Number of lines -------- 2

Number of wires ------- 3 per line

18. LIGHTING AND ATTACHED POWER FACILITIES.

18.1 High-tension distribution lines.

In order to distribute power as the source of lighting and signals, from the switch house of each station, two systems of distribution cable should be laid all along the tunnel line; the cables should be contained in ceramic trought installed at the foot of the side-wall. Besides, such important load as the power source of drainage pumps and signals should be arranged to be automatically switched over to different systems.

18.2 Switch house.

At each station a switch house for lighting and signal equipments should be installed, where a 3-phase A. C. 5 KV current is transformed to 3-phase 400 V/230V A. C. of four-wire system.

18.3 Low-tension distribution line.

For the source of small power and lighting in the tunnel, distribution lines of 3-phase A. C. 400V/230V four-wire system should be installed. Illumination lamps are of single-phase 230V type and installed zigzag at every 20 m.

Low-tension distribution lines of 230V two-wire system are installed as a source for signals.

18.4 Drainage pump.

For the drainage of tunnel leakage, slop and penetrating rainwater pump rooms should be installed at necessary places in the deepest part of the tunnel and 2 or 3 pumps (including spare units) of about 15 KW should be equipped.

18.5 Ventilator.

Principal stations should be equipped with exhaust towers to enable forced draft.

HP of ventilator ------- 37-100 KW

Number of ventilator --- 3 for a large station; 2 for a small station.

18.6 Lighting of station.

Stations should be illuminated with fluorescent lamps: the standard intensity of illumination for the first class stations should be 500 lux and that for stations below the second class 300 lux.

The distribution line should be of a 3-phase 400V/230V 4-wire system and the lighting circuit should be of 230V. Besides, for the source of emergency lamps at the time of service interruption a storage battery should be installed in the switch house to enable automatic change-over to D. C. 200V in part.

18. 7 Escalator.

Escalators should be installed in principal stations to operate from the platform to the mezzanine.

Height of mezzanine ----- 5m

Width of step ----------- wide enough for two persons abreast

HP of motor ------------- about 11 KW

19. SIGNAL EQUIPMENTS.

The signal method should be of an automatic train control system including an automatic train stop device. The signal is designed on the basis of 2 minutes headway operation of 8 - car trains. The intermediate signal should be, as a rule, a color-light and three-position signal indicating 'stop', 'caution' and 'proceed', but, for the prevention either of overrun or overspeed, a warning or speed limiting signal should also be employed. The signal control system should be of the full overlap system of control.

The interlocking device should be of an interlocking relay type; it should be installed at the starting and terminal stations and also at the turn-back points halfway.

19. 1 Specification of automatic block signal.

Type of signal ---------- color-light and three-position signal

Indication system ------ 3-position (stop, caution and proceed)

Control system -------- full overlap system

19. 2 Interlocking device.

Type of interlocking device -- electro-pneumatic relay interlocking

Method of interlocking ------ route lever type

Kind of power-drivent point : electro-pneumatic point

19.3 Air compressor room.

Air compressors should be installed in principal stations where interlocking devices are placed; from these air compressors air should be supplied through pneumatic tubes to operate the electro-pneumatic point and automatic train stop devices. For each position are installed two compressors, one of which is a spare unit.

19.4 Automatic train control device.

The automatic train control device constantly supervises whether or not the train speed is always kept within the speed limit indicated by the track circuit signal; in case of an overspeed the device instantly applies the automatic control, which is then released when the train speed reduces below the limit. Furthermore, by dint of this device the emergency brake is automatically applied when a stop signal is indicated.

Accordingly, this device interferes in no way with the driver who is conducting a normal operation, but, as soon as he does wrongly, it starts to work and reduces the train speed or brings the train to a hault.

Being a continuous induction type with audio-frequency track circuits, this device is placed under continuous control which enables the ground signal to be received aboard the train; any signal change on the ground is instantly communicated to the train, wherever it may be, bringing the automatic control device into operation, which improves the safety of train operation and smooth and efficient transport as well.

The characteristics of this device are as follows;

(a) The rail circuit system consists of kilocycle rail circuits utilized in the continuous control system.

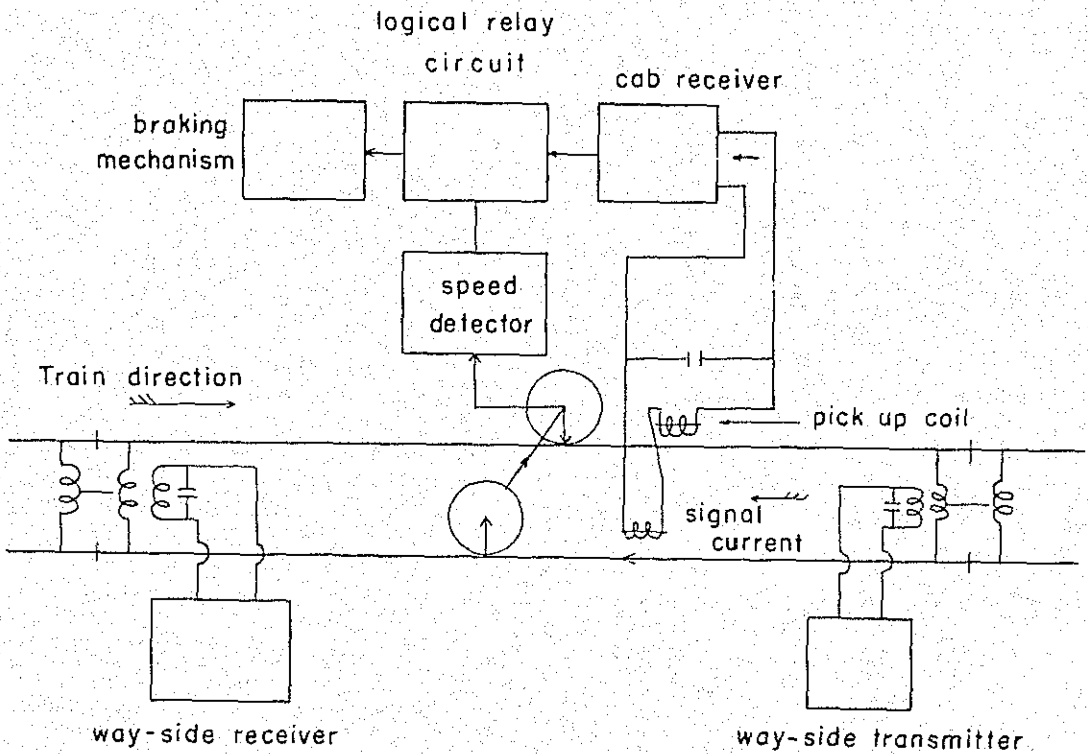
(b) The device on board the car is of a contactless relay type, and the ground device is transitorized.

