

Design project 2

Design an assistive mobility device for passenger at railway station

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Mobility and Vehicle Design

Content

- Background research
- Product research
- User research
- Design brief
- Ergonomics study
- Benchmarking
- Packaging
- Ideations

Background study

Captive Passengers

India is the densely populated country. Considering the example of Mumbai's rail system is the world's busiest, serving **7.5 million riders** a day.

Trains most often operate far beyond official capacity – **2.6 times** on average, according to officials – with between **14-16 people per square meter**.

Thane handles as many as **6.54 lakh** passengers daily. Every day, more than 1,000 trains pass through Thane, which has **10 platforms** catering to two corridors each for the fast and slow tracks and the Trans-harbour network. As many as 55-60 long distance trains halt at the station.

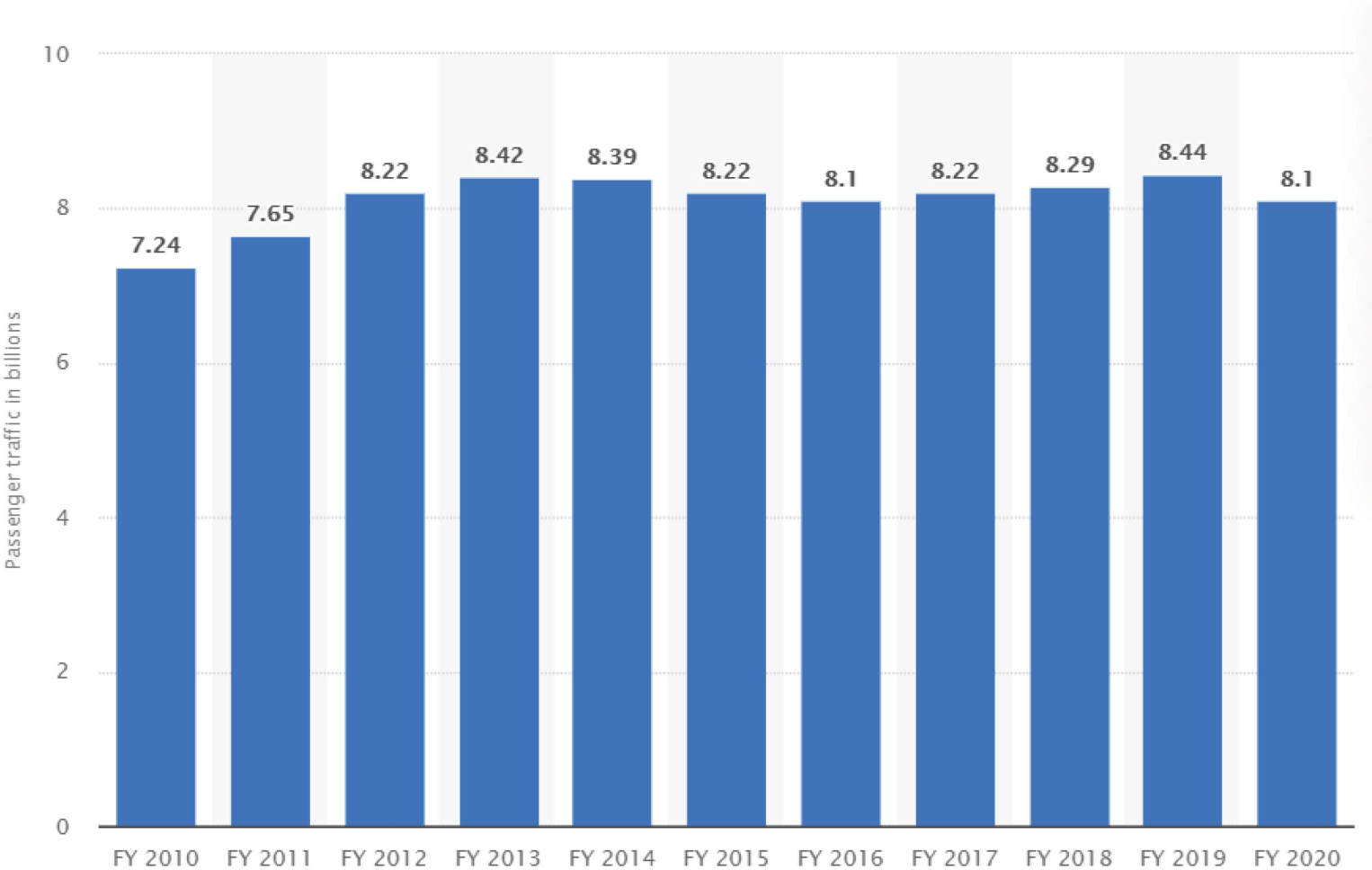
CST still accounts for several footfalls with **6.36 lakh** passengers, followed by Kurla and Kalyan with **3.81 lakh** and **3.60 lakh** passengers daily. Other crowded stations on CR are Dadar with 2.90 lakh passengers followed by Dombivli with 2.83 lakh passengers.

On the Harbour line, Vashi handles **2.34 lakh** passengers followed by Belapur with 1.82 lakh passengers and **1.73 lakh** passengers at Chembur.



Passenger traffic in railways across India from financial year 2010 to 2020

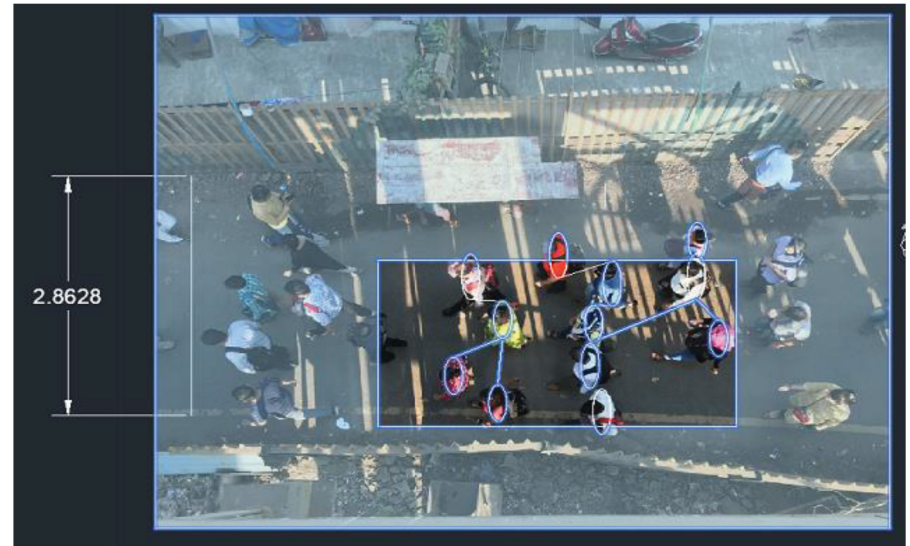
The railway network in India was forecast to become the third largest across the globe in the next five years. The passenger traffic in the railway sector amounted to over eight billion across India in fiscal year 2020. Overall, the railway network transported over 22 million passengers every day.



Under-Designed Spaces

Reports claim that at peak hour around **100,000** people use the foot-over bridge between the stations, leading to incidents of frequent **panic and chaos**. But it's not only the bridge where there are issues of under-designed or poorly thought access infrastructure. There are **four entry-exit points** to the two stations, some served by narrow access roads. Surveying one of these, we estimated about **38,600** people per hour flowed through in just one evening.

Lack of designated designed spaces also leaves minimal space (0.2-0.5m) between people and buggy, leading to frequent conflicts between people and vehicles.



Under-Designed Spaces and Exploit of the Capacity

Overcrowded platforms, walkways and foot bridges are a spill over effect of overcrowded trains. But station access design often makes things worse. At railway station, crowds alight from trains onto a wide platform (7.9m) only to be shoved into a 3.5m-wide staircase. Density here ranges between 10-12 people per square meter.

Even if there is a elevator at some railway station, it is flooded with the people.



Understanding Comfort and Conflicting Use Cases

Crowding is quantifiable and creates clear safety risks; however, station areas do more than provide access to transit for commuters, they also help set the tone for interactions between commuters and are spaces of economic activity.

Street vendors and hawkers, who sell everything from food and clothes on trains and in stations and use the system to transport lunch dabbas and other products from markets across the city. There's a fear of the space being cleared to create better **pedestrian movement** and what it would mean for their livelihoods.

Tracing the route of a user through this space makes design problems clear at every turn. The crowd density is **14-16 people per square meter**. Commuters press against each other, struggling and leading to asphyxiation and extreme discomfort, especially in the summer months.



Japan shows how transport systems can adapt

Japan is at the forefront of this phenomenon: [by 2050, a third of the population will be 65 or older](#), up from [an already world-leading 25% today](#).


One challenge in ageing societies is transportation. As people age, they need new ways to get around – particularly alternatives to driving. Trains and buses can often substitute for private cars, but even in Japan, a country renowned for its extensive and efficient public transportation, service is far from universal. In rural areas especially, where populations are even older than average and traditional kinds of public transport are scarcer, the need to fill “mobility gaps” for the elderly is acute.

Istanbul buggy service at airport

They got this service for €6,- a person. It took us already 15 minutes by buggy to get from the lounge to the gate. So, a buggy service might be the right solution for a more relaxed stay in the lounge or when you are in a hurry.



Advertisements



Battery Operated Cars provided at Secunderabad Railway Station

Secunderabad Division has always been in the forefront to provide improved amenities to facilitate the passengers and one such initiative is the provision of Battery Operated Cars (BOCs) at Secunderabad Railway Station. In addition to the existing facilities of Lifts, Escalators and Wheel chairs, 5 Battery Operated Cars have been provided for ferrying of passengers across the platforms, at Secunderabad Railway station. While the service is available to all passengers; preference would be given to Senior Citizens, Divyangjan, Pregnant women and medically sick.


The service of Battery Operated Cars can be availed by advance booking through the dedicated mobile number 91-88273-31111. The services are available round the clock at a cost of Rs. 45/- (including GST) per passenger and computerised bill is issued for all transactions. Secunderabad station is a Digi-Pay station and digital payment modes like Point of Sale (POS) machines and Paytm are accepted for usage of Battery Operated Cars.

These Battery Operated Cars are spacious and can accommodate 6 passengers at a time with luggage carrier on the roof. Passengers will experience a smooth ride on the car because of the specifications like foam-covered handles, shock absorbers, Leaf Spring Suspension etc. The cars also have safety features like automatic stoppage in case of electrical failures, availability of hand brake for emergency stoppage during technical snags etc. To ensure the safety of the passengers using the service, the cars are operated by professionally trained drivers, who are in touch with the railway supervisors. Cameras are being installed in the cars as an additional security feature and for continuous GPS tracking.

South Central Railway
South Eastern Railway
South Western Railway
South Railway
South Railway
South Railway

Battery operated Passenger Cart Service at Tatanagar Station of Chakradharpur Division

Passengers' Convenience



- The facility of Prepaid Passenger Cart Vehicle to transport needy passengers when they exit/enter the station
- The facility is particularly convenient for the aged, sick, divyang passengers to commute comfortably
- The carts are basically non polluting battery operated vehicles, re-affirming the commitment of Railways for a better environment

South Eastern Railway
We serve with a smile

follow us on:

Battery Operated Passenger Cart Service... No handicap can be a deterrent

- Very busy Railway Stations have the facility of Prepaid Passenger Cart Vehicle to transport needy passengers when they exit/enter the Station
- The facility is particularly convenient for the aged, sick, divyang passengers to comfortably commute
- The carts are basically non polluting battery operated vehicles, re-affirming the commitment of Railways for a better environment



TIPS FOR A HAPPIER RAIL TRAVEL

5

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South Central Railway SCRailwayIndia
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SOUTH WESTERN RAILWAYS BANGALORE DIVISION

BUGGY SERVICE

Available from 27th December 2017



+91 98451 20000

Cost per person ₹20/-

Booking Counters on platform no. 1 & 8

QUALITY, COMFORT AND CONVENIENCE

Mainli Buggies are stylish, sleek and reliable modern vehicles.



- Vehicle Capacity 2 to 14 Seats
- Colour Options 2000+
- Zero Emission Eco Friendly
- Body Dent proof ABS

Product Research



Packaging

Passenger capacity



Easy ingress and egress



Visually strong



spacious



Passenger capacity

Available products

- Frame material: steel aluminum
- Rated power of motor: 500W-1000W
- Load: 200kg
- Battery: 48V/20Ah lead-acid battery
- Range per charge: 85- 100km
- Charge time: 6 - 8hrs
- Power consumption: 1.1kWh/100km
- Charge voltages: AC 70-90V
- Max speed: 25-35km/h
- Net weight: 104kg
- Size of packing: 1380*640*660mm
- Conveyance:
 - Qty/20' FCL: 36pcs
 - Qty/40' HQ: 75pcs





Vehicle Specifications			
Performance		Controller	DC 48V 275A Curtis controller
Seating Capacity	2 Persons	Charger	48V 18A
Speed Range	18 - 24 Km/h	Battery	6 x 8V 170 Ah
Traveling Range	70 - 80 Km	Rear Axle Ratio	12.49 :1
Climbing Capacity	30°	Mechanical	
Braking Range	4.5 m	Steering	Rack & pinion
Turning Radius	6 m	Brakes	Rear mechanical drum
Carrying Capacity	320 Kg	Tyres	18 x 8.50-8, 4 - ply
Electrical		Ground Clearance	10 cm
Power Source	48V DC	L x W x H	234 x 120 x 176 cm
Motor	DC 48V 3KW	Gross Weight	490 kg
Horsepower	3.3 kW Rated	Accessories	Golf bag bracket

AX - A5



Vehicle Specifications			
Seating Capacity	1 Person	Tyres	13 X 6.50 - 6 Tubeless
Dimension (L X W X H) mm	1500 X 830 X 980	Brakes	Electromagnetic Parking brakes
Wheel Base	945 mm	Braking Distance	< 4m
Batteries	12V80AH X 2PCS Maintenance Free	Minimum Vehicle Speed	13 km / h
Motor	24V 800W	Minimum Turning Diameter	< 3m
Controller	Curtis Controller	Maximum Grade Ability	20
Steering	Handle Steering Wheel	Loading Weight	Around 20 kgs.
Frame	Welded high tensile steel with double coating	Charge Time	Around 6 hours
Body	PP	Running Time	Around 6 hours
		3 Speed key switch, horn. headlight	

Available Product

Battery Capacity	~90km to 100km
Motor Power Rating	750 W
Load Capacity	450kg
Max Speed	25km/h
Motor Power	1kW
Motor Type	BLDC
Motor Voltage	48 V





Stroller for elderly

- Pros-
 - can maneuver by individual
 - no assistance required
 - small turning radius
- Cons-
 - No place to accommodate luggage
 - Can't travel though stairs/ elevator

Other options available



Palkhi

- The heavy Palkhi rest upon their shoulders causing injury and long-term muscle damage to the Palkhi bearers.
- Cons-
 - Muscle injury
 - Less safety
 - Non-motorized
 - Need more physical effort
 - Heavy

THE LITHIUM ION ADVANTAGE



MAINTENANCE

Lithium batteries have virtually no maintenance costs. You save on maintenance equipment and wages for maintenance personnel.



CHARGE TIME

With a consistent full-charge time of 2 hours, lithium batteries keep working long after traditional batteries give up.



MEMORY EFFECT

Experience 100% fleet availability with opportunity charging. Lithium eliminates down time to switch out batteries or wait a full charge cycle.



BATTERY LIFETIME/SERVICE LIFE

Lithium batteries last twice as long as traditional lead-acid and gel batteries so there's no need to buy frequent replacements.



SAFETY

Battery rooms will be a thing of the past for your warehouse with safe, cost effective lithium batteries.



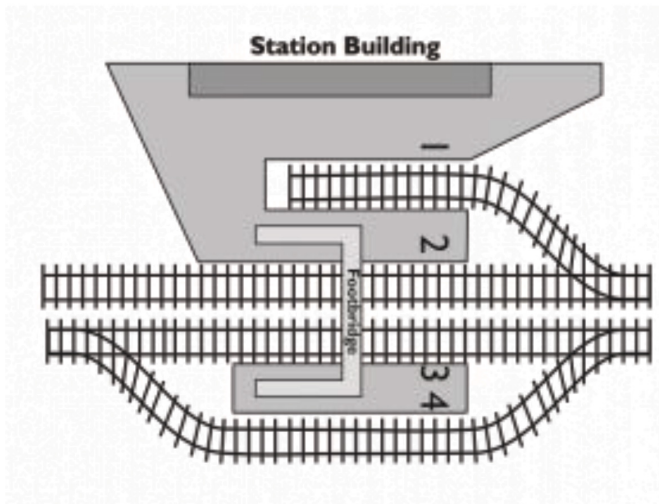
POWER SAVINGS

Save up to 15% in energy costs when you switch from traditional lead-acid or gel batteries to lithium batteries.

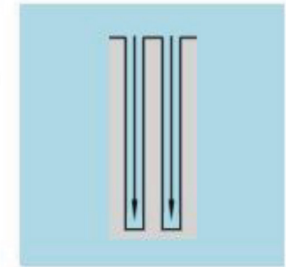
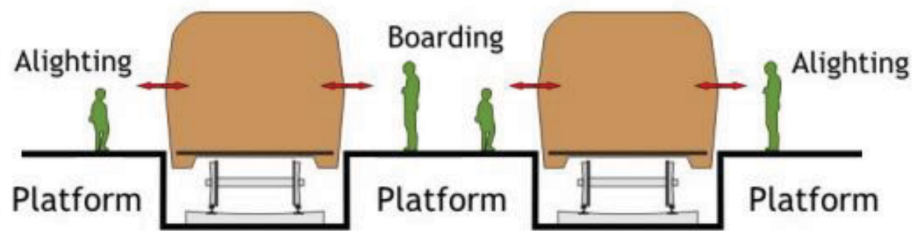


Railway platform types

- A railway platform is a section of pathway, alongside rail tracks at a railway station, metro station or tram stop, at which passengers may board or alight from trains or trams. Almost all rail stations have some form of platform, with larger stations having multiple platforms.
- The term “railway platform” can also mean any type of freight platform beside a rail siding for loading/unloading freight to/from rail cars.



Platform 1 is a “bay” platform, while platforms 2, 3 and 4 are “through” platforms. The platform accommodating 3 and 4 is an “island” platform.



Flow-Through Platforms

Flow-through platforms allow passengers to board and alight the train from dedicated platforms, thereby eliminating conflicting passenger flows. Flow-through platforms speed boarding and alighting and therefore reduce vehicle dwell time at the platform. Flow-through platforms are not typically used due to cost and operational considerations, but they may have applications where very high passenger volumes and/or unique passenger characteristics (e.g., a high percentage of passengers with bags) require that the station designer minimize cross-flows on the platform and dwell times.

