REPORT OF SURVEY ON EDUCATION AND TRAINING OF SGRRO PERSONNEL

1980, 8

Japan International Cooperation Agency

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CONTENTS

1. INTRODUCTION

In December 1979, we, Japanese National Railways (JNR)

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were dispatched by JICA to Saudi Arabia. The purpose of the assignment was to deal with the wishes of the Saudi Government Railroad Organization (SGRRO) towards Japan. We were requested by SGRRO to prepare a report suggesting concrete measures to be taken towards the improvement of operations of the railway and its training center.

During our period of residence, we judged that it would be difficult to comply with SGRRO's requests due to our insufficient staff and materials. Therefore, we conducted our survey focused on the operation of the training center, and informed SGRRO of our intention to study the results upon our return to Japan, after which we would send the report. In this matter we received SGRRO's understanding.

The following report is based upon these various particulars, and is organized into three parts, entitled "Introduction," "Contents and Findings of the Survey," and "Consideration of Survey Results."

Because our survey time was limited, we fear that in the contents of this report there may be points which do not answer expectations; there are also many points that are insufficiently presented.

2. CONTENTS AND FINDINGS OF THE SURVEY

(1) State of operations in the rolling stock inspection and repair sector

A. Organization and personnel

Rolling stock inspection and repair is managed by the Motice Power and Equipment Department. This department also performs maintenance of mechanical equipment.

In this regard SGRRO resembles JNR, in which case rolling stock as well as mechanical equipment is managed by the Rolling Stock and Mechanical Engineering Department. However, there is a conspicuous difference in that SGRRO conducts these operations with and extremely small staff. The Director of this department has merely a few foreign technicians to provide assistance, yet they handle a vast amount of work, ranging from duties befitting the Director to miscellaneous day-to-day operations. As a result, it appears that they are so pressured by day-to-day operations that they can hardly deal with planning work.

Solution of the problems within this department must be implemented from, first, the expansion and strengthening of the staff, and second, the transfer, to a great extent, of the Director's authority to the staff. Otherwise, the planning and progress of improvement measures may not procede smoothly.

As Reference Material #1 we present an organizational chart of the Rolling Stock & Mechanical Engineering Department and its workshops in JNR:

B. State of inspection and repair operations

There are many points of difference between SGRRO and JNR in the state of rolling stock inspection and repair operations.

The first difference is in organization. In SGRRO, everything from shop operations to day-to-day inspection and driver supervision is dealt with at one location. In JNR, in contrast, workshop operations and the train operation are dealt with at separate places.

Second, there is a difference in inspection systems. The system in SGRRO centers on day-to-day inspection, whereas JNR emphasizes, in addition to day-to-day inspection, preventive maintenance inspection,

which is composed of periodical complete overhaul, with the objective of preventing car trouble.

Furthermore, there exist other defferences in such matters as the present condition of facilities, but these various differences between SGRRO and JNR arise mainly from the following conditions:

(a) The traffic volume in JNR is extremely large, and high-speed operations are conducted on a dense schedule. Accordingly, there are many cases in which car trouble will have extremely grave consequences. In certain cases there is the fear of accidents which might result in passenger casualties.

In order to prevent this situation it is necessary to aim at perfection in maintenance inspections.

(b) The number of rolling stock in JNR is extremely large, and huge outlays must be invested in rolling stock inspection and repairs. In order to make this outlay economical, an effort is always made to aim for rational repairs. Data necessary for this is obtained mainly through maintenance inspection.

(c) The number of trains in JNR is extremely large; therefore, the rolling stock used for these trains must be employed in a rational manner. If car trouble occurs frequently spare cars become necessary in large numbers. Because of the large number of trains, even a small percentage increase in spare cars becomes an enormous number when viewed in terms of total figures. In this regard, too, prevention of car trouble is highly important.

(d) With respect to organization, the work volume at JNR is huge, and it is impossible to manage a range of operations at one location. Therefore, a rational administrative organization is set up and an organic operations management is conducted on the bases of each location possessing a specific authority.

Reference Material #2 presents JNR's number of rolling stock and its inspection system.

C. Future Plans

The traffic configuration of SGRRO differs from that of JNR, and it is not entirely necessary to aim at a level equal to that of JNR; nevertheless, we feel that the following items constitute necessary reforms.

(a) Improvement of maintenance level

With regard to parts important for safety, such as wheels and axles, we look to the improvement of the level of maintenance through such measures as the introduction of non-destructive inspections. In addition, it is necessary to improve the technical ability of the staff.

(b) The pursuit of economic efficiency

It is necessary to correct the tendency to use new parts, and to aim at more economical maintenance. It is also necessary to deal with parts repairs in a more positive manner.

(c) Drastic improvement of shop facilities

In order to deal with chronic manpower shortages and along with the modernization of rolling stock it is necessary to mechanize shopwork as much as possible. In view of the extent to which currently existing structures are being used facility improvement will be difficult due to space limitations. Therefore, it is desirable to secure completely different space and establish new shops on the basis of new conceptions, while using present facilities for day-to-day inspection.

(2) State of operations in the track maintenance sector

A. Organization and personnel

We surveyed the work system and its personnel maintaining the 565km-long main line track between Dammam and Riyadh. We realized that this was the maintenance stricture, consisting of Track Maintenance Depot — Track Sub-depot — Tack Gang, that was used in Japan about 15 years ago. Ignoring the length of track covered, work environment, work hours, and work efficiency, the size of work force also resembles that of Japan at that time.

