FEAP-UG 97/85
June 1997

Prefabricated Concrete Panel Railroad Crossings With Preformed Rubber Flangeway Fillers

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SF 298

Prefabricated concrete railroad crossings are especially well suited to locations on Army installations that experience significant traffic from heavy trucks or a large volume of vehicle traffic at speeds above 25 mph, where a smooth ride is important. They are also useful where track surfacing and adjacent road surfacing may be needed on occasion.

Rubber flangeway fillers can be used in standard railroad crossing installations in place of asphalt or instead of leaving the flangeways open. They are especially useful where crossing geometry and low relative elevation naturally direct rainwater to the crossing flangeways and where crossing drainage is naturally difficult, or where crossing heave from freeze-thaw cycles is a common problem.

This user guide gives prospective Army end-users information on applications, costs, procurement, and installation of prefabricated concrete crossings with rubber flangeway fillers.

Foreword

This study was conducted for U.S. Army Center for Public Works under the Facilities Engineering Application Program (FEAP) Work Unit FX6, "New Road Crossing Technology." The technical monitor was A. Michael Dean, CECPW-ER.

The work was performed by the Maintenance Management and Preservation Division (FL-P) of the Facilities Technology Laboratory (FL), U.S. Army Construction Engineering Research Laboratories (USACERL). The USACERL Principal Investigator was Donald Plotkin. Dr. Simon S. Kim is Chief, CECER-FLP, and Donald F. Fournier is Acting Operations Chief, CECER-FL. The USACERL technical editor was Gordon L. Cohen, Technical Information Team.

The author is indebted to Gary Reasnor and Chuck Edwards of the McAlester Army Ammunition Plant, and the McAlester railroad and road maintenance crews. These people scheduled the project, took delivery of and checked all project materials, arranged for traffic control and rerouting during construction, performed all the preparation work, rebuilt the track and drainage at both crossing sites, installed both crossings, and rebuilt the road approaches. All their work was of good workmanlike quality and their efforts resulted in successful crossing installations and a successful FEAP project. Appreciation is also extended to Gene Richter of Premier Concrete Railroad Crossings and Tom Hogue of RFR Industries, who took the time to travel to McAlester and assist in the proper installation of the crossing panels and flangeway fillers. Special thanks go to Dena Lawrence of the USACERL Small Purchases Branch, who made an extra effort to ensure specifications were clear and complete, and helped to arrange and expedite material delivery to McAlester AAP.

Dr. Michael J. O'Connor is the Director of USACERL.

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1 Executive Summary

Description

Prefabricated concrete panel railroad crossings, made from high-strength concrete, form a hard, durable crossing surface. They are assembled in place from separate panels, each of manageable size for handling with a backhoe or small crane. The paneled design makes these crossings easy to install and allows them to be removed and replaced as needed for track maintenance. Figure 1 illustrates the two designs of crossings installed during the demonstration project.

Preformed rubber flangeway fillers have a cross-section made to fit a standard crossing flangeway. During crossing installation, the preformed fillers are pushed into the flangeway with a lining bar or long prybar. The fillers seal the flangeway space, preventing rain and runoff from entering the flangeway and saturating the track and subgrade. Like the crossing panels, preformed rubber flangeway fillers may be removed and replaced without damage for access to the track when maintenance is required.

Figure 2 shows the RFR-style fillers and how they fit between the crossing panels and the rail.

Demonstration Site

McAlester Army Ammunition Plant in McAlester, OK, was the chosen demonstration site. This site met several desirable criteria. The installation's railroad maintenance crew had never installed this type of crossing before, so it would be a good crew to help evaluate ease of installation. McAlester's roads handle significant heavy truck traffic, and they are exposed to a full range of hot and cold seasonal weather, significant annual rainfall, snow removal requirements, and less-than-ideal subgrade support—all of which would rigorously test crossing durability.

Two concrete panel crossings were installed for the demonstration: one from the Premier Concrete Railroad Crossing Company and the other from the American Concrete Products Company. The rubber flangeway fillers for both crossings were

