ES101

Diesel-Electric Locomotive

Sketch Report

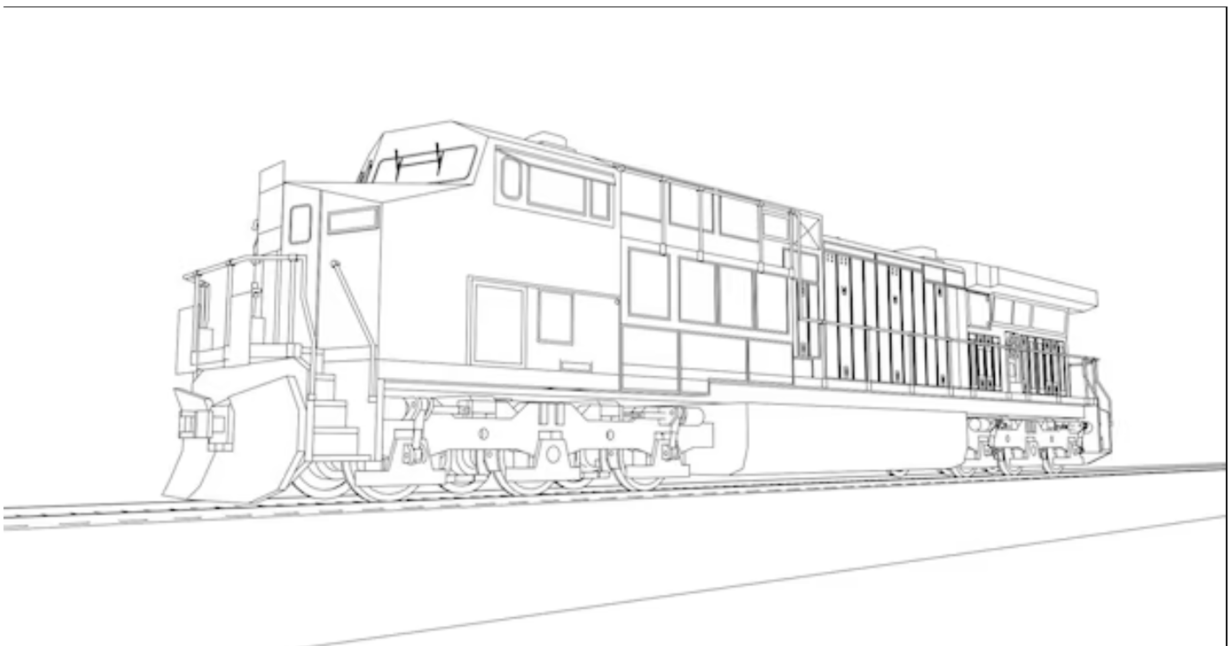
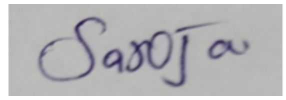
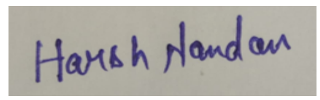
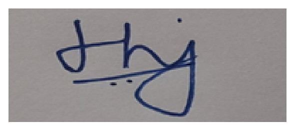
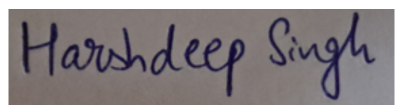
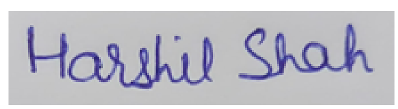
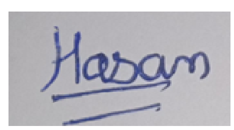
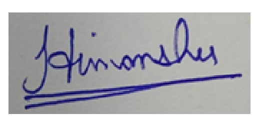
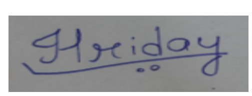


Fig 1. Diesel-Electric Locomotive - Base picture

Prepared by: Group 13

SIGNATURES

Sr. No	Name	Signature
1	Haravath Saroja (23110127)	
2	Harinarayan J (23110128)	
3	Harsh Nandan (23110129)	
4	Harsh Jamgaonkar (23110130)	
5	Harshdeep Singh Shekhawat (23110131)	
6	Shah Harshil Hardik (23110132)	
7	Hasan Ali (23110133)	
8	Himanshu Singh (23110134)	
9	Hiteshi Nikhil Meisheri (23110135)	
10	Hriday Tejasbhai Pandya (23110136)	

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PREFACE

"The best way to see a country is from the footplate of a locomotive." as said by George Dow depicts the importance of locomotives for the development of any country. The Diesel-Electric Locomotive, sometimes known as a "diesel locomotive," is a magnificent engineering achievement that significantly advanced locomotive technology worldwide.

Our primary motivation in choosing this specific project is to appreciate the inspiration and development caused by the then-innovative technology of Diesel-Electric Locomotive, which continues to inspire people even after a century. While the emissions are an environmental hazard, ongoing efforts to improve technology and explore alternative fuels are helping to reduce this problem. The improving diesel-electric locomotive will play a significant role in the ever-developing railway sector. Not only from an academic perspective of grades, we are also motivated to do this project considering the design and the beauty of diesel-electric locomotives. When new trains of all kinds and sizes are invented and built in our fast-paced world, we should appreciate the diesel-electric locomotive, a watershed moment in history. Despite the many types of locomotives, diesel-electric locomotives still account for 37% of the Indian Railways, which prompted us to choose them.

Regarding prospects, diesel-electric locomotives are crucial in railway transportation, particularly in areas where electrification costs are not feasible. Nevertheless, the sector continues to expand, with continuous research and development endeavors to enhance effectiveness and minimize emissions. The use of hybrid diesel-electric locomotives, which include battery storage and regenerative braking, is becoming more popular.

The diesel-electric locomotive exemplifies human creativity and engineering competence. Its compelling mix of diesel engine and electric transmission has made it the backbone of contemporary rail transportation, allowing the moving of goods and people over long distances with fantastic efficiency and dependability. While environmental issues remain, continual advances in diesel technology and exploring alternative fuels ensure these locomotives have a more sustainable future. As rail transportation plays an essential part in the global economy, the diesel-electric locomotive continues to be a driving force behind its success, a symbol of progress on rails, and a tribute to the enduring heritage of invention.

Here is the freehand sketch for the entire model:

MAIN SKETCH:

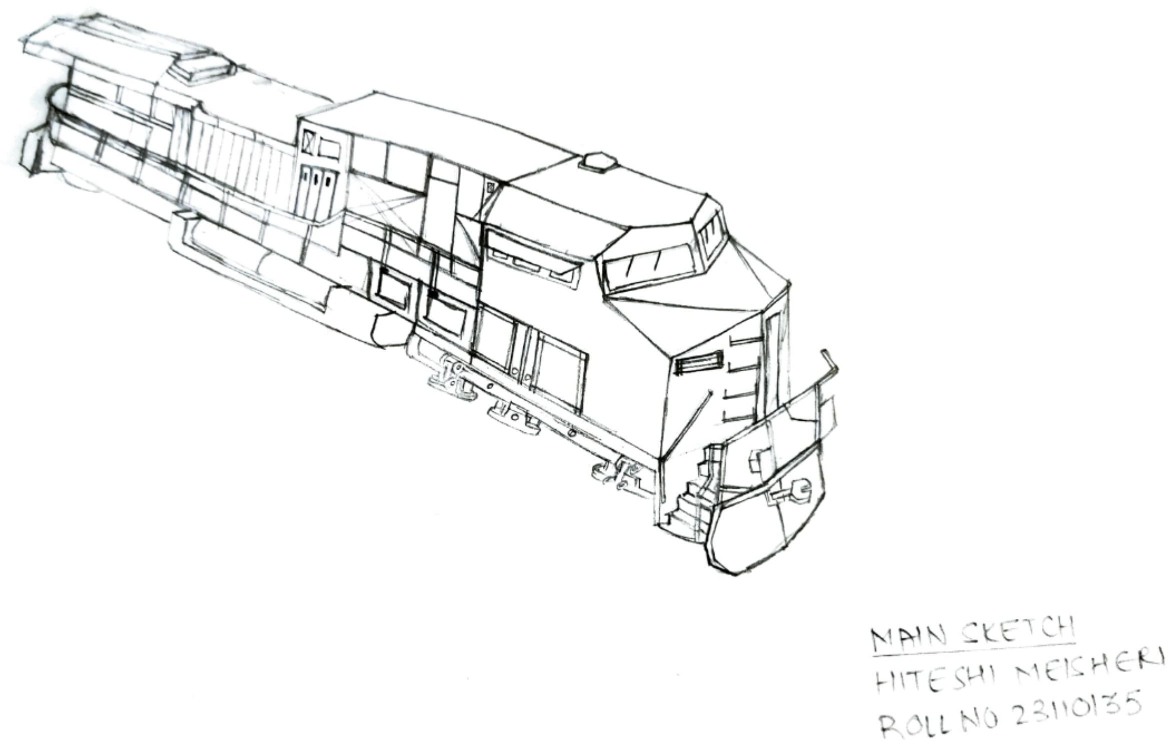


Fig. 2: Main Sketch of the model by Hiteshi Meisheri

GENERAL MODIFICATIONS

The modifications that we will be doing in our Diesel-Electric Locomotive and the reasons for doing it are as follows:

We removed the parts Coupling and Coupling cables as those parts are used for connecting coaches, and we realised it is better to just work on one coach - the engine coach. Initially, we planned to make the entire train; however, as per our Tutor's instructions, we finalised creating just the engine coach.

We removed the part Engine Control Panel as it was unnecessary for our project. We are also following the suggestion of the Tutor after a discussion with the team members as it is a challenging component to build with details in Autodesk, and we need to focus on a feasible project.

We removed the part Exhaust Gas Recirculation System as the Water System is already representing it, and the complexity of the details of the system is not feasible to be made in Autodesk within the given time constraints. As our Tutor suggested, we removed this part after carefully considering all the group members' opinions.

The overall dimensions will be in mm and dimensions will vary from the actual model. The dimensions of all parts are selected by considering all the other parts as each part is dependent on the other.

