PK is approved in partial fulfillment of the requirements for Master of Design Degree in Mobility & Vehicle Design, IIT Bombay.

Project Guide:



Chair person:

Internal Examiner:



External Examiner:



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1. INTRODUCTION

The bike taxi is a motorized taxi that carries one passenger as a pillion behind the driver. These taxis are motor vehicle used to carry passengers for hire. These vehicles require a legal contract/ permit for usage as contract carriage. They are available for general public and usually lack regular routes, fixed timings, and fixed stations. A passenger can book or hail a bike taxi ride with the help of a smart-phone application or website using internet. Passengers can book or hire a bike taxi for a decided route, which would be pre-defined by the passenger.

In last few years, a few companies have come up in multiple cities in India providing bike taxi services. With the Central Government's rule of allowing two-wheelers as legal and commercial vehicles and 8 states already legalized the same, it has become easier for the companies to design a working framework to provide easy and comfortable commute to the people. Key players operating in the India bike taxi market include Baxi, Bixie, Desto-Bike Taxi, Dunzo, Jugnoo, Mopedo, Ola, PykUpz, Rapido, and Uber Technologies, Inc.



UberMOTO

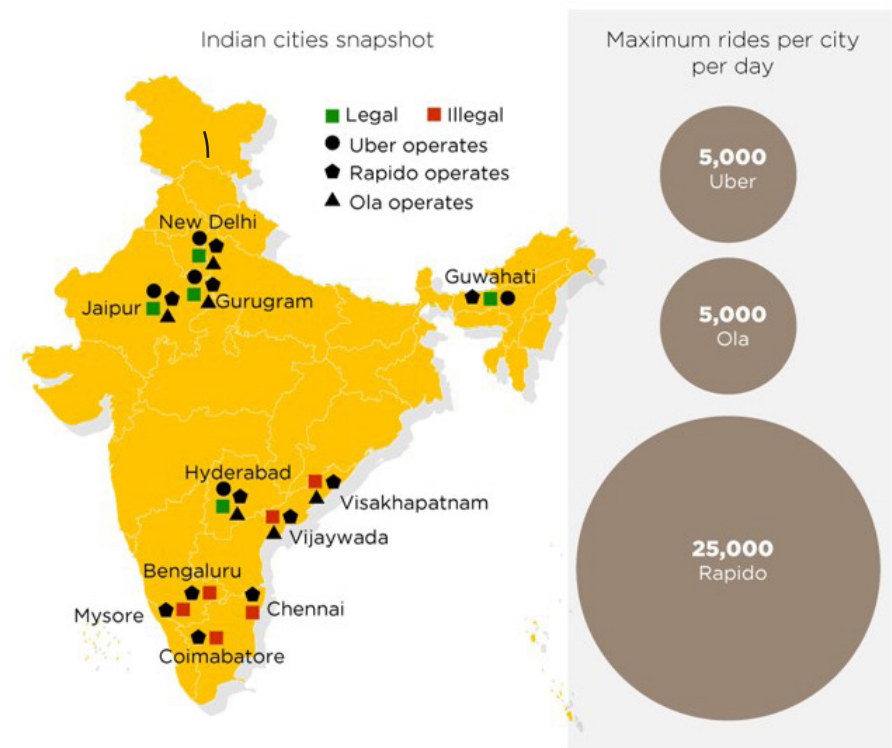
OLA BIKE

Rapido, India's biggest bike-taxi platform, has expanded to 31 cities in 4 years. Giants like Ola and Uber have had to pare down operations. Rapido, though, never slowed down, Goa was the only Indian state that allowed bike-taxis up until 2015. Elsewhere, they operate largely in a grey, underground market.

Rapido does close to 90,000 rides a day across 31 Indian cities. It's one of the few bike-taxi startups that has survived the frequent regulatory maelstroms. Even heavy-weights like Ola and Uber have struggled. Their current bike-taxi operations pale in comparison to their cab footprint.

POLE POSITION

While Ola and Uber have struggled, Rapido has zoomed ahead



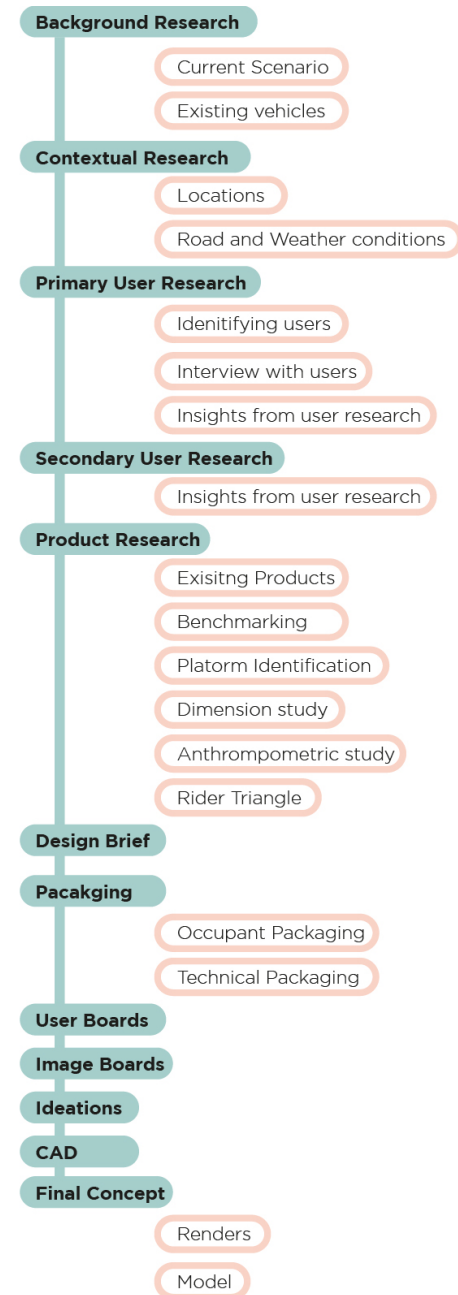
Factors such as increased trend of on-demand ride hailing services, surge in traffic congestion in cities, and rise in demand for first and last mile connectivity are expected to drive the growth of the bike taxi market. However, legal issues associated with bike taxi and resistance from local public transport operators restrains the market growth. On the contrary, surge in inclusion of e-bikes and technological advancement in bike sharing system is projected to offer lucrative growth opportunities for the market players.

Company	Funding	Status
Ola Bikes	USD 3.8 bn - for all Ola categories - over 23 rounds	Currently running in 200 cities and towns with over 300,000 bike-partners
Uber Moto	Uber became a publicly listed company in 2019	Completing over 150,000 trips a day across 30 cities
Rapido	USD 78.4 mn over 8 rounds	Present in over 90 cities with 500,000 partners catering to 10 million customers
Baxi/ Baxi Fresh	USD 1.8 mn over 3 rounds	One of the first bike-taxi companies; Now pivoted into hyperlocal deliveries

Data Source: Crunchbase, as of March 4, 2020



2. METHODOLOGY



3. BACKGROUND RESEARCH

3.1 Current scenario

In last few years, a few companies have come up in multiple cities in India providing bike taxi services. With the Central Government's rule of allowing two-wheelers as legal and commercial vehicles and 8 states already legalized the same, it has become easier for the companies to design a working framework to provide easy and comfortable commute to the people. Key players operating in the India bike taxi market include Baxi, Bikxie, Desto-Bike Taxi, Dunzo, Jugnoo, Mopedo, Ola, PykUpz, Rapido, and Uber Technologies, Inc. Goa was the only Indian state that allowed bike-taxis up until 2015. Rapido does close to 0,000 rides a day across 31 Indian cities. It's one of the few bike taxi- startups that has survived the frequent regulatory maelstroms.



3.2 Existing vehicles in use

A commuter bike is designed to take you from point A to point B with optimum comfort and fuel efficiency. They usually have small capacity engines designed for reliability and mileage rather than out and out performance, all of the existing vehicles in use by bike drivers are commuter motorcycles which are lightweight, low cost and fuel efficient. Showroom price range of these vehicles range from 70,000 to 1,00,000 and used vehicles can be as low as 20,000. These vehicles are also very popular for private usage which makes easier and cheaper to maintain for taxi usage. All of the vehicles are running on Internal Combustion Engines.

Dimensions of these vehicles range from

- L - (1750mm - 2050mm)
- W - (680mm - 800mm)
- H - (1000 - 1100 mm)

Weight of these vehicles range from 105 Kg to 120 Kg engine displacement of the vehicles range from 100cc to 125cc



Hero Splendor



Honda Shine



Hero Glamour



Hero Passion



TVS Jupiter



Suzuki Access



Bajaj CT100



Honda Activa



Bajaj Platina



Hero HF Deluxe



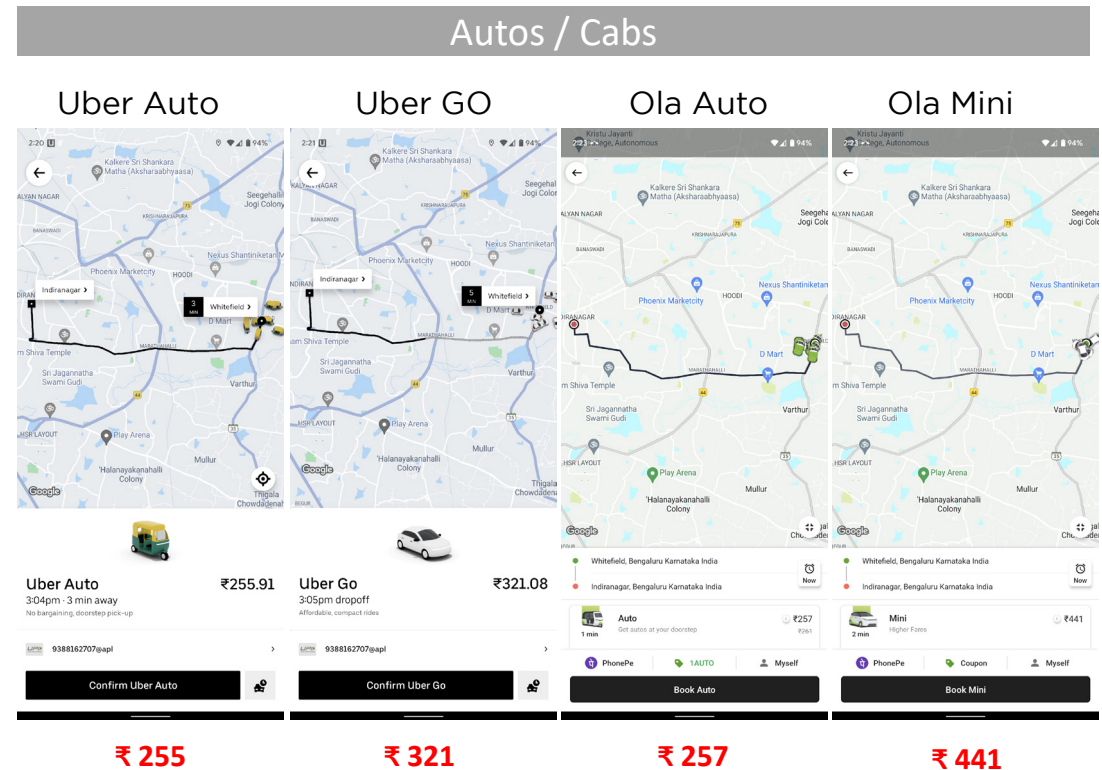
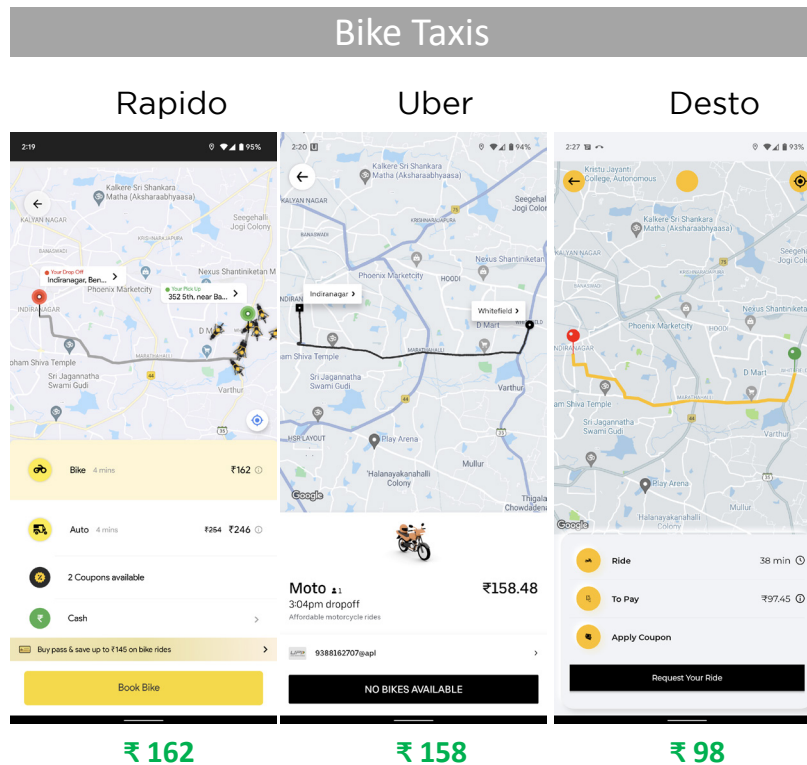
TVS Ntorq



Honda Dio

3.3 Fare comparison of taxi services

One of the primary reasons a lot of people considers bike taxi over cabs and autorikshaws is the low fare. On comparisons of a few bike taxi services like Ola, Rapdio and Uber to their Autorikshaw and Cab counterparts in same route the fare is found to be less than half or even one third at many times. (Fig x)



4. CONTEXT

4.1 Tier I, II and III cities in India

Bike-taxis are a popular choice of intra-city travel in India's urban agglomerations as well as the hinterlands. Bike-taxi operations in Gurugram, for instance, witnessed 100% growth in the number of bookings within 7 months of launch. Further, with 70-85% of the rides under 7 km in cities of varying sizes, bike-taxis are an effective mode of travel for short distances in Tier I, II and III cities in India. Through a time-of-use analysis, it is found that 50- 60% of the bike-taxi rides occur in two peak periods of the day - from 8 AM to 12 PM, and 4 PM to 8 PM, corresponding with office timings in India. Bike-taxis are thus found to be an affordable mode of daily commute to and fro work, especially for short distances and accessing public transport



4.2 Tourist locations

Bike-taxis are also ideal to promote tourism as has been witnessed in a city like Jaipur, Goa etc..



4.3 Road and weather conditions

Indian cities have very diverse road conditions which includes well-paved highways, uneven paved roads, broken roads, unpaved road, flooded roads and very narrow streets. Dense road conditions along with poor road conditions multiplies the severity of these issues. A vehicle which will be primarily going to be used in these conditions should definitely take into these conditions in consideration during the design process.



Due to diverse geography across the country and the accompanied weather conditions like harsh sun, heavy rain and dusts, design of the new vehicle should have features that can offer a comfortable travel experience during usage.



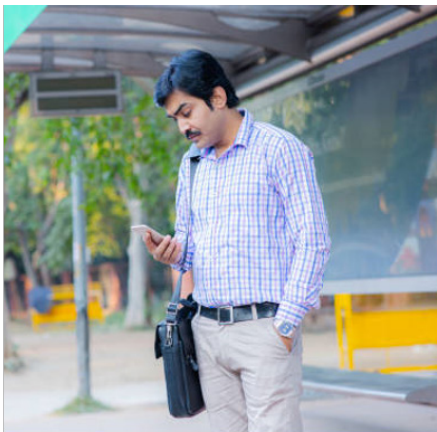
5. USER RESEARCH

User research provides an essential foundation for design strategy. It helps us to create an optimal product for users. Most importantly, we will have the data to back your strategy, design decisions and requirements. User research also helps you to identify early adopters and potential new users who would use the product. For this particular project understanding the requirements, needs and aspiration of users is very important to coming up with an ideal solution for improving quality of bike taxi services in India

5.1 User classification

For this particular project, four different but connected users were identified, there are:

1. Passengers who hire a bike taxi for commute through an app.
2. Private drivers who use their own personal vehicles as a taxi
3. Service companies connecting passengers to drivers.
4. Fleet drivers who work as taxi drivers for any service companies.



