

Medical First Responder Vehicle for Chennai

Harish Kumar P

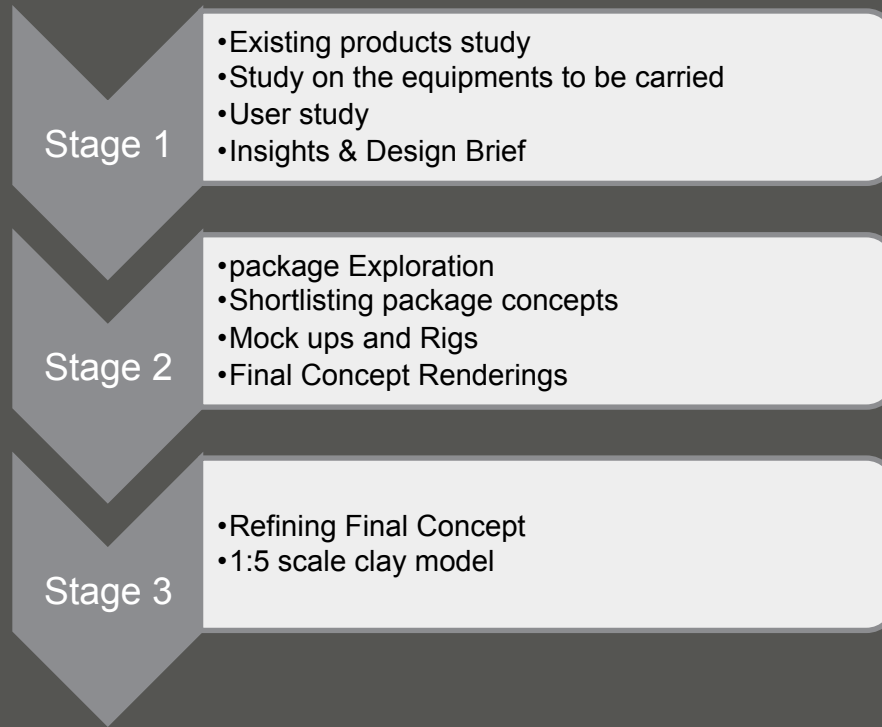
MD 126390004

Design Project 3

Guide : prof. B. Bhaumik

Overview

- Understanding First responder vehicle
- First Aid – Who does it? ; how it is done?
- The scenario – Why Chennai?
- Which Vehicle to choose?
- Insights and Design Brief
- Explorations
- Packaging
- Concepts
- Model



Medical First Responder vehicles

“Vehicles that can carry all necessary equipment and paramedics to reach the destination as quickly as possible and give pre-medical care for medical emergencies”

Difference between ambulance and First Responder Vehicle

Ambulance

Gives Treatment on the way

Can Carry patients

More than two attenders

Almost all important Equipment

Usually large

First Responder Vehicle

On the spot pre-medical care

Does not Carry patients

Maximum two attenders

Only First Aid Equipment

Compact is the keyword



Existing First Responder Vehicles

- Assessing an incident's severity
- First Aid
- Resource saving
- Improve response times
- Supervisor vehicle

Four Wheeled FRV



Czech Republic



Austria



Sweden



Belgium



Frankfurt



Italy



Toronto

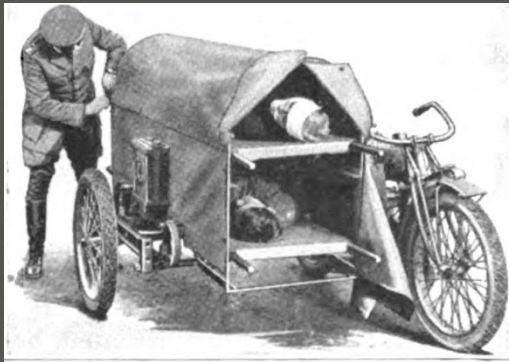


Germany

Motorcycle Ambulance



- Built During world war 1 by British, French & Americans
- Lightweight, Speed and Mobility
- Used Side cars to carry a injured soldiers



Motorcycle Responder



Serbia



South Sudan



Birmingham



Hong Kong



London



Japan

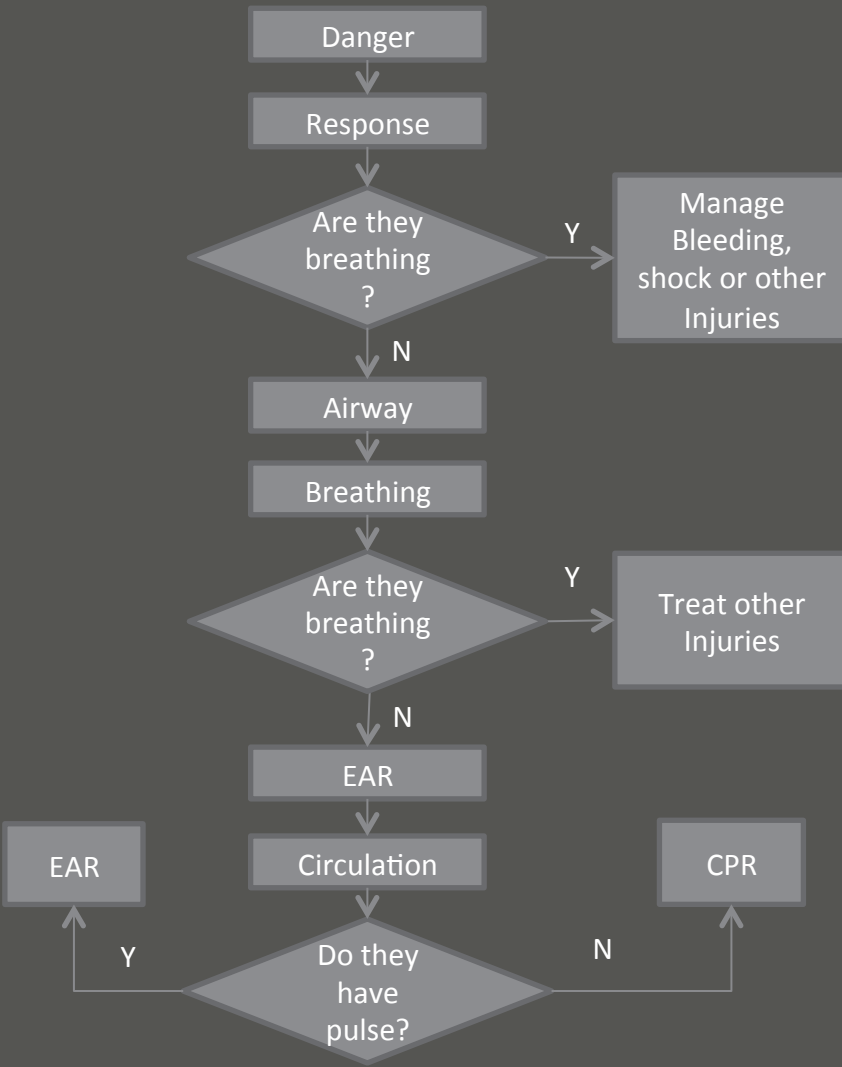
Compact is the keyword



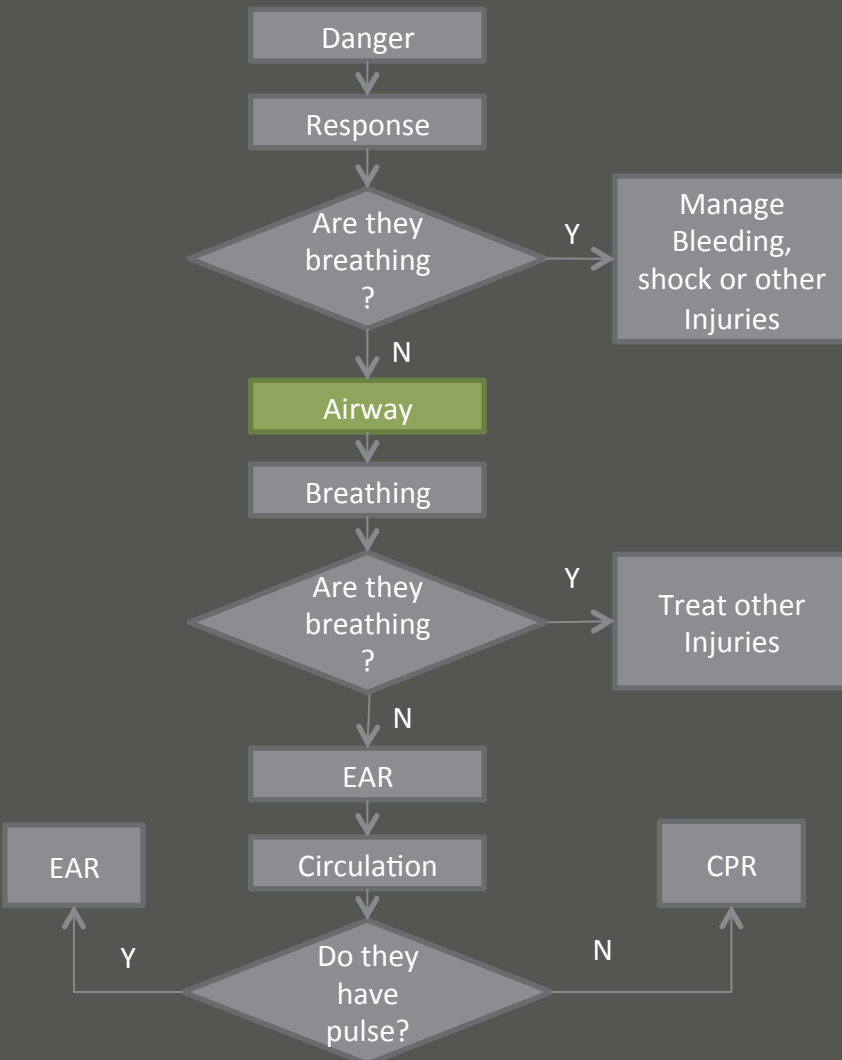
Renault Twizy



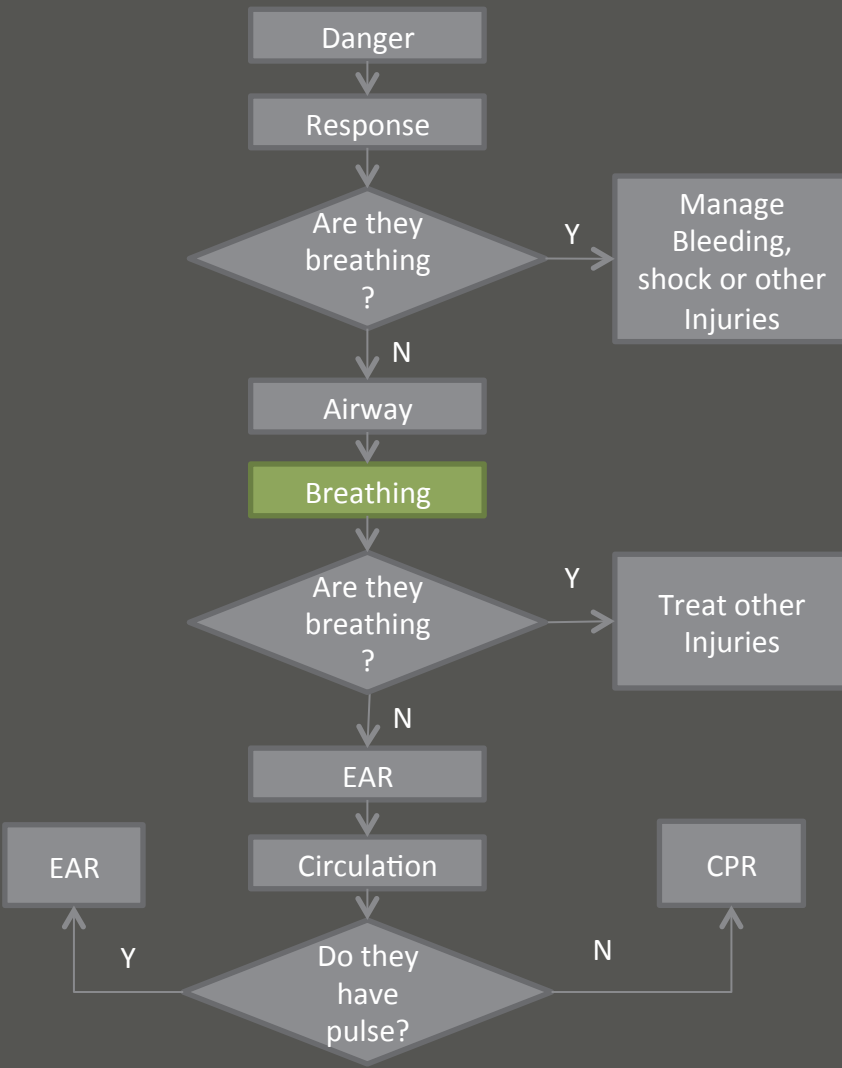
How It is done?



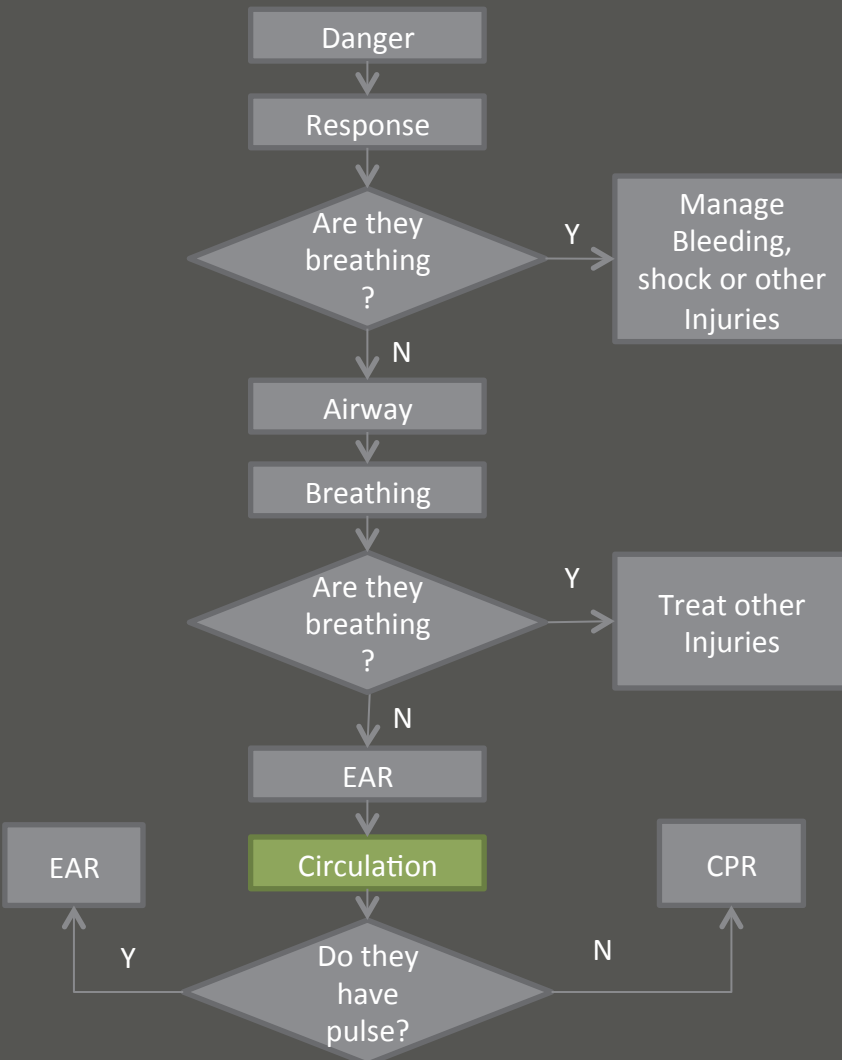
How it is done?



How it is done?



How it is done?



Who does it?



Mr. Ramadoss
Ambulance Coordinator

- There is a plan of making a first responder vehicle
- Tamil Nadu government not cooperating
- Male nurses – B.Sc., M.Sc.
- Drivers with paramedic training – Ambulance orderly, pilot
- Response time is ~ 20 mins.
- “Apollo First” project.

Case example

Feb 5, 2005



- India's first fully-equipped two-wheeler ambulance service called 'Apollo First' in Chennai.
- "Irrespective of all that we do with the siren, still there is a lot of time that is being wasted because of traffic block. So, for that we have created this two-wheeler ambulance 'Apollo First', so that two-wheeler can negotiate itself and go to patient care almost immediately and attend to his urgent need. The ambulance will follow if it is necessary for him to be shifted to the hospital. So the two-wheeler ambulance to beat the traffic and to reach the patient at the earliest is the first. We are launching it across the country," said PC Reddy, Apollo chairman.

Case example

Feb 5, 2005



- TVS Centra Bike
- Carried Basic Life Support equipment
- Two Paramedics
- They used backpack also
- Lasted for only a few months

Case example- Why it failed?

