Barrier Free Ajanta: Resign of Palanquin System

Submitted in partial fulfillment of requirements

of the degree of

Master of Design

by
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Guide:
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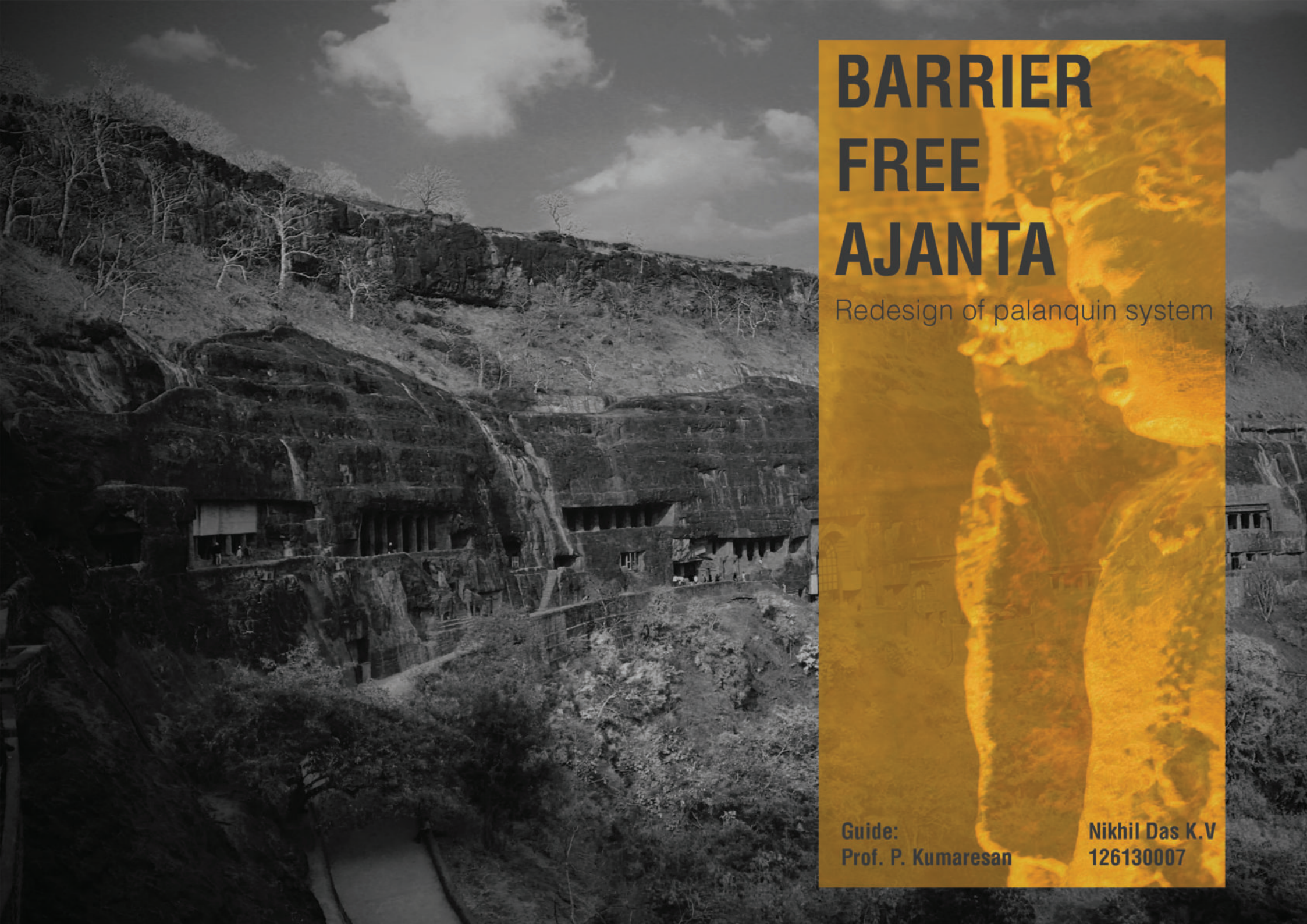
INDUSTRIAL DESIGN CENTER

INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

2014



BARRIER FREE AJANTA

Redesign of palanquin system

Guide:
Prof. P. Kumaresan

Nikhil Das K.V
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Acknowledgment

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Special thanks to my friends and my classmates for their great help and support.
Great thanks to IDC for providing me with all kind of infrastructure and opportunity.

Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsifi ed any idea/data/fact/ source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

(Signature) 

(Name of student)

NIHIL DAS K.V

(Roll number)

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6/09/2014.

Approval Sheet

Industrial Design Project 03
Barrier Free Ajanta

By:-Nikhil Das K.V
M.Des Industrial Design 2012-2014
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is approved as a partial fulfilment of requirement of post graduate degree in industrial Design.

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introduction

Abstract

'Barrier free Ajanta' is aimed to design and develop an accessible system which will resolve the existing accessibility issues of Ajanta caves, a world famous historic monument at Fardapur in Aurangabad District of Maharashtra.

The Ajanta caves are a complex of 30 rock-cut Buddhist caves containing paintings and sculptures which is a perfect example of Indian art and tradition, especially Buddhist religious art. Ajanta Caves have been a UNESCO World Heritage Site since 1983. Because of these reasons, thousands of pilgrims, foreign and domestic tourists visit this site every year. The visitors also include a large number of elderly and physically challenged people.

For some, visiting Ajanta caves is akin to making a pilgrimage. But for the elderly and handicapped people, the rough terrain, steep inclinations and large number of steps makes this an arduous task. Just like other people, they also have equal rights to visit and enjoy these places.

In this project, I have tried to conduct a detailed research on present accessibility systems and barriers in the existing scenario. My research and study is based on some design considerations. Primarily, the design should enhance accessibility of the elderly and people with disabilities. The new systems should not destroy the current livelihood of the porters and designed system should also keep Ajanta's heritage value. The design should further reduce the porter's efforts, and be part of a system that provides more safety and comfort to visitors.

The palanquin system is the existing answer to these accessibility issues. The role of palanquin in Ajanta is tremendous. The existing palanquin is made from wood or bamboo by local carpenters or the porter himself and is carried by four male porters. The palanquin is the only accessible system for elderly and physically challenged people. Introducing a new system to this context will be difficult and impractical, so I focused on 're-design of palanquin system' for the scope of my project.

Fig.1 Ajanta Caves: A still from Upper view point

Fig.2 A View from one of the cave

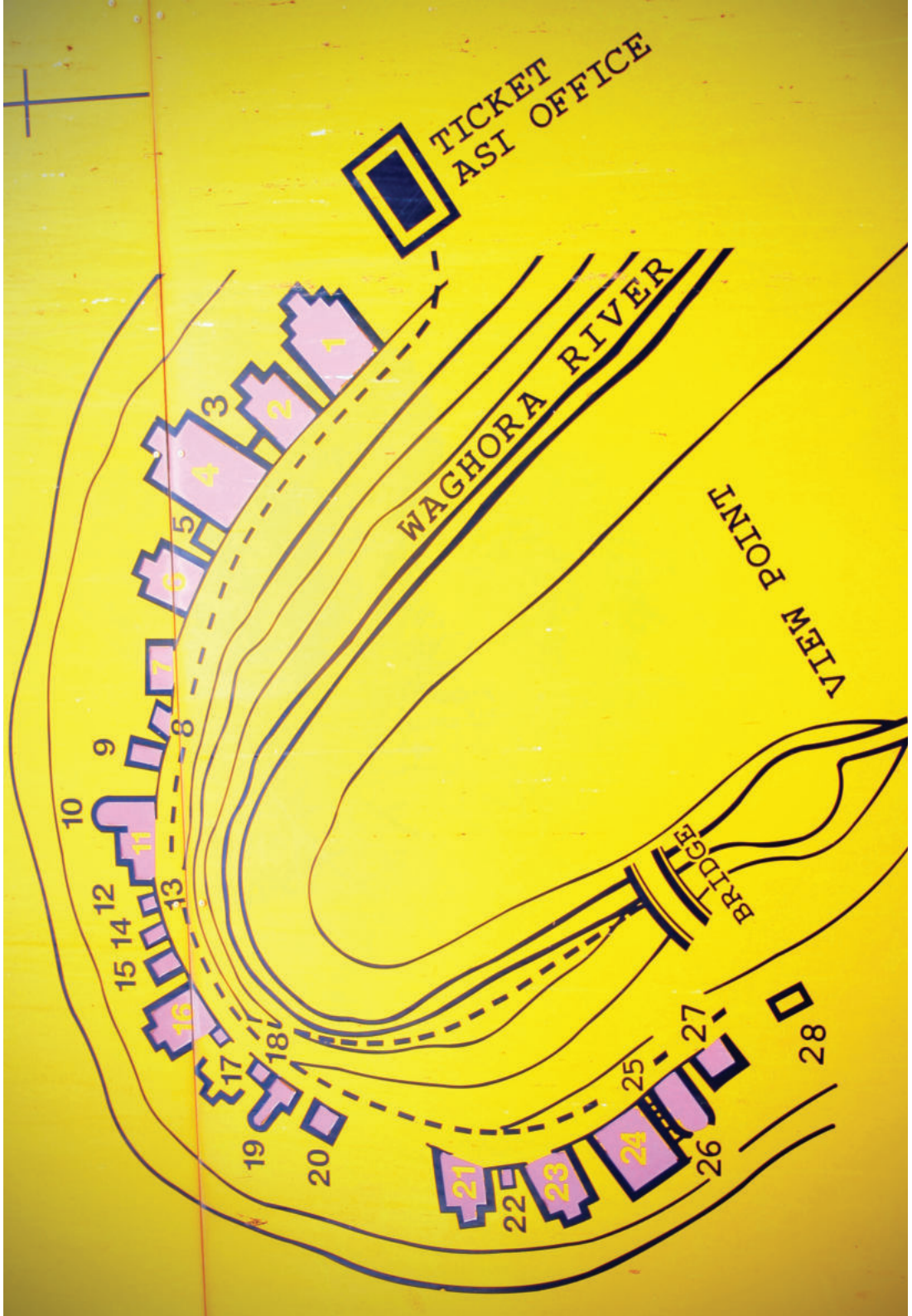
Introduction to project

`Barrier free Ajanta' project is a part of 'Ajanta project, which is one of the collaborative megaprojects of IDC, IIT Bombay along with other collaborators under the initiative of MHRD. The main vision of this megaproject is imparting knowledge and education through design and implementation of real world projects. For this, four project spaces were identified which include sites of ecological, historical and contemporary significance. These are

1) Mumbai
2) Ajanta
3) Varanasi
4) Himalayan Ecology and Culture

The Ajanta and Mumbai Project are coordinated by IIT-Bombay.
The project aspires to develop a deep understanding of the importance of the Ajanta caves in particular and through it, the plethora of historical monuments across India and explore ways in which it can be integrated into the process of development of our country and our people. To understand all the aspects, explore and implement various solutions will require a cross-disciplinary and multi-institutional approach.

Source: The Genesis of the Project – The Design Manifesto by MHRD



Introduction to Ajanta caves

Ajanta is one of the world's greatest historic monuments situated in Aurangabad district of Maharashtra, India which dates from 2nd century BCE to about 480 or 650 CE. It is a cave complex consisting of about 30 Buddhist cave monuments.

The paintings and sculptures of Ajanta are the finest example of Indian Art especially for Buddhist religious art. The paintings consist of illustrations of Jataka tales, and stories about the life of Prince Gautama Buddha. The Ajanta caves have been a UNESCO World Heritage Site since 1983 and site has been protected and maintained by Archaeological Survey of India (ASI), Aurangabad circle.

Ajanta caves were discovered by an Army Officer in the Madras Regiment of the British Army in 1819 during one of his hunting expeditions. The caves were inaccessible and a part of a dense forest area until his rediscovery. These caves are excavated in 'U' shape into side of a cliff on the south side of river Waghora.

The caves are numbered one to twenty eight based on their location along the current pedestrian path which begins from the main entrance. Several of the caves are unfinished and some of them hardly initiated. There are two groups of caves, which include five sanctuaries or Chaitya-grihas (caves 9, 10, 19, 26 and 29) and monastic complex called sangharamas or viharas.

Fig.3 Map of Ajanta Caves

Source: http://goo.gl/VwQ4q5 : http://goo.gl/W3fPJV

Research

Demand for access

India has thirty world heritage sites that are recognized by the United Nations Educational, Scientific and Cultural Organization (UNESCO). As of 2013 and at present, there are more than 3650 ancient monuments and archaeological sites and remains of national importance valued for their impeccable beauty, diversity & historical significance. Millions of foreign and domestic travellers visit them every year. These heritage monuments belong to different periods ranging from the prehistoric period to the colonial period and are located in different geographical settings. They are living examples of ancient Indian art, culture, tradition.

The Ajanta caves collaboratively carry exceptional demonstration to the evolution of Indian art, as well as defining the role of Buddhism, intellectual and religious foyers, schools and reception centres in the India of the Gupta period and their immediate successors.

Generally, in Ajanta there are two categories of tourists visiting, the first one is the common tourist, who wants to explore new places, experience the beauty of Ajanta paintings and sculptures and appreciate the monumental efforts that went in to the creation of such enormous beauty, structure or edifice. The other ones are the followers of Lord Buddha, those who experience Ajanta as a pilgrim monument. They are more concerned about the spiritual background of Ajanta.

Thousands of people visit Ajanta every year, but actually sizeable amount of visitors are left out due to physical barriers like steep inclination, staircases, narrow pathways, multiple levels and rough terrains. The better percentage of these people are elderly and physically challenged. They also have equal rights to visit these places. Hence the accessibility into these places must be incorporated with special needs of these people in mind.

Fig.4 One of the Sculpture work from Ajanta

Source:http://goo.gl/nQGjga
: http://goo.gl/X5ewUV
: http://goo.gl/eDS9CT

Tourism Statistics:-Growing demand

Tourism in India:

The tourism industry of India is economically important and is growing rapidly. India ranks 7th in terms of international tourist arrivals in Asia and the Pacific region. The World Travel & Tourism Council calculated that tourism generated INR 6.4 trillion or 6.6% of the nation's GDP in 2012. It supported 39.5 million jobs, 7.7% of its total employment. The sector is expected to grow at an average annual rate of 7.9% from 2013 to 2023.This gives India the third rank among countries with the fastest growing tourism industries over the next decade.

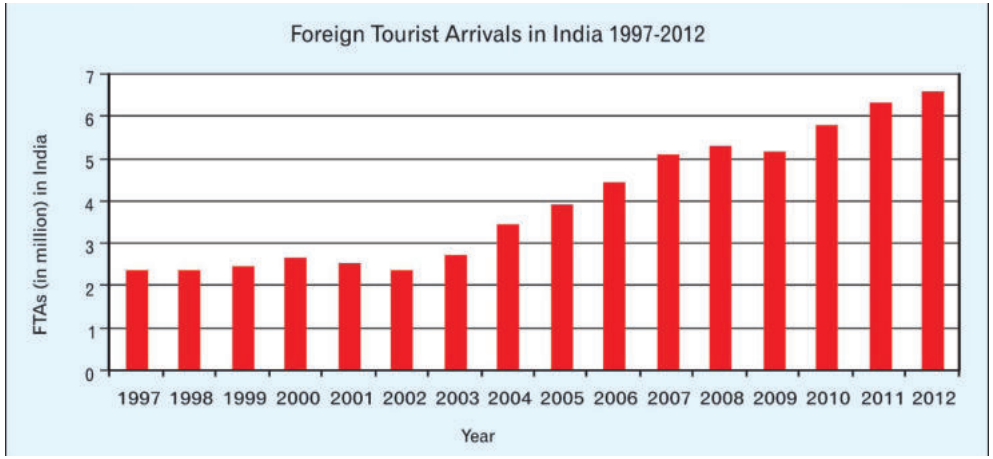


Fig.5 Foreign Tourist Arrivals in India

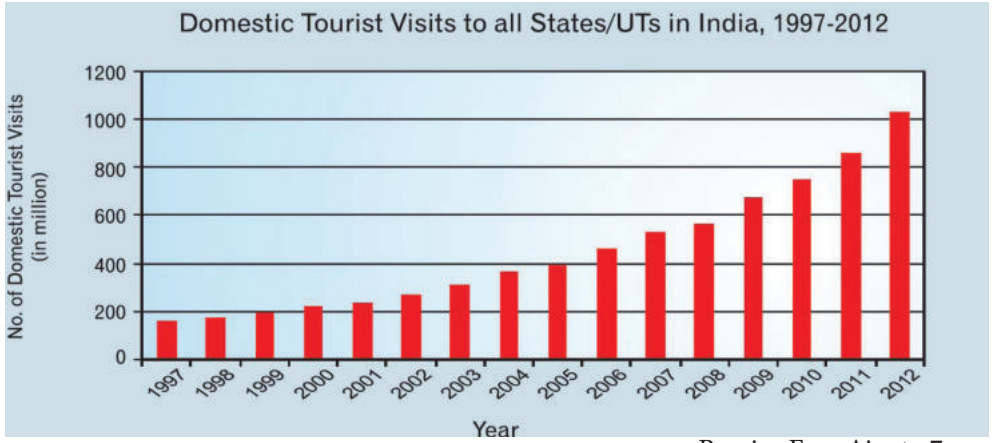


Fig.6 Domestic Tourist Visits to all states

Source: http://goo.gl/LiSmv5
: http://goo.gl/gbqCBv

Tourism in Maharashtra

Maharashtra is a land of colourful festivals, numerous forts, ancient temple, sculptures and other historic monuments. Maharashtra topped the list in number of foreign tourist visits, followed by Tamil Nadu and New Delhi. Maharashtra received nearly 4.8 million tourists (Union Ministry of Tourism). Maharashtra ranks fifth in domestic tourist arrivals and the growth rate is 6.5% (Ministry of tourism). The following graph shows the percentage share of top 10 States/UTs in terms of foreign tourist visits in 2012.

