

STANDARD PRACTICE CARDS ON THE ERIE.

Approved Methods for Performing Different Maintenance of Way Operations.—Work Standardized on All Divisions.

BY O. S. BEYER, JR.

Under modern operating conditions no part of the physical plant of our railways is more severely taxed than the roadbed and track, and no phase of the general railway maintenance problem, perhaps, presents so many difficulties as that of maintaining the roadbed and track in fit condition for the safe and efficient con-

standardize the various methods, practices, and conditions in a positive and effective manner.

The benefits which result from a system of this kind are extensive. Instead of following a multitude of varying practices and methods for the accomplishment of certain results, the best and identical methods are employed over the entire system. This eliminates, to a certain extent, waste of material, and assures a greater uniformity in the purchase of material. It insures the use of good and correct processes where otherwise questionable

No. 1. ERIE RAILROAD COMPANY. 3-31-11						
NEW YORK, SUSQUEHANNA & WESTERN RAILROAD NEW JERSEY & NEW YORK RAILROAD CHICAGO & ERIE RAILROAD						
MAINTENANCE OF WAY AND STRUCTURES						
STANDARD PRACTICE:—Elevation and Gauge of Track						
Degree of Curve	TABLE FOR ELEVATION OF OUTER RAIL.			Track shall be gauged to	Gauge allowed account of Rail-wear	Pt. In.
	30-Miles Speed in Miles Per Hour	40-Miles Speed in Miles Per Hour	50-Miles Speed in Miles Per Hour			
1	1 1/4	1 3/4	1 1/2	4	8 1/2	4 9
2	1 1/2	2 1/4	3	4	8 1/2	4 9
3	1 3/4	3 1/4	4 1/2	6	4 8 1/2	4 9
4	2 1/4	4 1/4	6	6	4 8 3/4	4 9 1/4
5	3	5 1/4	6	...	4 8 3/4	4 9 1/4
6	3 1/2	6	6	...	4 8 3/4	4 9 1/4
7	4 3/8	6	...	...	4 8 3/4	4 9 1/4
8	4 3/4	6	...	...	4 8 7/8	4 9 3/8
9	5 1/4	6	...	...	4 8 7/8	4 9 3/8
10	6	6	...	...	4 9	4 9 1/2
11	6	...	...	...	4 9	4 9 1/2
12	6	...	...	...	4 9	4 9 1/2
13	...	...	...	...	4 9	4 9 1/2
14	...	...	...	...	4 9	4 9 1/2
15	...	...	...	...	4 9	4 9 1/2

Maximum elevation should not exceed 6 inches.

(OVER)

Fig. 1—Standard Practice Card for Elevation and Gage of Track.

duct of high speed and heavy tonnage transportation. That these problems are very serious must be admitted when the many recent failures, which have resulted in such disastrous accidents, are considered. Failures and waste on railways, where they occur, are in part at least due to faulty practices. One of the problems which must be solved effectively is the prevention of faulty practices and their eradication where they exist.

An attempt in this direction made by the Erie Railroad is the extension of the Standard practice card system, as adopted in the mechanical department, to the maintenance of way department. The work of maintaining the roadbed and track of a railway property employs many processes and methods which are

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MAINTENANCE OF WAY AND STRUCTURES			
STANDARD PRACTICE: Ballast. Application of, Method to be Employed, and Force Required.			
NEW BALLAST.			
New Ballast should not be applied until the sub-grade has been prepared to conform with standard section per standard practice card No. 2. Tracks should be raised to stakes set by engineer.			
STONE BALLAST—Method.			
Pick tamp all ties on both side from the ends to a point twelve (12) inches inside the rail. Center of ties to be lightly filled by use of ballast fork. Allow sufficient time (minimum, one week) to elapse for ties to secure a good bearing, then resurface the tracks with a light raise. In resurfacing joint ties they should be tamped hard at the joint end, easing off on the quarter.			
When track has been put to a true line fill and trim to standard section per standard practice card No. 2. Ballast should be neatly lined on the outside by using a straight edge six (6) inches wide.			