Feb 5, 2005



- People did not accept this idea, not cooperating
- Paramedics were not comfortable to ride it on Chennai traffic and weather
- Vehicle is not designed to carry more than two persons
- Its not safe for the paramedics too



Mr. Sudhakar
Sr. Nursing Officer

- BLS, ACLS ambulance
- No clear curriculum
- Male nurses are the paramedics
- Male because it involves lot of physical work
- Male nurses need almost one year of field experience to handle cases
- They work on 12 hours shift basis

CITIES » CHENNAI

CHENNAI, August 26, 2013

Updated: August 26, 2013 09:04 IST

In Chennai, '108' most used for road accident cases

B.Tech from MIT - Manipal - Ranked 5th Across Engg. Colleges in India. Admissions Open for 2014
manipal.edu/Admission_Open_2014

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SERENA JOSEPHINE M.

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On an average, 108 caters to 3,500 emergencies a month in the city. The number of cases has increased from last year — Photo: M. Vedhan

The city may well be the road accident capital of the country going by the emergency calls made to the 108 ambulance service.

The city's utilisation of 108 has been increasing but emergency care managers say the ambulances were mostly sought for accident cases as against pregnancies and other emergencies like chest pain.

On an average, 108 caters to 3,500 emergencies a month in the city. The number of cases has increased from last year — in April 2012, 108 handled 2,299 cases, whereas, this July, the number of cases stood at 3,776.

"When we look at the State figures for utilisation of 108 ambulances in the city, nearly 26 per cent of cases are pregnancy-related emergencies followed by road traffic accidents at 24 per cent. In Chennai, 25 per cent cases comprise accidents and just 10 per cent are pregnancies. Other emergencies

such as chest pain and acute abdominal pain are single digit contributors to the overall utilisation percentage," said B. Prabhudoss, regional manager of GVK-Emergency Management and Research Institute (EMRI).

People should understand they can use 108 for any kind of trauma and medical emergency including respiratory problems, oral poisoning, and insect, snake and animal bites, he said.

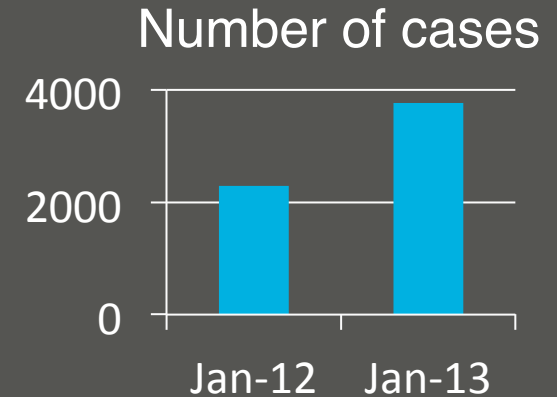
The Tamil Nadu Health Systems Project is the nodal agency that sponsors the 108 emergency response service along with GVK-EMRI, which is a private partner. There are 629 ambulances in the State, of which 35 operate in the city. "The ambulances are fully equipped with medicines, equipment and oxygen. It is available free of cost to patients. They can choose the hospital they want to go to. In an emergency situation, it should be the nearest medical facility," he said.

V. Kanagasabai, dean of Government General Hospital, said more than 60 per cent of cases brought to the GH were of trauma. "Two-wheeler accidents constitute a major share," he said.



108 Ambulance

- On an average, 3500 emergencies a month in the city (Aug 2013)
- Chennai is the road accident capital of the country
- 25 % emergencies are accidents
- 10% are pregnancies
- Rest of them are acute abdominal pain, chest pain, poisoning , insect, snake, animal bites, respiratory problems.





03/10/16

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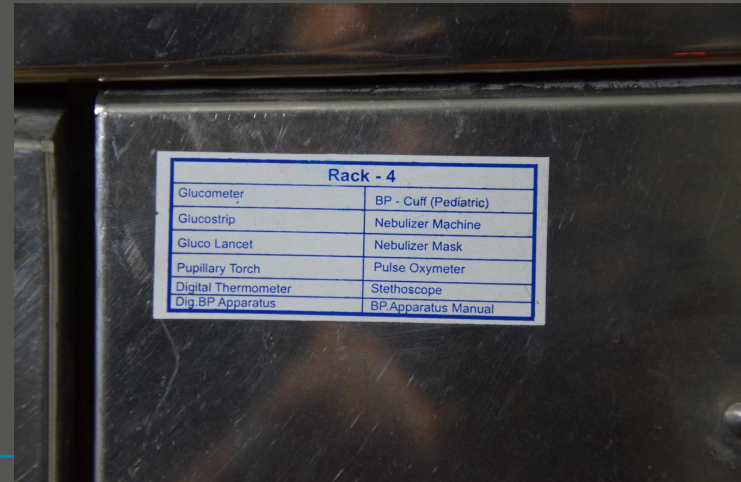
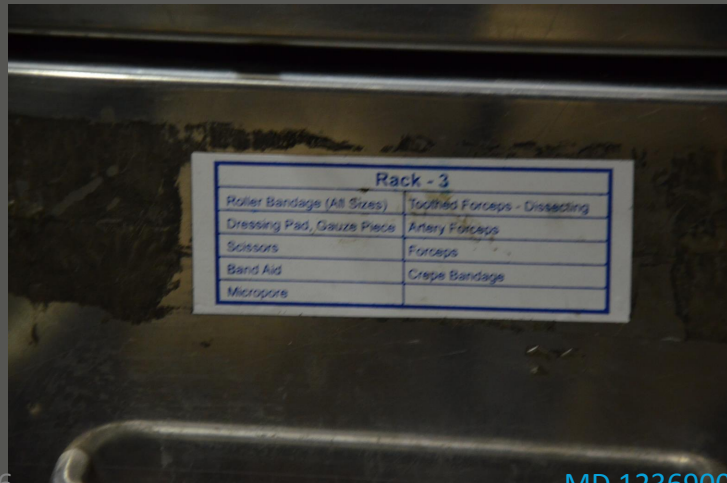
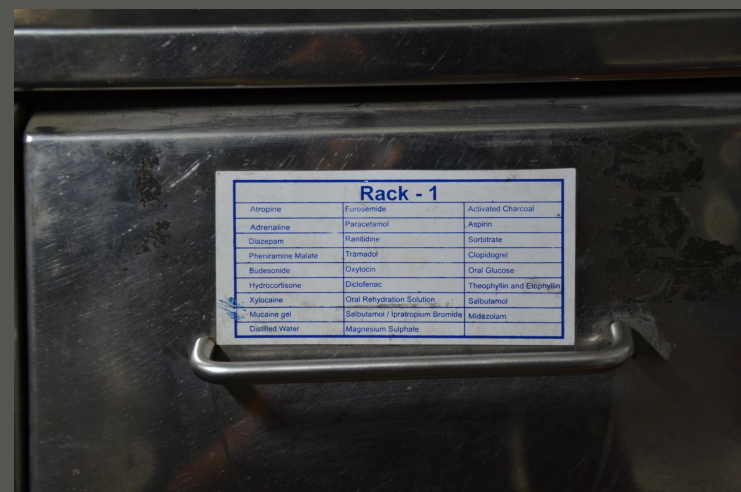
03/10/16

MD 123690004 | Project 3



Mr. Rajan
108 Ambulance paramedic

- Will be called at any time, works more than 12 hours a day
- Usually road accidents cases
- Because of unavailability of other ambulances, at times response time goes more than 40 minutes
- Did not worry much about the sanity of the vehicle.



User

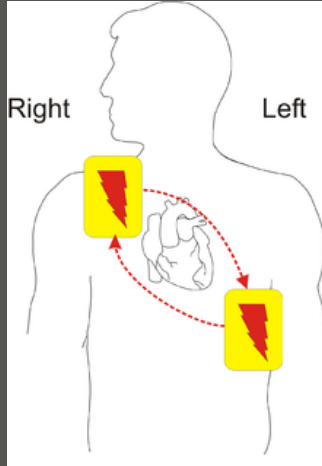


- Male Nurse (paramedics) – 2nos
- Age – 20 + years
- Trained in BLS and have good field experience
- Knows to drive well
- Need to communicate before, during and after the trip
- Records all events, vital stats
- Works fast and knows to use all equipment
- Trip sheet

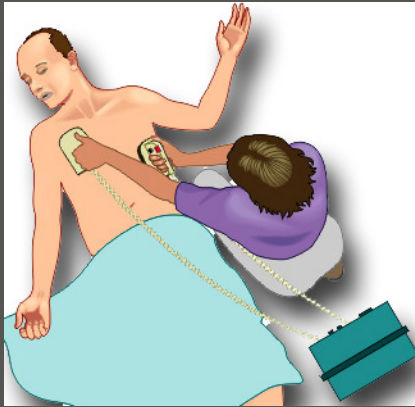
Equipment

- Defibrillator
- Suction Apparatus
- Immobilization Equipment
- Breathing Apparatus
- Bandages and Splints
- Drugs

Defibrillator



- Used in treating for life threatening cardiac problems
- produces therapeutic electrical energy
- The charges target the critical heart muscles and stops the dysrhythmia and makes normal sinus rhythm





Defibrillator

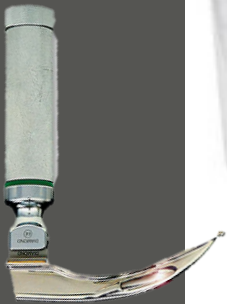


- Manual External Defibrillator
- Automatic External Defibrillator
- Semi Automated External Defibrillator

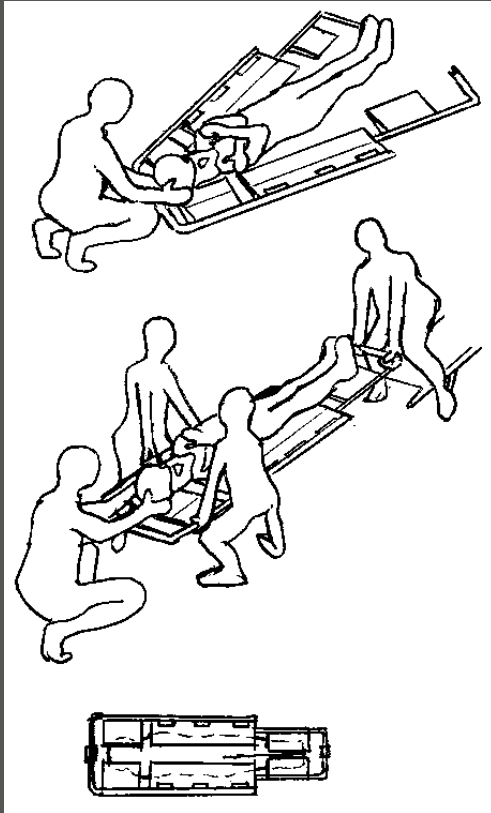


Suction apparatus

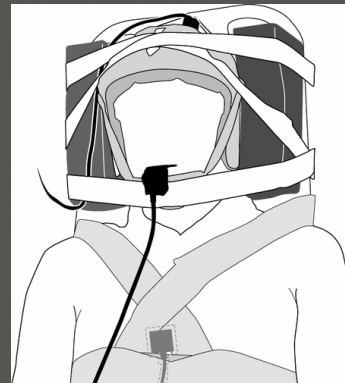
- aspirating fluids and vomit from the mouth and airways
- sucks the material through a catheter into a bottle.
- Laryngoscope to easily use the catheter



Scoop stretcher



Spine Board with straps



Spine Immobilization

Immobilization

Foldable stretcher

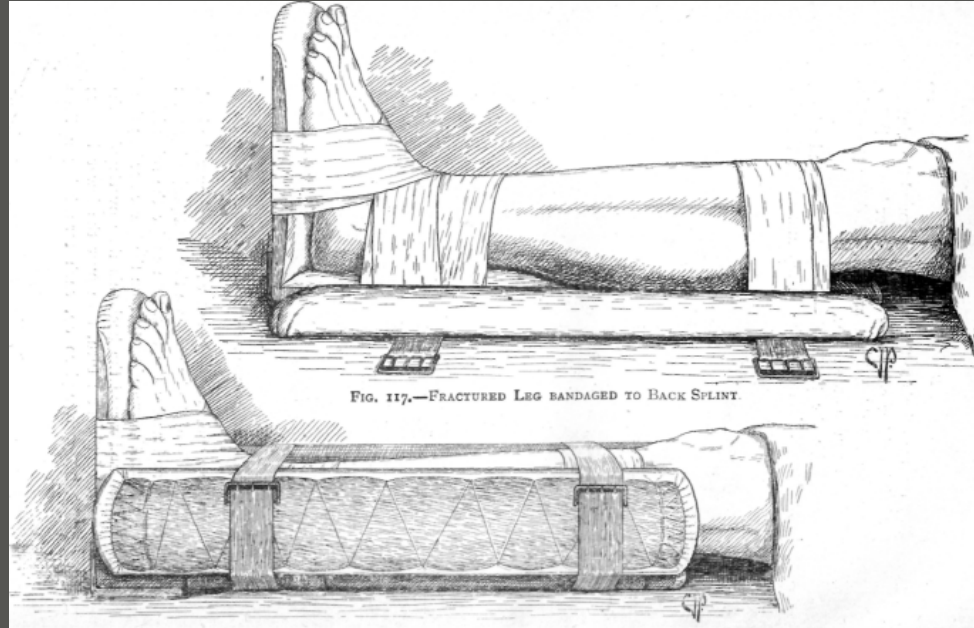


Breathing Apparatus

AMBU Bag - Artificial Manual Breathing Unit



Bandages and Splints



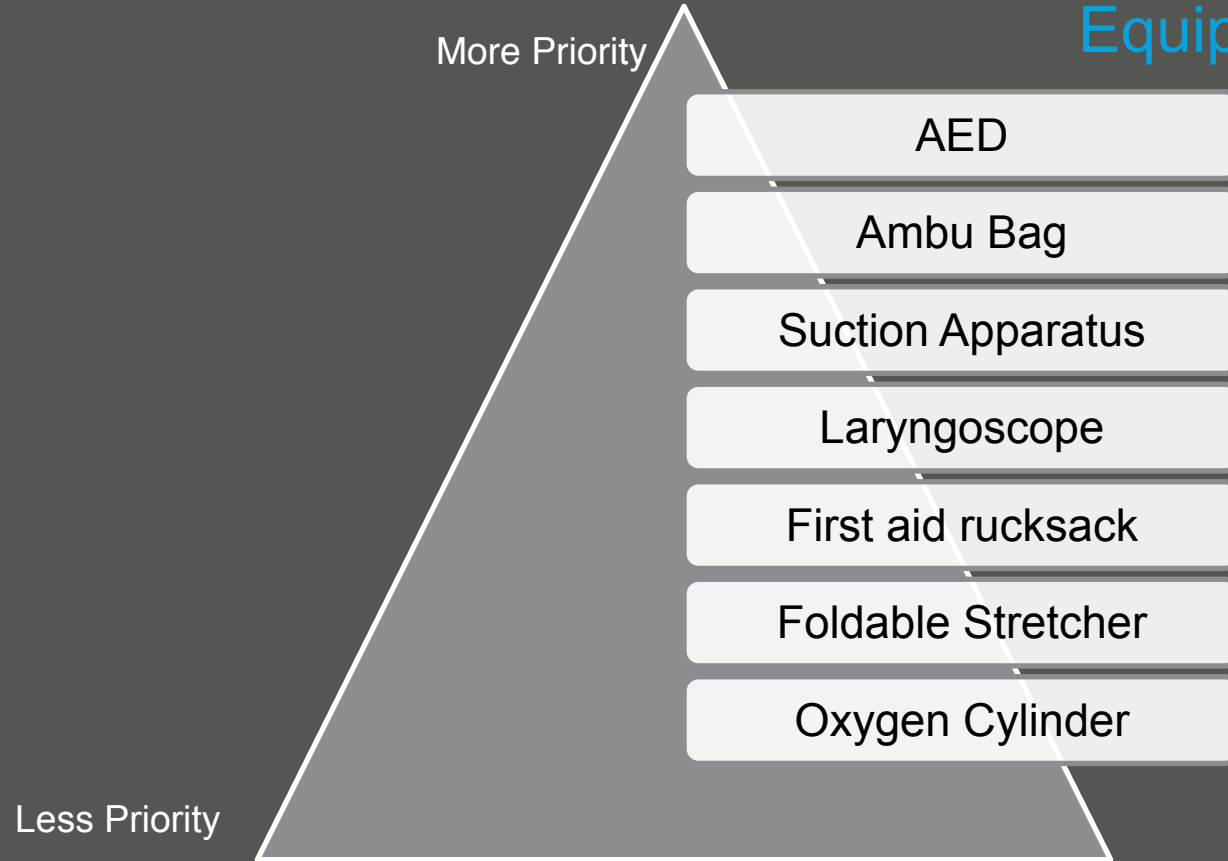
Some of the more common medical emergencies that require drugs are

- cardiac arrests/arrhythmias
- strokes
- Seizures
- allergic reactions
- Overdoses
- traumatic injuries.

