

STYLING OF SMALL SPORTS UTILITY VEHICLE

PROJECT II

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under guidance of
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APPROVAL SHEET

Project II

Styling of Small Sports Utility Vehicle

By

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1

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ABSTRACT

2

The project idea emerged out of need for such relevant vehicles in India. Our road infrastructure is so designed that one need not have to go for any off-roading adventure. It is not a surprise why Sports utility vehicles are not so popular in India despite all its suitable features meant for our kind of roads, because imported SUVs are simply not affordable and not much choices are left in indigenous SUVs. Apart from this, SUVs are massive in nature, which is difficult to drive in city roads, so a smaller version of regular size SUV will be good enough to serve the users' need. The sales figure of Mahindra Scorpio gave us the ray of hope to proceed with this project which could be the choice of any Indian SUV buyer.

This project is an attempt to design a vehicle which will be a perfect cross between a sport utility and urban activity vehicle within a price range of 6-7 lakhs rupees.

SCOPE OF THE PROJECT

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By the end of 2004, Indian customers will have a choice to choose a Sports Utility Vehicle from a wide range of 15 to 20 SUVs. But almost 80 percent of them will be imported one. Increase in sales and demand in domestic market as well as global market clearly indicates that there is a definite need of newer SUVs. New in terms of technology and styling in particular. As far as India is concerned, the specially designed roads itself is enough to create the demand, but the increase in traffic congestion and population doesn't allow us to run massive fully blown SUVs like landcruiser, hummer, jeep Cherokee.

Other Asian manufacturers like TOYOTA and Mitsubishi has identified the need and started the trend with smaller SUVs which suits their conditions and now gaining popularity rapidly all over. A few such smaller versions of RAV 4 and Pajero Pinin were seen in Indian roads recently and were well appreciated. Honda, Hyundai, Suzuki, GM, ford etc have started launching their products here and by the end of the coming year we shall be having a variety of vehicles to choose from.

Despite having lots of options, we as Indians still go for indigenous SUVs like safari and Scorpio because they are easy to maintain and affordable. So, its high time to give our very own customers a product which makes them feel proud of owning a vehicle which is contemporary in terms of styling and also allows them to use it as a urban activity vehicle which is possibly the need of the hour.

AIM

4

To design a vehicle which is relevant for Indian road conditions and also fulfil the aesthetical demands of the user. The success story of M&M Scorpio triggered the passion of all the aspiring buyers of SUV who are waiting eagerly for a correctly sized visually appealing SUV to roll in, not just only for sports utility but also for regular urban activity as a family vehicle.

The sales figures of the last five years shows that there is a tremendous growth of automobile population because the no. of vehicles per family has gone up because of different kinds of needs of the people. Apart from that the economy of working class people has gone up in certain segments. So they are looking for newer options within their reach. That is why, a much needed small capacity sports utility vehicle with contemporary looks has to be designed with a mission to compete the global players.



DATA COLLECTION

5

5.1 BRIEF HISTORY OF OFF-ROADERS

A Brief **History of Jeeps** (from CJ's to ZJ's, and beyond)

I have tried to make this history as complete as possible, without going into too much detail about the individual models, also, I have organized it more by model, than by chronological order, so the years may skip around some.

Jeep history and trivia:

In the beginning God created the heavens and the earth...and it was good. In 1940 Karl Probst created the Jeep, and it rocked! This is the story of how the legendary Jeep came to be...and how it has come to be what it is today...

By 1939 the US military needed a new, universal vehicle to replace the motorcycle and its other vehicles (such as the modified Ford Model-T), so they invited 135 different car companies to compete for a contract to build a new vehicle for the military. The vehicle had to meet certain specs, such as a payload capacity of 600lbs, a wheelbase under 75 inches, a fold-down windshield, a gross vehicle weight of under 1200lbs, and it must be four-wheel drive. Only three companies entered, Bantam, Willy-Overland, and Ford.

Bantam enlisted the help of Karl Probst, and in 1940 was the first to produce a working prototype for the military, dubbed the Bantam Blitzbuggy and "Old Number One". Willy's-Overland and Ford soon followed with their own prototypes, the Willys Quad and the Ford Pygmy, which were basically knock-offs of the Bantam car. Willys eventually won the contract because of their 60hp "Go-Devil" engine, but Ford was also given a contract to help keep up with the military's demand for the

vehicles for use in WWII. Willys later renamed their jeeps the MA and the MB, while Ford called theirs the GP and GPW. Many believe, as I do, that the Jeep won the war for the Allies.

As for the name 'Jeep', no one really knows for sure where it came from. Some people believe that it evolved from the Ford 'GP' designation, which many think stood for 'general purpose', which is incorrect. The "G" was for Government and the "P" was the vehicle class (80' wheelbase 4x4 $\frac{1}{4}$ ton truck). Another possibility is that the name came from Popeye's magical sidekick named jeep, who could do almost anything.

5.2 BACKGROUND KNOWLEDGE

5.21 Major Players

Major companies like General Motors, Mitsubishi, Toyota, Range Rover, Chrysler, Ford manufactures SUVs which are well famous because of its size, raw power and style. Some of their products which are very popular in the market are shown in the left side.



JEEP WILLYS



LANDCRUISER



PRADO



RANGEROVER



PAJERO



HUMMER



1986 3-Door

GYPSY



1991 3-Door

SIERRA



1998 5-Door

SAFARI



2002 5-Door

SCORPIO

5.22 Indian Scenario

In India, we have very limited options for buying a SUV. In the name of SUV we get MPVs and few so called SUVs which are not competent enough to stand against any of the imported models. The Indian companies which manufactures SUVs are namely TELCO, Mahindra & Mahindra and Maruti Udyog Ltd. Some of their products are shown:

- Maruti gypsy has been launched in the year 1987 and picked up the market because of its utilities in certain region. But again, bumpy ride quality and lack of comfortable rear seats, it could not become the favorite vehicle.

- Tata sierra was launched in 1991 with correct styling and in the correct time, but since it has got 1 door on either side, ingress / egress to the rear seat was a big problem and just because of that, it failed in gaining popularity despite having comfortable seats and sufficient luggage space.

- Tata safari rolled in to the market in the year 1998 with all the features an SUV buyer is looking for, but again priced too high for and Indian to buy an Indian vehicle at that price.

- Mahindra & Mahindra Scorpio was the first attempt by them and actually tapped the market, the waiting list for booking the vehicle tells the success story of that vehicle and how much relevant it is to our own customers.



M & M Bolero



TATA sumo



TATA Mobile



TOYOTA Qualis

5.23 Other Indigenous Off-rovers

Other off-rovers which are quiet popular in Indian roads are Mahindra Bolero, Tata sumo, Tata mobile, Toyota quails.

■ Mahindra bolero is again a robust and true off-roader needed for our roads but again cannot be used as and urban utility vehicle for its overpowering masculinity and crude looks.

■ Tata sumo is doing very well in its own segment for the flexibility it offers in utility. It is one of the best product Tata has ever produced.

■ Tata mobile which is a pick up truck is the only product in that category in real sense. Other pick up trucks are so plain looking that they gives a feeling of garbage carrier, which cannot be driven by the owner at any cost.

■ Toyota quails is one of few successful vehicle in India which has become so popular after being launched despite its ugly proportions. It gained popularity just because of the quality of ride it offers and interiors.

INDIAN MODELS



7.2-10.0 lakhs
TATA Safari



5.8 - 7.2 lakhs
M&M Scorpio



4.5-5.0 lakhs
MARUTI Gypsy



5.5-6.0 lakhs
TATA Sierra

Sub 10 lakhs category

5.24 Price listing

The prices of the Indian as well as the imported model of SUVs clearly indicates that the price is a deciding factor due to which the SUVs are not popular in India. Indian manufacturers gave the consumers a very limited option to choose from, so arrival of a new and an appropriate SUV at an affordable price would fulfill the desire.

IMPORTED MODELS

MITSUBISHI Pajero (33.8 lakhs)



TOYOTA Landcruiser (33.0 lakhs)



TOYOTA RAV 4 (16.0 lakhs)



HONDA CR-V (15.0 lakhs)



HYUNDAI Terracan (18.0 lakhs)



SUZUKI Grand Vitara (19.8 lakhs)



Above 10 lakhs category
ranging from 14 - 34 lakhs

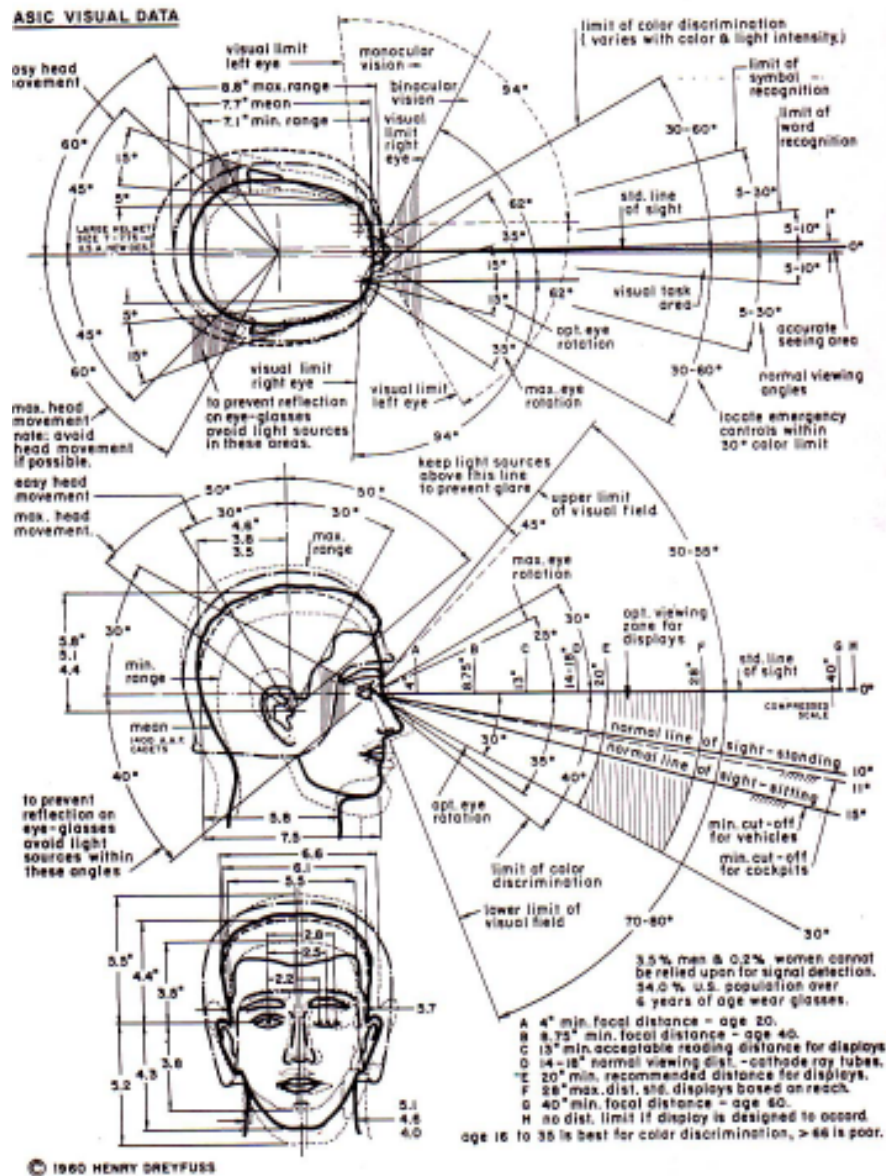


fig. 5.31(a)