(OVER)

Fig. 3—Front of Standard Practice Card for Ballasting Work.

or faulty ones might be employed. Guess work is done away with. Individual judgment, based on limited experience, is replaced by the judgment and experience of a large body of capable men. It establishes definitely, over the entire railway, just exactly what special conditions are to be maintained. The card

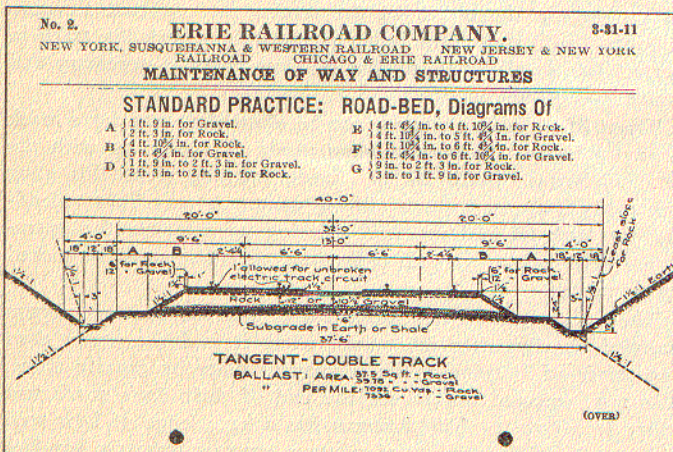


Fig. 2—Standard Practice Card for Roadbed Diagrams.

more or less the same and in general use over the entire system. Certain definite conditions which are continually being disturbed by the wear and tear incident to operation are periodically re-established. The standard practice system takes cognizance of these characteristics of maintenance of way work and seeks to

All surplus ballast should be piled and promptly removed after second raising and resurfacing.

Use ballast forks for handling stone ballast.

In gravel, granulated slag and cinder ballast, tamping picks should be used only on joint ties, using shovels on all others.

STONE BALLAST—Force.	
Foreman	1
Assistant Foreman	1
Assistant Foreman	1
Laborers	1
Laborers	2
Laborers	2
Laborers	4
Laborers	4
Laborers	4
Laborers	16
Laborers	4
Laborers	4
Total	37

Fig. 4—Back of Standard Practice Card for Ballasting Work.

feature of the system insures the carrying out of the standardized practices, since the cards are placed in the hands of every officer of the department, from the very head down to the section foreman. They all are required to familiarize themselves thoroughly with the practices as established. Instead of disseminating the instructions with which the cards deal either verbally or by means of circular letters, placards, or bulletins, the instructions are forcibly and systematically brought to the attention of the men in the field, who, more than anyone else, are to be guided by them. Verbal instructions are soon forgotten or become stale;

Circular letters are buried in the files; placards are lost and bulletins are either buried, lost or forgotten. Through the systematic method of establishing and introducing these cards, as well as the prescribed necessity for maintaining a continual check, the higher department officers, too, become thoroughly familiar with the standardized practices. By means of this system, a direct channel is opened, which enables officers to get certain kinds of instruction down definitely to where they are needed. In general, this plan of standardizing practices weeds out faulty practices and establishes good ones, all of which helps to effect efficient and economic maintenance and safe operation.

HOW ESTABLISHED.

The supervision of the establishment of the standard practice card system and the continued introduction of new cards is the

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MAINTENANCE OF WAY AND STRUCTURES				
STANDARD PRACTICE: Laying Rail. Method to be Employed, and Force Required.				
LOCATION.	Location is determined upon at the end of the calendar year. During the winter when track work is impracticable, the adzing, as far as possible, should be done.			
SUPERVISION.	Whenever possible the Supervisor should be present when the rail is relaid.			
Force required for laying single rail:				
FORCE:				
Foreman	1	Spike pullers	4	
Assistant Foreman	1	Spikers	4	
Assistant Foreman	1	Adzers	5	
Flagmen	2	Shim men	2	
Tong men	8	Tools and supplies	1	
Applying joints	8	Rail removers	2	
Water carrier	1			
Total force				40 (over)

Fig. 5—Standard Practice Card for Laying Rail.

assigned duty of an expert sufficiently familiar with maintenance of way work to properly suggest and draft up cards himself, check proposed cards, and in conjunction with the head of the department, decide from the result of criticisms submitted on pro-