Dimensions

Product	Dimensions	weights
Zoll X Series AED	260mmx200mmx226mm	6 Kgs
Portable Suction apparatus	450mm× 200mm× 320mm	6.2 Kgs
Rucksack for the First Aider	400mm x 300mm x 140mm	1 kg
Ambu Bag	400mm x 120mm(dia)	415 g
Foldable Stretcher	960mm x 180mm x 540mm	8 kgs
Laryngoscope	140mmx 200 mm(dia)	100 g
Oxygen Cylinder	300 X 80 mm (dia)	1.4 kgs

Equipment priority



- Maximum number of road accidents
- Slow moving traffic
- Hot and humid weather conditions
- Bad road conditions



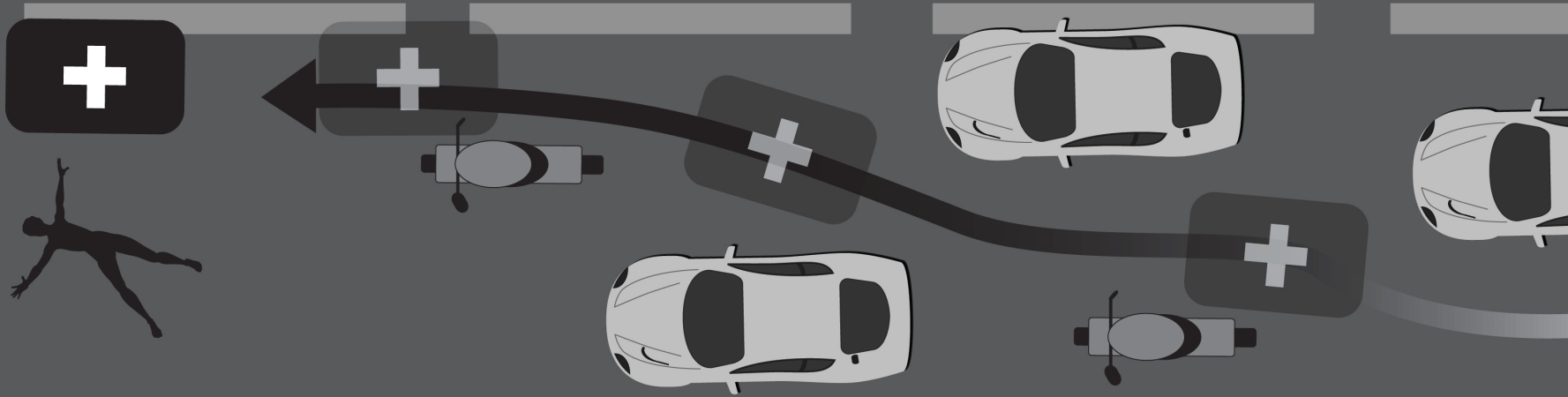
Inferences

- Male nurses are looking for comfort as they work for 12 hours a day.
- Ambulances take more than 20 minutes response time.
- Chennai traffic is not controllable.
- Hot sun in Chennai is a big problem, both for the male nurse and the patient.
- The male nurse must remember all the events happening during the trip.
- Two wheelers are not a good option in Chennai.
- people look for the image that will make them feel confident that the first response will be effective.
- There is no communication happening between the ambulance and the hospital to the doctor during the trip. It is happening only after the trip.
- Sanitation is a big issue.
- Sirens are not helping in a big way.
- The male nurses are not feeling comfortable with the current facilities provided to them.
- There is no assurance that the male nurses will be safe on roads when they are giving the first aid.

On the Road



Heavy traffic conditions



Inside any building



- Package all the equipment
- As compact as possible
- good acceleration
- good ground clearance

Choosing the base vehicle

Vehicles considered



	Nano	Reva	Wagon R	Indica v2	i10 Era	Eon
Turning radius	4 m	3.9 M	4.6 m	4.9 m	4.75 m	4.6 m
width	1495 mm	1514 mm	1475mm	1,665 mm	1595mm	1550mm
length	3099 mm	3280 mm	3599mm	3,675 mm	3585mm	3495mm
Acceleration (0-60 kmph)	8 sec	11 sec	8.03 sec	7.3 sec	6 sec	6.41 sec
Ground clearance	180 mm	180 mm	165mm	170 mm	165mm	170 mm

Weighted matrix

	Weights	Nano	Reva	Indica v2	Wagon R	i10 Era	Eon
Turning radius	5	4	5	2	3	3	3
width	4	5	4	2	5	3	3
length	3	5	5	2	3	3	3
Acceleration	2	4	3	4	4	5	5
Ground clearance	3	5	5	4	3	3	4
		78	77	44	61	55	58

Why Reva E2O over Tata Nano?

- Reva E2O has a linear torque curve, good for quick pick up
- Range is not an issue since one charge gives 90 Kms
- Quick charging (1 hours gives 20 kms)
- Speed and acceleration can be increased just by tuning ECU
- Better turning radius (very vital)
- Battery provides 10 units of power
- Good for two passengers

Mahindra Reva E20



VEHICLE SPECIFICATION

Type	Two door hatchback
Seating Capacity	Four adults
Motor	3 Phase Induction Motor
Power	19 kW @ 3750 rpm
Torque	53 N-m @ [0-3400 rpm]
Battery	48V maintenance-free Lithium-ion
Steering Mechanism	Rack & Pinion
Transmission	Fully Automatic
Suspension: Front	MacPherson strut - Gas filled
Suspension: Rear	Gas filled shock absorber with coil springs
Brake: Front	Disc: 215 mm
Brake: Rear	Drum: 180mm
Tyre (Front & Rear)	155 / 70 R 13, Tubeless Low Resistance

DIMENSIONS

Length x Width x Height	3280 mm x 1514 mm x 1560 mm
Wheelbase	1958 mm
Ground Clearance	180 mm
Turning Radius	3.9 m
Kerb Weight	830 kg

Design Brief

Technical Specifications

The base vehicle is Mahindra Reva E2O

wheelbase - 1958 mm

width - 1514 mm

Height - 1560 mm

ground clearance - 180 mm

Turning Radius - 3.9 m

Transmission - automatic

Vital Needs

- Carry all equipment
- Carry two paramedics
- Access to equipment must be easy (prioritize)
- Secure the equipment from shock

Essential

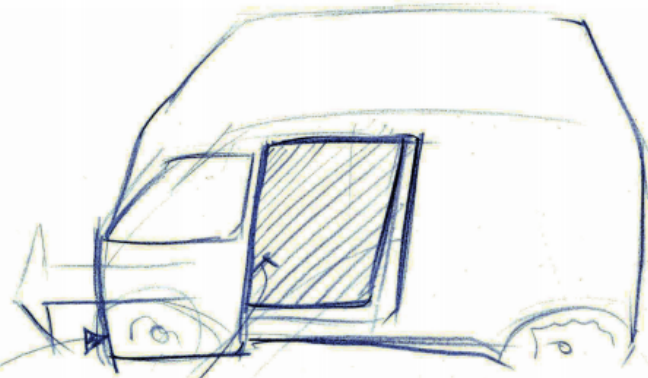
- Sun & rain protection for treatment
- Night time visibility for treatment
- Provision to discard waste after treatment
- Easy to clean
- Communication devices

Nice to have

- Additional storage for more equipment
- Better way of incoming alert

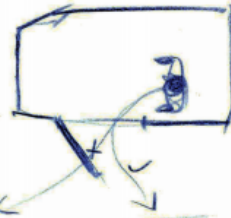
Explorations

Refer report page 49



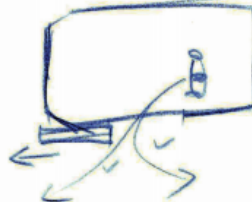
Access of
Equipment
will also be easy

Top



Normal door

Top

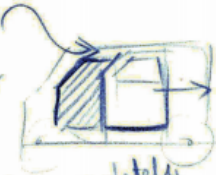


slide door

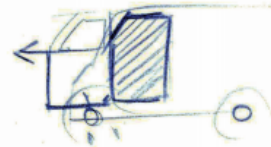
// might interfere
with front
wheel.