5.3 ERGONOMIC DATA COLLECTION ERGONOMIC CONSTRAINTS

5.31 Data For Head Room And Blind Spots

The relevant data required for calculating the head room and blind spots are taken from the figures shown, and utilized in the design. For detailed info please refer annexure 1

SEAT WIDTH: 19" MIN.
ARM REST INSIDE SPACING: 19"
ARM REST WIDTH: 2"

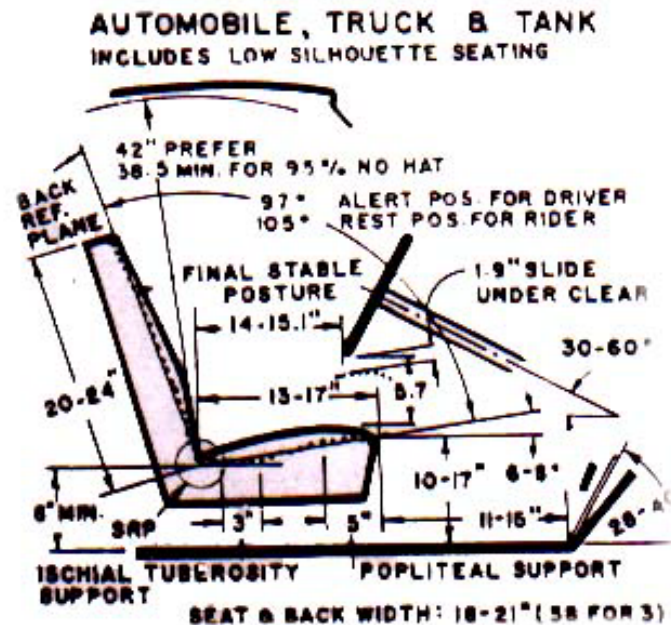
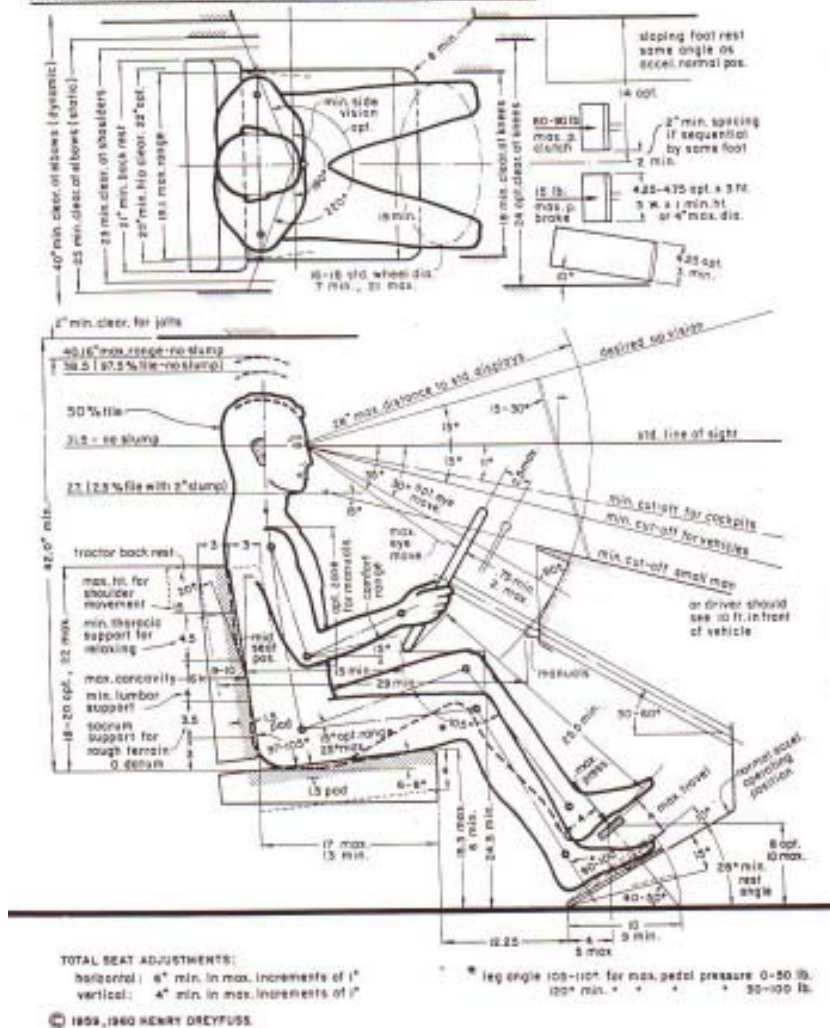


fig. 5.31(b)



5.32 Data For Seat and leg room

Data from figure shown in the left gave us minimum requirement for comfortable seating with ample leg room and seating arrangement. For clarity please refer annexe1.

SPACE CREATION

Rough dimensions from the visual map and from the ergonomic data collected to create the internal space.

- width of individual seat 535 mm (front)
- width of individual seat 535 mm (rear)
- width of child seat 400 mm (rear)
- Overall width of the vehicle from inside 1600 mm including shoulder clearance of 50 mm on both left and right seat. (minimum)
- Total inside height of the roof from floor pan 1310 mm (minimum) including headroom of 200 mm.
- Total length of the cabin from inside 2235 mm (maximum) for luxurious seating with ample legroom.
- Total boot space 0.78 cubic meter
- Total trunk volume 4.0 cubic meter

fig. 5.32(a)

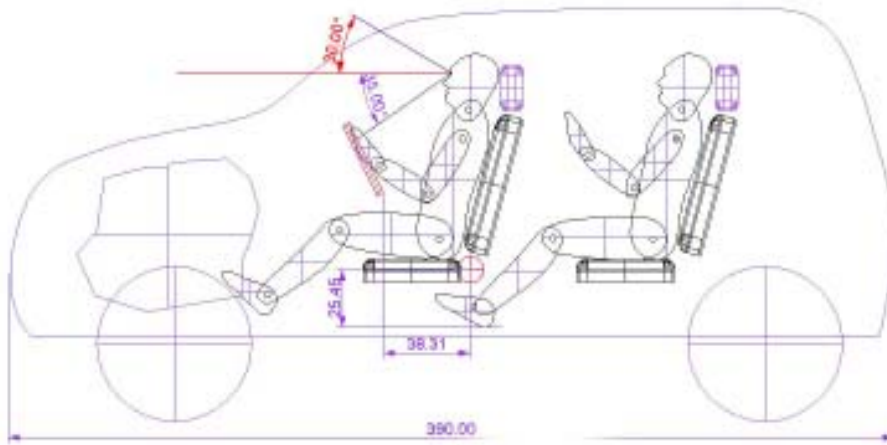


fig. 5. 32(b)

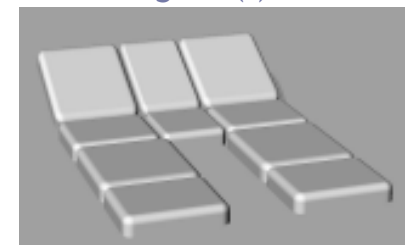
Fig. 5.32(b) is a done in 3-d CAD tool rhino to calculate the whole internal volume, height of the roof from floor pan for erect driving posture, seat height from the floor pan, leg room, head room, length of the seat with respect to the length of the volume created inside. The seats have to slide forward and then the backrest after removing the headrest has to recline completely to convert the whole seating arrangement into a bed as shown in fig. 5.32(d). For this purpose we used 1:10 scale mannequins of 95% ile which is about 1781 mm strature length, to calculate the required dimensions. It also gave us the wheel base with respect to rear seat height, wind shield height at the top and bottom, bonnet height for proper vision, boot length and overall length of the car approximately, which was very helpful in imagining the proportions while sketching initial concepts. Please refer to Annexure 2 for dimensions.

- Head rest removed and seats reclined back completely to make a bed.
- Both the rows of seat can be slid forward to create that platform.

fig. 5. 32(c)



fig. 5. 32(d)



5.4 USER SURVEY

To know users' aspirations for aesthetics and other requirements, an extensive user survey is done qualitatively among the current SUV users, aspiring buyers and dealers. We prepared eight different image boards with different intentions for each and every one in order to know the psyche and the hidden desire of the user. Out of which four were not found to be very useful for our design so we are showing just four of them in the figures. Related questions were asked while showing the image boards which deals with certain issues, discussed later. Questions were different for different people as and when the situation demanded. The image boards were of shoes, eye wears, sports utility vehicle and Indian off-roader vehicles.

The issues are:

- What the user think while buying an SUV
- How brand conscious they are
- What is their priority ? (styling, technical, functional features)

Image board no. 1

(All types of adventure related and sport shoes.)

This image board shows sports shoes, adventure trekking shoes, formal and informal boots. The idea of having this kind of images is to know what kind of shoes they like within the range of sports shoes, which gives the idea of their personality and their priorities. Some personal questions were also asked just to know the user better.

