



APPLICATION DEVELOPMENT WITH GE PLASTICS: REDESIGN OF INTERIORS OF AC CHAIR CAR FOR INDIAN RAILWAYS

Industrial Design Project 2
IDC
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INTRODUCTION

The project aims at enhancing the comfort level of the passengers traveling by Second Class AC Chair Car coach.

Budget Airlines offer very affordable rates, providing stiff competition to the Indian Railways in this concern.

CONCERNS OF THE INDIAN RAILWAYS (IR):

- Increasing the capacity of the coaches -
- Using the existing skeletal frame of the coach produced by either the RCF (Kapurtala) or ICF (Perambur)
- Adhering to the safety standards employed by the IR
- Creating fire-resistant, wear-resistant design that is vandalism proof



INTRODUCTION

PROJECT BRIEF

Designing the interiors of the AC Chair Car coach for the Indian Railways, focusing on user amenities around the seat.

DESIGN OBJECTIVES

- Responding to the Indian user's needs for different user amenities
- Addressing the lighting and ventilation solution within the coach
- Developing ideal luggage storage solutions for every passenger



USER STUDY & ANALYSIS

ACTIVE PEOPLE WATCHING

For the User Study, we observed and recorded behavioral responses within the given context, without interfering with the user's activities

USERS STUDIED

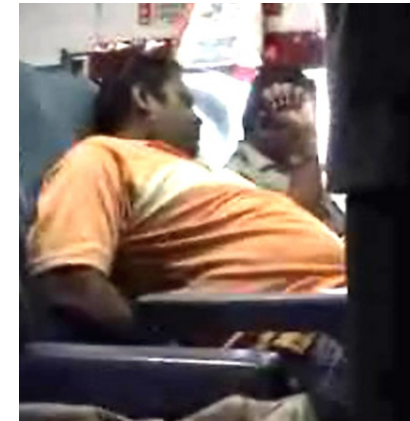
Jyoti Prakash 35 M Software consultant

Sanket Shelve 23 M MBA student

Arun Shinde 30 M Sales personnel

ROUTES STUDIED

- Mumbai- Pune Intercity Express,
- Mumbai - Ahmedabad Shatabdi Express,
- Mumbai- Margaon Jan Shatabdi Express and
- Chennai - Bangalore Shatabdi Express



Jyoti Prakash



Sanket Shelve



Arun Shinde

USER STUDY & ANALYSIS

The following observations were recorded as part of the user study:

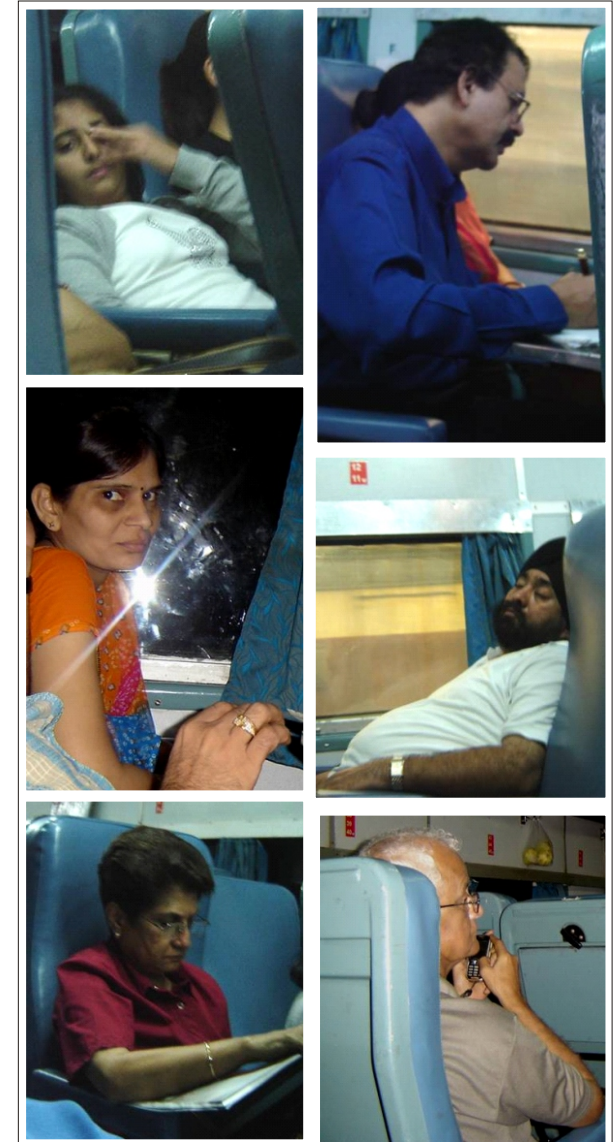
STRATA OF SOCIETY:

High income professionals (management personnel, businessmen, doctors)

Upper class individuals who are concerned about luxury & safety

AGE GROUP OF USERS:

AGE GROUP	% OF TRAVELERS *
0 - 17 years	9%
18 - 30 years	22%
31 - 45 years	40%
46 - 60 years	14%
Above 60 years	15%



Users of different ages & different strata of society

* All figures stated have been collected from CRSE, AC section, WR , courtesy: Census of IR passengers for the year 2004.

PURPOSE OF TRAVEL:

- Business trips
- Company sponsored trips
- Leisure One- day trips (short trips)
- Tours (foreigners, NRIs)
- Vacation trips
- Reservation for National Awardees

REASONS FOR CHOICE OF AC CHAIR CAR:

- Safety (especially for women traveling alone)
- Comfort & luxury
- Psychological aspects of comfort like less crowd, no beggars or other disturbances
- Can work during travel hours and still feel fresh.

USER STUDY & ANALYSIS

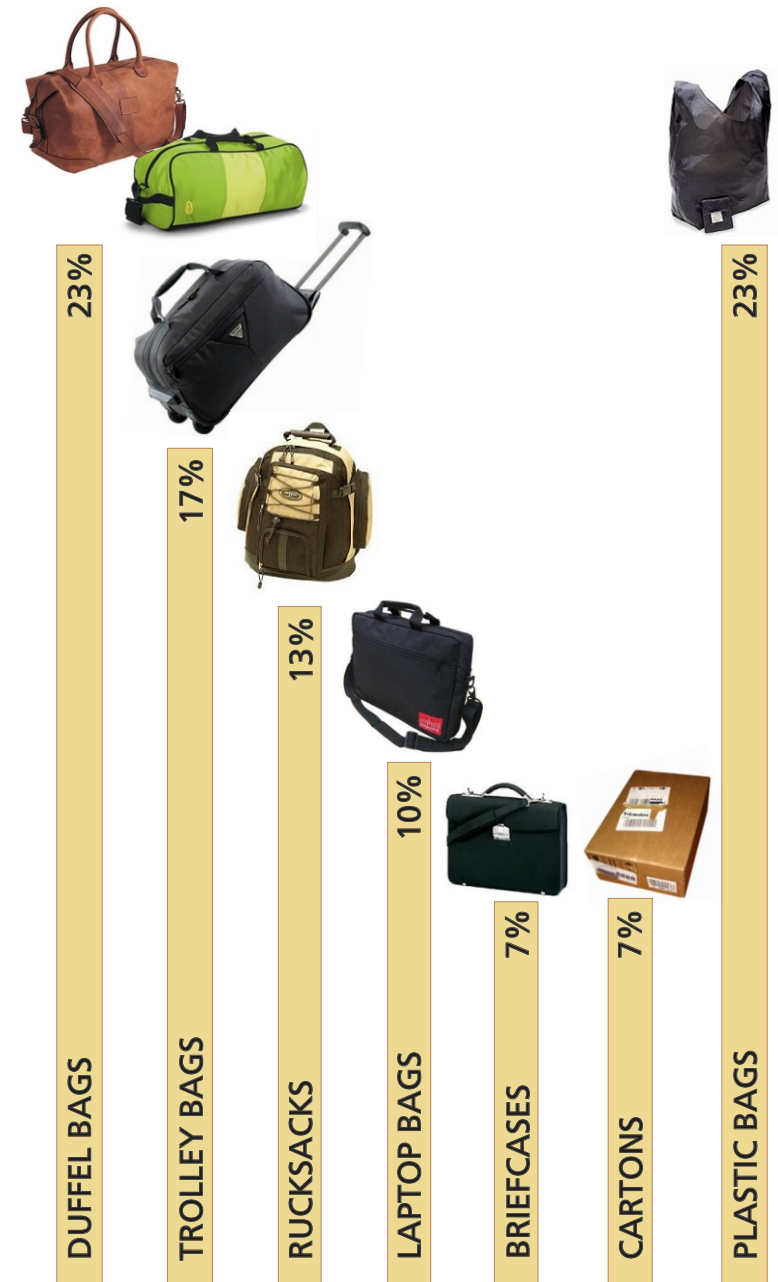
TYPES OF LUGGAGE:

PERSONAL LUGGAGE CARRIED

Personal handbags
Laptops
I-pods
Mobile phones
Walkman
Foodstuff apart from their heavy luggage

ISSUES FOR LUGGAGE SPACE:

- Safety of luggage storage
- Accessibility of luggage stored
- Every passenger carries at least 2-3 bags.



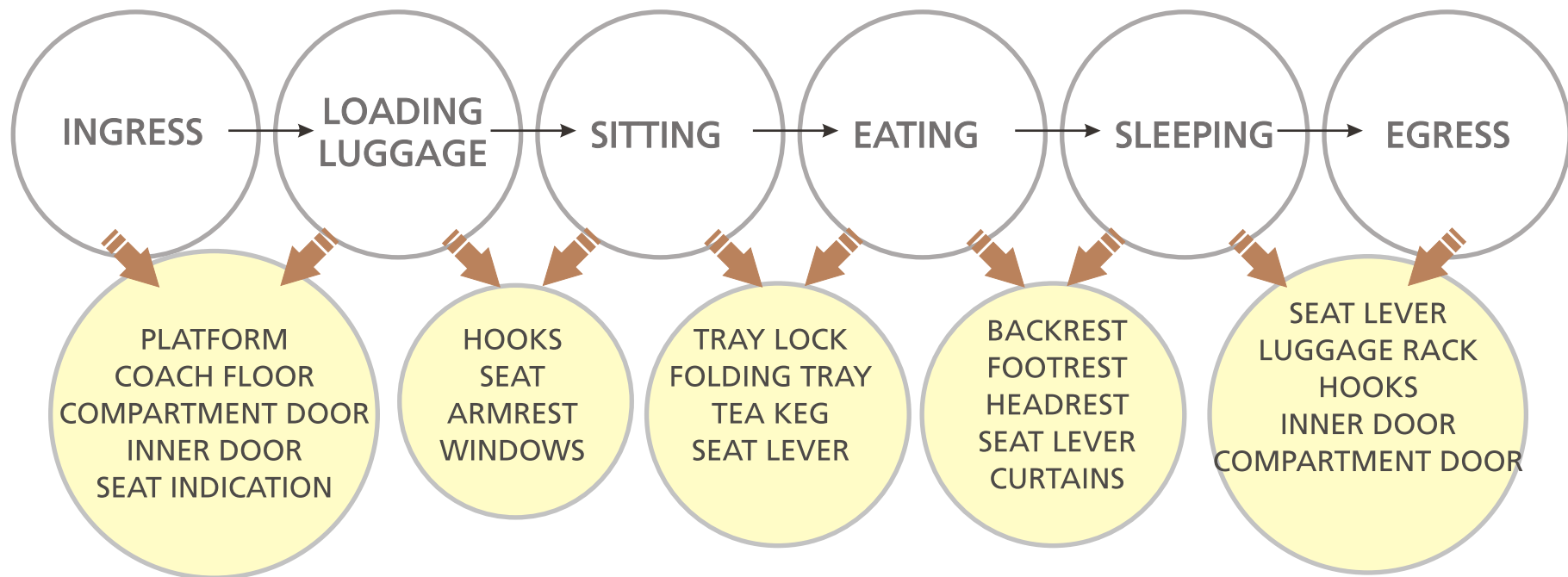
** All figures stated have been collected from study carried out by the design team over four different routes in the same season*

ACTIVITY & ERROR ANALYSIS

Listing/ representing in detail, all tasks, actions, objects, performers and interactions involved in the process.

Listing all things that can go wrong when using a product and determine the various possible causes

ACTIVITY FLOW DIAGRAM



ACTIVITY & ERROR ANALYSIS

INGRESS

Owing to the fact that the inner compartment has to be air-conditioned, the entry doors will have to avoid leakage of cold air to the external area.

Hence, the system should allow for passengers to move in easily with luggage in hand and yet provide a full-proof solution for maintaining the air-conditioned environment within the internal compartment.



LOADING LUGGAGE

Users need to keep luggage visibly close to them for assurance of security and at the same time, the bags should be easily accessible, sometimes even during the time of the journey. Secure storage solutions are a must to avoid accidents



ACTIVITY & ERROR ANALYSIS

SEATING

Chairs are where the passenger spends most of the travel time and should be comfortable enough to accommodate a multitude of postures like sitting, squatting, sleeping, eating, etc. The mechanisms used for reclining features and amenities should work consistently, because the repair cycle time of the Railways is slow. Privacy is a main issue to be addressed in the seating elements - for sharing armrests and using amenities



EATING

The design of the tray should accommodate for larger trays and cater to a variety of functions apart from eating. With the amount of vibration from the movement of the train, the vibration of the tray should be dampened in the new design to avoid serious accidents of spilling of hot drinks. The tray should also be designed to take sudden impacts from accidents or emergency situations.



ACTIVITY & ERROR ANALYSIS

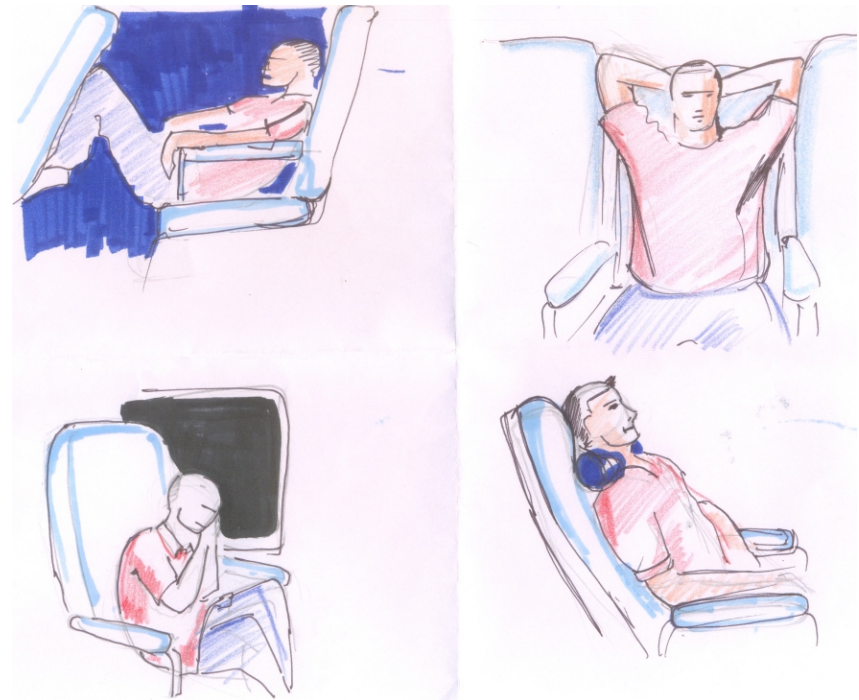
SLEEPING

For sleeping, the head and neck support are crucial, since passengers spend most of the travel time relaxing and sleeping.

The passengers tends to draw his legs close to the body while sleeping and adequate footrest support should be provided. Lighting should not interfere with the sleeping activity.

HVAC & VENTILATION

The air-conditioning provided should be uniformly distributed along the entire length of the compartment. The temperature cannot be controlled individually, however, personal controls for air-draft pressure should be provided. Heaters could be provided for use during cold seasons in colder places.



LIGHTING

Ambient lighting and task lighting should be handled differently in the compartment. The ambient lighting levels should be diffused and should not interfere with the sleeping activity. At the same time, individual task lighting should cater to more intense functions of reading, working, etc. Energy conservation is a key issue to be addressed, considering the fact that the lights are lit all through the journey time.

USER AMENITIES

Integration of all amenities into common units which can be individually controlled for maximum comfort and ease of use. The amenities provided should be intuitively used and should not create confusions. The amenities could also provide for changes with advancements in technology.

INDUSTRY FEEDBACK

Meetings were held with the design team at GE Plastics in Gurgaon to discuss the user study and design concerns that would be taken up for study basis during conceptualization.

The design team helped in redefining the product brief in accordance with understanding the process of design employed by the Indian Railways. Further light was shed on design for ease of manufacture and durability in design by Mr. Ritesh Gohil at Harita Seating, Bangalore.

GE PLASTICS, GURGAON - MR. ANAND HINGNE & DESIGN TEAM FEEDBACK

HIERARCHY OF PARTIES INVOLVED IN THE DESIGN PROJECT

RAW MATERIAL SUPPLIERS



TIER 1 AGENCIES



OEM's



END USERS



Fig.4.1

Bench- marking different transport systems - Aircraft and Metro interiors

With the Application Development activity, GE Plastics was already involved with the Indian Railways and are well acquainted with the aspects of implementation revolving around cost angle. The Indian Railways however, does not have ideas of costing and tendering with the notion of tooling and component cost



*Bench- marking
foreign train systems*



Fig.4.2

2) The data collection should entail **bench - marking** other modes of travel on parallel lines like

- Aircraft interiors - Boeing aircraft interiors, Airbus interiors
- Luxury bus coaches interiors - Volvo luxury buses, large fleet services operation from Mumbai to Pune
- International Rail systems (TGV designs employed by the SNCF, German metro services in Bonn and Dusseldorf)

The design team must look into more areas of Chair car routes to study the imported LHB railway coaches that are already being employed by the Indian railways

3) The major pain areas of the Indian Railways are:

- Seating elements have to be redesigned - Harita seating and Surat seating are already involved in analyzing the major faults with the existing design, and developing an ideal solution to suit the Indian user's needs.
- Luggage storage solutions are a dire need in the space - Another major pain area , causing so many accidents every year, which could be addressed separately, working with the various OEM's involved in this area
- Wall paneling in the interior compartment catering to daylight-openings and user amenities integrated within the panel, including lighting solutions and holders, hooks, etc. The design could be independently handled in association with Leers Ltd, Pune, for further development

HARITA SEATING

HARITA SEATING, BANGALORE - MR. RITESH GOHIL



*Bus seat designs developed by Harita Seatings - providing the SLUMBERITT eliminates the need for a footrest for long distance journeys
A typical seat design incorporated in the luxury Volvo bus designs with the slumberitts*

- 1) Ease of manufacture for plastic productions and detailing - structural PP (injection molding) was suggested for use in elements owing to the existing huge dependence of the automotive industry on this production process
- 2) Safety issues in case of Fire, Derailing and other Emergency situations
- 3) Durability and Design for Vandalism, owing to the context of use
- 4) Ease of replaceability and repair - on the spot replaceability well as yard servicing, understanding the attitude towards assembly scheme and fixing.
- 5) Joinery and details ideal for Indian conditions - sliding details do not last as long as the pivoted joints over extreme use and load.
- 6) The use of a "slumberitt", can actually avoid the need for a footrest in the seating element. The slumberitt has been used successfully in the new design for most of the luxury Volvo buses
And can be very comfortable especially for long journey hours.

5.IDEA GENERATION

CONCEPT SKETCHING

From this stage on, concepts were developed taking into consideration the basic dimensions of the elements coming into the defined shell structure. Taking cues from existing aircraft interiors and metro rail systems of other countries,(Shiangkansen -Japan, Underground Tube - London and TGV - SNCF -France), concept ideas were generated for individual elements that existed in the user amenities zone. Clusters of ideas were generated based on user's needs and requirements of the Indian Railways

TARGETED AREAS

Creating sense of privacy for personal spaces
Maximizing the use of space for user amenities

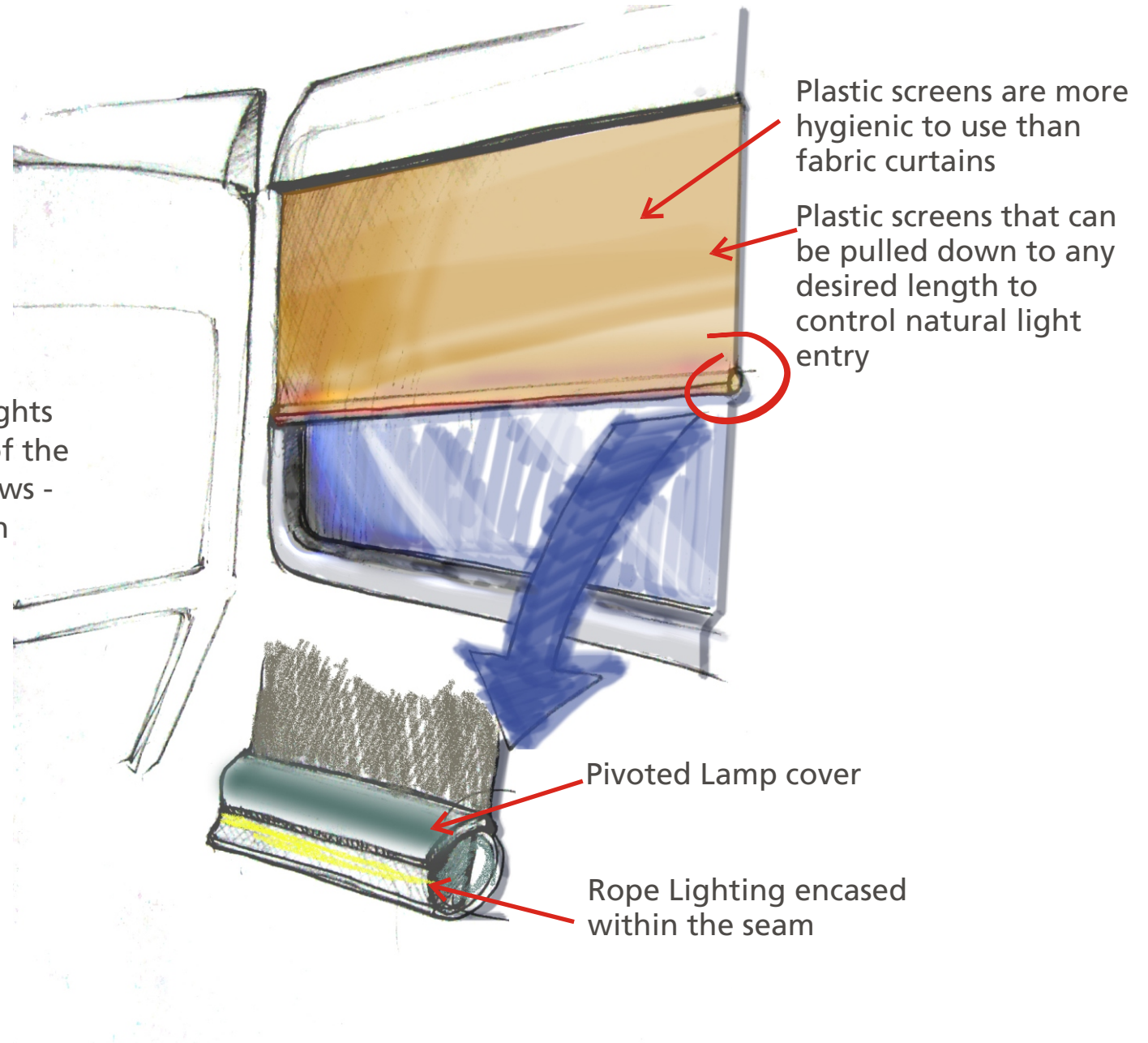
Luggage Storage solutions (heavy & personal luggage)
Natural & Artificial Lighting Solutions

User Amenities (Bottle & Cup holder, Food tray, Mobile charging sockets, magazine rack, lighting controls)

Layouts within the coach - breaking away from existing layout
Using coaches manufactured by the RCF (Kapurtala) or ICF (PERAMBUR) , registered by the Indian Railways only.

