RECENT IMPROVEMENTS TO THE PERMANENT WAY IN SRI LANKA RAILWAYS

by

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Abstract

The article illustrates the developments which have taken place recently and future developments which are in hand for the Permanent way of the Sri Lanka Railway. The Permanent way (Track) being a integral part in any rail network the opportunity is taken to put on record the present systems of Track maintenance, problems encountered, monitoring of Track maintenance work, recent developments which have taken place and proposed future developments.

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With the Sri Lanka Railways entering 125 years of service to the nation, the author wishes to place on record the recent developments which have taken place and the future developments which are in hand for the permanent way. Many are aware that much criticism has been levelled in the recent past to the Railway in general. The Permanent Way (Track) being an integral part in any rail network the opportunity is taken to illustrate the present systems of Track maintenance, problems encountered (both technical and social), monitoring of Track maintenance work, recent developments which have taken place and future developments proposed.

The routine maintenance of track is the most vital aspect in permanent way. A badly maintained track will obviously give an uncomfortable ride, damage rolling stock, other track components and is prone to accidents.

The maintenance of track can be subdivided into

a) daily inputs

b) long term inputs

The daily inputs to maintenance are to counter the wear and tear the track suffers over the passage of trains. Such wear and tear is attended to by permanet way gangs stationed approximately every 3 miles in single line sections and every 1½ miles in double line sections. These gangs are supervised by a foreman platelayer who is in charge of approximately 20-25 miles of track. The work of the foreman plate-

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layers is overlooked by an Inspector who is stationed at the District headquarters and who is directly responsible to the District Engineer.

In Sri Lanka the entire track network of 960 miles is divided into five districts. The Central District is the largest with around 260 route miles, the other four districts ranging from 120 to 200 miles. The five district engineers and their Assistants are responsible to the Chief Engineer Way & Works, who is assisted by three other engineers. The Organisation chart is attached.

Daily maintenance may be categorised with attention mainly to the following defects.

1) Low joints

2) Alignment kinks

1) A low joint is formed at a place where two rails are joined by a pair of fish plates. A joint such as this is suspended across two sleepers and is called an elastic joint. The function should be that it should not be subject to permanet deformation on passage of trains. However, there are many contributory factors for forming of a low joint. The main cause is that two or more sleepers on either side of the joint are not properly packed or the sleepers on either side are weak. Another reason for a low joint is that the joint itself is unable to take up the load due to loss of elastic properties. This happens in cases where the joint bolts are loose or the joint itself has not been greased or oiled for a considerable time. Any joint neglected in this manner is detrimental to the rails and rolling stock. A neglected low joint will give rise to a permanent defect in the rails, the end of the rails being permanently hogged.

The rail joint or the fishplated joint is the weakest part on the track and it needs attention more than the rest of the track.

2) <u>Alignment Kinks</u>

The lateral kinks are noticeable when the spikes are found loose.

a) Due to corrosion on spike or the rail flange or both.
b) Spikes driven on decayed sleepers
c) The toe load exerted by certain type of spikes being insufficient due to heavy axle loads, speeds and intensity of traffic.

The Sri Lanka Railway is faced with a very serious problem on its Coast line between Fort and Panadura due to heavy corrosion of rails and fastenings. It is found that the rails and fastenings do not last for more than five years if untreated and about 7 years with protection coating. In these areas where there is heavy corrosion the toe load exerted by the spike on the rail decreases with time and ultimately there comes a stage where the rail moves in the direction of traffic which is technically referred to as "rail creep". This is further aggravated due to uni-directional traffic between Fort and Panadura.

The use of partly worn rails on the coast line from recoveries on the Northern line having a residual life of about 7 years was started in the early 1960's, after applying a protective coat of tar. By this method the rail could be used for its full life span, the last 7 years on the Coast line, without having to reject a new rail after just 5 to 7 years. Similarly fastenings too are dipped in tar and used. However, in a rail which lies about 5 years by the side of the ocean, corrosion attacks much of its bottom flange and web and this can give rise to rail fracture and creep. The fractures generally propagate from rail joints, and the gangers, spannermen and platelayers have to be more vigilant on such rails.

In such instances the creep is arrested by using rail anchors, elastic spikes and pandrol base plate and clips which thrust a heavier toe load than the conventional dog spike.

The daily inputs to track maintenance can be drastically reduced if long term inputs to maintenance are carried out systematically.

Longterm inputs are categorised as follows.

