EXTERIOR STYLING OF A SEDAN FOR THE UPPER STRATA OF THE SOCIETY

Product design Project III

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Submitted in partial fulfillment of the requirements of the degree of Master Of Design In Industrial Design

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APPROVAL SHEET

Industrial Design Project II titled

EXTERIOR STYLING OF A LUXURY SEDAN

By

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is approved for the partial fulfillment of the requirements for the postgraduate degree of

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1. ABSTRACT

This project deals with only the exterior styling aspects of the ‘F segment’ vehicle .For the initial study benchmarking was done considering a lower and an upper end car in the same segment.

These benchmarks were then studied on different grounds such as the engine and the overall dimensions of the vehicle.’Aggression’ was the metaphor used for this design which was reflected in different concepts.

A concept was finalized based on the user study,which was then refined in different 2D and 3D softwares such as Adobe Photoshop and ALIAS Studiotools leading to the development of a final physical scaled model.

2. PROJECT AIM:

Exterior Styling of a Luxury Sedan for the middle aged professionals from the upper class segment of the society.

3. TYPE OF USERS:

Persons who are exceptionally rich and who really believe in having a new driving experience every time they sit in the car. Their age would be in the group range of 32-45 years.

4. SCOPE OF THE PROJECT:

The project will be concentrated only on the exterior styling of the sedan and it will be a pure styling project. However data whenever , wherever will be clarified with the help of any ergonomics data if required.

It is Love at first sight

For most consumers, choosing a car has as much to do with its design as with its performance and driving capacities.

6. INTRODUCTION:

6.1 TYPES OF VEHICLES:

Cars can come in a large variety of different body styles. These styles are largely independent of a car's classification in terms of price, size and intended broad market; the same car model might be available in multiple body styles.

Sports car:

This small lightweight class combines performance and handling. Often inspired by racing vehicles, this class ranges from sporty vehicles such as the Mazda Miata/MX-5 to derivatives of true racing thoroughbreds such as the Lotus Elise.

Examples of sports cars

- **Porsche 911**
- **Honda NSX**

Convertible:

Also called an open saloon, roadster or drop-head coupe, this type of car has a roof (fabric, vinyl, metal or glass) which can be folded away. Convertibles were very popular in hotter places before the advent of automotive air-conditioning. 2-seat convertible sports cars are commonly named roadster or spyder.

Examples of convertibles:

- **Volkswagen Eos**
- **Mercedes-Benz SLK**

6. INTRODUCTION:

Van/Minivan:

Also known as people carriers, this class of cars resemble tall station wagons. Larger minivans may have seating for up to eigth passengers.

Being taller than a family car improves visibility for the driver (while reducing visibility for other road users) and may help access for the elderly or disabled. They also offer more seats and increased load capacity than hatchbacks or station wagons.

Examples of Vans/Minivans:

- **Dodge Ram Van**
- **Mercedes-Benz Sprinter**
- **Dodge Caravan**

Sport utility vehicle:

Sport utility vehicles are off-road vehicles with a body-on-frame chassis, four-wheel drive and true off-road capability. SUVs can be troublesome in accidents. A high center of gravity gives SUVs means SUVs rollover more easily than automobiles.

Examples of 4x4s / SUVs:

- **Mitsubishi Pajero**
- **Land Rover Range Rover**
- **Suzuki Samurai**

6.2 CLASSIFICATION OF CARS:[1]

A Segment Cars:

A **city car** (or **urban car**) is a small, moderately powered automobile intended for use in urban areas. Has four seats and their length is usually between 3.40 m and 3.60 m.(Wheelbase ~ 2.3m)

Examples of city cars:

- **Fiat Panda**
- **Peugeot 107**

B Segment Cars:

A **subcompact car** is an automobile in a vehicle size class smaller than a compact car but larger than a city car (and known as superminis in Europe). This is also known as the **B-segment** class. Such cars usually have four or more seats and in North America, subcompacts are usually considered to be those cars that have a length of 3.9 m to 4.2 m.

Examples of superminis / subcompact cars:

- **Hyundai Accent**
- **Suzuki Swift**

6. INTRODUCTION:

C Segment Cars:

Compact car is a largely North American term denoting an automobile smaller than a mid-size car, but larger than a subcompact car, similarly recognized in much of the world as a "*C-segment*" (between B and D-segment) vehicles. Compact cars usually have lengths ranging from 4.25 m to 4.5 m

Examples of compact cars:

- **Honda Civic**
- **Mitsubishi Lancer**
- **Toyota Corolla**

D Segment Cars:

Mid-size cars have room for five adults and a large trunk. Engines are more powerful than compact cars and six-cylinder engines are more common than in smaller cars. Car sizes vary from region to region; in Europe, large family cars are rarely over 4700 mm long, while in North America and Australia they may be well over 4800 mm.

Examples of large family cars / mid-size cars:

- **Honda Accord**
- **Toyota Camry**

6. INTRODUCTION:

E Segment Cars:

An executive car or mid-luxury car is larger than a compact executive car/entry-level luxury car. They are usually very roomy, powerful and luxurious, making them more expensive than "standard" sedans.Their lengths usually range from 4.5 m to 5.0 m.

Examples of executive cars / mid-luxury cars:

- **Jaguar S-Type**
- **Volvo S80**
- **BMW 3 series**
- **Chrysler 300**

F Segment Cars:

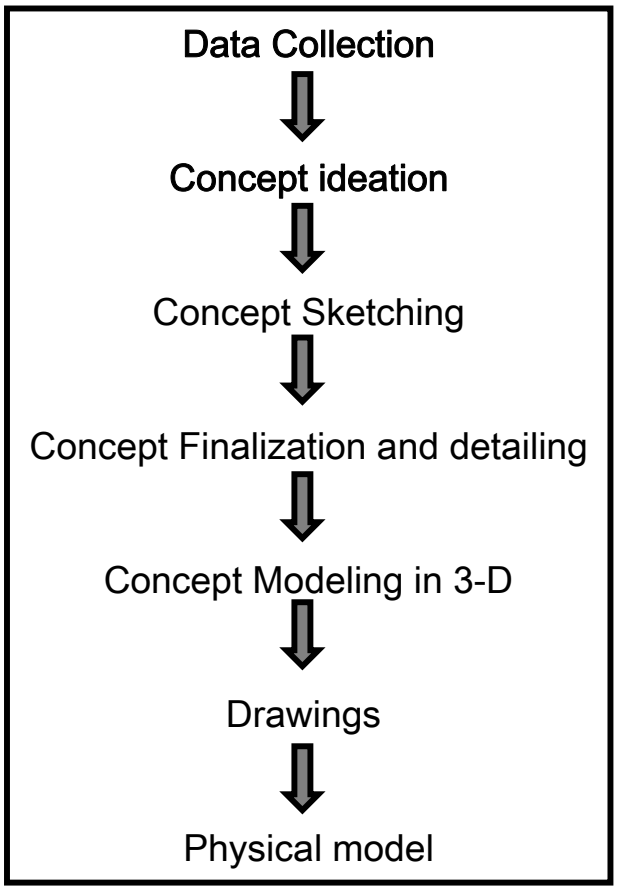
A full-size luxury car is typically a four-door sedan. These are the most powerful sedans, with eight and twelve-cylinder engines and have more equipment than smaller models.Their length usually is above 5.0 m

Examples of full-size luxury cars:

- **Audi A8**
- **Mercedes-Benz S-Class**
- **Maybach**
- **Rolls Royce Phantom**

7. DESIGN PROCESS:

The Design process followed for this is as follows:[2]



Data collection:

This will involve study of Research papers on Automotive styling, study of different car related terminologies, study of silhouettes, what they mean, how efficient they are in defining the stance,the feel of the car and the richness in design.

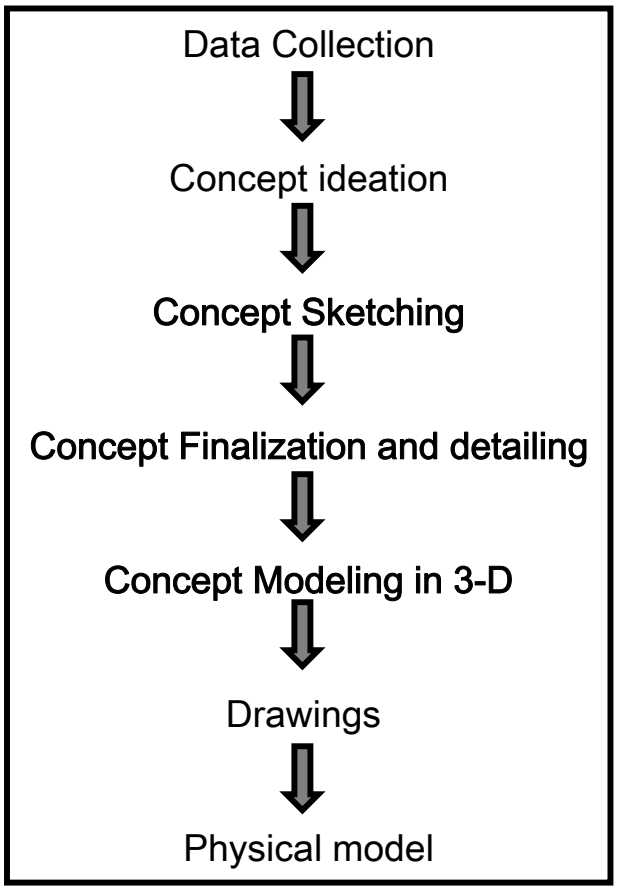
Some case studies will also be studied in terms of the promotional videos of the car which will help in defining the metaphors for different contours on the car.

Other than this there will be also some cars which will be taken as benchmarks which will be referred so as to clearly understand the surfaces and the metaphor used for their cars.

Concept Ideation:

Using the Design Brief as the basis, ideation sketches are made which are relatively quicker to visualize ideas, themes and styles.For example, a concept design for a car might consist of a sketch showing a car with four wheels and the engine mounted at the front of the car. The exact details of the components such as the diameter of the wheels or the size of the engine are determined at the detail design stage.

7. DESIGN PROCESS:



Concept Sketching:

This will involve further sketching in terms of hand renderings or digital renderings.The hand renderings is a conventional way of making renderings with the use of dry crayons,water colours and marker renderings.

Digital renderings on the other hand are much more realistic and quicker than the hand renders generally made in Adobe Photoshop or Alias Sketchbookpro and Corel Painter.

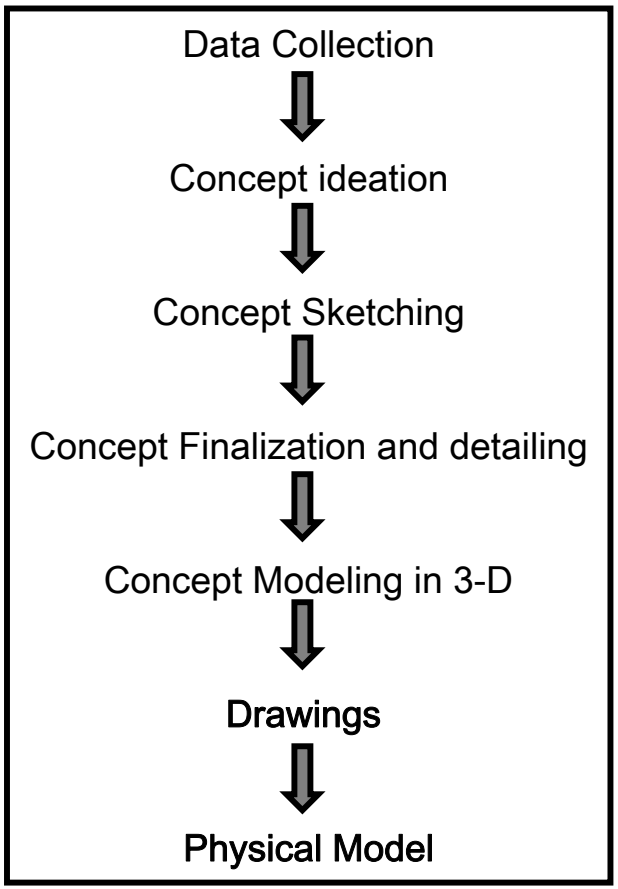
Concept Finalization and detailing:

This stage involves the selection of a concept for further development,in terms of the details of the surfaces and any other details as required.This stage will also involve a 1:1 Tape drawing of the final concept.

Concept Modeling in 3-D:

This involves the 3-D rendering of the selected concept in a 3-D modeling software such as Alias Studiotools or Rhinoceros and digitally rendered.

7. DESIGN PROCESS:



Drawings:

The drawings will be generated from the 3-D data and this will actually define the overall length, width and the height of the sedan.

Physical Model:

The drawings generated from the 3-D data will then be used to make a scaled model.The scaled model is generally in the ratio of 1:5 and is made of Styling Clay or Polyurethane foam.

8. CAR DESIGN TERMINOLOGY AND JARGON:

A glossary of terms as relating to automotive design.[3]

Beltline
The longitudinal frontier between the car's main mass and the greenhouse.

Bone Line
Designers often use natural metaphors to describe body shapes, talking of hard muscle under soft flesh.
A bone line is a suggestion of solid structure beneath the body's surface.

DLO
Daylight opening, or window. Shape and position are influential on a car's character.

DRG
Down-the-road-graphics. The frontal appearance which defines the marque from a considerable distance.

Greenhouse
Glazed upper part of the passenger cabin comprising of the DLOs.

8. CAR DESIGN TERMINOLOGY AND JARGON:

Hardpoints

Hardpoint has an actual and metaphorical meaning. It is the stage of design after Broadbrush, or conceptual phase. Hardpoints are also the fixed or frozen positions of, for example, the top of the radiator, top of the engine, top of the scuttle, suspension mounts and so on. Hardpoints might include greenhouse pillar sections, spare tyre location or side glass surface at a driver's eye level. Hardpoints are used in continuous comparative evaluation of competitors.

H-Point

A theoretical point (R-point in Europe) from which critical dimensions relating to legislation are measured. The h-point is approximately in line with the driver's hip joint. The position 'eye ellipse' is derived from the h-point. The eye ellipse is used to generate legally required vision lines.

