

3-2 Data on the Meteorology, Geology and Water Analysis in the District of
KM 10 Workshop

The meteorology, geology and water analysis in the district of KM 10 Workshop is as shown in Table 3.2.1.

Table 3.2.1 Data on the Meteorology, Geology and Water Analysis
in the District of KM 10 Workshop

| | | |
|--------------------------------|---|--------------------------------------|
| Atmospheric Temperature | Annual maximum | 37.8 °C. |
| | Annual minimum | -4.8 °C. |
| Relative Humidity | Annual average | 74% |
| Precipitation | Annual precipitation | 994 mm |
| | Monthly maximum precipitation | 123 mm |
| Wind Velocity | Annual average wind velocity | 15 km/h |
| | Maximum wind velocity | 18 km/h |
| Bearing Capacity of soil | Examination point | About 10 km south of P. Constitución |
| | Minimum bearing capacity (5 m underground) | 11 kg/cm ² |
| | Maximum bearing capacity (3 m underground) | 55 kg/cm ² |
| Earthquake | Nonexistent | |
| Water Analysis | Chromaticity | 2 or less |
| | Cloudiness | 0.2 or less |
| | Taste | -- |
| | PH value | 6.8 ~ 9.2 |
| | Total dissolution of solids | 50 ~ 600 p.p.m. |
| | Total hardness | 30 ~ 100 p.p.m. |
| | Total alkali content | 30 ~ 200 p.p.m |

Note) Meteorological data are of AEROPARQUE District and water analysis data are based on Argentine regulation on drinking water.

3-3 Inspection/Repairing Process

Overall and Intermediary Inspection process of electric railcars is shown in Fig. 3.3.1. The detailed process of Overall Inspection including inspection/repairing processes of parts are shown in Fig. 3.3.2.

The detailed process of the Intermediary Inspection is the same as that of the Overall Inspection, except it eliminates car-body painting work and reduces mounting work by one day.

Technical specifications of electric railcars to be adopted in future on the General Roca Line will be the same as those used at present. However, the following items are to be added in the future.

- (1) cooling unit
- (2) electric power source for (1)

Specifications of cooling unit and its power source are undecided now. Therefore, their layout will be drawn up taking into consideration the function of equipments generally mounted on electric railcars.

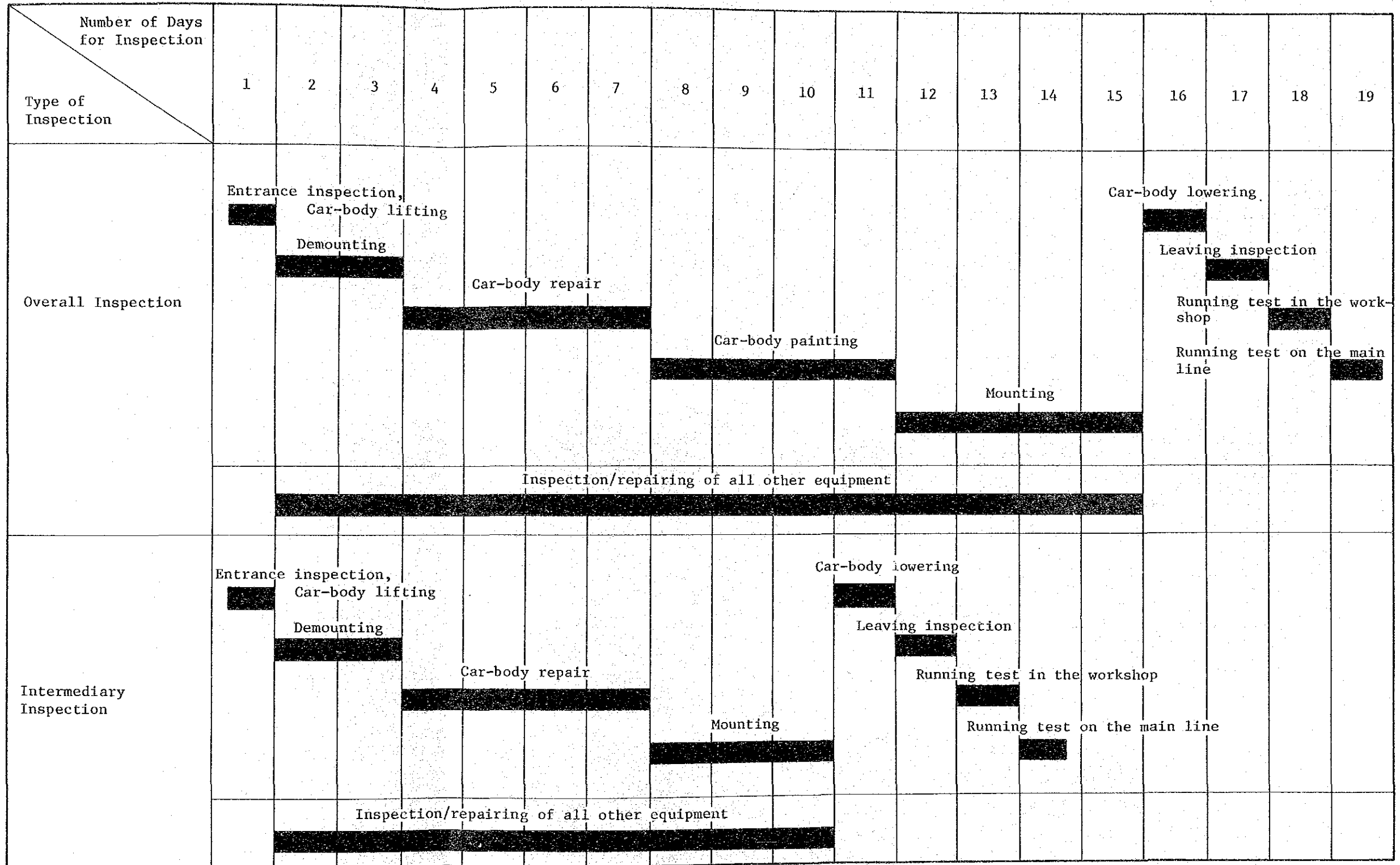


Fig. 3.3.1 Inspection/Repairing Process

Inspection/repairing works are processed as follows.

- (1) After being airblasted outdoors, a three-car unit is pushed into Entrance/Leaving Inspection Shop by a shunting locomotive and undergoes Entrance Inspection.
- (2) A three-car unit is uncoupled. Each car is pushed into the Car-body Lifting/Lowering shop. Pantograph, VCB, other equipments on the roof, seating cushions and windows are demounted.
- (3) Car-body is lifted up by lifting jacks, bogies are removed, and car-body is reset on temporary bogies.
- (4) Bogies thus removed are sent to the Bogie Shop through the turntable. Wheels and axles, and traction motors are demounted. Bogies, wheels and axles, and traction motors are inspected, repaired, and reassembled at their respective shops.
- (5) Car-body mounted on temporary bogies is conveyed to the Car-body Shop by traverser.
- (6) At the Car-body Shop, coupler, rotating equipment, air brake equipment, electric equipment and car-body equipment are demounted and sent to their respective shops for inspection/repairing work.
- (7) Car-body is inspected and repaired after demounting various parts of equipments.
- (8) In the case of Overall Inspection, side sliding doors will be attached to the car-body and the car-body will be sent to the Car-body Painting shop. Car-body painting work will be carried out on 3 cars at a time.
- (9) After painting, the car-body is returned to the Car-body Shop and various finished equipments are mounted.
- (10) The car-body is sent back by traverser to the Car-body Lifting/Lowering Shop. There, the car-body is lifted up, the temporary

bogies are removed, and the finished bogies are mounted. On-the-roof equipments are also mounted here.

- (11) When all equipments are mounted, the cars are pulled out to the Entrance/Leaving Inspection Shop. Then, Leaving Inspection and running test in the workshop and running test on the main line are conducted. These will complete the workshop inspection/repairing works.