1. Inputs of rails, sleepers and fastenings according to yearly programmes.

2. Input of ballast with standard of 6"-7" of ballast under the sleepers for present day axle loads and speeds.

3. Introduction of a good drainage system in open line where problems are encountered due to improper drainage.

4. Formulating a good drainage system in busy station yards.

5. Welding of rails resulting in less wear and tear of rails and rolling stock. Less maintenance to track and less deterioration of track due to less joints.

6. Introduction of concrete sleepers instead of the conventional wooden sleeper to get over the present shortage of timber, longer life span and greater stability of track.

Inputs of rails, sleepers & fastenings

The rails and fastenings are imported items which involve foreign exchange; therefore it is the duty of every track employee to utilise them to their full life period by preserving same and handling them with care. The wear on the rails on curves could be minimised by allowing the proper cant or superelevation and also using check rails on very sharp curves. Also it is observed that trains which run far in excess of the stipulated speed on curves give rise to appreciable wear on the high rail. Also certain other drivers of trains do not control the speed gradually and hence due to sudden retardation or acceleration cause damage to the top surface of the rail which is called a "wheel burn".

As mentioned earlier rails could be used for a longer period on Coast line if a protective coating is applied. Scabby or roaring rails are seen at places where there are weak sleepers and where the formation is weak. However, this is more noticeable in 88lbs. rail section than in 80 lbs. rail section. These scabs could be taken off by grinding the rail top. The wear on rails and points and crossings could be reduced by using high manganese wear resistant rails. However, special tools have to be used for cutting and machining them. The cracks on rails generally propagate from the ends and hence these joints have to be opened out periodically for visual examination and greasing. The spikes of every sleeper should be driven in firmly otherwise the sleeper may not act as a support and hence the span will increase which will result in failure in the rail. Problems encountered are fastenings removed by vandals to be used as weight for fishing nets. The rails are generally condemned where the rail head is wasted below that of the minimum safe wasted rail template or if there is any other noticeable defect in the rail.

Sleepers

Sleepers used are of two varieties soft wood and hardwood. The following species are used as soft wood sleepers.

a) Hora

b) Eucalyptus microforms

c) Eucalyptus grandis

Hora after creosoting has proved to last around 15 years in the track; while Eucalyptus microforms which is mostly used in the hill country also has proved to last around 12 years. Eucalyptus grandis is presently under test. The main property of the sleeper is that it should be able to hold the spike firmly against the rail. The life of the sleeper is dependant on the formation and also on the ballast cushion under the sleeper. If the formation is weak and collects water during rainy seasons the tendency is for the sleeper to get decayed soon. If the ballast under the sleeper is insufficient, on passage of traffic the sleeper gets damaged mainly at the rail seat.

With the scarcity of timber and due to many other factors it has been decided to switch over to concrete sleepers. In the near future a concrete sleeper manufacturing plant will be commissioned which will produce around 5000 sleepers per month. Problems encountered are shortage in supplies of wooden sleepers that they are robbed to be used as firewood and due to constant maintenance the spike holes tend to get big and thereby diminishes the holding power of spikes. Wooden sleepers could be set on fire by saboteurs to disrupt the service.

Input of Ballast

A good ballast cushion under the sleeper will enhance the life of rails, sleepers and rolling stock in addition to passenger comfort. In Sri Lanka our passenger line contains between 4" to 7" of ballast under the sleepers which is decided mainly by the speed and the axle load of vehicles. The ballast which is 1½" to 2" metal distributes the load to the subgrade. Due to high price of metal a large sum is allocated each year for track ballasting.

Normally track tamping is done manually using pick axes. However, due to poor output and due to quality of packing not being uniform, machine packing has been introduced recently. It is observed that a machine packed track in the Coast Line can stand with hardly any maintenance for about 9 months to 1 year. These methods are less labour intensive and around 03 Nos. 45 ft. rail lengths could be packed per hour. However, in single line sections around 10 men are required to remove the machine to allow for a train to pass, or to put it back to the track after the train has passed.

The problems that are encountered are mainly social, people walk across the track and along the track to the beach, thus disturbing the ballast.

Pilferage of ballast for construction purposes after reducing their size is also observed. Habitation along the coastal belt, at certain places very close to the track, induce the inhabitants to use the track as their washing place. In certain places at Koralawella and Kompannavidiya there is hardly any room to replace a sleeper and sleepers are found hanging due to erosion of soil layer at the bottom of the sleeper because people walk across. In certain other places it is observed that drains from houses and adjoining gardens lead directly on to the track. At Angulana the track cesses are used to dump garbage and hence there is water-logging during rainy seasons.

Introduction to good drainage

The main drainage problems are due to unauthorised tenements and due to lease of Railway land which is technically unacceptable to the Railway by decision makers. There have been many instances in Ganemulls and Nugegoda where shops and boutiques have been constructed over main rain water drains.