(c) It enables, by means of equipping a few kinds of signal audiofrequencies, to conduct a multi-stage control of the train speed or to bring the train to a hault.

(d) If any accident to the signal device cuts off the signal current, the emergency brake of the train works.

This device consists of a ground transmitter, a ground receiver, a rail circuit and an apparatus aboard the car, the coutline of which is shown in Fig. 38.

FIG 38 The principle of the automatic train control



19.5 Automatic operation of train.

As automatic operation of trains is being conducted in Tokyo, tentatively and with success, by the Teito Rapid Transit Authority, this system may be possible to be adopted also in the underground railway of Caracas. However, train operation without drivers involves a problem in view of the psychology of passengers, and this matter should be determined pending further studies and discussions with the persons concerned in Caracas.

This device of automatic train operation works as follows: by the push-button action of the driver, the start, acceleration, notch-off, speed-control and stop at regular positions of a train are all conducted automatically; it can also be converted to the operation without drivers, if the push-button action is conducted by the remote control device installed in the station platform.

19.6 Indicator of train position.

An indicator of train positions should be installed in the train dispatching office.

20. COMMUNICATION FACILITIES.

20.1 Railway telephone.

A switchboard of crossbar type should be installed for the business of the main office and field work offices, and in each of the latter automatic telephones are also installed.

As for the liaison telephone for communications between the dispatching office for power supply or maintenance field offices and field works a bare hard copper wiring, available for manegto-system telephone, should be laid all along the track to enable telephone talk from any spots on the track.

20.2 Train dispatching telephone.

For the regulation of train operation, liaison in case of accidents and urgent instructions in time of emergencies train dispatching telephone should be installed between the train dispatching office and necessary field offices of operation.

20.3 Telephone for dispatch of electric power supply.

For the liaison, directions and urgent instructions in time of emergencies telephone for the dispatch of power supply should be installed between the dispatching office, substations and important maintenance offices.

20.4 Emergency telephone.

(a) Inductive radio.

By making use of inductive radio the crewmen of running trains can not only talk with the dispatching office of power supply and train dispatching office, but also stop the feed of power from the substations concerned, immediately and automatically, by pushing the emergency button.

(b) Wire telephone.

By making use of the emergency telephone line in the tunnel and connecting their portable telephone sets, the train crewmen can come in contact with the dispatching offices of train and electric power supply, etc.

20.5 Communication channel.

(a) Telephone cable.

On each side of the tunnel a telephone cable should be laid.

(b) Overhead telephone line.

On each side of the tunnel and the central poles respectively one overhead telephone line should be installed. These three lines consist of two circuits of emergency telephone and a circuit of safety service telephone.

(c) Inductive radio apparatus.

The inductive radio apparatus for emergency telephone call conducts the call by the radio induction between the emergency telephone line installed on the side-wall of the tunnel and the car antenna. The principle of its function is shown in Fig. 39.

20.6 Layout of electrical facilities in tunnel.

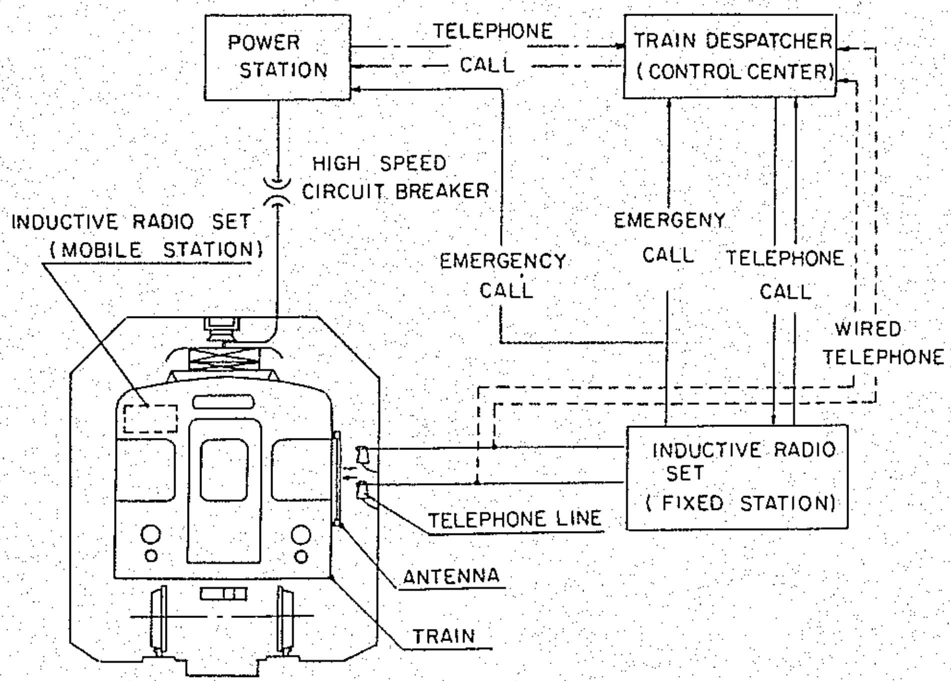
The layout of the electrical facilities in the tunnel is shown in Fig. 40.