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MAINTENANCE OF WAY AND STRUCTURES				
STANDARD PRACTICE: Program of Season's Work by Regular Section Forces.				
Section Force: One Foreman. The number of men to be designated by the Superintendent and approved by the Engineer, Maintenance of Way. Under normal conditions the following routine will prevail and in the order named:				
1.	Drain the road-bed by removing all obstructions in ditches and culverts in order to allow water to run off freely.			
2.	Clean up yards, tracks, station grounds and right of way.			
3.	As the frost leaves the ground remove all shims and take them to tool-house.			
4.	Go over entire section and do the preliminary surfacing, tamp loose ties, drive home all spikes and tighten all bolts.			
(OVER)				

Fig. 6—Front of First Standard Practice Card Outlining Program of Season's Work.

posed standard practices which the best practices are to be followed. First, all those practices most apparent and universal are outlined, submitted to every general officer of the department and to the division engineers, who, together with their individual staffs, discuss the proposed practices and criticize them. The criticisms are then submitted to the officer supervising the installation of the cards, who carefully goes over them, tabulates them, and finally, together with the head of the department and perhaps some other persons peculiarly fitted to pass judgment on some particular practices, decides what the final standard practices shall be. These practices are then outlined on a card in clear, concise language. Illustrations, if necessary,

are employed to make the meanings clearer. The cards are then distributed to the various officials and foremen who are to use them and be guided by them.

From time to time, as certain things occur which indicate faulty practices, investigations are made with a view of eliminating them and establishing in their place correct practices by

5.	Make tie renewals and switch timber renewals in main track, beginning at end of section farthest removed from, and working toward tool-house.
	It is required that all ties be fully spiked, tamped, and ballast replaced the same day they are applied.
	In putting in new ties the use of picks or sharp pointed instruments is forbidden.
	During the renewal all condemned ties removed from track should be piled for burning as removed and burned each week when conditions permit.
6.	After new ties are placed in track a sufficient time (minimum one week) should elapse to permit the new ties to secure a good bearing, when the track should be gone over, giving a finishing surface, and aligned by use of level and gauge, trimming the ballast at the same time to conform to the standard section per standard practice card No. 2, and clean ballast of vegetation.
	Note. When the rail or ballast program provides for rail renewal new ties should not, under normal conditions, be applied until new rail or ballast is laid.

Fig. 7—Back of First Standard Practice Card Outlining Program of Season's Work.

means of standard practice cards. In order to eradicate as promptly as possible all methods, practices, and conditions which are faulty and wasteful, everyone is encouraged to make recommendations as soon as things are noted to go wrong, or in time to prevent things going wrong. These recommendations are carefully investigated and adopted whenever of sufficient importance to warrant their application. Thus it is not the duty of anyone in particular to help effect the desired object of the standard practice card system. Everybody is expected and encouraged to take a hand.

HOW USED.

The standard practice cards, as finally issued, fit into a loose-leaf binder of convenient size to be carried in a pocket. Those officers and foremen actively engaged in supervising and directing maintenance of way work are required to carry these books with them continually while performing their duties, so that they will

No. 6.	ERIE RAILROAD COMPANY.	Card 2.
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MAINTENANCE OF WAY AND STRUCTURES		
7.	It is required that the right of way be mowed at the time designated by the Engineer, Maintenance of Way, to prevent noxious weeds going to seed. The order of this item may be changed if necessary.	
8.	Do the necessary ditching and repairing of embankments.	
9.	Renew the necessary switch timbers and ties in side tracks, cutting them off at the proper length.	
10.	Reduce the force to meet winter conditions.	
	Note: It is required that care be exercised at all times to keep all switches fitting tightly; switch stands properly secured; frogs tight and in proper position; guard rails properly secured in correct position and track to proper gauge, cross level and super-elevation. All emergencies should be properly met regardless of the order of routine.	

Fig. 8—Front of Second Standard Practice Card Outlining Program of Season's Work.

always have them ready for reference in case any questions come up regarding proper practices and methods to be employed or standard conditions to be maintained.

When new cards are received outlining a new standard practice to be followed, the division engineer, at the first meeting of his staff, introduces a thorough discussion of the new cards. The various features of the standardized practices in their application,

are thoroughly explained and questions raised and answered in regard to them. Each supervisor or roadmaster and section foreman, after having had opportunity to thoroughly familiarize himself with the new practice and its purpose, applies it in his future work. Constant vigilance from the highest officer in the department, down to the supervisor or roadmaster, is maintained by checking the actual work done under the direct supervision of the section foremen, with the results as they should be secured by

practice would naturally be about the first one to be standardized.