A boot lover's entire taste will be different if compared to a canvas shoe lover, but when it comes to vehicle, both of them might like the same vehicle. So, idea was to know the users more and more closely.



fig. 5. 4(a)

Image board no. 2 (Sports Eye wears, regular eye wears and fancy eye wears)

This is to judge the person what they look for when it's a fashionable wearing product and what impact they create when it comes on their face. Like in earlier case, a person who wears an aviator and a person who loves sporty glasses may have similar choices for some other product. Only the taste changes when it comes to fashion or other products whatever the case may be.



fig. 5.4(b)

Image board no. 3

(Sports utility vehicles)

The vehicle shown in this board are Sports Utility Vehicles styled on different philosophy. Some of them are based on American school of styling where as the others are European or Japanese school of styling and all of them are distinctively different from each other. The idea of showing this image board is to learn from them what kind of styling they are looking for. Though it is difficult to understand the concept of styling just by looking at the image of the vehicle from one view, yet an attempt is made to gather information.



fig. 5. 4(c)

Image board no. 4

(Indian off roaders)

This board shows all the good looking Indian off-roaders available ,which is more closely observed by the users. If he/she has to buy any one of these, what will be his/her buying criteria, will it be performance, styling or brand image?



fig. 5. 4(d)

DATA ANALYSIS

6

6.1 Users Identification

Primary Users

Profile:

The Target Users are very passionate lovers of SUV and falls under the age group of 20-30 years. They have aggressive attitude, energetic and very adventurous by nature.

Secondary Users

Profile:

The people who have earned money and buys imported SUVs just because they don't get a quality indigenous model. They are passionate equally like the young generation, but falls under the age group of 30-45 years. They have the same qualities as that of the primary users but the intensity of their attitude mellows down as they grow older.

Tertiary Users

Profile:

Some percentage of people who buys other vehicles like Honda city, lancer, palio and other nice looking cars under 10 lakhs and cannot afford more than that. Indian SUVs are not appealing to them is another factor why they may go for a new hot thing.

6.2 Analyzing the user

- Users are very particular about the choice they make when they have to make a decision which vehicle to buy. They even make up their mind which make to go for, its color, all the technical specification and other features of their interest.
- They are very adventurous by nature and often go for some weekend trips
- They are very much brand conscious, because they feel that 'its the brand which brings the quality' and never mind paying extra if satisfied with the quality.
- They are very possessive about their vehicle and likes showing off. They are sentimentally attached with the product so much that they don't mind offending someone who is very close to them.
- They want their vehicle to have road presence, if not visually then physically.
- Users are mischievous and fun loving people who loves to do the dangerous stunts with their vehicle.
- Unlike other vehicle owners, SUV owners are generally much more knowledgeable in the field of automobiles and keep themselves updated with auto news.

6.3 Activities of the users

- They go for picnic once in a while with family or friends. In case of friends, its generally 3-4 persons in total and in urban setup people have small nuclear family with maximum 4-5 persons.
- Holiday trip to near by place or visiting nearby tourist spots during the weekends, which normally takes 4-12 hours by road.
- Attending family functions like marriages, engagement, festivals etc., which is not adventurous but equally important as social get together.
- Regular commuting, like going to office or for business deals.

REQUIREMENTS EMERGING OUT OF DATA ANALYSIS

7

7.1 Bare Technical requirements

- optional 4x4 wheel drive with shorter wheel base
- engine should develop at least 90-110 bhp
- exposed and prominent spare wheel
- strong A / B / C pillars
- Sturdy Roof Rails

7.2 Functional requirements

- Easy Ingress / Egress to the rear seat
- sufficient luggage space for the weekend trips and picnic programs. Need not have to be very large because Indian people don't go for adventurous sports like mountain cycling, kayaking, rafting etc.

7.3 Styling requirements

- The vehicle has to be sturdy and robust looking
- It has to be aggressive, but as per the power developed under the hood.
- It has to have energy like a sports person.
- Should be able to behave like a gentle beast wherever and whenever required

METHODOLOGY

8

After the data collection is over, a process of going about the vehicle form is planned out which is all about understanding the existing product well. The product range that was studied were of all the off roaders that are doing well in their respective segment whether may it be current production model car, futuristic car or utility pick up truck.

- 1) Understanding the placement of product in transportation design
- 2) Visually mapping the existing products which represents their characteristics in each segment
- 3) As per user need, target segment is selected where exactly I want to place the product.
- 4) Viewing the Indian market for scope of the product
- 5) After selecting the target segment, three vehicles were selected from that segment which are much in talk these days for their styling.
- 6) Formal analysis of those vehicles and bench marking them for styling.
- 7) Lots of styling clues gathered from the map itself with which we proceeded forward.
- 8) Product brief has been prepared which was again provided by the visual map with all the basic requirements - styling, technical specifications and functional requirements

- 9) Concept generation which will be discussed later
- 10) Concepts
- 11) Evaluation of concepts
- 12) Evaluation of the concepts and one chosen for further development
- 13) Final concept
- 14) Further refinements in suitable material
- 15) Final model of the refinements and details.

VISUAL MAPPING

9

Entire range of products were studied for gathering the knowledge of visual grammar of vehicles which includes conventional SUVs, Jeeps, MPVs, Pick ups, Mini - SUVs, Urban Activity Vehicles, concept Pick ups and concept SUVs. Making proper Product Map is not a easy task at all, it needs a lot of research and extensive study, but an attempt has been made to follow the procedure which may lead to a relevant design. Based on the above studies, two product maps have been prepared, one for vehicles worldwide and another within the nation for SUVs and Pick ups. The map for Indian vehicles was made just to get an idea, what kind of scope is available and where exactly we want to place our vehicle. Also it tells us how much freedom can be enjoyed while designing. This map will be used to put a check on how much we have deviated from the target. Each segment is represented by the vehicles that we found to be the most appropriate to represent that particular segment.

The vehicles are basically placed on a plain with an axis for cargo carrying capacity that increases when moved radially from top most left corner. For personal vehicles, it tends to become a hatch back rather than a SUV as we move very close to left most vertical line and finally may convert to a sedan if crosses it. The vertical axis varies from conventional to non-conventional futuristic vehicle in its own category, whether may it be Jeeps or full blown SUVs as we go up.

9.1 PLACEMENT OF VEHICLE IN TRANSPORTATION DESIGN

This map gives an idea where the designer is going to place his design. If he is designing for society, company, individual or for group of people. Since SUVs and pick ups are designed for individual, so we will be concerned only with the rightmost bottom quadrant.

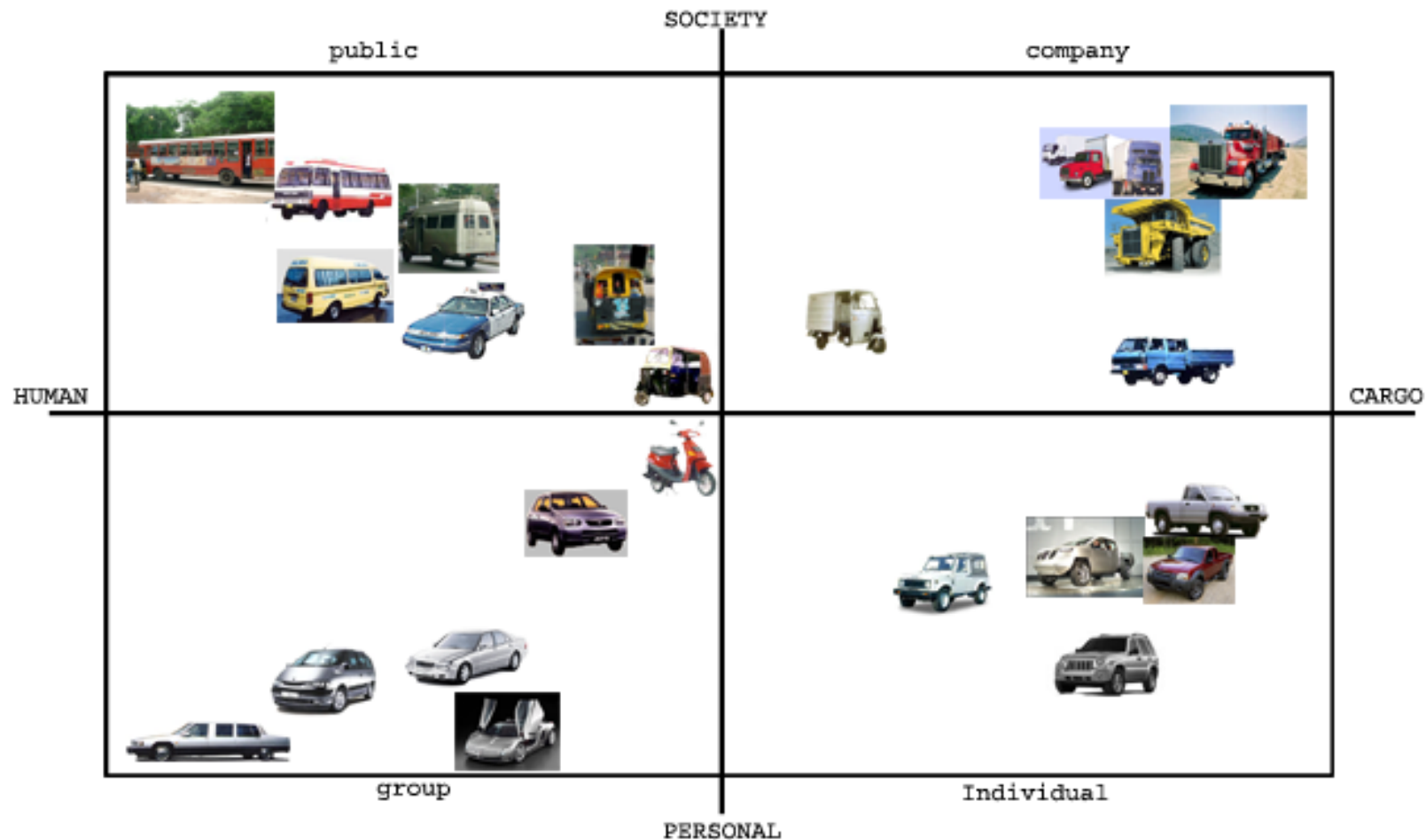


fig.9.1(a)

9.2 VISUAL MAP FOR PLACING THE ENTIRE RANGE OF OFF-ROADERS SPECIALLY SUVs AND IDENTIFYING THE TARGET SEGMENT

This visual map shows the entire spectrum of cargo carrying pick up trucks to personal sports utility vehicle which bear their respective characteristics. The intensity of goods priority and passenger priority varies linearly

Apart from that, passenger carrying capacity and goods carrying capacity are distributed radially from left most top corner in increasing order.

