



Rickshaw

Exterior Design for A Three Passenger Auto Rickshaw

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# Design of the Exterior for a Three Passenger Autorickshaw

Product Design Project III

By

**Nikhil S. Rane**

02613002

Guide

**Prof. V. P. Bapat**

**INDUSTRIAL DESIGN CENTRE  
INDIAN INSTITUTE OF TECHNOLOGY  
BOMBAY**

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Autorickshaw.....Exterior.....Design

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## Approval Sheet

The project entitled 'Design of the Exterior for a Three Passenger Autorickshaw' by Nikhil S. Rane is approved in partial fulfillment for the Master's Degree in Industrial Design course at Industrial Design Centre, Indian Institute of technology, Bombay

Guide:

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Chairperson:

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Internal Examiner:

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External Examiner

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## Acknowledgements

I wish to express my deepest gratitude to my guide, Prof. V. P. Bapat for providing me with this great opportunity to design such a unique vehicle and guiding me with his knowledge in this area and for going all the way to make things easier for me and my colleagues on all aspects of work.

I wish to thank Prof. R. Hazra, with whom I have enjoyed working previously and continue to do so under his guidance and constant encouragement.

The company has given me a great opportunity to understand real life problems and to design a unique and very useful vehicle for which I am very indebted.

A heartfelt thanks to Prof. M. Bhandari for encouraging me at all times with his valuable comments and suggestions.

My sincere thanks to all my colleagues, the faculty and workshop staff for taking interest in my project and enriching my work with their valuable inputs.

I must thank my colleague, Abhijeet Kumar (Project on Interior Design of Autorickshaw) with whom I learnt the essence of teamwork and the subtle joys in working together.

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## Abstract

The 'Autorickshaw' has established a name for itself as a functional and relatively comfortable mode of transport for almost two decades. It provides an efficient means of commuting over short distances such as in cities or towns.

The very construction and the mode of operation of the three passenger autorickshaw has rendered it very useful in developing countries where low cost transportation is an important need of the economy

Inspite of this, its design has undergone very few changes and it has been subject to vast and sometimes outrageous modifications by owners to suit their taste and need. Also the monopoly associated with autorickshaw manufacture has made newer designs and improvements very slow in arriving.

It is in this light that the project attempts to design a passenger autorickshaw. The project aims at designing an autorickshaw which will provide a higher level of comfort, superior technology, safety and a fresh new look, thus proving to be a strong competitor to the existing one. Due to the vast nature of the overall project, the scope of the project is 'Design of the Exterior' with close co-ordination with 'Interior Design'.

It goes without saying that considerable attention has been given to an existing setup, mechanicals and other constraints, which are infact nothing but .....

..... Design Opportunities

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# 1 Introduction To The Project

## 1.1 Aim Of The Project

This project aims at designing the exterior for a three-passenger autorickshaw on the basis of a chassis and engine setup provided by a company.

## 1.2 Objective of the Company

To design and develop a three passenger auto rickshaw to cater to the three wheeler passenger vehicle segment

## 1.3 Personal objectives

Through this project I wish to

- Explore the process of design of rigorously used products like the autorickshaw
- Expand my understanding of 'Design for the local environment'
- Understand and attempt to do design as a 'collaborative effort' which is a strong feature in the automotive industry

## 2 Three Wheelers



### 2.1 World Scenario for three wheelers

There are more than a hundred three wheelers manufacturers in the world today manufacturing three wheelers that range from personal (single person) transport to cargo carriers. <sup>1</sup>

In the West and Europe, these vehicles are used mostly as goods carriers or as novelty vehicles. But in the Asian countries, especially India and South East Asia they form an important part of low cost transportation for people and cargo over relatively short distances.

The Auto rickshaw derivative, defined by its function and body style is made in India, Thailand and a few other countries. Italy is the only known manufacturer for auto rickshaws in the EU, with its Piaggio brand of three wheelers.

### 2.2 The Indian Scenario

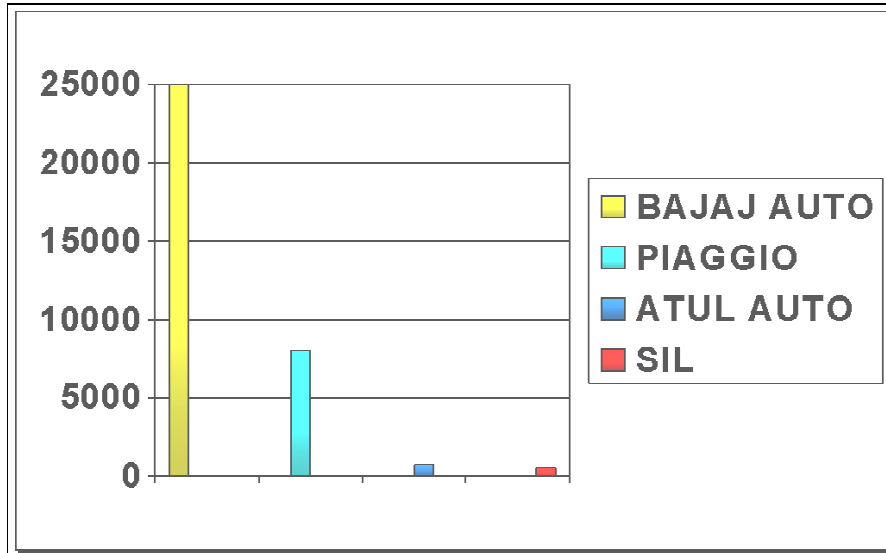
Production of three wheeled vehicles began in India in 1955. Total production grew from 1500 in 1955 to 40000 in 1978.<sup>2</sup> The four major Indian manufacturers during that period were

Bajaj Auto, Pune

Automotive Products of India (API), Bombay

Bajaj tempo, Pune

Scooters India Limited (SIL) Lucknow



**Statistical Data for Three Wheelers in India  
Sales/2 months (approx)**

{Source – Refer Auto India Dec 2003}

### 2.3 Demand and Supply Statistics on annual basis for India (2002 – 2003)<sup>3</sup>

Total Demand = 3 lakh/year

Total Sales = 2.25 lakh/year

Bajaj Auto sold 1,50,000 petrol auto rickshaws in 2002 – 2003

Total diesel auto rickshaw production 75000/year

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### 3 Information made available by the company

#### 3.1 Engine Specifications

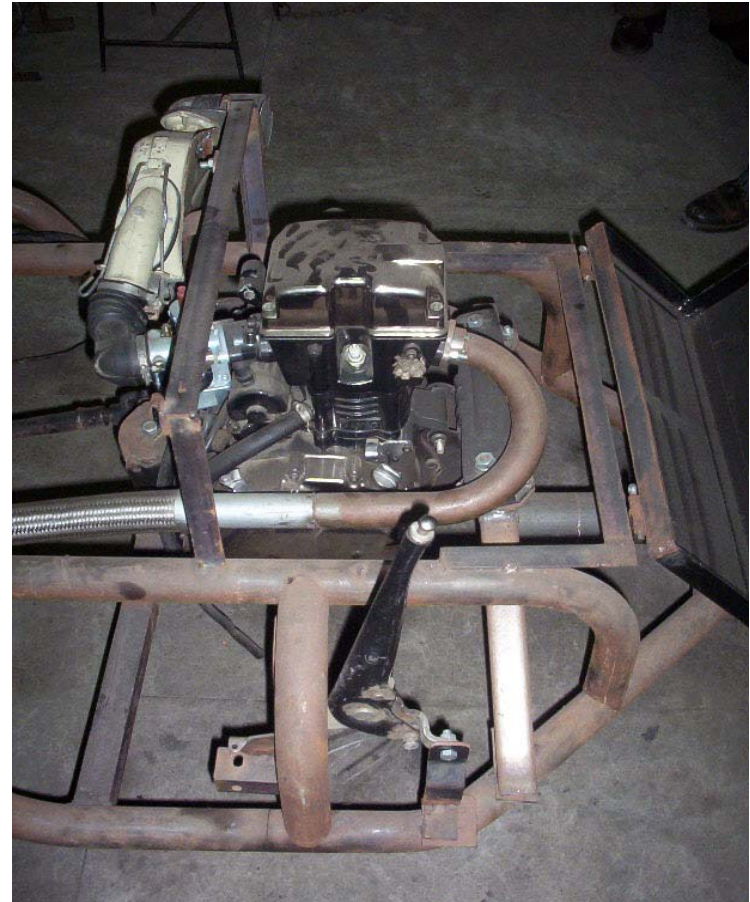
1	Engine Type	4 – Stroke, Spark Ignition, Single cylinder
2	Engine displacement	150cc
3	Maximum Power	13.4bhp@9500rpm
4	Maximum Torque	10.52 Nm@7500rpm
5	Fuel	Petrol / CNG

#### 3.2 The chassis and engine framework

The company has developed a tubular chassis of round cross section, which houses the engine and the wheel and suspension setup. The engine is mounted below the driver's seat, thereby arriving at a mid engine layout



### 3.3 Images of prototype chassis



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### 3.4 Discussion with Company officials

A visit to the company's design and development facility and discussions with the design engineers yielded very useful insights and a correct assessment of the company's intention and mental images of what they expected from the proposed vehicle.

A visit to the manufacturing facilities was necessary to understand their manufacturing capability, capacity and processes. Understanding of the processes used in manufacture of their existing vehicles was very useful in the design of the new proposed rickshaw.

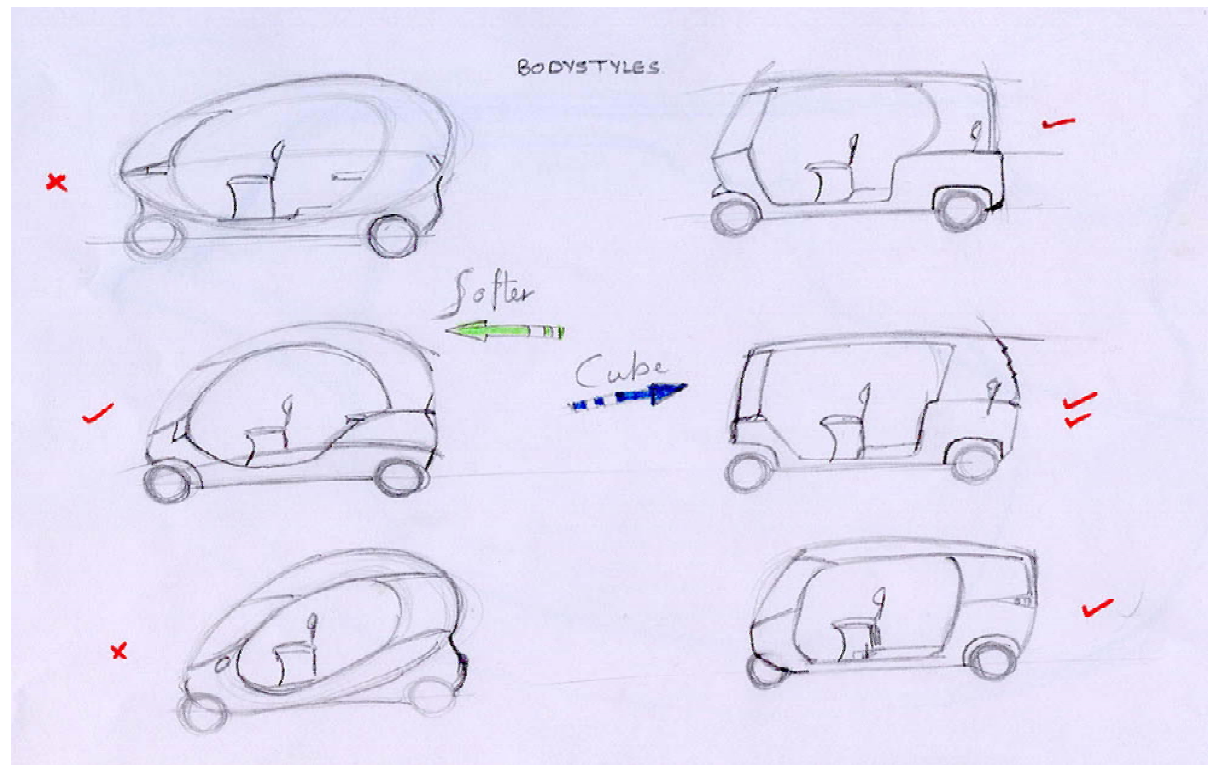
#### Important Notes

- Drawing processes for the front and rear edge panels
- Bending processes for sheet metal
- Capability to produce full size windshield glass (single piece)
- other processes such as welding, painting, assembly (manual), etc
- One interesting fact was the R&D involved in the experimentation with FRP bodies for three and six seater passenger auto rickshaws

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This was followed by a quick ideation session to create several body style options based on inferences from above points. Preferences were indicated by R&D engineers based on a general idea of the following

- Manufacturing capability
- Functional Space
- Competitor model
- Existing mechanicals



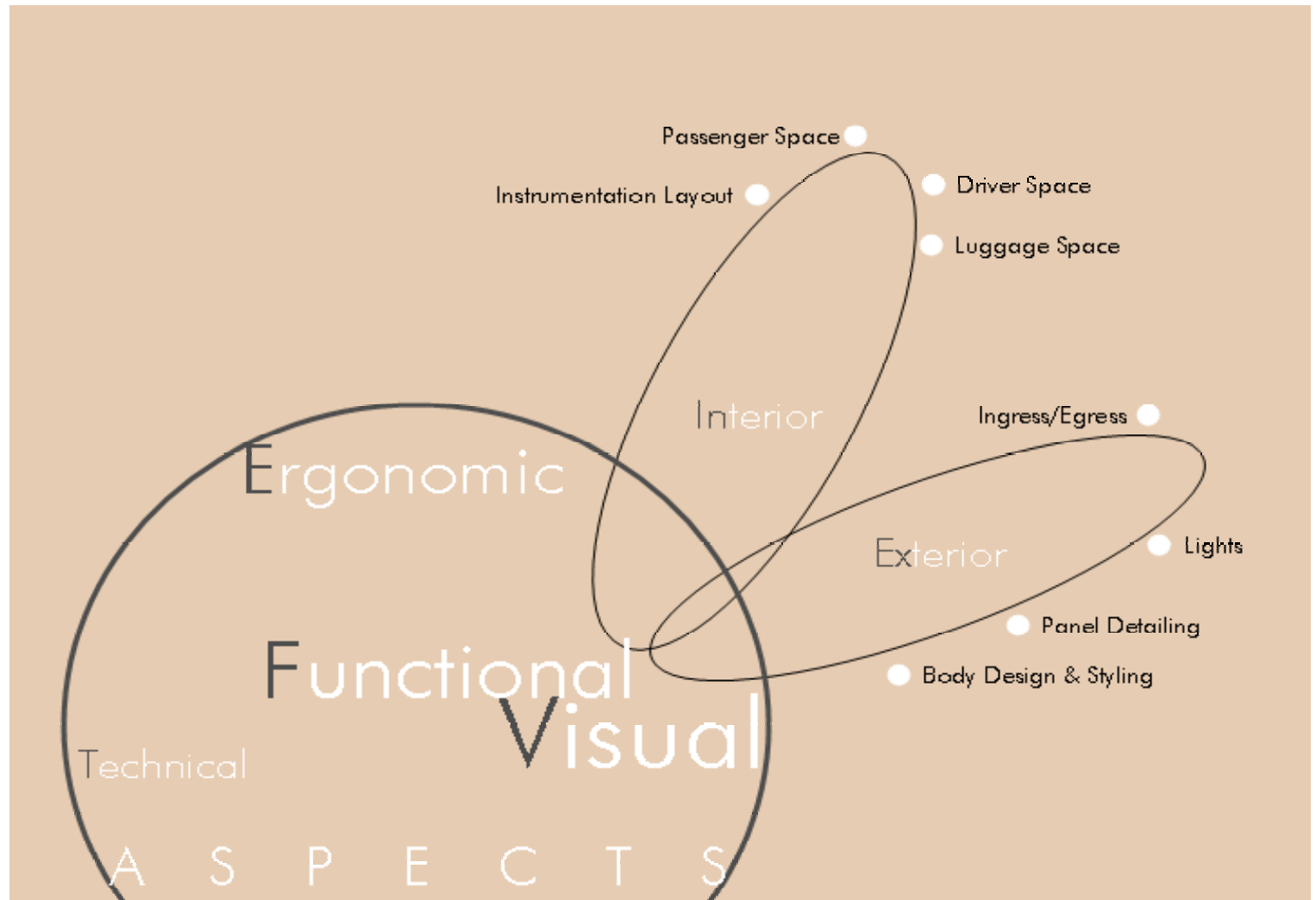
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### 3.5 Product Brief

A product brief was necessary at this stage to give correct direction and an action plan to the project. A rough draft of the desired product characteristics was drawn from the company visit and the user study which began in the very early stages of the project. These activities were carried out in co-ordination with the Interior Design activities

- Design for manufacture:  
Vehicle should have a **sheet metal body** with consideration to manufacturing processes like drawing, bending, welding, etc
- Design for **maximum passenger space** and driving comfort in its category
- Providing a new body style for the vehicle which aids maximum space utilization, preferably a **small van like body**
- Optimizing the overall height of rickshaw
- Providing contemporary styling, adapting **features of higher end vehicles** wherever possible
- Innovating in areas of safety (especially **hood area**), comfort and aesthetic appeal for both driver and passengers through design
- Design should include scope for **personalization** for owner/driver
- Detachable components** should be design for an integrated look when added,  
Example: side doors and side openings

### 3.6 Schematic Representation Of The Interaction Between Exterior And Interior Design



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## 4 Study Of Existing Products

### 4.1 Product Survey

Indian Passenger auto rickshaw manufacturers and their models are featured below in brief



#### Bajaj Auto, Pune

It is the largest auto rickshaw manufacturer in India. More than 90% of all auto rickshaws sold in India are Bajaj models.

The most modern and popular one now is the RE CNG Four Stroke.



#### Scooters India Limited, Lucknow

They manufacture the Vikram range of three wheelers and also the Vikram EV, The electric rickshaw.



Atul Auto, Rajkot, Gujarat

They are manufacturers of a variety of three wheelers having a presence in Gujarat, Rajasthan, Madhya Pradesh, Chattishgarh and Andra Pradesh.