Pillar/Post

Identified by the letters A,B,C,D (A pillar being the foremost or windscreen pillar), as they move rearwards through the greenhouse, the vertical (almost always angled) members of the bodywork support the roof, the equivalent of glazing bars in architecture. Montante in Italian.

8. CAR DESIGN TERMINOLOGY AND JARGON:

Razor Edge
The origami school of car design, where sharp, geometrical forms of angles dominate the overall shape.

Rocker Panel
In US English, the body part between the bottom of the doors and the ground. Sill in British English.

Shut Line
The line between panels and doors. The precision and economy of these lines is a matter of intense competition between manufacturers and is a serious test of manufacturing finesse. The way the shut lines are articulated by designers is an unconciously powerful influence on the customer's perception of the car's character.

Swage Line
An emphatic crease in a metal panel.

Tumblehome
The angle between the vertical and the greenhouse when seen from the front.

Wheel arch
The aperture containing the wheels.

9. BENCHMARKING

Benchmarking[4] (also "best practice benchmarking" or "process benchmarking") is a process used in managementand particularly strategic management , in which organizations evaluate various aspects of their processes in relation to best practice , usually within their own sector.

A more accurate term for the above process with respect to the context would be ‘Competitive Benchmarking’. **Competitive benchmarking** is used in competitor analysis wherein the companies best or well established in their processes are studied.

A similar kind of benchmarking is done for this project wherein different car designs are studied not only in terms of their features and promotional videos but also in terms of different case studies.

Since my scope of project only relates to the exterior aspects of car styling therefore much concentration is given to the external styling features and elements. Few case studies are discussed in the subsequent pages in the report.

9.1 BENCHMARK STUDY OF DIFFERENT CARS:

The following tables 9.1.1 and 9.1.2 shows the benchmark data used for the comparison purpose and also to be used a reference for the design of the car in terms of the finalization of the layout..

FEATURES	BENTLEY CONTINENTAL FLYING SPUR	BMW 7-SERIES	MERCEDES BENZ S-CLASS
			
1. YEAR	2007	2007	2007
2. MAKE	BENTLEY	BMW	MERCEDES BENZ
3. MODEL	CONTINENTAL FLYING SPUR	7 - SERIES	S CLASS
4. ENGINE LOCATION	FRONT	FRONT	FRONT
5. DRIVE TYPE	AWD	REAR WHEEL	REAR WHEEL,4WD
6. PRICE	Rs 80,00,000/-	Rs 36,00,000/-	Rs 41,53,200/-
ENGINE			
1. DISPLACEMENT	5998.00 CC, 6 L	4800.6 CC, 4.80 L	5500.5 CC, 5.50 L
2. ENGINE TYPE	W 12	V 8	V 8
DIMENSIONS			
1. LENGTH	5307.1 MM	5039.4 MM	5207.0 MM
2. WIDTH	1915.9 MM	1902.5 MM	1872.0 MM
3. HEIGHT	1479.1 MM	1491.0 MM	1473.2 MM
4. WHEELBASE	3065 MM	2989.6 MM	3164.9 MM
5. TYRES	275/40 R 19	245/50 R 18	255/45 R 18

Table 9.1.1

10.1 BENCHMARK STUDY OF DIFFERENT CARS:

FEATURES	HONDA ACCORD	LEXUS LS	JAGUAR S-TYPE
			
1. YEAR	2006-2007	2007	2007
2. MAKE	HONDA	LEXUS	JAGUAR
3. MODEL	ACCORD	LS-460	S TYPE
4. ENGINE LOCATION	FRONT	FRONT	FRONT
5. DRIVE TYPE	FRONT WHEEL	REAR WHEEL	REAR WHEEL
6. PRICE	Rs 8,94,000/-	Rs 35,41,440/-	Rs 22,07,760/-
ENGINE			
1. DISPLACEMENT	2354.00 CC, 2.4 L	4600 CC, 4.6 L	3001 CC, 3.0 L
2. ENGINE TYPE	I 4	V 8	V 6
DIMENSIONS			
1. LENGTH	4854.0 MM	5029.2 MM	4904.8 MM
2. WIDTH	1818.7 MM	1874.5 MM	2060.0 MM
3. HEIGHT	1452.9 MM	1475.8 MM	1447.8 MM
4. WHEELBASE	2740.7 MM	2969.3 MM	2908.3 MM
5. TYRES	195/65 R 15	235/50 R 18	235/50 R 17

Table 19.1.2

9.2 STYLING BENCHMARKS:

Figures 9.2.1,9.2.2,9.2.3 and 9.2.4 shows some of the benchmarks that were considered as a base for the exterior styling of the vehicle.

Fig 9.2.1 ALFA ROMEO

Fig 9.2.2 HONDA ACCORD

Fig 9.2.3 HONDA CIVIC

Fig 9.2.4 MERCEDES BENZ S- CLASS

10. CASE STUDIES OF DIFFERENT CARS:

A few case studies were studied which included cars from different segments.This study was basically done to understand the designers' intentions of the features they design in the cars.

These case studies helps to know the various themes or metaphors associated with different features in the styling of a car.

These case studies also help to know the success and the failures in the design in terms of styling.

10. CASE STUDIES OF DIFFERENT CARS:

10.1 MERCEDES S-CLASS (F-SEGMENT)[5]

Fig 10.1.1

Fig 10.1.2

Front Features:

The edges of the classic grille with horizontal slats are demarcated by two deep creases along the surface of the bonnet to separate the area from the headlights as shown in Fig 10.1.1.

The large headlights underscore the greater presence of the car,with a trenchant design and circular theme reminiscent of a camera lens.The profile of the headlights influences the flow of the sides.

Influence of Motion:

The direct transition from the line of the headlights to the bumper line creates a very distinctive motion that continues along and accentuates the solidity of the wheel arch.The rear arches are also accentuated and are echoed in the profile of the rear light clusters.

Dynamism:

The curved flank midline pushes the volume of the car forward creating dynamism.there is a marked contrast between the arc of the roof and the waistline which continues in the taillight split by two bodycolour strips to increase the impression of width.The general effect is of great solidity which graphically expresses the effective stability of the car on the road as shown in Fig 10.1.2.

10. CASE STUDIES OF DIFFERENT CARS:

10.1 MERCEDES S-CLASS (F-SEGMENT)

Fig 10.1.3

Front and Rear wheelarches:

The front and the rear wheel arches are highly pronounced are on of the styling elements to strike a compromise between the stern and conservative nature and its potentially sporty and emotive spirit as shown in Fig 10.1.3.

Fig 10.1.4

Rear features:

The tail contour is inclined forward as is the profile of the rear lights stressing the almost coupe like rake angle of the rear screen in contrast with the large superimposed volume of the boot lid which splits the bodyline into two distinct designs: the descending curvature of the main bodywork and the more angular and the evident shape of the boot lid as shown in Fig 10.1.4.

10.2 CITROEN C6: (F-SEGMENT)[6]

Fig 10.2.1

Dynamism:

The dynamism of this car is derived from lines that drop down towards the tail.This confers an image of power, solidity and majesty to the car as a whole.The front is rather sleek and very aerodynamic in a perfect fusion of form and function,with perfectly integrated state of the art technology.It is as shown in Fig 10.2.1.

Rear Features:

The treatment of the tail where the two contrasting lines meet is intentionally kept ambiguous and even puzzling making it a surprise element. Seen from the side,it looks like a two box shape,but from the rear three quarter view it looks like a three box saloon,this is because of the clever use of lines.Also space for the trunk is made by making the rear screen negatively curved.

10.3 SEAT LEON: (E-SEGMENT)[7]

Fig 10.3.1

Fig 10.3.2

Aggression and Dynamism:

The front of the car has a decisive and rather aggressive dynamic impact conferred by the converging lines of the bonnet and lights towards the grille.The configuration also had a prominent swage line running across the flank as shown in Fig 10.3.1.

Rear Features:

At the tail the designers managed to create light clusters neatly confined to two single elements as shown in Fig 10.3.2.

Door opening details:

The handle of the rear door is completely invisible giving the car a more coupe like look.For the door to open a recess has been cut into the polycarbonate rear quarter DLO for the hand.

10.4 VOLKSWAGON Eos: (COUPE)[8]

Fig 10.4.1

Elegance:

The roof forms a tight arch from windscreen to tail creating a sporty and an elegant effect.The roofline is streamlined, the rear of the car is muscular and the whole appearance is prestigious.

The proportions create a pure,fun shape with no frills, no make up, with positive, freehand forms, not dictated by mathematical surfaces.A sculpture with soft curves yet defined by bold lines to prevent the car from looking like a soap bar.The details are as shown in Fig 10.4.1.

Fig 10.4.2

Front Features:

The bonnet hangs slightly over the lights,like a sort of eyebrow and the position and shape of the headlights and grille inturn influence the design of the bonnet itself.

The V shape motif of the front grille continues along the bonnet with a long crease whereas the sides are slighly rounded.giving the car visually original wings and wheel arches.The rear is no less muscular and athletic.the wings extend upwards with a slight curvature over a continuous lateral swage as shown in Fig 10.4.2.

10.4 VOLKSWAGON Eos: (COUPE)

Fig 10.4.3

Rear Features:

The muscular design of the tail is defined by three elements: the clear-cut vertical surface of the boot,the imposing bumper wrapping around into the arches and the bold light clusters.It is as shown in Fig 10.4.3.

10.5 LAMBORGHINI GALLARDO : (SPORTS COUPE)[9]

Fig 10.5.1

Fig 10.5.2

Proportions:

The design of the car makes one to immediately notice the athletic compactness and the dynamic appearance conferred by thelong wheelbase, the very short overhangs while still preserving thepurity and angularity.

The cab-forward cockpit integrated in the body by a strongly slanted front screen and tensed pillars, the complex surfacing intersected by crisp graphics and its cooling flow oriented detailing evokes as in the Lamborghini tradition in its proportions and formal language a strong aeronautical influence. Starring blade like front light graphics, the front face is orchestrated around the dominant cooling inlets.

There is an interesting feature, as the roof deploys,two horns sprout out for a few seconds: “the horns of the Lamborghini bull”.

In theory its unbalanced.But then it is only this that creates a character in reality.The design details are as shown in Fig 10.5.1 and Fig 10.5.2 respectively.

Door opening:

There is a step right in the flank at the end of the door.It also works as a door handle,looking perfectly rational.

11. DESIGN BRIEF:

General Specifications:

The car will have a Front Mounted Engine and will be have a Rear wheel drive.

Engine Specifications:

3800 cc, 4 Liter V8 Engine

Overall Dimensions: (Subject to change according to styling)

Length ~ 5100 mm
Breadth~ 2000 mm
Height ~ 1450 mm

Tire Dimensions:

255/45 R18
18” Light Alloy wheels

Theme of the Design:

The theme used throughout the styling process would be ‘Aggression’’, a killer instinct.

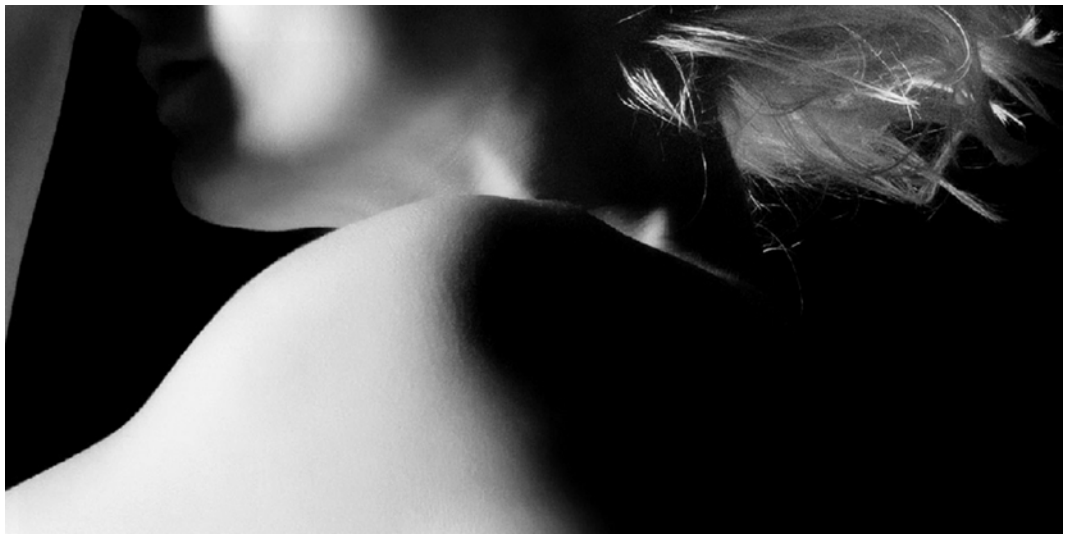
The theme ‘Aggression’ was selected because it is the current trend going on in the market.Sao a design will be made which will actually fit into this line of cars.

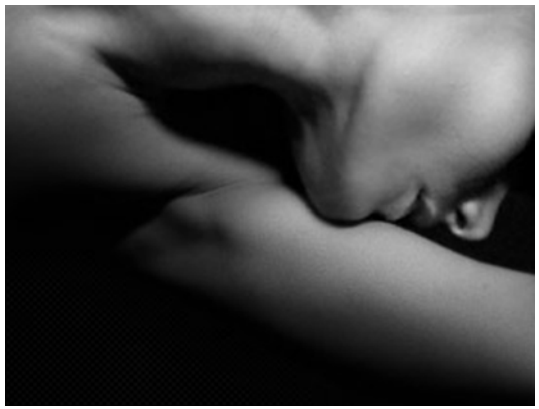
12. NATURAL INSPIRATIONS:

Curves play an important role when it comes to the form definition.This basically reflects the identity of the car.Proportions also make a great difference in terms of the overall surface behaviour in the car.

12.1 NATURAL INSPIRATIONS: Human Figures

Human silhouettes are considered as the striking examples in terms of the proportions and the surface behaviour. An image board representing these curves and proportions is shown below.