21. ROLLING-STOCK.

21.1 Principle of design and outline.

In view of the characteristics of the underground railway the first consideration of its rolling-stock should consist in its absolute safety, fireproofing and solidity against such accidents as fire, collision, etc. While the sectional area of the tunnel, having a great deal to do with the

FIG 39 INDUCTIVE RADIO SYSTEM WITH EMERGENCY CALLING DEVICE



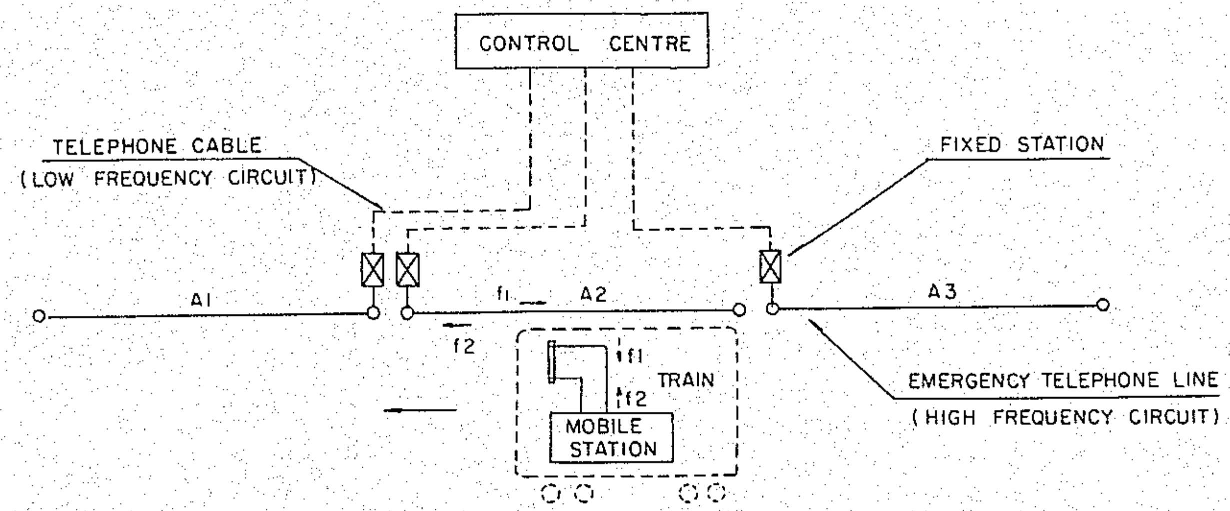
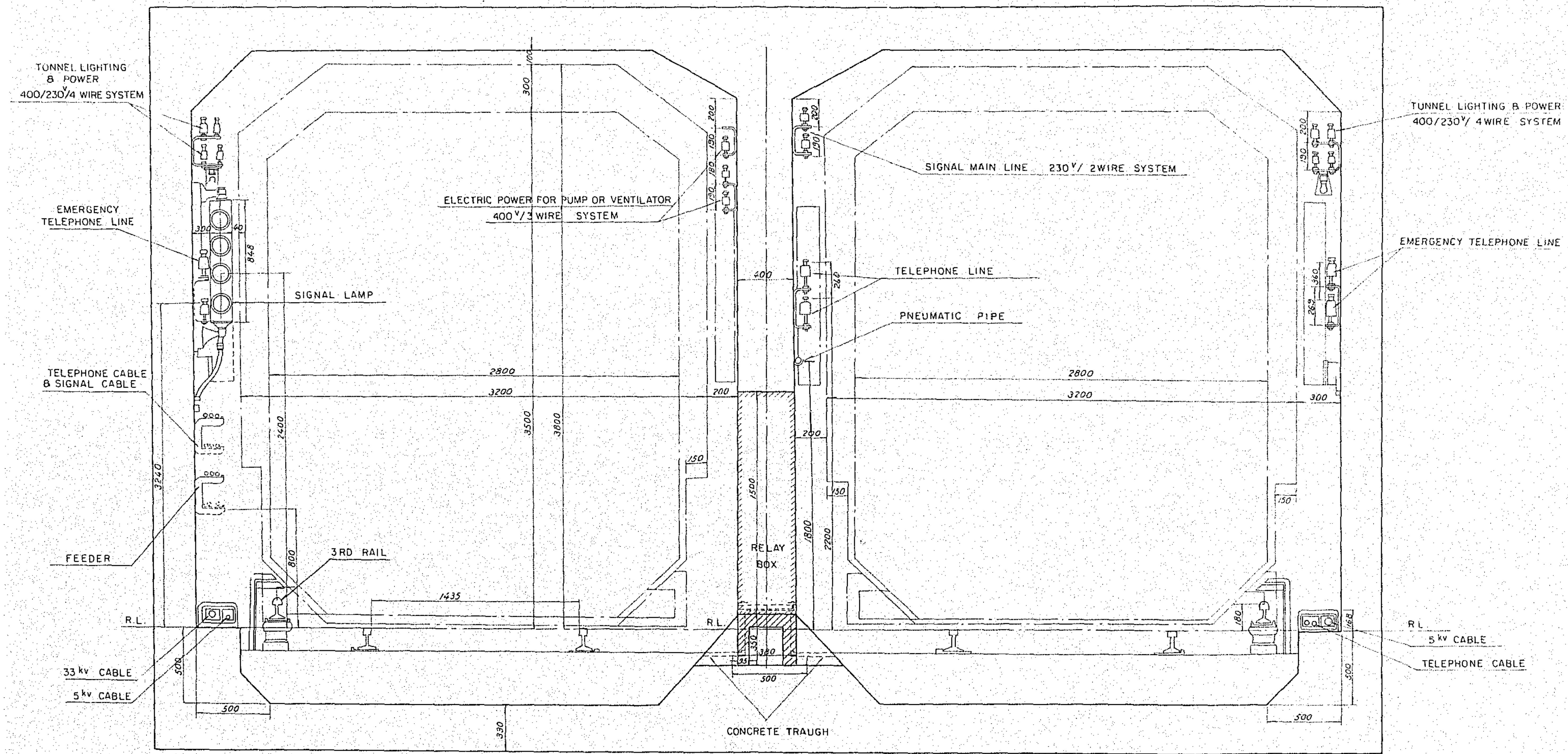