However, it was clear that the disposition of necessary personnel differs considerably. In the case of Japan, the Chief of the Track Maintenance Depot is aided in his work by several assistant chiefs, clerks and technical clerks, and the Chief of a Sub-depot is given work assistance by several clerks and technical clerks. These employees also control the compilation of work diaries and statistical reports on work performance, the management of materials procurement, and furthermore, the pursuit of track condition management. Further, in the Maintenance of Way Section of the above organization, technicians are assigned to assist in the duties of the Section Chief, and they perform the work of writing up and analyzing statistical materials, a drawing up work plans and budgetary requests. (See Reference Material #3)

Because our survey was incomplete it may be mistaken and may lack accuracy, however, it appeared to us that because in every level of work allotments and authority has not been carried out, the management is constantly pressured by decision management of routine operations while also managing planning, drafting of policies, and studies. To the extent that this system continues, not only will it be impossible to train successors and effect a smooth change of generations, but it will become difficult to study work improvements.

B. State of track maintenance operations

We wished to confirm whether the improvement measures for track maintenance work suggested 10 years ago by the late Shigeo Miura had been implemented, but within the limited time frame, we were unable to perform a quantitative survey of the form and conditions of implementation of track maintenance work.

We ascertained that in the form of the establishment of mechanized work gangs using multiple tie tampers as well as the implementation of track irregularity inspections by means of track inspection cars, the improvement measures contained in Mr. Miura's report are being steadily advanced. In conjunction with the future realization of mechanized work gangs, it will be necessary to think about the reduction of personnel in work gangs that mainly perform manual labor, and the restructuring of the organization.

Track renewal work with emphasis on the use of heavier rails is being advanced in a positive manner. There is the problem of 30t axle loads, however along with the passing tonnage we cannot overlook the effect of the sandy roadbed. We were unable to determine to what extent track maintenance work is carried out per year, but judging from the use of track materials we feel it is and appropriate quantity.

The introduction of concrete ties is being studied, and, thinking in terms of the present condition and the future, we feel it should make a start on such a step. The service life of wood ties is said to be approximately 15 years, and the occurrence of deterioration in certain amount each year is a fate which cannot be avoided. It is predicted that as track tamping work with multiple tie tampers is further advanced, tie damage known as "tucking in" will occur more frequently than it has up to now.

Thinking in terms of the personnel supply and demand situation, and the rail traffic in the SGRRO we feel it would be desirable to plan the introduction of durable rails and ties while decreasing the overall scale of track maintenance personnel. It would be sufficiently possible to cover track repair work by using the multiple tie tamper. Because the operation of machinery for track maintenance work will increase in the future, we feel it will become necessary to establish operational rules to prevent operating accidents.

C. Future plans

In order to open the new lines called for in the Third Five-Year Plan, it is necessary to think at the same time about the increase in personnel needed for operation. In the plans of the SGRRO, too, the question of necessary personnel is given careful thought; therefore, we cannot find any inadequacies in terms of planning. With regard to the scale of personnel, however, our survey on organization as well as work details was incomplete, we do not feel we can discuss this matter freely. Even if the magnitude of the personnel increase mentioned in the plans were to be revised by future studies, it would be extremely difficult to secure experienced employees on a scale comparable to that of current SGRRO personnel. For that reason, too, we feel that

the education of employees in the training center has to be started as early as possible.

We feel that in the areas we surveyed concerning employee hiring in the SGRRO, consisting of age and academic records of those hired, and number of years of service after hiring, there are some problems. If there exists the condition in which only an elementary school graduates join the company, it is very difficult to train them as a result of their limited knowledge of mathematics and physics. No matter how much experience they accumulate, we feel that they can only rise to the level of foremen in the future.

Even if approximately half the number of personnel needed to operate the railway length to be opened during the next five years could be supplied by reassigning currently working employees, it will be necessary to fill the gap left by departing experienced people with the entrants. Therefore, it is necessary to provide the work places with a leadership structure which will be applied to the disposition of problems. More concretely, an assignment of experienced people to track maintenance depots and sub-depots to be responsible for guiding on-the-job training, through which technical skills are acquired.

(3) State of affairs of necessary personnel in the SGRRO

A. Recruiting

We surveyed the employee hiring conditions in the SGRRO. We heard that approximately 30 people were hired last year (1979). They ranged in age from 22 to 30 years, with the elementary school level educational background, had been employed previously in other industries.

Saudi Arabia attaches great importance to education as a pillar of modernization, and we were told that because all education from elementary school through college is free, fewer than 10% of the students end their education after 6 years of elementary school. Yet high school and college graduates do not join the National Railway; those who enter are elementary school graduates with experience in other industries. There seems to be, after all, a lack of PR and recognition concerning the National Railway.

B. Work configuration and employee stability

We were able to learn about the work configuration of the employees in the SGRRO. Almost all the work locations are on day shift (7:30 A.M. - 2:00 P.M.), but the shops have adopted a 3-shift work structure.

Shop employees are switched to early duty, late duty, and night shift, in one month units. We were told that these employees who shoulder shop work which is almost all outdoor work under the direct influence of harsh climatic conditions, must moreover work the night shift for a period of one month. We feel that from the aspect of biology there would be much fatigue, and there would be a considerable decrease in work efficiency.

In the summer and winter, time periods and work hours for employees engaged in track maintenance, which must be carried out under the direct sunshine, are changed. The sunshine is strong compared to Japan, and we could imagine how extraordinary are the hardships entailed in track maintenance work that is carried out in the summer.

Perhaps it is because much of the work in the railroad is outdoor labor, but we heard that the stability of personnel is extremely poor, since apporximately half the personnel retire after 8 or 10 years of experience. Considering that those employees with ten years of work experience form the backbone of railway work, we feel that it gives rise to fears about the future.