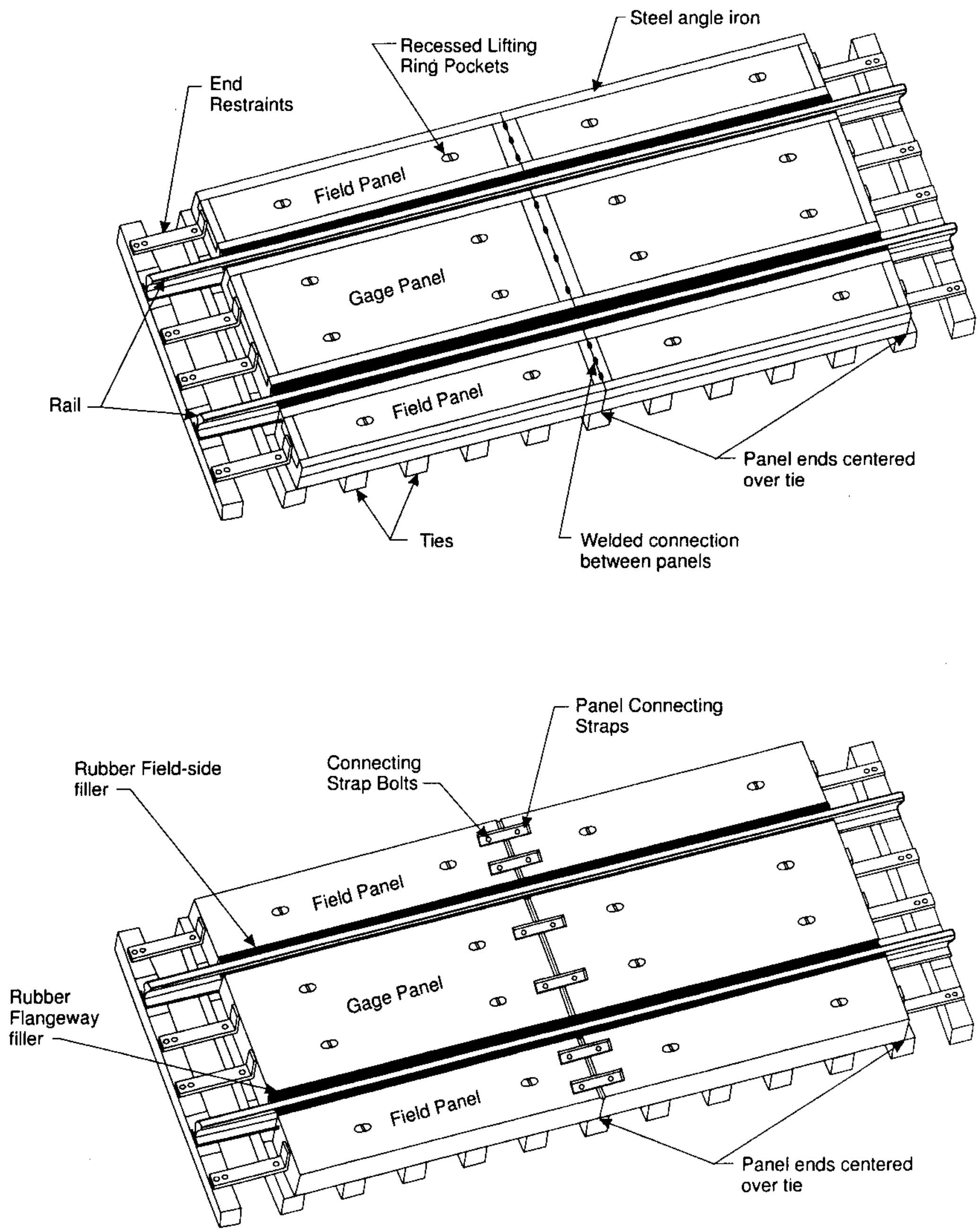

Figure 1. Crossing designs chosen for the demonstration site.

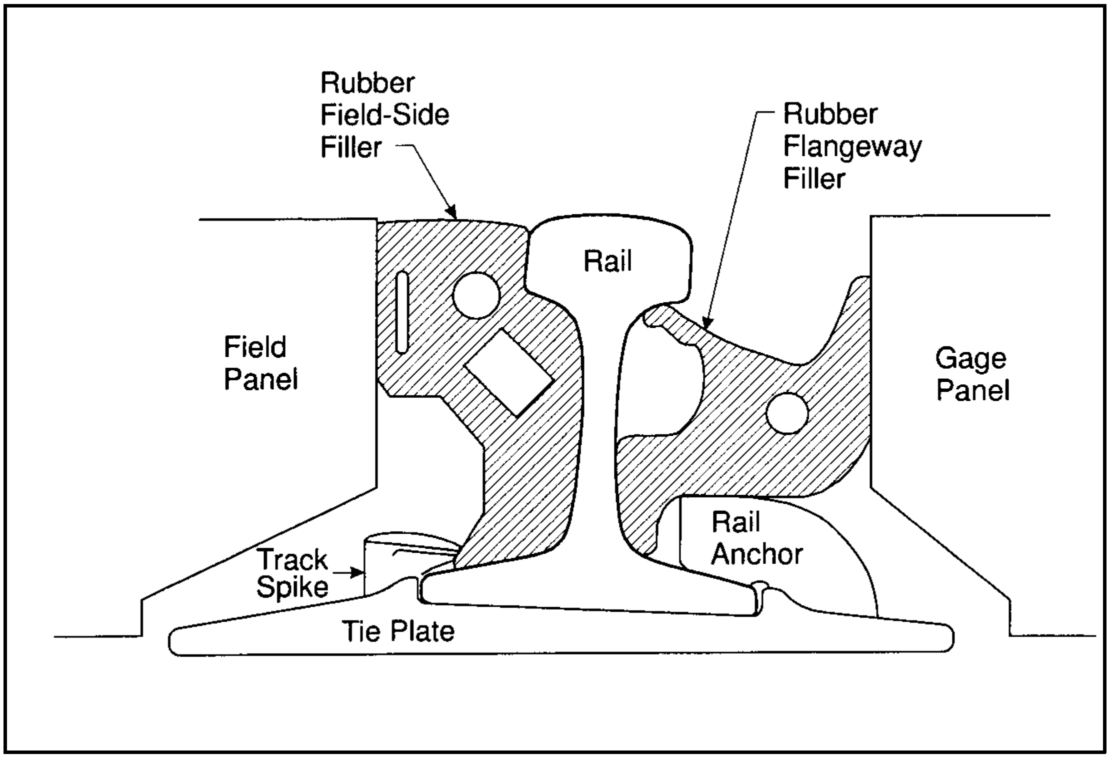

Figure 2. Crossing components at rail and flangeway (cross section).