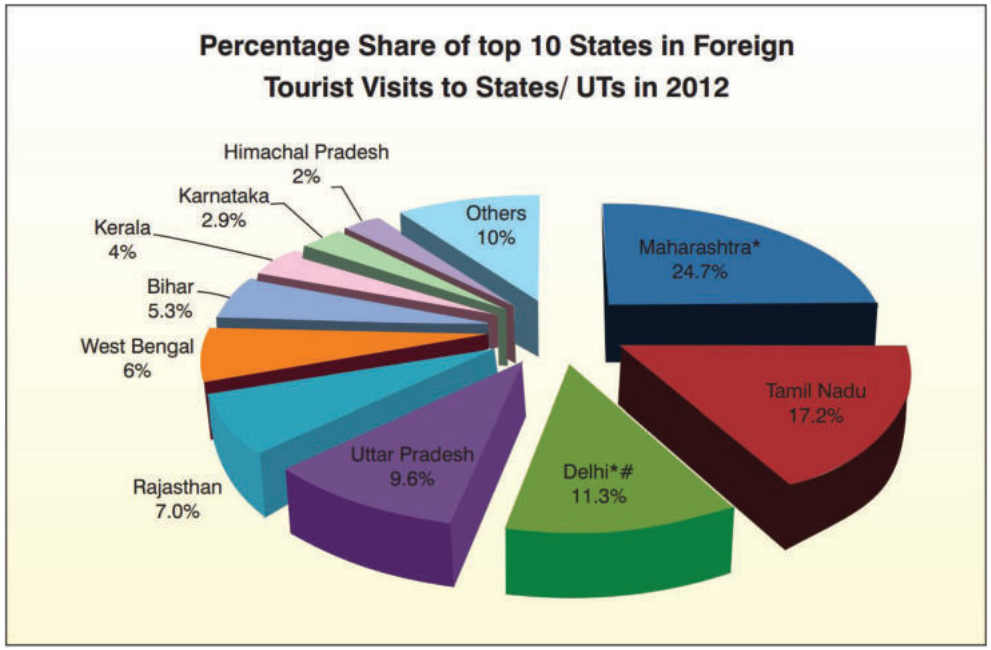


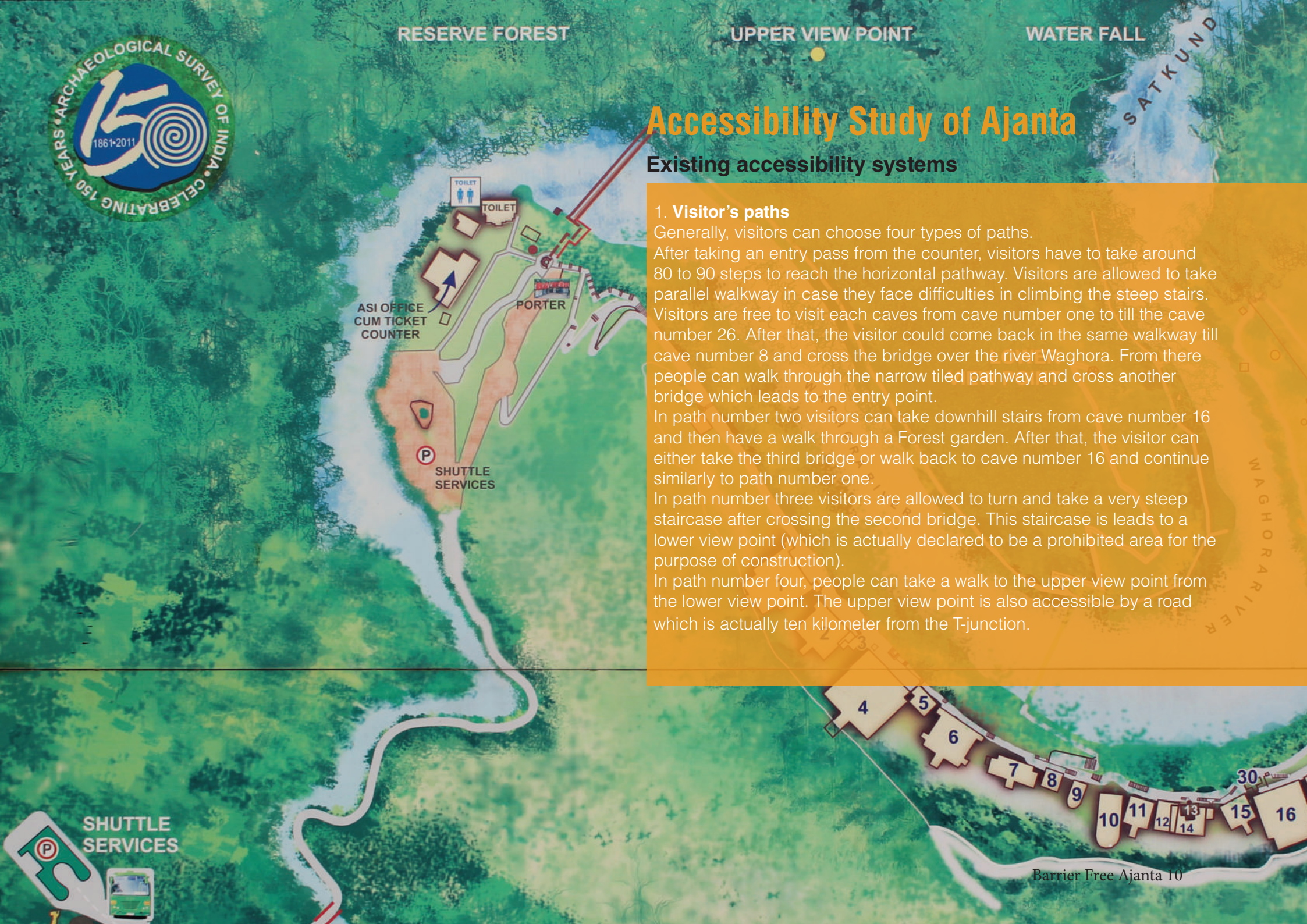
Fig.7 Percentage Share of top 10 States in Foreign Tourist Visits to States/UTs in 2012

Source: http://goo.gl/bQKUCz
: http://goo.gl/BYtRWE
: TourismStatisticsofMaharash(2011-2012)

Data collection

Trip to Ajanta

21st February- 24th February



Accessibility Study of Ajanta

Existing accessibility systems

1. **Visitor's paths**

Generally, visitors can choose four types of paths.

After taking an entry pass from the counter, visitors have to take around 80 to 90 steps to reach the horizontal pathway. Visitors are allowed to take parallel walkway in case they face difficulties in climbing the steep stairs. Visitors are free to visit each caves from cave number one to till the cave number 26. After that, the visitor could come back in the same walkway till cave number 8 and cross the bridge over the river Waghora. From there people can walk through the narrow tiled pathway and cross another bridge which leads to the entry point.

In path number two visitors can take downhill stairs from cave number 16 and then have a walk through a Forest garden. After that, the visitor can either take the third bridge or walk back to cave number 16 and continue similarly to path number one.

In path number three visitors are allowed to turn and take a very steep staircase after crossing the second bridge. This staircase is leads to a lower view point (which is actually declared to be a prohibited area for the purpose of construction).

In path number four, people can take a walk to the upper view point from the lower view point. The upper view point is also accessible by a road which is actually ten kilometer from the T-junction.

Fig.8 PathNo.1

Fig.9 PathNo.2

Fig.10 PathNo.3

Fig.11 PathNo.4

2. The Shuttle service :
The Shuttle service has been provided by Maharashtra State Road Transport Corporation (MSRTC) from visitor's centre to Ajanta caves which is a four kilometre journey though deep forest. There are two types of buses, one is normal green colour bus and the other one is the white colour air conditioned buses.

Fig.12 Shuttle service

Fig.13 Bus shuttle service root map

Fig.14 Shuttle service

3. Palanquin services :
There are ten Palanquins and around forty porters dedicated to this service. The four porters carrying palanquin system is very helpful for elderly and physically challenged people. Palanquin services are available from the entry point, they cost eight hundred rupees for one trip. Generally palanquin service form entry point to cave number twenty six and return to entry point. The porters are local people who is authorized by archaeological survey of India (ASI).

Fig.15 Wooden ramps

4. Wooden ramps:
Wooden ramps are provided over the entry and exit point of some caves, which avoid the sudden plat

5. Porter services to carry kids:
Palanquin porters are also providing service like carrying kids who visit with family, which costs two hundred for one trip. Here one porter carries the kids either atop the shoulder or on his hand.

Other services:

1. Ajanta visitor center:
   Ajanta Visitor Center is a Ministry of Tourism Projects which is under construction. Which consists of info graphic panels, maps, narrative movies, interactive screens, sculptures and cave replicas. Visitor centers aimed at the tourist who come for a quick frequent visits and the physically challenged.
2. Shopping plaza for visitors to buy handicraft products, books, foods etc.
3. MTDC restaurant and beer parlor at entry point of the walkway.
4. Drinking water facility for visitors
5. Tour guide services
6. Information boards in front of caves

Fig.16 Shuttle service

Existing barriers in Ajanta

1. Entry to MTDC shuttle bus services:
Entry to shuttle bus services is a nightmare for elderly, physically challenged people and visitors who come with their kids. The entry door is very narrow and very steep.

2. No ramp to ticket counter:
Ramp is not provided at ticket counter making it inaccessible for the elderly and physically challenged visitors.

Fig.17 ticket counter

Fig.18 No handrail;Woman struggling to climb without handrail

3. No handrail

Handrails are not provided at many staircases which is actually very difficult for the elderly and physically changed visitors to access.

4. Steep initial staircase and large number of steps:

The staircase at the starting point of the walkway has a very steep inclination without proper hand rail system. There are flat ramps which start after 10-12m of steep gradient, which is actually too lengthy and without handrails.

Fig.19 Initial staircase

Fig.20 Narrow and uneven paths;A Woman struggling to pass through

5. Narrow and uneven paths.

Entry and Exit points of the caves are too narrow and dark. The walk way over some places are extremely congested and hardly one person can walk through this way. The porters with palanquin finds it very difficult to pass through this way.

6. No resting and refreshing places:

There are no resting and refreshing points are provided for visitors after taking longer and steeper staircases. At present people are resting over the small fence which actually made for the safety. The other side of the small wall is a deep cliff, even though visitors are forced to rest over the wall because of the tiredness.

The drinking water points are too slippery and are in multiple levels which is dangerously difficult for the elderly and looks unhygienic.

Fig.21 Visitors resting on the fence

Fig.22 Poor lighting inside the caves

7. Poor lighting inside the caves

Paintings and sculptures are not visible because of poor lighting. One of the main idea is that visitors should experience the details of ancient painting works which ironically is hardly visible to visitors. The barricade inside the caves are far from the paintings which is another barrier for visitors to understand details of the great works.

8. Rock fall during monsoon season

The caves are a part of geographical feature with exposed rock surface and prone to rockfall during monsoons, etc.

Fig.23 Caution Board

user analysis

Discussion with

Fig.24
Mr.Danve DS
Ajanta caves world heritage site incharge

Key information

Visitors information:

- Avg. 300 people visited per day (2013)
- Around109500 people visited last year
- 300 foreigners visited last year (visitors from ``SAARC'' and ``BIMS TEC'' are not counted)
- Season starts from September to February
- No system is available for counting types of visitors

Current accessing system:

- 42 palki porters are working
- 10 palanquins are available
- Each palki transportation costs 800 rupees
- Total distance covered by palki in one up and down transportation is 800m, it takes almost one hour

Key insights

- "Whatever you do, it is not going to be installed here"
- "designed system should represent past"
- System should not destroy the current livelihood of the porters

Questionnaire for porter

The following Questions were asked to the Palanquin porters

1. Why did you choose palki job?
2. How long have you been doing this job?
3. How much you earn in a day?
4. How many days you work in a week?
5. Would you like to continue this job?
6. Do you have any discomfort after the work?
7. Do you get pain in any specific area?
8. Will you shift position of holding palki fre quently?
9. Do you have any particular method to carry the palki?
10. Do you want to change the existing ramp? If yes, what do you suggest?
11. Do you have any suggestions to improve the palki?

interview with……

Fig:25
Mr.KADOOBHA
Porter
Age:38
From: fardapur

Key points

- He has been working at Ajanta since 2003
- There are no other jobs out there in village, no industry, unable to farm in his land because of water
- He doesn't want to continue porter's job
- Even though he has to continue his job for feeding his family
- Palki turning is a major issue, mainly while changing directions uphill/downhill
- He thought of fixing umbrella on palki for protect passenger from sunlight

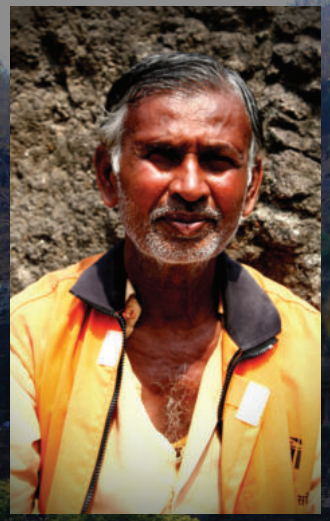


Fig.26
Mr. RASHEED
Porter
Age:60
From: fardapur

Key points

- He has been working at Ajanta since 30years
- He works maximum three days in a week (on season)
- He feels back pain, shoulder pain and knee pain
- He earns maximum 600 per week
- He doesn't want any kind of changes in existing ramps because that will affect his livelihood
- According to him attaching umbrella on palki is not a good idea because it makes issues by wind
- He prefers cushion on palki
- He wanted to get support from government by providing a better palki

Fig.27
Mr.KADOOBHA
Porter
Age:38
From: fardapur

Key points

- He has been working at Ajanta for 30years
- He works five days in a week (on season)
- He gets around 300 rupees per week (600 rupees in peak season)
- He feels back pain, shoulder pain knee pain, hair formation because of excess heat
- He doesn't want any kind of changes in existing ramps because that will affect his livelihood
- According to him attaching cushion on palki or keeping cushion on shoulder makes palki slip

Questionnaire for elderly people (palki user)

The following Questions were asked to the Palanquin passengers

1. Why did you choose palki?
2. Are you able to experience place around you while riding on palki?
3. Did you feel safe enough in palki?
4. Do you feel palki riding is royal and a luxury?
5. Do you think palki riding is expensive?
6. Do you feel handicapped while using palki?
7. Did the porter force you to use palki?
8. What are the discomforts you feel while taking ride in palki?
9. Do you have any suggestions to improve palki system?
10. Do you have any suggestions to improve accessibility in Ajanta?

Discussion with palki user

Fig.28
Mr.R S BUDHYAL
Retired banker
Visitor
Age:62
From: Mumbai

Key points

- He is unable to climb extensively
- He visits historic monuments very frequently
- He visits historic monuments because he believes, he is owning the rich heritage culture from these places
- According to him palki fare is tolerable, but it will be expensive for lower middle class visitors
- As he claimed by, Palki system is very efficient method of transportation in historical monuments like Ajanta because it won't disturb its inheritance
- As per his opinion, palki system is very safe because four experienced people surround the passenger, but he is a bit worried about the strength of palki
- As he suggests, it can be made up on in metal and technologically superior
- He doesn't feel royal or luxury while riding on palki
- He never feels handicapped while riding in palki \
- Palki can fitted with seat belt

Questionnaire for elderly people (non-palki user)

The following Questions were asked to the non-palanquin passengers

1. How often you visit historic monuments?
2. Did you choose palki for visiting? If not, why?
3. Do you think Ajanta is accessible for elderly and handi capped people?
4. Do you feel tired while visiting Ajanta?
5. Did you able to rest or refresh while visiting?
6. Where did you rest?
7. How did you feel after taking initial stairs in Ajanta?
8. How do you feel after taking the visit?
9. Do you have any suggestions to improve accessibility in Ajanta?

interview with……

Fig.29
Mr. INGLE
GOVT.SERVICE
Visitor (non-palki user)
Age: 59
From: Mumbai

Key points

- He visits historic monuments frequently
- He preferred to walk, even though he has knee pain
- There are no handrails
- Initial stairs are very steep
- No place for rest
- According to him palki system is very helpful for elderly
- As he claims, Ajanta is not that accessible for elderly and handicapped people

Fig.30
Mr.WIMALRATHA
Retired banker
Visitor (non-palki user)
Age:65
From: BANGALORE

Key points

- He is a frequent visitor of historic monuments
- He visits Ajanta because he is a Buddhist
- He enjoys walking rather than transported by palki system
- According to him Ajanta is not easy to access for elderly and handicapped
- Stairs at the exit point are very big and there are no handrail for that
- No resting point
- Frequent removal of footwear
- He claims that palki system is good solution for people who feel difficult to walk

Fig.31
Mr .MIKO
Retired PROF.
Visitor (non-palki user)
Age:70
From: CANADA

Key points

- The palki system is very foreign to him
- He thinks palki system is a good idea
- According to him palki systems are not visibly comfortable
- He did not feel safe enough on seeing
- palki
- There are cool drinks points, he feels existing drinking water facility is not hygienic
- There are so many stairs
- There no formal places for sit or rest
- It must be helpful if provides shades and cool drinks facility
- The lights inside the caves are poor and they are very far from the viewer
- It must be good if they can use glass and take viewer close

Accessibility at other Historic monuments and pilgrimage center

Fig 32.Amarnath Temple

Ref:http://goo.gl/Q59qgg

Ref:http://goo.gl/r4ugv9

Amarnath cave is a Hindu shrine situated in Jammu and Kashmir, India. It is dedicated to Shiva. The cave is positioned about 141 km from Srinagar, the capital of Jammu and Kashmir and reached through Pahalgam town It cost fifteen thousand rupees for a the round trip from Pahalgam to Amarnath which is six four kilometre distance.

Ref:http://goo.gl/GfQpiF

Fig 33.Pzhani Temple

http://goo.gl/PNX87D

http://goo.gl/dJoX0A

http://goo.gl/eyDaCN

The Hill Temple of Pazhani is one of the most well-known temples of Murugan in India. It is situated in the town of Pazhani, 100 km southeast of Coimbatore. There are two types of accessible systems which are funicular railway and rope way system.

Ref:http://goo.gl/VOegUP

Fig34.Heidelberg castle

ref:http://goo.gl/DztmJ6

ref:http://goo.gl/rRBP76

Heidelberg Castle is a famous ruin in Germany and landmark of Heidelberg. The castle remains are among the most significant Renaissance constructions north of the Alps. Funicular railway system is using as the accessible solution in Heidelberg Castle.

ref:http://goo.gl/oLTJhy

Fig35. Budapest Castle Hill

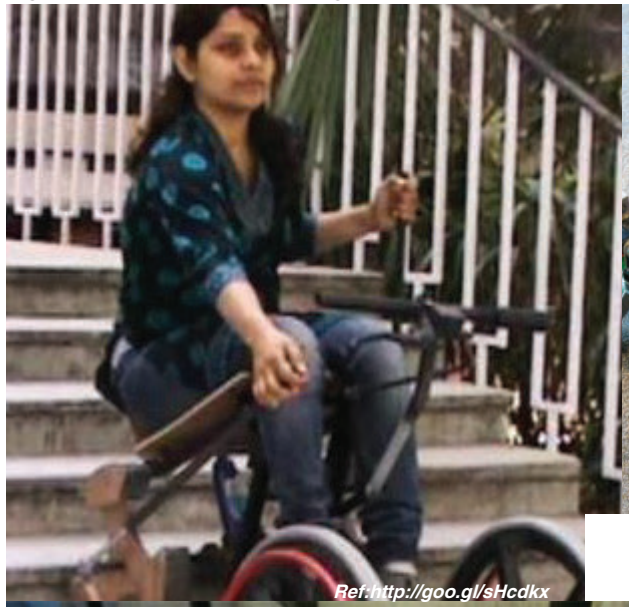
Ref:http://goo.gl/U7USHS

Ref:http://goo.gl/sZk1hA

Buda Castle is the historical castle and palace complex of the Hungarian kings in Budapest, and was first completed in 1265. Funicular railway system is using as the accessible solution in Budapest Castle Hill.