Piaggio-Greaves

They assemble the APE brand of three wheelers in India in the Cargo, Van and three seater passenger categories



Kerala Automobiles Limited



Goel Tempo Limited, Ghaziabad (UP)

The company is supplying its three wheeler mainly to transporters in UP, Punjab, Rajasthan and Haryana

For more pictures of three wheeler models across the world **See enclosed CD**

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## 4.2 Glimpses of Thailand's Tuk Tuks



Racecar inspired form



Tourist attraction



A Family Outing



Office commuting

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### 4.3 Product analysis

#### **Rickshaw Model Chosen For Further Detailed Analysis And Study:**

The most popular and the best selling autorickshaw in India today is the **Bajaj RE**

Therefore the Bajaj RE was chosen as the model for study

For the dimensional drawing of the Bajaj RE

**See Annexure 1**

The comparative figures for the wheelbase and wheel track of the Bajaj RE and the proposed rickshaw are as follows

#### Wheelbase

Bajaj RE => 2000mm

Chosen chassis => 1850mm

#### Wheel track

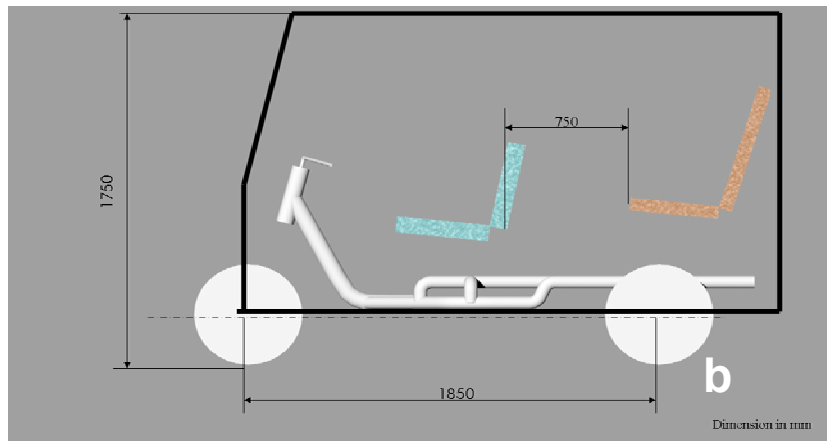
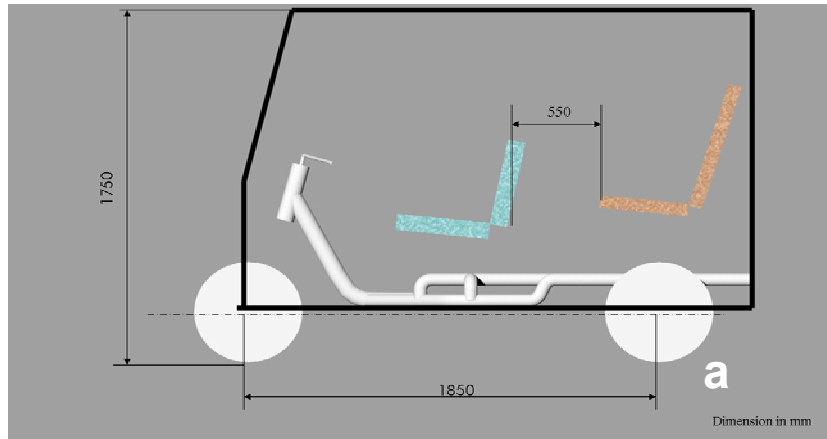
Bajaj RE => 1150mm

Chosen Chassis => 1155mm

From the above values, we can infer that the proposed vehicle will have a smaller turning radius, which would be an advantage in tight manoeuvring procedures and turns.

The wheel track being almost same, the width of both the rickshaw and consequently the passenger seat width will be almost equal. This means that any increase in passenger comfort must be achieved by liberating space longitudinally, i.e. along the length of the rickshaw. For anthropometric analysis of Bajaj RE

**See Annexure 2**



#### 4.4 Model Of Vehicle Layout To Visualize Vehicle Size

A 3D cad model was generated to determine the possibility of increasing passenger space longitudinally and vertically which would inturn help in determining the footprint and the overall volume available to design a body. This stage is necessary as it reduces the possibility of rejecting design concepts because they do not confirm to desired size.

The diagram (a) shows a legroom of 550 mm which is approx. equivalent to Bajaj RE's legroom; i.e. 550mm. If we move the seat rearwards by another 200mm (which is possible because the engine is mounted below the driver's seat) we can create ample leg space for passengers and also space for luggage. The outer bodyshell envelope is now determined by the new size. This is shown in diagram (b)



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## 5 User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.

Driver (talk to..... try being one)

Passenger/s (Talk to.....Travel as  
.....travel with)

Owner

Service mechanics

Local Vendors

For the Complete User & Product Study [See Annexure 3](#)

## User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.



The **integration** of front and rear weakens at the **sides**,

Both structurally and visually

Driver says ' I need side **half height side doors**.....like a jeep

Passenger adds ' I need more safety on side for **children and luggage** against brushing vehicles, rain water splashing.....

### Insights & Ideas

Design retractable door beams

Integrate through more organic colour bands from rear to front

Wrap cabin with safety bands all around

Rexin doors with MS rod frames for passengers

## User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.



Sagging canopy problem hampers look and causes leaks during rains



Metal hood faces rust problem and dents

Tubes for canopy are visually weak

They do not offer any occupant safety also as they are collapsible

### Insights & Ideas

Design roll over cage

Larger diameter tubes for canopy

Expose tubular members as elements of strength

Try stainless Steel or electroplated members

# User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.



Flat front windshield and umbrella like interruptions in longitudinal axis on canopy hamper aerodynamics....air flow is not streamlined

## Insights & Ideas

Use Double curvature glass for windscreen

If interruptions in canopy are design elements, design them for transverse direction

# User Study

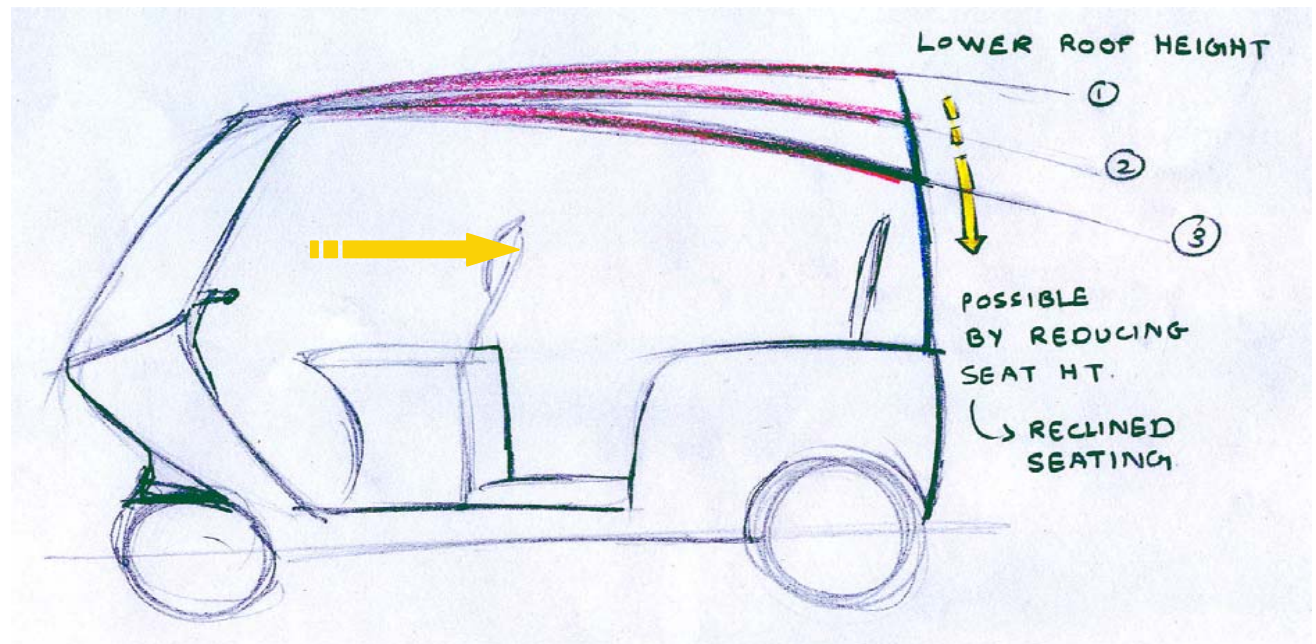
Understanding the **Users**, their **Needs** and **Desires** i.e.



Rickshaw is **too high**.....can't the height be reduced

All rickshaw in the market today are taller than most cars, yet they cannot accommodate most percentiles comfortably

Insights & Ideas



# User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.



**Visibility** through passenger space is too less.....

Visibility is through side cover, top and rear canopy area

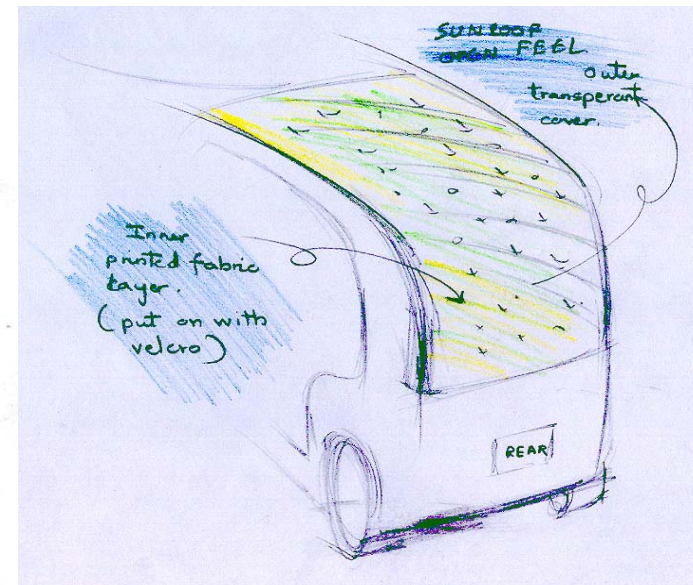
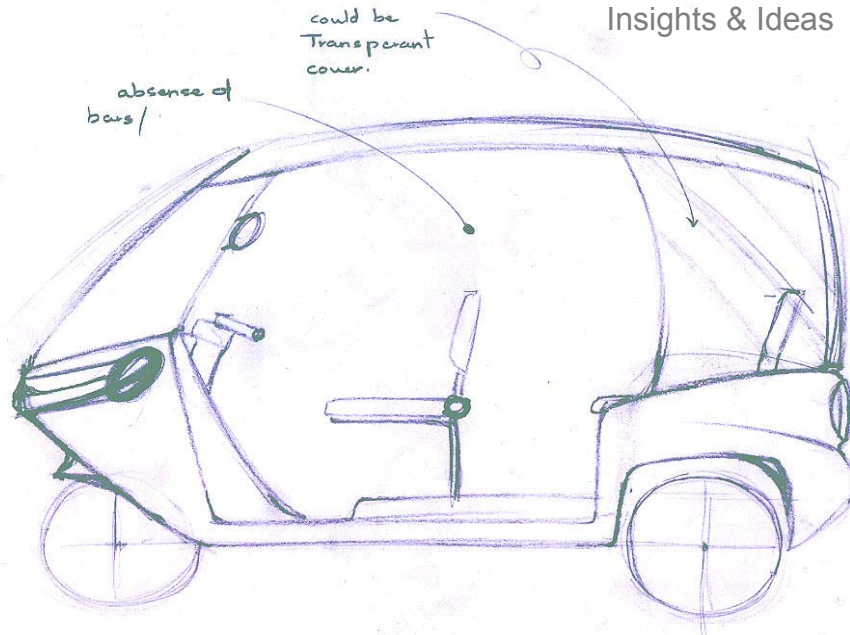
....try transparent cover.....too sunny.....needs additional cover

....replace tubular members with rear pillars or roll over bar setup

➤this might eliminate need for driver side supports

....cleaner integrated body

## Insights & Ideas



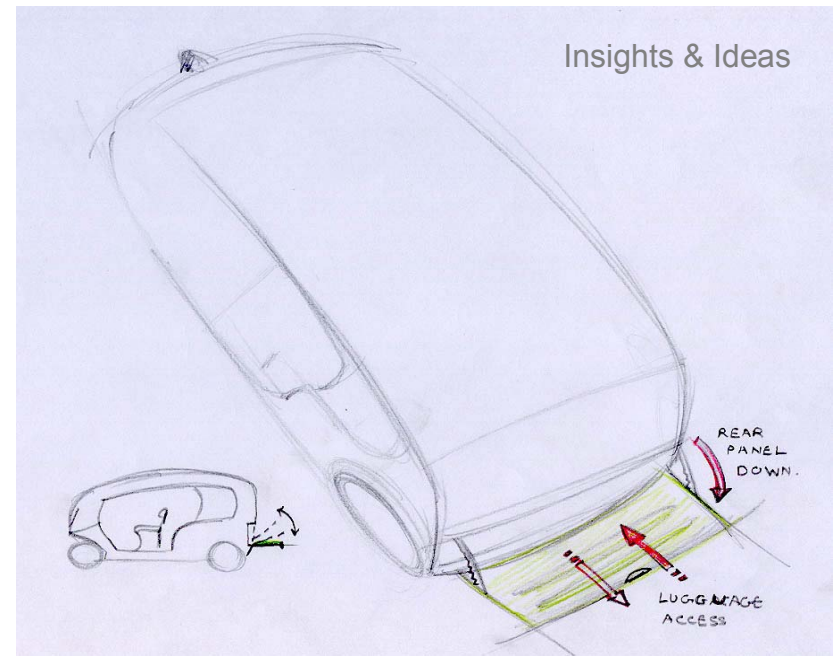
# User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.



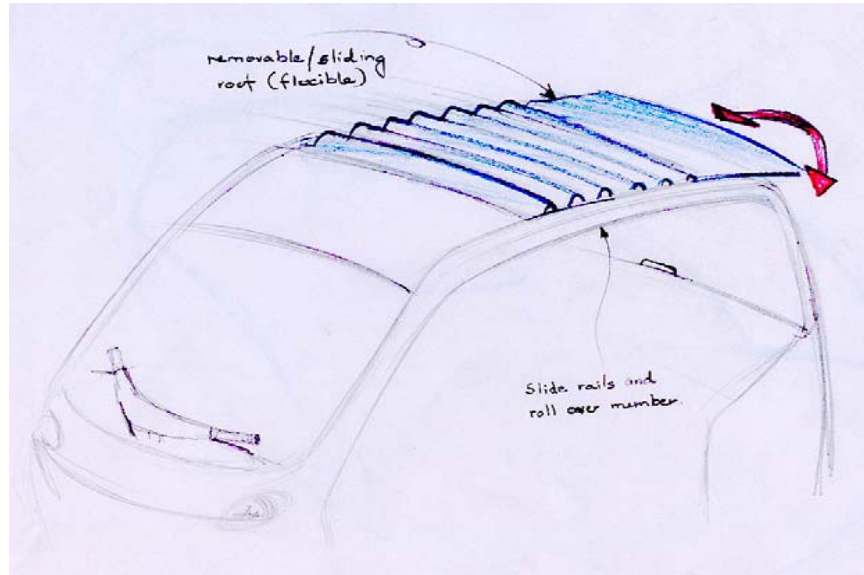
Luggage compartment is **inaccessible & intrusive** (into passenger backrest)

Can we provide all luggage access through sides  
..... or ..... use rear opening boot lid to access storage area under seat

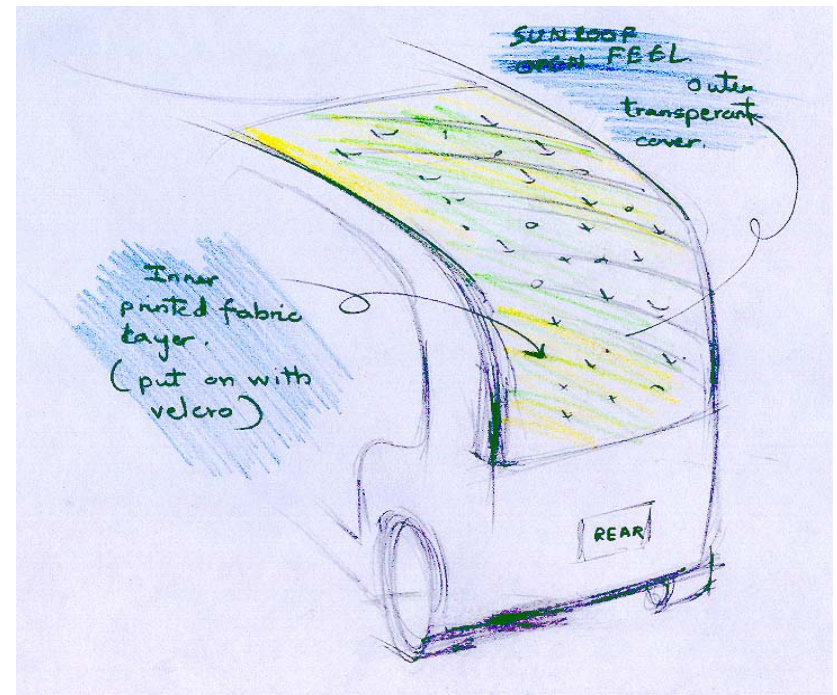


# User Study

Understanding the **Users**, their **Needs** and **Desires** i.e.



## Insights & Ideas

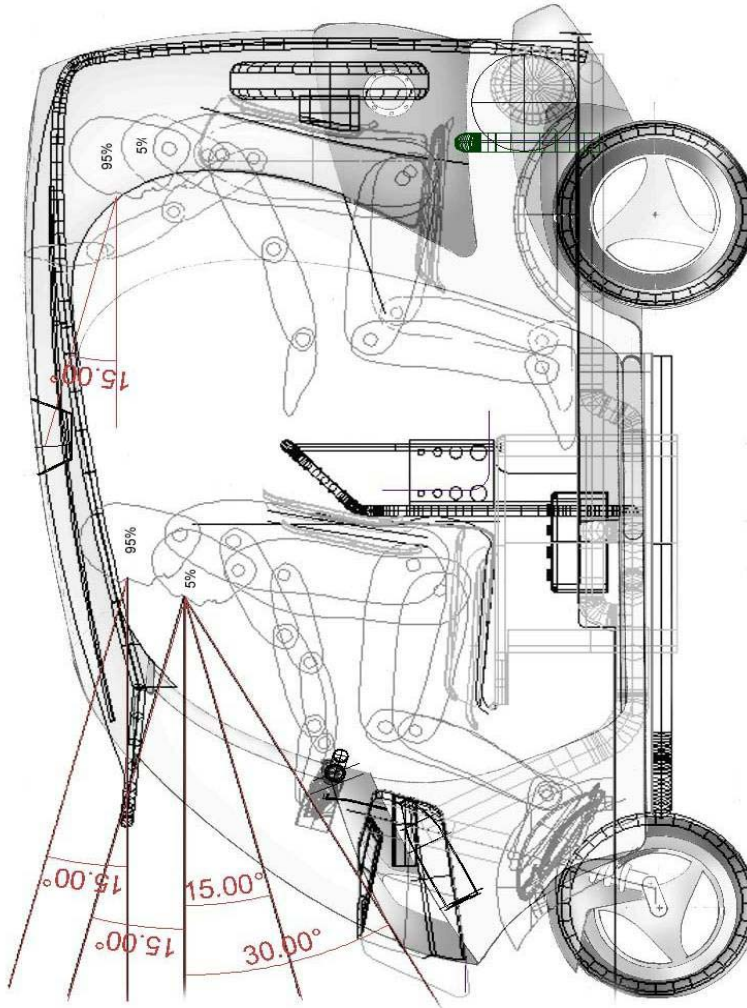


## 6 Ergonomic Analysis

This involved a combined activity with the interior design. This activity was conducted in parallel with the product and user study. It consisted of the following

- Use of full scale 5th % and 95th % male mannequins for analysis of seating posture, control reach driver visibility through windscreen and longitudinal legroom (Courtesy : Dr. Gaur G. Ray, Prof., Industrial Design Centre, IIT Bombay)
- Use of data book for Indian Anthropometric Data  
[See Bibliography](#)
- Use of information from previous project reports on the subject  
[See Bibliography](#) .
- Use of digitized mannequins for analysis using 2D CAD data

The male mannequins were chosen as nearly 100% of the auto rickshaw drivers are male and the 5th and 95th % male size gives the two extremities in size.