from RFR Industries, Inc. The crossings and flangeway fillers were selected after consulting manufacturers, railroad personnel who had experience with crossings, and other industry sources.

The crossings were installed in late October and early November 1996. Each crossing was nominally 32 ft long, and both were done with a lagless installation on 10-ft long ties. Each was installed on a different road, but both locations had heavy truck traffic.

Applications

Prefabricated concrete crossings are especially well suited to locations on Army installations that experience significant traffic from heavy trucks or a large volume of vehicle traffic at speeds above 25 mph, where a smooth ride is important. They are also useful where track surfacing and adjacent road surfacing may be needed on occasion.

Rubber flangeway fillers can be used in standard crossing installations in place of asphalt or instead of leaving the flangeways open. They are especially useful where crossing geometry and low relative elevation naturally direct rainwater to the crossing flangeways and where crossing drainage is naturally difficult, or where crossing heave from freeze-thaw cycles is a common problem.

Benefits

Prefabricated concrete crossings are capable of providing a hard and durable crossing surface. With proper support, they can withstand repeated high loading from heavy trucks and also maintain an even crossing surface where ride smoothness is important, as it is for higher speed traffic. These types of crossings are not subject to decay as are standard timber crossings, and they are much less subject to damage from plow blades during snow removal operations compared to timber, rubber, or gravel crossings. In addition, they may be most suitable to accommodate traffic from tracked vehicles.

When either track or adjacent road maintenance is required, prefabricated concrete crossings can be removed with relative ease, in part or whole, and replaced without damage to the crossing material or track, and without loss of original surface evenness.

Preformed rubber flangeway fillers effectively seal crossing flangeways, which otherwise commonly allow the entry of rain and runoff water—a major cause of crossing deterioration. They are removable where access to track fastenings is needed for inspection or maintenance, and then replaceable the same as originally installed. Where crossings are subsequently rebuilt, the fillers may be reused with the new crossing or installed at a different crossing, if desired.

Limitations

As with other crossing surfaces, prefabricated concrete crossings do not act alone—their performance depends on solid support from below. Unless recently constructed, the track, ballast section, and drainage system must first be rebuilt on a well prepared subgrade before installing the crossing. The drainage system must effectively empty water well outside the crossing limits. Generally, prefabricated concrete crossings can only be used with 115-lb or larger rail, and bolted rail joints must be eliminated from within the crossing limits.

Rubber flangeway fillers are made to fit standard flangeway widths and standard crossing designs. With some filler designs there must be at least a timber header or other smooth, solid surface opposite the rail to ensure good fit and proper seal, and also to allow them to be removed and replaced without damage.

Costs

Table 1 gives approximate prices and estimated service life ranges for three common types of crossings. The cost covers the purchase price of the crossing surface only. All crossing installations are assumed to require a track rebuild, and this process costs about the same regardless of crossing surface. It should be noted that most of the labor cost is related to the track rebuild rather than crossing surface installation. Therefore, labor cost is not considered to be a deciding factor in crossing surface selection. Although a “lagless” crossing installation is usually faster and thus somewhat lower in cost than standard lagged installation, this cost difference is also not considered a significant deciding factor. In some cases, initial material cost will be a factor, but the main issue is how long the surface will last.

The cost estimates in Table 1 are for crossings on a straight (tangent) single track. The listed costs include an average shipping charge, which is a significant amount for concrete panel crossings. Concrete panel and full-depth rubber crossing costs include rubber flangeway fillers. Timber costs assume asphalt-filled flangeways.

Recommendation for Use

Concrete panel crossings are one alternative where more durability is needed than can be obtained with a standard timber or asphalt crossing. They are well suited to locations handling frequent heavy truck traffic and where long-term ride smoothness is important. They are also a good alternative where tracked vehicles or snow removal operations (plow blades) have damaged or shortened the lives of other types of crossings in the past. They may also be a good choice where track must be surfaced through crossings because the panels can be removed and replaced without track or panel damage. Finally, if road or track use plans change, prefabricated concrete panel crossings may be reused at another location.

Table 1. Cost and service life for the three types of crossings.