Ref:http://goo.gl/bNHofq

Fig36.Colash of stair climbing solutions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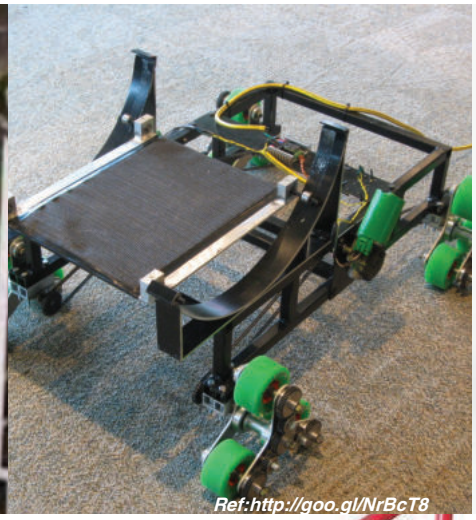
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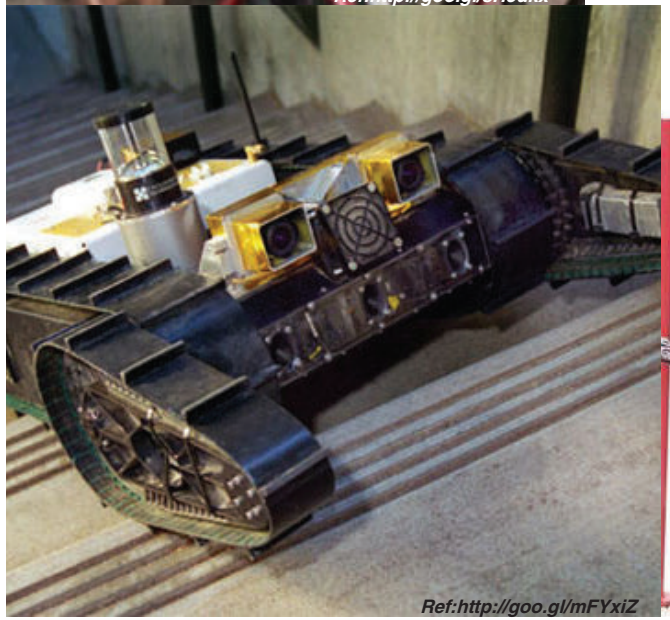
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Design directions from data collection

- Design should enhance accessibility of elderly and person with disability
- System should not destroy the current livelihood of the porters
- Designed system should keep Ajanta's inheritance
- Design should be visibly comfortable for visitors
- Design should reduce porters' efforts
- System should provide more safety
- Provide more comfort to visitors

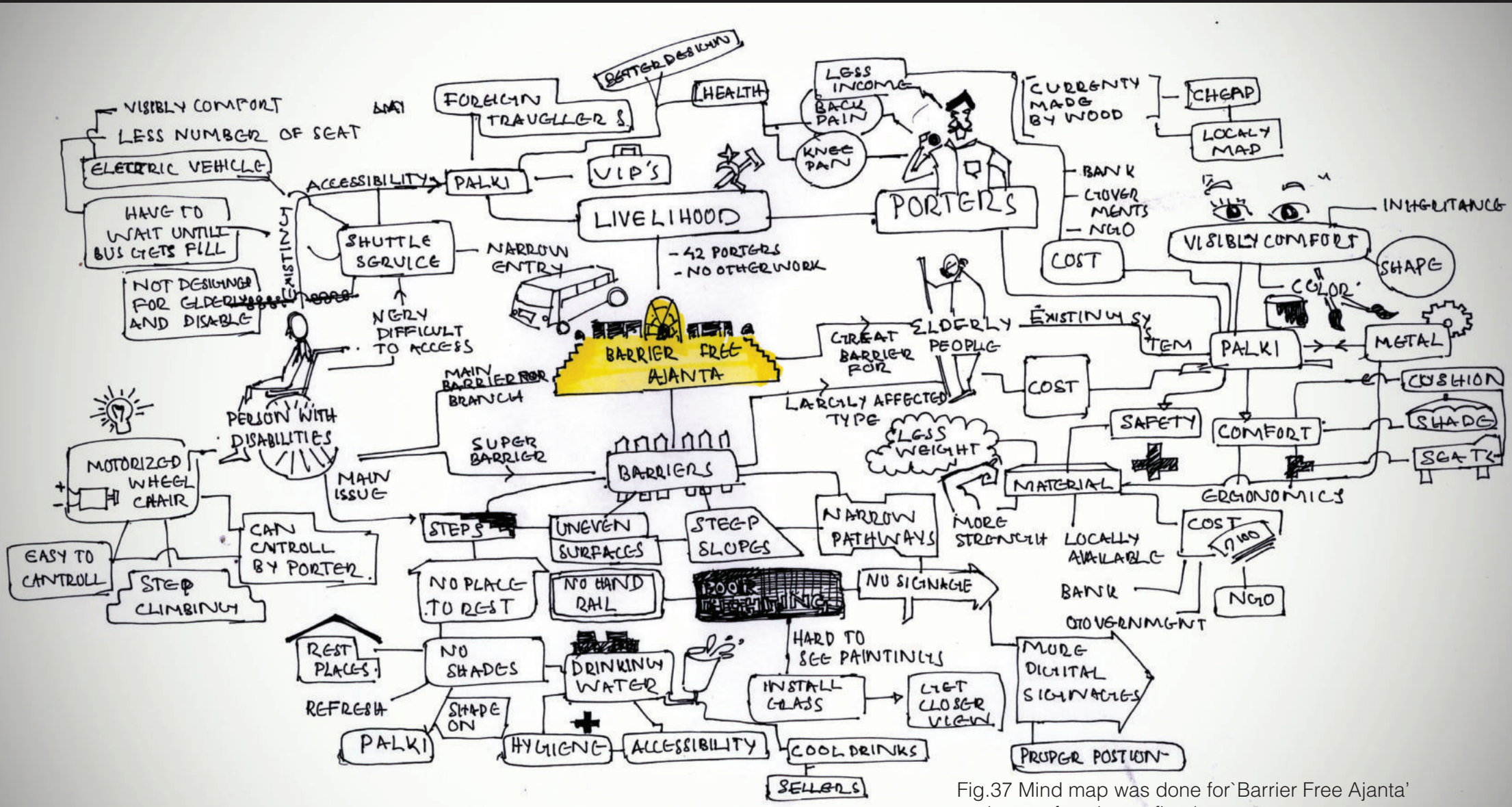


Fig.37 Mind map was done for`Barrier Free Ajanta' and area of work was fixed.

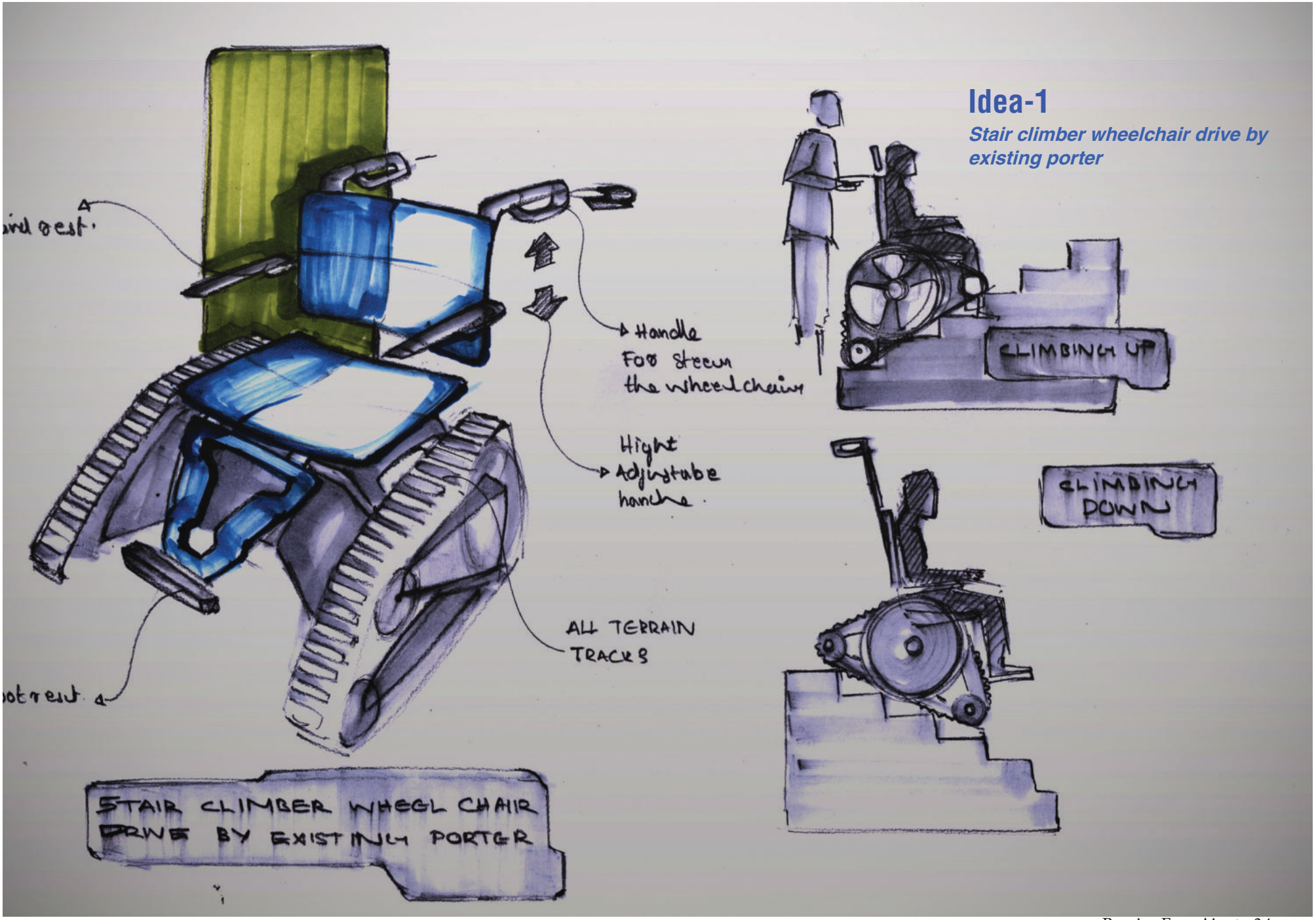
Design brief

"An idea that is developed and put into action is more important than an idea that exists only as an idea."

Buddha

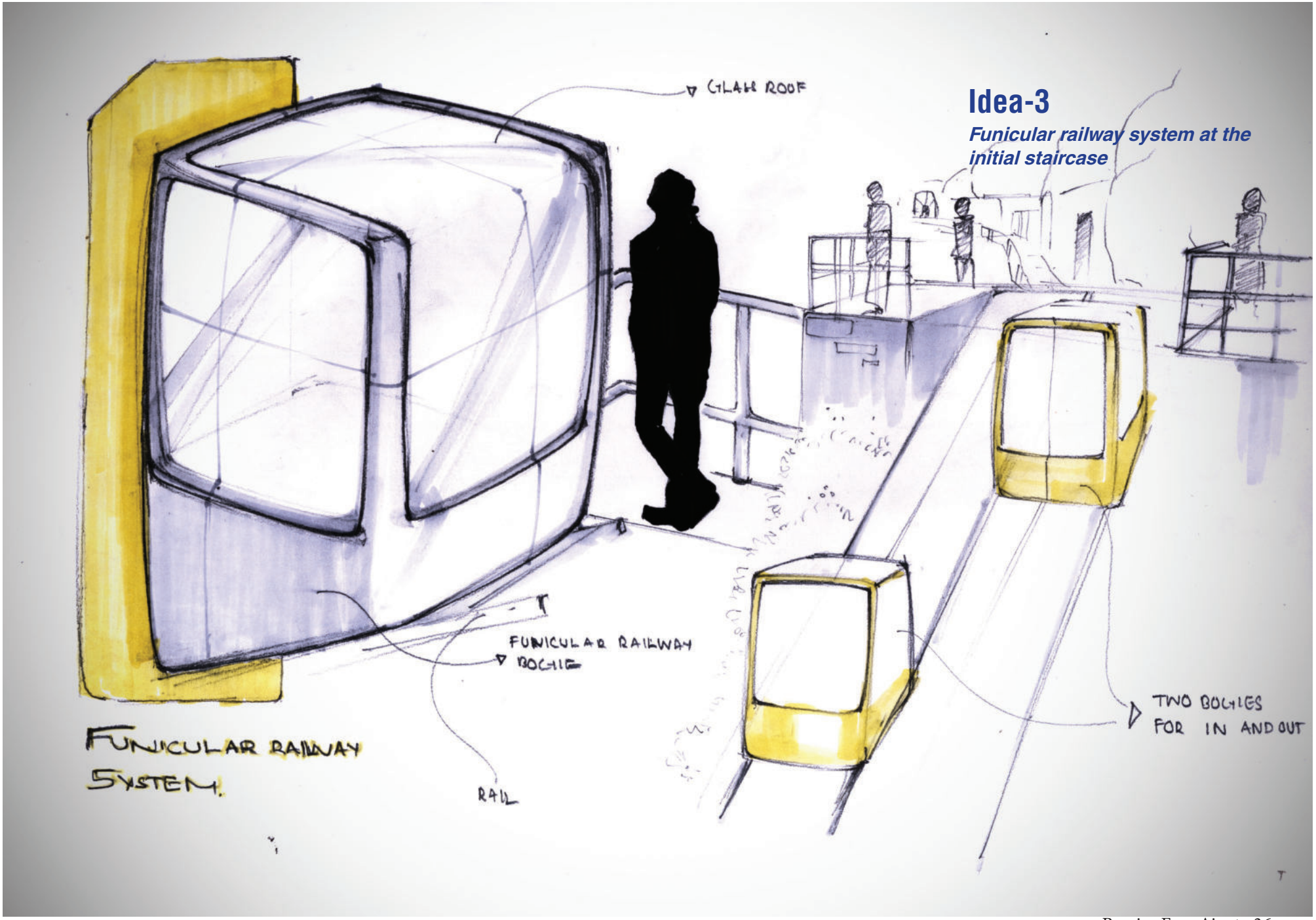
The project aims at the design and development of a transportation system within the context of Ajanta caves, a world heritage site. The proposed system should enhance the accessibility of elderly and people with disabilities without affecting the existing livelihood of palanquin porters.
The design should significantly reduce porters' efforts. It should provide more safety and comfort to both the visitors to the site and the porters. All this has to be achieved being consciously aware of Ajanta's heritage value and its unique cultural context.

Initial Ideations


Idea-1
Stair climber wheelchair drive by existing porter
Handle
For steem
the wheelchair
Hight
Adjustabe
handle
ALL TERRAIN
TRACKS
CLIMBING UP
CLIMBING
DOWN
STAIR CLIMBER WHEEL CHAIR
DRIVE BY EXISTING PORTER

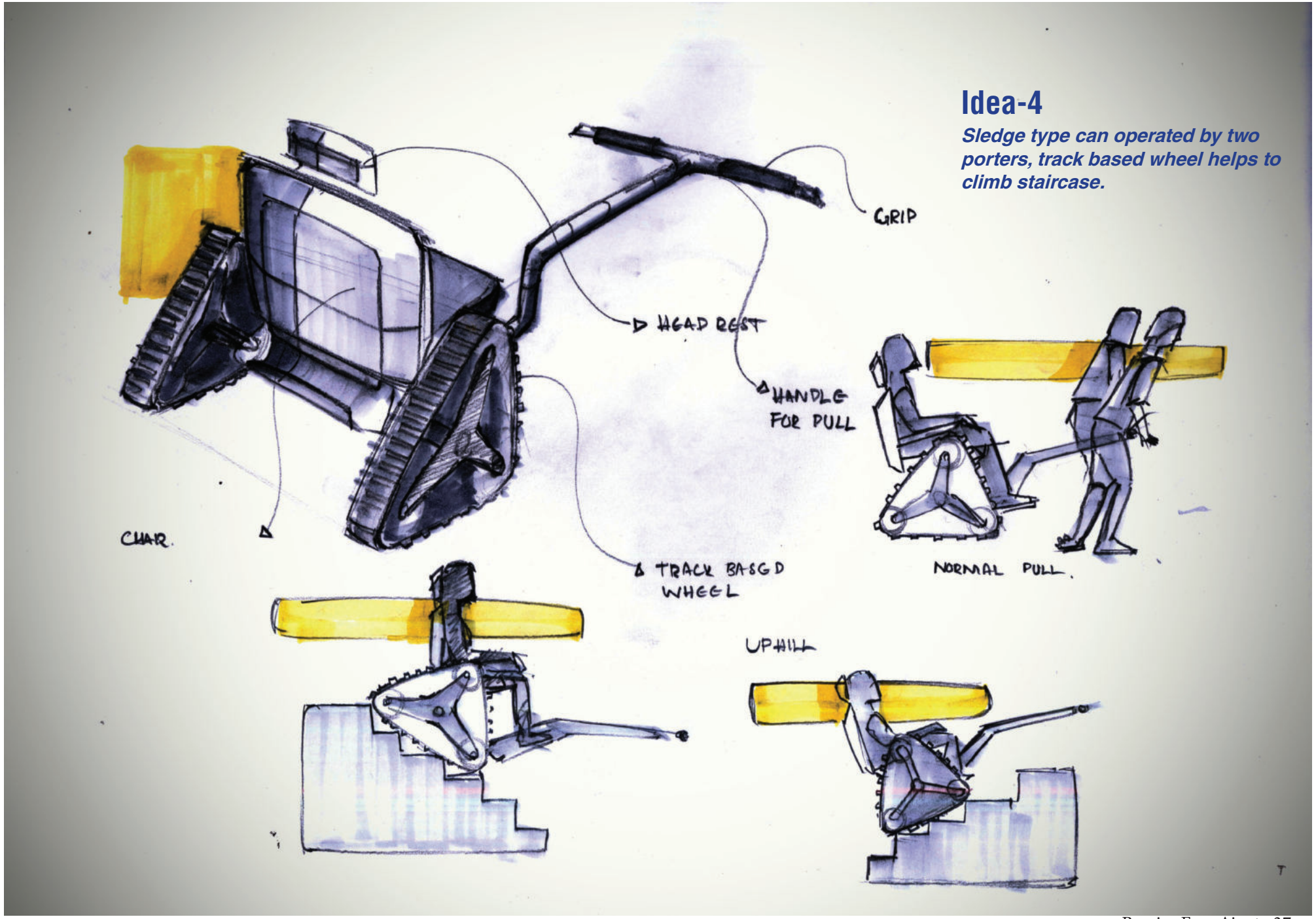
Idea-2

Ropeway system from upper view point



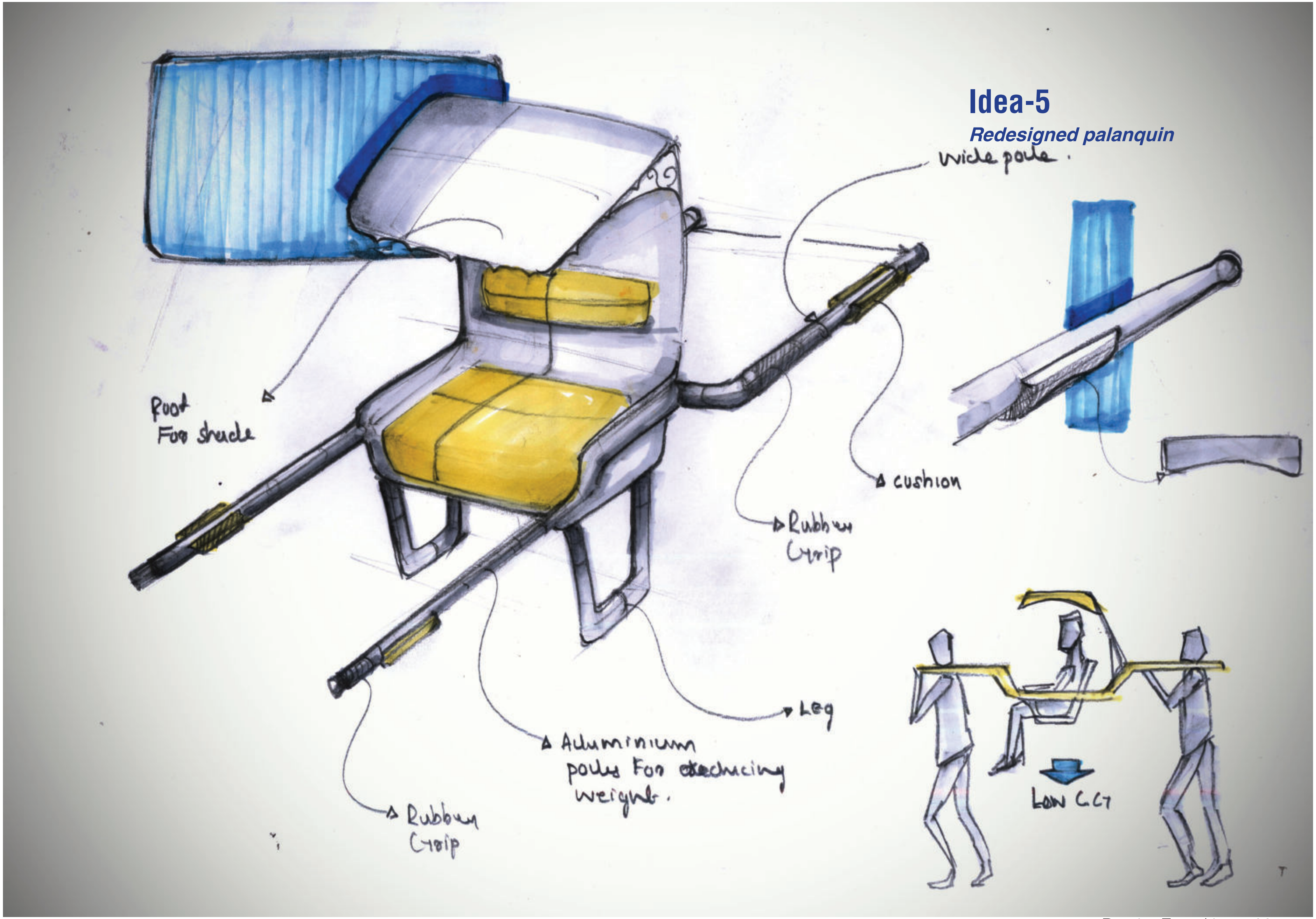
Idea-3

Funicular railway system at the initial staircase


Idea-4
Sledge type can operated by two porters, track based wheel helps to climb staircase.
GRIP
HEAD REST
HANDLE FOR PULL
CHAIR
TRACK BASED WHEEL
NORMAL PULL
UPHILL

Idea-5

Redesigned palanquin



Stage one feedbacks

Stage one presentation was held on 7th March 2014 and the feedback from the jury and other faculty members were:

- Go on with the palanquin system redesign
- Design palanquin by considering all heritage and pilgrim centres in India apart from Ajanta
- Add more palanquin centered research
- Understand user aspirations
- Design walkway hand rail for Ajanta
- Check wheelchair services in Swami Vivekananda heritage centre

Image Ref:http://goo.gl/IrM9QI

Revised Design Brief

Based on the research along with its inferences and feedback from the jury members, I prepared a revised design brief.