3-4 Annual Inspection/Repairing Quantity and the Quantity of Electric Railcar Parts and Equipments Simultaneously Existing at Each Shop

When electric railcars come into the Workshop in accordance with the conditions described so far, the annual inspection/repairing quantity will be as shown in Table 3.4.1 and the quantity of electric railcar parts and equipments simultaneously existing at each shop will be as shown in Table 3.4.2.

The annual inspection/repairing quantity of various equipments and parts has been used to determine the inspection/repairing capacity of the Workshop, and the quantity of parts and equipments simultaneously existing at each shop has been used to assess the area to put them in each shop.

Table 3.4.1 Annual Inspection/Repairing Quantity (Periodical Inspection)

| Railcar Parts | A Quantity per One Unit | B Annual Inspection/ Repairing Quantity Overall Inspection A × 28 Intermediary Inspection A × 28 | C Average Number of Shop-in Quantity per Day B ÷ 268 |
|--|-------------------------------|--|--|
| Car-body | 3 | 168 | 0.63 |
| Bogie | 6 | 336 | 1.25 |
| Wheel and axle | 12 | 672 | 2.51 |
| Traction motor | 8 | 448 | 1.67 |
| *Pantograph | 1 | 28 | 0.10 |
| Motor alternator | 1 | 56 | 0.21 |
| *ATS | 2 | 56 | 0.21 |
| Air-compressor | 1 | 56 | 0.21 |
| *Main rectifier | 1 | 28 | 0.10 |
| Automatic coupler | 2 | 112 | 0.42 |
| Rod type coupler | 2 | 112 | 0.42 |
| *Ventilation fan for passenger's room | 23 | 644 | 2.40 |
| *Seat pedestal | 116 | 3,248 | 12.12 |
| *Side sliding door | 36 | 1,008 | 3.76 |

*Parts will be inspected in the Intermediary Inspection without removing them from car-body.

Table 3.4.2 Quantity of Electric Railcar Parts Simultaneously Existing at Each Shop

| Shop | Parts | Simultaneously Existing Quantity |
|-------------------------------------|---------------------|----------------------------------|
| B Entrance/Leaving Inspection Shop | Electric car | 6 |
| C Car-body Lifting/Lowering Shop | Electric car | 2 |
| D Electric Equipment Shop | Electric equipment | 3 units |
| E Car-body Equipment Shop | End sliding door | 12 |
| | Seat pedestal | 232 |
| | Window, louver | 328 |
| | Side sliding door | 72 |
| F Air Brake Equipment Shop | Air brake equipment | 3 units |
| G Parts Painting Shop | Door engine | 54 |
| | Wiper | 6 |
| | Draft regulator | 69 |
| | Valve | 96 |
| H Seat and Vestibule Diaphragm Shop | Seating cushion | 464 |
| | Vestibule diaphragm | 8 |
| I Car-body Shop | Car-body | 12 |
| J Pipe Works Shop | Piping, wiring | 3 units |
| K Car-body Painting Shop | Car-body | 3 |
| L Bogie Shop | Bogie | 9 |
| M Wheel and Axle Shop | Wheel and axle | 36 |
| N Traction Motor Shop | Traction motor | 24 |
| O Rotating Equipment Shop | Rotating equipment | 3 units |
| S Temporary Bogie Shed | Temporary bogie | 12 |
| T Cooling Unit Shop | Cooling unit | 6 |
| U Car-body Major Repair Shop | Car-body | 6 |

3-5 Principles of Shop Amplification

The number of electric railcars assigned to KM 10 Workshop for Inspection/Repairing works in the 1st Step Electrification are 156 cars. In the 2nd Step Electrification, this will increase to 318 cars. Therefore, with few exceptions, most of the Shops will have to be amplified.

Shop amplification will be planned based on the following principles.

- (1) To enable the Inspection/Repairing works to be so conducted as to secure the required functions of electric railcars and to improve their reliability
- (2) To enable efficient performance of Inspection/Repairing works
- (3) To make the best use of the Workshop facilities of the 1st Step Electrification, and use domestic products as much as possible
- (4) To maintain normal workshop operation during amplification construction work

In studying the amplification of each shop, the details of works and the volume of works of each shop have been reexamined to enable efficient inspection/repairing operation. As a result, certain shops have been divided into separate shops and new shops have been installed as needed.

Based on the above principles, the following changes will be made in the shops.

- (1) In the 1st Step Workshop the inspection/repairing work on rotating equipments, was carried out together with traction motors in the Traction Motor Shop, but this will be separated and the Rotating Equipment Shop will be newly installed, and the rotating equipment will be carried out in this shop.
- (2) In the 1st Step Workshop the inspection/repairing work on seat and vestibule diaphragm, and material storage work were carried out in the

Car-body Equipment Shop, and the Seat and Vestibule Diaphragm Shop and the Warehouse will be newly installed respectively.

- (3) In the 1st Step Workshop the temporary bogies were placed in the available spaces of the Entrance/Leaving Inspection Shop and Demounting/Mounting Shop, but they will be kept the Temporary Bogie Shed to be newly installed.
- (4) The Parts Painting Shop will be newly installed to centralize the parts painting works. Previously these works were carried out at the available spaces of various shops.
- (5) The Car-body Major Repair Shop will be newly installed for special inspection/repairing works and railcar modification works such as to prolong railcar life.
- (6) The Cooling Unit Shop will be newly installed for inspection/repairing works of cooling units which are expected to be furnished on the electric railcars in future.
- (7) The Tool Room will be newly installed to collectively control tools.

In accordance with the new installation of shops, the names of shops and their symbols, before and after the amplification works, are comparatively shown in Table 3.5.1.

The area of each shop to handle the 318 electric railcars when the Workshop is amplified is shown in Table 3.5.2. Taken into account were the area of machine installations, the area of parts and equipments storage and the area of shop work activity, etc.

That is to say, shop amplification of 7800 m² is necessary, and together with the shop area of the 1st Step Workshop, the total area becomes about 20,000 m².

The layout of each shop after amplification and that of the 1st Step Workshop is compared in Fig. 3.5.1.

Table 3.5.1. Names of the Shops and Their Symbols

| Symbol | Name of Shop | |
|--------|-----------------------------------|----------------------------------|
| | After Amplification | Before Amplification |
| A | Workshop yard | General |
| B | Entrance/leaving inspection shop | Entrance/leaving inspection shop |
| C | Car-body lifting/lowering shop | Demounting/mounting shop |
| D | Electric equipment shop | Electric equipment shop |
| E | Car-body equipment shop | Car-body equipment shop |
| F | Air brake equipment shop | Air brake equipment shop |
| G | Parts painting shop | -- |
| H | Seat and vestibule diaphragm shop | -- |
| I | Car-body shop | Car-body shop |
| J | Pipe works shop | Pipe works shop |
| K | Car-body painting shop | Car-body painting shop |
| L | Bogie shop | Bogie shop |
| M | Wheel and axle shop | Wheel and axle shop |
| N | Traction motor shop | Traction motor shop |
| O | Rotating equipment shop | |
| P | Ironwork shop | Ironwork shop |
| O | Machine shop | Machine shop |
| R | Tool room | -- |
| S | Temporary bogie shed | -- |
| T | Cooling unit shop | -- |
| U | Car-body major repair shop | -- |
| V | Warehouse | -- |
| W | Energy center | Energy center |

