

A report on

Design of a Three Passenger Auto Rickshaw (the Interiors)

PROJECT III

APPROVAL SHEET

The project entitled “**DESIGN OF THREE PASSENGER AUTO RICKSHAW (The interiors)**” by Abhijeet Kumar is approved in partial fulfillment for the Masters Degree in Industrial Design course at Industrial Design Center, Indian Institute of Technology, Bombay.

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INDEX

1	ABSTRACT	1
2	INTRODUCTION	2
3	DATA COLLECTION	5
	Basic Data From the Company	5
	Indian and International Products	8
	Auto Expo 2004	15
	User Survey	17
	Understanding and Analyzing Competitors	19
	Problems With the Existing Product	21
	Important Observations	29
4	DESIGN BRIEF	32
5	CONCEPT GENERATION	34
6	CONCEPT SELECTION	46
	Selection Process	47
	Final Concept	49
7	DESIGN IDEAS AND ALTERNATIVES	51
8	FIRST STAGE REFINEMENT	56
9	FULL SCALE MOCK UP RIG	70
10	FINAL DESIGN AFTER REFINEMENT	82
11	1:5 SCALE FINAL MODEL	98
12	BIBLIOGRAPHY	
13	ACKNOWLEDGEMENT	

ABSTRACT

The project was approached by a company with a vision to launch a three-passenger auto rickshaw, which would enter the market with an impact to compete against the country's best selling vehicle in that segment, 'the Bajaj RE'. The vehicle should have its own identity, better engineered and designed to suit all climatic conditions. Currently the company doesn't have any product in this range. Their other products have good demand in the northern part of India, but were never accepted in the southern, western and eastern part of India. The decision of producing a three-passenger auto rickshaw was a bold move by the company, because a failure might sweep them away from the business. Currently the company is not doing very well, but a success would give them a boost to flourish further and will cause worry for the competitors. The nature of the project demanded some radical changes in the vehicle so as to be different and better than the competitors' product, but at the same time should not deviate too much from the today's auto rickshaw.

INTRODUCTION

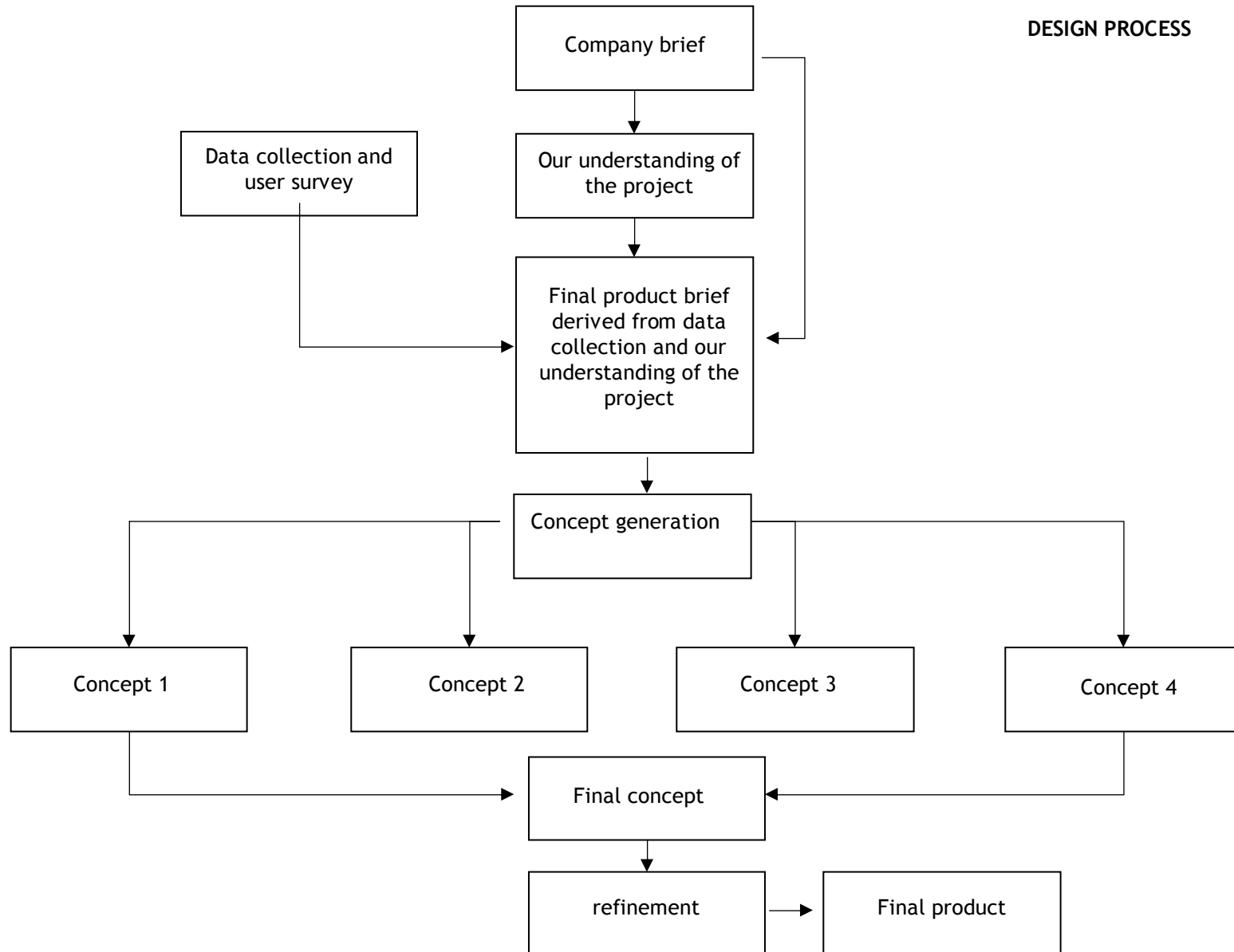
This project is a live project sponsored by the company, which has to be brought to some stage of detailing, so the whole project was divided into exterior design and the interior design. My work basically deals with the interiors, but both of us worked hand in hand giving feedback to each other at different stages of the project. In an auto rickshaw, the interior is a part of exterior and is exposed, so it cannot be done in isolation unlike other fully enclosed vehicles. The interiors have to be dealt with sensitivity of the exterior design to have coherence within the interior components as well as with the exterior design. The domain of a interior designer is limited to space creation, solving functional issues, creating a new experience both to driver and the passengers and adding extra features to make the rickshaw more user centric. The interaction between the driver-rickshaw and passenger-rickshaw was given utmost priority.

Since the time is limited for the whole product to reach certain level of detailing, the initial concept generation phase was shorter than the refinement of the final concept phase.

There were lots of design constraints which we took as opportunities and that finally helped us in bringing out some difference in the interiors. The only point of worry was the chassis height given by the company, which we discussed and resolved, but the execution depends upon them.

The design feasibility has been tested in a full-scale wire frame rig with interior layouts and final feedback given was taken care of in the final design. There has to be another stage of refinement that is very essential as an industry project, but time does not permit us to go to that detail.

DESIGN PROCESS



DATA COLLECTION

Basic data from the company

Visit to the company was paid to see the company's manufacturing capabilities in order to find out what kind of freedom we could enjoy during the design process. An elaborated discussion with the marketing, manufacturing and R&D team of the company was made to realize the seriousness of the project.

Structural drawing of the chassis and engine mounting position was provided.

Technical specifications of the engine, suspension and transmission details were given.

Some of the changes proposed to the company then and there, which we felt was essential at that point of time.

PHOTOGRAPHS OF THE CHASSIS

DRAWINGS and SPECIFICATION CHART(attached as appendix)

The company's chassis drawings

2 Dimensional drawings of the chassis with engine mounting position were given to us to build the body upon.

We have taken the hard points and started developing concepts around it. We didn't have flexibility to change some of the components like the steering bar inclination angle, but can raise or lower the pivot point if required.

The seat positions were not fixed, we can even think of some different layout. The overall dimensions like the track width, wheelbase were given which almost gave us the overall dimension of the vehicle.

The chassis is fabricated with strong tubular sectioned members, which is strong enough for a vehicle like this. So, we thought of strengthening it from the top also which could be the extension taken from the main chassis to support the frame and to act as a roll over cage.



Company's chassis prototype

The engine is mounted on the central part of the chassis, which is water cooled and develops around 15 bhp. The drivers seat comes over the engine which could lead to fatigue for the driver due to vibration, so special attention has to be given for the driver seat design.

Heat is another problem that has to be tackled once the design reaches some stage of detailing.





CNG Version



Diesel Version



Petrol Version



For US Market



For Asian market

3 WHEELERS IN INDIA

Bajaj auto ltd

Bajaj Auto is the market leader in this segment; it has got more than 70 % of the market share. It produces diesel version of the same category and exports some of its model to US and other Asian countries.



Khushbu road master



Khushbu road king



Rural big



Shakti tanga



Passenger deluxe



Khushbo mark

Atul auto

The company has presence in Gujarat, Rajasthan, Madhya Pradesh, Chattishgarh and Andra Pradesh. It has plans to enter the markets in Tamil Nadu and Karnataka in the current financial year. The company has manufactured over 8,000 units in the financial year 2003-2004 as compared with around 5,000 units in fiscal 2002-2003, a growth of over 60 per cent. With the ongoing expansion, the company is expecting to manufacture around 15,000 units, a growth of over 87 per cent.



SALOON

Scooters india ltd

In 1975, company started its commercial production of Scooters under the brand name of Vijay Super for domestic market and Lambretta for overseas market. It added one more wheel to its product range and introduced three wheelers under the brand name of VIKRAM/LAMBRO. However, in 1997, strategically, the company discontinued its two-wheeler production and concentrated only on manufacturing and marketing of 3 wheelers. These three wheelers have become more relevant in the present socio-economic environment as it transports goods and passengers at least cost.



VIKRAM 410g

Vikram EV is driven by DC motor with power input at 72 volts from special deep discharge cycle batteries. It is totally clean and non-polluting vehicle. It has neither engine nor gearbox nor radiator nor silencer and thus it is practically a noise-free vehicle and has no cylinder and piston to wear and tear. It does not require any maintenance.



VIKRAM ev



Piaggio

Kerala auto model

Kerala auto has its presence only in Kerala, a few pieces were sighted in some of the south Indian states.





3 seater deluxe version



3 seater regular version

Goel tempo models

Goel Tempo can not be considered as a big competitor of Bajaj Auto, but it holds a small market in the north Indian states like Haryana and Rajasthan.



Delivery van



Pick up



Comfortable seats



Comfortable riding posture

SIMILAR PRODUCT IN INTERNATIONAL CIRCUIT

Tuk tuks

Tuk tuks are mainly used in Thailand, Singapore, Malaysia and some other Asian countries as a tourist entertainment vehicle. The tourist takes a ride just to experience it, so the passenger seats are made very comfortable with headrest, proper inclination of the backrest and lots of legroom. Sufficient amount of viewable area is left for the passengers to enjoy the ride. The driver also rides the vehicle in a royal posture, which is very comfortable unlike our kind of auto rickshaws. He sits right on top of the engine and feels the power.

Taking ride in tuk tuks is purely for fun and experience, which should not be compared with Indian rickshaws, that operates in totally different context like- climatic conditions, road infrastructure and public transportation system.



Engine mounted under the driver seat



Longer version of tuk tuk



Bajaj CNG



PIAGGIO
mobile fruit
center



PIAGGIO pick up

Auto expo 2004 held in New Delhi coincided with the project, so we got a better idea of what is going on around the world and what could be the limit up to which we can stretch our project. Competitors' products were studied and analyzed thoroughly and then compared with one another, because expo is the only place where we get to see all the products together in the same place. Some concept vehicles gave us the direction of trend.



PIAGGIO mobile
shop

SOME FACTS AND FIGURES

“As diesel prices are almost 60 per cent of petrol prices in India, most of the companies produce diesel vehicles. Another reason for the demand for diesel vehicles is the availability of Lombardini engines in India through Greaves Ltd,” said Patel.

The total production of diesel auto rickshaws in India is at around 75,000 vehicles per annum, while Bajaj Auto manufactures 1,50,000 petrol vehicles.

While the total supply of auto rickshaws in India is at around 2,25,000 per annum, the present day demand is at around 3,00,000 vehicles per annum.

Atul Auto has a 12 per cent share in the diesel auto rickshaw market, while it holds a four per cent share of the overall auto rickshaw industry.

Atul Auto has plans to hike its market share to over 20 per cent in the diesel auto rickshaw sector and to around seven per cent in the industry.

The turnover of the company at the end of fiscal 2003-2004 was Rs 90 crore and the company expects a turnover between Rs 140 crore and Rs 150 crore by the end of the current fiscal.

USER SURVEY

Users

Driver	primary user
Passenger	primary user
Owner	secondary user

As the product will be use by the primary users only, so our focus was in this user group only. Sometimes the driver owns the vehicle but that does not shift our focus to the owners, because it's the driver who has to live with the rickshaw for more than 10 hrs a day.

Interaction With the Users

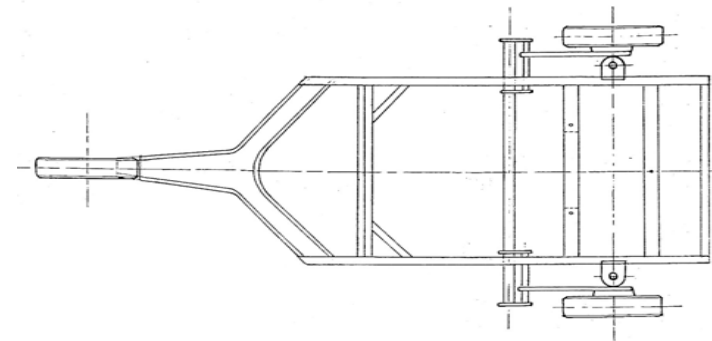
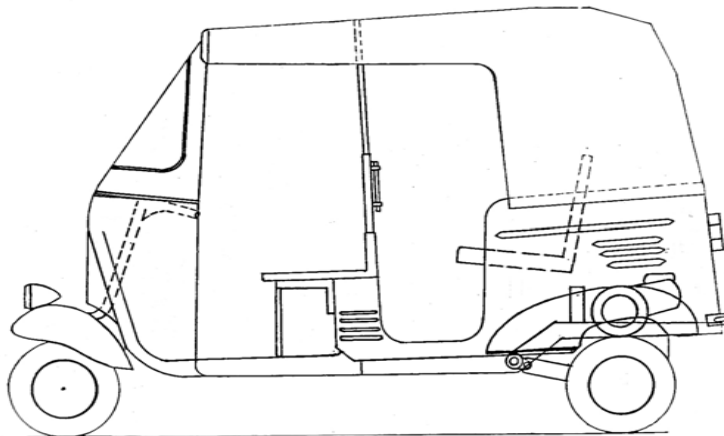
To know the actual problem, the users- mainly drivers were interviewed very intimately. Some of them were later so involved that they gave us lots of design inputs, which were utilized during concept generation.

We all know that current best selling product, the Bajaj RE, is already optimized to the a great extent, but good insights can always lead to a good design. So, user survey was done extensively with drivers as well as regular passengers. Each problem has been discussed in this chapter assisted with photographs.



UNDERSTANDING COMPETITOR/S

Our direct competitor is BAJAJ AUTO LIMITED, so we have taken their best selling model **Bajaj RE** for our study purpose.



TYPICAL CHARACTERISTICS OF AUTO RICKSHAW

- ☛ Suitable for short distance travel say 10-15 minutes
- ☛ Fast ingress / egress
- ☛ Saves from direct sunlight and rain
- ☛ Like private taxi which will drop from any point to any point
- ☛ Cheaper than taxi
- ☛ Encloses the passenger from outsiders
- ☛ Excellent maneuverability through traffic
- ☛ Whole family can travel
- ☛ Cheaper as compared to taxi As costly as bus if shared with others

PROBLEMS WITH THE CURRENT MODEL

Visibility related



Front visibility through the windshield



Side visibility along the roadside



Driver has to bent down to view the rear through the mirror



Negligible rear window area, which doesn't give any view to the driver



Rear view mirror of no use, except to bother female passengers



Sunshade reduces the visibility as well as increases air friction

View taken from the eye level of 95 % ile driver

Ergonomics, safety and function related



Bend head to view road ahead



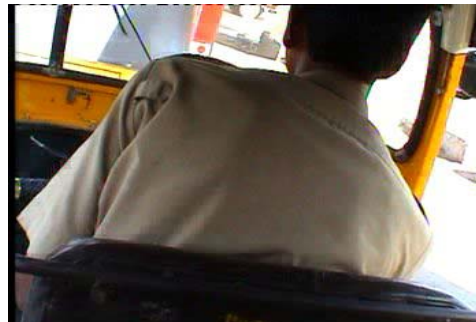
Looking out for the signal light



Driver always sits in a very cramped position because of handle bar position, visibility, seat design etc.



Waiting for the signal to turn green



Tall drivers normally bend sideways in an awkward position to see the other vehicle ahead.



Very tiring posture to start the vehicle if not working within 2/3 pulls



No proper place to rest the foot, so driver finds is comfortable to support it somewhere and operate the brake



The channel which is the part of chassis is used as foot rest, ultimately the position of left and right legs are different leading to early fatigue.



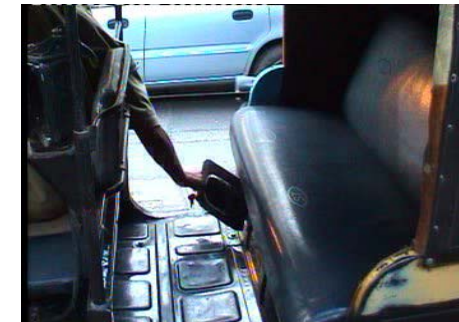
Improved and inclined backrest with no front sunshade which allows the driver to seat erect



Driver has to move back in a very painful position to read the meter.



Taking the fare and reading the meter is a situation cannot be avoided without this scene.



To check the pressure the driver sits in his seat and turns around, sometimes get severe cramp.



Brake lever too hard which leads to wrist ache



Putting the meter down needs to be done with a very difficult hand movement



Seat is being used to carry luggage which occupies the entire seat area



The rickshaw driver has to change posture while the rickshaw is idle because of bad seat design.



Central bar used for grabbing, which could be very dangerous incase of toppling or brushing against other vehicle.



Passenger has to bend down to get in or out



Putting bigger luggage inside like a big sack, computer box or TV sets is difficult or not possible because of the central pillar.



Putting holy stickers and offering agarbattis, garlands etc



No proper place for keeping water bottles



No place for newspapers, match box, beedis etc



Spare tire kept under the driver's seat which looks very untidy along with other things they put under it.



Extra box fitted to the non-existing dash board.



Pressed floor board to give strength, but grooves accumulate dirt.



Handle lock broken intentionally to reduce turning diameter
Handle hits front panel when turned more
Handle hits knees on turning



Handlebar is too close to knee
Turning difficulty
Cramped seating posture due to low handle bar and less legroom



Customized dashboard Causes obstruction to knees and eats up leg room



Canopy stretched too much downward, obstructs vision
Loose and flexible strap for holding



Music system eliminates luggage space
Hits head when passenger leans backward



Speakers are too large and powerful for the passengers, often causing irritation to them
Prone to theft



No provision for child safety



Fuel cylinder inaccessible to driver so he comes around and disturbs the passengers



Absolutely no space for keeping small bags or luggage near leg area due to cramped seating with three passengers



Exposed area under seat gathers dirt, difficult to clean



Viewing possibilities for passenger seated on left , middle or right



Note use of plastic holder to keep personal belongings like comb, cigarettes and beedis

SOME IMPORTANT OBSERVATIONS (insights)

Observation #1

While travelling, the parent hold the central pillar or put her leg forward so that he/she psychologically feels secured about the child. The mother/father doesn't care about any comfort because their priority is their child's safety.