Design and development a better palanquin system to enhance Ajanta tourisms by using product design strategy which would,

Reduce porters' efforts
More safety to palanquin users
More visually strong and comfortable
More easy to get in and out from palanquin
Easy to transport through walk way
Keep identity of India and Ajanta
Aesthetically pleasing

Elephanta caves; A parallel study

- The Elephanta Caves are a network of sculpted caves located on Elephanta Island, or Gharapuri in Mumbai Harbour, 10 kilometres to the east of the city of Mumbai in the Indian state of Maharashtra.
- Two groups of caves—the first is a large group of five Hindu caves, the second, a smaller group of two Buddhist caves.
- The rock cut architecture of the caves has been dated to between the 5th and 8th centuries
- The Elephanta Caves have been designated a UNESCO World Heritage Site since 1987 to preserve the artwork and the monument is currently preserved by the Archaeological Survey of India (ASI).

Ref: http://goo.gl/SpMIlq

Source: Google map

Fig.36 Palanquin

Palanquin system in Elephanta Caves

Palanquin system in Elephanta is bigger in size than Ajanta. They are actually made by the wood and bamboo as same as the Ajanta Palanquin. In Ajanta, poles of the palanquins are same in length, but the front ones are longer than rear ones in Elephanta. The visitors are very rarely using the palanquin in Elephanta caves.

Fig.37 Palanquin

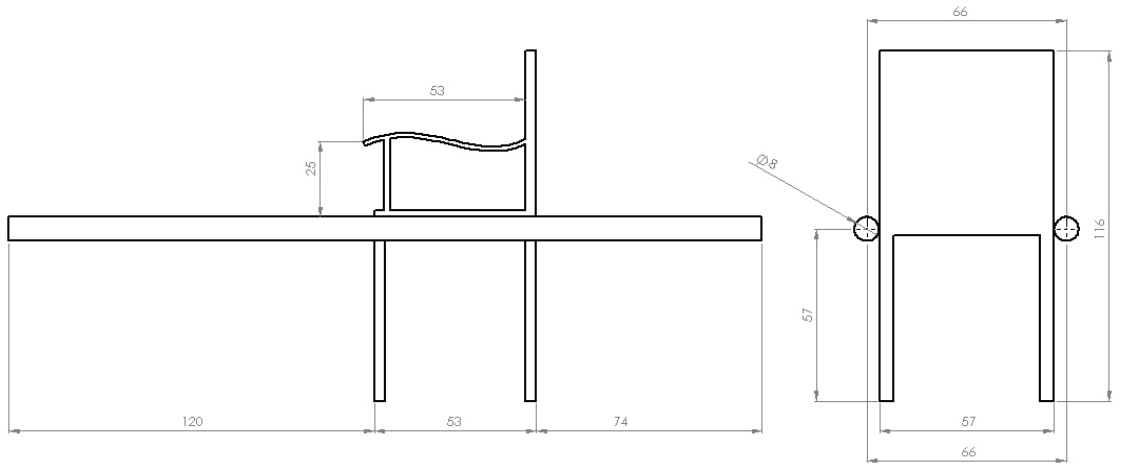
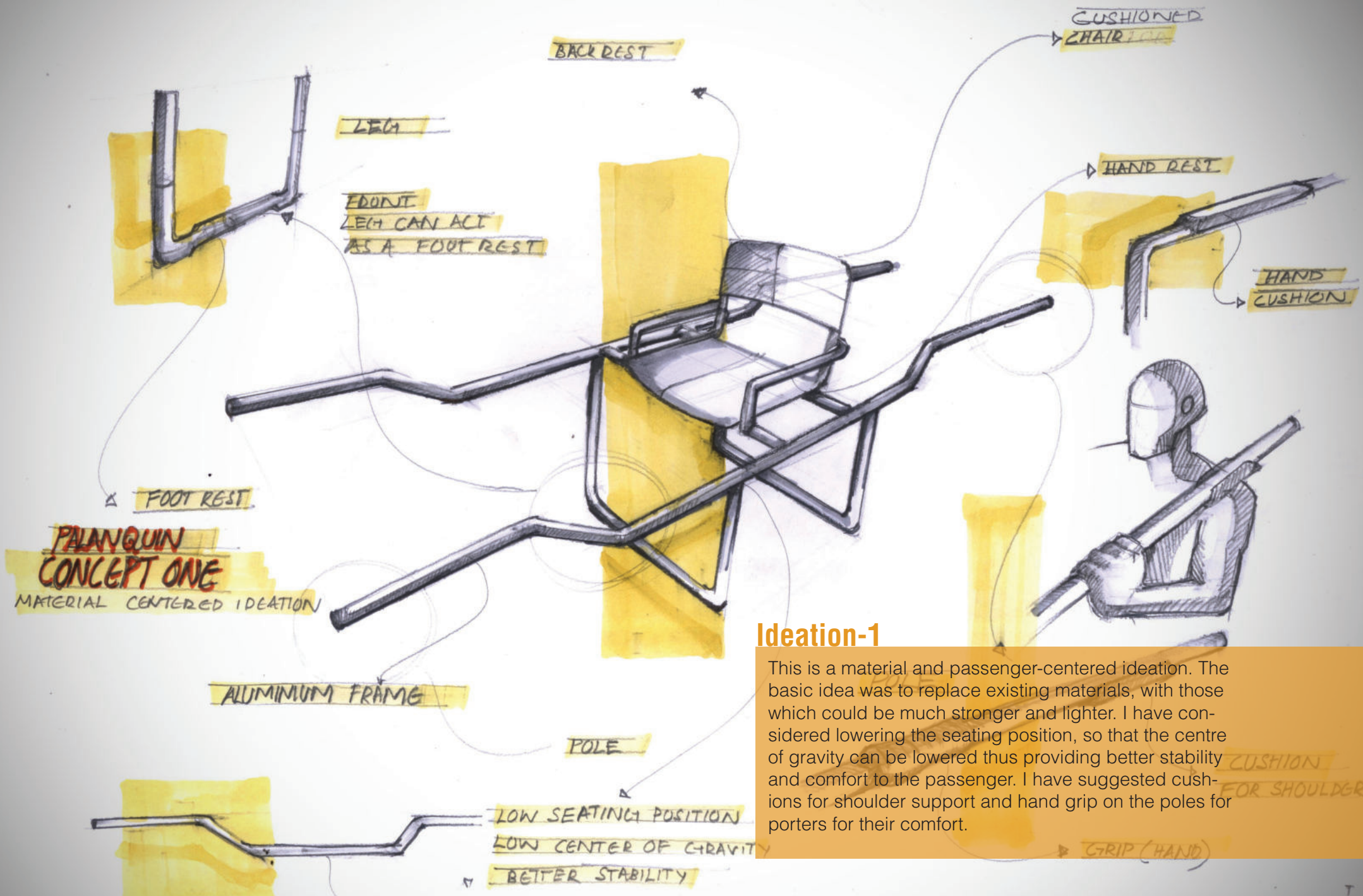


Fig.38 Palanquin dimension

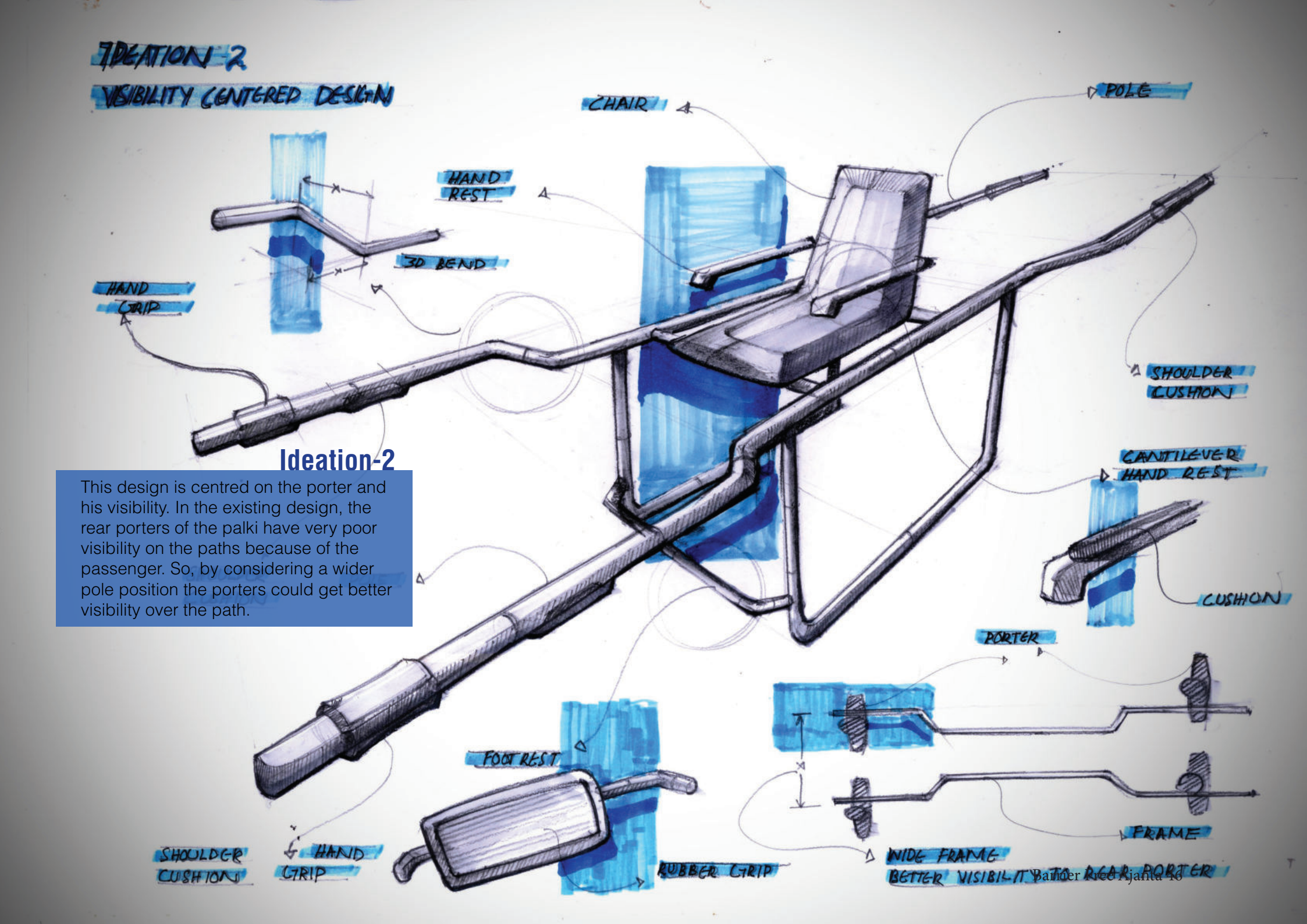
Detailed ideations

Idea Mapping



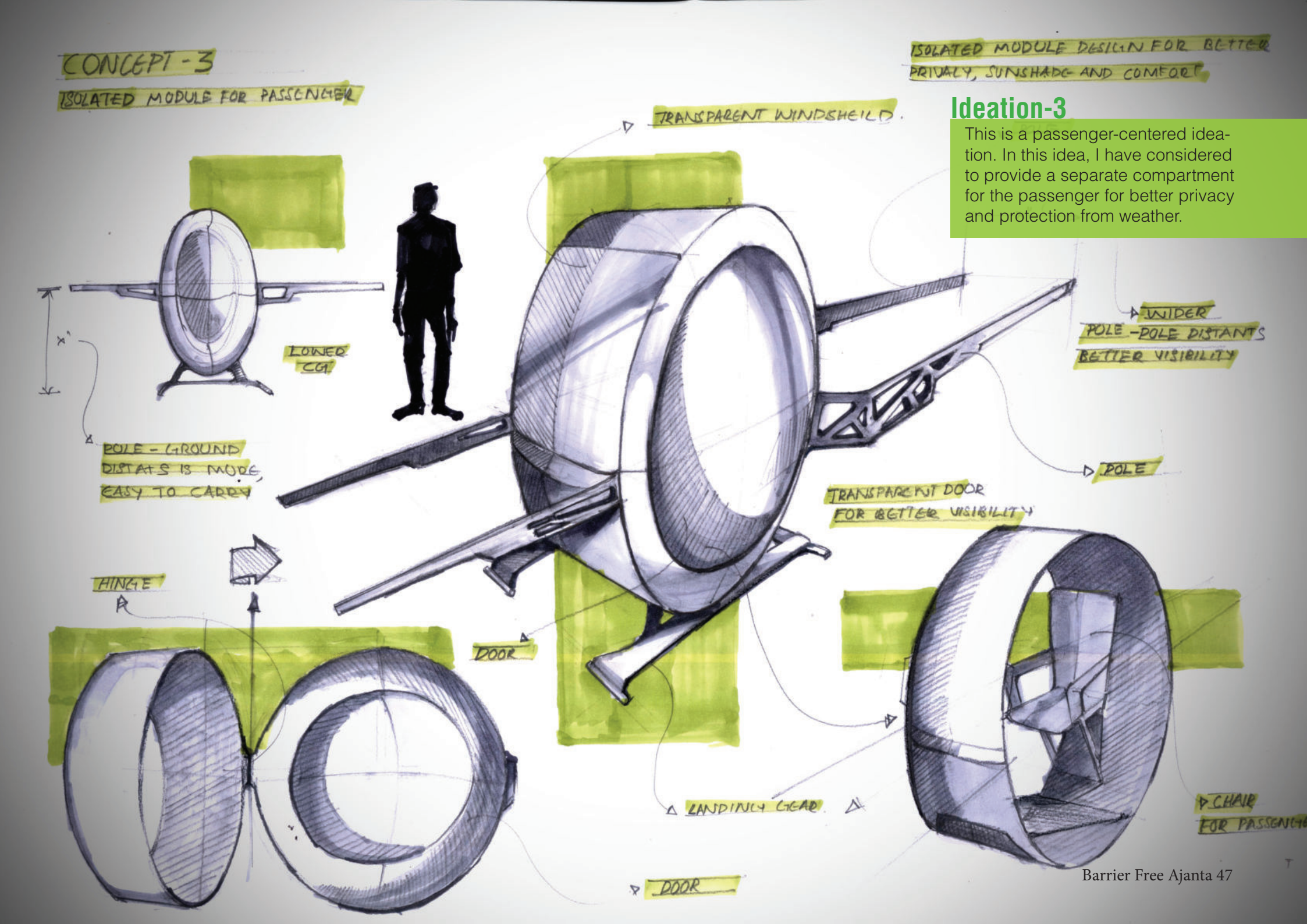
Ideation-1

This is a material and passenger-centered ideation. The basic idea was to replace existing materials, with those which could be much stronger and lighter. I have considered lowering the seating position, so that the centre of gravity can be lowered thus providing better stability and comfort to the passenger. I have suggested cushions for shoulder support and hand grip on the poles for porters for their comfort.



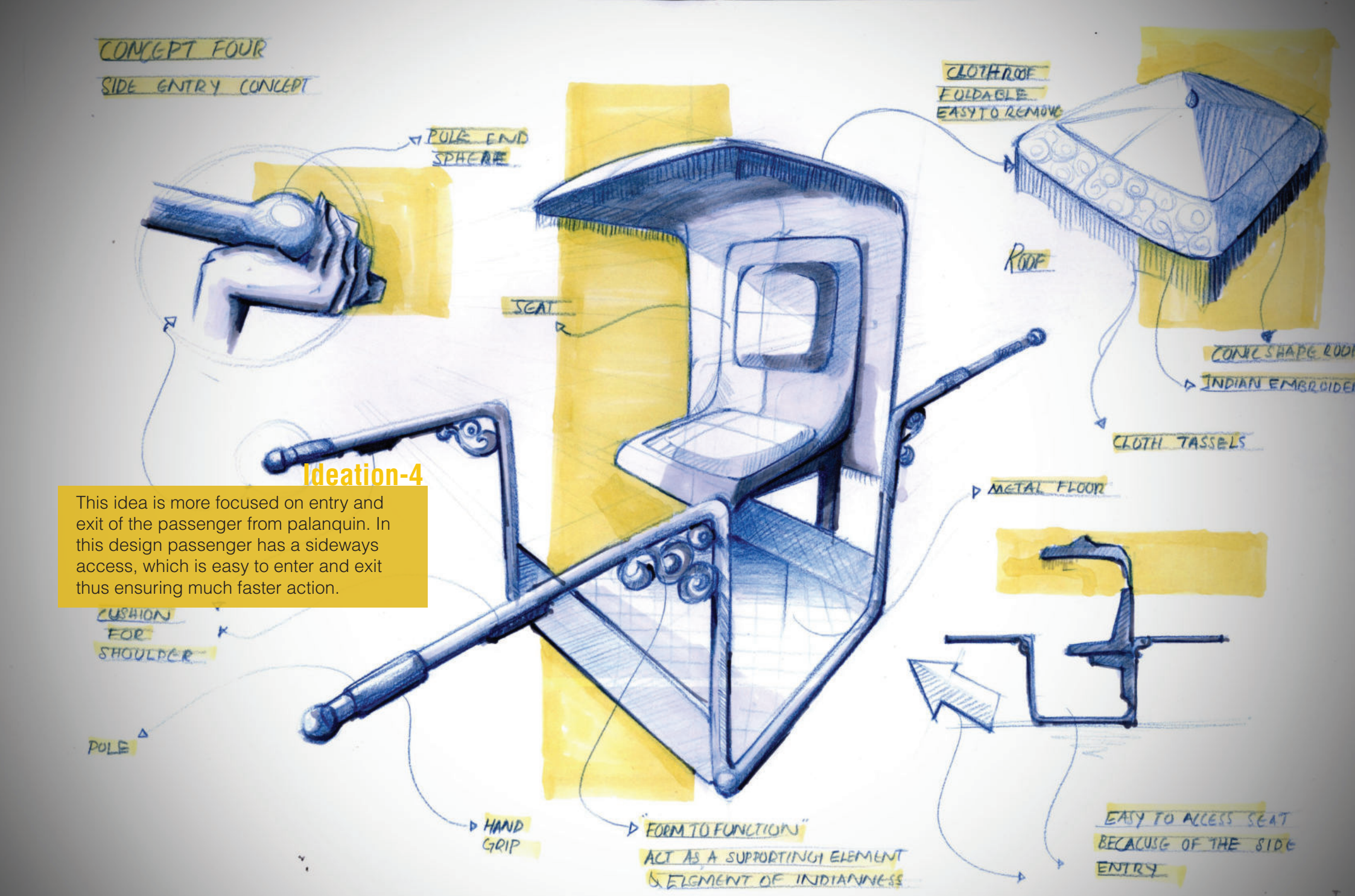
Ideation-2

This design is centred on the porter and his visibility. In the existing design, the rear porters of the palki have very poor visibility on the paths because of the passenger. So, by considering a wider pole position the porters could get better visibility over the path.