Exploitation of product



Product is used for other than intended purpose



Uncomfortable ergonomics

Courtesy: Mid-day(27/09/21)

Railway study

- Easy retro-fitment and seamless integration is needed in the current design of coaches serving different age groups and physical capabilities.



The ends of the platforms should be provided with ramps at a slope not steeper than 1 in 6 = **16.66%** gradient.

9.46 degrees

User Study

For user study questionnaire has been made and asked to the potential user of the railway system. Various kinds of users are taken into consideration for in depth study.

Questionnaire

1. Can you tell me something about you and the difficulties you are facing?
2. How often do you travel by train?
3. How much kg of luggage do you carry when travelling by train?
4. How do you find Indian train railway services?
5. Have you ever used buggy service at railway station? If yes, then how was the experience?
6. How often do you use this service?
7. In Indian scenario, all railway stations don't have this buggy service? So, do you suggest that there should be services to assist needed passenger?
8. Did you face any difficulties while using this service?
9. What will you suggest to improve the service?
10. Do you think there should be need to improve system?
11. What is your opinion about crowd at railway station?
12. What will you suggest to manage crowd in a better way?

User 1

Name: Lila

Age: 83 years

Profession: Housewife

Location: Chandrapur

She has 2 sons who live in different cities for their livelihood.

She is using train services since very long time to visit sons' places. Generally, she **carries one hand- bag and one suitcase** with her. With increasing age, she is finding it **difficult to carry and ascend stairs** with these much heavy luggage.

“If there was a buggy service at railway station to move around the platform then that would be really helpful.”



User 2

Name: Srushti

Age: 29 years

Profession: IT employee

Location: Mumbai

She has been working in IT industry since last 5 years and generally uses local service for going to office. But now she avoids to go by local since there is **no proper facilities** for pregnant woman and because of crowd. She suggested if there is some **potential solution** to manage crowd then users like us can take benefits of this facility.

Also, buggy gives comfort to travel but **maneuvering buggy through crowd is difficult**. She feels there should be separate passage for buggy and for emergency services.



User 3

Name: Rakesh

Age: 38 years

Profession: Consultant

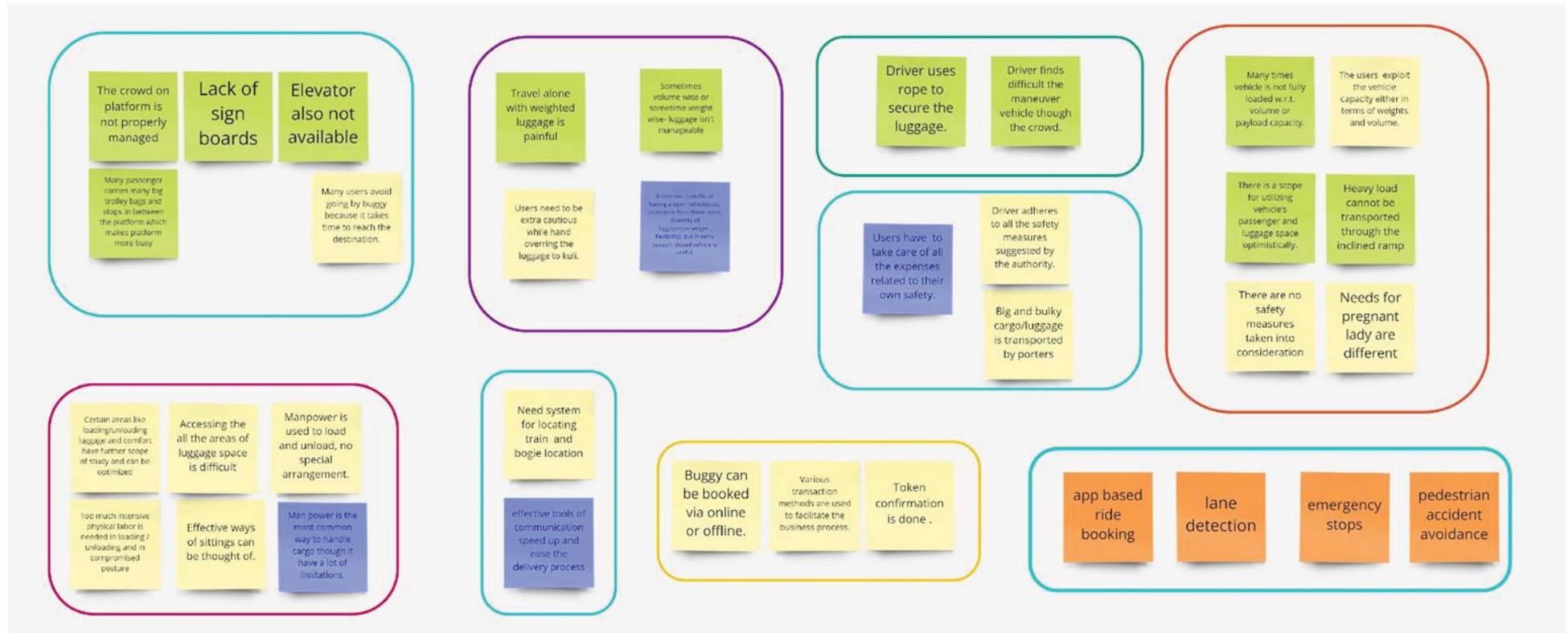
Location: Pune

Rakesh is a handicapped person who is a constant user of Indian railway. He finds his way too **difficult to move across the platform** because of the crowd. Though railway has special facilities for handicapped, but he is honestly disappointed with the platform service. Sometimes he has to wait a lot so that he can **move his wheelchair without any trouble**. Also, crowd is a pain point for him.

He **can't find buggy** service at each railway station. Even if he does, then there are problems in **getting into these vehicles**.



Key Insights



Problems Identified

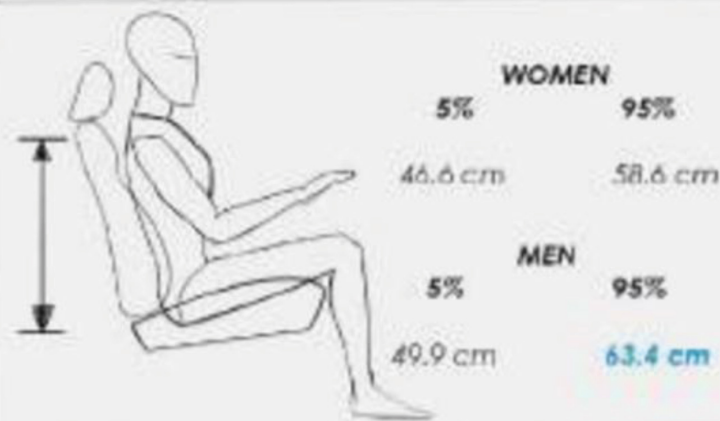
- These focused users' energy level doesn't match the energy level of the rest crowd, so they need an assistant vehicle
- Vehicle must have small turning radius because of lack of spaces
- Reaching to the destination through crowd is very hectic
- The vehicle has to travel within the platform
- Current passenger vehicle is not capable of carrying passenger with their luggage
- Pregnant women aren't finding vehicle ergonomically comfortable
- Safety issue
- For disabled people- ingress and egress problems

ERGONOMICS STUDY

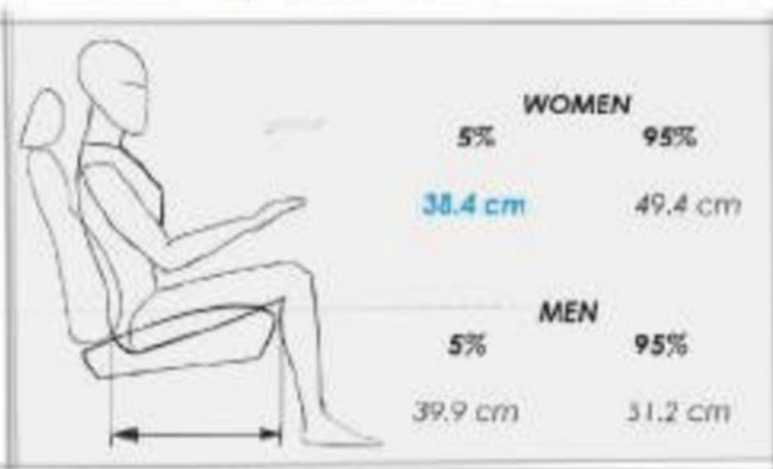
According to Indian Anthropometric data



Shoulder Height



ergonomics



Buttock - Popliteal Length

Elbow Rest Height





Bi-Deltoid Breadth

WOMEN

5% 95%

31.9 cm 44.9 cm

MEN

5% 95%

37.9 cm 48.2 cm



Hip Breadth

WOMEN

5% 95%

25.9 cm 42.9 cm

MEN

5% 95%

27.2 cm 40.5 cm



Elbow-to-Elbow (Closed) Length

WOMEN

5% 95%

32.5 cm 43.5 cm

MEN

5% 95%

37.5 cm 48.9 cm



Bufftock to Knee Length

WOMEN

5% 95%

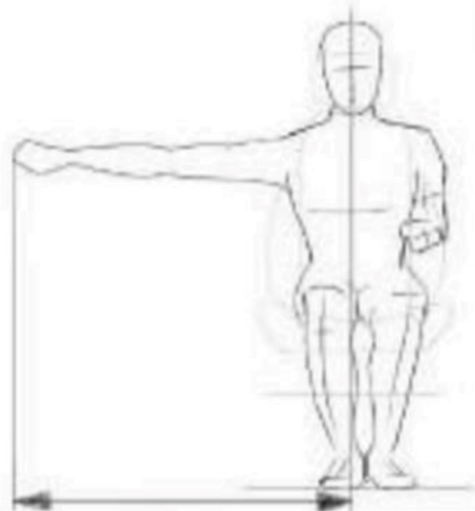
45.9 cm 58.5 cm

MEN

5% 95%

48.9 cm 61.5 cm

Indian Anthropometric Data



Side Arm Reach Length

WOMEN

5% 95%
45.9 cm 58.5 cm

MEN

5% 95%
48.9 cm 61.5 cm



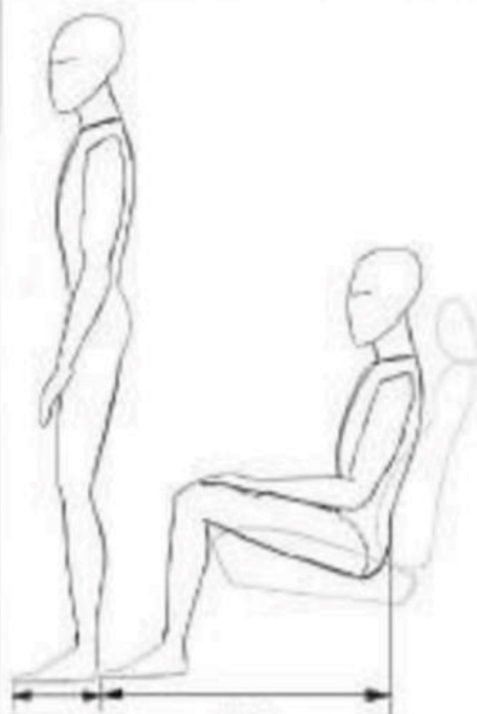
Thumb Tip Reach Length

WOMEN

5% 95%
45.9 cm 58.5 cm

MEN

5% 95%
48.9 cm 61.5 cm



27.1 cm 77.9 cm

Buttock to leg length
normal sitting

+
Standing person in front



27.1 cm 76.9 cm

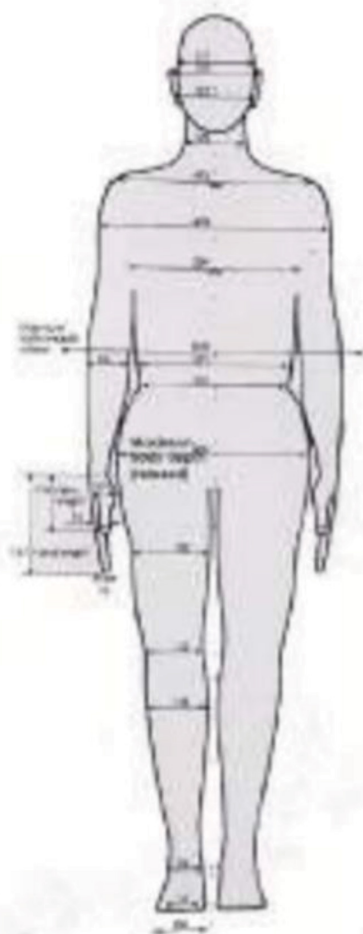
Buttock to leg length while
raised on toe

+
Standing person in front

95 percentile Human Body Dimension
of Indian population male-female combined

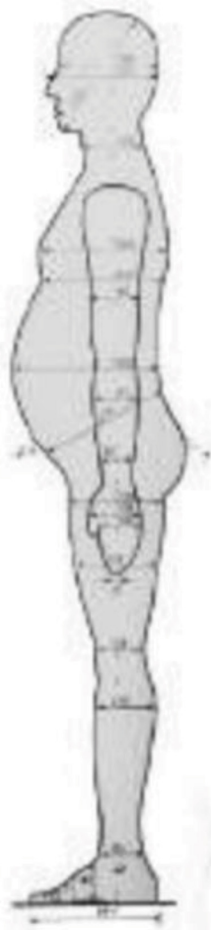


Buttock to popliteal length
+
Standing person in front
(minimum legroom case)



Body Weight 74kg

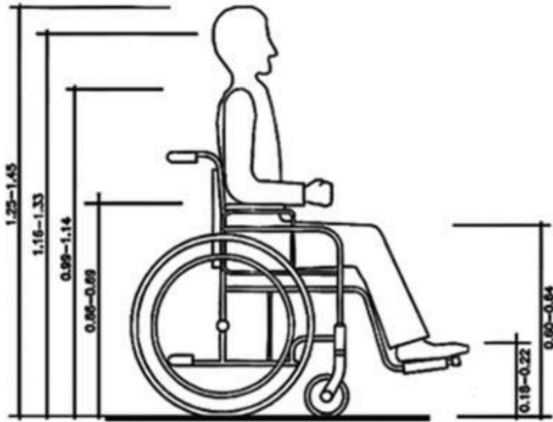
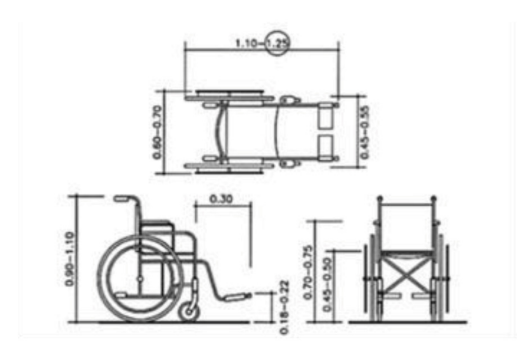
- Height
- 1771 - Stature
 - 1420 - Eye
 - 1415 - Neck
 - 1420 - Throat
 - 1436 - Cervical
 - 1471 - Mid Shoulder
 - 1458 - Acromion
 - 1444 - Nipple Height
 - 1448 - Tip of tongue
 - 1176 - Sub Glacium
 - 1122 - Upper Lumbar
 - 1115 - Elbow
 - 1107 - Abdominal extension
 - 1047 - Waist
 - 1029 - Lower Lumbar
 - 999 - Top Shoulder
 - 911 - Buttock Extension
 - 892 - Tip of Ankle
 - 820 - Crotch
 - 807 - Gluteal Fatness
 - 779 - Anus
 - 676 - Calciphen
 - 614 - Mid-calf
 - 533 - Popliteal
 - 50 - Medial malleolus
 - 70 - Lateral malleolus
 - 44 - Heel



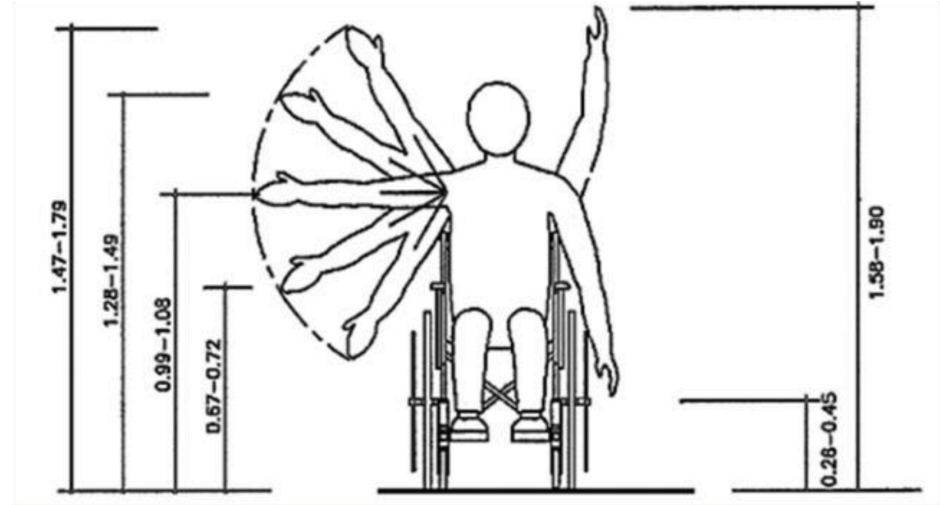
Legroom Analysis

- Most comfy Scenario - **105 cm**
- Comfy Scenario - **104 cm**
- Minimum Scenario - **74.1 cm**

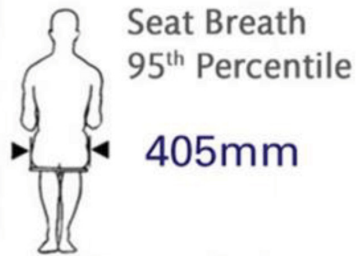
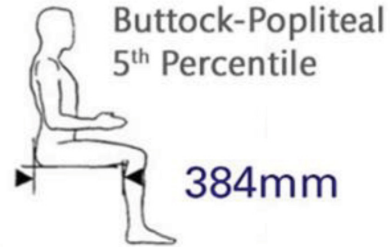
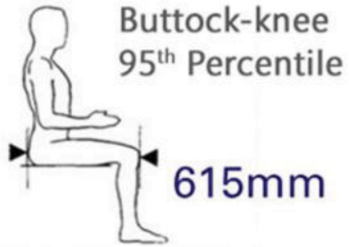
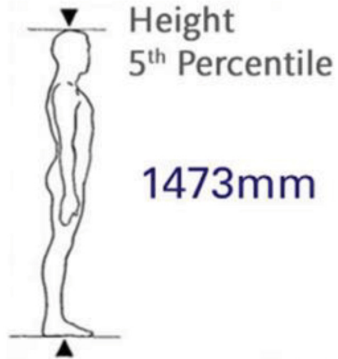
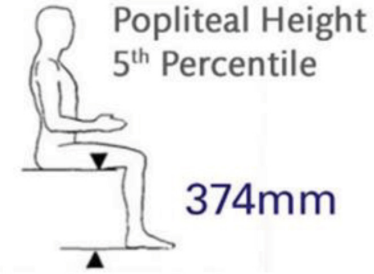
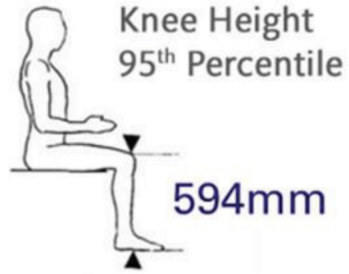
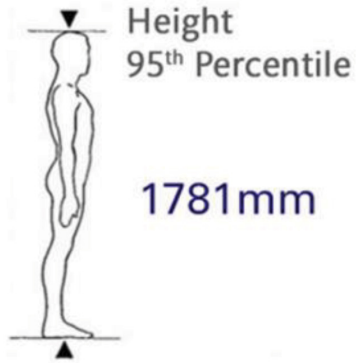
Dimensional data of a wheelchair user



Horizontal forward reach of a wheelchair user



Vertical reaching zones of a wheelchair user



Indian Anthropometric Data

Ergonomic study for pregnant woman

Sitting Posture

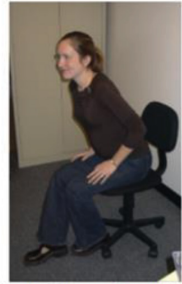
Sitting Posture

Suggestions:

- Choose a firm, chair with arm rests
- Lower back support
- Foot stool

****Having a lower back support and a foot stool help to give the lower back its natural curve****

- If you must sit for a long time, stand and move about the office or home every 30-40 minutes.