Table 3.5.2 Area of Each Shop

Unit: m²

| Symbol | Shop | Necessary Area when Amplified | Area in 1st Step Workshop | Area of Required Expansion | Note |
|--------|-----------------------------------|-------------------------------|---------------------------|----------------------------|---------------------------|
| B | Entrance/leaving inspection shop | 1,800 | 1,800 | 0 | |
| C | Car-body lifting/lowering shop | 720 | 720 | 0 | |
| D | Electric equipment shop | 1,120 | 1,030 | 90 | |
| E | Car-body equipment shop | 400 | *940 | -540 | * E 270 H 360 V 310 |
| F | Air brake equipment shop | 370 | 310 | 60 | |
| G | Parts painting shop | 260 | 0 | 260 | |
| H | Seat and vestibule diaphragm shop | 340 | 0 | 340 | |
| I | Car-body shop | 3,600 | 1,760 | 1,840 | |
| J | Pipe works shop | 280 | 230 | 50 | |
| K | Car-body painting shop | 900 | 720 | 180 | |
| L | Bogie shop | 1,700 | 1,425 | 275 | |
| M | Wheel and axle shop | 2,240 | 1,135 | 1,105 | |
| N | Traction motor shop | 560 | | | * N and O |
| O | Rotating equipment shop | 470 | *600 | 430 | are the same shop, |
| P | Ironwork shop | 500 | 690 | -190 | |
| Q | Machine shop | 400 | 360 | 40 | |
| R | Tool room | 80 | 0 | 80 | |
| S | Temporary bogie shed | 216 | 0 | 216 | |
| T | Cooling unit shop | 500 | 0 | 500 | |
| U | Car-body major repair shop | 1,800 | 0 | 1,800 | |
| V | Warehouse | *1,080 | 0 | 1,080 | * Separate Building |
| W | Energy center | *630 | 450 | 180 | * Separate Building |
| Total | | 19,966 | 12,170 | 7,796 | |

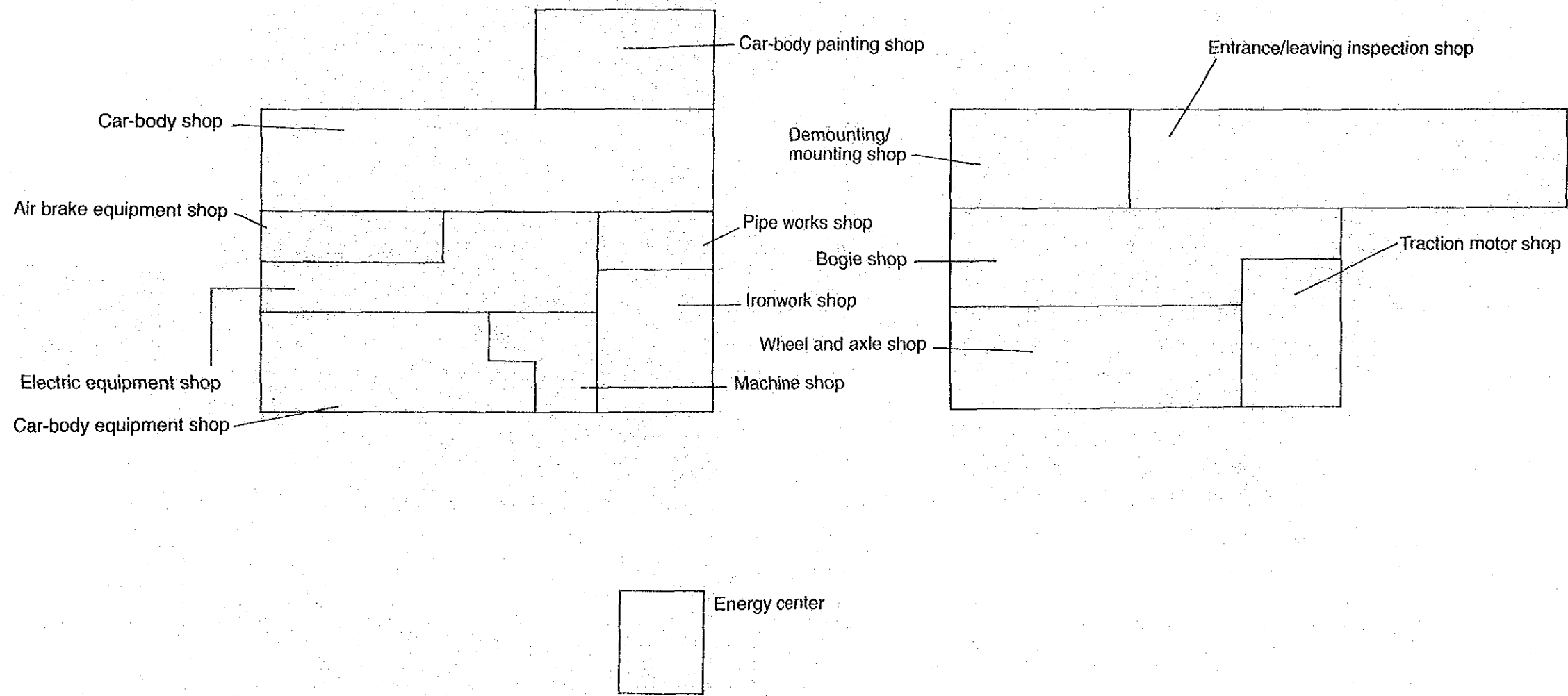
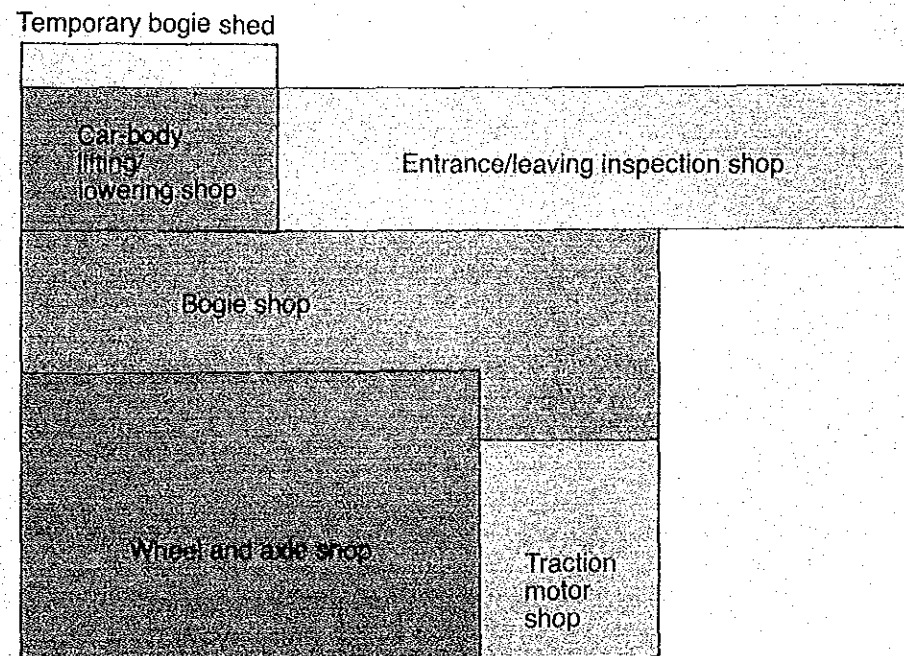
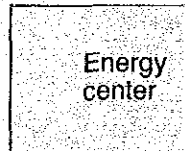
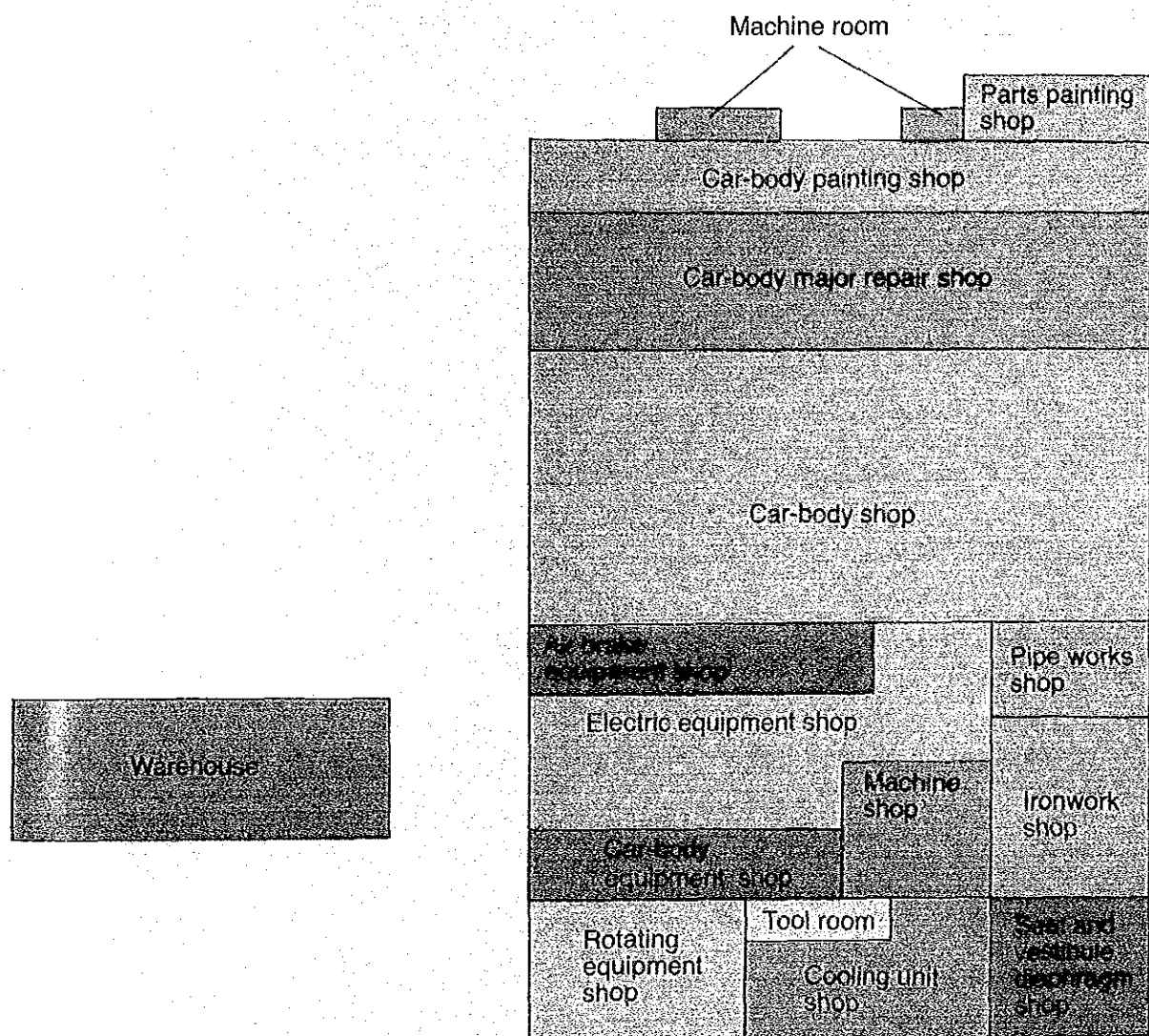