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## 7 Design Brief

The design brief is a result of the summation of

- The Project Scope and Product Brief
- Interaction with  
Company engineers, designers and marketing  
personnel
- Auto rickshaw owners/ drivers, passengers
- People using bus, taxi and two wheelers as  
transport
- Existing product study  
Product Survey  
Product Analysis

### Functional Requirements

- Comfortable seating for three passengers  
(involves visual comfort, openings, access to  
surroundings)
- Ingress/ Egress space and location for passenger and  
luggage
- Safety in the form of better lighting, larger windscreen  
area stronger canopy structure
- Adapting vehicle for tropical climate
- Weather protection in the form of canopy, door  
attachment and accessories
- Modularity in Construction for assembly and  
disassembly for service, transport, etc
- Explore possibilities for various applications on one  
platform

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## Form

- **Visual and material Integration** of rickshaw body
- Endowing the vehicle with a **strong and distinct identity** in its category
- Enhancing the **unique experience** of a rickshaw ride
- Use **existing chassis and powerplant characteristics** to advantage in form generation
- Project increased passenger cabin space and comfort as a visual element to attain **an inviting look** for prospective customers

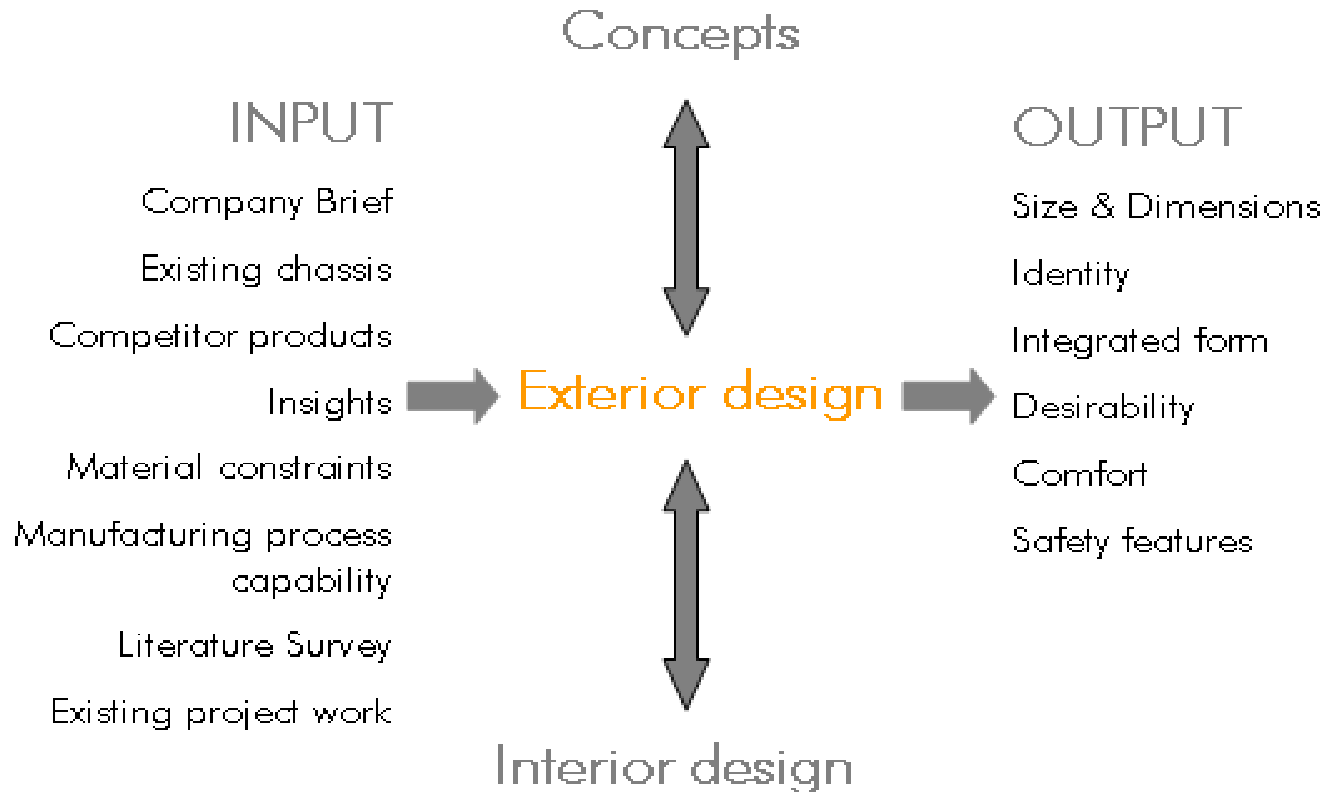
## Size Aspects

- **“Compact Exteriors, Spacious Interiors”**  
Obtained from full scale anthropometrical study done on side profile of chassis and seat layout  
[Use of anthropometric dimensions data book](#)

## Constraints/Opportunities

- Use of sheet metal and soft, flexible materials for body design
- Existing chassis and engine setup
- Manufacturing capability and capacity

## 8 A Simplified Design model with Interactions



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## On Concept Generation

**Desired common features for all concepts (As a result of perceived primary needs of users)**

- Soft top options
- Transparent covers/removable Velcro fastening for inner layer
  - Printed fabric inner layer
  - Rexin, Canvas for hood
- Sheet metal body
- Twin headlamps for increased illumination and safety
- Stronger members for soft top, roll over cage if possible in both longitudinal and transverse direction
- Central driving position
- Larger windscreen area as compared to existing rickshaw
- Elimination of middle support tube for canopy

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## 9 On Concept Generation

The aspects of the auto rickshaw that fascinated me most were its unassuming functionality and its unique form resulting from a plethora of seemingly disparate yet meaningful parts and features.

The following ideas were some of the many used in concept visualization

**Question:** How do I make the rickshaw better?  
“Pay attention to passenger comfort”

### FREE UP SPACE

“Make it fashionable, in its context”

### MAKE IT ‘CHIC’

“We have a gentleman here in a ‘formal’ suit  
But with a jean to boot”  
Clue – Don’t change the trousers  
Give him a t-shirt instead

PEOPLE CARRIER IT MIGHT BE,  
BORING IT NEED NOT

# 10 Concepts

Maximum space within



An inspiring form

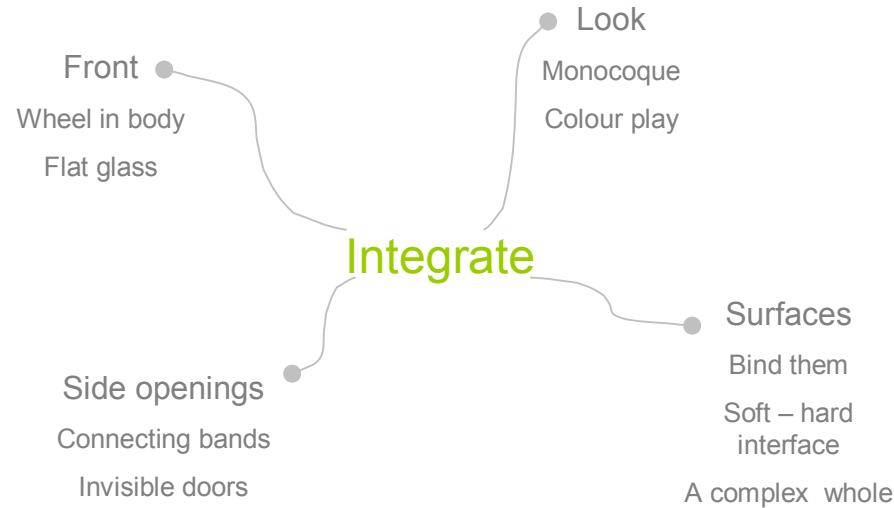


A van with open sides



Concept 1 attempts to interpret integration,  
the source of the inspiration .....

.....as 'Structure'

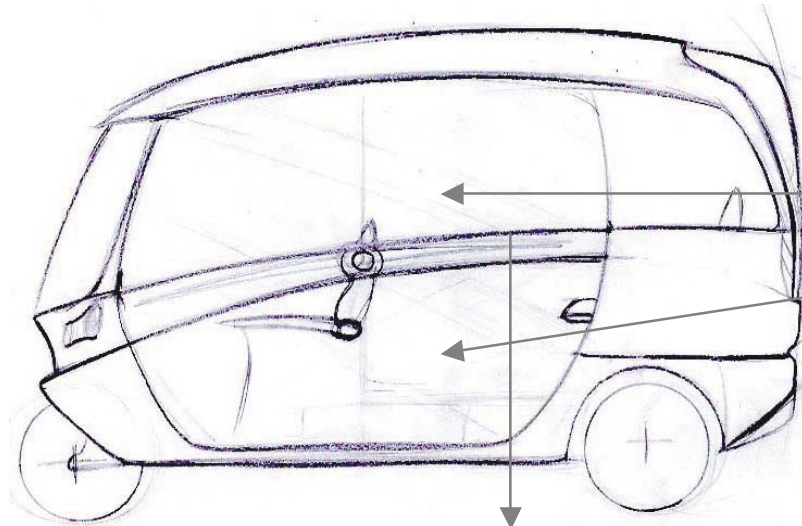


*Integration*

**Combine**  
**Whole**  
**Mono**  
**Amalgamate**

Concept 1

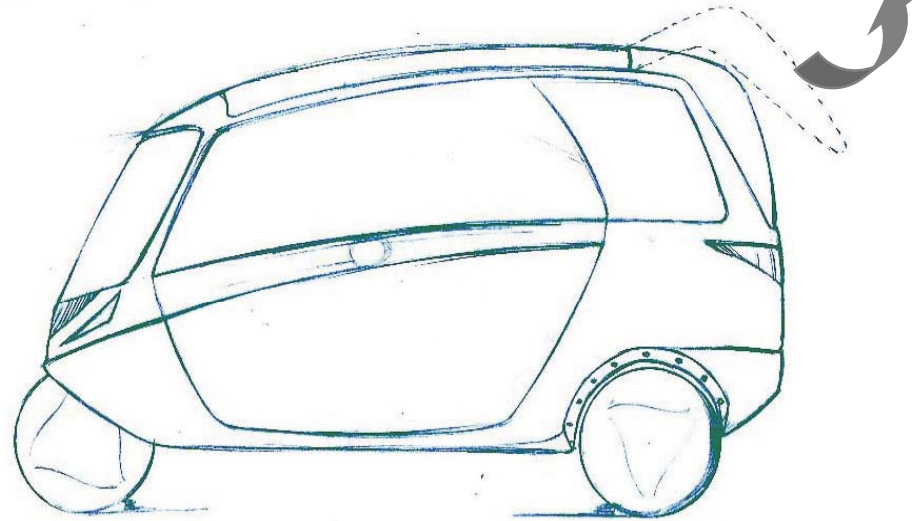
Idea Sketches



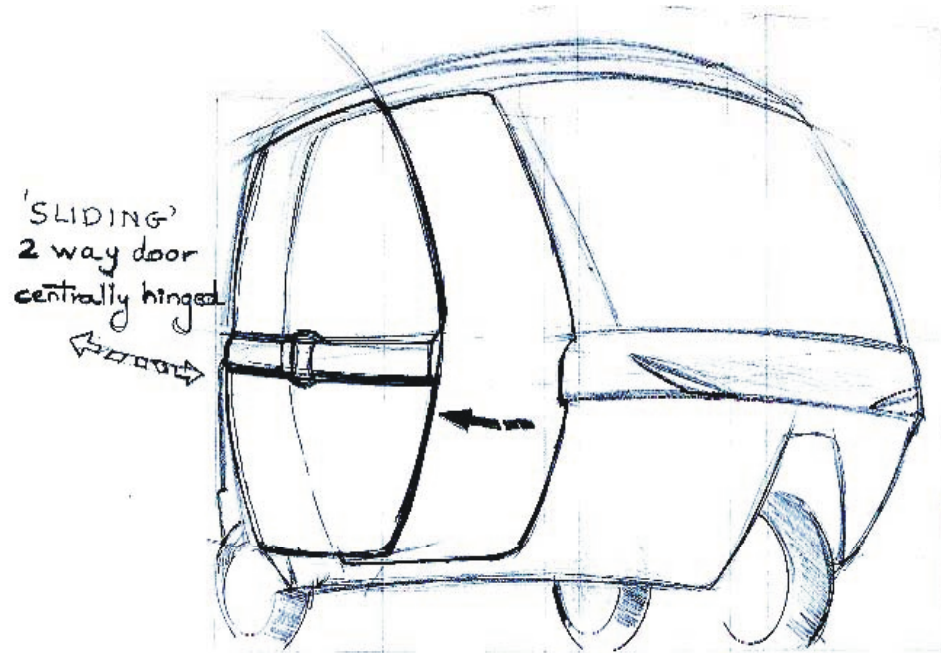
Door attachment beam  
*'A visual wrapping'*

Transparent flexible sheets removable

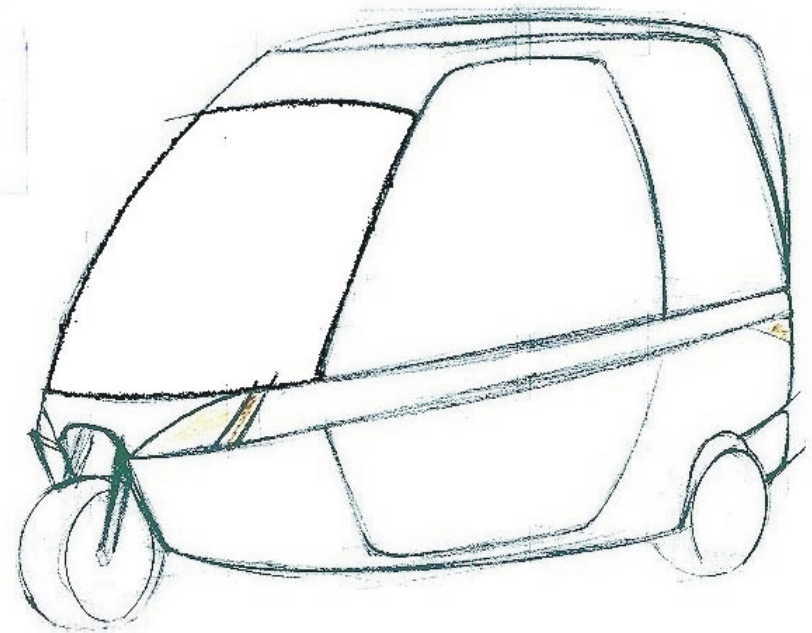
Hatchback rear boot lid of POLYCARBONATE



Idea Sketches



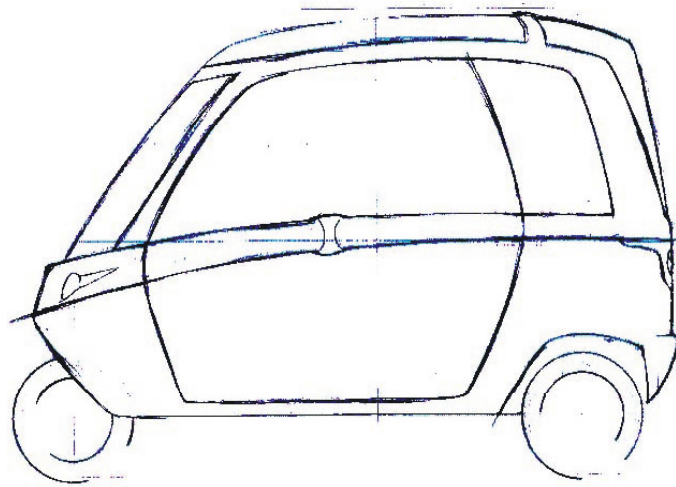
Interesting form  
Size it to scale  
Develop more



Resolve proportions in 2D



I call it **Mono**

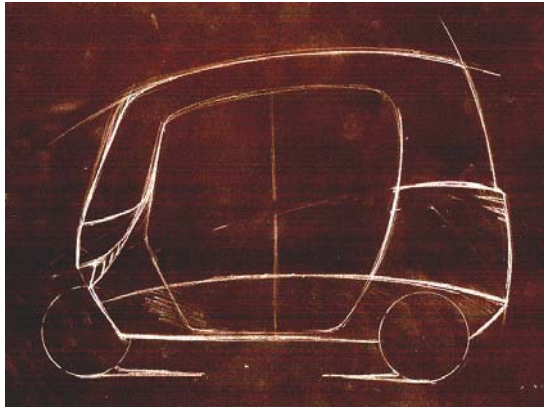


Soft top in Rexin 'soft grey'



Connecting bands  
&  
Transparent openings  
made from PVC sheets

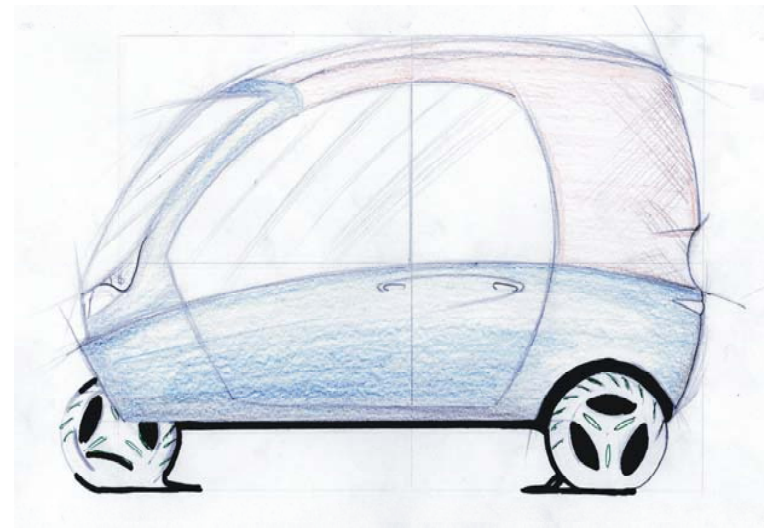
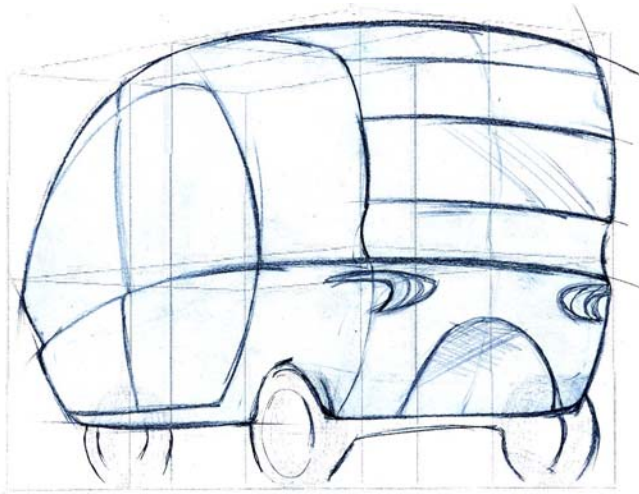
# Concepts



Concept 2 explores integration as a more fluid entity...  
..... a **seamless whole**