Passenger



Private Drivers



Service Companies



Fleet Drivers

5.2 Passengers

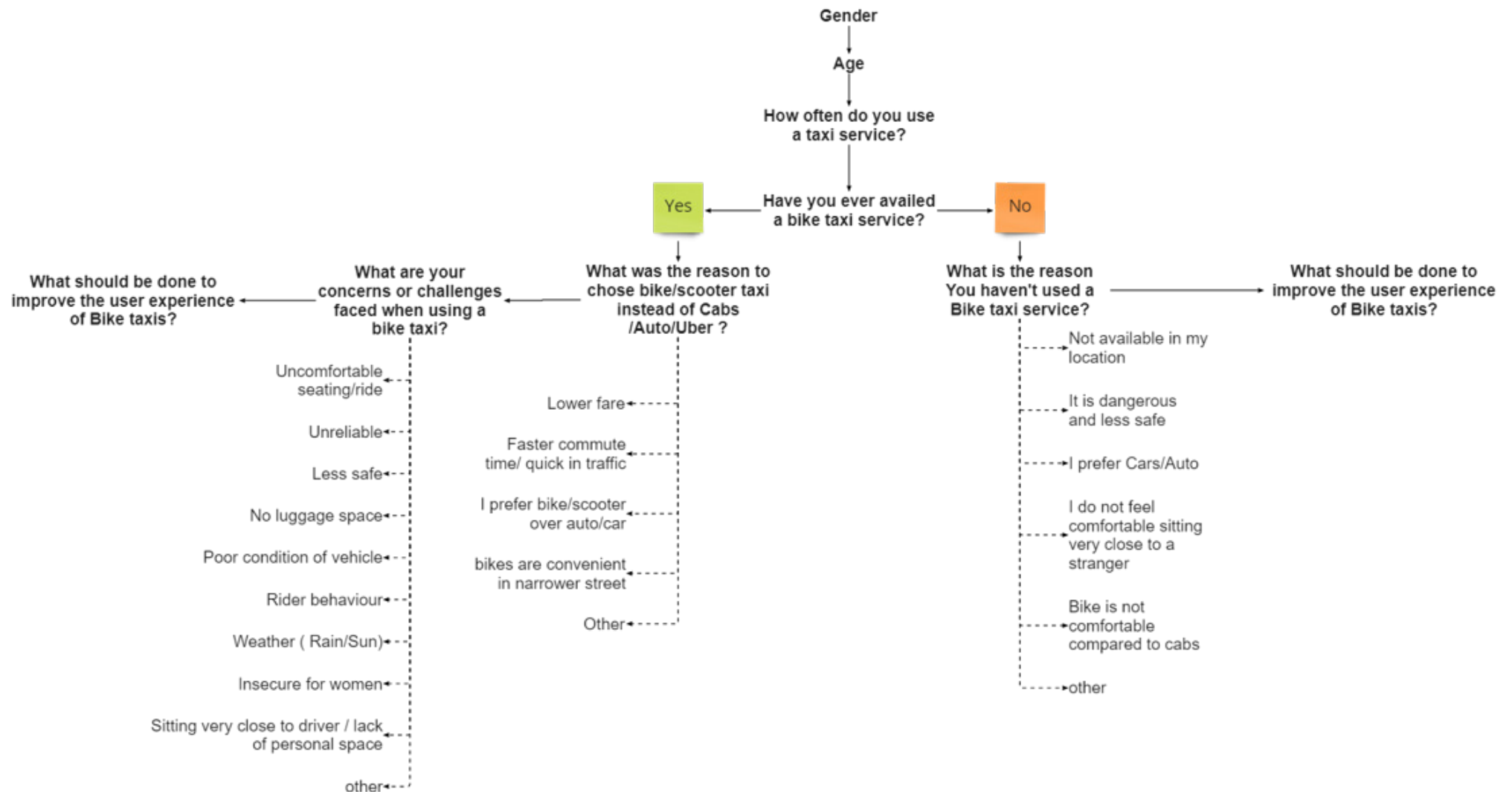
Passengers are the most important factor in a taxi service industry, there some difference in the user group of Bike taxis and other Cabs/Autorickshaws. Bike taxi passengers are generally more on the younger spectrum of users and are mosre cost conscius. Bike taxi users in Indian cities can be generally categorized into four as following:

1. Students
2. Working Professionals
3. Travellers
4. Others (Shoppers, Personal commute etc)



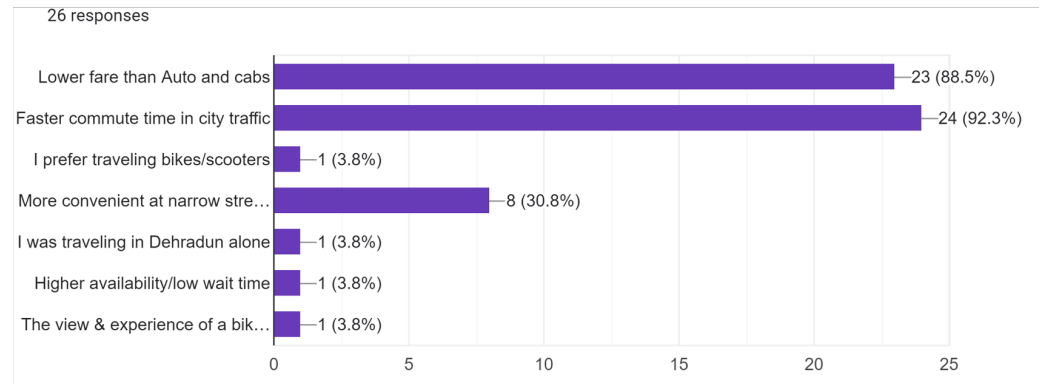
5.3 Passengers user study questionnaire

User experience surveys are meant to help us improve your user/customer experience, so we can adjust our product design and strategy. A set of questions was asked to users though online and in person to understand thier problems, requirements and expectations of bike taxi services in India. Different sets of questions were asked to existitng users and potential users for better understanding.

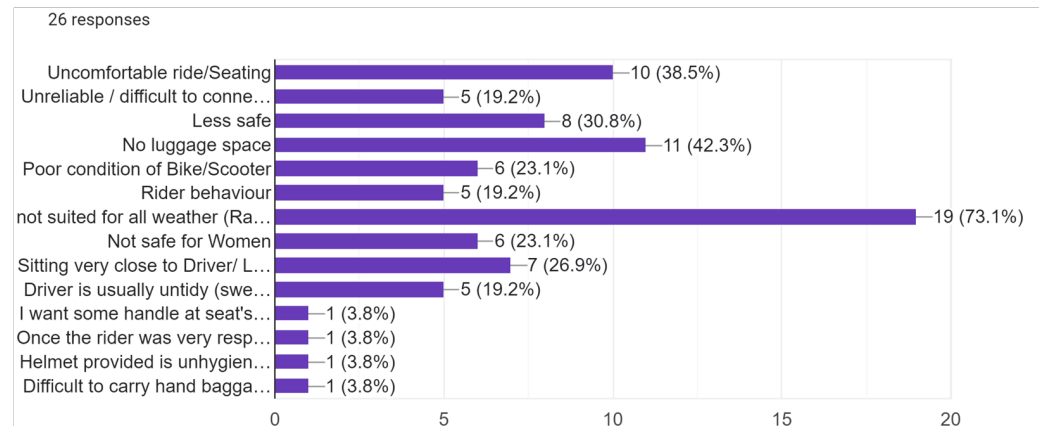


5.4 User responses

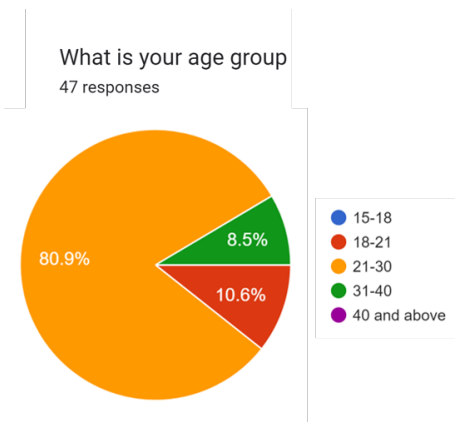
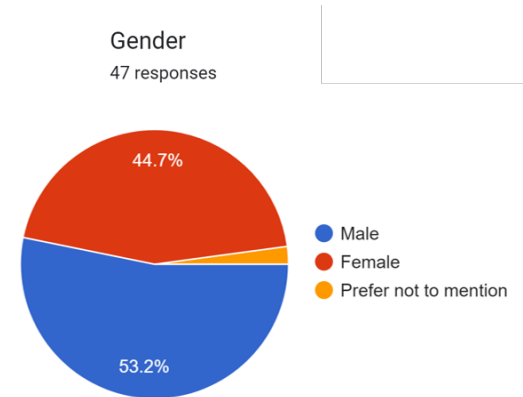
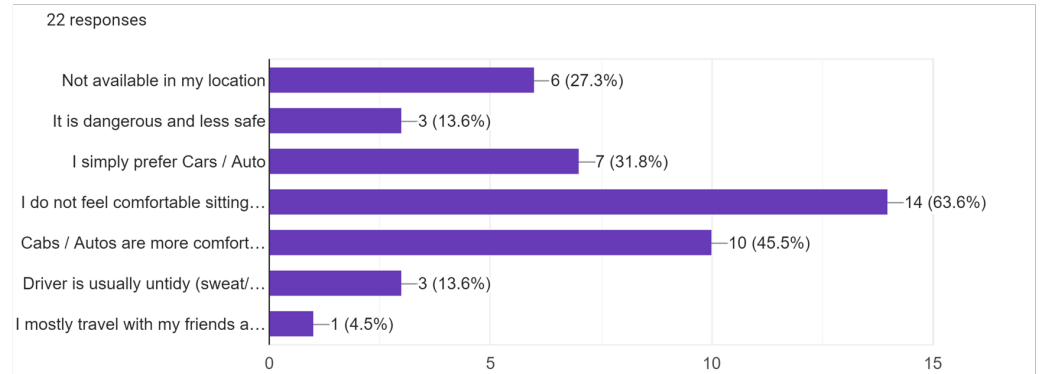
What was the reason to chose bike/scooter taxi instead of Autorickshaw or other cab service?



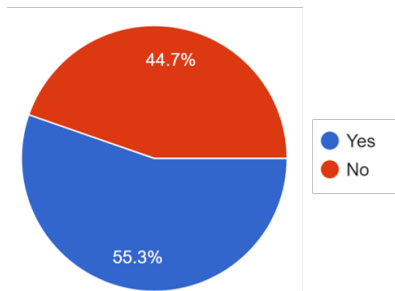
What are your concerns or problems faced when using a bike taxi?



What is the reason You haven't used a Bike taxi service?



Have you ever availed a Bike taxi service?
47 responses



5.5 Primary user research insights

Before getting into details of actual user perception of bike taxi services, basics question to understand the gender and group were asked to users. of which

- 53 percent is males and 44 percent is females,
- 81 percent of the attendees are from 21-30 age group.
- More than 55 percent of the attendees have experience with bike taxis services and 44 percent of the attendees have not used the service till date. due to various reasons.

As for the people who have experience with bike taxi service highlighted some key reason on why they chose to use bike taxi instead of other (Cabs/Auto). the most important are:

- Bikes taxis have much lower fare compared to cabs and Autorikshaws
- Bike taxis have much faster commute time in city traffic compared to other vehicles
- Also, Bike taxis are more effective and convenient in narrow streets.

The reasons for why some people who have not used a bike taxi service despite the service being available and prefers to take Autos and Cabs are:

- Many do not feel comfortable sitting very next to a driver who is a stranger.
- Many find commuting in a Cabs or autos more comfortable

Major concerns and challenges of existing bike taxi service users are the following:

- Bike taxis are not suited for all weather conditions especially during rains.
- Bike taxis lack sufficient luggage space
- Rides on bike taxis are not very comfortable since most of the vehicles are poorly maintained.

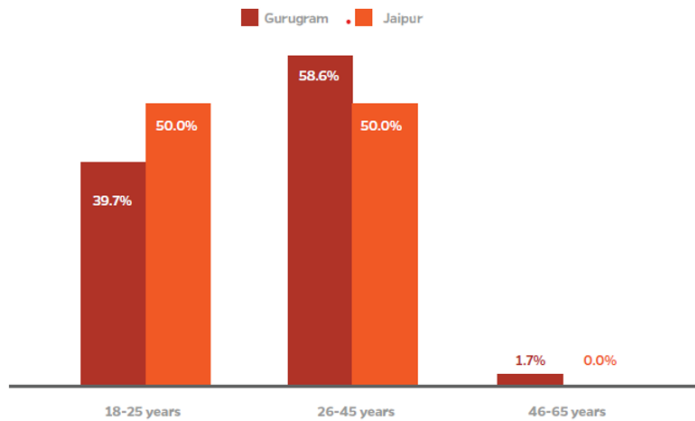
Product related suggestions put forward by the users which can enable more users for the bike taxi services are following:

- Bikes should have some sort of weather protection.
- separation between driver and passenger to avoid unsolicited physical contact.
- Seats could be wider for the pillion.
- Drivers should always carry a good second helmet.
- Design a vehicle specifically for the purpose of bike taxis.

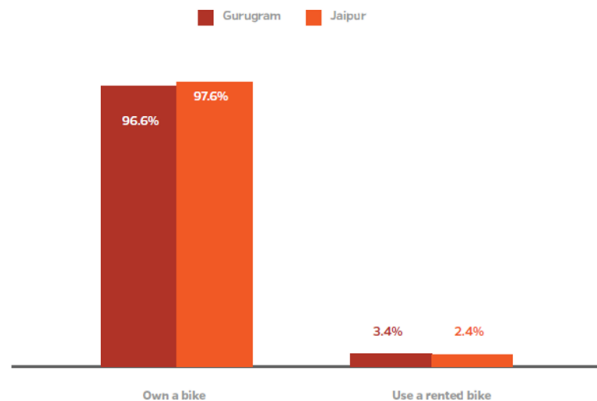
Users also had some very important suggestions and improvements that could be handled by the service provider, they are:

- System to solve the language barrier between rider and passenger.
- Lower rate of ride cancellation.
- Character evaluation before hiring drivers

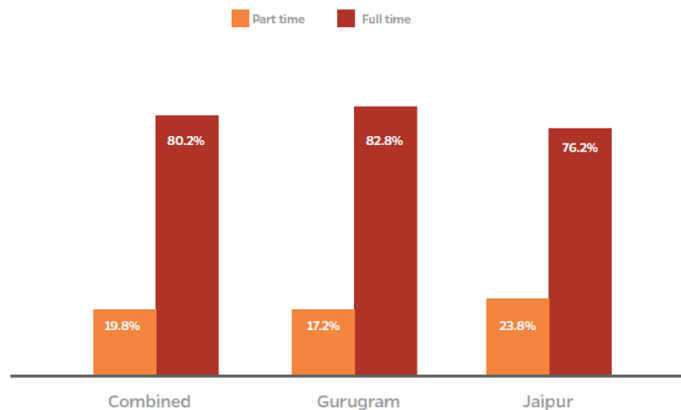
Distribution of Bike-taxi Drivers by Age



Distribution of Bike-taxi Drivers by Vehicle ownership



Distribution of Bike-taxi Drivers by Working Hours



5.6 Secondary research

Existing relevant research and published articles about Bike taxis in India was studied to broaden the understanding about users and their needs. Data from the following sources which were found to be relevant is listed below:

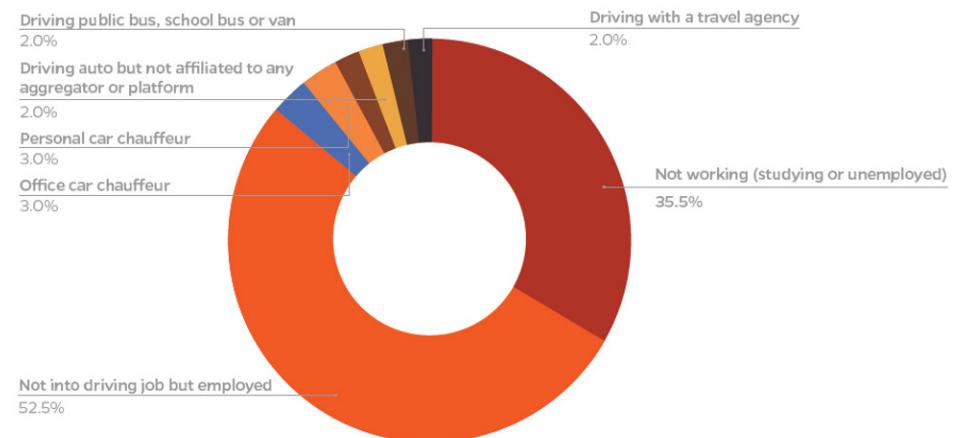
- The Power of Two Wheels, Bike- Taxi: India's new shared Mobility Frontier, A Study by Ola Mobility Institute

5.7 Secondary research insights

- More than 50 percentage of bike taxi drivers belong in 26-45 age group and more than 40 percentage are in 18-25 age group.
- More than 52% of bike taxi drivers come from a previous non-driving related job and more than 35% are either students or unemployed previously.
- 97% of existing bike taxi drivers interviewed reported using their own bikes for taxi operation which is utilization of an existing asset.
- Bike-Taxi is a viable earning opportunity for both part-time (2-4 hours) and as a fulltime job (6+ hours)

Distribution of Bike-taxi Drivers by Occupation

Distribution of respondents by their past occupation



5.8 Problems faced by passengers

**No Personal space
between rider and
passenger**

**Lack of Luggage / Storage
space**

Less safe than 3W and 4W

**Uncomfortable Ride /
Seating**

Lack of weather protection

5.9 Problems faced by drivers

Difficult to store second
helmet

Exhaustion and back pain
on continuous ride

No space to keep luggage,
shopping bags, covers etc..

Bike taxi is suited for short
trips only

Difficult to manage
Navigation device on 2W

No Weather Protection

Higher probability to get
into accidents on 2W

No personal space b/w
driver and passenger

6. PRODUCT RESEARCH

6.1 Two wheelers

A motorcycle, often called a motorbike, bike, cycle, or (if three-wheeled) trike, is a two or three wheeled motor vehicle. Motorcycle design varies greatly to suit a range of different purposes: long-distance travel, commuting, cruising, sport (including racing), and off-road riding. Street bikes include cruisers, sportbikes, scooters and mopeds, and many other types. Motorcycles and scooters of all kind and were evaluated based on thier functionality before finalzing a platform best suited for a bike taxi vehicle. Among exsting vehicles standard commuter motorcycles and scooters were found to be most suited based on use case and pricing.