FIG 40 ELECTRICAL EQUIPMENTS. STANDARD TUNNEL OF UNDERGROUND RAILWAY



construction cost, should be as small as possible, that of the rolling-stock had better be as large as possible in order to increase its transport capacity. Therefore, the size of the rolling-stock has been designed to be as large as allowable in order to make the best of the tunnel sectional area, both in economy and efficiency.

The relations of the tunnel construction gauge to the car gauge have been already shown above in Fig. 22. Besides, the outline of the car is as follows:

Type of Car ------------	passenger car; four wheel bogie and all metal electric motor car
Track gauge -----------	1,435 mm
Unloaded weight --------	33.0 - 35.0 ton
Maximum riding capacity --------	150 persons (60 seats and 90 standing seats)
Electric system --------	750 V D.C., third rail system
Traction motor ---------	D.C. series, with interpoles, weak field control with inductive shunt
	one hour rating --- 100 KW, 375 V, 300 A
	Number ---------- 4
Maximum speed --------	100 km/H
Acceralation -----------	3.5 km/H/S
Deceralation -----------	4.0 km/H/S (in emergencies 5.0 km/H/S)
Schedule speed ---------	38.5 km/H - 44.5 km/H
Average distance between stations ------	1.0 km - 1.38 km
Average stoppage-time -----	20 seconds

The outline drawing of the car is shown in Fig. 41.

21.2 Car body.

(a) Outline.

The material and structure of the car should be so selected that the car is highly fireproof, comfortable even at a high speed, light in weight and convenient to maintain.

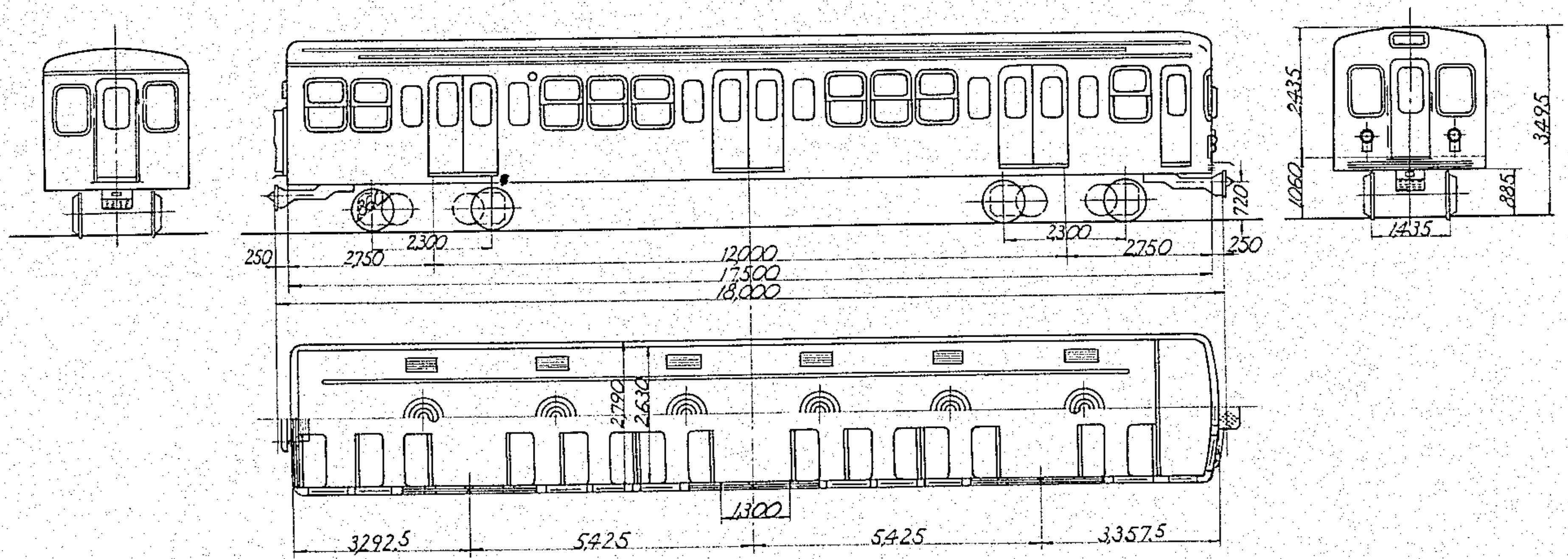
Maximum dimensions -------------

length (between couplers) ---------- 18,000 mm

length (between outside panels) ---- 175,000 mm

FIG 41

Electric car for the underground railway



Width (between outside panels) ----- 2,800 mm

Height (roof top) ----------------- 3,500 mm

Distance between truck centers ---- 12,000 mm

Unload weight ------------------- 33.00 ton - 35.00 ton

(b) Body under frame.