12.2 STUDY OF SILHOUETTES OF DIFFERENT SEDANS

Fig 12.2.1 below shows the silhouettes sketches of various cars as seen in dark.This basically gives the idea about the stance and the proportions of the vehicle.

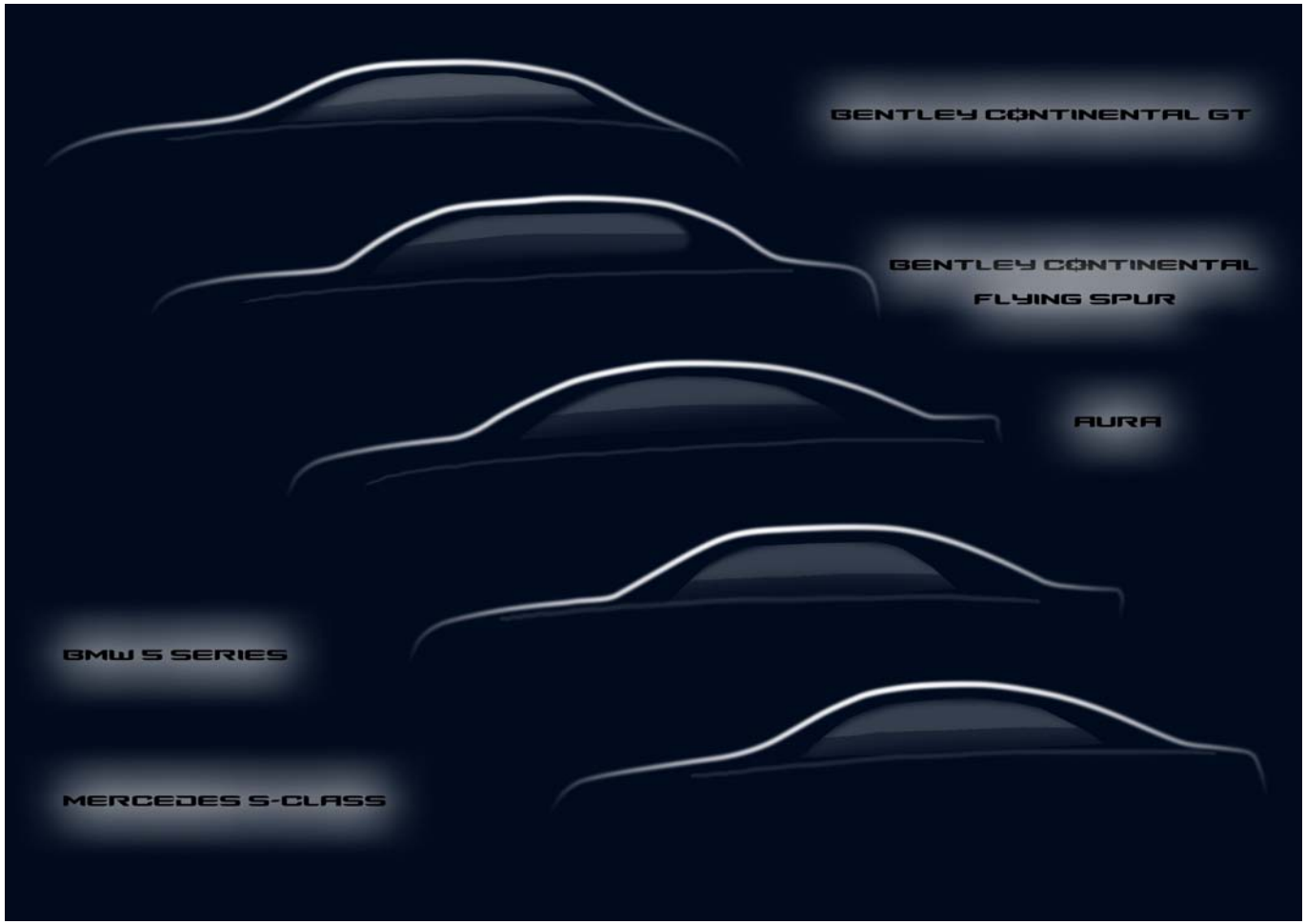


Fig 12.2.1

12.3 NATURAL INSPIRATIONS: Elements of Aggression

Since ‘Aggression’ was the theme chosen for the design an image board was made showing all the expressions which were then studied and reflected in terms of design cues in the car.The image is as shown in Fig 12.3.1.

Fig 12.3.1

13. IDEATION SKETCHES:

Ideation sketches were made after carefully going through the image boards trying to reflect the basic emotions of aggression in the design.They are as shown in Figures 13.1, 13.2 and 13.3 respectively.