What makes them quit? We were unable to acquire sufficient knowledge to answer the question of whether this is a phenomenon unique to the last few years. This may not be correct, due to the incompleteness of our survey, but we heard that the pay of the national railway employees has been set at the low level of approximately half that private industries, and that employees are also drawn away by special lodging privileges. Perhaps it cannot be helped that the wage system conforms to that of national civil servants, but we feel that efforts must be made to bury the wage difference by providing a special allowance which takes into account the content of the work and the working environment.

C. Promotion rules and personnel interchange

We were presented with data on the number of personnel in the SGRRO and the percentage of the Saudis. Because of the incompleteness of the details of our request, the data were not calculated in sections according to the organization of work locations. However, we were able to obtain data describing the track maintenance organization and its personnel structure.

Employees assigned to track maintenance work locations are promoted to the position of foreman after approximately 3 years of work experience as gangman. We heard that after apporximately 15 years of experience, foremen are promoted to roadmaster. We feel that the period of time up to promotion to foreman is a little bit short, but this probably cannot be helped as long as the maintenance system relies on manual labor, as it does at present. As track maintenance work comes to center around use of the multiple tie tampers, it may become necessary to consider promotion rules for people in charge of machine operators.

We were unable to determine the promotion rules for track maintenance supervisor. Furthermore, we were unable to ascertain the personnel interchange between the SGRRO's Hqs. and field offices. We imagine that any number of people who work at the head office are probably exchanged with those from the field every year. For the operation and progress of the National Railway we feel it is necessary to have personnel interchange and to advance the work of unifying the head office with the field offices.

(4) The educational system in SGRRO

A. Conditions of education and training in the past

We were able to learn about the conditions of the training school education carried out in the past by the SGRRO. We were unable to conduct a detailed survey, but learned about the way of thinking about education in SGRRO.

The number of graduates of the educational curriculum established by 8 instructors from Egypt and Lebanon has reached 74 people. The graduates are in service in various sectors of civil engineering,

shop, electricity, and train operation. It was explained that during the 6-month training period students attended from outside were paid a stipend of 1500 rials a month, while those from within received a 15% increase in pay.

Because almost all the students were with the elementary school level educational background, we surmise that the curriculum might have consisted of fundamental knowledge for railways in general, mathematics, science, and work training.

As educational training for railway employees, we feel that the combination of education at school and on the job training is effective. We think it is necessary to establish an educational system integrating school and work location, having students acquire basic knowledge at school through lectures and practice, and having them polish their technique and skill through work at their work locations. The reason is that the SGRRO's educational objective is to train entrants in the training center as well as those with 1 to 2 years experience, and during the 1 to 2 years after graduation, to train them so that they master the handling of machinery and tools, and understand an entire chain of work.

In introducing this educational system integrating school and work locations, it would be needed to establish an office called the Education and Training Section in the Organization.

B. Treatment of graduates

We were unable to study what kind of work the employees are engaged in after 6-month training. It was not clear how many graduates have been assigned to the track maintenance section, but learned only 8 remain at present. Of these, 6 work as people responsible for work operations, and 2 function as their deputies. Perhaps the personnel situation is such that it is inevitable that those with less than 2 years' experience after graduation have to carry out foreman-class duties, but on the other hand this may be attributable to the fact that the stabilization of employees at technical work locations is not being striven for.

We think that the devising of policies for the stabilization of employees is a matter that should be given preference above all else. No matter how much the employee educational system is established and fostered, the situation in which graduates retire means that the effects of the education will not be reflected in work, nor will they be linked with a solution to the difficult conditions facing the SGRRO.

We were unable to survey in detail the reasons why employee stability is rather poor, but we feel that the problems lay in the wages. The greater part of railway work is accounted for by labor handling in outdoors. Compared to work performed in air-conditioned offices, this work, which is carried out in harsh natural environment, is greatly fatiguing and conspicuously dirty. There is also the reason that the pay for civil service employees is left standing at a level lower than in private industry, and the pay for SGRRO employees is comparable to that of national civil servants; in any event, the employees move to better-paying private industries just when they have become used to their work. Because work experience is viewed as valuable in technical work locations, we feel that by paying a special allowance calculated according to type of work and years of experience, a wedge can be driven into this situation in which experienced employees tend to move to private enterprise, and the stabilization of personnel can thus be promoted. We believe that with the stabilization of personnel, it will be possible to strive for the improvement of the technical level at technical work locations.

3. CONSIDERATION OF SURVEY RESULTS

(1) The educational system and its objectives

From the present condition of the employee hiring in SGRRO, we feel it is desirable to study the educational system and curriculum of the employees at the elementary school graduate level. We feel it is desirable to implement an educational course focused on the new entrants and to set up a foreman-class educational course once they got on the right track.

Concerning the educational curriculum for a beginning course aimed at new employees, the main stress should be on railway knowledge, work details, and the method of handling the machinery and tools necessary to perform work.

Educational objective	To make newly-hired employees understand railway work, and to take the first step in training them as future foremen
Education period	3 years 1st year: Fundamental education at the training center 2nd year: Assign a half-day work, and in the afternoon conduct fundamental education and specialized education at the center 3rd year:
Curriculum	(1) Basic course: English, mathematics, physics, chemistry (2) Specialized course : Knowledge necessary to advance on-site work (3) Practical training : Mastery of actual work including handling of machinery and tools

In Japan, fewer than 10 percent of middle school graduates seed employment and the majority enters high school. As a result, we do not feel that the educational curriculum implemented at the training schools in JNR is appropriate for SGRRO; however, we have appended the curriculum for reference.