STANDARD



- All-Purpose functionality, from touring to commuting
- Average seat height
- Upright neutral riding position w/ low to midrange handlebars
- Usually contains small front fairing or none

CRUISER



- Best for Highway cruising
- Lower seat height
- Leaned back riding position
- Usually very heavy
- Usually contain small front fairing or none

SPORT



- Best track riding, fast riding
- Taller seat hight
- Forward leaning riding posture w/ low-range handlebars
- Equipped with complete fairing for maximum aerodynamics

TOURER



- Best for extended riding periods
- Average seat height equipped with wide seats for comfort
- Upright neutral riding position with mid range handlebars
- Heavy weight
- Additional Luggage space

MOPED



- Best for commuting in the city
- Lower seat height
- Upright neutral riding position with mid-range handlebars
- Very Lightweight & fuel efficient
- Usually has no front fairing

OFF-ROAD



- Best for Offroad conditions
- Taller seat height to accommodate larger suspension travel
- Upright neutral riding position w/ mid-range handlebars
- Usually contains small front fairing or none

DUAL PURPOSE



- Ideal for both on and limited off-roading
- Taller seat height
- Upright neutral riding position with mid-range handlebars
- Usually contains small front fairing
- Comes with good ground clearance

SCOOTER



- Best for commuting in the city
- Lower seat height
- Upright neutral riding position with mid-range handlebars
- Lightweight & fuel efficient
- Usually contains small front fairing

6.2 Benchmarking

Benchmarking is a research tool to improve product design and user experience based on existing similar products that are currently available to users. In this case there are no existing vehicles that are purposefully designed for bike taxi services, but there are some vehicles in production and concepts that have some of the features like luggage space, sufficient physical separation between occupants and weather protection. Such vehicles features and design were studied either partly or fully to understand more about how such features can be integrated as part of a bike taxi vehicle.

Benelli Adiva / Adiva AD 125

The Benelli Adiva is the first scooter manufactured as a joint venture between Benelli and Adiva SRL. The Adiva has an innovative folding metal roof, which together with the windscreen and side wind deflectors, offers excellent weather protection for rider and pillion passenger. When not required, the roof can be folded up and stored in rear storage box (90 liters).

The 90L rear trunk can accommodate two helmets, riding gear and bags. The upper half of the tandem seat features a bucket-seat style that envelops the passenger. In addition to the headrest and backrest, left and right side supports are also equipped. The upper half of the tandem seat features a bucket-seat style that envelops the passenger. In addition to the headrest and backrest, left and right side supports are also equipped.



Intigo Tunisia

IntiGo is a bike taxi startup that allows users to book bike rides in Tunis (Tunisia's capital) that are 20 to 30 percent cheaper than a regular taxi. The vehicle used by the service are modified maxi scooters based on the existing Suzuki Burgman 125 scooter platform.



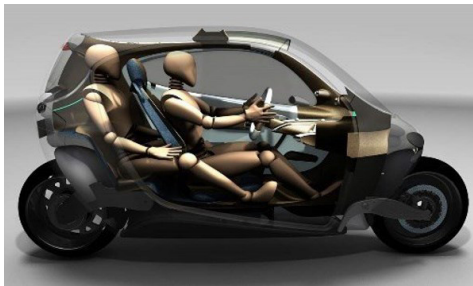
Peugeot Hymotion 3

Peugeot's HYmotion 3 is a concept vehicle which facilitates urban mobility by bridging the gap between an electric scooter and a car. This vehicle comes with three wheels – two in front equipped with electric motor and one in the back powered by a diesel engine. HYmotion 3 is a hybrid vehicle that can be driven in the city in an electric mode. It is a slightly leaned and small frame vehicle with a maximum speed of 70mph covered with a glass on the top



LIT C1 - Self balancing car-scooter

The C1 is an electric self-balancing scooter-car cross-over from motorcycle innovation company Lit Motors from San Francisco, U.S. The scooter contains an innovative dual gyroscope based self-balancing system. Similar to a motorcycle, the original C-1 design has two wheels, but uses a small steering wheel instead of handlebars. Direct-drive in-hub motors in both wheels were designed to provide a high amount of torque, stability and traction control, while allowing for the body form to be about half the size of a car



BMW Simple concept

Simple combines features and advantages from both automobiles and motorcycles. The concept owes its passenger cell to the car, providing protection from wind and weather as well as shielding the driver from exterior noise and offering occupants a high degree of safety in the event of an accident. The motorcycle inspired the slim design of the Simple (at just 110 centimetres wide) and its configuration for two people sitting one behind the other. Plus it has the dynamic driving style typical of a two-wheeler.



Renault UBLO concept

The concept offers an innovative alternative to conventional scooters. The Ublo also introduces a world-first front vertical airbag, housed between the windshield and the handlebars. The 'bag deploys vertically in a crash to protect the rider. The three-wheeler also gets a car-like Xenon headlight and three rear brake lights, one high-mounted on the Plexiglass "roof". Rear vision is provided by a rear-mounted camera, images from which are shown on a screen in the Ublo's instrument panel.



Maxi-scooters

Maxi scooters are the bigger version of the scooter fitted with a usually big engine popped into a scooter frame. These vehicles are more comfortable with better pillion provision and have space and storage, as well as being suited to the longer distance of riding capacity.



6.3 Roof systems in two wheelers

Providing a effective roofing system for weather protection in two wheelers has always been a challenging task to automakers mainly due to smaller footprint of motorcycles and scooters. Also adding a full effective roof to two wheelers decreases the many advantages a compact two wheelers have. It makes the vehicle larger, bulkier and difficult to maneuver. The study takes a look at how different auto-makers has tried to come upwith a roofing system in Motorcycles / Scooters.



Honda Elysium Concept scooter with a Retractable roof



Honda Gyro Canopy Scooter



Peugeot Hymotion with Roll cage and Fixed Glass Roof



BMW C1 with Roll cage and Roof



Piaggio MP3 with removable soft roof



Adiva Foldable Roofing system



NIU TQi GT Scooter with fixed Roof

6.4 Luggage systems in two wheelers

Based on the user requirements, there should be more luggage provision in a bike taxi vehicles than what is available in the existing Motorcycles and Scooters. Different methods and solutions in existence to carry luggage in a two wheeler was studied in detail to understand the possibilities for the same in a bike taxi vehicle.



90L rear trunk on Adiva Scooter can accommodate two helmets, riding gear and bags.



Under-seat storage space in generic scooters.



Side Panniers



Helmet Storage behind pillion seat in Honda Elysium



Car-like Trunk Space in tourers



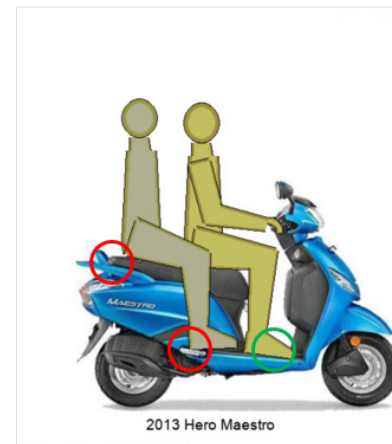
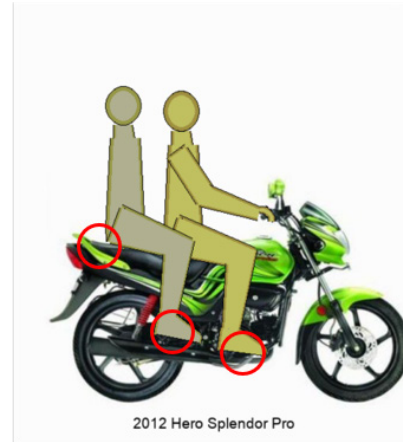
Top box that can be fitted on to most scooters and bikes.



Flat rack where luggage can be fastened

6.5 Seating in existing bike taxi vehicles

In all of these existing commuter motorcycles and scooters, rider and pillion sits very close with unavoidable body contact. This is because all of the existing vehicles are designed for private purposes, hence there was no need to provide a physical separation between the rider and the pillion. Research insights have shown that physical barrier between rider and pillion should be present in a taxi vehicle.



Additionally, in current motorcycles and scooters, contacts points such as footrest and grab rails are not considered very comfortable, especially when a pillion is carrying some bags or luggages. Extra caution and care is required from the pillion to ensure safe commute on a two wheeler.

6.6 Platform - Scooter

A scooter (motor scooter) is a motorcycle with an under-bone or step-through frame, a seat, and a platform for the rider's feet, emphasizing comfort and fuel economy. Scooters are popular for personal transportation partly due to being more affordable, easier to operate, and more convenient. Motorscooters are also considered more female friendly due to its relaxed ergonomics and riding dynamics.

A scooter platform will be ideal for a bike taxi than a conventional motorcycles because:

- Equally suited for both male and female riders
- More packaging allowance to smaller wheel size
- Less aggressive and more approachable compared to motorcycles

Different types of scooters such as Regular step through, Maxi scooters, Trikes and enclosed scooters were compared to understand their uses, advantages and disadvantages.

Maxi-Scooter



- Longer Wheelbase
- Allows more storage space
- Much better pillion provision With split seat
- Better wind protection

Step Through/Step over

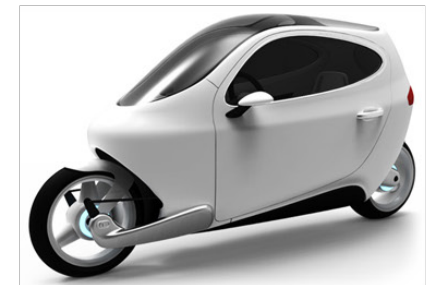


- Shortest Wheelbase
- Easy to manoeuvre
- Lightweight
- Smaller footprint

Trike Scooter



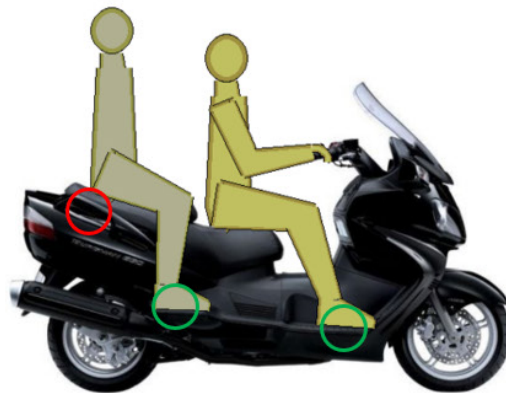
- More stable with additional wheel
- Better pillion provision
- Wider footprint
- Mechanically complex



- Mostly conceptual
- poor cost/benefit ratio

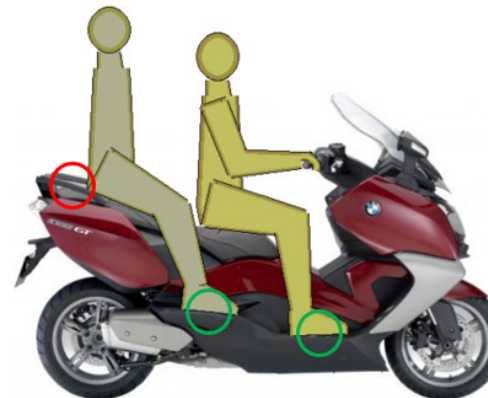
6.7 Pillion provision in Maxi-scooters

Among all scooters and motorcycles, maxi-scooters has the best pillion seat provision in terms of comfort and space, while still being capable of being a daily driver vehicle, Hence a dimensional study was done on three very prominent maxi scotters in the market to understand how a better seat provision is provided to both pillion and rider and how thier physical design and dimensions differ from smaller scooters to provide better pillion provision and space.



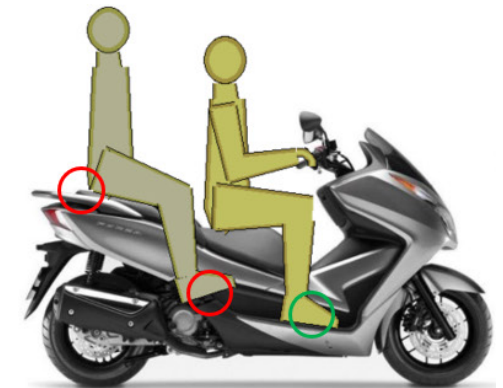
2013 Suzuki Burgman 650

Calculated seat height: 29.9"
Forward lean: 0°
Knee angle: 117° (smaller number means more bent)
Hip angle: 81° (smaller number means more crouched)



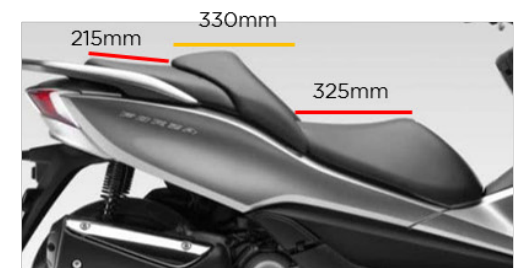
2013 BMW C650 GT

Calculated seat height: 31.1"
Forward lean: 0°
Knee angle: 108° (smaller number means more bent)
Hip angle: 86° (smaller number means more crouched)



2013 Honda Forza 300|NSS300

Calculated seat height: 28.4"
Forward lean: 0°
Knee angle: 88° (smaller number means more bent)
Hip angle: 75° (smaller number means more crouched)



6.8 Tandem seating in scooters

Tandem, is a seating arrangement in which two people are lined up one behind another in separate seats, all facing in the same direction, the advantage of this arrangement is that both the people get their own space and privacy. Tandem seating in two wheeler also requires a longer wheelbase while increasing the overall vehicle length. This sort of arrangement ensures complete space privacy for the pillion at the cost of increasing overall length of the vehicle.

Arcimoto FUV

1770 mm



1455 mm

2870 mm



2180 mm



Pacscooter Tandem



2050 mm



6.9 Dimensions study

To understand the optimum dimensions of the proposed vehicle design, It is important to study and analyse the packaging and dimensions of existing vehicles that have same or similar function. The vehicles that were chosen for the study are Honda Activa, Honda CB shine, Suzuki Burgman 400, BMW C650GT, Honda NSS 300 Forza, Arcimoto FUV, and Adiva AD 125.

The Parameters chosen to analyse and compare in these vehicles are Length, width, Height, Wheelbase, Ground Clearance, Seat heights, Rake angle, Wheelsizes, Rider triangle dynamics etc. Based on this study it is concluded that physical dimensions of the proposed vehicle should ideally be:

Length - less than 2000mm
 Width - 750-800mm
 Wheelbase - 1260-1400mm
 G Clearance - 155mm
 Rake Angle :26°

	Activa	Suzuki Burgman	BMW C650 GT	Honda NSS 300	Adiva AD 125
Length	1814	2265	2218	2166	2230
Width	704	760	916	753	720
Wheelbase	1260	1585	1591	1546	1640
Ground Clearance	155	125	1591	1546	145
Rake angle	28°	26°	26°	32°	28°
F - Seat Height	755	710	795	716	745
R -Seat Height	804	900	945	900	820
Front Wheel	90/100 R12	120/80 R14	120/70 R15	120/70 R14	120/70 R14
Rear Wheel	90/100 R10	150/70 R13	160/60 R15	140/70 R13	140/70 R14

Honda Activa



Length - 1761
 Width - 710
 Height - 1158
 Wheelbase - 1238
 G Clearance - 153

Honda CB Shine



Length - 2014
 Width - 762
 Height - 1071
 Wheelbase - 1266
 G Clearance - 157

Suzuki Burgman 400



Length - 2265
 Width - 810
 Height - 1420
 Wheelbase - 1585
 G Clearance - 125

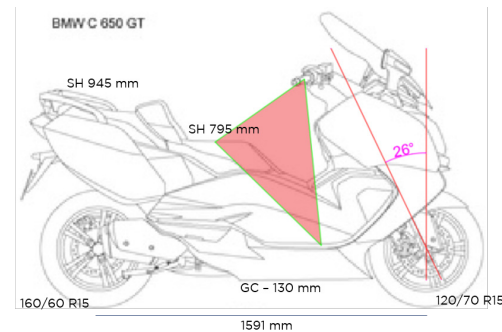
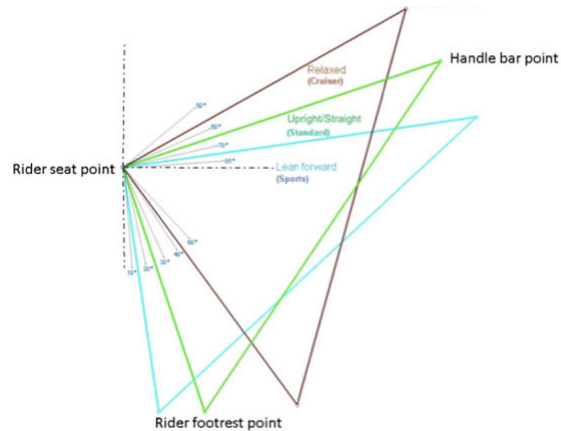
Arcimoto FUV



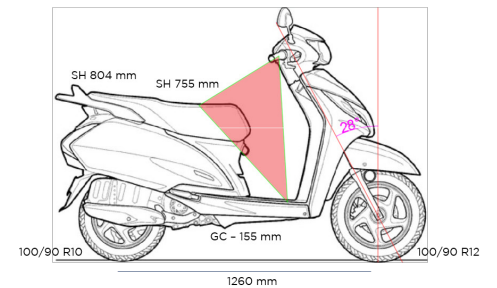
Length - 2870
 Width - 1549
 Height - 1651
 Wheelbase - 2032
 G Clearance - 1397

6.10 Rider triangle

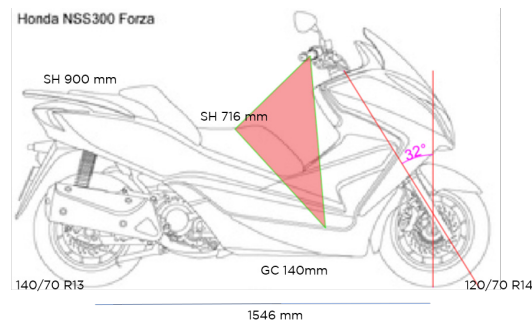
It is the triangle that is formed by connecting three points - the rider's seating position, the handlebar position, and the footrest. The angles of the triangle change depending on the type of motorcycle. Scooters have a the standard or upright riding position. In this riding position, riders sit with their body straight and back upright. The arms comfortably rest on the grips and are comfortably extended. The shoulders are slightly pushed back and elbows remain slightly bent and relaxed. Coming to the position of legs while riding in standard body position, the knees are positioned approximately direct above feet, and the feet make an approximate 90-degree angle on the footpegs..