I tried to fill up the gaps with the best possible production model cars or concept cars of today to show the upcoming trends and crowding in the region which is need of the hour.

VISUAL MAPPING OF SUVs

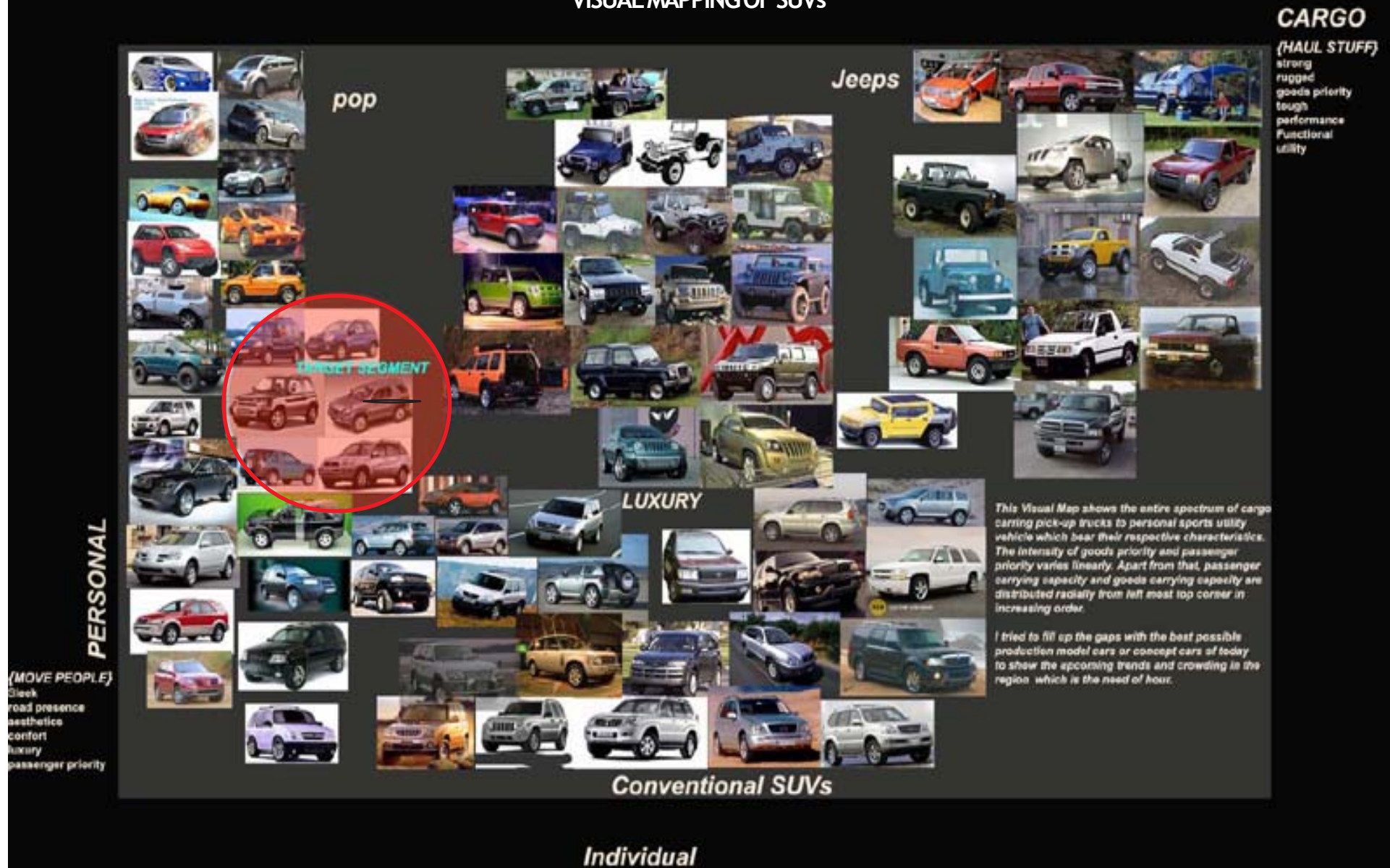


fig.9.2(a)

9.3 INDIAN SCENARIO FOR THE AVAILABLE OFF-ROADERS .

This map shows that there is a definite need in the target segment as well as surrounding areas also which were hatched. Currently there are no indigenous vehicles available in that segment. This also gives us a little freedom to move away from our target a little bit as there is no chance of overlapping between our vehicle and the other. It will still be a fresh one for Indian market. But, effort will be put not to deviate from the target segment.

INDIAN SCENARIO

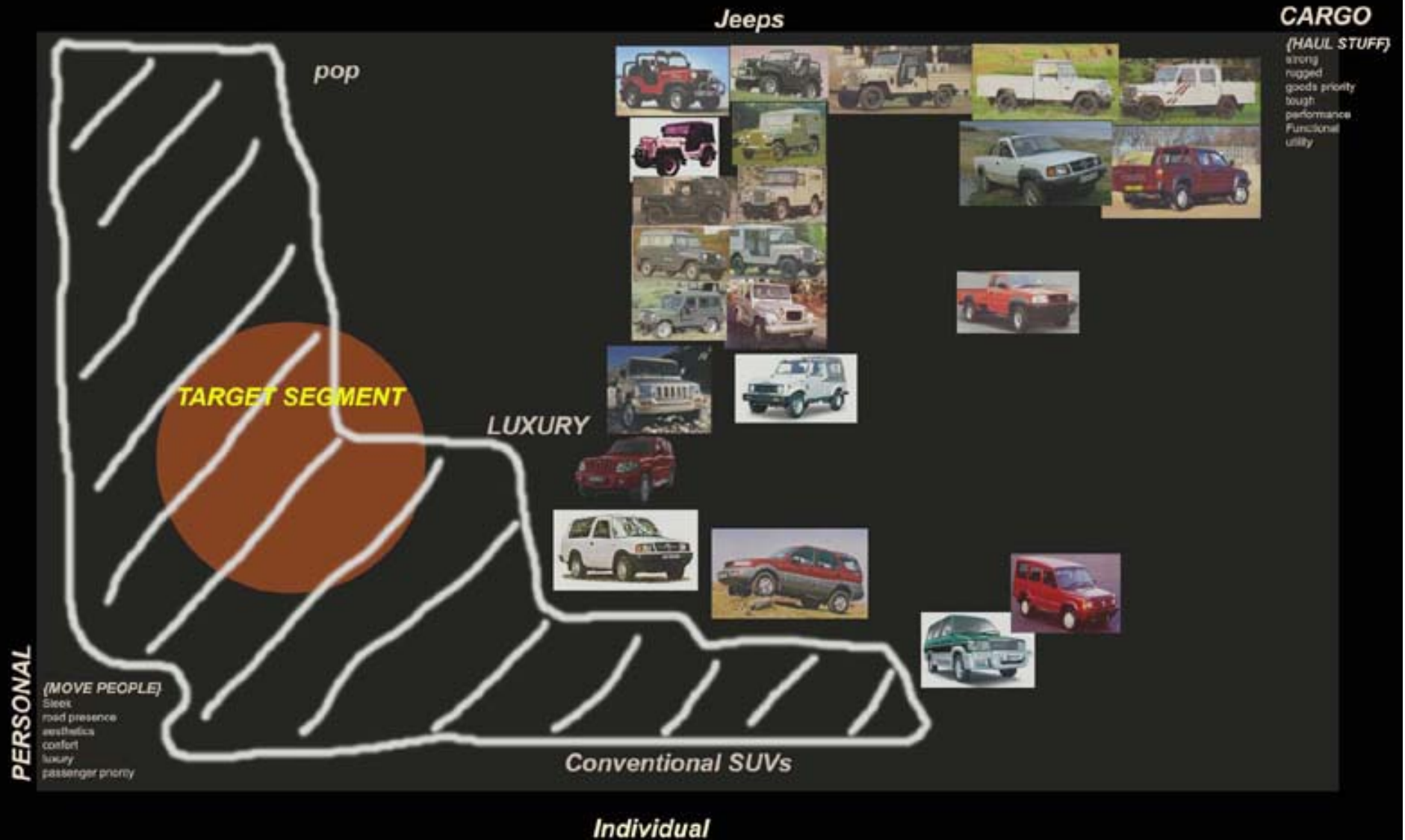


fig. 9.3(a)

IDENTIFYING THE NEED SEGMENT AND BENCH MARKING

10

After analyzing the data we came to know where the need segment is? Once the target segment is identified, we got styling needs, dimensional requirements, trunk volume, required engine power and other Technical details from the map itself. It also gives us the idea about other segments and their needs which could be of help at some stage of the project in the future. Preparing the map of Indian vehicle not only help us in understanding the need but also gave us some encouragement that during the course of form evolution, slight deviation would not harm our project in a big way as there are no vehicles in India within or around that need segment. The much important Product Brief was also derived from the visual maps.

The vehicles that falls under the need segments are the one whom we are very closely and thoroughly following, because those SUVs actually gave us the product brief and will be our bench marks in terms of styling in particular. The vehicles are:

Bench Marks

- TOYOTA RAV-4 {3-door, 5-door}
- MITSUBISHI Pajero Pinin {3-door}
- ISUZU Vehicross {3-door}

BENCHMARKS

11

11.1 TOYOTARAV-4

5-door version



3-door version



The RAV4 Sport Package for 2003 dresses up the exterior with a new grille, aerodynamic multi-reflective headlamps with blackout trim, a hood scoop and gray-painted over fenders. A tubular roof rack with polished stainless steel finish adds style and function. Special sport fabric seats are exclusive to this new package, which also includes color-keyed heated exterior mirrors and door handles. The over all form is robust and dynamic to some extent. Perfect proportions between window area, waistline and bonnet height. Solid looking head lamps that protrudes outside gives the character to the vehicle. The placement of the spare tire is excellent as it occupies very less visible area of the rear window and also has been given some aesthetic treatment with a cover on it. The rear door handle goes well with the back and looks strong, however the side door handles are not that strong looking though goes with the profile of the car. The combination makes the RAV4 Sport one of the best-equipped, and best values, in its class. The skid plate is very intelligently hidden under the fenders as the vehicle is aimed to give an urban look rather than a proper SUV look.