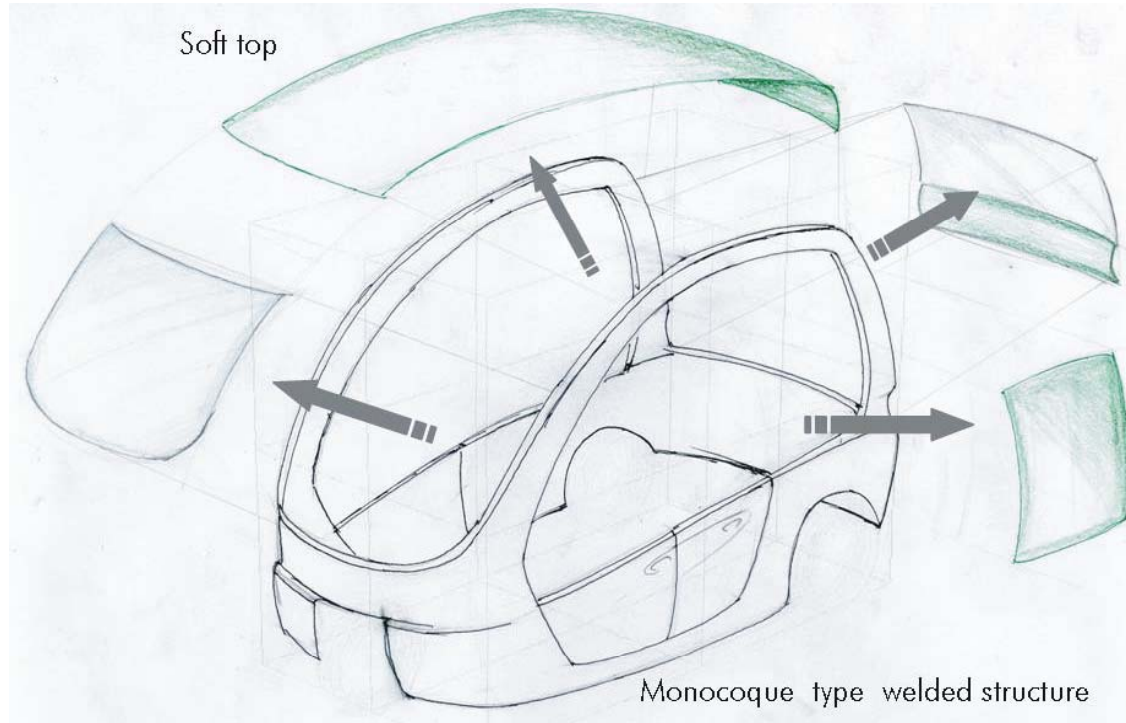
Idea Sketches

**Integration**  
Mix  
Unite  
One  
Wrap

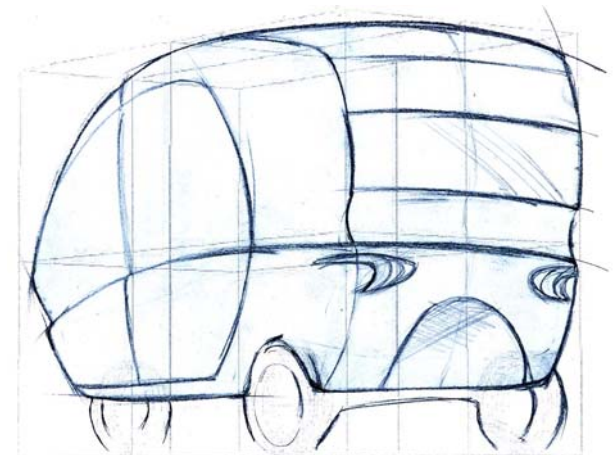


Concept 2

# Concepts

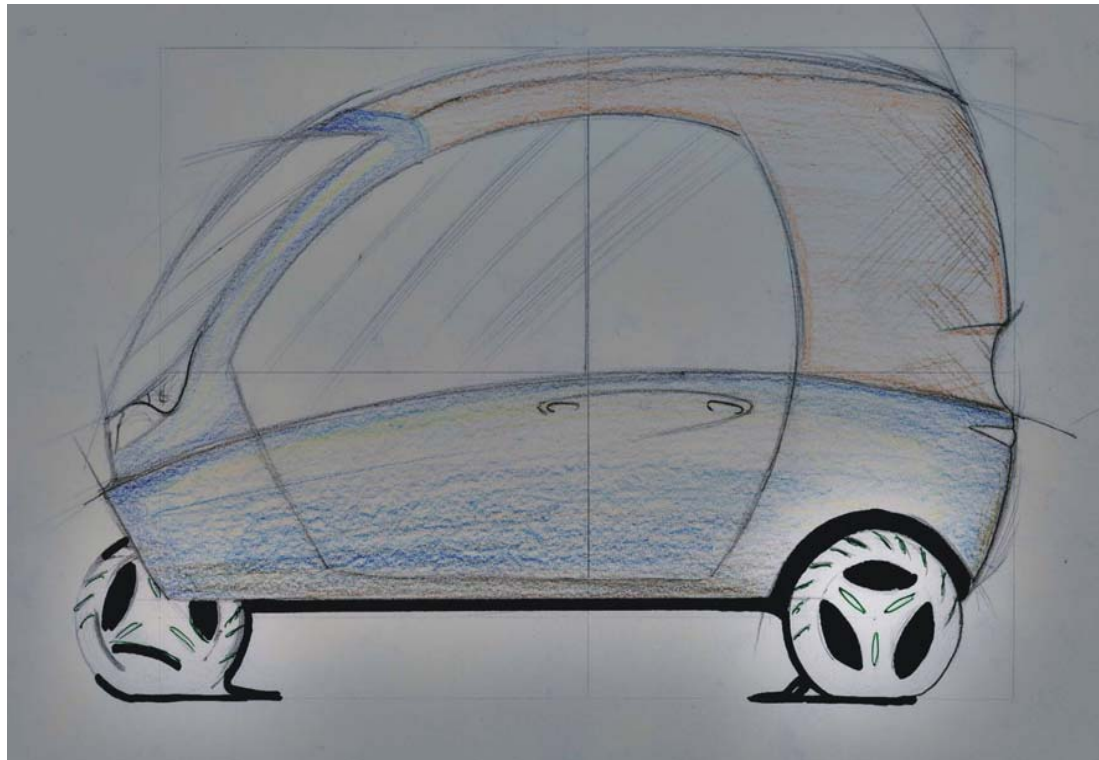


The concept is based on the idea that the form embodies the 'integration' though its functional aesthetic 'Safety' is the underlying element used to conceptualize the monocoque type structure with its new purposeful visage which boldly exhibits its..... car inspired styling

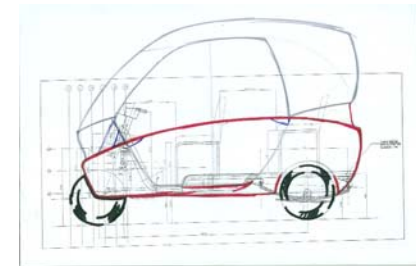
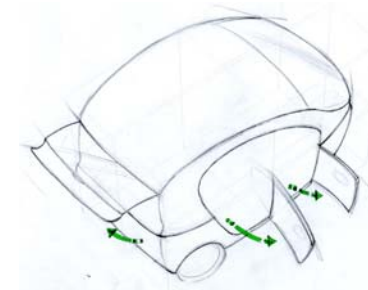


Concept 2

# Concepts

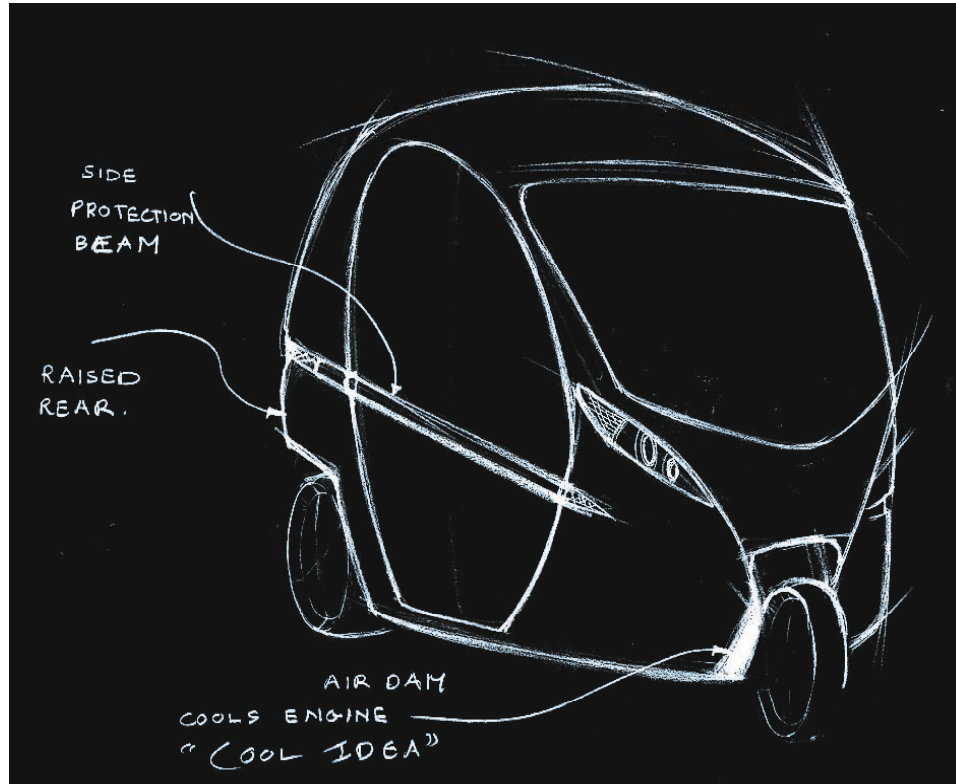


Ingress/ Egress ...car style



Checking concept for dimensional acceptance on given chassis

# Concepts

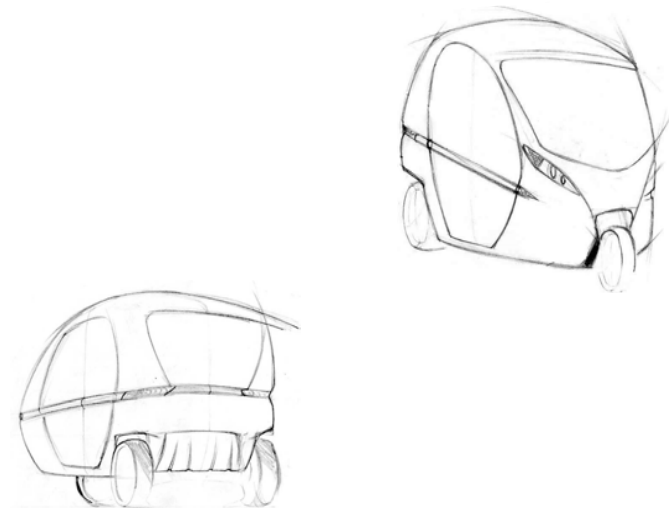


Concept 3 explores the role of innovations in rickshaw design as a means to emphasize comfort and safety

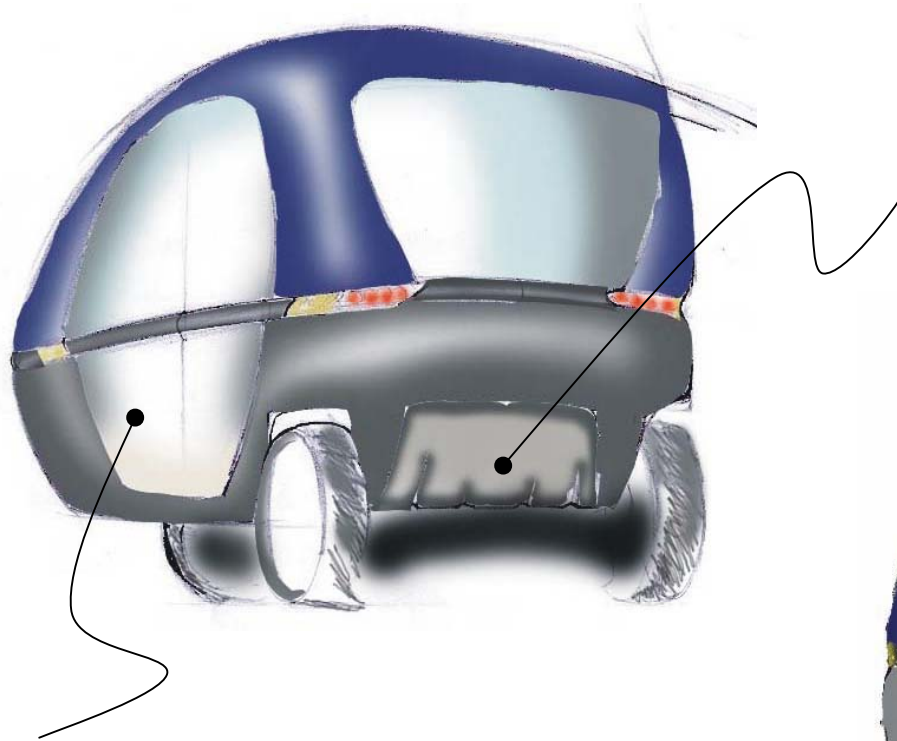
..... its explores them as interrelated and interdependent entities

An air dam in front cools front mounted engine and increases comfort levels for driver through reduction in fatigue due to engine heating

A raised rear end gives a feel of a performance vehicle



# Concepts



Removable doors with moulded door beams

Dirt tray to protect underbelly  
.....doubles up as luggage  
access door



Concept 3

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# Concepts

Comfort

.....Carrying forward the rickshaw tradition

Consolation

Soft

Relax

Relief

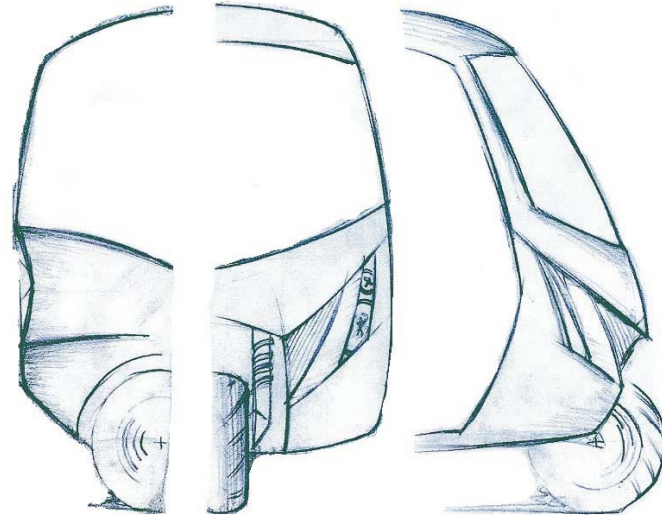
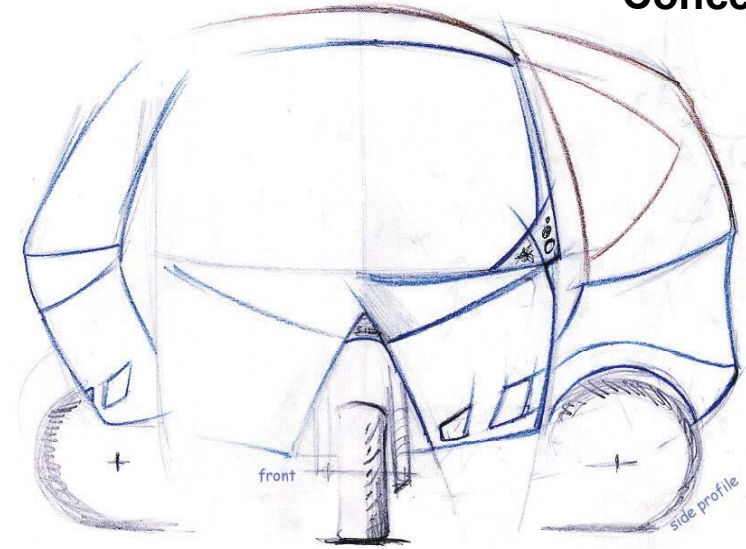
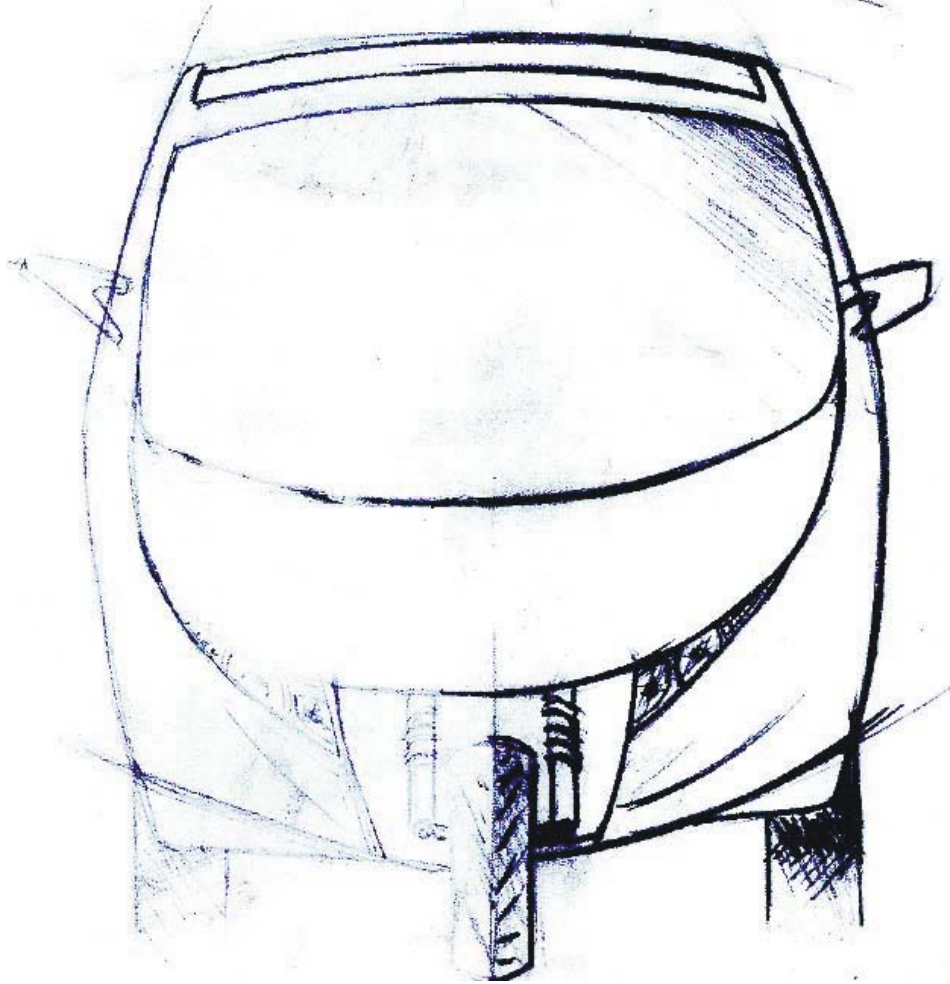
Freedom