Fig. 3.5.1 Layout of Shops



CHAPTER 4 DESIGN PLANNING

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4-1 Civil Engineering

4-1-1 Roads in the Workshop Yard

Along with the construction of new buildings and the extension of the existing buildings, the portion of roads interfering with those works will be removed and new roads surrounding new buildings will be built and connected with the existing roads.

The width of roads will be of two kinds, 7 m and 4 m. The main roads for large vehicles such as truck and tank lorry will be 7 m wide and the roads for part carriers and smaller vehicles of inspection/repairing works will be 4 m wide.

The road structure standards will be the same as those hitherto.

New roads to be constructed are:

(1) 7 m roads

Around the traverser and both sides of the Car-body Painting Shop.

(2) 4 m roads

Along the Car-body Painting Shop and the Entrance/Leaving Inspection Shop.

The details are shown in Fig. 4.1.1.

4-1-2 Track

(1) Tracks

Along with the Amplification of the Workshop, some portions of tracks in the Workshop building and the Workshop yard will be removed and new tracks will be laid according to the necessity (see Fig. 4.1.2). The structure standards will be the same as those hitherto.

1) No. 1 Workshop

On account of new construction of the Temporary Bogie Shed, the tracks on the site of the Shed will be relocated. As the remaining tracks will be used for stabling track, buffer stops will be installed at the track end.

2) No. 2 Workshop

The 2 tracks of the Car-body Painting Shop in the 1st Step Workshop will be removed on account of 10 m spacing of track laying (between track centers) for the Workshop Amplification.

In accordance with shop amplification, the following new track constructions will be executed.

| | |
|-------------------------------|----------|
| a) Car-body Shop | 2 tracks |
| b) Car-body Major Repair Shop | 2 tracks |
| c) Car-body Painting Shop | 1 track |

3) Workshop Yard

In order to enable direct passage to and from the Car-body Shop and Car-body Major Repair Shop without having to pass through the Entrance/Leaving Inspection Shop, some portions of tracks will be relocated and track centers will be adjusted.

(2) Turnout

The present turnouts on the branching track from the main line into the Workshop Yard, and on those in the Workshop Yard will be usable intact.

(3) Marks and the Like

There will be no removal, no transfer and no new installations of marks, etc. relating to track in this amplification work.