11.2 MITSUBISHI Pajero Pinin



The market for Sports Utility Vehicles (SUVs) has grown dramatically over the last few years, and the Mitsubishi PAJERO has long dominated this category in Europe. However, while many city dwellers long for a stylish and sophisticated 4WD vehicle, they need one that is more compact, lightweight and practical for urban use. The 3-door PAJERO PININ is designed specifically to appeal to this highly selective market.

It combines the heritage and off-road ability of the PAJERO with a smooth on-road driving experience and aggressive styling. Its tight turning circle, as well as short front and rear overhangs make it extremely agile in town. It has one of the best ground clearances in its class and is the only compact 4X4 which has the SS4-i system which allows it to switch between 4WD and 2WD. Thanks to its PAJERO heritage, the PAJERO PININ is a true off-roader, but at the same time it is compact, lightweight and highly functional for city use.

Its styling combines the rugged appeal of a true off-roader with a more sophisticated look which fits perfectly into an urban setting. The Japanese market version of the PAJERO PININ, has already proved to be a tremendous success with sales to date of 46,000 units in the six months since it was launched. Mitsubishi called in Pininfarina to ensure that the PAJERO PININ suited European tastes and that it met EU regulations, as well as to carry out certain styling and design changes.



OFF-ROAD EXCITEMENT



11.3 ISUZU vehicross (2001)



Now available in the US, Isuzu's Vehi CROSS is powered by a 3.5-liter DOHC 24-valve V-6 with 215 hp and a 4-speed automatic transmission. It's a truly unique, 4 wheel drive, 3 door SUV .Now available in the US, Isuzu's VehiCROSS is powered by a 3.5-liter DOHC 24-valve V-6 with 215 hp and a 4-speed automatic transmission. It's a truly unique, 4 wheel drive, 3 door SUV .

Excellent sporty vehicle. It has lots of speed and handles very well. One couldn't be more pleased. Powerful Engine, nice Recaro seats, handling, smooth ride are the strengths of this vehicle. Excellent sporty vehicle. It has lots of speed and handles very well. One couldn't be more pleased. Powerful Engine, nice Recaro seats, handling, smooth ride are the strengths of this vehicle.

Weaknesses:

back window is hard to see out. Needs back door release latch inside.

Strength:

Full frontal showing the sexy and aggressive styling of the VX. The large alloy wheels with broader grip, and the Clear Corners clear turn signals and parking lights accent the appearance. The squatting stance of the vehicle enhances the raw power and aggression of the vehicle. Front skid plates are not hidden underneath the fenders unlike the other two vehicle, rather exposed and exposed very well to make it a beauty statement. Full frontal showing the sexy and aggressive styling of the VX. The large alloy wheels with broader grip, and the Clear Corners clear turn signals and parking lights accent the appearance. The squatting stance of the vehicle enhances the raw power and aggression of the vehicle. Front skid plates are not hidden underneath the fenders unlike the other two vehicle, rather exposed and exposed very well to make it a beauty statement.

Tail lights, custom modified by Clear Corners house LED converted signals and brake lights, along with a smoked lens. The offset of the wheels and tires make for a more predatory look. From the rear, the VX shows off it's powerful LED tail lights. Definitely alien. There is no second guessing this ride. Also features rear side clear parking lights.

PRODUCT BRIEF

12

The increase in sales of SUVs in India and the success story of M&M Scorpio clearly indicates that the market for SUVs in India will grow day by day. Though a full blown SUV is too expensive and frankly too much car on the city road, a small SUV would perfectly suit our environment and road infrastructure. This is a segment waiting to be tapped and one with tremendous potential. The increase in sales of SUVs in India and the success story of M&M Scorpio clearly indicates that the market for SUVs in India will grow day by day.

This project aims at designing a small Sports Utility Vehicle for the upcoming Indian market and at the same time be competitive with its benchmarks. The vehicle will be basically for sports utilities and urban activities and the styling has to address both these issues.

product brief

a) Technical specification

- A trunk volume excluding luggage space of around 4.0 cubic meters for comfortable seating and a luggage space of about 0.7 cubic meters.
- A powerful engine of 90-110 bhp under the bonnet would be sufficient for all kinds of terrain (common rail direct injection with turbo charger)
- Length / breadth / height of 4000 / 1750 / 1750 mm
- wheel base - 2500 mm

- Ground clearance - 200mm
- Optional 4X4 Wheel drive on the fly
- 4 side doors + 1 boot / rear door
- Tires - 225 / 60 R17
- 4 adult seats + 1 child seat
- Monocoque chassis

b) Styling

- Aggressive styling is the in-trend feature of smaller SUVs and should be treated in totality.
- The basic visual requirements of a SUV should also be present in whatever suitable proportions.
- Wheel size, wheelbase and stance of the vehicle should be as per the required styling and should maintain excellent proportionality.
- Accessories that gives the character to the vehicles should be treated as integral parts and cannot be designed in isolation.
- Semantically the styling should speak about the engine power.
- The vehicle should be able to make a road presence

- Spare tire should be placed outside to make it an aesthetic statement and save boot space
- Newer concepts of detailing has to be brought in as this project cannot deviate too much in overall form from the benchmarks.

Functional

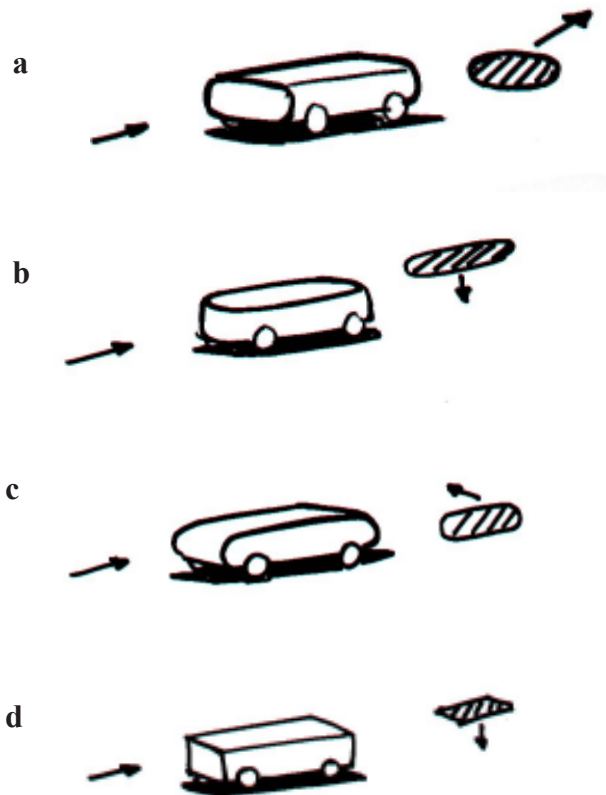
- Easy ingress / egress
- Slidable roof for fresh air intake and give a feeling of freedom while driving outside city
- Easy access to the boot

CONCEPT GENERATION

13

Initially the sketches were based on basic shapes of automobiles and then random sketching done to bring out some new ideas which may be anything, right from the overall form to the side view mirrors. These sketches can't be called as concepts or alternatives for some concepts, so good features of these sketches are carried to the second stage of sketching where we got the brief from the visual map. Expressions required in the form was studied, understood and then tried to achieve that in the vehicle form, where we might have borrowed some ideas from the initial sketches done randomly. Here we worked upon two concepts which is explained in this chapter. The third concept is evolved out of a metaphor 'cheetah' which was refined to meet the target form. So, basically we have three concepts to evaluate.

13.1 Sketches based on basic shapes of automobiles



All the automobiles are classified in the following shapes or a combination of them. Some of the initial sketches done in this project are based on this principle.

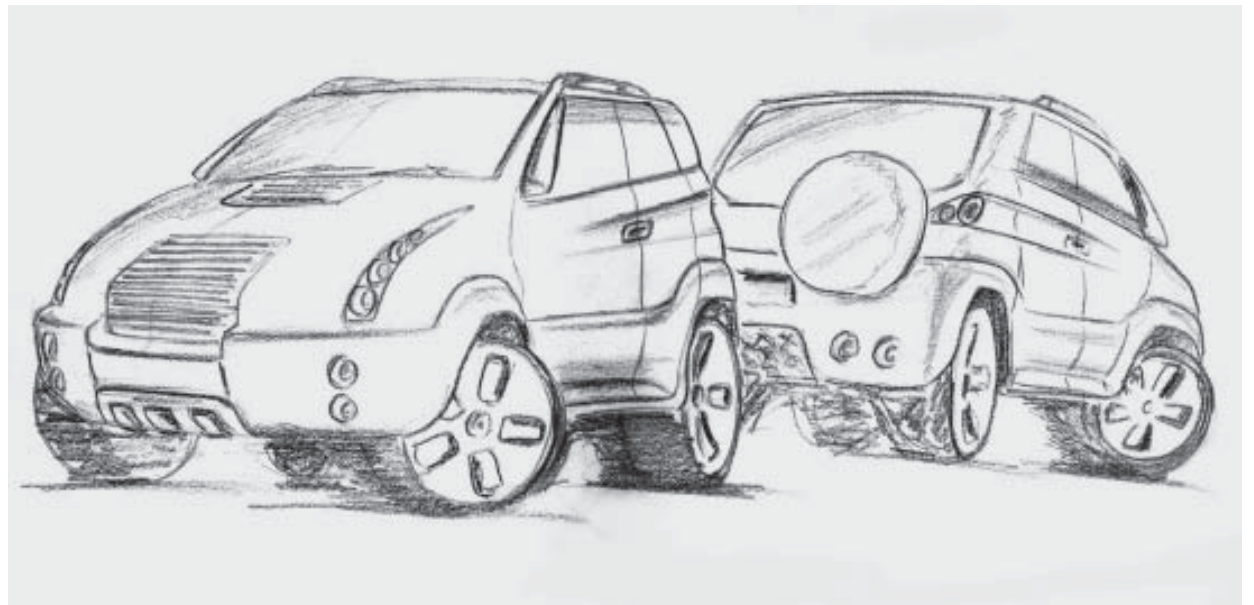
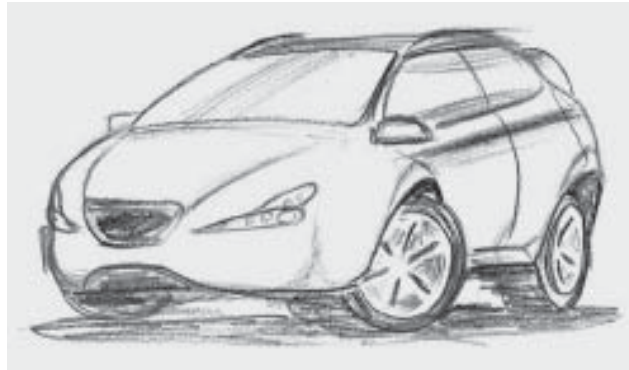
{a} tubular section extruded along the centre axis of the vehicle from front to rear end.