Enthusiasm

---

Concept 4

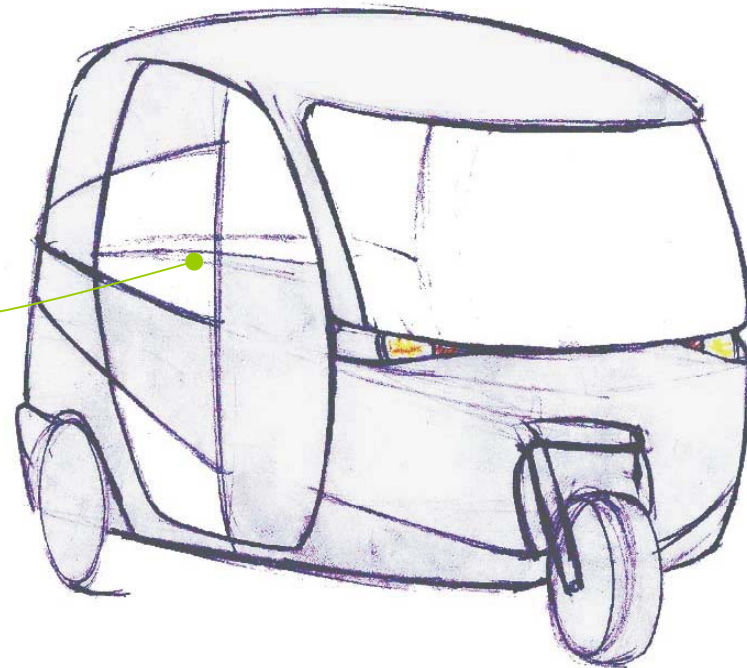
Initial Sketches



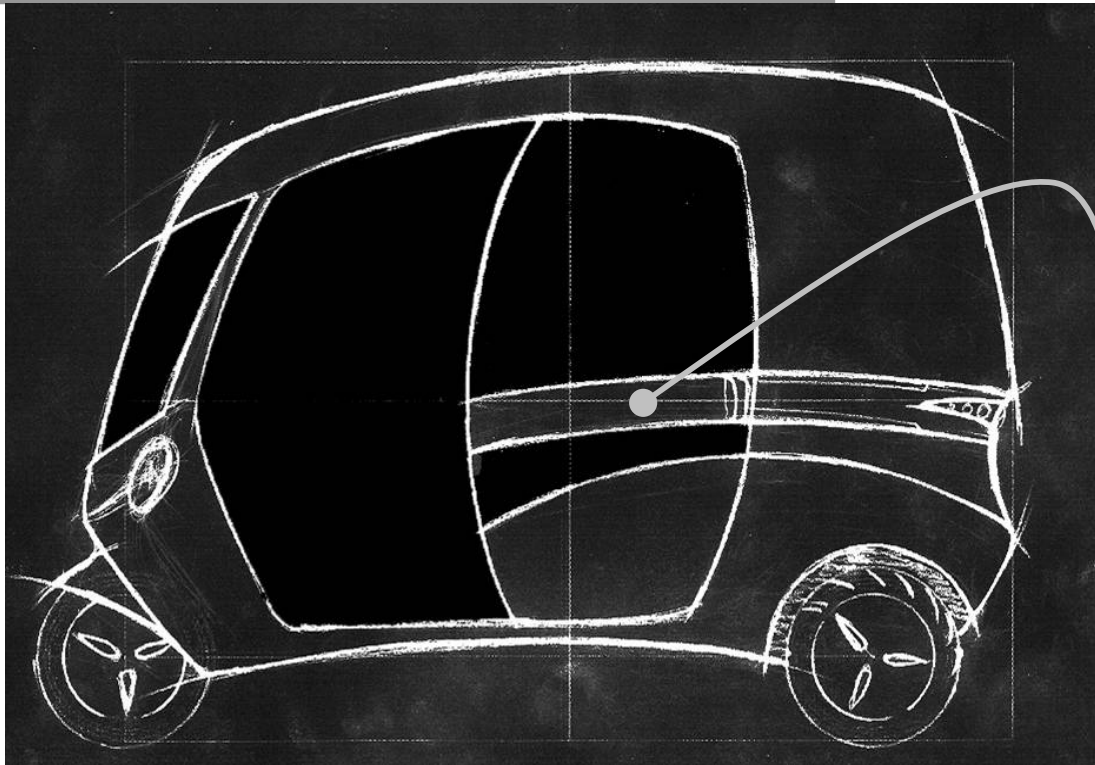
Interpreting elements of 'comfort' in form to emphasize the importance of visual comfort



Protect against harsh weather...  
..design with doors



## Concepts



The door is used not just as a protection against elements but is

An integral part of body design

Has a play of body coloured and transparent elements

Slides open for ingress/egress on gentle body patterns

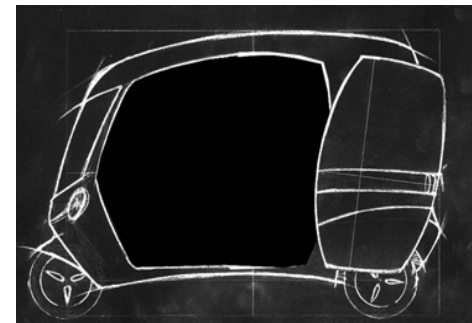
Thus rendering it more than a mundane entity

.....through design

Gentle curves...

... a move towards a more soothing feeling

...simplicity



---

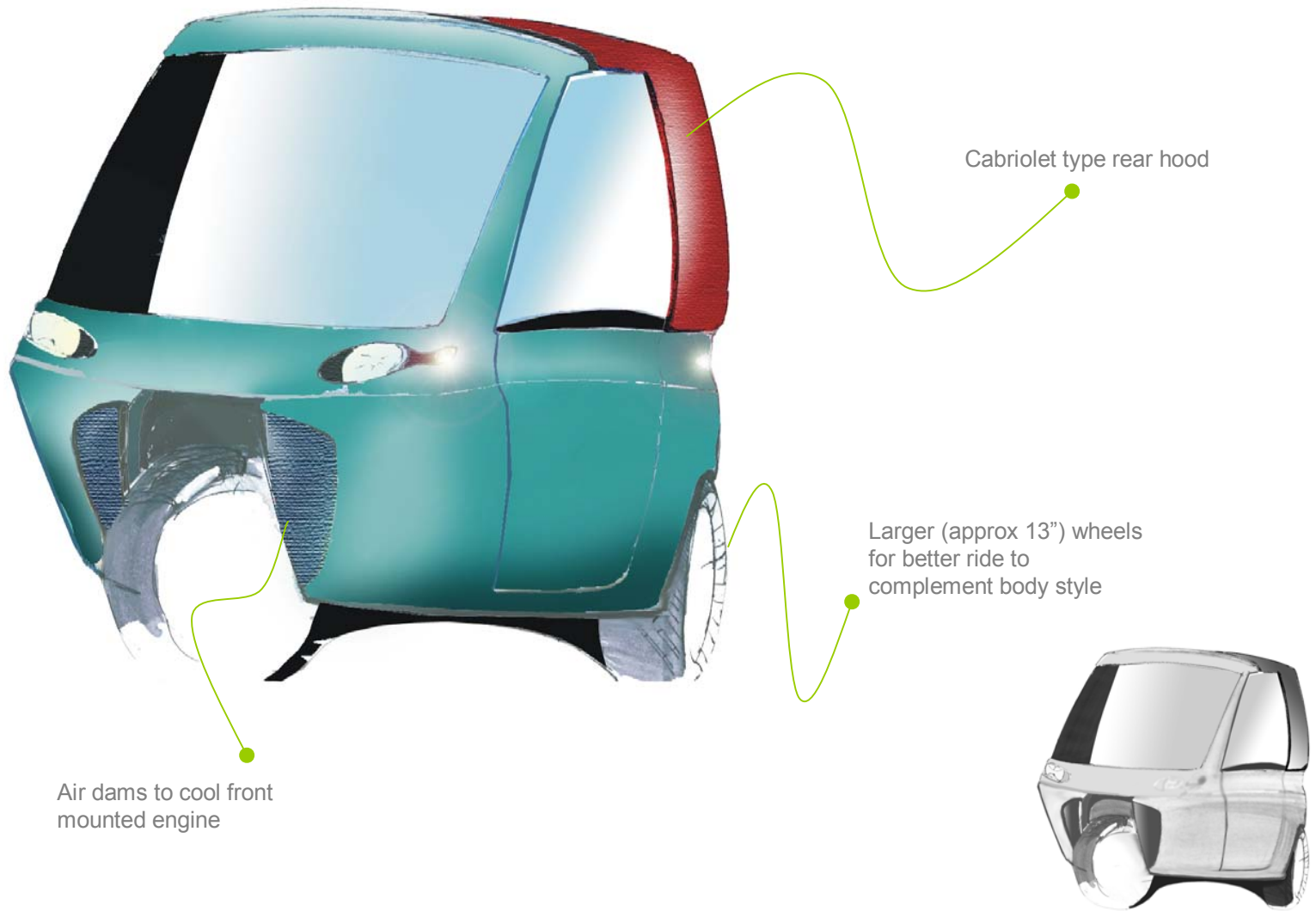
# Concepts

Modern

.....A new body style..... A freak ....'maverick' among concepts

Contemporary  
Style  
Refined  
Understated

Concept 5



Air dams to cool front mounted engine

Cabriolet type rear hood

Larger (approx 13") wheels for better ride to complement body style

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# Concepts

## Excitement

...would performance be inspiring

Twice the power of existing rickshaws

Large tyres

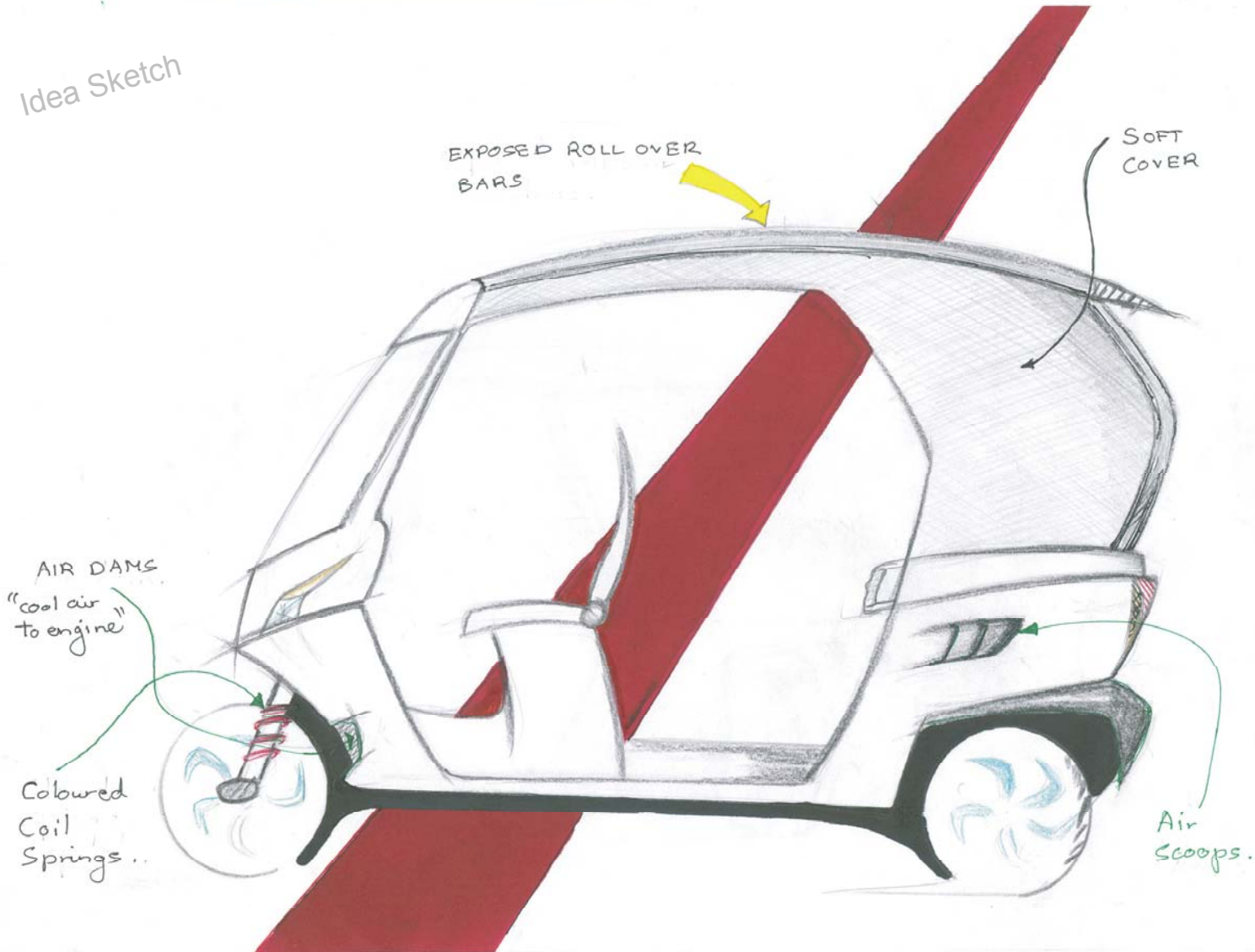
Dual coil springs in front

Higher ground clearance

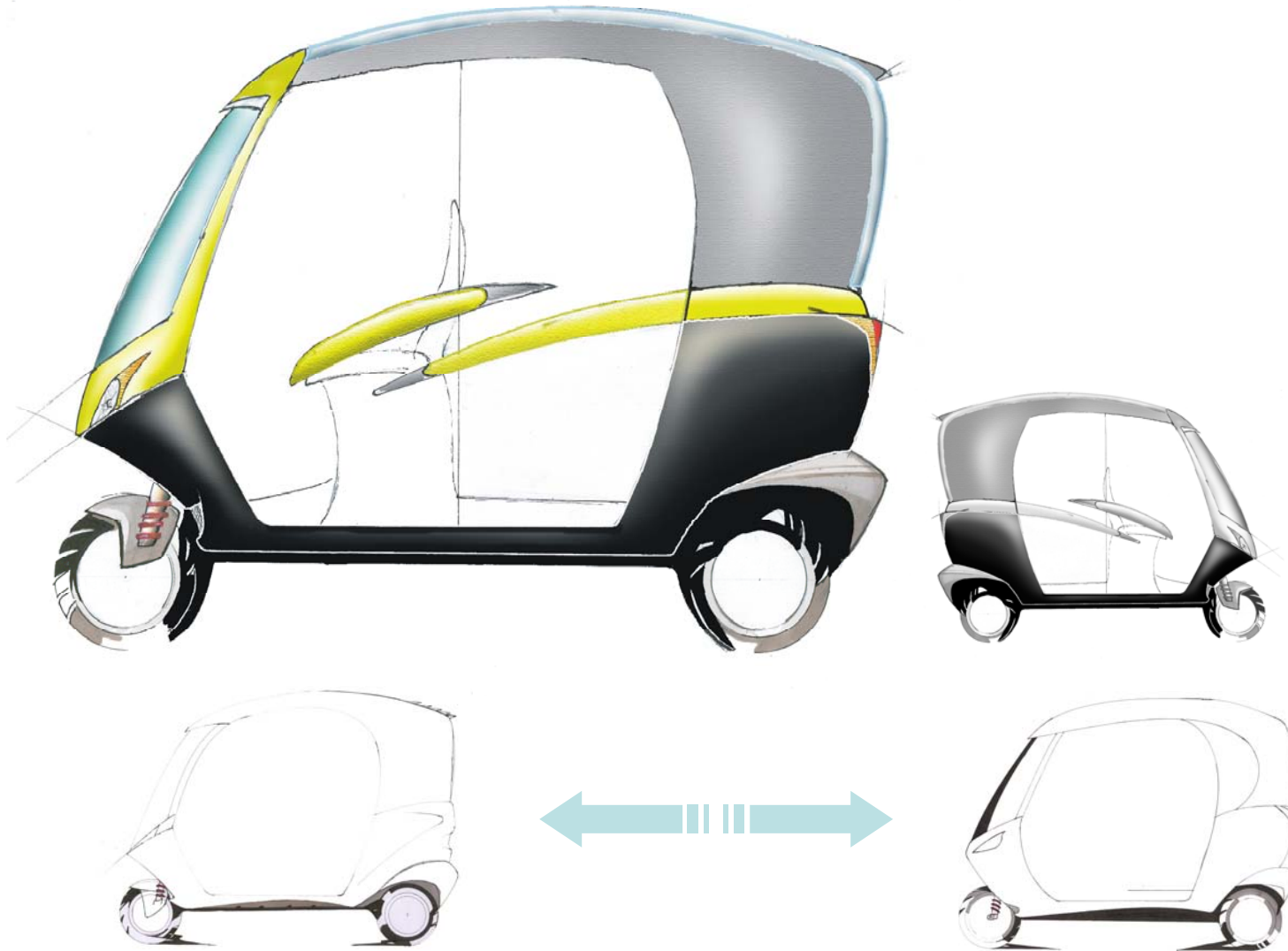
Facts

Concept 6

Idea Sketch



Concept 6



# Concepts

Young

Speed

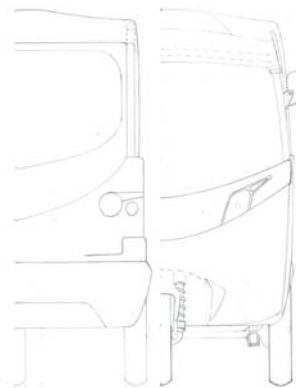
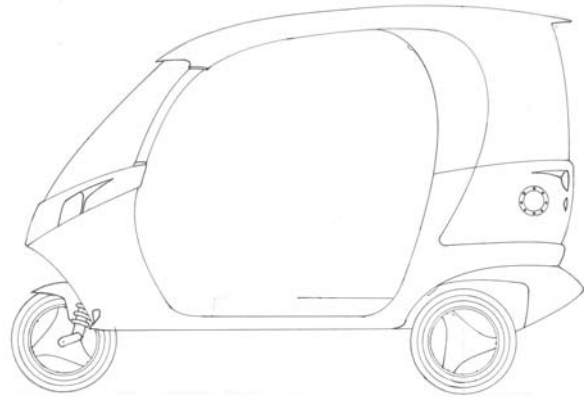
Experimenting with the form to lean on both the smoother and sharper side

Playful



Concept 6

# Concepts



Final iteration is more defined , has the bold and sharp features desired

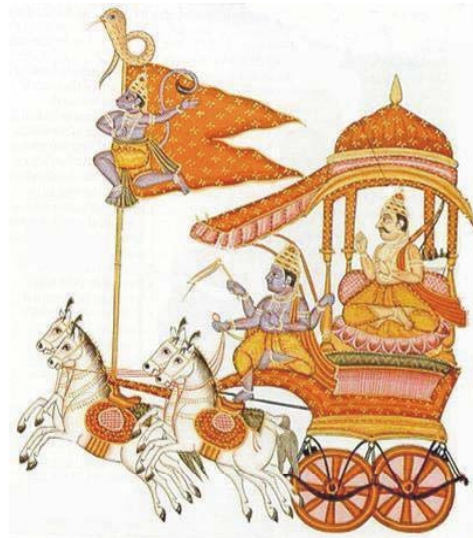
# Concepts

Carriage  
Tradition



Concept 7 moves away from the conventional rickshaw concept and proposes the more traditional form of seating