Wrong Position – when coming up to stand from a chair

Standing From a Chair

- Use your arms to push off the arm rests of a chair to help you stand.



Right Position

Standing Posture

- Weight evenly spread on both feet
- Bottom tucked under
- Chin down
- Shoulders back
- Ribcage flat
- Flat back
- Knees bent



Sitting in car

Work surface heights

- 2-4 inches below elbow for easy tasks
- 4-8 inches below elbow for hard tasks

*****DO NOT stand** for long periods of time; if you must, **remember to...**

- Put one foot on a stool in front of you, flexing the hip and knee (this decreases the weight on the lower back)
- Change positions often

Getting Into a Car

- Stand so the back of your legs are touching the car.



- Sit down on the car seat.



- Next, swing your feet into the car, one at a time.



Sitting in the Car

- Once in the car make sure the seat belt is fastened under the stomach and across the hips.
- Slightly recline the seat (100°- 110°)



Computer Use

Your **Monitor** should be...

- Placed in front of you (not to the right or left)
- Positioned with the top of the monitor being 2-3 inches above your eyes
- Arm's length away
- Glare free (use an anti-glare filter or an LCD display)



The **Keyboard** should be...

- On a keyboard/mouse tray
- Close to you
- Centered (use the B key as a center point of reference)
- Tilted down for better wrist posture (wrists should be as flat and straight as possible)

The **Mouse** should be...

- At a distance where your upper arm is relaxed, not overstretched or too close
- Angle at elbow should be greater than 90° to avoid pinching of the nerves

The **Desk** should be...

- Stable
- 28-30 inches above the floor

The **Chair** should have...

- 100-110 degrees of recline for supporting your back
- Lumbar support
- Changeable height option so feet can be placed flat on the floor or on a footrest

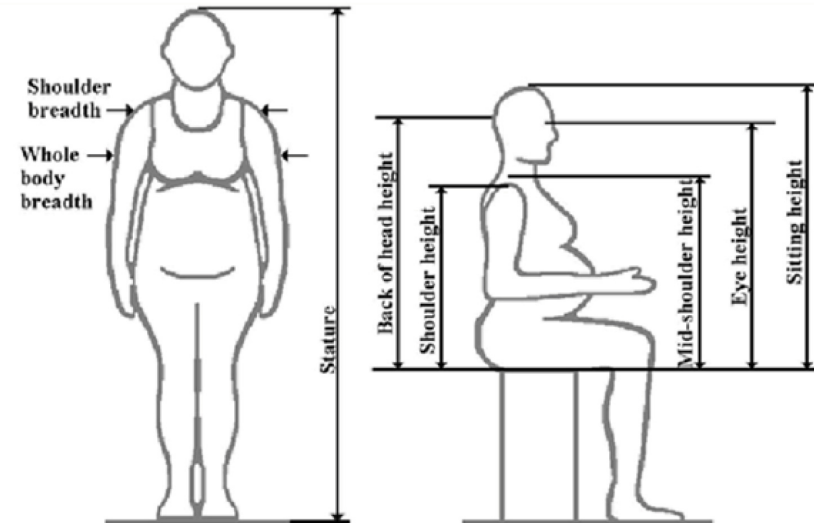
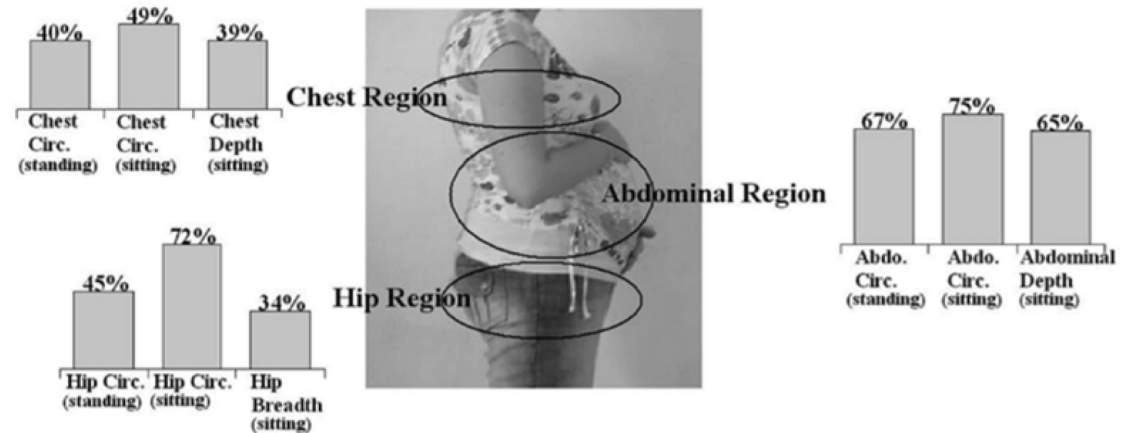
Body Position should be...

- Head and neck in alignment; as straight as possible.
- Elbows and upper arms at or greater than 90 degrees to stay away from elbow nerve compression

User perspective

In terms of vehicle dynamics in a collision accommodating the altered anthropometry of pregnant women could be critical. The increased weight during pregnancy may affect how the pregnant occupant moves during a collision. A benefit of accommodating pregnant woman's enlarged abdominal depth, combined with their lower limb dimensions, can be used to provide increased clearance between the front driver seat and the abdomen.

The key regions of physical change during pregnancy are the chest, abdominal, and hip regions. For these regions it is not adequate to assume that a large male, represented by the 95th percentile anthropometric data, would accommodate the anthropometric needs of a pregnant woman simply because the 95th percentile male has a greater stature. The size of the chest, abdomen and hips of a pregnant woman can be so enlarged during pregnancy that these measurements exceed the equivalent measurements of the large 95th percentile male by a considerable amount. Hence if a vehicle design is produced to accommodate the range up to the 95th percentile male, and does not consider the anthropometry of pregnant women, many women may be excluded from the design by their third trimester of pregnancy.



Passenger study

A sleeper class and a second-class passenger can carry luggage weighing 40 kg and 35 kg respectively without paying any extra money and a maximum of 80 kg and 70 kg respectively by paying for the excess luggage at the parcel office. The excess luggage would have to be put in the luggage van.

- ~10-20 kg of luggage is carried by passenger
- Many luggage bags don't have wheels
- Carrying the luggage through various spaces at railway station is painful



Luggage

- The national transporters will also ensure that luggage size adhere to the prescribed measurements of **100cm x 60cm x 25cm** (length, breadth, height).



Class	Free allowance	Marginal allowance	Maximum quantity permitted (including free allowance)
AC First Class	70 Kgs	15 Kgs	150 Kgs
AC 2-Tier sleeper/First class	50 Kgs	10 Kgs	100 Kgs
AC 3-tier sleeper/AC chair car	40 Kgs	10 Kgs	40 Kgs
Sleeper class	40 Kgs	10 Kgs	80 Kgs
Second class	35 Kgs	10 Kgs	70 Kgs

Platform research

- As per railway rules, the height of a platform should be between 760mm and 840mm from the top of the tracks and the maximum gap between the platform and the floor of the train should be between 342mm and 437mm.
- The gap varies from
460mm and 470mm
380mm and 390mm
- Proposed gap - 300mm to 310mm

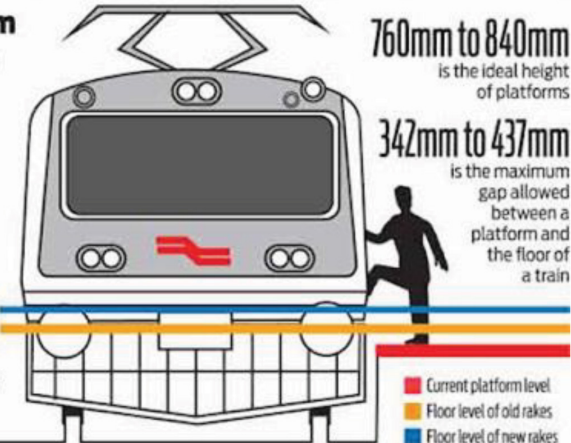


Traditionally speaking...

1,180-1,200mm is how high the floor of the old locals is from the top of the tracks. What stops the gap from becoming alarming, in this case, is the conventional air springs that the old rakes have, which compress, when a train is crowded, thereby bringing down the floor of the train and reducing the gap

How the problem has worsened...

The new Siemens and Bombardier rakes brought to the city are at a height of 1,220mm and 1,230mm, respectively, from the top of the tracks. It makes the gap 460-470mm at a 760-mm high platform and 380-390mm at a 840-mm high platform, both considered dangerous in this city. Also, new trains have modern air-suspension system, in which air springs don't compress, thereby maintaining the gap at the dangerous level



Brief

- Design an assistive mobility device for comfortable travel and convenient mode of transport at railway station to move 1 passenger across the platforms without any constraints. Design a system for the vehicle so it can easily maneuver through the busy platforms.
 - It should have minimal footprint
 - Carrying capacity 200 kgs
 - Its ergonomic design, flexible seating arrangement and roomy interior will make it the perfect transporter.
 - Can climb gradients up to 20%
 - Adaptable for people as well as luggage transportation
 - Collapsible 'fold-over' seats for flexible carrying
 - Design will be adapted according the surrounding
 - An advanced system to transport the passenger's luggage from vehicle to train
 - It will have small turning radius
 - Cost effective transit

Design considerations

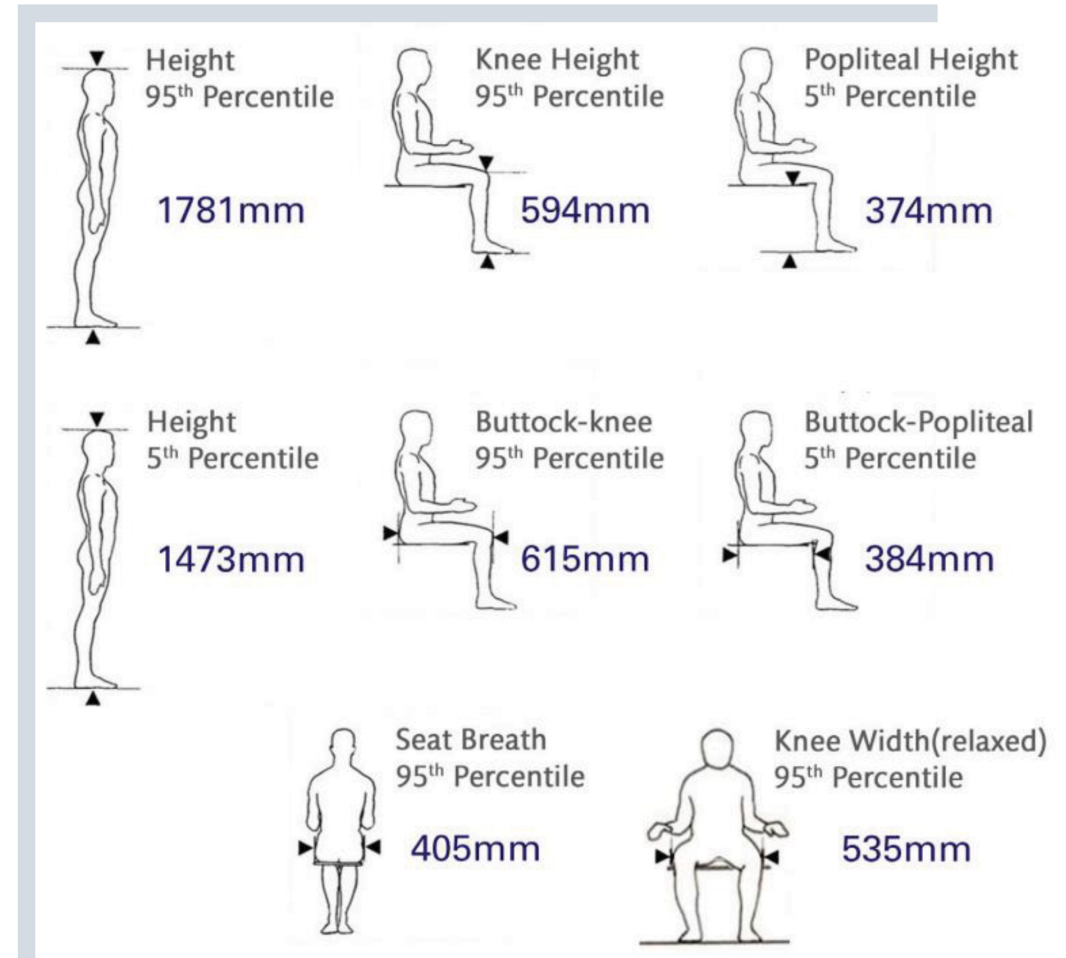
- Four-wheeled e-wheelchair offers full-size comfort and are ideal for indoor maneuverability.
- E-wheelchair in this category offer a wide array of features including low turning radius, swivel seats, arms rest, storage baskets and more.
- A three wheel and a wider wheelbase at rear create the stable platform within the mobility scooter category. Three-wheel mobility scooters are designed for maximum stability and built specifically for comfortable use.

Ergonomics of user

- Popliteal height from ground, buttock-popliteal length were taken from 5th percentile female
- Other measurements were taken from the 95th percentile male.

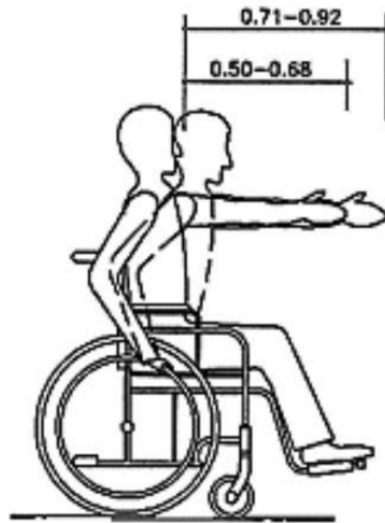
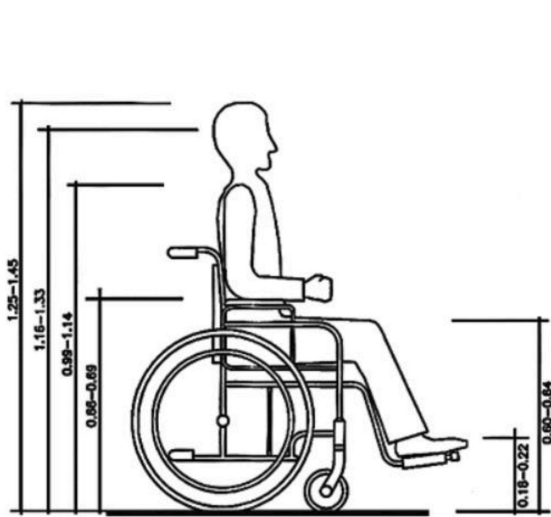
Taking knee height and buttock-knee length from **95th percentile** male ensures that the handle position will be such that it won't obstruct when used by any tall person.

Using popliteal height and buttock-popliteal length of a 5th percentile female insured that it won't be uncomfortable for any short lady to use the device. The most comfortable way to sit while riding is the upright position where backbone is close to perpendicular to the seat.

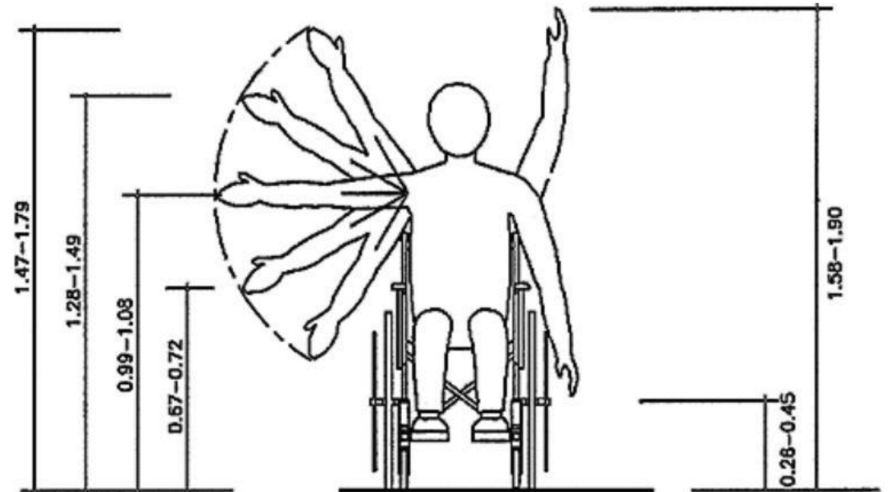


Indian Anthropometric Data

Dimensional data of a wheelchair user



Horizontal forward reach of a wheelchair user



Vertical reaching zones of a wheelchair user

GEM E2

Polaris | Passenger

- **Small Carbon Footprint:** With GEM, a **big payload leaves a small footprint.** GEM vehicles have zero emissions and are completely sustainable.
- **Spacious and Comfortable:** Enjoy your ride with high back forward-facing adjustable seats, 43" of legroom and almost 6" of suspension travel.
- **Safety Features:** With 3-point seat belts, LED turn signals, backup camera, and an automotive glass windshield, GEM offers more safety features than golf carts.
- **Street Legal:** A low speed vehicle (LSV), GEM is legal to drive on roads posted up to 35 mph in most states and provinces.
- **Customizable:** GEM offers a variety of interior and exterior accessories that allow you to work smarter and travel more comfortably.
- **\$.03 per Mile ** Operating Cost:** Unlike full size cars and trucks, GEM utilizes low-cost electric energy with minimal maintenance needs.