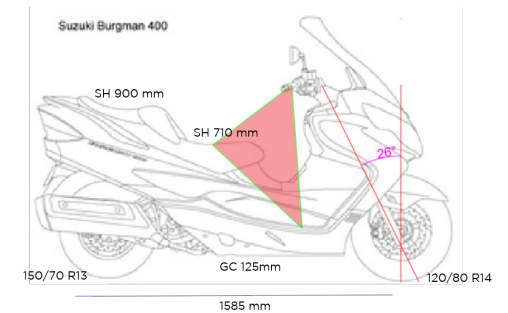
BMW C650 GT



Honda Active



Honda NSS 300 Forza

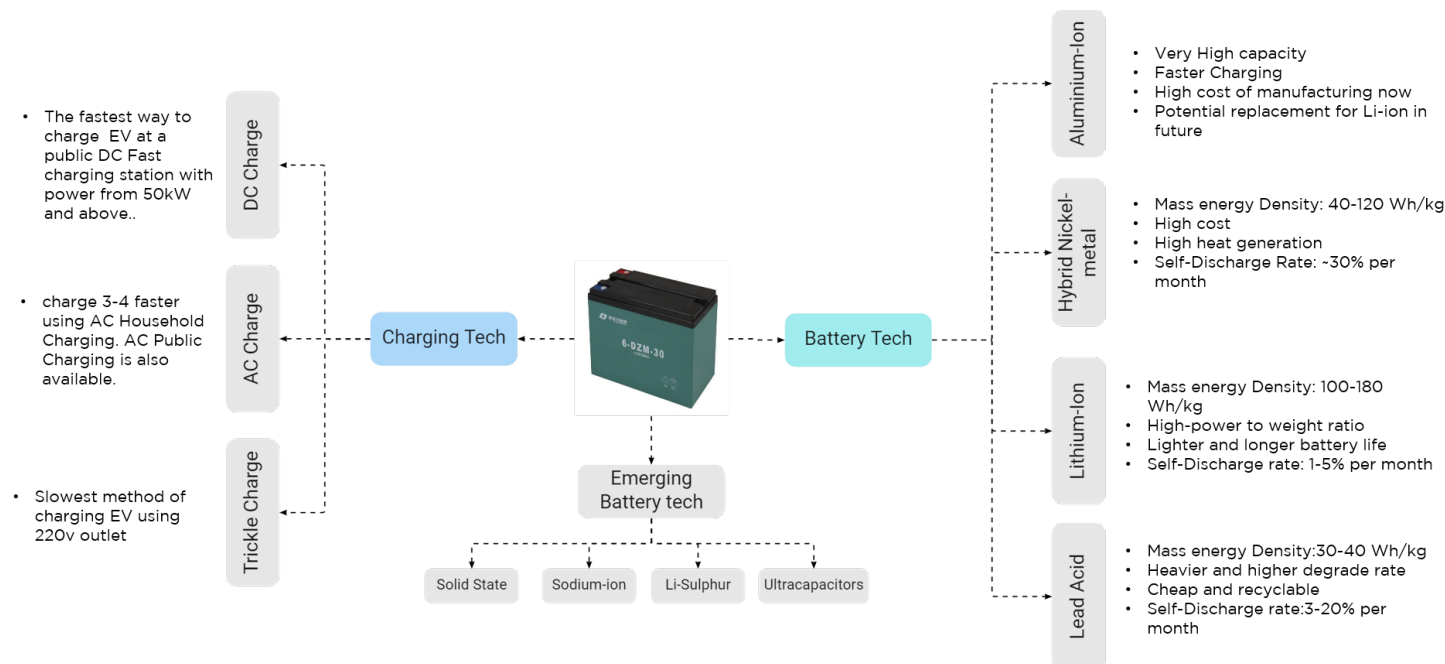
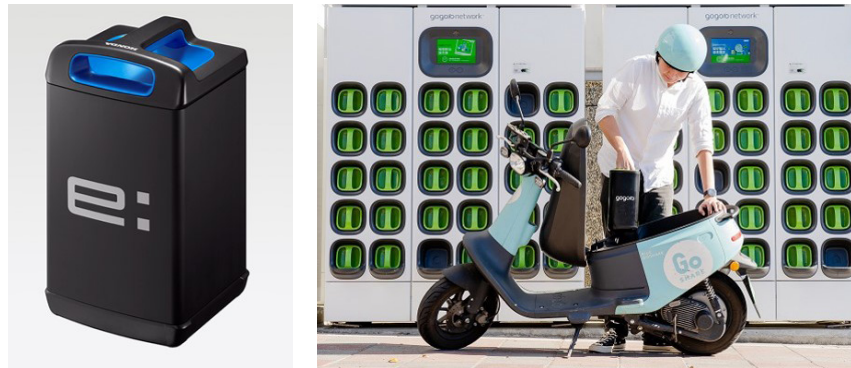


Suzuki Burgman 400

6.11 Battery system

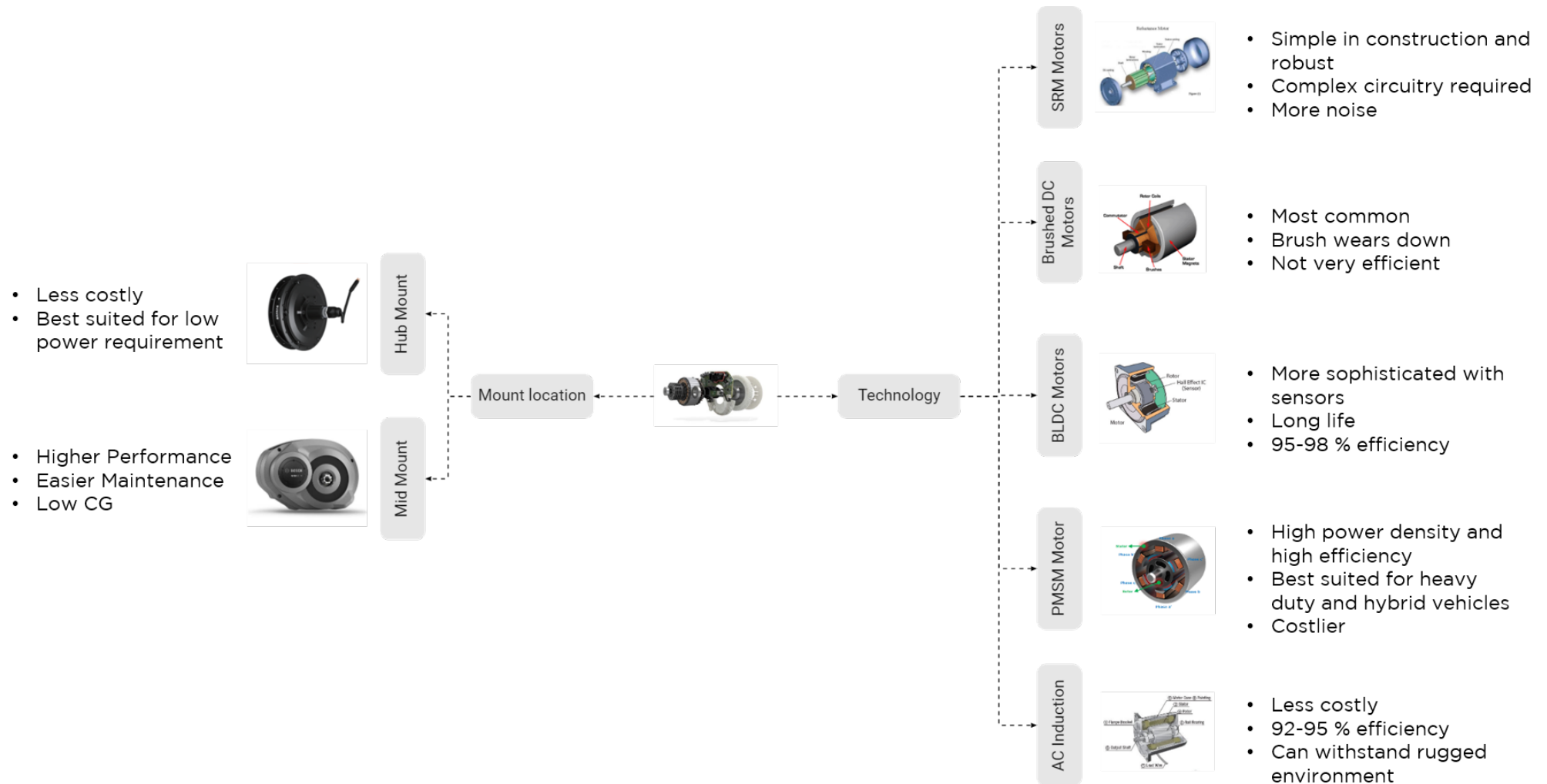
An electric vehicle battery is a rechargeable battery used to power the electric motors of a battery electric vehicle (BEV) or hybrid electric vehicle (HEV). The most common battery type in modern electric vehicles are lithium-ion and lithium polymer, because of their high energy density compared to their weight. Other types of rechargeable batteries used in electric vehicles include lead-acid ("flooded", deep-cycle, and valve regulated lead acid), nickel-cadmium, nickel-metal hydride, and, less commonly, zinc-air, and sodium nickel chloride ("zebra") batteries. Swappable batteries also very suited for Bike taxi vehicles since they will in continuous use of 6-8 hours/per day and riders cannot afford to spend several hours to get thier battery charged. swappable batteries allows them work more effiecently without wastage of time.

3.5 KWh Lithium-Ion Battery with a riding range of 150 kms will be ideal for a bike taxi scooter. In addition to a fixed battery, provision for swappabale battery system will add more value to the product.



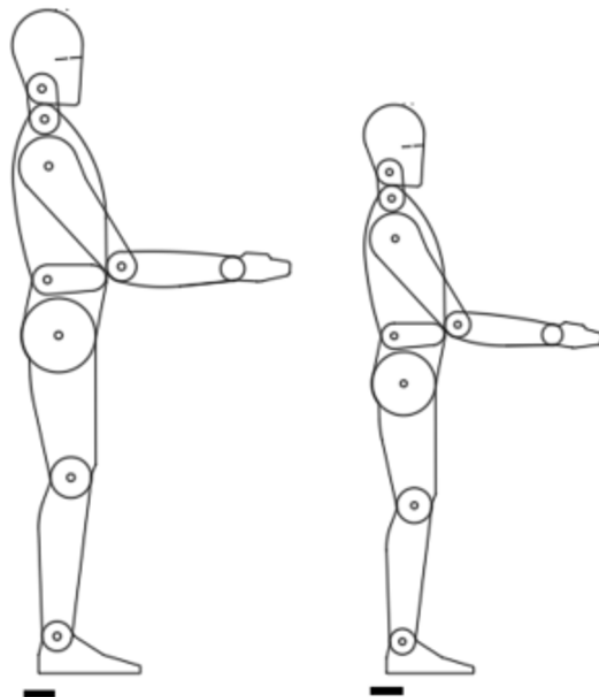
6.12 Electric motor

All-electric vehicles, also referred to as battery electric vehicles (BEVs), have an electric motor instead of an internal combustion engine. There are different types of electric motors suited for vehicle based on their technology and method of mounting. A hub mounted BLDC electric motor will be best suited for this project for maximum efficiency in power and technical packaging.



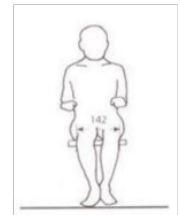
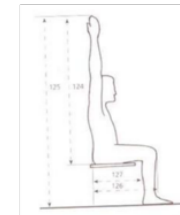
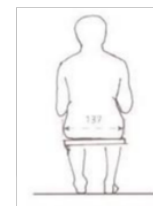
6.13 Anthropometrics

Anthropometry is the science that defines physical measures of a person's size, form, and functional capacities. For this particular exercise physical dimensions of 95th percentile Indian male and 50th percentile Indian female were considered since they represent the two extreme ends of physical dimensions of the potential users. Rperesented data is sourced from ' Indian Anthropometric Dimen- sions' by Debkumar Chakrabarti.



95th
percentile
male

50th
percentile
female



	Hip	Mid thigh-thigh external breadth	Buttock to popliteal length	Knee to knee length (closed)
95 th percentile male	405	449	512	235
50 th percentile female	314	379	439	189

*All dimensions are in mm

7. CURRENT SCENARIO

Problem : The current Motorcycles and scooters used by Bike taxi drivers are not designed or meant to be used for a Taxi service, Such services has some additional functional requirements when carrying an passenger (usually a stranger) which cannot be addressed by existing vehicles meant for private use. Majorly the problems can be listed out as:



Storage

Proximity

Constant alertness

Weather

- Not enough storage to keep bags carried by the customers
- Rider and Passengers sits very close with unavoidable physical contact which is not preferred by many users.
- riding on a two wheeler along with above mentioned issues requires passenger to be highly alert compared to a car/Auto.
- Bikes dont have weather protection from sun/rain.

8. DESIGN BRIEF

Design an electric scooter for private or fleet based Bike taxi service to be used in Indian road and weather conditions with following design considerations

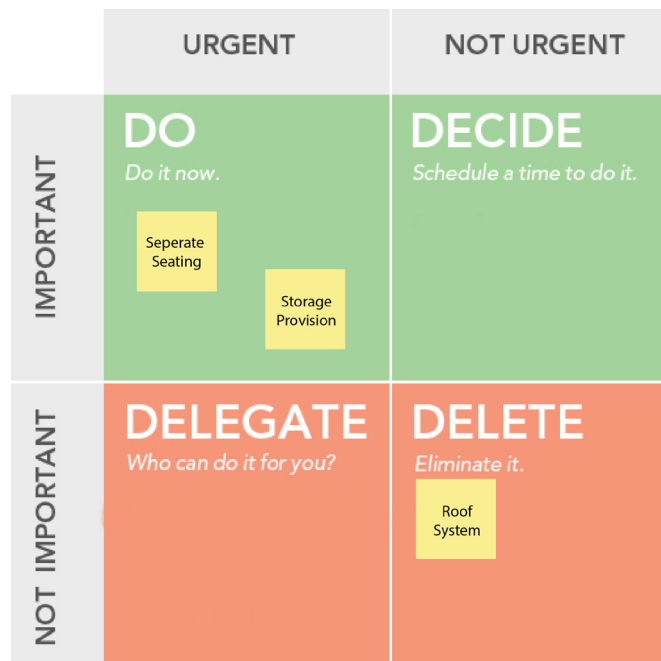
- Split seating for both rider and passenger to ensure adequate comfort, personal space and privacy.
- Luggage space of atleast 40 ltrs (Handbags, shopping covers, Backpacks etc..)

Dimensions of the vehicle should be within Length (2000-2200), Width (750-800), Height (1600-1700), Wheelbase (1400-1500), and Ground Clearance (155-170)

The vehicle should be visually appealing and physically accessible to everyone since it is a public service vehicle catering to a wide age group (15-60)

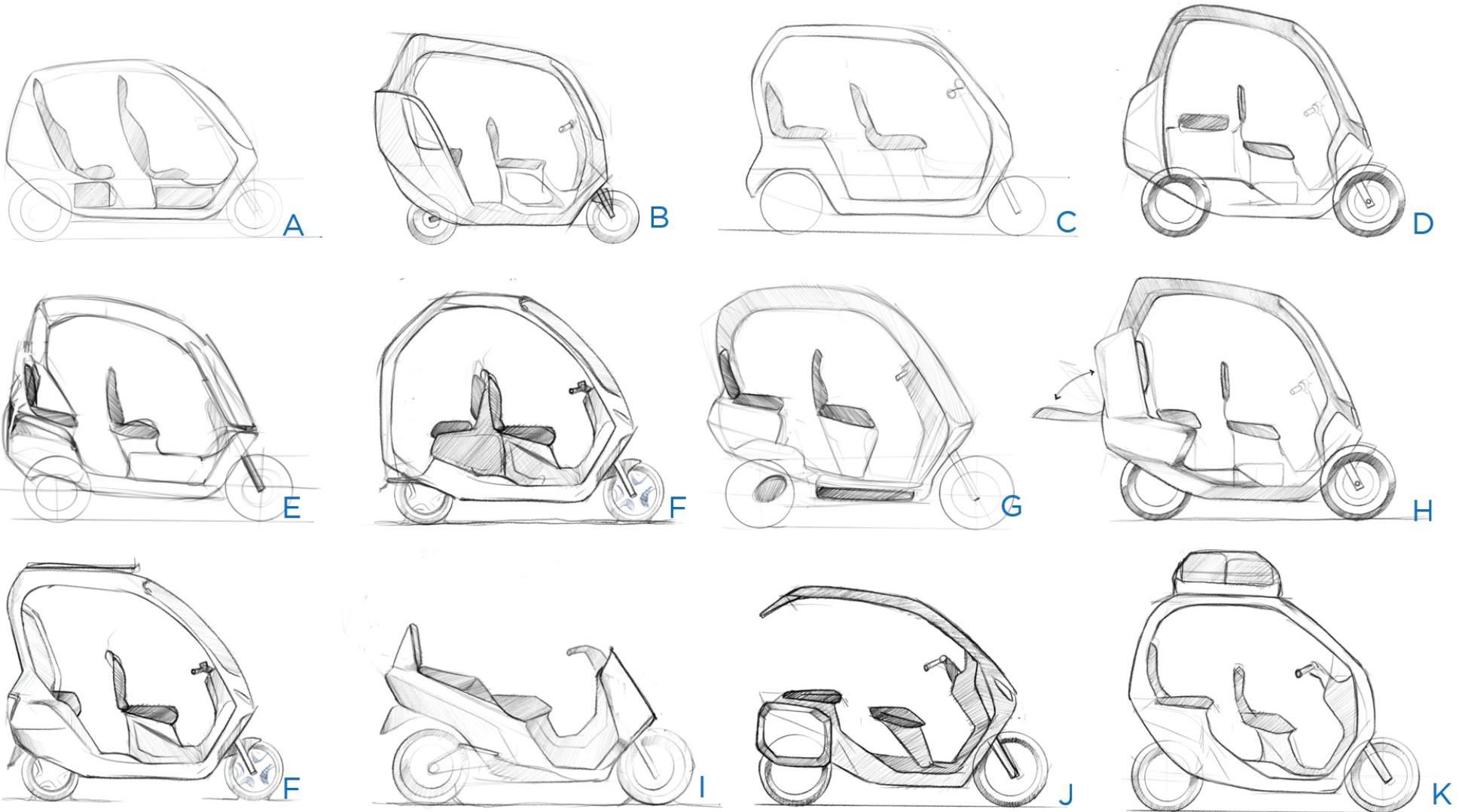
Easy ingress/egress than existing scooters and motorcycle

The seating and riding dynamics of the vehicle should be comfortable for the rider in the long term



8.1 Occupant packaging ideations

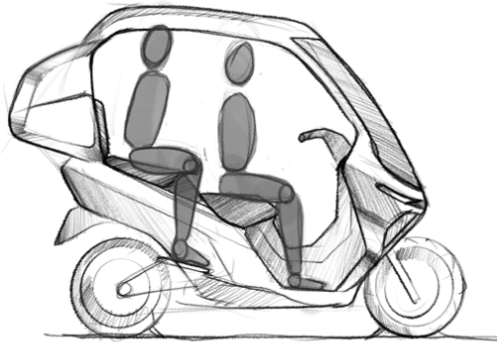
Ideations and comparisons on possible packaging with adequate personal space for both driver and passenger.