..... a different experience



Shelter  
Tonga



Concept 7

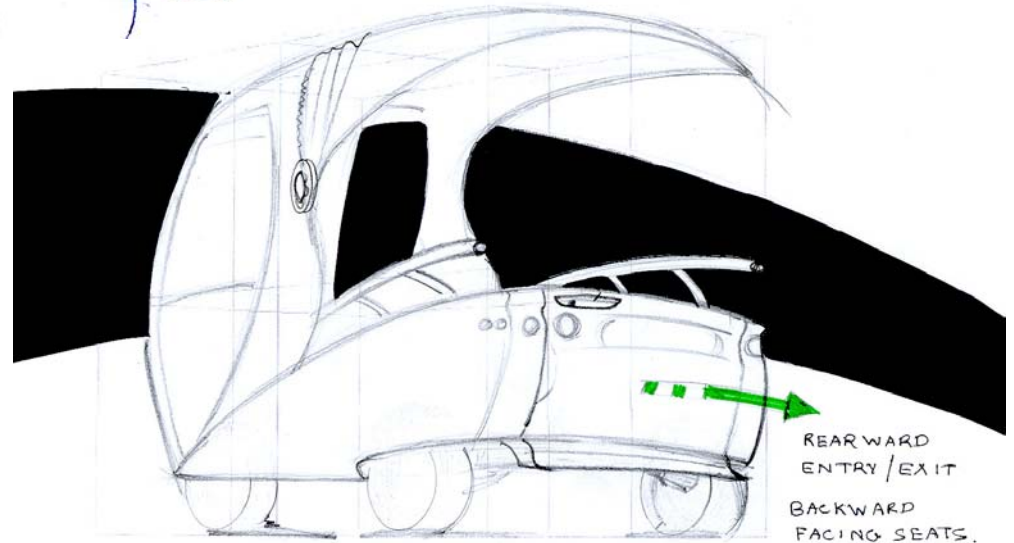
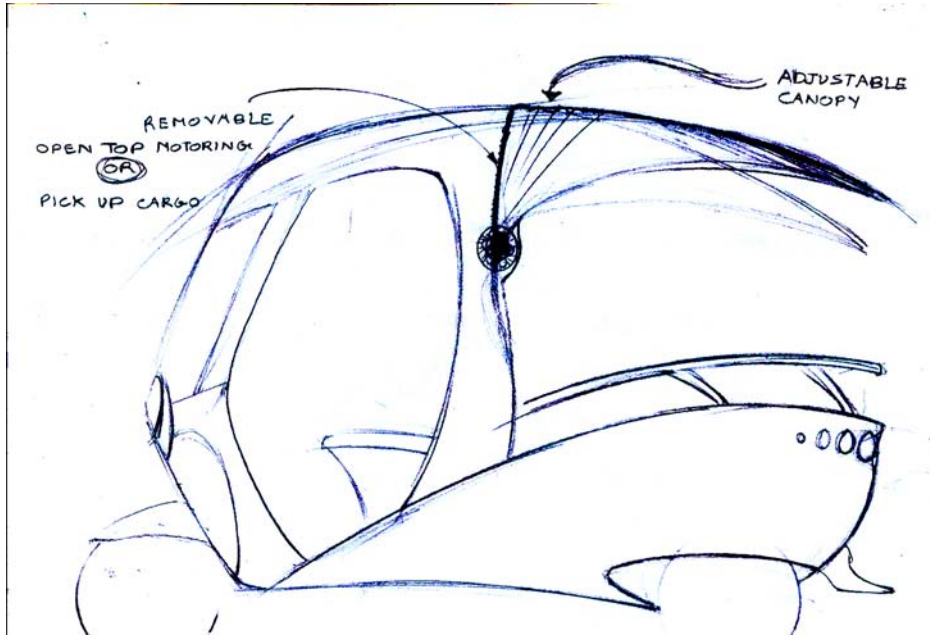
# Concepts

## The idea

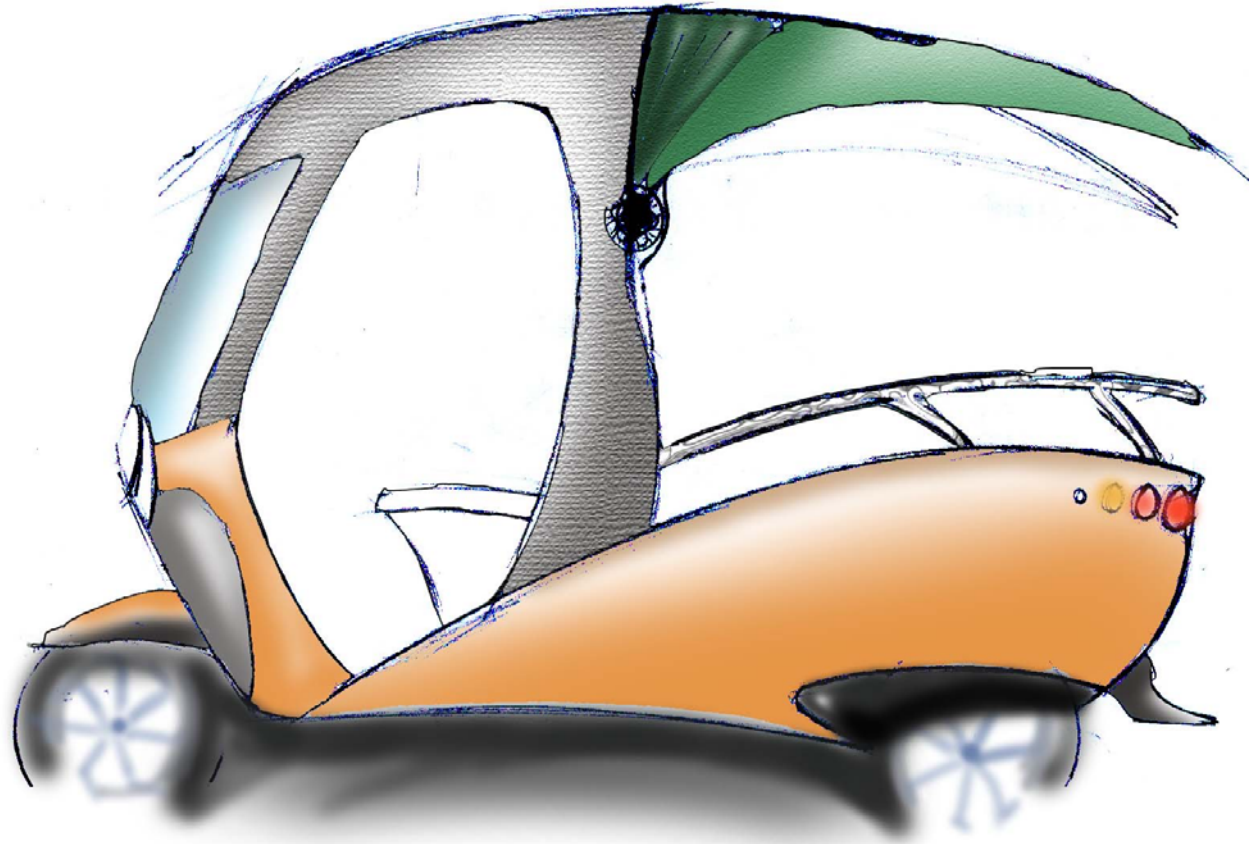
The idea behind the concept is to evolve a totally different experience in rickshaw manufacture and use. It suggests manufacture of a few critical components and use of localized facilities for assembly and outsourcing of components.

Components like railings, canopy and weather protection can be customized to suit the varying climatic conditions across the country.

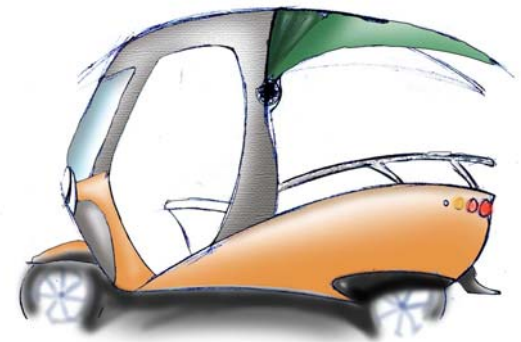
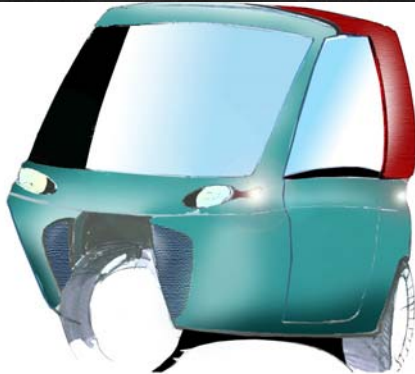
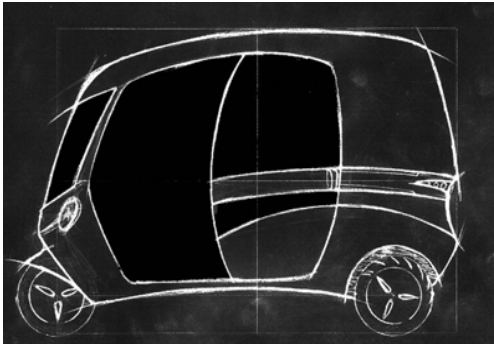
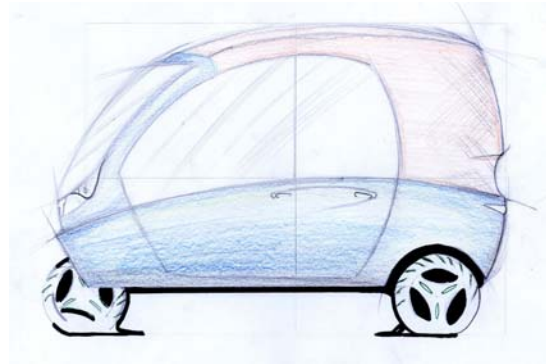
This will bring costs down and promote use of cultural elements in design



Concept 7



## 11 Evaluation Of Concepts



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## 11.1 Evaluation Criteria

### Stage I

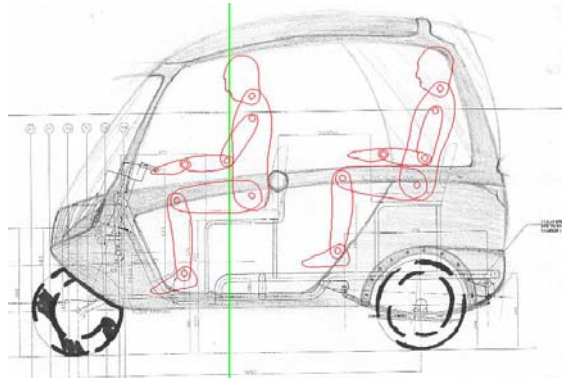
Since the concepts were developed within a frame work of overall size and some common features, they are now evaluated on the basis of

**Identity:** Concept 2 and concept 6 were the preferences due to their contrasting yet strong identities

**Practicality of Design:** Concept 1, concept4 and concept 6 were the preferences due to their highly functional nature

**Ease of Manufacture:** Concept 6 and concept 7 were the choices as they lent themselves to a correct mix of contemporary feel and feasibility for production

Note: Choices were made after qualitative evaluation with drivers, passengers and an understanding of depth of each concept and objective evaluation



Concept 1

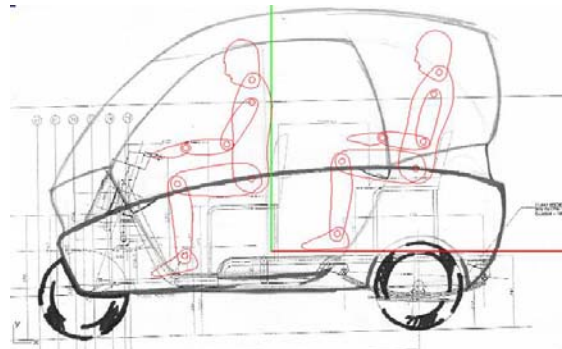
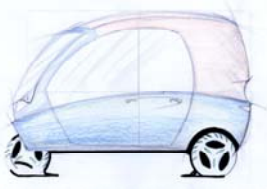
## 11.2 Chosen Concepts

The three selected concepts were

Concept 1

Concept 2

Concept 6



Concept 2

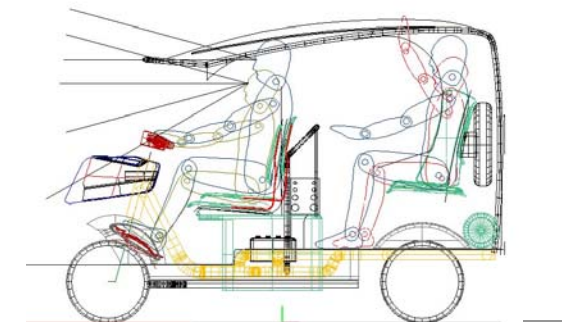
These were further compared on the basis of visual identity, body styles favoured by company (see page 11) and integration with interior design elements

All the three concepts were evaluated for driver and passenger space and layout. They were rearranged w.r.t. performance in above criteria as

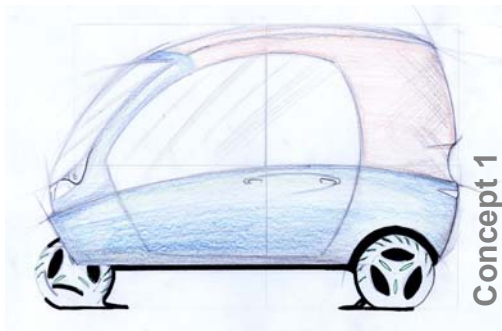
Concept 6

Concept 2

Concept 1



Concept 6



## Stage II

### Comments

Concept 1- looks more like a low cost than a premium auto

Might be expensive to manufacture in relatively small numbers

Concept 2 – looks like a new category of three wheeler rather than a rickshaw

Has the feel and form of a personal vehicle.....family car

Concept 3 – a fresh look and new details are evident

A good mix of functional elements and strong visual identity

Based on the evaluation and resulting inferences

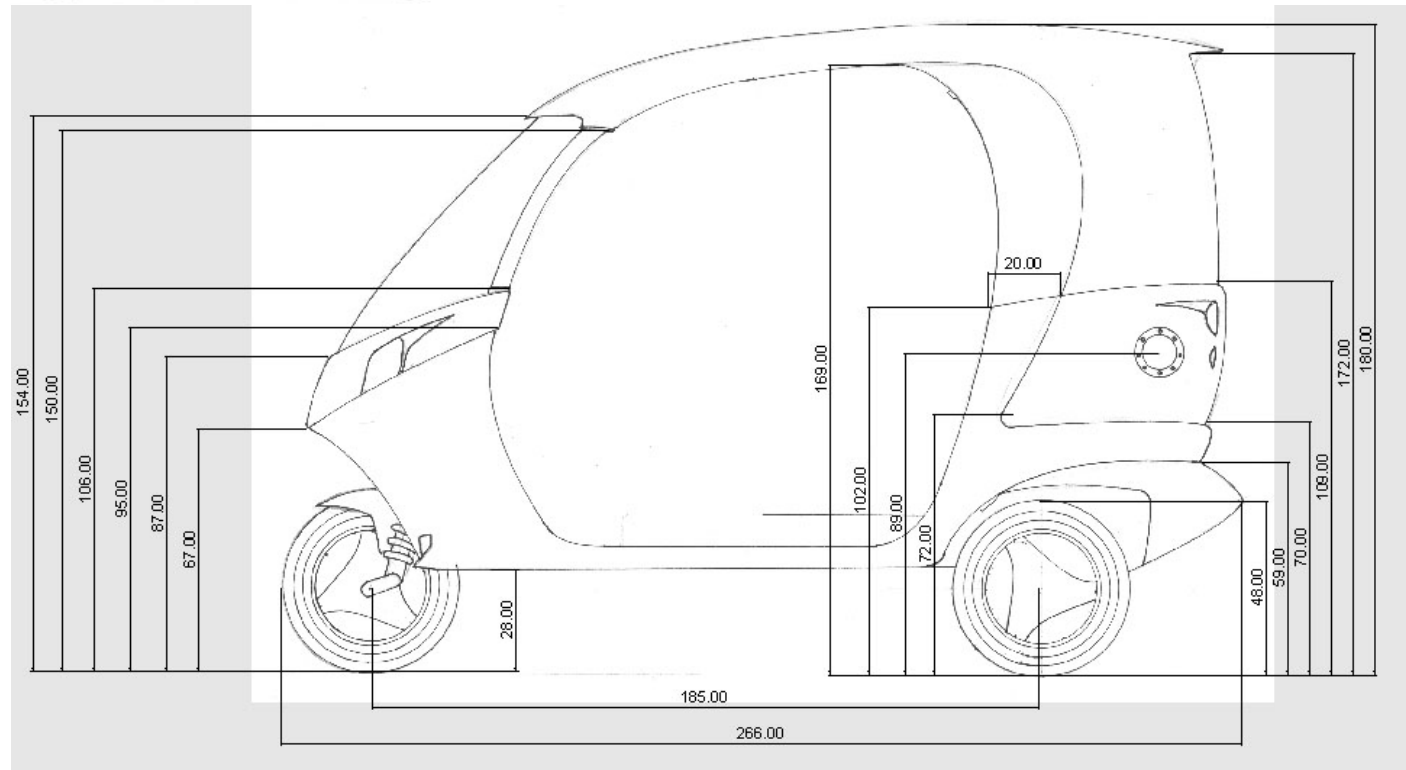
The **final** concept is

**Concept 6**

## 12 The Final Concept



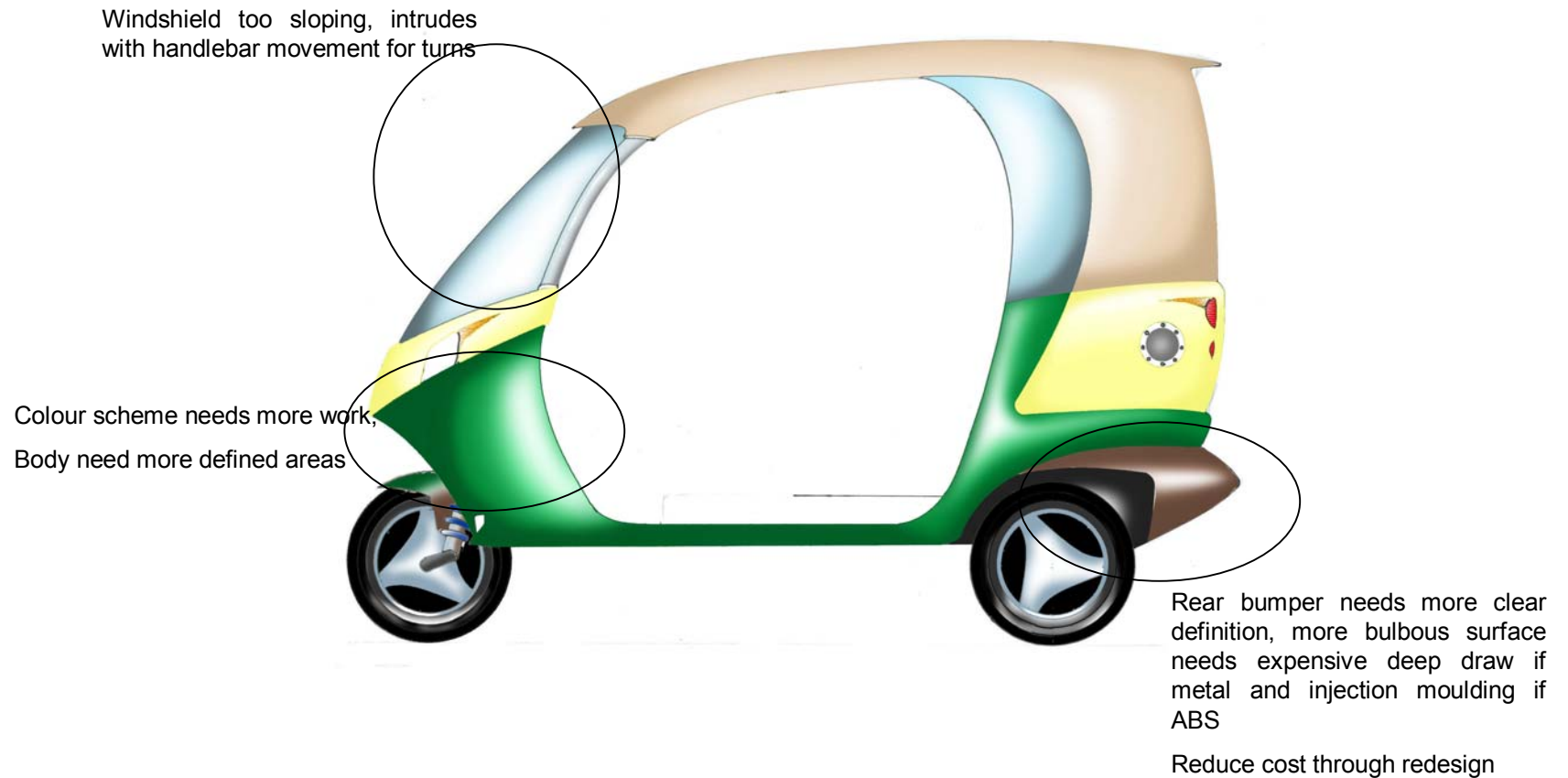
Adding dimensions and front and rear views



