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MTMC REPORT TE 79-4-37
RAIL AND MOTOR OUTLOADING CAPABILITY STUDY
FORT PICKETT, VIRGINIA

November 1979

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MILITARY TRAFFIC MANAGEMENT COMMAND
TRANSPORTATION ENGINEERING AGENCY
Newport News, Virginia 23606

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EXECUTIVE SUMMARY

1. SCOPE

The Military Traffic Management Command (MTMC) surveyed the rail and motor facilities at Fort Pickett, Virginia, from 2 through 6 April 1979, to determine the installation's outloading capability. All rail facilities in the Fort Pickett vicinity were included in the survey.

2. FINDINGS

The primary finding is that Fort Pickett has the potential capability to support relatively large-scale rail outloading operations. To transport the equipment of the units to be outloaded, 574 railcars would be required, with an estimated composition of 547 flatcars (290 for roadable equipment and 257 for nonroadable equipment) and 27 boxcars.^{1/} Since the installation outloading plans were incomplete and no time frame had been established for unit outloading, the analyses in this report are based on a 3-day outloading operation. During this period, no allowance has been made for incoming equipment, since none is scheduled to arrive.

The Norfolk and Western (N&W) Railroad serves Fort Pickett. The installation has no locomotives or railcars and the N&W provides switching service. Most of the Fort Pickett trackage is in basically good condition, but some does not conform to Class 2 specifications as defined by the Federal Railroad Administration (FRA) Track Safety Standards. The cost estimate for the needed track repair is included in appendix D.

Table 1 shows current and mobilization outloading capabilities (both rail and motor). The current rail outloading capability at Fort Pickett is limited not by the physical attributes of the rail system but by the small work force. Currently, using selected rail outloading sites at Fort Pickett, approximately 191 railcars per day could be outloaded. This outloading rate would meet the requirement to outload the required units within 3 days. The current supply of blocking

^{1/} Since most flatcars are 57 feet long (coupler to coupler), that length is used in this report; to convert to any other length, simply multiply the number of cars by 57 and divide by the desired length.

and bracing materials is inadequate for a 3-day outloading at the rate of 191 railcars per day. However, these materials are readily available locally.

TABLE 1
RAIL AND MOTOR OUTLOADING CAPABILITY

RAIL				
Rate	Number and Type of Railcars (57-ft Length, Coupler to Coupler)			Current Constraints
	Flatcars	Boxcars	Total Outloading	
Daily Current	6	0	6	Small work force
Daily Mobilize	182	9	191	Lack of outload- ing plans and trained blocking and bracing crews.
Plan 4 ^{a/}	182	9	191	ditto
Plan 5 ^{b/}	86	9	95	ditto
MOTOR				
Rate	Number of Trailers at Available Facilities			Current Constraints
	Flats	Van Semi- trailers	Total Outloading	
Daily Current:				Small work force
Concurrent (with rail operation)	2	2	4	
Separate (without rail operation)	4	4	8	
Daily Mobilize:				The probability of obtaining these numbers of flatbed and van semitrailers on a daily basis is remote.
Concurrent (with rail operation)	50	44	94	
Separate (without rail operation)	125	44	169	
^{a/} Recommended plan, outloads required railcars in 3 days and requires an expenditure of \$59,465. ^{b/} Considers only nonroadable equipment.				

The recommended plan, Plan 4, has a yield of 191 railcar loads per 24-hour period. Other options, producing 50, 91, 95 (nonroadable), and 151 railcar loads, are presented in this study, but Plan 4 satisfies the mobilization requirement. Plan 5 yields 95 railcar loads per 24-hour period for the nonroadable equipment only, which can be outloaded in 3 days.

A motor outloading survey of loading ramps and other equipment suitable for loading semitrailers revealed that, although the actual availability of semitrailers cannot be predetermined, the motor outloading capability of Fort Pickett far exceeds the probable supply of available commercial trailers. The most critical shortage is for heavy haulers, of which 35 per day are needed. Of course, if the port of Norfolk is the port of embarkation (POE), the trucks could probably make a 1-day cycle.

3. CONCLUSIONS

- a. Most of the Fort Pickett railroad trackage is in basically good condition, but some maintenance is needed. Most of the trackage conforms to Class 2 specifications, as defined by FRA Track Safety Standards.^{2/} The end ramps are in good condition. The primary constraint limiting the rail outloading capability is the lack of trained blocking and bracing crews and outloading plans.
- b. After the deficiencies noted above have been corrected and on receipt of sufficient railcars to permit full-scale outloading, Fort Pickett could achieve an outloading rate of 191 railcars per 24-hour period. At this rate, both the roadable and nonroadable equipment of the required units could be outloaded in 3 days.
- c. Costs for track repairs to the post main, the wye, and tracks 4, 5, 6, 7, and 8 total \$59,465 for the recommended outloading plan. However, maintenance is required periodically at all locations to insure continued effectiveness.

^{2/} AR 420-72, 24 March 1976, Surfaced Areas, Railroads, and Associated Structures, para 3-15a, states that track on military installations will be maintained to the minimum track safety standards required for Class 2 track, as outlined in the current Department of Transportation Federal Railway Administration Track Safety Standards (appendix A).

- d. Empty railcars (dedicated train lengths) destined for Fort Pickett should be positioned, in trainloading sequence, in the classification yard at Crewe.
- e. The N&W representative did not express any reservation regarding the outloading of Fort Pickett units concurrently with other commercial demands. However, Fort Pickett transportation personnel should coordinate planning of impending outloading operations with the N&W representatives at the earliest possible date.
- f. A maximum of two 120-ton locomotives are required on post at any one time during the day, with a total of 17 locomotive hours spent each day.
- g. For administrative-type moves, when leadtime is plentiful and costs must be considered, special-purpose railcars (such as bilevel autorack, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) cars) are more cost effective than the standard types and should be used to the extent they are available.
- h. For mobilization moves, when time is more critical than cost, the use of special-purpose railcars may not be possible because of the short leadtime and relatively short supply of these high-demand cars.
- i. For concurrent rail/motor operations, 50 flatbed and 44 van semitrailers could be loaded per 10-hour day (for daylight operations only), and for separate operations, 125 flatbed and 44 van semitrailers could be loaded during the same period. This capability far exceeds the likely available supply of flatbed semitrailers.
- j. The maximum degree of curvature of the railroad tracks at Fort Pickett is 14 degrees. Consequently, any known length of railcar can be used on the installation.

4. RECOMMENDATIONS

- a. Undertake those items listed in section II, paragraph D5, "Physical Improvements and Additions." These improvements will provide a rail system capability of 191 railcars per 24-hour day and will perpetuate an effective rail system at a cost of \$59,465.

- b. Prepare a detailed unit outloading plan, using the simulation in appendix B as an example, that specifies unit assignments at loadout sites and movement functions.
- c. Coordinate rail outloading plans with the N&W representatives at the earliest possible date.
- d. Continue routine rail facility maintenance to insure an effective rail system.
- e. Provide advance training for blocking and bracing crews as soon as possible after mobilization.
- f. Station road guards at all railroad crossings during outloading operations, and provide all train crewmen with walkie-talkies to insure a safer and more effective operation.
- g. Use special-purpose railcars (such as bilevel autoracks for small vehicles, TOFC cars for semitrailers and vans, and COFC cars for MILVANS) for administrative-type moves and, as available, for mobilization moves.
- h. Coordinate with MTMC any removal of railroad track that will be included in the mobilization outloading plan.
- i. Construct any new track with a maximum degree of curvature of 12 degrees.

I. INTRODUCTION

An onsite rail and motor outloading study of Fort Pickett, Virginia (fig 1), was conducted by the Military Traffic Management Command Transportation Engineering Agency, Newport News, Virginia, during the period 2 through 6 April 1979. The principal objective of the study was to determine the capability of the Fort Pickett rail system to support the deployment of units mobilized there. Another objective was to identify any physical improvement, as well as any suitable commercial rail facilities within a 25-mile radius, that would significantly increase the current capability. At the present time the rail outloading capability for mobilization of Fort Pickett is limited by the lack of outloading plans and trained blocking and bracing crews. The analyses in this study showed that, if these deficiencies were corrected, existing rail trackage and facilities could support an outloading rate of 191 railcars (daily mobilize) per 24-hour day. This study considers options that could produce 50, 91, 95 (nonroadable), 151, or 191 railcars per 24-hour period, but recommends the one with the 191 yield. At this rate, the units could be outloaded in approximately 3 days.

Fort Pickett is served by the Norfolk and Western (N&W) Railroad, which has a large classification yard in Crewe, 10 miles away. The N&W has no facilities in the vicinity that the US Army could use for outloading. Motor outloading capability is also considered.

Findings and recommendations in this report are based on analysis of data obtained during the field study and on other pertinent information relating to installation activities at that time. Any problems incurred in implementing the recommendations should be referred to MTMC TEA for resolution.

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Military Traffic Management Command
Transportation Engineering Agency
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PO Box 6276
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Telephone: AUTOVON 927-4641

County boundary: none

Navigable waterway or shoreline



Prepared by U. S. Geological Survey for the Office of
Policy and Program Development, Federal Railroad
Administration, United States Department of Transportation

1976

Figure 1. Fort Pickett and vicinity.

Symbol	Feature
—	State boundary
- - -	County boundary
—	Waterway
- - -	Shoreline
—	Other

II. ANALYSIS OF FORT PICKETT RAIL OUTLOADING FACILITIES

A. GENERAL

Discussions with personnel of the Transportation Office at Fort Pickett revealed that large-scale rail operations have not occurred at the post in recent years. Factual data about locomotive operating times and switching operations were gathered from other studies.

B. RAIL FACILITY DESCRIPTION

Fort Pickett has about 38,000 feet of trackage (fig 2). It also has two end-loading ramps and 16 positions where a forklift can load a boxcar through the door of a warehouse across a dock. Most of the trackage is in good, usable condition and conforms to Class 2 standards, as defined by the Track Safety Standards of the Federal Railroad Administration. However, isolated cases of nonconformity cause some of the tracks to be classified below Class 2. Also, some maintenance is needed at various locations for problems such as weeds, rotten ties, poor drainage, and contaminated ballast. The trackage is described in table 2. The following discussion describes in detail the recommended loading sites, listed in descending order of preference:

Track 3 (ramp 3) is a 57-railcar spur with a timber/dirt end-loading ramp (fig 3).

Track 7 (ramp 7) is a 57-railcar spur with a timber/dirt end-loading ramp (fig 4). Tracks 3 and 7 are well suited for outloading tracked vehicles, since they are located adjacent to the tank trails. These tracks share an excellent staging area.

Track 4 is a 50-railcar spur (fig 5), the timber and earth ramp at the end of this track has deteriorated and will have to be removed so that a portable timber ramp can be used there. It was not considered in this report.

Track 6 is a 35-railcar spur. This track is in good condition except for being out of gage at one place; its being out of gage causes the entire track to be classified below Class 2. A portable timber ramp will be used for loading.

Track 5 is a 38-railcar spur. The track is in good condition except for being out of gage at one place. There is a pile of dirt at the end

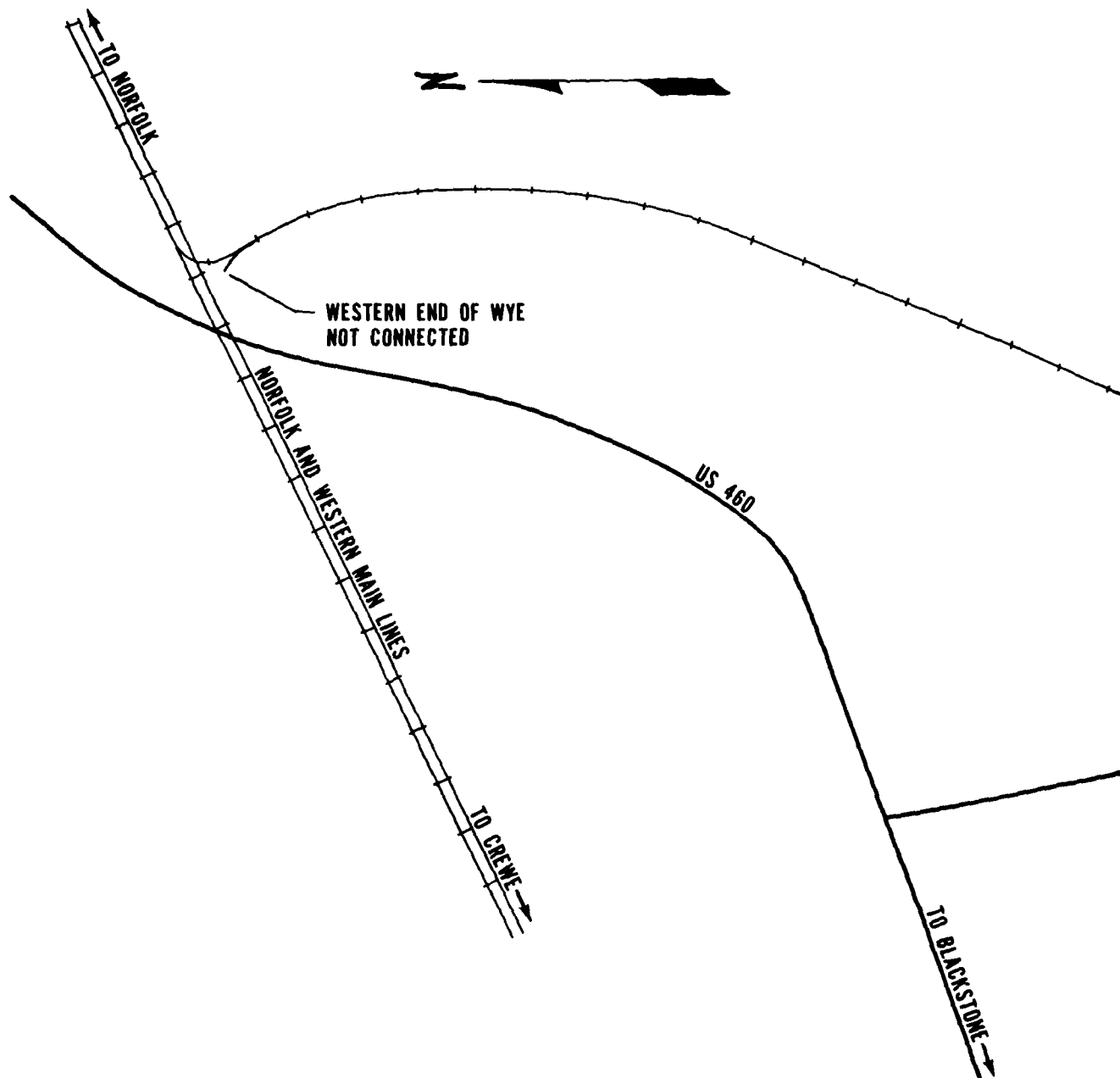
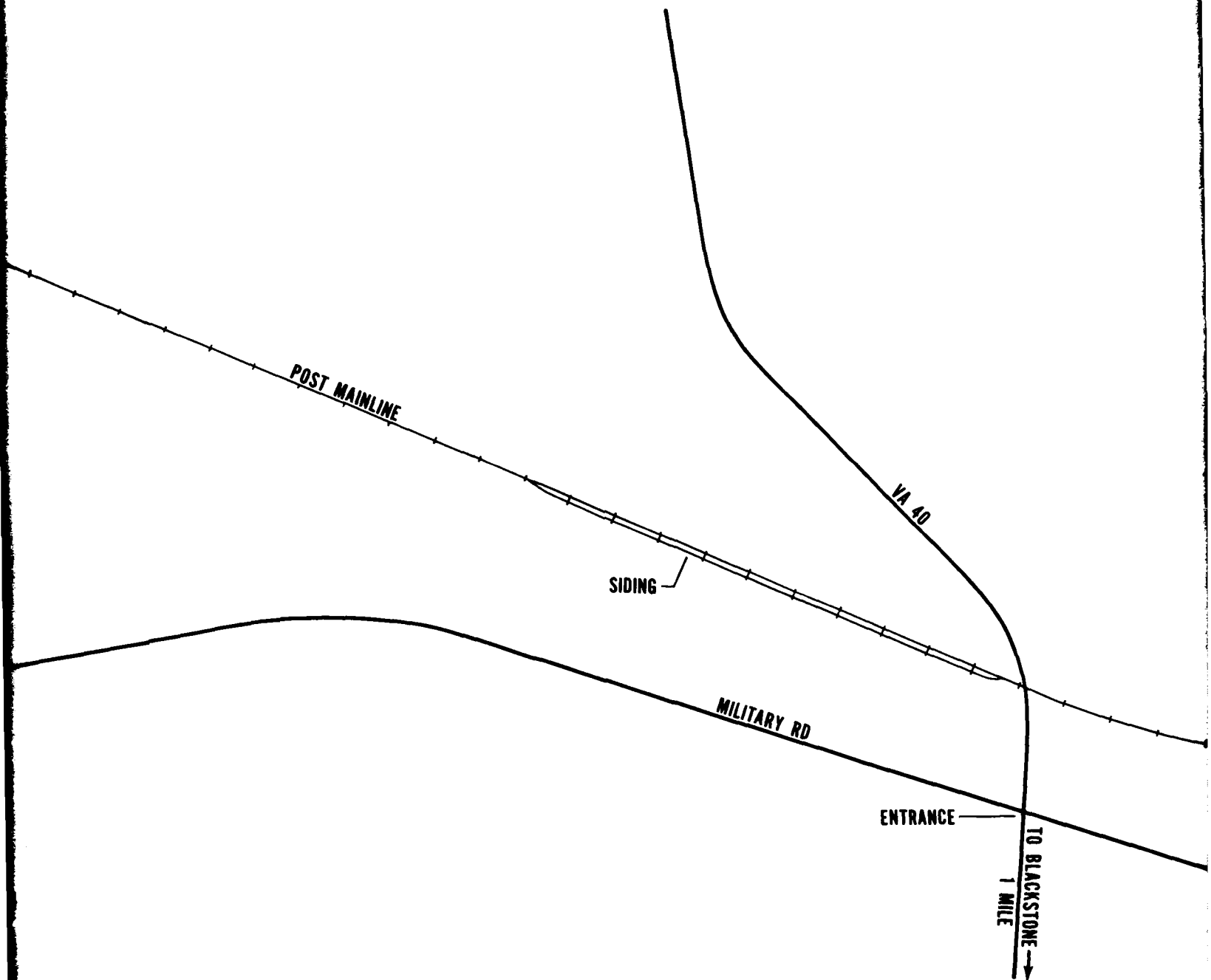
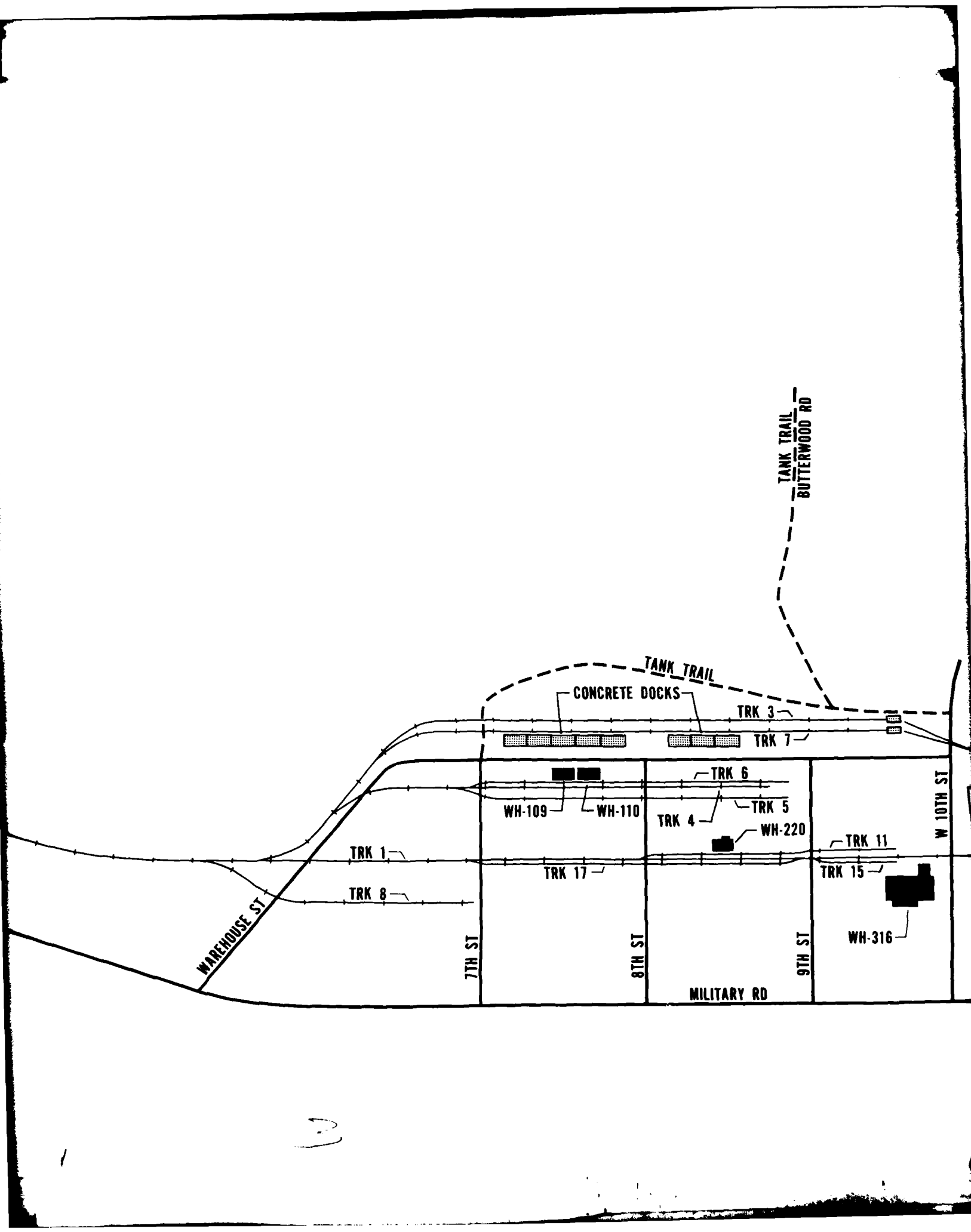