Occupant packaging ideations

Out of all the explorations, these four directions were selected to further analyse on their pros and cons. Ideation C was chosen as the final occupant packaging because:

- Easy Ingress and Egress
- Suited for passenger wearing any kind of dress.
- More efficient packaging of occupants, storage.



A

- Difficult ingress/egress for pillion
- Not suited for pillion wearing saree or similar dress
- Smaller wheelbase



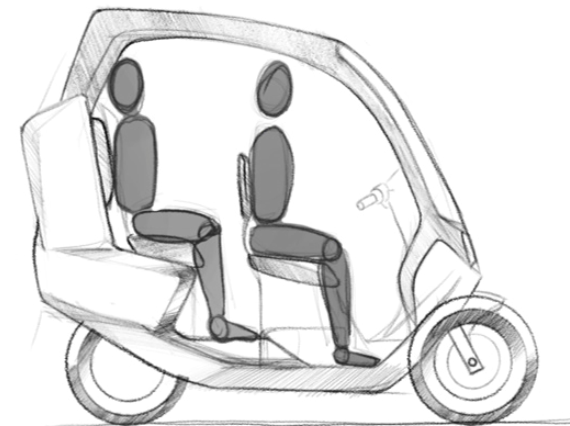
B

- Pillion might feel dizzy due facing opposite direction of movement
- Difficult to package suspension and motor
- Large storage under seat



D

- Easy ingress/egress
- Suited for pillion wearing any kind of dress
- Weight not balanced uniformly
- Increases the width of the vehicle



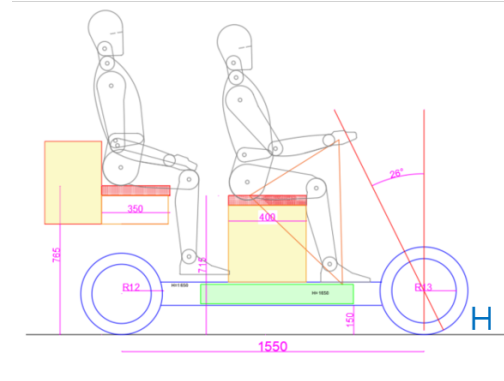
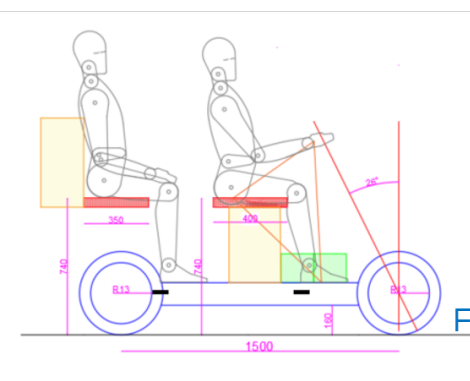
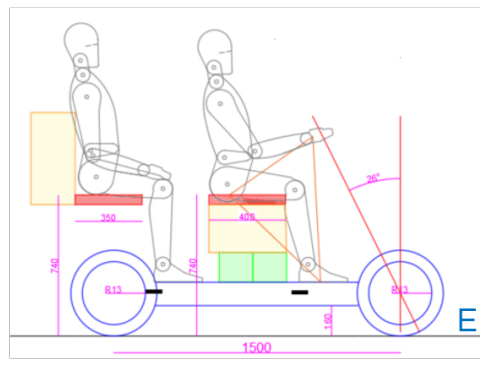
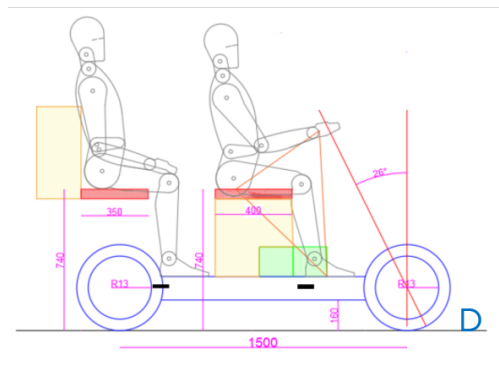
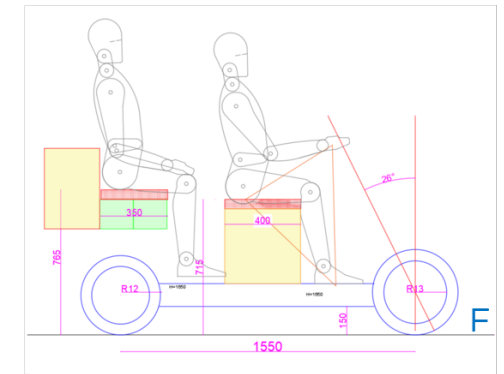
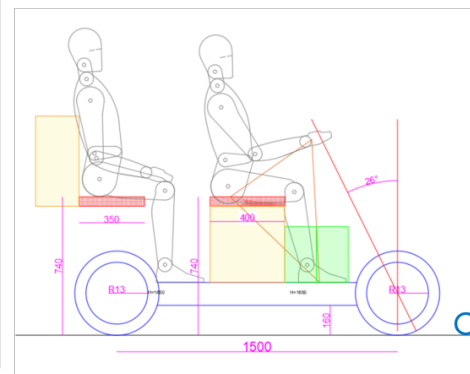
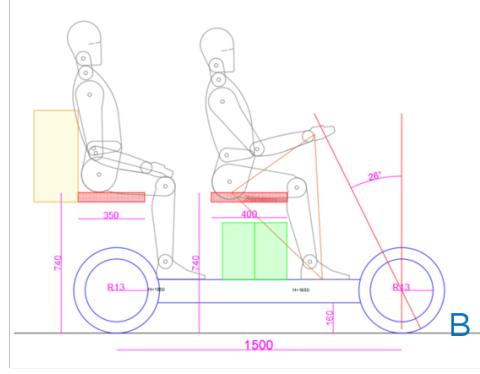
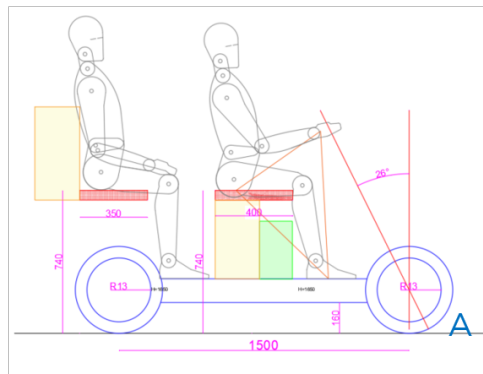
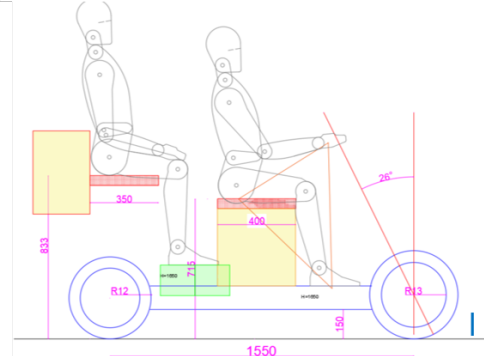
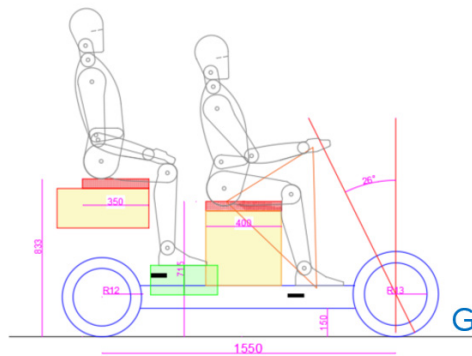
C

- Easy ingress/egress
- Suited for pillion wearing any kind of dress
- Increased wheelbase to accommodate legroom

8.2 Technical packaging ideations

Based on the chosen occupant package, more accurate ideations was done to explore most efficient technical packaging including position of electric motor, battery, storage space and exterior dimensions and ergonomics. Initially the wheelbase was fixed at 1550mm which was reduced further to 1350mm after several iterations.

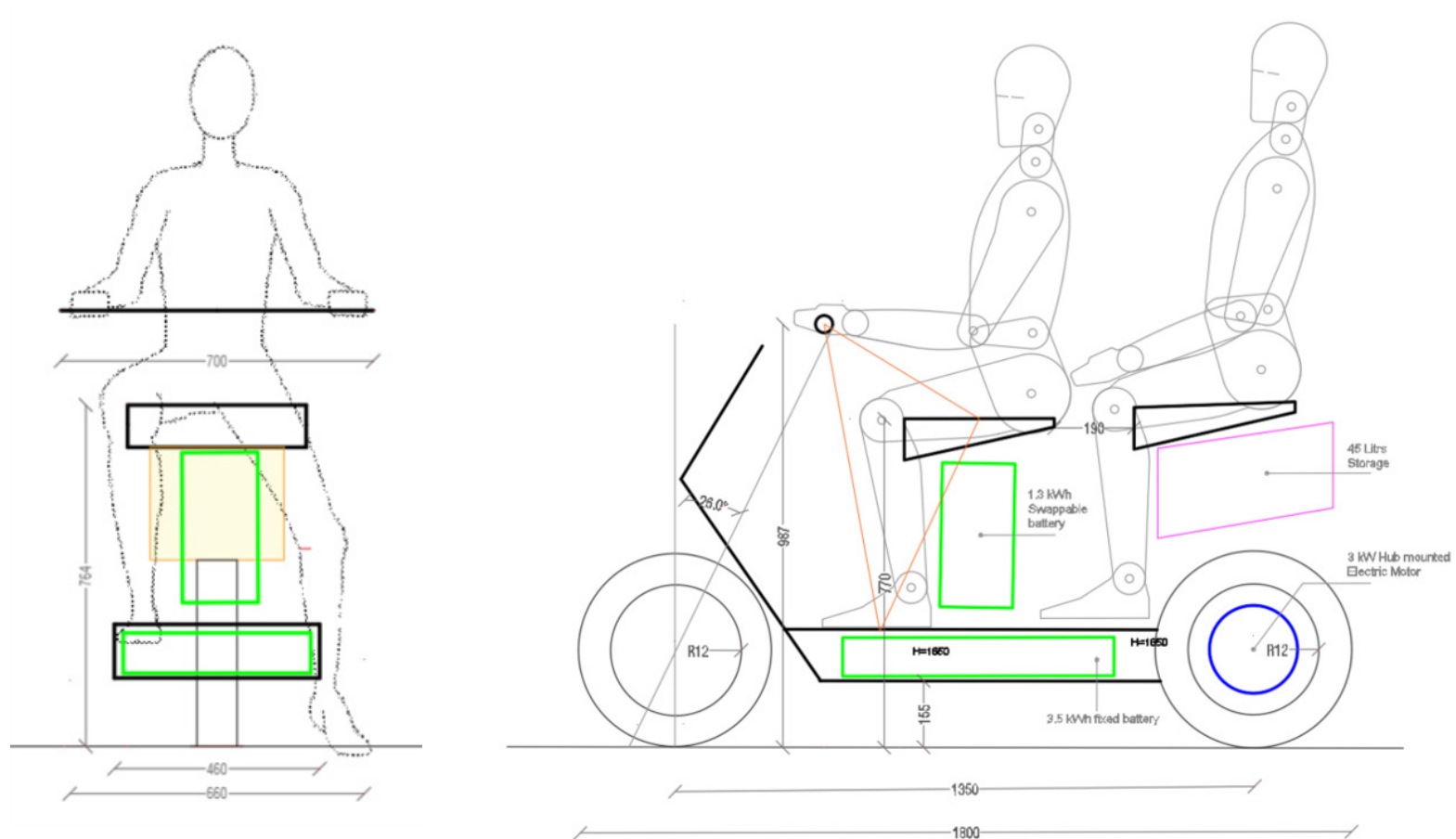
The electric motor is fixed on to the rear wheel hub for more efficient packaging of the rest of the components including a fixed battery, an optional swappable battery and atleast 45 litres of storage space for the pillion. The ground was initially at 150mm which was revised to 160mm.



8.3 Final technical package

The final technical package includes following specifications:

- Wheelbase: 1350 mm
- Total Length: 1800mm
- Total width: 700mm Handle to Handle
- Fixed Battery on Bed with 3.5 kwh capacity
- Optional swappable battery under driver seat with 1.3 kwh.
- Hub mounted motor with 3kw power output
- Wheel size of 12 inch diameter
- 26 degree rake angle.





8.4 User persona 1 : Passenger

Nithya

Nithya is a 23 year old recent graduate and junior architect at a architectural firm in Bengaluru. As a junior architect she earns around 20k per month and her working hours are usually from 10 AM to 6 PM which can occasionally extend upto 9-10 PM on busy days. As part of her work she is required to travel around Bengaluru to different construction sites usually carrying her laptop bag and rollpacks. She is also a person who frequently attends late night parties with friends and returns to her home late.

She has only used bike taxi service once or twice, she likes to use the service due its low fare but refrains from using it very much because she thinks its not safe for women and doesn't like the idea of sitting with a stranger.





8.5 User persona 2 : Driver

Vikas

Vikas is a 35 year old family man with a wife and a daughter from Bengaluru. Although he has degree and tried several jobs in the past years, he currently a full time bike taxi rider for past one year with a service provider using his old Mahindra Rodeo. He currently earns upto 35k per month from his jab as a driver, but he thinks a better vehicle which can appeal to all kind of customers will add more value to the service he is offering and also increase his earning.



8.6 Mood board

Moodboards are physical or digital collages that arrange images and other design elements into a format that's representative of the final design's intended mood. This particular moodboard inspires the designer to create a cool friendly product taking inspiration from a safe, tranquil and ideal urban environment.

URBAN



TRANQUIL



SAFE

8.7 Theme board

Theme board differ from moodboard by telling the designer specifically to achieve the desired mood board through specific design elements and details. This particular theme board highlights products that are designed with a sleek and sculpted design approach which could be used in the design process of the vehicle.