We do not have any other significant modifications. We have divided our parts into major systems rather than elementary ones. This also enables us to create detailed components in Autodesk; most parts contain a lot of assembling. This task will be challenging, but we are confident in our abilities.

FREEHAND SKETCHES, DIMENSIONS, MODIFICATIONS

Part: Body and Frame of the Train

Shah Harshil Hardik (23110132)

The body and frame are the most crucial components of the train. As the name suggests, all the internal parts of the train, like the operator's cab, engine water system, etc., will be placed inside the train's body. Dimensions of the body are

Height of the frame: 4366 mm

Width of the frame: 3656mm

Length of the frame: 16270 mm

Height of operator's cab: 1320 mm

Reason for selected dimensions:

All the dimensions would be good for the body. The dimensions of the body are larger as it is the outermost component and houses the rest of the internal parts of the train like the operator' cab, engine, air braking system, dynamic braking system, sand system, etc.

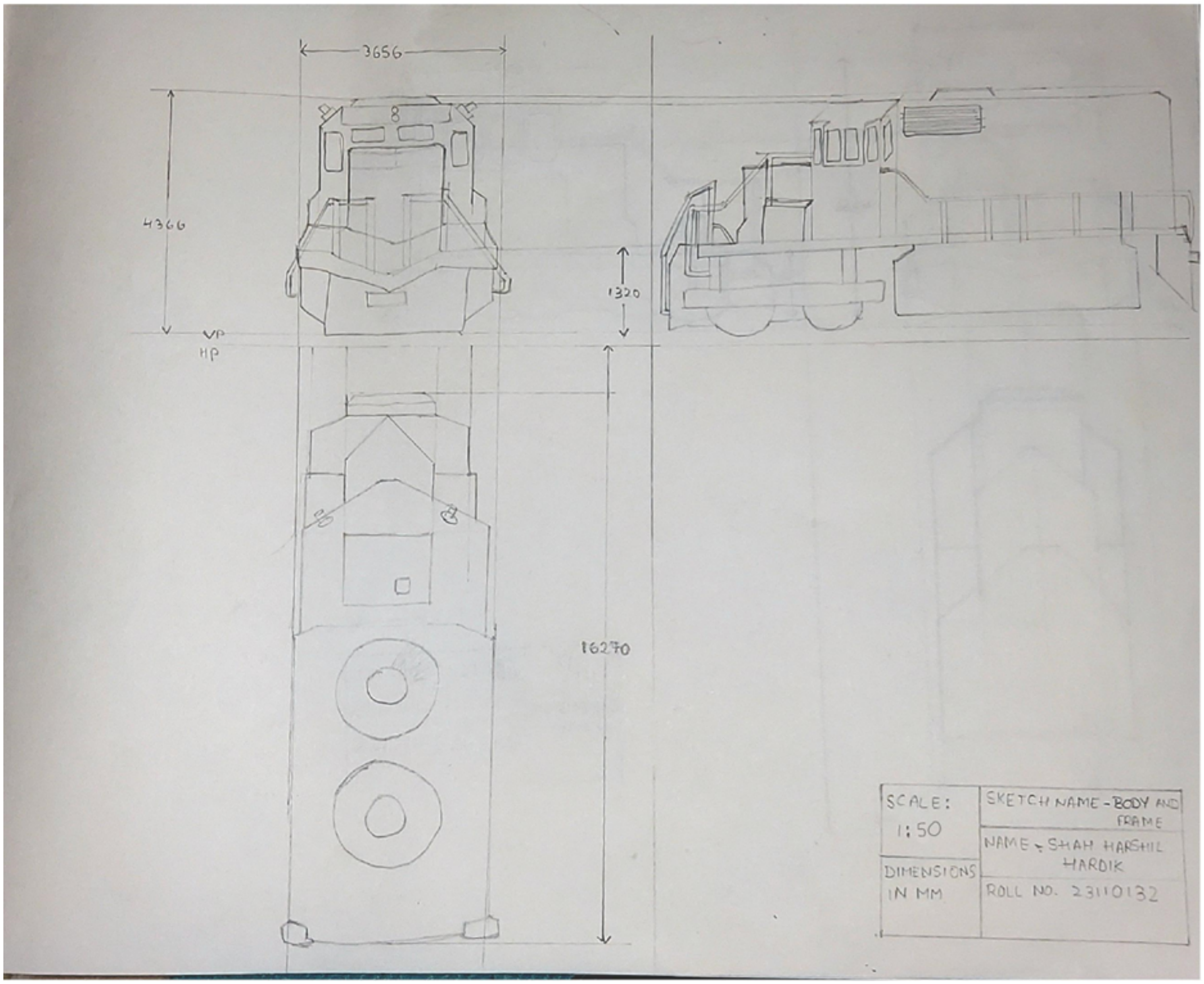


Fig. 3 Body and Frame of the Train

Materials:

The frame of the diesel-electric locomotive is a vital component of the train. It houses all the delicate internal parts of the train. Therefore, materials are carefully chosen to ensure durability, safety, and endurance. The body and frame of the train are made from high-strength steel (HSS) or Carbon steel with aluminium alloy. Carbon steel provides strength, and aluminium alloy helps achieve a lightweight composition, which helps to reduce the train load and increase the train's efficiency. Windows and windshield in the operator's cab is made from safety glass. The pilot (cowcatcher) is made from cast steel to ensure strength and resistance to fracture on colliding at high speed with obstacles on the track.

Part Name: Engine

Hiteshi Nikhil Meisheri (23110135)

The dimensions of the V16 engine were determined through a systematic approach. Initially, we established the engine's height at 1690 mm based on observations from various models, which indicated that V16 engines were typically around 60% of the height of locomotive coaches. This choice served as a fundamental starting point for our design.

Subsequently, we conducted an extensive review of V16 engine models and their specifications available online. By aggregating data from multiple sources, we calculated an average ratio for the engine's length, width, and height. While the process was not entirely formal, it allowed us to arrive at dimensions that struck a balance between various considerations.

Consequently, the final dimensions of the V16 engine were determined as follows: a length of 2850 mm, a width of 1020 mm, and a height of 1690 mm. These measurements were chosen thoughtfully to optimize the engine's performance and seamless integration within the locomotive coach.

The selection of materials for a V16 train engine is a meticulous process driven by both historical data and recent trends in engineering. According to statistics from the year 2000, the composition of engine materials is as follows: steel plate comprises 37%, steel bar 23%, cast iron 8%, aluminum alloy 8%, other non-ferrous alloys 2%, plastics 10%, rubber 7%, glass 2%, and miscellaneous materials 3%. However, the pursuit of greater lightweight-ing in recent years has led to a reduction in the reliance on steel, altering this composition.

Despite this trend, the fundamental materials for engine components remain iron-based alloys. These include structural steels, stainless steels, iron-based sintered metals, and cast iron. These materials offer a combination of strength, durability, and heat resistance that is essential for engine operation.

In a broader context, steel can be categorized into six main types, each tailored to specific engine requirements: cast steels, stainless steels, low carbon steels (with a carbon content of 0.10 to 0.20%), medium carbon steels (with a carbon content of 0.30 to 0.50%), high carbon steels (with a carbon content of 1.0%), and special steels. These categories provide engineers with a diverse palette of steel options, allowing them to select the most suitable material for each application within the V16 engine, ensuring optimal performance and longevity in the demanding world of locomotives.

Steel, in particular, stands out as the predominant material due to its numerous advantages. It boasts a relatively low cost, exceptional endurance strength, naturally hard surfaces, and the ability to fine-tune its strength and hardness through a wide range of heat treatments. However, steel is not without its drawbacks, including susceptibility to rapid corrosion, relatively low thermal conductivity, and challenges in casting processes. Nonetheless, its inherent properties make it the material of choice for crucial moving components such as crankshafts, gears, connecting rods, auxiliary shafts, and fasteners.

Engine parts

Part	Material	Remarks
Cylinder head	Gray Cast iron	Usual
Cylinder barrel	Cast aluminum	Small engines
Pistons	Forged aluminum	Good thermal conductivity
Piston pin	Steel	Wear resistant
Piston rings	Steel	Wear resistant
Connecting rod	Steel	Low cost
Crank shaft	Steel	Low cost

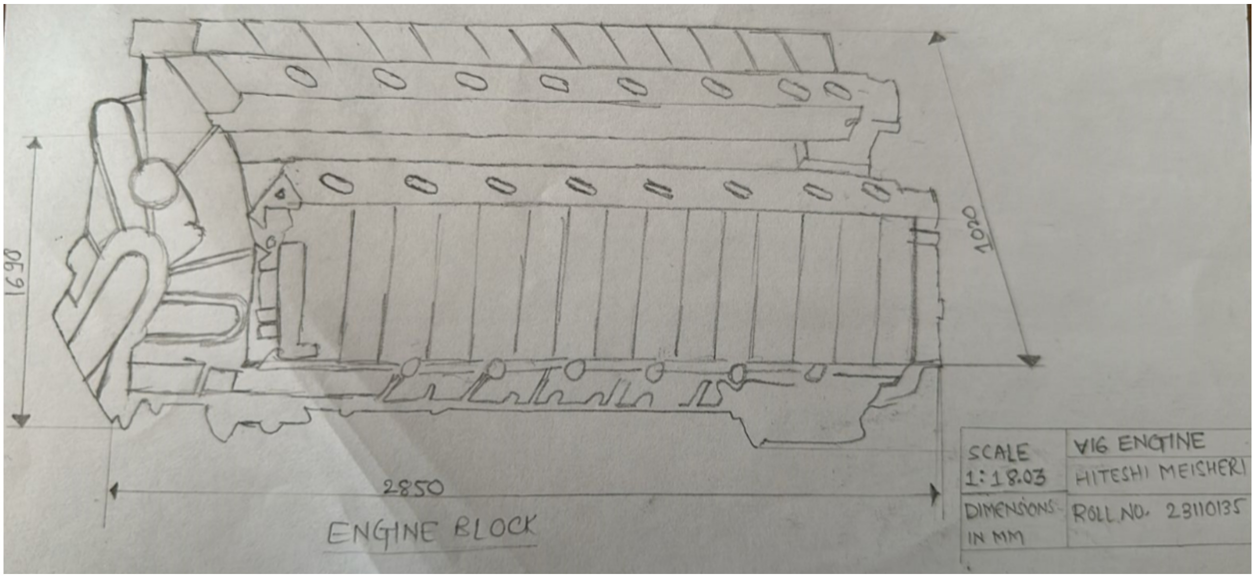

1690
1020
2850
ENGINE BLOCK
SCALE
1:18.03
DIMENSIONS
IN MM
V16 ENGINE
HITESHI MEISHERI
ROLL NO. 23110135

Fig. 4 Engine

Part Name: Air Breaking System

Harsh Nandan (23110129)

Reasons for selecting the dimension:

Main role of air braking system in train is to provide resistance in it's motion when it is required, it is located in bogie just near the wheels. By considering this i took it's overall heights such that it can fit inside the bogie. Other dimensions like distance between the brake shoe and it's length depends on what is length between the wheels in bogie because brake shoes just aligned with the wheel. So by discussing with my team mates distance between the brake shoes and overall height are 2600 mm and 1200 mm respectively. Also i adjust the length and width of MAR Tank (500mm,300mm) and compressor (400mm,300mm) accordingly. Height of brake valve and distance between the braking cylinders are taken as 250mm and 1570mm such that they can easily get fit into the bogie and distance between the brake pipe and braking cylinder is 250mm accordingly.