Figure 2. Fort Pickett rail system.







END RAMPS

W 10TH ST

THIS TRACK IS TOTALLY
ABANDONED SOUTH OF
10TH ST

TABLE 2
FORT PICKETT RAIL OUTLOADING FACILITIES

Track and Figure Number	Ramp/Dock	Lighting	Surface Conditions	Staging Area	Access Availability	Railcar Capacity		Track Condition*	Priority	
						Feet	Number of Cars			
1	None	None	Good	Fair	Excellent	4,600	80	Below Class 2		Track is on asphalt at 1st Street. Track is to be done south of 1st Street and is not complete. This report rated cross switch for 1st Street. Weeded between 9th Streets and contains near Warehouse in track at Street 2-1/2 wide. Dirt track near 1st Street.
3 (fig 3)	Timber/dirt end ramp	None	Good	Excellent	Excellent	3,300	57	Class 2 or better	1 of 6	Track is well suited for outloading vehicles.
4 (fig 4)	None	None	Good	Good	Excellent	2,900	50	Class 2 or better	3 of 6	Deteriorated switch at 1st Street. Weeded between 9th Streets. ramp was at the track, but complete dirt useless.
5	None	None	Good	Good	Excellent	2,200	38	Below Class 2	5 of 6	Track is on near 7th Street (55-1/2 inches). Weeded between 9th and 10th Streets.
6	None	None	Good	Good	Excellent	2,000	35	Below Class 2	4 of 6	Track is on near Warehouse (55-1/2 inches) between 8th and 9th Streets.
7 (fig 4)	Timber/dirt end ramp and concrete docks	None	Good	Excellent	Excellent	3,300	57	Below Class 2	2 of 6	Track is on 7th Street (55-1/2 inches). Weeded between 9th and 10th Streets. Warehouses well suited for outloading since it is close to the Warehouses. the track is well suited for outloading.
8 (fig 6)	None	None	Excellent paved	Good	Excellent	2,400	42	Class 2 or better	6 of 6	Crossties with coal but are the solid. Weeded between 9th and 10th Streets. Track has a deviation but this is for Class 2.
11	None	None	Good	Fair	Excellent	1,800	31	Below Class 2		Dirt covered near 9th Street. Contaminated near Warehouse. Weeds along 9th Street. Deteriorated at switch 1st Street.
15	None	None	Good	Fair	Excellent	500	8	Class 2 or better		Concrete paved track is in place to be used but track is for appreciable capability.
17	None	None	Good	Fair	Excellent	1,900	33	Class 2 or better		Switch is on south of 1st Street. Weeded between 9th and 10th Streets.

Notes

Track is covered with asphalt at 10th Street. Track is totally abandoned south of 10th Street and that portion is not considered in this report. Deteriorated crossties at switch for track 11. Weeded between 8th and 9th Streets. Weeded and contaminated ballast near Warehouse 316. Gap in track at Warehouse Street 2-1/2 inches wide. Dirt covering track near 9th Street.

Track is well suited for outloading tracked vehicles.

Deteriorated ties at switch at Warehouse 110. Weeded between 8th and 9th Streets. An end ramp was at the end of the track, but it is in complete disrepair and useless.

Track is out of gage near 7th Street (58 inches). weeded between 8th and 9th Streets.

Track is out of gage near Warehouse 109 (55-1/2 inches). Weeded between 8th and 9th Streets.

Track is out of gage at 7th Street (55-3/4 inches). Weeded along warehouses. Track is well suited for outloading tracked vehicles since it is located adjacent to the tank trails. Warehouses located along the track have concrete docks.

Crossties are covered with coal and gravel but are thought to be solid. Weeded at southern and northern end. Track has a 2-1/2-inch deviation in alignment, but this is acceptable for Class 2.

Dirt covering track near 9th Street. Dirt contaminated ballast near Warehouse 311. Weeds along warehouses. Deteriorated crossties at switch for Track 1.

Concrete pad at end of track is an excellent place to put end ramp but track is too short for appreciable capability.

Switch is inoperable on south side of track. Weeded between 8th and 9th Streets. Bad drain-

11	None	None	Good	Fair	Excellent	1,800	31	Below Class 2		Dirt cover near 9th contaminat near Wareh Weeds along Deteriorat at switch
15	None	None	Good	Fair	Excellent	500	8	Class 2 or better		Concrete track is a place to but track for apprec capability
17	None	None	Good	Fair	Excellent	1,900	33	Class 2 or better		Switch is on south Weeded bet 9th Street age near W
Siding	None	None	Fair	Poor	Poor	2,400	42	Class 2 or better		
Post Main	None	None	Fair	Poor	Poor	11,000	192	Class 2 or better		
Wye	None	None	Not applicable	Not applicable	Not applicable	600	10	Below Class 2		Track is o at dirt ro (58 inches inches). of wye has

*Indicates track condition based on a general inspection, not a detailed inspection, of all track components, which might result in classification of the track.

3

Deteriorated crossties
at switch for Track 1.

Concrete pad at end of
track is an excellent
place to put end ramp
but track is too short
for appreciable
capability.

Switch is inoperable
on south side of track.
Needed between 8th and
9th Streets. Bad drain-
age near Warehouse 220.

Track is out of gage
at dirt road crossing
(58 inches and 57-3/4
inches). Western end
of wye has been removed.

result in a lower

of the track that will have to be moved before the needed portable timber ramp can be placed.

Track 8 is a 42-railcar spur (fig 6). This track does not need an end-loading ramp, since boxcars will be loaded there.



Figure 3. Track 3 and ramp 3.



Figure 4. Track 7 and ramp 7.



Figure 5. Track 4.



Figure 6. Track 8

C. CURRENT PROCEDURES

Fort Pickett is served by the N&W railroad and has no rail crew or locomotives. Currently, switching is provided as needed by the N&W railroad. Very little track maintenance has been done in past years. All tracked vehicles are loaded/unloaded at tracks 3 and 7 because they are beside the tank trails. Rail operations averaged only about one car per month in 1978. No large-scale moves have occurred in recent years. Currently, no rail outloading plans have been developed by Fort Pickett personnel.

D. RAIL SYSTEM ANALYSIS

1. Current Outloading Capability

Current rail outloading capability at Fort Pickett is limited not by the physical attributes of the rail system but by the small work force. Currently, using only those rail outloading sites that the small work force can handle, six railcars per day can be out-loaded. This capability far exceeds the current outloading requirement. However; the current supply of blocking and bracing materials is much less than the amount required to out-load the units to be mobilized.

2. Rail Outloading Analysis

A complex system structure can be viewed as a series of interconnected subsystems. The limiting subsystem within the system establishes the maximum outloading capability. Therefore, in ascertaining the maximum rail outloading capability of Fort Pickett, the following subsystems separation was used:

a. Commercial Service Capabilities

Commercial service capabilities present no problem to Fort Pickett. The common carrier serving the post is the N&W and its operation in the vicinity of Fort Pickett is well organized. The N&W has double tracks running by the post and is very heavily traveled. Generally, loaded coal trains going to Norfolk use one track, and the empties return on the other track. Since the N&W has a large yard at Crewe (fig 7), 10 miles away, rail support for the outloading operation should not be a major problem.

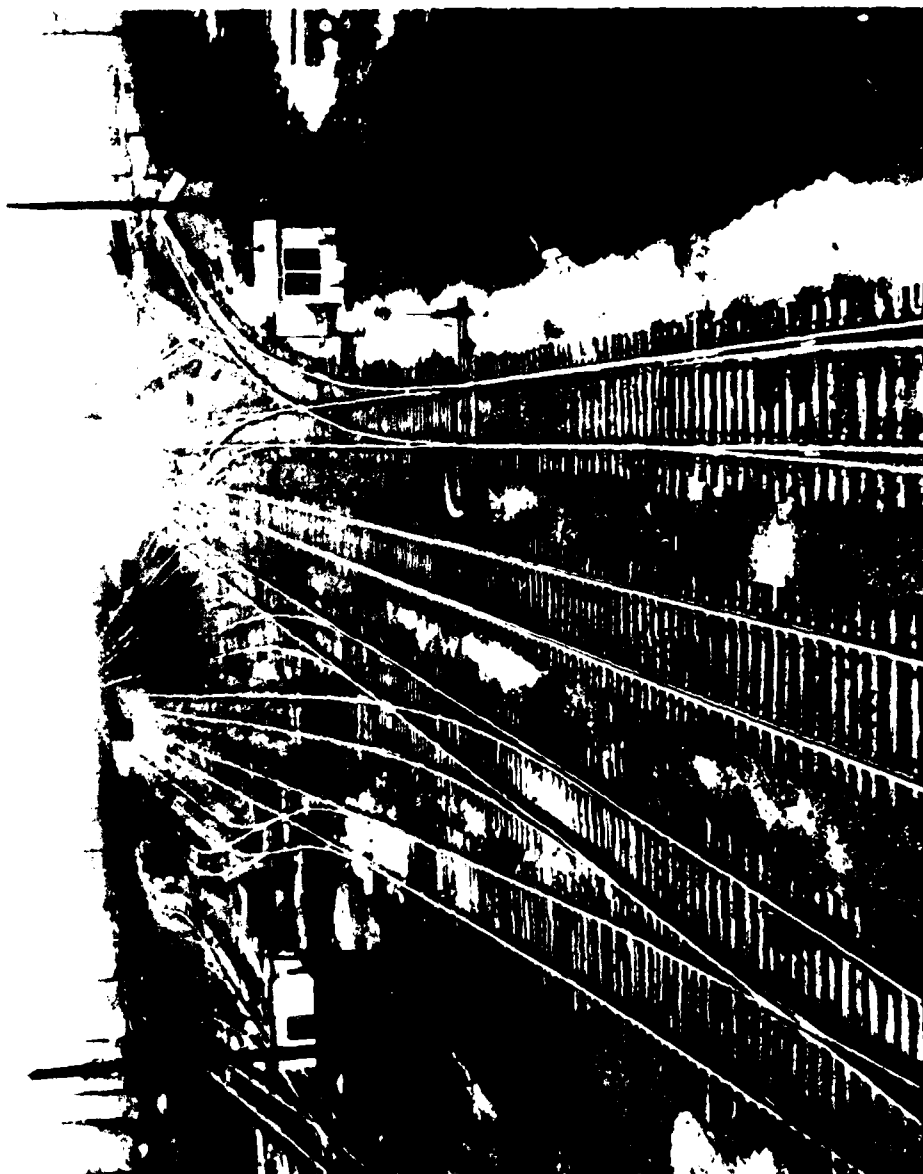


Figure 7. N&W classification yard at Crewe.

b. Moving to and Loading on Railcars at a Particular Site

The movement of cargo to loading sites is relatively quick and efficient since most of the equipment is self-propelled and access is along good, paved roads. Traffic patterns and traffic control would have to be set up, but such measures should be standard for full-scale outloading operations. Staging areas near the outloading sites are adequate, but queuing will block some streets. Recent field tests, during loading operations, revealed that vehicles move along the flatcars at an average speed of 1 mile per hour, with only one vehicle moving on a railcar at any one time. The longest string of empty flatcars used by the recommended outloading plan, assuming 57-foot car lengths (coupler to coupler), was the 43-car string on tracks 3 and 7. Using that figure, the first vehicle would reach the end of the last car 28 minutes after driving up the ramp; then, blocking and bracing could begin. Loading time is insignificant in comparison with blocking and bracing time (table 3). Therefore, moving to and loading on the railcars is not the limiting subsystem. However, driving wheeled vehicles on flatcars "circus style" depends on the use of bridgeplates to span the gap between the cars. According to the plan employed in our analysis, 177 sets of bridgeplates are required for simultaneous loading at all sites after completion of tracked vehicle loadings; wheeled vehicles will be loaded at all loading sites.

c. Blocking, Bracing, and Safety Inspections

Blocking, bracing, and safety inspection times are difficult to project. They depend on a number of variables such as:

- (1) Crew size and experience
- (2) Extent of the safety inspection
- (3) Documentation
- (4) Availability of blocking and bracing material and materials-handling equipment (MHE)

During REFORGER 76, the establishment of a 5-1/2- to 7-hour time limit for loading and blocking and bracing at a loading site, as a reasonable goal for crews, was based on experience and actual field tests of circus-style loadings. In addition, discussions with the blocking and bracing

TABLE 3
TIMES REQUIRED TO PERFORM VARIOUS LOADING FUNCTIONS

Action	Type Vehicle or Item Being Loaded	How Loaded	Time Required Min-Sec	Considerations
Vehicles Driving on Bilevel Railcars (89-ft long)	Jeep	Own power	1'-00" per Railcar Length	Average of 5 timings
Vehicles Driving on Bilevel Railcars (89-ft long)	1-1/4-Ton Pickup	Own power	1'-03" per Railcar Length	Average of 6 timings
Vehicles Driving on Bilevel Railcars (89-ft long)	Cama Goat	Own power	1'-32" per Railcar Length	Average of 8 timings
Average Total Time to Load, Tiedown Vehicles on Bilevel Railcar, Complete	The three types above plus 3/4-ton trucks, mixed	Own power	34'-00" per Railcar	Average number of Bilevels loaded in string of cars - 15
Truck Tractor Backing Semitrailers on String of 89-ft TOFC Railcars	Semitrailers	Truck tractor	0'-42" per Railcar Length	Average number of TOFC cars in string --11, 2 trailers per car
Average Total Time to Load and Secure Semi-trailer to Hitch on TOFC Railcar	Semitrailers	Truck tractor	10'-00" per Semi-trailer	Average number of TOFC cars in string --11, 2 trailers per car
2-1/2-Ton Trucks Circus Loading on 60-ft flats	2-1/2-Ton Trucks	Own power	30"-45" per Railcar Length	Average of several timings
Total Time to Circus Load 11 60-ft Flats With 2-1/2-Ton Trucks, 2 per car (load only)	2-1/2-Ton Trucks	Own power	35'-00" per 11 60-ft Cars	
Average Time for Rough Terrain Forklift Truck to Pick Standard-Size Containers (6-ft Wide, 8-ft Long, 5-ft High Approx) off Flatbed Truck, Transit 75 ft, and Load on Rail Flatcar.	Containers	Forklift	2'-12" per Container	Average of loading of 18 containers

instructors at Fort Eustis, Virginia, indicated that, to avoid wasted man-hours, there should be no more than eight men per crew, regardless of experience.