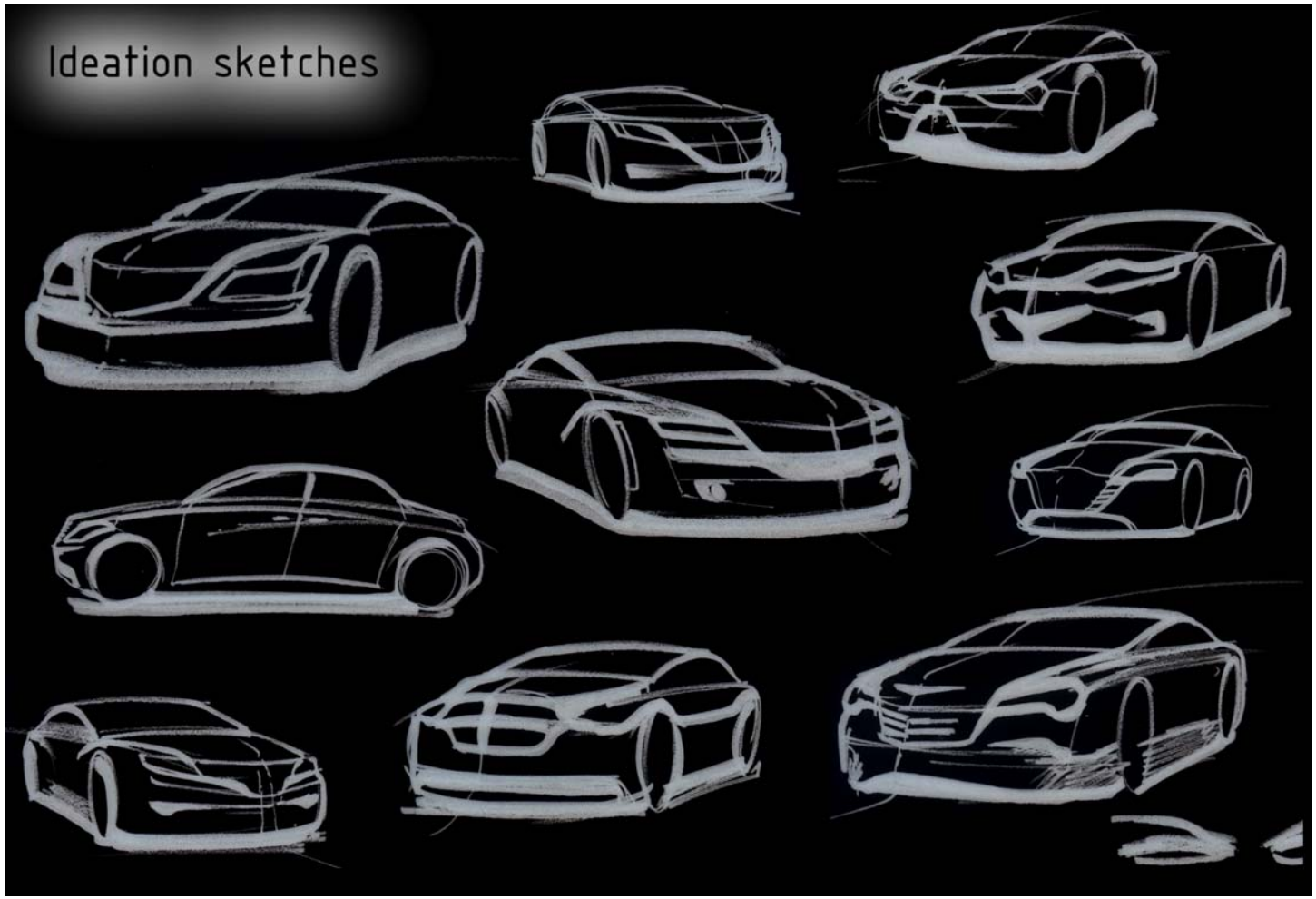


Fig 13.1

13. IDEATION SKETCHES:

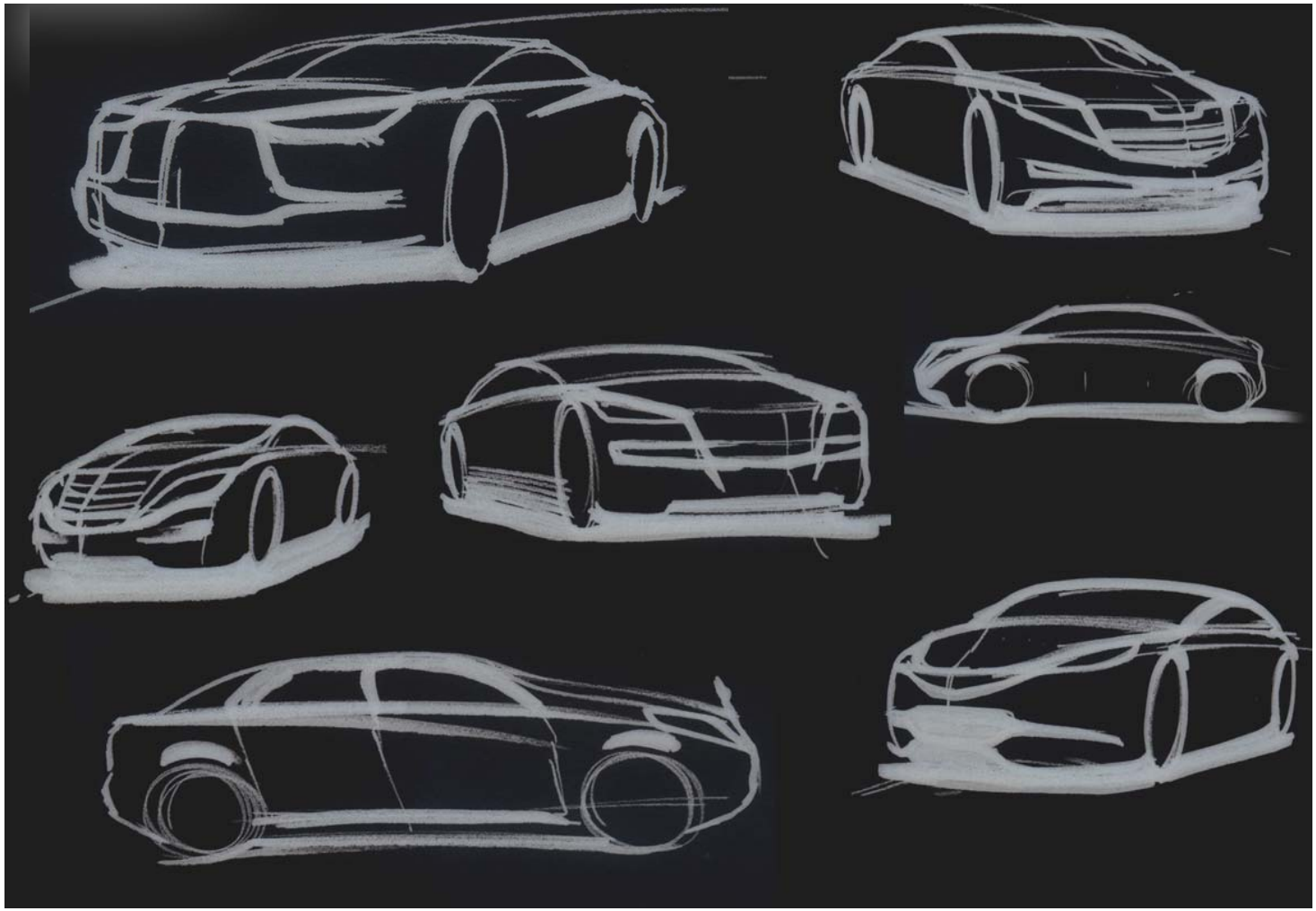


Fig 13.2

13. IDEATION SKETCHES:

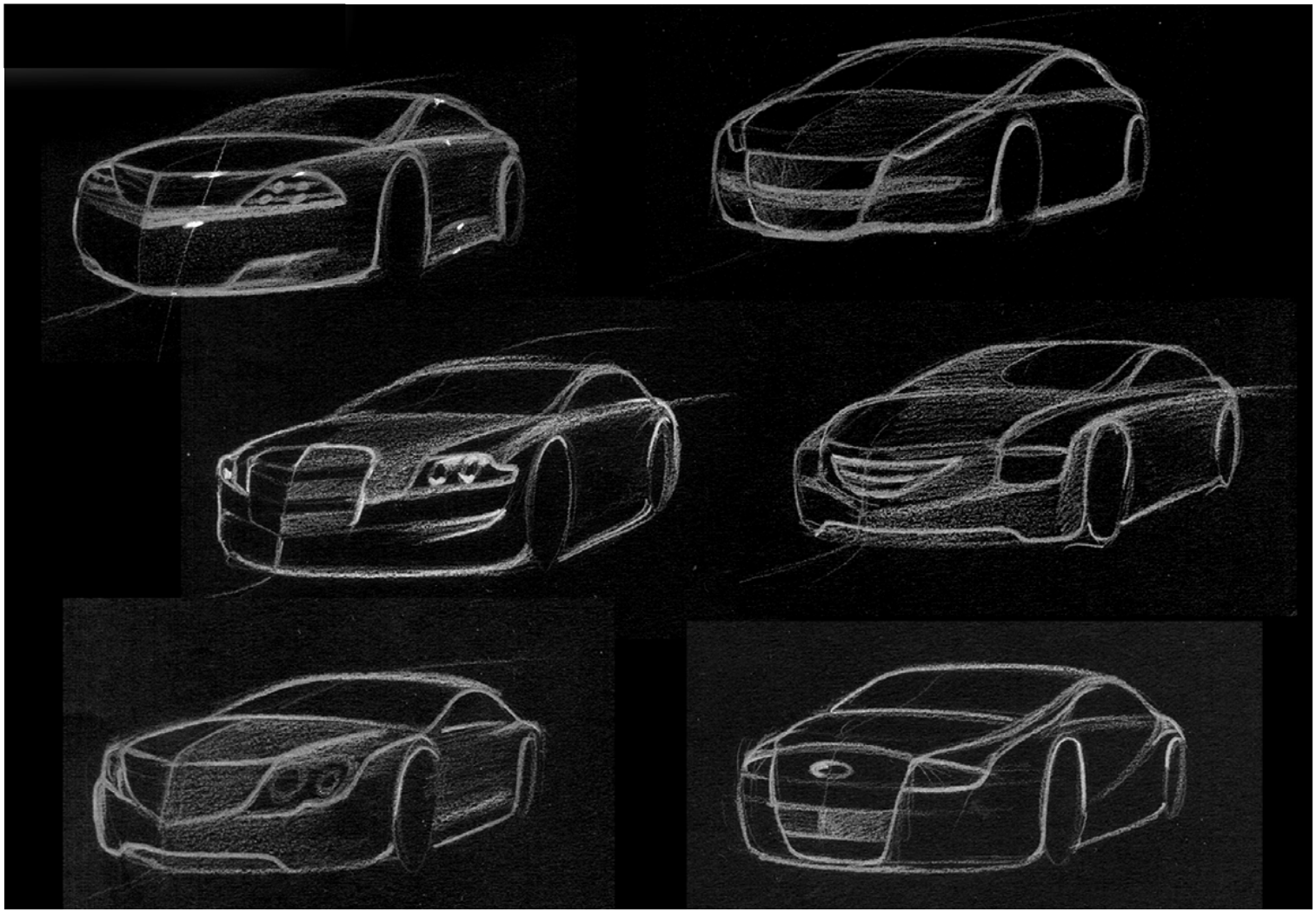


Fig 13.3

14. IDEATION CONCEPTS:

The first ideation concept was inspired from the expressions of a ninja in a fight.This emotion was then reflected in the concept sketch shown in Fig.14.1.

Fig.14.1

14. IDEATION CONCEPTS:

The second ideation concept was inspired from the type of clothes they wear. This attire was then reflected in terms of design cues in the vehicle.Basically in this the front grill which is the identity of the car is like the mask of the ninja which is a ninjas identity.This is shown in the following Fig.14.2.

Fig.14.2.

14. IDEATION CONCEPTS:

The third ideation concept was based on an animal,a leopard displaying the anger when in a fight.Also the proportions of the car are designed in such a way that it gives the feeling of dynamism and subtle flowlines.This concept is shown in Fig.14.3.

Fig.14.3.

14. IDEATION CONCEPTS:

The fourth ideation concept was based on a dragon displayed by sharp elements.The sharp elements actually gives a feeling of aggression.These sharp curvatures were then carefully translated for deciding the feature lines of the car.This is shown in Fig.14.4.

Fig.14.4.

14. IDEATION CONCEPTS:

Options were also made for the rear of the vehiclebecause there has to be a continuous flow between the front and the rear of the car.Some of the concepts of the rear three quarter views is as shown in Fig.14.5 below.

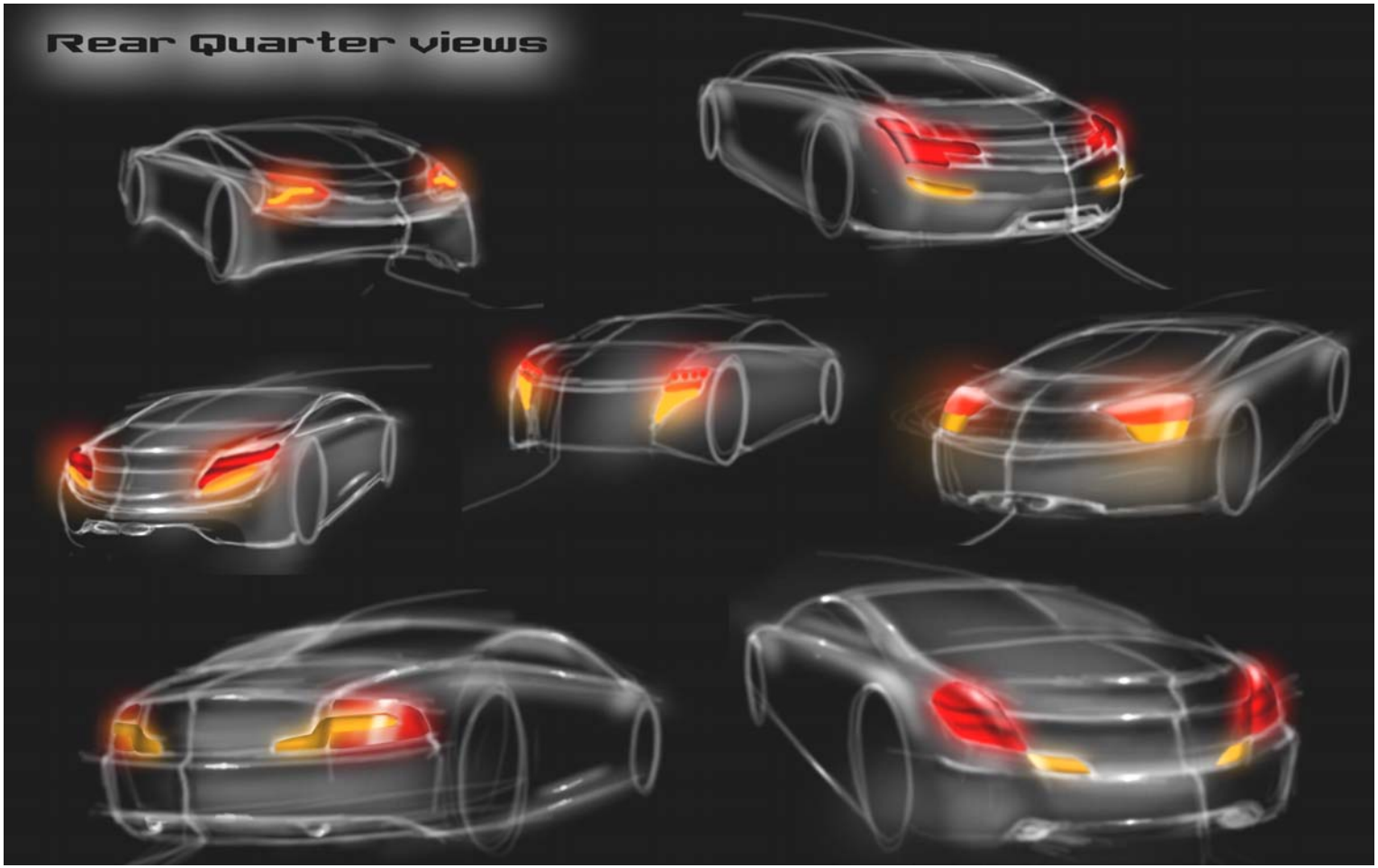


Fig.14.5.

15. CONCEPT RENDERINGS:

Some of the ideation sketches were then directly taken in Photoshop and the realistic renderings were made to give a realistic feeling of the car.

15. CONCEPT RENDERINGS:

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16. DATA EVALUATION:

The renderings of these five concepts were taken to people to know their opinions about the design in terms of different features.

The people included designers from reputed industries.prospective buyers and colleagues.

This data was then evaluated on a scale of 1 to 9, 1 being the lowest and 9 being the highest in terms of ranking basis.The data was then tabulated and summed up. The concept getting the highest score was then taken as a final concept for further development.

The different heads under which the data was evaluated was

1. Exterior Styling.
2. Luxury in terms of visual appeal.
3. Dynamism.
4. Overall styling.

The other heads under which the data was analysed was the different side views,the headlights, the taillights and the rear of the vehicle.

16. DATA TABULATION:

The feedback for **Styling (aggression)** from different users is tabulated as shown in Tables 16.1 and 16.2 respectively.

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Dharmesh Mistry Head,Sheet Metal Aggr. Mahindra Tractors Age: 41 years	6	5	4	2	3
Mr. Subhash Mago Head,Sourcing Department Mahindra Tractors Age: 47 years	7	6	8	5	4
Mr. Sumit Malpani Deputy Manager,S M Aggr. Mahindra Tractors Age: 25 years	1	3	9	5	7
Mrs. Ramkrupa Senior Designer, Styling Mahindra Automotive Age: 40 years	6	5	6	4	5

Table 16.1

16.1 DATA TABULATION:

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Jagdish Director, National Garage General Motors Age: 35 years	6	8	9	7.5	7.5
Mr. Anil Bhatt Sales Representative Force Motors Age: 30 years	5	9	5	1	3
Mr. Utkarsh Gautam Student IDC,IIT Bombay Age: 24 years	7	6	2	1	8
Ms. Shweta Suthar Student IDC,IIT Bombay Age: 25 years	7	5	1	3	9
TOTAL SCORE	45	**47**	44	28.5	46.5

Table 16.2

16.1 DATA TABULATION:

The feedback for **Luxury (Visual appeal)** from different users is tabulated as shown in Table 16.3 and 16.4 respectively.

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Dharmesh Mistry Head,Sheet Metal Aggr. Mahindra Tractors Age: 41 years	1	3	4	5	7
Mr. Subhash Mago Head,Sourcing Department Mahindra Tractors Age: 47 years	1	4	5	3	7
Mr. Sumit Malpani Deputy Manager,S M Aggr. Mahindra Tractors Age: 25 years	9	7	5	3	1
Mrs. Ramkrupa Senior Designer, Styling Mahindra Automotive Age: 40 years	3	4	4	7	6

Table 16.3

16.1 DATA TABULATION:

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Jagdish Director, National Garage General Motors Age: 35 years	5	7	3	1	9
Mr. Anil Bhatt Sales Representative Force Motors Age: 30 years	9	7	5	1	3
Mr. Utkarsh Gautam Student IDC,IIT Bombay Age: 24 years	3	7	6	4	8
Ms. Shweta Suthar Student IDC,IIT Bombay Age: 25 years	3	5	7	9	1
TOTAL SCORE	34	**44**	39	33	42

Table 16.4

16.1 DATA TABULATION:

The feedback for **Dynamism** from different users is tabulated as shown in Table 16.5 and 16.6 respectively.

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Dharmesh Mistry Head,Sheet Metal Aggr. Mahindra Tractors Age: 41 years	1	3	5	7	4
Mr. Subhash Mago Head,Sourcing Department Mahindra Tractors Age: 47 years	4	5	7	2	1
Mr. Sumit Malpani Deputy Manager,S M Aggr. Mahindra Tractors Age: 25 years	5	9	7	3	1
Mrs. Ramkrupa Senior Specialist, Styling Mahindra Automotive Age: 40 years	6	5	4	3	4

Table 16.5

16.1 DATA TABULATION:

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Jagdish Director, National Garage General Motors Age: 35 years	1	9	7	3	5
Mr. Anil Bhatt Sales Representative Force Motors Age: 30 years	7	5	9	3	1
Mr. Utkarsh Gautam Student IDC,IIT Bombay Age: 24 years	4	3	6	2	2
Ms. Shweta Suthar Student IDC,IIT Bombay Age: 25 years	1	9	3	7	1
TOTAL SCORE	29	**48**	**48**	30	19

Table 16.6

16.1 DATA TABULATION:

The feedback for **Overall Styling** from different users is tabulated as shown in Table 16.7 and 16.8 respectively.

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Dharmesh Mistry Head,Sheet Metal Aggr. Mahindra Tractors Age: 41 years	1	3	5	7	4
Mr. Subhash Mago Head,Sourcing Department Mahindra Tractors Age: 47 years	7	6	8	5	4
Mr. Sumit Malpani Deputy Manager,S M Aggr. Mahindra Tractors Age: 25 years	7	9	5	1	3
Mrs. Ramkrupa Senior Designer, Styling Mahindra Automotive Age: 40 years	4	4	5	5	6

Table 16.7

16.1 DATA TABULATION:

USERS	CONCEPT 1	CONCEPT 2	CONCEPT 3	CONCEPT 4	CONCEPT 5
					
Mr. Jagdish Director, National Garage General Motors Age: 35 years	1	3	9	7	5
Mr. Anil Bhatt Sales Representative Force Motors Age: 30 years	5	9	7	1	3
Mr. Utkarsh Gautam Student IDC,IIT Bombay Age: 24 years	2	5	4	4	7
Ms. Shweta Suthar Student IDC,IIT Bombay Age: 25 years	9	7	5	1	3
TOTAL SCORE	36	46	**48**	31	35

Table 16.8

16.1 DATA TABULATION:

The feedback for **Side views** from different users is tabulated as shown in Table 16.1.1 to 16.1.7 respectively.