Materials used:

- Brake shoes are responsible for producing large amount of friction on wheel to resist it's motion, So it is generally made up of semi-metalllic compound or ceramic material to ensure the production of large amount of friction with the wheels.
- Tanks are typically made up of steel or aluminium alloy to prevent corrosion.
- Brake pipes are responsible to carry the compressed air which is usually at very high pressure,So it is made up of steel, stainless steel, or reinforced rubber to make it comfortable at high pressure.
- Brake Callipers are responsible for applying force on brake shoe, that's why they need to be brittle in nature,So they are are made up of cast aluminium or cast iron.
- Brake valve also made up of steel or aluminium.

- Compressor is made up of cast iron or aluminium to sustain at high temperature and pressure.

Here we can conclude that materials used to make the components of air braking system have generally high tensile strength and they can withstand at high temperature and pressure. Also many of them corrosion resistant.

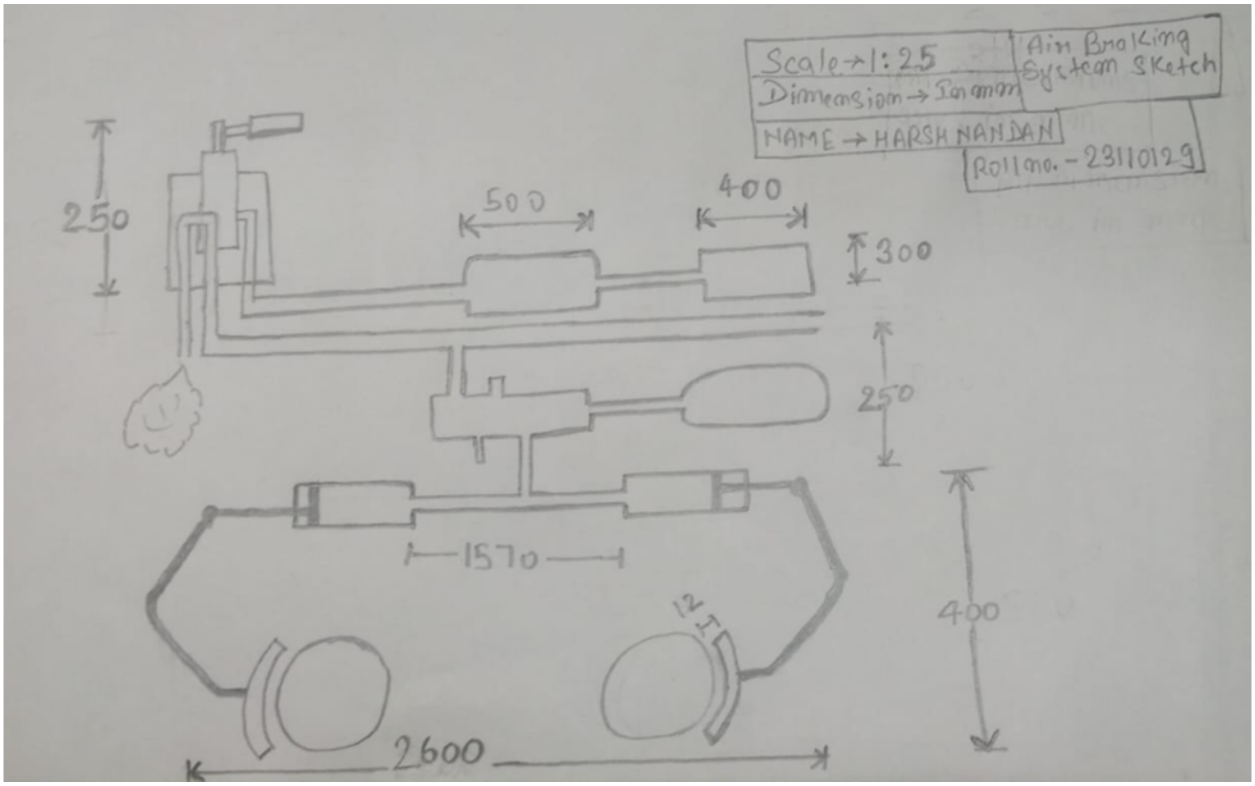


Fig. 5 Air Braking System

Part Name: Batteries

Harshdeep Singh Shekhawat (23110131)

The part that I have been assigned to sketch and make is the diesel - electric locomotive batteries. It is one of the key components for the functioning of the diesel - electric locomotive. So, choosing the correct dimensions of the batteries becomes very important for the overall sketch of the locomotive.

The batteries should not be too big so as to become a problem for the space of the other parts, but also it cannot be very small as it is required for many basic yet important functions of the diesel - electric locomotive.

While choosing the dimensions of the batteries, safety should also be kept in mind as the size of the batteries may affect the heat dissipation done by them and thus may affect the person handling them.

The dimensions also play a role in the cost of the batteries as it directly affects the amount of material required for the manufacturing of the batteries. Manufacturers consider this while manufacturing the batteries.

The dimensions of the batteries that we have decided on are based on the fact that the batteries need to fit properly in a designated position in the locomotive. Also, they need to be aligned perfectly with other parts of the locomotive that my fellow team members are designing so that they don't coincide and are placed at their correct place inside or outside the locomotive.

The following dimensions are decided for the batteries:

Length - 840mm

Width - 420mm

Height - 630mm

The above dimensions are what we think are the best suited dimensions for the batteries according to the overall size of the locomotive and also the size of the other individual components of the locomotive.

The overall form factor of the batteries has been considered before deciding the dimensions.

I think it will be a fairly easy part to make without any problems.

Materials used:

The batteries that are used in the diesel - electric locomotive are of the Acid Lead type of batteries.

The casing of the batteries is made of a heavy - duty hard rubber or rugged FRP (Fibre Reinforced Plastic)tray. This is chosen so that the batteries can survive rough handling and also to increase their durability.

The lids of the batteries are heat sealed on the top.

The batteries also need to survive harsh weather conditions because the locomotive moves long distances from one region to another. It may be cold weather somewhere, and then it may be hot weather somewhere else, and so the battery is covered properly and kept at a proper space inside the diesel - electric locomotive.

The maintenance cost of the batteries should also be minimal.

These days the recyclability and the impact of the batteries on the environment after they are discarded is also being considered by the manufacturers for deciding the materials to use for the batteries.

With passing time, more and more efficient, eco-friendly, and durable batteries will come to the market, which will be made from a better material than the older ones.