Fig. 2 illustrates diagrammatically the features and dimensions of the grade, subgrade, and drainage arrangements which should be maintained for the different types of roadbed employing either rock or gravel as ballast. Data is also provided giving the area of the ballast and the amount per mile necessary. The benefits resulting from this card are apparent.

Figs. 3 and 4 indicate the force required, the method to be em-

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MAINTENANCE OF WAY AND STRUCTURES		
STANDARD PRACTICE: Tie Inspection and Renewals.		
<p>INSPECTION:—The selection of ties to be removed from track for renewal on each Division should be made by one or more track Tie Inspectors, as soon after March 1st of each year as weather conditions will permit, and prior to July 1st, will submit his report direct to the Division Engineer.</p> <p>Each tie to be removed must be carefully examined, the local conditions being carefully studied and taken into consideration; the condition of ties on each side, and the amount and character of traffic, the location of the ties, whether on a tangent, curved track or under a joint, etc., must be carefully considered.</p> <p>A much more rigid inspection is possible on straight track with light traffic, than where traffic is heavy and on a sharp curve.</p> <p>When the inspection is made the Section Foreman on each section shall be present and assist in the work. A third man will be necessary to do the spotting and carry the work along rapidly. The inspection should begin at the lowest mile post and work toward the greater</p>		
(OVER)		

Fig. 9—Front of First Sheet of Standard Practice Card for Tie Inspection and Renewals.

No. 8.	ERIE RAILROAD COMPANY	Card 2.
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MAINTENANCE OF WAY AND STRUCTURES		
<p>The Supervisor will then forward to the Division Engineer and the Engineer of Maintenance of Way a report showing the number of miles completely finished on his sub-division, on the 10th, 20th and end of each month. No ties should be reported in a mile unless all the ties to be changed have been put in.</p> <p>No ties shall be removed from the track except broken ties or ties marked for renewals (except in cases of emergency), without the express permission of the Division Engineer, to vary from the inspection.</p> <p>SWITCH TIES:—Switch ties which have become unserviceable from decay or other causes will be renewed. These will be measured and the number and length of each to be renewed will be recorded and the rail painted by the Inspector, as for cross ties. The track and switch should be named and this information given the Division Engineer to enable the proper distribution of the switch ties to be made from the cars, which should be loaded in station order and lengths for this purpose.</p>		
(OVER)		

Fig. 11—Front of Second Standard Practice Card for Tie Inspection and Renewals.

the application of the standardized practice. Furthermore, when the prizes are awarded to the section foremen each year after the annual inspection made by the officials, besides taking into consideration the riding qualities of the roadbed and condition of the track as determined by the track testing and inspecting car and the general appearance of the right of way, the adherence of the foremen to the standard practices is also taken into consideration. All this tends to keep everyone keyed up to the spirit of the standard practice card system and insures the carrying out of the work as desired.

EXAMPLES.

A few standard practice cards, as used on the Erie Railroad, are appended hereto, by way of illustrating the system in its

application and the application of ballast. This card eliminates practices which are based on individual judgments, and substitutes, in their place, practices which are the result of the experience and judgment of a considerable number of persons. It outlines the forces to be employed in laying ballast and arranges their distribution. This assists in lining up the gangs at the start of the season's work.

Fig. 5 shows the card which standardizes the method employed and forces required to lay rail. This practice, like the one illustrated by Fig. 3, determines the best and safest methods. It tends to eliminate lost motion and waste. By designating the proper organization of the force employed and the duties of each member of the force, it ought not to be a difficult matter for the sec-

