EASWARI ENGINEERING COLLEGE
(Autonomous)

An Internship Report on

"L&T CMRL"

Submitted in Partial Fulfilment of for the award of degree of

BACHELOR OF ENGINEERING

In

ELECTRONICS AND COMMUNICATION ENGINEERING

Submitted by

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Internship carried out at

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CERTIFICATE

Certified that the Internship work entitled “L&T CMRL” is a Bonafide work carries work carried out by DHEERAJ T (310621106037) of Easwari Engineering College, Chennai. And this report is submitted in the Partial Fulfilment of the award of Bachelor of Engineering and Communication Engineering college, Chennai, during this year2024-2025

Signature of the Internal Guide	Signature of the HOD
Name	Name
Designation	Designation
Name of the college	Name of the college

Internal Viva

Name of the Examination	Signature of the examination

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THE CHENNAI METRO

Chennai metropolis has been growing rapidly and the traffic volumes on the roads have also been increasing enormously. Hence the need for a new rail based rapid transport system has been felt and towards the objective the government of Tamil Nadu have decided to implement the Chennai metro rail project. This project aims at providing the people of Chennai with a fast, reliable, convenient, efficient, modern and economical mode of public transport, which is properly integrated with others form of public and private transport including buses, sub-trains and MRTS.

The CMRL envisages the creation of 2 initial corridors under the proposed pharse-2 of the Chennai metro rail project has shown below:

CORRIDORS

Corridor 3(Purple line)

Length: 45.4Kms (19Km elevated and 26.4kms underground)

Depot: Madhavaram and SIPCOT

Number of stations: 49(20 elevated stations and 29 underground stations)

Madhavaram Milk Colony – Thapal petti - Murari Hospital – Moolakadi – Sembiyam -Preambur Market -Perambur Metro- Ayanavaram – Otteri - Pattalam – Perambur Barracks Road -Doveton junction -Purasaiwakkam High road -kellys -KMC -Chetpet Metro -Sterling road junction- Gemini- Thousand lights East -Royapeettah government hospital- Radhakrishnan salai junction- Thirumayilai Metro- Mandaiveli- Greenways Road Metro- Adyar Junction- Adyar depot- Indira nagar- Thiruvanmiyur metro- Taramani link road- Nehru nagar- Kandanchavadi- Perungudi- Thoripakkam- Mettukuppam- PTC colony- Okkiyampet- Karapakkam- Okkiyam Thoraipakkam- Sholinganallur- Sholinganalur lake- Sri Ponniamman temple- Sathyabama University- St.Joseph's college- Semmancheri- Gandhi Nagar- Navallur- Siruseri- Sipcot 1- SIPCOT.

Corridor 4(Orange line)

Length: 26.09Kms (16.02Kms elevated and 120.07Kms underground)

Depot: Poonamallee

Number of stations: 28(18 elevated stations and 10 underground stations)

Light House - Kutchery Road - Thirumayilai Metro, Alwarpet, Bharathidasan Road, Adyar Gate Junction, Nandanam, Panagal Park, Kodambakkam Sub Urban, Meenakshi College, Power House, Vadapalani, Saligramam, Avichi School, Alwarthirunagar, Valasaravakkam, Karambakkam, Alapakkam, Porur Junction, Chennai Bypass Crossing, Ramachandra Hospital, Iyyapanthangal Bus Depot, Kattupakkam, Kumananchavadi, Karayanchavadi, Mullai Thottam, Poonamalle bus terminus, Poonamallee Bypass, Poonamallee Bus Depot.

Corridor 5(Red line)

Length: 44.6Kms (38.77kms elevated and 5.83Kms underground)

Depot: Madhavaram

Number of stations : 48(42 elevated stations ,1 at-grade and 6 underground stations)