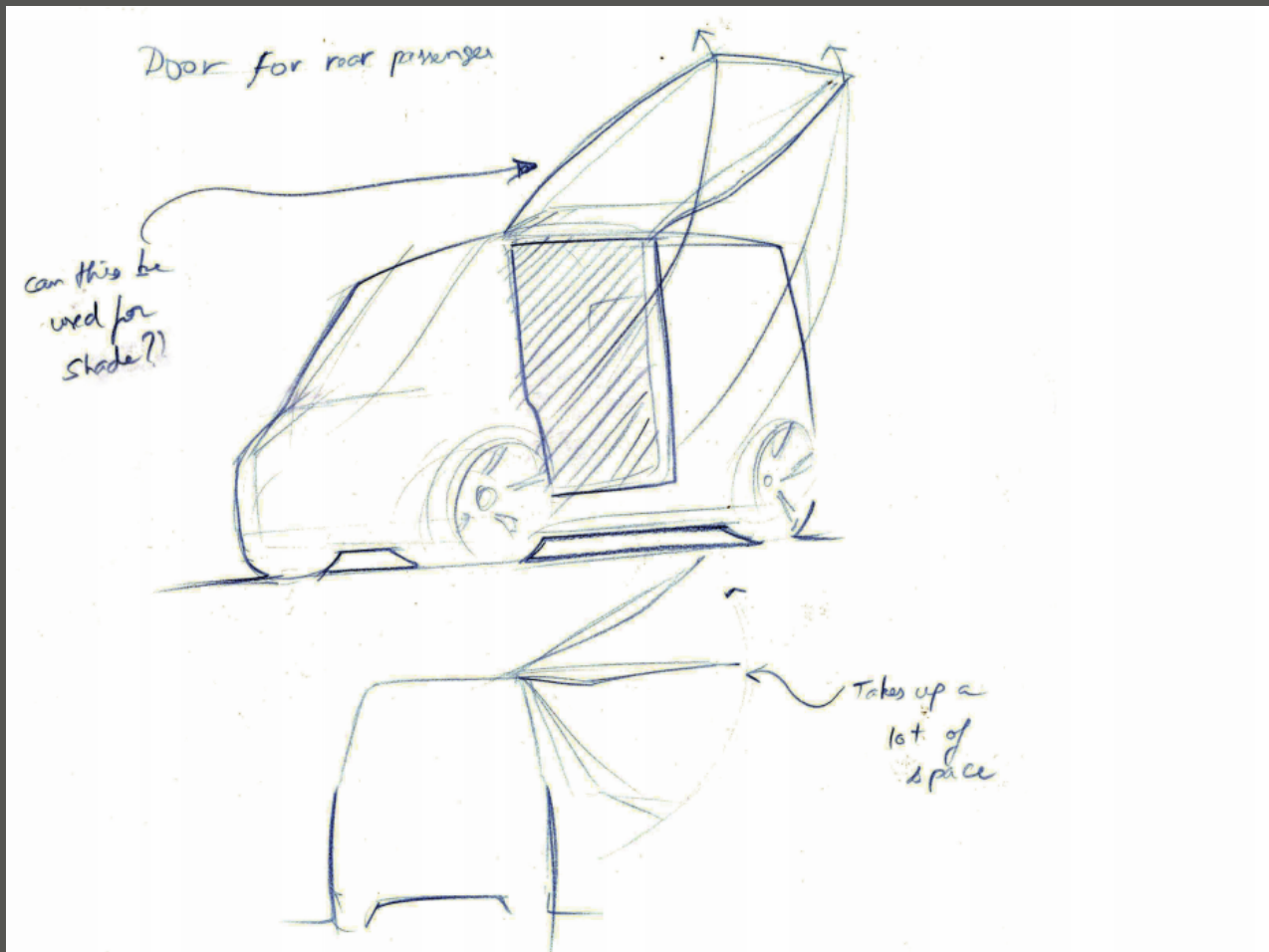
This
slide
does not
work,

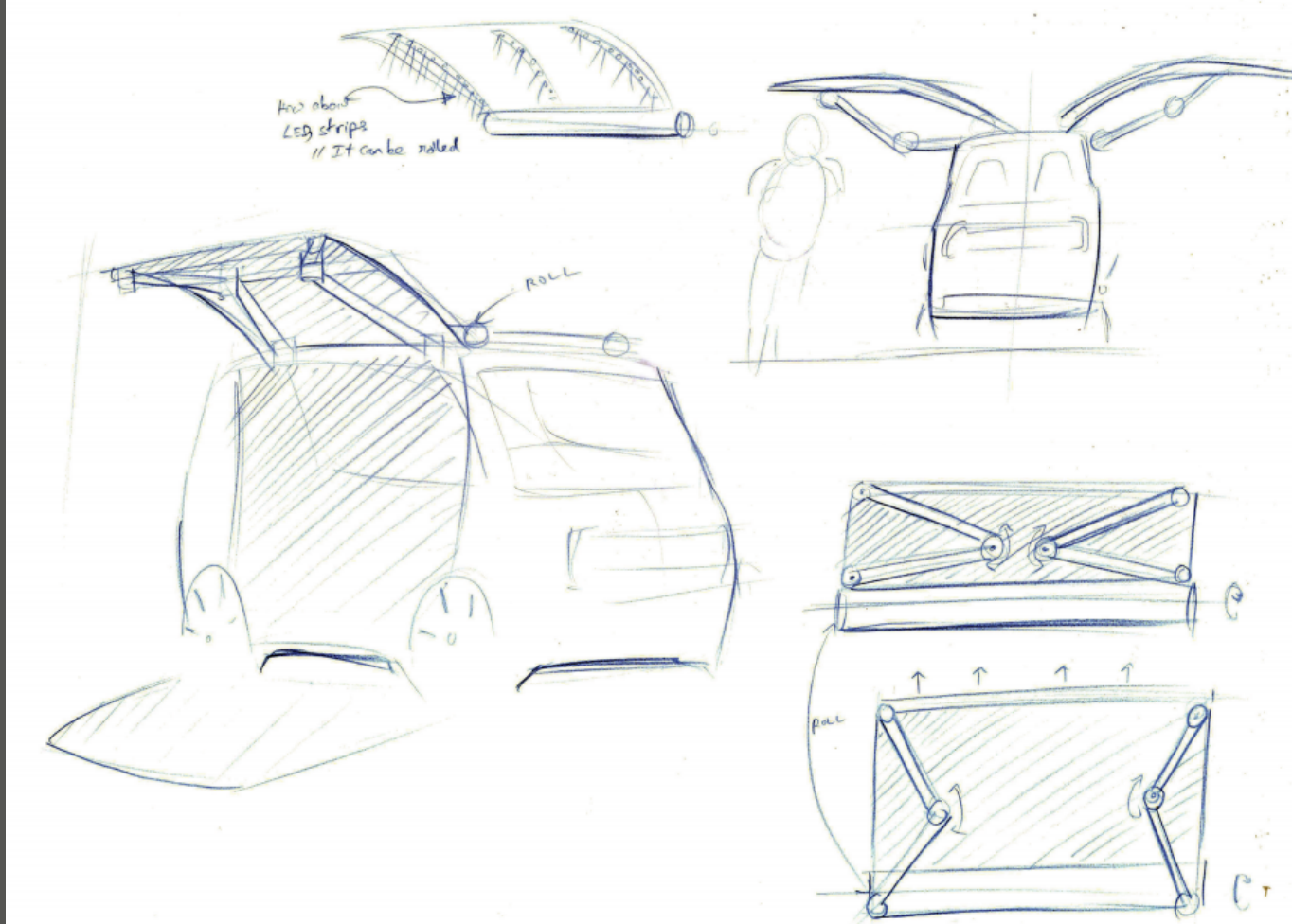
need
to slide completely
to get down

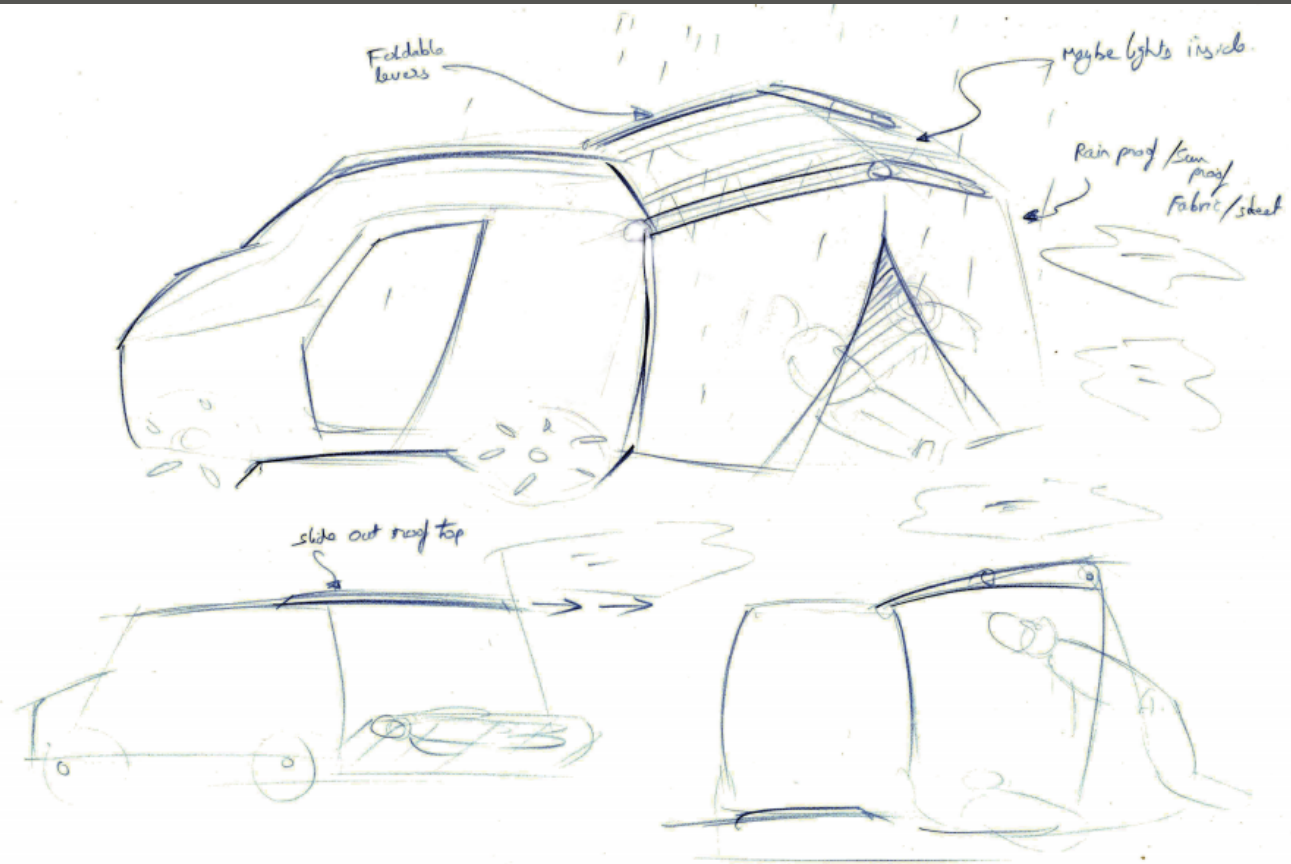


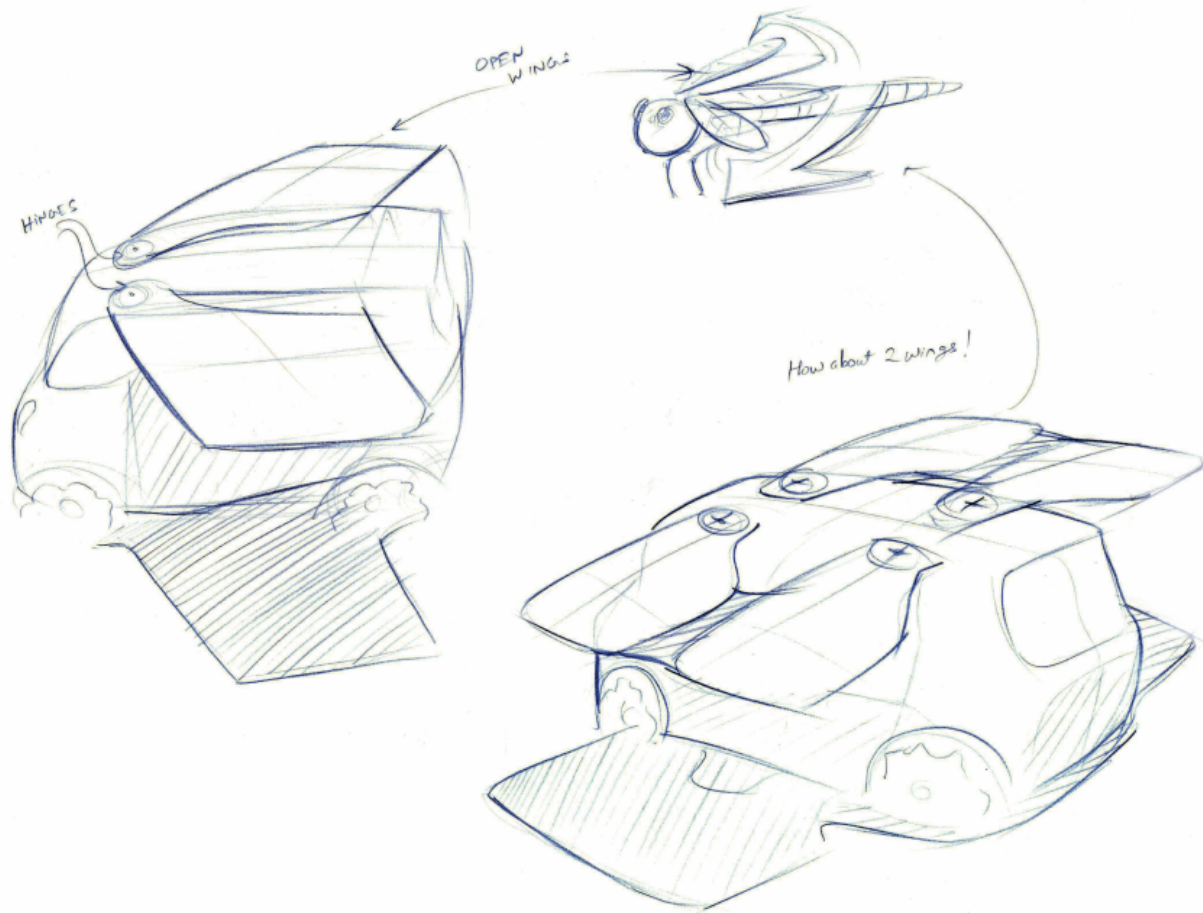
This slide will work
better.

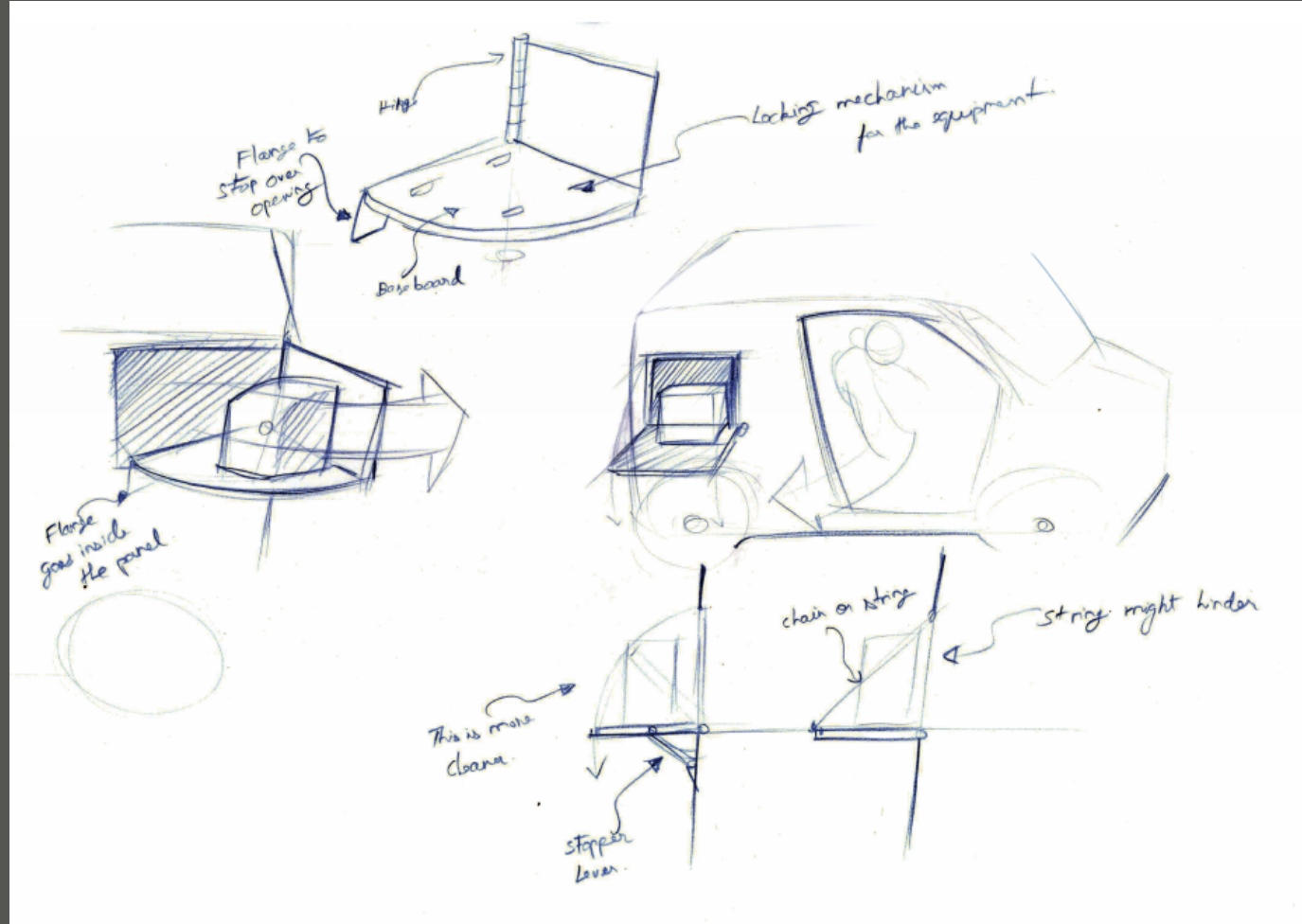


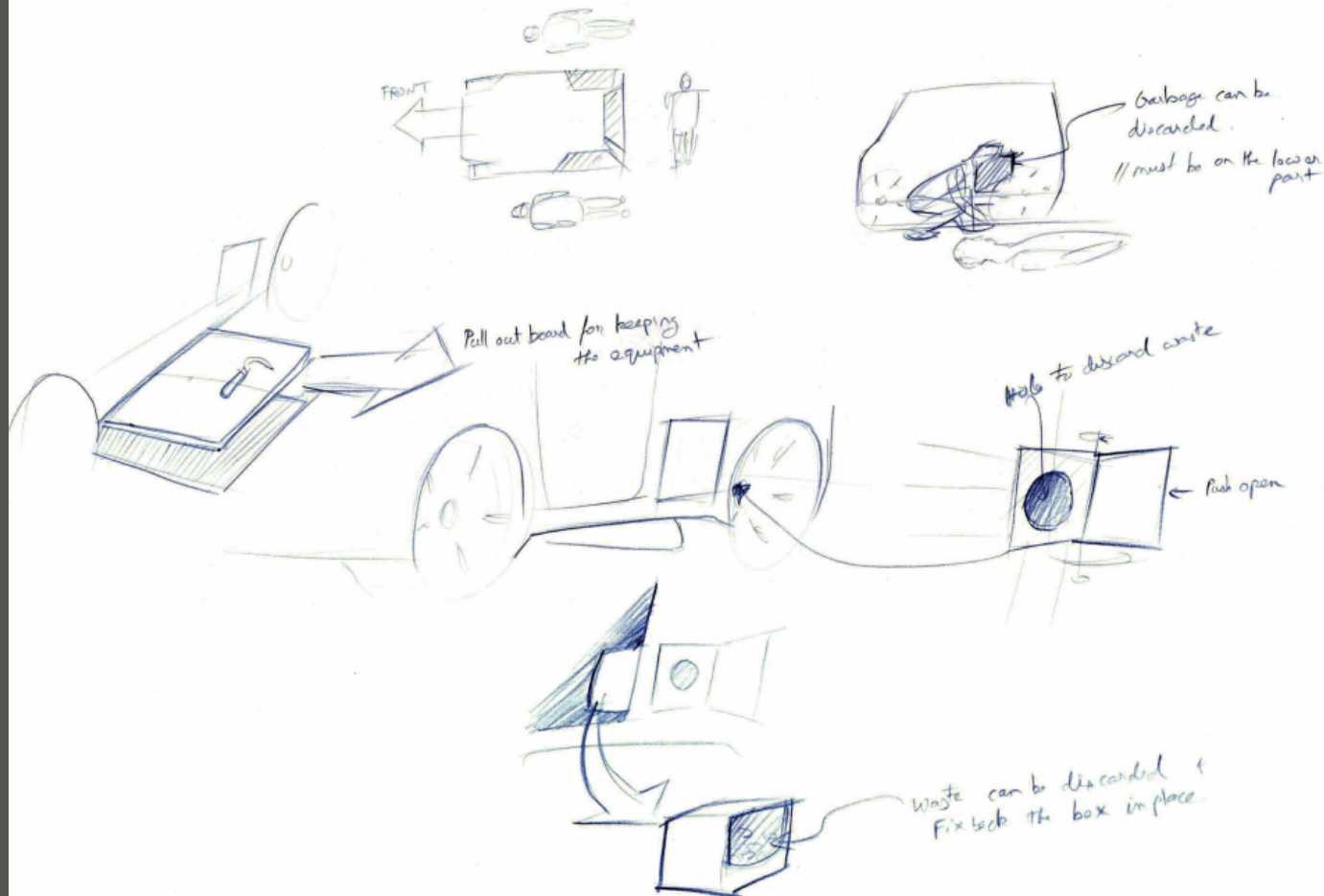


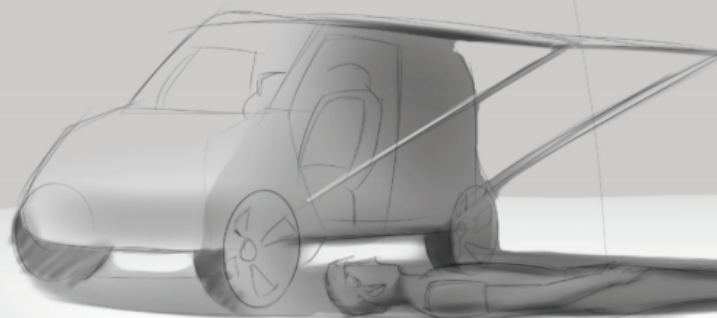
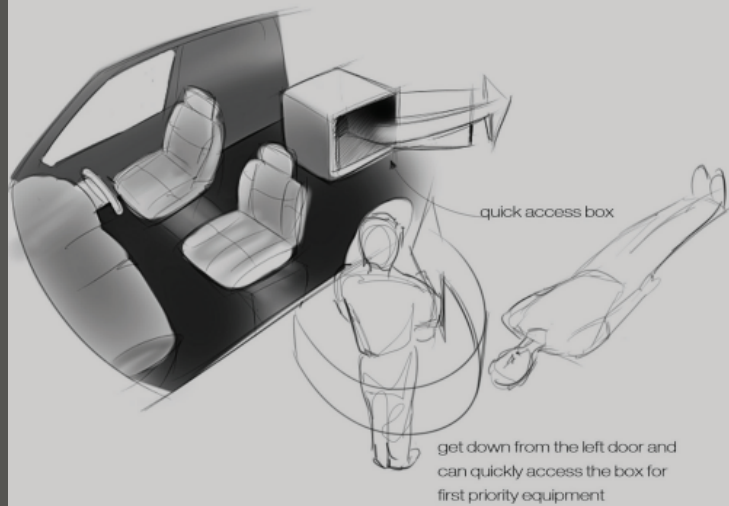