IDEA LOG 1

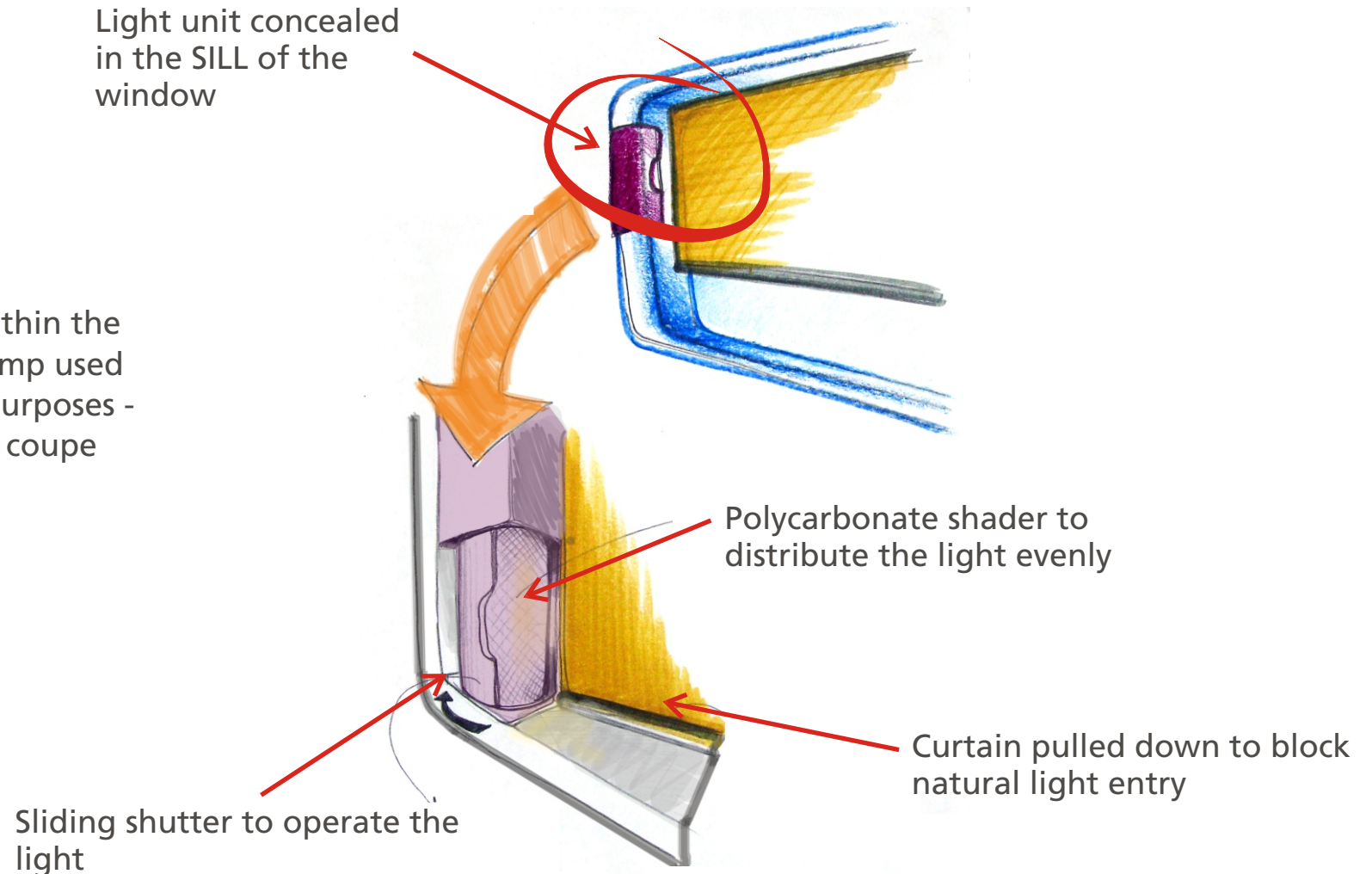
Twist to operate rope lights placed at the end seam of the plastic screen for windows - Task lighting solution



IDEA LOG 2

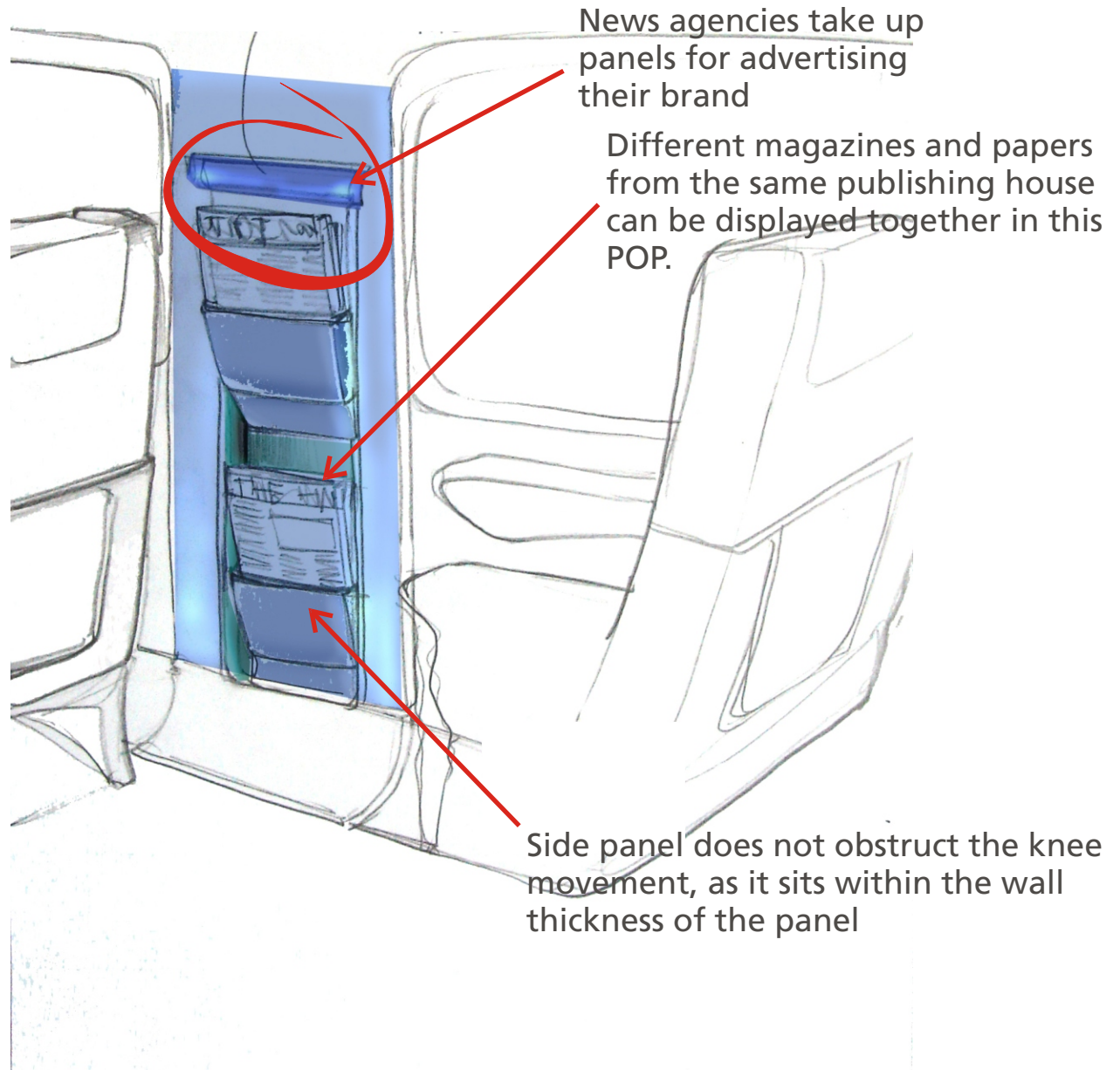
Light unit concealed
in the SILL of the
window

Task lighting placed within the
window frame - LED lamp used
for energy conserving purposes -
flip open to light the coupe

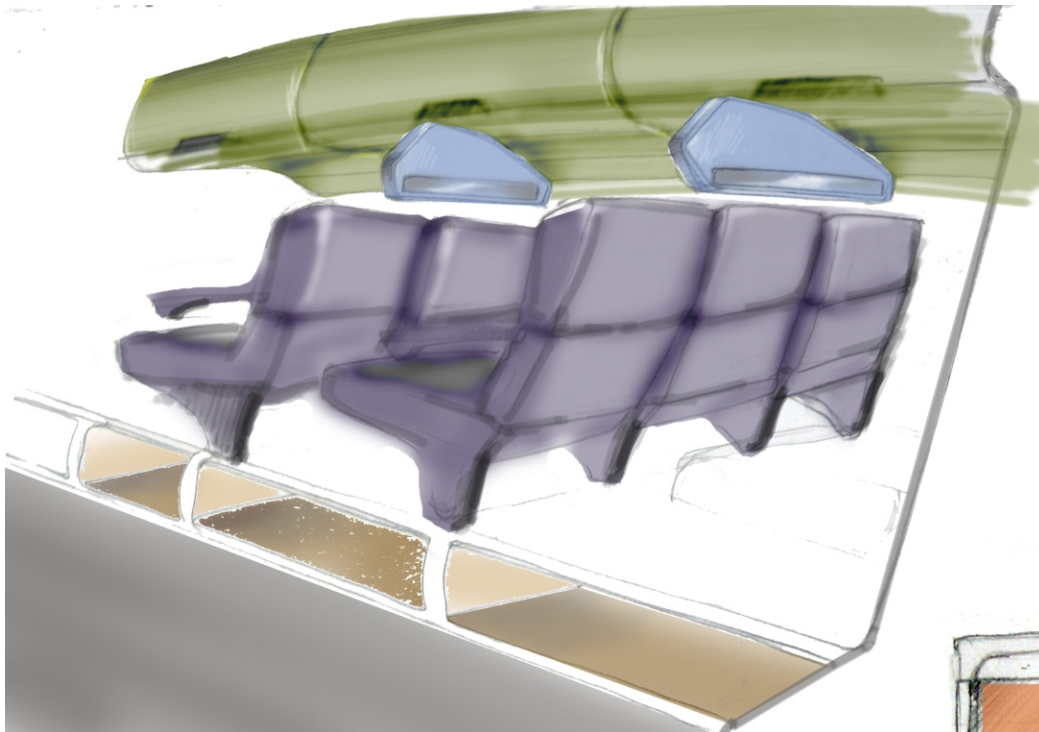


IDEA LOG 3

Side panels are employed for Newspaper branding - reputed news agencies can put up their rack to serve as magazine



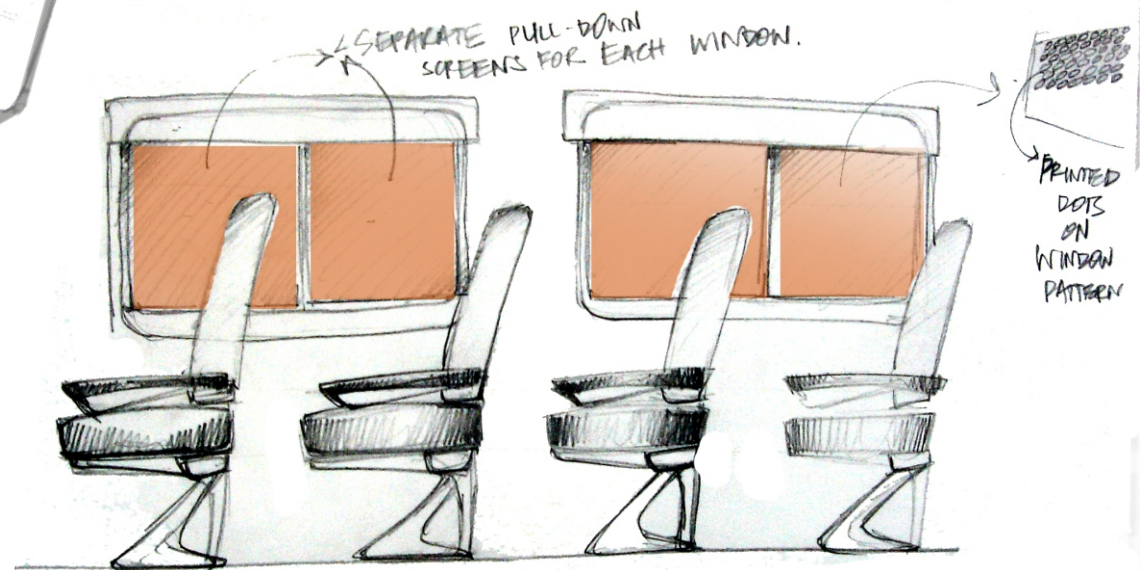
IDEA LOG 4



Roof mounted PA systems to inform about the train timings and arriving stations; overhead luggage storage as inspired from the aircraft interiors

IDEA LOG 5

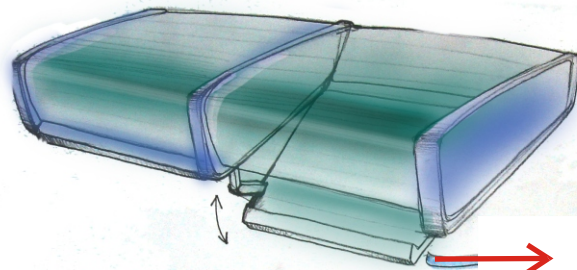
Individual window screens for the existing layout where most windows are shared by two passengers - so individual access to light filtering in



IDEA GENERATION

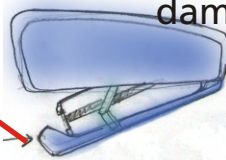
IDEA LOG

IDEA LOG 6

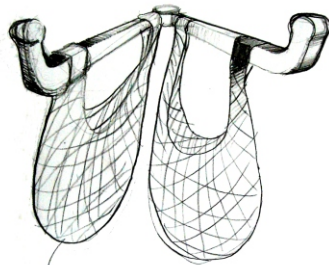


Rack tilts down allowing luggage to slip till RIDGE

Delayed release load bay using dampeners

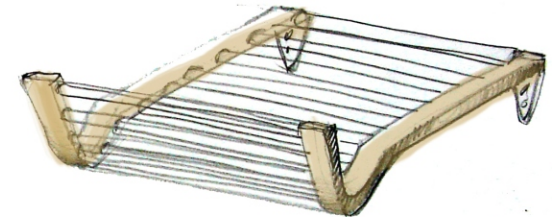
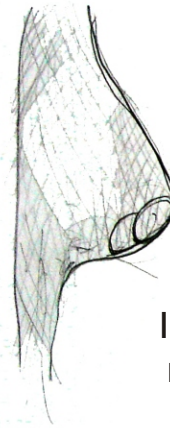


IDEA LOG 8

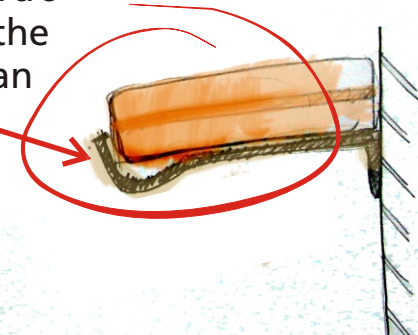


Luggage storage solutions to avoid slipping down into the aisle area; Nylon wire sacks provided below hooks to avoid bags tearing and falling down; Kinks in the end section to create a stopper for luggage slipping down from overhead rack.

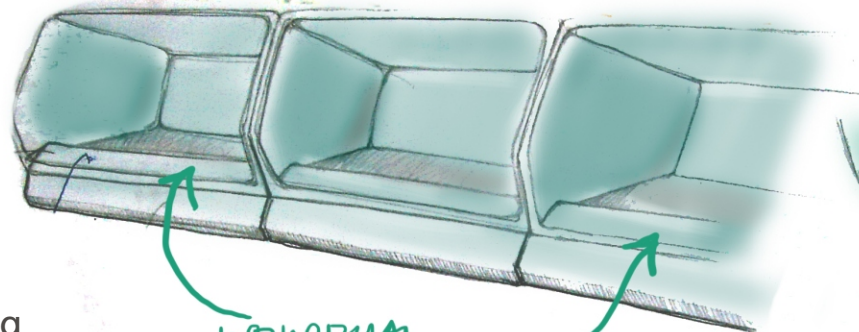
IDEA LOG 7



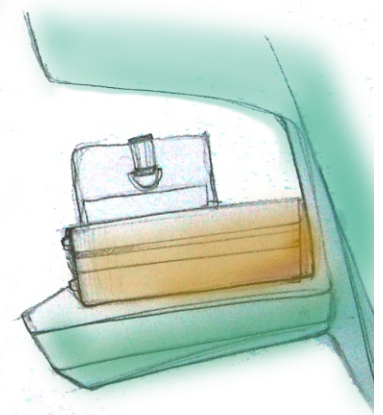
Inspired from the Weaver bird's nest, which does not allow the eggs to fall out, luggage can safely be stored



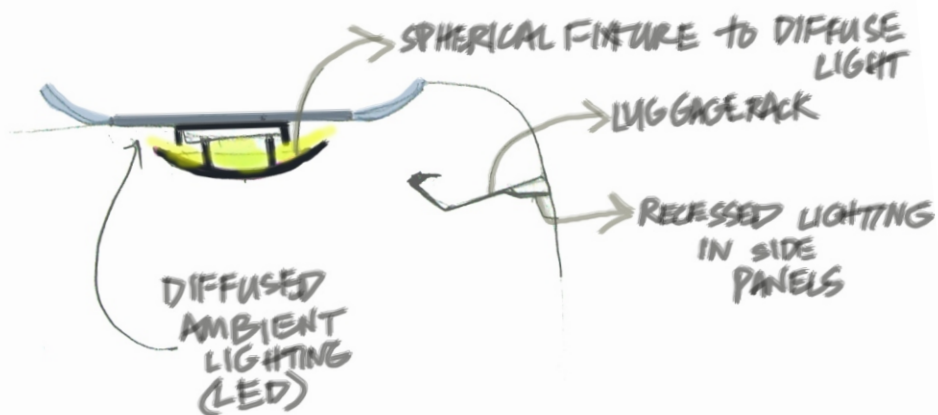
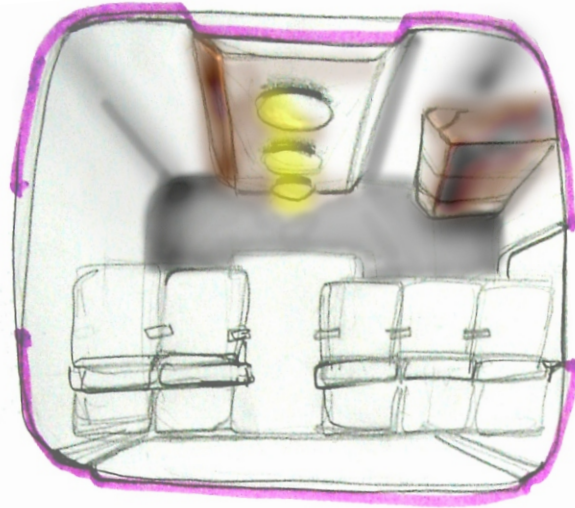
IDEA LOG 9



INDIVIDUAL RACK UNITS FOR STORING LUGGAGE

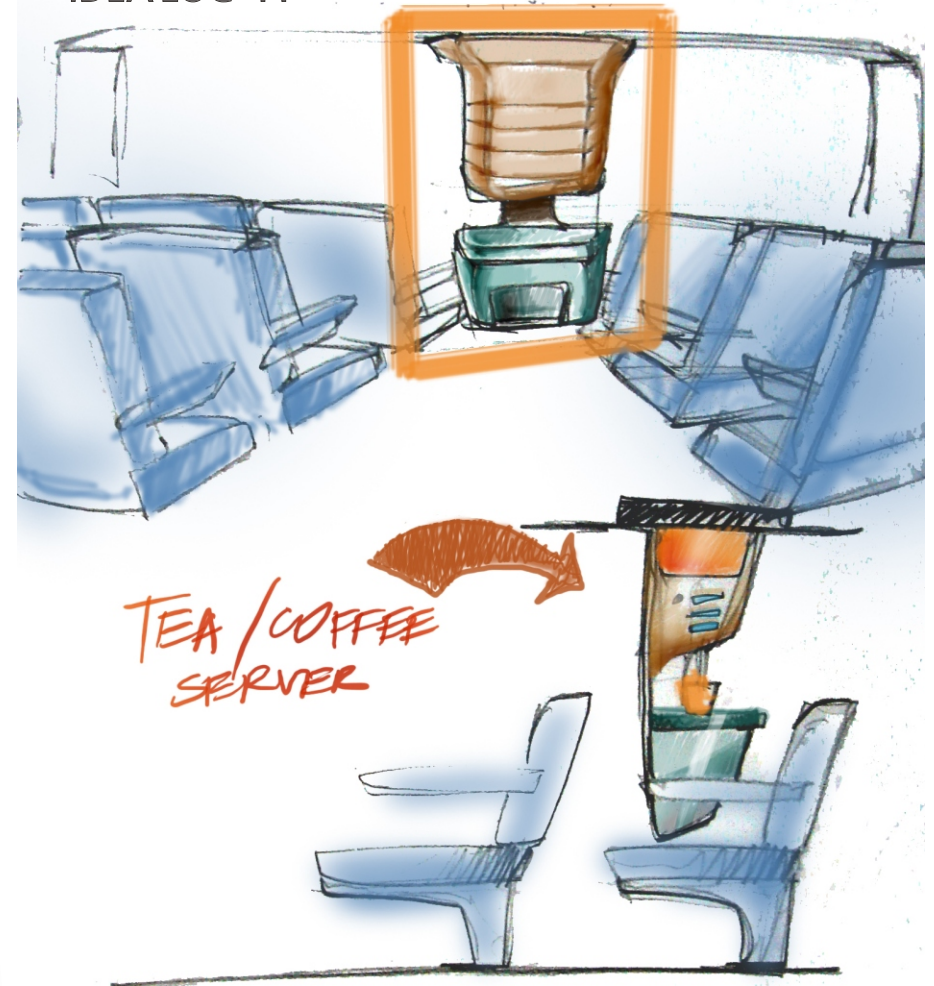


IDEA LOG 10



Ambient lighting solutions - LED lamps placed along the central aisle in spherical fixtures to