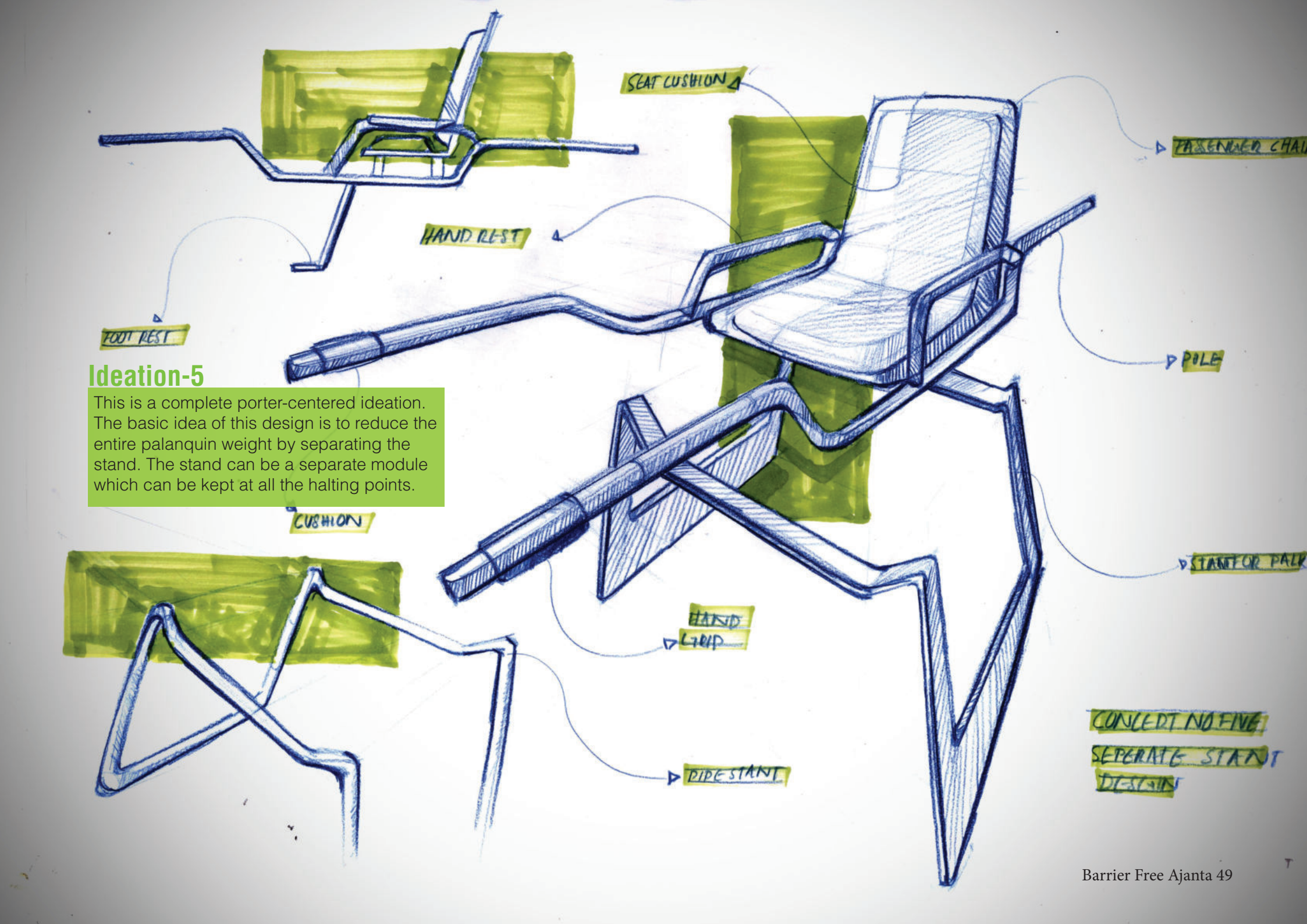
Ideation-3

This is a passenger-centered ideation. In this idea, I have considered to provide a separate compartment for the passenger for better privacy and protection from weather.



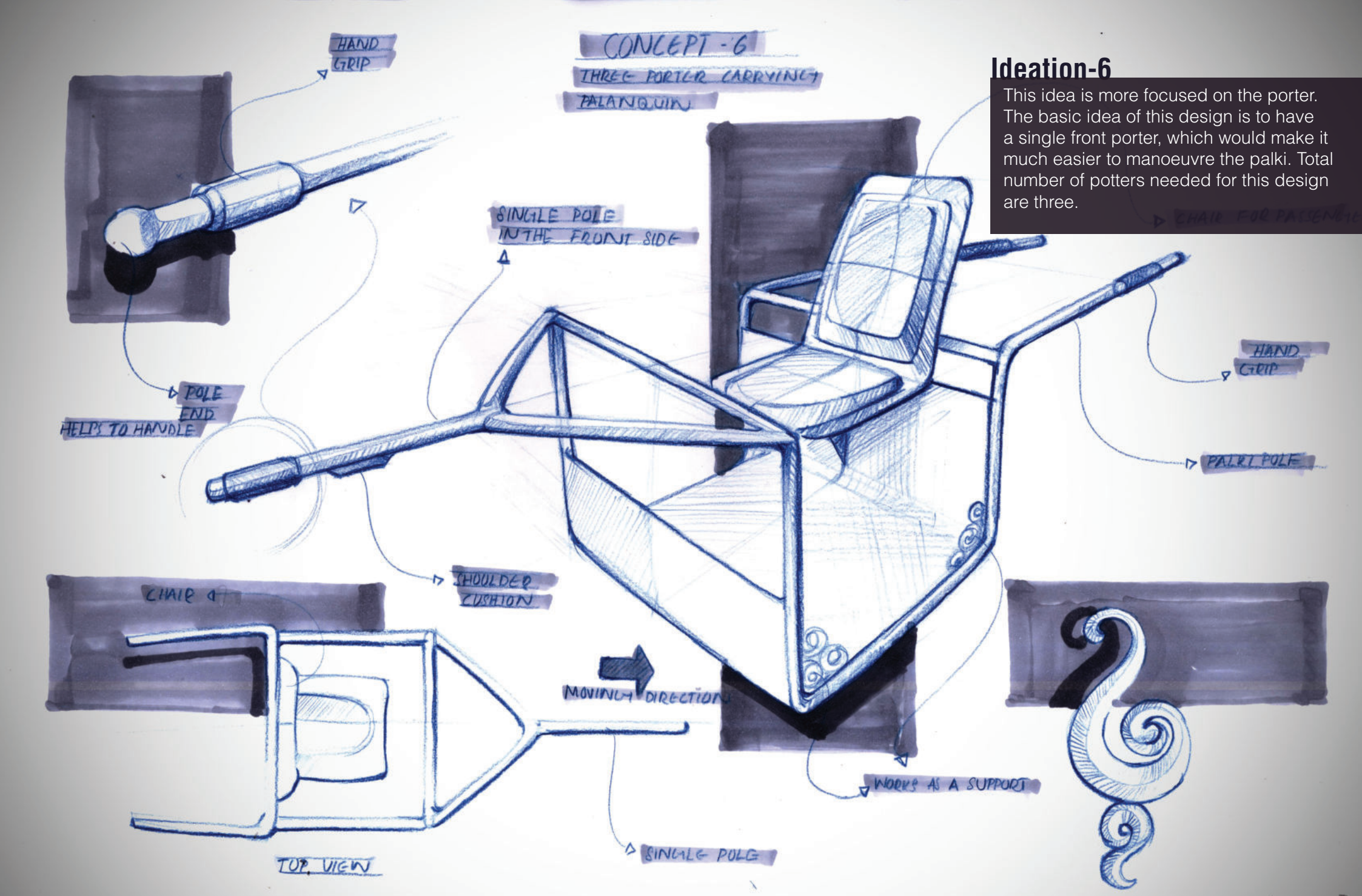
Ideation-4

This idea is more focused on entry and exit of the passenger from palanquin. In this design passenger has a sideways access, which is easy to enter and exit thus ensuring much faster action.



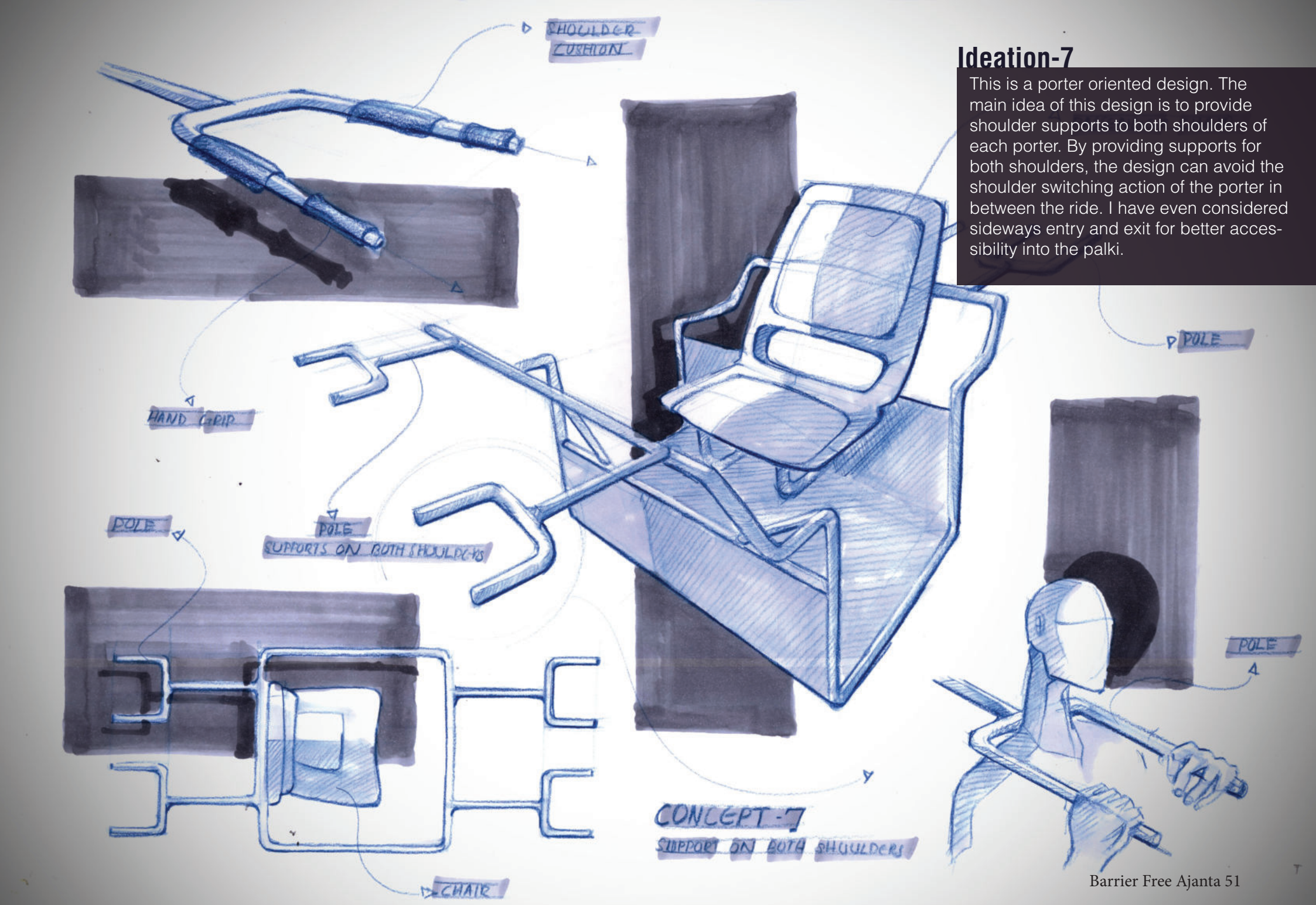
Ideation-5

This is a complete porter-centered ideation. The basic idea of this design is to reduce the entire palanquin weight by separating the stand. The stand can be a separate module which can be kept at all the halting points.



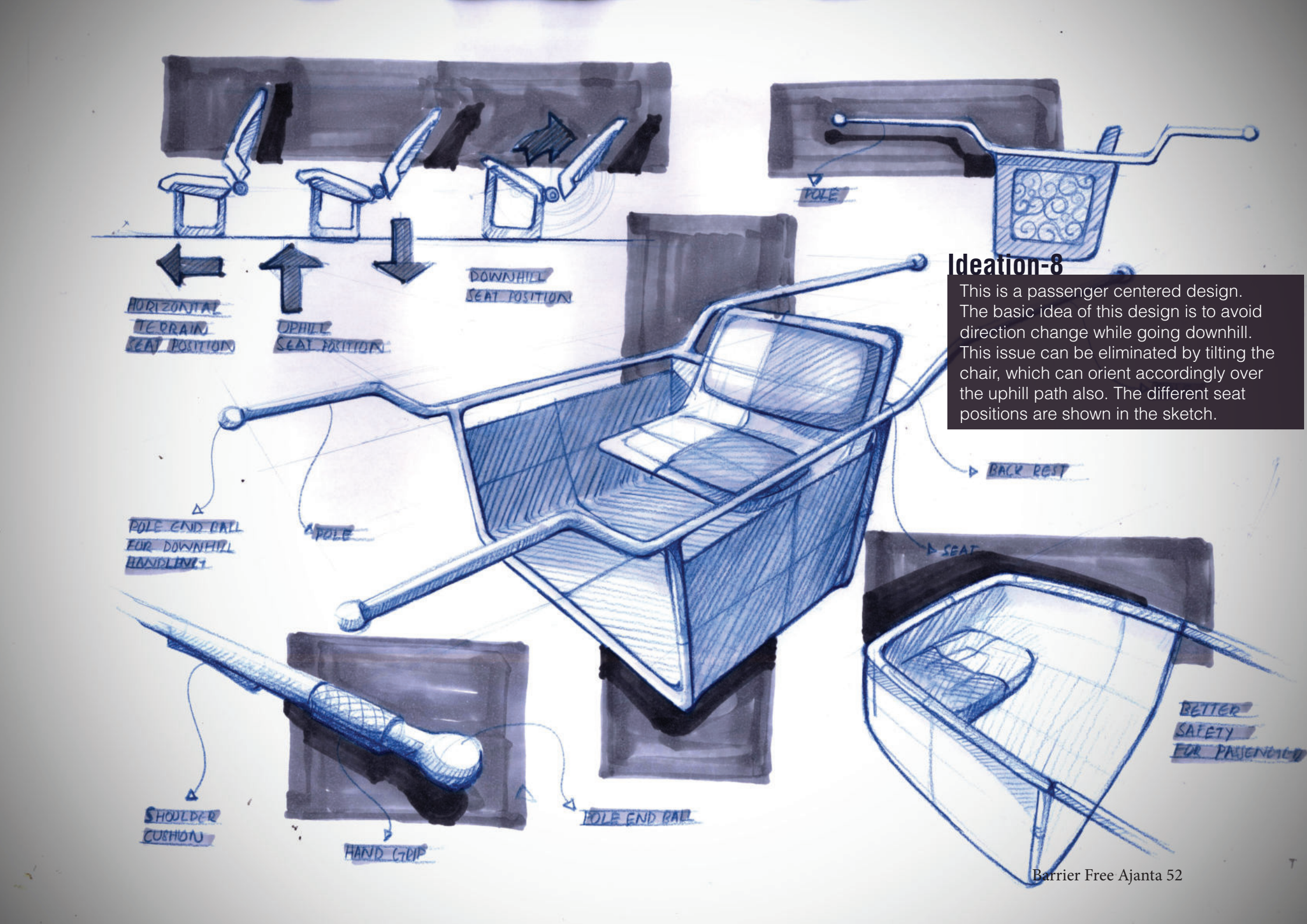
Ideation-6

This idea is more focused on the porter. The basic idea of this design is to have a single front porter, which would make it much easier to manoeuvre the palki. Total number of potters needed for this design are three.