Crossing Type	Estimated Purchase Price (per foot of crossing length)	Estimated Life Range (Years)	
		Heavy Truck Traffic	Mostly Auto Traffic
Concrete Panel	$175 - $200	20 - 35	30 - 50
Full-Depth Rubber	$300 - $360	5 - 15	10 - 30
Timber	$125 - $175	5 - 15	10 - 20

Points of Contact

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McAlester Army Ammunition Plant McAlester, OK 74501-5000	Gary Reasnor Chief, Operations and Maintenance Charles Edwards Foreman, Railroad Maintenance	Phone (918) 421-2607 FAX (918) 421-2323 Phone (918) 421-2787 FAX (918) 421-2323

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Description

Prefabricated concrete panel crossings enable a road to cross a railroad at the same elevation as the track. While dimensions may vary to match the particular location, their width (for crossing a single track) is commonly 10 ft, with a total length about 4 ft longer than the road width (2 ft longer at each side). Prefabricated crossings can be ordered to allow roads to cross either tangent (straight) or curved track.

The panels are made of high-strength concrete (6000–7500 pounds per square inch [psi] ultimate strength) with steel reinforcing strands or bars. There are two primary types of panels: gage and field. The gage panel fits between the rails, and the field panels fit between the rail and the end of the tie. All concrete crossing designs require at least one gage panel and two field panels. Panel lengths vary between about 8–20 ft and are ordered in sets (two field and one gage per set) to fit the road width. For example, a road 32 ft wide may call for three sets of 12 ft panels. Sometimes the end panels have a bevel or other modified design on their outer end edges.

The panels are supported by the track ties and rest on hard rubber pads that form a cushion between the panels and the ties. These pads reduce impacts from highway vehicles and help ensure full contact between ties and panels.

To form a smooth riding surface for highway vehicles and to prevent interference with the wheels of passing trains, panel thickness must match the distance from the top of the rubber tie pads to the top of the rail. Generally, panels are manufactured to fit only 115-lb and larger rail sizes. (If panels were made for smaller rail, they might not be thick enough to provide the required strength to withstand loading from heavy trucks).

Fastening methods vary with crossing design and manufacturer, but two general types of installation (or anchoring) methods are used:

- **Standard**. In a standard installation, the panels are "lagged" (attached) to the ties with lag bolts—not fastened to adjacent panels. This technique is similar to the one used to install a conventional timber crossing.

- **Lagless**. In a lagless installation, the field panels and gage panels are not bolted to the ties, but are fastened lengthwise to form three monolithic panels for the length of the crossing. Different methods are used to fasten the panels. End angles or other end-restraint devices are used to secure the crossing longitudinally. Vertical and lateral movement is prevented by the weight of the fastened panels in combination with confinement between the adjacent roadway and the rail (for field panels) or between the rails (for gage panels).

Determining Crossing Requirements

Before selecting crossing type, the characteristics of the road and railroad traffic at the location should be investigated, as well as the Army installation master and mobilization plans. Prefabricated concrete panel crossings are appropriate for locations with significant traffic from heavy trucks or a large volume of vehicle traffic at speeds above 25 mph where a smooth ride is important. They are also useful where track surfacing and adjacent road surfacing may be needed on occasion. In addition, they may be a favorable alternative where minimizing road and railroad closure is important or where tracked vehicles must be accommodated.

When the track is ready for crossing installation and the panels are at the crossing site, a properly equipped crew can install a typical 30–36 ft concrete panel crossing (lagless installation) in about 2 hours. Installation time includes placing the rubber pads on the ties, placing the panels, fastening the panels together, installing rubber flangeway fillers, and installing the panel end restraints.

Crossing selection generally will be governed by the amount and character of road and railroad traffic, crossing purchase price, estimated crossing durability, and maintenance requirements for both the road and railroad through the crossing location.

Part of crossing selection depends on how the flangeways are to be handled. Rubber flangeway fillers are especially useful where (1) crossing geometry and low relative elevation naturally direct rainwater to the crossing flangeways, (2) crossing drainage is naturally difficult, and (3) crossing heave from freeze-thaw cycles is a common problem from rainwater or snowmelt entering unsealed flangeways. Rubber fillers are also an alternative where asphalt filler has not held up well in the past. Generally, rubber fillers are recommended by the concrete crossing manufacturers and the railroads that use them. Rubber fillers may be incorporated into some crossing panel designs.

For crossings over curved track, through part of a turnout, or in other special situations manufacturers should be consulted to determine whether their products can be used satisfactorily in such locations.

Life-Cycle Costs and Benefits

Even for the most expensive crossing surfaces, the cost of rebuilding the track (especially when new rail is installed) and the road approaches usually totals more than the purchase and installation cost of the crossing system itself. Thus, where road traffic volume is significant, where significant numbers of heavy trucks pass over the crossing, or where vehicle speeds exceed 25 mph, the main life-cycle variable will be the expected durability of the crossing. When these road traffic situations exist, concrete panel crossings can be expected to offer two to three times the service life of other types of crossings. These durability cost savings should easily be obtained in cases where there are heavy truck traffic and annual snow plowing requirements, as snow plow blades typically cause significant damage to other types of crossing surfaces.