Overall Vehicle Size (L x W x H)	103 x 55.5 x 73 in (262 x 141 x 186 cm)
Wheelbase	69 in (175 cm)
Turning Radius	150 in (381 cm)
Flat Bed Dimensions (L x W)	32.5 x 42.5 in (83 x 108 cm) with optional S-Bed



Length	196 cm
Width	75 cm
Height	144 cm
Seat Height	50 cm
Weight	70kg on the prototype, we are targeting a 10-20kg reduction in production unit.
Wheels	20 inch
Wheelbase	96 cm
Turning circle	approx. 4m
Motor	250W mid-drive electric.

DRAFT

This will be a pedal assist configuration only, to comply with the EN15194 European regulation. This means the motor will stop assisting upon reaching 25km/h speed, but the rider can continue to pedal faster if they wish.

The mid drive motor is efficient. It provides power at the crank and fully exploits the mechanical advantage of PodRide's gearing, and enhances the range on battery.

The laws in North America are different. When we have a 3 wheel PodRide model available for the US/Canadian markets we will likely use a 500W motor and have both pedal assist and throttle modes. A maximum motor assist speed of 32kmh/20mph is allowed in the US.

Gears Internal Hub (Continuously Variable Transmission (CVT)).

Provides a smooth, continuous progression from one speed to another, with no harsh gear engagements. It also allows the changing of gears (approx. 30% range) whilst stationary.

Brakes Disk brakes front and rear.

Battery Battery capacities are yet to be decided. PodRide will allow the use of one (or more) batteries. This allows you to choose the battery capacity to suit your range requirement and budget.

Range (on battery) Up to 60km. Range can be more or less, depending on the battery capacity option chosen

Speed 25km/h (with motor).

Lights LED headlamp, indicators and brake lights.



PodRide
cycle anywhere, in any weather



Specifications

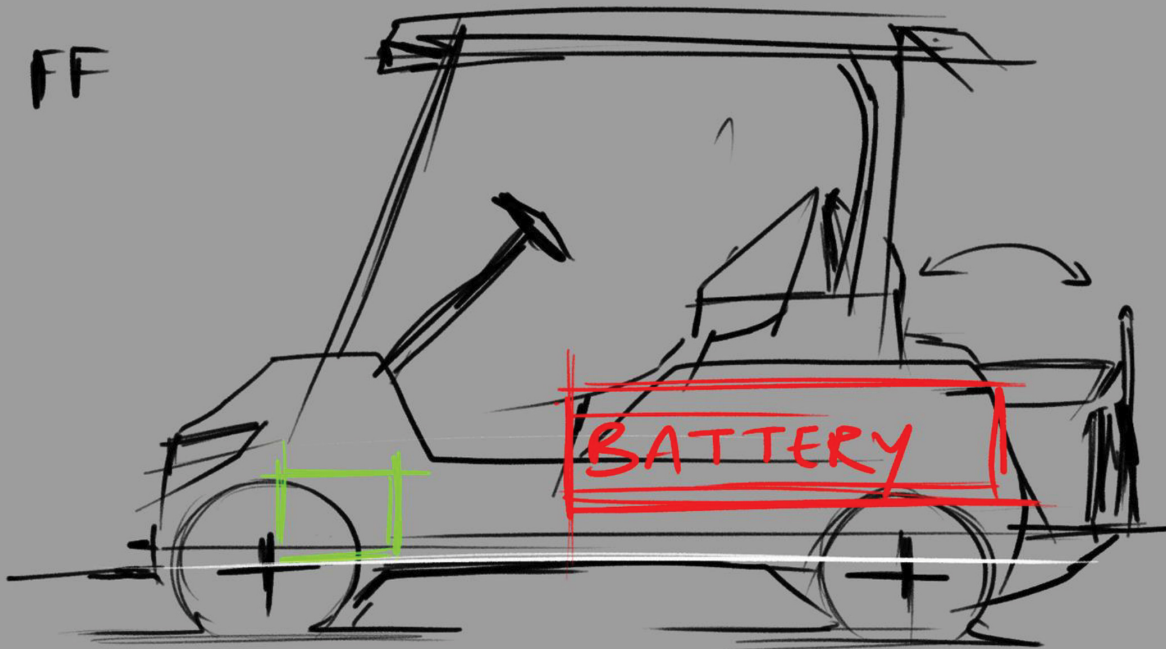
Battery Capacity	125 Ah, 24V
Battery Charging Time	Upto 8 Hours
Body Material	Stainless Steel
Corrosion Resistance	Yes
Is It Customized	Customized
Motor Power Rating	1000 W

- Overall Length – 106”
- Overall Width – 44”
 - Overall Height with Container – 45”
 - Garbage Container Size – 42.5” x 24.5”x 35”
 - Maximum Volume – 21 C.F.T



Current product packaging study

FF



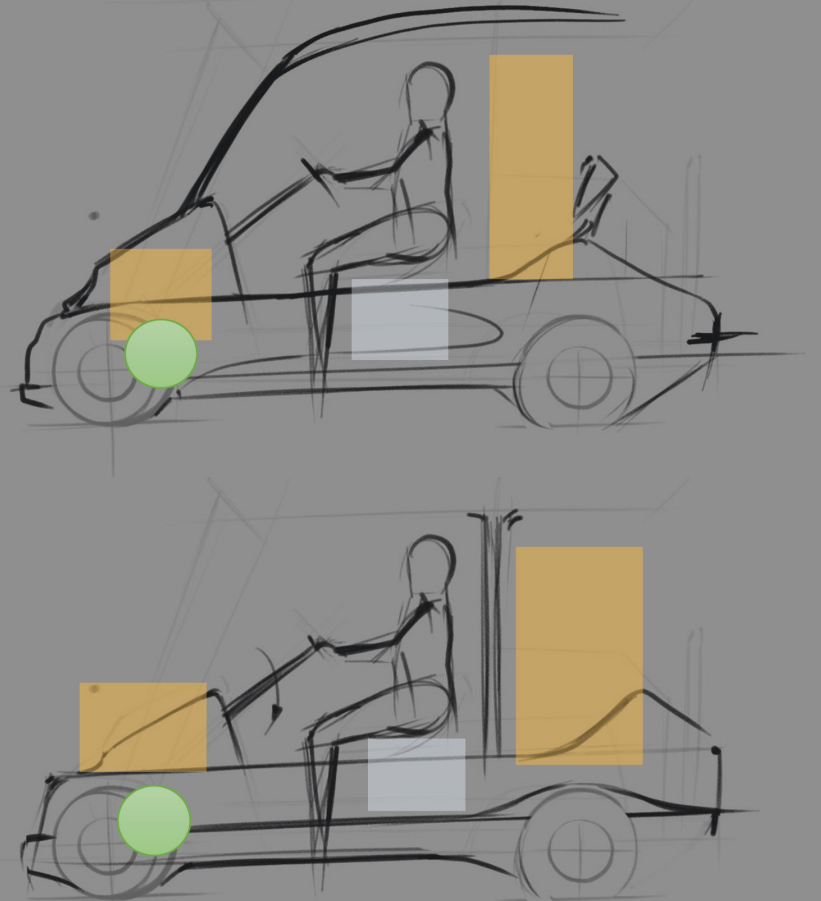
Cargo space



Battery



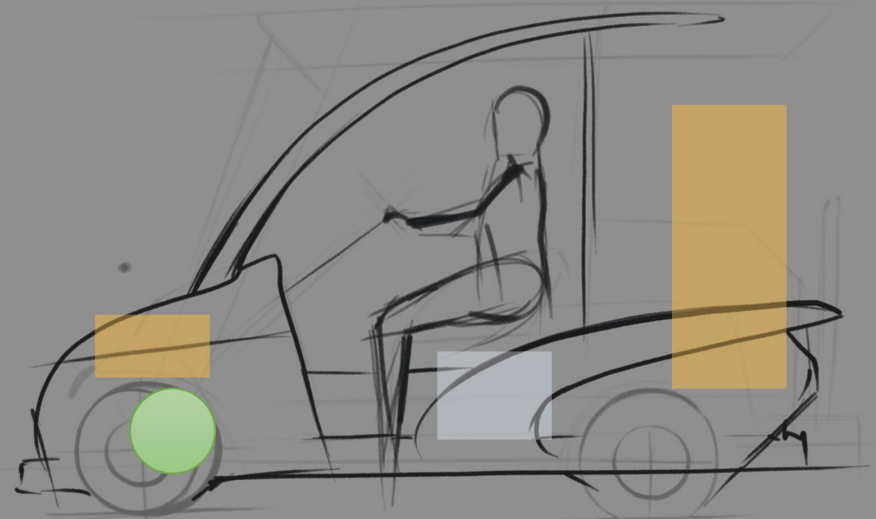
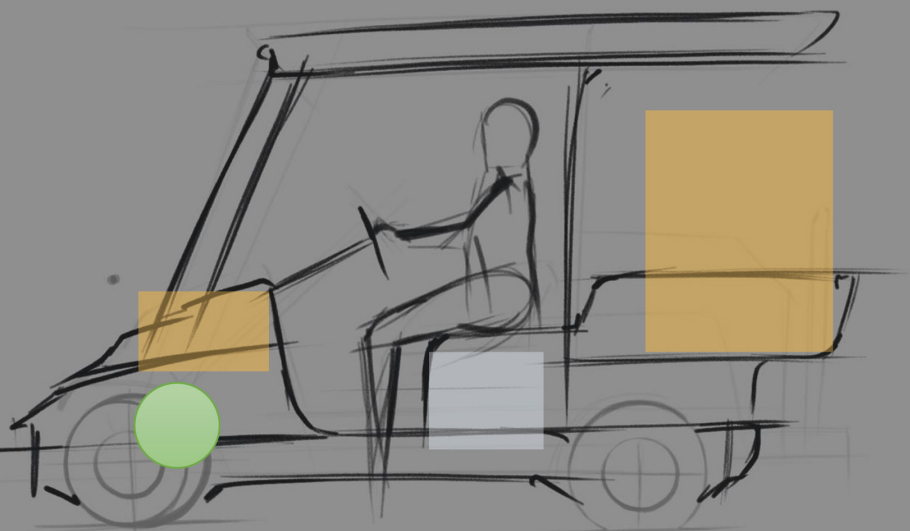
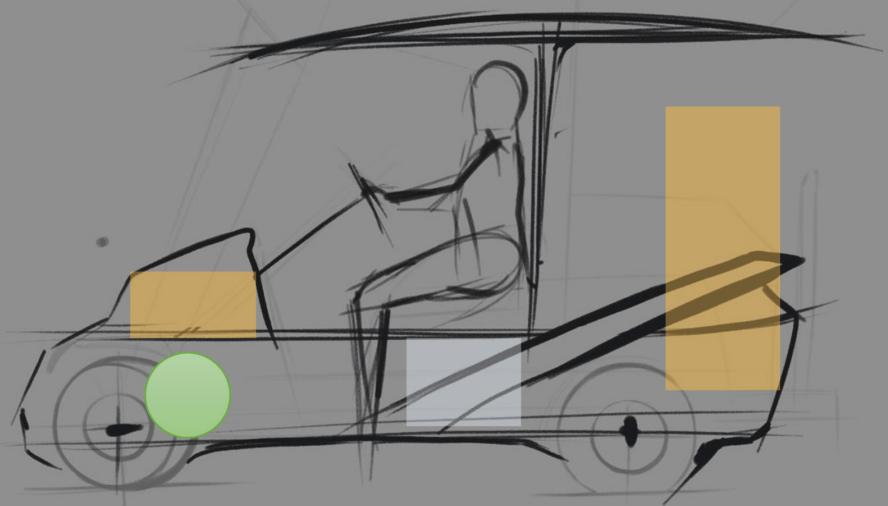
Motor

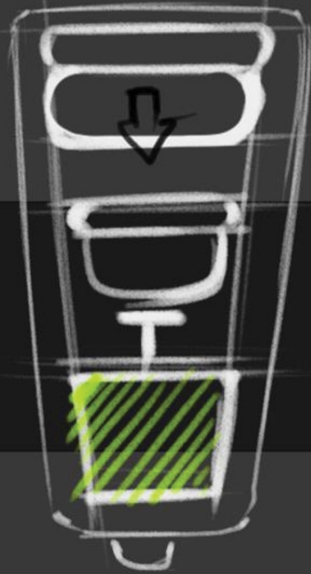


Cargo space

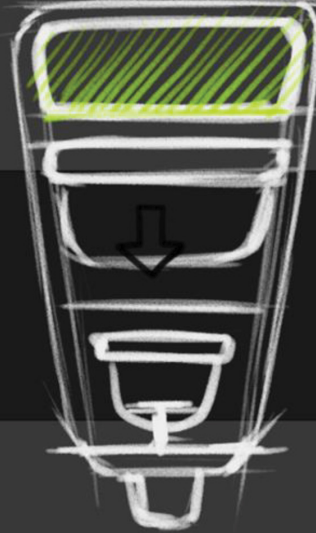
Battery

Motor

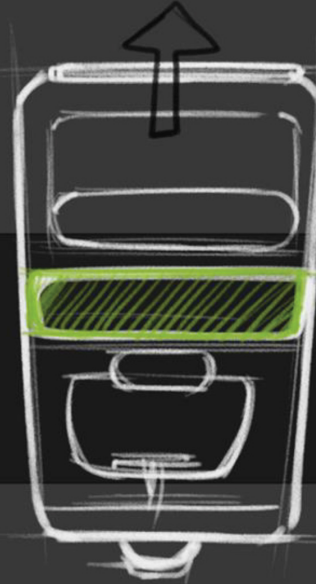




①



②



③

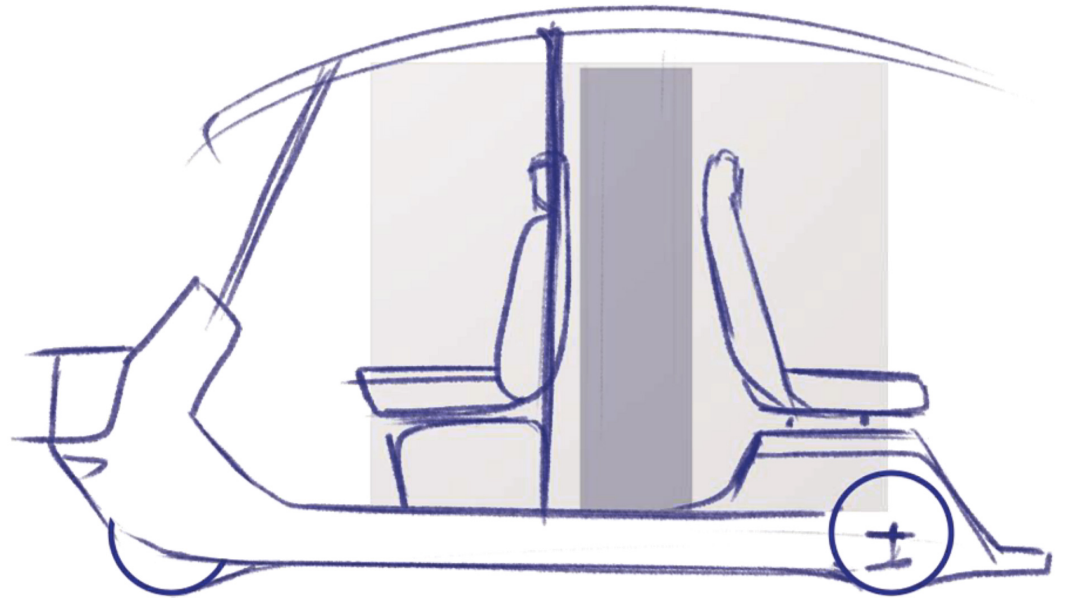
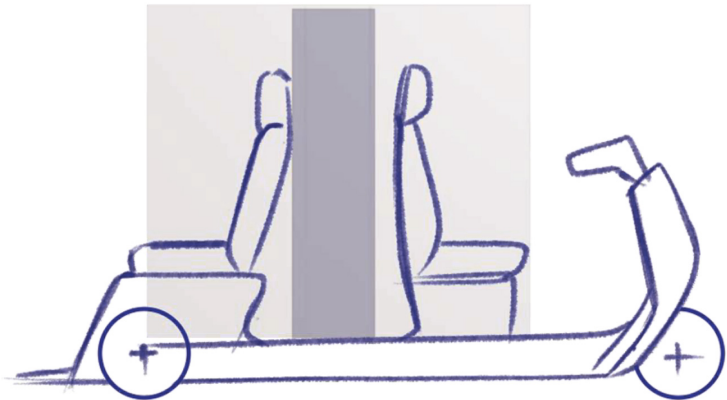
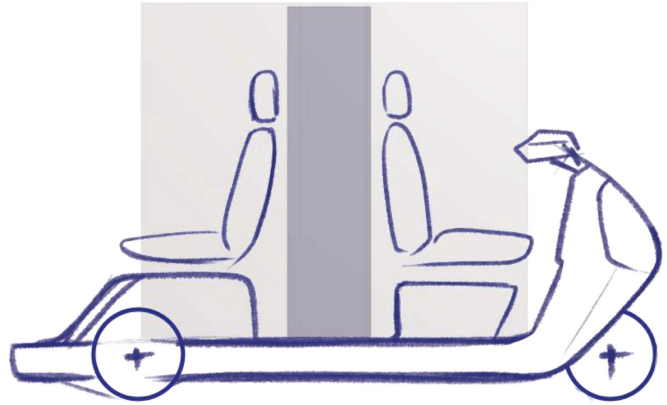
 Luggage