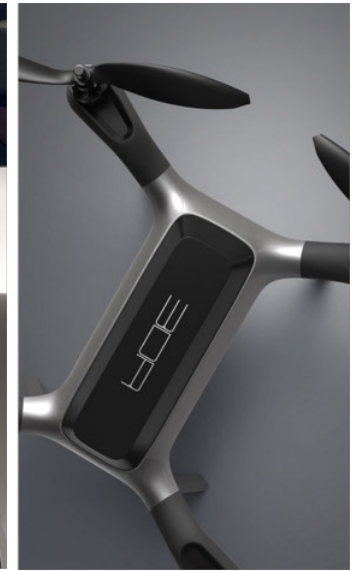
SLEEK



NEO

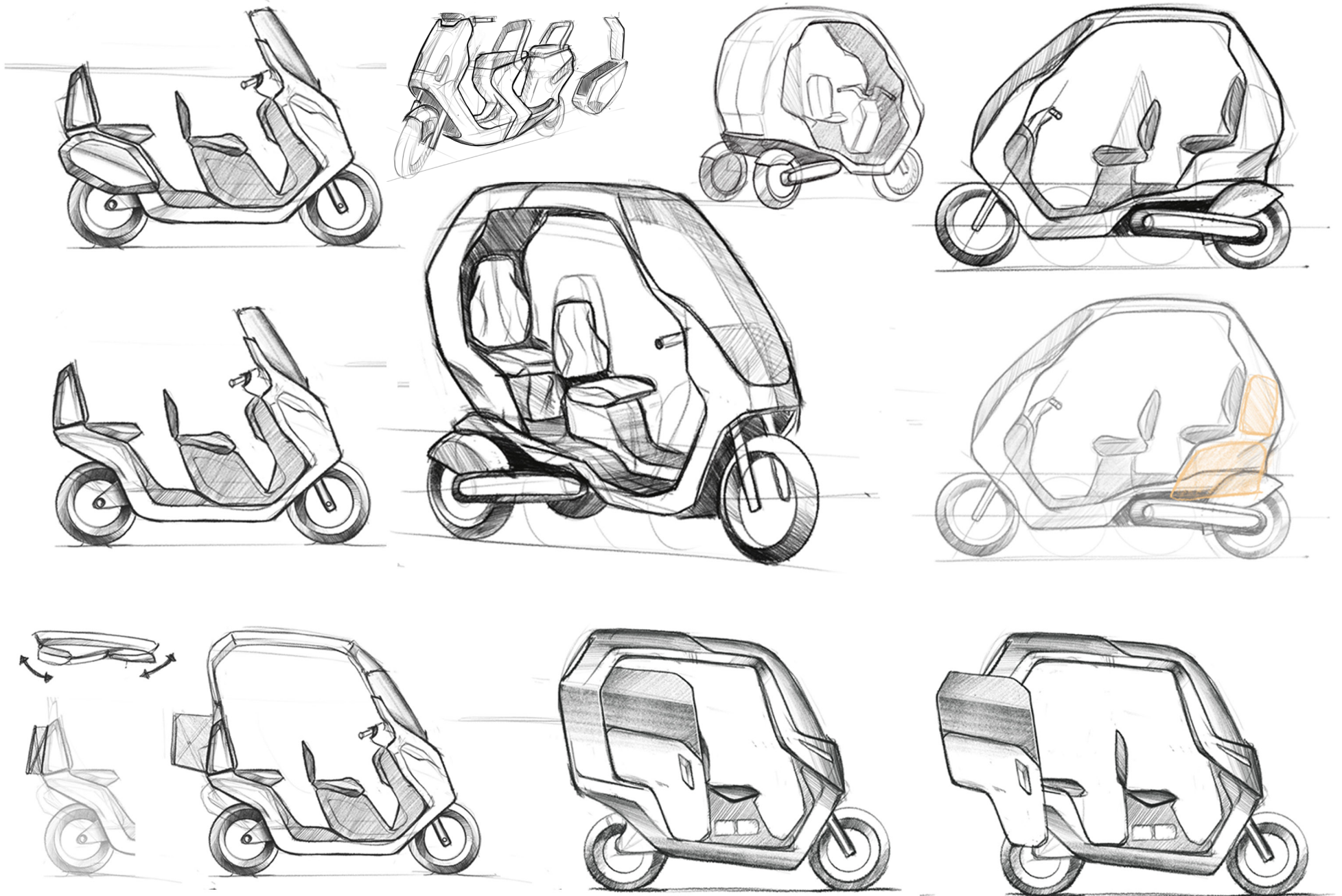


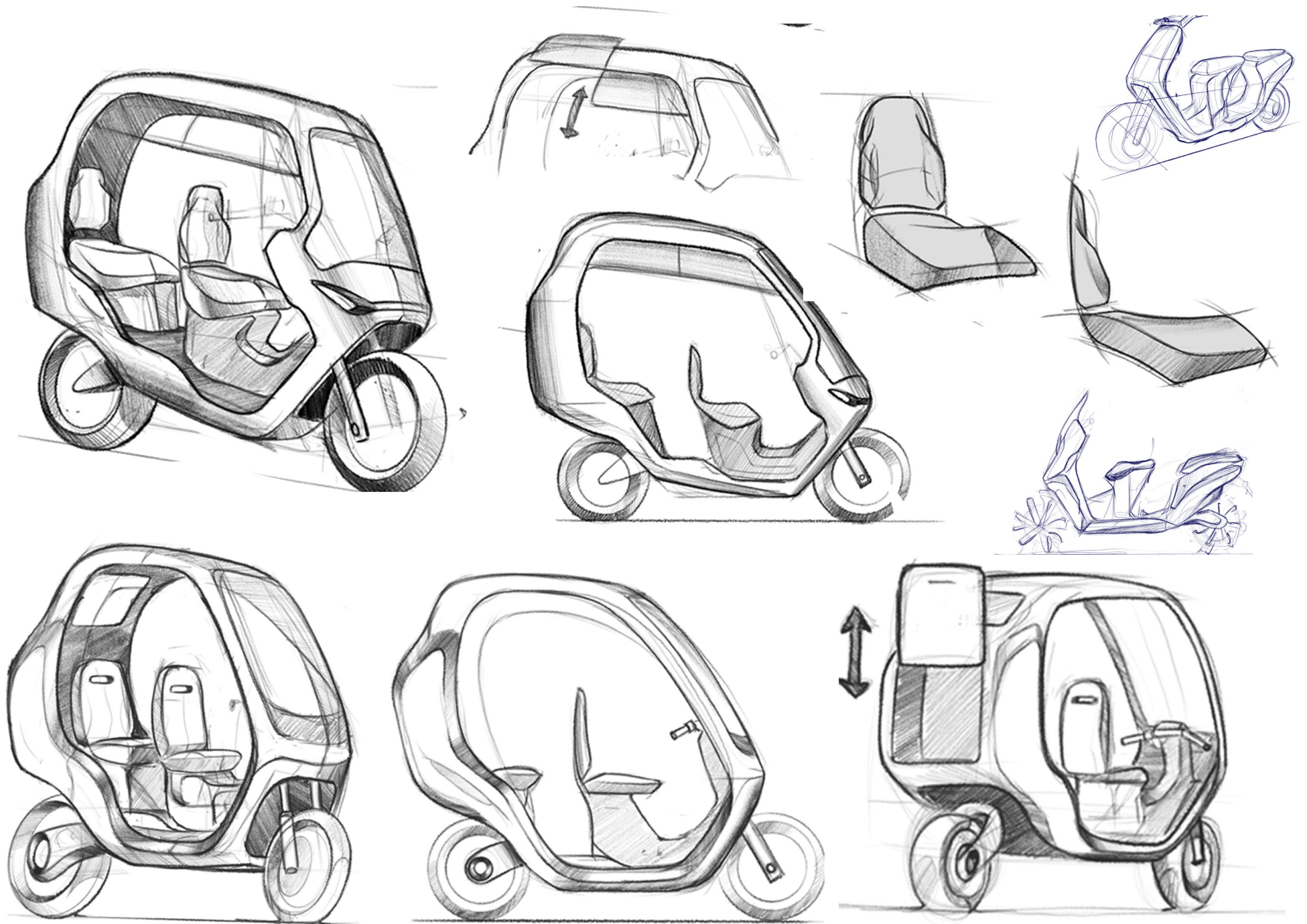
SCULPTED

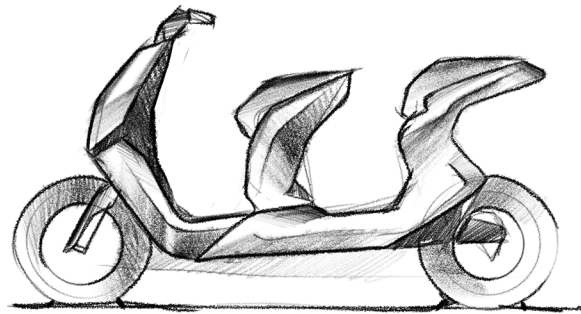


METALLIC

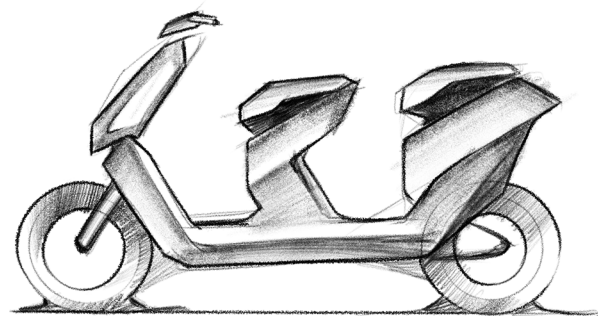
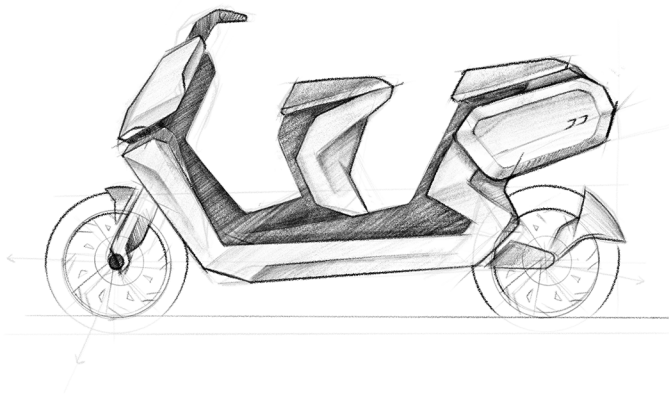
9. IDEATION SKETCHES