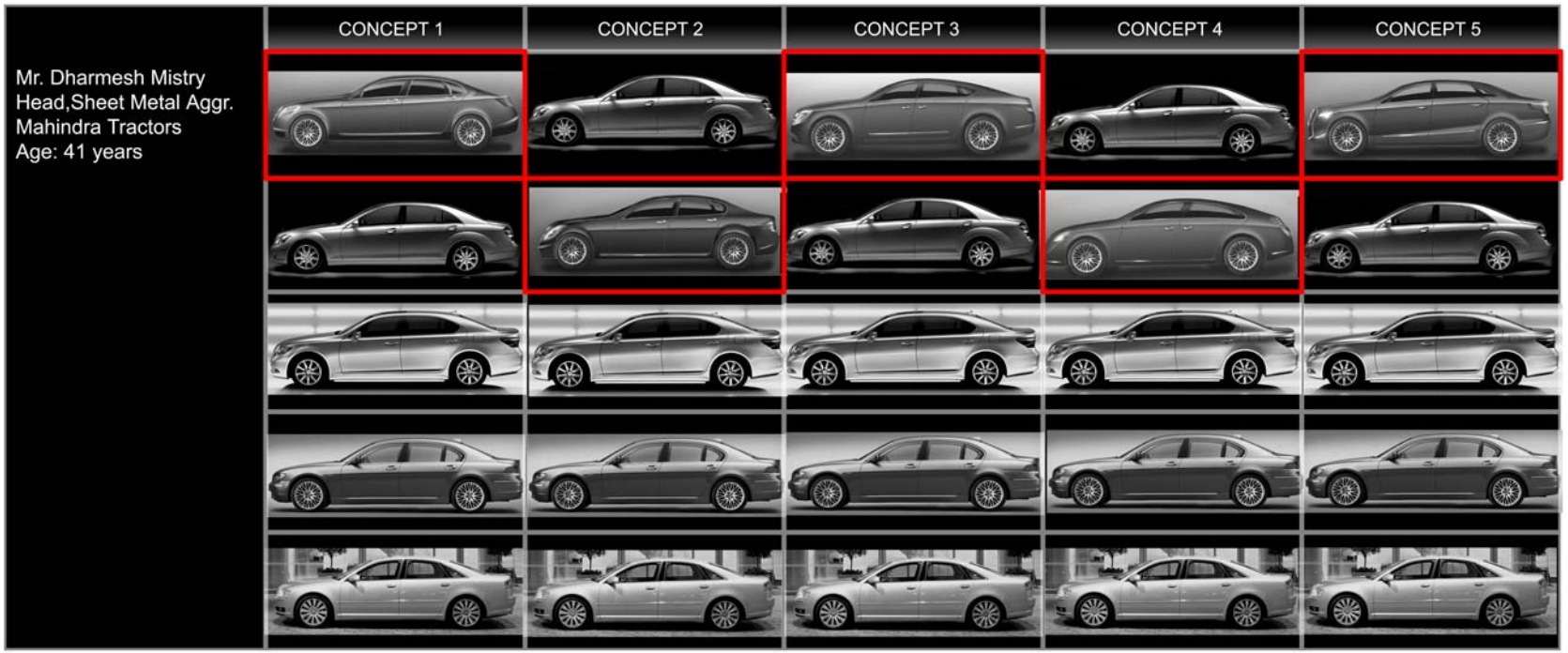


Table 16.1.1

16.1 DATA TABULATION:

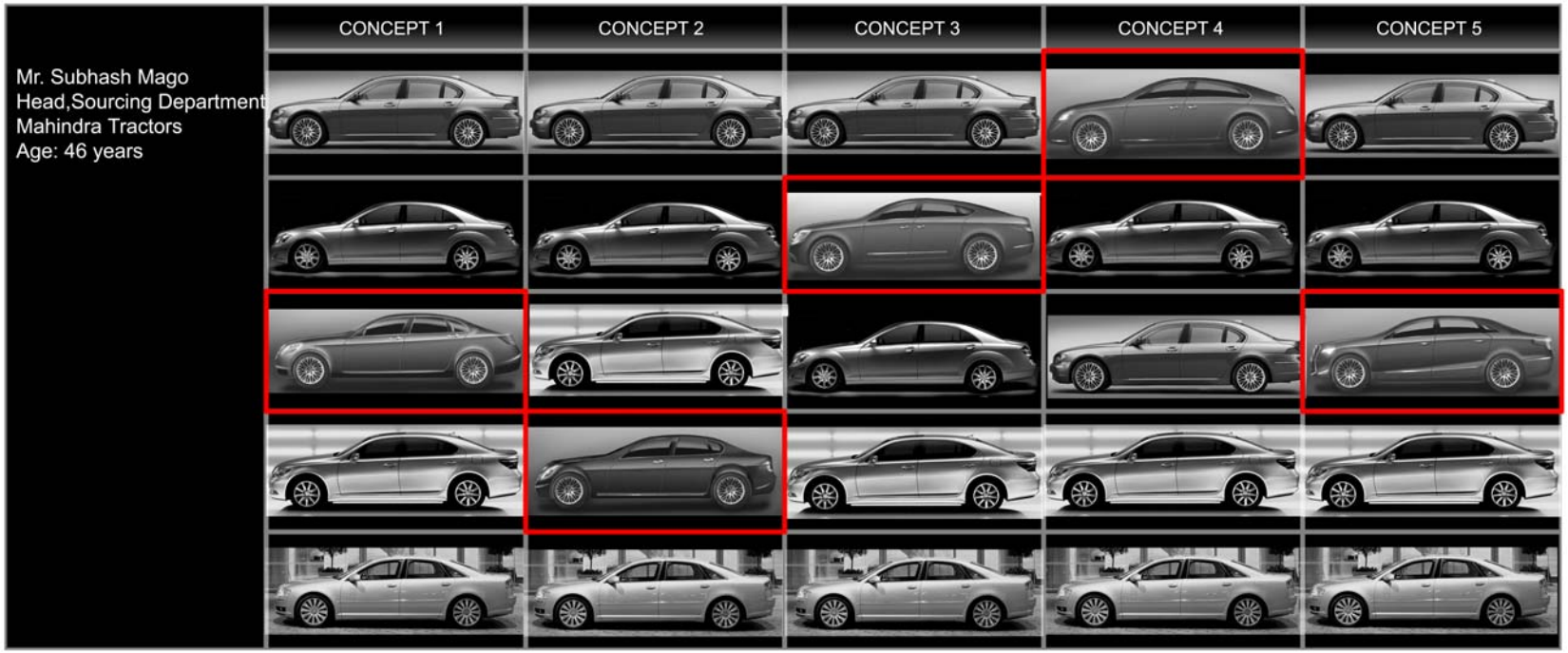


Table 16.1.2

16.1 DATA TABULATION:

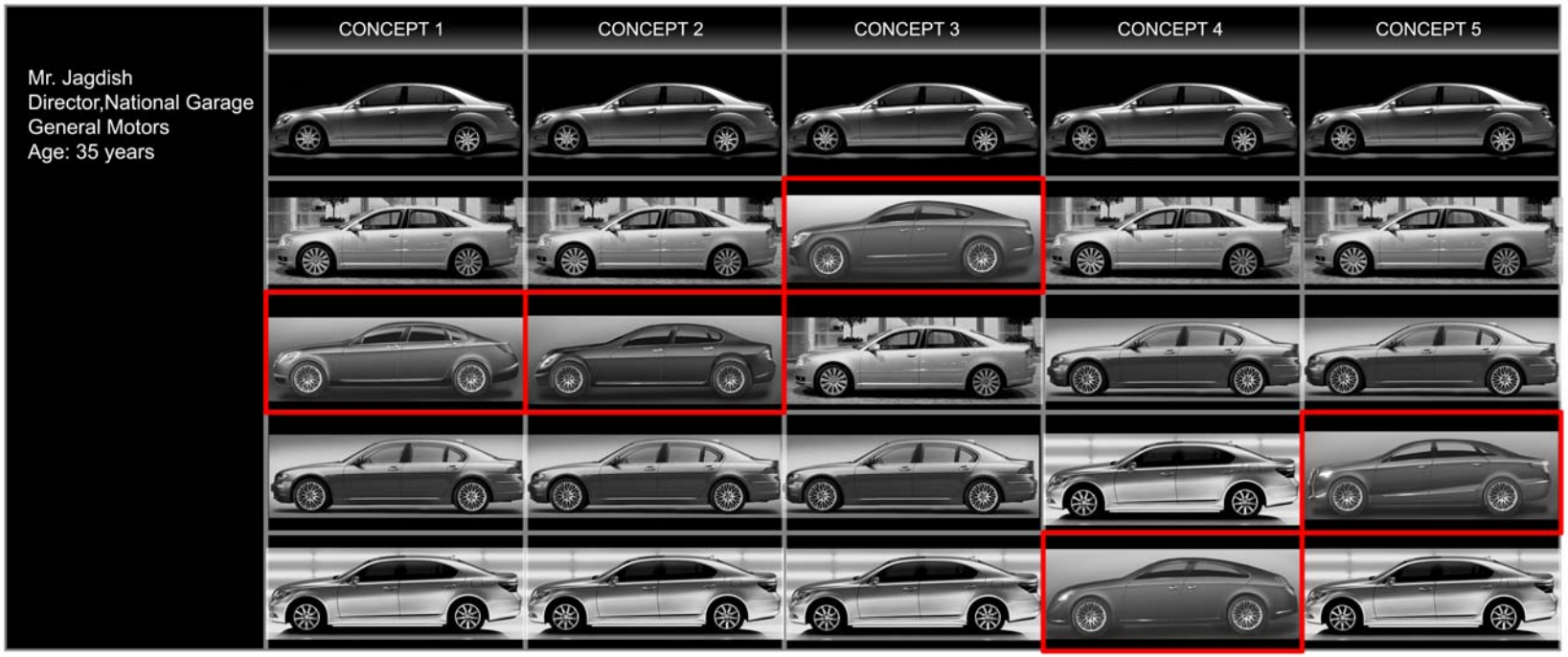


Table 16.1.3

16.1 DATA TABULATION:

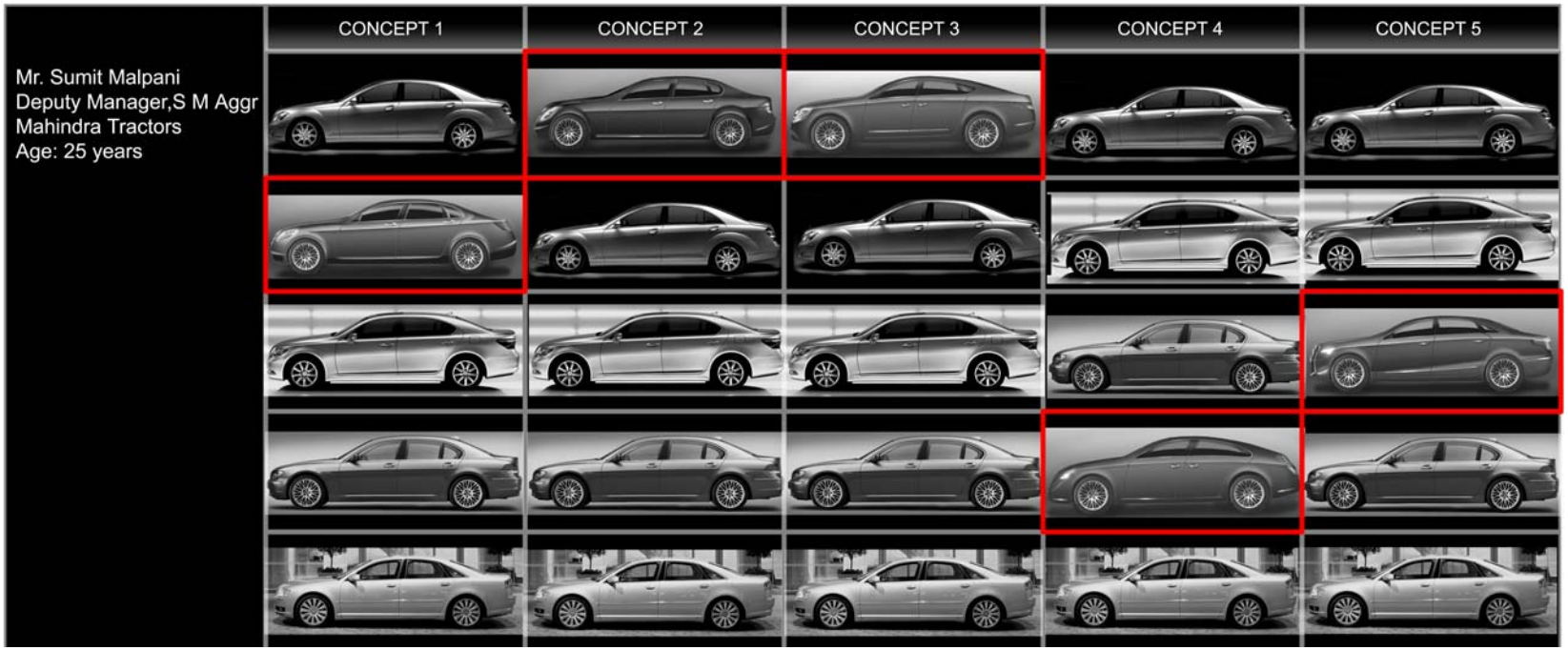


Table 16.1.4

16.1 DATA TABULATION:

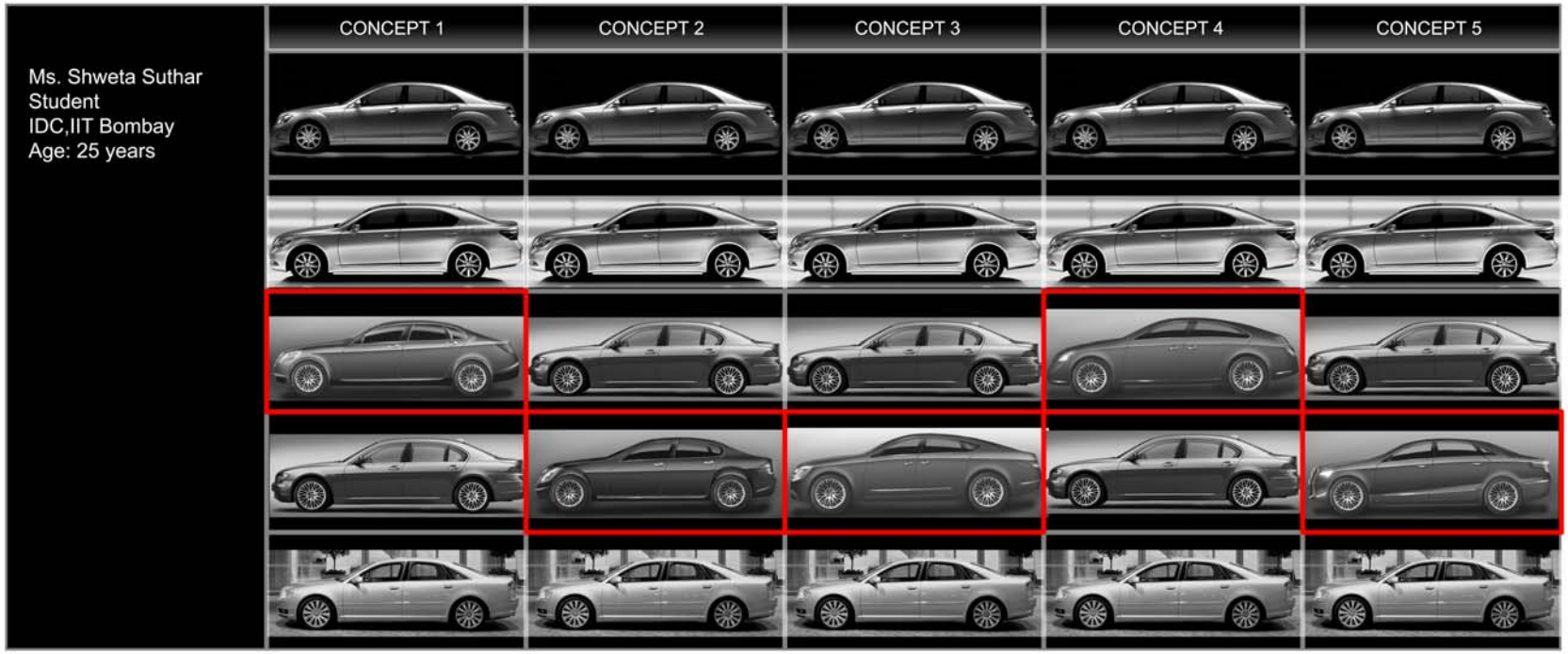


Table 16.1.5

16.1 DATA TABULATION:

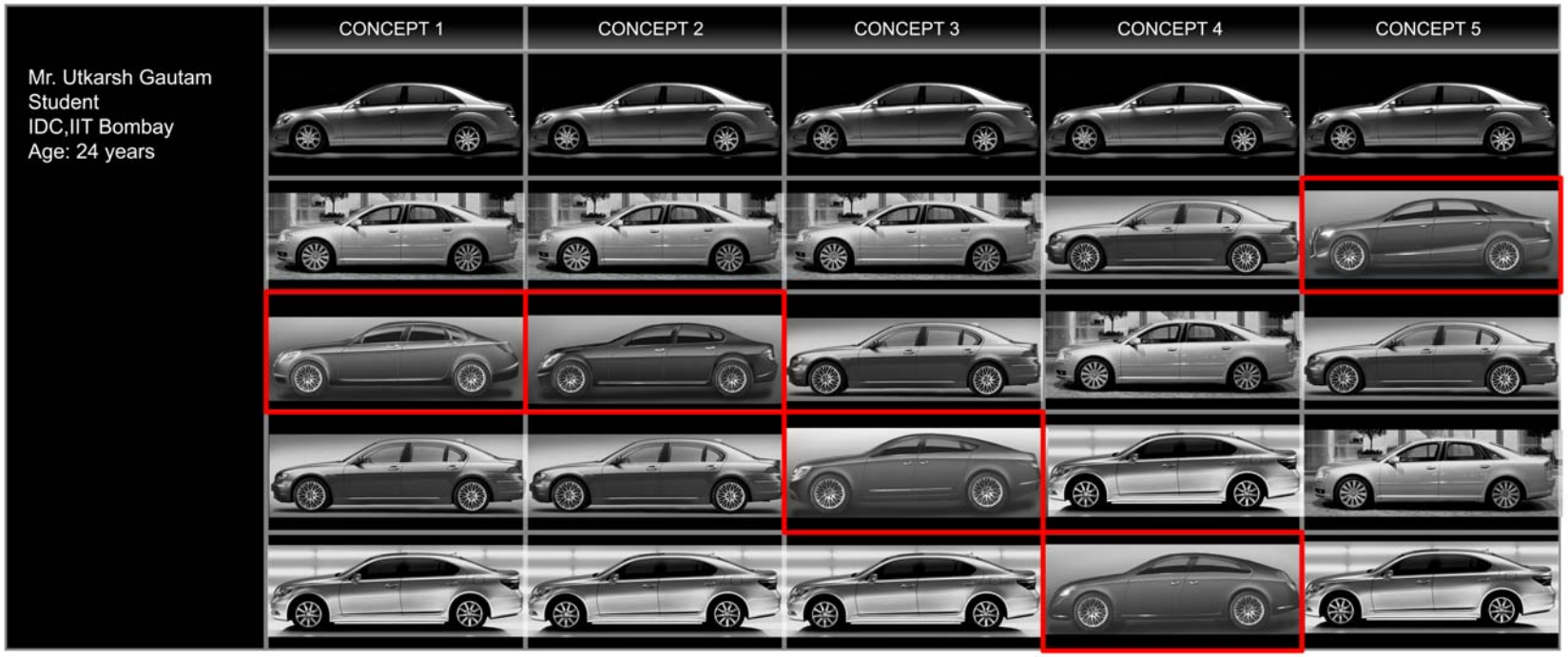


Table 16.1.6

16.1 DATA TABULATION:

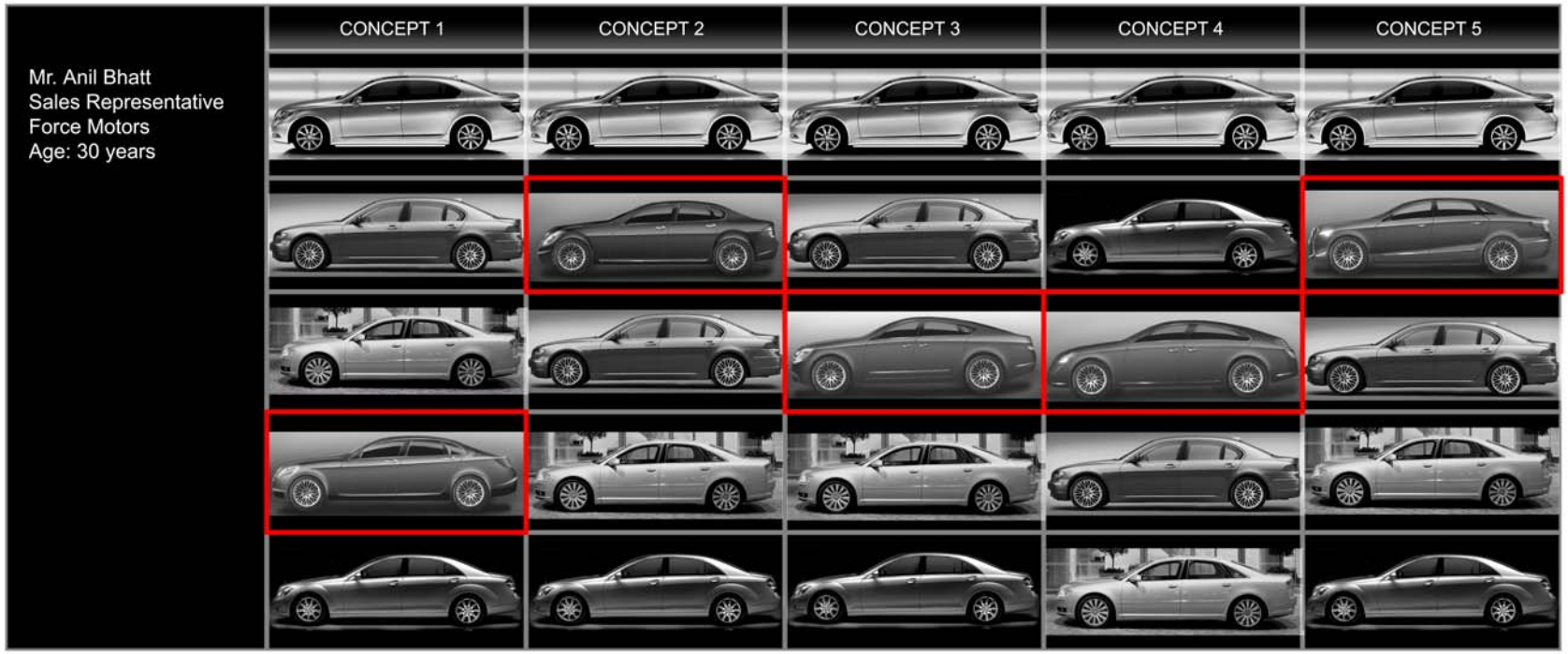


Table 16.1.7

16.1 DATA TABULATION:

General Comments:

MR.DHARMESH MISTRY:

1. Concept 5 feature line is disturbing.
2. Concept 5 rear is bulky.
3. Front grill angle makes it more aggressive.
4. Sharp edges makes it look aggressive.

MRS.RAMKRUPA:

1. Can be aggressive but at the same time it should be pleasing else the customer will not buy.
2. The front and the rear should actually make a continuous flow in all the concepts.

MR.ANAND GAWDE:

1. Styling is more aggressive in Concept 4
2. Rear of Concept 3 is good.
3. Side of Concept 2 is good.
4. Would buy a car having the rear of Concept 3 and front of Concept 2.

MR.SUBHASH MAGO:

1. Should be unique, a class apart.
2. Full of power, luxurious with shining looks and curvatures.
3. Did not like any of the grills .Change the grills.
4. Should be more royal,majestic.

16.1 DATA TABULATION:

General Comments:

MR.ADVANI:

1. Concept 3 has a bad roof, it is very low.
2. Would like the front grill to be rectangular and have straight slits like Mercedes.
3. B-pillar can be shifted to the front so that the rear interior space can be increased.
4. Likes a car which has a decent looks rather than smiling face like looks.
5. Rear view of Concept 1 is better.