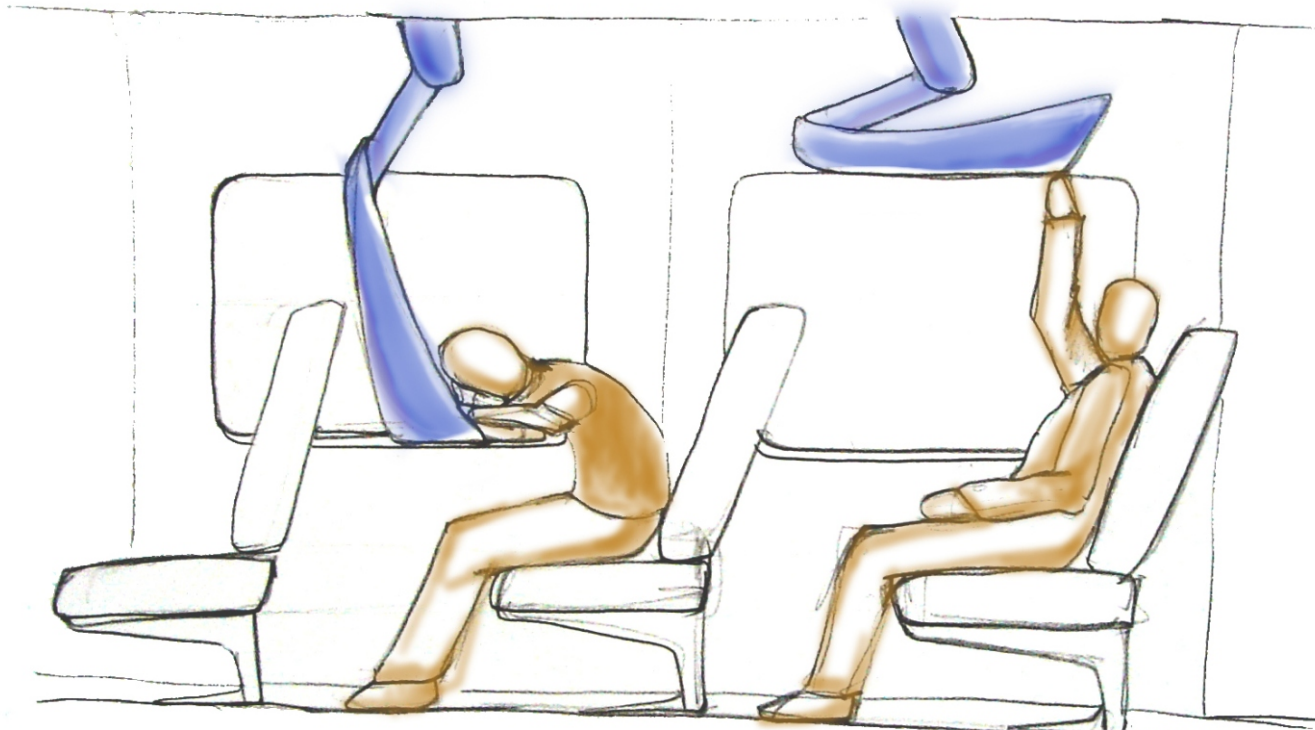
IDEA LOG 11



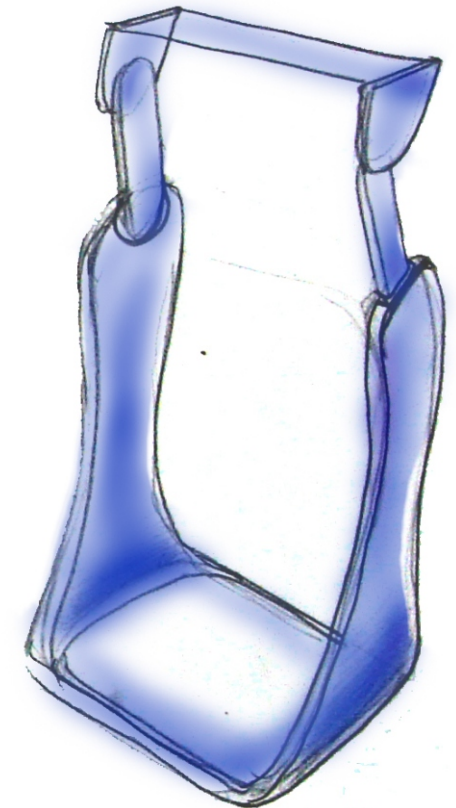
Hot drink service by robotic machine that marches up and down the aisle as and when required - eliminated the mess created by the pantry servers in the compartment

IDEA LOG 12

SLEEPING CONSOLES

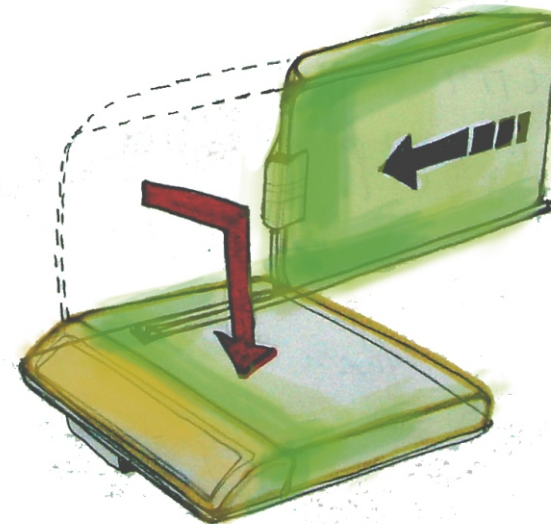
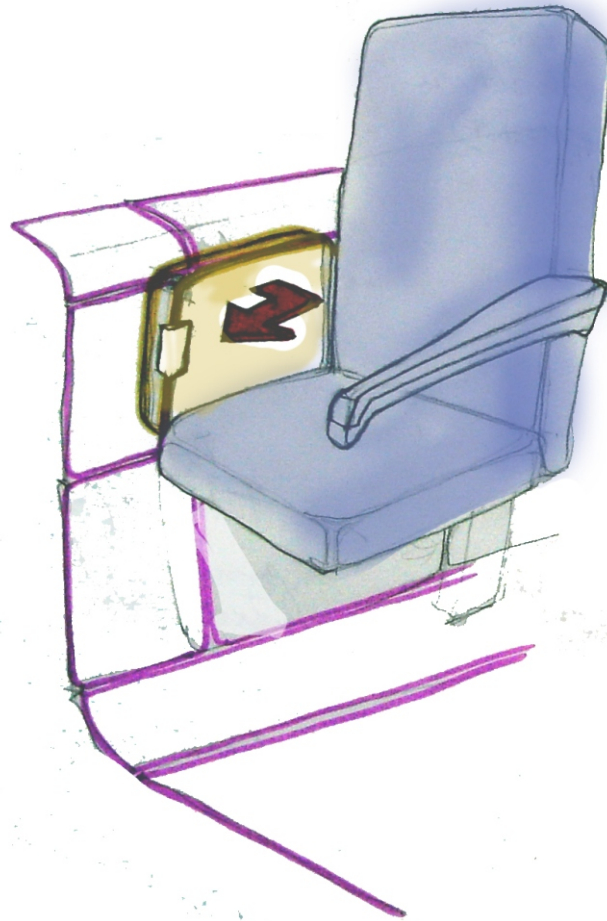


Creates a private niche for every passenger



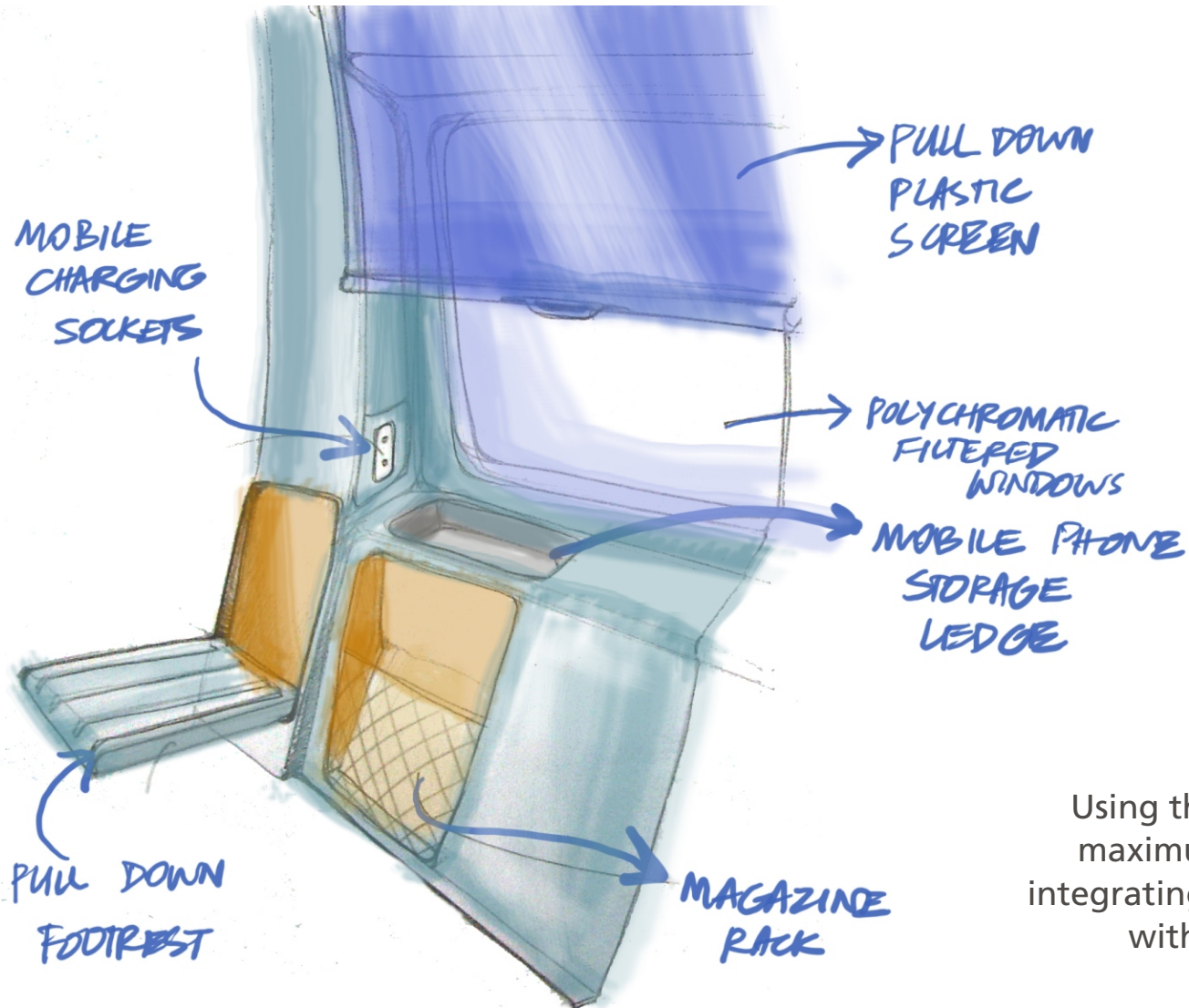
Providing a separate niche for privacy when sleeping - CONSOLES can be folded down from the roof and used with access to amenities like music, lighting for reading purposes, etc.

IDEA LOG 13



Side panels from the wall fold down to form the footrest and is very viable for passengers who choose to adapt to Indian postures of squatting for extra comfort

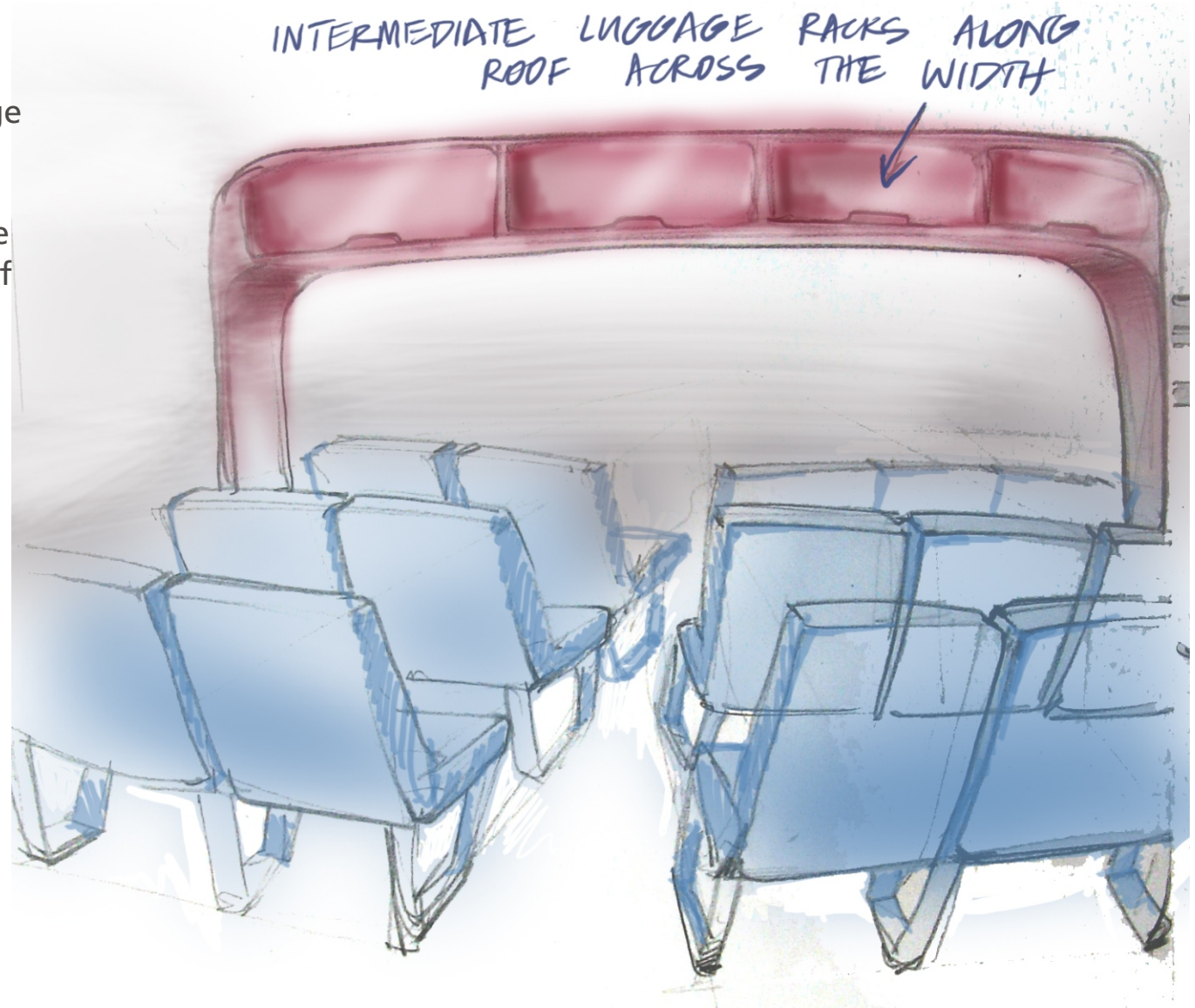
IDEA LOG 14



Using the side panel for maximum efficiency by integrating all user amenities within the panel

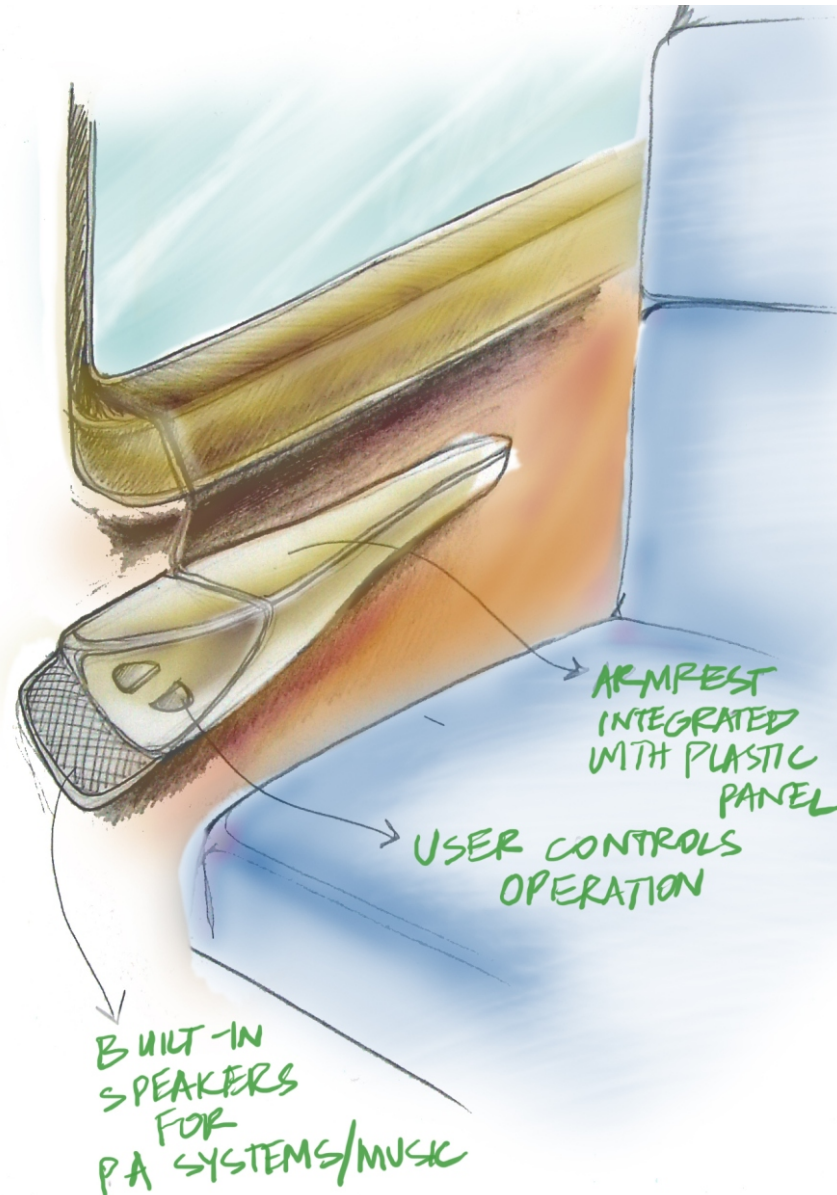
IDEA LOG 15

Intermediate luggage storage
across the width of the
compartment on the roof -
Provides extra storage space
and breaks the monotony of
the visual clutter



IDEA LOG 16

Armrest with user controls and speakers are integrated into the side panel moulding



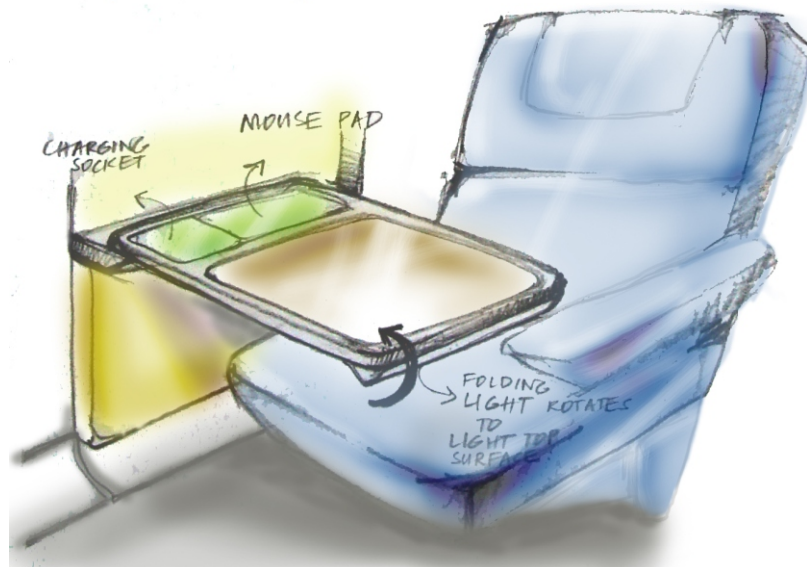
IDEA LOG 17

WORK PLATFORM FOR
TRAVELLING BUSINESSMEN:

Indian Railways
creates a separate "CLASS"
or
charges a slightly higher FARE for
"WINDOW SEATS"

ADDED COMFORTS:-

15" X 12" WORK SURFACE divided into separate
AREAS.
(FOR LAPTOPS)



Working surface where laptop and
mobile phone can be plugged in for
charging;

Surface level task lighting is also
provided for;

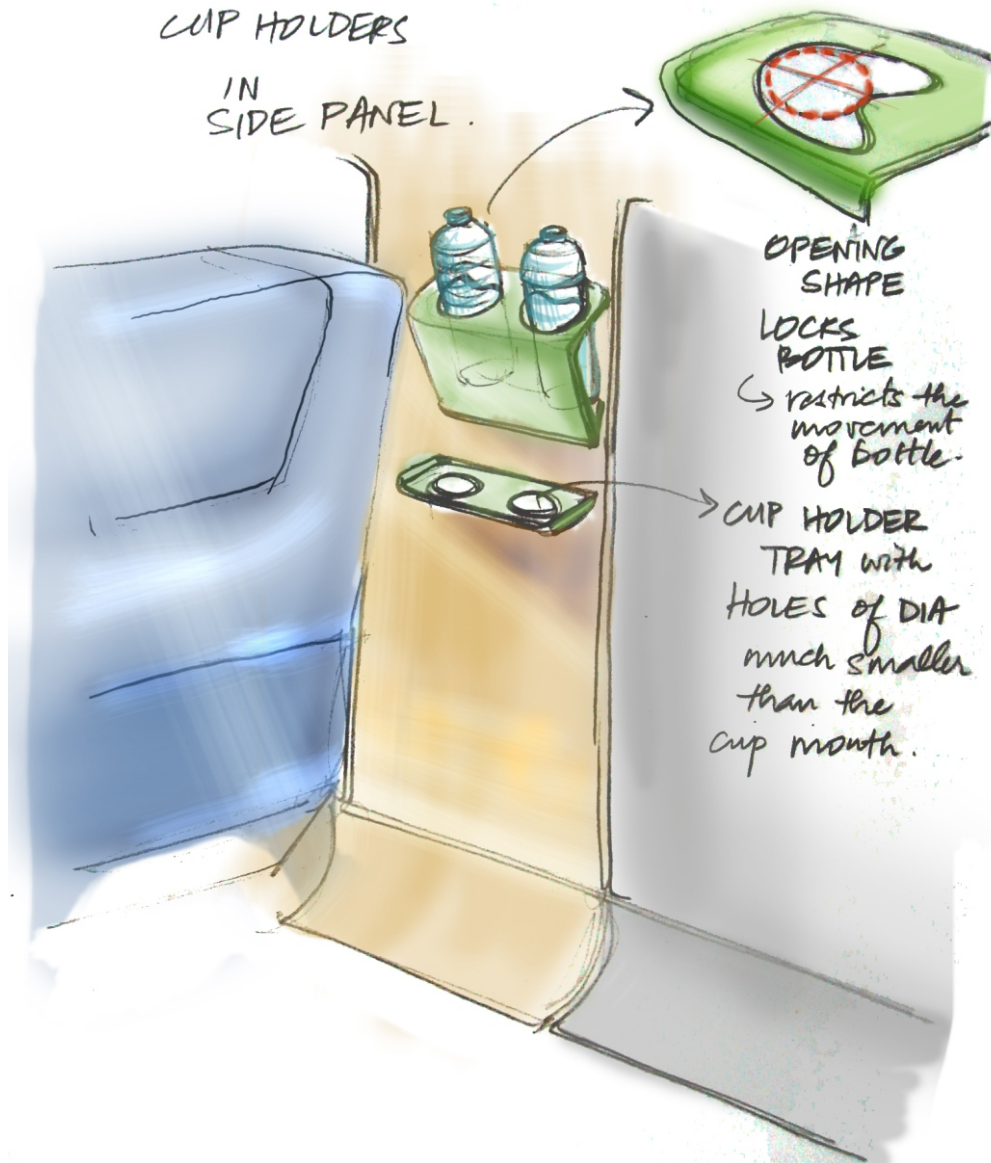
The tray is folded down into the side
panel

5. IDEA GENERATION

IDEA LOG

IDEA LOG 18

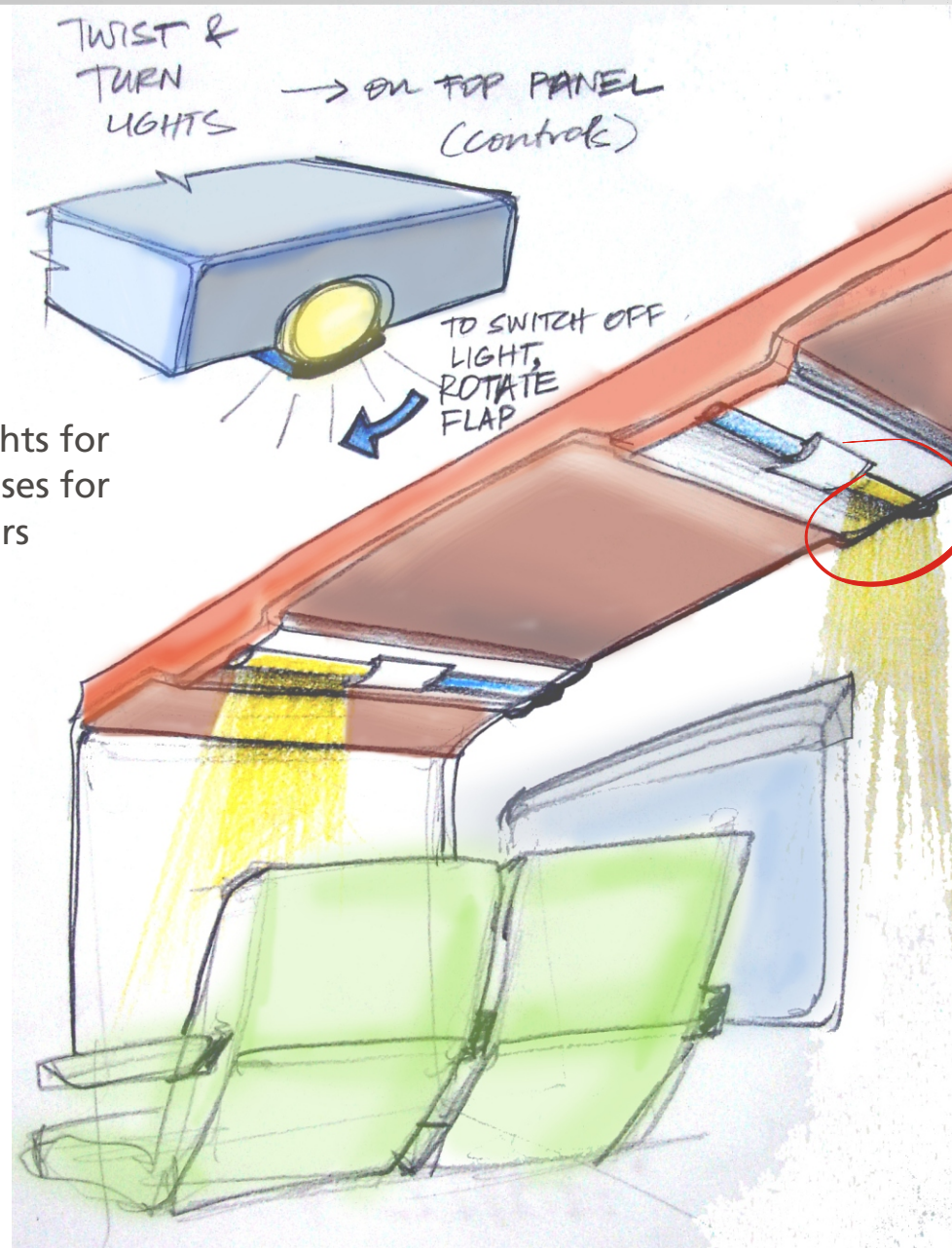
BOTTLE HOLDER/
CUP HOLDERS
IN
SIDE PANEL.