The body under frame should stand the impact load of 50 ton/cm^2 at the car end; each beam should be of rolled steel plate for general structural use which has undergone a bending work. The assembly should be conducted with sufficient solidity by means of welding.

(c) Steel framework.

Such members of framework as posts, beams, etc. should be all made up of steel plates for general structural use; the assembly and seams of each member should be welded and have sufficient strength and rigidity against bending and torsion.

(d) Car door.

In order to reduce the passengers' time in getting on and off the car, and, consequently, the stoppage-time of the train, the car should be equipped with three double doors on one side, each door leaf being as wide as 1,300 mm, which are all opened and shut simultaneously by an electric control device in the crew section. The driving device of each double door should be of a compressed air type.

(e) Crew section.

The crew section should be partitioned from the passengers' quarters and have a full width of the car in order to obtain a wide visual field. The position of the machinery and instrument, for which the crew is responsible, should be properly arranged so as not to give the crew a feeling of fatigue in order to ensure safe operation.

(f) Side window.

The side window should be made as wide as possible. It consists of two parts: the upper part and lower part; the former can be pushed up, while the latter can be raised only as high as 70 cm for fear of danger in the tunnel.

(g) Ventilator.

In addition to the natural ventilation through the window, six electric fans per car should be installed in the center line of the car.

(h) Illumination.

Illumination of the passenger quarters should be of a type by means of fluorescent lamps which are all switched on or off simultaneously from the crew section.

(i) Seat.

The seat of the car consists of two kinds: the long seat and cross seat; the nominal seating capacity of the former is about 54 persons, while that of the latter about 60.

The maximum seating capacity, including the standing per rush hour should be about 150 persons. Although a long seat is an effective equipment of increasing the number of standing passengers the cross seat type, has been adopted in view of the fact that the passengers are considered to prefer this type, and also for the convenience of those passengers who travel in the time belt other than rush hours.

(j) Equipments in passenger quarters.

Straps, other kinds of supports for the passengers near the entrance, and luggage nets in proper positions should be equipped in the car.

(k) Others.

In order to insulate the car from the outside noise and heat the under-surface and inside of the outside panel should be coated with asbestos, special vinyl chloride paint, etc. which have sound-insulating and adiabatic effects.

The floor should be applied with light fillers on the keystone plate, and its surface with flooring.

21.3 Truck.

(a) Outline.

The truck should be a four-wheel truck with solid structure and capable of conducting a high-speed, safe, comfortable and gentle operation, either loaded or unloaded.

Track gauge ----------- 1,435 mm

Wheel base ------------ 2,200 mm 2,300 mm

Center plate load ------- unloaded 9,000 - 10,000 kg

Brake type -------------- truck rigging type

(b) Wheel and bearing.

For the purpose of reducing the weight the wheel diameter should be 860 mm, and the bearing made up of spherial roller bearing.

(c) Truck frame.

The material of the truck frame should be high-tensile steel. The truck frame should be assembled by welding.

(d) Spring.

The spring of the truck consists of bolster springs and axle springs; the former are made up of air springs and the latter helical springs.

21.4 Traction motor.

(a) Outline.

In the rapid transit railway all axles of a car should be driving axles in order to make an efficient use of the adhesion of the wheel tread, by which high acceleration and deceleration are obtained. Such a car should also be equipped with an electric brake which can gain sufficient braking effects and applicable over a wide range of speed. This kind of brake not only ensures the safe and gentle operation of trains, but, being free from the brake shoe dust, prevents the interior of the tunnel from getting dirty and makes the underground railway a sanitary means of traffic.

(b) Specifications.

Type ------------------	D. C. series with interpoles, weak field control with inductive shunt; frame mounted; parallel Cardin drive.
One hour rating ---------	100 KW 375 V 300 A
Characteristic curves ---	Fig. 42