Solution

a side detachable bar could be added as a child safety feature (a nylon strap, a chain or a pivoted bar)

Observation #2

The passengers always get a very boring view of the drivers back and untidy roof.

Solution

A game to pass time or a transparent roof to experience a new view.

Observation #3

It is often observed that the rickshaw drivers take a lot of time to return the change, because they do not organize the coins properly and keep it in the pocket and later keeps on searching here and there.

Solution

Some people have made a flexible pouch made of rexin which hangs in front of the driver without obstructing his leg movement. A coin dispenser or a coin organiser could be added to the dash board.

Observation #4

Lot of the rickshaw drivers are literate and they keep themselves informed by reading newspapers. Normally they read it when they are idle and tuck it somewhere.

Solution

A personal space could be given to them so that they can keep their newspapers along with other belongings like comb, beedis, match box, candles, agarbattis etc

Observation #5

It is quite common to hear that people forget their luggage while leaving the auto, because the luggage was kept behind the passenger and due to an absent mind they forget it.

Solution

Luggage space could be brought in the front by moving the seat backwards, thus improving the leg room.

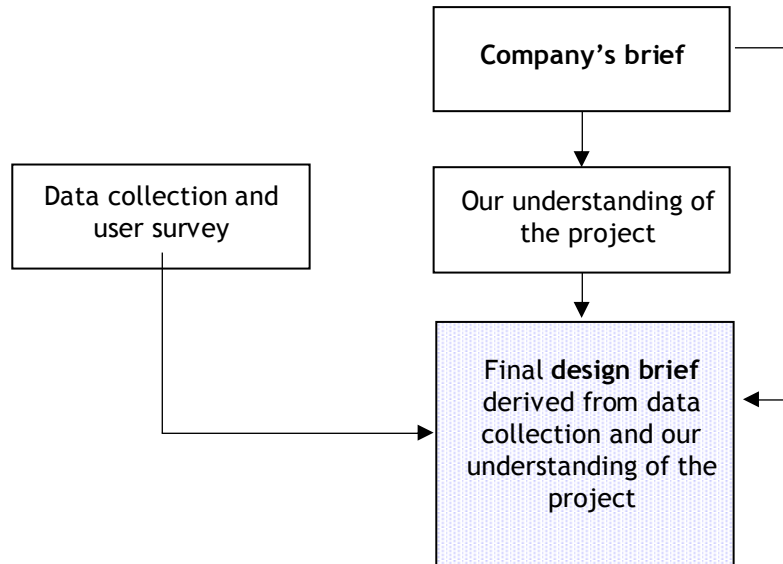
Observation #6

Sometimes people find it difficult to keep polythene bags (filled with vegetables, fish, meat) with them or even in the seat.

Solution

Some kind of hanger or hooks can be provided to hang the polythene bags, may be under the seat or behind the drivers back.

DESIGN BRIEF



Product Brief by the Company

A product that will set a trend by creating its own identity through superior styling which would compete the market's monopolized product.

Little freedom in the manufacturing cost can be enjoyed if the design is worth producing.

Inferences taken from data collection / user survey and our own understanding of the product along with the company's intention helped us deriving the final design brief. The design brief tells us the scope of the product which needs to be refined.

DESIGN BRIEF evolved after user survey

To design an interior which

Improves the drivers interaction with the vehicle

proper ingress/egress

driver friendly dashboard

improve fare meter position

space for driver's personalization

A proud riding posture to the driver

cruiser type seating with dampeners

curved footrest improves usability

better height for visibility

Has lot of space for luggage, driver and passengers without increasing the exterior dimension.

35:65 % rear seat fold ability

flat floor pan]

*slimmer seats because of proper contoured steam
pressed plywood*

Offers better safety, utility and durability.

usage standard tubular sectioned steel pipes

*pipes directly bolted or welded to main
chassis*

Gives minimum discomfort to both passengers and the driver.

proper lumbar support

nice contour for both 5th. & 95th. %ile Indians

Will create an identity in terms of technical and design superiority.

*sophisticated dashboard, speaker panels,
fare meter panels, added basket etc*

To use the design constraints as opportunities which would help us in creating the identity we are looking for.

*center mounted engine gives the
option of having a flat rear floor pan*

*high chassis saves from flood water and gives
the a high seating position to the driver*

CONCEPT GENERATION

To know the actual space available for the design, we have drawn the full scale floor board with given hard points. Then full scale human mannequins were used to know the flexibilities in seating layout and other possible changes.

Basis of concept generation has always been the needs emerged out of data collection. The needs/requirements were broadly classified as

- **Functional requirements**
- **Visual requirements**
- **Ergonomic requirements**
- **Psychological requirements**

The priorities of the above said needs have been shuffled to have distinctively different concepts during the process keeping the design intent same.

Anthropometrical study of the existing product before concept generation to compare with our seating layout



No headroom for 95th % (males) on passenger seat



Seat pan is high for 5th % (male)



50th % and above have to bend down to get in



Legroom adequate for two passenger in erect position Inadequate for three passengers and/or relaxed postures

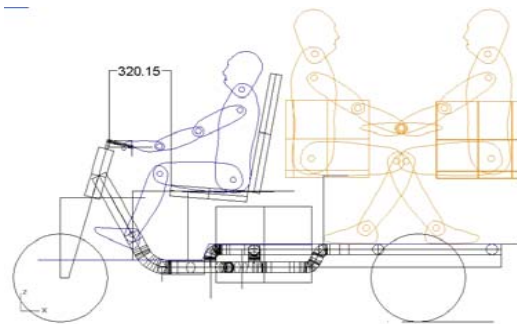
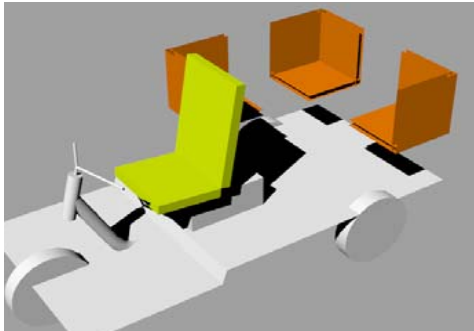


Backrest too far for 5th % (male) due to improper popliteal width of the seat



5th % (males) have problem reaching floorboard
Brake lever in awkward position

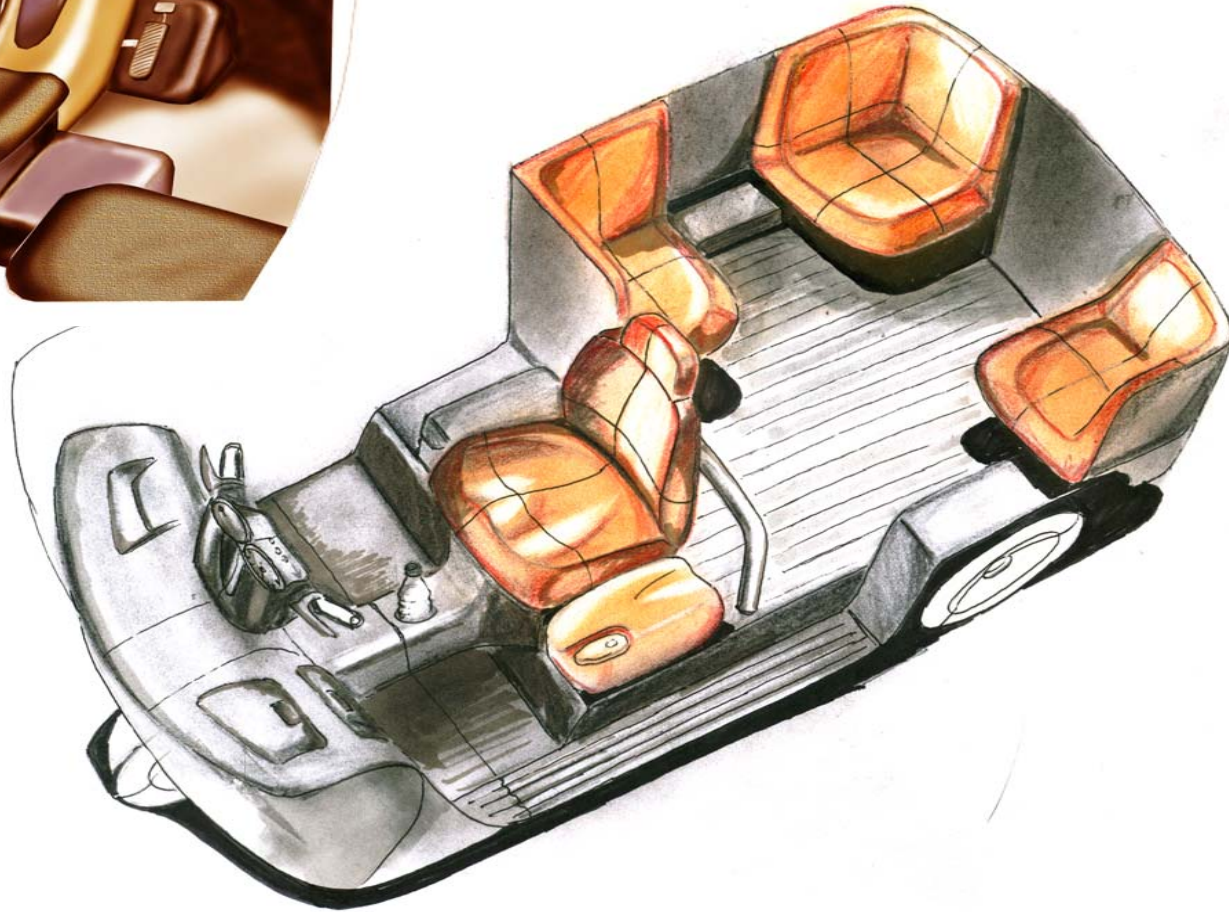
Concept 1



To get a realistic feel of interaction with the passengers and to feel the comfort level of seating people of different sizes were used to verify

Possibilities in terms of internal and external dimension using 95th. % mannequins

Concept 1



Concept 1



THE SEAT REQUIREMENTS

Contours of the backrest and the seat pan has been fixed using the contours of the 5th and 95th % ile male back and seat.

Driver's seat can have contours both ways but passenger seat and backrest can have one way curve only, because the combination of 3 person seating is difficult to manage within that much seat width available.

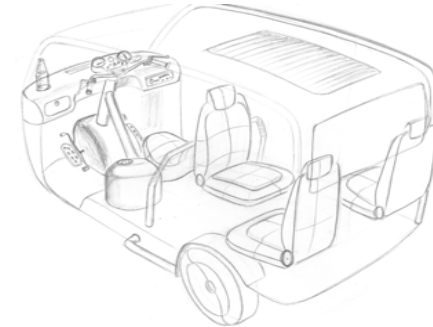
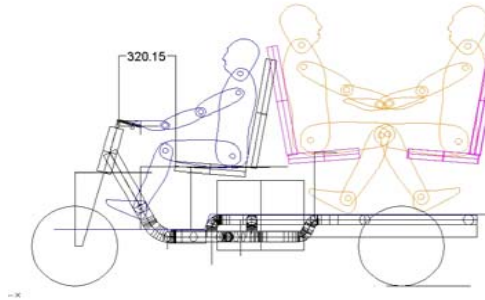
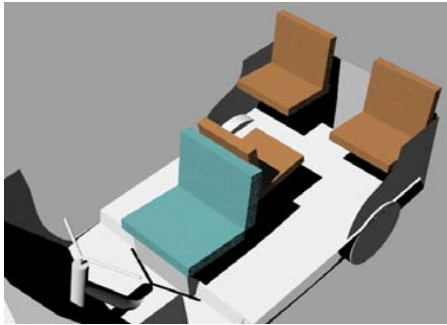
Room for extra thigh movement, which will allow the seat to be fixed for all % ile

Drivers seat pan - transition between a saddle seat and a traditional bucket seat.

FEATURES

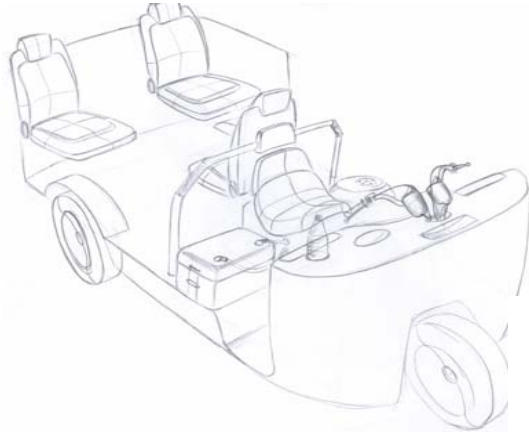
- Bucket seat for driver to improve his posture and reduce his discomfort
- Flexible seating for the passengers in terms of direction of seating.
- Meter and display cluster brought to handle bar made of moulded ABS.
- Exposed petrol tank treated as aesthetic element
- ABS moulded dash board with a coin collector, glove boxes
- Bottle holder, flat foot rest to improve the riding posture
- Battery cover integrated with engine cover.

Concept 2

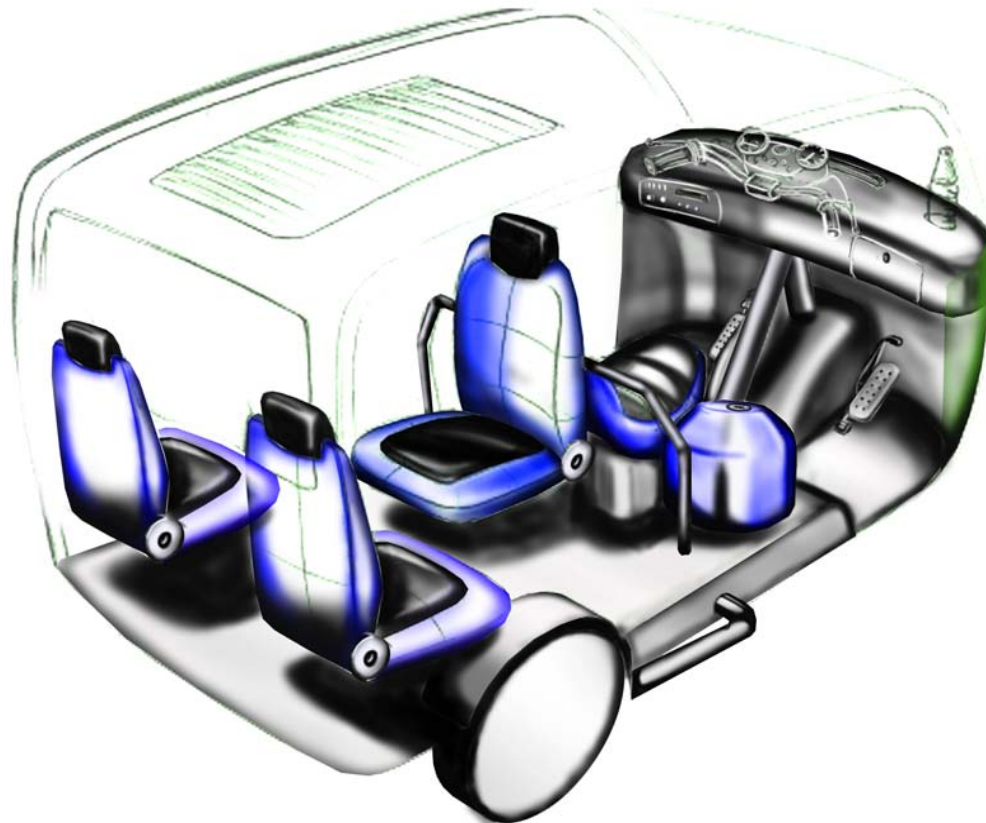


Possibilities in terms of internal and external dimension using 95th. % mannequins

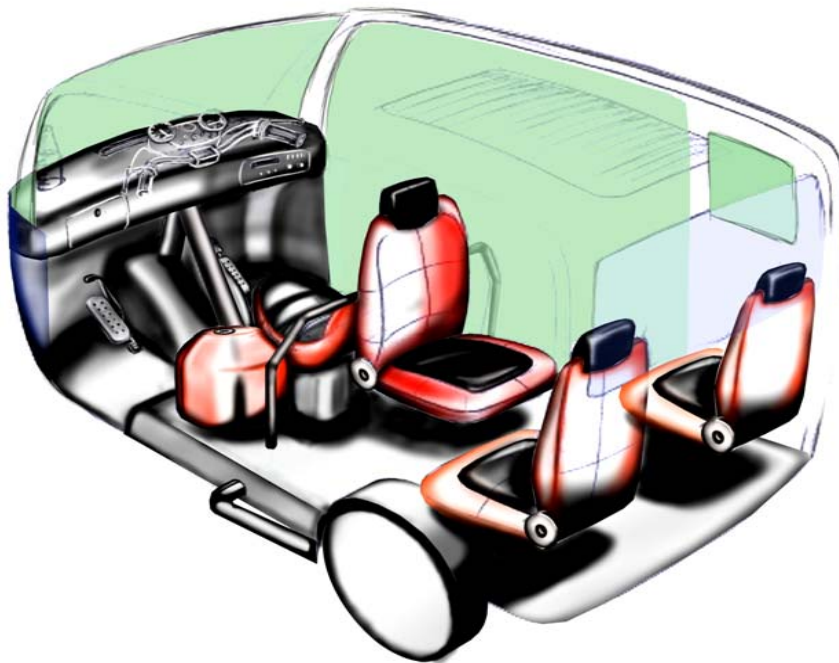
Layout is for 3 stout person seating without skin contact among each other



Concept 2



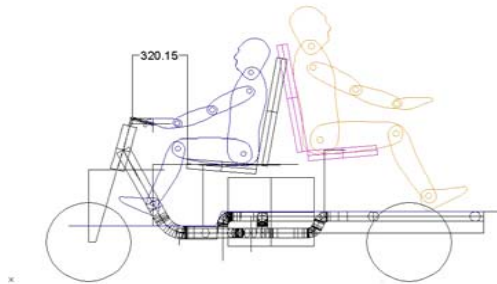
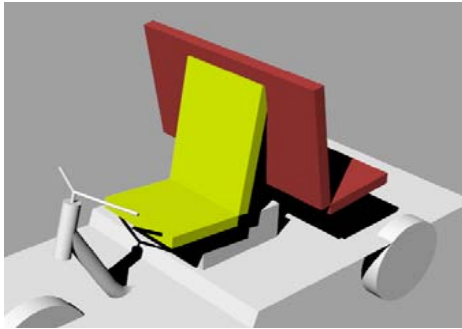
Concept 2



FEATURES

- Individual passenger seats with head rest so that three stout people can sit comfortably.
- Saddle kind of seat for driver for cruiser kind of seating posture
- Ingress/egress would be easier if entry is from both sides
- No skin contact between passengers and better interaction among them
- Common head rest for the driver and the passenger behind him
- Grab rail visually separates driver's and passenger's cabin
- Exposed chassis member in the front to cut cost and also to visually look stronger
- Lot of visibility through sides and rear to avoid motion sickness for the person sitting in the opposite direction
- Blinds used in the top to control light
- Exposed cylindrical petrol tank painted gives a feel of owning a superior rickshaw
- Brushed steel finished handle bar like cruiser bikes with prominent round dials, integrated display panels for a bike type feel which goes with the overall concept
- Dual colour scheme for seats, to make the interior more interesting
- Round metal pipe used as step for climbing into passengers cabin

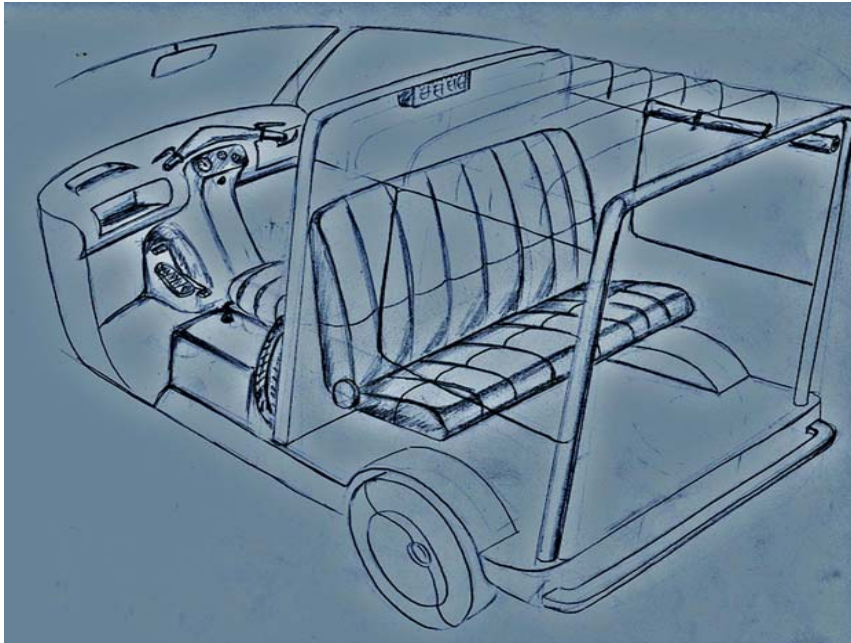
Concept 3



To get a different feel when all sitting in the opposite direction viewing the entire road and land marks leaving you.