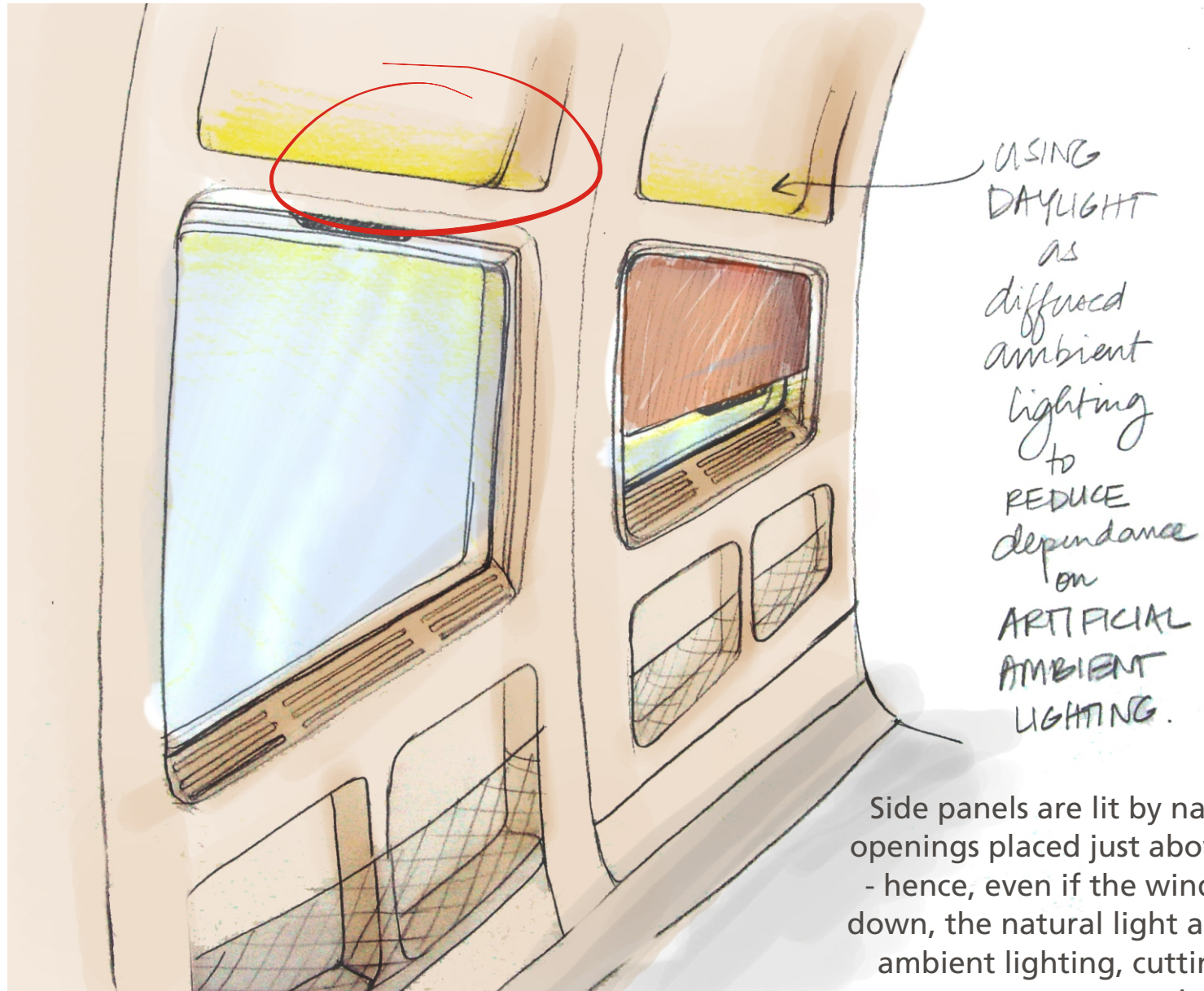
Side panels holds the bottle
holder and cup holder for easy

IDEA LOG 19

Twist to operate roof lights for overhead reading purposes for individual passengers



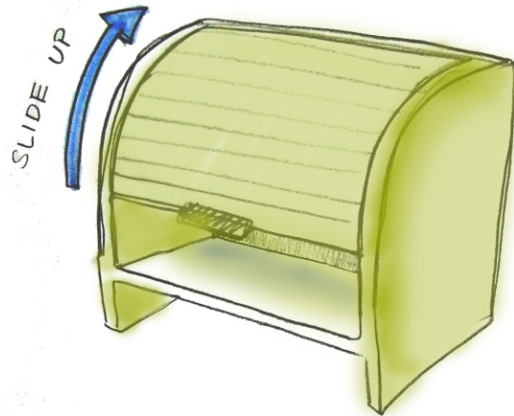
IDEA LOG 20



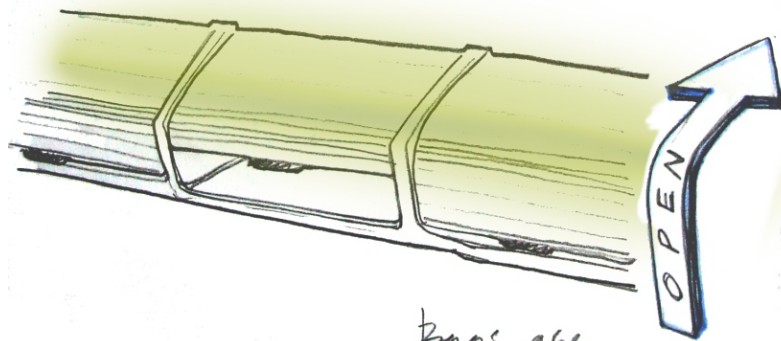
Side panels are lit by natural lighting openings placed just above the window - hence, even if the window shutter is down, the natural light accounts for the ambient lighting, cutting on energy consumption

IDEA LOG 21

CHEST OF DRAWERS/CABINET.
opening mechanism.

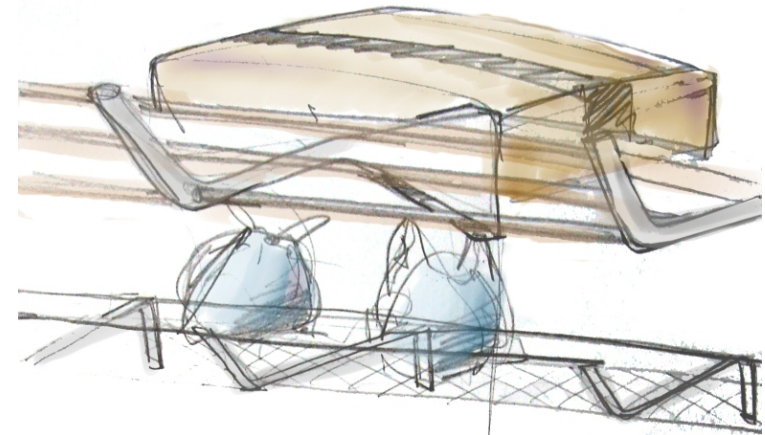


Cabinet style luggage rack with front covers that slide open and self-lock using the dead weight mechanism behind



Bags are secure & do not fall off

IDEA LOG 22



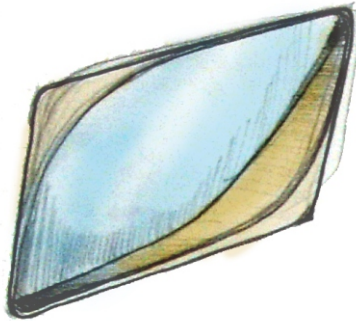
to AVOID HOOKS —
sub-level storage
to put bags. (smaller bags)

* — shelf could be made of plastic or WIRE RACK.

Luggage storage for smaller bags at the lower intermediate level to avoid the use of hooks

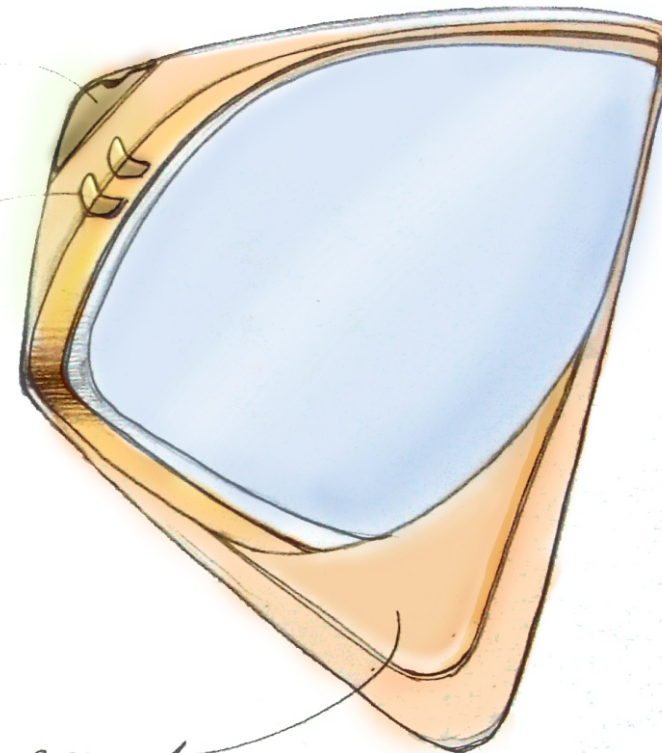
IDEA LOG 23

Aperture Openings
for TRAIN:



PUSH <
OPEN
LIGHTING

USER <
CONTROLS
FOR
LIGHTING

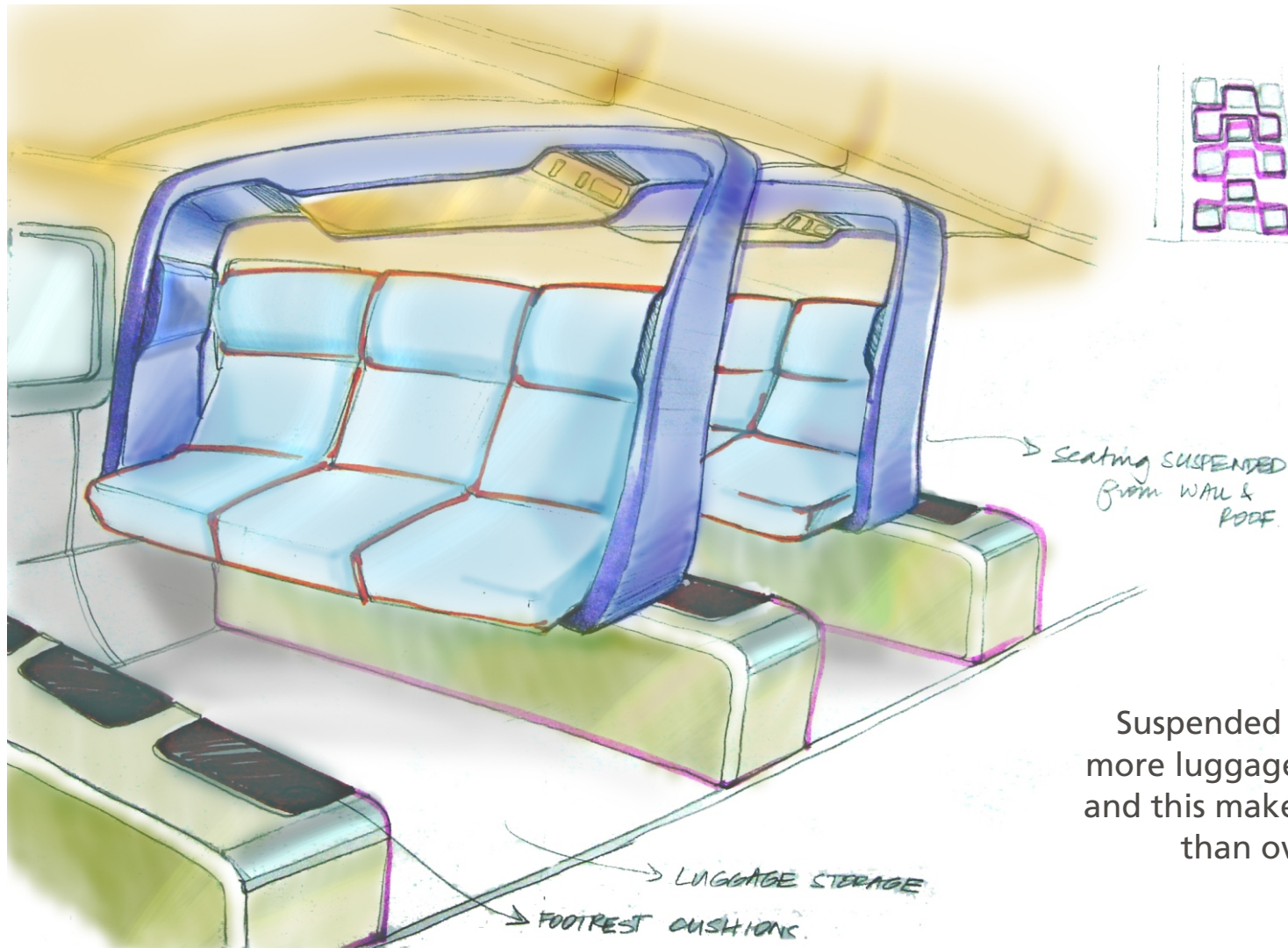


STORAGE <
FOR
SMALL
PERSONAL
ITEMS

WINDOWS:
imitate "EYES"
negative space used
for • STORAGE
• USER CONTROLS

Windows are shaped apertures from the inside, using the blocked spaces for mini-storage and user controls for lighting

IDEA LOG 24

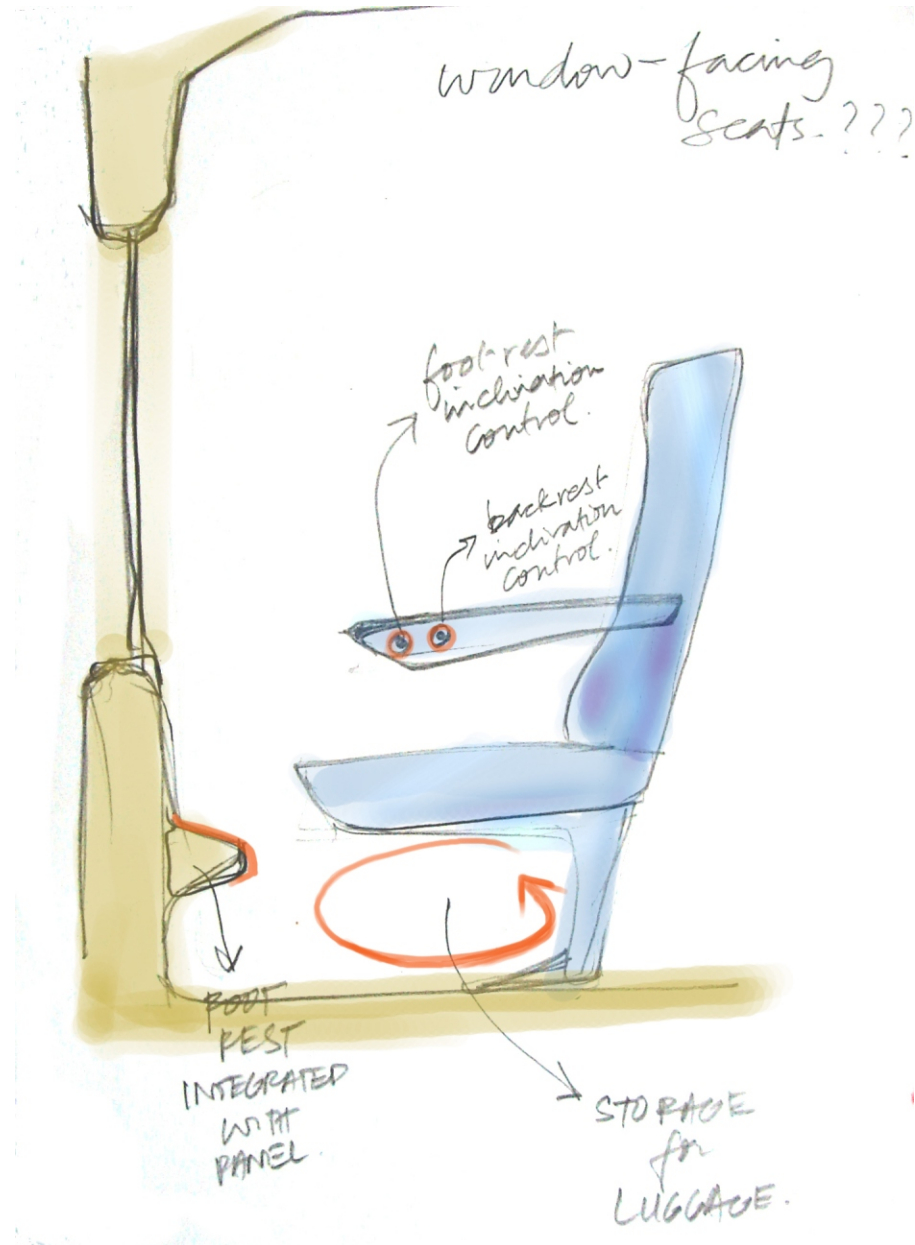


Suspended seats to allow for more luggage space on the floor and this makes it more accessible than overhead racks

IDEA LOG 25

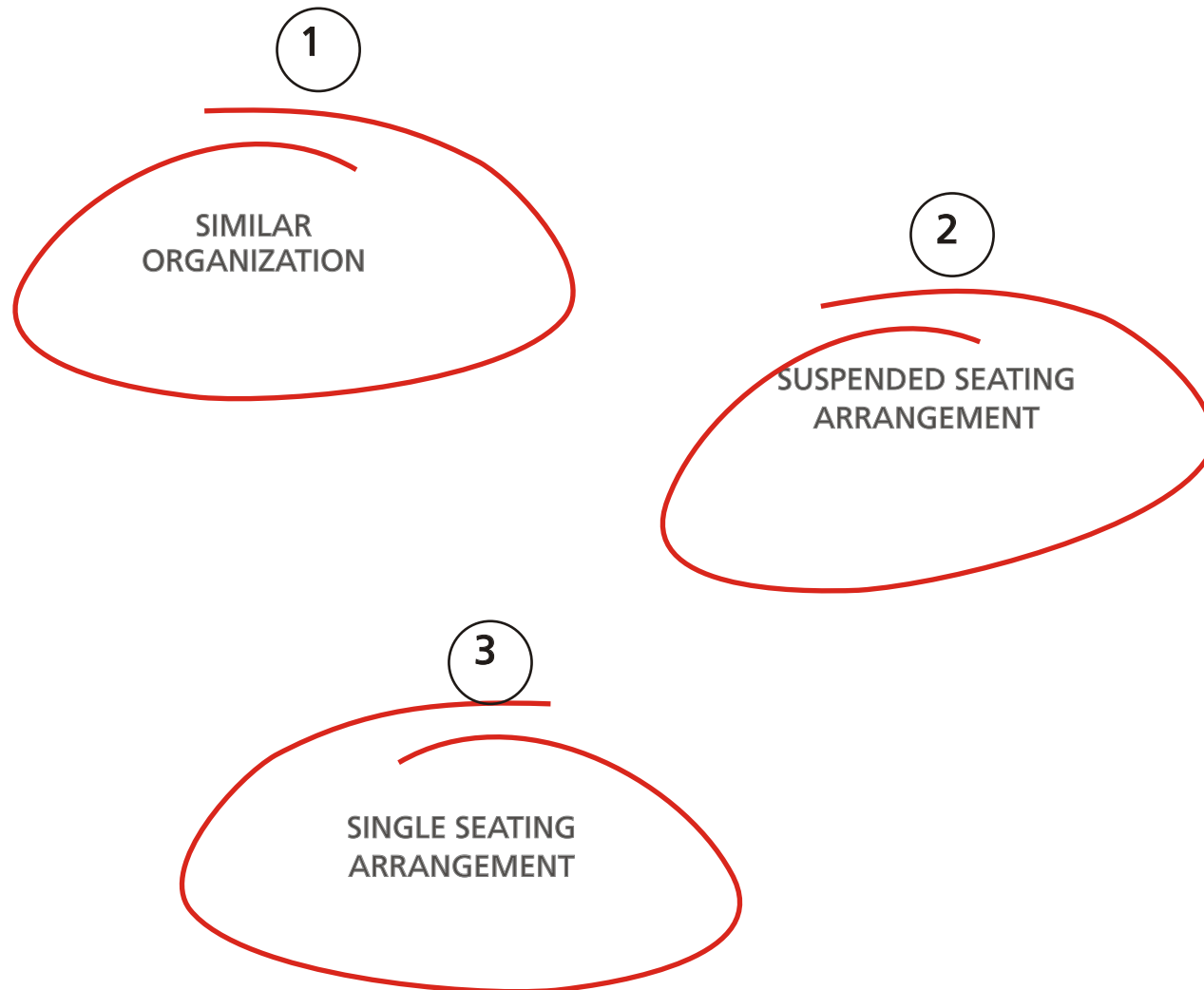
Seats could face the window with the footrest incorporated into the side panel for more comfort.

Each window could accommodate for two passengers?