Currently, Fort Pickett has stockpiled very little blocking and bracing material and few small handtools. These items, which are available locally, can be easily obtained when needed.

d. Interchange of Empty and Loaded Railcars

An efficient interchange of empty and loaded railcars requires careful planning and good coordination with the common carrier. Such an interchange can be established at Fort Pickett because the N&W has good rail access. Also, adequate trackage exists for interchange and storage of railcars.

The existence of N&W rail facilities in Crewe makes it possible to accumulate the number of empty cars required to maintain the operation. The various plans for spotting railcars depend on the type of operation. A place or location must be provided for railcars (1) in empty storage, (2) in loaded storage, and (3) at the loading sites. In general, three balanced or equally divided areas must exist somewhere in the vicinity.

Empty railcars destined for Fort Pickett should be accumulated and classified at Crewe in the N&W classification yard prior to being moved to Fort Pickett. Thus, if the interchange of railcars follows some semblance of the organization presented in the simulation (app B), this subsystem will not limit the rail outloading capabilities of Fort Pickett. The simulation is a detailed description, with respect to time, of the switching sequence for the empty and loaded railcars.

e. Summary

Considering all the subsystems, the lack of trained blocking and bracing crews and outloading plans emerges as the primary factor restraining any large-scale rail outloading operation at Fort Pickett. Therefore, provision of these items is the major prerequisite for a successful operation. The shortage of blocking and bracing materials is not considered important since supplies are readily available in the

area. Another factor that affects rail outloading at Fort Pickett is the destination of the unit material after it leaves the installation. Fort Pickett is within 800 miles of several ports of embarkation; consequently, roadable equipment could be driven to any of these. However, to provide for any contingency, the outloading plan is based on an all-rail move. An option is presented for moving the roadable equipment by highway and the nonroadable equipment by rail.

3. Rail System Outloading Options

The various options for outloading plans are shown in table 4. Six plans for daylight-only loading were developed using various combinations of recommended rail loading sites. All of the tracked vehicles can be outloaded at ramps 3 and 7. This is especially fortunate since the tank trails are near these ramps; therefore, none of the heavy tracked vehicles will have to be driven or hauled across the post to other locations.

TABLE 4
FORT PICKETT RAIL OUTLOADING OPTIONS

Track Number	Item Repair Cost	Railcar Capacity 57-Footer Lengths Coupler to Coupler	Ramp/Dock	Plan 1 50 RCPD	Plan 2 91 RCPD	Plan 3 151 RCPD	Plan 4 191 RCPD	Plan 5 95 RCPD (Nonroadable)
3	None	57	Timber/dirt end ramp	24	43	40	43	43
4	\$1,635	50	None			32	32	
5	\$1,220	38	None				32	
6	\$1,490	35	None			32	32	
7	\$1,670	57	Timber/dirt end ramp and concrete dock	24	43	40	43	43
8	\$1,945	42	None	2	5	7	9	9
Post Main	\$47,405		None	X	X	X	X	X
Wye	\$4,100			X	X	X	X	X
Total Cost				\$55,120	\$55,120	\$58,245	\$59,465	\$55,120

Plan 1 produces 50 railcars per day; it uses tracks 3, 7, and 8 (48 flatcars and 2 boxcars).

Plan 2 produces 91 railcars per day; it uses tracks 3, 7, and 8 (86 flatcars and 5 boxcars).

Plan 3 produces 151 railcars per day; it uses tracks 3, 4, 6, 7, and 8 (144 flatcars and 6 boxcars).

Plan 4, the recommended plan, produces 191 railcars per day.

The simulation (app B) pertains to Plan 4, which outloads the required number of railcars. Tracks 3, 4, 5, 6, 7, and 8 produce 182 flatcars per day, and track 8 produces 9 boxcars per day. Note that none of the main streets are blocked by this plan.

Plan 5, developed for the nonroadable equipment only, produces 95 railcars per day and requires 3 days to complete the outloading. It uses tracks 3 and 7 (86 flatcars) and track 8 (9 boxcars). Note that the total boxcar requirement is the same as that for Plan 4. All of the tracked vehicles are loaded at ramps 3 and 7.

4. Analysis of Railcar Requirements

The expected rail outloading from Fort Pickett during the peak outloading period will be a brigade-size unit.

As shown in table 5, the force will require 574 railcars and can be outloaded in 3 days. The 156 railcar loads of tracked vehicles can be outloaded from tracks 3 and 7 in 3 days at the rate of 52 railcars per day. Of course, wheeled vehicles will load at these tracks too. The 27 boxcars can be outloaded in 3 days at the rate of 9 railcars per day. Therefore, the limiting factor is the time required for the roadable vehicles. In 3 days, the 290 railcars of roadable vehicles can be outloaded at the rate of 97 railcars per day, the 257 railcars of nonroadable vehicles can be outloaded at the rate of 86 railcars per day, and the 27 boxcars can be outloaded at the rate of 9 boxcars per day. Thus, the total required rate is 191 railcars per day for 3 days.

TABLE 5
RAILCAR REQUIREMENTS FOR UNITS TO BE OUTLOADED

Type of Equipment	Number of Railcars			
	57-Foot	80-Ton	Box	Total
Roadable	290		0	290
Nonroadable	255	2	0	257
Tracked	(154)	(2)	0	(156)
Other	(101)		0	(101)
Miscellaneous	0		27	27
Total	545	2	27	574

5. Physical Improvements and Additions

Items listed below are all minimum requirements to provide the recommended outloading rate of 191 railcars per day (Plan 4) using existing trackage.

- a. Upgrade the following tracks for a total cost of \$59,465 (table 4): 4, 5, 6, 7, 8, post main, and the wye. Repair work on these tracks should begin within 1 year.
- b. Acquire the minimum stock of blocking and bracing material needed to supplement the post organic supply for handling all equipment when a rapid deployment of post units is required.
- c. Acquire bridgeplates for volume outloading of wheeled vehicles at Fort Pickett
- d. Acquire sufficient small tools, including powersaws, cable cutters, wrecking bars, cable-tensioning devices, hammers, and so forth, to permit operation of blocking and bracing crews at all outloading sites.
- e. Correct minor deficiencies, listed in table 2, of tracks earmarked for use in Plan 4, and maintain tracks at Class 2 level, as defined by FRA Track Safety Standards.

6. Discussion of Time and Costs

a. Physical Improvements

The cost estimates (app D) assure the rehabilitation of the post railroad track system. However, note that the repair cost of the post main differs between table 4 and appendix D. The cost estimate in appendix D of \$142,214 for repair of the post main includes replacing all crossties on that track. However, it is only necessary to replace every third crosstie instead of every one. Only eight nondeteriorated crossties per 39-foot rail length are required by Class 2 FRA Track Safety Standards. Therefore, the cost for replacing one-third of the deteriorated crossties is \$47,405, as shown in table 4.

b. Load Time Versus Equipment Type

- (1) Mobilization Moves. Two basic types of outloading moves are mobilization and administrative. Since

mobilization moves occur only during national emergencies, speed is paramount. The most rapid method of loading and securing mobile equipment on railcars is circus style.^{3/} For example, if unit integrity is to be maintained, 2-1/2-ton trucks that are to pull trailers drive onto the string of railcars towing their trailers, and the equipment is secured in this configuration. This procedure is fast, but it wastes railcar space. During actual field tests on standard-type railcars, site times for the loading, securing, and inspection of 2-1/2-ton trucks, two per railcar, varied from 5 hours for flatcars with chain tiedowns to 6-1/2 hours for flatcars without chain tiedowns (fig 8 and table 6, items 4 and 5). This was a fast, efficient operation. Other similar operations that could occur in a mobilization-type move, for most Army units, include loading various sizes of containers onto standard-type flatcars by using forklifts. This operation, including loading, securing, and so forth, was accomplished in 5-1/2 hours (table 6, item 9).



Figure 8. Circus-style loading of 2-1/2-ton trucks.

^{3/} Circus-style load--equipment is end loaded under its own power with little or no effort to fully utilize all floor space on the railcar; time is critical.

All things considered, the circus-style loading operations indicate that, for mobilization moves, using standard-type flatcars, the loading, blocking and bracing, and inspections can be accomplished within 5-1/2 to 7 hours for most equipment types (tables 6, items 9 and 5). However, if a unit has a significant number of small items, such as "mules" (table 6 item 6), a 10-hour site time will likely be required. This should be considered, rather than to assume that the work can be accomplished within 7 hours.

- (2) Administrative Moves. For an administrative move, plenty of time exists for planning; night operations are unnecessary except to finish work that is not completed during daylight hours and to switch railcars. This added flexibility helps to solve unforeseeable problems. The administrative move allows time to accumulate special-type railcars, such as bilevel autoracks and TOFC and COFC cars, which significantly reduces both labor and costs. For instance, small vehicles, such as jeeps, 3/4-ton trucks, 1-1/4-ton trucks, and gamma goats can be loaded on bilevel cars (fig 9); semitrailers and vans can be loaded on TOFC cars; and MILVANs, for which there are no chassis, can be loaded on COFC cars. Mobile equipment, some 2-1/2-ton trucks, and all smaller vehicles can be loaded on bilevel railcars. These three specific types of railcars require no blocking and bracing except that integral to the car.

Loading and securing times for bilevels varied from an average of 7-1/2 hours for a string of cars that were fully equipped with chain tiedowns to 10-3/4 hours for those where cable tiedowns had to be fabricated to replace missing chain tiedowns. The average total time for TOFC cars was 4 hours. Administrative loads, which require relatively longer times and more effort are illustrated in figures 10 and 11.^{4/} This type of

^{4/} Administrative load--equipment to be loaded (wheeled or otherwise) is placed on the car so as to achieve maximum utilization of floor space, and may be stacked; cost is important. Both types of loads, circus and administrative, may be used in either a mobilization or an administrative move, depending upon the type of equipment to be moved. Example: item 9 in a mobilization move, and item 5 in an administrative move.

TABLE 6
TYPICAL SITE LOADING AND BLOCKING AND

<div> LEGEND Type Railcar B1 - Bilevel TOFC - Trailer on flatcar COFC - Container on Flatcar <div>DF - Flatcar/Integral Chassis F - Standard-Type Flatcar</div> </div>						
Item	Type Railcar	Average Number Loaded (Range)	Type Load	How Loaded	Total Site Time Required (hrs) and Other Considerations	Details on Type
1	B1 89 ft	16 15-17	C	End, own power	7.5 All cars had chain tiedowns. Cars did not have bridge PL's, wooden PL's used	Typical Load: 50 jeeps, 16-1½ ton, 14 Gama Goats, 10 number vehicles - 170
2	B1 89 ft	14½ 11-18	C	End, own power	10.7 All cars did not have chain tiedowns, used wooden bridge PL's.	Typical Load: 50 jeeps, 16-1½ ton, 14 Gama Goats, 10 number vehicles - 170
3	TOFC 89 ft	12 10-12	C	End, backed on by tractor	4.0	Semitrailers - mostly MILV to form 40-ft semis. Some military vans on semis. T
4	DF 60 ft	11 9-14	C	End, own power	5.1 Chain tiedowns on all cars, wood wheel chocks, lateral wood blocking at wheels	All 2-1/2-ton trucks, varied per railcar.
5	F 54 ft	10	C	End, own power	6.5 Cable tiedowns made at site. Wheel chocks, lateral wheel blocking	All 2-1/2-ton trucks, varied per railcar.
6	F 54 ft	10 9-10	A	End, own power. Some forklift	10.0 Cable tiedowns made at site. Wood blocking as required.	1/4-ton trailers Wreckers Forklifts Mules, jeeps, CONEX contain
7	F 54 ft	9	A	Forklift, manpower	10.8 Cable tiedowns made at site. Wood blocking as required.	All 1/4-ton trailers or higher of similar small items.
8	DF 60 ft	10 8-13	A	Rough terrain forklifts	8.3 Chain tiedowns on all cars. Wheel blocking used also	All two-wheeled trailers (w pulled by 2-1/2-ton trucks) 5 trailers/railcar
9	F 54 ft	9	A	Rough terrain forklifts	5.5 Cable tiedowns made at site. Blocking as required.	All containers - 5 cars with 8 containers ea 3 cars with 4 containers ea 1 car with 10 containers ea

LE 6

ING AND BRACING TIMES (TOTAL)

Type Load
A - Administrative
C - Circus

ral Chain Tiedowns
Flatcar

Items on Type Load	Manpower	Typical Problems
Jeeps, 15-3/4-ton trucks, Goats, each level, total 170	1 1/2-2 men per vehicle	No bridge PL's on cars had to use wooden PL's. Man has to walk to front of vehicle as guide and to straighten bridge PL's. Delays if all vehicles not at site at loading time.
Jeeps, 15-3/4-ton trucks, Goats, each level, total 170	1 1/2-2 men per vehicle	Same as above; and, missing tiedowns; cable tiedowns had to be fabricated and used. (Storm, rain not included in total time)
stly MILVAN married together is. Some 20-ft semis and semis. Two per TOFC car.	6-8 man crew	Some older cars have trailer hitches which have to be "pulled-up" into position by a cable attached to the tractor.
cks, various kinds, two	10 men per railcar	None
cks, various kinds, two	10 men per railcar	None
XX containers	10 men per railcar	Improper installation of tiedowns and blocking. Large number of small items, 1/4-ton trailer slow the installation of blocking since work has to proceed from one end of railcar to the other.
ers or high percentage items.	10 men per railcar	Improper installation of tiedowns and blocking. Large number of small items, 1/4-ton trailer slow the installation of blocking since work has to proceed from one end of railcar to the other.
trailers (various types on trucks)	10 men per railcar	None noted
ainers each. ainers each. ainers each.	10 men per railcar	None noted

2



Figure 9. Lower level of bilevel cars loaded with jeeps, gama goats, 3/4-ton trucks, and 1-1/4-ton trucks.

load requires a total site time of 10 to 11 hours. In general, administrative moves should be planned for daylight hours, leaving night hours available for finishing up sites that started late or were slowed by problems and railcar switching. This type of planning allows enough flexibility to resolve problems and complete the operation on schedule. For mobilization moves, site time to load and secure equipment on a string of railcars should be accomplished in 5-1/2 to 7 hours, and for administrative moves, 4 to 11 hours (table 6, items 3 and 7).

The time/motion studies conducted during the REFORGER 76 exercise (an administrative move) resulted in the accumulation of valuable information for planning future station outloading operations and is included in tables 3 and 6.

It should be noted that times required to load are relatively minor when compared with times required to secure the equipment. As an example, a jeep can drive across an 89-foot-long bilevel car in 1 minute, and a forklift truck can load a container in 2 minutes 12 seconds. So, loading times are not the problem. Also, as soon as the first vehicle is in position, several simultaneous operations are in effect--loading, blocking, and

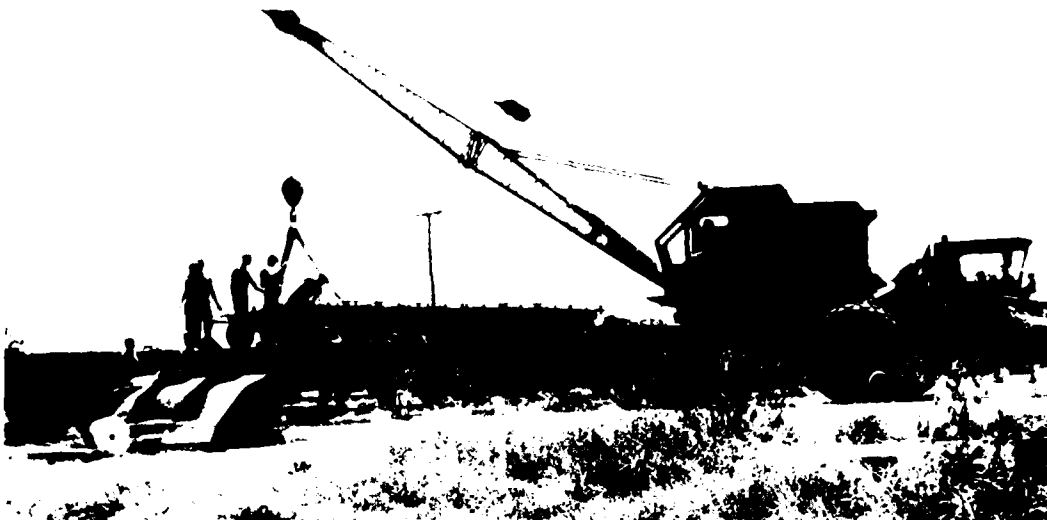


Figure 10. Administrative loading, mules.