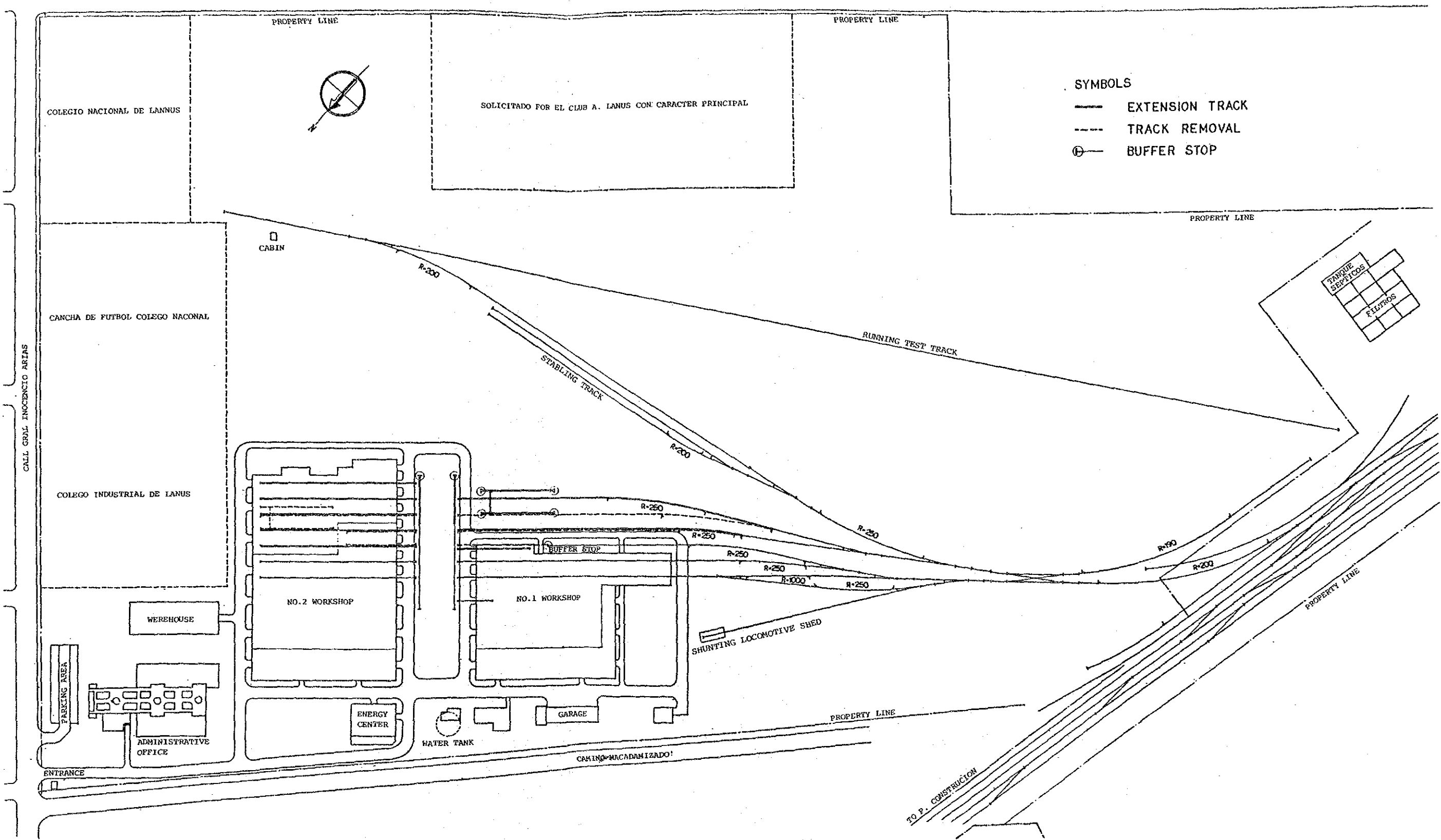


Fig. 4.1.2 New Construction and Removal of Tracks

4-2 Building

In line with the amplification of the KM 10 Workshop, extension of No. 1 Workshop Building, No. 2 Workshop Building, Energy Center, Administrative Building and Incidental Buildings will be undertaken.

These additional buildings and their areas are shown in Table 4.2.1. The structure specifications of these buildings are basically the same as those for the 1st Step Building and the outline of the buildings are explained below.

4-2-1. No. 1 Workshop Building and No. 2 Workshop Building

(1) Planning of Floor and Section

- 1) Floor Plan is based on the inspection/repairing works of electric railcars for this Project. The spaces for works, stock and passageway for works, etc. will be secured and arranged in it.
- 2) Section is planned taking into account the space required for operation of overhead travelling cranes and working activity area underneath, and the height of beam and span of columns are thus planned.

(2) Main Structure

- 1) Foundation designing will be based on the bearing capacity of soil, and approximate dimensions will then be presumed and underground beams will be connected with the whole structure.
- 2) The standard beam and girder spacing will be 9 m x 20 m as in the 1st Step Workshop.
- 3) Main structure will be structural steel frame and steel truss.

(3) Finishing

- 1) Exterior walls will be brickwork up to 5.2 m from the floor level and the upper portions will be covered with corrugated iron.
- 2) Floor will be reinforced concrete of 15 cm in thickness and finished with ferro-cement and flexiplast.
- 3) Roof will be covered with corrugated iron.

Table 4.2.1 Building Area

Unit: m²

| Building | Classification Shop | 1st Step Electri- fication | Building Area | |
|------------------|-----------------------------------|----------------------------------|------------------|-----------------------------|
| | | Present Condition | Building Area | Additional Building Area |
| No. 1 Workshop | Car-body lifting/lowering shop | 720 | 720 | 0 |
| | Entrance/leaving inspection shop | 1,800 | 1,800 | 0 |
| | Bogie shop | 1,425 | 2,055 | 630 |
| | Wheel and axle shop | 1,135 | 2,515 | 1,380 |
| | Traction motor shop | 600 | 735 | 135 |
| | Lavatory | 50 | 65 | 15 |
| | Office | 30 | 30 | 0 |
| | Building area(1) | 5,760 | 7,920 | 2,160 |
| No. 2 Workshop | Car-body painting shop | 720 | 900 | 180 |
| | Car-body shop | 1,760 | 3,545 | 1,785 |
| | Air brake equipment shop | 310 | 430 | 120 |
| | Electric equipment shop | 1,030 | 1,360 | 330 |
| | Pipe works shop | 230 | 345 | 115 |
| | Machine shop | 360 | 440 | 80 |
| | Ironwork shop | 690 | 575 | -115 |
| | Warehouse | 310 | 1,080 | 770 |
| | Car-body equipment shop | 270 | 395 | 125 |
| | Seat and vestibule diaphragm shop | 360 | 460 | 100 |
| | Rotating equipment shop | 0 | 620 | 620 |
| | Tool room | 0 | 220 | 220 |
| | Cooling unit shop | 0 | 500 | 500 |
| | Parts painting shop | 0 | 270 | 270 |
| | Car-body major repair shop | 0 | 1,785 | 1,785 |
| | Lavatory | 50 | 95 | 45 |
| Office | 30 | 30 | 0 | |
| Building area(2) | 6,120 | 13,050 | 6,930 | |

Unit: m²

| Building | Classification Shop | 1st Step Electri- fication | Building Area | |
|------------------------------|---|----------------------------------|------------------|-----------------------------|
| | | Present Condition | Building Area | Additional Building Area |
| Energy Center | Machine room | 435 | 615 | 180 |
| | Lavatory | 5 | 5 | 0 |
| | Dressing room | 10 | 10 | 0 |
| | Building area(3) | 450 | 630 | 180 |
| Incidental Building | Machine room (for painting shop) | 0 | 135 | 135 |
| | Temporary bogie shed | 0 | 216 | 216 |
| | Shunting locomotive shed | 84 | 84 | 0 |
| | Garage | 250 | 330 | 80 |
| | Dangerous items storage | 60 | 120 | 60 |
| | Sanitary room | 70 | 70 | 0 |
| | Effluent treatment plant | 270 | 270 | 0 |
| | Building area(4) | 734 | 1,225 | 491 |
| Administra- tive Building | Office | 793 | 793 | 0 |
| | Dressing room | 353 | 706 | 353 |
| | Dining room | 232 | 464 | 232 |
| | Patio | 897 | 1,180 | 283 |
| | Building area(5) | 2,275 | 3,143 | 868 |
| Total Area | Total building area of No. 1 Workshop and No. 2 Workshop | 11,880 | 20,970 | 9,090 |
| | Total building area of other buildings | 3,459 | 4,998 | 1,539 |
| | Grand Total of building area | 15,339 | 25,968 | 10,629 |

(4) Lighting Plan

- 1) Exterior walls will have 2 windows in each span as standard, and one window will be 3.5 m × 2.4 m.
- 2) Roofs will have windows to take in natural light.

(5) Ventilation Plan

Ventilation will be conducted by installing ventilation equipments at necessary points of the building.

4-2-2 Energy Center

- (1) New building of 9 m × 20 m will be added to the existing 18 m × 25 m building. The spaces for employees' room will remain intact.
- (2) Building structure will be reinforced concrete, the exterior walls will be brickwork, and the interior will be lined with felt. The column span will be 5 m × 9m.

4-2-3 Incidental Building

(1) Machine Room for Painting Shop

- 1) Along with heating equipment installation for Painting Shop a machine room will be newly constructed. The machine room will be divided into 5 m × 9 m and 5 m × 18 m based on the installation requirements.
- 2) The structure will be structural steel. Exterior walls will be built with brickwork and the roof will be covered with corrugated iron.

(2) Temporary Bogie Shed

- 1) In accordance with the increase in the number of temporary bogies, a new building of 6 m × 36 m will be constructed for temporary bogie storage space.
- 2) The structure will be structural steel. Exterior walls will be built with brickwork and the roof will be covered with corrugated iron.

(3) Shunting Locomotive Shed

Shunting locomotive shed will not be added because there will be no increase in the number of shunting locomotives.

(4) Garage

- 1) A building of 8 m × 10 m will be added to the existing garage of 10 m × 25 m in compliance with the increase in the number of tractors and trucks.
- 2) Building structure and road gradient will be in conformity with the existing buildings.

(5) Dangerous Items Storage

- 1) A building of 6 m × 10 m will be added to the existing 6 m × 10 m building.
- 2) The structure will be reinforced concrete, and the exterior walls will be brickwork. The column span will be 6 m × 5 m.

(6) Sanitary Room

Sanitary Room will not be added because there will be no requirement for the increase of equipments.