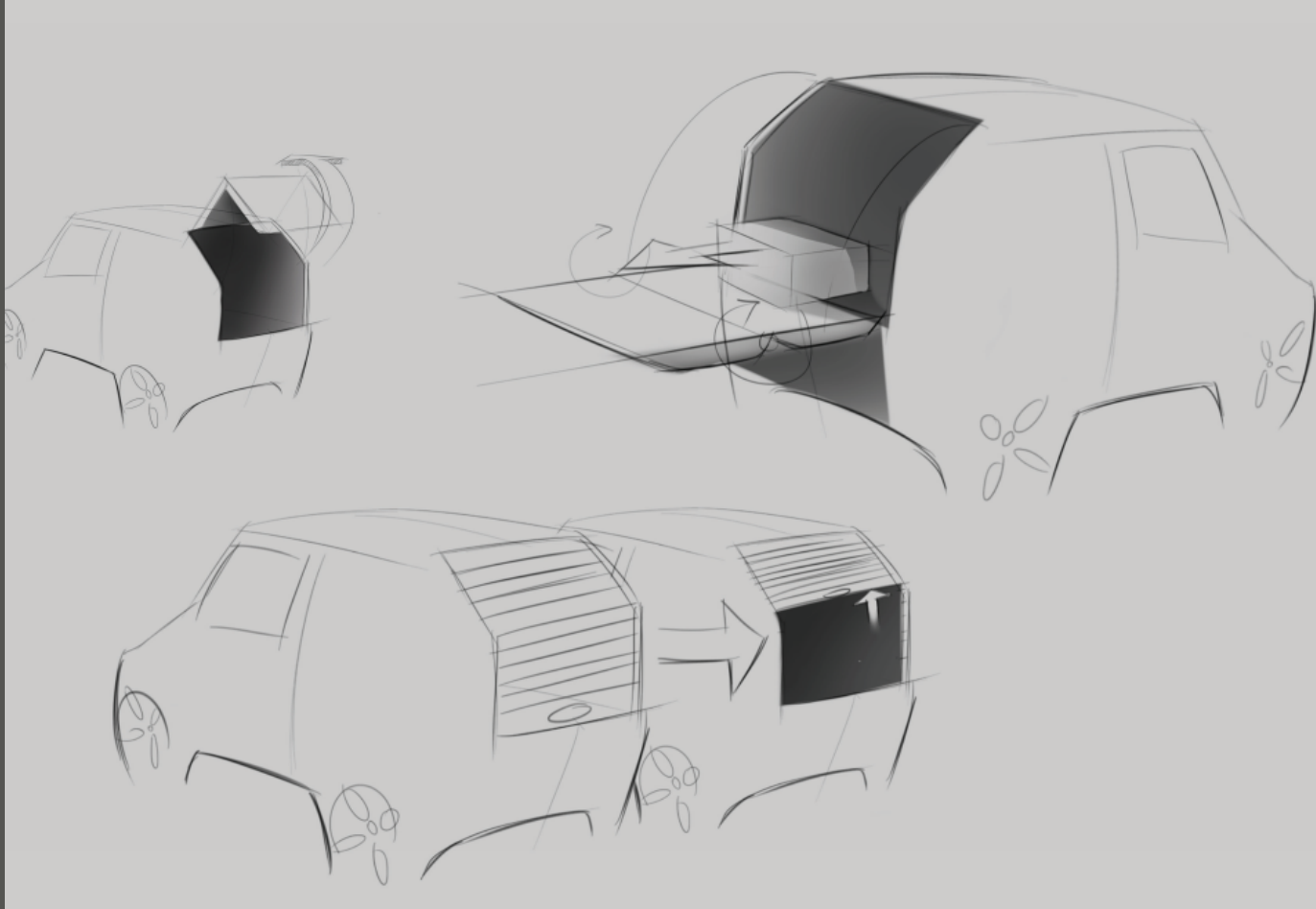


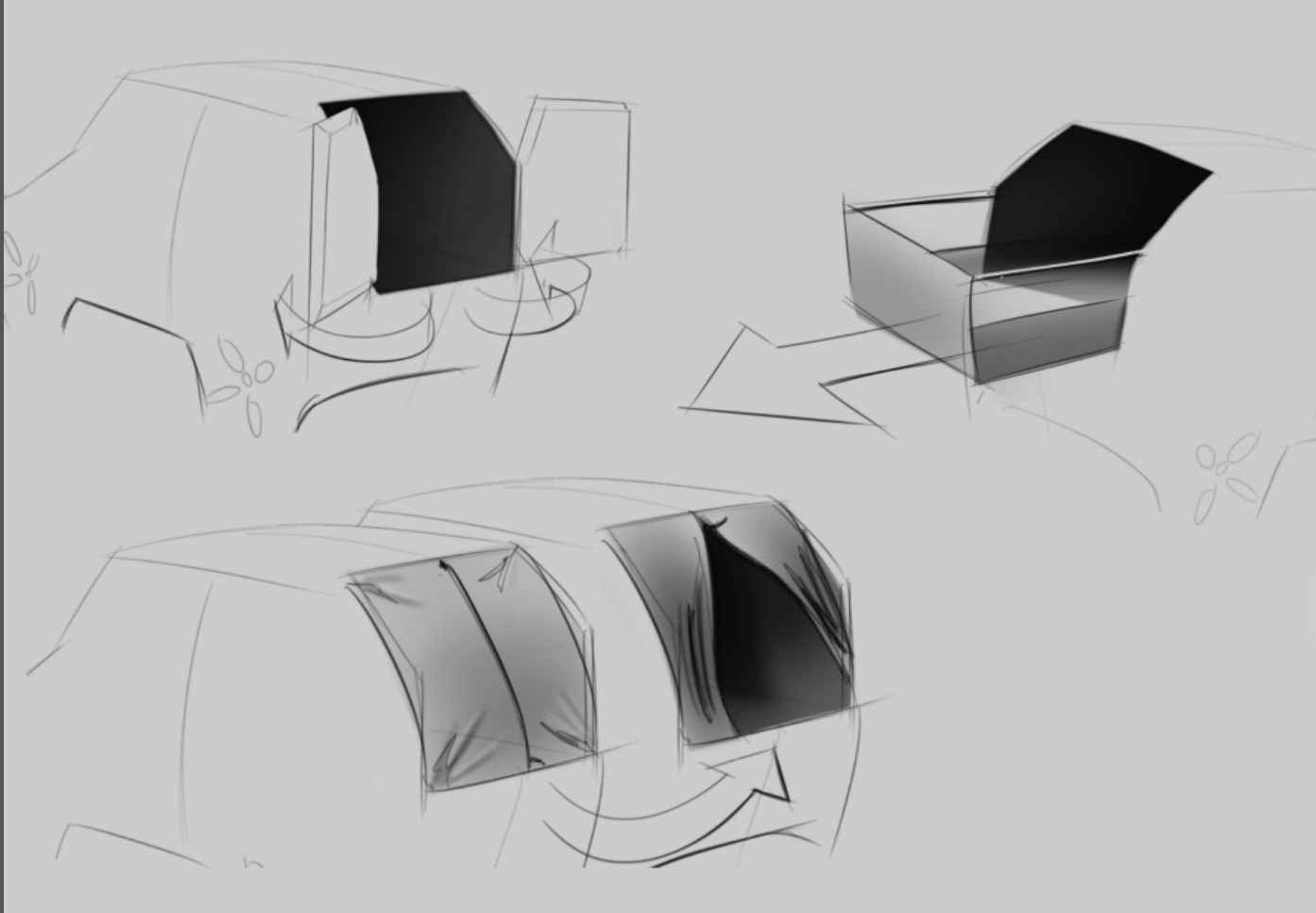


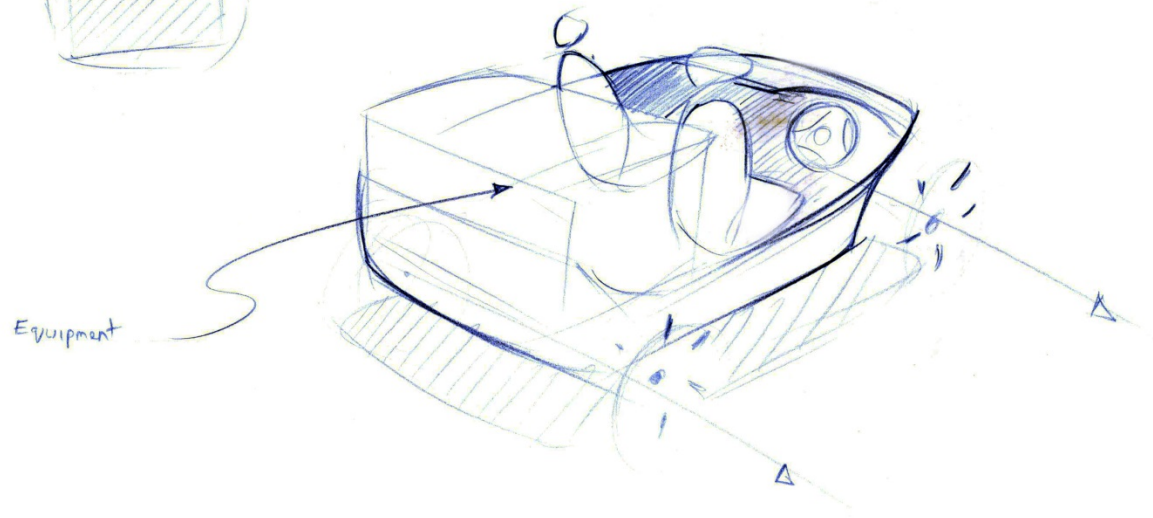
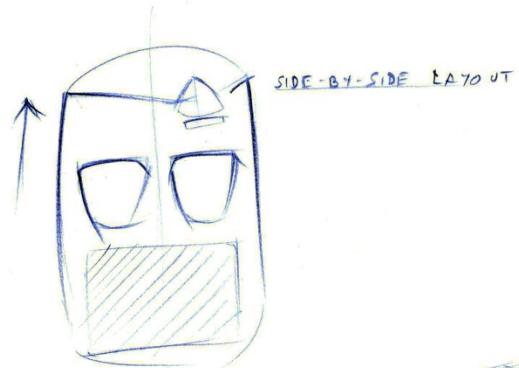


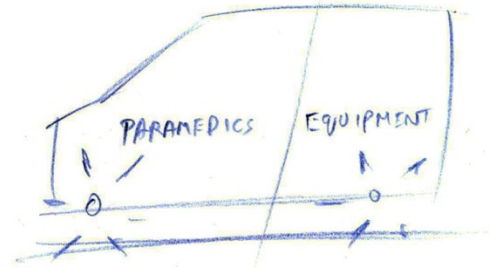
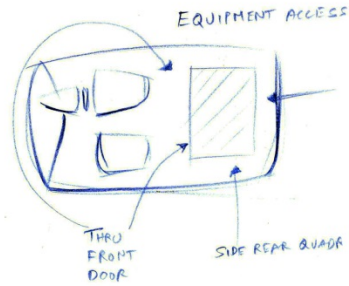




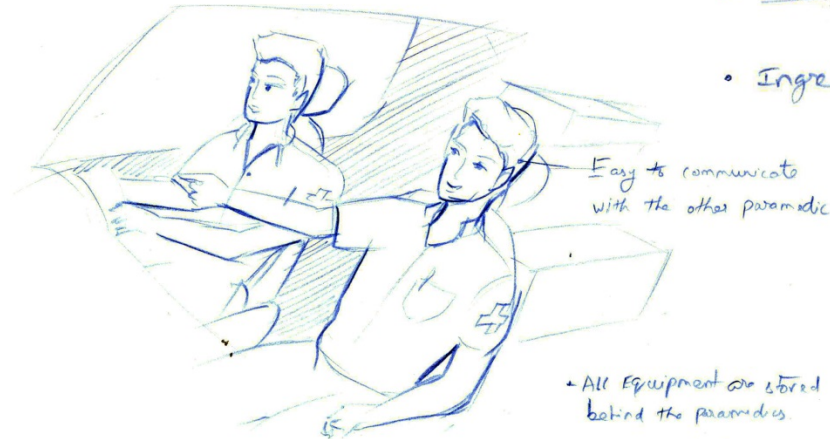




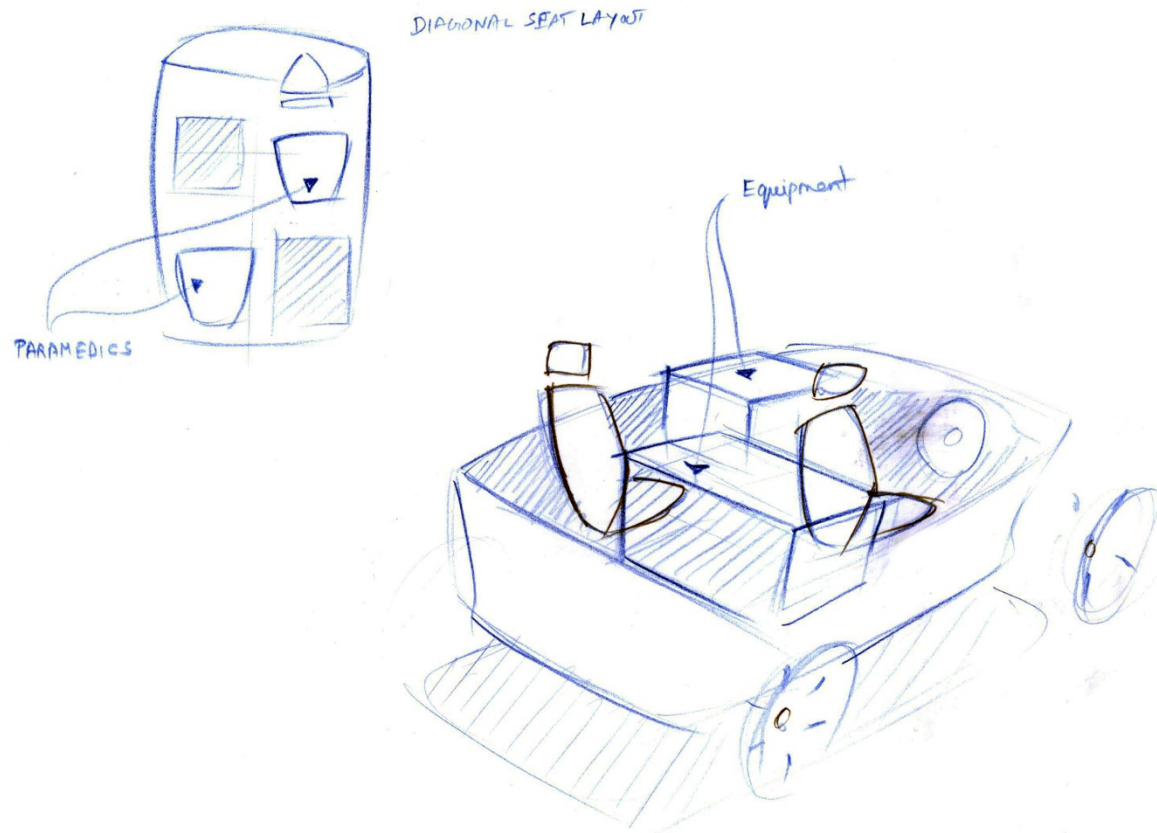




- ALL access from rear
- No immediate access
- Needs to stop, get down and then take the equipment out
- Ingress / Egress is easy