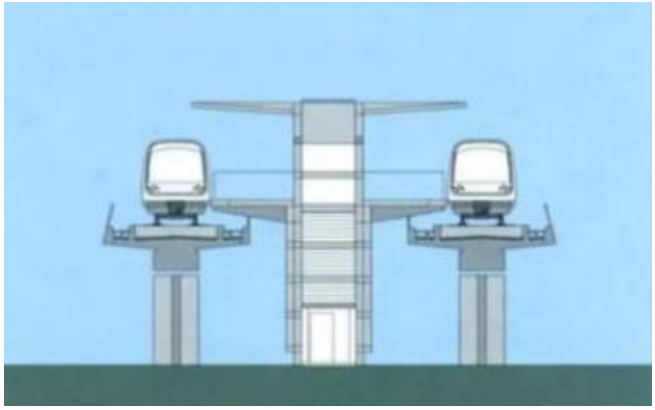
Madhavaram Milk colony -Venugopal Nagar -Assissi Nagar -Manjambakkam -Velmurugan Nagar -MMBT -Shastri nagar -Retteri junction -Kolathur Junction -Srinivasa Nagar -Villivakkam Metro -Villivakkam Bus Terminus -Nandhamuni -Anna nagar Depot -Thirumangalam -Kendriya Vidyalaya -KaliammanKoil street junction -CMBT -Grain market -Sai Nagar Bus stop -Elango Nagar Bus stop -Alwartiru Nagar -Valasaravakkam -Karabakkam -Alapakkam junction -Porur junction -Mugalivakka-DLF IT SEZ -Sathya nagar -CTC -Butt road -Alandur -St.Thomas mount -Adambakkam -Vanuvampet -Puzhuthivakkam -Madipakkam -Kilkattalai -Echangadu -Kovilambakkam -Vellakkal -Medavakkam Koot road -Kamraj Garden street -Medavakkam junction -Pperumbakkam -Global hospital -Elcot -Sholinganallur.

The portions of corridor-3 with a length of 45.8kms from Madhavaram milk colony to SIPCOT, and the portions of corridor-4 with the length of 26.09Kms from Light house to Poonamallee Bus depot, and corridor-5 with a length of 47.0kms from Madhavaram milk colony to Sholinganallur . The alignment and stations given above are tentative and subject to change during design and execution.

OVER VIEW OF THE PROJECT

- Number of underground stations:45 (C3-29, C4-10, C5-6)
- Number of elevated stations: 80 (C3-10, C4-18, C5-42)
- Number of depots: 2 (depot in Madhavaram and poonamallee)
- Elevated: Double U deck/W deck
- Underground construction: Shield tunneling method, except station which will be cut and cover method.
- Track gauge: Standard gauge (1,435 mm)
- Rolling stock: 2.9m width 3 car
- PSD (Platform screen doors): Full height in underground station
- PSD (Platform screen doors): Half height in elevated station.
- Signaling: GoA4(Driverless).