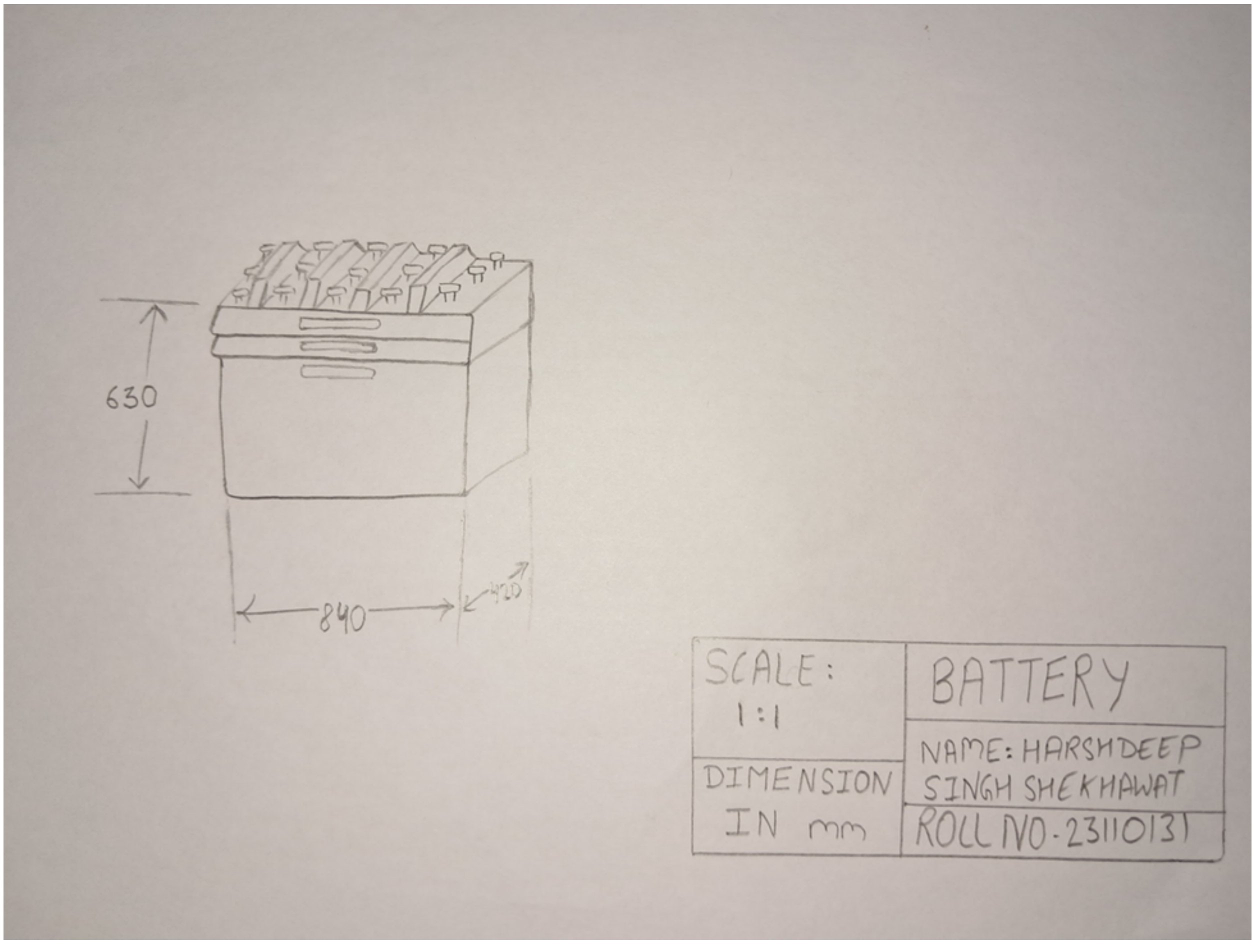


Fig. 6 Batteries

Part Name: Electrical Generator

Harsh Nilesh Jamgaonkar (23110130)

Materials used for Electrical Generators in Diesel Locomotives-

1) Aluminum- Main selling point of Aluminum are its light weight and corrosion-resistive property. That is the reason why it used in certain components of aluminum of generator like Rotors or cooling components etc.

2) Insulators- Insulating materials like mica, fiberglass etc is extensively used in generators to insulate the copper windings so as to prevent from short circuits.

3) Copper- In order to efficiently transfer electric energy, copper which has high electrical conductivity is used.

4) Iron and Steel- These are used to form the core structural unit of the generator. They provide the necessary hardness to the structure.

5) High Temperature Alloys- Whenever the generator operates at higher temperatures, Alloys like Inconel etc are used to maintain the integrity of the machine.

6) Composite Materials- Certain appropriate mixtures of metals can be used to overall reduce the weight of the machine while still maintaining the integrity of the machine.

7) Bearings and Lubricants- Generators need to carry out extensive work of the train. Sometimes due to external environment and heat generated, the machine doesn't operate perfectly due to friction. In order to reduce the possibilities of this outcome and ensure that the machine runs smoothly, lubricants and bearings are used.

8) Rare Earth Magnets- In certain trains, rare earth magnets like neodymium-iron-boron magnets are used to increase power output efficiency.

9) Coating and surface treatments-Materials like nickel plating are used to prevent corrosion of the metal.

The reason for choosing the dimensions-

The generator (or alternator) is situated besides the engine. The usual length of the generator is usually about 2/5 of generator's length so as to properly make both of them fit properly. The height is around the same as that of the engine. Generator also acts as the bridge between the engine and the locomotive traction motors and thus it should also be decently wide enough so as to carry the energy over.

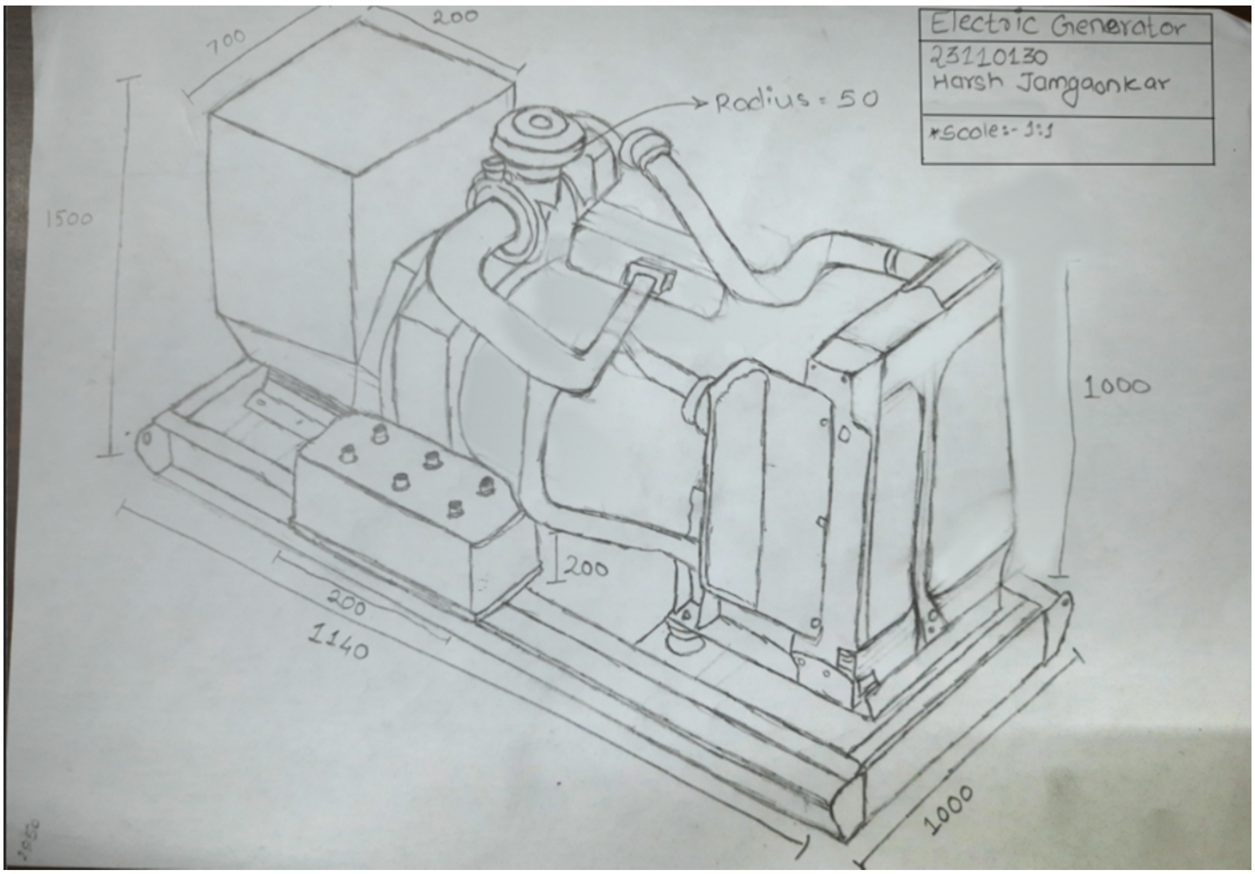


Fig. 7 Electrical Generator

Part Name: Bogie

Himanshu Singh (23110134)

The part I have been allotted is Bogey. Bogeys are a crucial part of the locomotive. They provide support to the whole upper body and hence they have to be as strong as possible. They provide stability to the system on straight as well as curved paths. They improve the quality of ride by reducing impact of centrifugal force while on circular tracks. It also absorbs vibration to make rides comfortable.

The most common material used in making bogeys is steel and aluminium. The material is decided on several factors such as strength, stress, stiffness, recyclability, resistance etc. Steel is used due to its strong nature, durability, corrosion resistant nature but is also bulky and heavier as well as expensive. However, aluminium is light, cheap and recyclable but weaker and has more tendency to break as compared to steel. One very important factor in determining the material is its thermal behavior.

Environment friendly materials should be used in making bogeys as nature is also our responsibility only. Coaches are connected to one another through:

- Screw Couplers
- Central Buffer Coupling Coupler
- Schaku Coupler

Generally, a bogey is attached at each end of a locomotive. These materials provide the necessary strength and durability to support the weight of the locomotive and distribute it evenly across the axles. The wheels, axles, suspension system, and other components within the bogey are also made of sturdy metals to withstand the stresses and strains encountered during locomotive operations.

Iron is also used as a material in making bogeys.

Axles are made up of SAE grade 41xx steel or SAE grade 10xx steel.

The distance between two wheels in a bogey is 2560 mm. The individual radius of the wheel is 445 mm. The length of a bogey is 2666 mm. The dimensions need to be accurate in order to ensure proper functioning of locomotive failing which will lead to accident and much causalities along with huge loss for money and resources. Also if dimensions are not accurate then there will be distortion while assembling the whole locomotive.