Concrete panel crossings achieve their longer service life in two ways. First is the rigidity of the concrete panels, which spreads vehicle wheel loads over a larger area, reducing the tendency for rutting or settlement in the tire path area of the crossing. Second is the toughness of the concrete surface, which is highly resistant to long-term wear from traffic and snow plow damage.

On occasion, there is a need to remove a crossing to surface the track, replace the rail, or perform other track maintenance. Only lagless full-depth rubber crossings offer the same ease of removal and replacement as lagless concrete panels without damaging the crossing surface or track.

Rubber flangeway fillers cost about $40–$50 per track foot (gage and field sides, both rails), or about $1440–$1800 for a nominal 32 ft crossing (actual surface length 36 ft). They can be installed by two people in about 30 minutes including assembling the sections together into 36 ft lengths and pushing the fillers into their final position. In heavy traffic crossings it is estimated that these fillers can have 3 to 5 times the service life of asphalt. Unlike asphalt, rubber fillers can be easily removed and replaced for track maintenance, or taken out and reused at another site. It is also estimated that, over time, properly installed rubber fillers will be more effective than asphalt in sealing the flangeways against water infiltration.

Limitations and Disadvantages

The current designs of prefabricated concrete panel crossings that incorporate high-strength concrete and lagless installation have not been in service long enough to positively document their long-term durability. It should be noted that the performance of this technology to date has reportedly been good, and that long service life expectations are reasonable for properly installed crossings where good drainage is maintained.

As previously indicated, where both railroad and road traffic are infrequent and speeds are slow, a simple gravel, timber-and-gravel, or asphalt crossing is probably more economical than a concrete panel crossing. Likewise, rubber flangeway fillers may not prove economical for crossings where traffic is light.

Concrete panel crossings are not recommended where a vertical curve in the track is required. In general, the concrete panels cannot conform to a curved or irregular surface although there typically is some flexibility designed into the panels to accommodate small surface changes at panel joints. However, the designed support for these crossings must be straight and solid.

Crossing Component Costs

The purchase price of prefabricated concrete crossing panels (without flangeway fillers included) is about \$115–\$135 per foot of crossing, as measured along the track. Flangeway fillers cost about \$40–\$50 per track foot. For crossing designs that include rubber fillers, the cost of panels and fillers would be covered by one price.

Shipping costs depend mainly on the crossing size and distance from the factory to the installation site. The typical cost to ship materials for a 32 ft crossing would be \$500–\$1000. For budgeting purposes, estimate 20 percent of the cost of the panels, not including rubber flangeway fillers. If the panels include flangeway fillers, use an estimate of 15 percent.

3 Acquisition

Design Alternatives and Sources

Several manufacturers now make prefabricated concrete panel crossings, each with their own design details and specifications. There currently is no industry standard for this type of product. Furthermore, manufacturers, designs, and options continue to change, so the buyer must research both the products and producers before placing an order.

In selecting a panel and crossing design, the following are important aspects to consider:

- strength of panels
- 28-day strength of the concrete used in the panels
- amount, type, and placement of reinforcement
- panel fastening methods
- flangeway design or provision for rubber flangeway fillers
- protection of concrete and reinforcement against corrosion and chemical attack from ice-melting compounds.
- availability of detailed and accurate information on the product
- material quality
- adherence to stated dimensional tolerances and design properties
- consistency of quality
- availability within required time frame
- manufacturer's ability to correctly fulfill order specifications.

Considering the total cost of a crossing installation, of which labor constitutes the largest portion, it is suggested that high-quality panels may be worth the extra costs by assuring durability, good fit, and a smooth riding surface.

A listing of manufacturers of concrete panel crossings can be obtained from the Railway Engineering-Maintenance Suppliers Association, Falls Church, VA (703-241-8514). Two industry yearbooks also carry information on concrete crossings: *Track Yearbook* (Trade Press Publishing, Milwaukee, WI [414-228-7701]) and the *Track Buyer's Guide* (Simmons-Boardman, New York [212-620-7200]). Track maintenance supervisors from the connecting commercial railroads and personnel from the railroad division (or railroad crossing office) of state departments of transportation are good sources to consult for experience with current and past products.

Specifying Panel Length

Manufacturers typically have at least three standard lengths available, usually ranging from about 8 ft to 20 ft each. Using fewer of the longer panels, especially in longer crossings where a lagless installation is used, will require fewer joints and connections in the crossing. However, if long panels are chosen, panel weight should be checked to ensure that onsite lifting capability is available for handling and installation.

One possible disadvantage of longer panels may be the greater difficulty of handling and transporting them. Another issue involves long-term crossing performance: joints between panels provide some allowance for differential vertical movement under load or in case crossing support is not exactly flat. Therefore, a larger number of short panels would provide more allowance for small amounts of bending or settlement throughout the length of the crossing. A discussion of site characteristics with the crossing manufacturer will help in evaluating the cracking risk associated with using longer panels versus any potential advantages.

Another issue to be considered in specifying panel length is the location of joints in relationship to traffic flows. Panel lengths should be selected to avoid placing joints in or near the normal tire paths along the road.