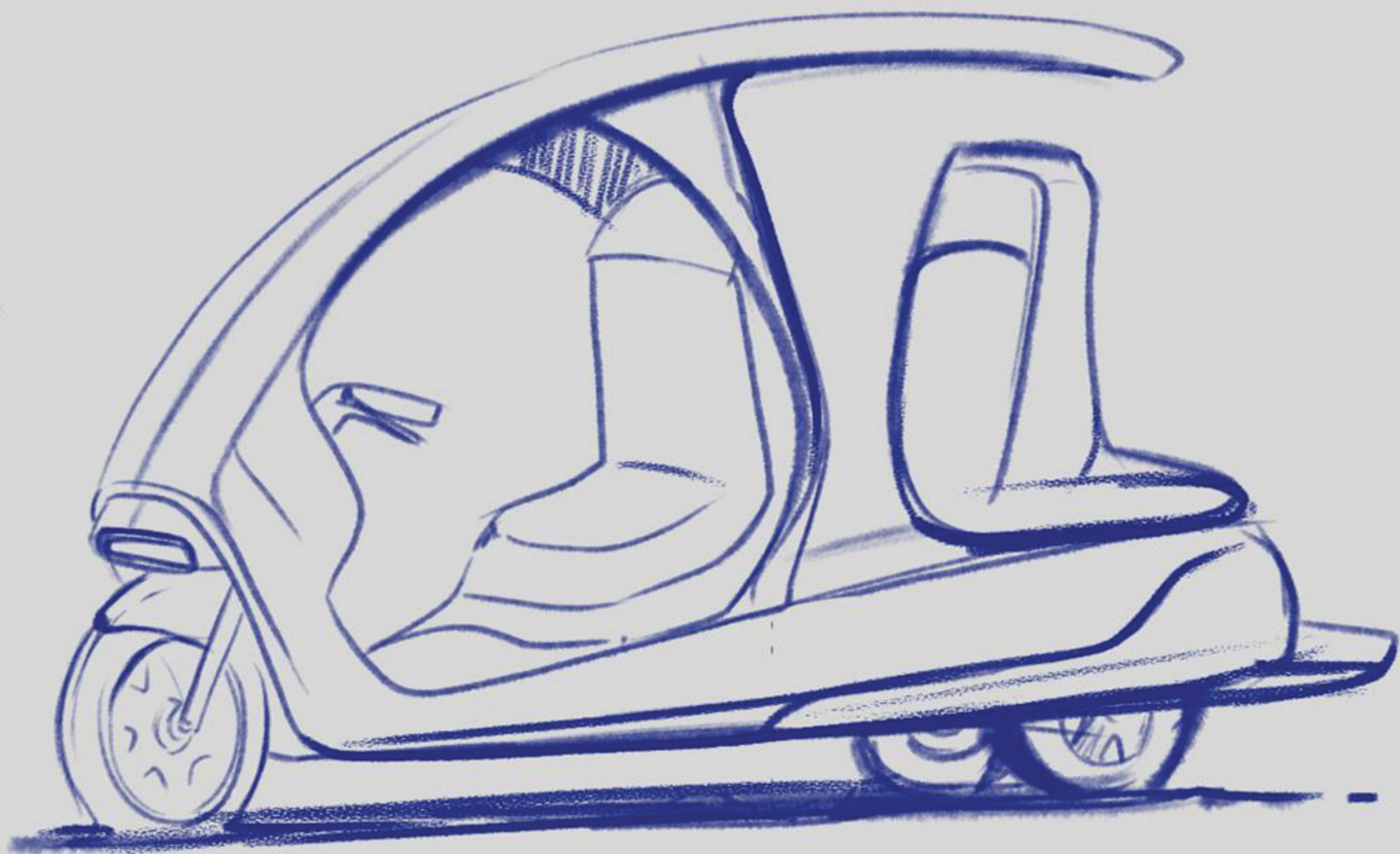
- Compact packaging design
- Chances of toppling
- Difficult ingress/egress

- Well compact
- Packaging well done
- Difficult ingress/egress

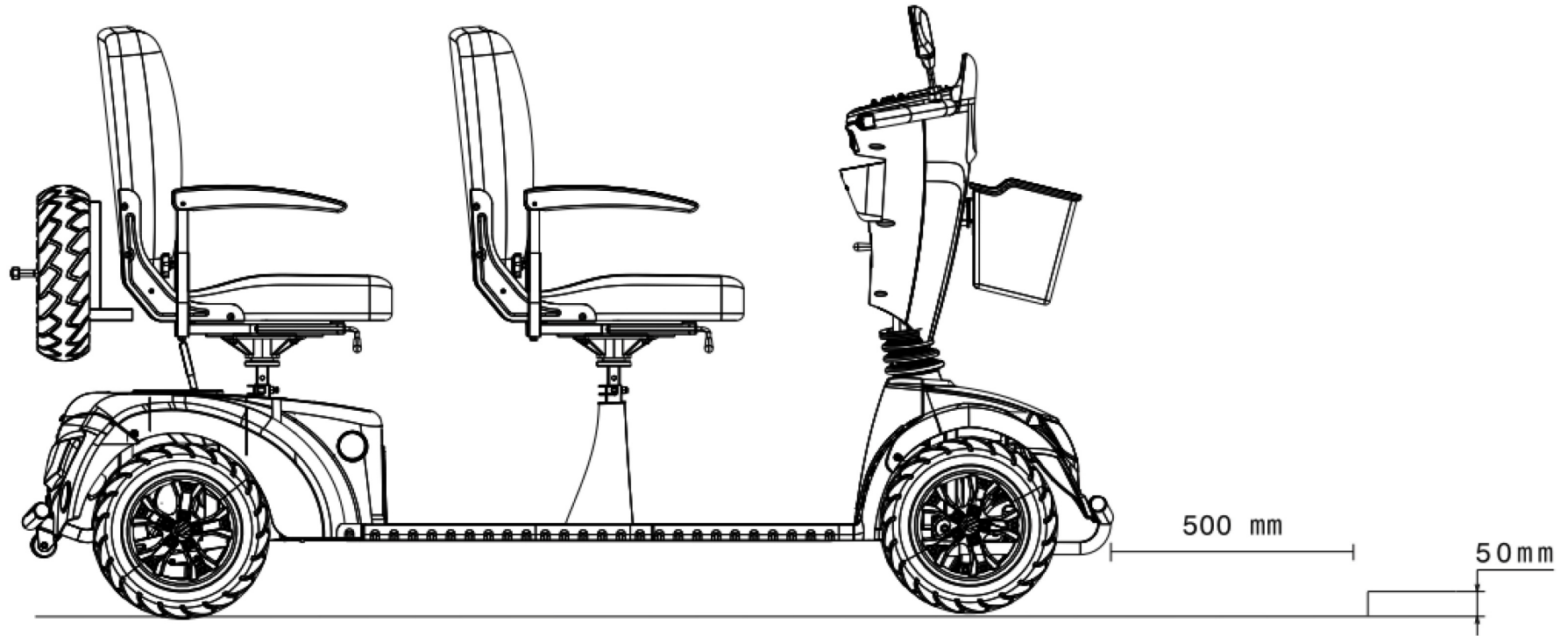
- Compact packaging
- Easy ingress/ egress
- Minimal footprint

Ideations





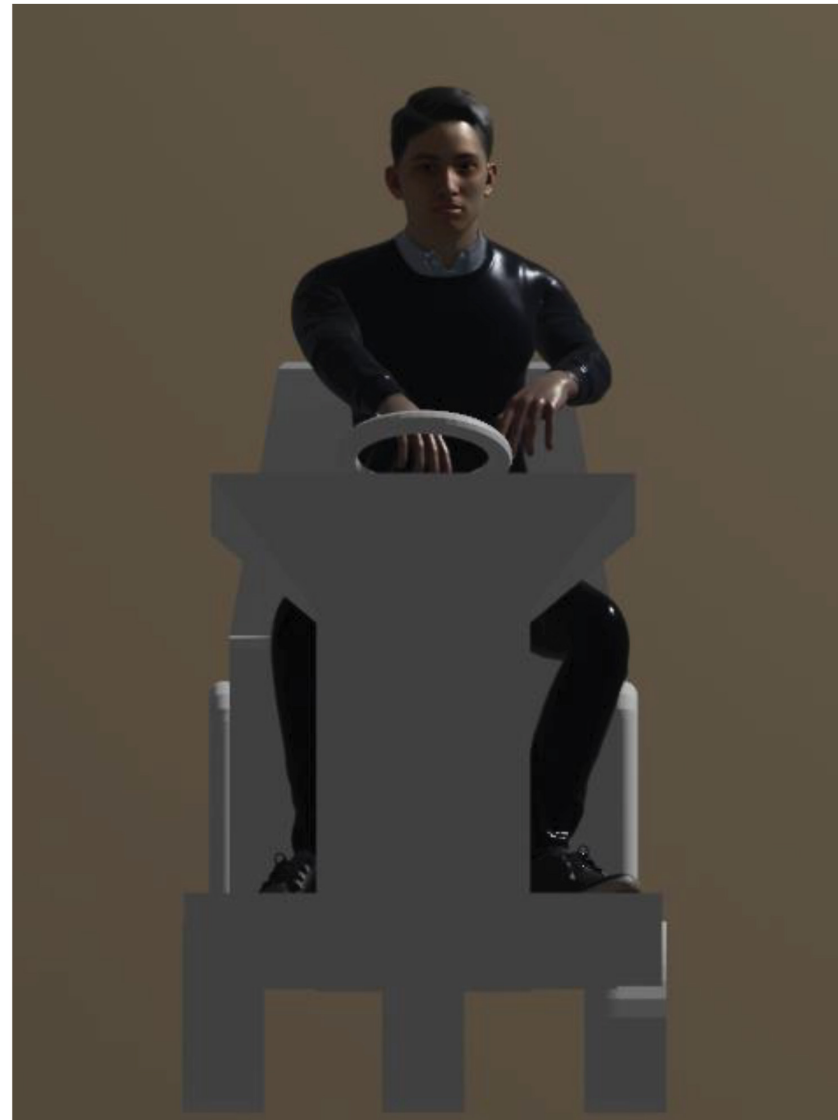
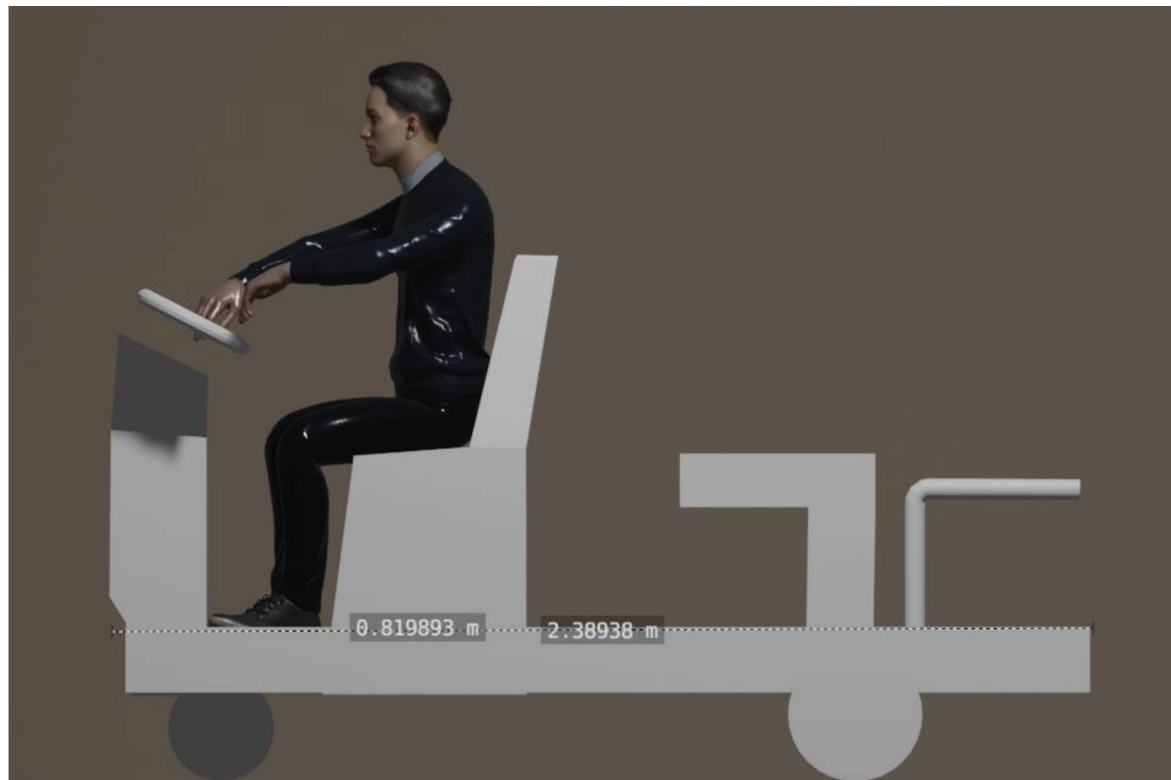
Benchmarking for Packaging 1

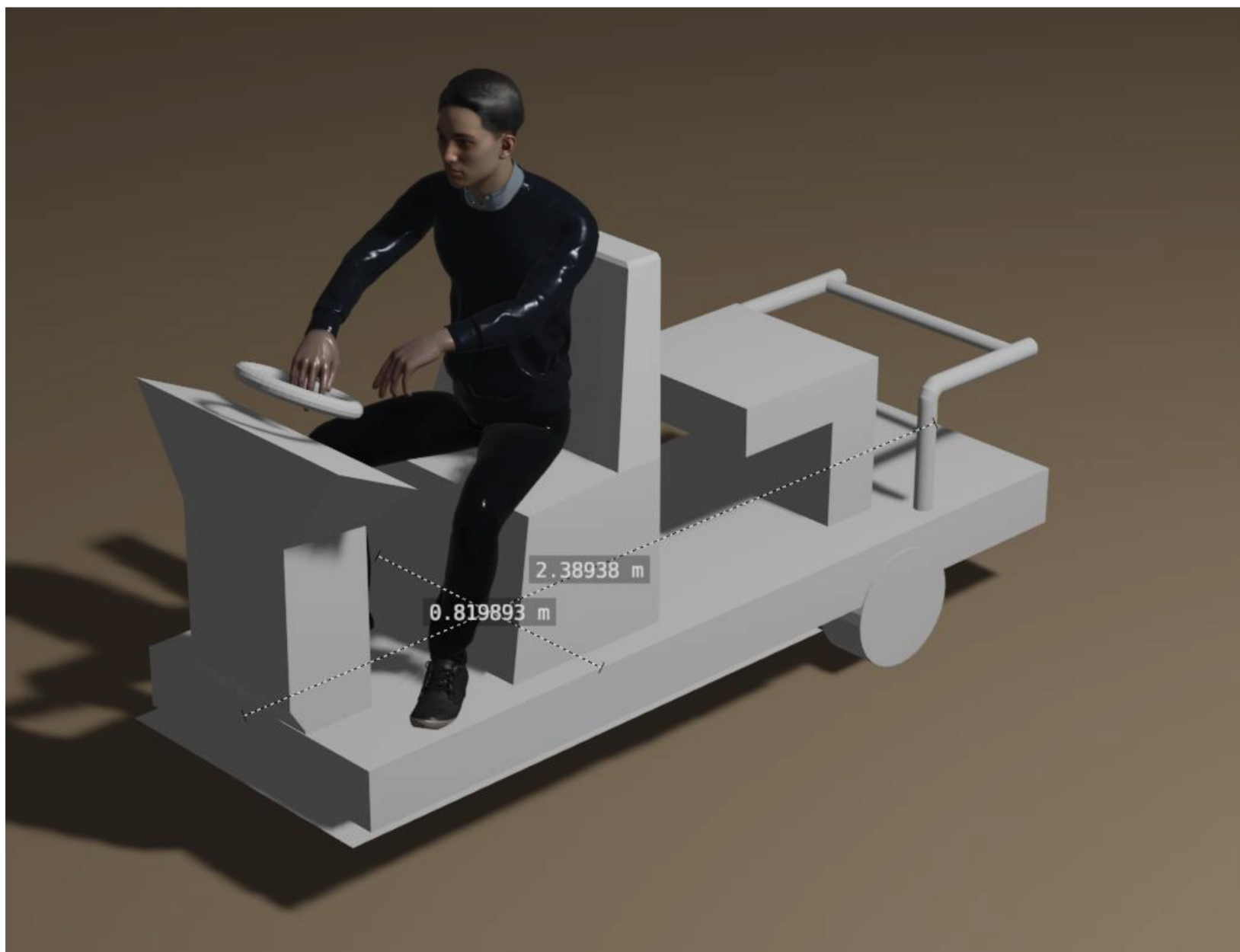


LxBxH
2250x700x1250

Max speed 13 km/h
Distance 41 km(90ah battery)

Packaging Direction 1

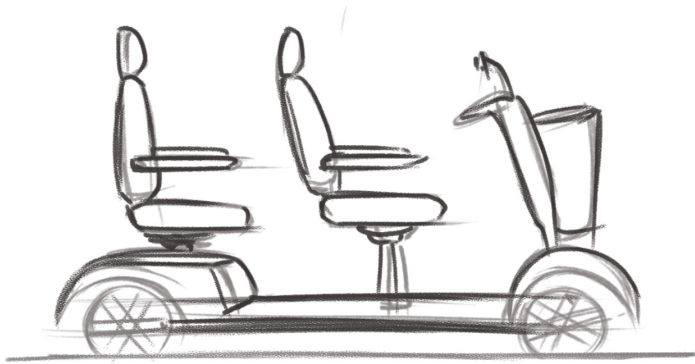




2.38938 m

0.819893 m

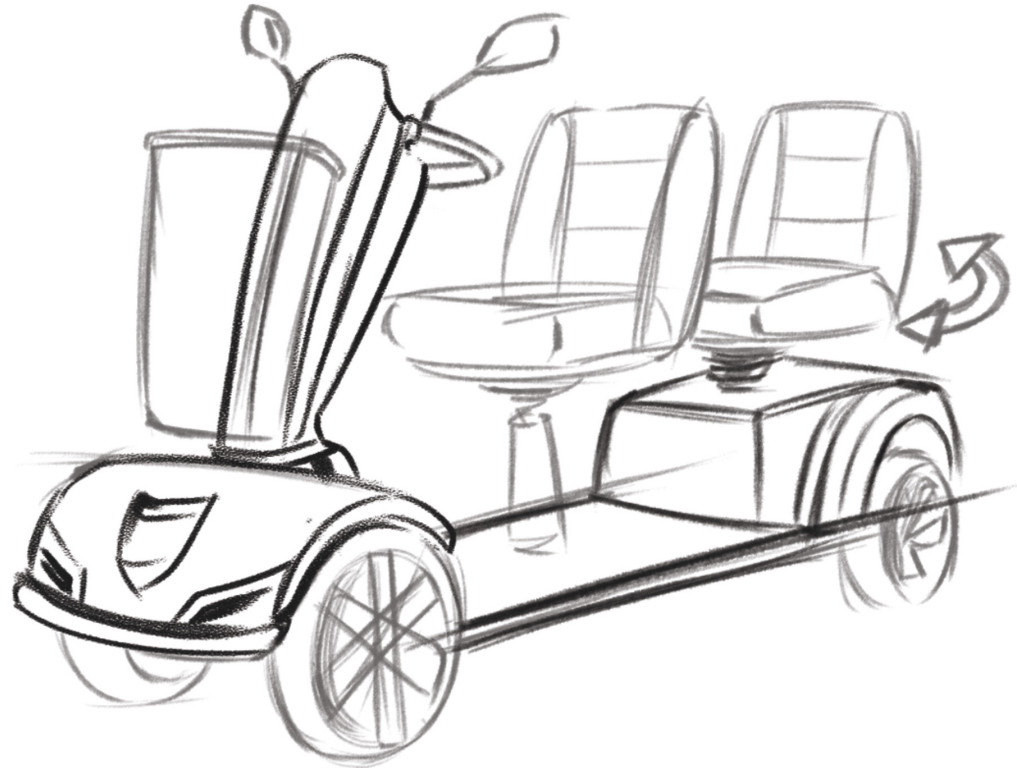
Ideation 1



This idea is like electric scooter which accommodate 1 passenger and 1 driver.