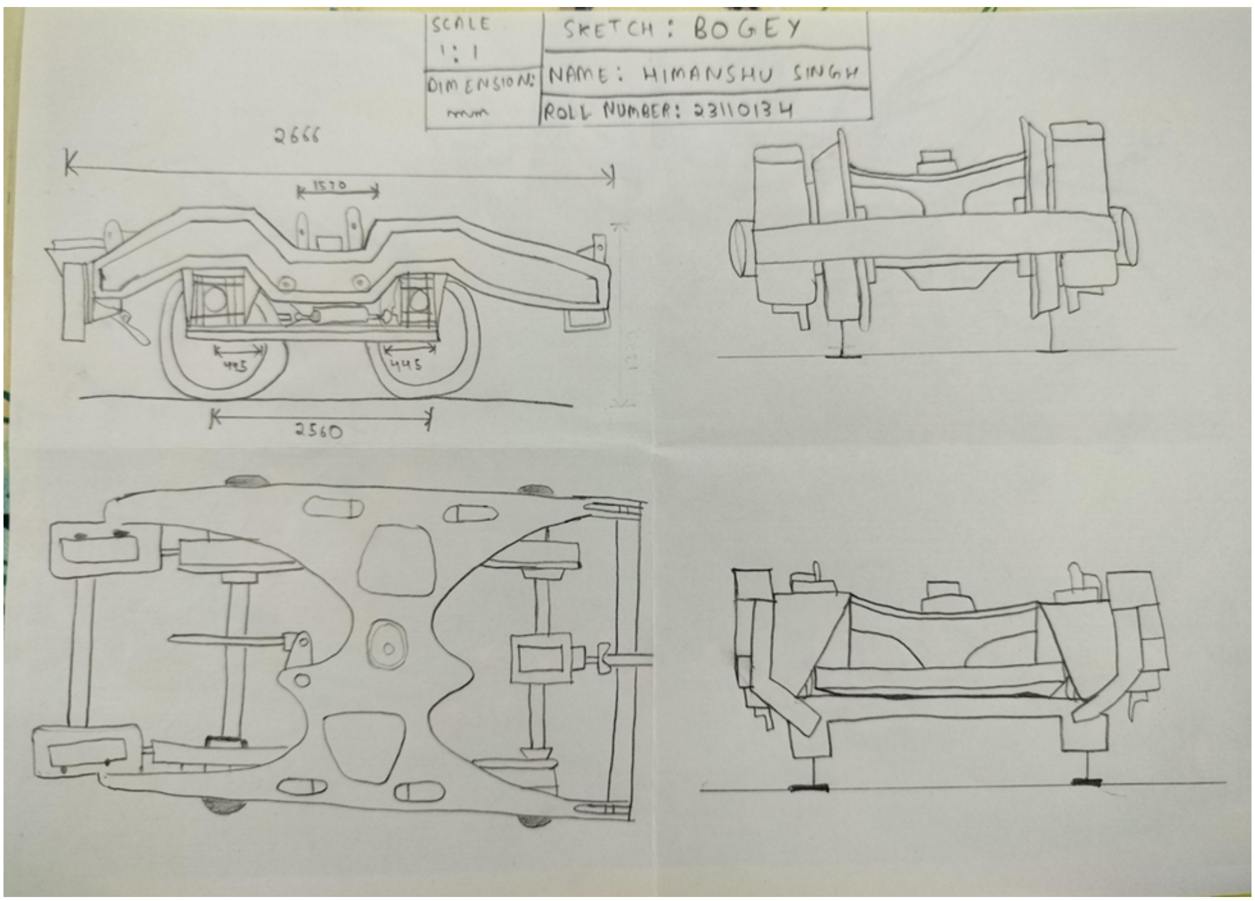


Fig. 8 Bogie

Part Name: Traction Motor

Hasan Ali (23110133)

Materials:
Traction motors are essential in the locomotive, providing the necessary power to propel the vehicle. The choice of materials for traction motors is critical to ensure their efficient and high overall performance. Electrical conductivity, magnetic properties, thermal conductivity, mechanical strength, and cost-effectiveness are considered when selecting the materials.

Below are some commonly used materials for traction motors:

Copper: Copper is commonly used in the windings of traction motor coils due to its excellent electrical conductivity. It helps minimize energy loss and heat generation during operation.

Aluminum: Aluminium is often used in traction motors' housing or structural components due to its lightweight nature and reasonable electrical conductivity. It helps reduce the engine's overall weight, contributing to better efficiency and vehicle performance.

Steel and Iron: These materials are used in the motor core, stator, and rotor due to their excellent magnetic properties. Steel is often used for the motor frame and core laminations to enhance magnetic flux and reduce eddy current losses.

Permanent Magnets: Various types of permanent magnets, such as neodymium-iron-boron and samarium-cobalt, are utilized in traction motors. These magnets provide a strong magnetic field, enhancing motor efficiency and performance.

Insulation Materials: Insulation materials like varnishes, resins, and specialized coatings are used to insulate and protect the windings from electrical and thermal stresses.

Ceramics and Composites: In some cases, ceramics and composite materials may be used for specific components to enhance thermal conductivity, reduce weight, or improve mechanical properties.

Rare Earth Elements (REEs): Materials containing rare earth elements, such as neodymium and dysprosium, are crucial for manufacturing high-performance permanent magnets in modern traction motors.

Thermal Conductive Materials: Materials with good thermal conductivity, such as copper or certain ceramics, may dissipate heat efficiently from the motor and maintain optimal operating temperatures.

Reason for Chosen Dimension:

Appropriate dimensions are required for the proper functioning of the locomotive. It is possible only due to adequate dimensioning that wheel alignment is possible, which provides stability and balance to the locomotive. Also, these should be made as compact as possible, taking less space in the locomotive.

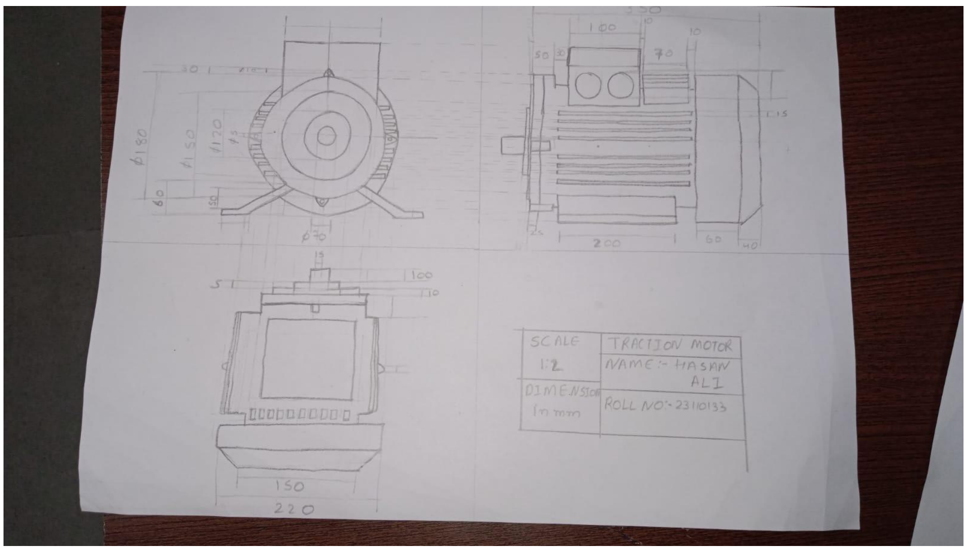


Fig. 9 Traction Motor

Part Name: Sand System

Hasan Ali (23110133)

Reason for Chosen Dimensions:

The dimensions of the sandbox depend on various factors to ensure effective performance.
The factors are:

- Sand Capacity:- It should hold an adequate amount of sand based on the needs. It should be sufficient for a particular duration.
- Weight Distribution:- The dimensions should be taken care of for proper weight distribution. It helps to prevent slipping and provides adhesion.
- Maintainance:- It should be designed for easy refilling and inspection.
- Safety:- It should be designed not to create any obstructions or hazards.
- Cost and Efficiency:- Cost-effectiveness should be considered while designing sandboxes. To have an adequate performance, there should be a balance between size, price, and efficiency.
- Weight: It is an essential factor in locomotives. The dimensions should be chosen to have minimum added weight to the locomotive.

Materials:

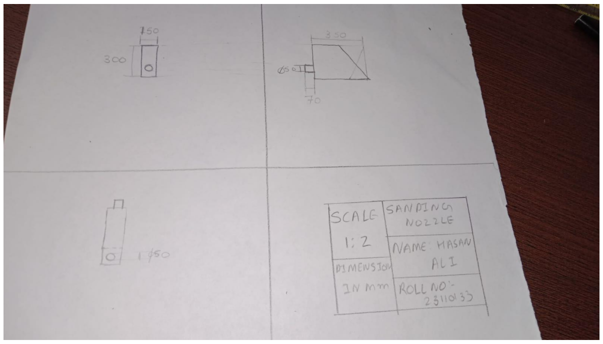
The materials depend on factors like design, environment, and many others. A sandbox is sealed to store the sand. The common materials used in making the sandbox are:-

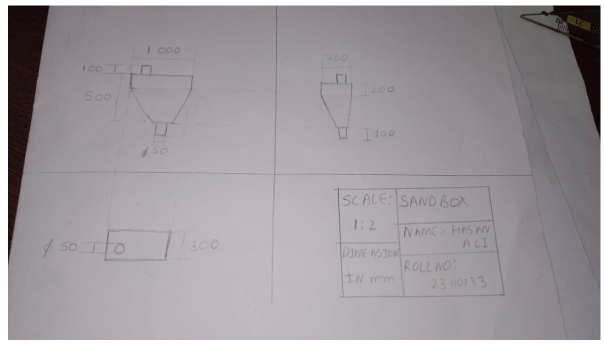
- Steel:- It is used because it provides the required strength and durability to sustain the railroad conditions
- Stainless Steel:- It is used because it provides high corrosion resistance, which helps it to withstand adverse climatic conditions.
- Aluminum:- It is used because it is lightweight, corrosion resistant, and has an excellent strength-to-weight ratio.
- Fiberglass:- It is used because it provides a good balance between strength and weight.
- Plastic:- It is used because it is lightweight, corrosion-resistant, and can be molded into complex shapes.

The sand inside the sandbox, also known as locomotive sand, is made of the following composition:-

- Silica (SiO_2):- 98.3%
- Aluminum Oxide(Al_2O_3):- 0.3%
- Ferric Oxide(Fe_2O_3):- $<1.29\%$
- Calcium Oxide(CaO):- $<0.2\%$
- Magnesium Oxide(MgO):- $<0.2\%$

The sand in the sandbox provides friction between the wheels and the rails in wet conditions. We should ensure that the sand used in the sandbox should be dry. This sand goes through the compressed air before throwing it on the rails.