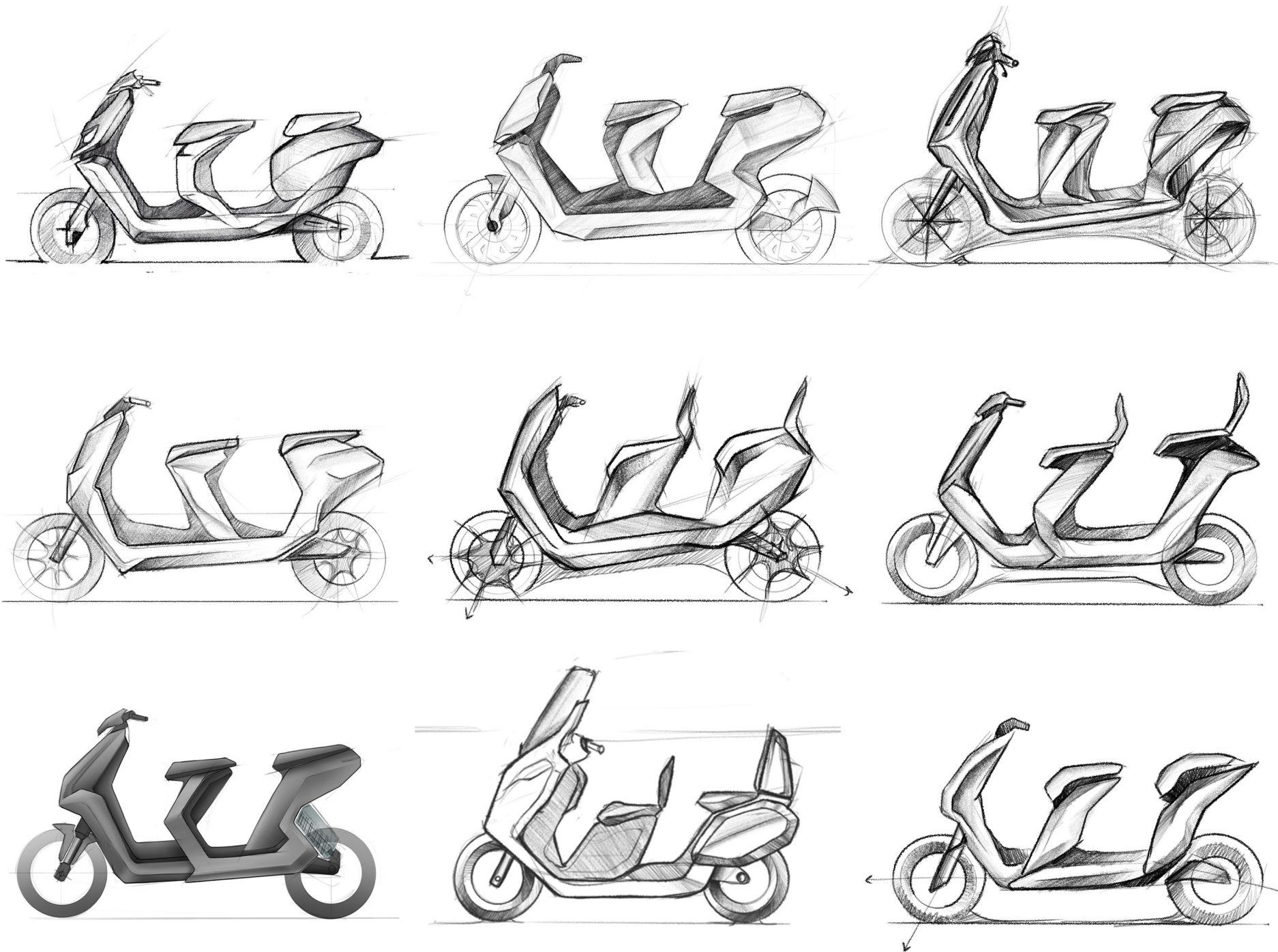


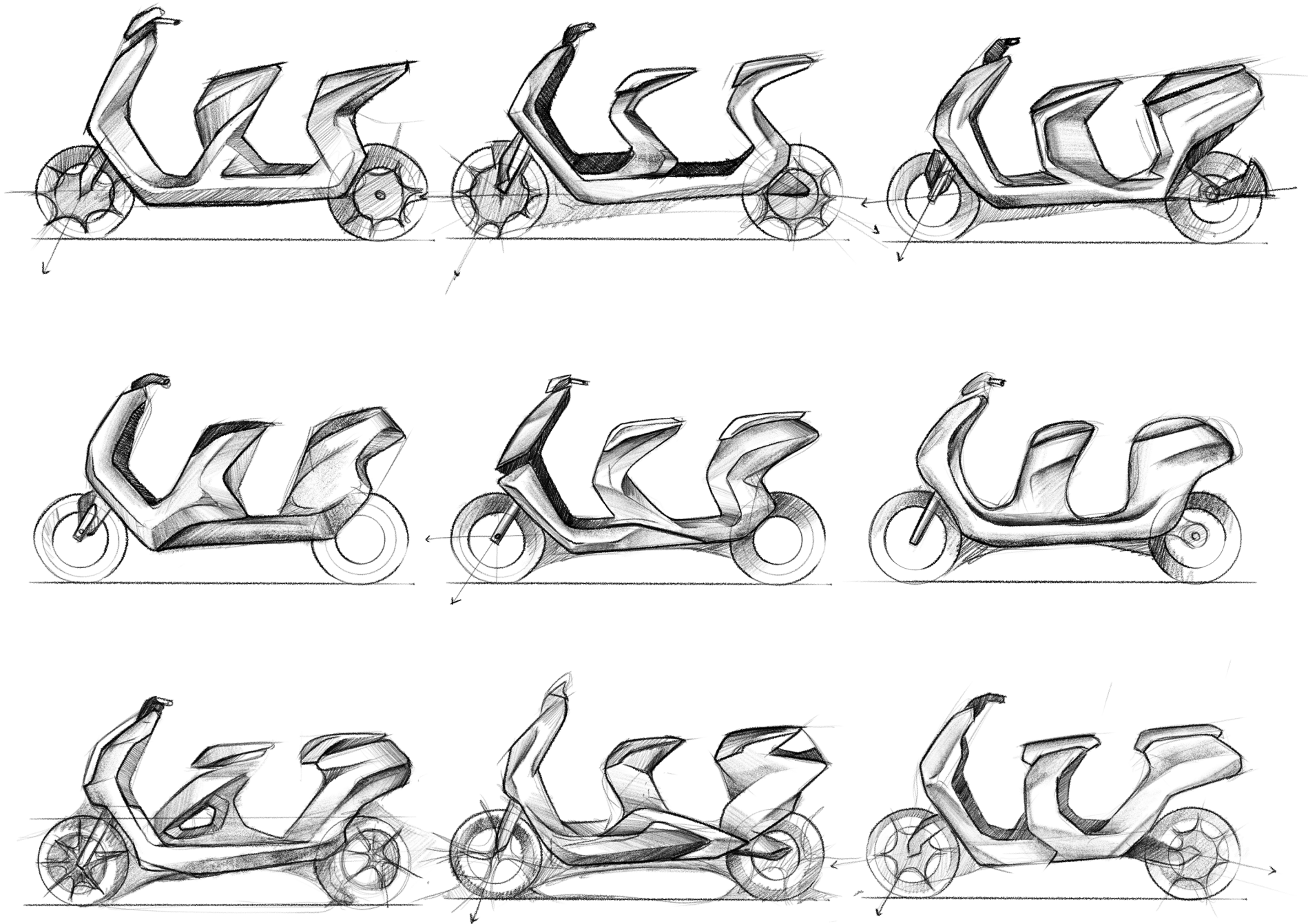


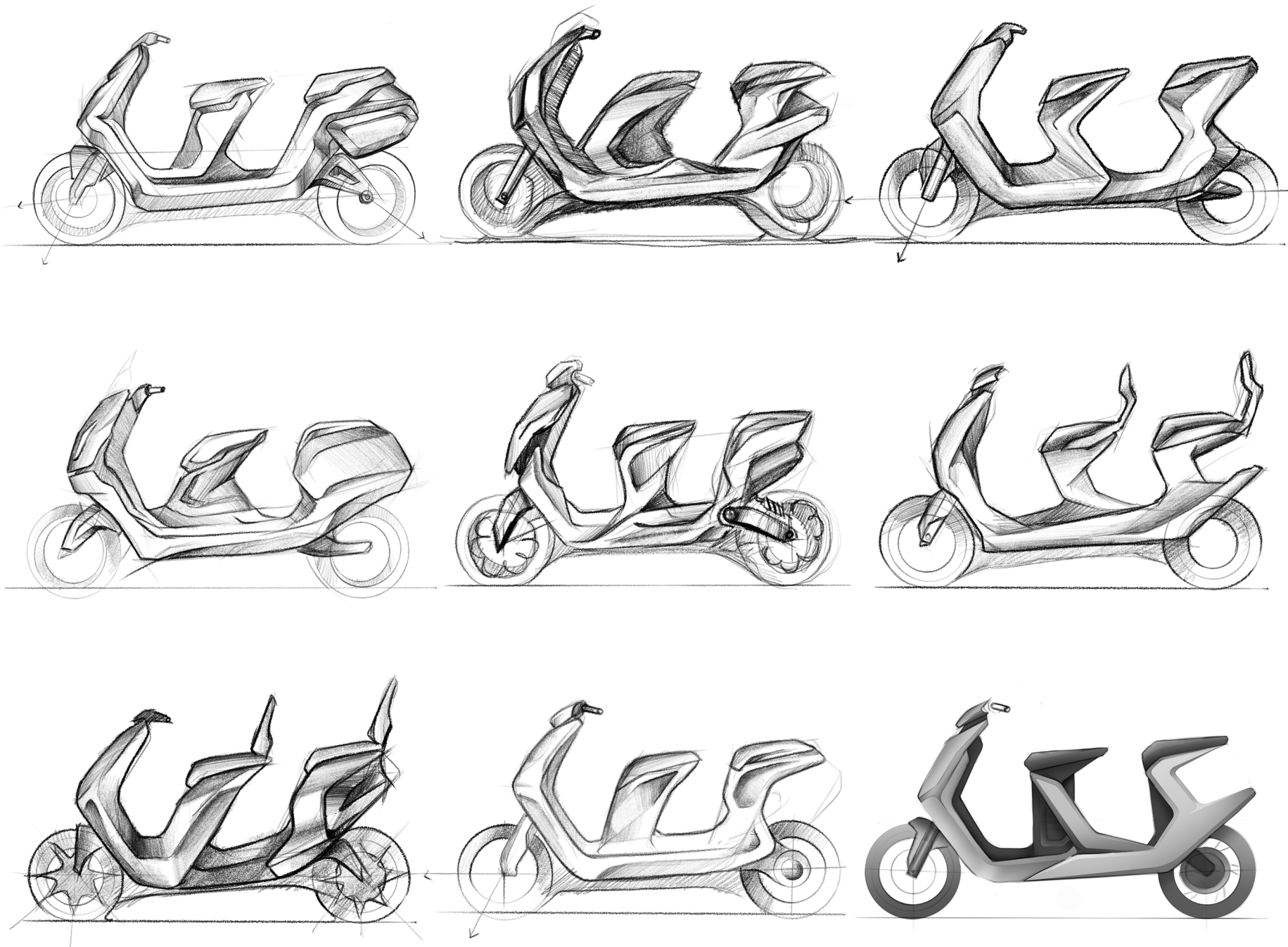


Design direction was further narrowed down to concepts without a roofing system following the final design brief and priority matrix.



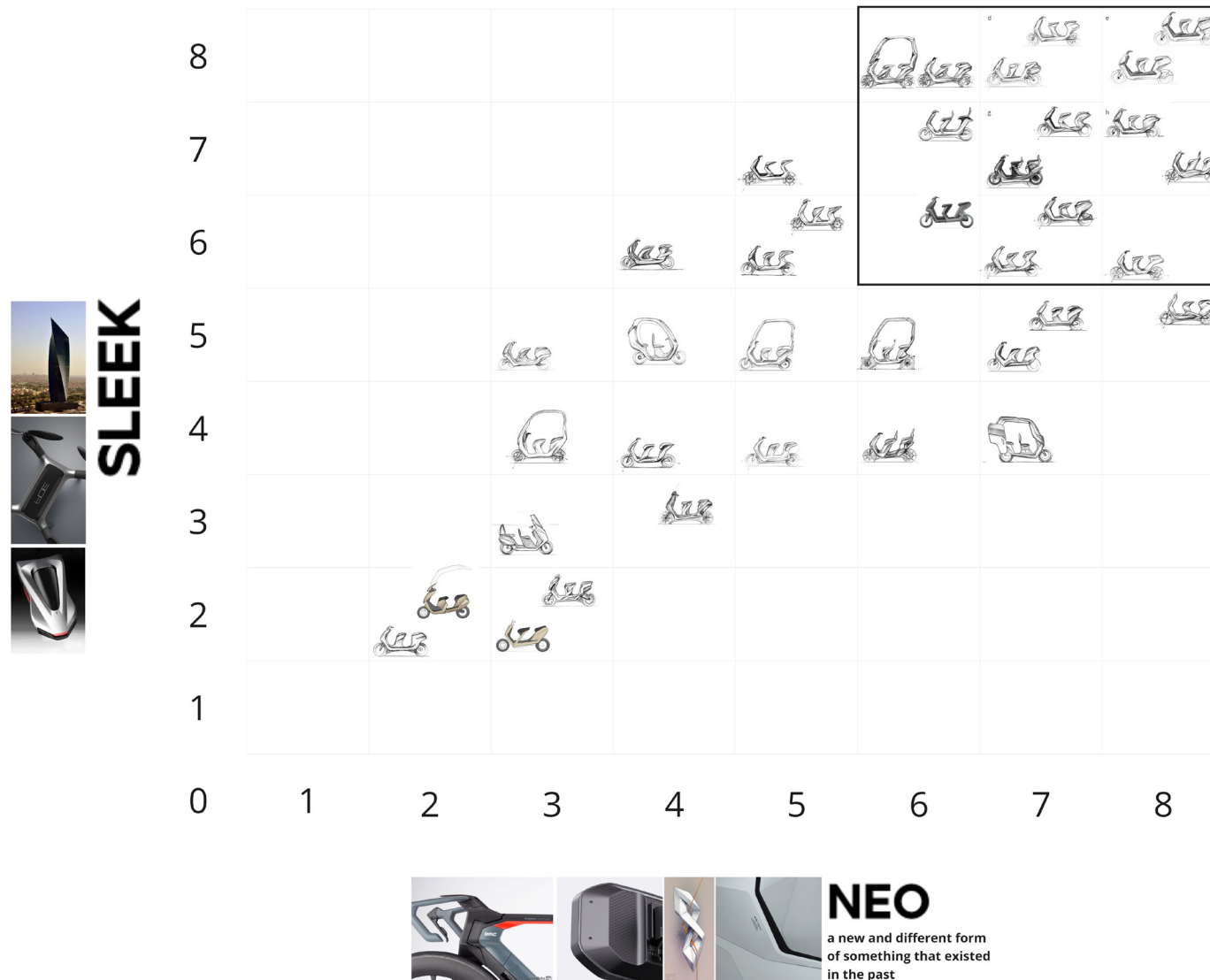


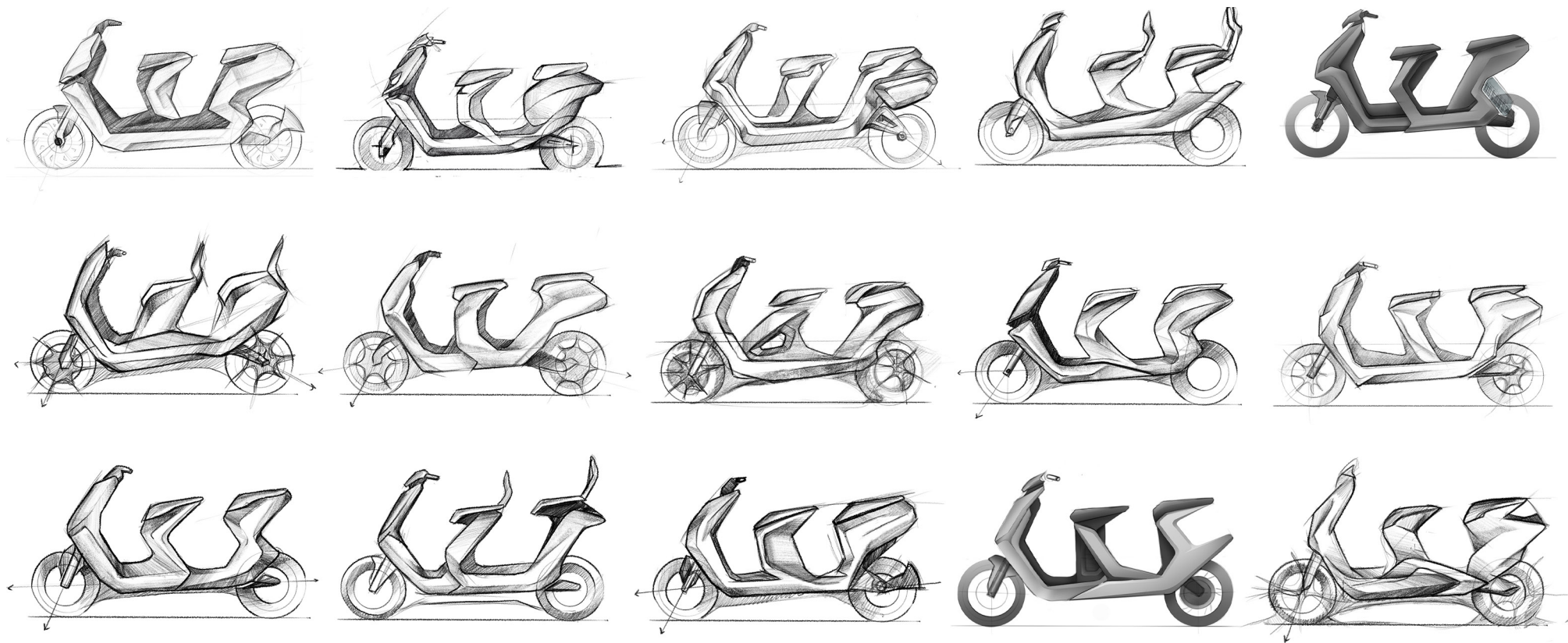




9.1 Sorting sketches based on theme

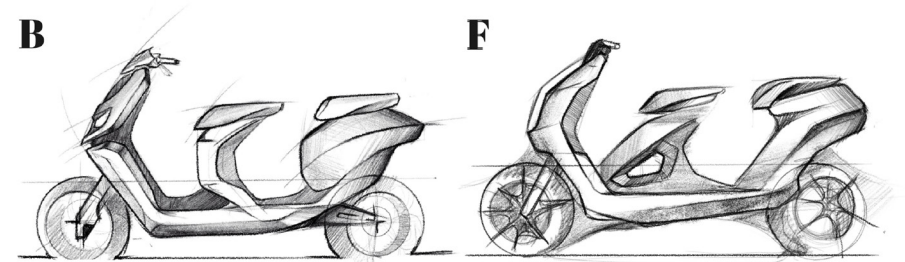
All the sketches were ordered and ranked on the basis of design keywords, after this process ,15 sketches were selected for further discussion and review.



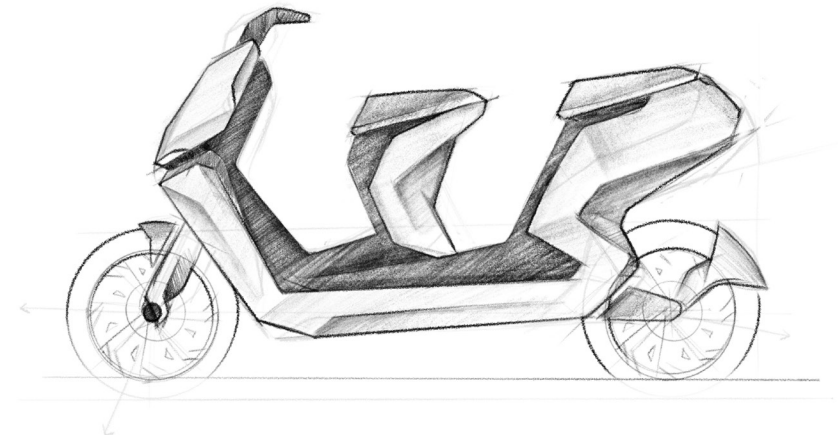




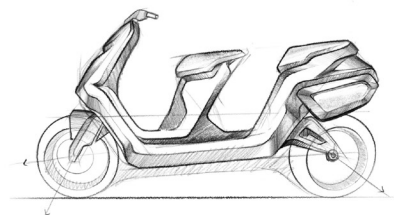
The selected 15 sketches were further reviewed and discussed with several potential users of the bike taxi service further narrow down the selection. After this process the 5 sketches were selected and finally one final key sketch (A) on which majority of the users agreed.