Figure 11. Administrative loading, 1/4-ton trailers.

tying down. Thus, for future planning, the following site times should be used as a general rule: 5-1/2 to 7 hours for a mobilization move, and 4 to 11 hours for an administrative move. The 5-1/2-hour minimum for a mobilization move is based on the assumption that only standard-type railcars are available. The 4-hour minimum for an administrative move carries the assumption that there is time to plan and assemble the most appropriate type of railcars for the equipment to be moved. The 4 hours, in this instance, was the average time required to load and secure semitrailers and vans on a string of twelve 89-foot-long TOFC cars.

To minimize the number of faulty or unacceptable loads that have to be done over, inspection of the loaded cars by the railroad inspector should proceed simultaneously with the work.

c. Transportation Equipment Costs--Bilevel Railcars Versus 54-Foot Standard Flatcars

A cost comparison, using nine different types of equipment scheduled for outloading in the REFORGER 77 exercise, revealed that \$129,431 in transportation and materials (timber, cable, and so forth) could be saved by shipping the equipment on bilevel railcars rather than on standard-type 54-foot flatcars. The equipment items vary from 1/4-ton trailers to 2-1/2-ton trucks. A total of 623 vehicles could be transported on 55 bilevel railcars; see table 7 for details and appendix C for more information on special-purpose railcars.

COST COMPARISON

Column Number	1	2	3	4	5
Item No.	Vehicle Type	Model Number	Weight (lbs)	Height (in.)	Length (in.)
1	2-1/2-Ton Truck	M35A2	13,360	80.8	264.8
2	Gama Goat, 1-1/4-Ton	M561	7,480	71.9	231.1
3	M105A2 1-1/2-Ton Trailer	M105A2	2,670	82.0	166.0
4	1/4-Ton Trailer	M416	580	44.0	108.5
5	400-Gal Water Trailer	M149A1	2,530	80.6	161.4
6	1-1/4-Ton Truck	M880	4,695	73.5	218.5
7	3/4-Ton Trailer	M101	1,350	50.0	147.0
8	1/4-Ton Truck	M151	2,350	52.5	131.5
9	1-1/4-Ton Como Truck	M884	4,648	67.5	218.5
Total					

SUMMARY

Total cost to ship the 9 different items (623 vehicles) by 54-foot-long standard
 Total cost to ship the 9 different items (623 vehicles) by 89-foot-long bilevel
 Savings in transportation costs if shipped by bilevel flats (Column 10-- Column
 Additional costs of blocking and bracing materials if shipped by 54-foot standard
 Total savings if these nine items shipped by bilevel versus 54-foot flatcar

- ^{1/} Excess vehicles shipped on other railcars that are not completely utilized.
^{2/} Estimated average additional costs of blocking and bracing materials per vehicle

TABLE 7

COMPARISON, BILEVELS VERSUS 54-FOOT FLATCARS

6	7	8	9	10 (8 x 9)	11	12	13	14 (12 x 13)
Quantity to be Shipped	Quantity on 54-ft Railcar	Dollars	No. of 54-ft Cars Required	Trans Cost for Item	Quantity on 89-ft Bilevel	Dollars	No. of Bilevels Required	Trans Cost for Item
110	2	2,413	55	132,715	6	7,238	18	130,284
27 ^{1/}	2	2,167	13	28,171	8	5,402	4	21,608
113	3	2,167	37	80,179	12	3,612	9	32,508
136	10	2,167	14	30,338	36	3,612	4	25,284
20	4	2,167	5	10,835	12	3,612	2	7,224
11	2	2,167	5	10,835	8	3,612	2	7,224
8	4	2,167	2	4,334	12	3,612	1	3,612
180	7	2,167	25	54,175	14	3,612	13	46,956
18	2	2,167	9	19,503	8	3,612	2	4,334
623				371,085			55	279,034

Standard flatcars, Column 10

\$371,085

Bilevel flatcars, Column 14

279,034

Column 14)

\$ 92,051

Standard flatcars

37,380

(\$60^{2/} x 623)

\$129,431

Article.

III. ANALYSIS OF RAIL FACILITIES WITHIN A 25-MILE RADIUS OF FORT PICKETT

Currently, the rail facilities at Fort Pickett are adequate to handle the continuing rail outloading requirement of the installation. However, the N&W commercial rail facilities within a 25-mile radius were considered to determine the feasibility of their use during a full-scale rail outloading operation at the installation. No commercial loading facilities exist within 25 miles of the installation, and the sidings are unavailable for Army use (loading vehicles with temporary ramps). All of the N&W sidings are very busy. There is a large classification yard at Crewe (fig 7) for storage of empty cars. Therefore, the empty cars can be assembled in the proper sequence at Crewe and then transported to Fort Pickett when needed.

IV. SPECIAL EQUIPMENT FOR EXPEDITING THE OUTLOADING OF MILVANS

A large supply of trailer-on-flatcar railcars is usually in the system, and container-on-flatcar railcars may be available. These cars should be used to transport semitrailers and MILVANS. If COFC or TOFC flatcars are not available, some blocking and bracing time and expense can be saved by using bulkhead flatcars for transporting MILVANS. See appendix C for additional information.

V. ANALYSIS OF MOTOR SYSTEM OUTLOADING CAPABILITY

A. GENERAL

Currently, highway access to Fort Pickett is provided by US Route 460 and Virginia Route 40. Fort Pickett is about 30 miles from Interstate Route 85 via US Route 460. The internal road network within Fort Pickett is capable of handling all types of highway vehicles along its major arteries. Neither access to the highway system nor the system itself restrains motor outloading capability or movement of roadable military vehicles. However, commercial trucking capability is lacking in the immediate area. Table 8 is an inventory of commercial semitrailers in a 50-mile radius of Fort Pickett.

TABLE 8
INVENTORY OF COMMERCIAL SEMITRAILERS IN THE
VICINITY OF FORT PICKETT

Vans	250
Flatbeds	0
Heavy Haulers	0

B. MOTOR LOADING FACILITIES

Basically two types of motor vehicles, flatbed and van semitrailers, would be required to meet the motor outloading needs of Fort Pickett. A description of the loading facilities associated with each vehicle type follows:

1. Loading Ramps

A survey of facilities that might have end-loading ramps for loading vehicles onto commercial flatbed semitrailers revealed that there are five such ramps that could be used concurrently with a rail outloading operation (table 9). One of the ramps is shown in figure 12. As a separate operation, without rail outloading, there are seven ramps, which include all existing rail ramps.

TABLE 9
MOTOR OUTLOADING FACILITIES

Number of Ramps/Docks	Location	Type of Ramp/Dock	Surface Conditions	Staging Area	Access	Remarks
1	Coal storage yard near track 8	Concrete/dirt ramp	Excellent, paved	Good	Excellent	Used for heavy haulers
1	Military Road and 10th Street	Timber/dirt ramp	Excellent, paved	Good	Good	
1	Garnett Ave and 10th Street	Timber/dirt ramp	Good, gravelled	Good	Excellent	
1	Kemper Ave and 10th Street	Timber/dirt ramp	Good, gravelled	Good	Good	
1	9th Street, near track 1	Dirt ramp	Good, gravelled	Good	Good	Used for heavy haulers
53	Warehouses	Timber dock	NA	NA	Good	Used for van semitrailers
58 above	See above					
9	Warehouses	Timber dock	NA	NA	Good	Used for van semitrailers
1	Track 3	Timber/dirt ramp	Good	Excellent	Excellent	
1	Track 7	ditto	Good	Excellent	Excellent	

Concurrent with
Rail OperationsSeparate Without
Rail Operations



Figure 12. Motor ramp in coal storage yard near track 8.

2. Loading Platforms/Docks

This type of motor outloading facility (loading platforms/docks) from which van semitrailers are loaded uses the platform and the forklift to transfer cargo from truck to truck, truck to warehouse, and vice versa. The warehouse area has 53 positions where van semitrailers can be loaded at loading docks concurrently with rail operations, and 62 positions without rail operations.

C. FLATBED SEMITRAILER OUTLOADING

The loading procedure could be as follows: A vehicle is driven up the ramp onto the waiting semitrailer, temporary chocks are placed, the loaded truck is driven slowly away from the ramp to a designated location, and the loaded vehicle is secured with tiedown chains. The next semitrailer is backed up to the ramp, and the procedure is repeated. Under this procedure the ramp is not occupied while loaded vehicles are being secured. Using a conservative 60 minutes for each cycle, one semitrailer could be loaded per hour per ramp, or

10 vehicles per ramp per 10-hour shift. In most cases, 60 minutes would not be required.

1. Concurrent With Rail Operations

There are five ramps that could be used while rail operations are in progress. Using a 60-minute cycle for each ramp, a 10-hour workday could produce 50 semitrailer loads, for daylight operation only. This does not include expedient means such as excavating sloping ditches into which semitrailers could be backed for loading, use of the commercial forklift trucks not assigned to railcar loading, nor use of the mobile cranes. Numerous possibilities exist for increasing motor outloading facilities.

2. Without Rail Operations

If rail operations are not in progress, there are seven loading ramps to load commercial semitrailers. At 60 minutes per cycle for each ramp, 70 semitrailers could be outloaded in a 10-hour workday. However, the possibility of obtaining 70 commercial flatbed semitrailers locally on any day seems highly unlikely. Therefore, since Fort Pickett has facilities for outloading a high volume of semitrailers, any constraint on its semitrailer outloading capability would not be the lack of facilities, but the lack of semitrailers.

D. VAN SEMITRAILER OUTLOADING

The loading procedure could be as follows: A van is backed up to the loading platform or dock, and cargo is transferred to the van from either an adjacent van or a warehouse, using one forklift per loading van. A cycle time of approximately 2-1/2 hours will be used to load a 40-foot van. Using this rate, one van could be loaded per 2-1/2 hours per position, or four vehicles per position per 10-hour shift. The loading of vans from warehouse docks is independent of rail loading operations. There are 62 such positions at Fort Pickett. However, only 11 forklifts of the 2,000- and 4,000-pound size are available. Therefore, at 2-1/2 hours per cycle for each position, only 44 vans could be outloaded in a 10-hour workday due to the limitation of the forklifts. However, this capability is more than adequate for the required outloading rate for vans.

E. SEMITRAILER REQUIREMENT

For an all-motor move, 981 roadable vehicles are move in convoy, and 488 nonroadable vehicles and other equipment are hauled by 410 commercial semitrailers; 104 of these semitrailers are heavy haulers, 37 are 40-foot vans, and 269 are 40,000-pound flatbeds. The rate of 70 flatbed semi trailers per day is inadequate to finish the outloading in 3 days. Although this capability is not enough for the requirement of 3 days, the needed additional ramp capacity can be acquired easily by the use of earthen ditches dug by bulldozers.

Therefore, the availability of commercial semitrailers, not the loading rate, is a constraint on the capability. For a 3-day outloading, about 35 heavy haulers and 90 flatbeds per day will be needed. This appears to be a constraint on the outloading capability because the inventory is not large enough to meet this need.

VI. CONCLUSIONS

- A. Most of the Fort Pickett railroad trackage is in basically good condition, but some maintenance is needed. Most of the trackage conforms to Class 2 specifications, as defined by FRA Track Safety Standards. The end ramps are in good condition. The primary constraint limiting the rail outloading capability is the lack of trained blocking and bracing crews and outloading plans.
- B. After the deficiencies noted above have been corrected and on receipt of sufficient railcars to permit full-scale outloading, Fort Pickett could achieve an outloading rate of 191 railcars per 24-hour period. At this rate, both the roadable and nonroadable equipment of the required units could be outloaded in 3 days.
- C. Costs for track repairs to the post main, the wye, and tracks 4, 5, 6, 7, and 8 total \$59,465 for the recommended outloading plan. However, maintenance is required periodically at all locations to insure continued effectiveness.
- D. Empty railcars (dedicated train lengths) destined for Fort Pickett should be positioned, in trainloading sequence, in the classification yard at Crewe.
- E. The N&W representative did not express any reservation regarding the outloading of Fort Pickett units concurrently with other commercial demands. However, Fort Pickett transportation personnel should coordinate planning of impending outloading operations with the N&W representatives at the earliest possible date.
- F. A maximum of two 120-ton locomotives are required on post at any one time during the day, with a total of 17 locomotive hours spent each day.
- G. For administrative-type moves, when leadtime is plentiful and costs must be considered, special-purpose railcars (such as bilevel auto-rack, trailer-on-flatcar (TOFC), and container-on-flatcar (COFC) cars) are more cost-effective than the standard types and should be used to the extent they are available.
- H. For mobilization moves, when time is more critical than cost, the use of special-purpose railcars may not be possible because of the short leadtime and relatively short supply of these high-demand cars.

- I. For concurrent rail/motor operations, 50 flatbed and 44 van semi-trailers could be loaded per 10-hour day (for daylight operations only), and for separate operations, 125 flatbed and 44 van semi-trailers could be loaded during the same period. This capability far exceeds the likely available supply of flatbed semitrailers.
- J. The maximum degree of curvature of the railroad tracks at Fort Pickett is 14 degrees. Consequently, any known length of railcar can be used on the installation.

VII. RECOMMENDATIONS

- A. Undertake those items listed in section II, paragraph D5, "Physical Improvements and Additions." These improvements will provide a rail system capability of 191 railcars per 24-hour day and will perpetuate an effective rail system at a cost of \$59,465.
- B. Prepare a detailed unit outloading plan, using the simulation in appendix B as an example, that specifies unit assignments at loadout sites and movement functions.
- C. Coordinate rail outloading plans with the N&W representatives at the earliest possible date.
- D. Continue routine rail facility maintenance to insure an effective rail system.
- E. Provide advance training for blocking and bracing crews as soon as possible after mobilization.
- F. Station road guards at all railroad crossings during outloading operations, and provide all train crewmen with walkie-talkies to insure a safer and more effective operation.
- G. Use special-purpose railcars (such as bilevel autoracks for small vehicles, TOFC cars for semitrailers and vans, and COFC cars for MILVANS) for administrative-type moves and, as available, for mobilization moves.
- H. Coordinate with MTMC any removal of railroad track that will be included in the mobilization outloading plan.
- I. Construct any new track with a maximum degree of curvature of 12 degrees.

APPENDIX A

TRACK SAFETY STANDARDS ^{4/}

PART 213— TRACK SAFETY STANDARDS

Subpart A — General

- Sec.
- 213.1 Scope of part.
- 213.3 Application.
- 213.5 Responsibility of track owners.
- 213.7 Designation of qualified persons to supervise certain renewals and inspect track.
- 213.9 Classes of track: operating speed limits
- 213.11 Restoration or renewal of track under traffic conditions.
- 213.13 Measuring track not under load.
- 213.15 Civil penalty.
- 213.17 Exemptions

Subpart B — Roadbed

- 213.31 Scope.
- 213.33 Drainage.
- 213.37 Vegetation.

Subpart C — Track Geometry

- 213.51 Scope.
- 213.53 Gage.
- Sec.
- 213.55 Alinement.
- 213.57 Curves; elevation and speed limitations.
- 213.59 Elevation of curved track; runoff.
- 213.61 Curve data for Classes 4 through 6 track.
- 213.63 Track surface.

Subpart D — Track Structure

- 213.101 Scope.
- 213.103 Ballast; general.
- 213.105 Ballast; disturbed track.
- 213.109 Crossties.
- 213.113 Defective rails.
- 213.115 Rail end mismatch
- 213.117 Rail end batter.
- 213.119 Continuous welded rail.

- 213.121 Rail joints.
- 213.123 Tie plates.
- 213.125 Rail anchoring
- 213.127 Track spikes.
- 213.129 Track shims.
- 213.131 Planks used in shimming.
- 213.133 Turnouts and track crossings generally.
- 213.135 Switches.
- 213.137 Frogs.
- 213.139 Spring rail frogs.
- 213.141 Self-guarded frogs.
- 213.143 Frog guard rails and guard faces; gage.

Subpart E — Track Appliances and Track-Related Devices

- 213.201 Scope.
- 213.205 Derails.
- 213.207 Switch heaters.

Subpart F — Inspection

- 213.231 Scope.
- 213.233 Track inspections.
- 213.235 Switch and track crossings inspections.
- 213.237 Inspection of rail.
- 213.239 Special inspections.
- 213.241 Inspection records.

APPENDIX A—MAXIMUM ALLOWABLE OPERATING SPEEDS FOR CURVED TRACK

AUTHORITY: The provisions of this Part 213 issued under sections 202 and 209, 84 Stat. 971, 975; 45 U.S.C. 431 and 438 and § 1.49(n) of the Regulations of the Office of the Secretary of Transportation; 49 CFR 1.49(n).

SOURCE: The provisions of this Part 213 appear at 36 F.R. 20336, Oct. 20, 1971, unless otherwise noted.

Subpart A — General

§ 213.1 Scope of part.

This part prescribes initial minimum safety requirements for railroad track

^{4/} Extracted from Title 49, Transportation, Parts 200 to 999, pp 8-19, Code of Federal Regulations, 1973.

that is part of the general railroad system of transportation. The requirements prescribed in this part apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from the requirements in this part, may require remedial action to provide for safe operations over that track.

§ 213.3 Application.

(a) Except as provided in paragraphs (b) and (c) of this section, this part applies to all standard gage track in the general railroad system of transportation.

(b) This part does not apply to track—

(1) Located inside an installation which is not part of the general railroad system of transportation; or

(2) Used exclusively for rapid transit, commuter, or other short-haul passenger service in a metropolitan or suburban area.