{b} tubular section extruded with axis perpendicular to the center axis.

{c} tubular section extruded from top to bottom

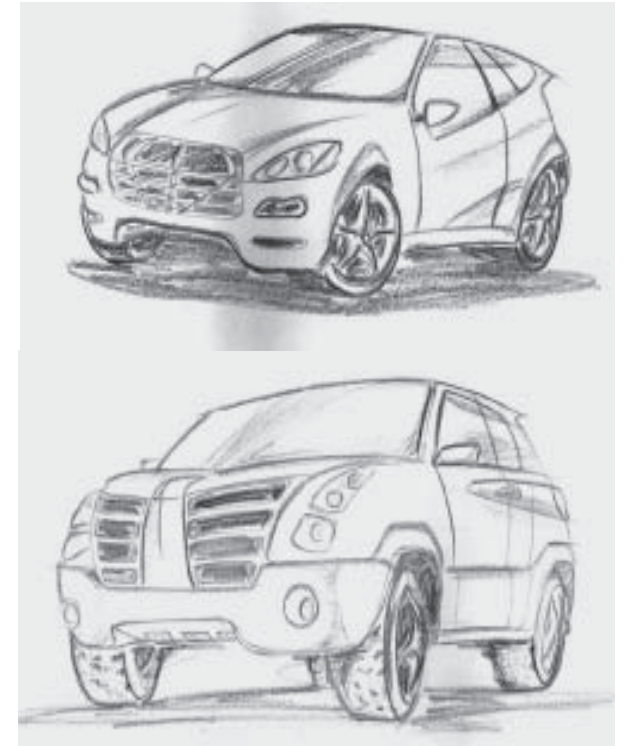
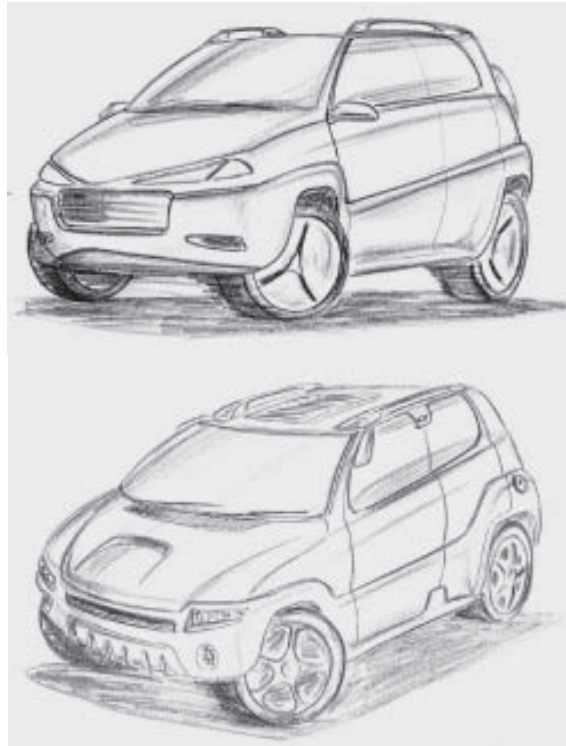
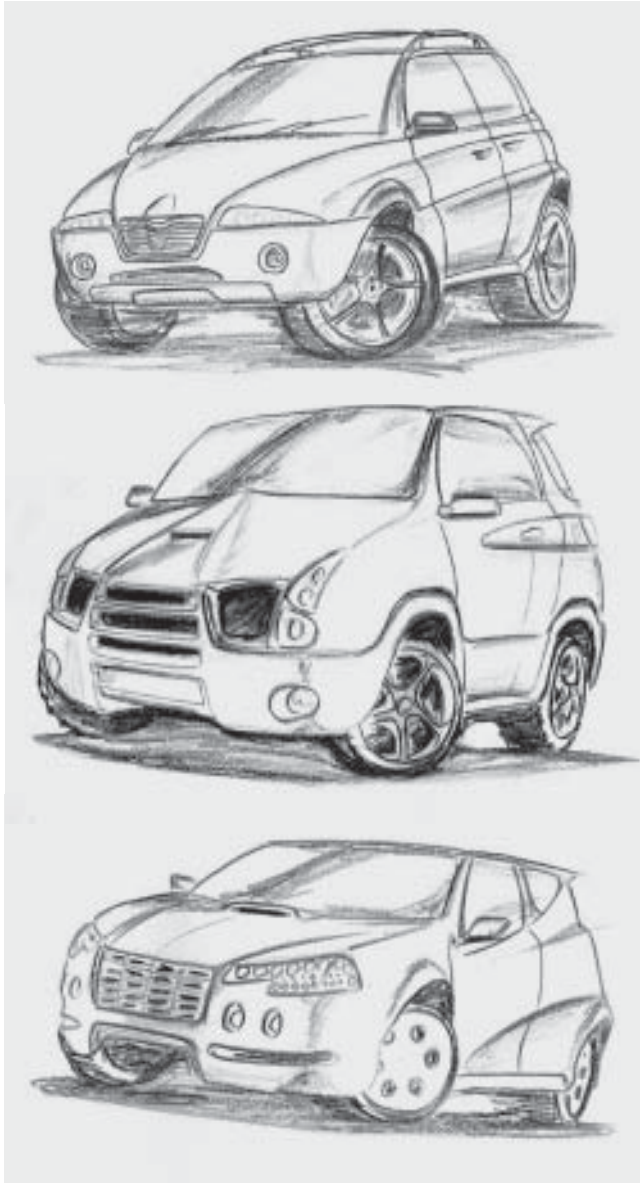
{d} box shaped

Sketches using Basic Automobile Shapes



13.2 Random Sketching:

From the start of the project the creative idea generation process through sketching was undertaken to come up with new and innovative forms.



13.3 Sketching based on the clues gathered from the visual map

We analyzed the form of all the vehicles in the product map, which are in and around the target segments, specially the bench marks. We tried to analyze what makes them stand apart within their own category. We also started learning what a SUV is and are the basic features that makes a car fall in that category.

Then we figured out what is required and what are the qualities our design should have, so as to be in or around that particular target segment and be able to compete with the bench marks. Despite all this, the vehicle should have a unique character which may be in terms of detailing to stand against all the competitors.

Some characteristics in the form of expression

- *Aggressive*
- *Robust*
- *Energetic*
- *Adventurous*



Aggression

The practice or habit of launching attacks

The act of initiating hostilities or invasion

A quality associated with a person with 'never say die attitude' and wins every impossible game he plays because his offense defends him. He is one who always love to experience adverse conditions, invades others' territory, conquers and returns back victorious. Very optimistic and therefore dominates the opponent irrespective of his size and strength.

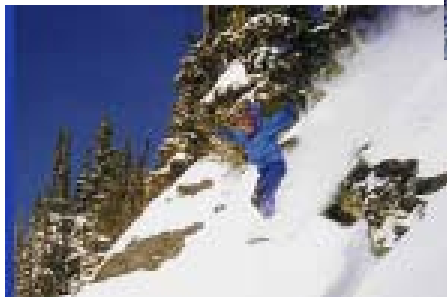


Robust

Full of health and strength, vigorous

Suited to physical endurance

The character which visually shows the strength, sturdiness and powerful built. It is loud, violent, rough, crude and boisterous which lacks in restraint and discipline.

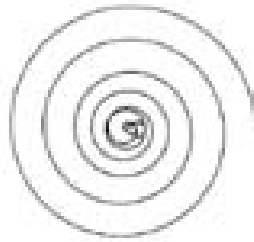


Adventurous

An undertaking or expertise of a hazardous nature

Unusual or exciting experiences

One who loves unusual or dangerous experiences and knowingly participates actively risking life. He doesn't have the fear of failure and willingly proceeds to face bigger hurdles ahead. He can be metaphorically termed as 'dare devil' who lives with danger, uncertainty and surprise in every phase of life.

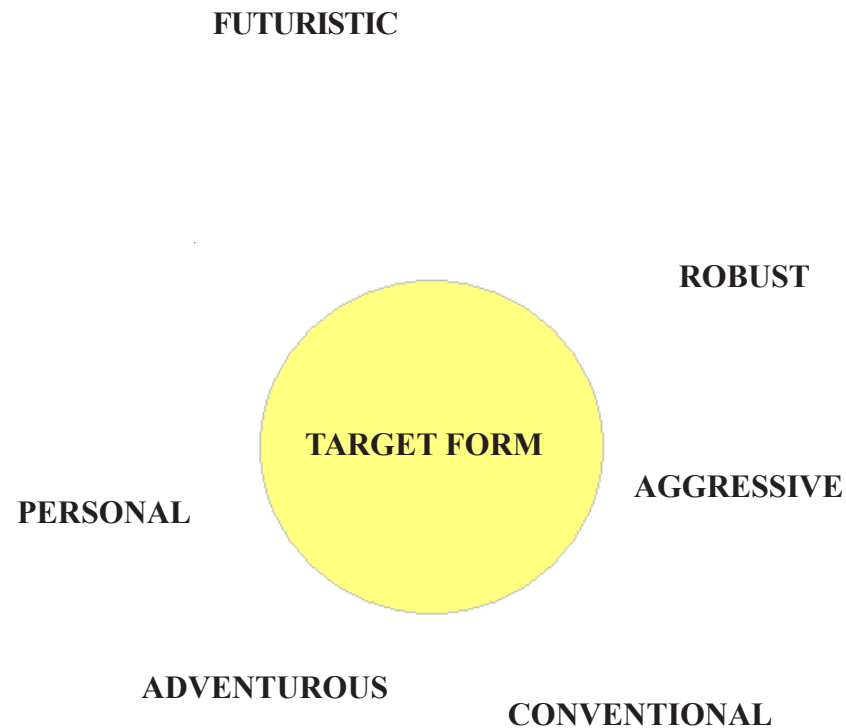


Energetic

Marked by intensity and vigor, forceful progress

Person with lots of enthusiasm and characterized by continuous change in activities or progress. He is marked by intensity, vigor, force or legal effectiveness of validity. The intensity may vary to produce different effect as in case of musical sound. He involves himself in competing or conflicting forces which actually helps him in making positive moves.