## 12.1 Refinement

### Step 1

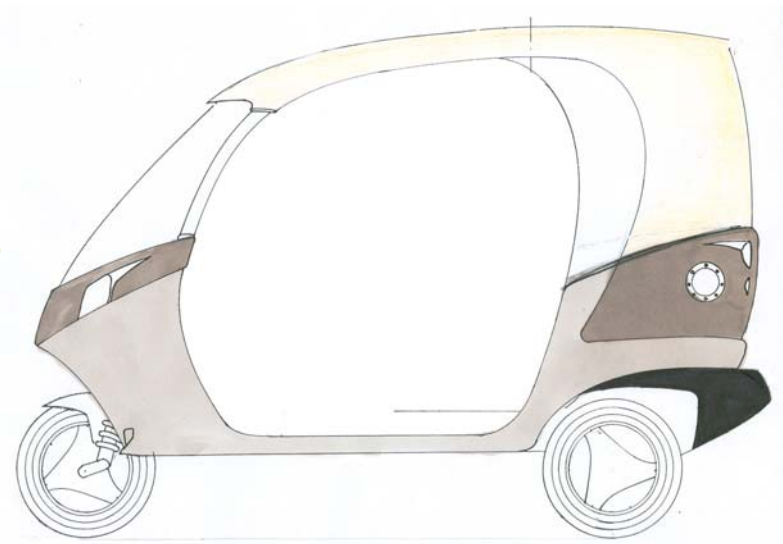
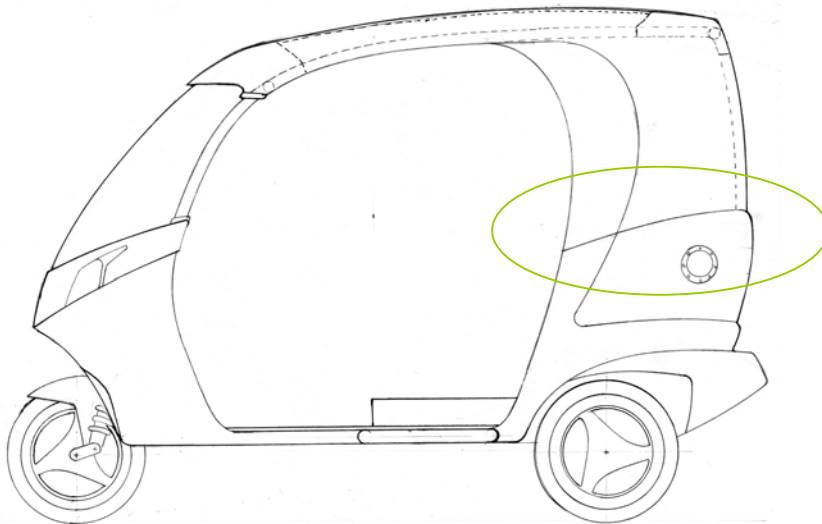
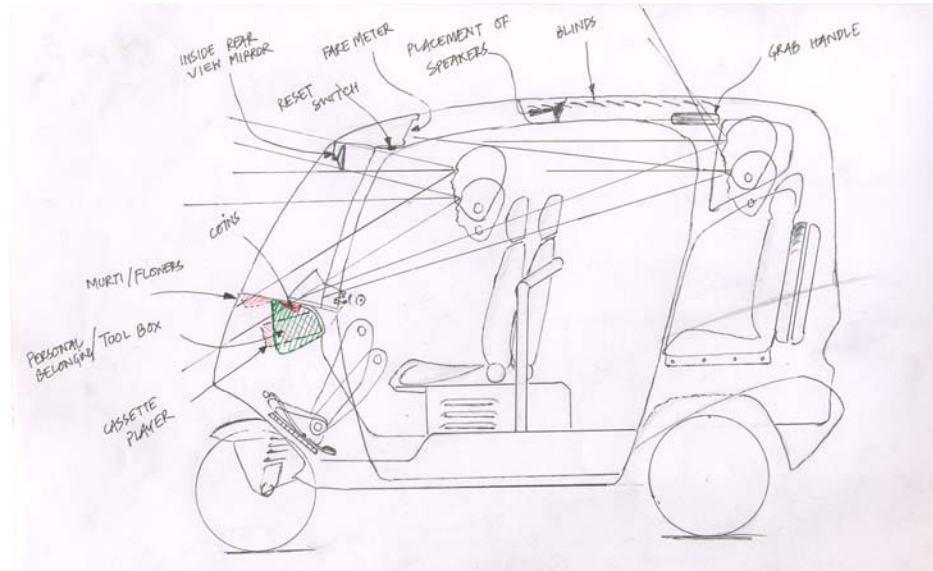
Perceived problem areas and refinement needed  
(after consultation with interior design team)



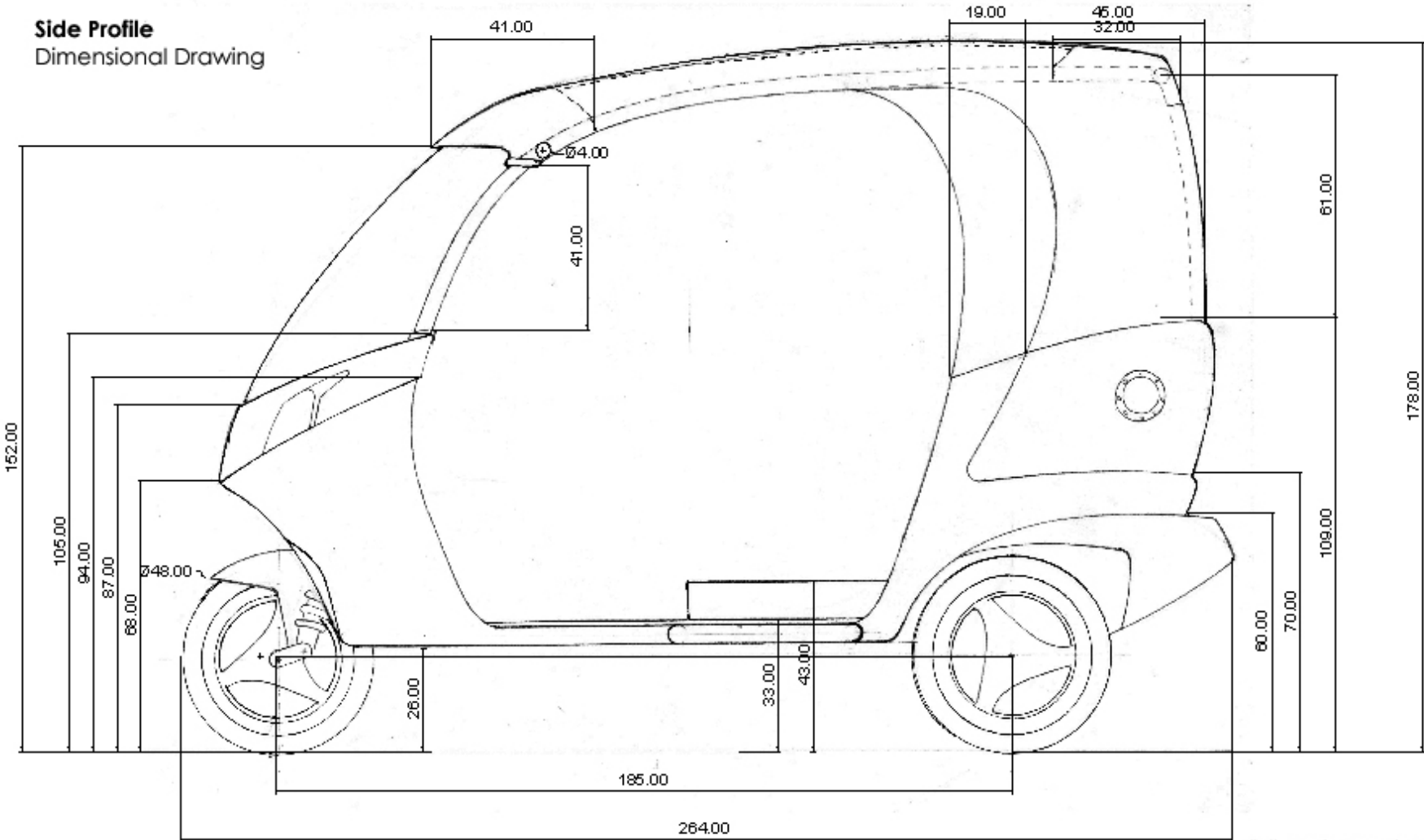
# The Final Concept

## Step 2

Refining the slopes on side panels to achieve a more prominent side profile



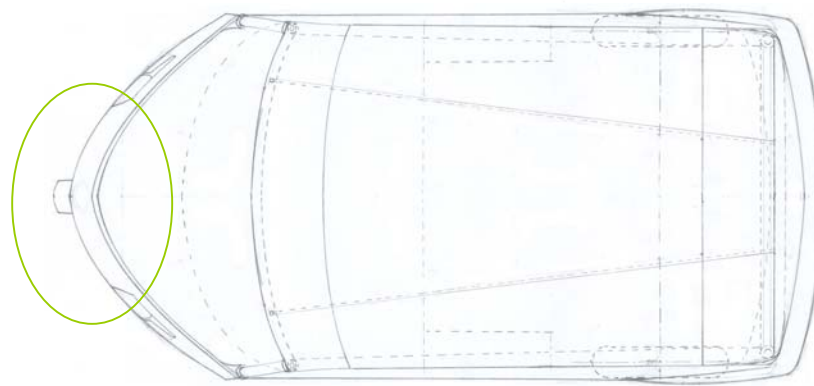
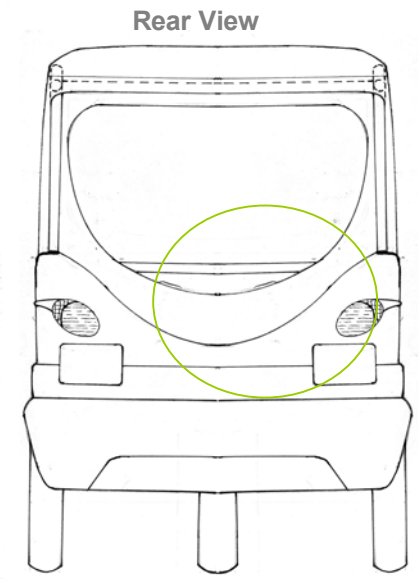
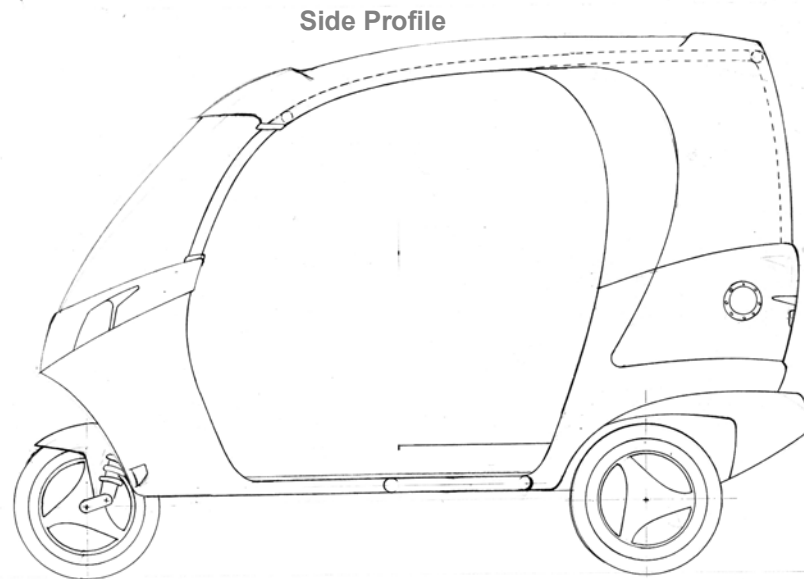
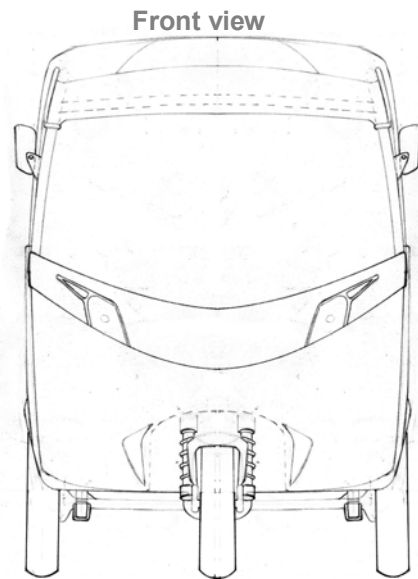
Side Profile  
Dimensional Drawing



All dimensions are in cm

# The Final Concept

## Step 4



Front panel too curvy, forms and edge, needs a more smoother profile....like a circular arc

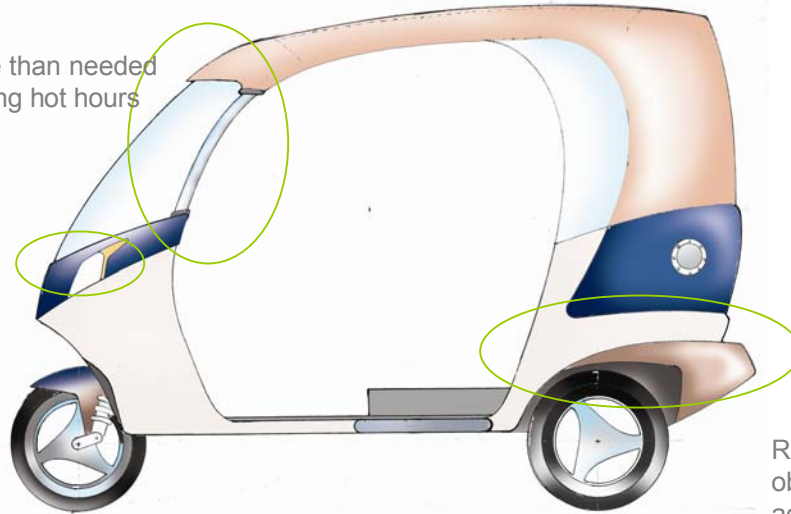
Rear profile not getting well with front face...looks a bit like an independent face

# The Final Concept

## Step 5

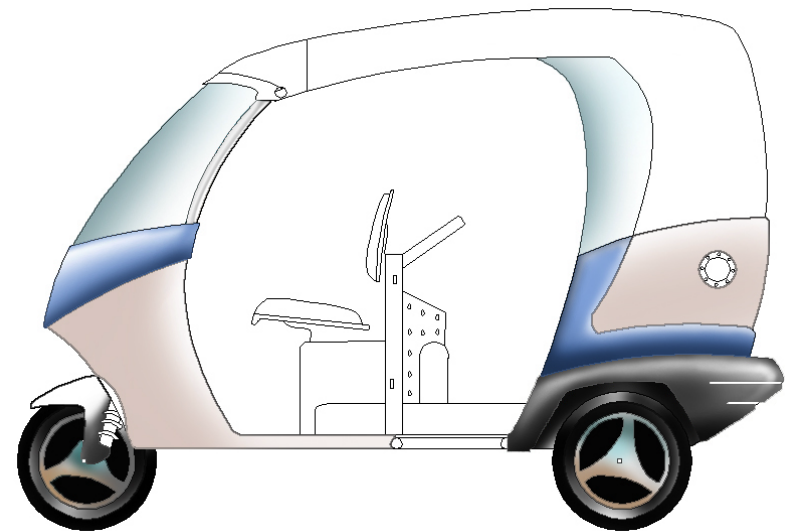
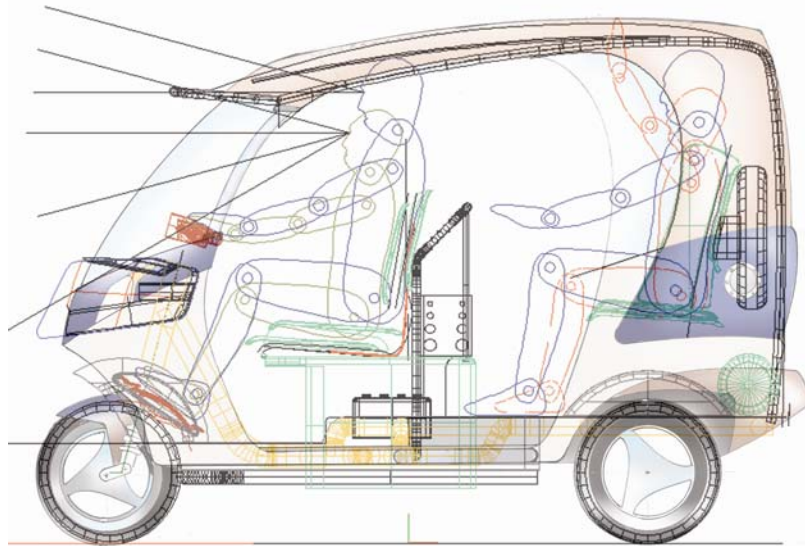
Windshield area too large .....more than needed  
May cause heating of interiors during hot hours

Rethink headlight design to achieve  
cost reduction with identical  
components on left and right side