Reference Materials #4 and #5.

(2) Problems in implementation

Educational training of employees will play an important role in finding a way out of the difficult situation of the SGRRO, but we feel that unless the following points are dealt with at the same time as indicated previously, its effectiveness will not be demonstrated to its fullest.

A. Improvement of pay

Unless the pay level of employees working on site is revised, they will be drawn away by other enterprise, and experienced workers will not be stable.

A reform of the pay system can be considered which will pay added compensation to regular wages in the form of a work allowance for those engaged in dangerous work or on-site work. In addition, it might be good to consider other pay reforms which have been introduced in private industries.

B. Promotion rules, and staff assignments

It is necessary to establish general rules concerning assignment of training school graduates and their later employment. It is desirable to assign several staff under responsible people at each level, so that they will be transferred to successively higher levels on the basis of experience, and also they will contribute to work improvement through analysis of present conditions and the study of countermeasures.

We think it is also necessary for training school graduates to take pride, and to provide them with favorable treatment as pioneers of the Organization.

C. Dormitories

Training school education requires rather long period of time, and the collective life, sleeping and eating together during the school period is a factor which, in corporate education, cannot be missed. Considering the current situation in which apartments are scarce, the range of the students entering school may become limited.

If possible, a dormitory equipped with dining facilities is desirable. We feel that communal rooms, rather than private rooms, would be preferable since friendly intercourse among fellow students is possible. Four-person rooms are common in Japan.

D. Establishment of the educational system and curriculum

There are great differences in the railway operation systems between JNR and SGRRO. For example, the rolling stock and its inspection and repair method are different. We received the impression that there is a big difference in track maintenance work methods, work flow, organization, and chain of command.

At the time of the training of employees controlling the maintenance of such facilities as rolling stock, track, and telecommunication which form the basis of railway operations, after instruction centering on lectures concerning basic knowledge about these various facilities, it would be effective to educate them by means of practical training concerning the advancement of track maintenance work, work details, work assignments, and chain of command.

If Japanese experts were to create the curriculum, it would be necessary to conduct a survey of the current situation of track maintenance work undertaken by the SGRRO; therefore, we must predict a considerable time period before starting training.

We feel that the experts who have been sent at present to provide technical cooperation with the SGRRO have a sufficient knowledge of the railway's current situation as well as the problems assumed to occur in the future. Thus, we think that the education of employees should be studied and promoted centering around these people. Because our period of residence was short, we were unable to discuss these problems sufficiently with those experts. We feel that the shortest

route is to respect the opinions of those experts and to further studies concerning the necessary educational curriculum. We anticipate that a project team will be formed under a qualified chief, and the educational system and curriculum will be studied taking into account the opinions of those people.

(3) Japan's competence

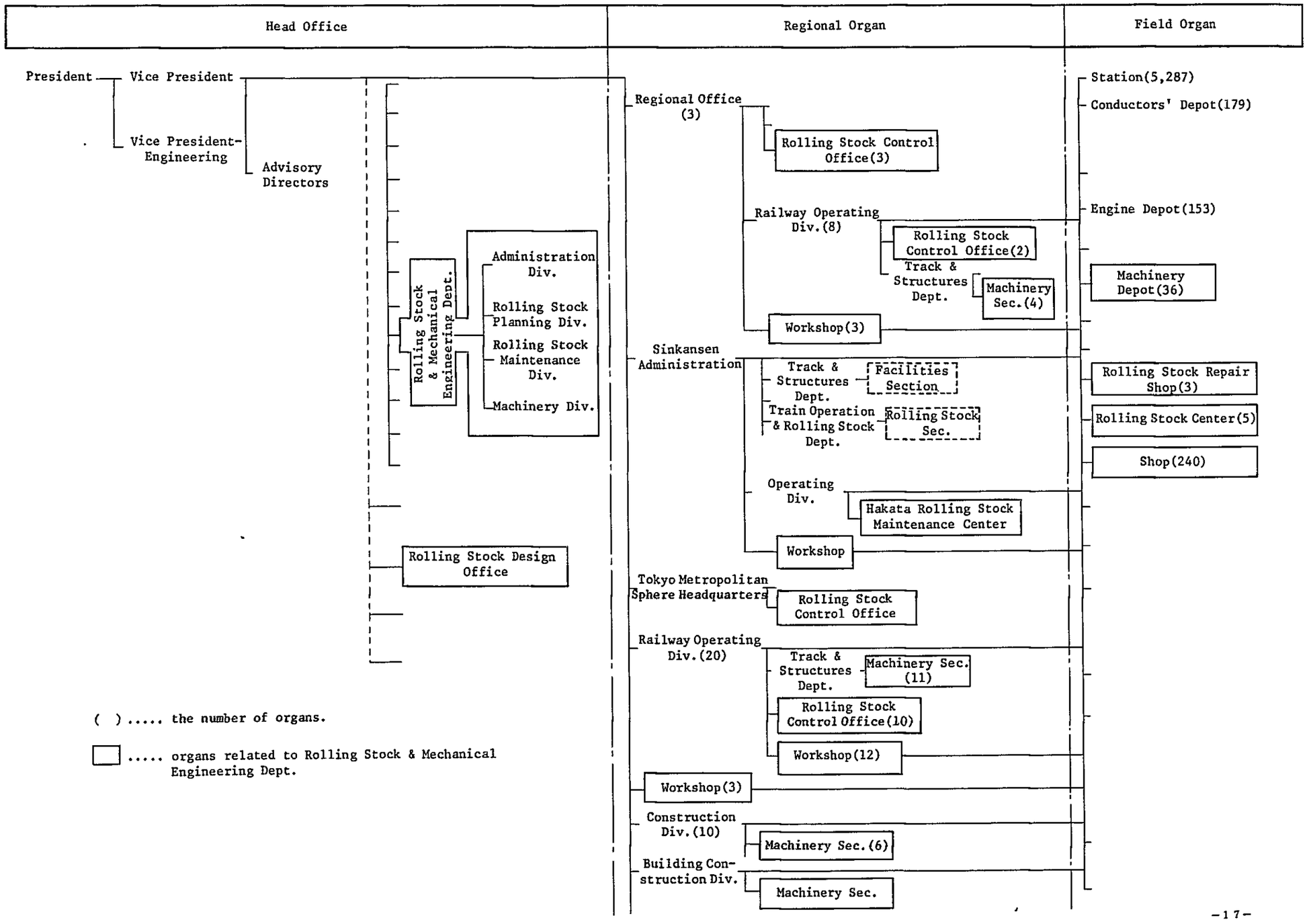
The employee education and training that SGRRO is considering will need a long period of time for implementation, and will require a great deal of patience which will not show immediate results. It is therefore necessary to tackle the operation of the training center with consistency.