Choosing Between Lagged and Lagless Installation

As with other construction options, there are adherents to both types of installation methods for concrete panel crossings. Of the two largest western railroads, one uses lagged installation and the other uses lagless installation. One large eastern railroad uses both methods without a clear preference stated for either; this company's personnel suggest that differences in the design and manufacture of the crossing itself, as well as the quality of track rebuilding and road-approach reconstruction, are the most important factors determining the success of crossing installation and performance—not panel-fastening methods.

The popularity of lagless installation is growing, however, and this success may have prompted improvements in lagged installation techniques. Previously, panels in some lagged installations had been observed to crack only a matter of months after installation track with heavy train traffic. This cracking was attributed to tight fastening of the relatively inflexible concrete panels to the more flexible track, the latter of which normally deflects somewhat under the train's wheel loads. The track could take such deflections with no negative effect, but the panels could not. In these earlier installations, the crossing panels were lagged in place much like standard timber crossings, with lag screws attached perhaps at every other tie. Meanwhile, lagless installations showed that concrete crossing panels can, to a great extent, depend on their own weight to stay in place. Following this concept, more recent lagged designs call for attachment at fewer ties, allowing the track more allowance to deflect under load independent of the crossing panels.

With either type of installation, the ties must be spaced so that all panel joints and the outer edges of the end panels are supported at the center of a tie. In a lagged installation, ties also must be spaced so that lag holes are centered over a tie.

Generally, lagless installation is recommended for prefabricated concrete crossings. However, if a lagged installation is preferred, it is suggested that the user choose a design that requires only two lag screws at each end of a panel.

Field Panel Clamping Rods

Figure 3 shows a most useful clamping device, designed and supplied by RFR Industries, for lagless installation of concrete panel crossings. These specially designed clamping rods hold the field side panels (and rubber filler) tightly against the rail until the road approaches can be reconstructed, ensuring a proper seal at the rail when the crossing is completed. One of these clamping rods is shown in Figure 3 as initially installed, with the handle (on the right) turned down against the ballast, ready for field panel placement. It employs a standard rail anchor to hook it

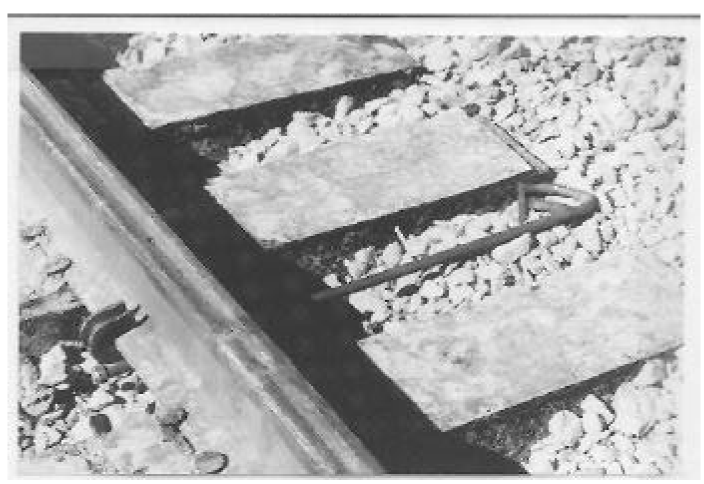

Figure 3. Field panel clamping rod in initial position.

around the rail base. A collar (not visible in the photo) is welded to the bottom of the anchor, which allows the rod to be rotated into the clamping position once the field panels are in place.

The right edge of the field panels in Figure 4 shows four clamping rods in their final position. After the field panels are placed they are pushed against the rail with the edge of a backhoe bucket, or manually, with lining bars. With inward pressure on the panels (against the rail), lining bars are used to rotate the "D" shaped handles of the clamping rods upward against the outer face of the panels. These clamping devices are left in place when the road approaches are completed.

Specifying Crossing Components

Manufacturers often can provide a planning form that lists most of the common specifications and options the buyer must address to match crossing panels to the crossing location. However, it is strongly recommended that the buyer research the options available and the requirements of the crossing location to ensure that the components ordered (1) will match the needs of the crossing location and (2) represent the most appropriate choice of available options.

Below is a list of dimensions, track data, and typical options that should be clearly specified in the crossing order:

1. **Crossing Length**. State the total required length of the crossing surface

Figure 4. Finished crossing with field panel clamping rods in place.

when all the panels are assembled in place. It is recommended that the crossing extend 2 ft past each edge of the road (including any shoulder width). Additional length will be required for a road crossing the track at an angle other than 90 degrees to assure at least a 2 ft extension at all four corners of the crossing.