CONCEPT GENERATION

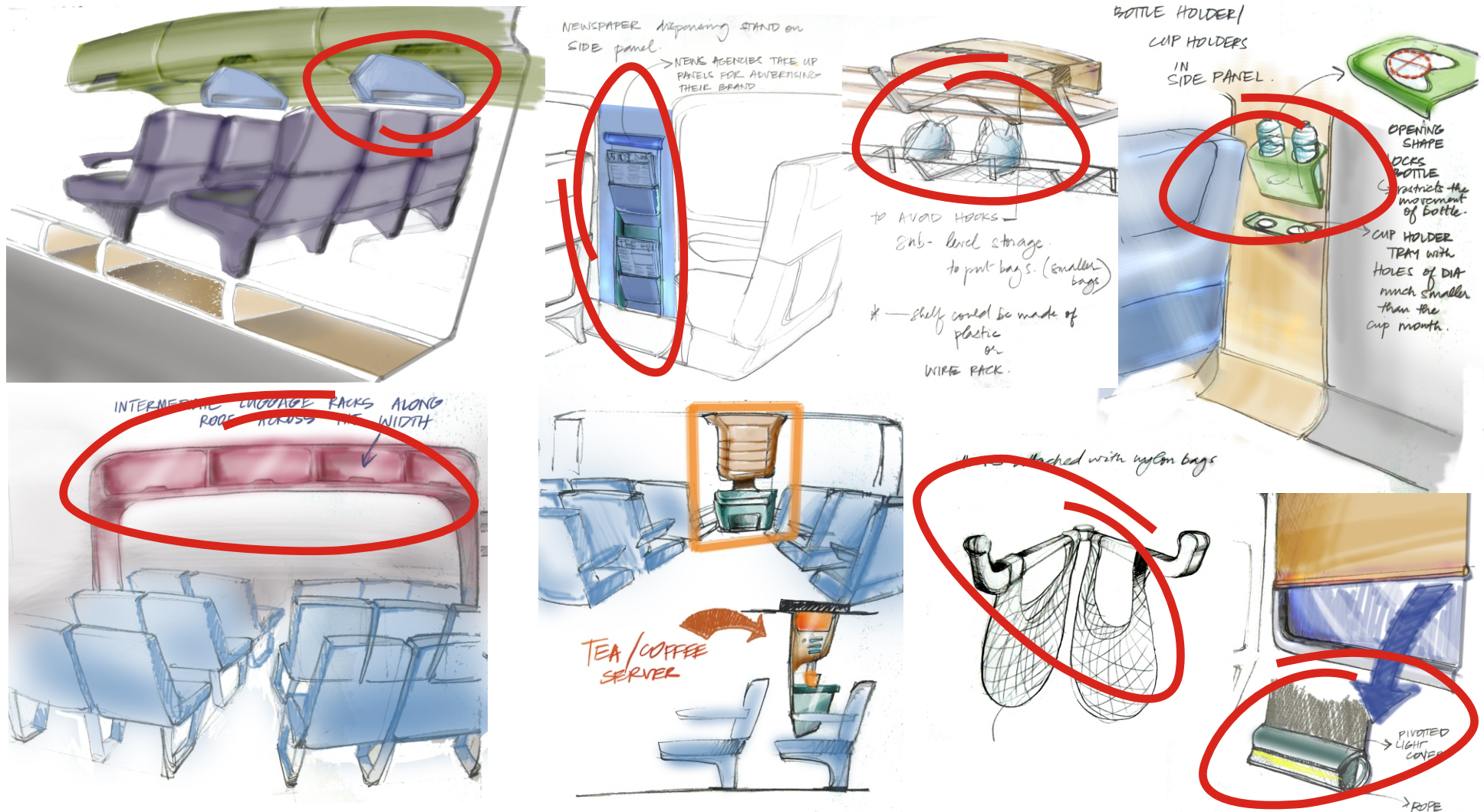
3 CLUSTERS FORMED



CONCEPT GENERATION

SIMILAR ORGANIZATION

The idea was to maintain the existing configuration (2 + 3 seating arrangement) and make the basic changes with the user amenities which would also be incorporated by the Indian Railways in the easiest manner.

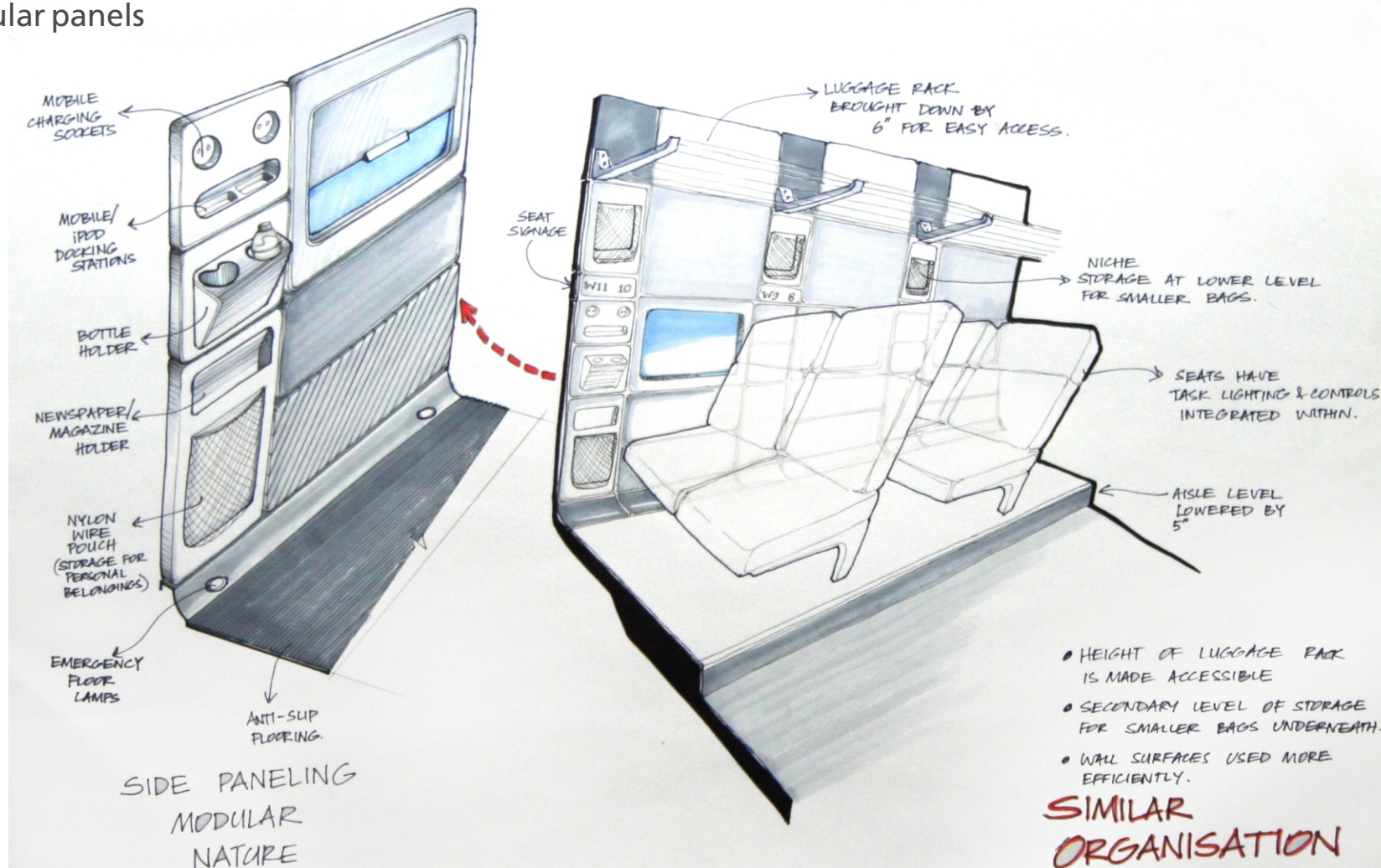


CONCEPT GENERATION

SIMILAR ORGANIZATION

CONCEPT 1 - SIMILAR ORGANIZATION

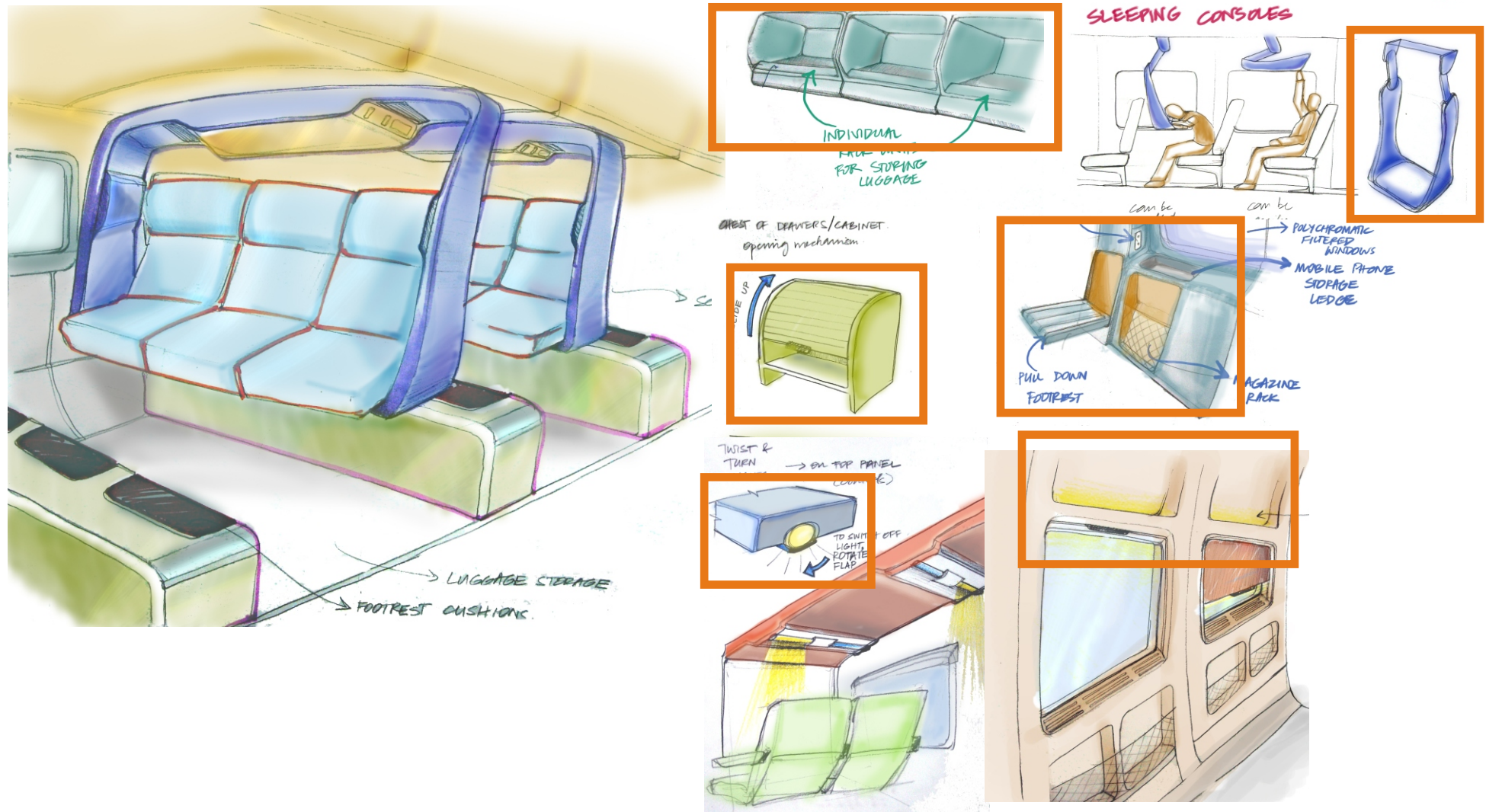
Keeping the same layout of the existing AC Chair car, (2 + 3 seating arrangement), one has attempted to bring down the luggage rack and create a step in the seating area, making the luggage more accessible to most users. This option however, cuts out the headroom in the seating area. Secondary level of storage is provided for smaller bags. Wall surfaces are used more efficiently with the use of modular panels



CONCEPT GENERATION

SUSPENDED SEATING ARRANGEMENT

The cluster was formed on basis of the idea of better luggage accessibility and directing the storage space towards the floor space, thereby placing the seats at a higher position from the ground and addressing the user amenities accordingly.



CONCEPT 2 - SUSPENDED SEATING ARRANGEMENT

Using the 2+2 seating arrangement, the floor space is raised to 8" above the actual floor level for user comfort. This allows for more accessible luggage space, further the seats fold up to make the luggage more accessible. User controls are integrated within the suspended system. Natural lighting is used to provide ambient lighting, even when shutters are pulled down. Side panels provide for user amenities.

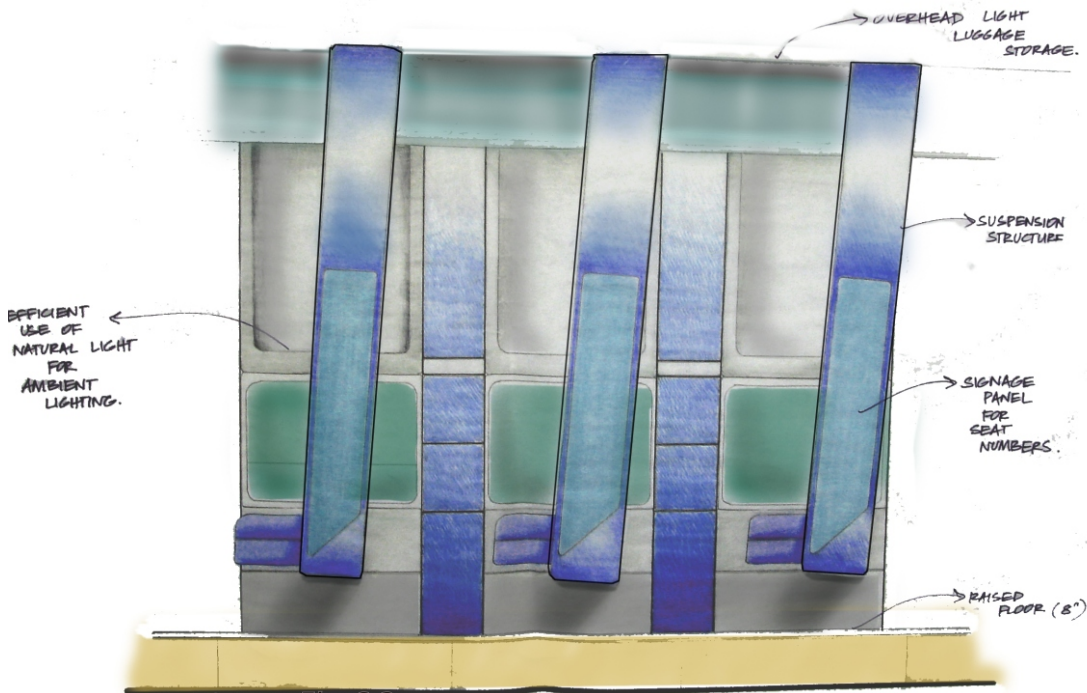


Fig.6.2

SIDE ELEVATION

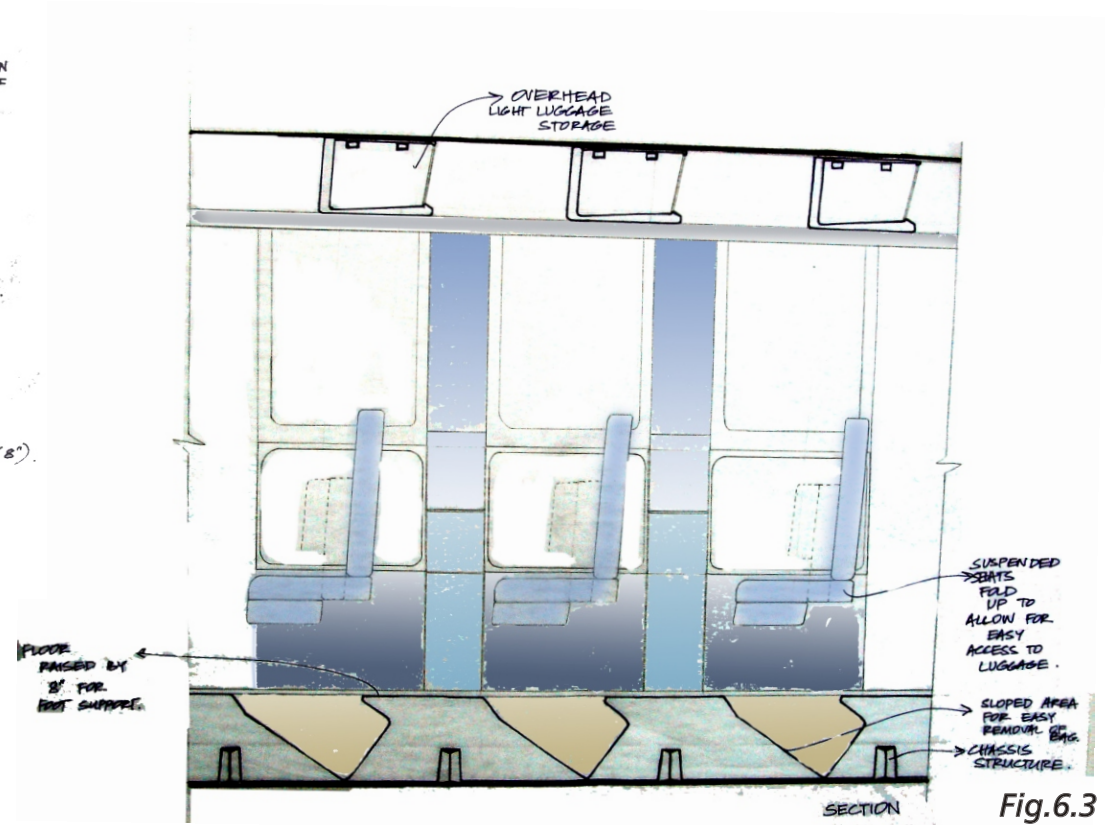
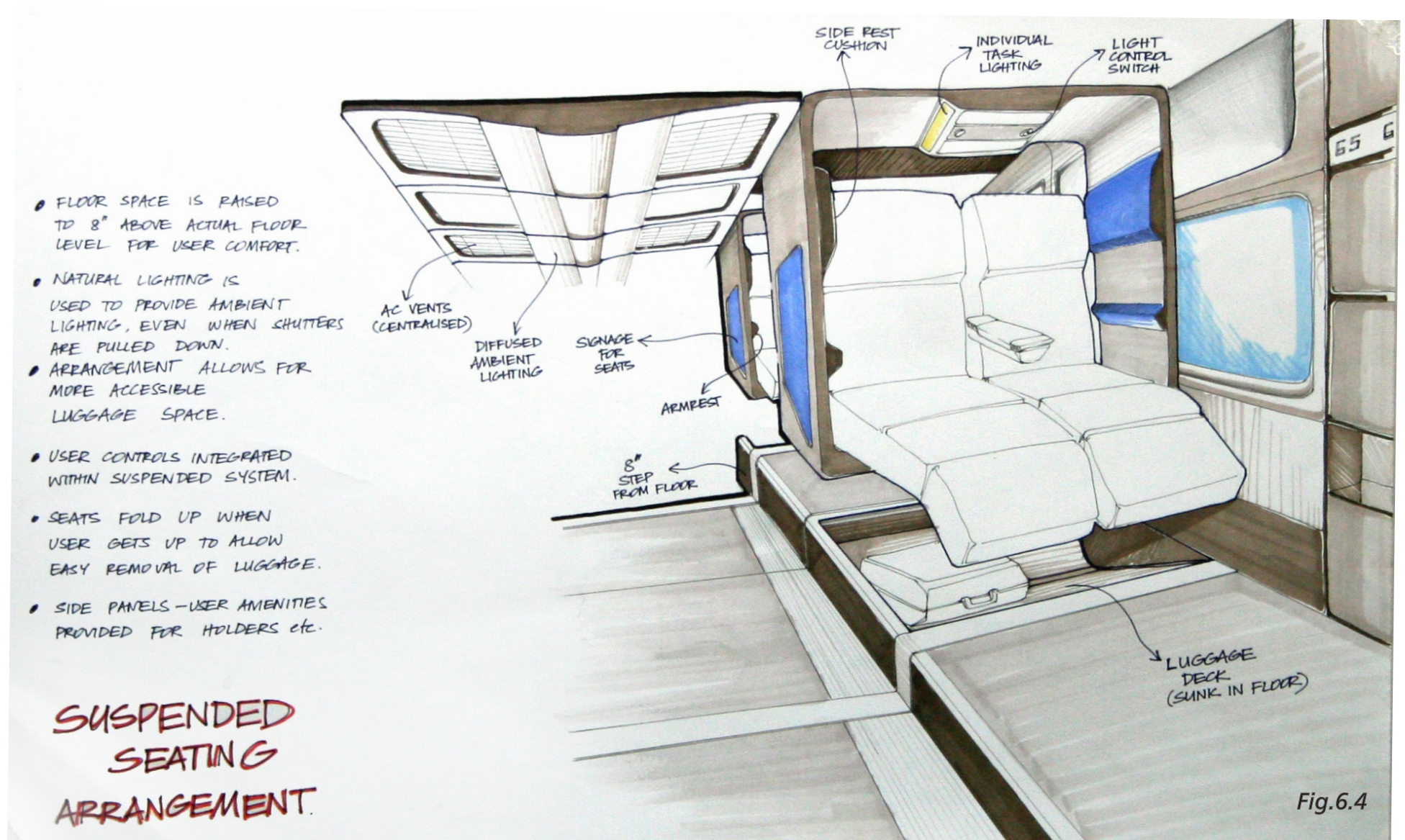


Fig.6.3

SECTION

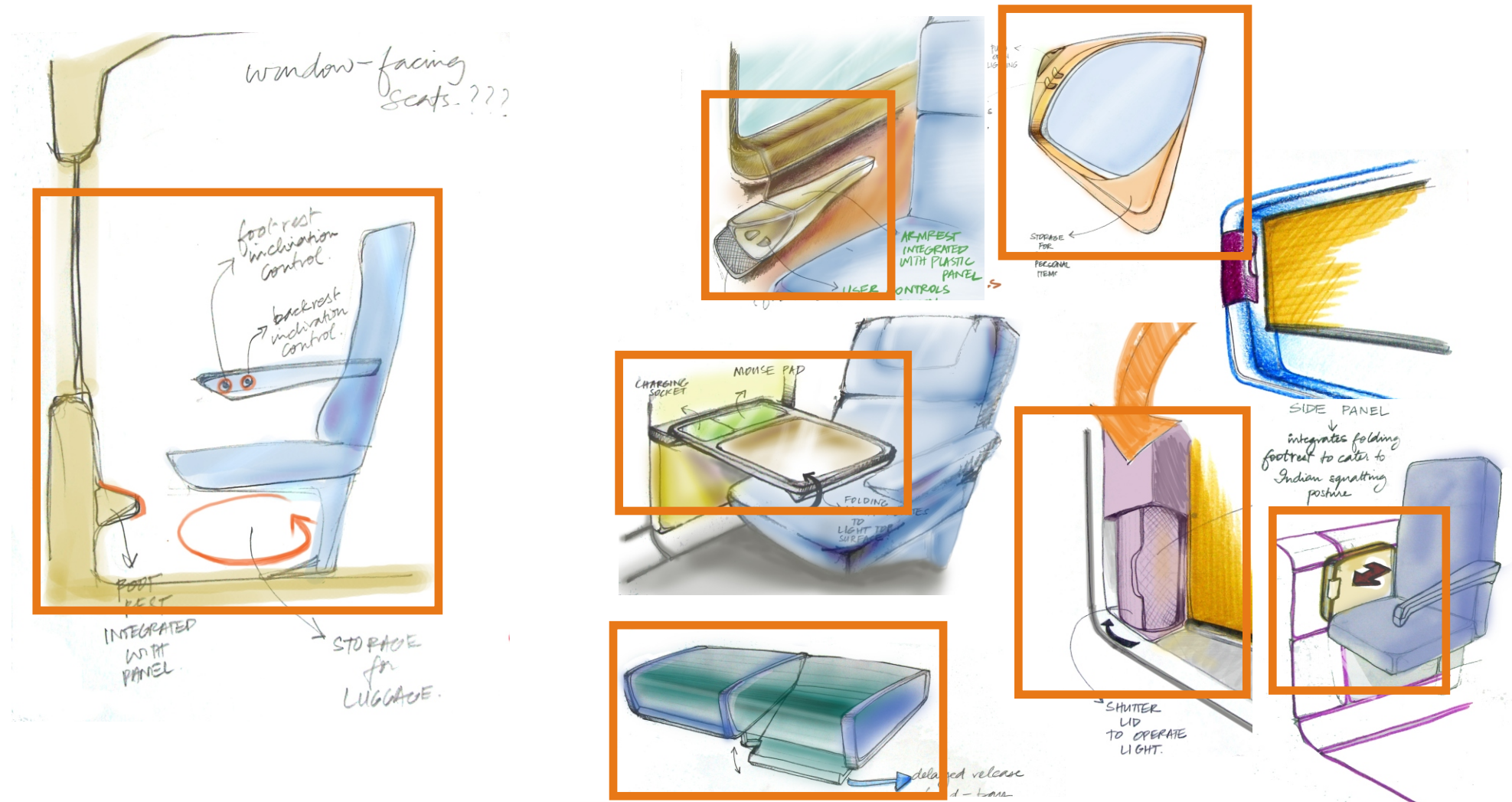
CONCEPT 2 - SUSPENDED SEATING ARRANGEMENT