One of the greatest problems which Japan's competence meets is the securing of experts proficient in conversational ability. Since experts who have good command of English are very much limited in number, it would be a great difficulty to send them for a long period of time. It can be further imagined that a considerable number of experts would have to be dispatched in order to manage everything from the preparation of curriculum and teaching materials to the guidance to teaching staff.

Under the circumstances, it would be difficult to comply with the request to cooperate in operating the SGRRO Training Center.

Reference Material #1

Organization Related to Rolling Stock and Mechanical Engineering Work



( ) ..... the number of organs.

□ ..... organs related to Rolling Stock & Mechanical Engineering Dept.

Reference Material #2

The number of rolling stock and the inspection system

Number of Rolling Stock

(April 1977)

Kind	Number
EL	2,067
DL	2,190
EC	14,401
TEC*	2,352
DC	5,342
PC	6,851
FC	134,986

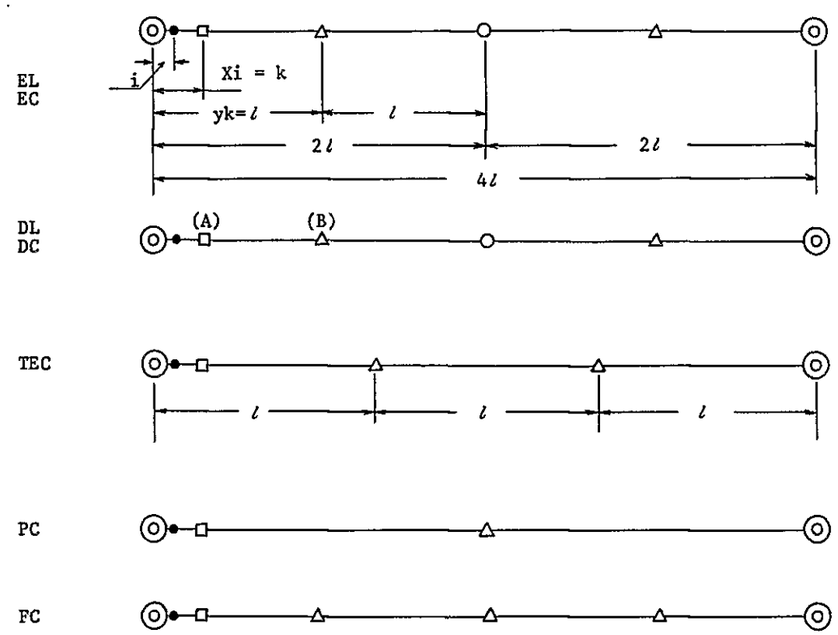
*Shinkansen railcar

Present Inspection System

		EL	DL	EC	TEC	DC	PC	FC
Daily Inspection		Determined properly depending on various conditions						
Regular Inspection		60 days 25,000 km	60 days 25,000 km	60 days 30,000 km	30 days 30,000 km	60 days 30,000 km	60 days 30,000 km	55 days
Intermediary Inspection	Bogie	15 months 200,000 km	15 months 125,000 km	12 months 200,000 km	12 months 300,000 km	12 months 125,000 km	12 months 250,000 km	18 months
	Main Parts	30 months 400,000 km	30 months 250,000 km	24 months 400,000 km	—	24 months 250,000 km	—	—
Overall Inspection		60 months 800,000 km	60 months 500,000 km	48 months 800,000 km	30 months 900,000 km	48 months 500,000 km	24 months 500,000 km	48 months