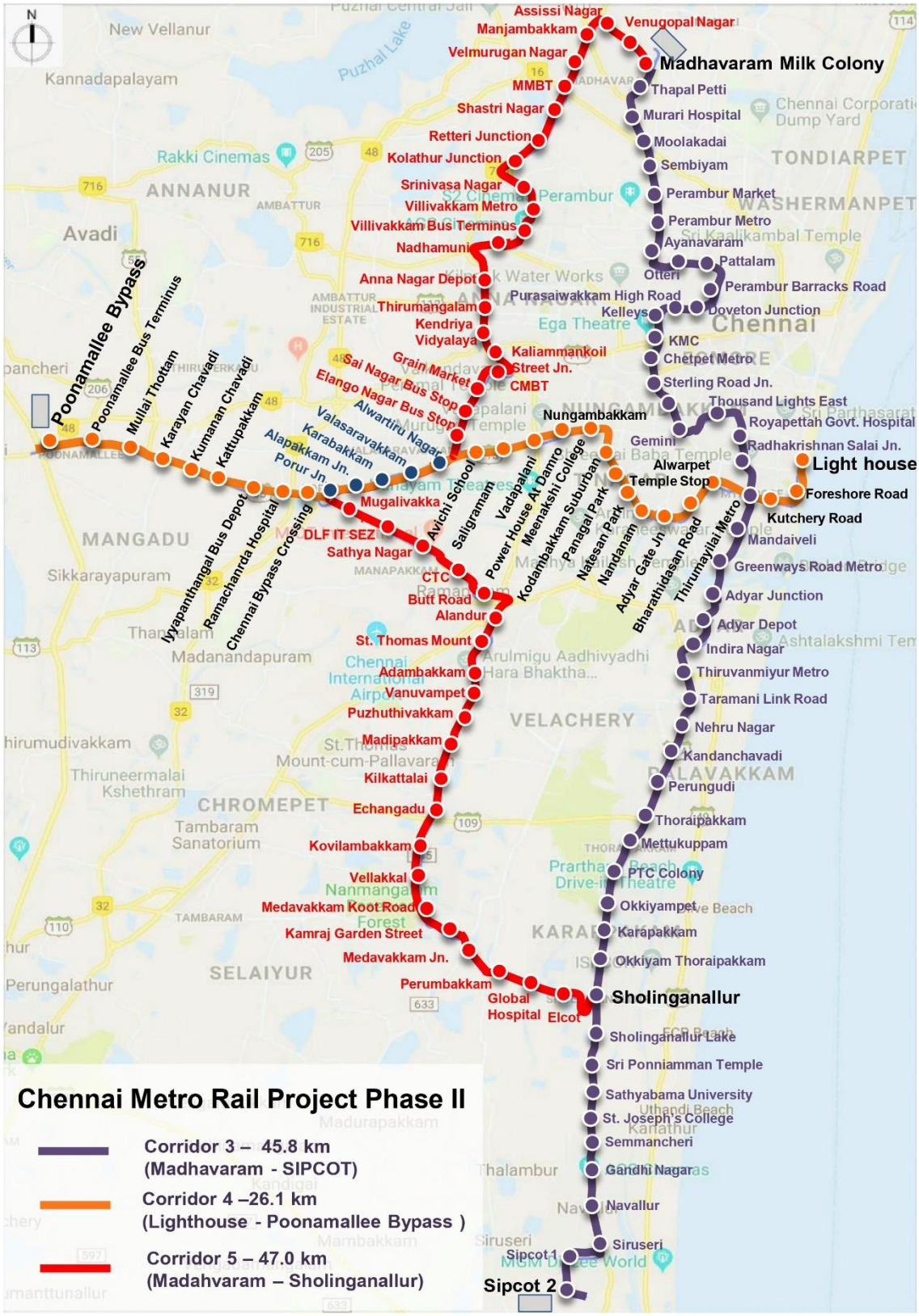
METRO STATIONS



ELEVATED STATIONS

UNDERGROUND(UG) STATIONS

CMRL ROUTE MAP OF CMRL PHARSE-2



POWER SUPPLY

Chennai City has 230kV, 110kV, 33kV power transmission and distribution network to cater to various types of demand in the vicinity of the proposed corridor. Keeping in view of the reliability requirements and considering the complete length of corridors, twelve (12 no's) Receiving Substations (RSS) are proposed to avail power supply for traction as well as auxiliary services from the Tamil Nadu Transmission Corporation Limited grid sub-stations at 110kV voltage through transmission lines or cable feeders for proposed corridors.
The Receiving substations (110/33/25 kV) planned for the power requirements of Chennai Metro Phase II corridors with the respective feeding zones and the length of cables of from the Grid Substations

RECEIVING SUBSTATIONS

Receiving substations are an integral part of electrical power distribution systems. They are points within the grid where electricity is received from higher voltage transmission lines and then distributed to lower voltage distribution lines for further delivery to end-users such as homes, businesses, and industries.

Key characteristics and functions of receiving substations include:

- Voltage Reduction
- Distribution
- Switching and Protection's
- Monitoring and control of the systems
- Integration with the grid

How the voltage stepdown process takes place?

In the receiving substations (RSS) of Chennai Metro Rail Limited (CMRL), voltage is stepped down using transformers. Transformers are essential components that allow for the adjustment of voltage levels while maintaining the frequency of the electrical supply.