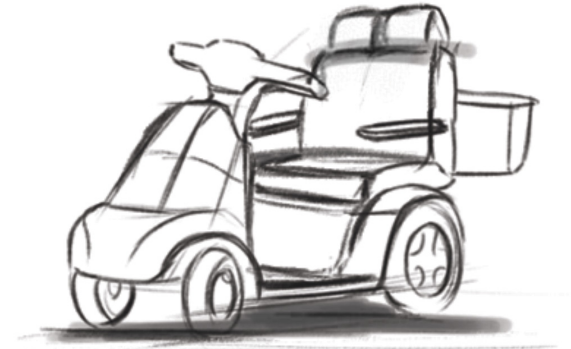
Pros:

- very less space for cargo
- passenger's less visibility area



Ideation 3

Side by side seating



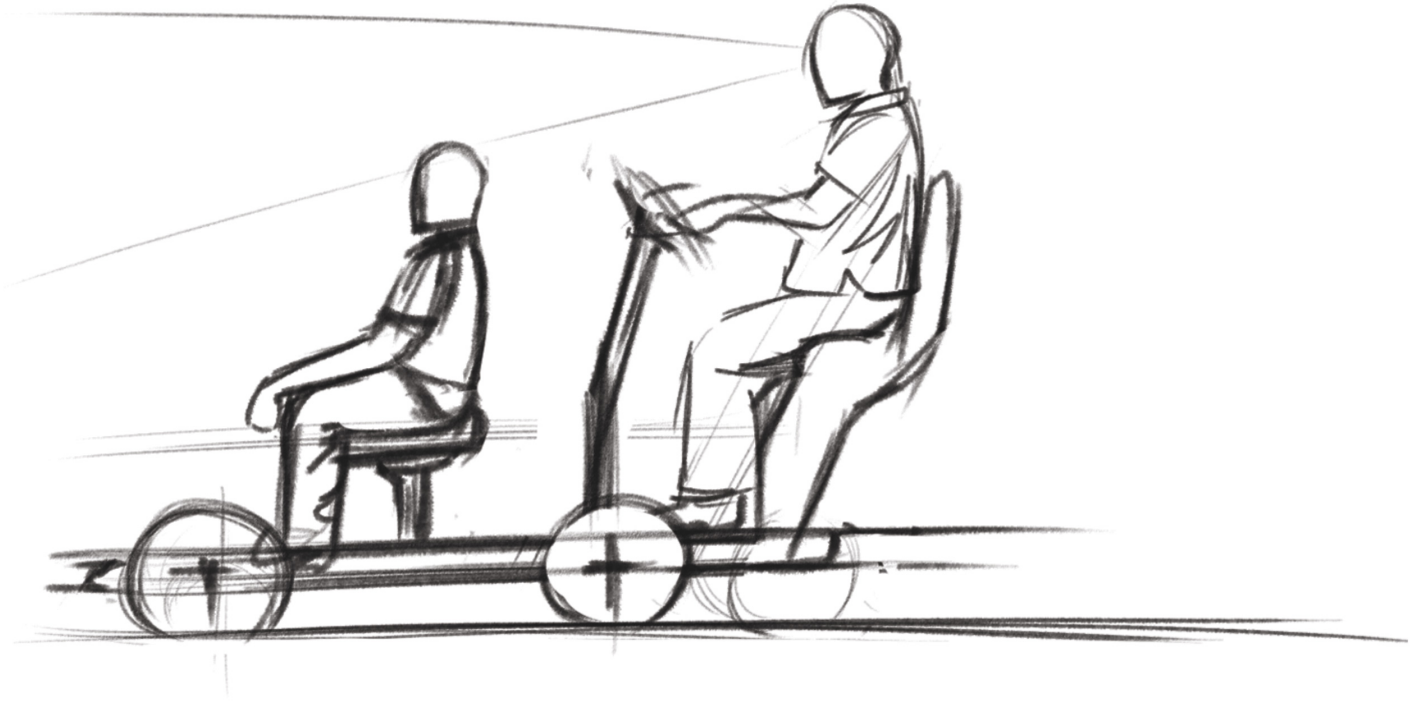
Very less space for cargo.
Also footprint is high.

Ideation 2

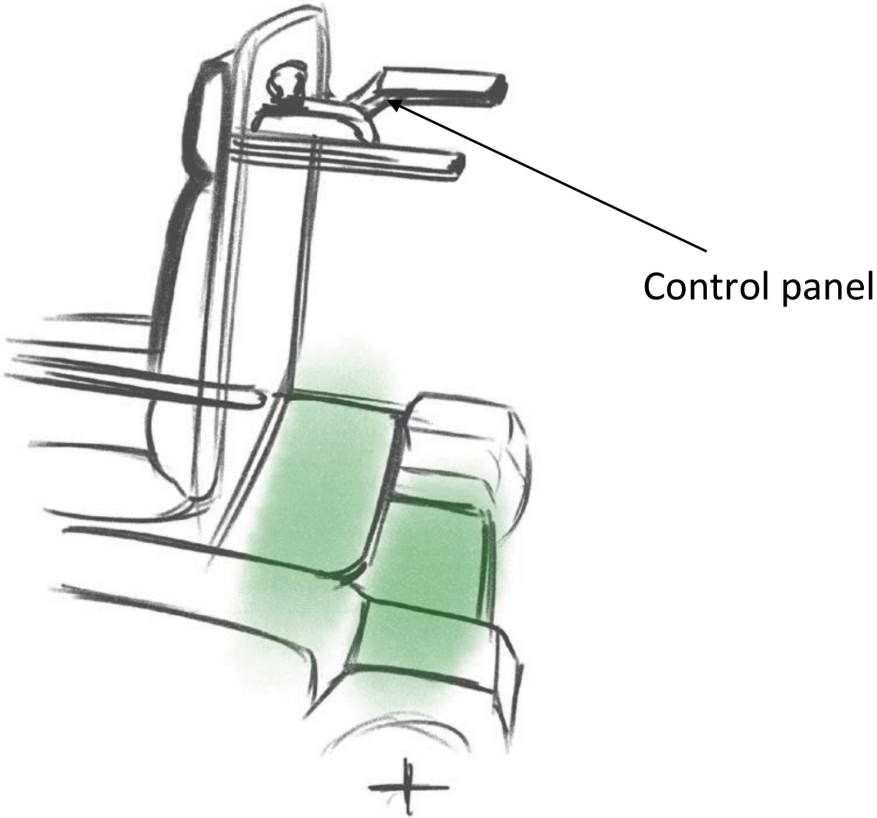
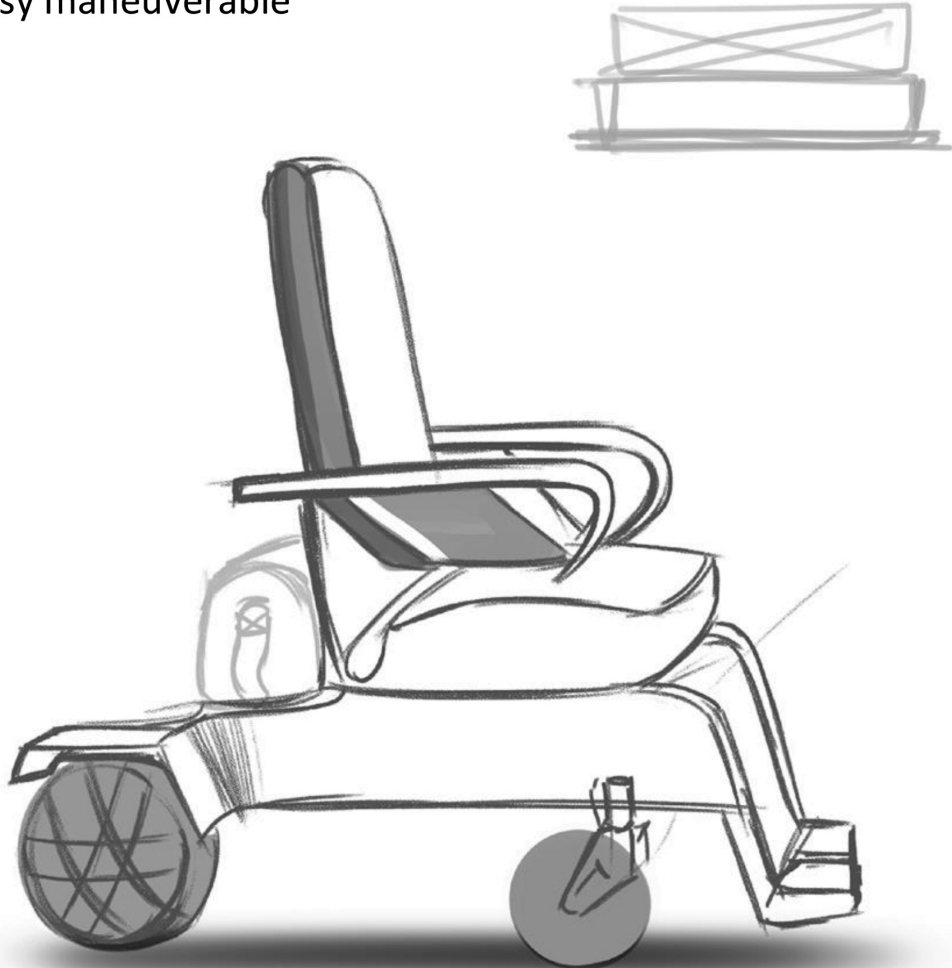
Driver seating position is after the passenger.

Pros:

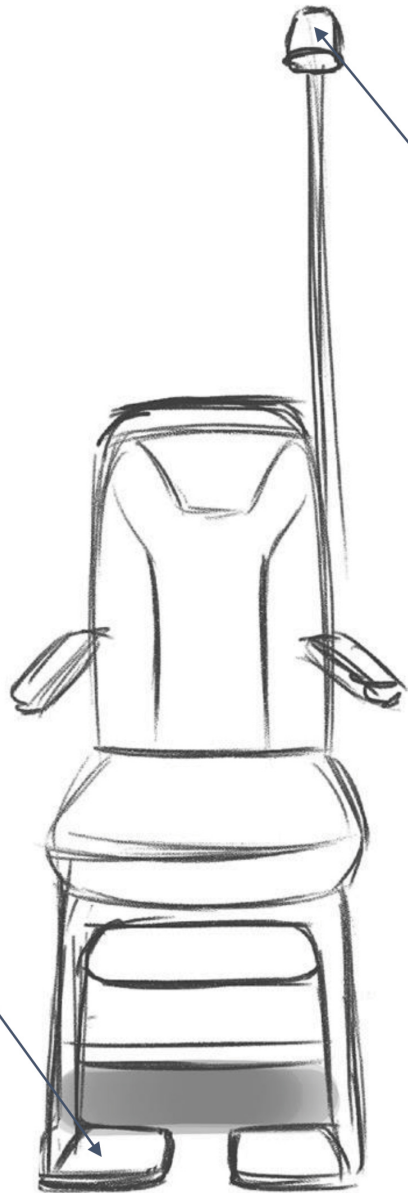
- Easy ingress/ egress for passenger
- No anxiety issues
- Good visibility for driver because of higher seat



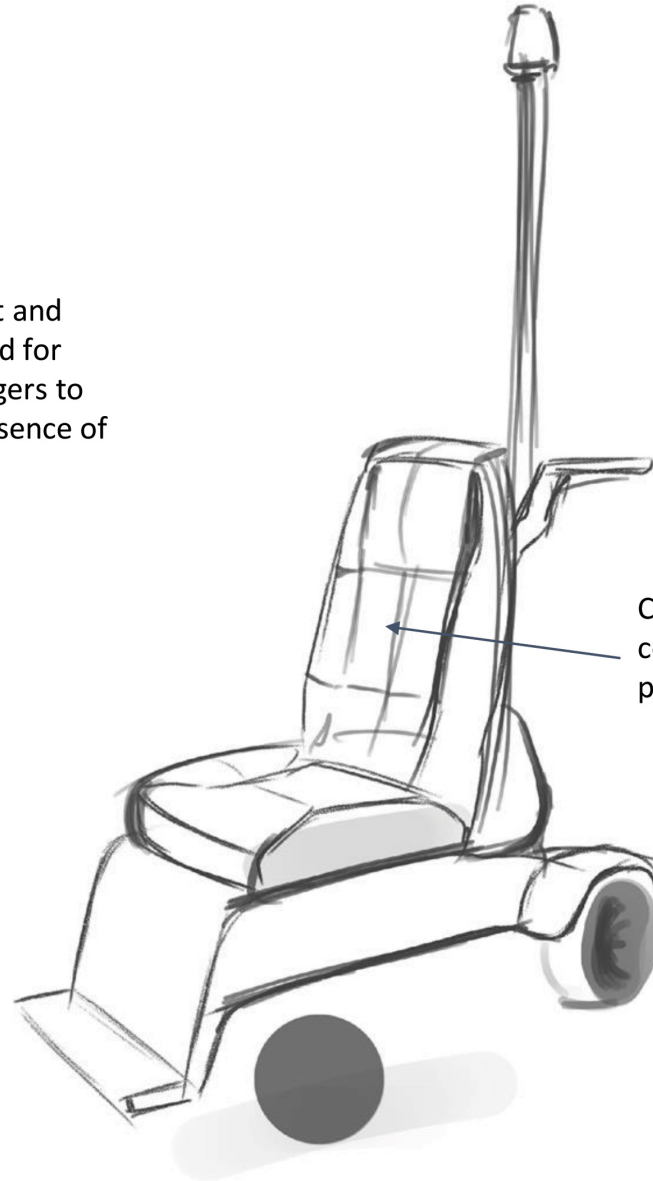
Small Compact and
Easy maneuverable



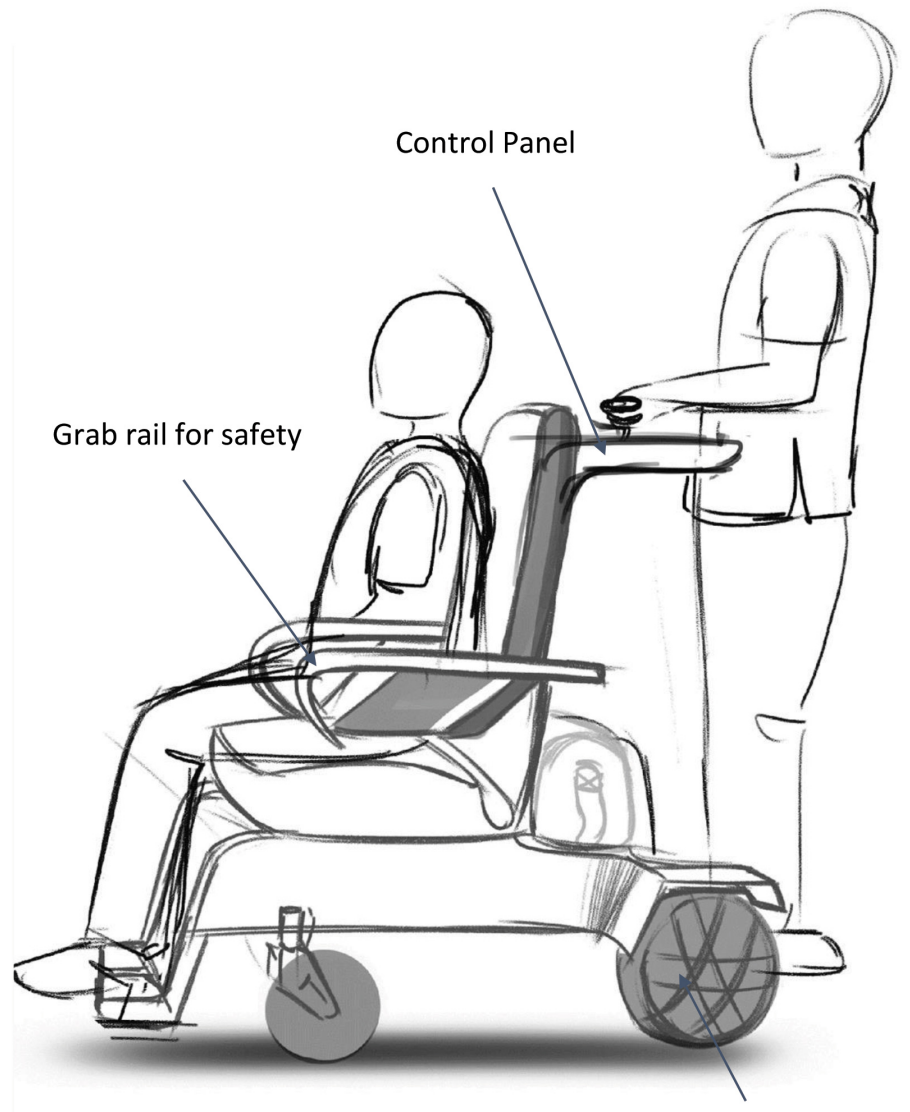
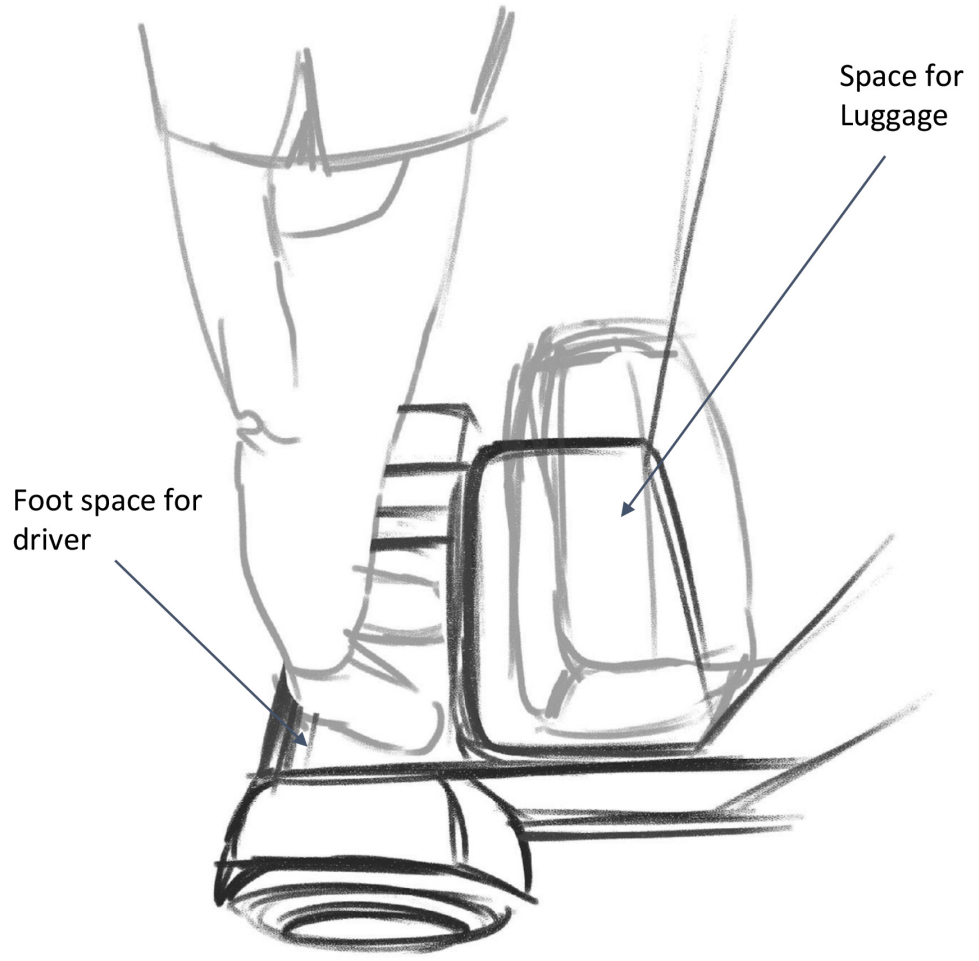
Footstep for the passenger