Arrangement of Periodic Inspection

Type of vehicle



◎ Overall inspection

○ Main components inspection

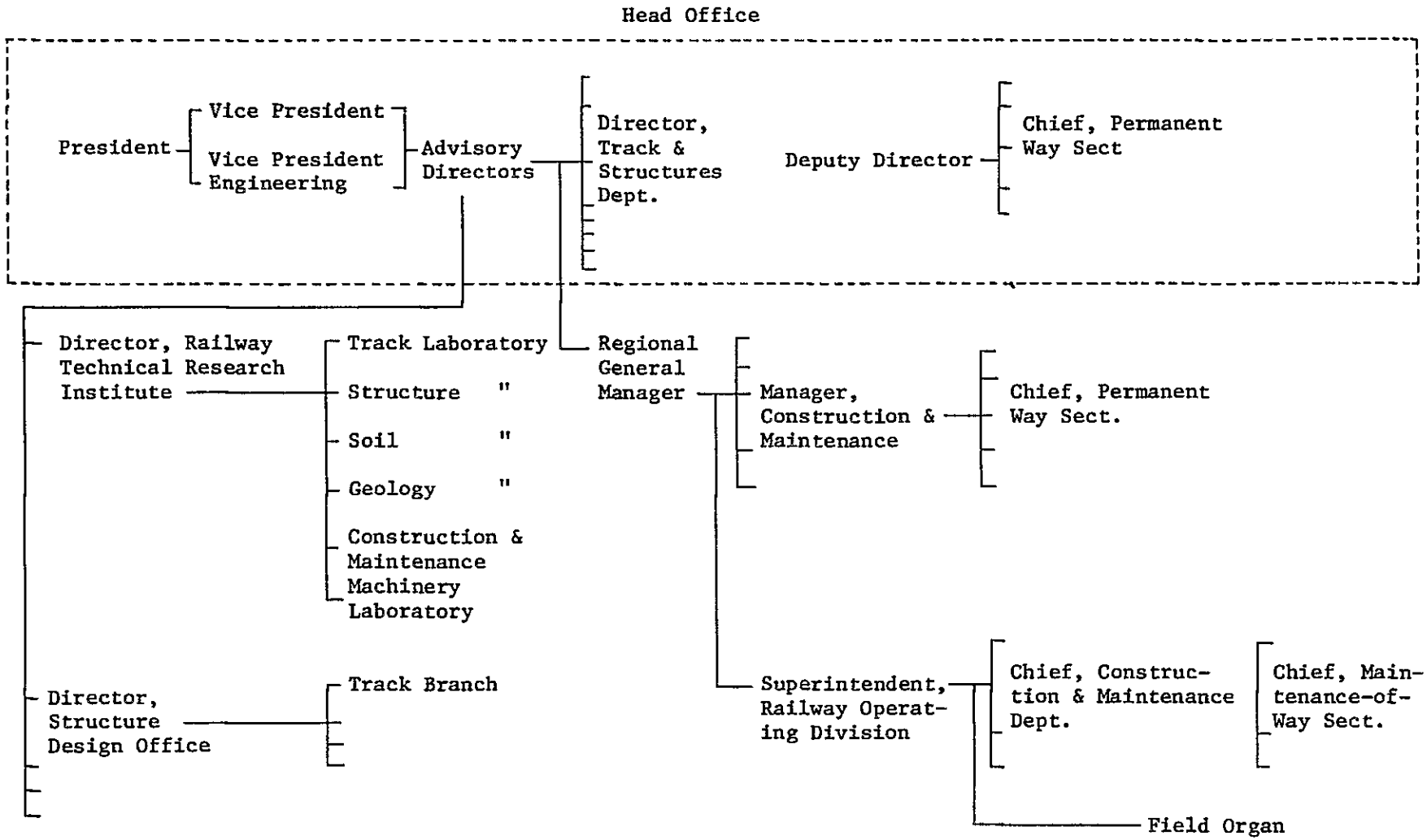
△ Bobie inspection (EL, EC, TEC)
Regular inspection (DL, DC)
Regular inspection (PC, FC)
(replacing designated parts)