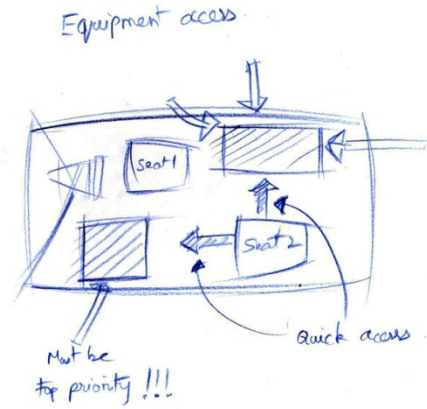


+ All Equipment is stored behind the paramedics

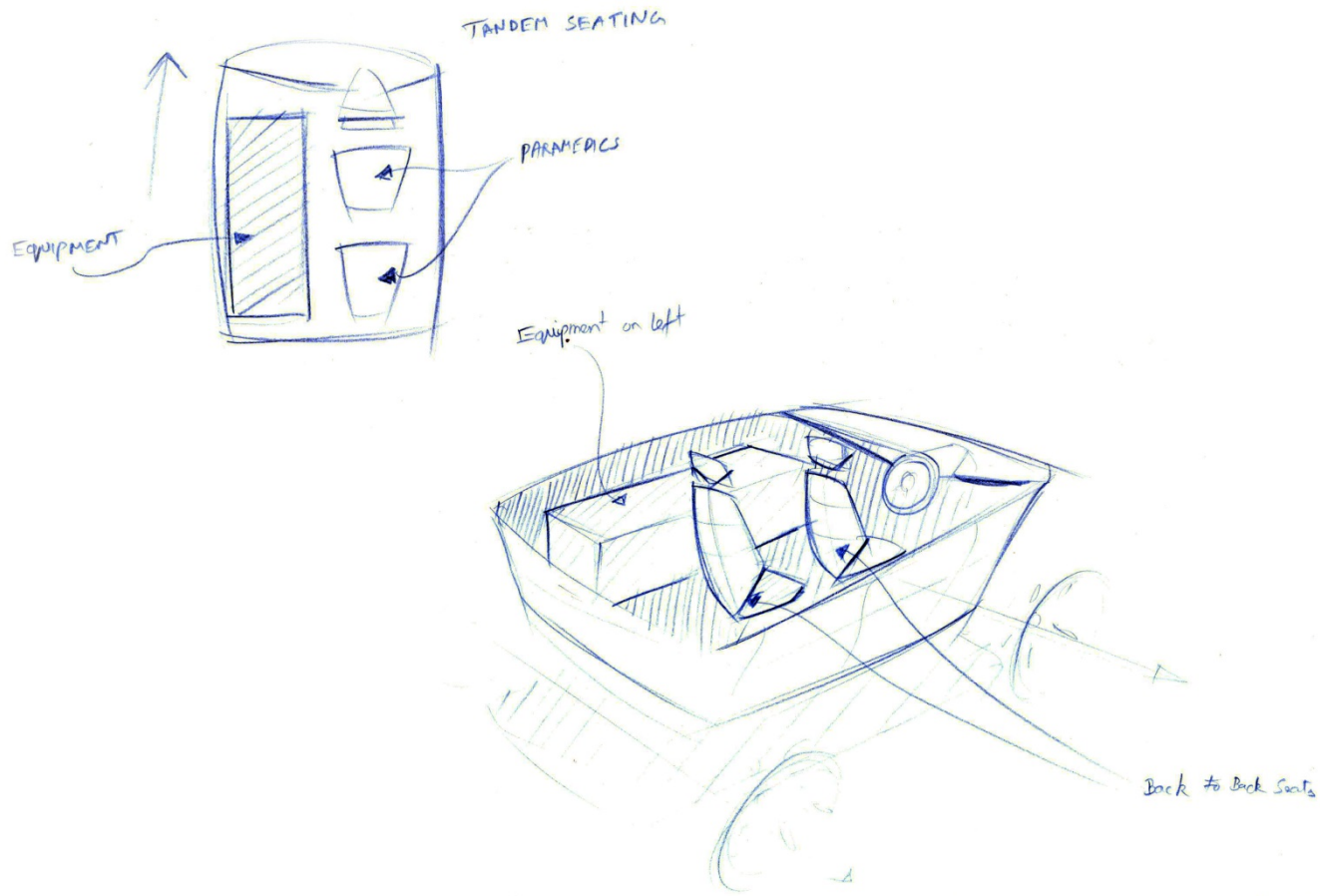


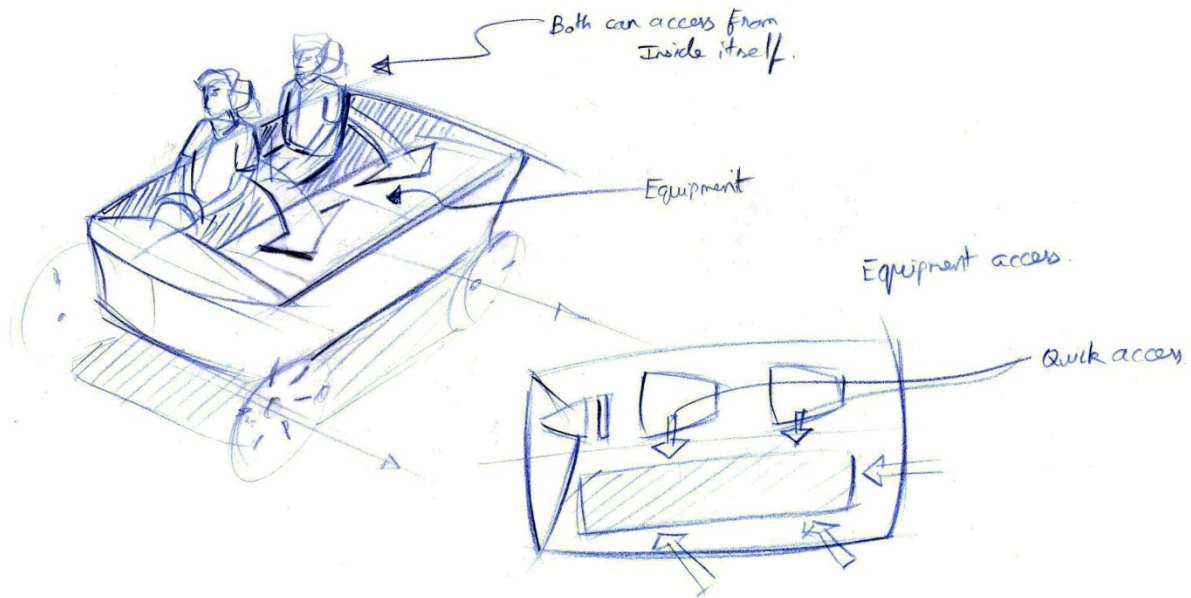


Allows paramedic
to get down
with the equipment

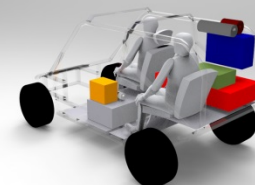
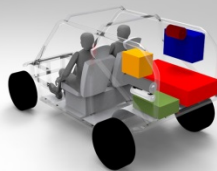
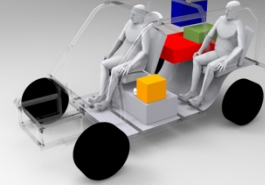
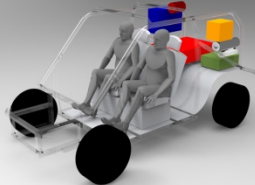
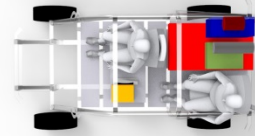
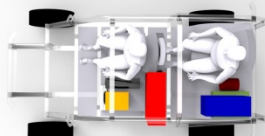
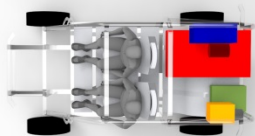


- + Ingress/Egress is a bit hindered as there is no rear seat
- + Quick access is very useful, can prepare the equipment before getting down
// very useful if it is very sunny outside or raining.





- * Ingress/Egress for rear passenger will be hard
- * Paramedics can't see both the sides while riding
- * Not so good for communication



Foldable stretcher



Rucksack



Oxygen cylinder



Laryngoscope



AED



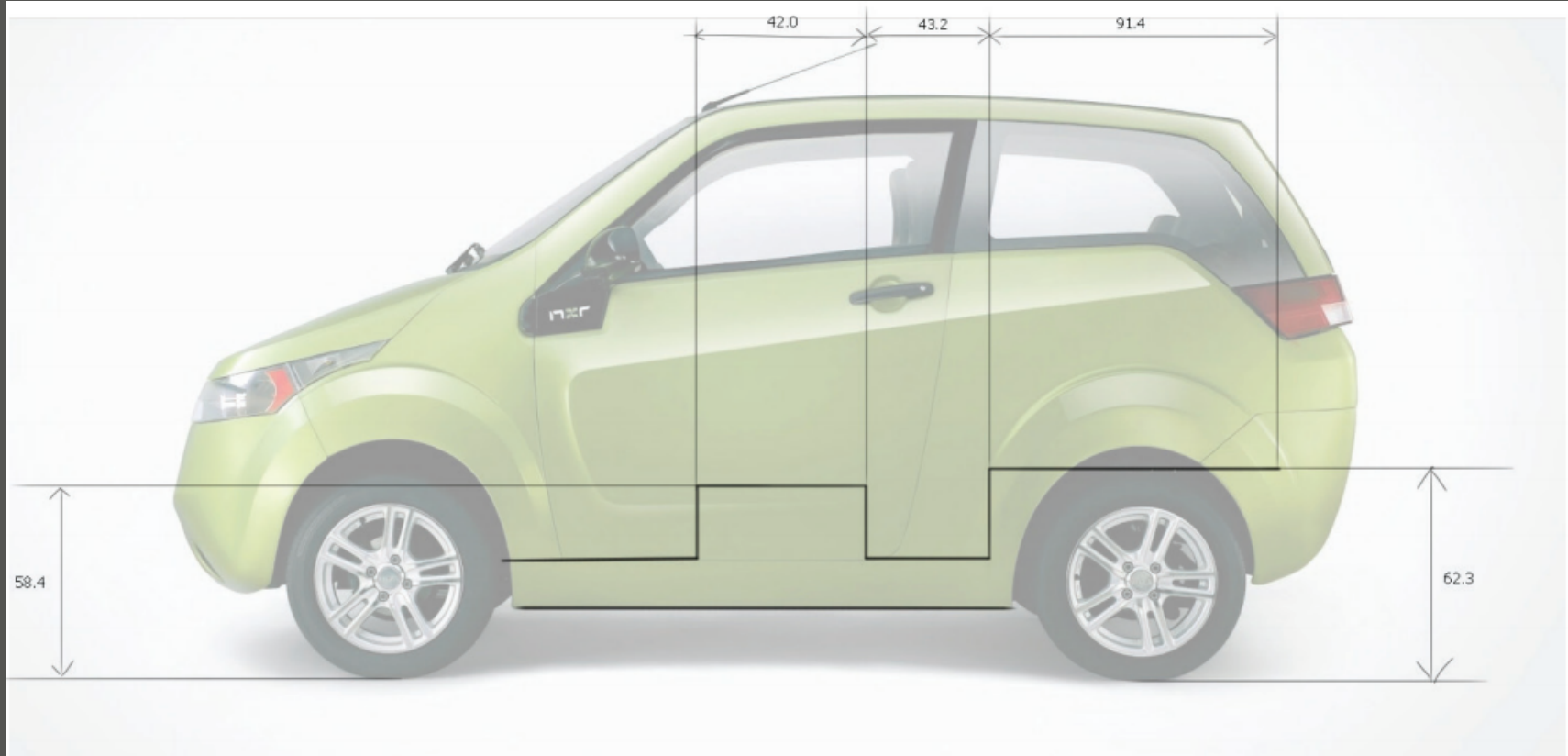
Suction apparatus



Ambu Bag

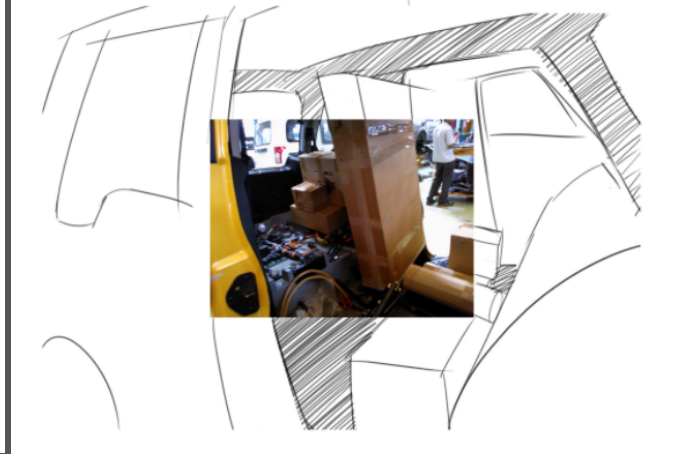
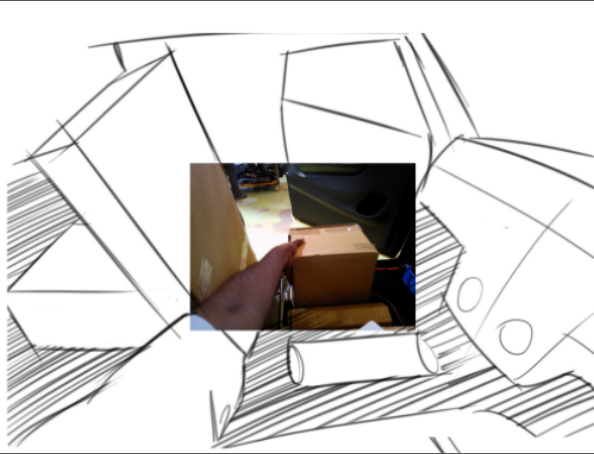


Equipment mockup

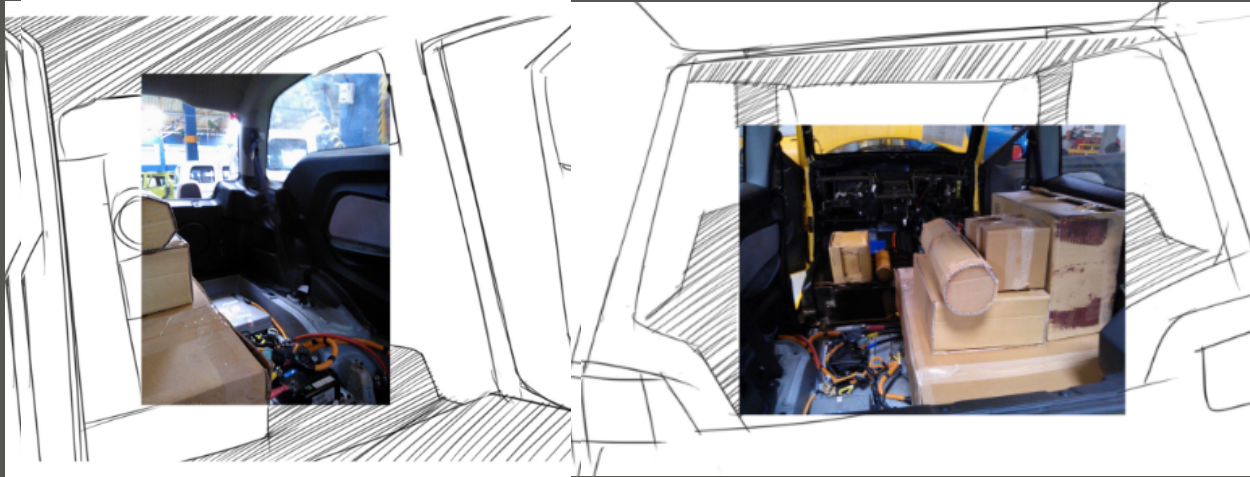


The floor board dimensions (in cms)

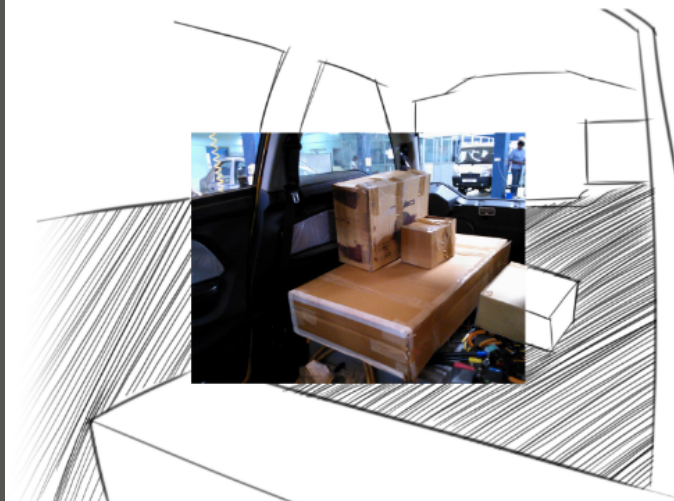
Back to back layout

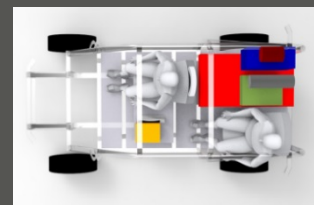
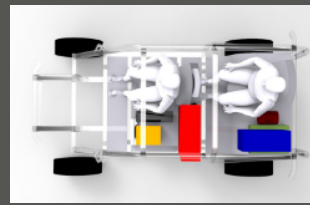
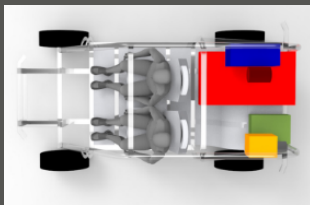


Diagonal layout



Side by side layout

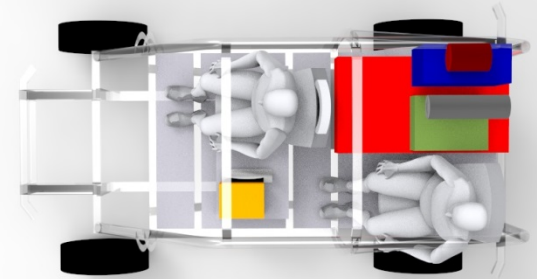
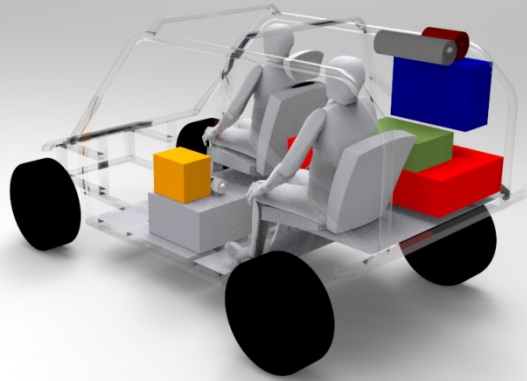
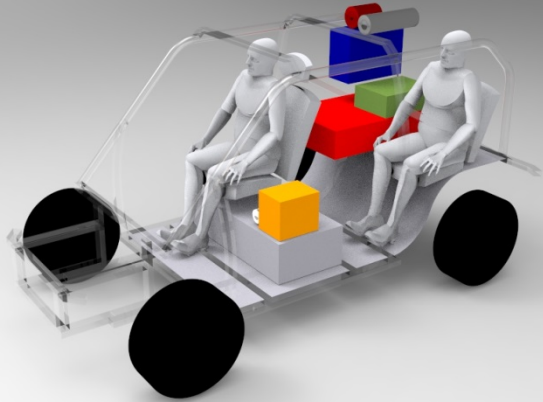




