Rail Inspection and Replacement

Report of Committee

W. M. Dowdy, Chairman, div. engr., C.&O., Clifton Forge, Va.

Since it is the duty of the track sectionman to maintain in safe condition a particular section of track, the first step in the process of replacing rail is usually a report from the section foreman to the track supervisor (roadmaster) that a certain stretch of track is in need of new rail or a good class of relay rail.

It is then the duty of the track supervisor to follow up the track foreman's report, make an inspection and, if conditions warrant, forward a request to his supervisory officer that a replacement of rail be made.

The track supervisor may rely on a visual inspection or he may use various mechanical means of inspecting rail, such as rail contour gauges, rail templates with taper gauges, mirrors for examining the under side of the head of the rail and a straight edge for checking rail-end batter.

All Areas Examined

During the inspection, all areas of the rail are examined, as well as the general condition of the track as to line and surface. Rail-end batter, gage wear, wheel burns, the fishing surfaces, any outward signs of internal failures, joint bar wear, the web, base, and head should be given a close check during the rail inspection.

Since the replacement of rail is usually one of the larger items in the railroad's budgets, it is generally handled on a program basis. Once the track supervisor's recommendations are submitted, the rail is subjected to further inspections by various supervisory personnel, such as the division engineer, engineer of track, manager of roadway maintenance, etc., according to the organizational setup of the different railroads.

The majority of the railroads covered by this report indicate that, in addition to the visual and mechanical inspection, rail detector cars, audigauge and reflectorscopes are used for rail inspection.

Inspections performed by rail detector cars are usually carried out by outside parties under contract to the railroads involved. These detector cars are generally operated from one to two times a year over all important main line and primary passing tracks, testing all rail which has been in service for at least four or five years. They are operated on branch lines according to traffic density or as dictated by rail service failure records. Some railroads operate the detector cars based on the number of gross tons of traffic which has moved over the track. However, the majority of the railroads reporting stated they operated the detector cars on a regular schedule.

Railroads either own or lease rail inspection equipment, such as audigauge, reflectorscopes, or ultrasonic rail testers for inspecting rail on bridges, in long grade crossings, and for testing rails damaged in derailments.

The frequency of rail inspections by any method depends largely upon local conditions, such as tonnage, speed, curvature, and grades. The personnel in charge of track maintenance are familiar with these conditions and perform their inspections accordingly.

There are many factors to be considered in recommending rail renewals, such as:

1. Condition of the base of rail.

2. Condition of the rail ends.

3. Condition of the head and surface of the rail.

4. General line and surface.

5. Rail detector car records.

6. History of service failures and defects.

7. Gross tons.

8. Transposition of rail.

While there may be many more factors than those listed above, the committee has chosen these factors for discussion and has not attempted to establish any order of importance.

Oil in Brine Territory

The majority of the railroads covered in this report indicate that the condition of the base of rail has little, if any, effect on out-of-face rail renewal recommendations. However, they all agree that the rail base warrants a close inspection and consideration where rail is subjected to dampness conditions, as in tunnels and where the rail is subject to chemical effect of cinder ballast, brine drippings, or salt water. Oil spraying of rail, on railroads experiencing ill effects of brine action and in salt-water areas, has practically eliminated this particular problem.

The condition of the base of rails located in grade crossings and station platforms should also be closely observed for possible breaks in the vicinity of the track spikes.

All railroads are concerned with the condition of the head and surface of the rail when programming rail renewals. Close inspection must be given to wheel burns, shelly areas, corrugations, corner gage wear, split heads, derailment damage, and general wear or roll on the rail. The line and general surface of rail is always to be considered as a factor in out-of-face rail renewal. Once rail has become surface bent or line kinked it is very costly to maintain, particularly in high-speed territory. When these conditions are caused by a rail condition, this factor must be given a high priority in considering rail renewal.

Is Rail to be Cropped?