<p>MARKING:—Ties to be removed should be designated by marking the web of the rail directly over the tie, with a spot of white lead paint, as directed by the Engineer, Maintenance of Way. Where it is expected the rail will be removed prior to the change of ties, in addition to the spot on the rail, the tie should be spotted near its end.</p> <p>LOCATION:—As the tie inspection is made the total number of ties in each mile will be counted and shown, and the number to be renewed in each quarter of a mile will be shown; also the number of unapplied ties.</p> <p>Where there is no mile post, telegraph poles will be used to designate the location.</p> <p>When the inspector has finished each section, he will forward one copy of his inspection report to the Division Engineer, one to the Supervisor and one to the Engineer of Maintenance of Way, and leave one with the section foreman. The Supervisor will then be enabled to distribute the ties needed for each mile or quarter of mile, per Standard Practice Card No. 7.</p> <p>RENEWALS:—When the Section Foreman has completely finished the renewal of ties on any one mile, he will forward a statement to the Supervisor, showing the exact number of ties that he changed on the section, whether it agrees with the inspection report or not, and if not, an explanation why.</p>

Fig. 10—Back of First Standard Practice Card for Tie Inspection and Renewals.

<p>SIDINGS:—It is desirable as far as possible, that the instructions above be applied to renewal of ties in sidings. The record of ties should be kept with the name of the siding instead of the quarter mile, the painting or marking to be done in the same way.</p> <p>Chestnut and cedar ties may be used on tangents of standing or back off track. A separate list covering such tracks should be kept in such cases.</p> <p>GENERAL:—It should be distinctly understood by the Track Supervisor that the above standard practice does not in any way relieve him of his responsibility for the proper maintenance of the track under his charge. If, on being furnished by the Division Engineer with statement of ties to be removed he is not satisfied that this number is sufficient for proper maintenance of the track, he shall satisfy himself as to the additional number required in the same detail the former inspection was made and recommend to the Division Engineer that the additional number be furnished him at each point where his judgment has indicated as being necessary. The Division Engineer will then assume the responsibility of failing to furnish the additional ties if, in his judgment, they are not needed.</p>
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Fig. 12—Back of Second Standard Practice Card for Tie Inspection and Renewals.

application. The cards are 4 x 6 in. in size, and where necessary, are printed on both sides. It oftentimes happens that a complete practice cannot be entirely outlined on one card. In such a case two or more cards are used. The cards are punched ready for insertion in the loose-leaf binders.

Fig. 1 shows the card which standardizes the elevation and the gage of the track. Not much comment need be made in connection with the adoption of this first card. This particular

tion foreman and the supervisor to decide promptly how best to handle the work.

Figs. 6, 7 and 8 illustrate a card outlining the program of the season's work by the regular section forces. This is a comprehensive attempt to fix definitely the general run of work of the regular forces. That one of the results of following this practice will be increased efficiency must be realized.

Figs. 9, 10, 11 and 12 illustrate the card standardizing tie in-

spection and renewals. While, of course, this card does not outline which ties should be renewed and which should not, it does outline the method to be employed when making the inspections, and standardizes the marking, reports and methods of distributing new ties. Uniformity and system in this particular work helps greatly to avoid confusion and aggravating and expensive mistakes in the removal and renewal of ties.

While the foregoing illustrations are of a more or less general nature, the possibilities and range of application of the standard practice card system in maintenance of way work will be recognized. The first cards adopted usually deal with the more general practices. As the system is extended, the more special practices are standardized.

PERSONAL CONTACT WITH THE FOREMAN.*

BY W. W. GREENLAND,

Assistant Engineer, Wabash, Moberly, Mo.

If you want an effective organization take care of the men. We have endeavored to follow this principle in the handling of foremen and future foremen on this division. The foremen and future foremen are made to feel that they are one of the family. The supervisors going over their territory on motor cars get in very close touch with the foremen and the men. In addition to talking over track matters and the economical handling of men and material, they go into the question of the condition of the foreman's house, whether it needs repairs, whether he has enough ground for garden, etc.

The engineer maintenance of way or assistant engineer makes trips over the road either on a hand car or motor car, not only to advise the foreman that a joint is low in a crossing, but to find out how the foreman and men are satisfied. They inquire as to their health. If any one is sick or needs a slight operation, they advise him about the company hospital at division point, or suggest a change in location. If the foreman or men come to the hospital, they send some one from the office to see them.