Here's a simplified explanation of how voltage is stepped down in RSS of CMRL:

- Incoming High voltage grid connections
- Stepdown Transforms
- Transformation process
- Voltage Regulation
- Distributions to metro system
- Monitoring and control

AUXILIARY SUBSTATIONS

Auxiliary sub-stations (ASS) are envisaged to be provided at each station for stepping down 33kV supply to 415V for auxiliary applications. The ASS will be located at mezzanine or platform level inside a room. The demand of power at each elevated station is expected to be about 200 kW in the initial years and is likely to reach 300 kW in the horizon year. Similarly, for the underground stations, the auxiliary load requirements have been assessed at 1000 kW for the initial years which is expected to increase to 1500 kW in the horizon year. The average load considered for elevated station

and underground station will have to be fine tuned to suit station requirement at the time of detailed design.
Each elevated station shall be provided with an Auxiliary Substation with two 33kV/415V, 3-phase, 500 kVA dry type cast resin transformers and the associated HT & LT switchgear.
The auxiliary power will be required for

- Lights & fans for station
- Service Buildings
- Foot over Bridges/Subways.
- Maintenance Depots
- Air-conditioning
- Lifts & Escalators
- Water Supply Pumping Stations – for washing, toilets as well as fire protection measures.
- Equipment – Signalling, Telecom, Automatic Fare Collection etc.

GAS INSULATED SWITCHGEAR

OTHER TECHNICAL FEATURE

- Platform screen doors (PSD) in underground stations
- Passengers' information
- CCTV
- Operational system-wide safety
- Rolling stock (Air- conditioned)
- Life safety and Security
- Environmental sustainability
- Previsions for persons with disability.

ENVIRONMENTAL & SOCIAL IMPACT ASSESSMENT

ENVIRONMENTAL LEGISALTION

The Acts, Rules and Norms relevant to the project are listed below:

- The Air (Prevention and Control of Pollution) (Union Territories) Rules
- 1982, 1983 (Consent for emission form)
- National Ambient Air Quality Standards 2009
- Guidelines for Ambient Air Quality Monitoring , CPCB, 2003
- The Water (Prevention and Control of Pollution) Act 1974 amended 1988
- The Water (Prevention and Control of Pollution) Rules 1975 (CTE or
- consent to discharge form)
- Guide Manual – Water and waste water analysis, CPCB
- Drinking water – Specifications IS 10500: 2012 and CPHEEO Manual 2012
- Noise Pollution (Regulation and Control) Rules, 2000 amendment in 2010
- Metro Rail Transit System, Guidelines for Noise and Vibrations, RDSO,
- Ministry of Railways, September 2015
- Construction and Demolition Waste Management Rules 2016
- Hazardous and Other Wastes (Management and Transboundary
- Movement) Rules 2016
- Solid Waste Management Rules 2016
- Coastal Regulation Zones Rules 2011
- Forest (Conservation) Act, 1980, amended 1988.
- Forest (Conservation) Rules 2003 and Forest (Conservation) Amendment
- Rules, 2014 (procedure for FC)
- The Indian Wild Life (Protection) Act 1972 and The Wildlife (Protection)
- Amendment Act 2002

ENVIRONMENTAL BASELINE DATA

Data on land environment has been collected and compiled from various sources and during field surveys. Information about geology, hydrology, natural hazards like earthquakes etc have been collected from literature reviews and authenticated information made available by government departments.

LAND ENVIRONMENT

- **Physiography:** Chennai is located on the South–Eastern coast of India in the North–Eastern part of Tamil Nadu. It is situated on a flat coastal plain that's why it is also known as the Eastern Coastal Plains. The average elevation of the city is not more than 22 ft above mean sea-level, while most of the localities are just at sea-level and drainage in such areas remains a serious problem.
- **Soil:** The recent sandy soil (Entisols) is immature soils and is predominant in the city and it occurs in small patches. Inceptisols and Vertisols are found in a very limited area only.
  These soils are generally poor in soil nutrients. Soil samples were collected at 20 locations along the three proposed metro corridors.
- **Geology and Minerals: The** geological formations in the region are from the

Archaean's to the recent Alluvium. The geological formations can be grouped into three units, namely (i) the Archaean crystalline rocks, (ii) consolidated Gondwana with Tertiary sediments and (iii) the recent Alluvium.

- **Land Use Land Cover:** Land use distribution in the city is uneven. The north and west of the Fort and older city are most congested areas. During last three decades, the settlement density at outskirts of city is on increase. It depicts that the built-up area is 58.05%, forest area 4.48%, water body 8.51%, agricultural land 2.75% and waste land is 20.27%.
- **Seismicity:** The Bureau of Indian Standard upgraded the seismic status of Chennai from Low Seismic Hazard (Zone II) to Moderate Seismic Hazard (Zone III) – (BIS: 1893 (2001)). Suitable seismic coefficient needs to be adopted in the design of structures to commensurate with the Indian Standard seismic zoning of the country.