2. **Panel Length**. State the length of each panel set (2 field, 1 gage) and the number of sets required to span the crossing.
3. **Number of Tracks**. Specify the number of adjacent tracks the road must cross.
4. **Track Alignment**. Specify tangent or curved track. If curved, specify the degree of curvature.
5. **Rail Size**. Specify the weight and section.
6. **Tie Plate Length**. Specify in inches.
7. **Rail Anchors To Be Used Through Crossing**. State yes or no.
8. **Tie Type**. Specify wood or concrete. Wood ties are recommended for road crossing reconstruction. If a location should require concrete ties, special crossing ties must be ordered, because the standard concrete track tie will not work with concrete panel crossings.
9. **Tie Length In Crossing**. Standard crossing width is 10 ft. Use of 10 ft ties is recommended as they will provide full support beneath the field-side panels. Concrete crossing ties are made standard to a 10-ft length, but refer to item 8 above before specifying concrete ties.
10. **Rail/Plate Fasteners.** Specify screw spikes or standard cut spikes.
11. **Crossing Pads To Be Supplied**. State yes or no. These pads are 3/16-in. to 1/4-in.-thick hard rubber pads that cover the tie (three pieces per tie corresponding to gage and field sides). They provide a cushion for the crossing panels. Manufacturers sometimes automatically provide these with each crossing, but in all cases use of these pads is strongly recommended and should be specified in the order.
12. **Number of Ties**. Using the tie spacing recommended by the manufacturer or otherwise required at the location, list the number of ties that will be under the full length of the panels. Include the ties at each edge of the crossing. This number will determine the number of tie pads needed.
13. **Crossing Insulation**. Specify whether active warning devices (flashing lights, gates) protect a crossing. If no warning devices are installed, no electrical insulation is required.
14. **Crossing Installation Method**. Specify lagged or lagless installation. (See “Choosing Between Lagged and Lagless Installation” above).
15. **Panel End Restraints**. If lagless installation is chosen, end restraints will be needed. As noted previously, end restraints are not needed for lagged installation.

16. **Panel Lifting System**. Use of panels with cast-in rings and custom-designed lifting hardware is recommended when available. These systems can simplify handling procedures and minimize panel damage during installation.
17. **Preformed Flangeway Filler**. Use of these fillers is recommended. Some panel designs incorporate a rubber filler. If the crossing manufacturer does not supply rubber fillers, the user should seek manufacturer guidance to select and order properly fitting fillers.
18. **End Panel Bevels**. State yes or no. Some manufacturers offer this option. Most lagless installations require a full-height (unbeveled) end to allow proper installation of end restraints. If lagged installation is specified, beveled end panels are recommended to provide some protection in cases of equipment unintentionally dragging from a car or engine (long end air hoses, broken load -securing chains, etc.).
19. **Other Requirements**. Specify that the crossing components meet all geometric and material criteria and tolerances provided in supplier's current specification.

Procurement Documents

Procurement documents for buying concrete panel crossings are to be prepared the same as for buying any manufactured track material. The description on the front page of the requisition or purchase order might be worded: "(Total length in feet) Concrete Panel Crossing (Style, Type), Per Attached Specifications." Written specifications covering all items addressed in the previous section should be attached. The specifications must also include any design-specific characteristics discussed with the manufacturer.

Even if certain items such as tie pads or connecting hardware are stated by the manufacturer as automatically included with the crossing, these items should still be listed separately on the specifications page. This detailed list serves as a reminder for the manufacturer and it serves as a checklist when the order is received. Most importantly, the list documents for both parties exactly what is to be received in return for the purchase price.

Before listing a delivery date on a purchase order, have the manufacturer's representative check with the production plant to verify that the desired date can be met.

Procurement Scheduling

It is recommended that the delivery date agreed to with the manufacturer be at least 4 to 6 weeks before the crossing replacement is scheduled. This lead time will provide a reasonable allowance for some delay in delivery as well as time to replace any missing or damaged crossing components. Considering the potential problems for road and rail traffic on the installation that could result from delays during construction, it is very important to verify that everything on order has been received, is the right type, and is in good condition.

4 Post Acquisition

Project Plan and Traffic Coordination

All installation offices involved in road traffic movement, railroad operations, military exercises, and mobilization planning must be consulted when planning the crossing replacement. All affected offices must know when the road will be closed, what the detour arrangements will be (temporary run-around and crossing at the site, or complete rerouting, for example), and when the railroad traffic must be stopped at the crossing location.

Installation rules and policies relating to crossing-replacement work must be checked and followed. These will encompass such activities as the posting of detour signs, setting up barricades, and assigning personnel to direct traffic, for example.

It is important to have a contingency plan to handle unexpected subgrade conditions found while removing the old track and excavating the roadbed. Any adverse subgrade conditions must be properly remedied before proceeding with track reconstruction and crossing installation.

Site Preparation

As noted previously, all track and road approaches associated with a crossing are usually rebuilt as part of the project. The track and drainage should be rebuilt as specified in Chapter 6 of *Railroad Design and Rehabilitation* (TM 5-850-2). For concrete panel crossings there cannot be any rail joints within the crossing limits. It is also important to keep in mind that all concrete panels must be solidly supported by the track and ballast; if not, the panels will crack or break long before their expected service life has been achieved.