CONCEPT GENERATION

SINGLE SEATING ARRANGEMENT

This cluster started from the idea of providing the passenger utmost luxury and comfort with maximum space. Further, all amenities were re-directed towards the side panel and integrating all facilities including foot rest into the side wall mould. The issue of capacity of passengers in this cluster was not addressed for the time

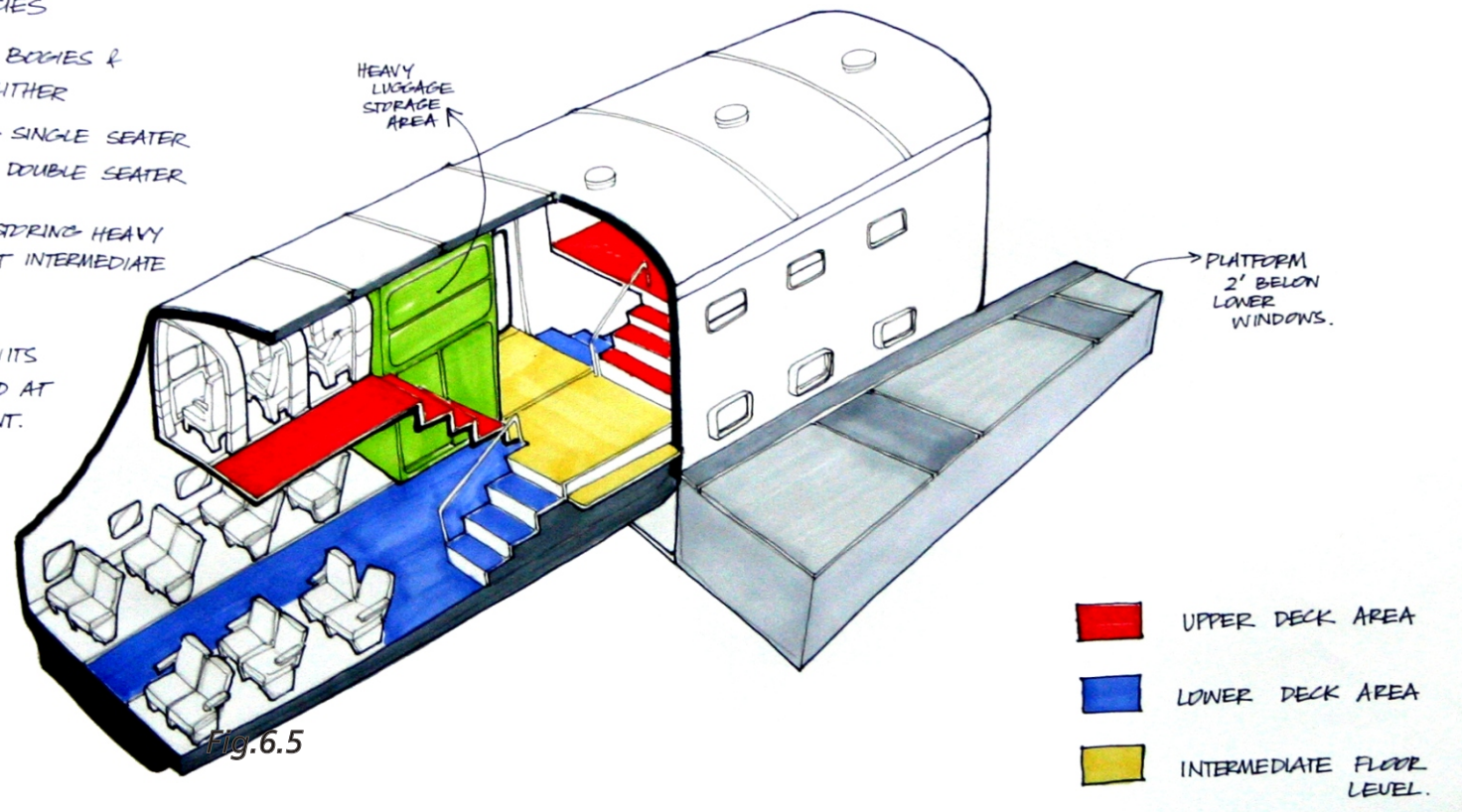


CONCEPT 3 - DOUBLE DECKER ARRANGEMENT

Employing the coaches already manufactured by the tier-one agencies [RCF(Kapurtala) and ICF (Perambur)], the double decker coach could be converted into an AC Chair Car and can accommodate more passengers than the standard AC Chair Car coach, providing more luxury and space per passenger. Air conditioning units are placed as RMPU's (Roof-mounted Power Units) above the lavatories at either ends.

DOUBLE DECKER ARRANGEMENT

- COACHES ALREADY MANUFACTURED BY TIER 1 AGENCIES
- CONVERTED TO AC BODIES & CAN ACCOMMODATE EITHER
90 PASSENGERS — SINGLE SEATER
180 PASSENGERS — DOUBLE SEATER
- COMPARTMENTS FOR STORING HEAVY LUGGAGE PROVIDED AT INTERMEDIATE LEVEL
- AIR-CONDITIONING UNITS & COMPRESSORS PLACED AT ENDS OF COMPARTMENT.



CONCEPT GENERATION

SINGLE SEATING ARRANGEMENT

CONCEPT 3

DOUBLE DECKER ARRANGEMENT - SINGLE SEATING

Two concepts for seating within the double decker coach were arrived at. The first concept was a single seating arrangement which would be afforded by people who wouldn't mind spending for extra luxury and comfort. The single seat would have individual user-centered controls, private luggage space and extra provisions for the working professional to suit his needs. Ample luggage space would also be provided for.

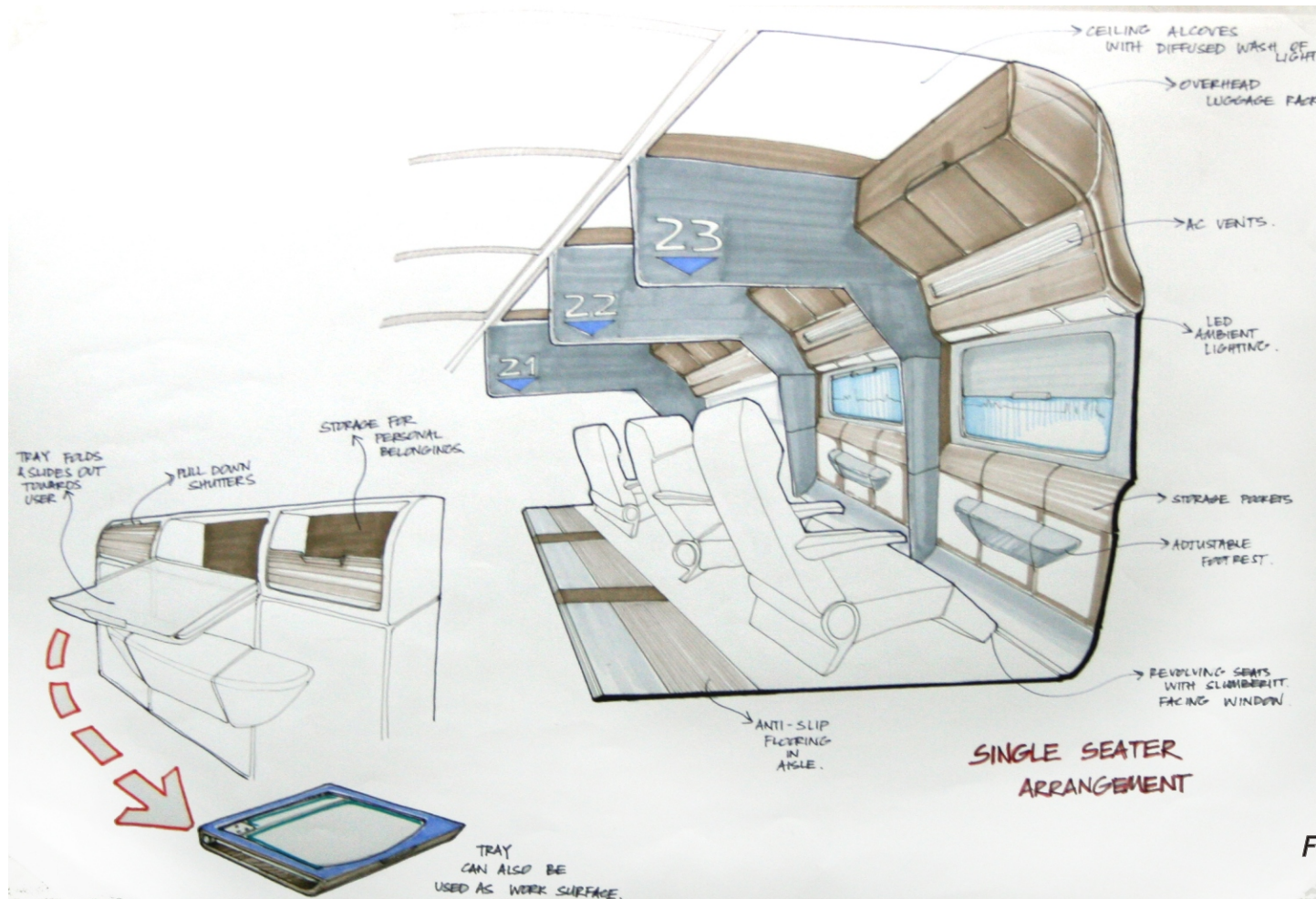


Fig.6.6

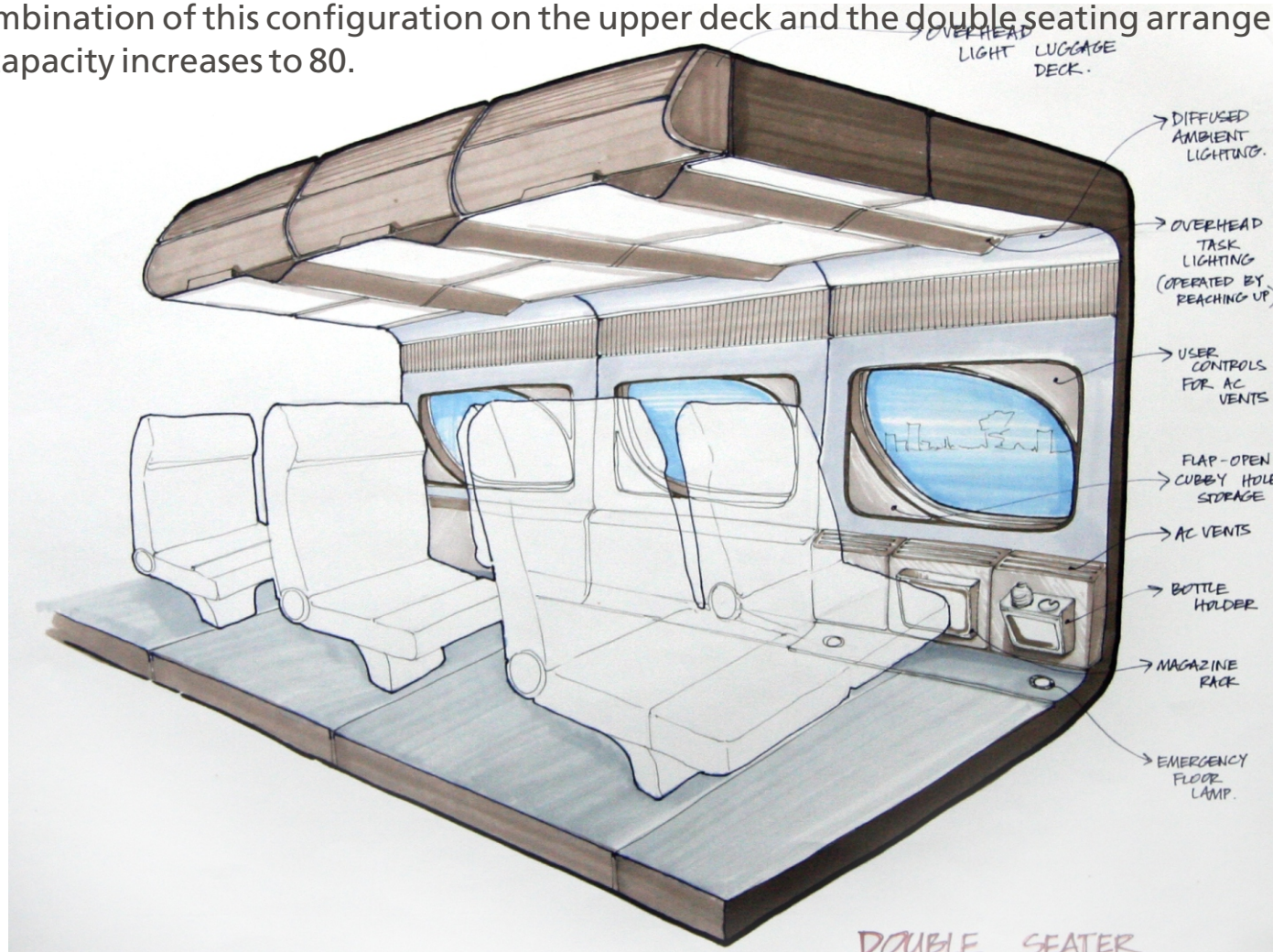
CONCEPT GENERATION

SINGLE SEATING ARRANGEMENT

CONCEPT 3

DOUBLE DECKER ARRANGEMENT - DOUBLE SEATING

The second concept deals with the 2 +2 seating arrangement, with overhead storage space for smaller luggage. User amenities are provided for on the side panels. The space provided per passenger is a lot more than the existing configuration. Using this configuration on both the floor decks can accommodate a total of 88 passengers. With a combination of this configuration on the upper deck and the double seating arrangement on the lower deck, the total capacity increases to 80.



CONCEPT EVALUATION

Each concept was then evaluated based on the product brief and the criteria of evaluation determined during the user study.

CRITERIA FOR EVALUATION

COMFORT SPACE PER PASSENGER

1 (less comfortable)  9 (more comfortable)

LUGGAGE STORAGE SPACE

1 (tight space)  9 (ample storage space)

ACCESSIBILITY OF STORAGE

1 (less accessible)  9 (easily accessible)

SECURITY OF LUGGAGE STORED

1 (less secure)  9 (more secure)

CRITERIA FOR EVALUATION

INDIVIDUAL USER CONTROLS

1 (less no. of controls)  9 (more controls)

CAPACITY OF PASSENGERS PER COACH

1 (more dense)  9 (less dense)

ADAPTABILITY TO INDIAN RAILWAYS

1 (more changes)  9 (less no. of changes)

MAINTENANCE & SERVICING

1 (hard to maintain)  9 (easy maintenance)

MODULARITY

1 (less modular)  9 (more modular)

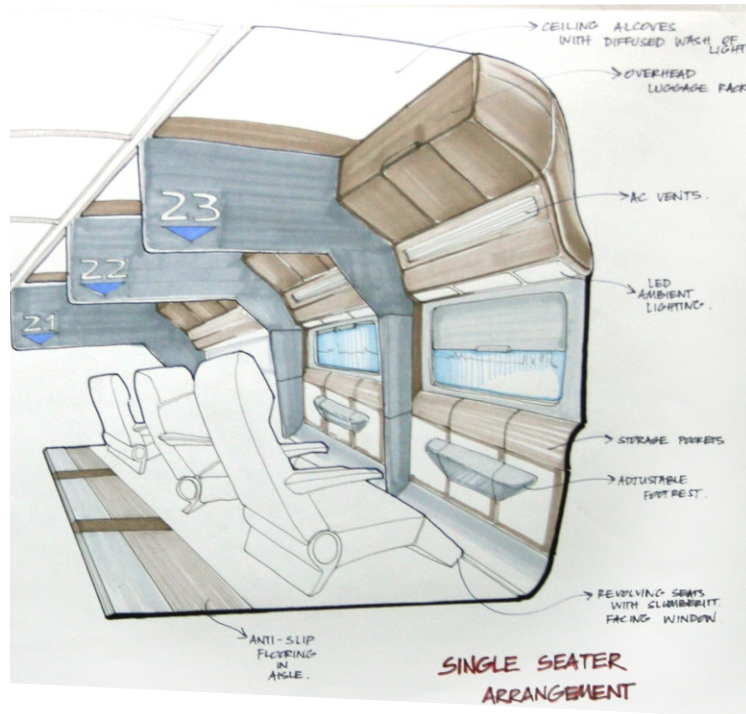
CONCEPT EVALUATION

EVALUATION TABLE

CRITERIA FOR EVALUATION *	EXISTING AC CHAIR CAR COACH	CONCEPT 1 SIMILAR ORG.	CONCEPT 2 SUSPENDED SEATING	CONCEPT 3 DOUBLE DECKER ARR.
COMFORT SPACE PER PASSENGER	4	4	6	8
LUGGAGE STORAGE SPACE	2	2	7	7
ACCESSIBILITY OF STORAGE	2	2	6	9
SECURITY OF LUGGAGE STORED	4	5	5	8
INDIVIDUAL USER CONTROLS	2	3	5	8
CAPACITY OF PASSENGERS PER COACH	5	5	2	7
MAINTENANCE AND SERVICING	9	8	2	4
MODULARITY IN DESIGN	6	8	4	5
ADAPTABILITY TO INDIAN RAILWAYS	9	8	5	6
TOTAL	43	45	42	62

* The evaluation was carried out on a scale of 1 to 9, the criteria for which were explained in the earlier pages

FINAL PROPOSAL



REFINEMENT OF FINAL CONCEPT

Passengers today are willing to spend for the right service and comfort, and the final concept now addressed for these key issues.

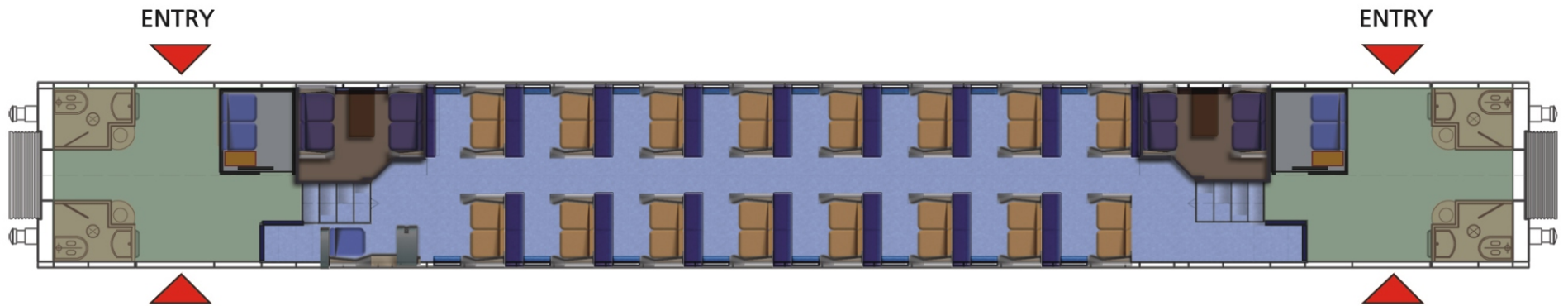
Luggage storage for most big suitcases are also catered to, with the inclusion of different user amenities in close proximity to the passenger

Comfort space provided per passenger : 1570 mm x 650 mm

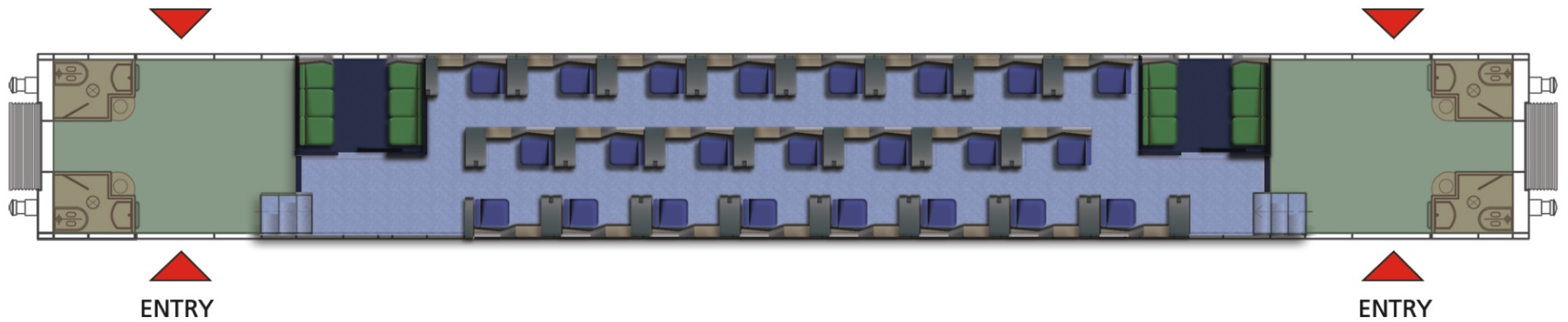
The decision to use both types of seating arrangements was finalized to provide different classes for traveling in the AC Chair Car coach.

The total capacity now increases to 80 passengers, from the 72 that the normal Chair Car coach would accommodate.