Whether or not the replaced rail ends are to be cropped is another important factor to be considered in renewing rail. The degree of rail-end batter, wear on fishing surface, bolt-hole wear or cracks, surface condition of the rail end, and for what purpose the replaced rail will be used, should be considered when deciding whether or not rail should be cropped.

Seventy-six percent of the railroads covered in this report indicate that they use the records of rail detector cars as a factor in recommendations for rail renewal. These records, together with histories of rail service failures, may indicate a heavy concentration of failures in a particular lot of rail which demands consideration of lot removal.

Fifty-eight percent of the railroads replying to the questionnaire in connection with this report indicated that the factor of gross tons passing over rail is considered to varying degrees, the majority using gross tons as more of a guide or scale in their recommendations for rail renewal.

Another factor to be given consideration in recommending rail renewal is whether or not to renew both curve and tangent rail at the same time. The majority of the railroads replied in the affirmative in that the better relay rail is released from tangent track and, in predominately curve territory, the tangent rail territories are so short that it would not be economical to by-pass them in out-of-face renewal.

Still another factor to be considered in recommending out-of-face rail renewal is whether or not rail can be turned or transposed to prolong its serviceable life. Seventy-three percent of the railroads canvassed indicated that they considered the turning or transposing of rail economically justified.

The turning or transposing of rail will not only correct gage-worn track, but, if shelly rail is turned or transposed before the shell area spreads across the entire surface of the head, a much greater length of service may be realized from the rail.

Some railroads do not recommend turning or transposing rail of less than 90-lb. sections and do not transpose when the low rail indicates a wear of more than 1/4 in. to 3/8 in. on the head.

Most railroads agree that the same factors considered in recommending renewal of conventional rail would be considered in recommendations for renewal of continuous welded rail. However, there is apparently no history of welded rail renewal cycles available as yet to the railroads covered by this report.

Inspection Before Out-of-Face Renewal to Determine Classification for use as Second-Hand Replacement

Rail which is to be renewed is generally classified by such people as the roadmasters, engineers of track, division engineers, general track supervisors, etc., and in some cases by the Stores department of the railroads.

This classification inspection is usually visual. However, some railroads used such mechanical instruments as covered in the rail inspection section of this report.

There are many factors to be considered in classifying rail for second-hand replacement, such as the amount of wear on the head, gage wear, joint conditions, engine burns, shelly areas, surface and line, etc. Once all the factors involved have been given due consideration, the rail is marked or classified according to the standard desired by the individual railroad.

The marking or classification may be accomplished by vertical or horizontal paint stripes or bars, approximately 3/4 in. in width, with one stripe indicating a number one rail, two stripes for a number two. rail, and so on.

One railroad has set the following standards for classifying rail for second-hand replacement.

Number One rail can have no surface defects, wear on the surface of the head of the rail must not exceed .095 in. and gage wear must not exceed 1/8 in.

Number Two rail is the same as Number One rail in wear tolerances but may have up to four small wheel burns or other defects in the surface of the head.

Number Three rail cannot exceed .150 in. in wear on the surface of the head or more than 1/4 in. gage wear. Its maximum use is confined to branch lines.

Number Three "A" rail is that on which head and gage wear exceed the tolerance for Number Three rail and is usually recommended for use in side tracks of light traffic movement.

Number Four rail is classified as scrap, not to be used in any type of track.

The majority of railroads covered in this report indicate that they do not crop rail or straighten rail to be used as second-hand replacement nor is any work performed, such as building up battered rail ends or out-of-face surface grinding, on such rail just prior to its removal from the track. Although, most are in favor of surfacing the track just prior to or as soon after rail renewal to provide a more uniform bearing for the new rail.

Only one railroad reported that it welded secondhand rail into long lengths after cropping. This welded rail was then used only in important tracks.

Reporting Rail Failures

The failure of individual rails is reported usually by the track foreman, and is checked by the track supervisor who prepares the usual paper report form for each rail failure.