(c) Until October 16, 1972, Subparts A, B, D (except § 213.109), E, and F of this part do not apply to track constructed or under construction before October 15, 1971. Until October 16, 1973, Subpart C and § 213.109 of Subpart D do not apply to track constructed or under construction before October 15, 1971.

§ 213.5 Responsibility of track owners.

(a) Any owner of track to which this part applies who knows or has notice that the track does not comply with the requirements of this part, shall—

(1) Bring the track into compliance; or

(2) Halt operations over that track.

(b) If an owner of track to which this part applies assigns responsibility for the track to another person (by lease or otherwise), any party to that assignment may petition the Federal Railroad Administrator to recognize the person to whom that responsibility is assigned for purposes of compliance with this part. Each petition must be in writing and include the following—

(1) The name and address of the track owner;

(2) The name and address of the person to whom responsibility is assigned (assignee);

(3) A statement of the exact relationship between the track owner and the assignee;

(4) A precise identification of the track;

(5) A statement as to the competence and ability of the assignee to carry out the duties of the track owner under this part; and

(6) A statement signed by the assignee acknowledging the assignment to him of responsibility for purposes of compliance with this part.

(c) If the Administrator is satisfied that the assignee is competent and able to carry out the duties and responsibilities of the track owner under this part, he may grant the petition subject to any conditions he deems necessary. If the Administrator grants a petition under this section, he shall so notify the owner and the assignee. After the Administrator grants a petition, he may hold the track owner or the assignee or both responsible for compliance with this part and subject to penalties under § 213.15.

§ 213.7 Designation of qualified persons to supervise certain renewals and inspect track.

(a) Each track owner to which this part applies shall designate qualified persons to supervise restorations and renewals of track under traffic conditions. Each person designated must have—

(1) At least—

(i) One year of supervisory experience in railroad track maintenance; or

(ii) A combination of supervisory experience in track maintenance and training from a course in track maintenance or from a college level educational program related to track maintenance;

(2) Demonstrated to the owner that he—

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements in this part.

(b) Each track owner to which this part applies shall designate qualified persons to inspect track for defects. Each person designated must have—

(1) At least—

(i) One year of experience in railroad track inspection; or

(ii) A combination of experience in track inspection and training from a course in track inspection or from a college level educational program related to track inspection;

(2) Demonstrated to the owner that he—

(i) Knows and understands the requirements of this part;

(ii) Can detect deviations from those requirements; and

(iii) Can prescribe appropriate remedial action to correct or safely compensate for those deviations; and

(3) Written authorization from the track owner to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this part, pending review by a qualified person designated under paragraph (a) of this section.

(c) With respect to designations under paragraphs (a) and (b) of this section, each track owner must maintain written records of—

(1) Each designation in effect;

(2) The basis for each designation, and

(3) Track inspections made by each designated qualified person as required by § 213.241.

These records must be kept available for inspection or copying by the Federal Railroad Administrator during regular business hours.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973]

§ 213.9 Classes of track: operating speed limits.

(a) Except as provided in paragraphs (b) and (c) of this section and §§ 213.57 (b), 213.59(a), 213.105, 213.113 (a) and (b), and 213.137 (b) and (c), the following maximum allowable operating speeds apply:

[In miles per hour]

Over track that meets all of the requirements prescribed in this part for—	The maximum allowable operating speed for freight trains is—	The maximum allowable operating speed for passenger trains is—
Class 1 track.....	10	15
Class 2 track.....	25	30
Class 3 track.....	40	60
Class 4 track.....	60	80
Class 5 track.....	80	90
Class 6 track.....	110	110

(b) If a segment of track does not meet all of the requirements for its intended class, it is reclassified to the next lowest class of track for which it does meet all of the requirements of this part. However, if it does not at least meet the requirements for class 1 track, no operations may be conducted over that segment except as provided in § 213.11.

(c) Maximum operating speed may not exceed 110 m.p.h. without prior approval of the Federal Railroad Administrator. Petitions for approval must be filed in the manner and contain the information required by § 211.11 of this chapter. Each petition must provide sufficient information concerning the performance characteristics of the track, signaling, grade crossing protection, trespasser control where appropriate, and equipment involved and also concerning maintenance and inspection practices and procedures to be followed, to establish that the proposed speed can be sustained in safety.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973; 38 FR 23405, Aug. 30, 1973]

§ 213.11 Restoration or renewal of track under traffic conditions.

If, during a period of restoration or renewal, track is under traffic conditions and does not meet all of the requirements prescribed in this part, the work and operations on the track must be under the continuous supervision of a person designated under § 213.7(a).

§ 213.13 Measuring track not under load.

When unloaded track is measured to determine compliance with requirements of this part, the amount of rail movement, if any, that occurs while the track is loaded must be added to the measurement of the unloaded track.

[38 FR 875, Jan. 5, 1973]

§ 213.15 Civil penalty.

(a) Any owner of track to which this part applies, or any person held by the Federal Railroad Administrator to be responsible under § 213.5(c), who violates any requirement prescribed in this part is subject to a civil penalty of at least \$250 but not more than \$2,500.

(b) For the purpose of this section, each day a violation persists shall be treated as a separate offense.

Exemptions.

(a) Any owner of track to which this part applies may petition the Federal Railroad Administrator for exemption from any or all requirements prescribed in this part.

(b) Each petition for exemption under this section must be filed in the manner and contain the information required by § 211.11 of this chapter.

(c) If the Administrator finds that an exemption is in the public interest and is consistent with railroad safety, he may grant the exemption subject to any conditions he deems necessary. Notice of each exemption granted is published in the FEDERAL REGISTER together with a statement of the reasons therefor.

Subpart B—Roadbed

§ 213.31 Scope.

This subpart prescribes minimum requirements for roadbed and areas immediately adjacent to roadbed.

§ 213.33 Drainage.

Each drainage or other water carrying facility under or immediately adjacent to the roadbed must be maintained and kept free of obstruction, to accommodate expected water flow for the area concerned.

§ 213.37 Vegetation.

Vegetation on railroad property which is on or immediately adjacent to roadbed must be controlled so that it does not—

(a) Become a fire hazard to track-carrying structures;

(b) Obstruct visibility of railroad signs and signals;

(c) Interfere with railroad employees performing normal trackside duties;

(d) Prevent proper functioning of signal and communication lines; or

(e) Prevent railroad employees from visually inspecting moving equipment from their normal duty stations.

Subpart C—Track Geometry

§ 213.51 Scope.

This subpart prescribes requirements for the gage, alinement, and surface of track, and the elevation of outer rails and speed limitations for curved track.

§ 213.53 Gage.

(a) Gage is measured between the heads of the rails at right angles to the

rails in a plane five-eighths of an inch below the top of the rail head.

(b) Gage must be within the limits prescribed in the following table:

Class of track	The gage of tangent track must be—		The gage of curved track must be—	
	At least—	But not more than—	At least—	But not more than—
1.....	4' 8"	4' 9 $\frac{3}{4}$ "	4' 8"	4' 9 $\frac{3}{4}$ "
2 and 3.....	4' 8"	4' 9 $\frac{1}{2}$ "	4' 8"	4' 9 $\frac{1}{2}$ "
4.....	4' 8"	4' 9 $\frac{1}{4}$ "	4' 8"	4' 9 $\frac{1}{2}$ "
5.....	4' 8"	4' 9"	4' 8"	4' 9 $\frac{1}{2}$ "
6.....	4' 8"	4' 8 $\frac{3}{4}$ "	4' 8"	4' 9"

§ 213.55 Alinement.

Alinement may not deviate from uniformity more than the amount prescribed in the following table:

Class of track	Tangent track	Curved track
	The deviation of the mid-offset from 62-foot line ¹ may not be more than—	The deviation of the mid-ordinate from 62-foot chord ² may not be more than—
1.....	5"	5"
2.....	3"	3"
3.....	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "
4.....	1 $\frac{1}{4}$ "	1 $\frac{1}{2}$ "
5.....	$\frac{3}{4}$ "	$\frac{5}{8}$ "
6.....	$\frac{1}{2}$ "	$\frac{3}{4}$ "

¹ The ends of the line must be at points on the gage side of the line rail, five eighths of an inch below the top of the railhead. Either rail may be used as the line rail, however, the same rail must be used for the full length of that tangential segment of track.

² The ends of the chord must be at points on the gage side of the outer rail, five-eighths of an inch below the top of the railhead.

§ 213.57 Curves; elevation and speed limitations.

(a) Except as provided in § 213.63, the outside rail of a curve may not be lower than the inside rail or have more than 6 inches of elevation.

(b) The maximum allowable operating speed for each curve is determined by the following formula:

$$V_{max} = \sqrt{\frac{E_a + 3}{0.0007d}}$$

where

V_{max} = Maximum allowable operating speed (miles per hour).

E_a = Actual elevation of the outside rail (inches).

d = Degree of curvature (degrees).

Appendix A is a table of maximum allowable operating speed computed in accordance with this formula for various elevations and degrees of curvature.

§ 213.59 Elevation of curved track; runoff.

(a) If a curve is elevated, the full elevation must be provided throughout the curve, unless physical conditions do not permit. If elevation runoff occurs in a curve, the actual minimum elevation must be used in computing the maximum allowable operating speed for that curve under § 213.57(b).

(b) Elevation runoff must be at a uniform rate, within the limits of track surface deviation prescribed in § 213.63, and it must extend at least the full length of the spirals. If physical conditions do not permit a spiral long enough to accommodate the minimum length of

runoff, part of the runoff may be on tangent track.

§ 213.61 Curve data for Classes 4 through 6 track.

(a) Each owner of track to which this part applies shall maintain a record of each curve in its Classes 4 through 6 track. The record must contain the following information:

- (1) Location;
- (2) Degree of curvature;
- (3) Designated elevation;
- (4) Designated length of elevation runoff; and
- (5) Maximum allowable operating speed.

[38 FR 875, Jan. 5, 1973]

§ 213.63 Track surface.

Each owner of the track to which this part applies shall maintain the surface of its track within the limits prescribed in the following table:

Track surface	Class of track					
	1	2	3	4	5	6
The runoff in any 31 feet of rail at the end of a raise may not be more than.....	3½"	3"	2"	1½"	1"	½"
The deviation from uniform profile on either rail at the midordinate of a 62-foot chord may not be more than.....	3"	2¾"	2¼"	2"	1¾"	½"
Deviation from designated elevation on spirals may not be more than.....	1¾"	1½"	1¼"	1"	¾"	½"
Deviation in cross level on spirals in any 31 feet may not be more than.....	2"	1¾"	1¼"	1"	¾"	½"
Deviation from zero cross level at any point on tangent or from designated elevation on curves between spirals may not be more than.....	3"	2"	1¾"	1¼"	1"	½"
The difference in cross level between any two points less than 62 feet apart on tangents and curves between spirals may not be more than.....	3"	2"	1¾"	1¼"	1"	½"

Subpart D—Track Structure

§ 213.101 Scope.

This subpart prescribes minimum requirements for ballast, crossties, track assembly fittings, and the physical condition of rails.

§ 213.103 Ballast; general.

Unless it is otherwise structurally supported, all track must be supported by material which will—

(a) Transmit and distribute the load of the track and railroad rolling equipment to the subgrade;

(b) Restrain the track laterally, longitudinally, and vertically under dynamic loads imposed by railroad rolling

equipment and thermal stress exerted by the rails;

(c) Provide adequate drainage for the track; and

(d) Maintain proper track cross-level, surface, and alignment.

§ 213.105 Ballast; disturbed track.

If track is disturbed, a person designated under § 213.7 shall examine the track to determine whether or not the ballast is sufficiently compacted to perform the functions described in § 213.103. If the person making the examination considers it to be necessary in the interest of safety, operating speed over the disturbed segment of track must be

reduced to a speed that he considers safe.

§ 213.109 Crossties.

(a) Crossties may be made of any material to which rails can be securely fastened. The material must be capable of holding the rails to gage within the limits prescribed in § 213.53(b) and distributing the load from the rails to the ballast section.

(b) A timber crosstie is considered to be defective when it is—

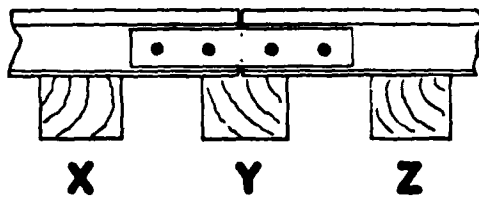
(1) Broken through;

(2) Split or otherwise impaired to the extent it will not hold spikes or will allow the ballast to work through;

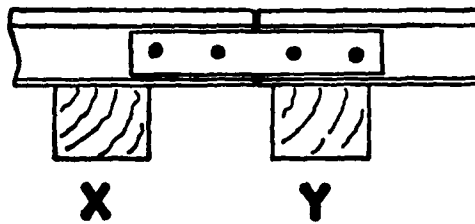
(3) So deteriorated that the tie plate or base of rail can move laterally more than one-half inch relative to the crosstie;

(4) Cut by the tie plate through more than 40 percent of its thickness; or

SUPPORTED JOINT



SUSPENDED JOINT



Class of track	Minimum number of nondefective ties under a joint	Required position of nondefective ties	
		Supported joint	Suspended joint
1.....	1.....	X, Y, or Z.....	X or Y.
2, 3.....	1.....	Y.....	X or Y.
4, 5, 6.....	2.....	X and Y, or Y and Z.	X and Y.

(e) Except in an emergency or for a temporary installation of not more than 6-months duration, crossties may not be interlaced to take the place of switch ties. [36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973]

§ 213.113 Defective rails.

(a) When an owner of track to which this part applies learns, through inspection or otherwise, that a rail in that track

(5) Not spiked as required by § 213.127.

(c) If timber crossties are used, each 39 feet of track must be supported by nondefective ties as set forth in the following table:

Class of track	Minimum number of nondefective ties per 39 feet of track	Maximum distance between nondefective ties (center to center) (inches)
1.....	5	100
2, 3.....	8	70
4, 5.....	12	48
6.....	14	48

(d) If timber ties are used, the minimum number of nondefective ties under a rail joint and their relative positions under the joint are described in the following chart. The letters in the chart correspond to letters underneath the ties for each type of joint depicted.

contains any of the defects listed in the following table, a person designated under § 213.7 shall determine whether or not the track may continue in use. If he determines that the track may continue in use, operation over the defective rail is not permitted until—

(1) The rail is replaced; or

(2) The remedial action prescribed in the table is initiated:

Defect	REMEDIAL ACTION				If defective rail is not replaced, take the remedial action prescribed in note—
	Length of defect (inch)		Percent of railhead cross-sectional area weakened by defect		
	More than	But not more than	Less than	But not less than	
Transverse fissure.....			20	20	B.
			100	100	B.
			20		A.
Compound fissure.....			100	20	B.
				100	A.
Detail fracture.....			20		C.
Engine burn fracture.....			100	20	D.
Defective weld.....				100	A, or E and H.
Horizontal split head.....	0	2			H and F.
	2	4			I and G.
	4				B.
Vertical split head.....	(Break out in railhead)				A.
Split web.....	0	1½			H and F.
Piped rail.....	½	3			I and G.
	3				B.
Head web separation.....	(Break out in railhead)				A.
	0	½			H and F.
	½	1½			I and G.
Bolt hole crack.....	1½				B.
	(Break out in railhead)				A.
Broken base.....	0	6			E and I.
	6				(Replace rail).
Ordinary break.....					A or E.
Damaged rail.....					C.

NOTE:

- A—Assign person designated under § 213.7 to visually supervise each operation over defective rail.
 B—Limit operating speed to 10 m.p.h. over defective rail.
 C—Apply joint bars bolted only through the outermost holes to defect within 20 days after it is determined to continue the track in use. In the case of classes 3 through 6 track, limit operating speed over defective rail to 30 m.p.h. until angle bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
 D—Apply joint bars bolted only through the outermost holes to defect within 10 days after it is determined to continue the track in use. Limit operating speed over defective rail to 10 m.p.h. until angle bars are applied; thereafter, limit speed to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
 E—Apply joint bars to defect and bolt in accordance with § 213.121 (d) and (e).
 F—Inspect rail 90 days after it is determined to continue the track in use.
 G—Inspect rail 30 days after it is determined to continue the track in use.
 H—Limit operating speed over defective rail to 50 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.
 I—Limit operating speed over defective rail to 30 m.p.h. or the maximum allowable speed under § 213.9 for the class of track concerned, whichever is lower.

(b) If a rail in classes 3 through 6 track or class 2 track on which passenger trains operate evidences any of the conditions listed in the following table, the remedial action prescribed in the table must be taken:

Condition	Remedial action	
	If a person designated under § 213.7 determines that condition requires rail to be replaced	If a person designated under § 213.7 determines that condition does not require rail to be replaced
Shelly spots.....	Limit speed to 20 m.p.h. and schedule the rail for replacement.	Inspect the rail for internal defects at intervals of not more than every 12 months.
Head checks.....		
Engine burn (out not fracture).....	do.....	Inspect the rail at intervals of not more than every 6 months.
Mill defect.....		
Flaking.....		
Slivered.....		
Corrugated.....		
Corroded.....		

(c) As used in this section—

(1) "Transverse Fissure" means a progressive crosswise fracture starting from a crystalline center or nucleus inside the head from which it spreads outward as a smooth, bright, or dark, round or oval surface substantially at a right angle to the length of the rail. The distinguishing features of a transverse fissure from other types of fractures or defects are the crystalline center or nucleus and the nearly smooth surface of the development which surrounds it.

(2) "Compound Fissure" means a progressive fracture originating in a horizontal split head which turns up or down in the head of the rail as a smooth, bright, or dark surface progressing until substantially at a right angle to the length of the rail. Compound fissures require examination of both faces of the fracture to locate the horizontal split head from which they originate.