One of the essentials of a good

track is drainage. In dry areas this aspect is not considered as important as in wet areas, but neglect of drainage in dry areas will cause problems during heavy showers. One of the important factors of good drainage is clean ballast and rapid disposal of rain water. The shoulders of cesses should be lower than the toe of the ballast for rain water to have a free flow.

When existing cess shoulders are high they should be trimmed to be lower than the ballast toe and the cess should be cut open at intervals for water to flow out.

Drainage of sub surface water and diversion of surplus water from track structures becomes one of the main services which has to be rendered to ensure stability of the track carried. The efficiency of a modern track carrying heavier and faster loads depends entirely on preservation and retention of the stability and elasticity by proper drainage.

This means that if the drainage is poor and there is water stagnant on the track or beneath the formation many defects such as ballast pockets, low joints, pumping sleepers, unstable formation, slipping and subsiding banks will crop up and these defects have to be remedied very often to see that traffic is taken through uninterrupted. Therefore, it is more economical to maintain a good drainage system especially at places where there could be drainage problems. With good drainage life of rails, sleepers and fastenings and ballast could be prolonged in addition to cutting down on labour costs in maintenance of track.

Drainage in Station Yards

In busy station yards many drainage problems are encountered due to malfunctioning of existing systems and non-availability of an adequate drainage system. Unlike in open line in busy stations there are many sources by which water flows into the track. For eg. - The water from rain water down pipes, the waste water from platform canteens, water from platform stand taps etc. Unlike in more developed countries where all this water is directed through under ground means we have to accommodate and allow such water to flow along surface drains between the track to a main sewer.

The surface drains tend to get blocked very often due to paper, polythene and coconut shells obstructing passage of water. In turn water overflows from the sides of the drains and finds its way on to the track causing pumping of sleepers, low joints and other serious problems to track. These too could be regarded as social problems where our train travellers are not much concerned about where they throw an empty king coconut after consumption or throwing away polythene sheets with which they use to wrap their lunch packets. The track and station labour who are assigned to maintain the track and clean up the rubbish fallen on tracks and adjoining drains are reluctant to do so in busy stations seen by the travelling public. There are instances where even main sewers get blocked specially during heavy rains as there has not been much improvement to main Municipal sewers during the years and to the many low-lying land which need to be filled for the water to flow freely without remaining stagnant.

Another problem which is encountered mainly in station yards and fuelling points in the sheds is the oil logged track due to dripping of oil and dieseline from locomotives. In such places many defects such as pumping sleepers, low joints, unclean ballast are seen.

To overcome this situation as adopted in more developed countries, a concrete slab track has been constructed at the fuelling point at the locomotive

shed at Maradana (As seen in photograph). This enables the track to be free of maintenance. A similar concrete slab track has been constructed in Zone 1 in the Ceylon Petroluem Corporation, Kolonnawa.

Welding of Rails

Welding of rails prior to 1975 was confined to short stretches of track in different locations. One such important location was the welding of rails for one mile stretch between Kurunegala and Wellawa where welding was carried out in short panels of 5 rails on concrete sleepers. In the post 1980's welding has been done on a much greater scale from Maradana to Veyangoda on the up line and about 10 km on the down line near Veyangoda. In the Coast line too between Panadura and Fort on the up line welding has been done, joining 2 rails together. In addition to above a contract was signed last year with an Indian Firm to weld 3000 joints on the Coast Line and this was successfully completed by welding the entire stretch between Kosgoda and Balapitiya, which is also laid with concrete sleepers. Another contract has been agreed to with the same firm to do another 4000 joints on the Coast Line. The welding carried out in Sri Lanka is Thermit Welding, mainly in panels of 5 rails.

Initial investment on thermit welding is very much less compared to other forms of welding such as Electric Arc, Flash Butt and Oxyacetylene. Thermit welding could be carried out by adjusting the rails which are presently on track to the required gap of 10-12 mm and welding in site in between the passage of trains. Otherwise the rails could be welded outside the track and replaced later. Advantages of welding of joints are listed below.

1. Less wear and tear in rolling stock
2. Comfort for passengers
3. Less number of joints on the track and hence easy to maintain.
4. Less fastenings
5. Reduced hammering action and battering of rail ends
6. Tendency for fastenings to get loose is less due to less vibration
7. Rail creep could be arrested.