WATER ENVIRONMENT

- **Water Resources:** Ground water resources in Chennai are replenished by rain water and the city's average rainfall is 1,276 mm. Chennai Metropolitan Area (CMA) has 22 water sources, including three rivers, a canal, and four reservoir tanks. This also includes 16 minor waterways. Supply of ground water to the residents and sewage management in Chennai is taken care of by the Chennai Metropolitan Water Supply and Sewage Board (Metro Water).
- **Drainage:** Adyar River originates at the confluence (Thiruneermalai) of two streams that drains the upstream area of Chembarambakkam tank. It drains the southern part of the district and remains flooded during monsoon. The flow of Cooum River at Korattur is 40.2 MCM/year for an average duration of 31 days in a year.
- **Water Quality :** In order to assess the baseline water quality status of the study area, samples at 20 locations along the three proposed corridors were collected. Laboratory analysis of water sample depicts that all parameters are in acceptable limit except some parameters viz. turbidity, calcium, chloride, hardness, magnesium, mercury, lead are exceeded the permissible limit at 12 locations.

METEOROLOGY AND AIR ENVIRONMENT

The air pollutants emitted by point and non-point sources are transported, dispersed or concentrated by meteorological and topographical conditions. Meteorological data on rainfall, wind, humidity, and temperature were collected from Indian Meteorological Department (IMD) for last five years.

- **Meteorology:** Chennai has a tropical wet and dry climate. The city lies on the thermal equator and is also on the coast, which prevents extreme variation in seasonal temperature. Meteorological data like monthly total rainfall, maximum & minimum temperature, Windrose and relative humidity of the Chennai collected from Indian Meteorological Department.
- **Air Quality:** Nineteen monitoring stations were selected strategically along three proposed metro corridors. The monitoring stations were selected to generate the representative samples for air quality covering residential, institutional and industrial area along the corridors. 24 hour air quality monitoring results indicates that SO2, NO2, PM10 and PM2.5 were within the limits for residential, Industrial and rural areas. It is collected from The National Ambient Air Quality Standard (NAAQ) laid down by central Pollution Control Board(CPCB).

NOISE ENVIRONMENT

The noise data was collected at noise monitoring stations at hourly interval during morning, afternoon and evening such that peak and off peak hours are covered. Most of the stretch is along the existing road. There are 19 locations identified strategically for carrying out Noise monitoring along 3 corridors. The Ambient Noise Quality standards laid down by CPCB

ECOLOGICAL ENVIRONMENT

- **Forest:** Chennai city today is devoid of any forest areas; however, many big parks are located in the city. Forest cover map of Chennai district. About 662 m2 (0.0662 hectare) area exists near proposed metro station Medavakkam Koot Road Bus Stop along Corridor-5.
- **Flora and Fauna:** Tree survey was carried out along the proposed alignments. Most of the trees exist along the road on sides and median. Site construction activities will result in loss of trees about 2043. Trees of corridor 5 have been accounted in corridor 4 as some portion of which is overlapping on it. No rare or endangered species of trees were noticed during field studies.

NEGATIVE ENVIRONMENTAL IMPACTS

- Impacts due to Project Location
- Impacts due to Project Design
- Impacts due to Construction
- Impacts due to Project Operation.

Impacts due to Project Location

- Project Affected People (PAPs)
- Change of Land use
- Loss of trees/forest
- Utility/Drainage Problems
- Impact on Historical and Cultural Monuments.

Impacts due to Project Design

- Right of way
- Alignment and Architectural design
- Inter-modal integration
- Use of energy and water at stations
- Risk due to earthquake.

Impact Due to Project Construction

- Soil erosion
- Air pollution due to construction
- Noise Pollution and Vibration
- Impact due to land subsidence
- Impact due to Labour Camp

ENVIRONMENT HEALTH SAFETY (EHS) DEPARTMENT

The EHS department of Larsen and Toubro is based on EHS Management system and procedures that follows the codes ISO4500, ISO14001 and ISO9001.