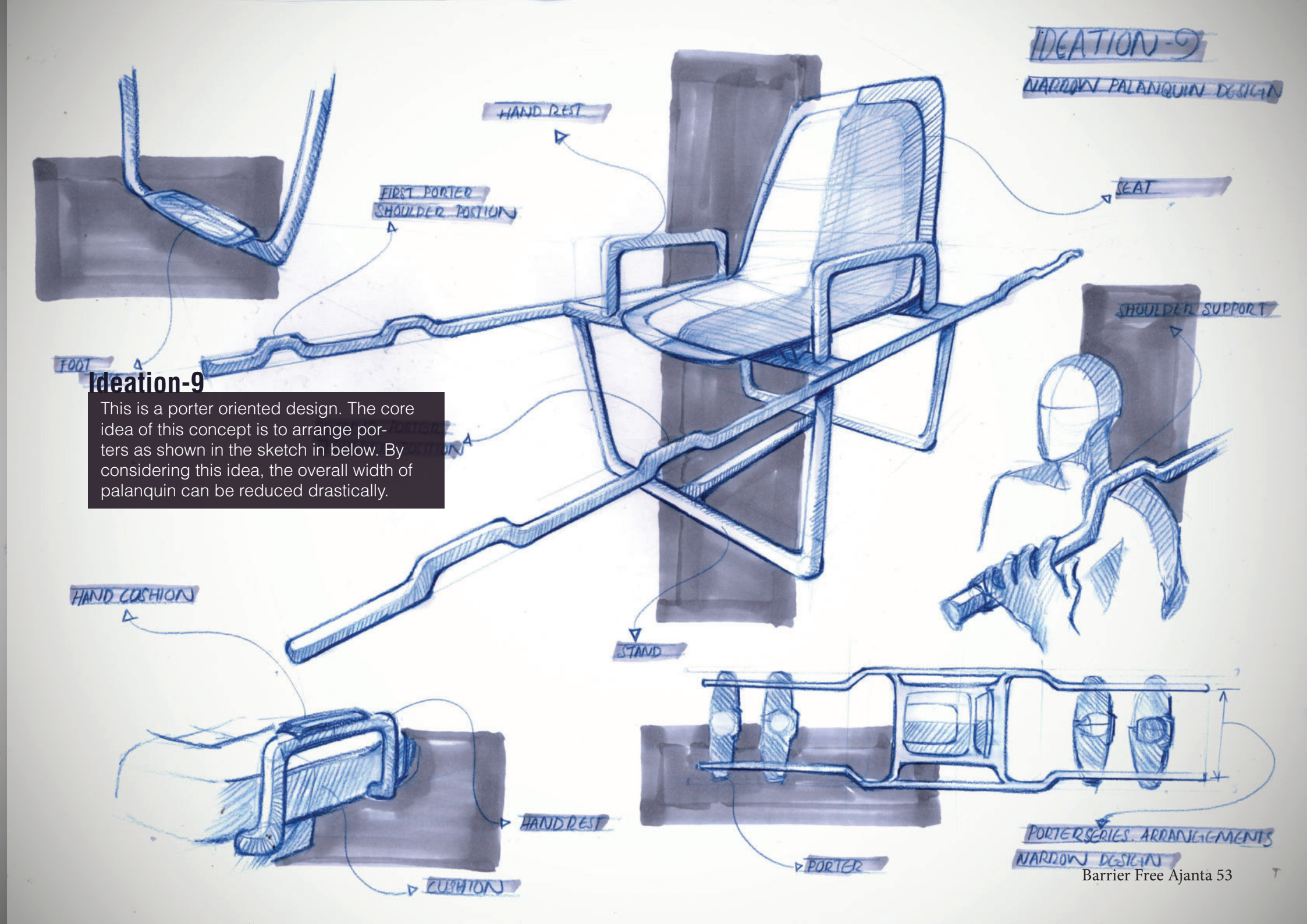
Ideation-7

This is a porter oriented design. The main idea of this design is to provide shoulder supports to both shoulders of each porter. By providing supports for both shoulders, the design can avoid the shoulder switching action of the porter in between the ride. I have even considered sideways entry and exit for better accessibility into the palki.



Ideation-8

This is a passenger centered design. The basic idea of this design is to avoid direction change while going downhill. This issue can be eliminated by tilting the chair, which can orient accordingly over the uphill path also. The different seat positions are shown in the sketch.

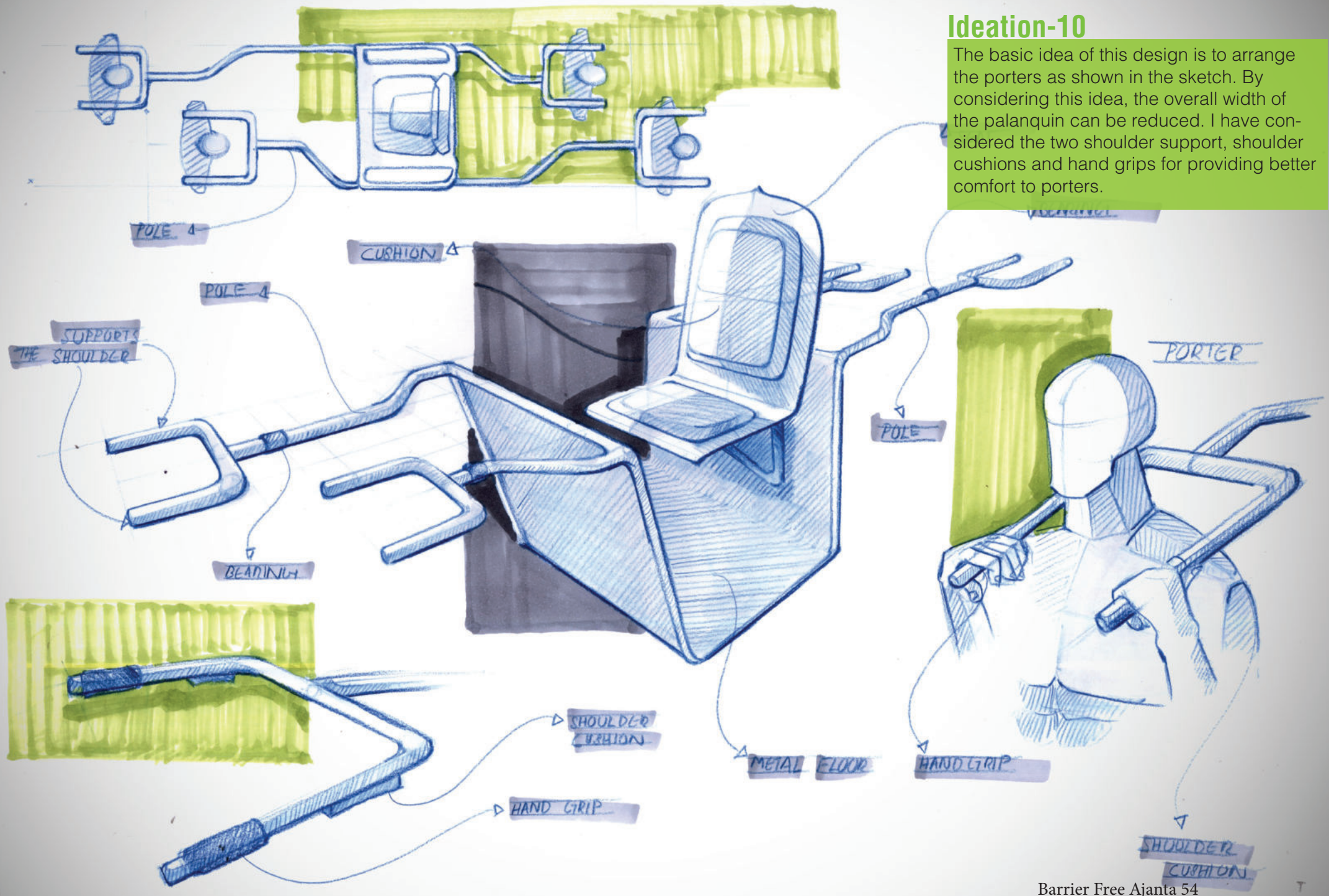


Ideation-9

This is a porter oriented design. The core idea of this concept is to arrange porters as shown in the sketch in below. By considering this idea, the overall width of palanquin can be reduced drastically.

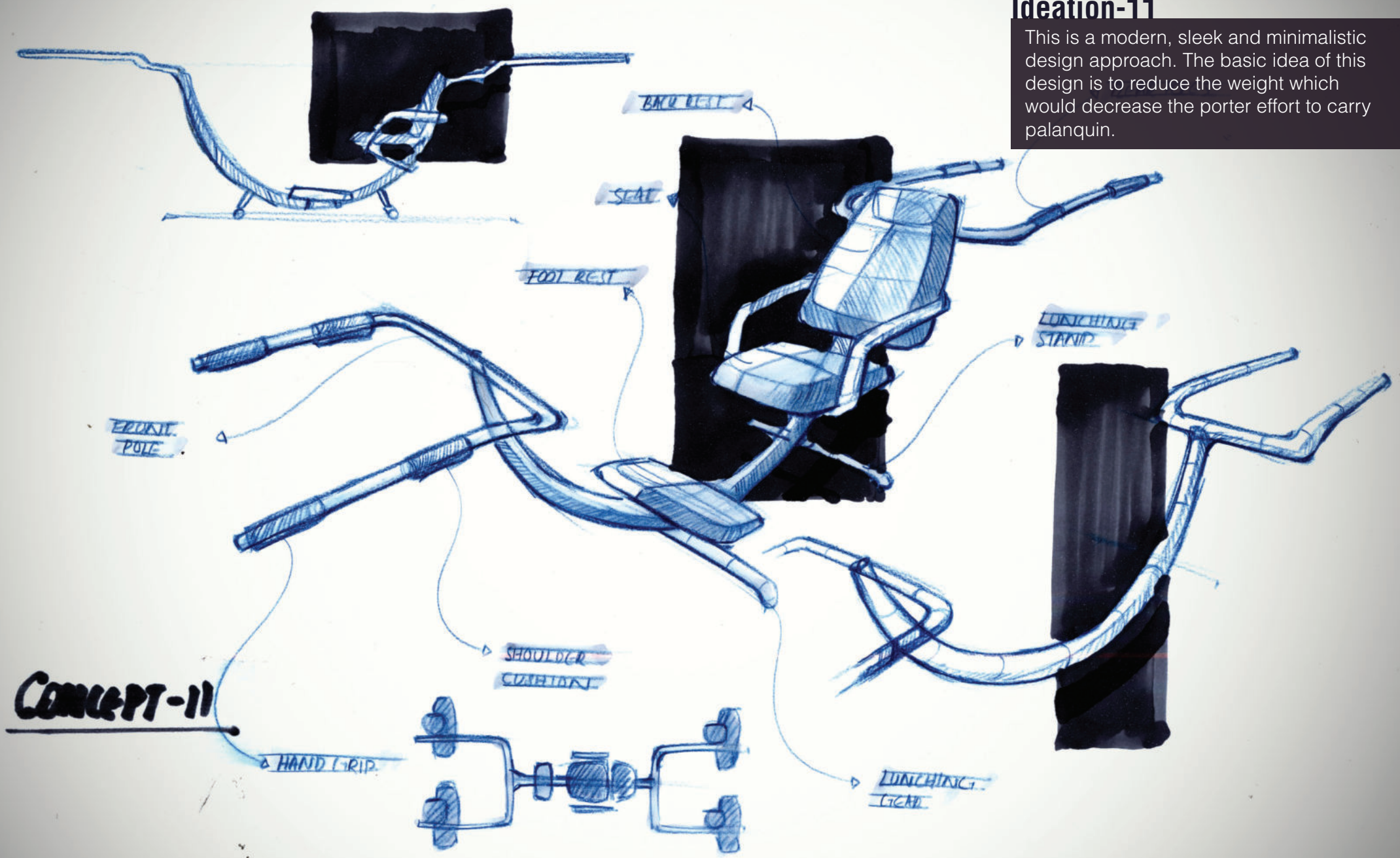
Ideation-10

The basic idea of this design is to arrange the porters as shown in the sketch. By considering this idea, the overall width of the palanquin can be reduced. I have considered the two shoulder support, shoulder cushions and hand grips for providing better comfort to porters.

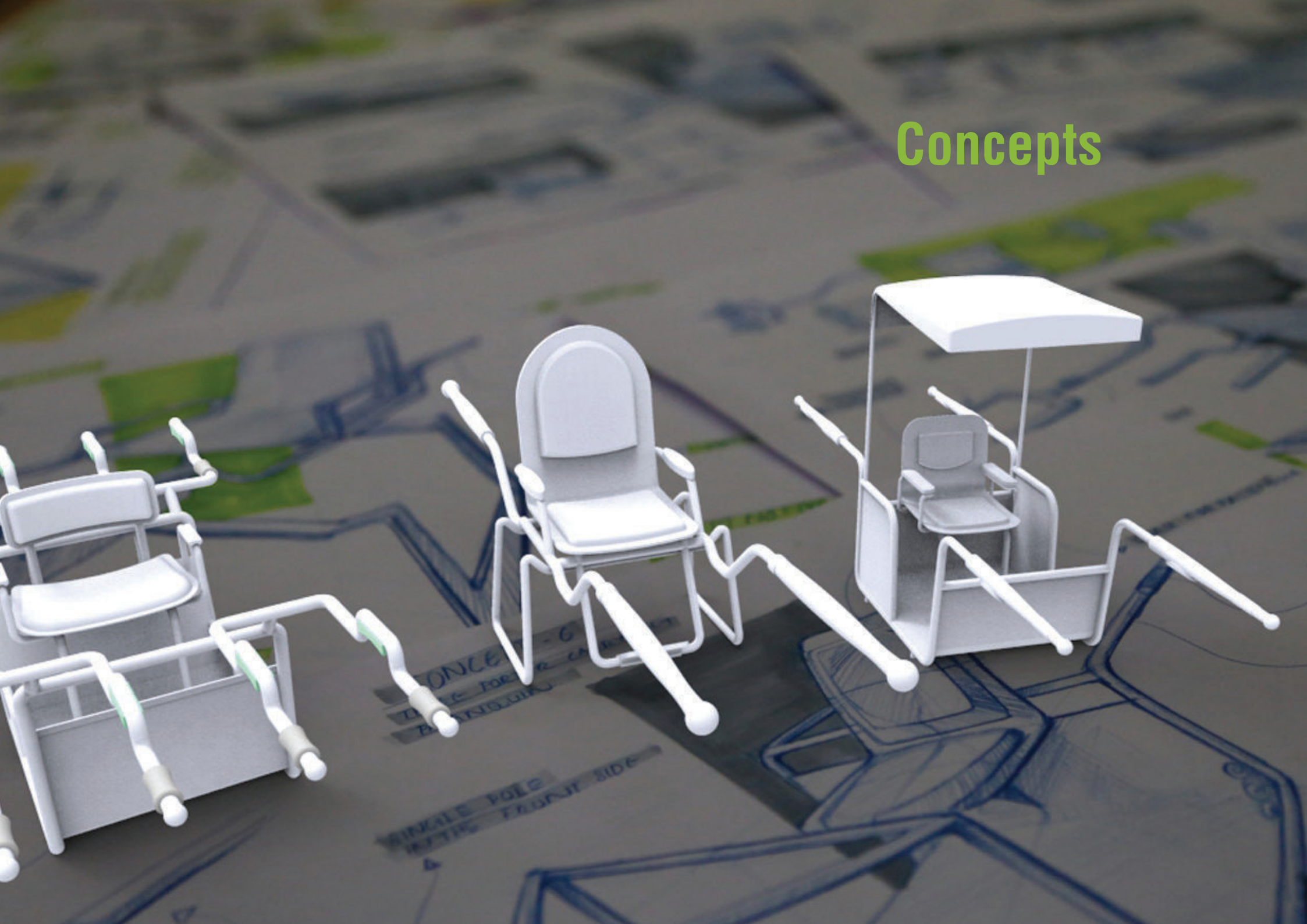


Ideation-11

This is a modern, sleek and minimalistic design approach. The basic idea of this design is to reduce the weight which would decrease the porter effort to carry palanquin.