The superintendent makes frequent trips in his car over the division, "highballs" foremen and men and at station stops where the foremen and men happen to be at work, gives them a word of encouragement and asks how they are getting along. We do not make a practice of reducing our section forces in winter months below the requirements of safety, thereby protecting our tracks and giving the future foremen continuous service which tends to make them more contented. Good treatment of foremen and future section foremen, the supplying of good section houses and ground, the hospital service, a trip to the city with the supervisor at times to look over new work or terminals, makes satisfied men who know they will be taken care of in sickness or in health. When these men go out on a car at 7 a. m. they are thinking of their track, and continue to think of it most of the 24 hours. In this way foremen are held and the future foremen are shown that if they work to the interest of the company they will be looked after and will later be made foremen.

A CORRECTION.

We are advised that figures relative to the costs of protecting the yards of the Cotton Belt and Iron Mountain roads at Bird's Point, Mo., just above Cairo, Ill., from the floods of the Mississippi river, which were given in our issue of April 19, as stated by A. M. Van Auken in a discussion before the American Railway Bridge and Building Association, should be revised as follows: In 1897, 3,750 lineal ft. of bank were protected at a cost of \$26,634.19; in 1903, 2,930 lineal ft. of bank were protected at a cost of \$19,631.85.

*Submitted in the contest on The Section Foreman Problem, which closed April 25, 1912.

ACTUAL ECONOMY IN RAILWAY MAINTENANCE.

BY R. P. BLACK,

Engineer, Maintenance of Way, Kanawha & Michigan.

The study of economy in railroading is largely relative. The economies practiced by a railway of small gross earnings per mile would not be applicable to one of very large earnings and of high speed traffic with excellency of service the paramount issue.

Large opportunities for economies in the purchase of material are afforded by the selection of materials which will give the best, safest and longest service for the money value. This does not necessarily mean that the appliance will be the best that can be had or the most durable. Durability in many a case is very costly. Durability regardless of cost is frequently the standard of the heads of the maintenance of way departments of the larger railway systems. This may be the best policy, but it is often not the most economical.

Since the compound interest on money invested in a device will become equal to the principal in 12 years at 6 per cent. it is not economy to tie up money in an additional first cost to get relatively longer service. Any additional capital is a loss equal to 6 per cent. per year. Should this capital be twice the amount required to get 12 years' service, there is a loss of 100 per cent., being the 100 per cent additional capital plus an equal amount of interest less the first cost required for renewal.

The selection of suitable frogs, switches and guard rails for the renewal and maintenance of turnouts, permits of a great amount of economy. The following practice has been found to be economical in the maintenance of turnouts over which the traffic is chiefly heavy tonnage freight trains without high speed passenger service. The main track is laid with 90 lb. rail, sidings with 70 lb. The country traversed has a mild temperature.

For main track turnouts where the wheelage movement is small over the diverging track the single spring frog giving the closed rail for the main track movement is used. This frog will last in the track as long as the rail which is 8 to 10 years and its cost, say \$48, is nominal. The switch for such a turnout should be made of rails of the same analysis or consistency as the main track. Such a switch whose cost is \$43 and whose life is the same as the rail in the main track, is the most economical.

For turnouts, where the wheelage movement to the diverging track is 25 per cent. or more of the total, the short solid cast manganese steel frog should be used. This frog's life is at least 10 years and on account of being free from bolts is very cheap to maintain. The cost of such a frog is \$85, which compared with the cost of three single spring frogs which would wear out in the same time, at \$48 less \$6, each scrap value, gives a saving of \$41. Besides this saving there will be less labor expense for maintenance which will more than discount the interest on the additional first cost of the higher priced frog. The switch for such a turnout where the wear would be considerably more on the point closed for the diverging route, should be made of the same rail as the main track, equipped with a 30-in. or longer manganese steel point on the side to be closed for the diverging route. Service tests of such manganese steel points at turnouts such as those leading from a yard, where all freight trains pull into and out of the main track, have demonstrated their lasting qualities. The manganese point will last at least five years or more in such a place, whereas the ordinary Bessemer or Open Hearth steel point would not last one year. The cost of a switch equipped with a manganese steel point on one side is \$56, as compared with \$43 for the ordinary steel rail switch. This is an increased first cost of \$13 per switch, but it will show a saving in five years of \$82.50.

The guard rails for the two turnouts mentioned should be of similar design. For such service the single piece guard rail made of cast manganese steel should be used. Its construction of manganese steel will give it a life of at least that of the rail in the track. The cost of this single piece cast guard rail is \$16, which