21.5 Control device.

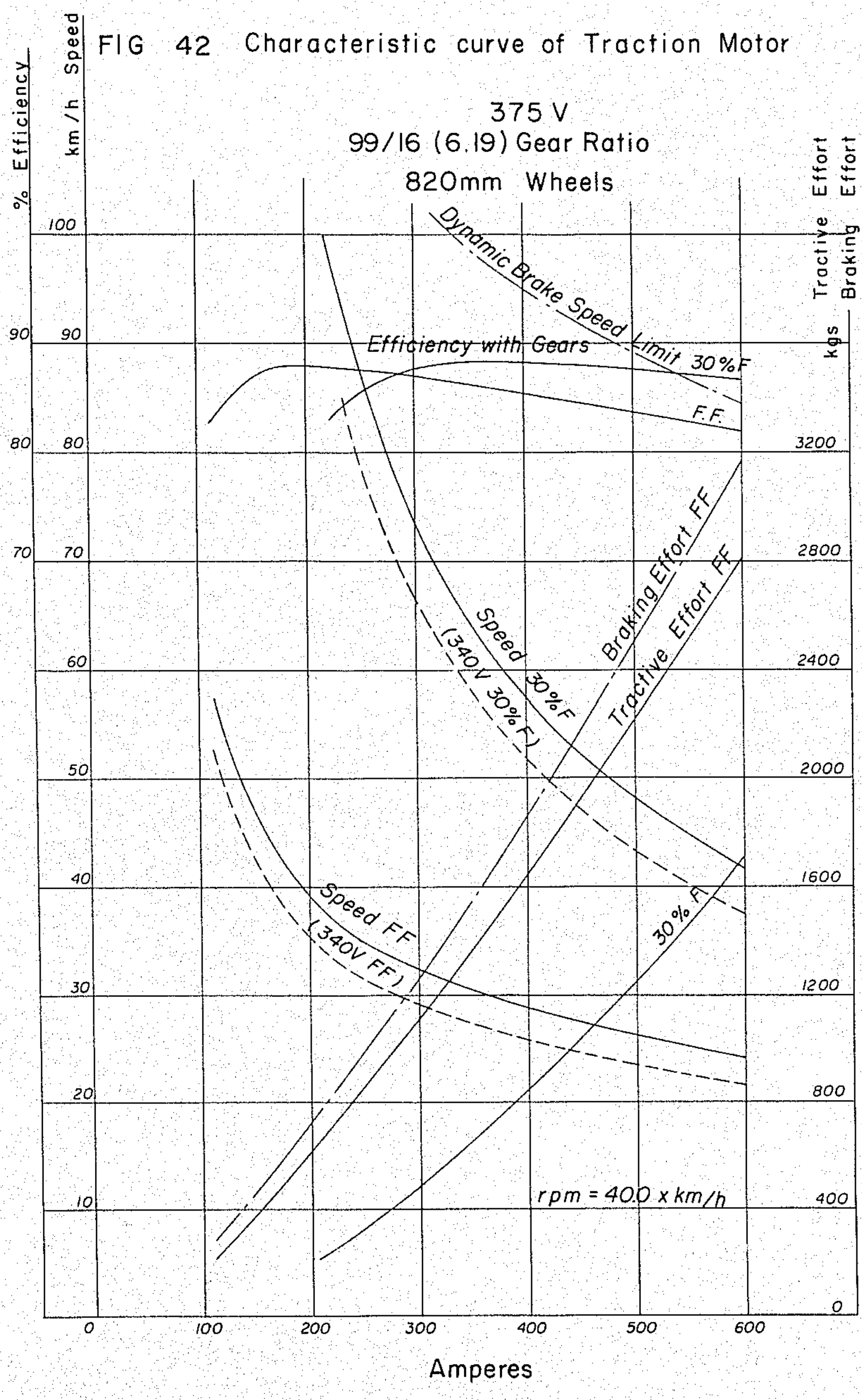
(a) Outline.

In order to improve at a high accleration and deceleration, the comfortableness of riding and reduce the undesirable effects on the traction motor and substation the control system should be of a Vernier control type which can gain super-multistep notches.

(b) Specifications.

Type ------------------	single cam shaft with electric drive; super multistep type by means of Vernier resistance and Vernier switch; load compensating control device
Number of notches ------	more than 50 steps in operation
Acceleration -----------	3.5 Km/H/S
Deceleration -----------	4.0 km/H/S: emergency 5.0 km/H/S

FIG 42 Characteristic curve of Traction Motor



Main circuit ------------ series parallel and weak field control and current limit breaking

Pre-excitation --------- none

(c) Characteristics.

i) It can obtain a fixed acceleration of 3.5 km/H/S whether or not the car is loaded.

ii) The braking amount of the dynamic brake and air brake can be regulated by the brake-valve handle alone.

iii) Being super-multistepped the peak current at the notches is low, which is desirable for the traction motor and substation.

iv) Being super-multistepped, it can ensure a comfortable riding quality.

v) Being of a Vernier control type, the number of the cam switches is small, and its maintenance is facile in spite of the super-multisteps of more than 50.

vi) Being of a one-rotation type of cam shaft, its structure is simple and, accordingly, its maintenance is facile.

vii) It can obtain a sufficient building-up of the dynamic brake even without a pre-excitation; therefore, the specific power consumption is small, and the maintenance is facile because of its simple structure.

viii) It is interlocked with the automatic train control device.

21.6 Low-tension power source apparatus.

This apparatus, being fed by the third rail at 750 KV D.C., is meant for getting a power source at low-tension for the car lighting, ventilation, signal, control device, etc.; its control device is made up of light and small-sized semi-conductors.

21.7 Driving device.

The driving device should be of a parallel Cardan drive type of gear-coupling, which is facile to maintain with less noise and more comfortableness in riding. The gearing should be of single reduction of single helical gears.

21.8 Braking device.

The braking device should be of an electro-pneumatic, electromagnetic, combined automatic and straight type. The service brake should be an electric brake which can be cut over automatically to the air brake at a low train speed. In emergencies the automatic emergency brake works and interlocks the automatic train control device, conducting an automatic speed control and train stoppage.

The air brake should be of a wheel clasp type, by means of which alone positive braking effects can be obtained.

21.9 Coupling device.

The coupling device should be a tight lock coupler having a rubber buffer; its lower part is attached to an automatic electric coupler.

This device not only enables the coupling and uncoupling of cars automatically and mechanically from the driver's cabin but also requires no special hand, as it is equipped with a self-aligning apparatus; that means, the driver alone can do the coupling and uncoupling easily and in a short time.

21.10. Current collecting device.

Current collecting is conducted by means of a third rail; a current collecting shoe which is installed, through an insulated beam, on the truck side, does the work. Four shoes are equipped per car.

21.11 Automatic train control device.

This is a kilocycle signal system equipped with a continuous induction type with audio-frequency track circuits and automatically controls the train speed while interlocking the ground signal by means of a contactless logic relay type. It enables to improve the safe operation of trains and also to increase the smoothness and efficiency of transport.