(3) "Horizontal Split Head" means a horizontal progressive defect originating inside of the rail head, usually one-quarter inch or more below the running surface and progressing horizontally in all directions, and generally accompanied by a flat spot on the running surface. The defect appears as a crack lengthwise of the rail when it reaches the side of the rail head.

(4) "Vertical Split Head" means a vertical split through or near the middle of the head, and extending into or through it. A crack or rust streak may show under the head close to the web or pieces may be split off the side of the head.

(5) "Split Web" means a lengthwise crack along the side of the web and extending into or through it.

(6) "Piped Rail" means a vertical split in a rail, usually in the web, due to failure of the sides of the shrinkage cavity in the ingot to unite in rolling.

(7) "Broken Base" means any break in the base of a rail.

(8) "Detail Fracture" means a progressive fracture originating at or near the surface of the rail head. These fractures should not be confused with transverse fissures, compound fissures, or other defects which have internal origins. Detail fractures may arise from shelly spots, head checks, or flaking.

(9) "Engine Burn Fracture" means a progressive fracture originating in spots where driving wheels have slipped on top of the rail head. In developing downward they frequently resemble the compound or even transverse fissure with which they should not be confused or classified.

(10) "Ordinary Break" means a partial or complete break in which there is no sign of a fissure, and in which none of the other defects described in this paragraph are found.

(11) "Damaged rail" means any rail broken or injured by wrecks, broken, flat, or unbalanced wheels, slipping, or similar causes.

(12) "Shelly spots" means a condition where a thin (usually three-eighths inch in depth or less) shell-like piece of surface metal becomes separated from the parent metal in the railhead, generally at the gage corner. It may be evidenced by a black spot appearing on the railhead over the zone of separation or a piece of metal breaking out completely,

leaving a shallow cavity in the railhead. In the case of a small shell there may be no surface evidence, the existence of the shell being apparent only after the rail is broken or sectioned.

(13) "Head checks" mean hair fine cracks which appear in the gage corner of the rail head, at any angle with the length of the rail. When not readily visible the presence of the checks may often be detected by the raspy feeling of their sharp edges.

(14) "Flaking" means small shallow flakes of surface metal generally not more than one-quarter inch in length or width break out of the gage corner of the railhead.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 875, Jan. 5, 1973; 38 FR 1508, Jan. 15, 1973]

§ 213.115 Rail end mismatch.

Any mismatch of rails at joints may not be more than that prescribed by the following table:

Class of track	Any mismatch of rails at joints may not be more than the following—	
	On the trend of the rail ends (inch)	On the gage side of the rail ends (inch)
1.....	$\frac{1}{8}$	$\frac{1}{8}$
2.....	$\frac{1}{8}$	$\frac{1}{8}$
3.....	$\frac{1}{8}$	$\frac{1}{8}$
4, 5.....	$\frac{1}{8}$	$\frac{1}{8}$
6.....	$\frac{1}{8}$	$\frac{1}{8}$

§ 213.117 Rail end batter.

(a) Rail end batter is the depth of depression at one-half inch from the rail end. It is measured by placing an 18-inch straightedge on the tread on the rail end, without bridging the joint, and measuring the distance between the bottom of the straightedge and the top of the rail at one-half inch from the rail end.

(b) Rail end batter may not be more than that prescribed by the following table:

Class of track	Rail end batter may not be more than— (inch)
1.....	$\frac{1}{8}$
2.....	$\frac{3}{16}$
3.....	$\frac{3}{16}$
4.....	$\frac{1}{4}$
5.....	$\frac{1}{4}$
6.....	$\frac{1}{4}$

§ 213.119 Continuous welded rail.

(a) When continuous welded rail is being installed, it must be installed at, or adjusted for, a rail temperature range

that should not result in compressive or tensile forces that will produce lateral displacement of the track or pulling apart of rail ends or welds.

(b) After continuous welded rail has been installed it should not be disturbed at rail temperatures higher than its installation or adjusted installation temperature.

§ 213.121 Rail joints.

(a) Each rail joint, insulated joint, and compromise joint must be of the proper design and dimensions for the rail on which it is applied.

(b) If a joint bar on classes 3 through 6 track is cracked, broken, or because of wear allows vertical movement of either rail when all bolts are tight, it must be replaced.

(c) If a joint bar is cracked or broken between the middle two bolt holes it must be replaced.

(d) In the case of conventional jointed track, each rail must be bolted with at least two bolts at each joint in classes 2 through 6 track, and with at least one bolt in class 1 track.

(e) In the case of continuous welded rail track, each rail must be bolted with at least two bolts at each joint.

(f) Each joint bar must be held in position by track bolts tightened to allow the joint bar to firmly support the abutting rail ends and to allow longitudinal movement of the rail in the joint to accommodate expansion and contraction due to temperature variations. When out-of-face, no-slip, joint-to-rail contact exists by design, the requirements of this paragraph do not apply. Those locations are considered to be continuous welded rail track and must meet all the requirements for continuous welded rail track prescribed in this part.

(g) No rail or angle bar having a torch cut or burned bolt hole may be used in classes 3 through 6 track.

§ 213.123 Tie plates.

(a) In classes 3 through 6 track where timber cross ties are in use there must be tie plates under the running rails on at least eight of any 10 consecutive ties.

(b) Tie plates having shoulders must be placed so that no part of the shoulder is under the base of the rail.

§ 213.125 Rail anchoring.

Longitudinal rail movement must be effectively controlled. If rail anchors

which bear on the sides of ties are used for this purpose, they must be on the same side of the tie on both rails.

§ 213.127 Track spikes.

(a) When conventional track is used with timber ties and cut track spikes, the rails must be spiked to the ties with at least one line-holding spike on the gage side and one line-holding spike on the field side. The total number of track spikes per rail per tie, including plate-holding spikes, must be at least the number prescribed in the following table:

MINIMUM NUMBER OF TRACK SPIKES PER RAIL PER TIE, INCLUDING PLATE-HOLDING SPIKES

Class of track	Tangent track and curved track with not more than 2° of curvature	Curved track with more than 2° but not more than 4° of curvature	Curved track with more than 4° but not more than 6° of curvature	Curved track with more than 6° of curvature
1	2	2	2	2
2	2	2	2	3
3	2	2	2	3
4	2	2	3	3
5	2	3	3	3
6	2	3	3	3

(b) A tie that does not meet the requirements of paragraph (a) of this section is considered to be defective for the purposes of § 213.109(b).

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.129 Track shims.

(a) If track does not meet the geometric standards in Subpart C of this part and working of ballast is not possible due to weather or other natural conditions, track shims may be installed to correct the deficiencies. If shims are used, they must be removed and the track resurfaced as soon as weather and other natural conditions permit.

(b) When shims are used they must be—

- (1) At least the size of the tie plate;
- (2) Inserted directly on top of the tie, beneath the rail and tie plate;
- (3) Spiked directly to the tie with spikes which penetrate the tie at least 4 inches.

(c) When a rail is shimmed more than 1½ inches, it must be securely braced on at least every third tie for the full length of the shimming.

(d) When a rail is shimmed more than 2 inches a combination of shims and 2-

inch or 4-inch planks, as the case may be, must be used with the shims on top of the planks.

§ 213.131 Planks used in shimming.

(a) Planks used in shimming must be at least as wide as the tie plates, but in no case less than 5½ inches wide. Whenever possible they must extend the full length of the tie. If a plank is shorter than the tie, it must be at least 3 feet long and its outer end must be flush with the end of the tie.

(b) When planks are used in shimming on uneven ties, or if the two rails being shimmed heave unevenly, additional shims may be placed between the ties and planks under the rails to compensate for the unevenness.

(c) Planks must be nailed to the ties with at least four 8-inch wire spikes. Before spiking the rails or shim braces, planks must be bored with ⅝-inch holes.

§ 213.133 Turnouts and track crossings generally.

(a) In turnouts and track crossings, the fastenings must be intact and maintained so as to keep the components securely in place. Also, each switch, frog, and guard rail must be kept free of obstructions that may interfere with the passage of wheels.

(b) Classes 4 through 6 track must be equipped with rail anchors through and on each side of track crossings and turnouts, to restrain rail movement affecting the position of switch points and frogs.

(c) Each flangeway at turnouts and track crossings must be at least 1½ inches wide.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.135 Switches.

(a) Each stock rail must be securely seated in switch plates, but care must be used to avoid canting the rail by over-tightening the rail braces.

(b) Each switch point must fit its stock rail properly, with the switch stand in either of its closed positions to allow wheels to pass the switch point. Lateral and vertical movement of a stock rail in the switch plates or of a switch plate on a tie must not adversely affect the fit of the switch point to the stock rail.

(c) Each switch must be maintained so that the outer edge of the wheel tread

cannot contact the gage side of the stock rail.

(d) The heel of each switch rail must be secure and the bolts in each heel must be kept tight.

(e) Each switch stand and connecting rod must be securely fastened and operable without excessive lost motion.

(f) Each throw lever must be maintained so that it cannot be operated with the lock or keeper in place.

(g) Each switch position indicator must be clearly visible at all times.

(h) Unusually chipped or worn switch points must be repaired or replaced. Metal flow must be removed to insure proper closure.

§ 213.137 Frogs.

(a) The flangeway depth measured from a plane across the wheel-bearing area of a frog on class 1 track may not be less than 1⅞ inches, or less than 1½ inches on classes 2 through 6 track.

(b) If a frog point is chipped, broken, or worn more than five-eighths inch down and 6 inches back, operating speed over that frog may not be more than 10 miles per hour.

(c) If the tread portion of a frog casting is worn down more than three-eighths inch below the original contour, operating speed over that frog may not be more than 10 miles per hour.

§ 213.139 Spring rail frogs.

(a) The outer edge of a wheel tread may not contact the gage side of a spring wing rail.

(b) The toe of each wing rail must be solidly tamped and fully and tightly bolted.

(c) Each frog with a bolt hole defect or head-web separation must be replaced.

(d) Each spring must have a tension sufficient to hold the wing rail against the point rail.

(e) The clearance between the hold-down housing and the horn may not be more than one-fourth of an inch.

§ 213.141 Self-guarded frogs.

(a) The raised guard on a self-guarded frog may not be worn more than three-eighths of an inch.

(b) If repairs are made to a self-guarded frog without removing it from service, the guarding face must be restored before rebuilding the point.

§ 213.143 Frog guard rails and guard faces; gage.

The guard check and guard face gages in frogs must be within the limits prescribed in the following table:

Class of track	Guard check gage	Guard face gage
	The distance between the gage line of a frog to the guard line ¹ of its guard rail or guarding face, measured across the track at right angles to the gage line, ² may not be less than—	The distance between guard lines, ¹ measured across the track at right angles to the gage line, ² may not be more than—
1.....	4' 8 3/4"	4' 8 3/4"
2.....	4' 6 3/4"	4' 5 1/4"
3, 4.....	4' 6 3/4"	4' 5 1/4"
5, 6.....	4' 6 1/2"	4' 5"

¹ A line along that side of the flangeway which is nearer to the center of the track and at the same elevation as the gage line.

² A line 3/4 inch below the top of the center line of the head of the running rail, or corresponding location of the tread portion of the track structure.

Subpart E—Track Appliances and Track-Related Devices

§ 213.201 Scope.

This subpart prescribes minimum requirements for certain track appliances and track-related devices.

§ 213.205 Derails.

(a) Each derail must be clearly visible. When in a locked position a derail must be free of any lost motion which would allow it to be operated without removing the lock.

(b) When the lever of a remotely controlled derail is operated and latched it must actuate the derail.

§ 213.207 Switch heaters.

The operation of a switch heater must not interfere with the proper operation of the switch or otherwise jeopardize the safety of railroad equipment.

Subpart F—Inspection

§ 213.231 Scope.

This subpart prescribes requirements for the frequency and manner of inspecting track to detect deviations from the standards prescribed in this part.

§ 213.233 Track inspections.

(a) All track must be inspected in accordance with the schedule prescribed

in paragraph (c) of this section by a person designated under § 213.7.

(b) Each inspection must be made on foot or by riding over the track in a vehicle at a speed that allows the person making the inspection to visually inspect the track structure for compliance with this part. However, mechanical or electrical inspection devices approved by the Federal Railroad Administrator may be used to supplement visual inspection. If a vehicle is used for visual inspection, the speed of the vehicle may not be more than 5 miles per hour when passing over track crossings, highway crossings, or switches.

(c) Each track inspection must be made in accordance with the following schedule:

Class of track	Type of track	Required frequency
1, 2, 3.....	Main track and sidings.	Weekly with at least 3 calendar days interval between inspections, or before use, if the track is used less than once a week, or twice weekly with at least 1 calendar day interval between inspections, if the track carries passenger trains or more than 10 million gross tons of traffic during the preceding calendar year.
1, 2, 3.....	Other than main track and sidings.	Monthly with at least 20 calendar days interval between inspections.
4, 5, 6.....		Twice weekly with at least 1 calendar day interval between inspections.

(d) If the person making the inspection finds a deviation from the requirements of this part, he shall immediately initiate remedial action.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.235 Switch and track crossing inspections.

(a) Except as provided in paragraph (b) of this section, each switch and track crossing must be inspected on foot at least monthly.

(b) In the case of track that is used less than once a month, each switch and track crossing must be inspected on foot before it is used.

§ 213.237 Inspection of rail.

(a) In addition to the track inspections required by § 213.233, at least once a

year a continuous search for internal defects must be made of all jointed and welded rails in Classes 4 through 6 track, and Class 3 track over which passenger trains operate. However, in the case of a new rail, if before installation or within 6 months thereafter it is inductively or ultrasonically inspected over its entire length and all defects are removed, the next continuous search for internal defects need not be made until 3 years after that inspection.

(b) Inspection equipment must be capable of detecting defects between joint bars, in the area enclosed by joint bars.

(c) Each defective rail must be marked with a highly visible marking on both sides of the web and base.

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

§ 213.239 Special inspections.

In the event of fire, flood, severe storm, or other occurrence which might have damaged track structure, a special inspection must be made of the track involved as soon as possible after the occurrence.

§ 213.241 Inspection records.

(a) Each owner of track to which this part applies shall keep a record of each inspection required to be performed on that track under this subpart.

(b) Each record of an inspection under §§ 213.233 and 213.235 shall be prepared on the day the inspection is made and signed by the person making the inspection. Records must specify the track inspected, date of inspection, location and nature of any deviation from the requirements of this part, and the remedial action taken by the person making the inspection. The owner shall retain each record at its division headquarters for at least 1 year after the inspection covered by the record.

(c) Rail inspection records must specify the date of inspection, the location, and nature of any internal rail defects found, and the remedial action taken and the date thereof. The owner shall retain a rail inspection record for at least 2 years after the inspection and for 1 year after remedial action is taken.

(d) Each owner required to keep inspection records under this section shall make those records available for inspection and copying by the Federal Railroad Administrator.

APPENDIX A—MAXIMUM ALLOWABLE OPERATING SPEEDS FOR CURVED TRACK

Degree of Curvature	Elevation of outer rail (inches)												
	0	½	1	1½	2	2½	3	3½	4	4½	5	5½	6
Maximum allowable operating speed (mph)													
0°30'	93	100	107										
0°40'	80	87	93	98	103	109							
0°50'	72	78	83	88	93	97	101	106	110				
1°00'	66	71	76	80	85	89	93	96	100	104	107	110	
1°15'	59	63	68	72	76	79	83	86	89	93	96	99	101
1°30'	54	58	62	66	69	72	76	79	82	85	87	90	93
1°45'	50	54	57	61	64	67	70	73	76	78	81	83	86
2°00'	46	50	54	57	60	63	66	68	71	73	76	78	80
2°15'	44	47	50	54	56	59	62	64	67	69	71	74	76
2°30'	41	45	48	51	54	56	59	61	63	66	68	70	72
2°45'	40	43	46	48	51	54	56	58	60	62	65	66	68
3°00'	38	41	44	46	49	51	54	56	58	60	62	64	66
3°15'	36	39	42	45	47	49	51	54	56	57	59	61	63
3°30'	35	38	40	43	45	47	50	52	54	55	57	59	61
3°45'	34	37	39	41	44	46	48	50	52	54	55	57	59
4°00'	33	35	38	40	42	44	46	48	50	52	54	55	57
4°30'	31	33	36	38	40	42	44	45	47	49	50	52	54
5°00'	29	32	34	36	38	40	41	43	45	46	48	49	51
6°30'	28	30	32	34	36	38	40	41	43	44	46	47	48
6°00'	27	29	31	33	35	36	38	39	41	42	44	45	46
6°30'	26	28	30	31	33	35	36	38	39	41	42	43	45
7°00'	25	27	29	30	32	34	35	36	38	39	40	42	43
8°00'	23	25	27	28	30	31	33	34	35	37	38	39	40
9°00'	22	24	25	27	28	30	31	32	33	35	36	37	38
10°00'	21	22	24	25	27	28	29	31	32	33	34	35	36
11°00'	20	21	23	24	26	27	28	29	30	31	32	33	34
12°00'	19	20	22	23	24	26	27	28	29	30	31	32	3

[36 FR 20336, Oct. 20, 1971, as amended at 38 FR 876, Jan. 5, 1973]

APPENDIX B

PROPOSED RAIL OUTLOADING PROCEDURE FOR A MOBILIZATION MOVE AT FORT PICKETT

Maximum rail outloading operations use a cyclic schedule to minimize conflicts and improve control. The simulation (fig 13) for the recommended rail outloading plan, Plan 4, shows that 191 railcars can be outloaded per day.