The report covers all types of rail failures, such as transverse fissures, transverse defects, engine burn fractures, detailed fractures, etc. The same classifications are used by detector car personnel and by utilizing these reports, some railroads have established two or more rail classifications: (1) Suspicious heat rails, or those rails of the same heat having three or less transverse fissures; and (2) condemned heat rails, or those rails of the same heat which have had up to eight transverse fissures. The suspicious heat rails may be laid in unimportant tracks, but not in road crossings or switches where observations are restricted. Condemned heat rails are not used in any important sidings or yard tracks.

Practices in Handling Various Types of Defects Found

After rails are removed from the track, the handling accorded them is most important. The handling of, and the final disposition is governed by the type of failure or degree to which damaged. Experience over many years with detail fractures and fissure-type failures has indicated that these rails be not again used in main tracks and, to a very limited degree, in any track. It is almost the universal practice to dispose of them as scrap.

The problem here is the marking of the rails in such a manner that they keep their identity as rejected rails until disposed of. Many methods are in general use, such as painting with distinctive colors, drilling of holes in the web, or defacing of the running surface. There seems to be not much advantage or disadvantage of one method over the other so long as the end result is kept in mind: The making absolutely certain that they do not again find their way into tracks.

The very nature of these kinds of defects, being invisible, makes it imperative that markings be of a semi-permanent nature as it is not always economically feasible to transport them to the point of disposition immediately. Such factors as distance from disposition point, the frequency of inspection with detector equipment, and the forces and machinery available to handle the rail, will govern this.

Break Rails at Defect

These type failures should be immediately isolated from any other rail on hand and the rails broken at the point of defect at the first practical opportunity. Economic factors again will govern whether they are broken in the

field or at the concentration point. In case of the latter, the advantage of a semi-permanent marking at the time of removal is apparent.

Vertical and horizontal split heads, piped, broken bases, cracks in fillets and bolt holes, all being visible defects, can be accorded different handling. The removal of split-head rails, all types, is governed by speed and the amount of traffic over the track in question. Being progressive in nature, they often can be carried for long periods, once their presence is known, by frequent observation to determine the degree of progression, keeping in mind the condition and age of adjacent rails. Once removed from a main track, however, they should not again be used in a similar track and should be marked in a manner that would limit their use to unimportant auxiliary side tracks.

Rails with broken bases and cracks in fillets are unfit for use in any tracks and should be disposed of as scrap. Rails with breaks or cracks through bolt holes, with no other defects, are suitable for use in any track after cropping.

Rails damaged by defective wheels or derailments should have careful consideration as to the degree of damage and speed permitted over the track before a decision is reached to remove them. Defective wheels invariably damage only the head and, unless the rails are damaged to the extent of causing rough riding or excessive wheel click for fast trains, present no undue hazard to the premature failure of the fail.

Rails damaged on the base should be removed from the main track without question and their future use should be limited to yard or industry tracks. Shelly rail does not present such a great problem in itself. Extensive shelling is sometimes an indication of proneness of rail to develop detail fractures, but, with frequent inspection by electronic or sonic equipment, which is almost universal on all major railroads today, shelly rail can be carried safely until the defects indicate that removal is necessary. Transposition of rail on light to medium-heavy curves when shelling first appears, will often result in an appreciable increase in rail life. Once removed, however, their use should be restricted.

DISCUSSION

President Tracy: Thank you very much, Mr. Dowdy, for that fine report and the excellent manner in which you presented it.

Gentlemen, this is something I hope we will have some discussion on. Does anyone wish to ask Mr. Dowdy any questions on what was developed by his Committee? We have a few minutes yet for this report. I hope I am not going to have to do what I did yesterday - start calling out names. Mr. Fox isn't in here, so he won't get up.