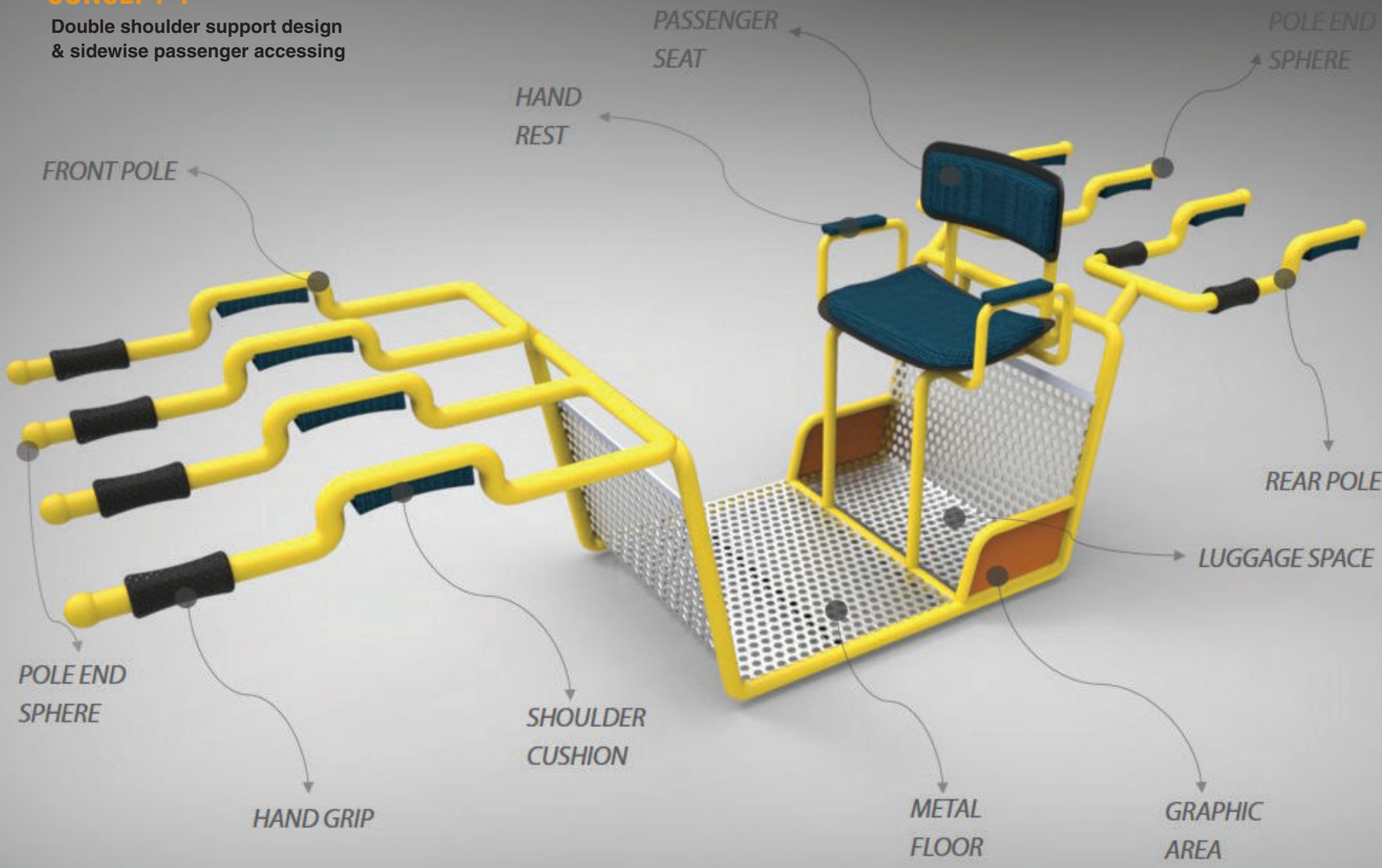


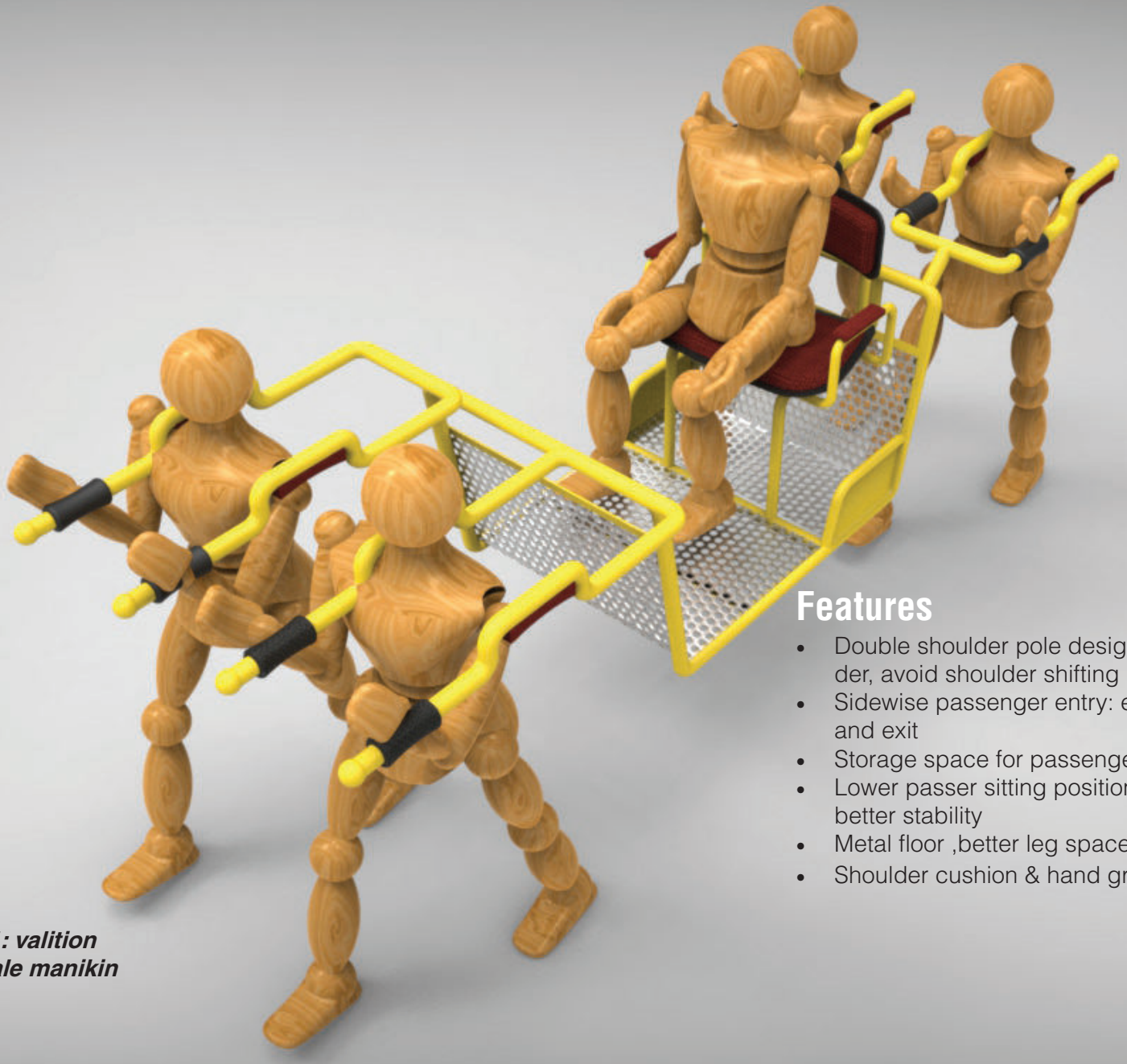
Concepts



CONCEPT-1

Double shoulder support design
& sidewise passenger accessing





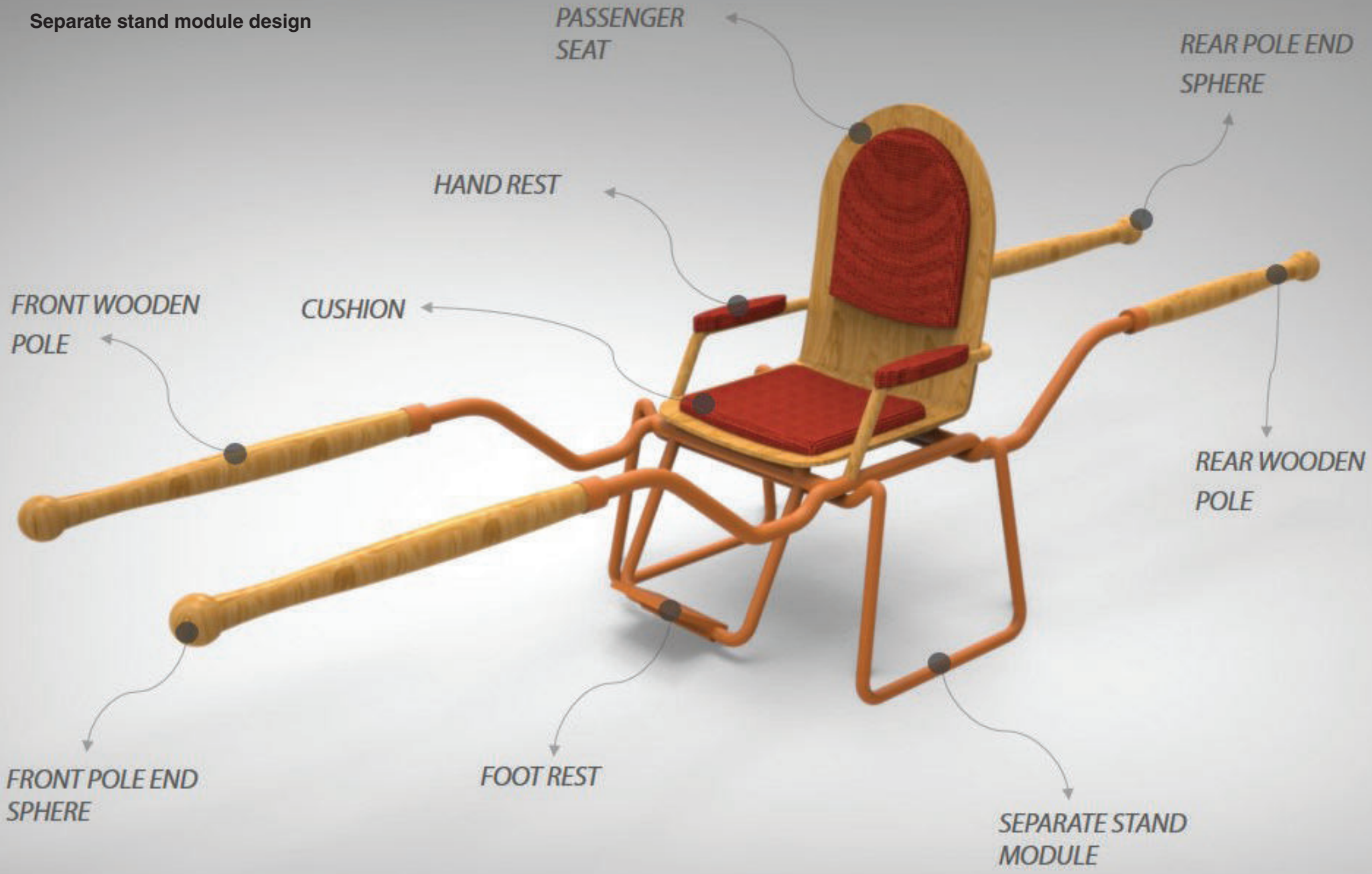
CONCEPT-1: valition with full scale manikin

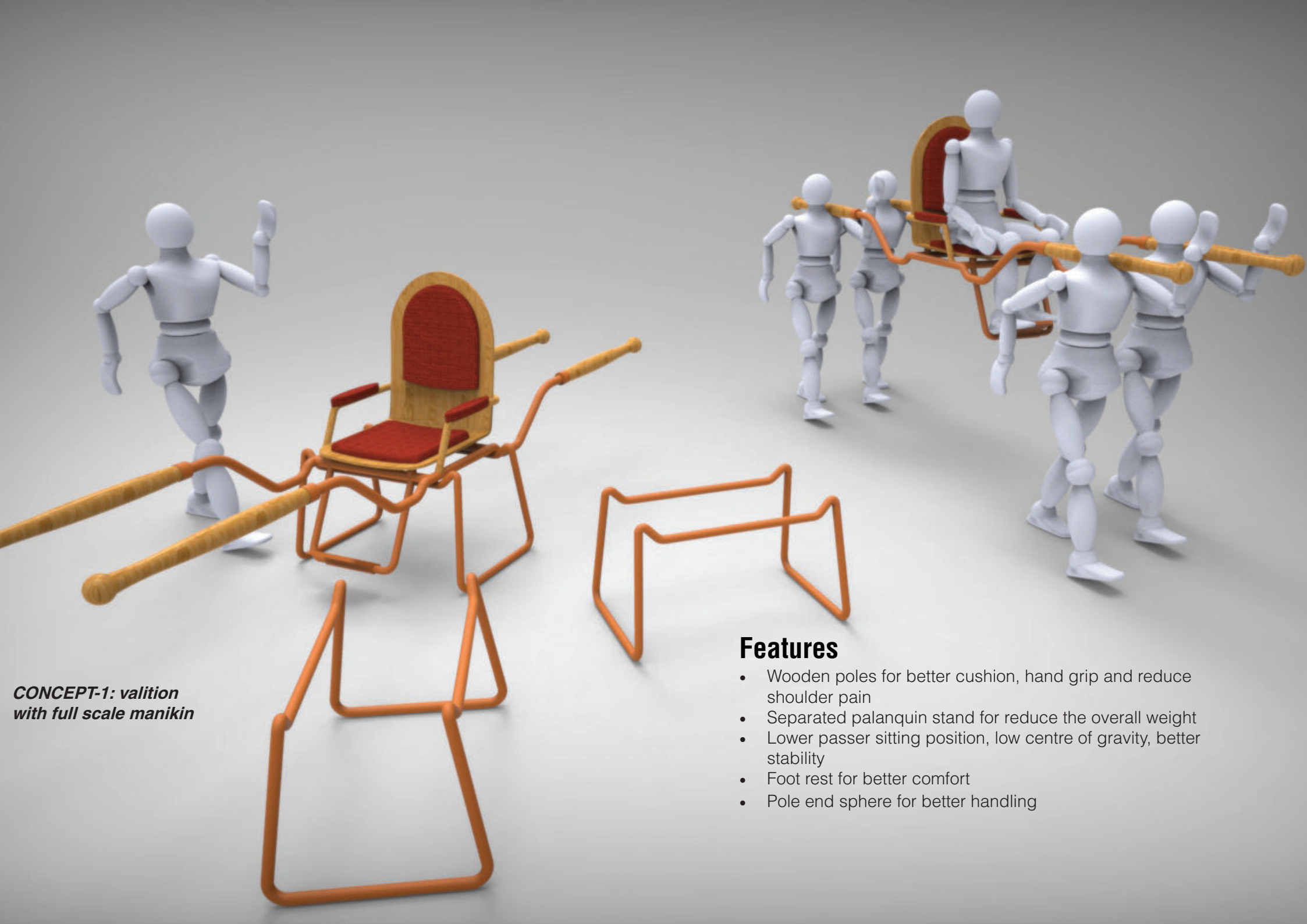
Features

- Double shoulder pole design: supports both shoulder, avoid shoulder shifting
- Sidewise passenger entry: easy and fast to enter and exit
- Storage space for passenger luggage
- Lower passer sitting position, low centre of gravity, better stability
- Metal floor ,better leg space
- Shoulder cushion & hand grip

CONCEPT-2

Separate stand module design





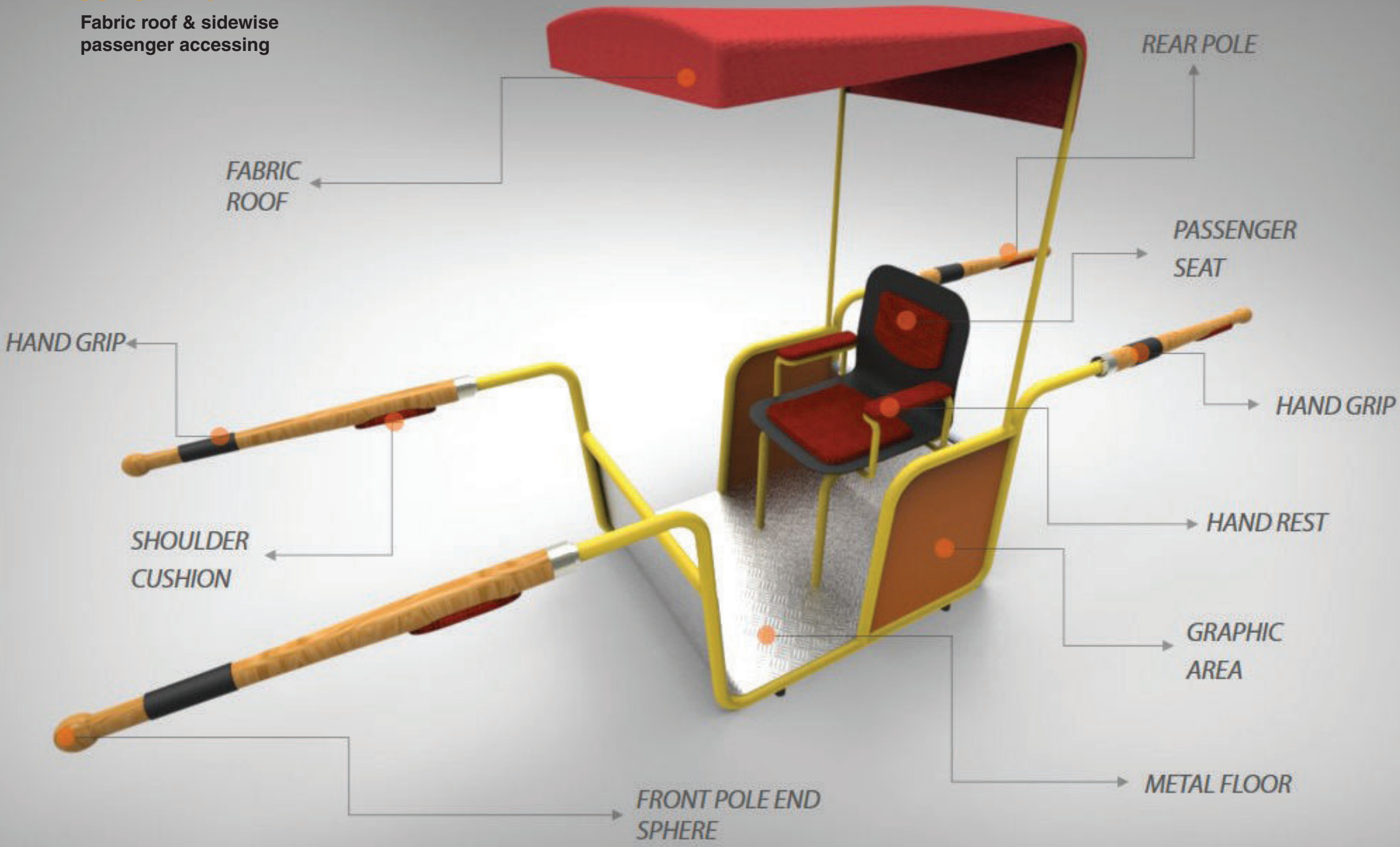
CONCEPT-1: valition with full scale manikin

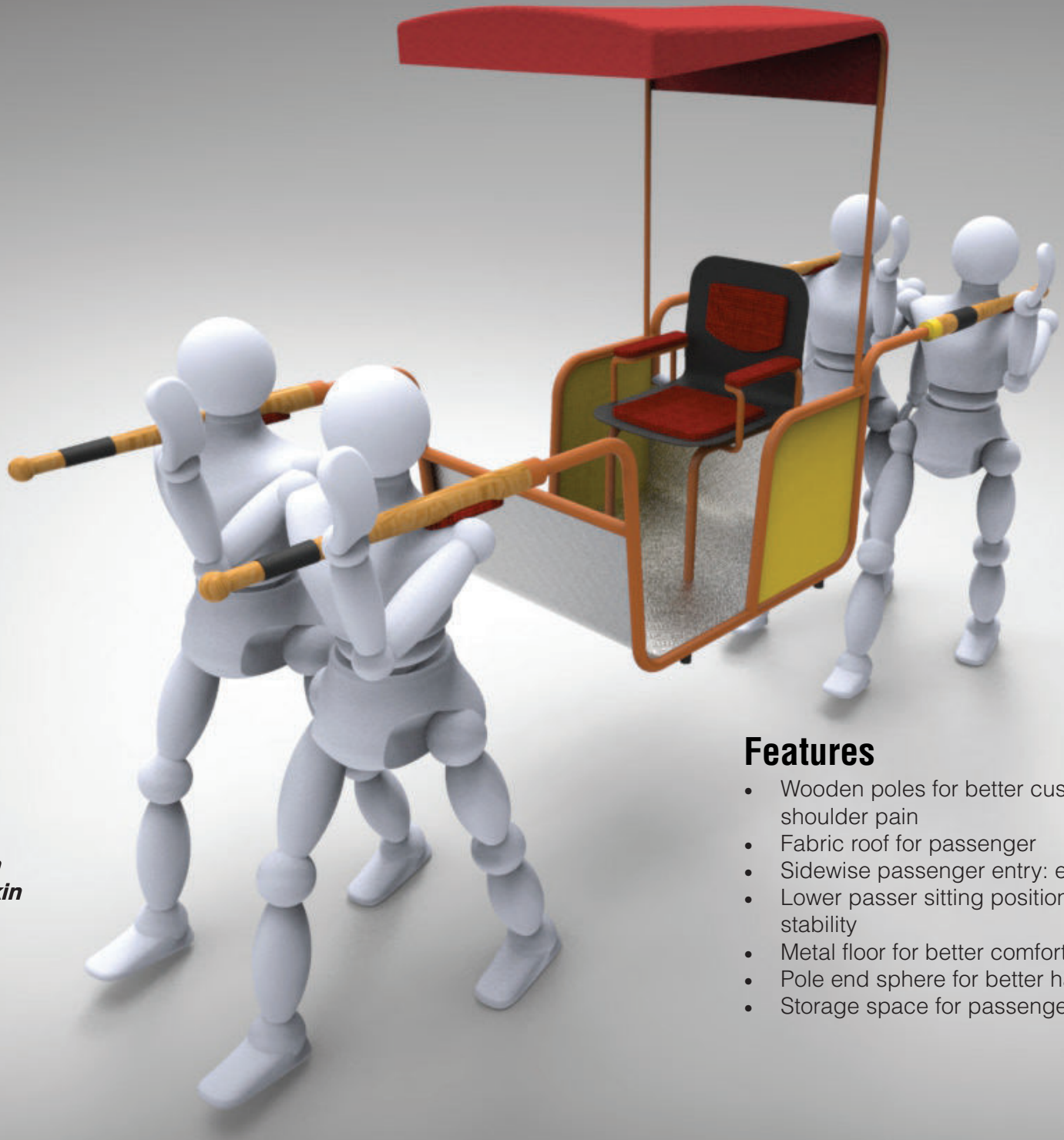
Features

- Wooden poles for better cushion, hand grip and reduce shoulder pain
- Separated palanquin stand for reduce the overall weight
- Lower passer sitting position, low centre of gravity, better stability
- Foot rest for better comfort
- Pole end sphere for better handling