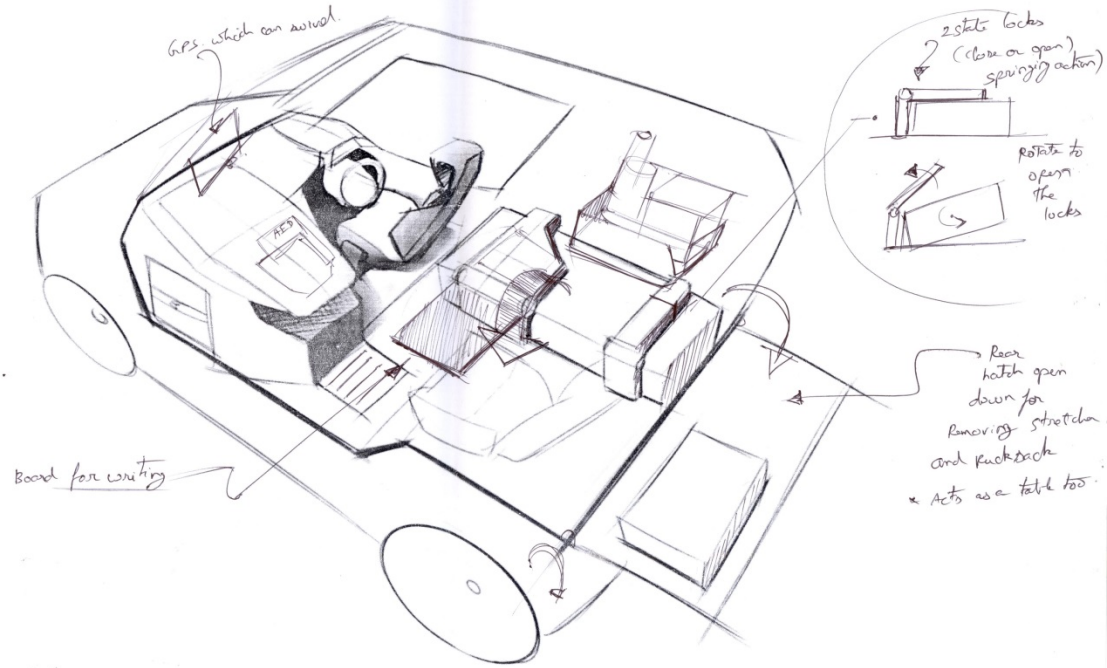
Criteria	weightage	Package 1 (side by side)	Package 2 (back to back)	Package 3 (diagonal)
Ingress/egress	5	5	2	4
Equipment accessibility	5	3	4	5
not claustrophobic	4	5	2	5
Communication between paramedics	3	5	2	4
Visibility (for both paramedics)	2	4	3	4
Total		83	47	85

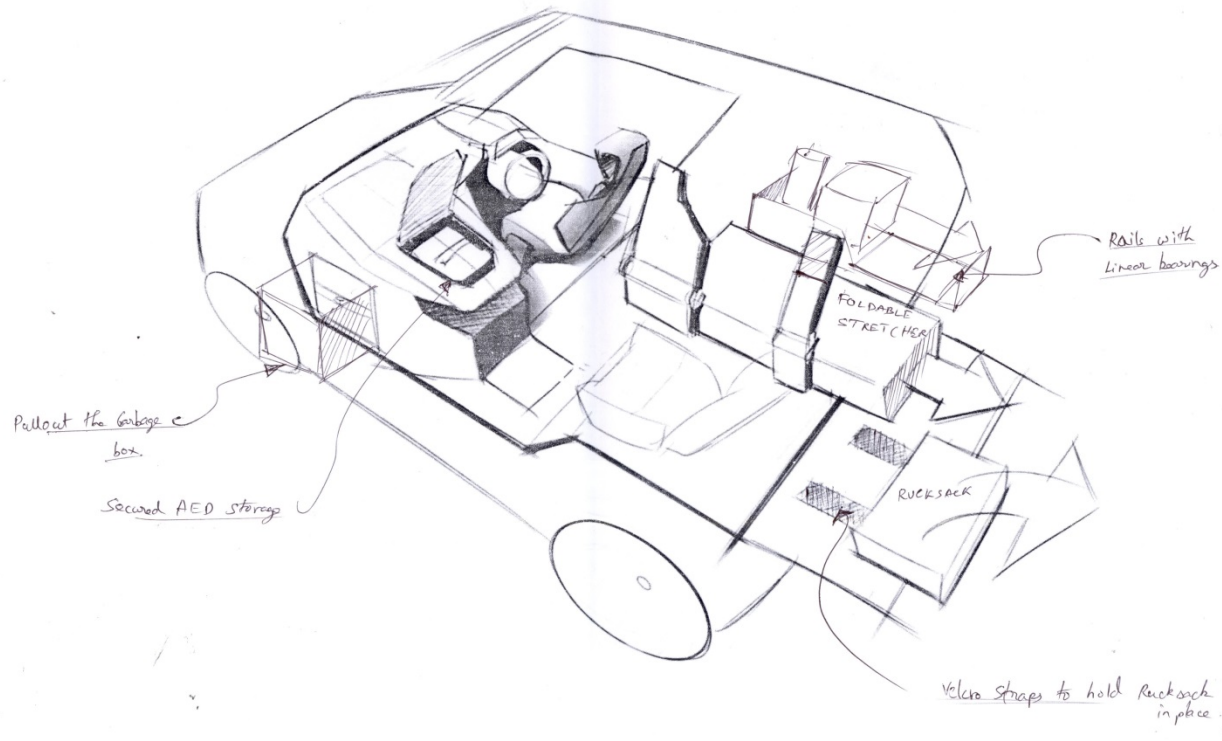
Package 3 – Diagonal layout

- Allows the paramedic to prepare even before he gets down
- Both paramedics can access the equipment
- Not safe to have AED on dashboard since it is heavy (6kgs) and expensive

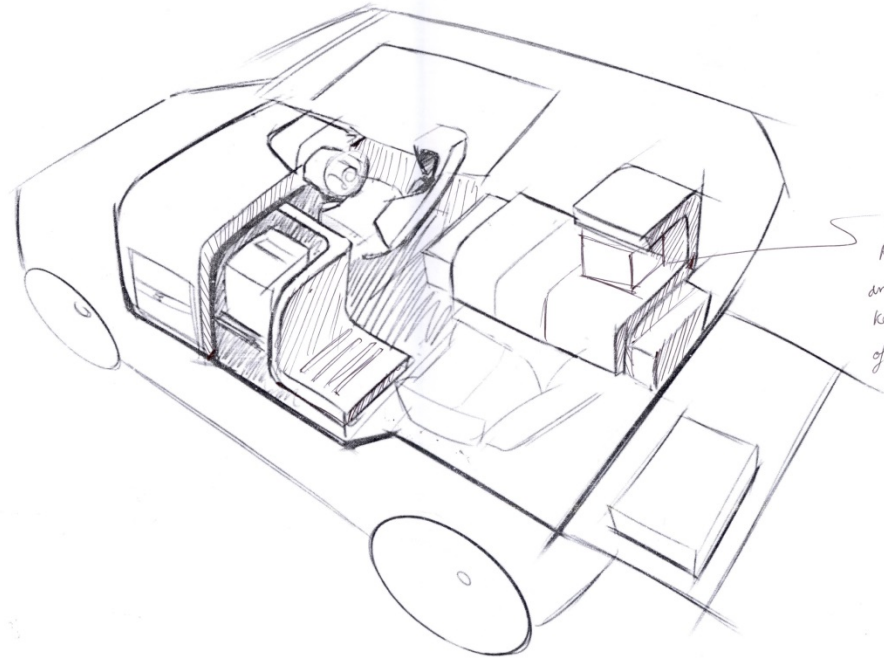


CONCEPT 1
FIXED PLACES FOR THE EQUIPMENT

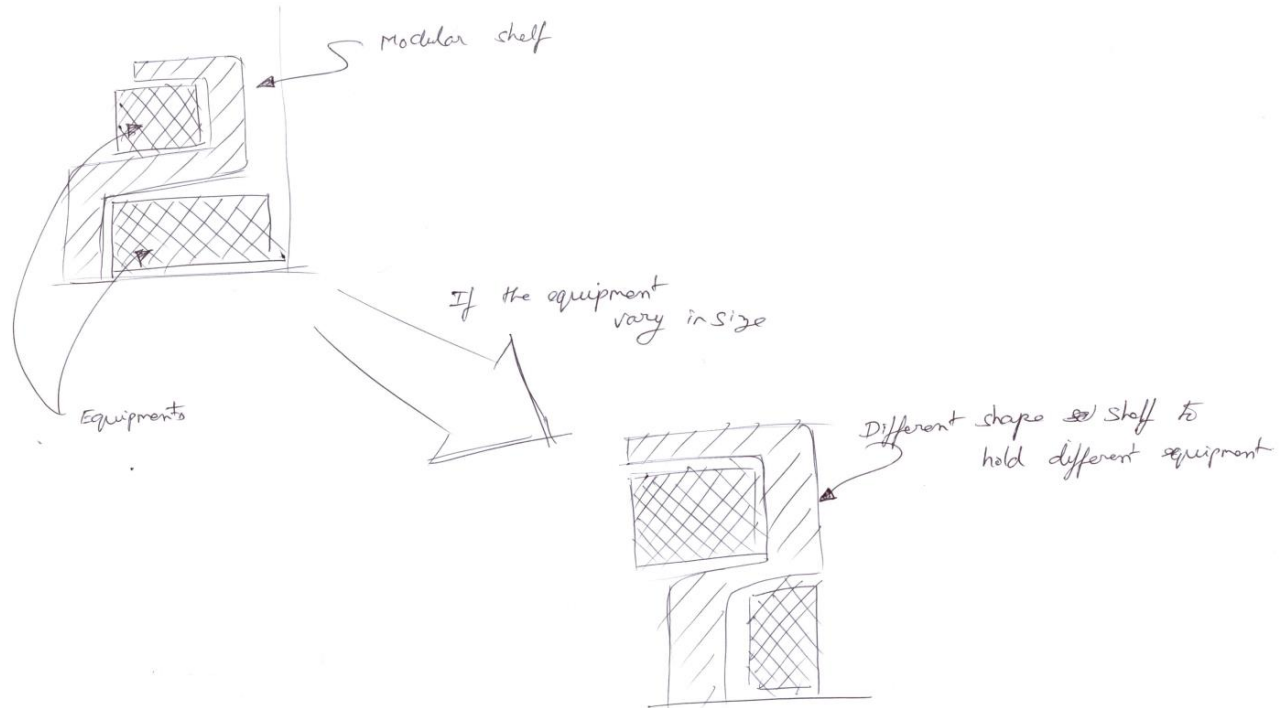




CONCEPT 2
MODULAR RACKS

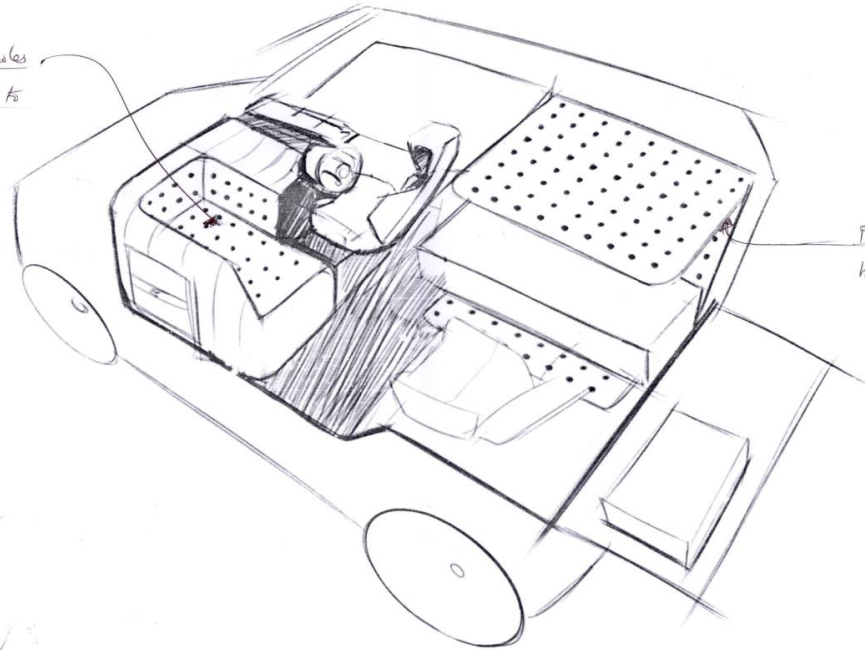


Racks which can be removed and another one can be kept for the purpose of the vehicle.

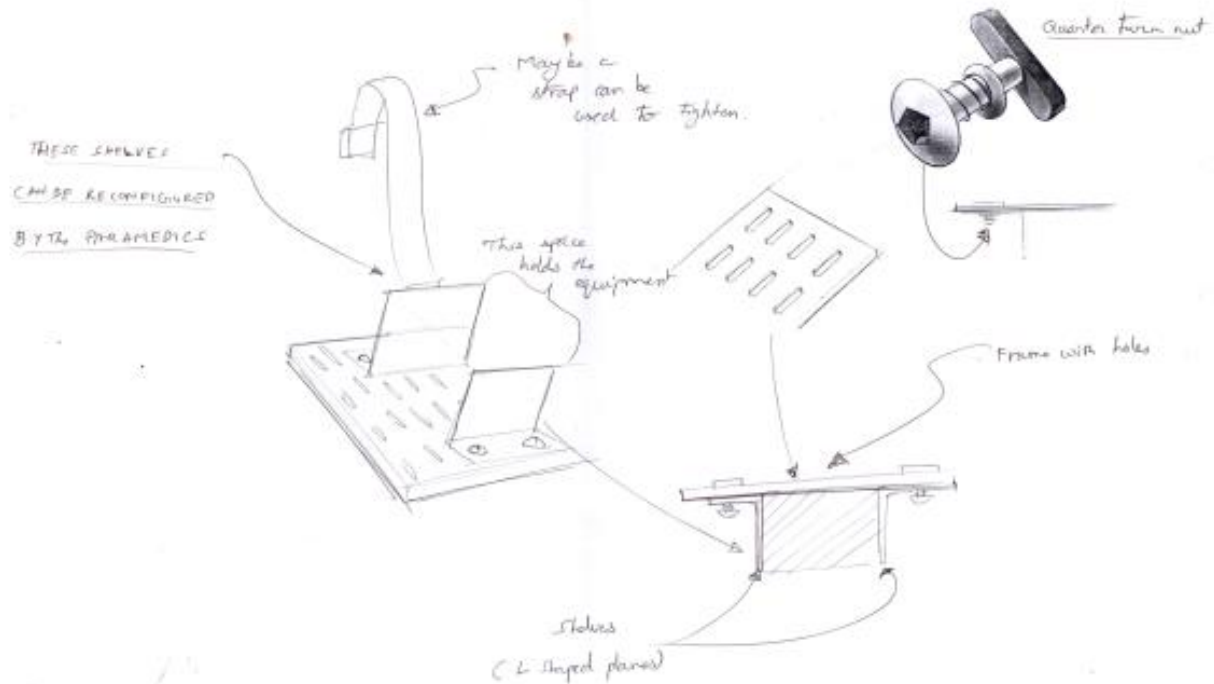


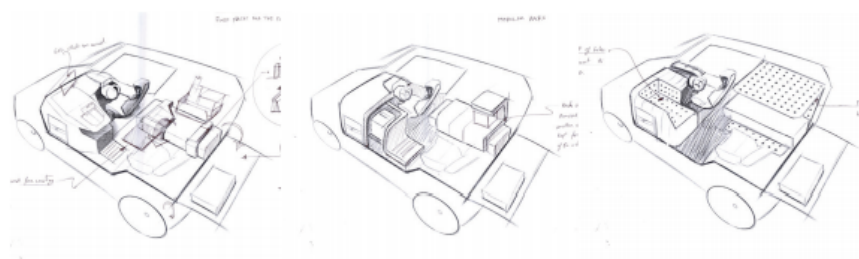
CONCEPT 3
LEGO CONCEPT

Another set of holes
in the front to
hold AED.