□ Regular inspection

● Daily inspection

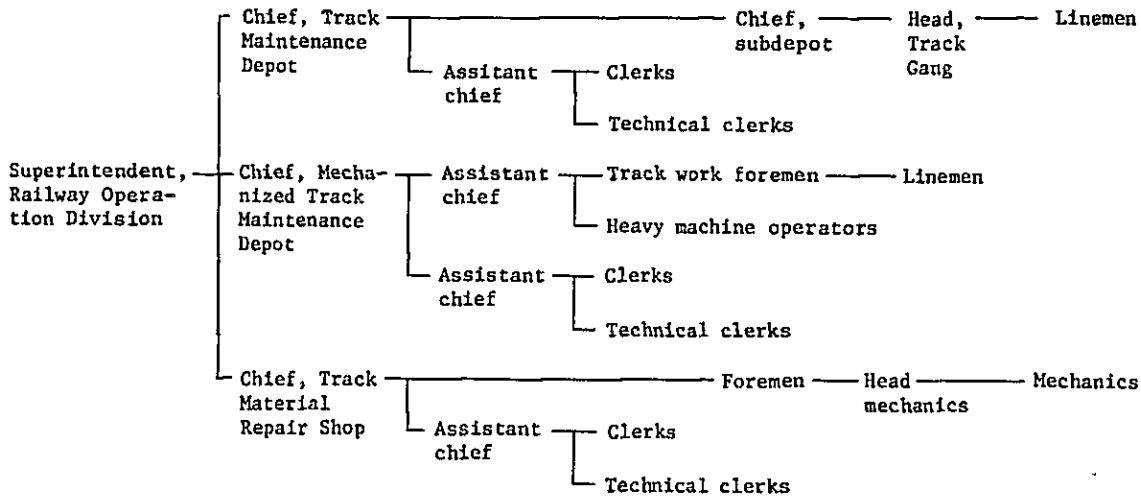
Reference material #3

Organization Chart at Administrative Level

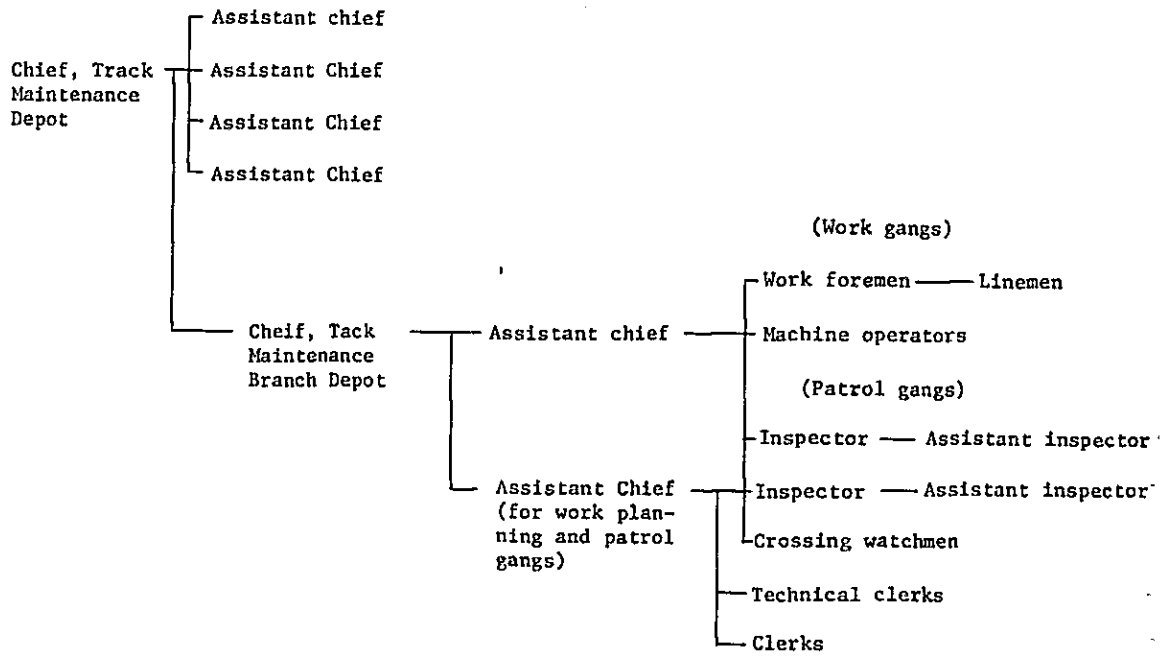


Organization Chart at Field Level

Old Organization



New Organization



Reference Material #4 Examples from JNR Curriculum

Common Training Course

Rolling Stock Repair

(Machinery)

Student ..... Graduates of middle school

Objective .... To provide mastery of techniques and skills as workshop employees

Period ..... To be implemented over a period of three years

Subject	Total Hours
National Railway Employees	60
Japanese Language	175
Sociology	175
Mathematics	325
Science	210
Art	40
English	210
Production Engineering	60
Safety and Hygiene	50
Railway Rolling Stock	245
Mechanical Engineering Regulations (I)	135

Subject	Total Hours
Mechanical Engineering Regulations (II)	90
Mechanical Drawing	250
Machine Design (I)	88
Machine Design (II)	87
Electrical Engineering	210
Motors	140
Basic Practice	600
Applied Practice	1600
Health and Physical Education	245
Total	4995

Examples of Concrete Curriculum Contents

Subject : Railway Rolling Stock
Teaching Hours: 245 hrs.

Teaching Objective : To acquire basic general knowledge concerning rolling stock, and outlines of rolling stock safety and structure.

Main Points	Points	Details	Total Hours
Rolling Stock in General 58 hrs.	General 13 hrs.	Importance of Rolling Stock in the Railway Industry	1
		Rolling Stock Structural Standards	3
		Rolling Stock Classification and Designation	1
		Rolling Stock Painting and Markings	2
		Rolling Stock Conversion	5
		Rolling Stock Planning	6
		Management of Rolling Stock Property	8
	Outline of Rolling Stock 26 hrs.	Passenger and Freight Cars	5
		Electric Cars	8
		Diesel Cars	
	Rolling Stock Engineering 19 hrs.	Rolling Stock Performance	
		Rolling Stock Brakes	
		Train Control	3
		Rolling Stock and Facilities	6
Rolling Stock Maintenance 39 hrs.		The Importance of Rolling Stock Maintenance	1
		Outline of Rolling Stock Maintenance	3
		Rolling Stock Inspection	1
		Rules of Rolling Stock Management	5
		Operating Accident Prevention and Countermeasures	8
Rolling Stock Structure and Repair 148 hrs.		Rolling Stock Structure	118
		Rolling Stock Repair	30

Subject : Basic Practice
Teaching Hours: 600 hrs.

Main Points	Points	Details	Total Hours
Practice in General 3 hrs.			3
Engineering, Fundamental Work 200 hrs.		Using a Scriber	10
		Using a Cold Chisel	30
		Using a File	80
		Using a Hacksaw	5

Main Points	Points	Details	Total Hours
		Using a Punch	5
		Using a Tap	5
		Using a Die	5
		Using a Reamer	5

Main Points	Points	Details	Total Hours
		Using a Scraper	10
		Sheet Metal Wodk	30
		Hammering	15

Main Points	Points	Details	Total Hours
Machinery, Fundamental Operation 130 hrs.		Gas Welding Work	30
		Arc Welding Work	30
		Press Working	20
		Bending Work	10
		Lathe Operation	20

Main Points	Points	Details	Total Hours
		Shaping Machine Operation	10

Main Points	Points	Details	Total Hours
		Fraise Operation	10
Measuring Inspection, Fundamental Work 30 hrs.		The Funcamental Work of Measuring	20

Main Points	Points	Details	Total Hours
		Non-destructive Inspection	10
Servicing, Fundamental work (Machinery) 77 hrs.		Tools for Assembly Work	2
		Assembly, Fundamental Work	8
		Overhaul Work	12