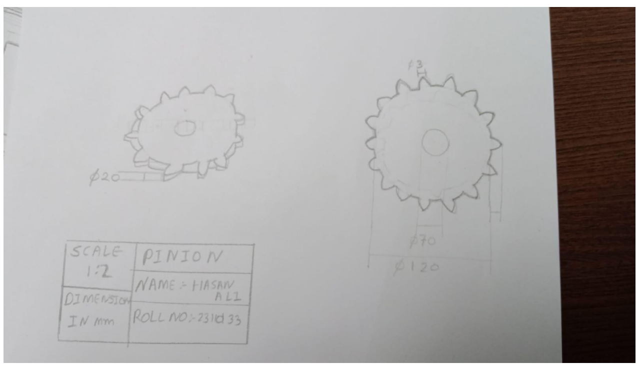


Fig. 10.1 Sanding Nozzle
Fig 10.2 Sandbox
Fig 10.3 Pinion

<u>Part Name: Turbocharger</u>

Hriday Pandya (23110136)

Reason for Chosen Dimensions:

The turbocharger is an essential part of a diesel locomotive whose function is to provide more fuel to the engine by compressing more air inside the cylinder. The dimensions of the turbocharger are:-

1. Diameter of inlet pipe:- 74.2 mm
2. Length of outlet pipe:- 138.4 mm
3. Width of Outlet pipe:- 126.8 mm
4. Height of Cylinder in Turbocharger:- 422 mm
5. The diameter of the Cylinder in the Turbocharger:- 99.5 mm

The reason for choosing these dimensions is to avoid any problems during the assembly. This part is connected to 2 to 3 essential elements of the locomotive, so it should be appropriately measured. The turbocharger's inlet and outlet pipe should be adequately measured so that a proper amount of air flows throughout the system. The impeller/ compressor wheel consists of blades that help air to discharge radially. The more the blades and the velocity of the impeller, the more will be discharging air flow, maintaining the air pressure. It will help more air to come outside the turbocharger. With the help of exhaust gases, the turbine wheel helps the compressor create high atmospheric pressure for the engine. The length should be accurate enough to connect the turbine wheel and compressor, as it is its primary function.

Materials:

Due to design factors, many avoidable and unavoidable factors can affect the material of turbochargers, like thermal cracking, failure of the structure of the turbocharger, fatigue of rotating parts due to some problems in the engine, and many more. So, to overcome these problems, we use cast aluminum as the most common material for the turbocharger. We use some cast aluminum alloys like Al-Si-Cu-Mg. Pure aluminum is soft and ductile, so alloying it with Silicon improves its castability and fluidity. By alloying it, it prevents the dislocation movement of metal due to external factors. Nowadays, the impeller in the turbocharger is also made up of steel as it can withstand a tremendous amount of stress and temperature than the aluminum alloy.

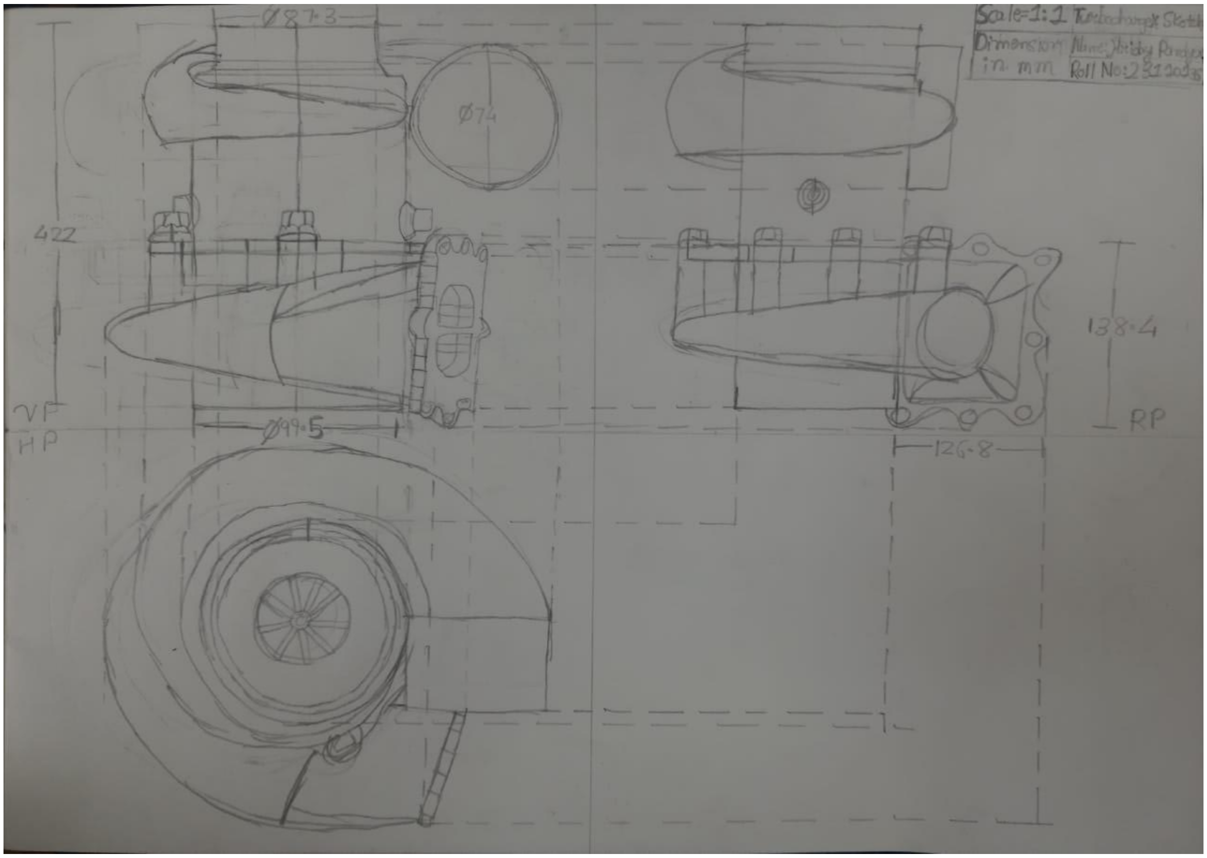


Fig. 11 Turbocharger

Part Name: Crew Member’s Area and Water System

Haravath Saroja (23110127)

Reasons for selected dimensions:

The selection of the dimensions of the crew member area in a diesel-electric locomotive is based on several important factors, primarily focused on ensuring the safety, comfort, and efficiency of the crew members who operate and maintain the locomotive.

The dimensions are as follows:

Length = 1150 mm

Breadth = 720 mm

Width = 540 mm

Here are some of the key reasons for selecting the dimensions of the crew member area:

Safety: Safety is paramount in the design of locomotives. The crew member area must provide enough space for crew members to move around safely while performing their duties. Adequate space helps prevent accidents and injuries that could occur in confined spaces.

Ergonomics: The dimensions of the crew member area should be designed with ergonomics in mind. Crew members often spend long hours in the locomotive, so it's crucial to have well-designed seats, controls, and workspaces to minimize fatigue and discomfort.

Accessibility: The crew member section should be conveniently accessible in order for crew members to quickly enter and exit the locomotive in the event of an emergency or routine operation. This includes the creation of suitable doors and paths.

Visibility: In order to run the locomotive safely, crew members must have clear view of the track and surrounding regions. The proportions of the cabin should allow for unimpeded views from windows and displays.

Comfort: For crew members who spend extended periods of time in the locomotive, comfort is crucial. Crew comfort is affected by elements such as adequate room, seats, climate control, and noise insulation.

Functionality: The crew member compartment should be built to provide all necessary controls, communication equipment, and storage space for tools and personal things. It should also make movement and access to vital systems easier.

Materials that can be used to fabricate and Reasons:

The water and crew member's compartment in a diesel-electric locomotive must be designed and built with attention to assure safety, longevity, and functionality. Some common materials utilized for these reasons are as follows:

Steel: Due to its strength and longevity, steel is a common material used in locomotive construction. It is frequently used for the locomotive's frame, undercarriage, and structural components, such as the framework of the crew cabin.

Aluminum is occasionally utilized for non-structural components such as body panels, doors, and crew cabin interior coatings. It is lighter than steel and more corrosion-resistant.

Fiberglass Reinforced Plastic (FRP): FRP is utilized for several interior components and panels due to its lightweight, corrosion resistance, and ease of manufacture.

Rubber seals and gaskets are used in water storage tanks, doors, and other places where leaks must be avoided. Copper and steel tube are used in the locomotive's plumbing system, including water and fuel lines.

Fire-resistant Materials: In critical areas, fire-resistant materials such as fire-rated insulation and fire-resistant coatings are used to increase crew safety.

Conclusions

In conclusion, dimension selection is an important phase in problem-solving, analysis, and decision-making processes. To make educated choices that contribute to the success of a project or activity, it takes a thorough and systematic strategy that evaluates relevance, data quality, interpretability, and a variety of other criteria.

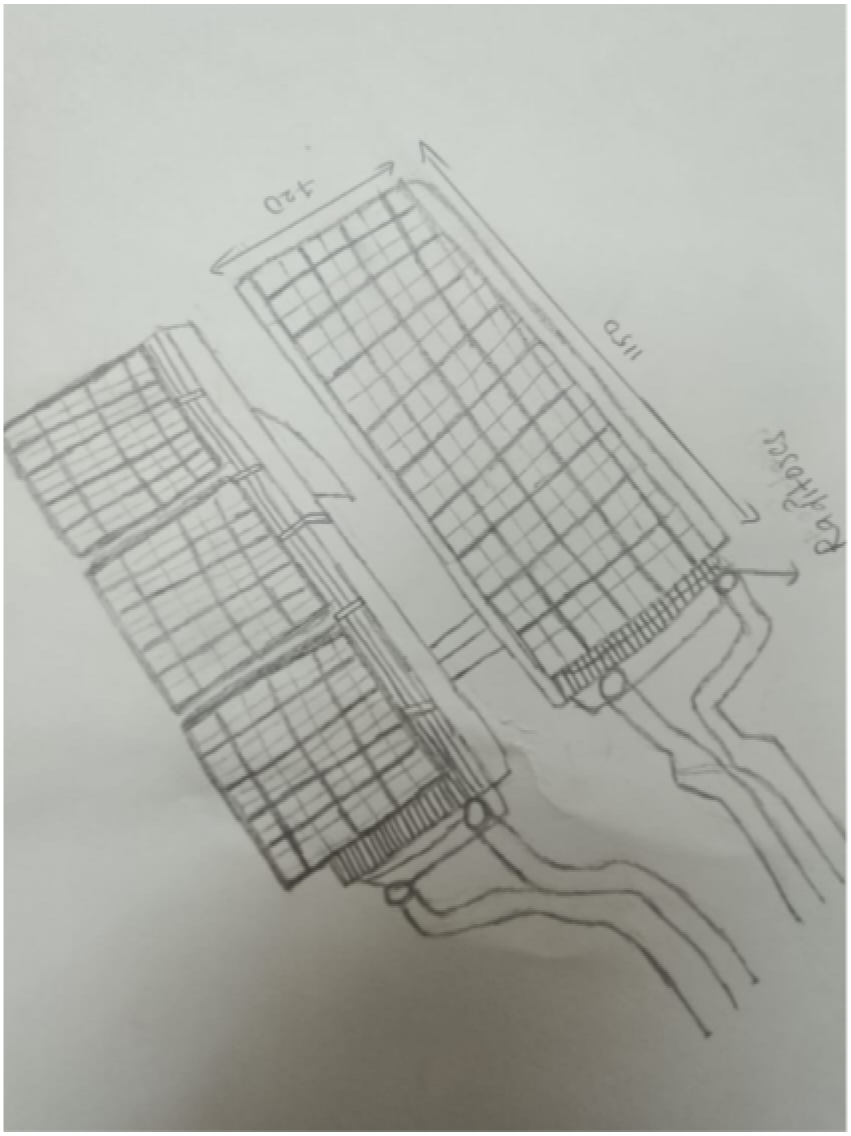


Fig. 12 Water System

Part Name: Draft Gear

Himanshu Singh (23110134)