Mr. Hagen (I.C.): Mr. Chairman, I would like to ask Mr. Dowdy what his Committee has determined as the correct amount of wear at the head of the rail before it is removed from the main track?

Chairman Dowdy: Apparently, most railroads base their renewal on wear and, as I said in the report, one railroad has set this standard, before removal. I think it depends entirely on where the rail is, the type of traffic, and so forth. It is strictly local problems in most cases.

Mr. Hagen: Thank you.

President Tracy: Anyone else have any questions or comments on this report on rail? Mr. Dowdy, I guess you and your Committee answered all the questions.

Effect of Traffic on Renewals

Mr. Vansandt (S.P.) : Mr. Chairman, I noticed they mentioned tonnage in various places in that report. Just what is considered the maximum tonnage that rails should carry before given consideration for renewal?

Chairman Dowdy: As the report stated, we had a large range of differences on this tonnage question. Most of them apparently use tonnage more or less as a reference for renewal. They go strictly by wear off the surface. That one particular lot we renewed on the C.&O. this year, in two and one-half years that rail was worn 3/8ths to one-half inch off the ball. It had to come out. This is on a 5.5 degree reverse curve section, about 0.5 per cent grade. Most roads indicated they considered tonnage in varying degrees as the recommendation.

Mr. Heaton (F.E.C.) : Does the Committee have any rule or measurements of curve roll in rails as to when it should be transposed?

Chairman Dowdy: I forget those figures exactly but I believe the one railroad I quoted ran something like one-quarter inch maximum for gage wear on the curves. Are you speaking of gage or ball?

Mr. Heaton: Ball.

Chairman Dowdy: Well, as I say, this section of rail we took out this past year had from 1/2 to 3/8ths inches gone off it. And I was a little worried about it myself about a year before we ever took it out of there. So I think local conditions will have to govern in most cases like that.

Asks About Rail Cropping

W. M. Z. Wood (T.&N.O.): Did the Committee develop anything for extending the life of the rail by cropping and, if so, what were their recommendations as to the amount to be cropped?

Chairman Dowdy: As far as the amount to be cropped, we did not cover that. And very few railroads indicated that they did crop rail. Only one railroad indicated they had, but they welded it in long lengths after it was cropped.

President Tracy: Anybody else any comment? Mr. Woolford, we have a couple of minutes here yet. You talked to us very excellently this morning, and I wonder if you would say a word or two?

Mr. Woolford: I think I talked enough. I don't think you want me to talk any more. There are some disputable facts. I didn't hear all the report on the rail. I wondered how many railroads the Committee covered? He made the statement there was only one railroad that cropped. I know of several that are cropping rail and not welding either. Some are field cropping and some are shop cropping and using it. I don't know what railroads he covered in his questionnaire. I don't think he covered all of them. He may, in the cross section he covered, have found some that don't crop.

President Tracy: Thank you very much, Mr. Woolford. What Mr. Woolford said brings home another point that we on the Executive Committee of this Association have been trying to say for some time. We send out cards covering the subjects selected by you. We consolidate them, summarize them, pick out the subjects. We send out cards asking you to show your first choice, second choice, and third choice, and you return the cards to the Secretary and we make up the list of committees. That's about all we think we can do. The rest of it is up to you.

These committees make reports based upon the information they are able to obtain, which in some cases I am sorry to say is not too much. The cooperation the committee chairmen get isn't too great. I think what Mr. Woolford has said indicates the need for more cooperation of the members of this Association to fill out reports so that we can all get the benefit of the knowledge that you have. That is the only way we are going to learn anything. If the committee gets up here and makes a report and no one brings up any questions or gives any additional information, we all lose.

Reduced Budgets Necessitate Cropping

Mr. Woolford: I might say one thing, that with the way we are getting allowances on the railroads now, I think we are going to have to go to more cropping. I know a lot of us are not getting any more new rail. I think the only thing we can do is crop the old rail and use it the best way we can.