Before rebuilding the track structure, mark the centerline for the crossing—usually the center of the road—on both sides of the track. Lines scored on the face of the road approach excavation will suffice, or temporary stakes can be driven. Ties should then be placed on the ballast and their spacing and location measured using the crossing centerline as a reference. Begin at the center of the crossing and work outward in both directions. Make sure that a tie is centered under the planned location of every panel joint. For lagged installations, a tie should be centered under the planned location of lag holes, too. Recheck tie spacing before spiking in case ties have shifted while putting the plates and rail in place.

When surfacing the track, pull it to within about 1 in. of final elevation, then have an installation locomotive run back and forth over the location about 10 times to provide for some initial ballast settlement. Then put the final line and surface on the track. Whether on a tangent or curve, the track must be precisely aligned and surfaced to obtain proper fit of the panels and to otherwise avoid difficulties and delays during crossing installation.

Installation of the New Crossing

The crossing manufacturer's specific installation instructions must be followed carefully. However, for the information of Army railroad maintenance personnel, the procedure outlined below will generally apply to installing concrete panel crossings. The procedure may also provide some useful ideas not included with the manufacturer's instructions, such as the recommended step of filling lifting-ring and panel-connection pockets when installation is finished.

First, sweep the rail base and tops of ties clean to ensure that nothing will interfere with the fit of the panels and rubber flangeway fillers. Then nail the rubber pads on top of the ties with 1 in. galvanized roofing nails. (If concrete ties are required for the crossing, apply construction adhesive to the tops with a caulking gun to hold the tie pads in place). If field panel clamps were purchased, they should be hooked around the rail base at the desired intervals at this time, with their handles turned down (to the side) against the ballast.

If the chosen design uses bolts in the panel connections, it is strongly recommended that the threaded inserts and bolt threads be well cleaned before installation. If the threaded inserts are rusted, a thread chase matching the bolt threads should be obtained; the insert threads should be restored using the chase and light oil, and then wiped clean. Whether initially clean or not, it is also recommended that the insert threads be coated with an anti-seize compound just before installing the bolts. (Anti-sieze compound is commonly available from auto parts dealers, farm implement dealers, and machine shop supply houses).

Use the manufacturer-recommended lifting devices to lift the panels and lower them into place. Before placing each panel, check the bottom surface to see that it is clean and free of any interfering objects or projections. Begin placing panels at the center of the crossing and work outward. Use a lining bar to move a panel into its exact final position before placing another panel next to it. There should be full contact at joining edges. Field-side rubber inserts, if not integral with the panel, should be assembled to full length and placed against the rail web before placing the field panels.

Figure 5 shows a gage panel being placed. Note how using the special lifting devices hooked into the recessed lifting rings produces a level, well-balanced load, making panel positioning easy and reducing the likelihood of panel damage during installation. Figure 6 shows a field panel being eased into its final position. Here, the special lifting device is clearly visible, along with the way it fastens to the recessed lifting rings. Note also the rubber pads on the tops of the ties. Both photos also show the use of cables to lift and position the panels—a much safer option than chains.

If using lagged installation, lag each panel in place before placing the next one. Use lining bars to hold the panel tight in its proper position during tie-drilling and lagging. If using lagless installation, connect the panels together after all have

Figure 5. Placing a gage panel.

Figure 6. Placing a field panel.

been placed, then tighten the field panel clamps (if used). Install the end restraint devices and gage flangeway inserts (if the removable type was ordered). Figure 4 (see Chapter 3) shows a finished lagless crossing with end restraints and field panel clamping rods in place.

Although not typically addressed by the manufacturers, it is strongly recommended that the recessed lifting-ring pockets (and panel-connection pockets, if any) be filled with a removable joint-sealing material after installation is complete. If not filled, these pockets hold water, debris, and the residues of ice-melting compounds used on the road. These substances create a highly corrosive environment that will make any metal hardware (such as lifting rings) unusable in the future. Unusable lifting rings would be a problem if it becomes necessary to remove the panels, as for track maintenance. Neither coated nor galvanized metals should be considered to be properly protected if the pockets are left unsealed. Therefore, before the crossing is opened to vehicle traffic, all lifting-ring and fastener pockets should be cleaned and sealed either with a conventional filler (Fed. Spec. 1401) or silicone concrete pavement joint filler. It is best to fill the pockets only up to about a quarter-inch below the concrete panel surface to minimize disturbance of the filler material by vehicle tires. In any case, all metal parts within the hardware pockets should be fully covered.

Rebuilding Road Approaches

After the crossing panels are installed, it is suggested that some train traffic be run over the crossing before the road approaches are reconstructed. The approaches should be built on a solid base of support to prevent settlement and surface mismatch at the edge of the crossing. To help sustain a smooth road-to-crossing transition in future years, it is suggested that concrete approaches be installed, even if the remainder of the road is asphalt. In any case, a standard pavement joint should be made at the edge of the crossing panels.

Performance Monitoring

Monitoring the performance of the crossing is usually a simple matter of observing how the crossing surface is holding up. Check for any cracks in the panels. Make sure that panel joints remain tight and that a smooth road-to-crossing transition still exists. Rubber flangeway inserts should be checked periodically for wear, and deterioration; the inserts also should be inspected to make sure that they remain properly seated between the rails and concrete panels.

References

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