Possibilities in terms of internal and external dimension using 95th. % mannequins

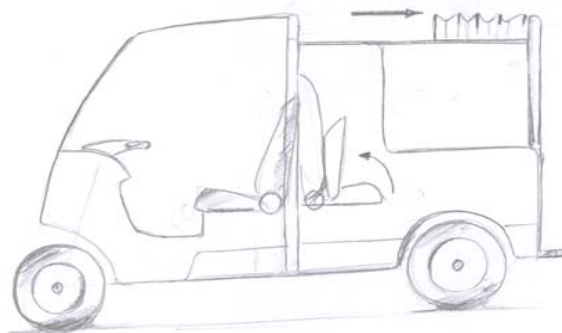
Concept 3



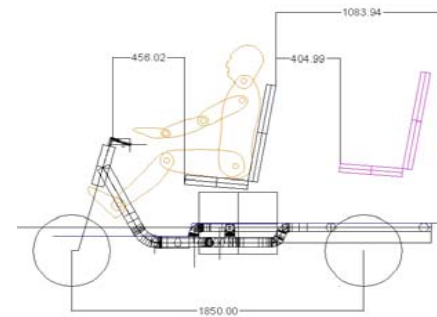
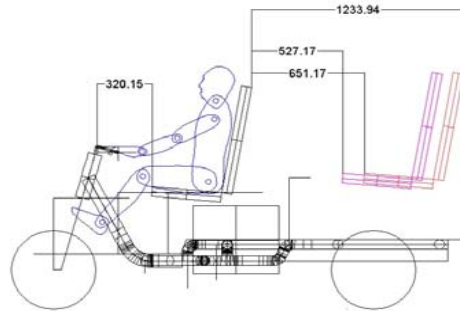
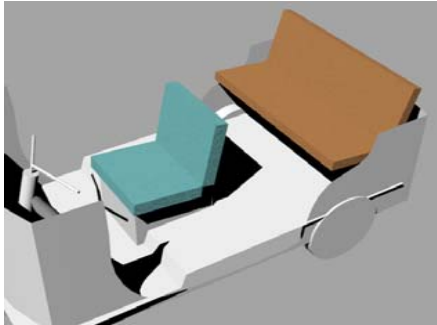
FEATURES

Concept was originated from tanga which used to be very common a couple of decades back. To retain its essence we tried to give a feel of tanga ride to the passenger and the driver.

- Can be used as a pick up if the passenger's seat is folded up
- Intentionally both the passenger and the driver's cabin are separated with a sheet with very little opening for interaction
- Seating in the opposite direction of motion gives a feel of leaving the landmarks unlike other vehicles where landmarks are approached by the vehicle. So, the viewing area is important. More the view better it is for people who have motion sickness.
- Retractable roof
- Easy ingress/egress
- Safe from rain as it won't hit the passengers directly
- Lot of leg room, luggage room
- More suitable for tourist
- Safer for passengers in case of an accident, because they won't be thrown outside and the cushion will absorb some shock.
- More than utility of the vehicle experience is given priority



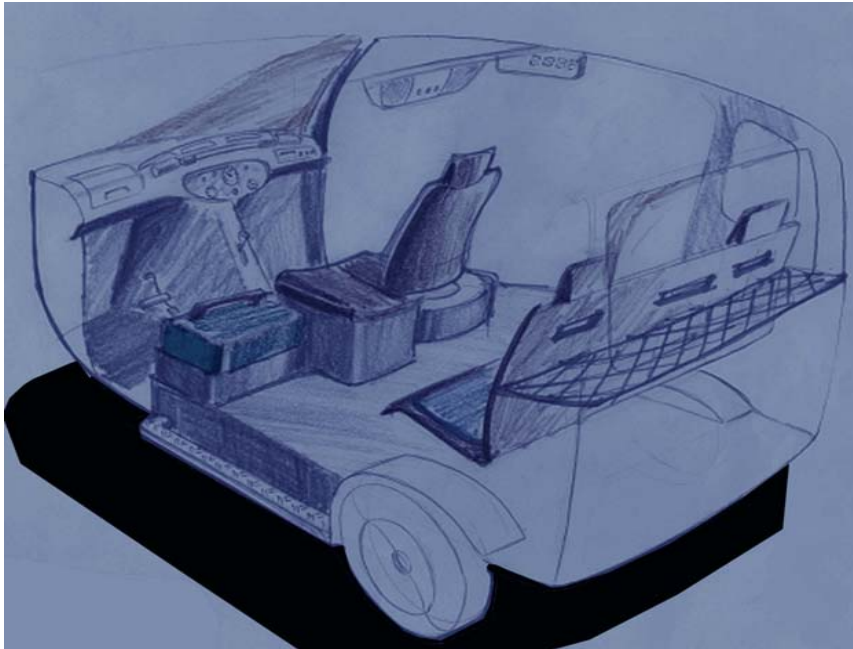
Concept 4



Advantage of this type of seating over other type of seating layout is its ease of manufacturing, fixing details, utility, cost and many other.

Flexibility in pushing the rear seat backward and creating lots of room for luggage and legs.

Concept 4



FEATURES

Straight ahead sitting layout pushed backward a little bit to increase legroom

Foldable rear seat in 65:35 ratio, so that it can be used to carry bigger luggage in situational cases

Nylon net behind the rear seat to put soft and lighter luggage

Display console in the dashboard but near to the driver with a smoothly curved aluminium handle bar

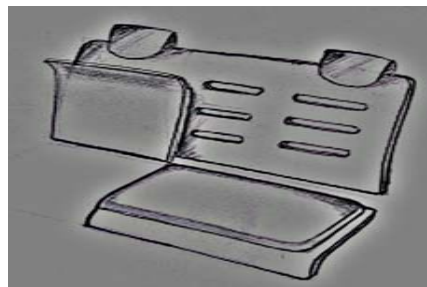
Improved visibility by adding the side glass

Spare tire and battery covered with moulded plastic lid

Speakers just behind the head of driver and in front of passengers

Flat floor pan to accommodate luggage under the seat to be accessed from inside

Steam pressed backrest with proper contour and slits for ventilation. No cushioning in the backrest.



CRITERIA FOR CONCEPT SELECTION

As the matter of fact, the selection of one concept was little difficult, because we could not discard the good features of anyone of the concepts directly. So, the evaluation was done on the basis of

practicality,

Utility and

feasibility of the product.

The final concept was finalised on the basis of seating layout. Some of the features found worthy in other concepts were borrowed to optimise the design on every aspect

CONCEPT SELECTION

Features that were found good in each concept are discussed below and the final concept is an attempt to amalgamate all the possible features with coherence to each other.

Concept 1

- Driver seating posture could be achieved for all percentile if refined further
- The seat design was an interesting idea to work upon.
- Coin collector is another good feature in this concept

Concept 2

- Exposed chassis member in terms of cost cutting and the psychological advantage that the vehicle looks stronger and durable
- Saddle type seat to improve riding posture
- Blinds to control light within the enclosure
- Cruiser kind of handle bar will make the drive feel proud of riding a personal vehicle rather than a passenger carrying vehicle

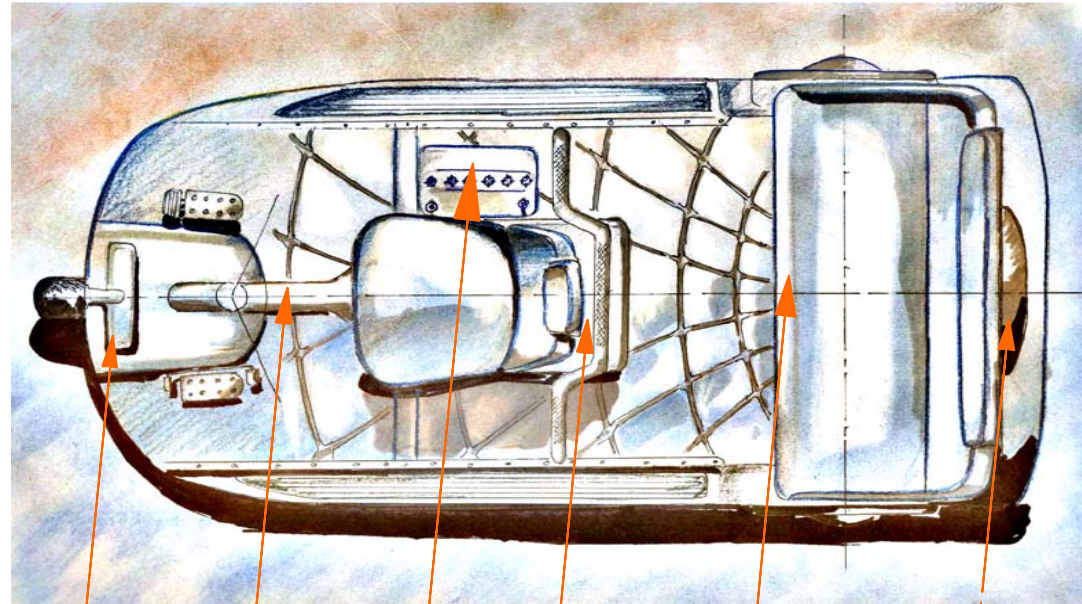
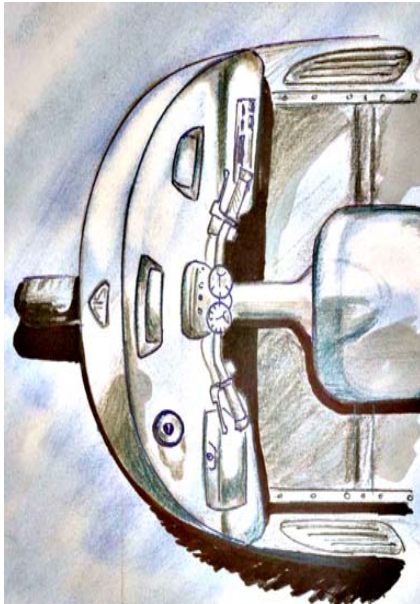
Concept 3

- 🔗 Convertible option of becoming a pick up might be a good option for the buyer to use it differently
- 🔗 Retractable roof gives the flexibility of having a open roof which would suit certain climatic conditions and regions.

Concept 4

- 🔗 Seating layout was selected because of it cost and ease of fixing
- 🔗 Extra space for soft luggage behind the passenger seat
- 🔗 Speaker placement
- 🔗 Flat floor pan
- 🔗 65:35 Fold ability of the rear seat
- 🔗 Steam moulded plywood seats

FINAL CONCEPT (rough layout)



Petrol tank

Exposed
chassis
member

battery

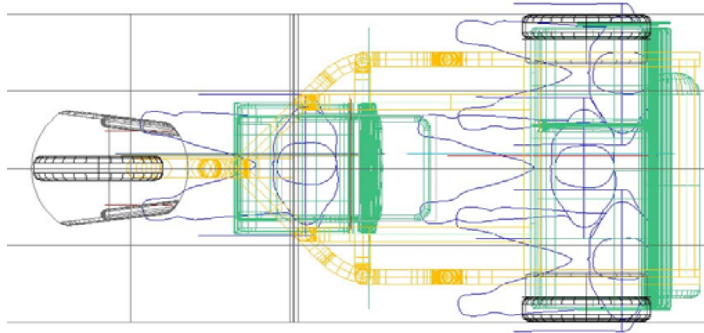
Space behind the
driver's seat and
engine top

Ribbed floor pan
for strength

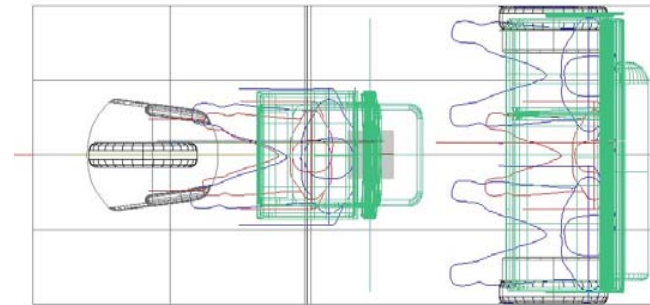
Spare tire
mounted in the
backrest of
passenger seat

The **final concept** is derived from some of the initial concepts, ideas were borrowed from them which we felt would add value to the design and also discarded some of the ideas which we found to be irrelevant to our design.

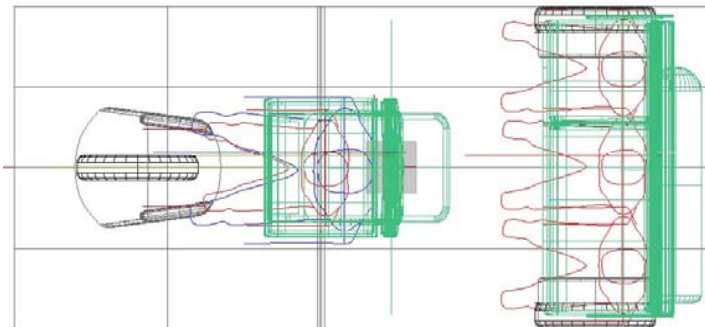
Seating scenarios for different sizes of people



95TH. % ile persons seating together has to adjust within the width of the seat, but enough legroom for the middle person

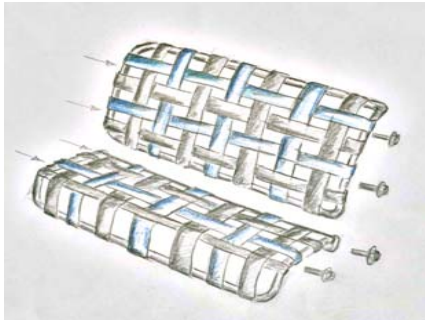


Two 95TH. % ile persons and one 5th. % ile person can seat properly

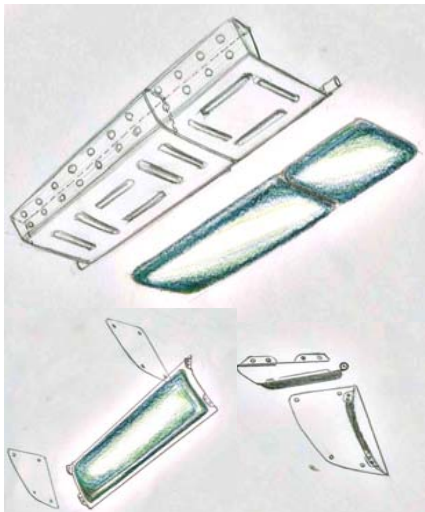


All three 5th. % ile persons can seat very comfortably

Seats

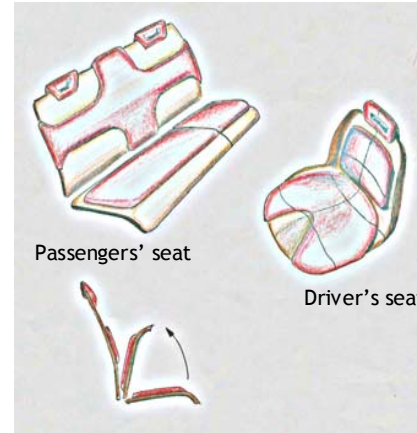


Weaved seats made of nylon ribbons

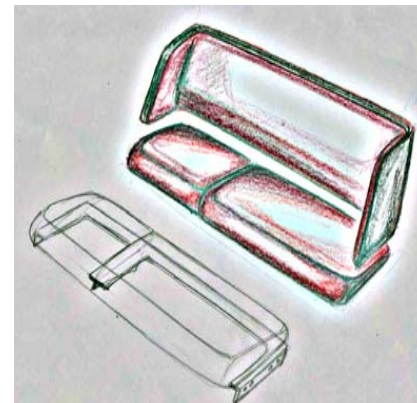


Pressed sheet metal base with normal cushioning with rexin cover

DESIGNS IDEAS AND ALTERNATIVES FOR INDIVIDUAL PARTS

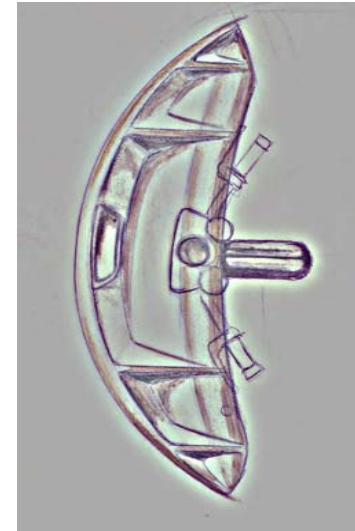
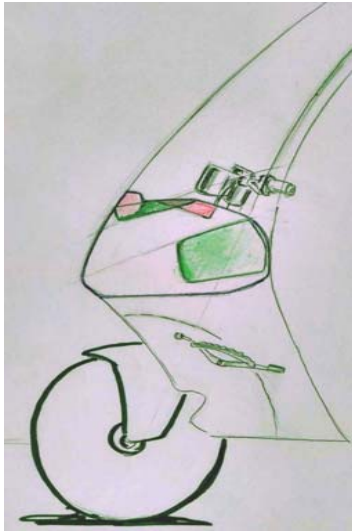


Steam pressed plywood seats-slim and optimised cushions in bright colours



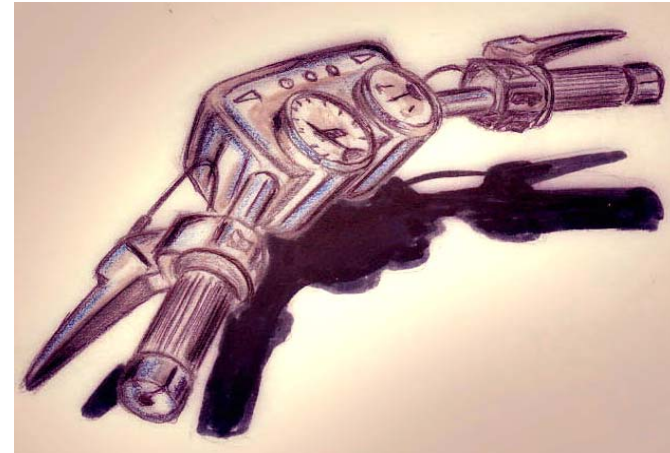
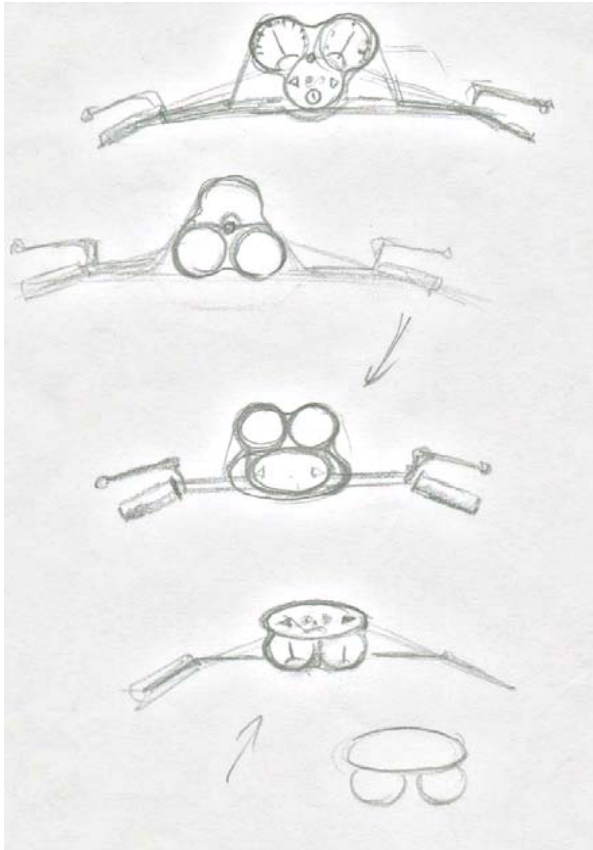
Plywood seats and with integrated shoulder pads

Dash board



Variation of Slotted dashboard for keeping coins, news papers, matchbox, agarbattis etc

Handle bar

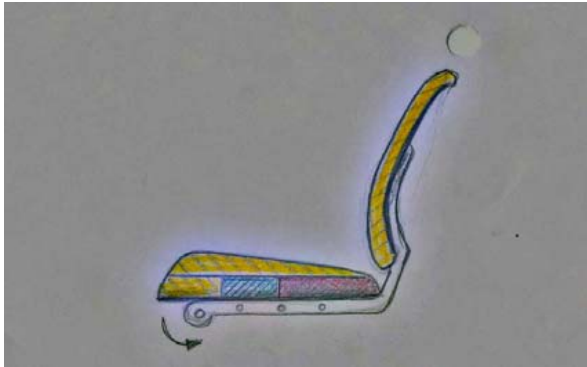


Brushed steel finished handle bar integrated with aluminium die casting parts

Display cluster integrated in the handle bar itself

Meters are exposed on the driver's side because this side will be visible to the user and not the front side unlike motorbikes though the essence has been taken from motorbikes.