The simulation begins with the assumption that it takes several days to accumulate the necessary number of railcars to start full-scale outloading operations. The empty cars are positioned at designated loading sites according to a preconceived plan. Simultaneously, the equipment to be loaded aboard the cars is prepared and staged. The cycle starts when loading begins at daylight, which is defined as zero hour. Loading, including securing (or blocking and bracing) of equipment will be completed within 7 hours during daylight hours. The railcar switching operations will follow and must be finished in 17 hours so that the next cycle can begin the next day. That is, the loaded cars must be removed, assembled into trains, and sent toward their destination, and empty cars must be placed at the loading sites before daylight the next morning. Personnel should be used to throw switches and act as road guards at all rail/highway crossings to reduce delays and insure a safer operation. The detailed switching sequence (fig 13) is described herewith. The times required for various railcar switching operations are shown in table 10.

The operation requires that eight 120-ton locomotives be available each day of the outloading. Two 120-ton locomotives are required to pick up the 95 loaded railcars. The switching sequence begins at the conclusion of blocking and bracing and inspection, which is 7 hours elapsed time since the cycle began. The locomotives couple nine loaded cars at track 8, release their brakes, and transport them to track 7. There the locomotives couple with 43 loaded cars and release their brakes. Now, with 52 cars, the locomotives transit to track 3, where 43 loaded cars are coupled and the brakes released. The first loaded train is now ready to leave. The trip to the wye at the N&W main line takes 18 minutes. At 9 hours 8 minutes elapsed time, the train leaves post with 95 loaded cars. Five minutes later, two locomotives arrive from Crewe and, in a fashion similar to that used for the first train, pick up 32 loaded cars on track 5, 32 loaded cars on track 6, and 32 loaded cars on track 4. At 11 hours 56 minutes elapsed time, the train leaves post with 96 loaded cars. Five minutes later, the first train of empty cars arrives from Crewe with one locomotive in front pulling and one locomotive in back pushing the string of cars. Thirteen minutes are required for the trip from the wye to a

ELAPSED TIME (HOURS) 7

LEGEND	
C	COUPLE
UC	UNCUPLE
TR	TRANSIT
L	LOADED
E	EMPTY
9	NUMBER OF RAILCARS
WT	WAIT
SB	SET BRAKE
RB	RELEASE BRAKE
(23)	TIME EXPENDED (MIN)
TRK	TRACK
TRK 6	TRACK LOCATION

2-120 TON LOCOMOTIVES	OPERATION	C-9-L RB	TR	C-43-L RB
	TIME(MINUTES)	(9)	(7)	(43)
	TRACK LOCATION	8	7	7
	NO. OF RAILCARS	9	9	52

TRACK CAPACITY IN NUMBER OF CARS	LOADING SITES LISTED BY PRIORITY OF USE	TRACK NUMBER	NO. OF CARS AT START
75	RAMP 3	3	43
57	RAMP 7	7	43
50	RAMP 4	4	32
35	RAMP 6	6	32
38	RAMP 5	5	32
42	TRACK 8	8	9

NOTE:
FOOTNOTES ARE NOT TO SCALE

1	2	3	4	5	6	7
UC-95-E	WT	TR	TR	UC-9-E	TR	WT
(1)	(2)	(1)	(2)	(1)	(2)	(4)
MAIN	MAIN	8	MAIN	MAIN	MAIN	8
0	95	0	95	86	86	0

* TO A POINT ABOUT 60
FT SOUTH OF TRACK 8.

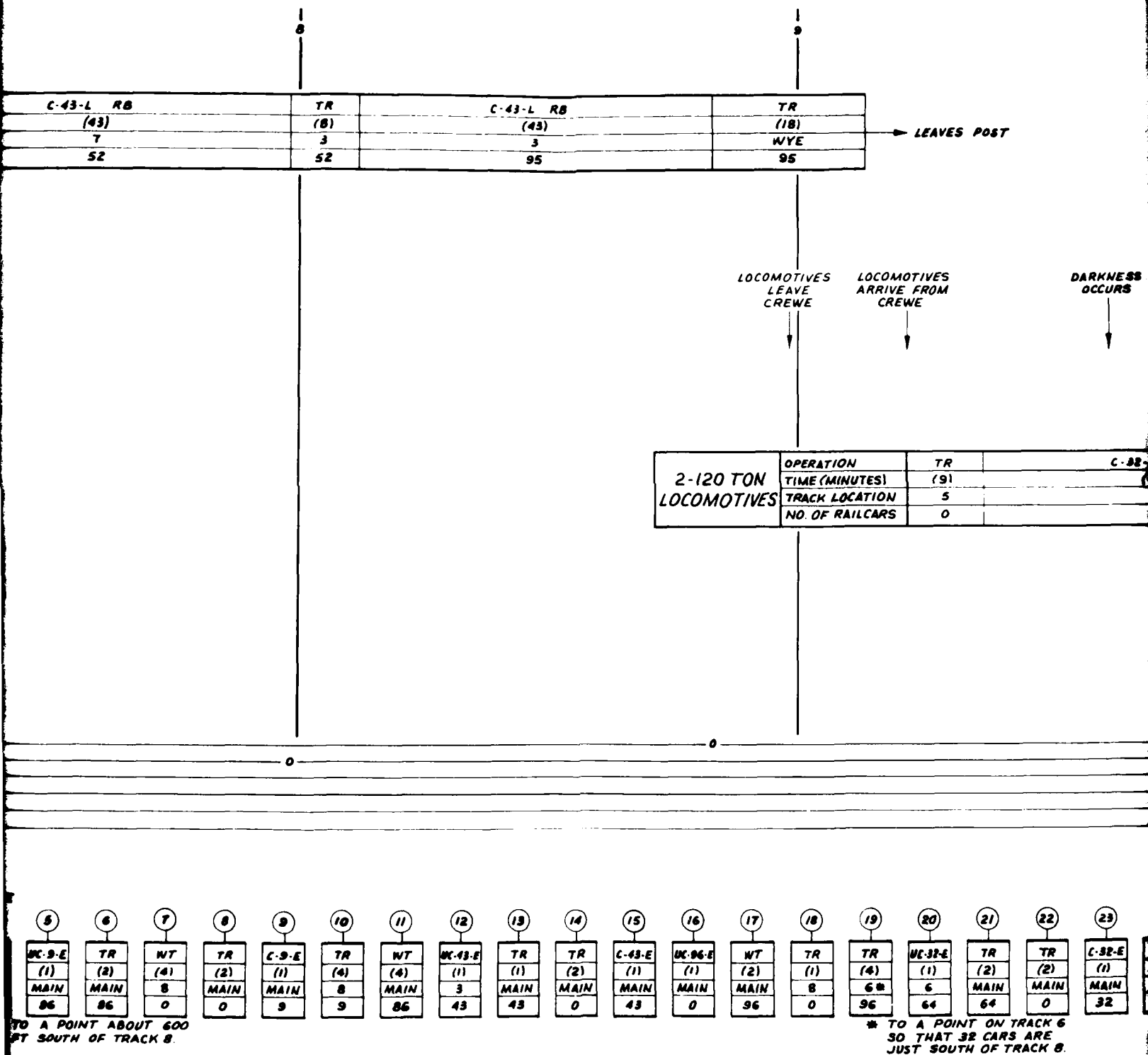


Figure 13. Rail outloading

10

DARKNESS
OCCURS

C-32-L RB

TR

(42)

(5)

5

6

32

32

0

22	23	24	25	26	27	28
TR	C-32-E	TR	WT	UK-32-E	TR	TR
(2)	(1)	(4)	(4)	(1)	(4)	(1)
MAIN	MAIN	6	MAIN	4	5	4
0	32	32	64	32	32	0

BACK 6
ARE
BACK 8.

outloading simulation.

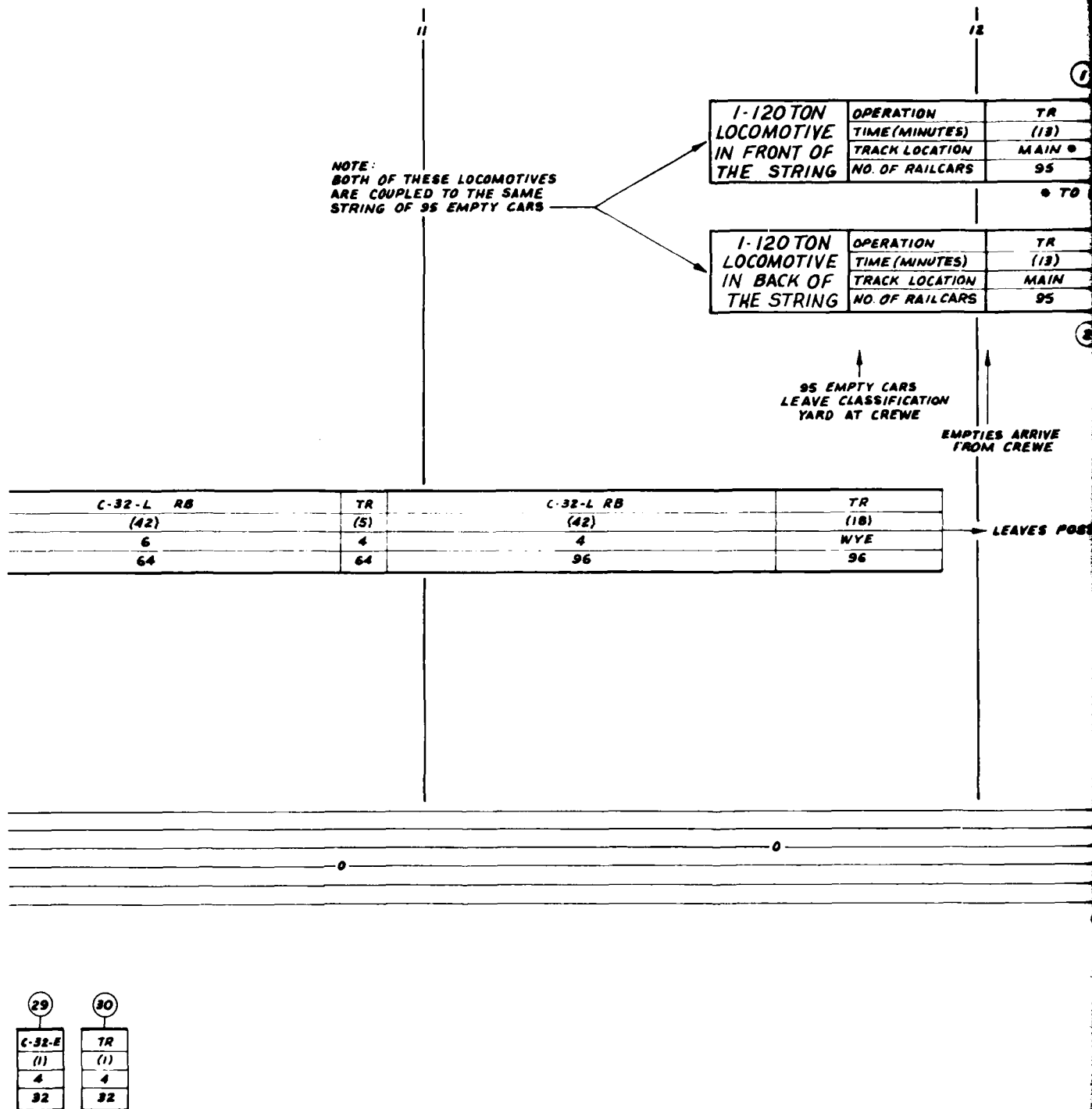


Figure 13. Continued.

12

13

14

1 3 7 8 9 10

14 15

OPERATION	TR				UC-9-E SB	TR		UC-43-E SB	TR	WT
TIME (MINUTES)	(18)				(12)	(5)		(57)	(12)	(6)
TRACK LOCATION	MAIN				8	3		3	WYE	
NO OF RAILCARS	95				0	43		0	0	

* TO A POINT JUST NORTH OF TRACK 8.

* TO A POINT ABOUT 43 CARLENGTHS SOUTH OF TRACK 8.

OPERATION	TR				TR	WT	TR	UC-43-E SB	TR
TIME (MINUTES)	(13)				(5)	(11)	(10)	(57)	(12)
TRACK LOCATION	MAIN				3	MAIN	7	7	WYE
NO OF RAILCARS	95				86	43	43	0	0

2 4 5 6 11 12 13

↑
EMPTY CARS
CLASSIFICATION
AT CREWE

↑
EMPTY CARS ARRIVE
FROM CREWE

1-120 TON
LOCOMOTIVE
IN FRONT OF
THE STRING

OPERATION
TIME (MIN)
TRACK LOC
NO. OF RAILCARS

TR
(18)
WYE
96

← LEAVES POST

1-120 TON
LOCOMOTIVE
IN BACK OF
THE STRING

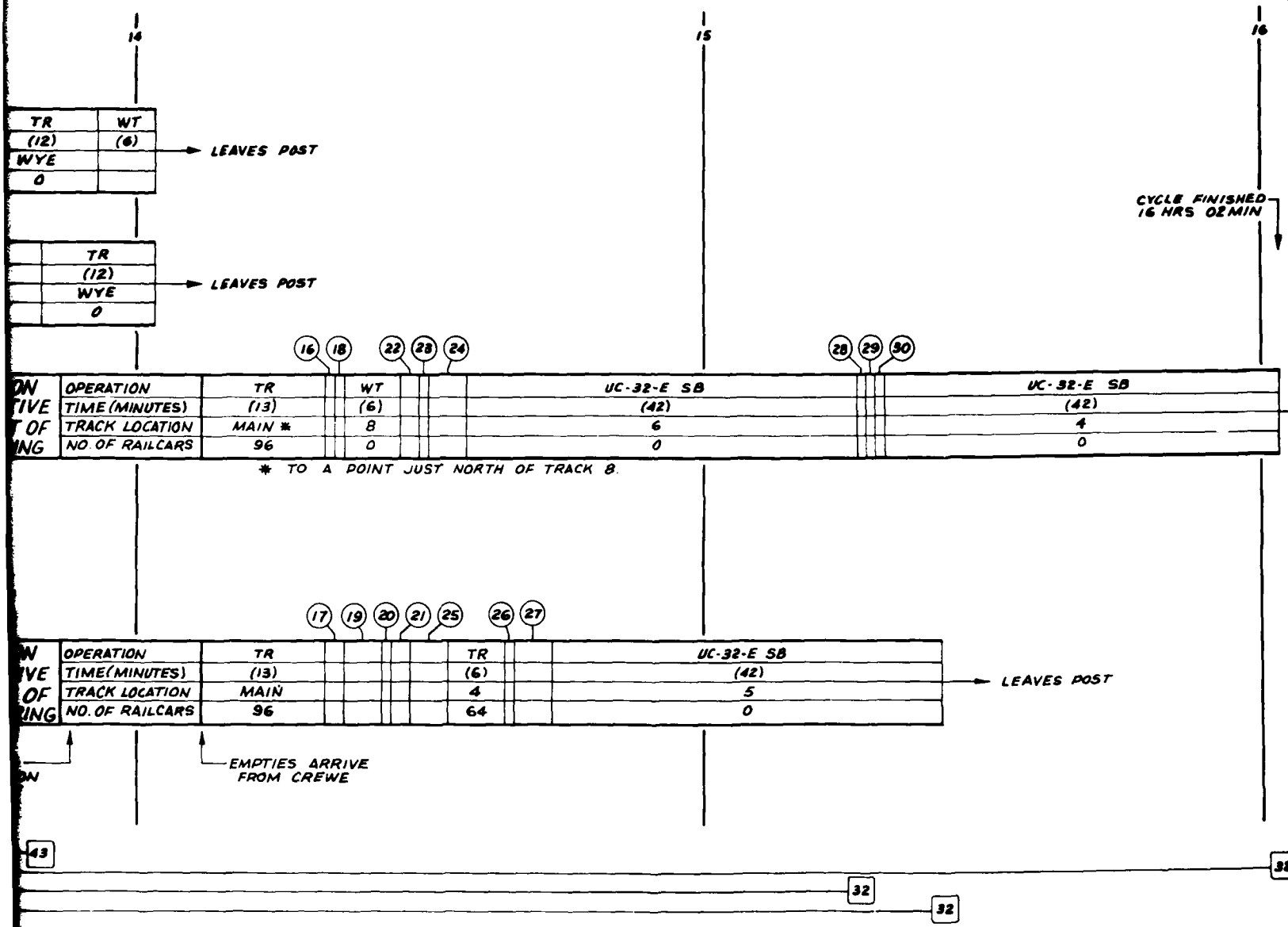
OPERATION
TIME (MIN)
TRACK LOC
NO. OF RAILCARS

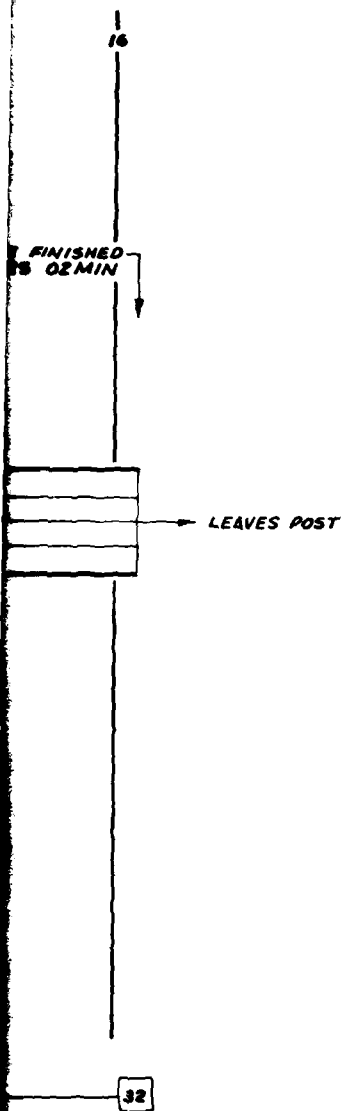
96 EMPTY CARS
LEAVE CLASSIFICATION
YARD AT CREWE

43

43

9





1

4

TABLE 10
TIMES REQUIRED FOR VARIOUS RAILCAR SWITCHING
OPERATIONS AND LOCOMOTIVE CAPABILITY

<u>Empty</u>	C=Couple UC=Uncouple E=Empty L=Loaded S.B.=Set Brakes Set brakes if cars are to be left overnight or loaded or on a steep grade. R.B.=Release Brakes UC-15-E (S.B.)=Uncouple 15 empty rail- cars, set brakes.
C-15-E (5 min)	
C-30-E (10 min)	
C-45-E (15 min)	
UC-15-E (1-2	
UC-15-E (S.B.) (15 min)	
UC-30-E (S.B.) (30 min)	

Loaded

C-15-L (5 min)
C-30-L (10 min)
C-45-L (15 min)
But if cars have been sitting overnight
brakes must be released.
C-15-L (R.B.) (15 min)
C-20-L (R.B.) (30 min) (or 15 min for 2 men)
C-45-L (R.B.) (45 min) (or 15 min for 3 men)
UC-15-L (1-2 min)
UC-15-L (S.B.) (15 min)
UC-30-L (S.B.) (30 min)

Note:

Above times are for daylight operations. Add 5 minutes at night if
brakes have to be set or checked.