Exploration Limits of Target form

The vehicle which are in the need zone gave us lot of inputs. It gives us the requirements of styling and functional needs like what should be the trunk volume, luggage space, overall size, other ergonomic requirements like head room, leg room etc.

We have to design our vehicle as per these constraints and cannot deviate too much from that area. The styling has to take care of the parameters which are bound to vary in each and every design and make sure that the freedom is enjoyed within the flexibility given. The variables are robust, aggressive, adventurous, spacious, futuristic, personalized and conventional styling.

Sketches Based On Constraints

- Styling should be as per requirements fetched from the visual map
- Wheel base cannot be more than 2500 mm
- Overall length should be around 4000 mm
- Total no. of doors 5
- Spare wheel should be outside to save boot space.

CONCEPT 1

This concept was developed on the line of robustness and adventure. It may be less dynamic but, certain amount of energy is there because of its adventurous character. Fenders are made prominent and chunky to give masculine character. No sharp edges used to style it, therefore looks robust. The sturdiness also comes through the proportions used for glass area, lesser wind shield rake, chunky side door panel, bold head lamps and the overall proportion of the vehicle with the wheels. The side panels are made flat to give elegance and to create some more interest, it is depressed into the body forming a separate chunk. It also helped us in solving the problem for side foot step as it is integrated with the body itself.

This is a dual color concept where the roof rail shares the same color as the fenders, claddings and some part of the upper body to maintain the visual grammar. Different alternatives for the same concept is tried out with different clusters to get a newer and appropriate design.

CONCEPT 1



Alternative 1 Eliptical head lights to bring out robustness, grille bent over the bonnet to give an aggressive look, converging skid plate to enhance the sturdiness. fresh air intake at the top as an idea.

Alternative 2 Chunky grille and trepezoidal headlamps with narrow end going upward brings energy to the form, organic side view mirror to make a balance between feminine and masculine form



Alternative 3 Cluster of lamps are put to make it look more civilized and perfect for urban activity, also door panel cladding is scooped out to develop some muscle for off-roading.

Alternative 4 Side door panel is depressed inside to create a chunk and make it look adventurous, head lamps put over fender material that flows till the midbonnet.





REPRESENTATIVE ALTERNATIVE FOR CONCEPT 1

Bold head lamp, bonnet being depressed to form a chunk and so the side door panel. side view mirror is put at the top of A-pillar to make it look light and adventurous. Roofrails are of the same color as that of fender and the side cladding flows till it meets the roof rails. Fuel cap is in dull aluminium to enhance the sporty look. No center pillar to save space and make it compact, but visually there is. Rear door hinge is at the back.

IMPROVISED THERMOCOLE MODEL ON SIMILAR LINES



CONCEPT 2

This concept was intended to be more energetic, dynamic and somewhat mischievous, because people who drive this type of vehicle like to indulge in non-standard practices and SUVs are frankly meant for that purpose only. It has got more sharp dynamic lines and very narrow mean looking head lamps to enhance the above said character. The stance is given special attention to make it more playful. Though some of the alternatives of this concept does not have SUV like fenders and claddings, but due to some surprising features, we have reconsidered and given alternatives with fenders and claddings..

In both the concepts we have taken inspiration or rather borrowed ideas from the previous sketches shown, whichever we found suitable.

CONCEPT 2



Alternative 1 No side claddings, narrow vertical long head lamps to give it a dynamic looks. Grille is massive and brings robustness. Air intake slits are provided in the bonnet that adds to the energy of the vehicle.

Alternative 2 Mean looking narrow head lamps, dynamic form of the side claddings, but no front fenders. aggressive air dam.



Alternative 3 Pinged bonnet makes it mischievous with long leaf like headlamps. dynamic cladding and strong roof rails with stainless steel finish

Alternative 4 Claddings going inward and reinforced steel tube tried out as side step. dynamic window line with tail lamps assisting the form to come out. spare tire sits firmly on the rear fenders. skid plate exposed in the rear.





FIGURE 2

FIGURE 3

FIGURE 4

FIGURE 5

FIGURE 6

FIGURE 7

FIGURE 8

FIGURE 9

FIGURE 10

FIGURE 11

FIGURE 12

FIGURE 13

FIGURE 14

FIGURE 15

FIGURE 16

FIGURE 17

FIGURE 18

FIGURE 19

FIGURE 20

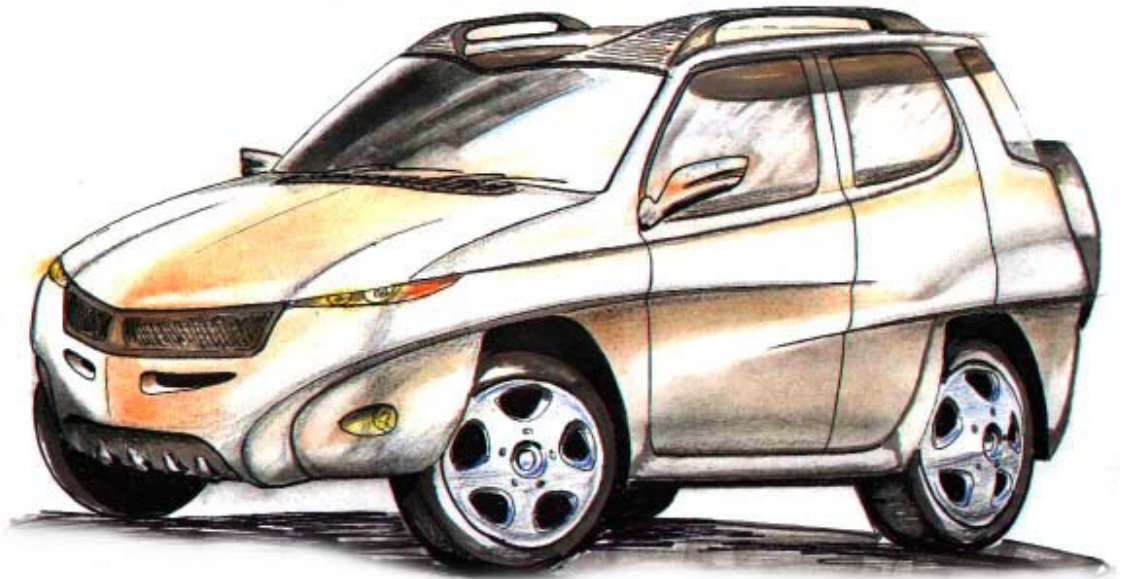
FIGURE 21

FIGURE 22

FIGURE 23

FIGURE 24

REPRESENTATIVE SKETCH OF CONCEPT 2 AND ITS IMPROVISATION IN THERMOCOLE MODEL



Absence of fenders and side claddings makes it more urban activity vehicle, pinged bonnet and wrinkled side panels brings out anger with aggressive looks through headlamps. Wheel arches are square and sharp. over all stance is very mobile and full of energy.



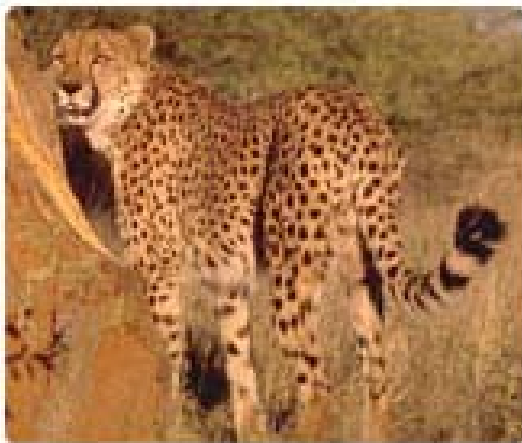
CONCEPT 3

Metaphor - '*Cheetah*'

Character - *aggression, elegant stride and maneuverability*

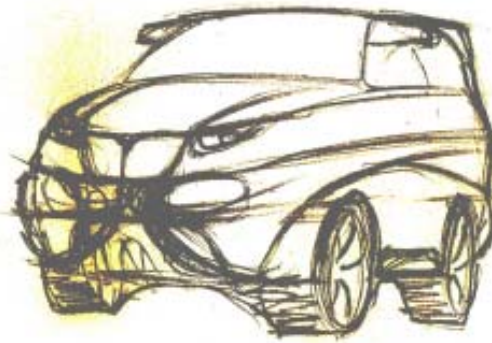
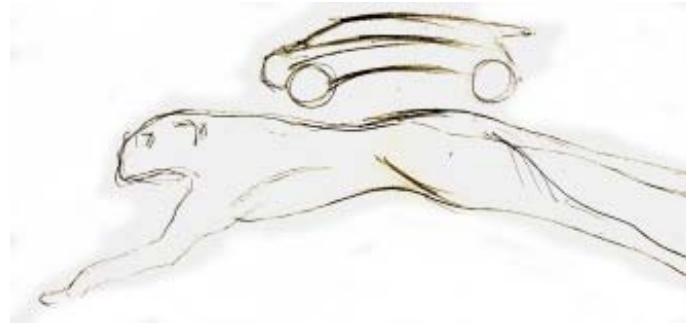
In this concept, for creative form generation we used the metaphor of Cheetah to capture the elegance when it strides forward and the ruthless facial aggression. It has also got amazing capability of maneuvering itself with great balance which is termed as reflex in sports. So, the form is adventurous and dynamic with the energy of a hunting Cheetah. It is the most appropriate metaphor we found for our design.

The initial form was too crude and obvious so, we kept on refining it until we got the expression right. Some stages of refinement has be shown as sketches with very small alterations. The next page shows the images signifying the expressions described above.