I think a committee ought to give a pretty detailed study to methods of cropping. Some very unique methods have come up recently. There are certain types of new saws and gang drills. They permit field cropping without having to take the rail in. There are some pretty unique things that have come up. I know they have in the West. I don't know whether they have in the East. There are some pretty unique ways come out on cropping.

President Tracy: Thank you, Mr. Woolford. Is anyone here from the U.P.? I understand they have done a lot of it on the U.P.

Mr. Woolford: You have some gentlemen in here who have done a lot of it.

President Tracy: Would some of you gentlemen mind taking a few minutes to tell us just how you do field cropping?

Describes Rail Cropping on S.P.

Mr. Vansandt: I'm from the Southern Pacific and I might say we have started cropping in the field. We started it three or four years ago. I believe we have cropped in the neighborhood of 100 miles. Most of it is 113-lb. rail, which was in physically good condition other than at the joint areas. We were experiencing a good many popouts on the ends of the rails on account of fillet wear. So we first started out with regular power hacksaws and power drills, which, of course, are slow. It takes quite a crew of men. We had about 28 men in the gang. We use reformed angle bars, new bolts, new nut locks. I believe this procedure cost about $4,000 a mile. And of course, we expect to get probably five, six, seven, or eight more years of life out of the rail.

In the last six months we have rented or bought two friction saws put out by a firm in Los Angeles, which is expediting the cropping tremendously. Actually, we can cut 113-lb. rail off in 16 seconds just like cheese with a cheese knife. It makes a beautiful cut.

They are now introducing gang drills that will drill either four or six holes, whichever you like, in a matter of seconds. We can expect to reduce the cost of cropping by almost half. As Mr. Woolford expressed a few moments ago, those things are almost a must as our budget has been reduced from 300 or 400 miles of new rail annually to about one. That makes it necessary to do the next best thing. If we can obtain another six or eight years from this rail, we probably have been missing something. We have been taking a large amount of our rail out from fillet wear and wear in the joint area. It hasn't actually been failing in any other portion of the rail.

That about sums it up. We are still cropping. We will probably continue to crop. We don't crop rail that has in the neighborhood of 400 million gross tons because we don't believe the potential is left in the rail to pay for the expense of cropping.

On this report that these gentlemen just made here, the reason I asked the question about tonnage. We feel we should get 500 to 600 million tons out of our tangent rail before it is removed. We begin to look at it suspiciously after 500 million tons. I believe that about wraps up what little I know about cropping. I am sorry the U.P. people are not present. I believe they have gone into this thing quite heavily in the West. They could probably give you a lot better information than I have. I thank you.

Member: How far back do you cut it?

Mr. Vansandt: We take our 39-ft. rail and cut 18 inches off both ends. We make 36-ft. lengths out of them. That gets you out of the bond wear area where the holes have been bored for bond wires. Put on reformed angle bars and you have a beautiful joint. We have had no difficulty whatever with our cropped rail up to now. Our first rail was cropped about three years ago in the field.

Closing Up for Trains

We use some "Dutchmen," about six or nine feet in length, for closing up rapidly for trains. However, we don't have to use them too often because of these saws, which operate so quickly. You can take out 12 rails and put in 13. In other words, you have these extra rails distributed at the proper locations. After these people have cropped for a few days, they know how long it takes to make a run of 12 or 13 rails. Even in our dense traffic, we just go right along and get as many as 50 and 75, and sometimes as many as 90 joints a day, with about 24 men.

Mr. Woolford: Mr. Vansandt, are you still using the method you started with, where you crop behind the joints and leave the "Dutchman" in with the straps, and then put it all in at once?

Mr. Vansandt: We kind of backed away from that because there is extra labor involved. We first made some slash bars. After you made the two cuts, you put the long bar on that would span all three cuts in the rail to let the trains over. That meant removal of angle bars and application straps and there is quite a little extra motion involved in the thing.

Mr. Woolford: You just wait for train time?