Driver's seat

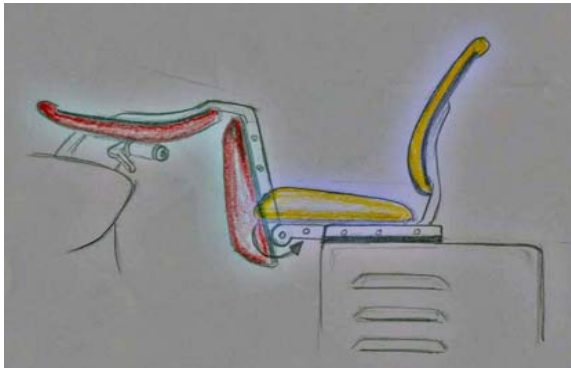


Adjustable driver's seat for all sizes of people and foldable to access the engine

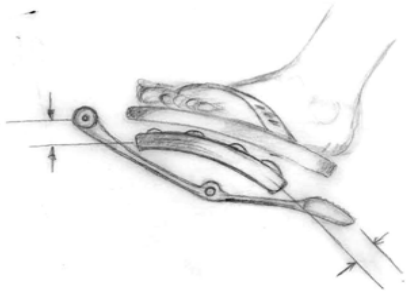
There will be three mounting positions, which will be for 5th., 50th. and 95th. % ile people.

The seat has to be mounted on a rubber plate so as to dampen the engine vibrations

The whole seat can be rotated on the pivot point shown in the diagram so as to access the engine in case of breakdowns.

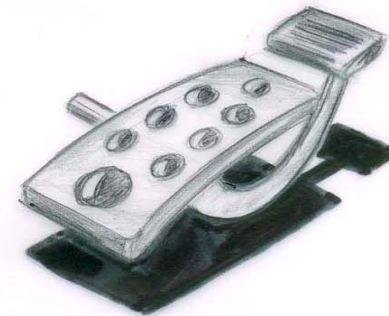
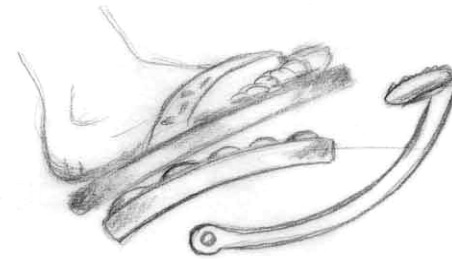
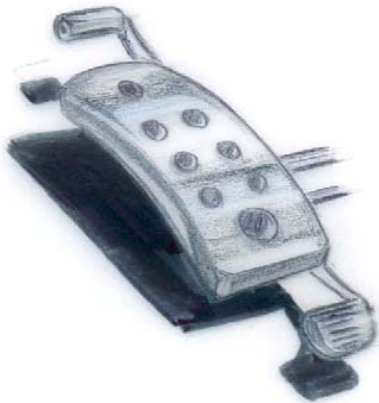


Gear Lever And Brake Pedal With Footrest



Curved foot rest for easy operation of the levers as it allows the foot to be rotated about the required instantaneous axis

Foot movement doesn't get arrested while pressing the brake or gear levers

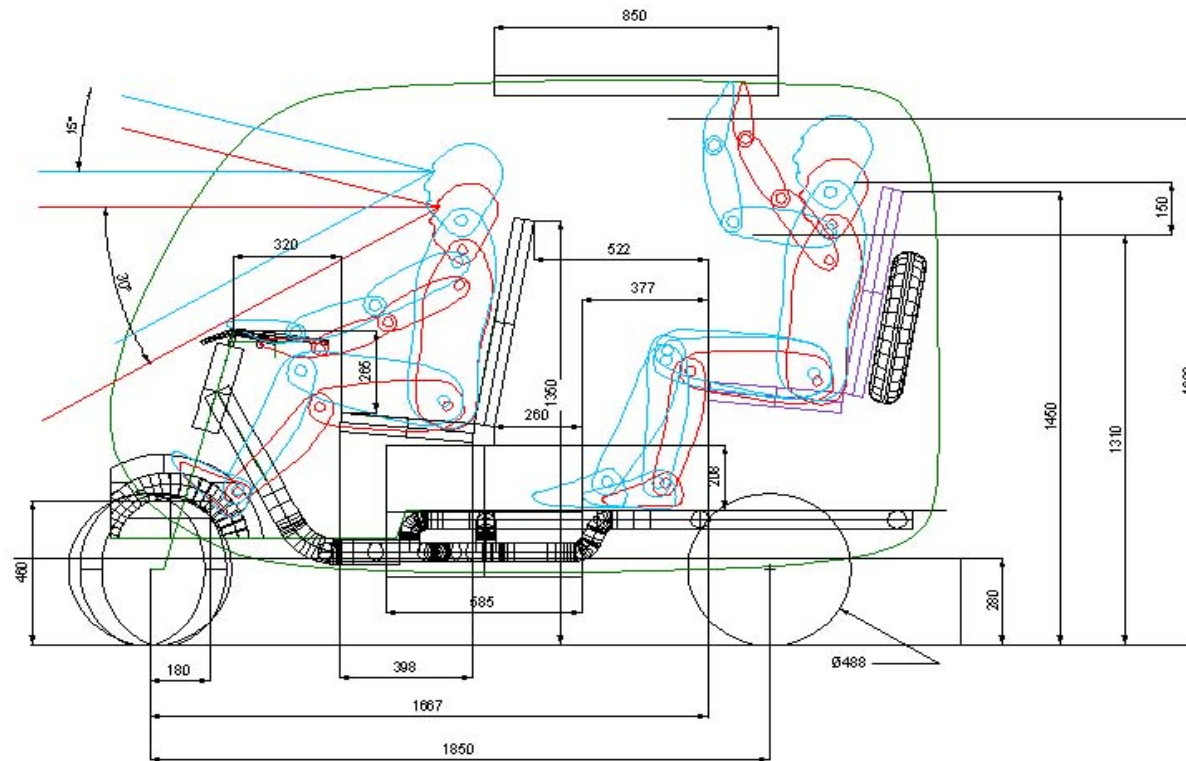


FIRST STAGE OF REFINEMENT

Required Dimension For Interiors

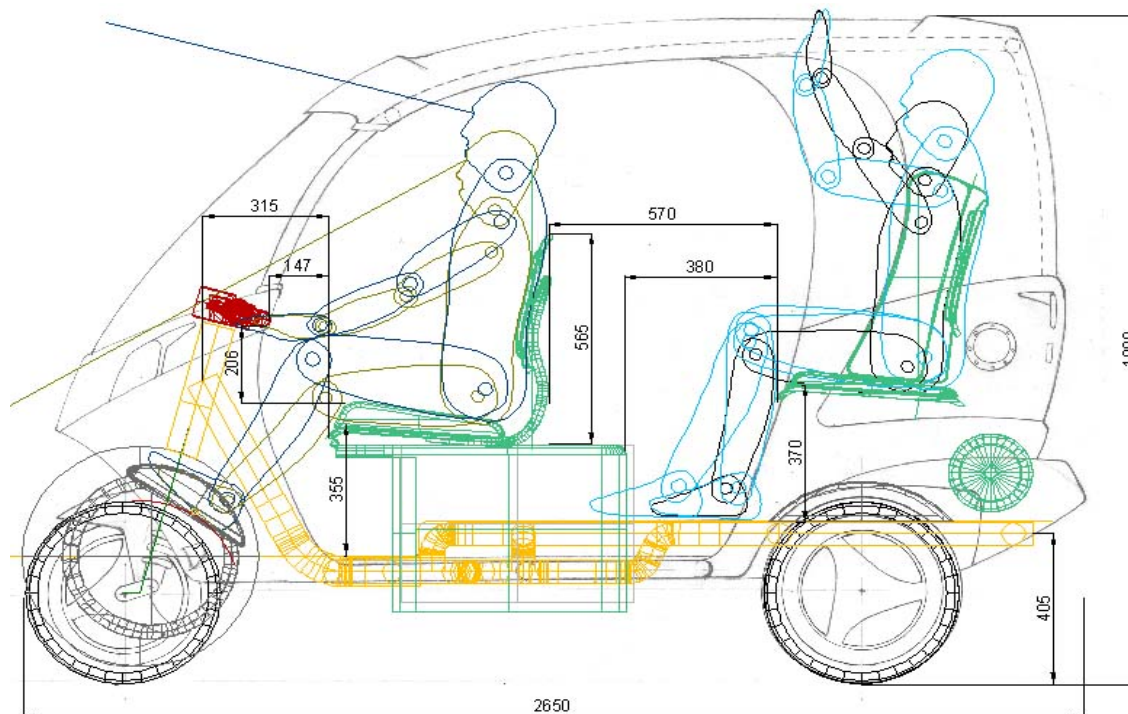
With the help of anthropometrics we have fixed the position of the seat and refined the seating postures of the driver as well as the passengers.

The placement of various components were checked and the requirements for the minimum internal space and visual transparency was put forward to the exterior designer so that he can style keeping the hard points in mind.



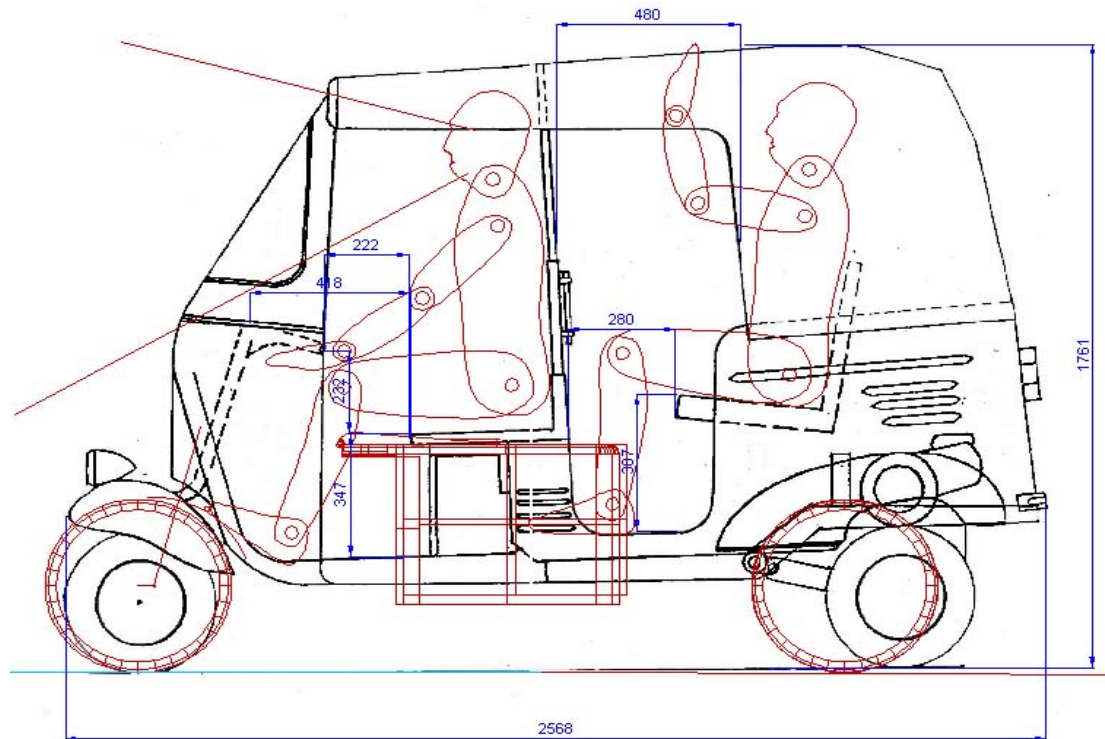
Exterior Layout With Internal Requirement

The drawing of the side elevation of the exterior design was given and then checked putting the interiors accordingly. Important dimensions were then taken and compared with Bajaj RE dimensions later. The overall dimensions like height, width and length of the rickshaw was finalised.

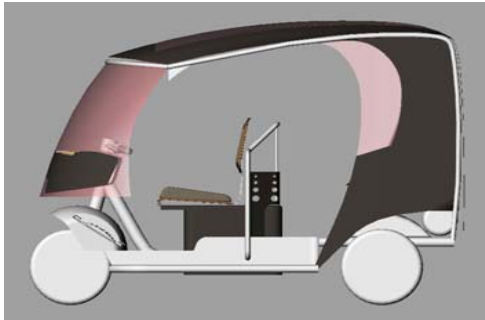


Bajaj RE Seating

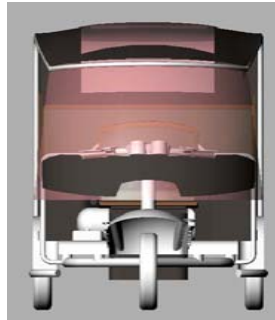
Dimensions were taken of Bajaj RE was taken to compare with our design in order to claim our superiority over their design.



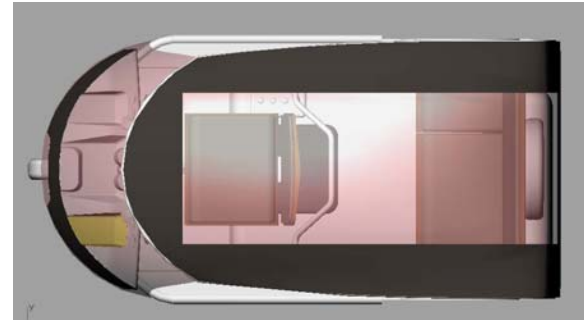
CAD Model



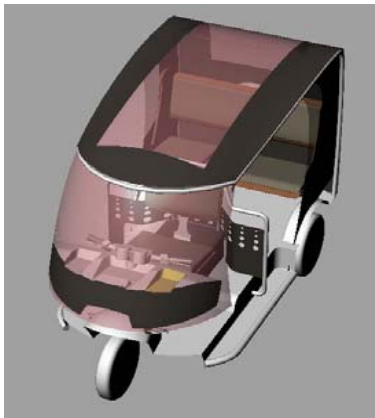
SIDE ELEVATION



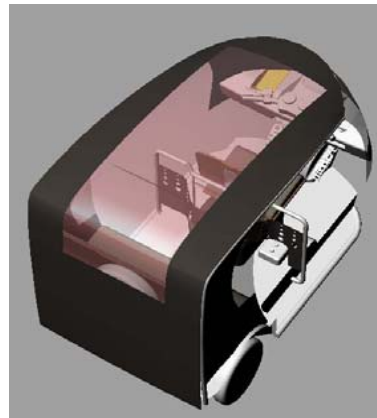
FRONT VIEW



PLAN



FRONT $\frac{3}{4}$ VIEW



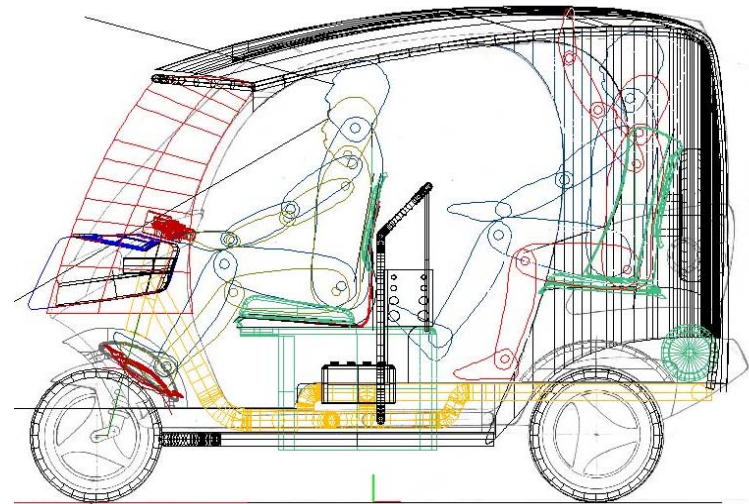
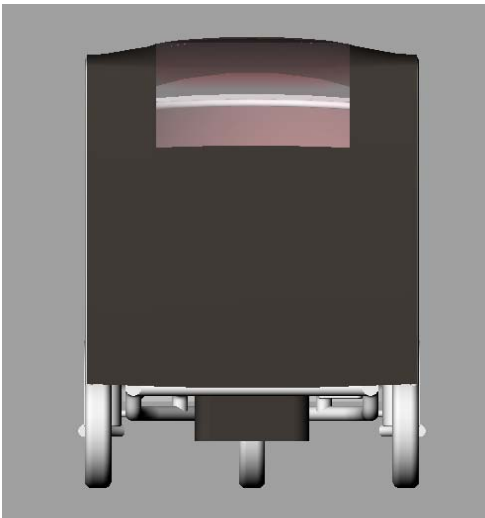
REAR $\frac{3}{4}$ VIEW

CAD model has been created for the interiors with and fitted on to a roughly done exterior with correct dimensions to verify the design