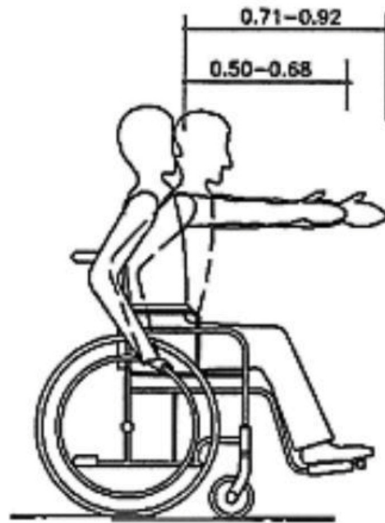
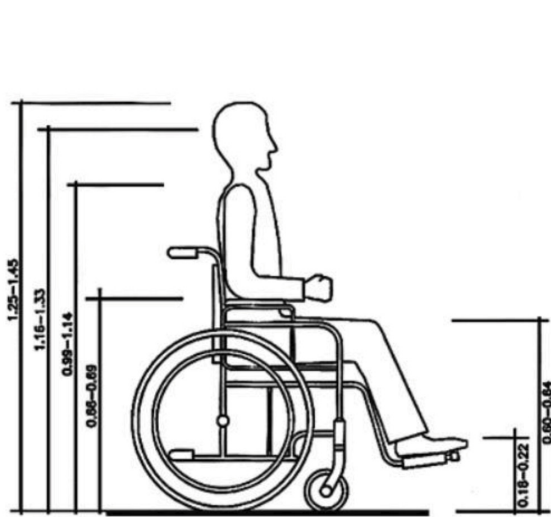
Indicator light and
beeping sound for
other passengers to
know the presence of
vehicle



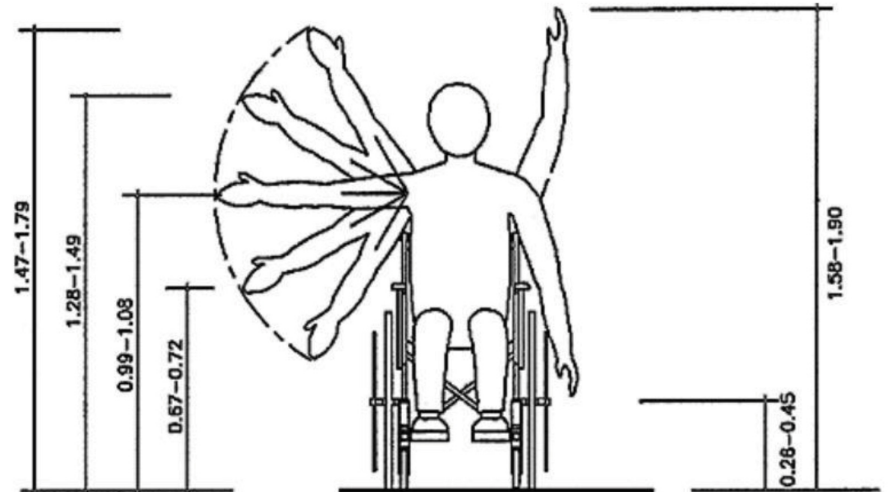
Cushion seat for
comfortness of
passenger



Dimensional data of a wheelchair user

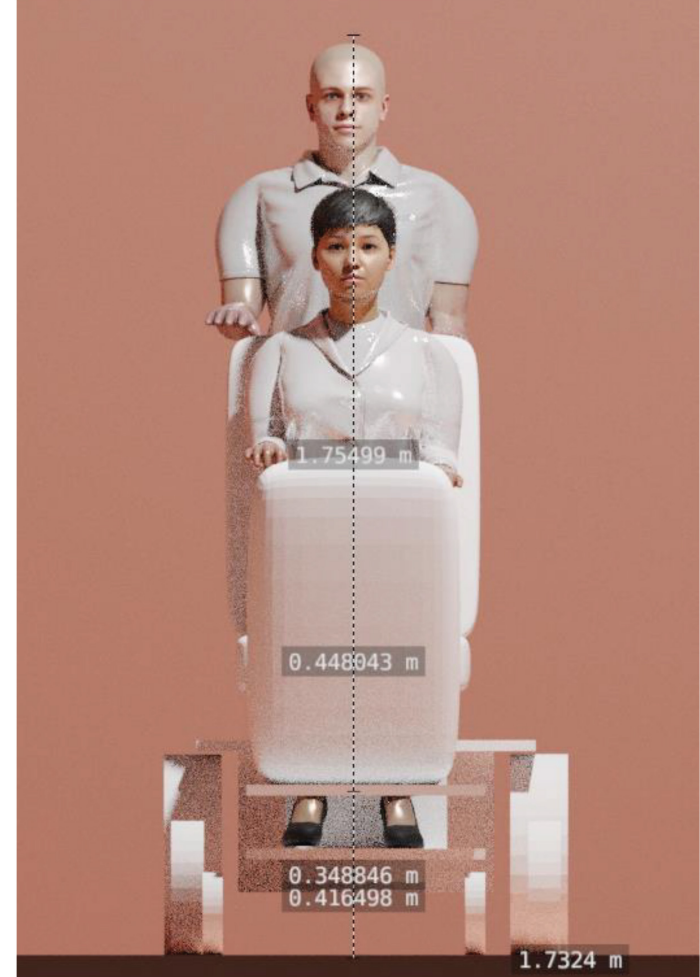
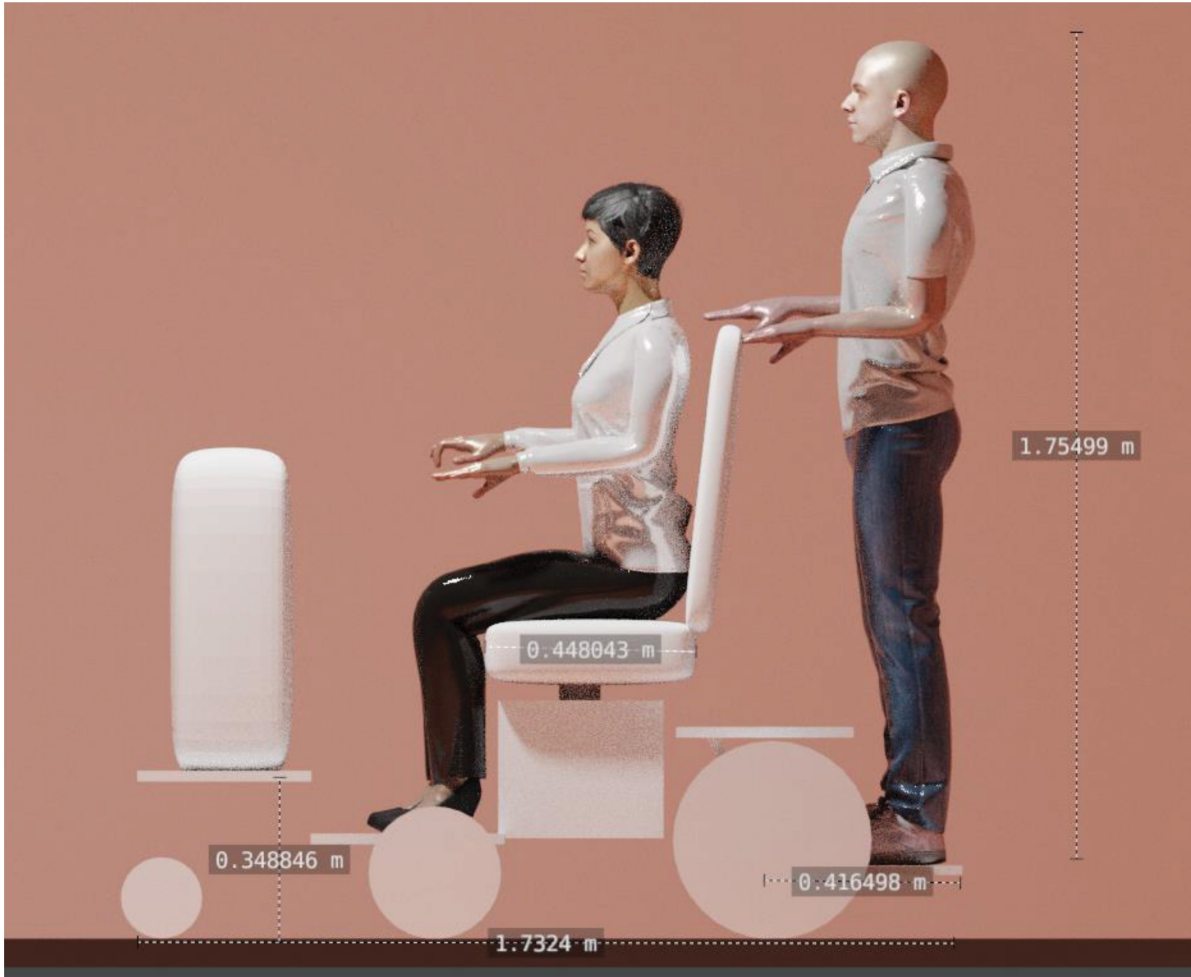


Horizontal forward reach of a wheelchair user



Vertical reaching zones of a wheelchair user

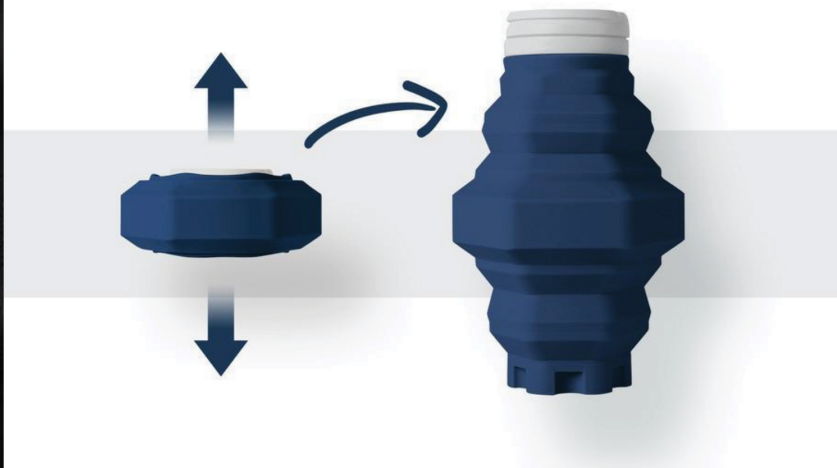
Packaging Study- Direction 2



Keywords



Safe

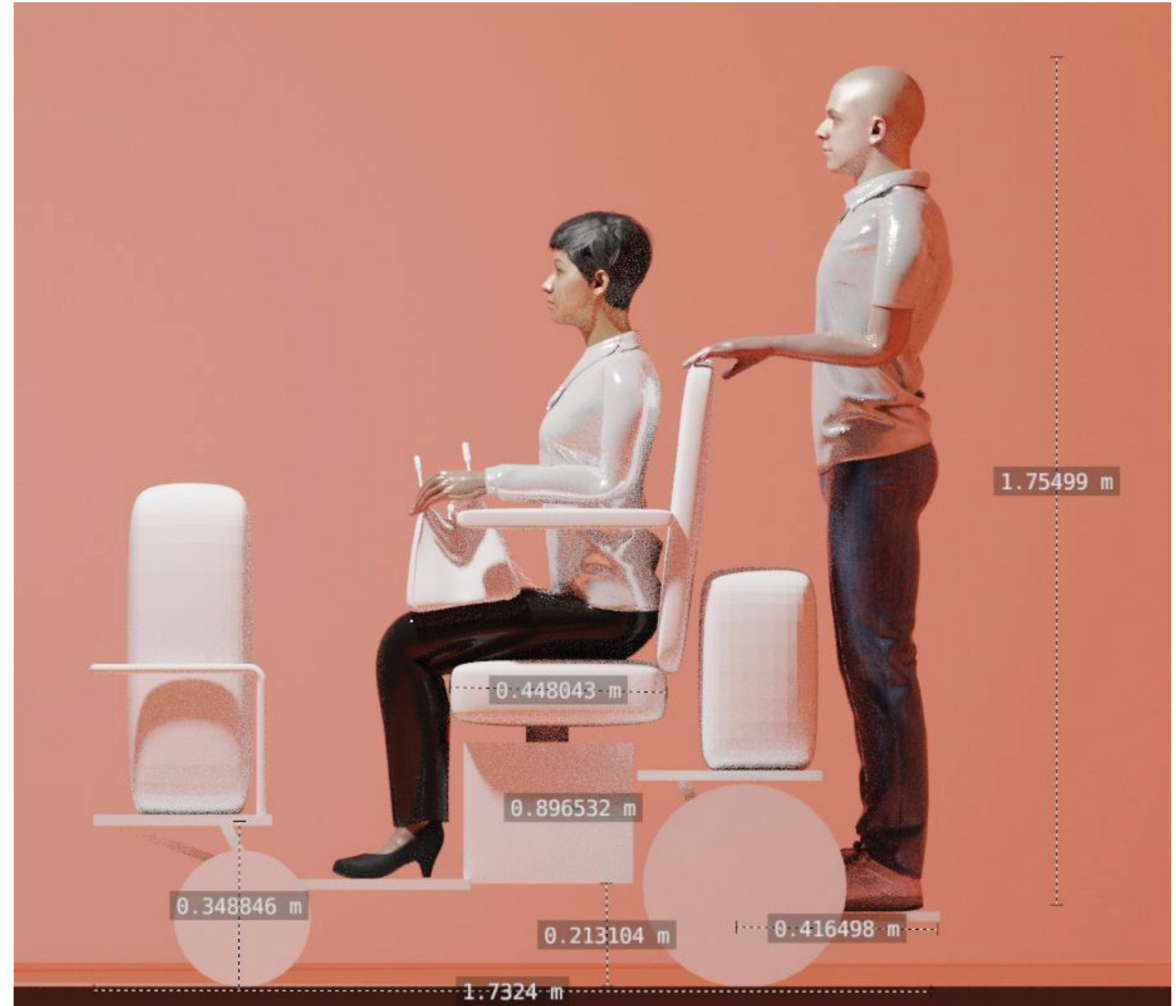
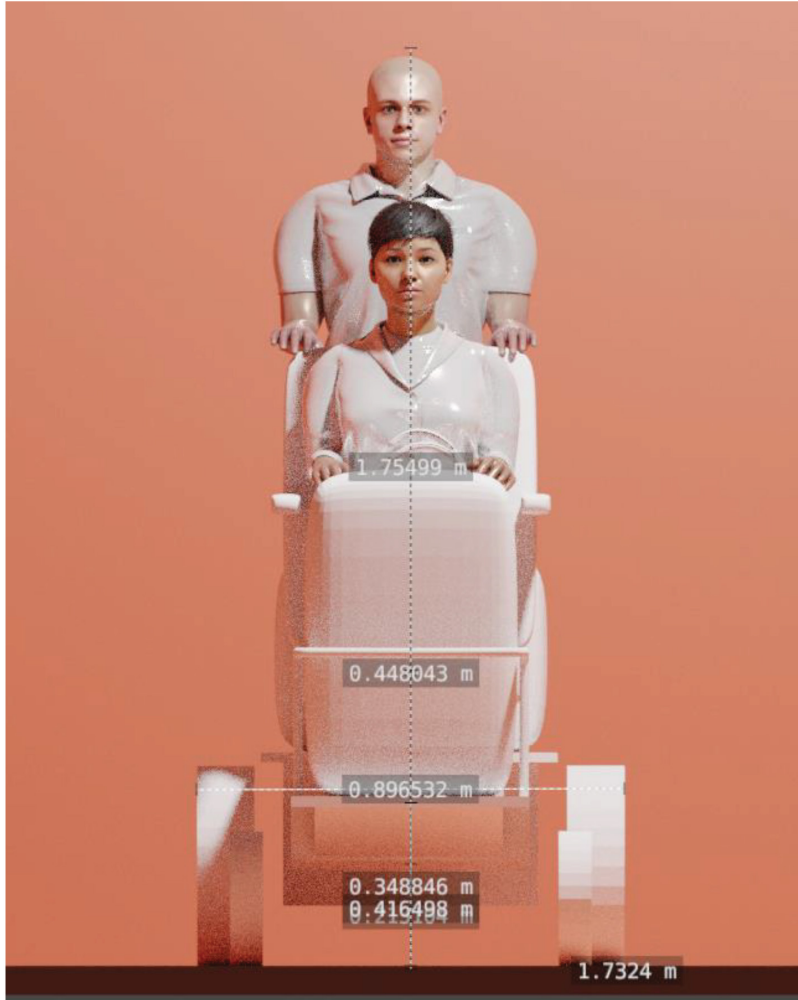