Draft gears are critical components in railcars and locomotives that provide a cushioning effect during train operations, helping to absorb and dissipate energy from sudden impacts or decelerations. They are designed to improve the safety and longevity of both the railcar and the track. The materials and dimensions of draft gears can vary based on the specific design, application, and regulations in different regions. However, I can provide general information on the materials and dimensions commonly used for draft gears.

Materials Used for Draft Gears:

Cast Steel:

Cast steel is a common material used for draft gears due to its strength, toughness, and ability to absorb and dissipate energy effectively.

Ductile Iron:

Ductile iron is another material choice known for its strength, impact resistance, and cost-effectiveness.

Rubber Elements:

Many draft gears incorporate rubber elements or pads to enhance shock absorption and provide additional cushioning.

Composite Materials:

Some modern draft gears use composite materials, which combine different materials like plastics, fibers, and resins to achieve the desired properties of strength and energy absorption.

Dimensions of Draft Gears:

The dimensions of draft gears can vary based on the specific design, manufacturer, and application. However, some common dimensions include:

Length (L):

The length of a draft gear typically ranges from around 304 mm to 609 mm or more.

Width (W):

The width of a draft gear is usually between 203 mm to 355 mm.

Height (H):

The height of a draft gear can range from 203 mm to 304 mm.

Weight:

Draft gears can weigh several hundred pounds (100-500+ pounds) depending on the design and intended application.

It's essential to note that the specific dimensions and materials used in draft gears can vary based on the railcar type, load capacity, regulatory requirements, and other factors. Manufacturers adhere to industry standards and regulations to ensure the safe and effective performance of draft gears in railway applications. For precise and up-to-date information on draft gear materials and dimensions, it's recommended to refer to the specifications provided by manufacturers or relevant industry organizations.

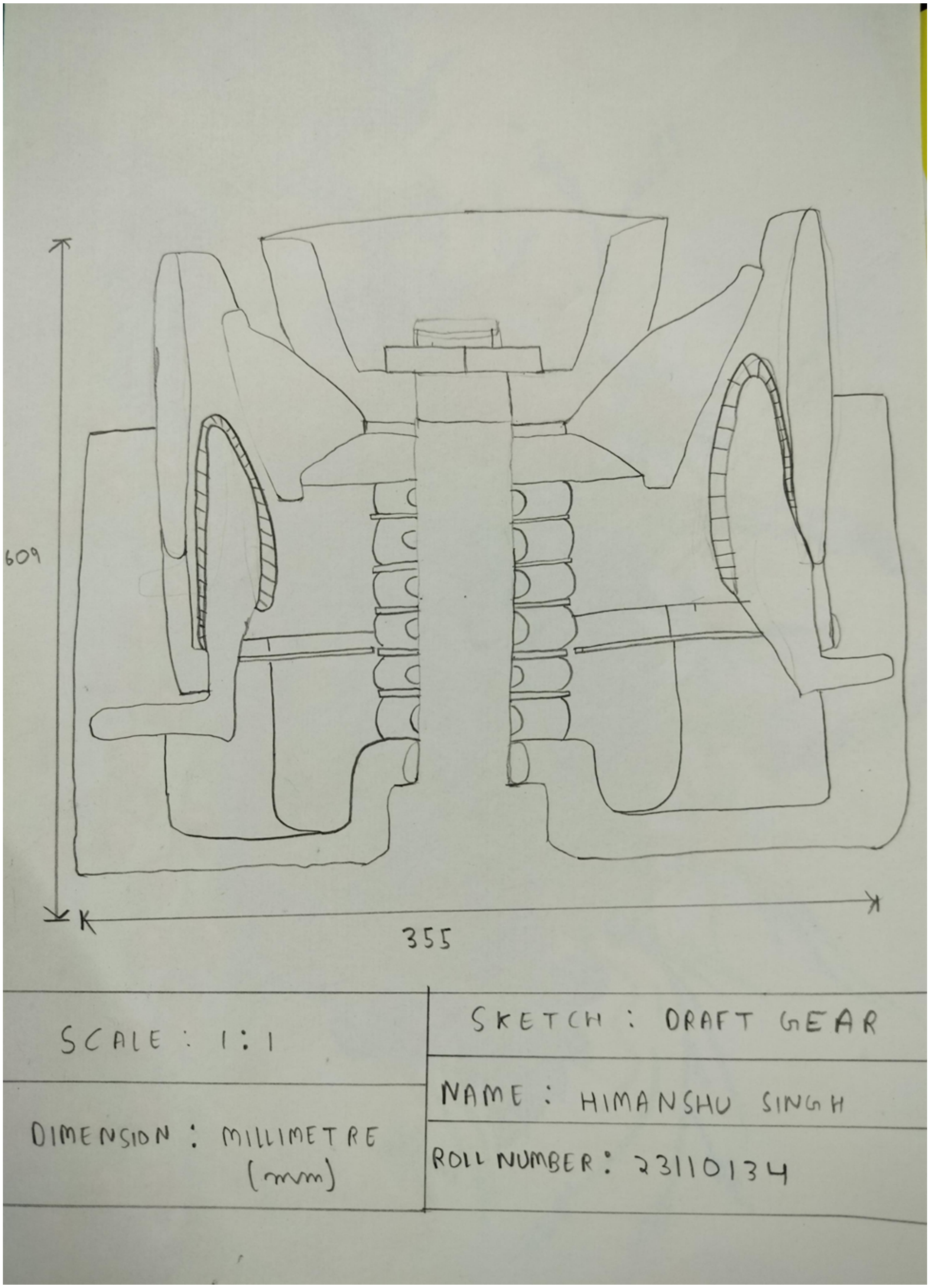


Fig. 13 Draft Gear

Part Name: Operator's Cabin

Hriday Pandya (23110136)

Reason for Chosen Dimensions:

In a diesel locomotive, the operator's cabin is found either inside the cabin or forms one of the essential structures of the locomotive. It is that locomotive element from where the whole train gets controlled. The dimensions of the cabin are:

1. Length of the cabin:- 2000 mm
2. Width of the cabin:- 1500 mm
3. Height of the cabin:- 2915 mm

The dimensions of the operator's cabin should be adequately measured and structured. The design of the operator's cabin requires enormous precision as it is concerned with the safety measures of the people inside the train. The dimensions should be accurate enough for the driver's visibility to have minimal possible blind spots. It should be appropriately designed to ensure the driver's safety from accidents, extreme climatic conditions, and many more. The cabin is connected to some parts of the locomotive; therefore, it should be accurately measured to avoid problems during the assembly. The space provided to the driver should be enough for his devices to accommodate. The entry and exit should be appropriate so the driver does not face an issue.

Materials:

Materials used in making the operator's cabin in diesel locomotives should have strength, durability, and the ability to withstand any adverse climatic conditions. The materials used are:-

- Aluminum alloy and steel provide rigidity and strength to the cabin.
- Insulation and Fire- Resistant materials to provide insulation from sound and heat to enhance safety in the cabin
- Electrical components such as switches, control panels, and wiring are made from durable and high-resistance materials.
- The seats are made of materials like vinyl and synthetic leather to comfort the team members. Rubber is a sealing material that prevents dust, water, and other components from entering the cabin.
- Toughened glasses on windows to ensure safety and visibility