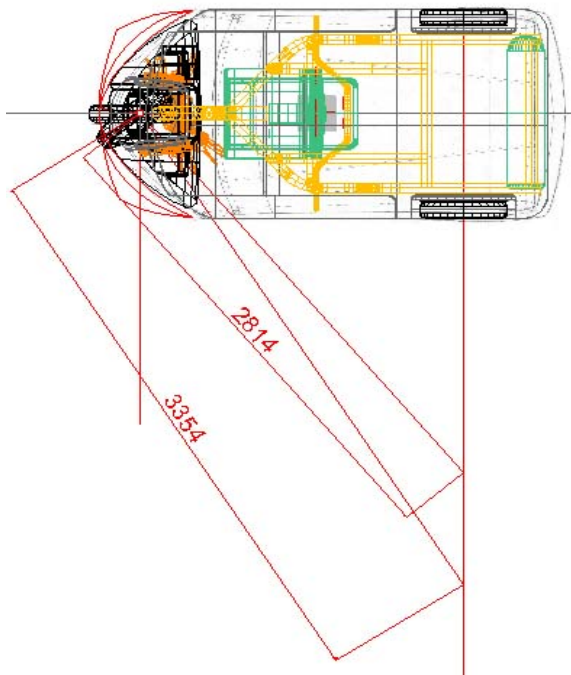
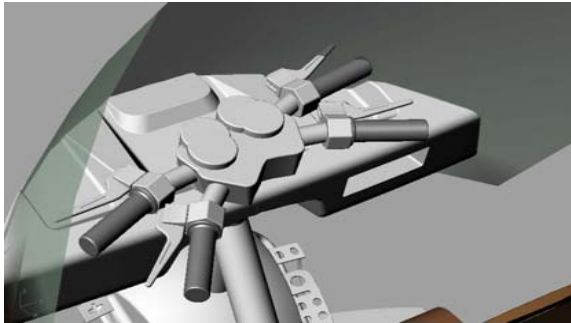
Visible Area



- Transparent side hood gives a good visibility even when the passenger is leaning in the backrest.
- Back view is possible because of absence of head rest and also the height of the backrest allows it
- Transparent area right over the top of the passenger in the canopy area, which could be control by using some blinds or curtains, discussed later.
- Side visibility is improved to a greater extent. Even 95th. % percent



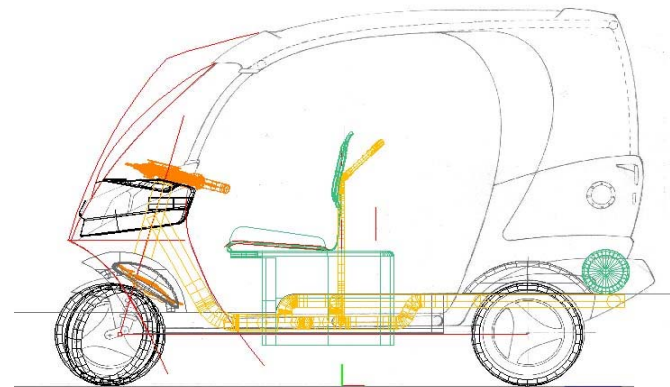
Problems With The Design

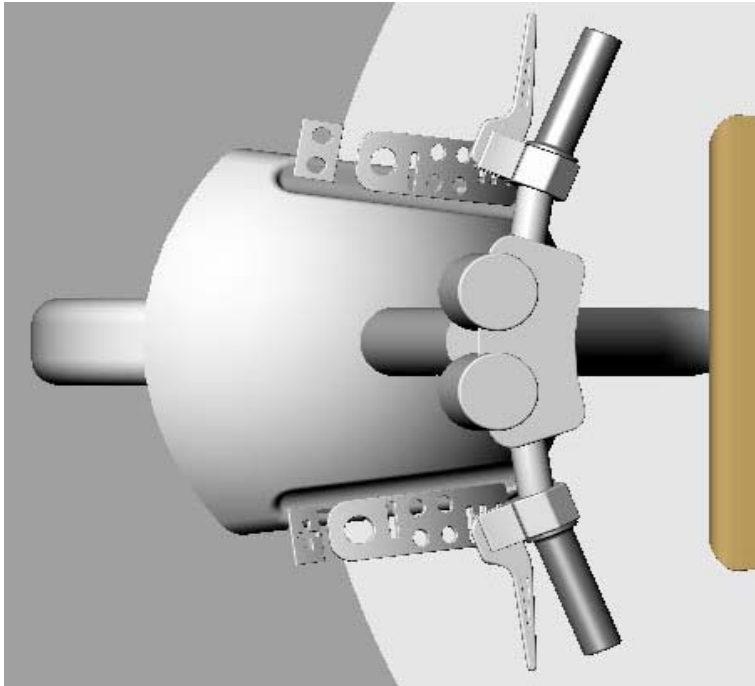


Turning radius

Handle Bar Rectification

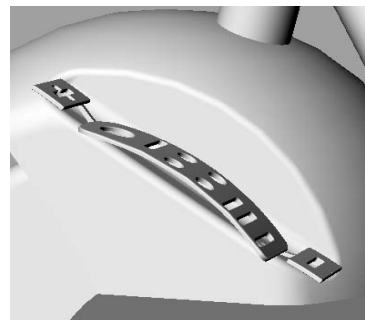
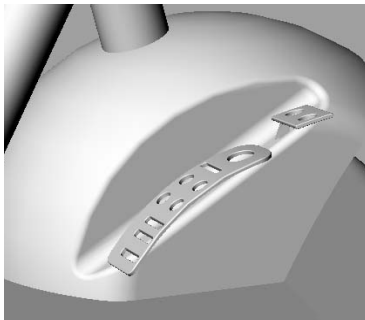
- ❏ Handle bar hitting the wind shield, because of more wind shield rake.
- ❏ Turning angle is 40 degrees, where as Bajaj RE's turning angle is 32 degrees.
- ❏ Some adjustment has been done by both the exterior and interior designer.
- ❏ The respective turning radii of Bajaj RE and our design are 3.35 m and 2.8 m.
- ❏ The exterior designer has rounded the front panel which was earlier too much converging and also reduced the rake angle
- ❏ The handle bar has been redesigned so as to have different pivot point which will avoid contact with the wind shield.

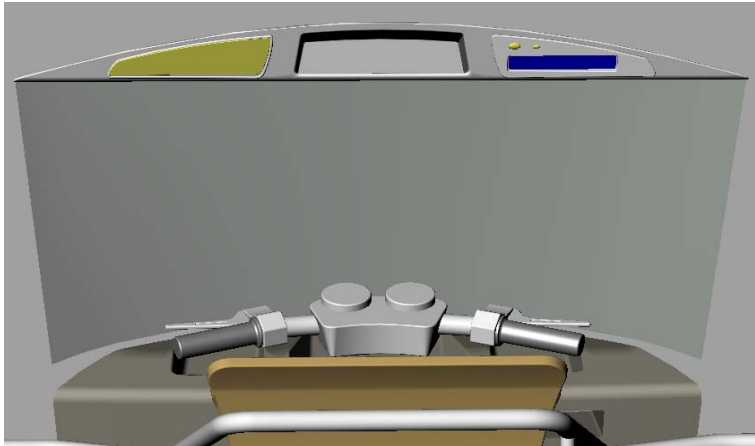




Footrest And Foot Levers

- The foot rests were too narrow to put the feet
- Manufacturing cost will increase if the slots have to be stamped out and then bend, so drilling would be a better solution
- No place for the linkages under the wheel well
- Length of the foot rests have to reduced a little bit

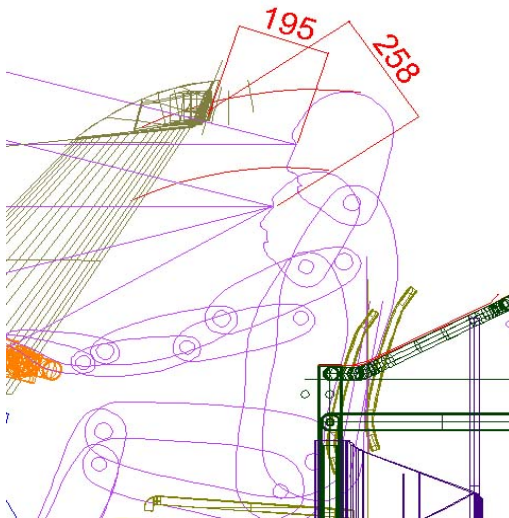


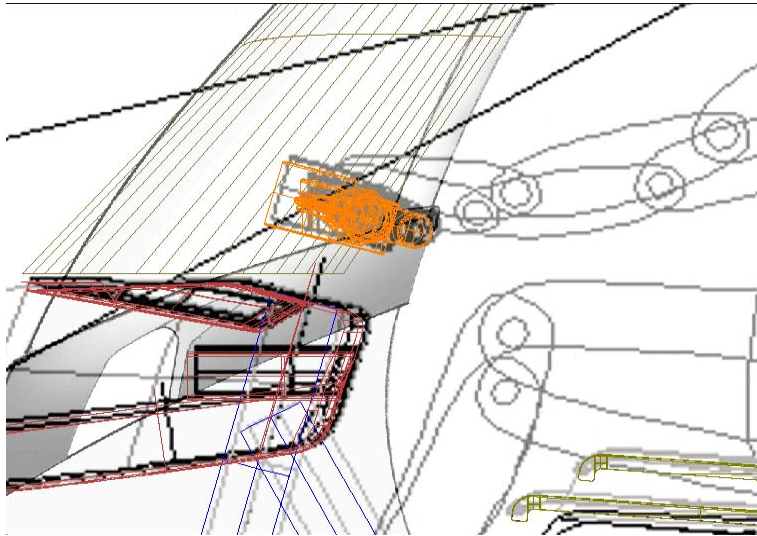


Fare Meter And Rear View Mirror

Box given for matchbox and newspapers in the centre of the panel is too close to the head of the 95th.% ile driver. Feels claustrophobic and might obstruct the view ahead

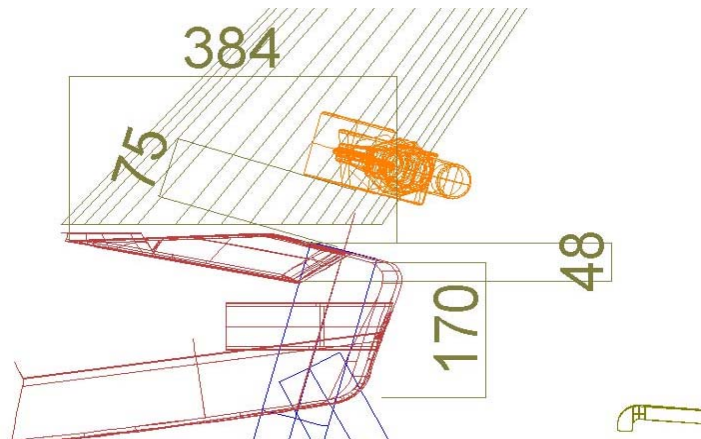
Rear view mirror too close and in the corner, so it won't be of much use to the driver.

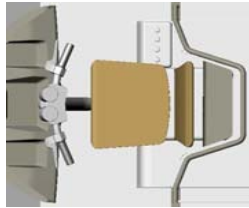




Handle Bar Clearance

- Clearance between knee and the bar was too less.
- The figure shown is of the raised handle bar to show the clearance. The posture of the driver is further improved as he can reach the bar more easily and the seat can slightly be taken back. To increase the height of the handle bar we have not changed the column angle.



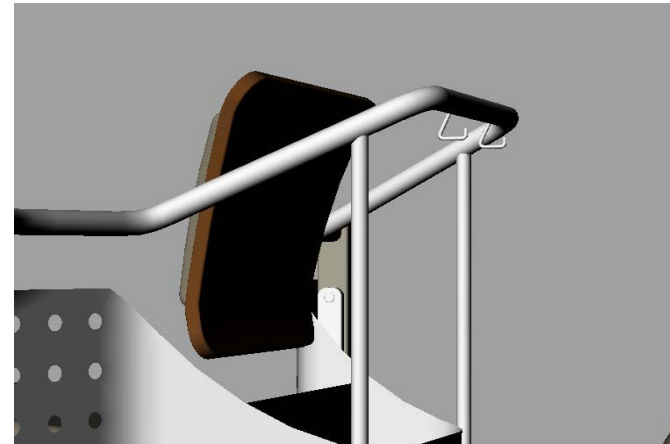
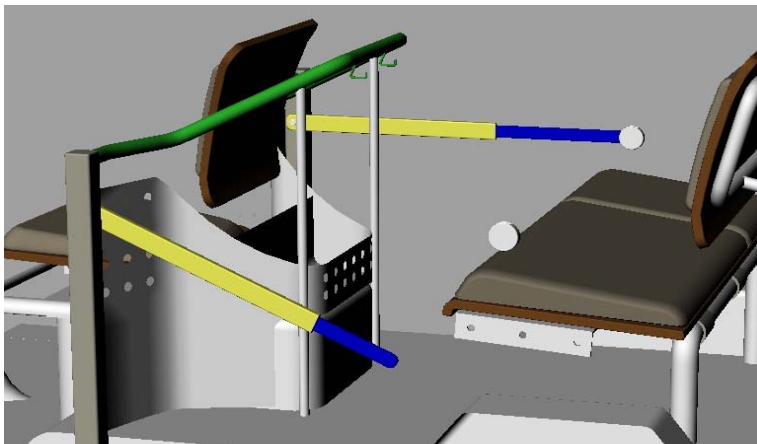


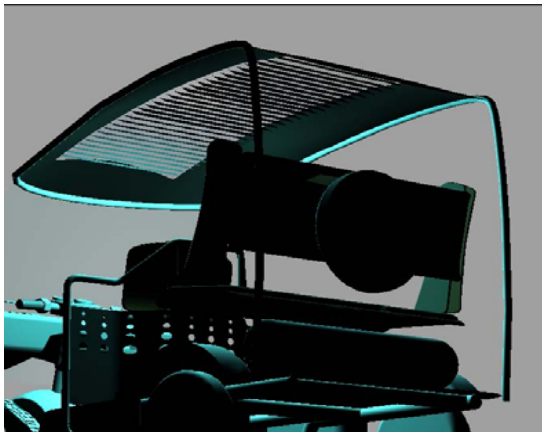
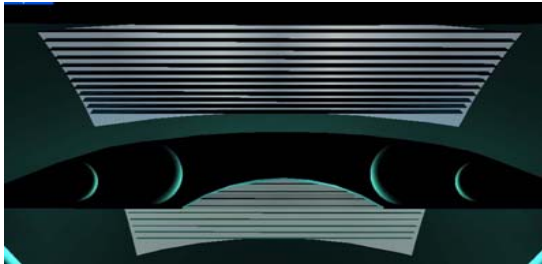
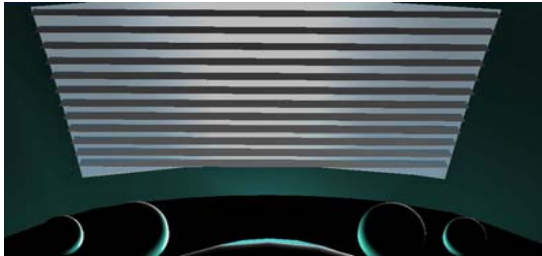
Odd Shape Of The Grab Rail

- The shape is too much sharp, should be given some curves to gel up with the overall form
- Ingress / egress problem for the driver. The mounting position should be shifted back

Child Safety

- Extendable bar pivoted in the central pillar will come out and locks in the side panel of the passenger cabin. The activity time is more in locking and unlocking and put it back to its original place and also the central pillar will be shifted towards the passenger cabin, so the design has to be changed.
- The hooks for polythene bags are sticking out of the grab rail which might hurt small kids.

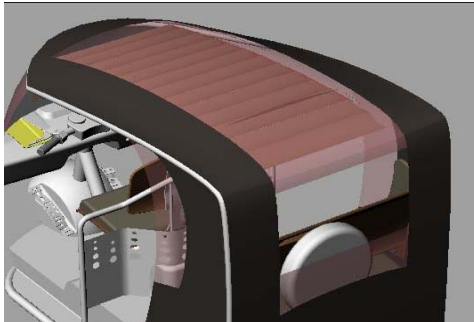




Blinds

👤The idea of giving blinds is to create a new riding experience for the passengers which is otherwise very monotonous. The light / sunlight can be controlled if not wanted by the passenger by the help of a knob.

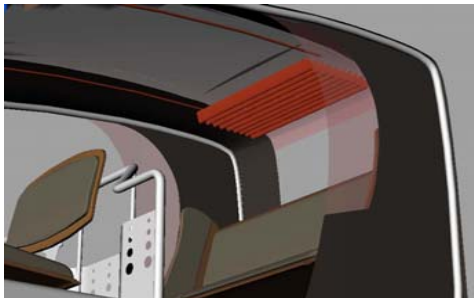
👤It is an option which may not be very practical due to maintenance problem.



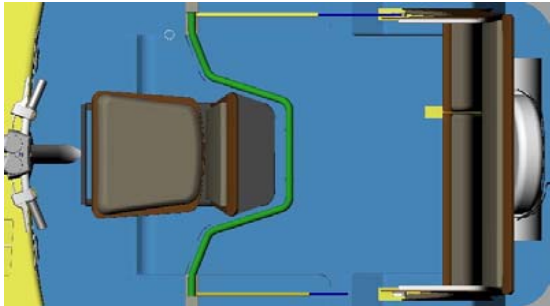
Retractable curtains

Another idea was a transparent top with retractable curtains that slides along to guides. The passenger decides how much visibility he wants. The experience of viewing something like sky, trees, street lamps, stars, buildings etc., which otherwise is not possible in any of the existing vehicle.

Due to cost and non availability of long lasting transparent material the idea can be just another option for the company to produce.



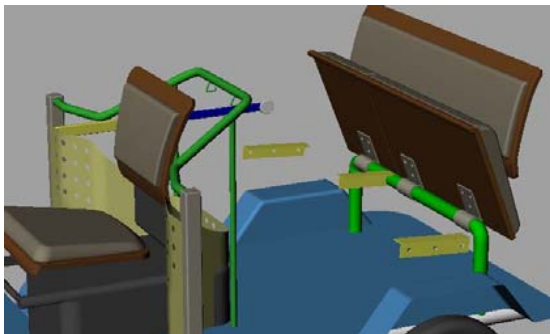
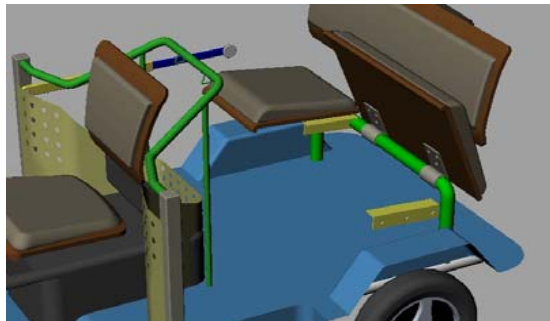
Some good features to be taken forward

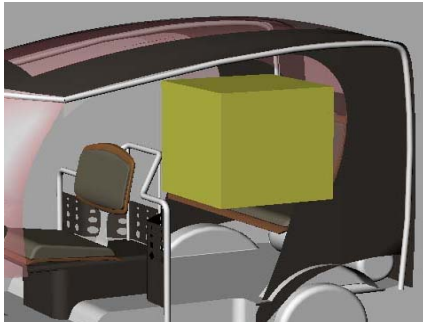


Space created when seats are folded up

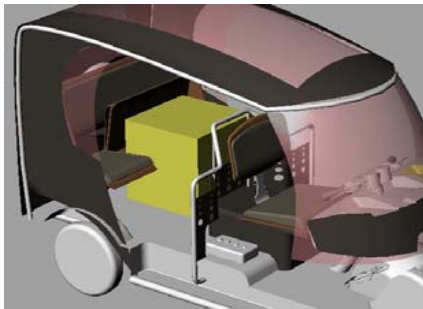
The space created when the seats are folded up is phenomenal. Some of the scenarios are shown in the figures to come.