Concrete sleepers

The use of concrete sleepers gives a greater stability and increases the track modulus. With the life span of the wooden sleepers being not more than 15 years due to the climatic condition and poor subgrade at places and considering the annual shortfall in the supply by over 100,000 sleepers when the annual demand is over 200,000 it has been now decided to supplement the deficiency at least partly by the use of concrete sleepers. The level crossings surfaces which are often found in a state of disrepair will be soon covered with detachable concrete slabs which will also enable track at the level crossings to be maintained better.

Bridges, New Line construction under Way & other proposals

Since 1981 aid is offered annually by the Government of Federal Republic of Germany to rehabilitate and renew steel bridges. Already three bridges at Hikkaduwa, Bentota and Wellawatta have been replaced with new spans. Kalutara bridges too will be replaced shortly under this programme. A modern bridge workshop to the value of Rs. 35 m has been constructed at Dematagoda which is geared to fabricate steel bridges. Further a British grant too was provided to renew bridges at Wellawatta, Maggona and Pinwatte.

Due to operational difficulties during peak hours, an additional 3rd line is being constructed from Fort to Ragama. The line has been now completed upto Urugodawatte and the balance work is expected to be completed by end of 1990.

A line to Sapugaskanda 3 miles in length had been completed taking off from the main line at Kelaniya.

Also proposals have been made to extend the Railway track from Matara to Badulla via Kataragama; Vavuniya to Trincomalee; Trincomalee to Batticaloa and Kalmunai; and Puttalam to Murunkan. Such an improved network will undoubtedly improve communication and transactions between communities and will ease the pressure on ethnic violence. It will also be a boon to the transport of goods from Mahaweli areas and thereby will be able to cut down on import of fuel.

A major track modernisation project using a heavier section rail with concrete sleepers and more ballast and modern track maintenance machinery funded by the Overseas Economic Co-operation Fund (OECF) of Japan is expected to commence by end of 1989. The project is to be phased out for three years initially.

Conclusion

In the future if the Railway has to compete with other modes of transport, speeds of trains will have to be increased at the same time looking into the safety and comfort of the travelling public. Workers too will be able to give a better output at work places. It is the intention to initially improve the tracks to achieve a speed of approx. 120 Km/h. If the electrification of suburban railways too could be taken up at the same time about 80% of the office workers could be transported to and from work. This will ease SLCTB from its burden, and there will be less congestion on our roads during peak hours. Reduction on import of fuel with result in a saving of foreign exchange. SLCTB on the other hand may be able to make use of part of its fleet to cater to places where there is no rail head.

For example if a train could be run from Matara to Colombo in 2 hours and Kandy to Colombo in 1½ to 2 hours, the housing problem in the city and the suburbs too could be solved to a great extent.