Compact

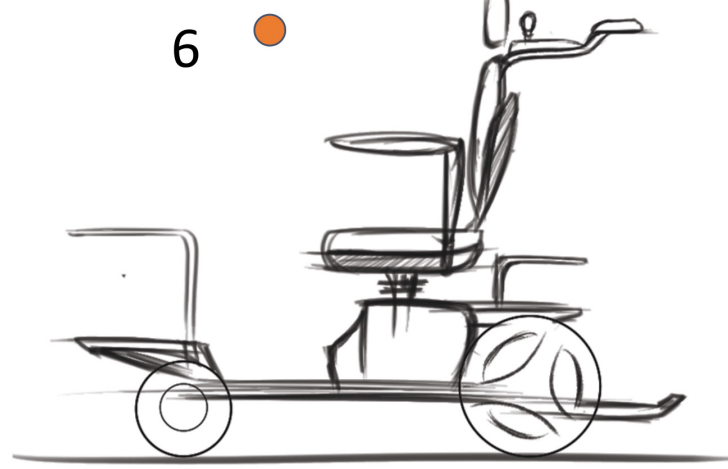
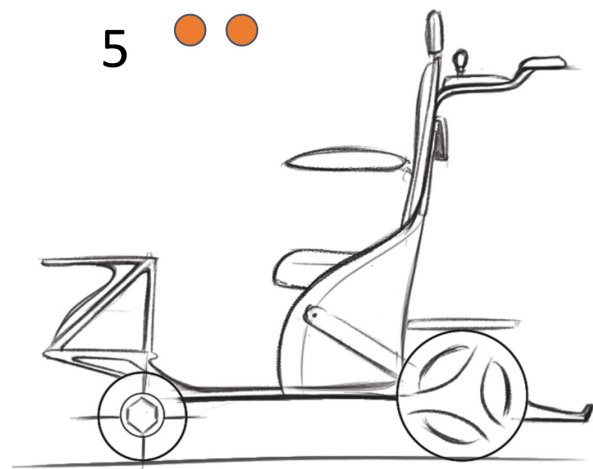
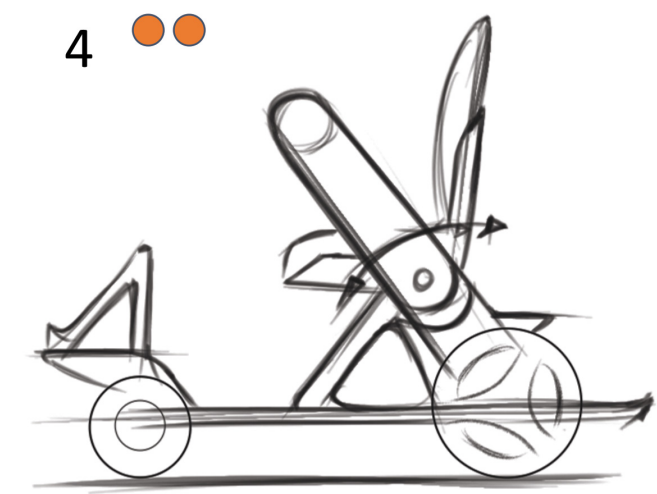
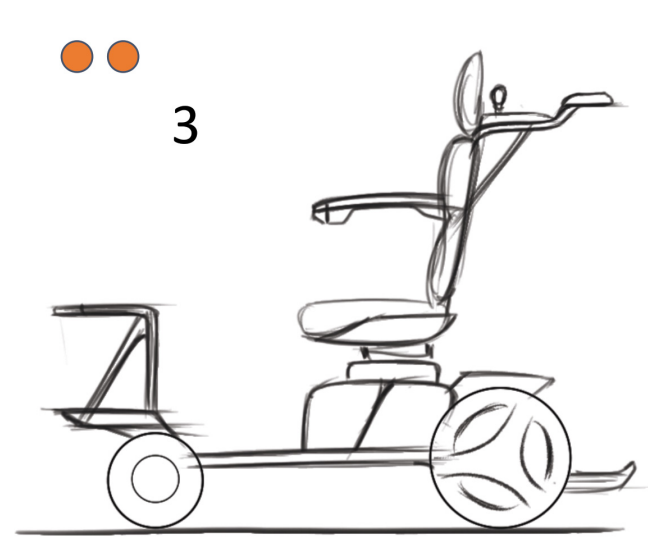
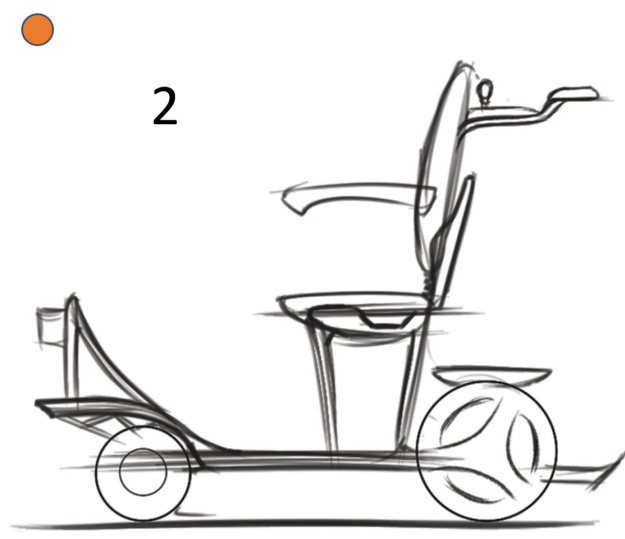
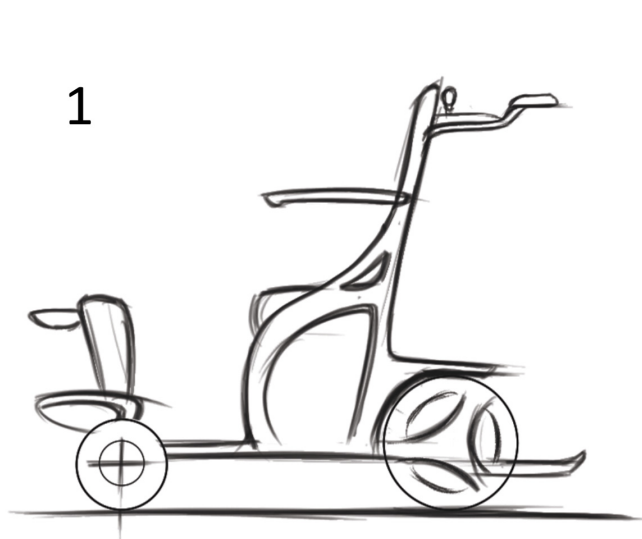


Minimal footprint

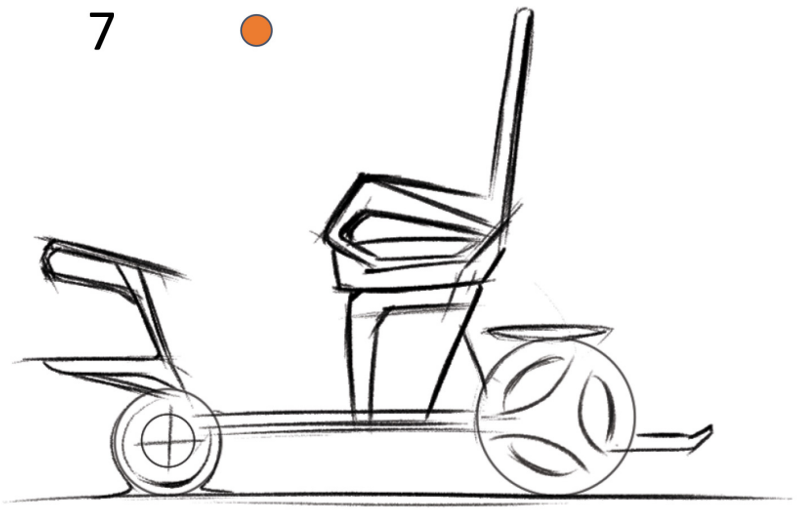
Packaging Study- Direction 3



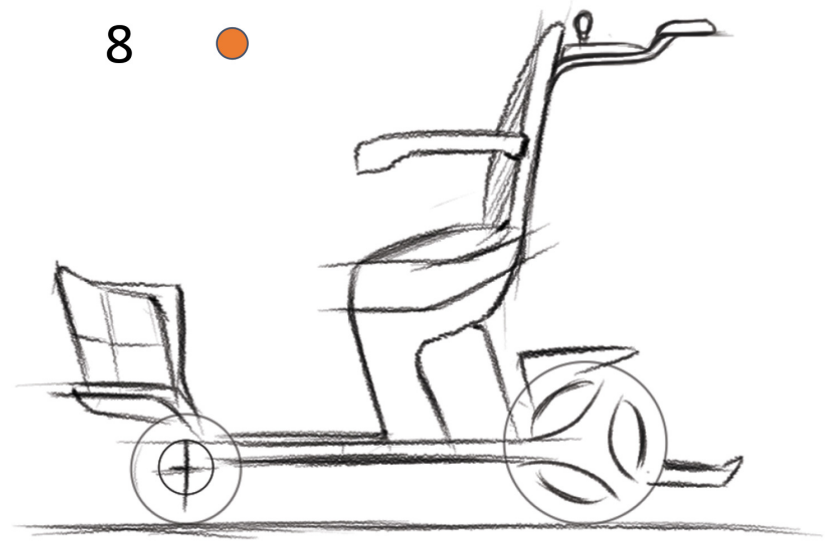




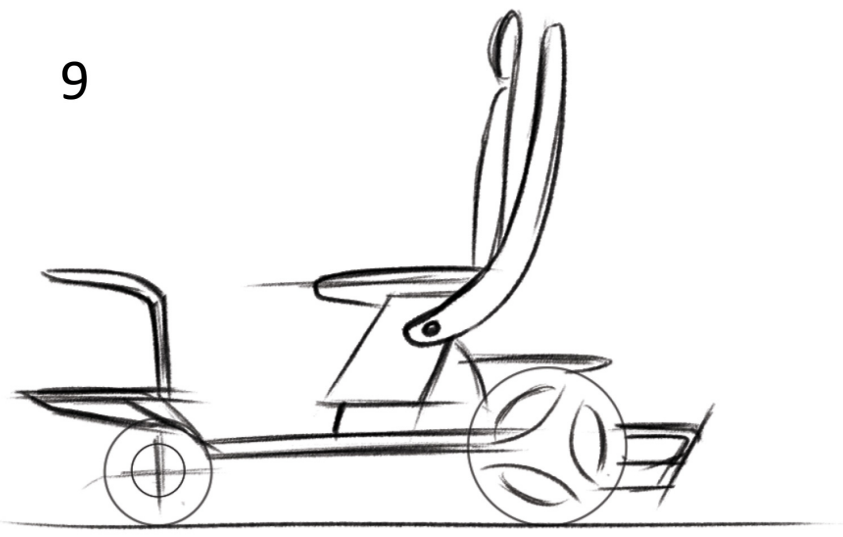
7



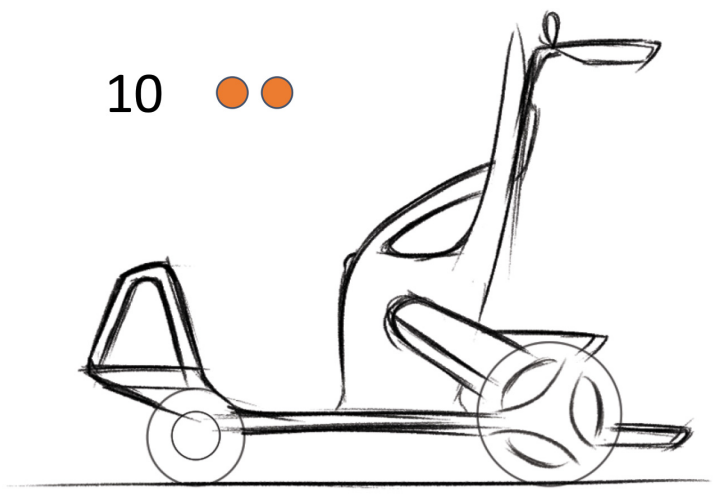
8



9



10



Key Sketch



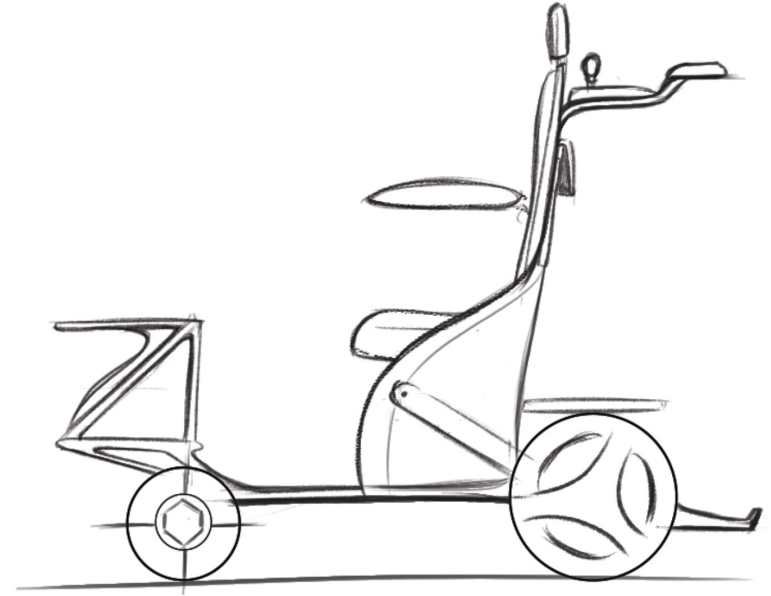
LOW FOOTPRINT



ADEQUATE SPACE
FOR CARGO



GOOD VISIBILITY FOR
DRIVER AS WELL AS
FOR PASSENGER



3D Model





Dashboard
(battery level, speed)

Foot-space for rider

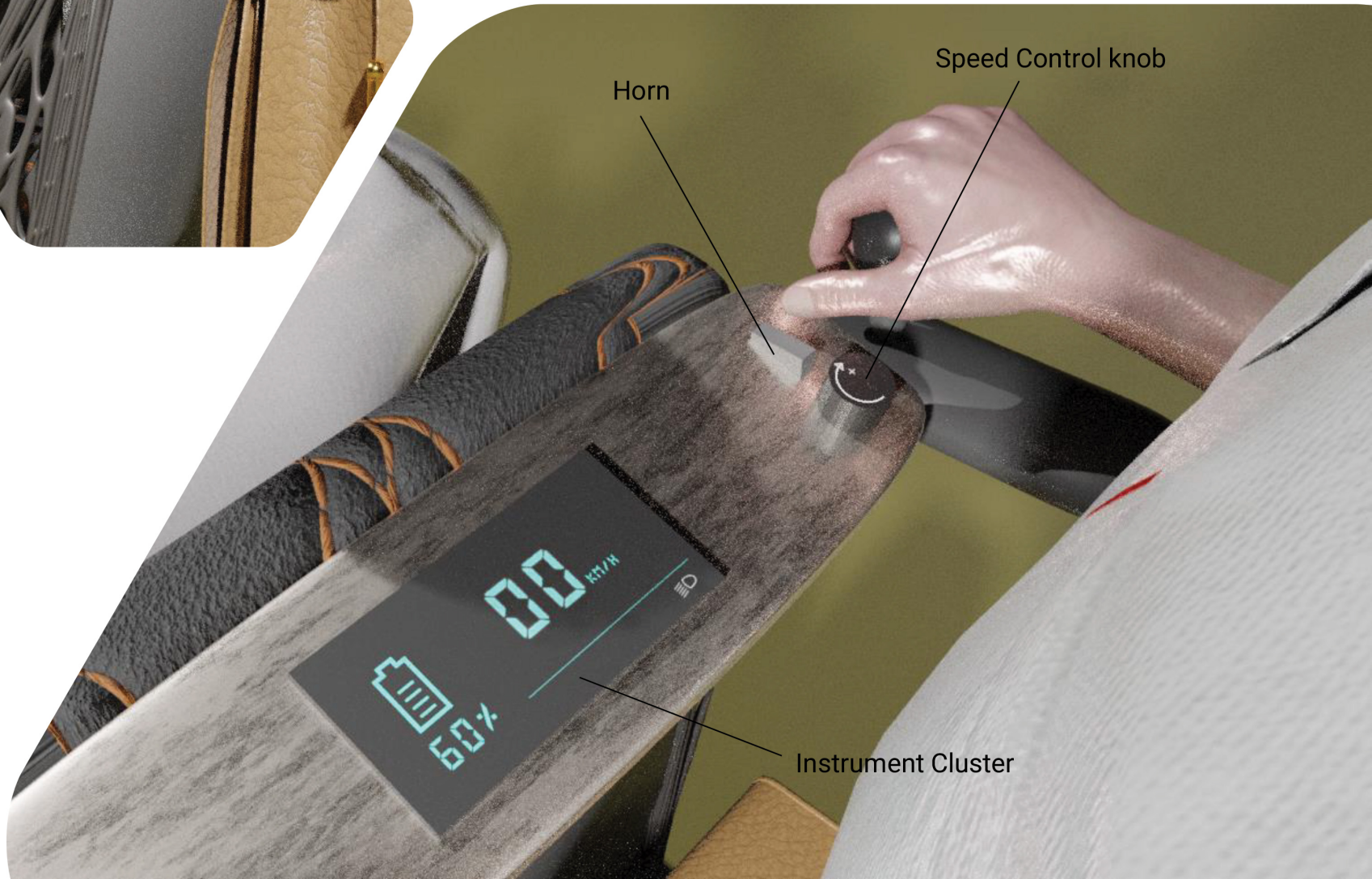
A 3D rendering of a motorized wheelchair. The wheelchair has a white frame, a grey upholstered seat and backrest, and four black tires. A joystick is mounted on the left side of the backrest. A flat, grey platform is located in front of the seat, serving as a cargo space. The wheelchair is positioned on a floor with a grid pattern of light blue lines on a brownish-tan background. A dark grey rectangular area is visible in the upper left corner of the image.

Joystick

Cargo space



Regenerative design



Horn

Speed Control knob

Instrument Cluster

References

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<http://prevalence.in/products-14-seater>

<https://www.bengaluruairport.com/travellers/passenger-services/special-services/buggy-service.html>

<https://www.telegraphindia.com/west-bengal/trolleys-carts-at-twin-stations-ease-rail-travails/cid/1277015>

<https://www.musafirnamah.com/railways-runs-battery-cars-disabled/#.YRAoBYgzZPY>

Thank you!