(7) Effluent Treatment Plant

Effluent Treatment Plant will not be added because there will be no need for the increase of facilities.

4-2-4 Administrative Building

(1) Scale

The extension of dining room and dressing room will be executed in accordance with the number of workers calculated under the personnel plan. The passageway will be also planned in the patio.

(2) Main Structure and Finishing

The main structure will be reinforced concrete, and column span will be 4.2 m × 4.2 m. The finishing works will be in conformity with the specifications of the existing buildings.

4-3 Facilities of Building

4-3-1 Plumbing Facilities

(1) Water Supply Facilities

Water will be supplied to respective places in the Workshop from the elevated water tank (capacity 250 m³), which is already installed. Water piping will be extended to the new buildings. However, it will not be necessary to increase water supply facilities.

(2) Drainage Facilities

The drainage system of the Workshop is composed of storm drain piping including floor drain of workshop building and effluent treated water, and waste piping including sanitary drain. The addition of pipe line and the drainage fittings will be executed for the extension of both of the above.

(3) Sewage

The sewer main pipe of the Workshop yard is connected to the public sewer. Therefore the portion of Workshop drain will flow into it after effluent treatment based on the drainage standard.

4-3-2 Air Conditioning/Ventilating Facilities

(1) Heating Facilities

1) Workshop Building

Specifications of heating facilities of the buildings to be extended will be the same as those for the 1st Step Workshop, and natural gas heaters will be used for direct heating. As for ventilating facilities, ceiling type ventilation fans will be furnished.

However, the Car-body Painting Shop, where independent heating equipment are installed, will be excluded.

2) Dressing Room

Heating of the extended portion of the dressing room will be conducted in the same way as the 1st Step Workshop, with heating equipment added in the exclusive machine room. These facilities will have air supply and return duct, and will be ordinarily used for ventilation.

(2) Air Conditioning Facilities

Air conditioning facilities, the same as those for the 1st Step Dining Room, will be installed in the Administrative Building to be extended. The equipment will be of the type fit for both summer and winter use, and the cooling facilities and the accessories will be installed on the rooftop.

(3) Ventilating Facilities

The Energy Center, Machine Room, etc., where generation of heat is expected, will have new ventilating facilities.

4-3-3 Fire Hydrant Facilities

(1) Piping for Fire Hydrant

Fire hydrant piping will be branched and extended from the present facilities to the respective fire plugs installed in the Workshop yard. Required water pressure at the end of the facilities is assumed to be secured.

(2) Fire Extinguisher

Chemical foaming cylinders and fire extinguishers, the same as those for the 1st Step Workshop, will be furnished as needed in the extended portions of the building. Where it is necessary, sand buckets will also be furnished.

4-4 Electric Facilities

4-4-1 Power Receiving and Distributing Facilities

(1) Power Receiving Facilities

High tension primary service wire for 13.2 kV, which is already installed, is composed of $3 \times 95 \text{ mm}^2$ cable for normal load of 2,109 KVA and $3 \times 25 \text{ mm}^2$ cable for emergency load of 61 KVA.

These cables have sufficient capacity for the increase of normal load of 1,357 KVA and emergency load of 28 KVA for the amplified facilities. Therefore, the power source for the added load after workshop amplification will be branched from the bus bar of high tension primary service wire.

High tension switchboard and low tension switchboard will have switching system to switch from normal power source to emergency power source.

Electric power load capacity for the portion of amplification is shown in Table 4.4.1.

Table 4.4.1 Power Load Capacity

Unit: KVA

| Building | Shop | Power Load Capacity | | |
|-----------------------------------|----------------------------------|---------------------------|-----------------------|--------------------------|
| | | Motive Power (normal use) | Lighting (normal use) | Lighting (emergency use) |
| No. 2 Workshop | Car-body lifting/lowering shop | -- | 32.7 | 5.9 |
| | Entrance/leaving inspection shop | 0.5 | | |
| | Bogie shop | 55.5 | | |
| | Wheel and axle shop | 290.5 | | |
| | Traction motor shop | 29.3 | | |
| | Temporary bogie shed | -- | | |
| | Subtotal (1) | 375.8 | | |
| No. 2 Workshop | Car-body painting shop | 96.8 | 57.5 | 10.5 |
| | Car-body shop | 117.5 | | |
| | Parts painting shop | 1.8 | | |
| | Car-body major repair shop | -- | | |
| | Subtotal (2) | 216.1 | | |
| | Air brake equipment shop | 67.1 | 24.8 | 4.5 |
| | Electric equipment shop | 38.1 | | |
| | Car-body equipment shop | 13.0 | | |
| | Rotating equipment shop | 24.6 | | |
| | Tool room | 21.5 | | |
| | Cooling unit shop | 82.5 | | |
| | Subtotal (3) | 246.8 | | |
| | Pipe works shop | 12.3 | Included in the above | |
| | Machine shop | 89.1 | | |
| | Ironwork shop | 157.1 | | |
| Seat and vestibule diaphragm shop | 8.8 | | | |
| Subtotal (4) | 267.3 | -- | -- | |
| *Warehouse | 29.1 | 14.9 | 2.7 | |
| Subtotal (5) | 29.1 | 14.9 | 2.7 | |

Unit: KVA

| Building | Shop | Power Load Capacity | | |
|-------------------------|----------------------------------|---------------------------|-----------------------|--------------------------|
| | | Motive Power (normal use) | Lighting (normal use) | Lighting (emergency use) |
| Energy Center | Machine room (for painting shop) | 28.8 | 2.5 | 0.5 |
| | Lavatory | -- | | |
| | Dressing room | -- | | |
| | *Garage | -- | 1.1 | 0.2 |
| | *Dangerous items storage | -- | 0.8 | 0.2 |
| | Subtotal (6) | 28.8 | 4.4 | 0.9 |
| Administrative Building | Dressing room | 16.1 | 17.9 | 3.3 |
| | Dining room | 24.3 | | |
| | Patio | -- | | |
| | Subtotal (7) | 40.4 | 17.9 | 3.3 |
| Total | | 1,204.3 | 152.2 | 27.8 |

* Separate Building

(2) Power Distributing Facilities

1) High-tension Power Distributing Facilities

High-tension electric power is supplied to each transformer through high tension panel board, high tension branch circuit board and two-way switch.

2) Low-tension Power Distributing Facilities

Low-tension power distributing facilities will be composed of transformer and low-tension power distribution board, and will supply electric power for motive power (380V) and for lighting (231V) in the buildings to be extended. Power distribution system will be divided into blocks according to respective load capacities. Lighting panel boards and motive panel boards will be furnished at the necessary places.

(3) Lighting Facilities in the Workshop Yard

Outdoor lighting will be increased for the roads surrounding Workshop building and other places necessary for security reasons.

(4) Fire Alarm Facilities

Automatic fire alarm facilities will be installed for the portions of buildings to be extended.

(5) Power Source for Traverser

Contact wire for the traverser will be extended in accordance with the new construction of the Car-body Major Repair Shop and the removal and the extension of the Car-body Painting Shop.

(6) Grounding

Grounding nets, the same as those for the 1st Step Workshop, will be installed in the portions of the building to be extended and electrical connections will be made. Grounding terminal will be buried.

4-4-2 Communication Facilities

(1) Telephone System

At present, a trunk line of 100 P is led in from the switchboard of Escalada Yard, and the circuits have surplus capacity. Therefore, telephones and local lines will be increased.

(2) Public Address System

Public address system will be increased for business and emergency communications. As for the loudspeakers, those of smaller capacity are preferable and they will be placed at a greater number of spots fully taking into consideration the sectioning walls, etc.

(3) Electric Clock

The repeater is already installed in the KM10 Workshop. Therefore, additional clocks and the local lines will be installed where they are necessary corresponding to the Workshop Amplification.

4-4-3 Catenary System

Catenary system of the Entrance/Leaving Track, Running Test Track and Connecting Track to the Running Test Track for the 1st Step Workshop will be usable intact. Therefore, new construction, extension and transfer of the catenary system will not be necessary.