TRANSIT SPEED

Average for all switching operations, 5 miles per hour.
Engine with no railcars, 10 miles per hour for distances
of one-half mile or more, (except for night time then add
5 minutes for each transit).

LOCOMOTIVE CAPABILITY

120-ton locomotive - 1200 tons on 2.5% grade
Empties 34 cars
Loaded 24 cars
2 M-60 tanks on series 38 car, 9 cars per locomotive
16 cars per locomotive with 1 tank per 57' car
2 locomotives - 2 times above capabilities

Speed vs Time

5 miles per hour = .00228 min/ft
10 miles per hour = .00114 min/ft
26 miles per hour = .000438 min/ft

point on the post main just north of track 8. Here, the locomotive in front of the string uncouples from the 95 empty cars and the locomotive in the rear waits for the locomotive in the front to get onto track 8, out of the way. Next, the locomotive in the rear pushes the 95 empty cars to a point on the post main about 600 feet south of track 8. Here, 9 cars are uncoupled, and the remaining 86 cars are backed up until enough clearance exists for the locomotive to leave track 8; it couples with the 9 cars, takes them to track 8, uncouples them, and sets the brakes. As soon as the 9 cars are off the main and on track 8 (at 12 hours 21 minutes elapsed time) the locomotive in the rear can transit south on the main to a point about 43 car lengths south of track 8 and uncouple 43 empty cars. Now, the locomotive backs up on the main for a few hundred feet, giving clearance for the locomotive in front to leave track 8 and to couple with the 43 empty cars south of track 8. The locomotive in front takes the 43 cars to track 3, uncouples them, and sets their brakes. The locomotive in the rear takes the 43 remaining cars to track 7, uncouples them, and sets their brakes. Both locomotives leave post at 14 hours 2 minutes elapsed time. Five minutes later, a train of 96 empty cars arrives from Crewe with one locomotive in front and one locomotive in the rear of the string of cars. The cars are put away in fashion similar to that used with the first train of empty cars, with 32 cars each on tracks 4, 5, and 6. The cycle is finished at 16 hours 2 minutes; 191 loaded cars have been removed and the loading positions have been refilled with empties for the next cycle.

APPENDIX C

SPECIAL-PURPOSE RAILCARS AND LOADING/UNLOADING PROCEDURES

Specially designed railcars, in particular those used for transporting vehicles, can greatly increase the speed and efficiency of a rail outloading operation. Bilevel and integral chain tiedown flatcars are the primary means of enhancing the loadout routine of most military vehicles. Bilevel railcars are best suited for the smaller vehicles, including 2-1/2-ton trucks. Although trilevel cars are in abundant supply, their relatively low deck clearances prohibit the movement of most military equipment and, therefore, cannot be considered a significant resource.

The integral tiedown flatcars will accommodate larger vehicles, including tanks. Loading and securing equipment on these railcars can be accelerated to 15 minutes per vehicle, for small vehicles, versus approximately 45 minutes for blocking and bracing procedures used on standard-type railcars. Also, the BTTX 89-foot flatcar has a capacity of six 2-1/2-ton trucks, doubling the single level capacity. Thus, in speed and capacity, special-purpose railcars are an advantage worth investigating.

There are essentially five methods of loading/unloading multilevel railcars, they are:

1. The "K" loader of 463L aircraft cargo-loading system.
2. The forklift and pallet used in conjunction with a crane and/or ramp.
3. The crane and ramp combination.
4. Adjustable ramps.
5. Adjustable built-in ramp on multilevel railcars.

The procedures used with each of the above are described in detail in TM 55-625^{6/}, as are tiedown procedures.

As of 1970, more than 70 percent of DOD installations had no organic capability to load/unload multilevel railcars. No outloading plans should include the use of these railcars until a thorough investigation verifies

^{6/} TM 55-625, Transportability Criteria and Guidance, Loading and Unloading Multilevel Railcars at Military Installations in the United States.

their availability at the time required. The supply of special-purpose flatcars with integral tiedowns is also limited. As a result, even though these types of railcars are very valuable for volume rail outloading operations, their availability is seriously in question unless advance preparations are made.

The following trends in flatcar supply are now operative and have been since the development of modern piggyback service in the mid-1950's:

1. The size of the flatcar fleet has been growing, both in number of flatcars and in relation to the size of the car fleet as a whole. This gain has been confined to specialized cars; for example, trailer-on-flatcar, container-on-flatcar, bilevel, trilevel, and bulkhead flatcars.
2. The size of the general-purpose flatcar fleet has decreased, though average length and capacity have increased.
3. A majority of all flatcars are owned by car companies, not by the railroads. Therefore, more flexibility in assignment, with improved utilization, has resulted. Fewer idle cars available for short-notice use than would be if each railroad maintained an adequate supply for its own needs.

Considering these trends, the sizes of the various components of the specialized flatcar fleet, and the blocking and bracing requirements for the various types of equipment to be shipped by rail, it does not appear prudent to express an installation's needs and outloading plan using only general-purpose flats. The TOFC fleet, in particular, is now most likely large enough to fill military requirements (table 11). The COFC fleet also has expanded to the point that it could carry most of the military's container movements, especially since COFC cars are used almost exclusively for import/export movements, which likely would be greatly disrupted in a mobilization period.

Accordingly, vans or containers should be outloaded on TOFC cars. If the movement is to a port for ocean shipment by other than RORO vessel, the use of COFC cars should be considered. However, the availability of COFC cars in the quantity desired without disrupting civilian container movements is highly improbable.

Other cars in the specialized flatcar fleet generally are assigned to specific services or to a carpool for one shipper's exclusive use. Therefore, although these cars can save blocking and bracing and should be requested when they can be employed profitably in a specific move, the likelihood of obtaining the cars is too weak to base outloading requirement on their use.

TABLE 11
TRAILER TRAIN COMPANY FLEET

Trailer Train Company ownership of selected car types as contained in the January 1979 Official Railway Equipment Register. Trailer Train owns in excess of 95 percent of total US ownership of TOFC, COFC, and autorack cars.

Type	Reporting Marks	Quantity
Flatcars with special equipment. See Legend	ATTX	303
	FTTX	1,839
	HTTX	763
	ITTX	1,164
	JTTX	2,474
	MTTX	1,239
	OTTX	2,519
	PTTX	926
	TTDX	222
	TTHX	391
	TTJX	205
	TTMX	21
	TTPX	1,426
	ZTTX	72
		13,564
TOFC	TTX	28,908
	TTAX	6,874 (see also COFC)
	GTTX	2,251
	LTTX	2,027
	XTTX	702
		40,762
COFC	TTAX	6,874 (see also TOFC)
	TTCX	699
		7,573
Bilevels	BTTX	1,882
	TTBX	5,720
	TTGX	1,002
	TTSX	8
		8,612
Trilevels	CTTX	1,002
	ETTX	5,034
	KTTX	1,160
	RTTX	2,540
	TTKX	6,703
	TTRX	2,696
		19,135
Legend - Definitions of Trailer Train Company's reporting marks		
ATTX - Flatcars, equipped with two continuous tiedown loops on center sills, continuous tiedown rails on each side, and bridgeplates. Not equipped with hitches, chains, jacks, and so forth.		
BTTX - Flatcars equipped with bilevel autoracks, furnished by participant railroads.		
CTTX - Flatcars equipped with coverless inclosed trilevel autoracks, furnished by participant railroads.		
ETTX - Flatcars equipped with fully inclosed trilevel autoracks, furnished by participant railroads.		
FTTX - Flatcars equipped with tiedown devices for loading automobile or truck frames.		
GTTX - Flatcars equipped with hitches and bridgeplates for transporting trailers. Cars built by General American Transportation Corporation.		
HTTX - Flatcars equipped with 38 heavy-duty chains, with snubbers and turnbuckles, each secured to movable and retractable tiedown winches in 4 longitudinal channels for transporting large, earth moving equipment.		
ITTX - Flatcars equipped with end pedestals, and 62 tiedown winches with chains and bridgeplates, for transporting trailer tractors saddleback style.		
JTTX - Flatcars specially modified or equipped by participant railroads with miscellaneous devices for special services.		
KTTX - Flatcars equipped with hinged-end trilevel autoracks, furnished by participant railroads.		
LTTX - Low-deck flatcars equipped with hitches and bridgeplates.		
MTTX - Sixty-ft flatcars with stake pockets and lading strap anchors for general service, or 85-ft flatcars with 16 stake pockets, 8 per side, for transporting long pipe.		
OTTX - Flatcars equipped with 64 chains, with snubbers, each secured to movable and retractable tiedown winches in 4 longitudinal channels, for transporting agricultural equipment.		
PTTX - Flatcars equipped with bulkheads, spaced 48 ft 6 in. apart, for transporting plywood, wallboard, and so forth.		
RTTX - Flatcars equipped with fixed trilevel autoracks, furnished by participant railroads.		
TTAX - Flush deck flatcars equipped with movable foldaway container pedestals, knockdown hitches, and bridgeplates, for transporting trailers or containers or combinations of both.		
TTBX - Flatcars equipped with bilevel autoracks, furnished by participant railroads.		
TTCX - Flush deck flatcars equipped with movable foldaway container pedestals for transporting containers.		
TTDX - Flatcars equipped with 16 tiedown winches with chains and bridgeplates, for transporting military vehicles semi-saddleback style.		
TTGX - Flatcars equipped with fully inclosed bilevel autoracks, furnished by participant railroads.		
TTHX - Flatcars equipped with heavy-duty chains anchored to removable stake pocket castings. When tie-downs are removed, car becomes same as 60-ft cars stencilled "MTTX."		
TTJX - Sixty-eight-ft, 90-ton flatcars with special tiedown devices, fixtures, and stake pockets.		
TTKX - Flatcars equipped with hinged-end trilevel autoracks, furnished by participant railroads.		
TTRX - Sixty-eight-ft, 100-ton flatcars with stake pockets and lading strap anchors for general service.		

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Flat - Flush Deck Flatcars Equipped with movable foldaway container pedestals, knockdown hitches, and bridgeplates, for transporting trailers or containers or combinations of both.

TTBX - Flatcars equipped with bilevel autoracks, furnished by participant railroads.

TTCX - Flush deck flatcars equipped with movable foldaway container pedestals for transporting containers.

TTDX - Flatcars equipped with 16 tiedown winches with chains and bridgeplates, for transporting military vehicles semi-saddleback style.

TTGX - Flatcars equipped with fully inclosed bilevel autoracks, furnished by participant railroads.

TTHX - Flatcars equipped with heavy-duty chains anchored to removable stake pocket castings. When tie-downs are removed, car becomes same as 60-ft cars stencilled "MTTX."

TTJX - Sixty-eight-ft, 90-ton flatcars with special tiedown devices, fixtures, and stake pockets.

TTKX - Flatcars equipped with hinged-end trilevel autoracks, furnished by participant railroads.

TTMX - Sixty-eight-ft, 100-ton flatcars with stake pockets and lading strap anchors for general service.

TTPX - Flatcars equipped with bulkheads spaced 62 ft 0 in. apart and 17 transverse tiedown anchors with chains, used for transporting wallboard, plywood, and so forth.

TTRX - Flatcars equipped with fixed trilevel autoracks, furnished by participant railroads.

TTSX - Flatcars equipped with coverless inclosed bilevel autoracks, furnished by participant railroads.

TTVX - Flatcars equipped with Vert-A-Pak superstructure, furnished by participant railroads.

TTX - Flatcars equipped with hitches and bridgeplates for transporting trailers. See Note 1.

XTTX - Flatcars equipped with four hitches and bridgeplates for transporting two trailers, one 45-ft and one 40-ft, or three 28-ft trailers.

ZTTX - Flatcars equipped with 30 stake pockets, 15 per side, for transporting long poles.

Note 1 - TTX 105-109 are specially equipped, multihitch instruction cars, not suitable for revenue service. For disposition or further information on these cars, contact Mr. M. B. Flagg, Manager, Inspection and Training, Trailer Train Company, 300 So. Wacker Dr., Chicago, IL 60606.

4. Bilevel and trilevel flats will require heavier chains and possibly different hooks to handle other than commercial specification vehicles. Due to the problem of close clearance on trilevel cars, emphasis on vehicle outloading should be placed on bilevel and flatcars.
5. Chain tiedown flats may require heavier chains, depending on the loads for which they were designed.
6. Where TOFC cars must be loaded using a ramp rather than side or overhead loading, the number of cars at a ramp should be limited to about 10 because of the delay involved in backing the trailers down the length of the cars and returning with the tractor.
7. Where sufficient suitable aprons and MHE are available, it may be desirable to load containers directly onto COFC cars rather than to place them on bogies and use TOFC cars.
8. If COFC or TOFC cars are not available, some blocking and bracing time and expense can be saved by using bulkhead flatcars to carry containers.
9. Bilevel and trilevel cars require, obviously, bilevel and trilevel ramps or other equipment as indicated in TM55-625.
10. TOFC, COFC, bilevel, and trilevel cars average 89 feet long. TOFC cars can handle two 40-foot trailers or one 40-foot and one 45-foot trailer. COFC cars can handle four 20-foot container equivalents. Autorack cars can accommodate four to seven vehicles per deck, depending on vehicle length and the number of tiedown chain sets.
11. Tracks used to store or load cars 89 feet long should be reachable without going through curves exceeding 14-degree curvature, and tracks used for cars between 55 and 65 feet should be reachable without going through curves exceeding 15-degree curvature.

Factors affecting the use of specialized flatcars include:

1. First priority for use of general-purpose flats should be to load tracked vehicles and nonstandard wheeled vehicles; for example, artillery.

2. First priority for requesting specialized flats should be for TOFC and COFC cars to load vans and containers, which require very extensive blocking and bracing to move on general-purpose cars.
3. TOFC and COFC cars require no blocking and bracing.

APPENDIX D

RAIL REHABILITATION COST ESTIMATE

ATZM-FP-FE (27 Apr 79) 1st Ind

SUBJECT: Rail and Motor Outloading Capability Study, Rail Rehabilitation
Costs, Fort Pickett, Virginia

HQ, US Army Garrison, Fort Pickett, Blackstone, Virginia MAY 2 1979

TO: Commander, Military Traffic Management Command, Transportation Engineering
Agency, ATTN: MTT-TEP, 12388 Warwick Blvd, Newport News, VA 23606

Cost estimates requested are as follows:

Track #4	\$ 1,635.00
Track #5	\$ 1,220.00
Track #6	\$ 1,490.00
Track #7	\$ 1,670.00
Track #8	\$ 1,945.00
Post Main	\$142,214.00
Wye	\$ 4,100.00

FOR THE COMMANDER:

Elizabeth C. Kerns
Elizabeth C. Kerns
Asst. Admin. Off.

DISTRIBUTION

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US Army Garrison
Fort Pickett
Blackstone, VA 23824 (2)

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Commander
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MacDill Air Force Base
Tampa, FL 33608 (4)

Chief, Army National Guard Bureau
Room 2D424 Pentagon
ATTN: NGB-ARL-T
Washington, DC 20310 (4)

HQDA DALO-TSM-P
Room 1D616 Pentagon
WASH, DC 20310 (1)

USA TSARCOM
Systems Analysis Office
ATTN: DRSTS-FR
4300 Goodfellow Boulevard
St. Louis, MO 63120 (1)

<p>Army Materiel Systems Analysis Activity ATTN: DRXSY-CL Aberdeen Proving Ground, MD 21005</p>	(1)
<p>Commander Military Traffic Management Command ATTN: MT-SA (2); MT-PLM (2) WASH, DC 20315</p>	(4)
<p>Commander Military Traffic Management Command, Eastern Area ATTN: MTE-PL Bayonne, NJ 07002</p>	(6)
<p>Commander Military Traffic Management Command, Western Area Oakland Army Base Oakland, CA 94626</p>	(2)
<p>Commandant US Army Transportation School ATTN: Transportation Library Fort Eustis, VA 23604</p>	(1)
<p>Chief, Army National Guard Bureau Rm 2D 424 Pentagon ATTN: NGB-ARL-T Washington, DC 20315</p>	(4)
<p>Director Military Traffic Management Command Transportation Engineering Agency Newport News, VA 23606</p>	(10)