A



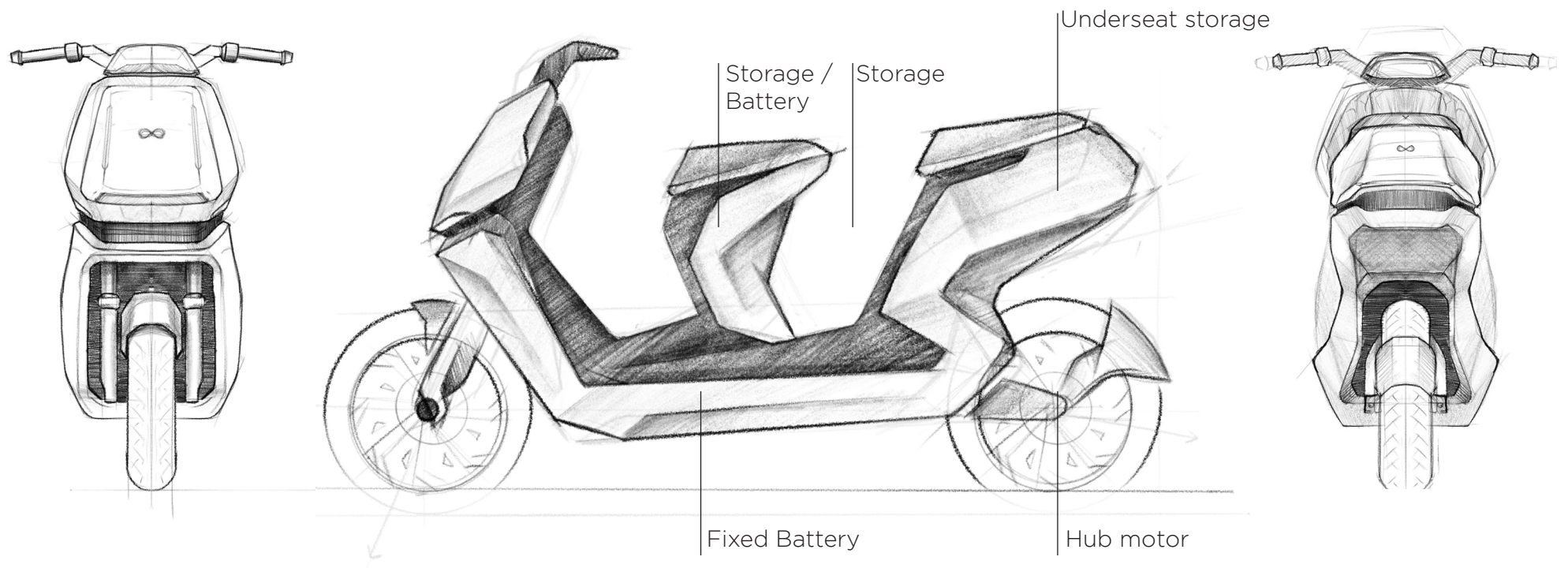
C



N

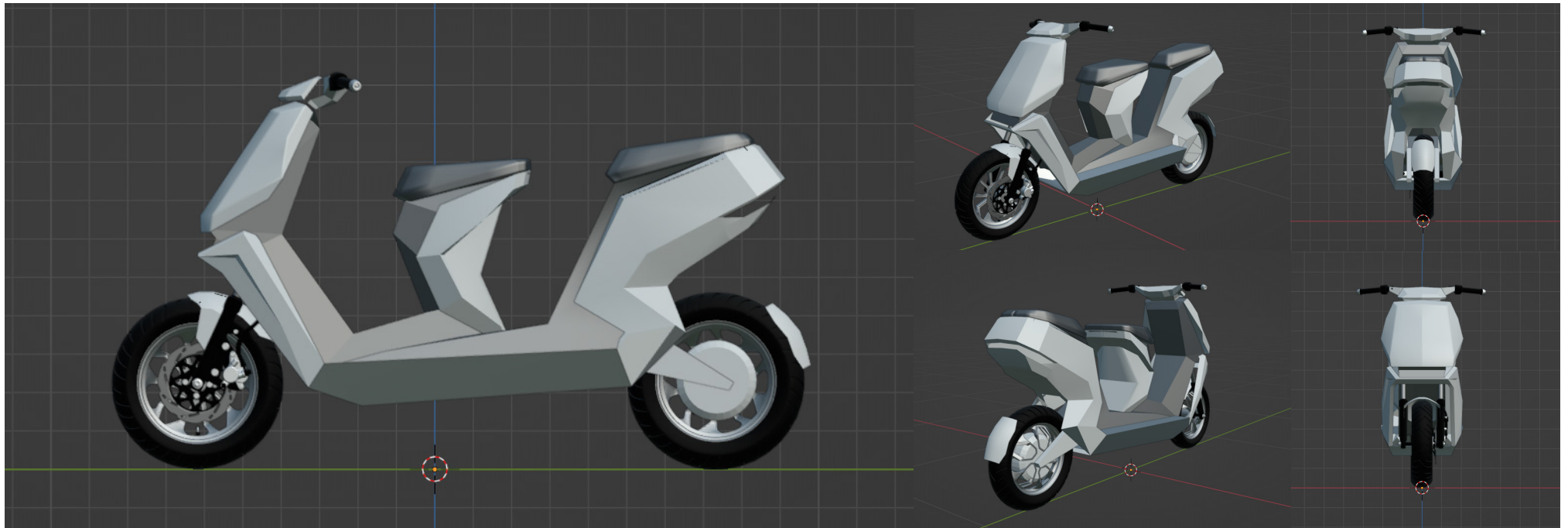


9.2 Key sketch



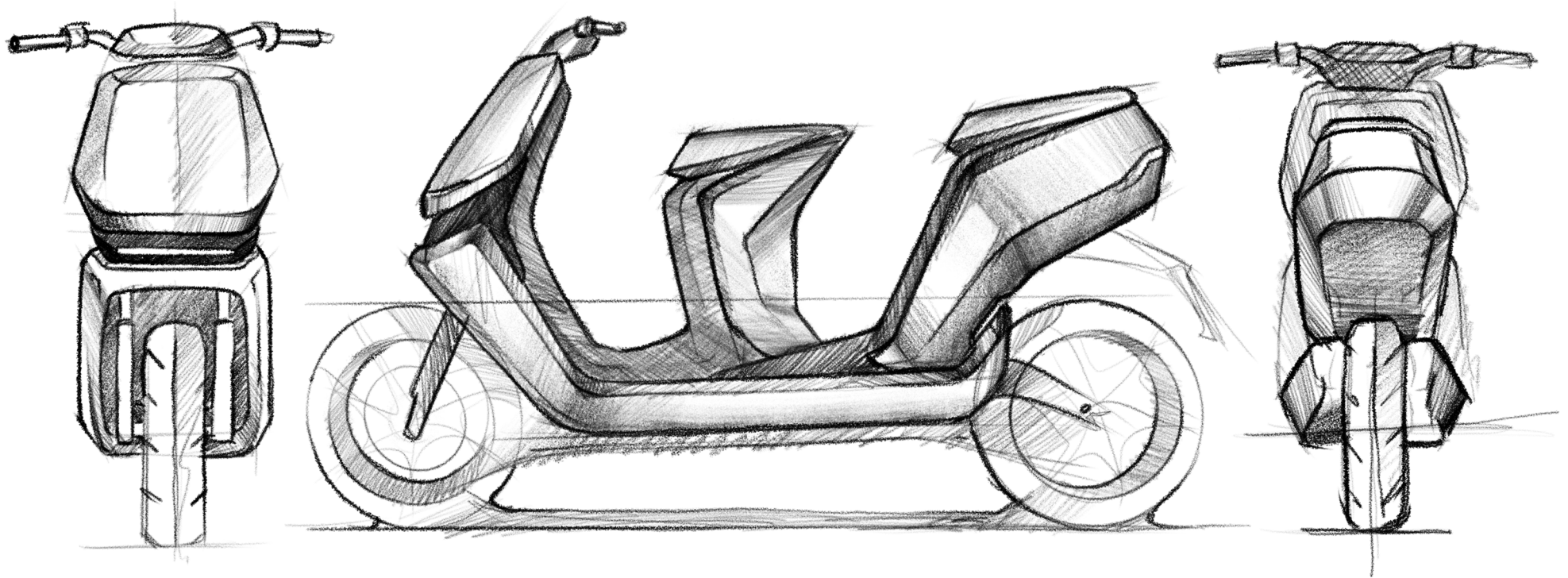
9.3 CAD ideations stage 1

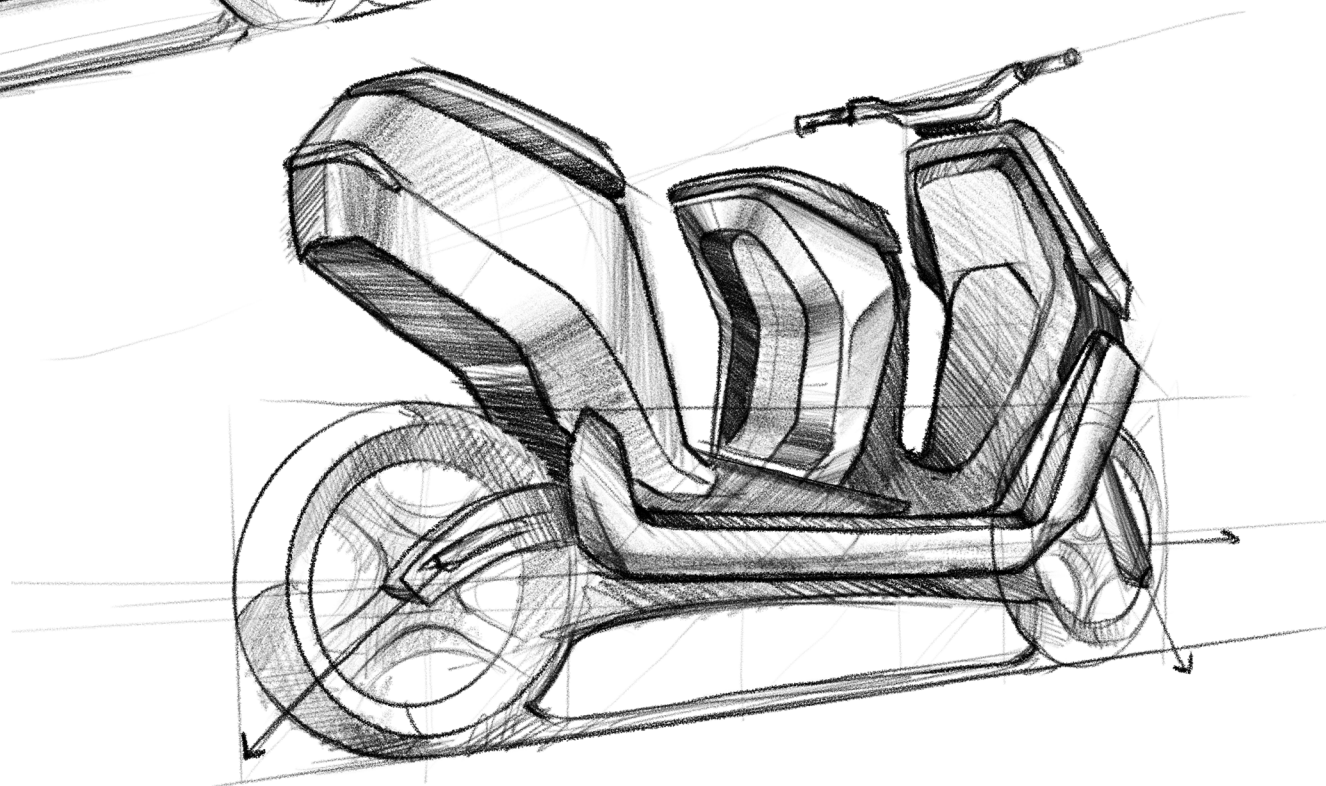
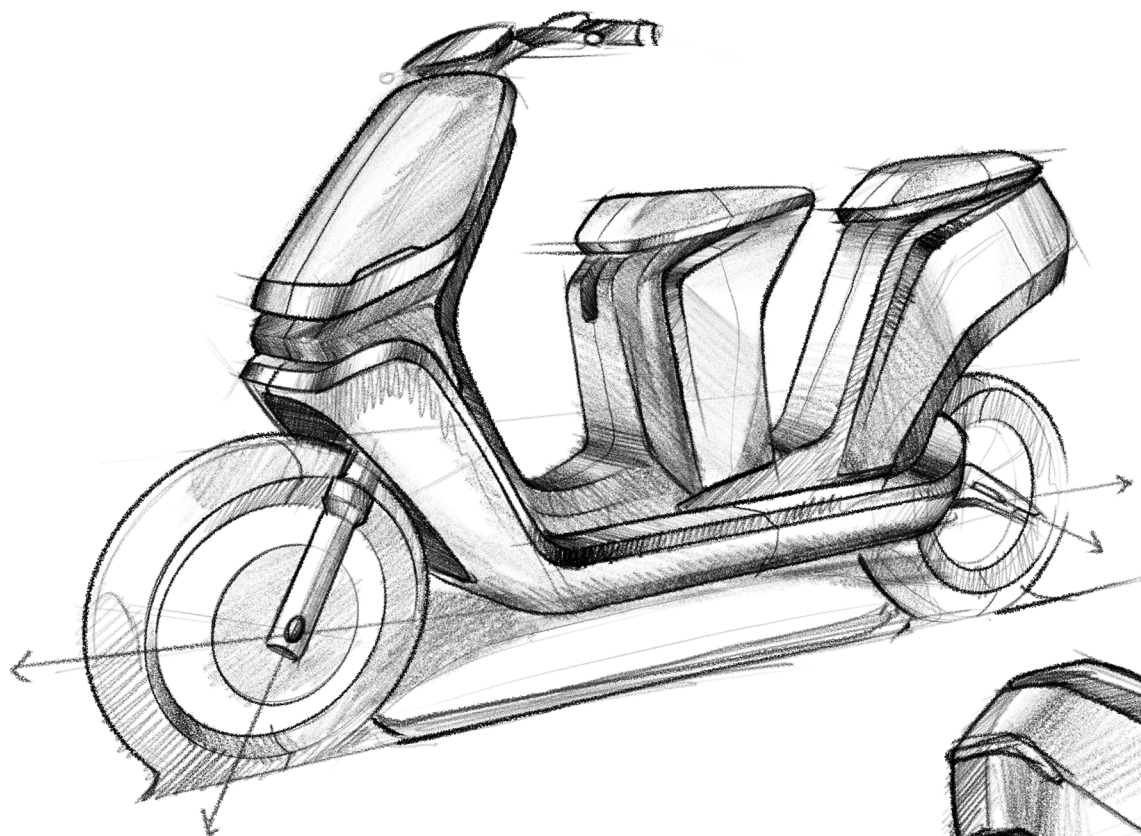
The selected key sketch was explored in a three dimensional space using a CAD software (Blender) understand the volume from all possible orientations.

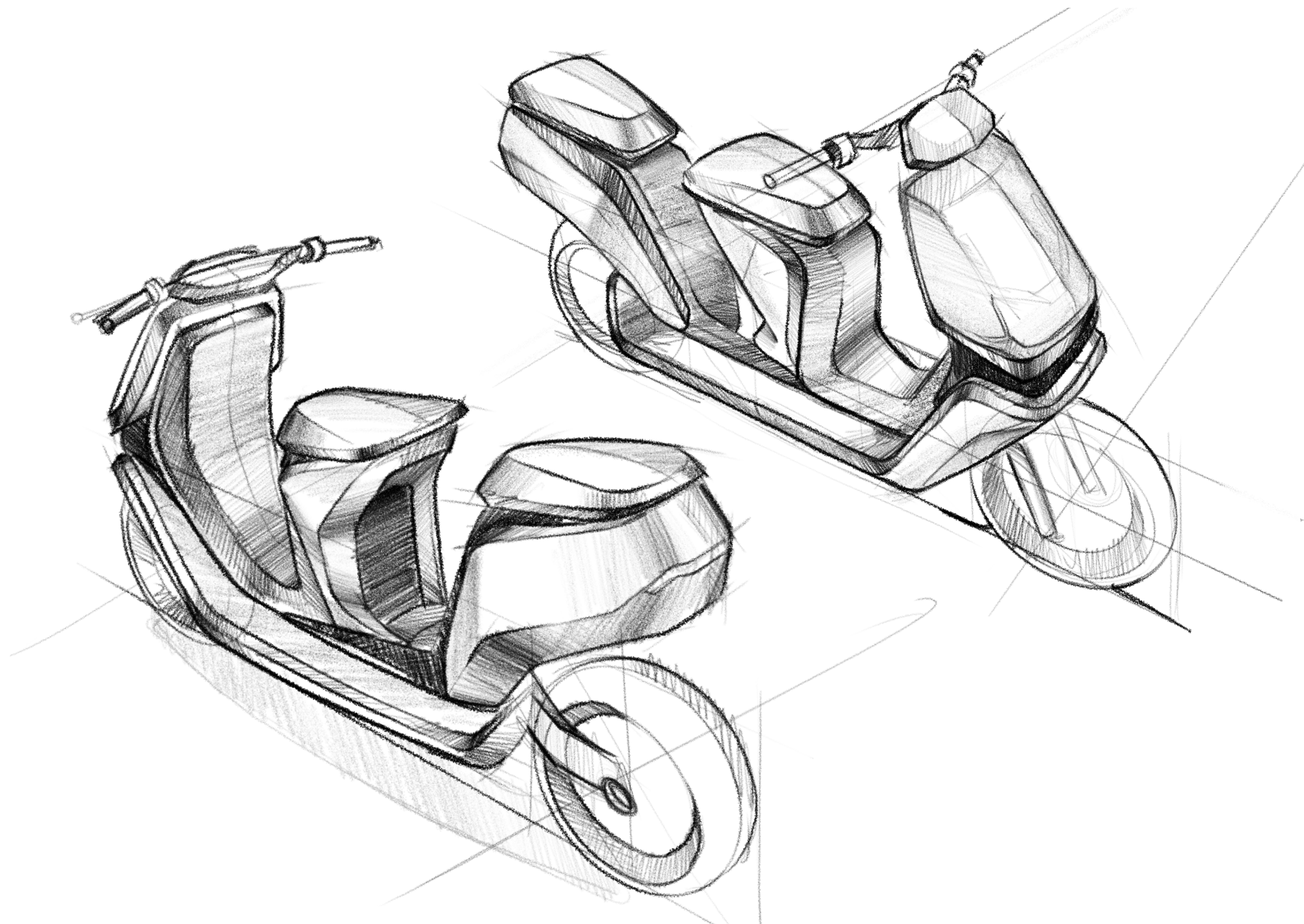


9.4 Refining the concept

Using the stage 1 CAD model as an underlay, design and the detail from the key sketch were further refined through several sketches while staying true to the themeboard.





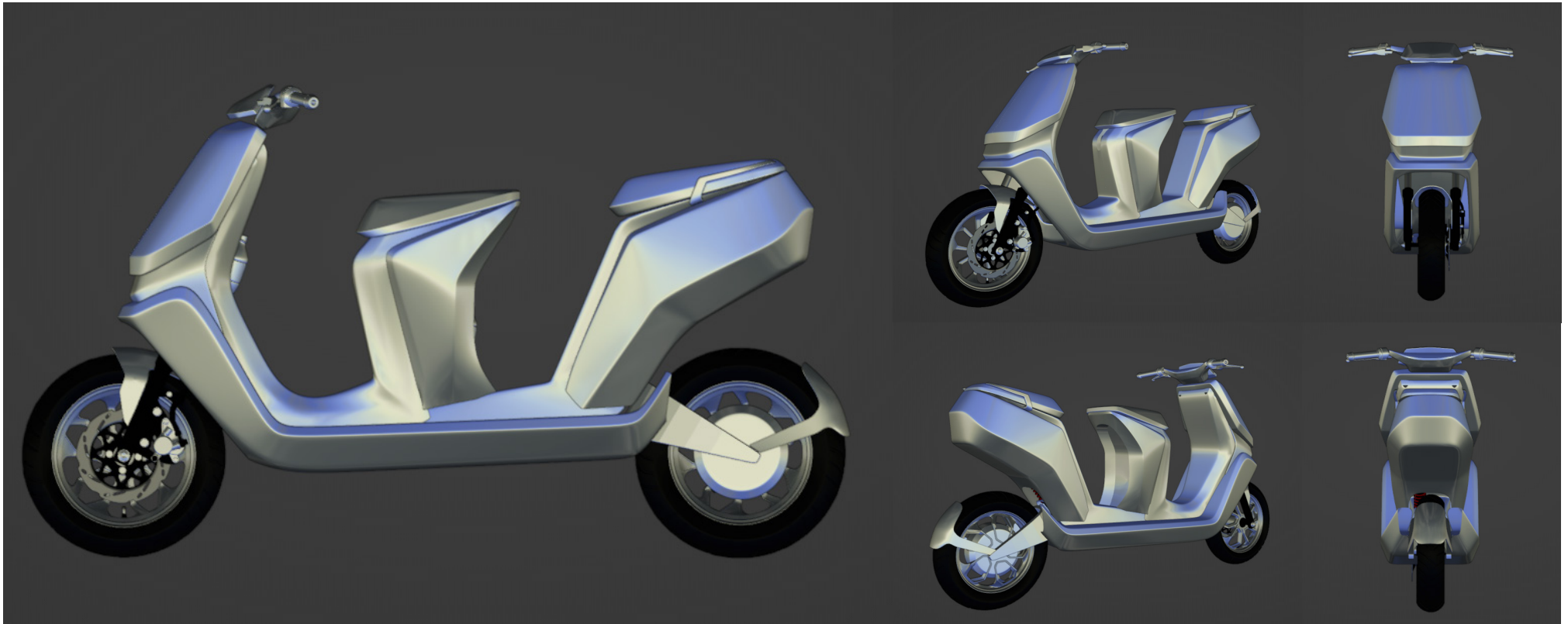


9.5 Concept render



9.6 Stage 2 CAD model

Based on the refined concept sketch, the model was also further developed following the sketch. which was again further tweaked several times to arrive at the final design of the vehicle.



10. FINAL DESIGN RENDERS























11. 1/5 SCALE PHYSICAL MODEL



12. REFERENCE

The following references were extremely helpful during the research phase of the project:

- https://en.wikipedia.org/wiki/Motorcycle_taxi
- <https://the-ken.com/story/grey-zone-rapidos-shortcut-bike-taxi/>
- <https://www.alliedmarketresearch.com/india-bike-taxi-market-A15920>
- <https://olawebcdn.com/ola-institute/bike-taxi-report.pdf>
- <https://thestartupscene.me/BehindTheStartup/Inti-Go-is-the-Scooter-Taxi-Startup-Solving-Tunisia-s-Transportation-Issues>
- <https://cleanscooter.in/lit-motors-c1/>
- <https://www.motorcycle.com/top10/top-10-best-cruisers-for-tall-people.html/attachment/rider-triangle-0909>
- https://en.wikipedia.org/wiki/Electric_vehicle_battery

THANK YOU