OHSAS stands for **Occupational Health safety Assessment Series**. Occupational safety means the safety norms to be followed on the construction site or any other workplace for the matter. The EHS procedures can be divided into 3 parts:

1.System Procedure (S.P): It defines all the legislative requirements that are to be followed on site and also defines the role and responsibilities of the staff and workman working in the direction of safety.

2.Control Procedure (C. P): It defines all the measures required to control the no.of accidents on site thus ensures a safer environment at the working site. It also defines the use of PPE (Personal protective equipment) like safety Helmet, Gloves, Safety jacket, Safety shoes etc. while on site.

3.General Procedures (G.P): It defines all the methods of workman welfare and safety materials used.

EHS department organizes a training for the workman so that each of them can safety work at site.

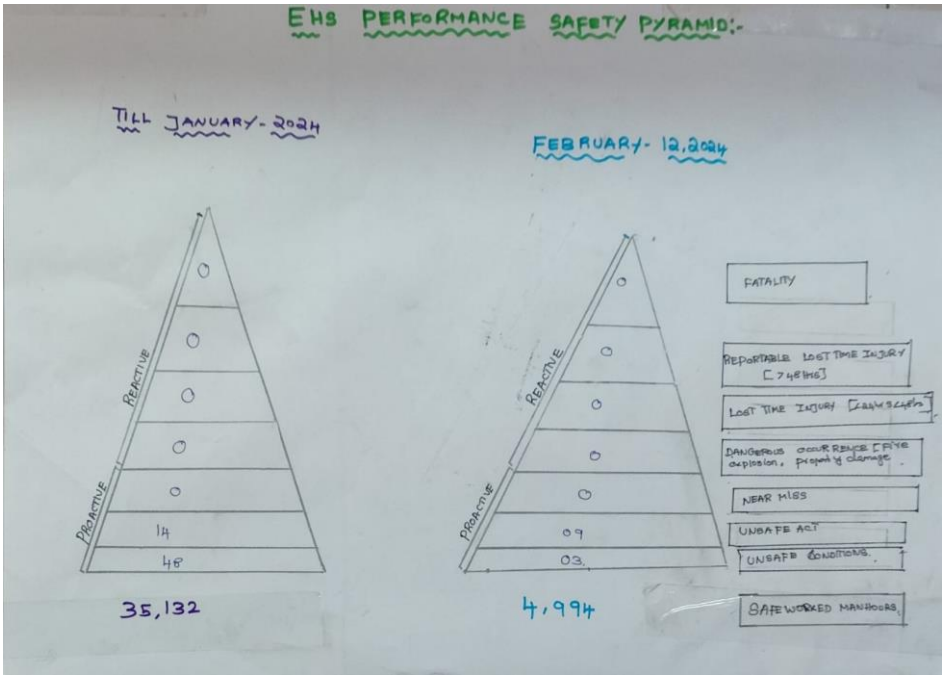
SAFETY VESTS

High visibility safety vests at first glance appear to be the same now as they been for many years. But there have been many improvements and variations made to make reflective safety vests more effective and comfortable for works. Depending on the estimated potential hazards of the job, the type of vests you wear may or may not be **American National Standards Institute (ANSI)** and **Occupational safety & Health Administration (OSHA)** approved.

Non-ANSI approved traffic safety vests are used in what is termed Class-1 environment, which are low traffic areas, like those faced by parking lot attendants.

The most often used color's:

1. Orange safety vest
2. Yellow safety vest
3. Lime green safety vest



A sign board indicating the use of personal protective equipment's at site for safety. The construction site is filled with many such sign boards indicating the safety measures that are to be taken while working at the site.

EHS department also issues a safe to start card on daily basis after basis observing that safety measures are taken at the site where work has to be done.

As the site consists of various engineers, sub-contractors, electricians, supervisors and workman, L&T follows a unique system of color coding that helps in identification of people working on the site.

The color codes is the color helmet wore by the person.

The color codes are as follow:

1. Green Helmet: For safety supervisor
2. Red Helmet: For Electrician
3. Purple Helmet: For Supervisors
4. White Helmet: For Engineers
5. Yellow Helmet: For Workman

Also, the EHS department maintains log sheets which indicates the location, activity, and number of the workman working at that location. This helps to ensure that no workman is anyway in danger of any facility or danger.