MR. JAGDISH:

1. Did not like the grill of Concept 4.
2. Concept 5 is Audi A8 like.
3. Not pleased with Concept 1.
4. Taillights of Concept 1 and 4 are good whereas 5,2 and 3 are bad.
5. Side profile of Concepts2 and 5 is good.
6. Front Grill of Concepts 2 and 3 is good.
7. Avoid suicide doors.
8. Chrome strips are good but don't overdo it.

MR.ANIL BHATT:

1. Front grill of Concepts 4 and 5 is not there in Indian cars so should be avoided.
2. Concepts 3,2 and 1 looks are nice.

16.1 DATA TABULATION:

General Comments:

MR. SUMIT:

- Change the indicators of Concepts 1 and 2.Make it like Concept 5.
- Concept 5 headlights are good.

MR.UTKARSH:

- Proportions of the vehicle are not clear.
- Concept 4 is like a man whose nose is cut.
- Concept 3 rear is static, no energy, soap box.
- Rear of Concept 4 is better due to better flow of surfaces.
- Rear of Concept 1 is also good.

MS.SHWETA SUTHAR:

1. Concept 5 waist line is good.muscular,tight,feature line is good, grill not good.
2. Concept 2 headlights can be put in Concept 5.
3. Taillights more aggressive in Concept4.
4. Taillights of Concept 1 extend to the waist line,continuous line.
5. Rear quarter windows of Concept 5 is nice.
6. There could be a center kink in Concept 2.
7. Concept 2 headlights can be put in Concept 1.

17. CONCEPT DETAILING:

A true scale projection of all the renderings of the concepts was done to get a true feeling of the design.This is done also to exaggerate any smallest detail into its actual size and also to find out any discrepancies in the proportions of the design as such.

17. CONCEPT DETAILING:

The concept renderings analyzed in its true scale are shown in Fig 16.1, 16.2,16.3,16.4 and 16.5 respectively.