Seats can be folded two at a time or smaller and bigger individually.

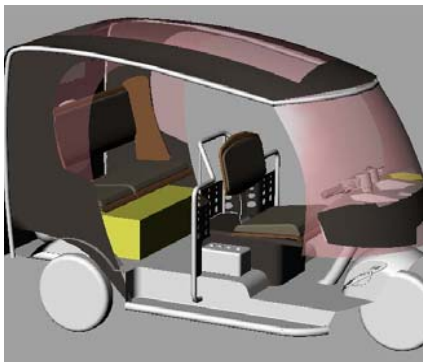




(a)



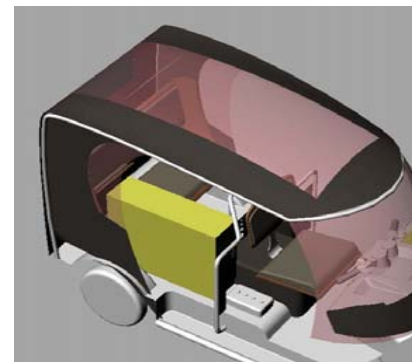
(b)



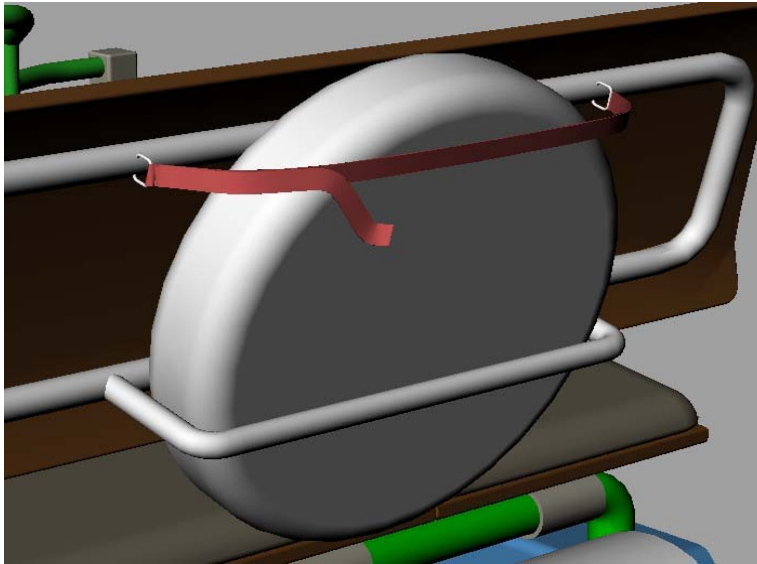
(c)

Scenarios

- a) Bigger boxes like computer boxes, TV sets etc can be very easily put it due to absence of full central pillar
- b) Foldable seats allows the flat floor pan to be utilised for keeping the box
- c) Thicker suitcases can slide under the seat which was not possible earlier
- d) Even bigger suitcase can be adjusted if only two passengers are travelling.



(d)



Spare tire mounting position

It is always difficult to bolt and unbolt the spare tire when it is mounted at a height and that too inside, so the mounting is made very simple and fast.

A nylon strap with Velcro tape as shown is used to tighten the tire to keep it in place.

Full scale mock up rig for study purpose and finer refinement



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

- Average three person of approximately 50th.% ile seating quiet comfortably in the 1:1 scale rig.
- No problem with the shoulder width
- Driver's posture is almost achieved what we intended to give.
- Enough legroom for the rear passenger
- Enough legroom for the driver who is 95th. Percentile.

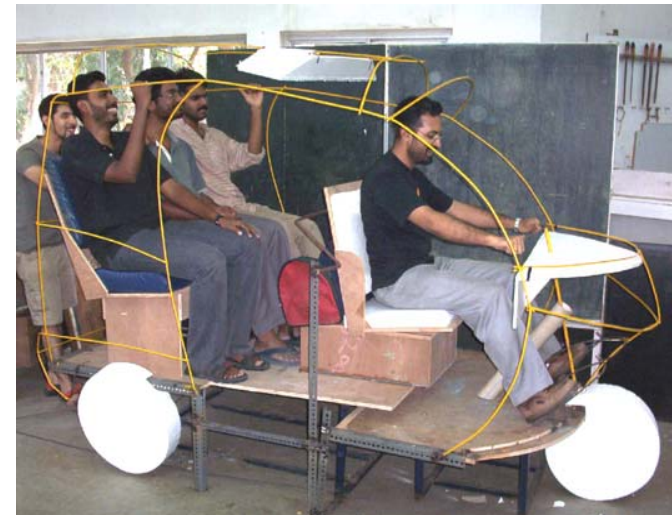


Full scale mock up rig for study purpose and finer refinement

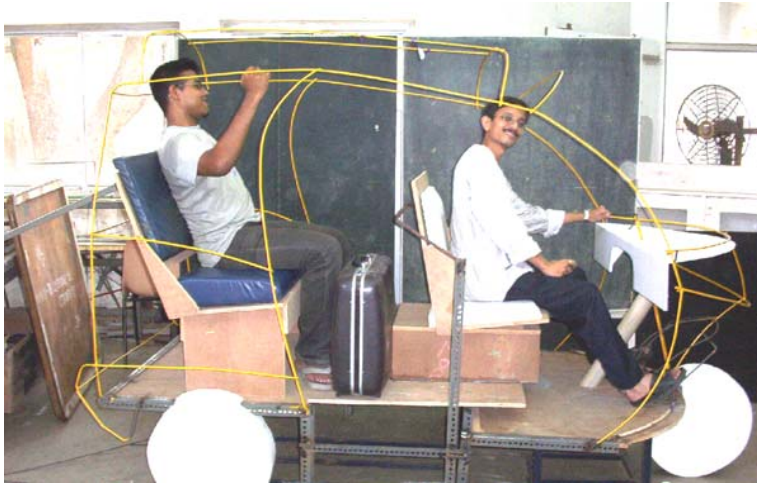


DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

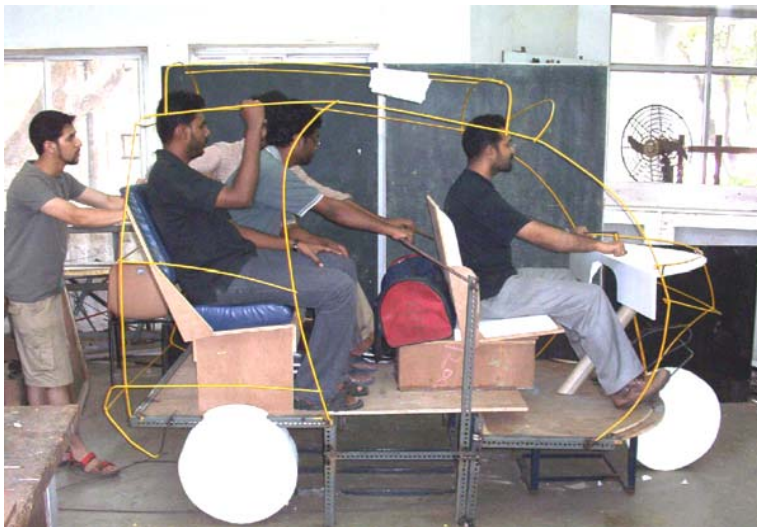
- 50th. Percentile driver with all three 95th. Percentile passengers.
- Somehow adjusted sideways, some interference in the shoulder level, but hip to hip seat is quiet alright.
- No problem with the leg room of the passenger
- Driver's posture is maintained by sliding forward the seat
- As per design, the driver's seat can also have height adjustment and backrest adjustment



Full scale mock up rig for study purpose and finer refinement

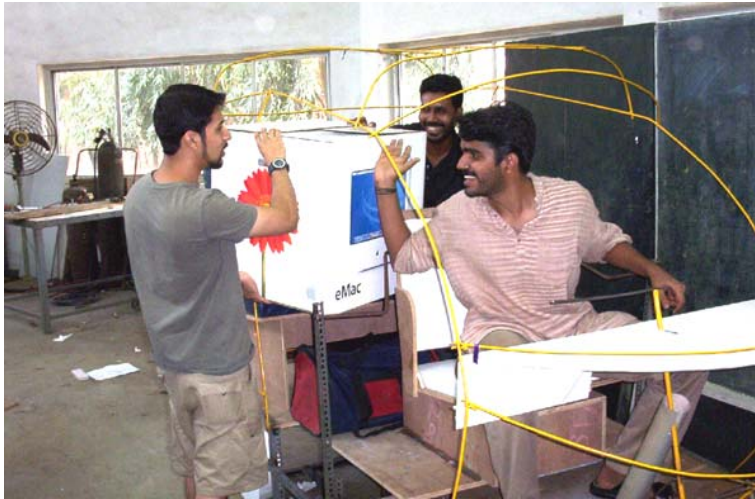


- Enough room for 5th percentile driver
- Space for leg left even if a suitcase is place in front of the passenger
- Grab rail may be too far from the passengers to grab, should be brought back a little bit
- Comfortable hand support position in the front of passenger head in either side of the roll over bars.

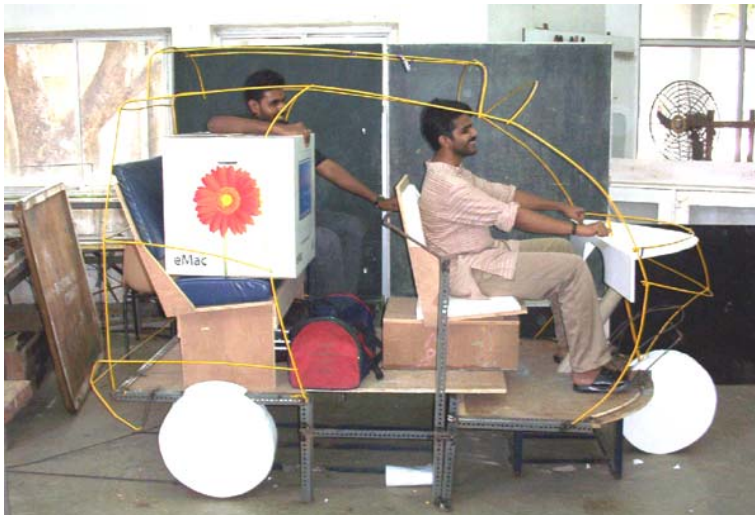


DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

Full scale mock up rig for study purpose and finer refinement

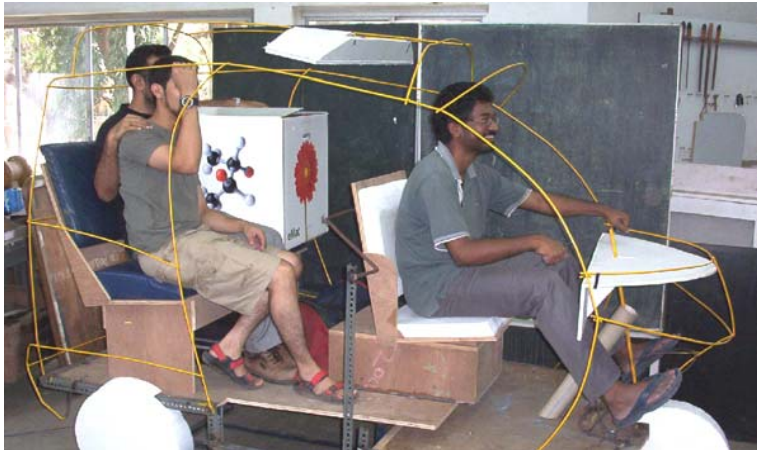


- Putting in luggage like TV sets and monitor boxes is possible due to absence of full centre pillar
- The seat can be folded up either 65 % or 35% at a time so that the box can be place easily
- In this photograph the box is placed over the seat, yet lots of space for a 95 % person to sit comfortably
- Total no. of luggage is three - a suitcase under the seat, an air bag and a monitor box, which is occupying a very less space as compared with Bajaj RE.



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

Full scale mock up rig for study purpose and finer refinement



Two persons and a computer box beside the passengers is also possible



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

Full scale mock up rig for study purpose and finer refinement



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

- Enough ingress/egress space for passengers, even older citizens can get in and out taking the help of the step and grab rail
- Step kept lower so that old ladies can climb taking the support of the rail
- No need to bend down for conversing with the driver even if both are tall



Full scale mock up rig for study purpose and finer refinement



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

• Driver's seat broad enough to seat another person at times when it is necessary, like- learning how to ride a rickshaw

• Nice posture of the driver in terms of height to make him feel proud of his vehicle comparing with the competitor's model



Full scale mock up rig for study purpose and finer refinement

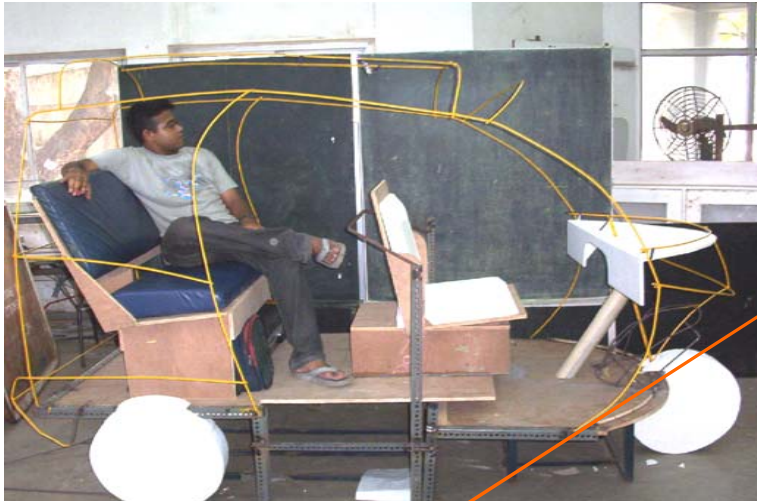


DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

- Enough leg and foot room for the driver
- Very comfortable ride for only two persons regardless of their sizes
- Well composed posture of the driver- looking up straight forward, almost perfect leg position



Full scale mock up rig for study purpose and finer refinement



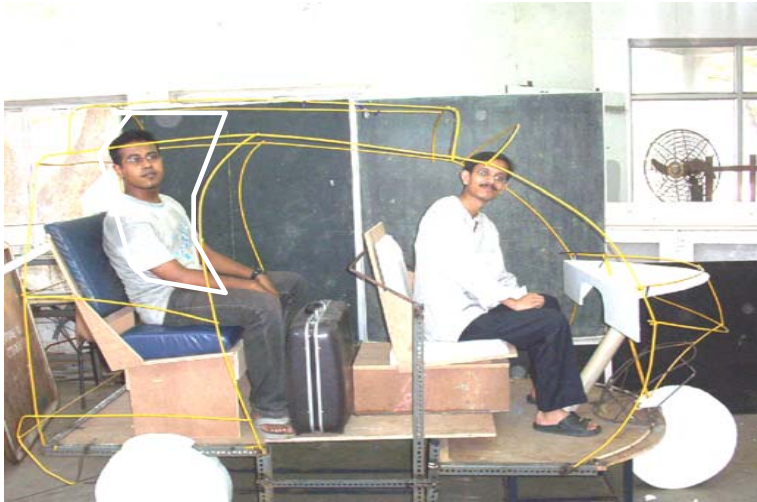
Viewing is not a problem in whatever position one might sit

Transparent area under



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

Full scale mock up rig for study purpose and finer refinement



• Viewing is not a problem even if one is leaning backward, easy to find out places without taking too much pain

• Yet another possibility to keep the suitcase



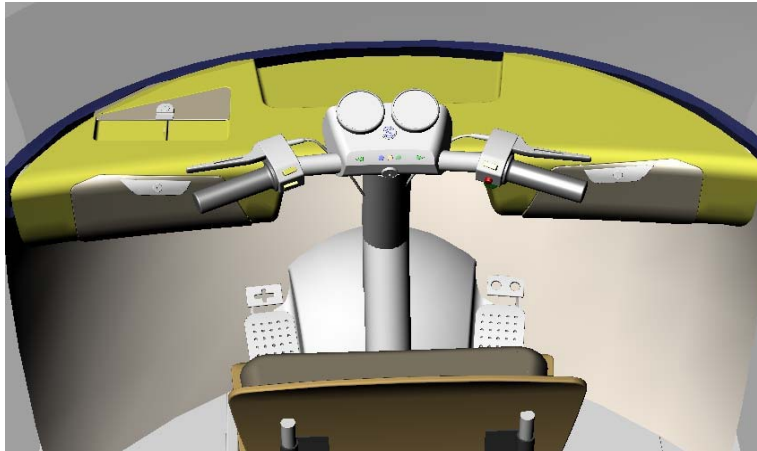
DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

Full scale mock up rig for study purpose and finer refinement



• Enough room for luggage under seat, because the floor board is completely flat

FINAL DESIGN AFTER REFINEMENT

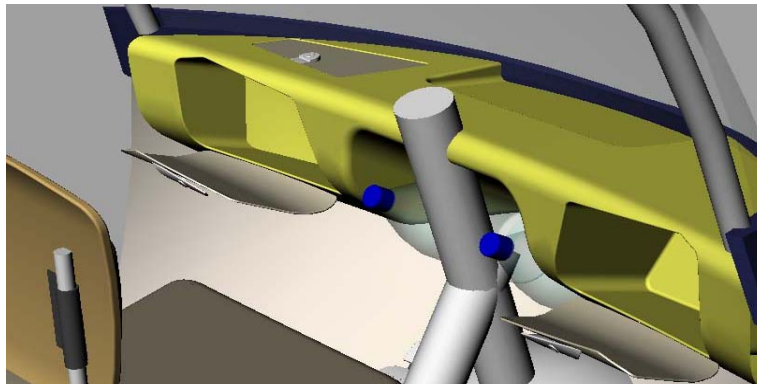


DASH BOARD

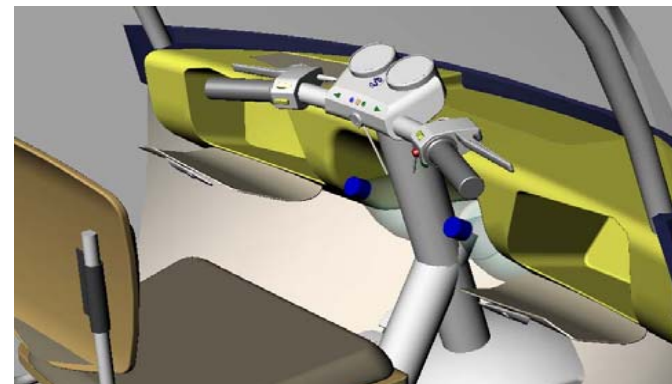
The refined dash board has a big depression in the centre for keeping new papers other things like tariff cards, rag etc.

One coin organizer in the left hand side with slid able cover and locking facility

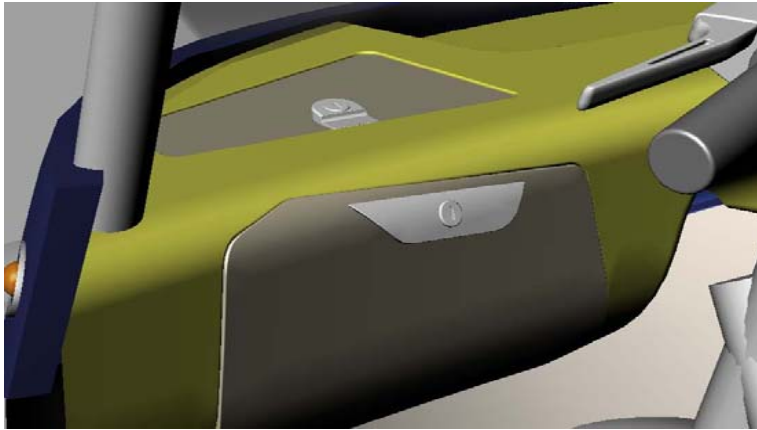
Two glove boxes with locking facilities on either side. One for personal belongings and the other one can be partitioned horizontally to keep music system with FM and tool box.