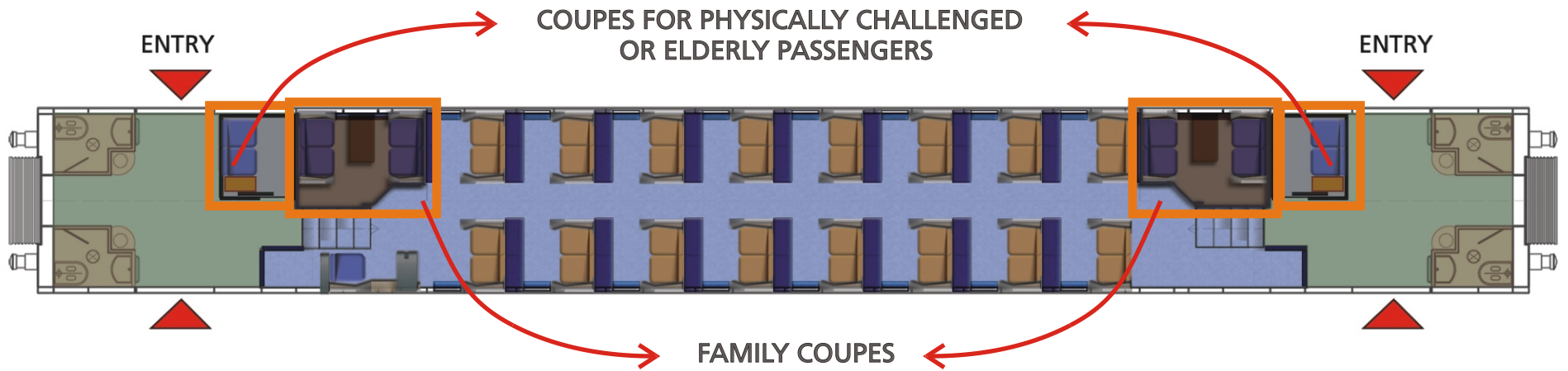
LOWER DECK LAYOUT



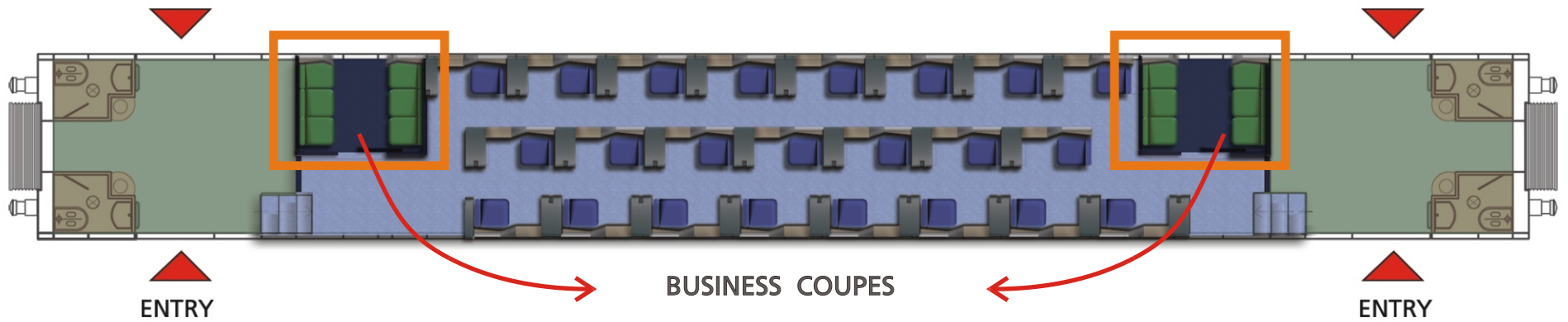
UPPER DECK LAYOUT



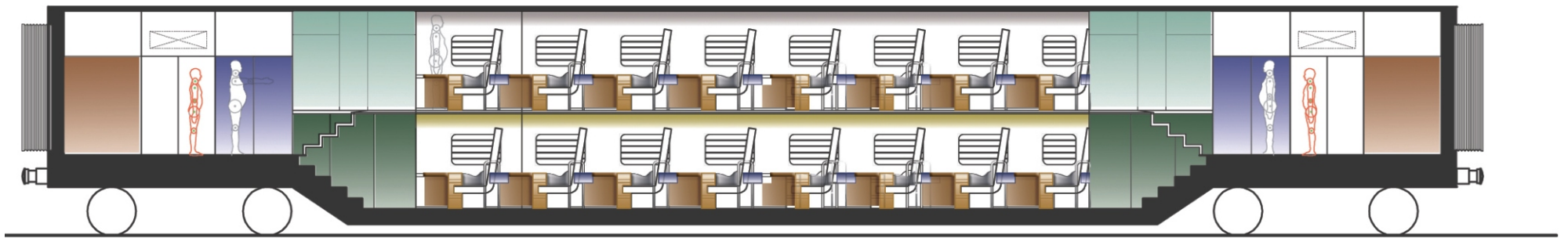
LOWER DECK FACILITIES



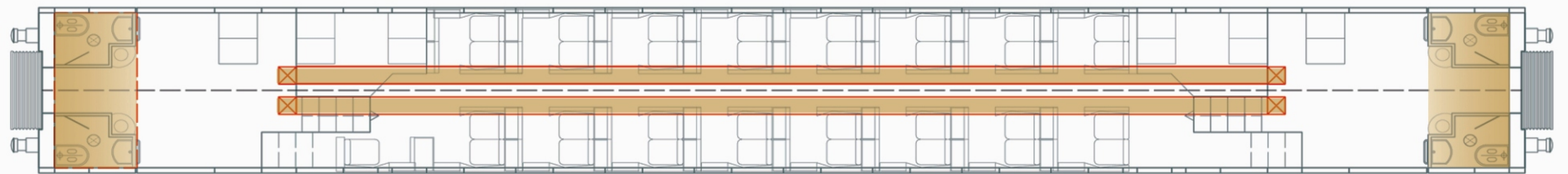
UPPER DECK FACILITIES



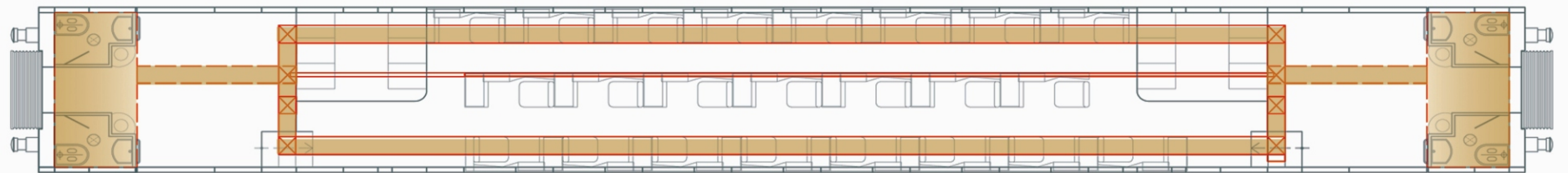
SECTION



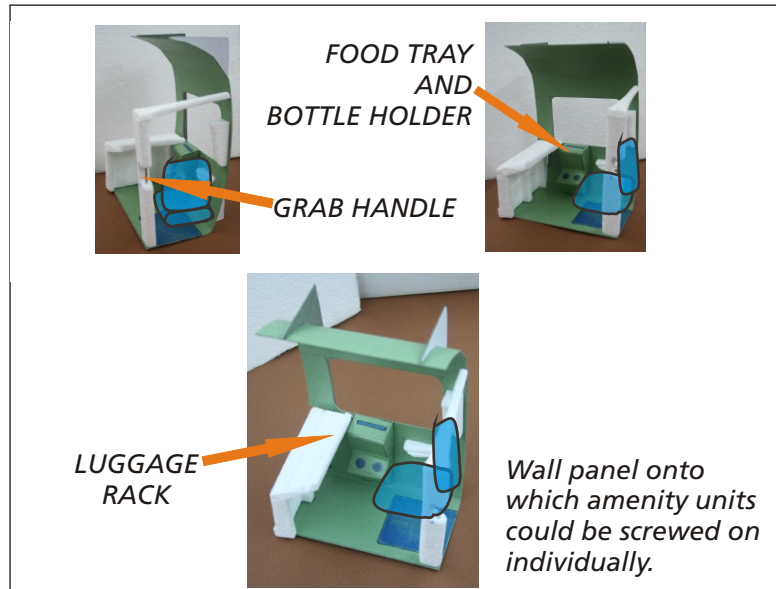
HVAC LAYOUT



LOWER DECK



UPPER DECK

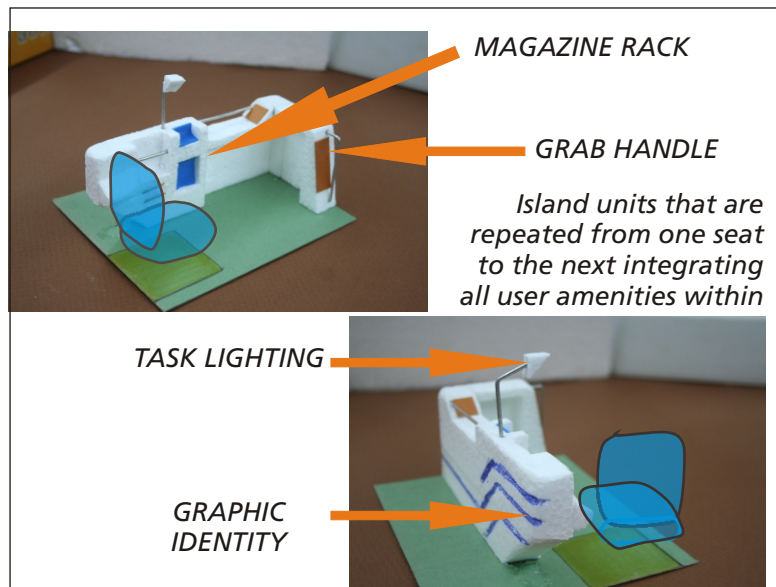


Primary amenities:

Mini-luggage storage
Task Lighting
Mobile phone charging facility

Secondary amenities:

Food tray
Working surface
Magazine rack
Shawl and pillow storage



Tertiary amenities:

Heavy luggage storage
Grab handles
Seat number indication

DESIGN EXPLORATION



Main structure of T-angles on sides

Curtain steel used in spanning members (3.15 mm thick)

L-angles used as tie members



Assembly methods were established by use of exploratory models and the final sequence of assembly was decided as:

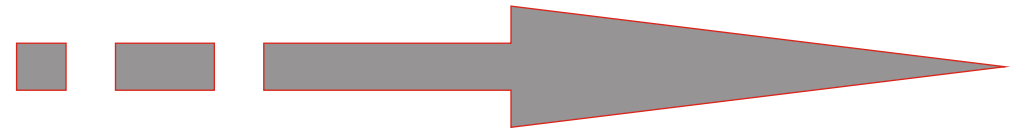
Basic structure

Windows

Mid panel

Roof panel

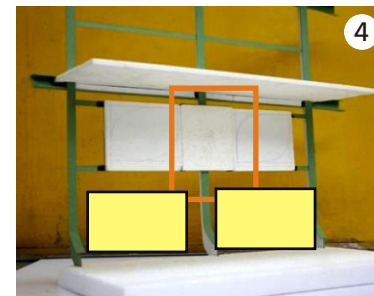
Consoles



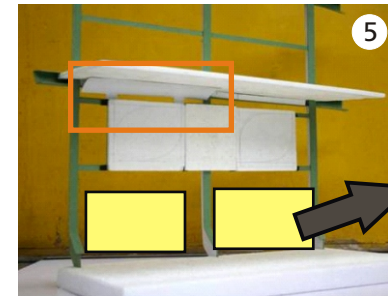
BASIC STRUCTURE



WINDOW UNIT



MID PANEL



ROOF PANEL

CONSOLES



USER AMENITIES CONSOLE

Island units were explored with understanding the different degrees of user amenities and keeping in mind the provision for visible luggage storage

ADVANTAGES

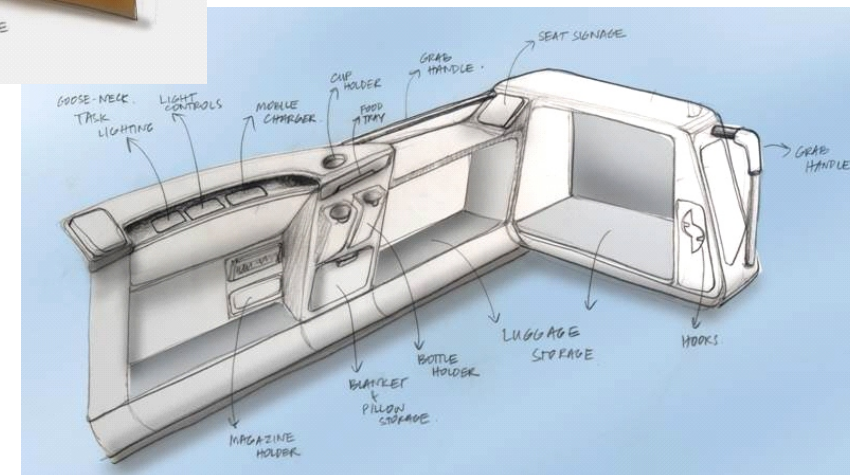
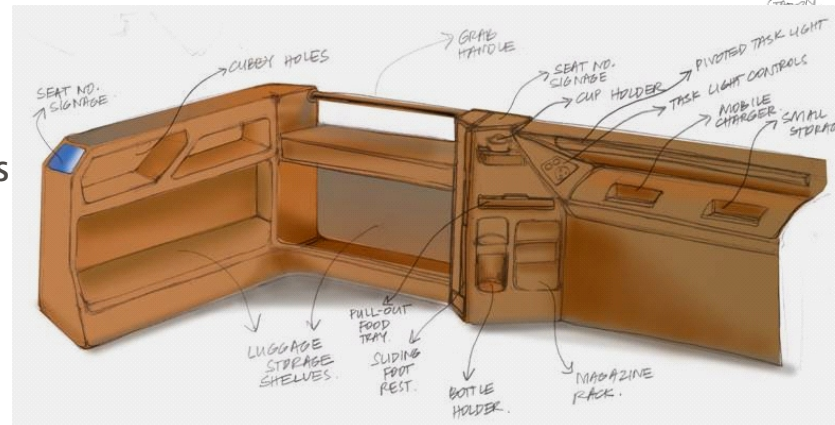
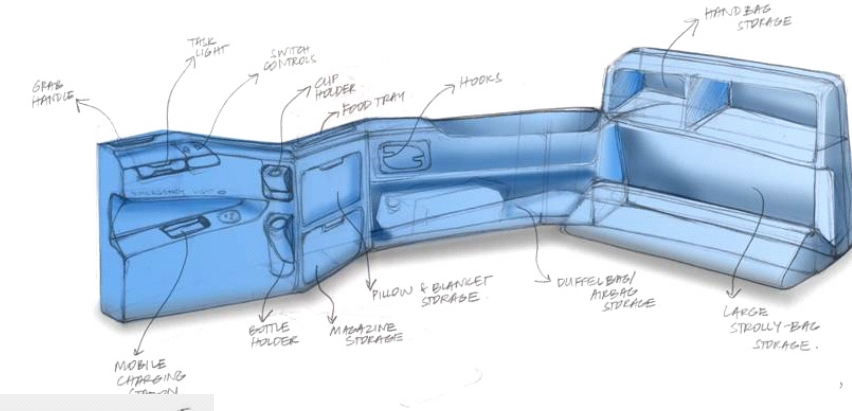
- Close proximity of the amenities
- Luggage stored is visible
- Ample leg room to stretch out
- Maintenance easy design
- Integrated with the wall panels
- Design against vandalism

DISADVANTAGES

- Material waste with too many back panels

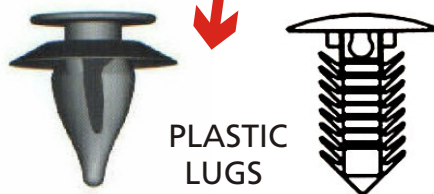
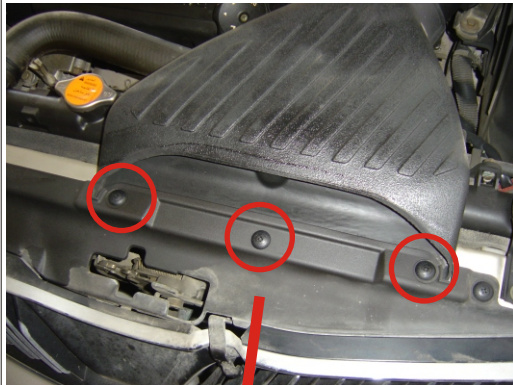
- Visual clutter may add with the bulk of each console unit

- Form of console does not allow for mirroring elements and hence have to be rotated

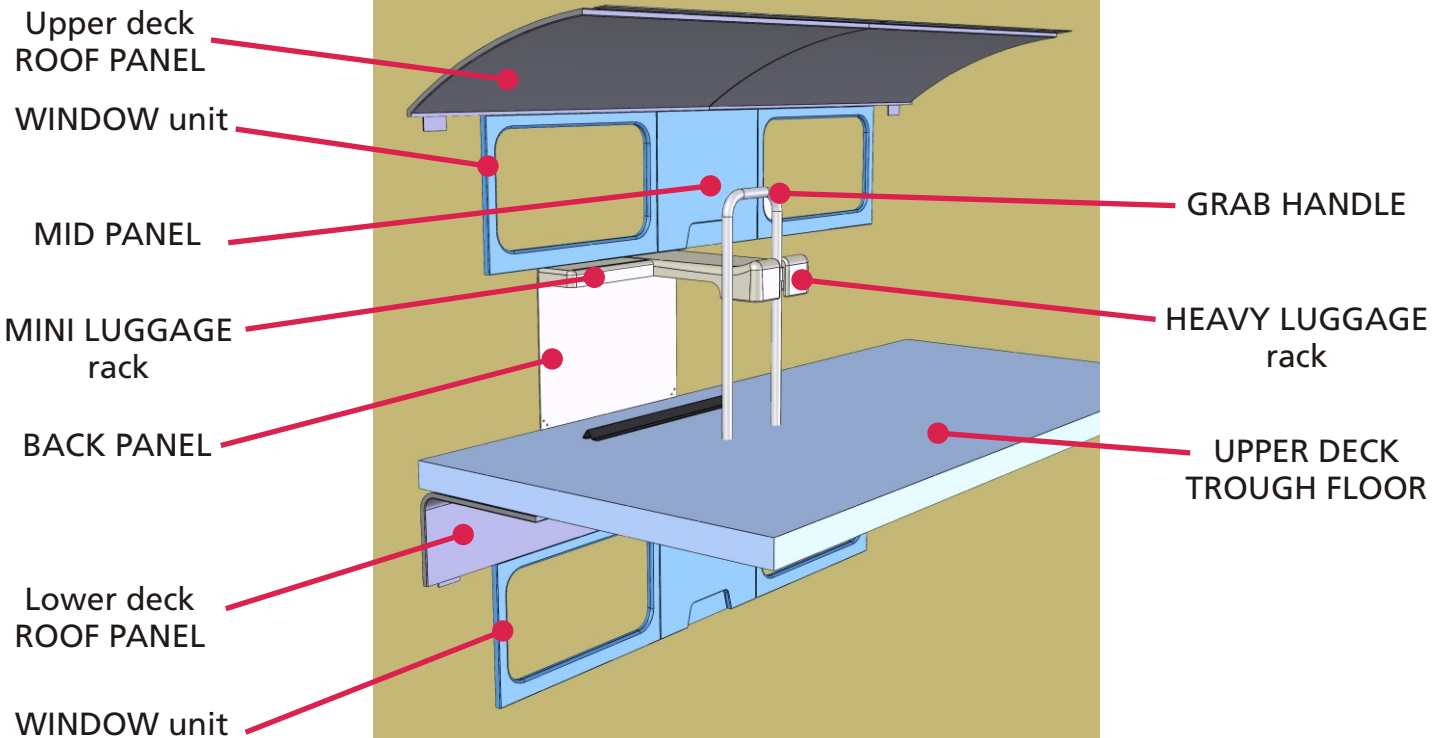




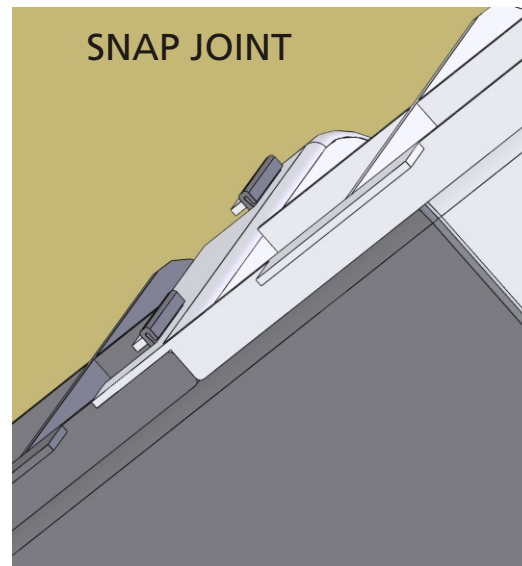
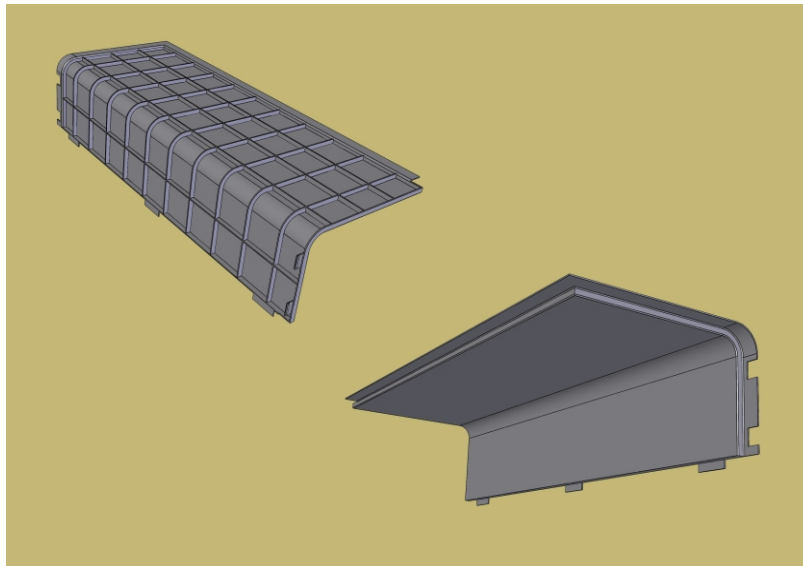
Internal panels used in automobiles are also made of structural polypropylene



PLASTIC LUGS



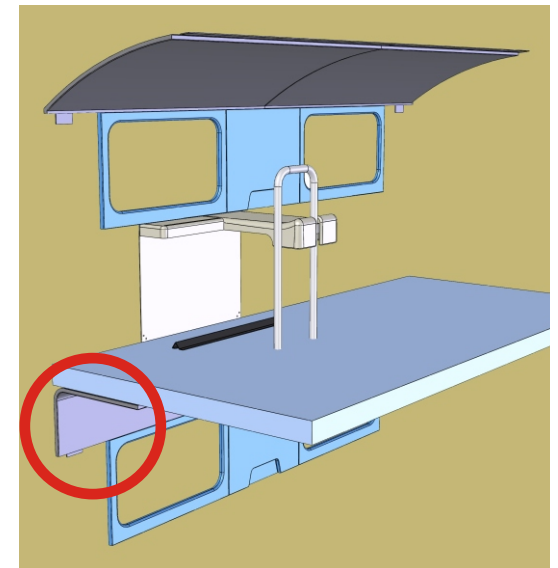
A log of all the parts assembled together are listed below:

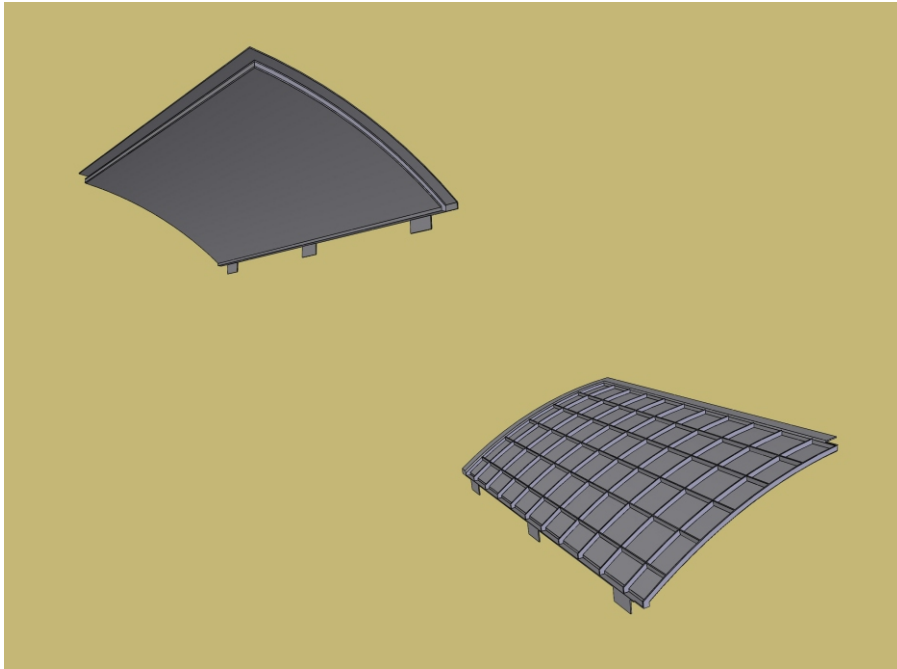


LOWER DECK ROOF PANEL

FEATURES:

Structural polypropylene member used for spanning 1.5 m
Roof panel will hold ambient lighting units.
Checkered grid is provided on the back side for strengthening
The panels will be snapped together on the sides for locking
Panels will be screwed on the top to the roof structure