4-4-4 Signal Facilities

Shunting operations over the main line are carried out by the instructions of the train operation dispatcher room in the Escalada Yard. There will be no basic changes in the turnout operation and signalling, and therefore, signal facilities will not be increased.

4-5 Machines

4-5-1 Machines to be Increased

Names and quantity of machines to be increased in accordance with the amplification of the Workshop are shown in Table 4.5.1.

The machines which are not installed in the 1st Step Workshop are shown together with their specifications in Table 4.5.2.

In line with the increase of these machines, the installation of respective power panel boards will be necessary.

Table 4.5.1 Machines to be Increased

| Shop | Name of Machine | Quantity |
|--|------------------------------------|----------|
| A Workshop Yard | Forklift truck (1.5 t) | 1 |
| | Forklift truck (2 t) | 2 |
| | Autotruck (6 t) | 1 |
| | Autotruck (1 t) | 1 |
| B Entrance/Leaving Inspection Shop | Air brake tester | 1 |
| D Electric Equipment Shop | Parts cleaner | 1 |
| | Dielectric strength tester | 1 |
| | Buffing machine | 1 |
| | Coiling machine | 1 |
| | Dust arresting equipment | 1 |
| | Electric coil drying oven | 1 |
| | Low platform cart (1.5 t) | 1 |
| | Overhead travelling crane (3 t) | 1 |
| E Car-body Equipment Shop | Bench drilling machine | 1 |
| | Bench grinding machine | 1 |
| | Crank press | 1 |
| | Shearing machine | 1 |
| | Bending roll | 1 |
| | Bending machine | 1 |
| | Nibbling machine | 1 |
| F Air Brake Equipment Shop | Air brake valve tester | 2 |
| | Parts cleaner | 1 |
| | Air conditioner | 2 |
| G Parts Painting Shop | Paint mixer | 1 |
| | Parts cleaner | 1 |
| H Seat and Vestibule Diaphragm Shop | Industrial sewing machine | 1 |
| | Seat transfer cart (1 t) | 6 |
| | Seat storing equipment | 1 |
| I Car-body Shop | Electric welder | 6 |
| | Scaffolding car for carbody repair | 6 |
| | Low platform cart (1.5 t) | 1 |
| | Forklift truck (1.5 t) | 2 |

| Shop | Name of Machine | Quantity |
|---------------------------|-----------------------------------|----------|
| J Pipe Works Shop | Pedestal grinding machine | 1 |
| | Threading machine | 2 |
| K Car-body Painting Shop | Car-body painting machine | 3 |
| | Scaffold for car-body painting | 1 |
| | Air heating equipment | 3 |
| L Bogie Shop | Air exhaust | 3 |
| | Hydraulic press | 1 |
| | Parts cleaner | 1 |
| M Wheel and Axle Shop | Electric arc welder | 2 |
| | Wheel lathe | 1 |
| | Ultrasonic flaw detector | 1 |
| | Wheel and axle washing equipment | 1 |
| | Wheel and axle rotating equipment | 1 |
| | Wheel and axle traverser | 1 |
| | Turntable | 4 |
| | Overhead travelling crane (5 t) | 2 |
| | Bearing heater | 1 |
| | Roller conveyer | 2 |
| N Traction Motor Shop | Axle box washing machine | 1 |
| | Wheel and axle transfer track | 1 |
| | Air conditioner | 2 |
| | Parts cleaner | 1 |
| | Slat conveyer | 3 |
| O Rotating Equipment Shop | Pedestal grinding machine | 1 |
| | Low platform cart(1.5 t) | 2 |
| | Air filter cleaning machine | 1 |
| | Air blast booth | 1 |
| | Insulation deterioration tester | 1 |
| | Dielectric strength tester | 1 |
| O Rotating Equipment Shop | Pedestal grinding machine | 1 |
| | Overhead travelling crane (3 t) | 1 |

| Shop | Name of Machine | Quantity |
|------------------------|--|----------|
| P Ironwork Shop | Electric welder | 3 |
| | Rust remover | 1 |
| | Parts cleaner | 1 |
| | Magnetic flaw detector | 1 |
| | Upright drilling machine | 1 |
| | Pedestal grinding machine | 1 |
| | Hydraulic press | 1 |
| | Bending roll | 1 |
| | Punching/shearing machine | 1 |
| | Spot welder | 1 |
| | Automatic gas cutting machine | 1 |
| | Argon gas arc welder | 1 |
| Q Machine Shop | Horizontal boring machine | 1 |
| | Centering machine | 1 |
| | Lathe (1,000) | 2 |
| | Lathe (2,000) | 1 |
| | Lathe (3,000) | 1 |
| | Upright drilling machine | 1 |
| | Radial drilling machine | 1 |
| | Vertical milling machine | 2 |
| | Pedestal grinding machine | 1 |
| | Surface grinder | 1 |
| | Universal tool grinding machine | 1 |
| | Cemented carbide tool grinding machine | 1 |
| Drill grinding machine | 1 | |
| R Tool Room | Air conditioner | 1 |
| S Temporary Bogie Shed | Temporary bogie | 12 |
| | Bogie turntable | 1 |
| T Cooling Unit Shop | Cleaning machine | 1 |
| | Air exhaust | 1 |
| | Cooling unit repairing carrier | 6 |
| | Cooling unit test equipment | 1 |
| | Overhead travelling crane (2 t) | 2 |

| Shop | Machine | Quantity |
|-----------------|---------------------------------|----------|
| V Warehouse | Forklift truck (2 t) | 2 |
| | Low platform cart (1.5 t) | 2 |
| | Overhead travelling crane (5 t) | 1 |
| | Air conditioner | 1 |
| W Energy Center | Boiler (4 t) | 1 |
| Total | | 160 |

Table 4.5.2 Main Functions of Machines to be Newly Installed

| Shop | Name of Machine | Main Functions |
|--------------------------------|--------------------------------|--|
| D Electric Equip- ment Shop | Parts cleaner | Solvent used Trichloroethane Dimensions about 1,000(L) × 600(W) × 800(H) mm Electric heating about 2 kW |
| | Coiling machine | Diameter of coiling wire 0.1 - 1.8 mm Coil diameter max. 250 mm |
| | Electric coil drying oven | Dimensions (Interior) about 700(L) × 500(W) × 700(H) mm Heat regulation range 100 - 200°C Electric heating about 10 kW |
| | Overhead travel- ling crane | Rated load 3 Ton Span 18.6 m Hoisting speed max. 5 m/min |
| E Car-body Equip- ment Shop | Crank press | Capacity 30 Ton Motor about 2.2 kW |
| | Shearing machine | Work size max. 3.2 × 1,300 mm Motor about 3 kW |
| | Bending roll | Work size max. 3.2 × 1,300 mm Motor about 2.2 kW |
| | Bending machine | Work size max. 3.2 × 2,000 mm Hand operation |
| | Nibbling machine | Thickness of work sheet max. 5 mm Motor about 1 kW |
| F Air Brake Equipment Shop | Parts cleaner | Cleaning booth about 1,200(L) × 600(W) × 600(H) mm Steam heating |