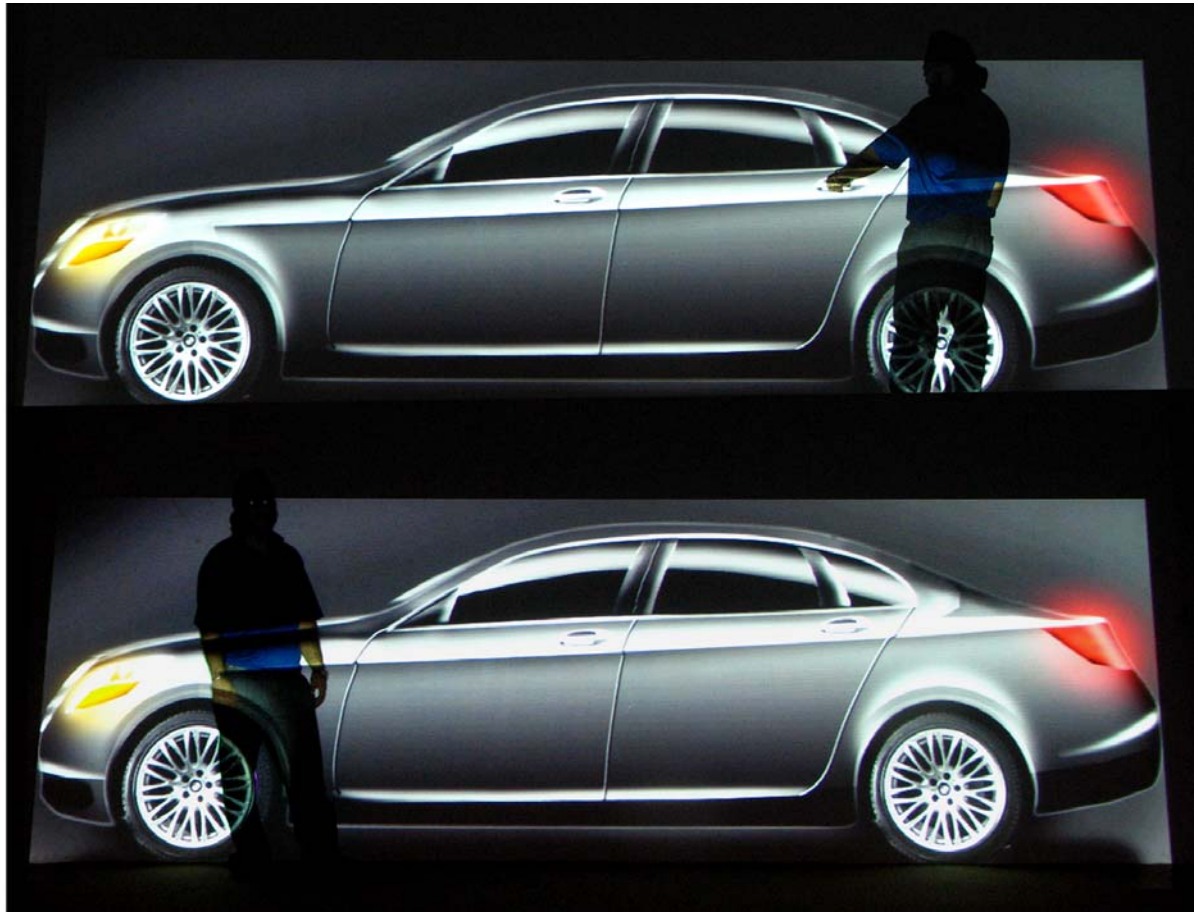


Fig.17.1: 1:1 projected rendering of Concept 1

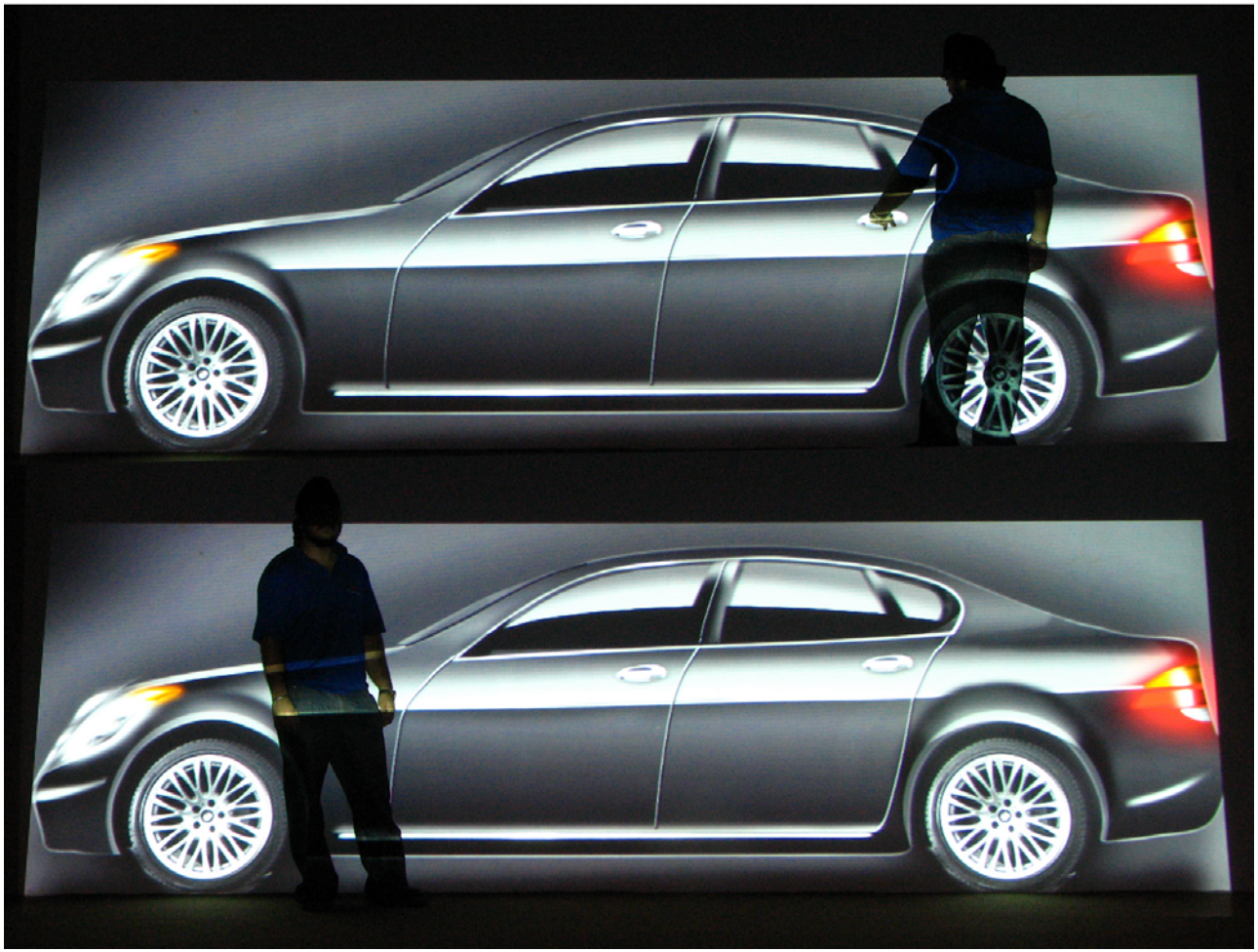


Fig.17.2: 1:1 projected rendering of Concept 2

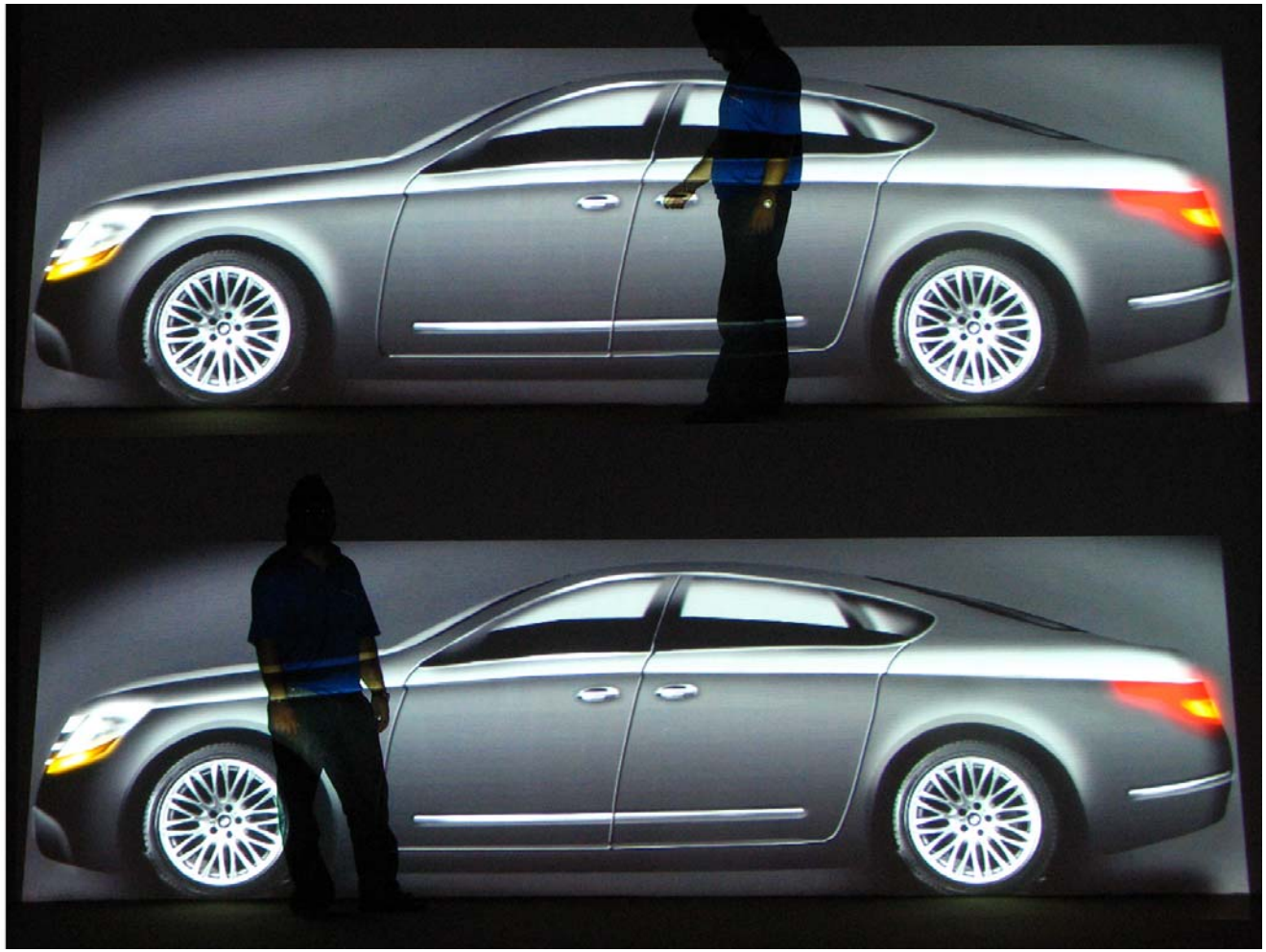


Fig.17.3: 1:1 projected rendering of Concept 3

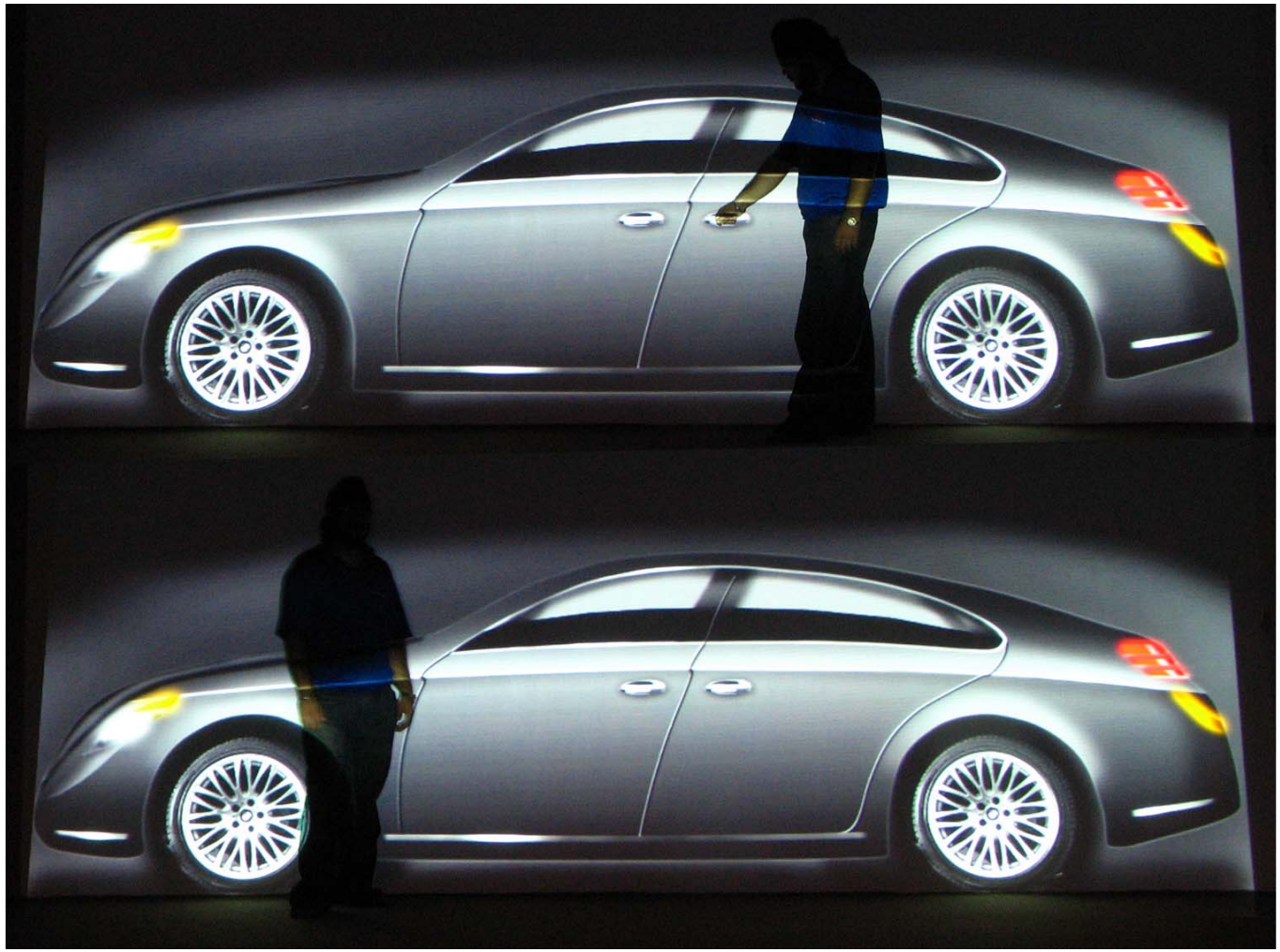


Fig.17.4: 1:1 projected rendering of Concept 4

Fig.17.5: 1:1 projected rendering of Concept 5

18. CONCEPT DEVELOPMENT:

18.1 Concept Exploratory Model:

Fig 18.1.1.

After the concepts were analyzed based on the ratings given by the users and their comments on the designs and also on the basis of the true scale renderings, Concept 2 was selected as the design for further development.

Concept 2 exploratory model was made so as to understand the surfaces better.This was done by making cross sections on the exploratory model itself. This gives a better understanding as far as flow of the surfaces is considered. It is as shown in Fig 18.1.1.

Also a better understanding of the proportions and the stance of the vehicle is determined before starting with the actual drafting and 3D Modeling.