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

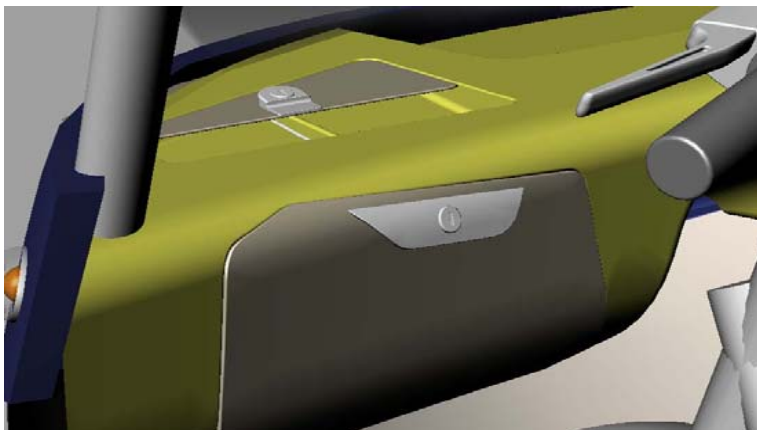


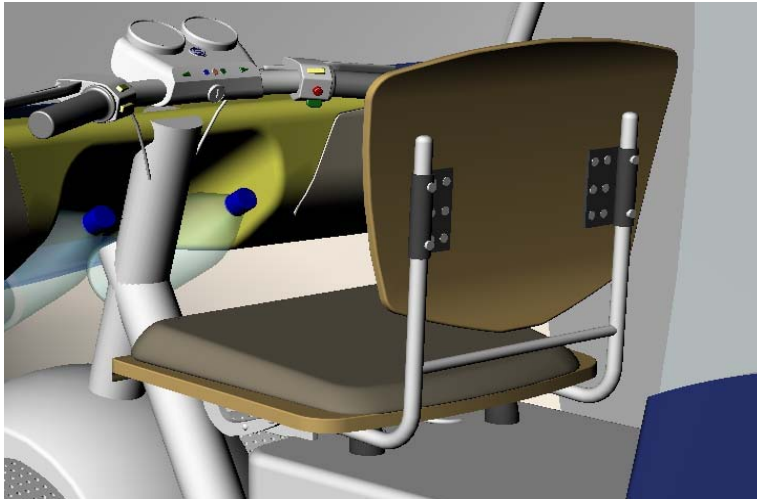
FINAL DESIGN AFTER REFINEMENT



COIN ORGANISER

A coin organizer with two slots for coins is provided with a slid able cover, which can be locked whenever the driver leaves the rickshaw. The depth of the slot is not too much and is sloping towards the driver so that there won't be any problem picking the coins.

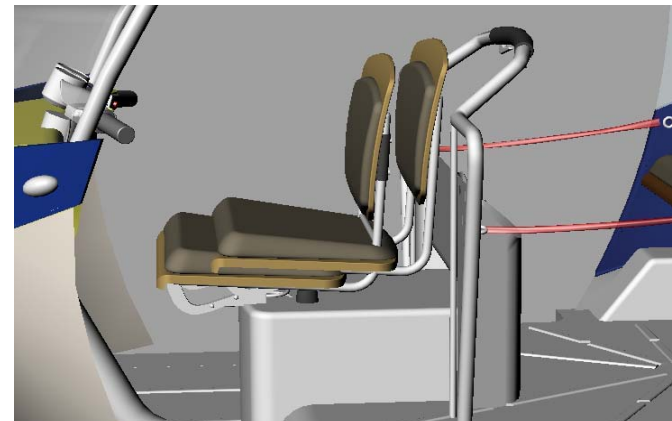




DRIVER SEAT ADJUSTABILITY

The backrest of the driver is mounted on two tubular sectioned pipe in such a way that it can be adjusted for height.

For maintaining the decided driving posture, the seat pan should have an adjustability both in the horizontal and vertical direction, which can be achieved by giving three different mounting positions in a inclined plane. The driver will mount it wherever he finds it convenient.



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

FINAL DESIGN AFTER REFINEMENT

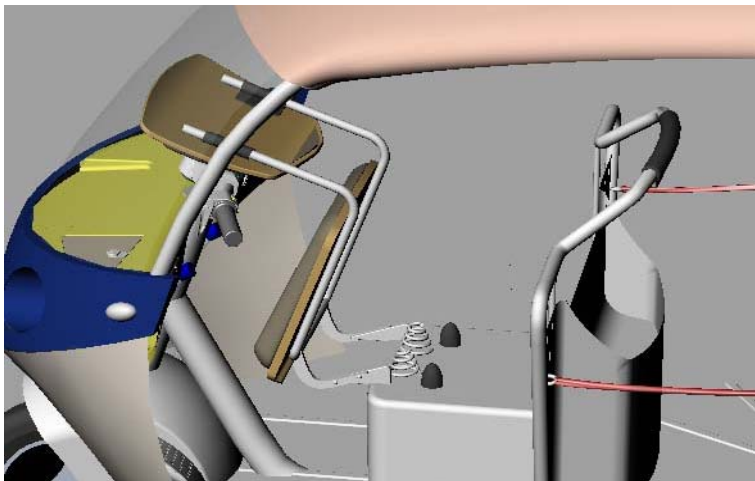


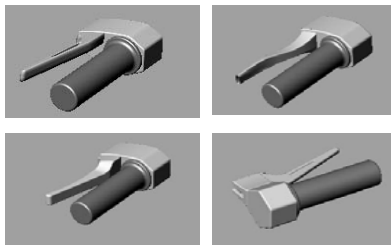
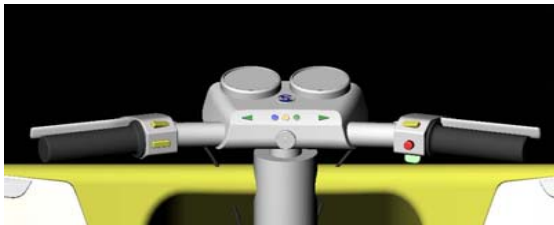
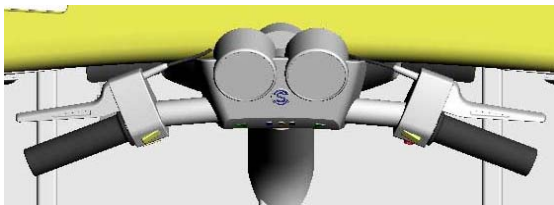
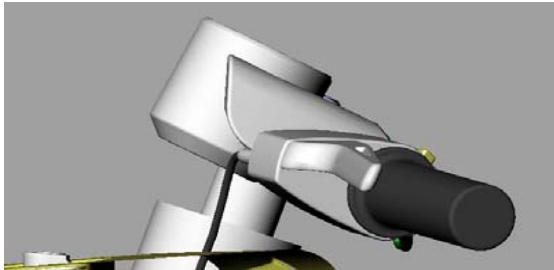
ENGINE ACCESS

The seat is mounted in a plate which has a pivot and can be turned about that point. The motion can be restricted at any desired position after detailing the mechanism later.

Engine is right under the driver's seat which will cause a lot of vibration. To dampen the effect a spring is provided with rubber dampeners to take away hazardous shock.

The seat does not touch the wind screen even if it is turned completely.

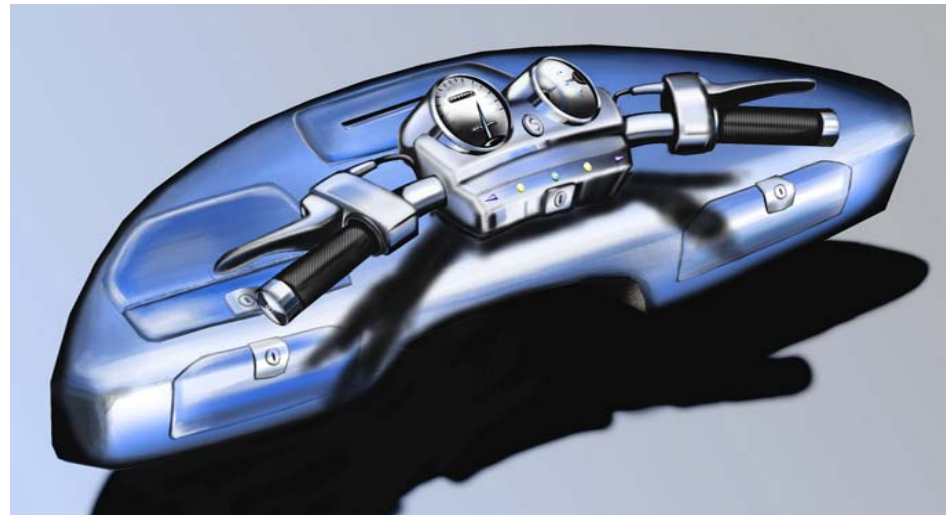


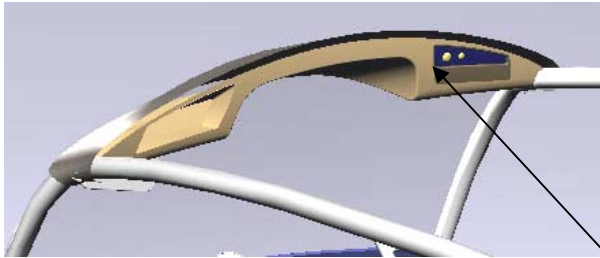


Brake lever alternatives

HANDLE BAR

The previous handle bar was looking like a motorcycle handle bar and somehow not gelling up with the dash board and driver's seat. To bring it close to a scooter handle the round dials were fitted in a box that gives a feel of form transition between motorbike handle and scooter handle.

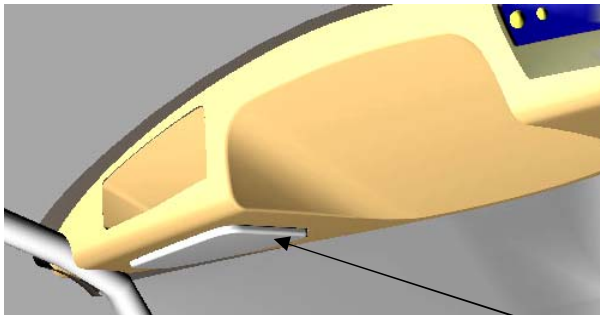




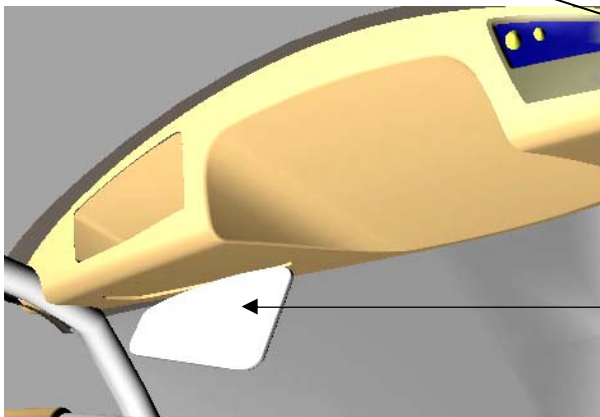
Fare meter panel

Plastic moulded textured panel with integrated digital fare meter on the right hand top of the driver and a small open box for his belongings like beedis, match box and tariff card etc.

Rear view mirror shifted to front left hand side which will be flushed with the panel as shown and can be adjusted at desired angle

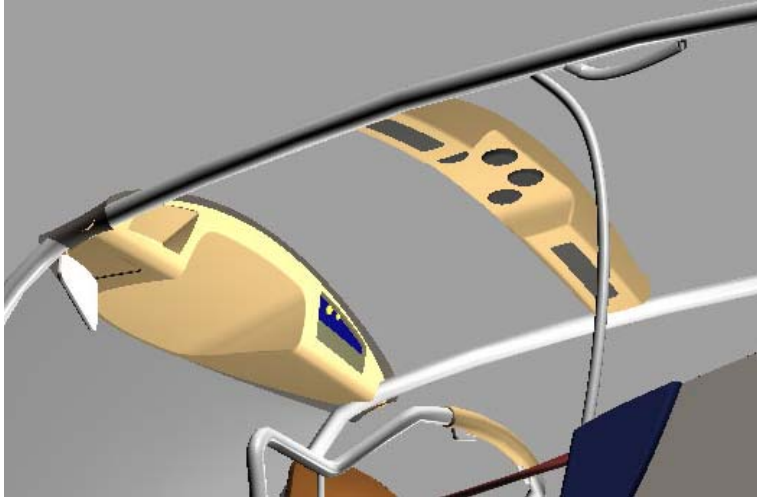


Digital fare meter with set reset buttons



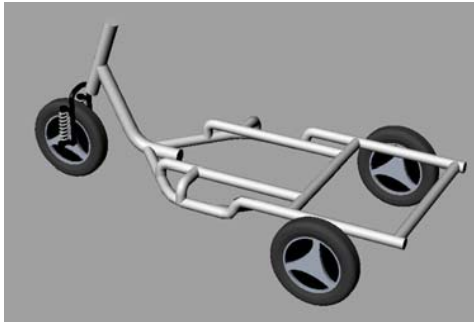
Rear view mirror in closed position

Rear view mirror in open position



Speaker and light panel

Plastic moulded textured panel for speakers and light fittings to be mounted on the roll over bars.

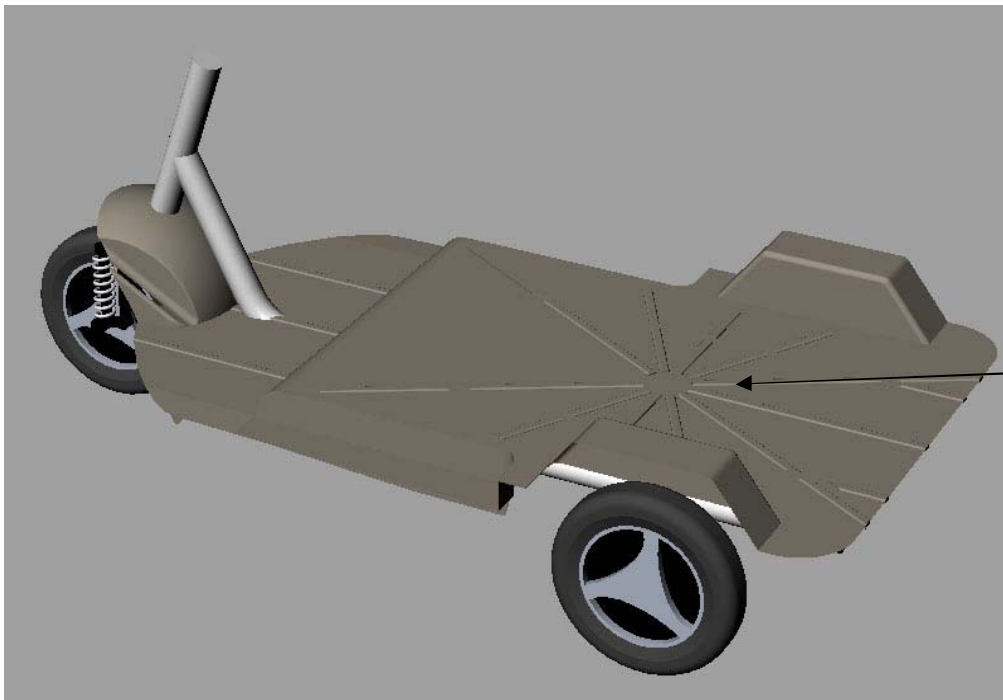


The chassis and the floor board

Floor board is developed to mount it over the chassis given to us. Some of the members are exposed because of design intent.

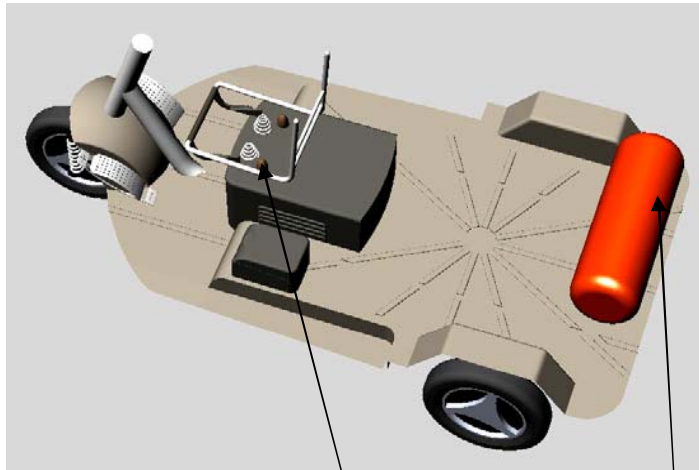
The floor board is strengthened with ribbing which has protrusions in the top side to make it more rigid and less area of contact for suitcases

The density of the ribs are maximum where the approximate centroid of the passenger cabin floor pan is