Mr. Vansandt: That's right.

Mr. Woolford: You are using the old bar saw? It is not really a friction saw? It's an abrasive.

Mr. Vansandt: They tell me it is a rubber saw impregnated with some abrasive. It is about 26 in. in diameter and it's the most marvelous thing you ever saw. It's like a cheese knife.

Mr. Woolford: I might tell you that when you cut that rail you can put your hand on the end and it won't burn it.

Mr. Vansandt: That's right.

Member: What weight rail are you cropping?

Mr. Vansandt: 113 and 132.

Member: What is the average cost per rail?

Mr. Vansandt: It cost about $4,000 a mile. I would have to use a slide rule to get the cost per rail. We expect to get that cost down. The reformed angle bars, I believe, are about $1.00 apiece. They go into scrap. We get them reformed and charge them out at about $1.00 or about $1.20 apiece. Actually, the bolts cost us more than anything; else. I think they are about four bits apiece.

Closing Rail Gaps

G. T. Summitt (Cotton Belt): What methods do you use for pulling the rail back?

Mr. Vansandt: We have a Speed Swing that we use in connection with this. We knock the creepers off and slide the rail through the spikes. It works out very well. We keep sliding them down until you ,can drop another rail in.

G. D. Mayor (C.&O): Are those angle bars merely brought up to the original section or are they oversize?

Mr. Vansandt: They are just brought back. If it is a 113-lb. bar, they bring it back to its original size.

Mr. Mayor: The reason I ask is because in many cases in order to avoid the necessity of strapping rail, we have had our own reforming plant reform the bars to an over-size for taking care of the wear in the fishing surface. When this reformed bar is applied, it eliminates the worn surface that may cause you to go to cropping.

Mr. Vansandt: We have never used oversize bars.

Fears Head Separation

Mr. Woolford: We are starting right now of having the bars reformed to over-size. We have some rail that has had terrific wear in the fishing area, that is, .around Stockton. We actually went out in the field and contoured the wear. Now we are putting that wear back on the bars. The worry in my mind is that I am going to pop that ball off.

Mr. Vansandt: Actually, some of our people don't even like to transpose the angle bars.

Mr. Woolford: We did some of the same thing. We took those bars off and had them reformed, which added to the receiving end and did nothing to the leaving end. So far, there has been no problem. It has corrected the position. Now I am doing it on both sides. Both sides are worn. That is what I want to ask the gentleman, if he has any trouble popping the ball off?

Mr. Mayor: I can say this, that our railroad carries extremely heavy tonnages, probably 50 to 60 million gross tons per mile. Therefore, the life of the rail is limited. We used over-size bars and had no trouble whatsoever with the ends popping.

President Tracy: I might add that as far as the Burlington is concerned, we have practiced it for a number of years. As a matter of fact, we followed it for so many years we put our cropping plant at Galesburg, Illinois, completely out of business. If you do not watch it closely and let the bars stay on too long, you get considerable

wear in the web of the rail. Then you are liable to have the trouble you fear. But, if you take care of the situation, you will not have that difficulty.

Gentlemen, this is the kind of information that we are trying to develop by these committee reports. It isn't a question of whether you agree with the Committee or don't agree with the Committee. They don't come up here with the idea that if you say something you are trying to tear their report apart. It is just a matter of information, just like Mr. Vansandt gave us and Mr. Woolford and the rest of you gentlemen who have taken part in this very important subject.

We are running a little bit late and I am supposed to keep things on schedule. I will excuse Mr. Dowdy and his Committee with the thanks of the Association.

The next report will be that of Standing Committee No. 3, "Roadway," Mr. F. N. Beighley. Mr. Beighley, the Chairman of that Committee, is Roadway Engineer of the St. Louis-San Francisco at St. Louis, Missouri. Will Mr. Beighley and his Committee please come to the platform. Mr. Beighley, will you please present your report.