18.2 Concept Drawings:

Concept 2 orthographic data was drafted so as to start with the 3D CAD Modeling. The four orthographic views generated are as shown in Fig.18.2.1

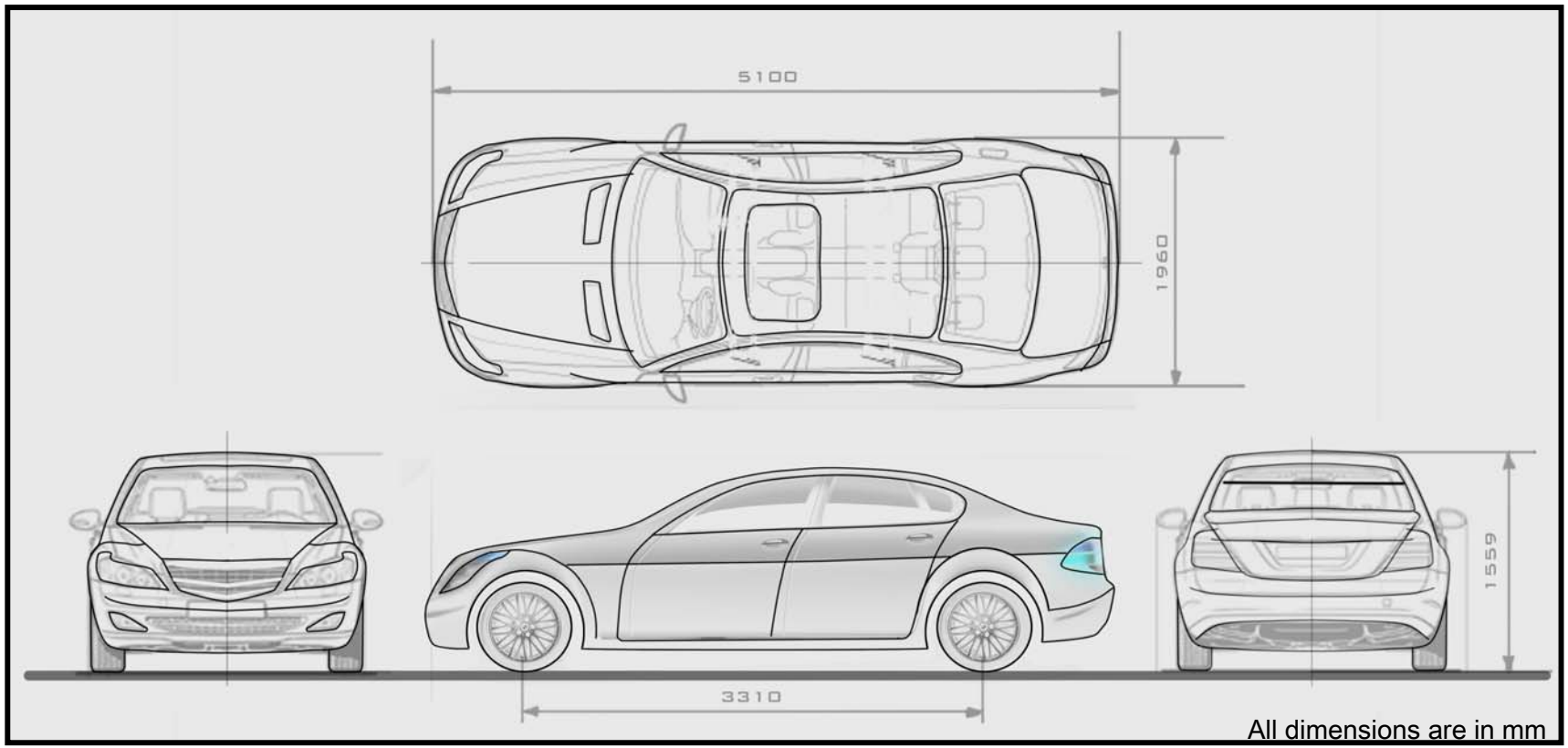


Fig.18.2.1 Orthographic views of Concept 2

18.3 CAD Surface Development Stages:

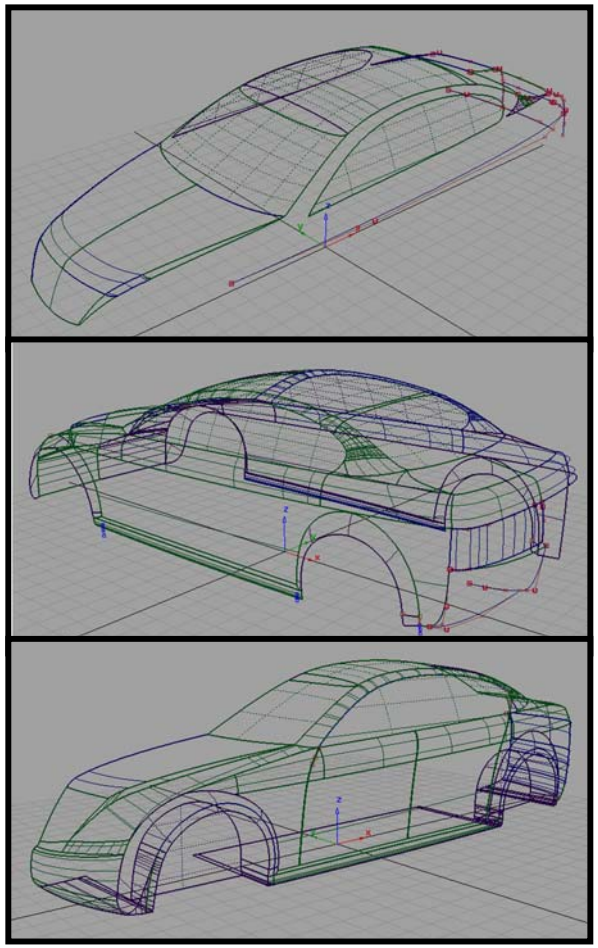


Fig 18.3.1.

The orthographic views were used as a base for this and surfaces were made on a 3Dd software.

At first a basic surface is made which actually helps in defining the overall proportions of the vehicle.Any changes to the surfaces can be made at this moment itself.

Changes made to the concept model should be only in the initial state when the number of surfaces is less.The more the surfaces get associated or attached to different surfaces,the more cumbersome it becomes to tweak the surfaces.

The software used for the above design was **Alias Studiotools.**

Fig 18.3.1 besides shows the surface development stages in surface modeling.

18. CONCEPT DEVELOPMENT:

Changes made to the different surfaces from the exploratory model made is shown here.The following Fig.18.3.2 shows the beltline of the vehicle before and after being changed from a soft curvature to a distinct change of surface. Also Fig.19.3.3 shows the negative rake of the vehicle before and after it was increased.

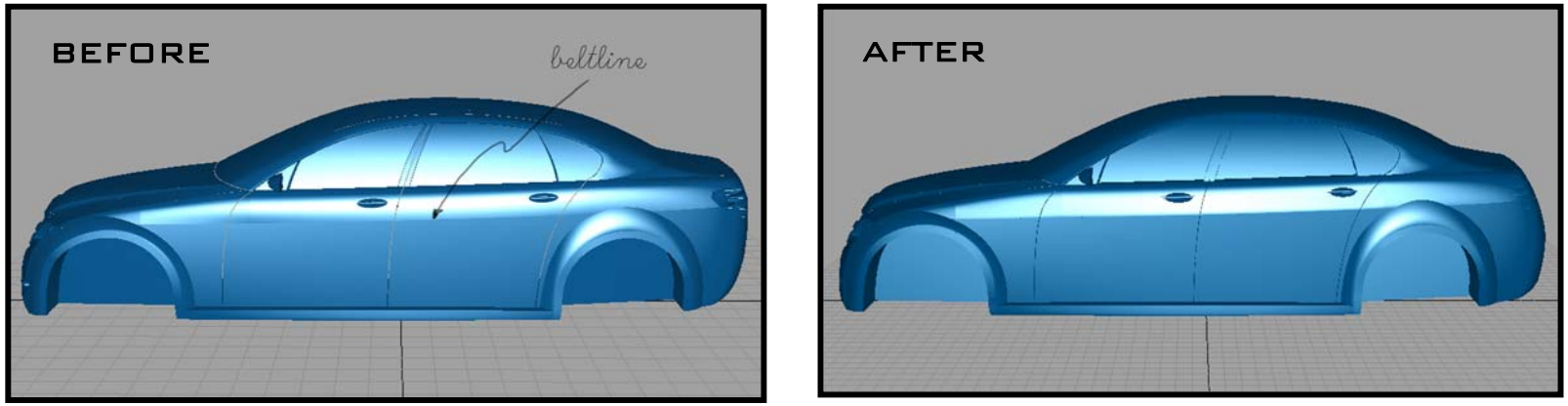


Fig.18.3.2: Beltline

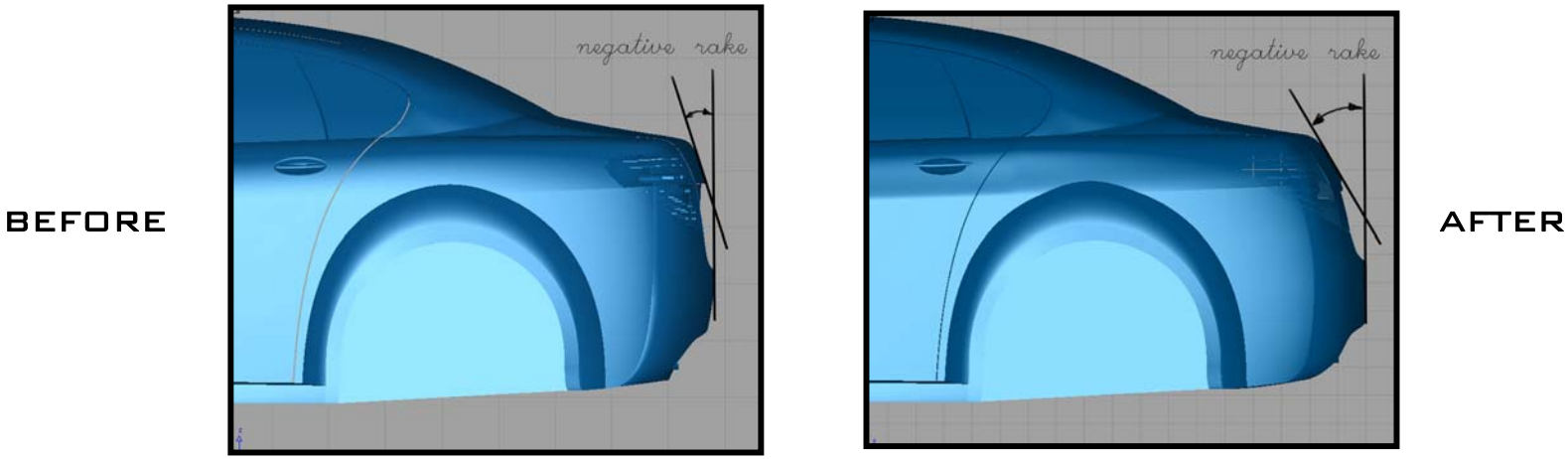


Fig.18.3.3: Rear Negative Rake angle

19. FINAL RENDERINGS:

Fig 19.1 below shows the different views of the rendered model of Concept 2.

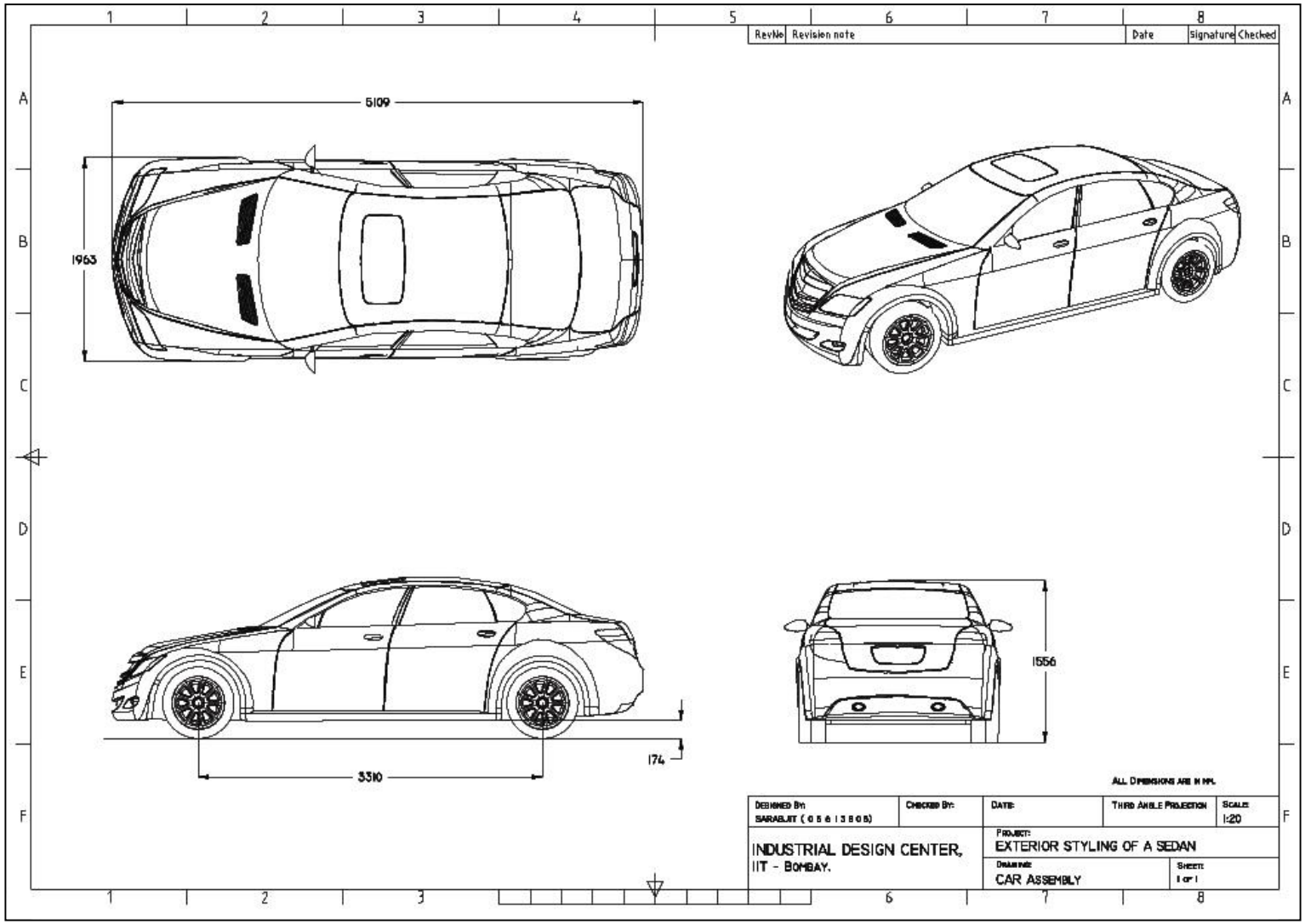
Fig 19.1

20. FINAL RENDERINGS:

Fig 19.1 below shows the different views of the rendered model of Concept 2.

Fig 19.1

20. FINAL RENDERINGS:



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