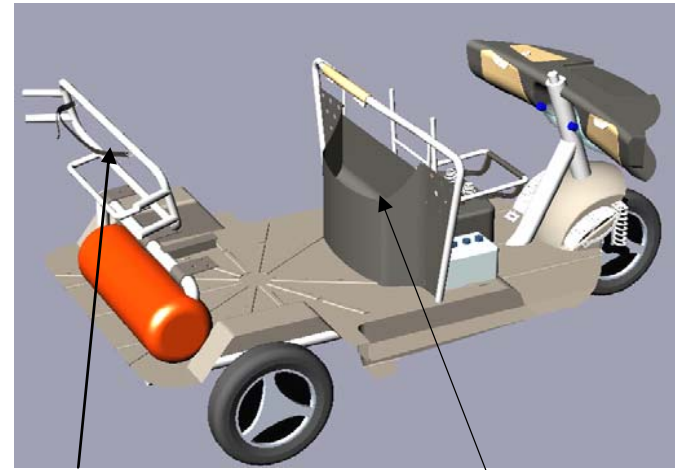
Ribbings in a circular fashion

Layer by layer representation of the CAD model



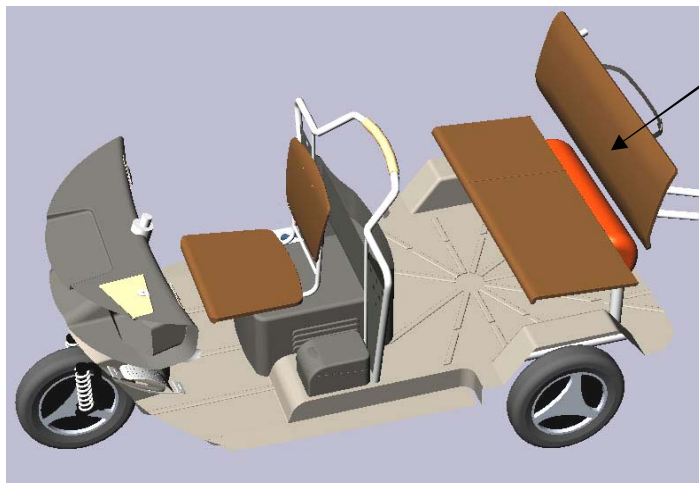
Engine with seat mounting mechanism

CNG Cylinder

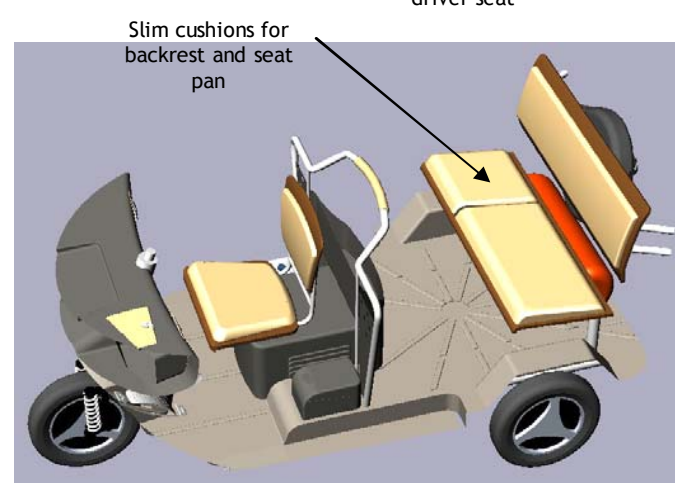


Mounting details of the rear seat

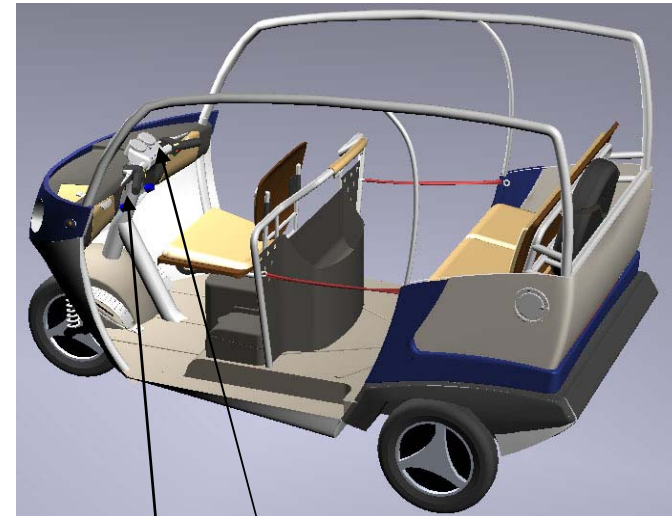
Storage area behind the driver seat



Steam pressed plywood seats



Slim cushions for backrest and seat pan



Handle for rear
passengers

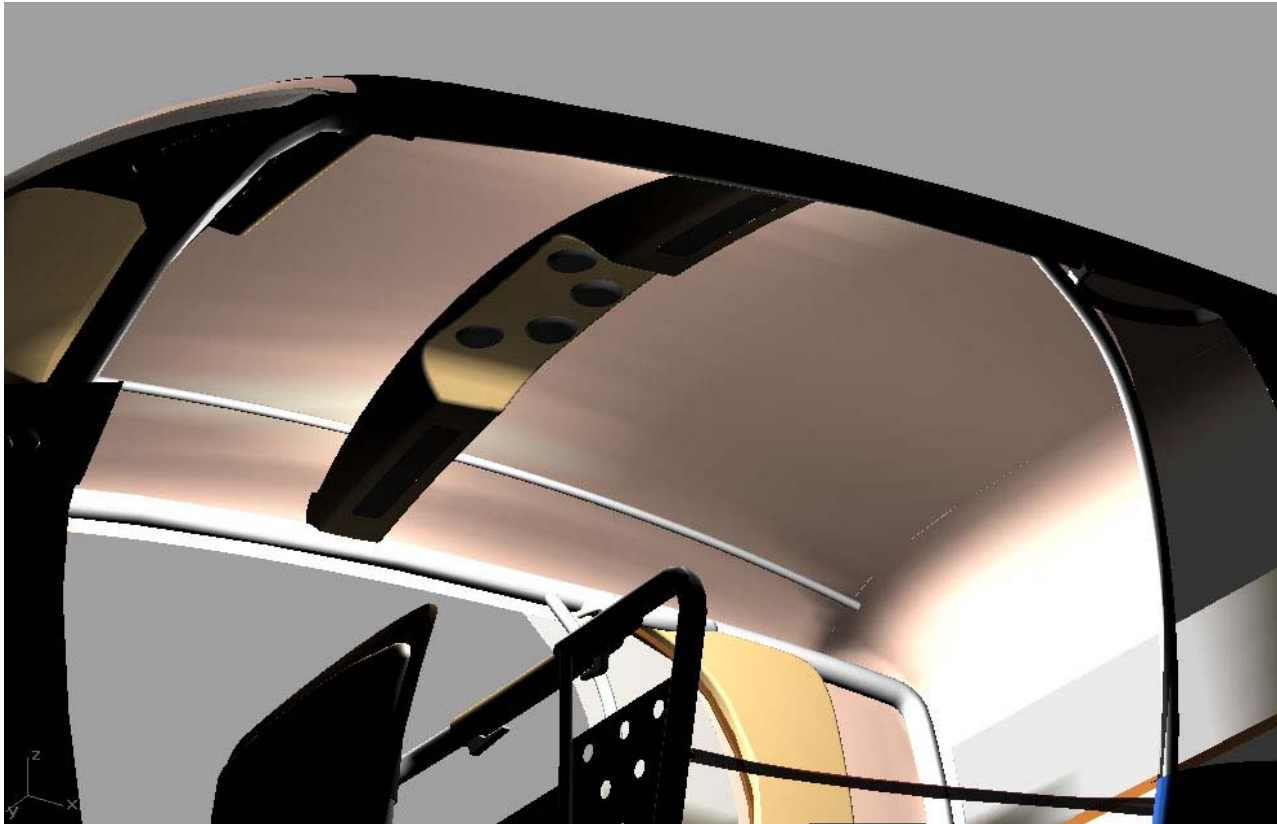
Steam pressed
plywood seats

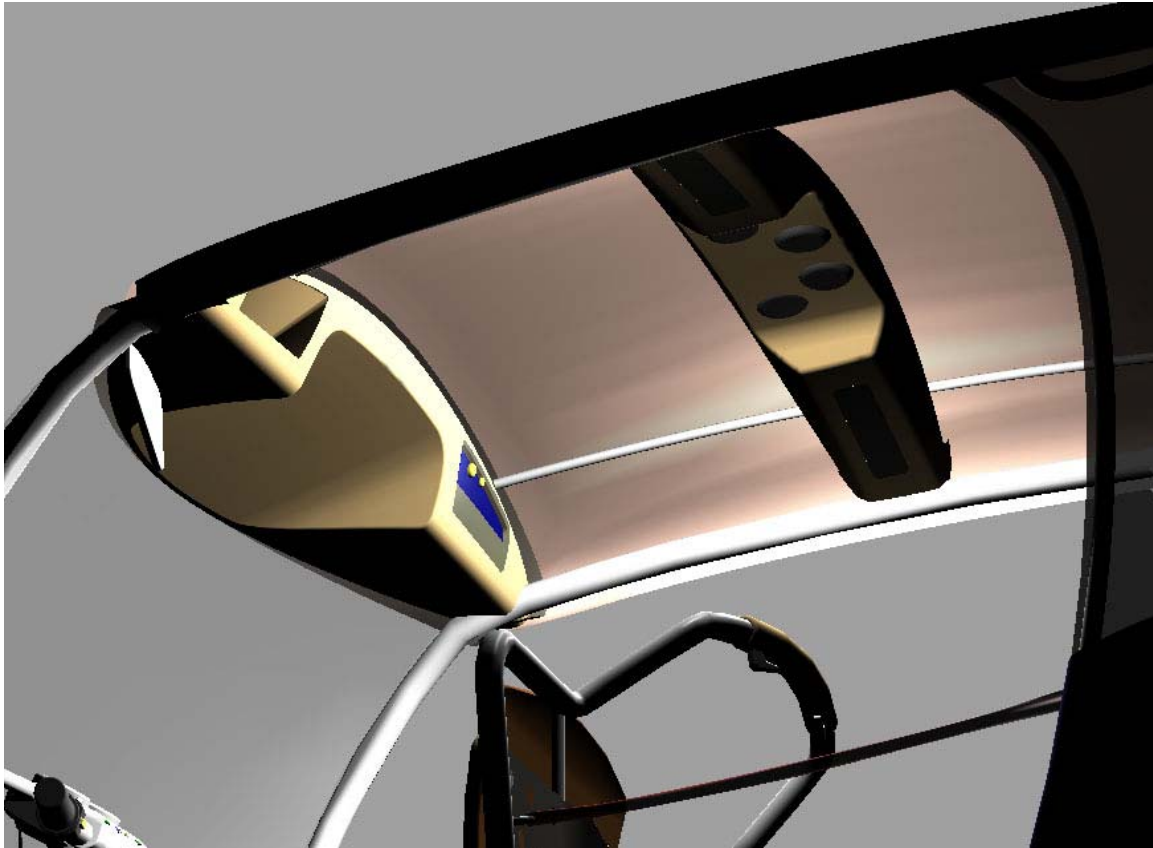
handlebar

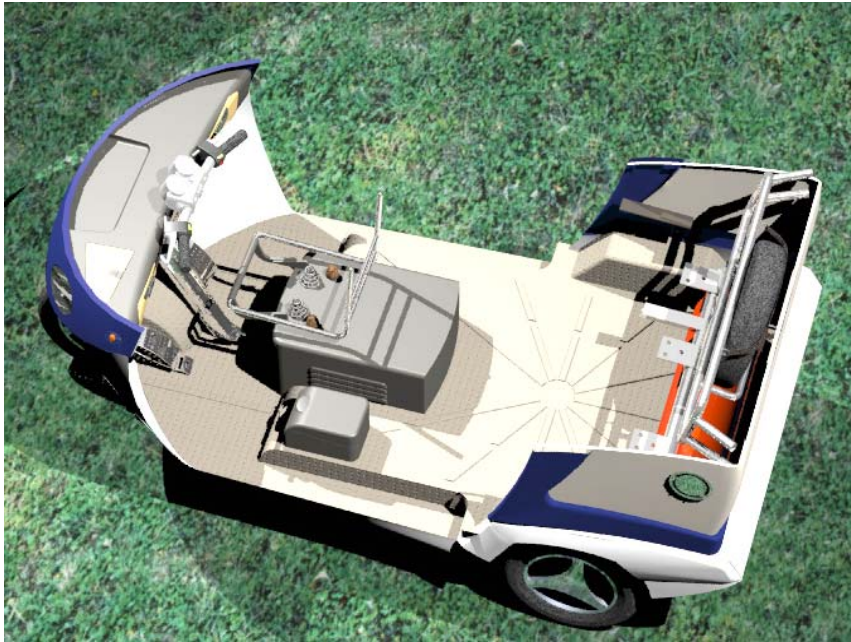
Space for bottle
right under the
dash board







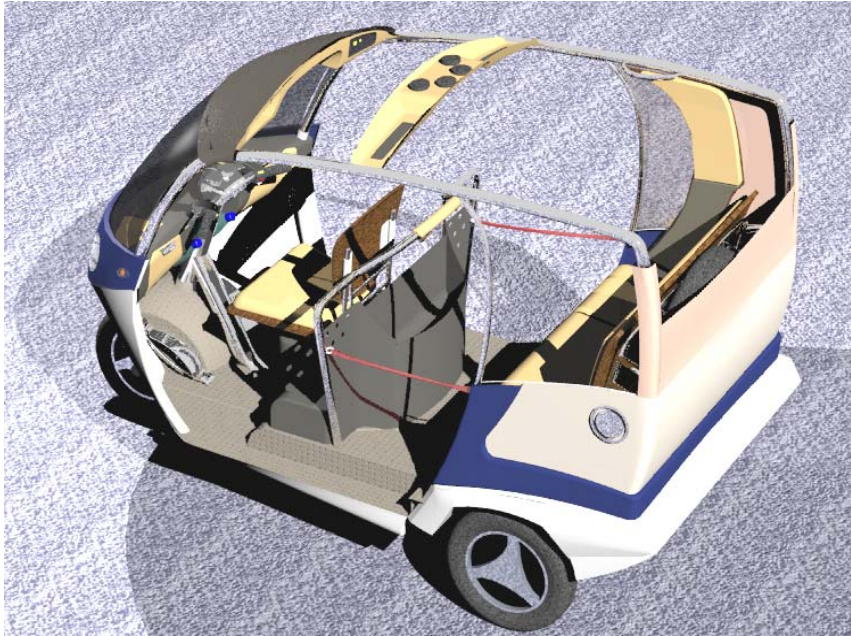




DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)



FINAL DESIGN AFTER REFINEMENT



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)



FINAL DESIGN AFTER REFINEMENT

1:5 SCALE MODEL



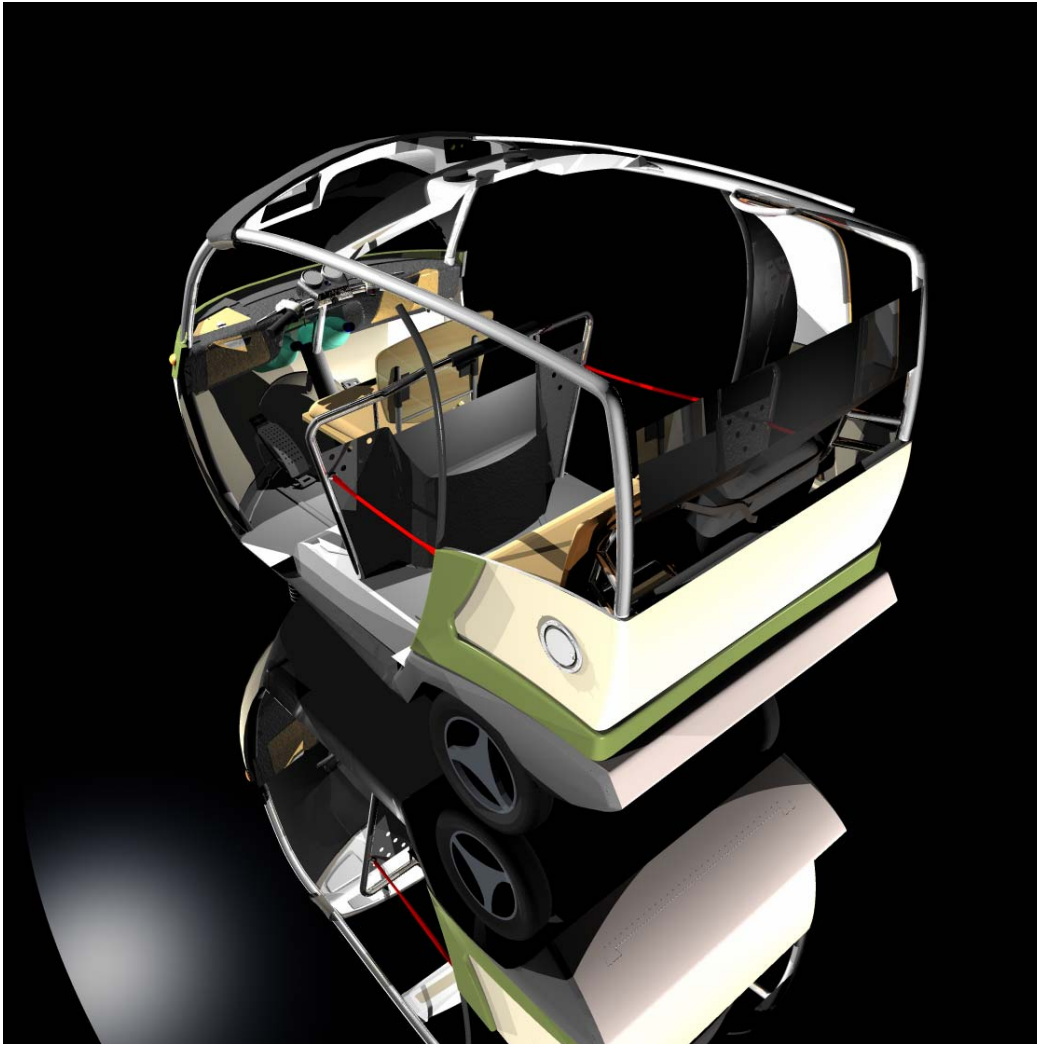
DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

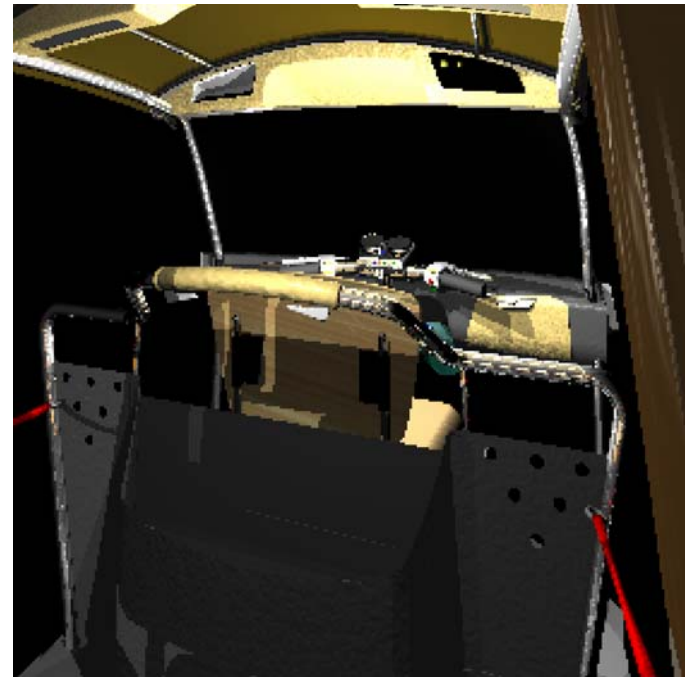
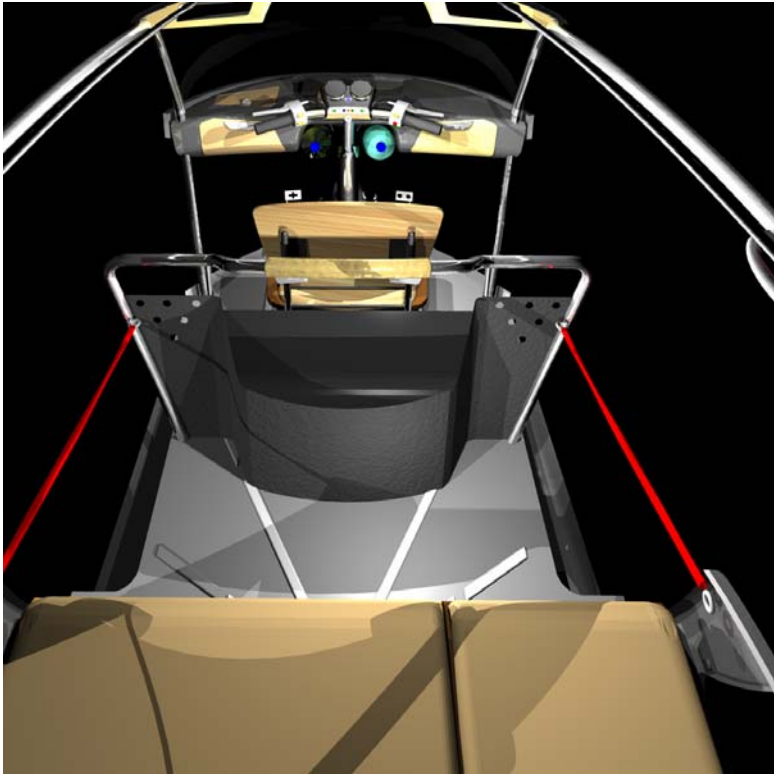
1:5 SCALE MODEL



DESIGN OF A THREE PASSENGER AUTO RICKSHAW (the interiors)

1:5 SCALE MODEL







Exploded view of the auto rickshaw

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■ MPR 100, IDC Library, Redesign Of Auto rickshaw Nov 1991

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■ Auto And Design, April 2004

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Lastly, I whole-heartedly acknowledge and appreciate my project partner “The real slim shady”, Nikhil, whose involvement in the project can never be matched. Without him the project wouldn't have been a success.