| Shop | Name of Machine | Main Functions |
|-------------------------------------|-----------------------------------|---|
| G Parts Painting Shop | Parts cleaner | Tank dimensions × Number about 2,500(L) × 1,000(W) × 1,000(H) mm × 2 Steam heating |
| H Seat and vestibule Diaphragm Shop | Seat transfer cart | Loading capacity 1,000 kg Bed about 2,600(L) × 1,000(W) × 200(H) mm |
| | Seat storing equipment | Conveyer dimension × Number about 15,000(L) × 1,200(W) × 750(H) mm × 3 Motor about 6.6 kW |
| I Car-body Shop | Forklift truck | Loading capacity 1.5 Ton Battery type |
| K Car-body Painting Shop | Air heating equipment | Blowing volume about 500 m ³ /min Heat generation max. 300,000 kcal/h Gas consumption volume max. 97 Nm ³ /h Motor about 22 kW |
| L Bogie Shop | Hydraulic press | Capacity 50 Ton Motor about 2.2 kW |
| | Parts cleaner | Number of tanks Chemicals × 1, Hot water × 1, Air blast × 1 Steam heating |
| M Wheel and Axle Shop | Wheel and axle washing equipment | Number of tank 1 Chemical washing/Hot water washing switch type Steam heating |
| | Wheel and axle rotating equipment | Range of revolution 1 - 3 r.p.m. Motor about 0.5 kW |
| | Axle box washing machine | Number of tanks Chemicals × 1, Hot water × 1, Air blast × 1 Steam heating |

| Shop | Name of Machine | Main Functions |
|---------------------------|-------------------------------|---|
| N Traction Motor Shop | Parts cleaner | Number of tanks Chemicals × 1, Hot water × 1, Air blast × 1 Steam heating |
| | Slat conveyer | Dimensions about 9,000(L) × 1,000(W) × 600(H) mm Loading capacity 1,200 kg/m |
| O Rotating Equipment Shop | Air filter cleaning machine | Number of tanks Chemicals × 1, Water × 1 Horizontal oscillating type |
| | Overhead traveling crane | Rated load 3 Ton Span 18.6 m Hoisting speed max. 5m/sec |
| P Ironwork Shop | Rust remover | Degree of vacuum × air blast volume 1,600 mmAq × 2.5 m ³ /min Motor about 3 kW |
| | Parts cleaner | Number of tanks Chemicals × 1, Hot water × 1 Steam heating |
| | Bending roll | Work size max. 6 × 1,300 mm Motor about 5 kW |
| | Punching/shearing machine | Capacity 50 Ton Motor about 5 kW |
| | Automatic gas cutting machine | Thickness of work sheet 3 - 150 mm Cutting speed 50 - 1,000 mm/min |
| | Argon gas arc welder | Electric current max. 500 A Electric power 23 kVA |
| Q Machine Shop | Horizontal boring machine | Main spindle diameter 80 mm Motor about 7.5 kW |
| | Centering machine | Drilling diameter max. 16 mm Motor about 0.7 kW |
| | Lathe | Swing × center distance max. 600 × 2,000 mm Motor about 11 kW |

| Shop | Name of Machine | Main Functions |
|---------------------|--|--|
| Q Machine Shop | Lathe | Swing × center distance max. 1,200 × 3,000 mm Motor about 15 kW |
| | Vertical milling machine | Table dimensions about 300 × 1,300 mm Motor about 5.5 kW |
| | Surface grinder | Table dimensions about 300 × 600 mm Motor about 3.7 kW |
| | Universal tool grinding machine | Swing × center distance max. 300 × 1,000 mm Motor about 3.7 kW |
| | Cemented carbide tool grinding machine | Main table dimensions about 200 × 400 mm Motor about 0.7 kW |
| | Drill grinding machine | Worked drill diameter 12 - 80 mm Motor about 0.5 kW |
| T Cooling Unit Shop | Cleaning machine | Ejection water volume × ejection pressure 400 l/h × 30 kg/cm ² Motor about 2.2 kW |
| | Air exhaust | Exhaust air volume 170 m ³ /min Motor about 2.2 kW |
| | Cooling unit repairing carrier | Loading capacity 2,000 kg Bed dimensions about 5,000 × 2,300 mm |
| | Cooling unit test equipment | Room dimensions about 5,300(L) × 4,000(W) × 2,600(H) mm Electric power about 38 kW |
| V Warehouse | Forklift truck | Loading capacity 2 Ton Battery type |
| | Overhead travelling Crane | Rated load 5 Ton Span 18.2 m Hoisting speed max. 5 m/min |

| Shop | Name of Machine | Main Functions |
|-----------------|-----------------|--|
| W Energy Center | Boiler | Steam generation max. 4 t/h Steam pressure 7 kg/cm ² Gas consumption max. 327 Nm ³ /h Heavy oil consumption max. 263 kg/h Electric power about 23 kW |

4-5-2 Machines to be Transferred

Names and quantity of machines to be transferred corresponding to the amplification of the Workshop are shown in Table 4.5.3.

Table 4.5.3 Machines to be Transferred

| Shop | Machine | Quantity |
|--|---|----------|
| D Electric Equipment Shop | Buffing machine | 1 |
| | Soft grit blasting machine | 1 |
| | Dust arresting equipment | 1 |
| | Water purifying equipment | 1 |
| | Washing equipment | 1 |
| | Dielectric strength tester | 1 |
| | M. A. control equipment tester | 1 |
| | Main rectifier tester | 1 |
| | Power source facility for testing | 1 |
| | Battery capacity tester | 1 |
| | Main controller tester | 1 |
| F Air Brake Equipment Shop | Door engine tester | 1 |
| H Seat and Vestibule Diaphragm Shop | Industrial sewing machine | 1 |
| K Car-body Painting Shop | Air exhaust | 6 |
| | Scaffold for car-body painting | 2 |
| | Paint mixer | 1 |
| L Bogie Shop | Upright drilling machine | 1 |
| | Pedestal grinding machine | 1 |
| | Bogie painting equipment | 1 |
| | Spring tester | 1 |
| | Magnetic flaw detector | 1 |
| | Jib crane (1/4 t) | 1 |
| M Wheel and Axle Shop | Axle lathe | 1 |
| | Hydraulic wheel press | 1 |
| | Jib crane (1/4 t) | 2 |
| | Turntable | 2 |
| | Vertical lathe | 1 |
| | Brake disk lathe | 1 |
| | Bearing cleaning equipment | 1 |
| | Turntable with wheel and axle rotating equipment | 1 |
| | Roller conveyer | 1 |

| Shop | Machine | Quantity |
|---------------------------|---|----------|
| N Traction Motor Shop | Lathe | 1 |
| | Pinion heater | 1 |
| | Air blast booth | 1 |
| | Dynamic balancing machine | 1 |
| | Dielectric strength tester | 1 |
| | Traction motor tester | 1 |
| | Traverser for rotating machine | 1 |
| O Rotating Equipment Shop | Drying oven | 1 |
| | Fan testing machine | 1 |
| | Air compressor tester | 1 |
| | Motor alternator tester | 1 |
| P Ironwork Shop | Draft gear disassembling/ assembling machine | 1 |
| Total | | 51 |

4-6 Utility Facilities

4-6-1 Effluent Treatment Facilities

Effluent Treatment facilities of the 1st Step Workshop have a capacity of 200 m³/day. Drainage volume after amplification will be 94.7 m³/day (53.5 m³/day for the 1st Step Workshop, 41.2 m³/day for the increase). Therefore, the additional equipment will not be necessary and only the drainage pipe extension will be executed.

4-6-2 Natural Gas Supply Facilities

By the additional construction of boilers, etc., natural gas consumption will be 923.2 Nm³/h after amplification (305.2 Nm³/h for the 1st Step Workshop, 618 Nm³/h for the increase), the gas pressure reducing equipments and natural gas pipe facilities will be increased.

4-6-3 Compressed Air Facilities

Increase of compressed air consumption is very little and so there will be no need for additional increase for air compressors. Only the air pipe extension to the new buildings will be executed.

4-6-4 Liquid Fuel Storage Facilities

The 1st Step Workshop has a liquid fuel storage capacity of 7,500 liters, and this can cope with about two days consumption even after the amplification of the Workshop. These facilities are basically installed as emergency use when gas supply is suspended. Judging from the probabilities of such a situation and the refuel method, the facilities intact will be able to fully cope with the requirement. Therefore, no addition to these facilities will be executed.

4-6-5 Steam Supply Facilities

Boiler facility increased are already planned in Item 4-5 "Machines". Therefore, the increase of steam piping and the accessory fittings will become necessary.