Rear bumper needs stronger  
elements....better details

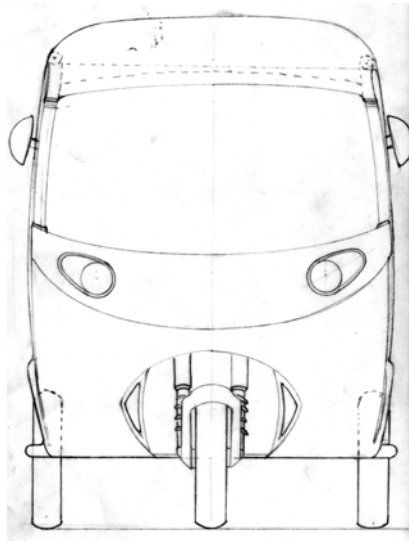
Reduction in windshield size can be  
obtained by increasing front panel height,  
adding further strength to front panel also



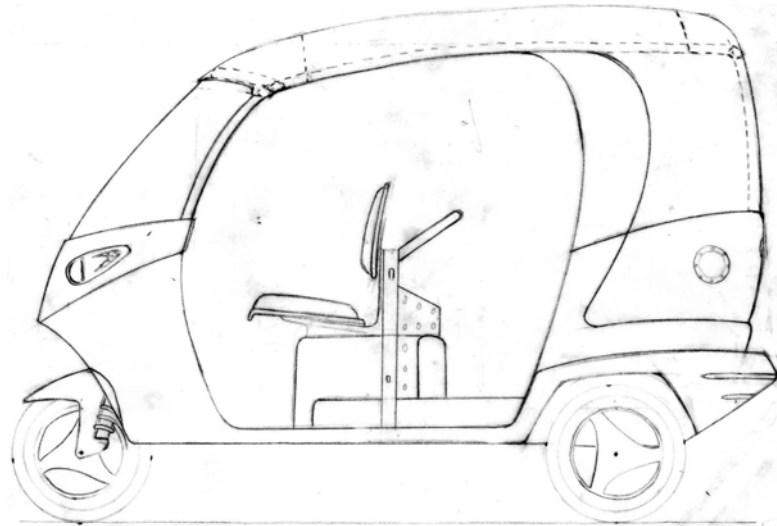
# The Final Concept

## Step 6

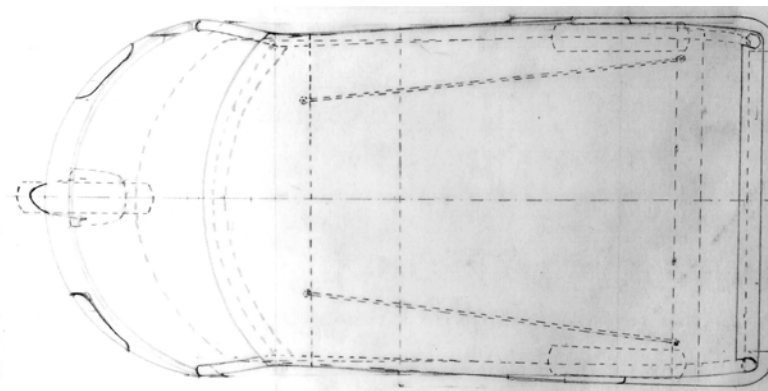
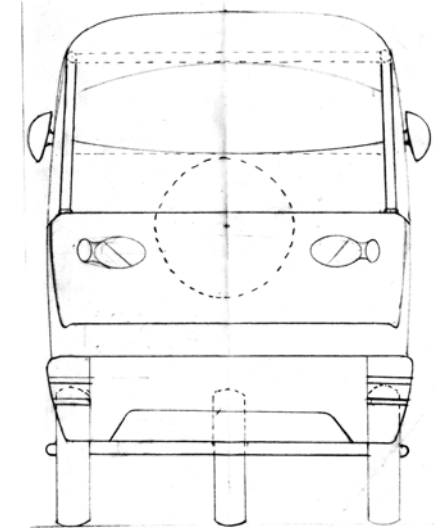
Front view



Side Profile



Rear View

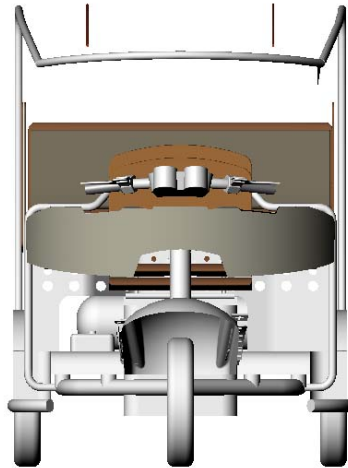


Use of more standard components in areas such as headlamps and taillamps would help to reduce cost. Of making separate components for left and right hand side

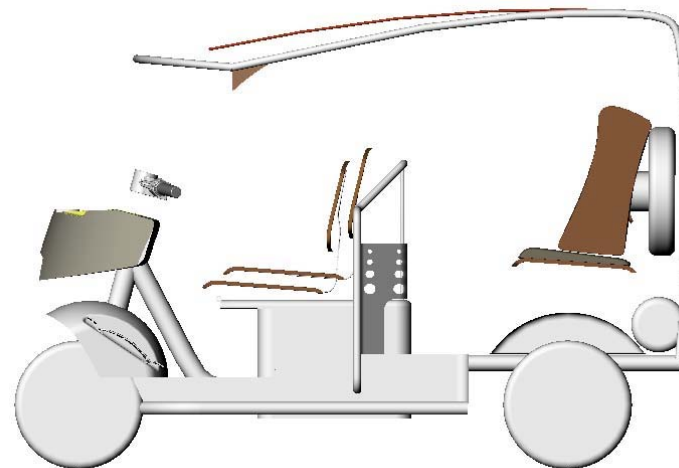
# The Final Concept

## Step 7

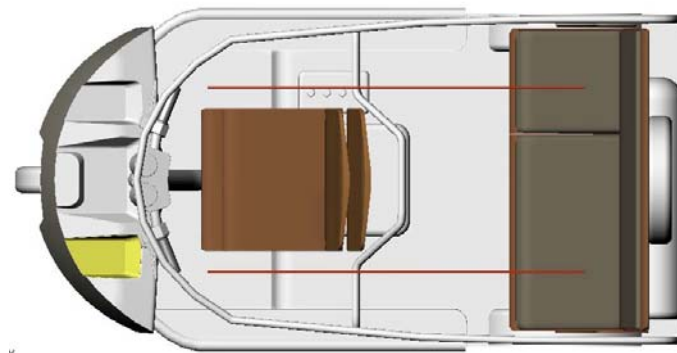
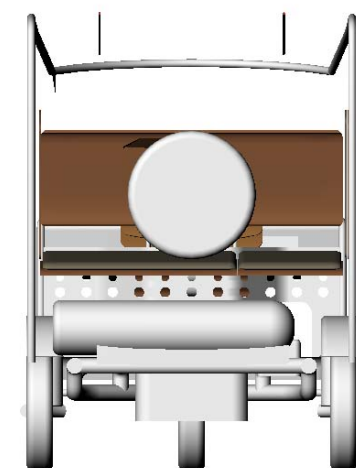
Front view



Side Profile



Rear View



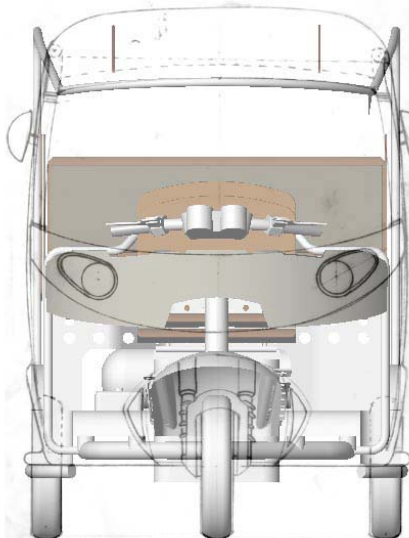
y  
—x

The refined interior model is obtained to integrate it with exterior design and exterior 3D model

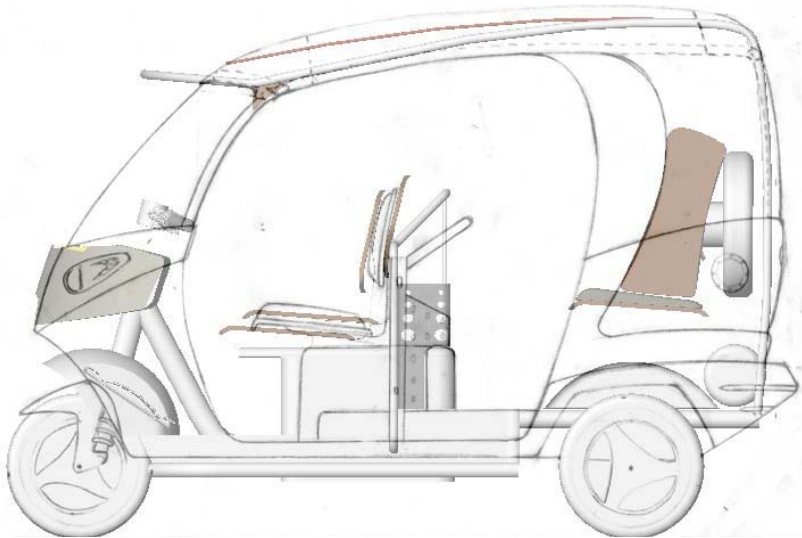
# The Final Concept

## Step 8

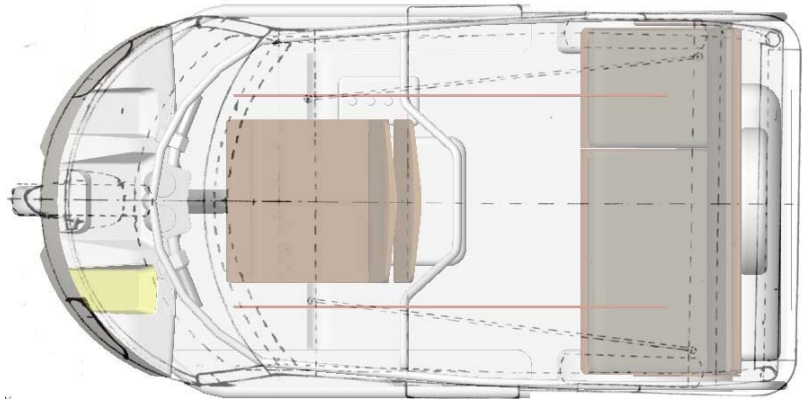
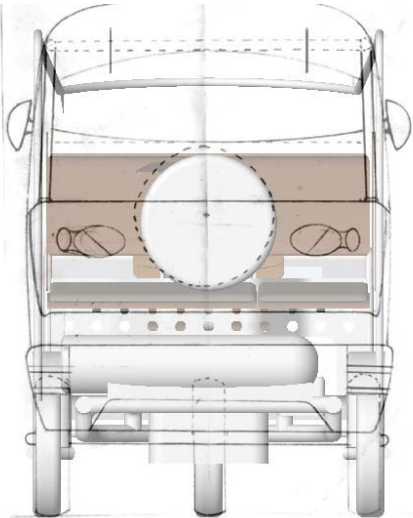
Front view



Side Profile



Rear View



Superimposing interior model on exterior to check for loopholes

## The Final Concept

### Step 9



A full size test model was constructed to verify

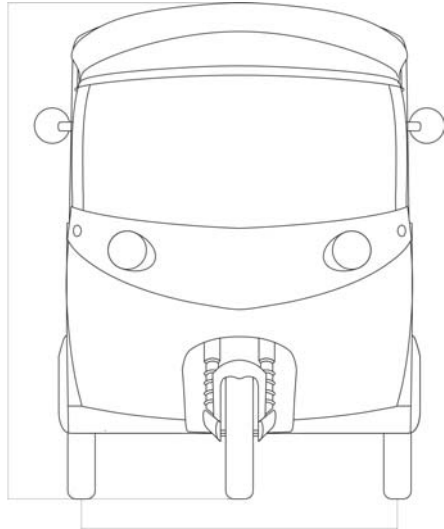
- Exterior form in wire frame
- Interaction of exterior with interior
- Seating ergonomics
- Passenger and driver space
- Visibility
- Ingress/ Egress
- Psychological factors affecting behaviour

For more pictures and scenarios [See enclosed CD](#)

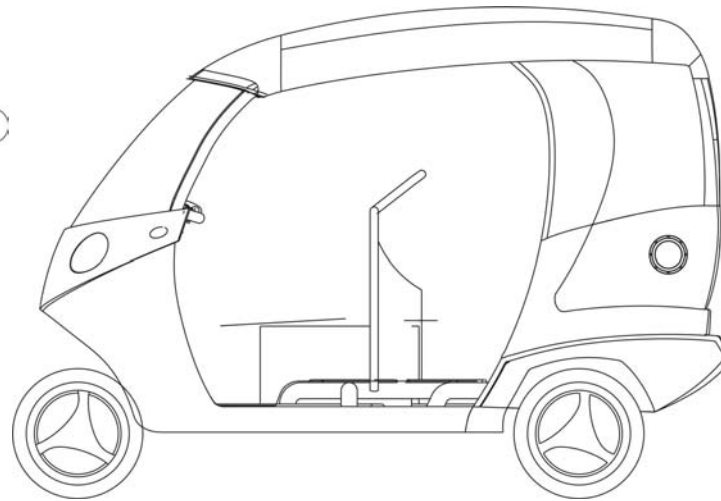
# The Final Concept

## Step 10

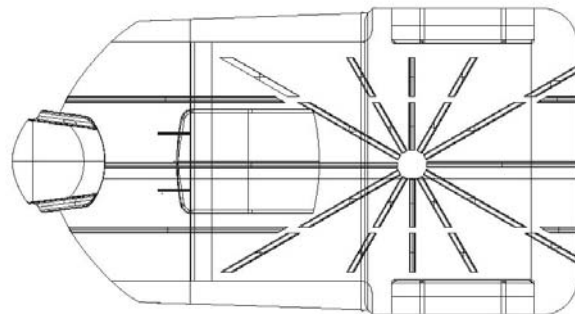
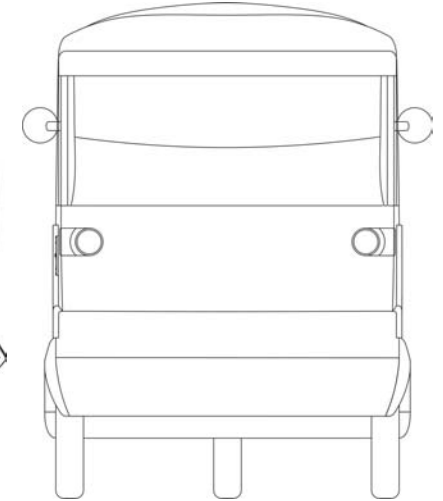
Front view



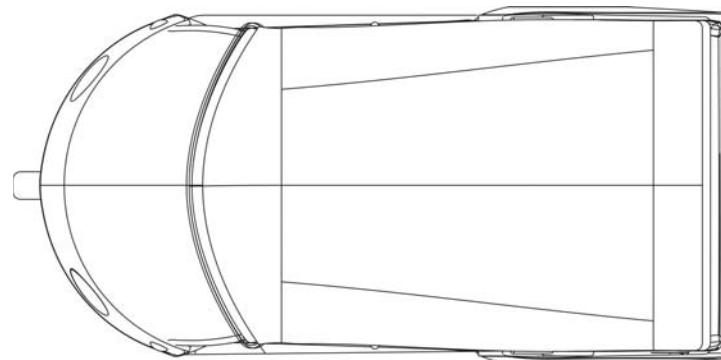
Side Profile



Rear View



Floor plan



Top view

Final Refinement of form and design of floor pan  
(in conjunction with interior design)

# The Final Concept

## 12.2 Renderings

Windshield held by top and bottom members

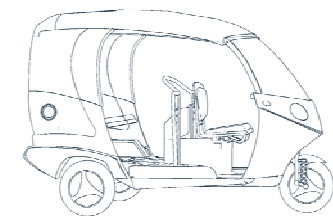
Transparent side openings for better side visibility

Twin headlights with clear lens headlamps

The colours chosen are Olive Greens in warmer shades

With the larger panel colours in Ivory White and tans

Dual coloured front Mudguard



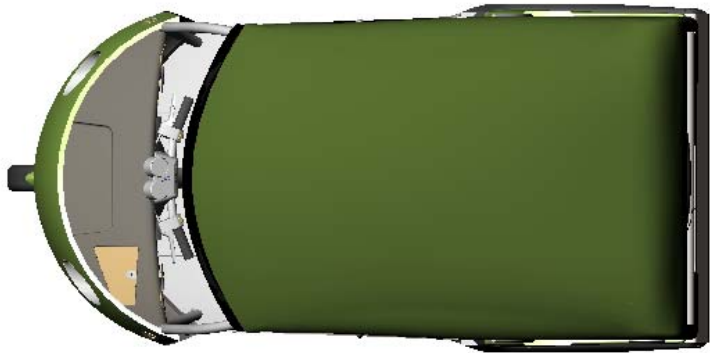
## The Final Concept



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# The Final Concept

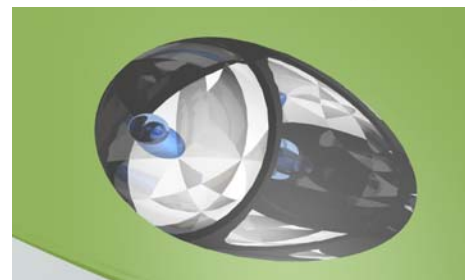
## 12.3 3D CAD Model



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# The Final Concept

## 12.4 Autorickshaws Rendered With Interiors



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## References

1. <http://www.threewheelers.com/azlist1.html>
2. [UNIDO, Development and Transfer of Technology Series No 3, The manufacturers of Low Cost Vehicles in Developing Countries, 1978]
3. [Yahoo India Webpage; NRI Special, News, By Piyush Pandey, 'Atul Auto to double output this fiscal']

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1. Grillo P. J., Form Function And Design; 1980, ISBN 0-486-20182-1; 101370, IDC Library IIT B
2. ICSID Journal,The Humane Village; 1994, ISSN 1198 –7448; M 256, IDC Library IIT B
3. Smith F. J. M., Fundamentals of Fabrication and Welding Engineering; 1993, ISBN 0-582-09799; OSZ 671.5 Central Library IITB
4. Chakrabarti Debkumar, Indian Anthropometric Dimensions for Ergonomic Design Practice 1997; ISBN 81-86199-15-0; M 599, IDC Library IIT B
5. MPR 230, IDC Library, Battery Powered Autorickshaw, April 2000
6. MPR 100, IDC Library, Redesign Of Autorickshaw Nov 1991
7. MDP 207, IDC Library, Three Wheeler For Rural Areas, April 1998
8. MDP 95, IDC Library, Redesign of Taxi, July 1988
9. MDP 69, IDC Library, Design Of A Campus Vehicle, Jun 1987
10. DP 26, IDC Library, Autorickshaw Design, April 1973

1. Dimensional drawings of Bajaj Auto's RE Autorickshaw
2. Anthropometric Analysis of Bajaj RE
3. User and Product Study

### 1. Dimensional drawings of Bajaj Auto's RE Autorickshaw

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## **Annexure**

### **2. Anthropometrical Analysis of Bajaj RE**

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## **Annexure**

### **3. User and Product Study**