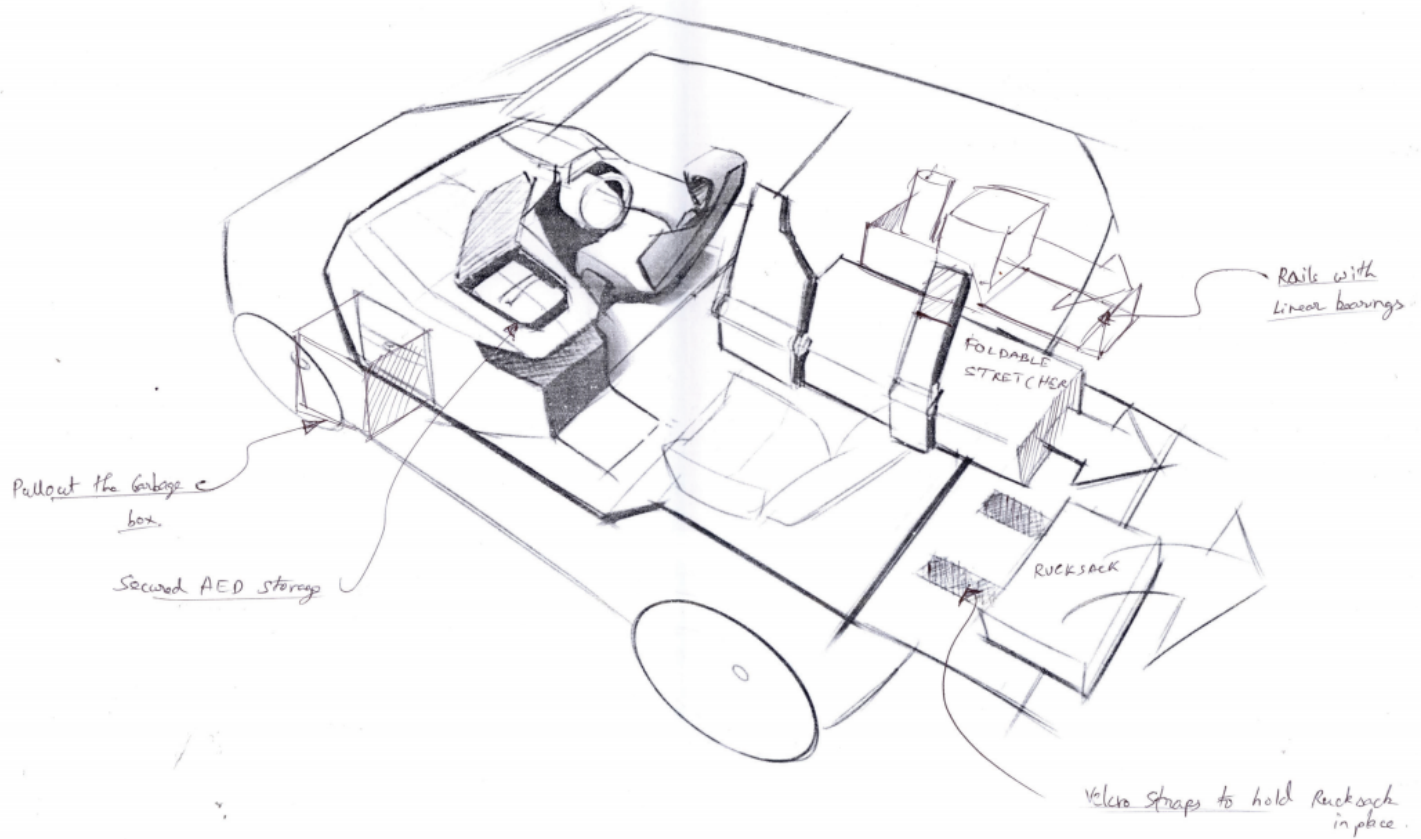
Frame which has
holes to hold shelves

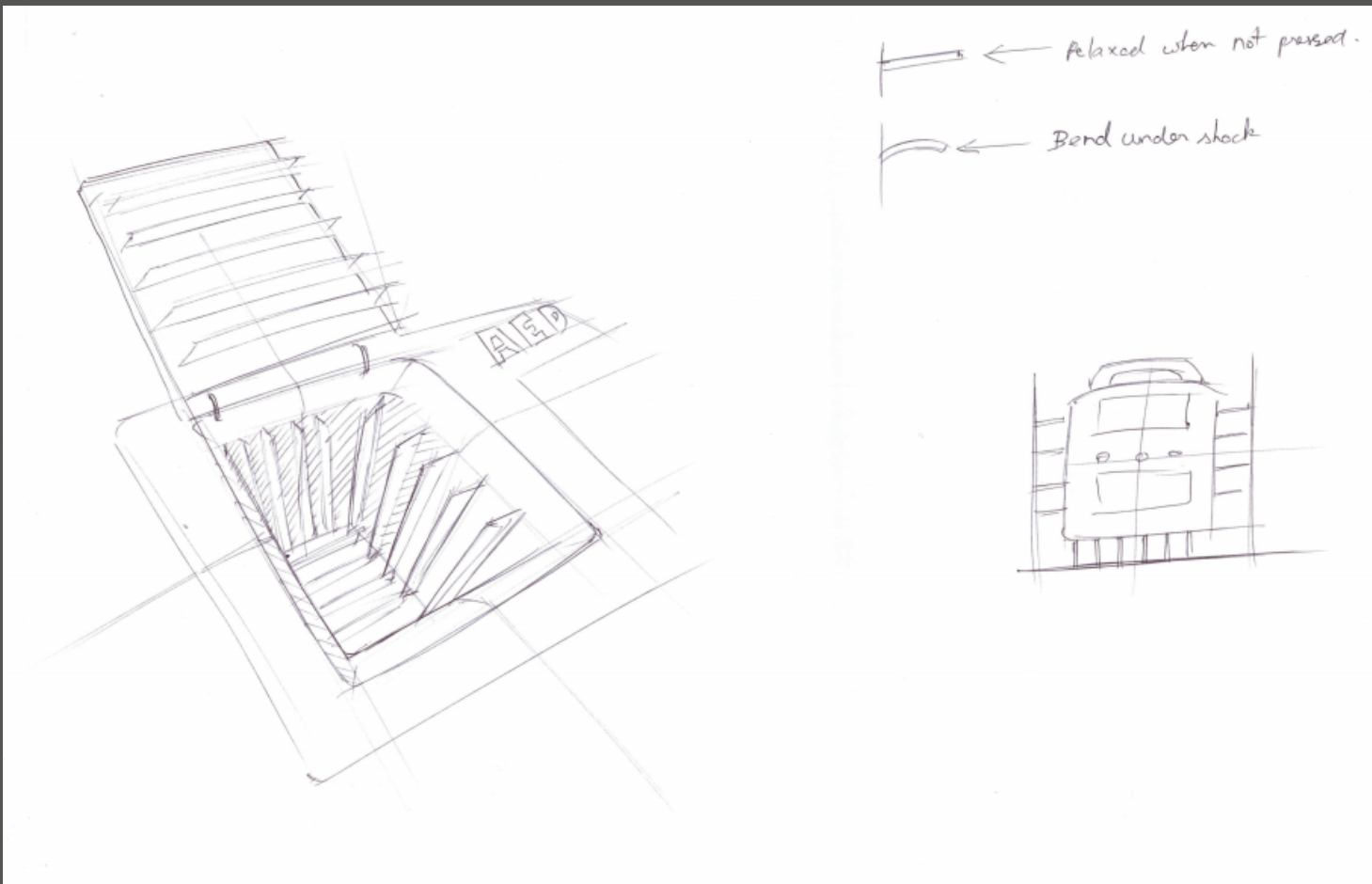


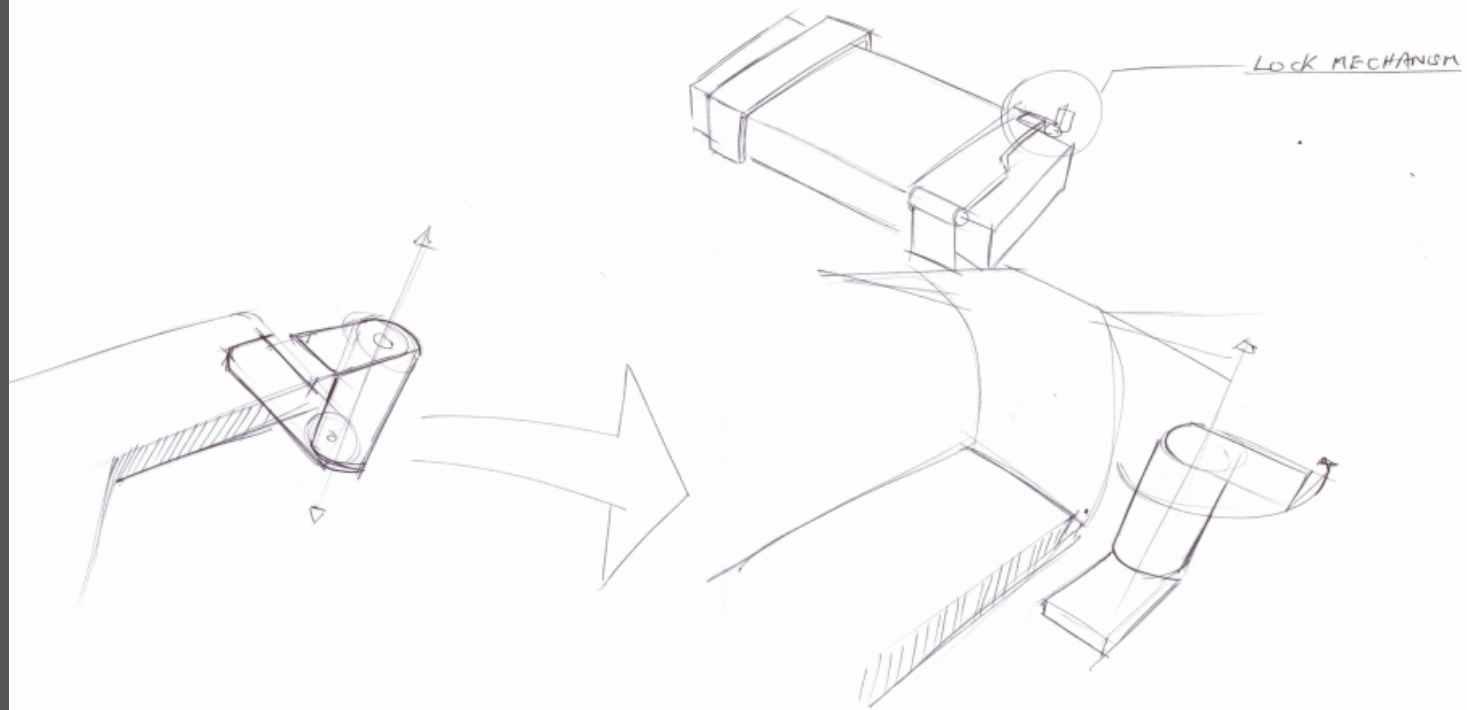


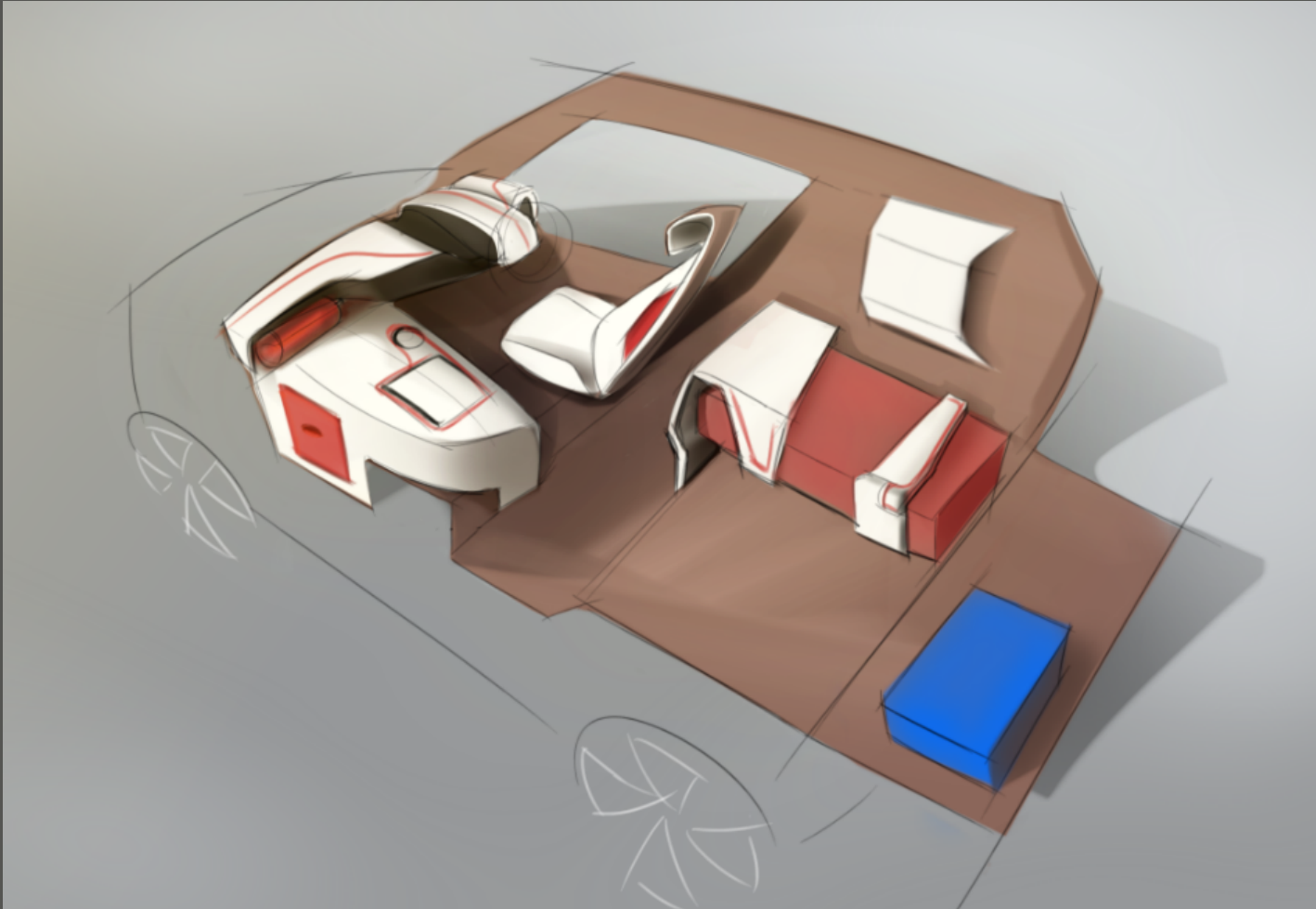
Criteria	weightage	Concept 1	Concept 2	Concept 3
Speed of retrieval	5	25	15	15
Securing equipment	5	25	15	10
Cleanability	4	12	16	8
Flexibility	3	3	9	15
Aesthetics	2	10	8	4
Total		75	63	52

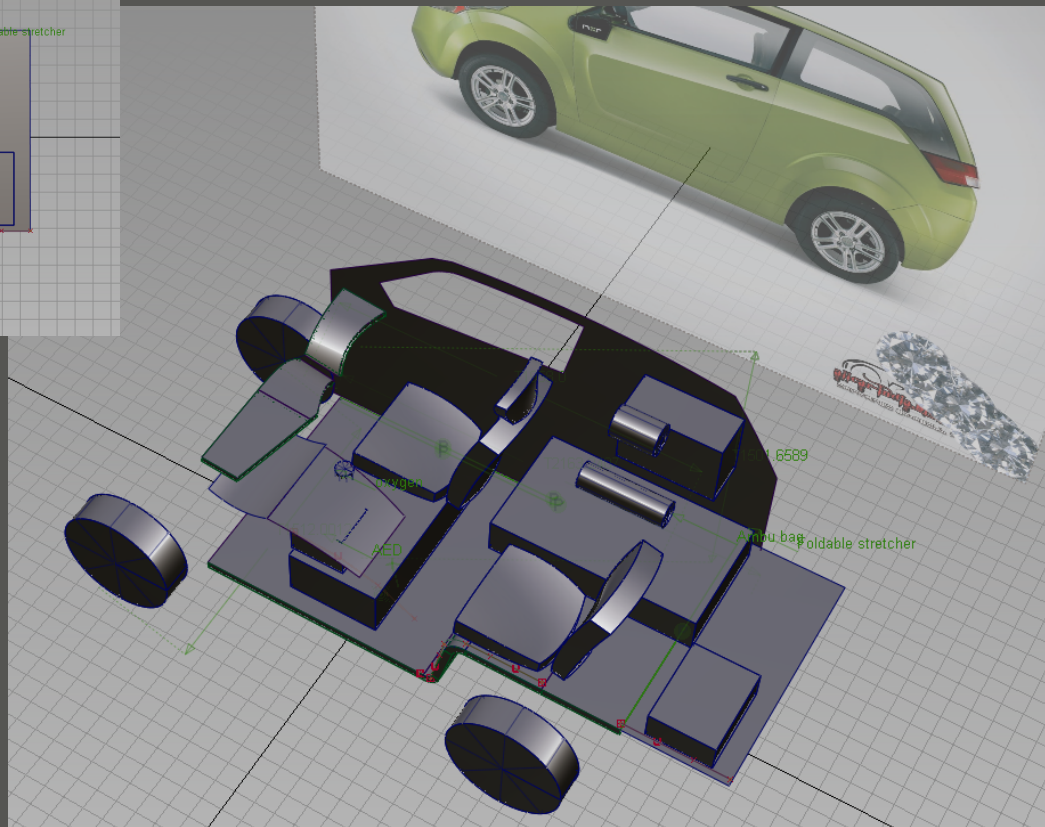
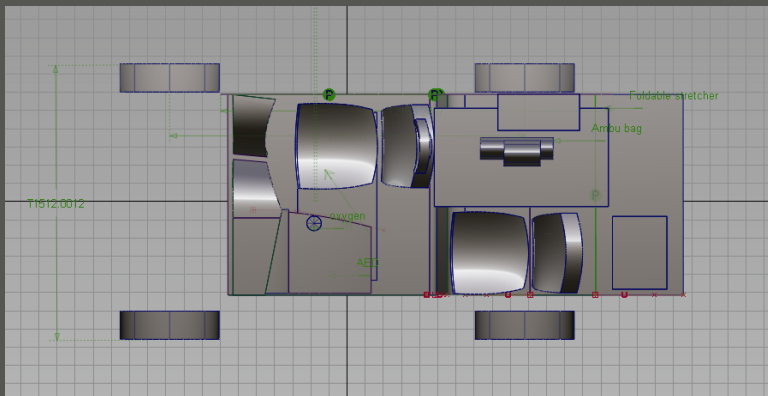
Criteria	weightage	Concept 1	Concept 2	Concept 3
Speed of retrieval	5	25	15	15
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References

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