CONCEPT-3

Fabric roof & sidewise passenger accessing





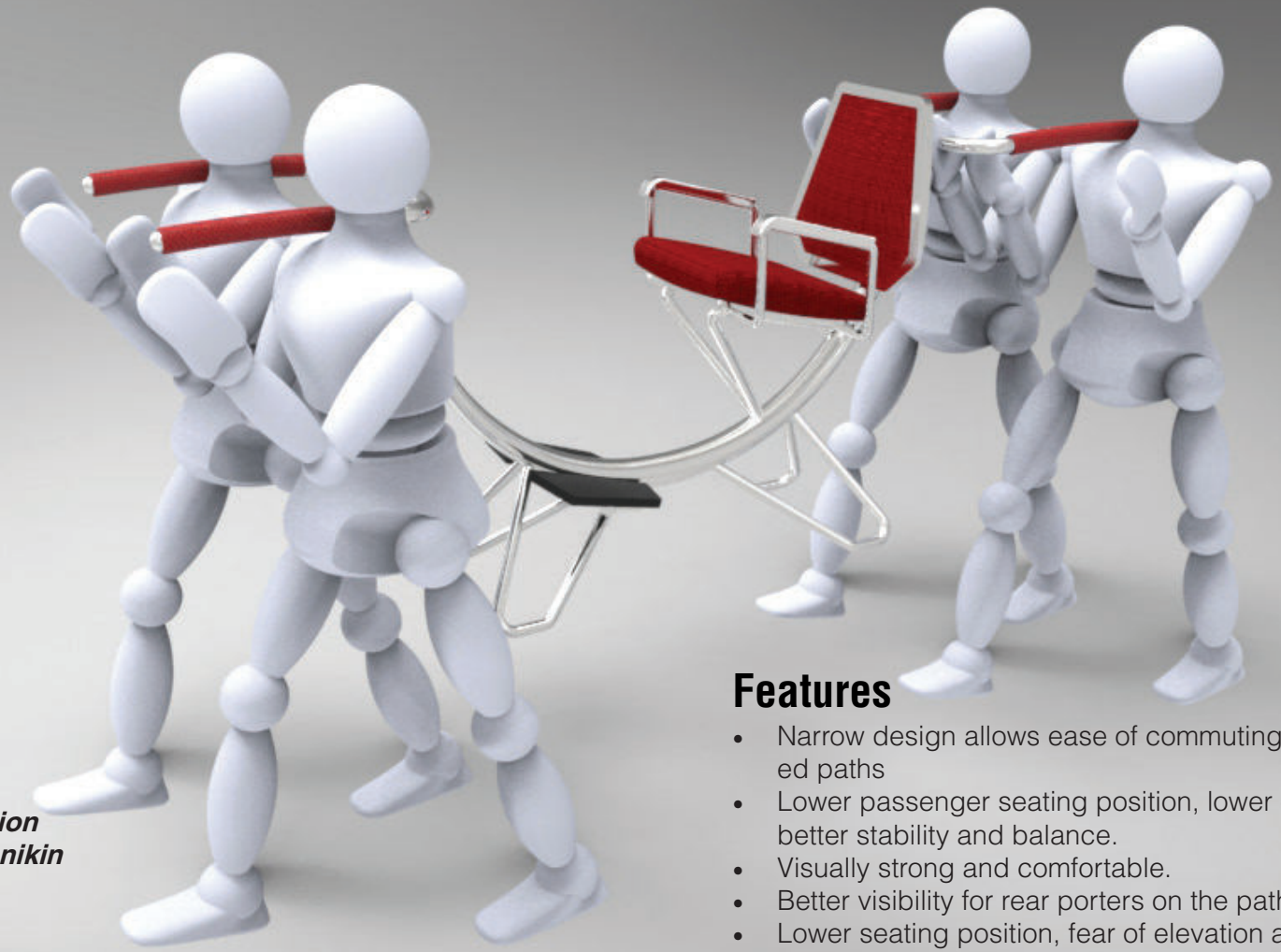
CONCEPT-1: valition with full scale manikin

Features

- Wooden poles for better cushion, hand grip and reduce shoulder pain
- Fabric roof for passenger
- Sidewise passenger entry: easy and fast to enter and exit
- Lower passer sitting position, low centre of gravity, better stability
- Metal floor for better comfort
- Pole end sphere for better handling
- Storage space for passenger luggage

CONCEPT-4

Modern, sleek and minimalistic design approach

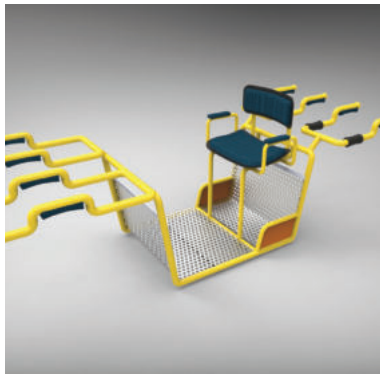
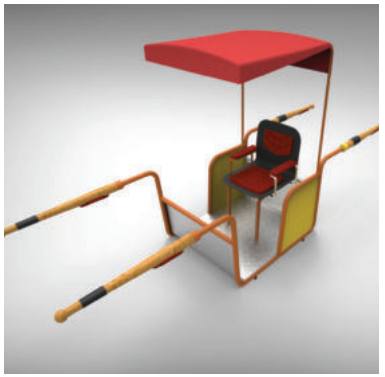


CONCEPT-1: valition with full scale manikin

Features

- Narrow design allows ease of commuting through congested paths
- Lower passenger seating position, lower centre of gravity, better stability and balance.
- Visually strong and comfortable.
- Better visibility for rear porters on the paths
- Lower seating position, fear of elevation and feeling of fall for the passenger will reduce
- Stands are provided for the palanquin to rest on ground when not in use

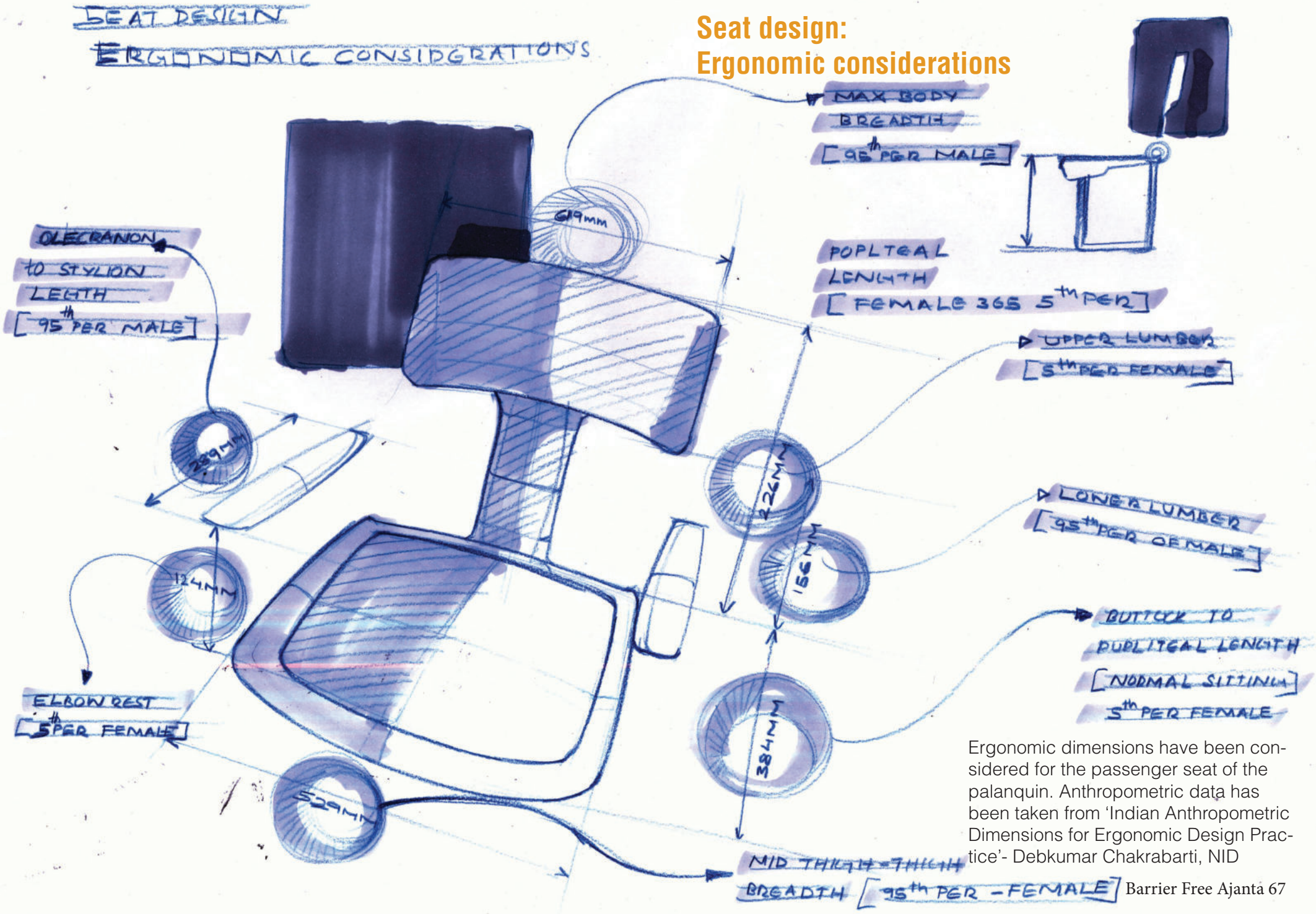
Concept Evaluation

Design Brief Points	Concept-1	Concept-2	Concept-3	Concept-4
				
Reduce porters' efforts	Positive	Positive	Negative	Positive
More safety to palanquin users	Positive	Positive	Positive	Positive
More visually strong and comfortable	Negative	Negative	Positive	Positive
Easy to get in and out from palanquin	Positive	Negative	Positive	Positive
Easy to transport through walk way	Negative	Positive	Positive	Positive
Aesthetically pleasing	Negative	Positive	Negative	Positive

Final Design

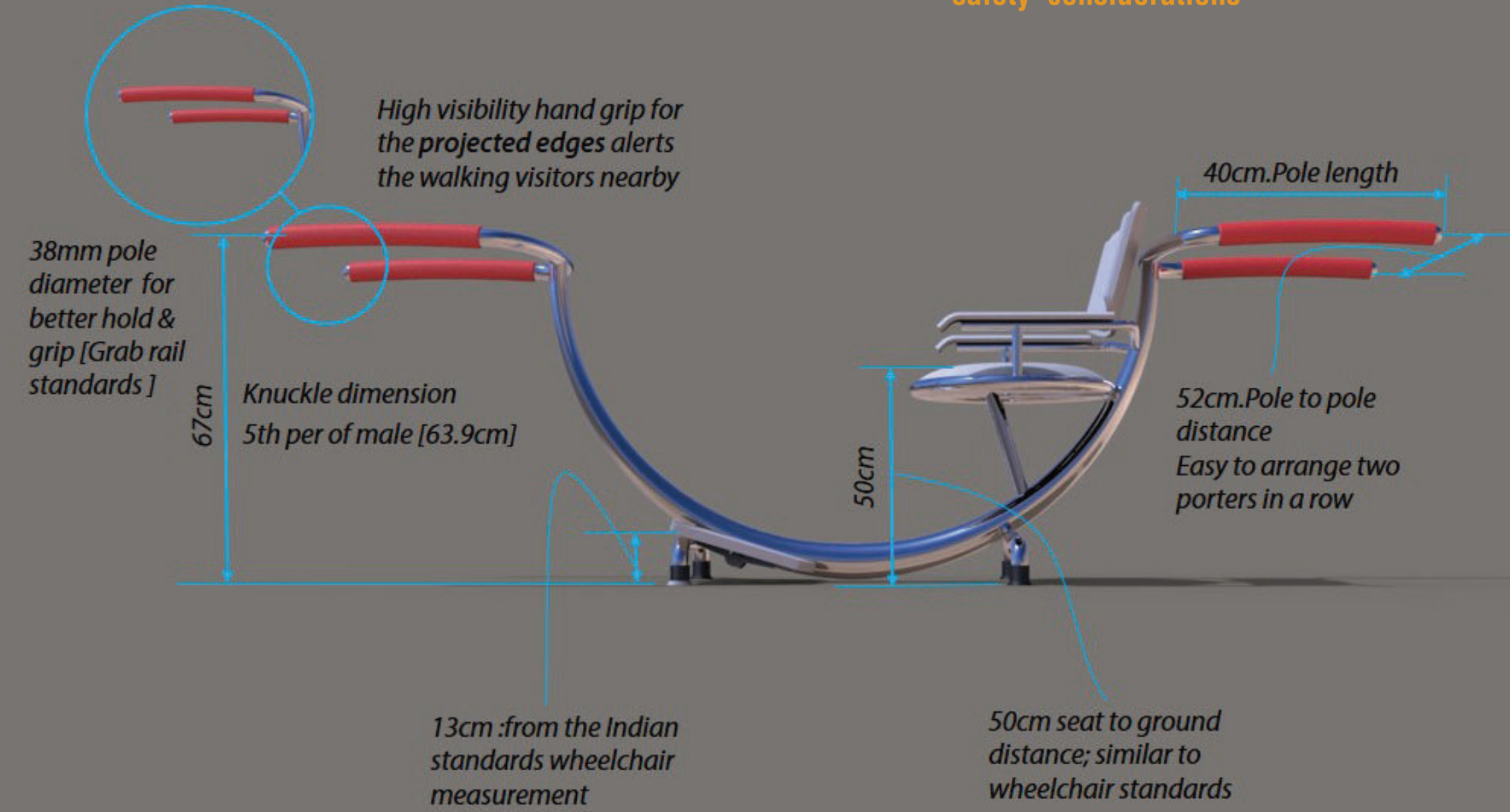
The final concept has been created by amalgamation of all the selected features of the earlier concepts. The required changes have been made in the selected final design from ‘Concept Evaluation’, changes such as the stands of the palanquin which have been reduced in height.

Seat design:
Ergonomic considerations

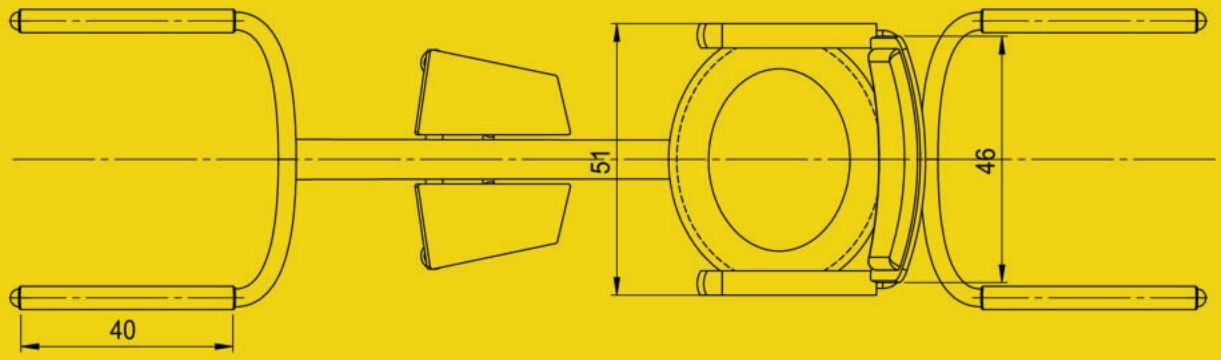


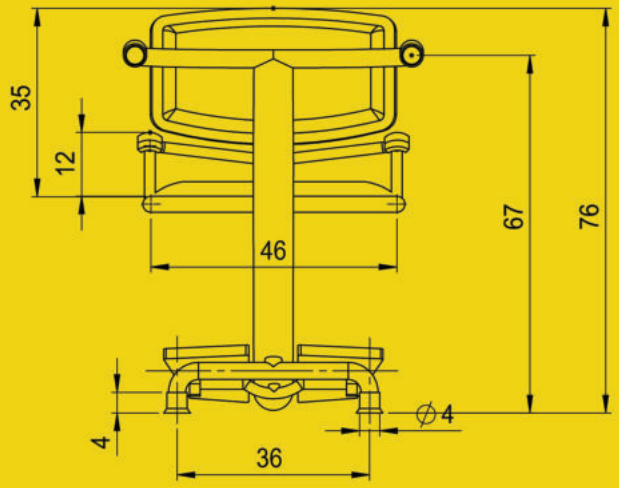
Ergonomic dimensions have been considered for the passenger seat of the palanquin. Anthropometric data has been taken from 'Indian Anthropometric Dimensions for Ergonomic Design Practice'- Debkumar Chakrabarti, NID

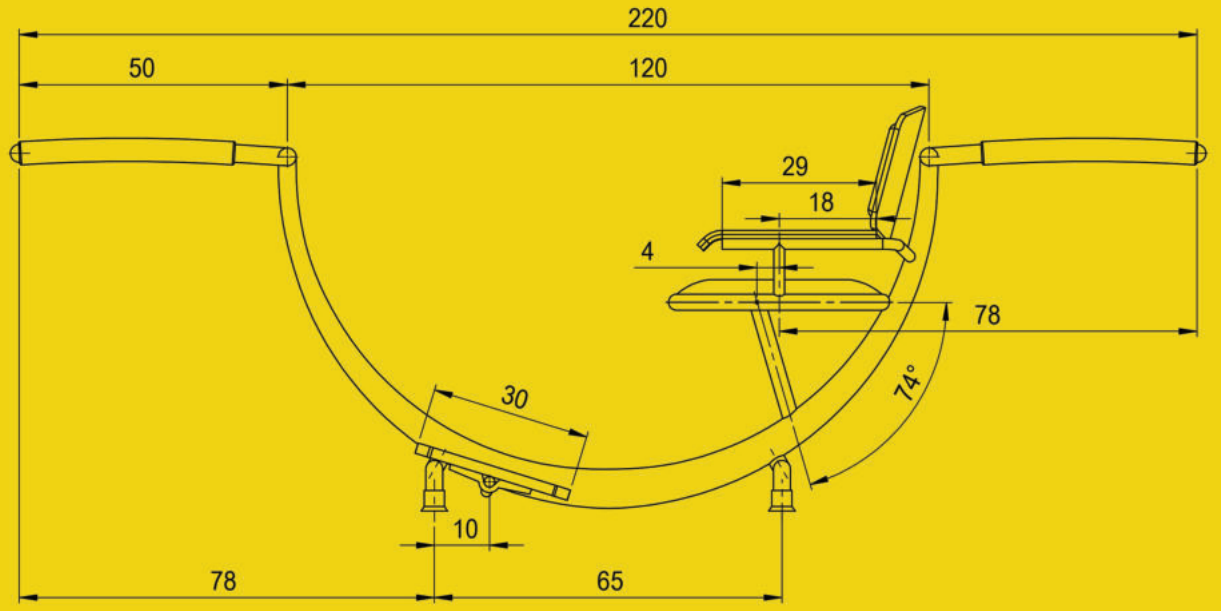
Palanquin frame: Ergonomic & safety considerations



Final Design: Dimensions







UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH: ERROR!:Finish		DEBUR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION	
	NAME	SIGNATURE	DATE	TITLE: Ajanta Palanquin		
DRAWN	NIKHIL					
CHK'D						
APPV'D						
MFG						
Q.A				MATERIAL: stainless steel	DWG NO.	A3
					SCALE:1:1	SHEET 1 OF 1

Final design considerations:

- Modern, sleek, minimalistic approach resulting in lesser weight
- Ergonomic design consideration for passengers and porters
- Sidewise entry and exit for passengers
- Hand grip and shoulder supports provided for all four porters
- Narrow design allows ease of commuting through congested paths
- Lower passenger seating position, lower centre of gravity, better stability and balance
- Visually strong and comfortable
- Better visibility for rear porters on the paths
- Lower seating position, fear of elevation and feeling of fall for the passenger reduced
- Stands provided for the palanquin to rest on ground when not in use

Material consideration: Stainless steel

- High corrosion resistance allows this to be used in rigorous environments
- Easy to fabricate
- Its strength-to-weight ratio advantage allows it to be used with a reduced material thickness over conventional grades, often allowing cost savings
- Low maintenance and replacement costs
- More durable than most sheet metals
- Availability of material

Final Design:
Mock up model

Final Prototype

Final Prototype: Testing

Refined Final Prototype

The final prototype has been refined according to the final jury feedbacks from the faculties and external examiner. Existing readymade chair has been replaced by cane-weaved chair which is easy to maintain locally, with easy availability of material and gives an ethnic look to the product.

The leg room space has been changed drastically and the pole length has been increased to ensure better holding for porters.


Thank you