Main Points	Points	Details	Total Hours
		Cleaning Work	5
		Painting	20

Main Points	Points	Details	Total Hours
		Plumbing Work	30
Safety and Hygiene Work 20 hrs.		Keeping Things in Order at the shop	5
		Safety in Work Handling Heavy Objects	2

Main Points	Points	Details	Total Hours
		Safety in Handling Shop Machinery and Tools	3
		Safety in Waste and Scrap	3
		Safety through Work Uniforms and Other Clothing	2
		Rules for Use of Protective Devices	3
		Prevention of Electric Shock	2
Fundamental Electrical Work 94 hrs.		Electric Cable Connection	4

Main Points	Points	Details	Total Hours
		Wiring	20
		Measuring	40
		Electrical Machine	20
		Electronics	
Servicing, Fundamental Work (Electricity) 46 hrs.		Electrical Machinery in Cars	46
		Equipment Repair	

Reference Material #5

Elementary Course

Track & Structures Course

Subject Teaching Hours	General 8	Teaching Objective	To deepen the understanding to related work, and to recognize both the importance of National Railway work, and the relations between each kind of work.
Subject Teaching Hours	Train Operation 10	Teaching Objective	To have new employees acquire knowledge about the performance of operation work connected with facilities.
Subject Teaching Hours	Disaster Prevention 6	Teaching Objective	To have new employees acquire knowledge about disaster prevention.
Subject Teaching Hours	Construction 5	Teaching Objective	To have new employees understand the concept of National Railway construction work.
Subject Teaching Hours	Buildings 4	Teaching Objective	To have new employees understand the special nature of National Railway building work.

Subject : Permanent Way and Station
Teaching Hours: 20 hrs.

Teaching Objective : To have new employees understand track structure and the various related regulations, and to have them learn about station facilities.

Main Points	Points	Details	Contents of Instruction
Permanent Way 12 hrs.	Track standards 10 hrs.	Class of track	· Significance of track, 1st class track, 2nd class track, 3rd class track, 4th class track
		Track structure	· Operating base level width, ballast, ties, roadbed, drainage ditches, stone walls
		Construction clearance and car clearance	· Significance, the necessity of clearance Basis of calculation
		Curves and grades	· Types of curves and the names of their parts, cant, slacking · Types of grades, grade limits
	Railway posts 2 hrs.	Types and their uses	· Distance posts, grade posts, curve posts
Stations 6 hrs.	Outline of stations, and facilities 6 hrs.	Classification of stations	· Significance of stations · Classification as viewed from work details
		Station facilities	· Passenger facilities, freight facilities, operating facilities
		Line names and effective lengths of track	· Names of main lines, sidings · Significance of effective track length, purpose of its establishment · Manner of taking effective track length · Car stops, scotch blocks
Turnouts 1 hr.	Looking at turnouts 1 hr.	Normal and reverse positions of turnouts	· Normal position, reverse position
Railroad crossings 1 hr.		Types of railroad crossings	· Type 1, type 3, type 4

Subject : Track Maintenance Teaching objective: To have new employees understand the basics of track maintenacne work, and have them master right-of-way management.

Teaching Hours:

Main Points	Points	Details	Contents of Instruction
Track Maintenance Work, General 2 hrs.		Contents of track maintenance work	· Maintenance management of railway track, bridges, tunnels
Classification of track maintenance work 17 hrs.	Track work 10 hrs.	Track repair work	· Track repair, surfacing, re-alignment, repair of rail-ro-tie fastening devices
		Materials repair work	
		Materials replacement work	· Rail renewal, tie replacement
	Turnout work 4 hrs.	Turnout repair work	· Gauge and re-alignment, repair of rail-ro-tie fastening devices
		Materials repair work	· Repair of rail accessories, repair of ties
		Materials replacement work	· Entire replacement, parts replacement, accessories replacement
	Roadbed work 1 hr.	Operating base level arrangement	
		Side drain arrangement	
		Weed control	
	Snow removing work 1 hr.	Snow removing work	
		Others	

Main Points	Points	Details	Contents of Instruction
	Miscellaneous work 1 hr.	Transportation work Miscellaneous signpost work	· Track materials, waste material · Replacement, cleaning, and painting of miscellaneous signposts
Mechanization of track maintenance work 1 hr.	Organized machine groups 1 hr.	Large machine groups Medium-sized machine groups Special machine groups	
Right-of-way maintenance work 2 hrs.	Management 0.5 hr.	The concept of management	· Characteristics of right-of-way, work contents
	Maintenance 1.5 hrs	Maintenance work	· Work contents and maintenance organs

Course title : Work Safety
Teaching Hours: 6 hrs.

Teaching objective: To have new employees acquire minimum requirements for safety.

Subject : Practical Training
Teaching Hours: 11 hrs.

Teaching objective: To have new employees understand actual work conditions by having them visit facilities and sites and having them practice basic actions.

Main Points	Points	Details	Contents of Instruction
Site visits 7 hrs.		Work preparation	· Roll call, work preparation, work machinery and tools
		Track maintenance work	· Repair of rail-to-tie fastening devices, tamping, tie tamper, track spiking
		Equipment name	
		Visits to stations	· Signals, turnouts
Basic actions 7 hrs.		Driving rail spikes	· Stance
		Ballast tamping using a beater	· Way of holding beater, position of feet, way of swinging
		Ballast tamping using a tie tamper	· Handling the machine, names of parts, thrusting action

Subject	Total Hours
National Railway Employees	40
Orientation	7
Work-site Operations, General	8
Train Operation	10
Disaster Prevention	6
Right-of-way and Stations	20
Track Maintenance	22
Constrction	5
Building	4
Work Safety	6

Subject	Total Hours
Practical Training	14
Health and Physical Education	6
Total	148