The automatic train control device receives, from the kilocycle track circuit employed for ground signals, the speed signal which is induced aboard, by means of a cab receiver installed under the car body, to be discriminated according to its kinds and then given to the logical equipment; on the other hand, the speed signal from the induction type speed meter is also given to the logical equipment which logically deciphers the two signals above said to dictate the traction controller and the brake device the application and release of the brake.

21.12 Communication device and emergency annunciator.

A telephone apparatus by means of induction radio which enables the communication of operation directions and other calls with the maintenance offices on the earth surface should be installed together with emergency annunciators in order to break, by the operation of crew, the power transmission from substations.

Besides, a telephone apparatus for the communication between crewmen, a loudspeaker apparatus for the crew to broadcast to the passengers, and emergency annunciators in the passenger quarters for the passengers to inform the crew of the emergency in the quarters should be installed.

22. CAR INSPECTION SHED AND WORKSHOP.

22.1 Outline of program.

Heavy repairs should be performed in workshops and light ones together with car inspection, in inspection sheds where storage tracks for the purpose are laid.

One inspection shed for each line should be installed: for No. 1 Line near Petare; for No. 2 Line near La Rinconade; for No. 3 Line near Parque Humbolt.

The workshop should be built also in Petare inspection shed, where all cars of the three lines, No. 1, No. 2 and No. 3, are gathered together.

22.2 Workshop.

(a) Calculation of number of cars hauled into workshop.

The number of cars to be taken care of in the workshop is 638 according to the First Plan, and 620 according to the Second Plan; in this case the workshop has been designed on the basis of the First Plan.

The types of repairs are divided into general repairs, partial repairs and temporary repairs; and the repair interval in running kilometer and the number of days of cars' stay in the workshop are decided as follows:

Type of repairs	Repair interval in running kilometer (km)	Days of stay (days)
General	400,000	25
Partial	200,000	14
Temporary	Rate of entering workshop per year 0.1	10

In the case of the First Plan the car running kilometer per day is:

No. 1 Line ------ 91,624 km

No. 2 Line ------ 87,384 "

No. 3 Line ------ 46,208 km

Total --------- 225,216 "

As a result, the following figures are obtained:

Average number of kilometer of travel per car year:

225,216 (km) ÷ 638(cars) x 365(days) = 128,400 (km)

Rate of entering the workshop for general repairs:

128,400 (km) ÷ 400,000 (km) = 0.321

Rate of entering the workshop for partial repairs:

128,400 (km) ÷ 200,000 (km) = 0.642

The number of cars to be repaired per year is as follows:

Number of cars receiving general repairs : 638(cars) x 0.321 = 205(cars)

" partial " : 638(") x 0.642 = 408(")

" temporary " : 638(") x 0.1 = 64(")

The total number od days per year of cars staying in workshop is as follows:

General repairs --------- 25 (days) x 205 (cars) = 5,125 (car day)

Partial repairs --------- 14 (") x 408 (") = 5,712 (")

Temporary repairs ------ 10 (") x 64 (") = 640 (")

The yearly average number per day of cars staying in the workshop is:

General repairs --------- 5,125 (car day) ÷ 365 (days) = 14 (cars)

Partial repairs --------- 5,712 (") ÷ 365 (") = 15.6 (")

Temporary repairs ------ 640 (") ÷ 365 (") = 1.8 (")

Total -- 31.4 (")

(b) Workshop facilities program.

Area of the shop site --------- 14,000 m^2

Floor space ----------------- 12,000 m^2

The principal machinery and instruments to be equipped should be as follows:

Machine tools (lathes, drilling machines, shapers, etc.)

Car wheel machines (car wheel lathes, wheel presses, etc.)

Materials handling machines (overhead travelling cranes, hoists, lifting jacks, conveying vehicles, etc.)

Testing machines (supersonic flaw detectors, magnetic flaw detectors, etc.)

Other machinery (automatic washing apparatuses of car trucks, various washing apparatuses of spare parts, electric welding machines, etc.)

22.3 Program of car inspection shed facilities.

The program of the car inspection shed facilities is outlined as follows:

	No. 1 Line	No. 2 Line	No. 3 Line
Location	Petare	La Rinconade	Parque Humbolt
Area of site (m^2)	56,000	45,000	29,000
Length of track (m)	12,000	9,000	5,300
Floor space of buildings (m^2)	4,800	3,800	2,300

The principal equipments should consist of automatic car washers, welding machines, drilling machines, grinders, etc.

The layout of the Tracks and car inspection shed of Petare is shown in Fig. 43.

23. ROUTGH ESTIMATE OF CONSTRUCTION COST.

On the basis of the above-mentioned program a rough estimate of the construction cost has been tabulated in Tables 10 and 11, respectively for the First Plan and the Second Plan. Besides, the quantities of such important materials as concrete, reinforcing bars and steel shapes, which have been included in the structure cost, have been tabulated together.

In addition to the items represented in the above Tables, the following items are necessary for the construction work:

(a) Interest on the raised fund of construction.

(b) Personal and other expenses incidental to survey, design and superintendence.

(c) Supplementary expenses, that is, expenses of the road expansion, highway renewal, etc. in connection with this rapid transit railway work.

(d) Cost of site : although the site of this underground railway should, in principle, pass through the site of the existing roads, the purchase of some space of necessary lot will be enevitable. Moreover, a considerable area of land will be needed for installing the entrances and exits of stations, substations on the earth surface, motor-car parking places, car sheds, workshops, etc.