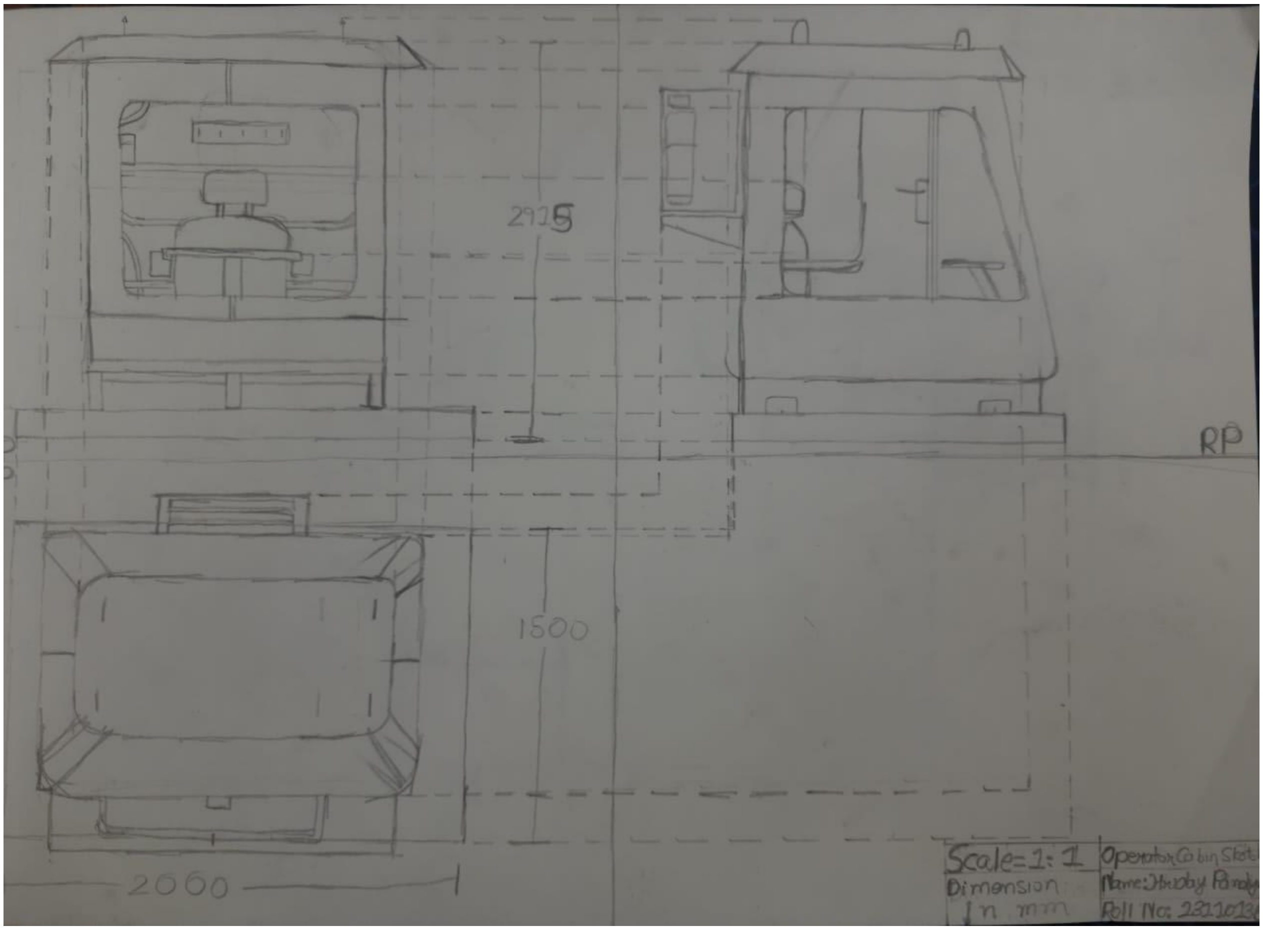


Fig. 14 Operator’s Cabin

Part Name: Nose

Harinarayan J (23110128)

Dimensions:

Length: 1600 mm

Height: 4366 mm

Width: 3656 mm

Reasons for dimensions:

The dimensions of the nose of the locomotive needs to be appropriate in order to ensure high speed of the locomotive. If the dimensions of the nose are disturbed then the whole locomotive will get imbalanced and will not be able to gain speed. Hence precision of dimensions is necessary for proper functioning of the locomotive. The length of the Nose was taken directly from the standard source. The Height and Width is same as the entire Body.

Materials:

A diesel-electric locomotive's control panel and the crew's workspace are in the locomotive's nose. For this vital locomotive component, particular materials are carefully chosen to guarantee durability, safety, and effectiveness.

The frame and structural components of the locomotive are made of high-strength steel.

Safety glass is used in the cab's windows and windshields.

Insulating materials are used to line the inner walls and ceiling of the cab to control temperature and lessen noise.

Given the proximity of the diesel engine, it is best to employ fire-resistant paints and insulation to reduce the risk of a fire if the engine breaks down.

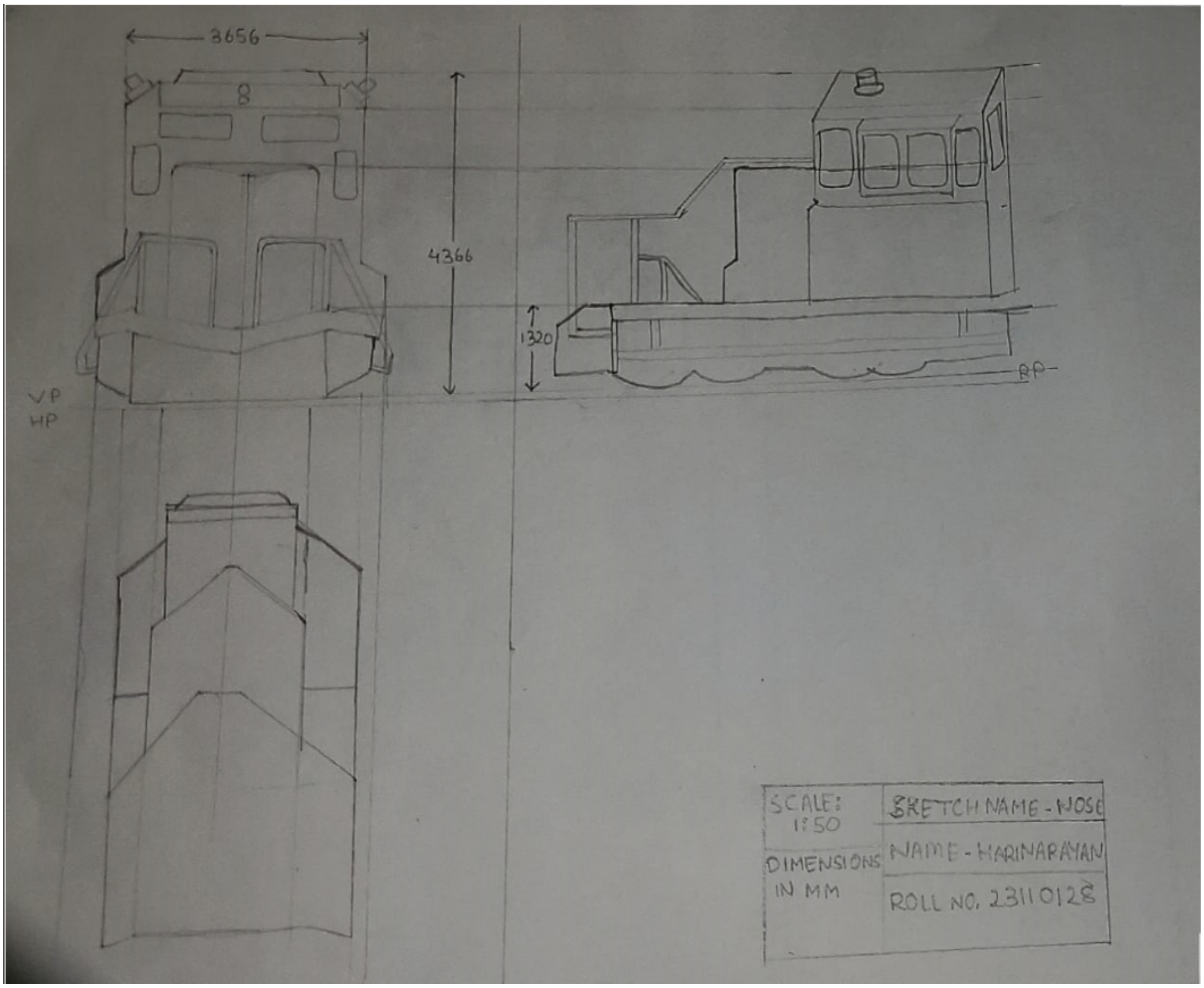


Fig. 15 Nose

Meeting Minutes

Meeting 1:

Date: 1/9/2023

Time- 6 PM (30min)

Absent: N/A

The meeting was called to discuss and decide the topic for the project.

Meeting 2:

Date: 4/9/2023

Time- 10:30 PM (30min)

Absent: N/A

The meeting was called to finalize the topic for the project.

Meeting 3:

Date: 6/9/2023

Time- 12:50 PM (20min)

Absent: N/A

The meeting was called to discuss the parts distribution for content writing.

Meeting 4:

Date: 8/9/2023

Time- 11 PM (30min)

Absent: N/A

The meeting was called to discuss the progress of each member and the selection of a formal captain.

Meeting 5:

Date: 17/9/2023

Time-5:30 PM (30min)

Absent: N/A

The meeting was called to distribute the parts of sketches and discuss the process.

Meeting 6:

Date: 23/9/2023

Time - 10:30 PM (30min)

Absent: N/A

The meeting was called to discuss the suggestions given by the Tutor.

Meeting 7:

Date: 25/9/2023

Time - 10:30 PM (30min)

Absent: N/A

The meeting was called to discuss the progress of each member.

Work Distribution

PROPOSAL:

1. Cover page with signatures – Harinarayan

2. Illustration on the cover page- Hiteshi Meisheri

3. Coordinating all individual write-ups: Himanshu Singh

4. Introduction Formatting- Harinarayan

5. Proposal editing- Harinarayan, Hiteshi Meisheri, Himanshu Singh, Hriday Pandya

6. Sketches: All team members individual sketch

7. Idea and format of Proposal document: Hiteshi Meisheri, Harinarayan

8. Compiling individual report: Harinarayan

<u>SKETCH REPORT</u>:

1. Cover page – Harinarayan

2. Signature page – Harinarayan

3. Index- Harinarayan

4. Preface– Harinarayan

5. Whole model sketches – Hiteshi Meisheri

6. Modifications – Harinarayan

7. Grammatical corrections for other members' writeups- Harinarayan

8. Meeting minutes- Harinarayan

9. Work distribution writeup- Harinarayan

10. Report formatting and editing- Harinarayan

11. Recordings + attendance – Harinarayan

12. Scheduling the Meetings- Harinarayan

13. Compilation: Harinarayan, Hriday Pandya, Himanshu Singh

14. Bibliography: All members, compiled by Harinarayan

Bibliography

1. Diesel-Electric Locomotive - Wikipedia
2. Diesel-Electric Powertrain - Wikipedia
3. Diesel-Electric Locomotive - Youtube
4. Materials Data
5. Standard Outer Body Dimensions

THANK YOU!

We are grateful to the Tutor for the valuable suggestions that helped us realize our capabilities.

We are highly excited about our project and we are determined to finish this project as expected. We will start making model parts very soon and follow deadlines strictly.