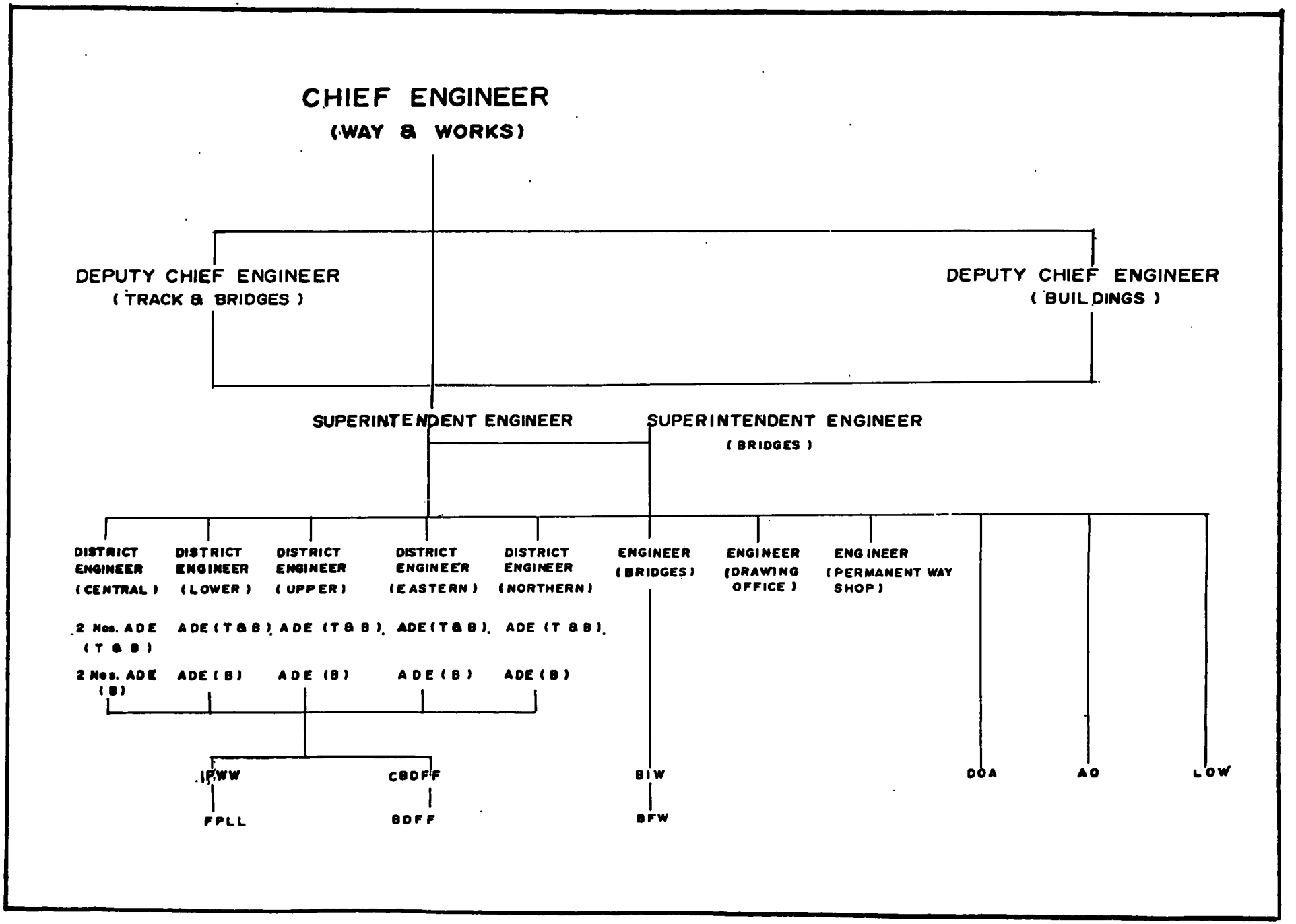
Acknowledgement

The opportunity is taken to thank the GMR Mr. D.C. Lelwela and Chief Engineer (Way & Works) Mr. W.K.B. Weragama for granting me permission to extract valuable information from departmental files to submit this article to the IESL Journal.

References

1. British Railway Track - R.A.A Hamnett

2. Railway Track - K.F. Antia.


CHIEF ENGINEER
(WAY & WORKS)
DEPUTY CHIEF ENGINEER
(TRACK & BRIDGES)
DEPUTY CHIEF ENGINEER
(BUILDINGS)
SUPERINTENDENT ENGINEER
SUPERINTENDENT ENGINEER
(BRIDGES)
DISTRICT ENGINEER (CENTRAL)
DISTRICT ENGINEER (LOWER)
DISTRICT ENGINEER (UPPER)
DISTRICT ENGINEER (EASTERN)
DISTRICT ENGINEER (NORTHERN)
ENGINEER (BRIDGES)
ENGINEER (DRAWING OFFICE)
ENGINEER (PERMANENT WAY SHOP)
2 Nos. ADE (T & B)
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IPWW
CBDFF
FPLL
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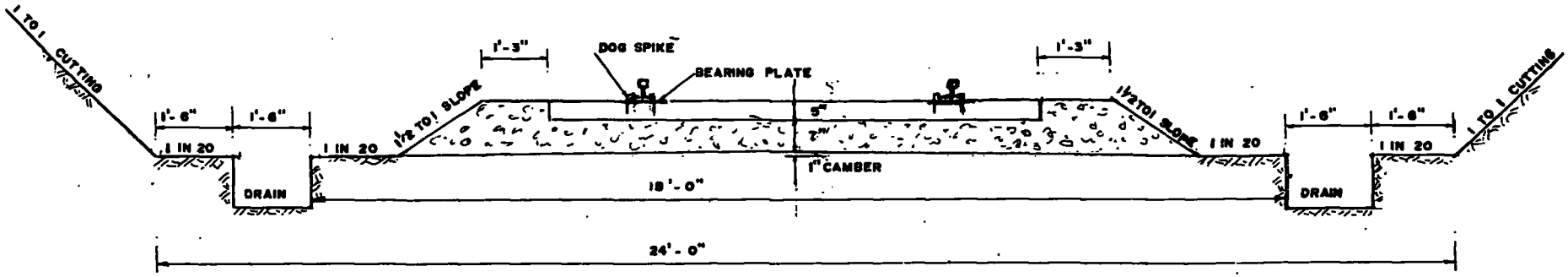
BIW
BFW
DOA
AO
LOW

S. L. G. R.

STANDARD CROSS SECTION OF BROAD – GAUGE TRACK

SCALE: 1/2" TO A FOOT



SECTION OF TRACK FOR CUTTING