When any new employee or workman or trainee join the site, he undergoes a "Safety induction process" in which he is taught the various safety measures to be maintained at the site. The induction process of a trainee is done by the safety officer or safety in-charge of the site.

Before allowing a workman to join the site he also undergoes a medical chech-up and then a screening test by the in-charge of the department he is to work in. On passing the screening test he undergoes the induction process and then he is ready to work.

SCOPE OF WORK

1. **CIVIL WORKS-ALIGNMENT:**
   To carry out detailed topographic surveys along the suggested three corridors i.e. Corridor 3 - From Madhavaram to SIPCOT (45.8 km), Corridor 4 - From Lighthouse to Poonamallee Bypass (26.1 km) and Corridor 5 - From Madhavaram to Sholinganallur (47.0 km). The topographic survey would be conducted to establish the alignment, right of way, locations of stations, interchange points, maintenance depots and identification of land reservation requirements, building lines, number of properties affected, etc., along the metro Corridor.
   To examine integration / interchange requirements with existing corridors and other modes of the transport.

2. **STATIONS**
   To identify station locations taking into account catchment area, adequacy of R.O.W, feasibility of entry/exit facilities, availability of parking areas, air funnel locations of stations in the vicinity of the airport and any other factor having impact on constructability and functioning of the station.
   To prepare site-specific stations layouts to handle the projected traffic-stations will follow 'closed system' with complete access control through AFC. Lifts/escalators will be provided for the comfort of passengers especially physically challenged passengers. Stations may have single/double entry.

3. **TRAIN OPERATION PLAN**
   To prepare the Train operating plan to manage the projected ridership and recommend its phased implementation. Based on the Train operation plan, requirement of rolling stock will be worked out. Design parameters will be finalized in consultation with Client.

4. **TRACTION & POWER SUPPLY**
   Consultant shall propose suitable Traction & Power supply system i.e. overhead AC traction systems to serve the Train operation Plan effectively. Consultant shall also provide the sufficient details for power supply arrangements.

5. **SIGNALING**
   Consultants shall propose suitable signalling system i.e. CBTC to serve the Train operation Plan effectively. The recommended system has to be cost-effective.

6. **ROLLING STOCK**
   Consultant shall recommend suitable Rolling Stock requirements with optimal lifecycle cost.

7. **COMMUNICATION**
   Consultant shall recommend appropriate Communication System to serve all the operational requirements of the system.

8. **TUNNEL VENTILATION SYSTEM**
   Consultant shall propose suitable tunnel ventilation system

SIGNALING AND TELECOMMUNICATION

The signaling system shall provide means of an efficient train control ensuring safety in train movements. It assists in optimization of metro infrastructure investment and running of efficient train services on metro network. System will have the following design parameters:

- Ridership (Design Year 2055): 27361 PHPDT (Corridor-3), 29940 PHPDT
- (Corridor-4) & 35714 PHPDT (Corridor-5)
- Standard Gauge: 1435 mm
- Average Speed: 32 kmph
- Total Stations: 50 (Corridor -3), 30 (Corridor -4) & 48 (Corridor – 5)
- Train Configuration: 3 & 6 Car Rake
- Required Headway: 277seconds (Corridor-3), 240 seconds (Corridor -4) & 212 seconds (Corridor-5)

It has advanced features of Continuous Automatic Train Control (CATC), consisting of sub-systems like Automatic Train Supervision (ATS), Automatic, Train Protection (ATP) and Automatic Train Operation (ATO).

TELECOMMUNICATION SYSTEM

Telecommunication system acts as communication backbone for Signaling and other systems and provides telecommunication services to meet operational and administrative requirements of metro network.

Proposed Telecommunication System and Transmission Media

- Digital Transmission System (DTS)
- Telephone Exchange
- Mobile Radio Communication
- Public Address System
- Centralized Clock system
- Passenger information display
- Close circuit Television (CCTV)
- Central Voice Recording System (CVRS)
- Central Fault Reporting System (CFRS)
- Uninterrupted Power supply