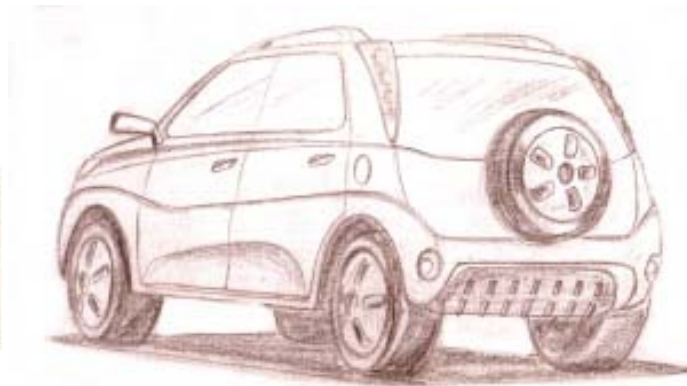
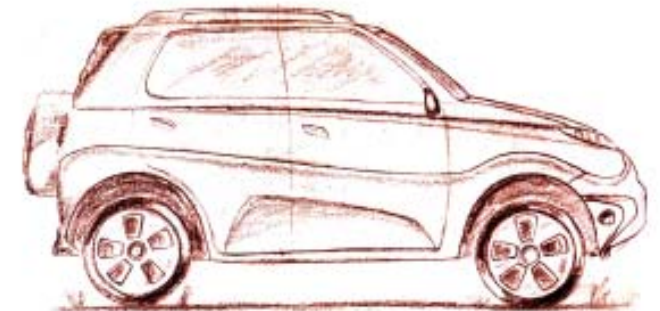


Images of cheetah showing its elegant stride and facial aggression

CAPTURING THE EXPRESSIONS



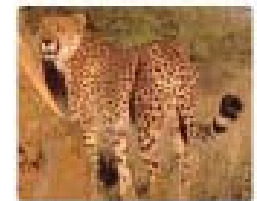
REFINEMENT STAGES



REFINED SKETCHES



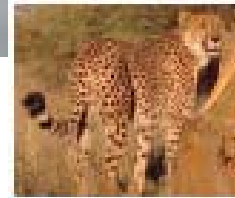
Cheetah as metaphor



Thermocole model of CONCEPT 3



Cheetah as metaphor



EVALUATION OF CONCEPTS

14

14.1 Evaluation criteria

All the three final concepts were evaluated using weighted matrix method with a few no. of evaluators. The parameters for evaluation are given below and they were assigned some credits as per their importance in our design :

■	Robustness	4
■	Aggression	5
■	Energetic	4
■	Adventurous	3
■	SUV character	4

Mean of all points given to each parameter by all the evaluators was taken in the chart which was rated out of 10 points multiplied by its credit. Mean of all points given to each parameter by all the evaluators was taken in the chart which was rated out of 10 points multiplied by its credit.

14.2 evaluation chart

	robustness X (4)	aggression X (5)	energetic X (4)	adventurous X (3)	SUVness X (4)	total
concept 1	7 X 4=28	4 X 5=20	5 X 4=20	5 X 3=15	7 X 4=28	111
concept 2	3 X 4=12	5 X 5=25	6 X 4=24	6 X 3=18	2 X 4=8	87
concept 3	6 X 4=24	8 X 5=40	7 X 4=28	7 X 3=21	8 X 4=32	145

concept 3 tops the chart in total and concept 2 scores minimum



concept 1



concept 2



concept 3

ANALYSIS AFTER EVALUATION

15

Analysis was done for why concept 3 gets maximum total points and concept 2 gets minimum total points and also what are the unique and potential features of concept 1 where it scored maximum points. Analysis was done for why concept 3 gets maximum total points and concept 2 gets minimum total points and also what are the unique and potential features of concept 1 where it scored maximum points.

After analyzing all the three concepts we came to know that concept 2 cannot be really called a SUV, as the fenders and claddings were missing, but there was definitely something which appealed almost everyone of us whoever was evaluating. So, we gave another thought not only to those features of concept 2, but all the concepts which we found to be interesting for the final design.

Since concept 3 topped the chart with maximum total points we will go ahead with that concept and try to incorporate all the features of other concepts which were reconsidered. Since concept 3 topped the chart with maximum total points we will go ahead with that concept and try to incorporate all the features of other concepts which were reconsidered.

Apart from the features which appealed the evaluators, we also sorted out the problems and certain areas where improvement has to be done.



1

The side band made in ABS was becoming more obvious and monotonous.



2

Side window glass area was very disproportionate as it is very narrow compared to the overall height of the vehicle thus, making it look more robust than required and also have some usability issues



3

Side step was integrated with the overall form, where the side door panels goes in, but the section was so thin that it has become visually very weak..

PROBLEMS IN CONCEPT 3



4

Tail lamps extended up to the roof breaks the visual grammar.



5

Putting head lamps cluster was an issue, whether to put it on the ABS band or under the that.



6

Wheel arch corner in the side cladding was very sharp and does not go with the other parts



7

Over all form was softer and wind shield is little more curved than required.



8

Very chaotic front with skid plate, number plate, fender, grille and ABS band all overlapping with each other.

FINAL CONCEPT

16

After the inputs gathered from all the sources and mistakes done in the earlier model, we made the necessary modifications and tried to optimize the design aesthetically as well as functionally. The final concept is based on the previous model with the aggressive character to it and lots of energy. The overall form is made up of different chunks to make it look more adventurous and to enhance this quality, two different colors were used in the design. One mainly for ABS material (fenders, cladding, band extended to roof rails and some body parts) which will be matt dark grey and the body color which ever is suitable.

Side indicators are integrated with the side view mirrors, head lamps on the band to make the band not only an element to express aggression but functional too. Fog lamps are put just under that band in the depressed part to give a mean look. Little bit of aggression also comes from the grille. Side step is created by scooping out some part of the side door panels and the step will be of reinforced steel to save the panel from any brushing. The band which in earlier model moves horizontally now broken near the wind shield and taken right up through the A-Pillar and meets the roof rail to break the monotony that we discussed. This concept was inspired from sports bike where the structural member is treated as an aesthetic element. Unlike sports bike, here the band is just a functional part which includes the head lamps and protects the edges from minor damages.



fig.17(a)

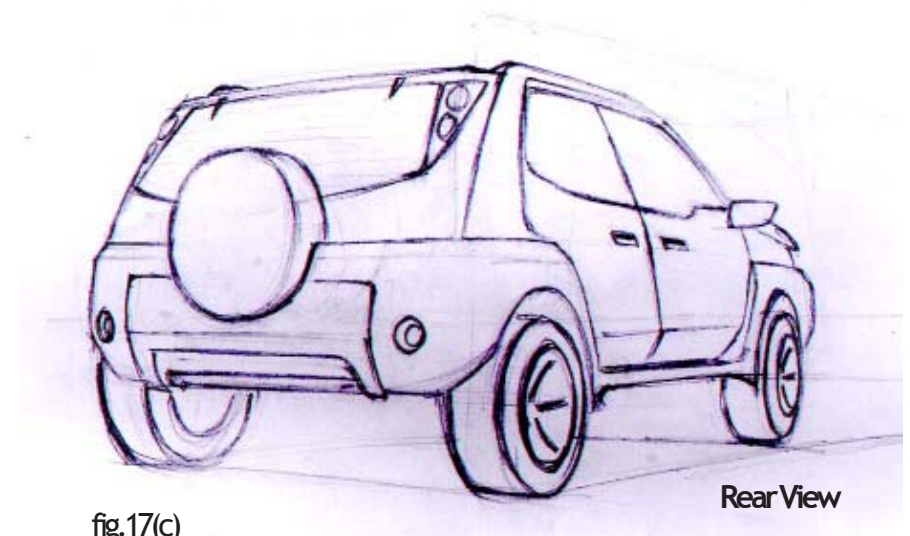


fig.17(b)

FINAL CONCEPT

Alternative 1

Round head lights may bring some integrity to the overall form. Grille is having vertical slits which varies in width and might look interesting. Very narrow fog lamps under the band may be trendy. Door panel is bend inwards at the bottom to create the side step which gives a refined but robust look.



Rear View

fig.17(c)

Alternative 2

Leaf shaped head lights and fog lights may give a character to the vehicle, but may look too much aggressive, front grille is enhancing the expression coming out of the vehicle. Side door panel is scooped out to create the side step, but unlike the first alternative, it more dynamic and less robust.



Clues are taken from both the alternatives and tried to make it aggressive and dynamic with lots of energy coming in through the band that has been wrapped around. Half cladding makes it more adventurous. Door handle are made in black metal to bring out contrast in the design. Lot of input in styling has been taken from sports gear and sports bike.



fig.17(d)



fig.17(e)

THERMO COLE MODEL OF THE FINAL CONCEPT



fig.17(f)



fig.17(g)



fig.17(h)

depressed panel under the head lights

side step on a reinforced steel member

convertible roof top

boot hinged at the top roof, opens vertically up

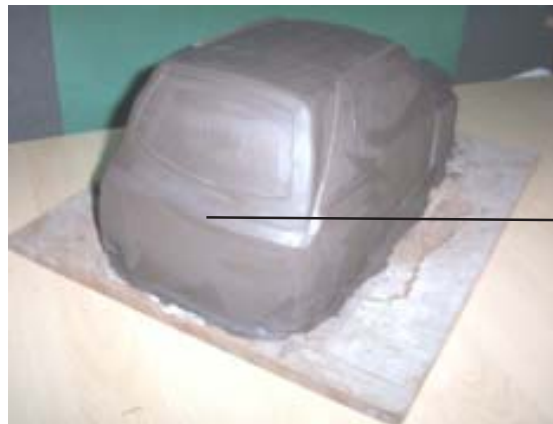


fig.18(a)



fig.18(b)



fig.18(c)

FURTHER IMPROVEMENTS

17



- Further refinement has to be done to calm down the aggression.
- The front is still confusing as all the lines are radiating from one single point.
- Bonnet needs to be little swooping down in the front.
- Space for no. plates have to created.
- Roof top has be given some treatment to strengthen it.
- Tail lamps position and spare placement has to be improved.

Improvements in clay model

Final improvements as per the requirements discussed earlier has been tried out in water clay to capture the expression of the final rendering which was not captured on the thermo Cole model.

FINAL CONCEPT AFTER REFINEMENT

18



FINAL MODEL
19



2D DRAWINGS

20

The drawings of the vehicle is in 1: 10 scale. Please refer the drawings attached to the report.

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