(e) Public taxes and charges:

FIG 43

Plan of the car shed and the work shop for the underground railway

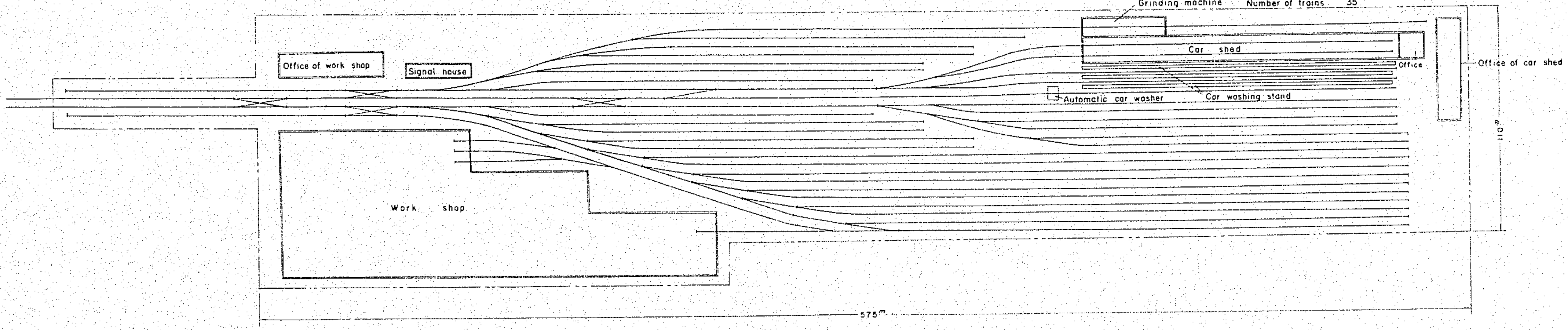
Area of the site about 70,000 m^2

Capacity about 280 cars

Length of car 18 m

Number of cars per train 8

Number of trains 35



(e-1) Import tariffs and related taxes imposed on the materials and machinary sent from Japan.

(e-2) Public taxes imposed on construction works.

(e-3) Public imposts on the resident Japanese nationals who stay in Venezuela for this construction work.

(e-4) Expenses for auxiliary facilities for operation and management, and expenses for technical supervision prior to the actual operation.

(First Plan)

Table 10 Estimate table of the cost for the construction of rapid transit railroad in Caracas City

Unit; $1,000
(conversion rate based upon the IMF Parity)

Item	1st stage work for the No. 1 line 6. K850	2nd stage work for the No. 2 line 10. K650	total of the No. 1 line 17. K500	No. 2 line 22. K800	No. 3 line 18. K000	Total sum 58. K300
(1) Costs for the structure	50, 230	48, 610	98, 840	105, 910	93, 180	297, 930
(2) Costs for the tracks	1, 460	2, 220	3, 680	4, 780	3, 780	12, 240
(3) Costs for the electric facilities	4, 580	10, 220	14, 800	17, 660	13, 190	45, 650
(4) Costs for the car sheds and workshops	80	2, 770	2, 850	2, 850	1, 340	6, 470
(5) Costs for the cars	(26 cars) 2, 890	(256 cars) 28, 440	(282 cars) 31, 330	(224 cars) 24, 890	(132 cars) 14, 670	(638 cars) 70, 890
(6) Total of the costs for construction	59, 240	92, 260	151, 500	155, 520	126, 160	433, 180
(7) Construction cost per km	8, 650	8, 660	8, 660	6, 820	7, 010	7, 430

Table of the major materials for the lines

Concrete (m^3)	247, 000	383, 000	630, 000	640, 000	584, 000	1, 854, 000
Reinforcement (ton)	27, 400	42, 600	70, 000	80, 400	68, 000	218, 400
Shape steel (ton)	51, 400	80, 000	131, 400	60, 000	105, 000	296, 400

Note; Concrete and reinforcement are the materials for the structures, while the shape steel shall be used as the temporary materials for the construction work.

(Second Plan)

Table 11 Estimate table of the cost for the construction of rapid transit railroad in Caracas City

Unit; $1,000
(conversion rate based upon the IMF Parity)

Item	1st stage work for the No. 1 line 6. K700	2nd stage work for the No. 2 line 10. K650	total of the No. 1 line 17. K350	No. 2 line 21. K770	No. 3 line 17. K640	Total sum 56. K760
(1) Costs for the structure	41, 710	48, 620	90, 320	100, 300	91, 030	281, 650
(2) Costs for the tracks	1, 430	2, 210	3, 640	4, 570	3, 700	11, 910
(3) Costs for the electric facilities	4, 410	10, 360	14, 770	17, 080	12, 970	44, 820
(4) Costs for the car sheds and workshops	70	2, 770	2, 850	2, 280	1, 340	6, 470
(5) Costs for the cars	(26 cars) 2, 890	(248 cars) 27, 550	(274 cars) 30, 440	(218 cars) 24, 220	(128 cars) 14, 220	(620 cars) 68, 880
(6) Total of the costs for construction	50, 510	91, 510	142, 020	148, 450	123, 260	413, 730
(7) *Construction cost per km*	7, 540	8, 590	8, 190	6, 820	6, 990	7, 290

Table of the major materials for the lines

Concrete (m^3)	241, 000	384, 000	625, 000	614, 000	571, 000	1, 810, 000
Reinforcement (ton)	26, 800	42, 600	69, 400	76, 480	66, 560	212, 440
Shape steel (ton)	50, 300	80, 000	130, 300	89, 000	106, 000	325, 300

Note; Concrete and reinforcement are the materials for the structures, while the shape steel shall be used as the temporary materials for the construction work.