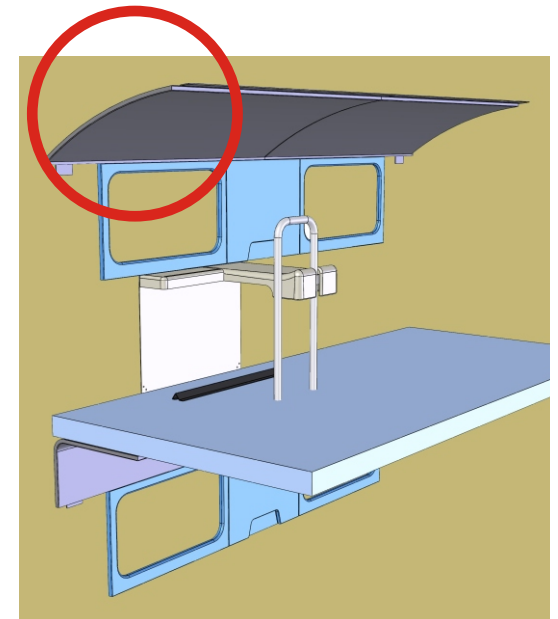


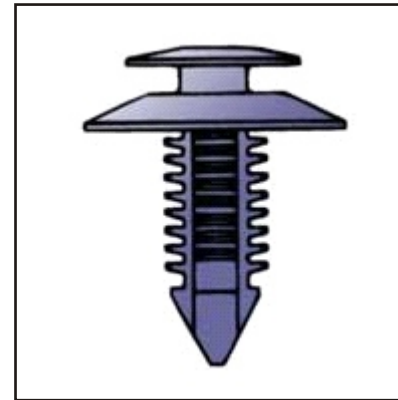
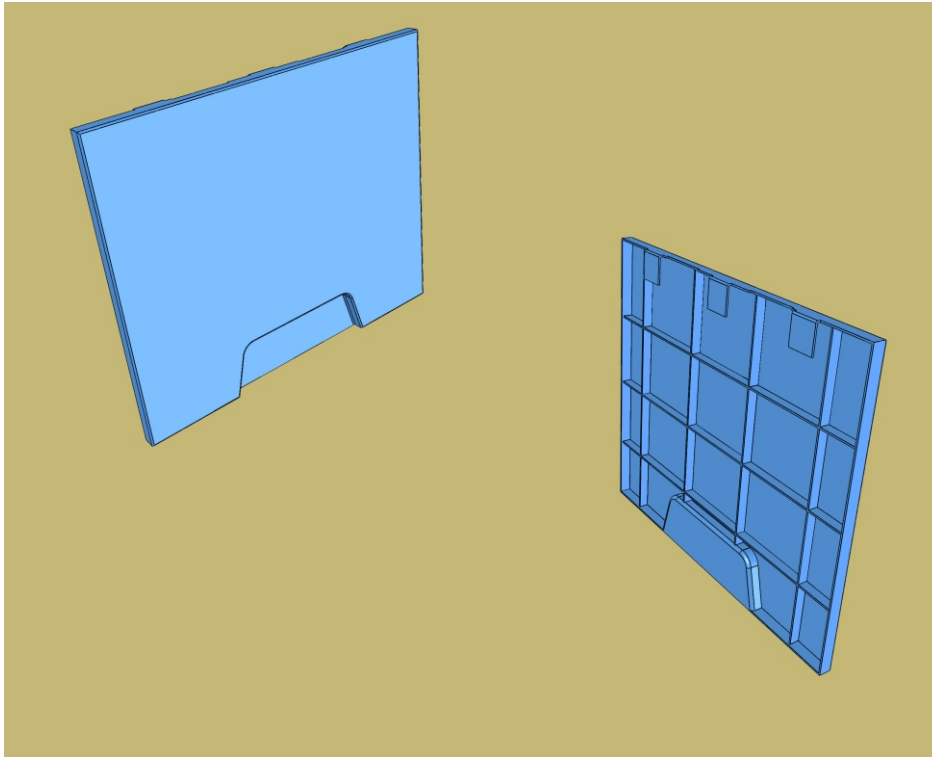


UPPER DECK ROOF
PANEL

FEATURES:

Structural polypropylene member used for spanning 1.5 m
Roof panel will hold ambient lighting units and AC vents.
Checkered grid is provided on the back side for strengthening
The panels will be snapped together on the sides for locking
Panels will be screwed on the top to the roof structure





PLASTIC LUG
using Christmas
tree detail

MID-PANEL

FEATURES:

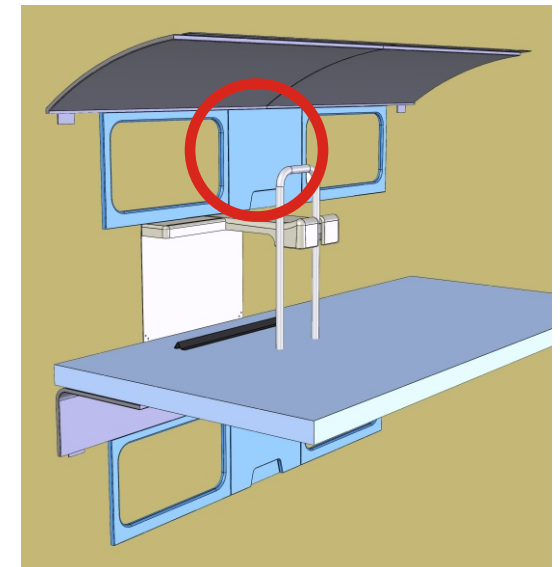
Structural polypropylene member used for mid panel

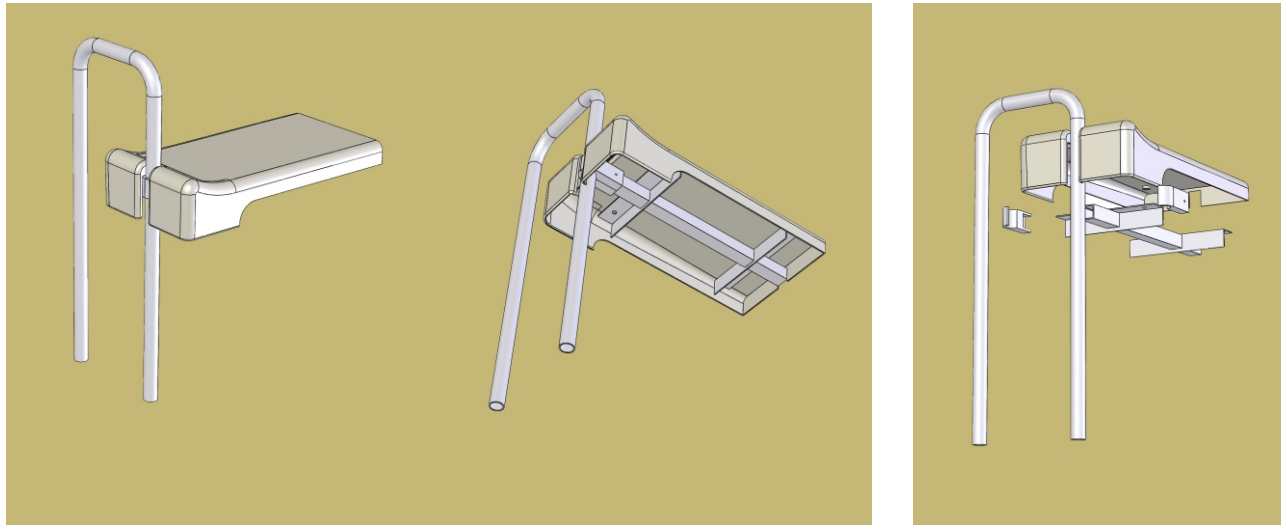
Mid-panel will have seat number indication.

Checkered grid is provided on the back side for strengthening

The panels will be hung from the top onto the structure

Panels will be screwed on the bottom to structure using plastic lugs/ metal screws

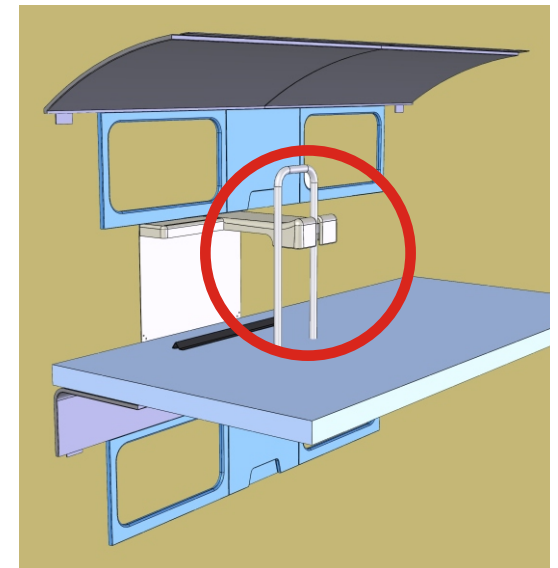


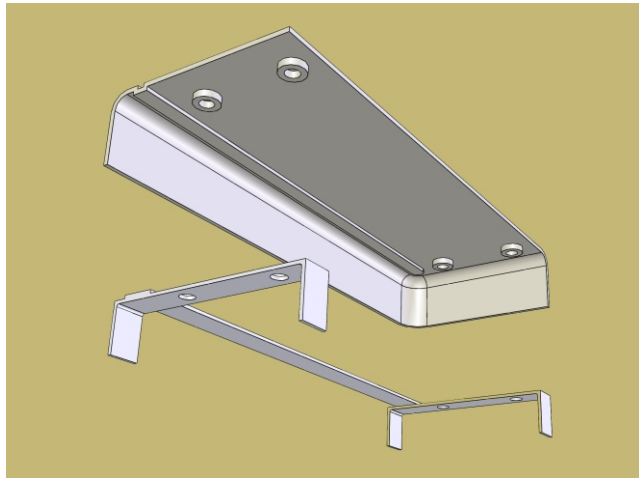


HEAVY LUGGAGE RACK

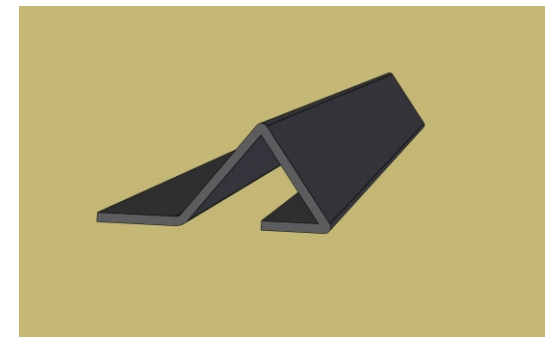
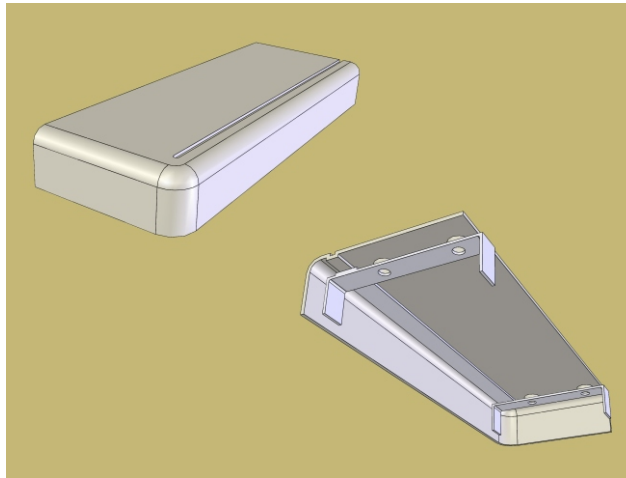
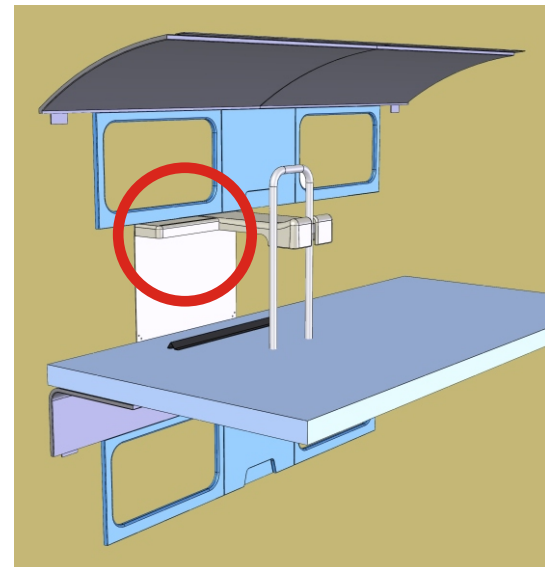
FEATURES:

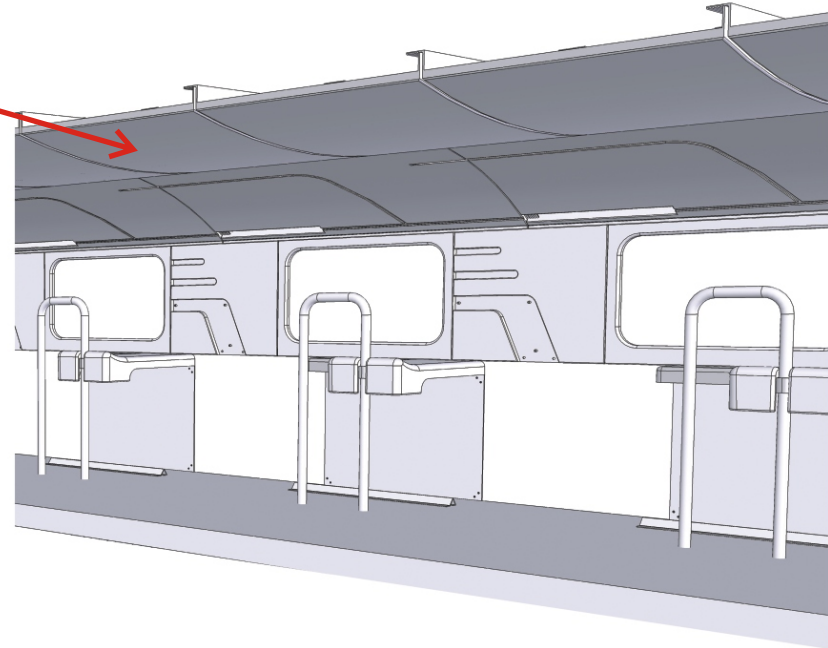
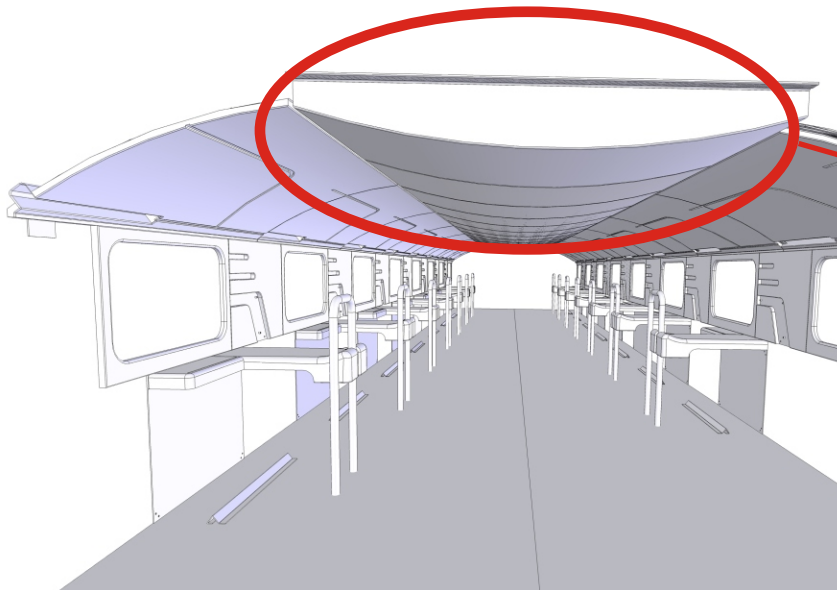
Structural polypropylene member used for heavy luggage rack
Smaller luggage is placed on top and heavy luggage is stored on the ground below the rack, restrained by an elastic strap.
Support structure of MS is welded onto main frame of train structure
The grab handle is made of GI pipe with shrink- wrapped fire-proof PVC coating or with(SS pipe and PU foam grip)
Plastic rack is screwed onto support structure using plastic bosses



**MINI LUGGAGE RACK****FEATURES:**

Structural polypropylene member that sits on metal frame structure
MS metal frame is welded onto main structure of train.
PLASTIC BOSSES are screwed to the structure.
The back panel continues from below this rack to the ground with an elastic restrainer to keep luggage in place.
Floor stopper prevents the luggage from sliding into the aisle

**FLOOR STOPPER**



LIGHTING PANEL

FEATURES:

Structural polypropylene member that hooks onto the aluminium frame above

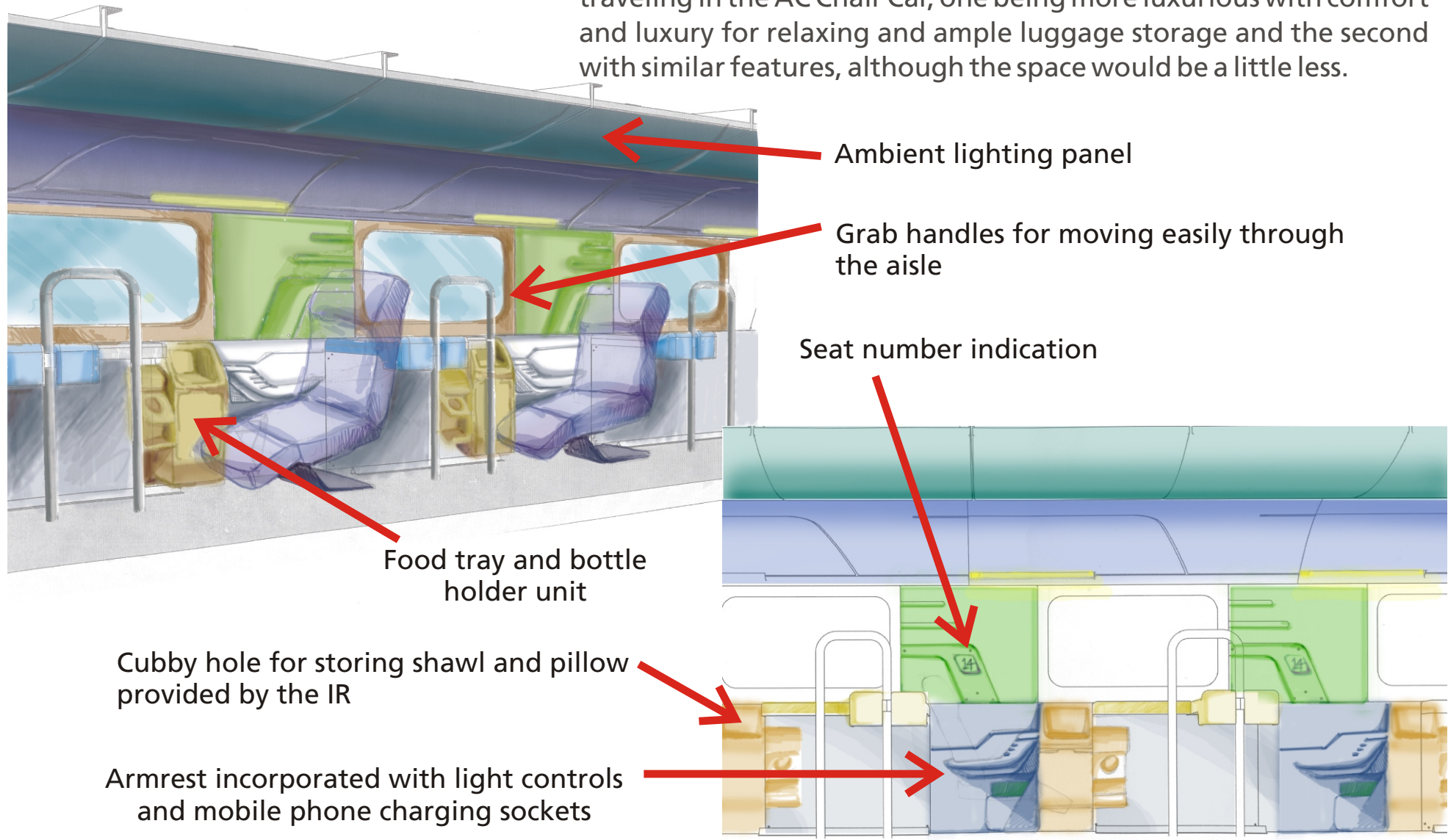
PLASTIC SNAPS and tamper-proof screws help in fixing onto overhead supporting frame

Each panel is placed in series with a little offset from the roof panels to allow the diffused light from the LED lamps to filter out.

Each panel can be easily replaced in case of bulb fuse or any electrical maintenance.

USER AMENITIES

The final concept would cater to two classes of passengers traveling in the AC Chair Car, one being more luxurious with comfort and luxury for relaxing and ample luggage storage and the second with similar features, although the space would be a little less.



FINAL PROPOSAL

FINAL MODEL



FINAL PROPOSAL

FINAL MODEL



LOWER DECK DOUBLE SEATING
LAYOUT



UPPER DECK SINGLE SEATING
LAYOUT





RECESSED LED LIGHTING IN
ROOF PANEL
CUP HOLDER

MOBILE CHARGING SOCKET
AND LIGHT CONTROLS

FOLDING FOOD TRAY

MAGAZINE RACK

BOTTLE HOLDER

CUBBY HOLE FOR STORING
SHAWL AND PILLOW

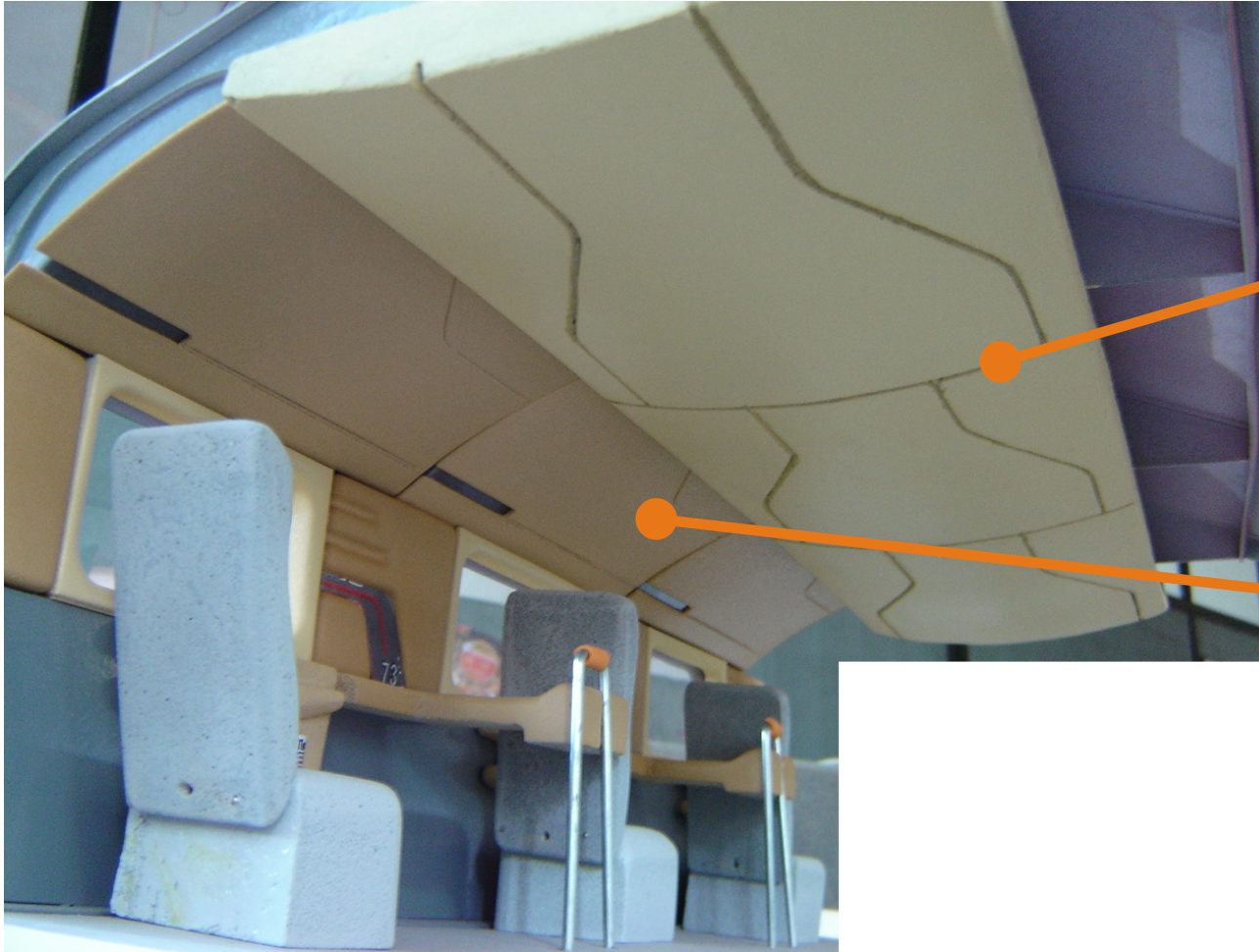
GRAB HANDLE WITH
RUBBERISED GRIP

LUGGAGE RACK



BACK LIT SIGNAGES FOR SEAT
NUMBER INDICATION

LUGGAGE STORED ON THE
FLOOR AND IS RESTRAINED BY
ELASTIC BANDS



LIGHTING PANEL FOR DIFFUSED
LIGHTING IN THE AISLE

ROOF PANEL WITH RECESSED
LED LIGHTING PANEL

THANK YOU