DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
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NAVFACINST 11230.1F
PWBL/FM&S/BSVE
24 February 2012

NAVFAC INSTRUCTION 11230.1F

From: Commander, Naval Facilities Engineering Command

Subj: INSPECTION, CERTIFICATION, AND AUDIT OF CRANE AND RAILROAD TRACKAGE

1. Purpose. To provide procedures for inspection, certification, sustainment and restoration management and audit of crane and railroad trackage. Additional requirements and tests for special purpose/hazardous load carrying trackage may be specified in other documents.

2. Cancellation. Replaces NAVFACINST 11230.1E of 10 Aug 2009 which is cancelled.

3. Background. Crane and railroad trackage is a valuable facility asset that needs to be maintained in a safe operating condition, ready for current use or future mobilization purposes, where required. Review of in-service trackage validates the need for inspection and sustainment criteria to assist in evaluating the physical condition and ensuring the safety of all crane and railroad trackage used in support of naval operations.

4. Action. All naval activities with crane (ground and elevated) and railroad trackage on plant account shall comply with the provisions of this instruction. Activities shall establish an inspection and sustainment program or affirm or modify their existing program to encompass the criteria herein and shall take coordinated action to ensure implementation of this instruction. Naval Facilities Engineering Command (NAVFACENGCOM) shall administer this program for the Chief of Naval Operations (CNO). Activities with Navy owned cranes operating on non-Navy trackage shall inspect and certify the trackage in accordance with this instruction, as required by NAVFAC P-307. NAVFACINST 11230.1F directs, based on RIE and risk based assessment, the audit schedule for 2 year audits, 4 year audits, and 6 year paperwork audits.

5. Scope. Criteria provided in this instruction establish minimum safety standards for track use. Standard operating procedures for track shall be maintained in accordance with criteria in Unified Facilities Criteria (UFC) 4-860-03 and herein to ensure safe use. This instruction is aligned with BMS B15.21, Trackage Audits.

6. Exceptions. Deviations from the standards set forth herein shall be submitted via the activity's region commander or major claimant to NAVFAC ESC for approval. Point of contact is Tyler Vander Schuur, NAVFAC Trackage SME at (805) 982-6093.

J. C. WASHINGTON
Assistant Commander for Public Works

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RECORD OF CHANGES

CHANGE NUMBER	DATE OF CHANGE	DATE ENTERED	BY WHOM ENTERED

INSPECTION, CERTIFICATION AND AUDIT
OF CRANE AND RAILROAD TRACKAGE

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ATTACHMENTS

REFERENCED DOCUMENTS

ANSI/ASNT CP189	2001 ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel
AREMA Manual	American Railway Engineering and Maintenance-of-Way Association - Manual for Railway Engineering
DOT FRA Standards (CFR)	The Department of Transportation (DOT), Code of Federal Regulations Title 49 Transportation, Chapter II Federal Railroad Administration, Part 213 Track Safety Standards
DOT Highway Standards	The Department of Transportation (DOT), Code of Federal Regulations (CFR) Title 23 Highways, Part 650, Subpart C National Bridge Inspection Standards
NAVFAC MO-104.2	Specialized Underwater Facilities Inspection
NAVFAC MO-312.2	A Field Guide for The Receipt and Inspection of Treated Wood Products by Installation Personnel
NAVFAC MO-321	Facilities Management
NAVFAC MO-322 Vol I	Vol I: Inspection of Shore Facilities
NAVFAC MO-322 Vol II	Vol II: Inspection of Shore Facilities
NAVFAC P-300	Management of Transportation Equipment
NAVFAC P-301	Navy Railway Operating Handbook
NAVFAC P-307	Management of Weight Handling Equipment
OPNAVINST 5102.1D	Navy & Marine Corps Mishap and Safety Investigation, Reporting, and Record Keeping Manual
OPNAVINST 5100.23G	Navy Safety and Occupational Health (SOH) Program Manual
UFC 4-150-07	Maintenance of Waterfront Facilities
UFC 4-860-03	Railroad Track Maintenance & Safety Standards
UFC 4-152-01	Piers and Wharves
UFC 3-320-07N	Weight Handling Equipment
UFGS 05 12 00	Structural Steel
UFGS 34 11 00	Railroad Track and Accessories
UFGS 34 11 19.00 20	Welding Crane and Railroad Rail - Thermite Method
UFGS 41 22 13.33	Portal Crane Track Installation

INSPECTION, CERTIFICATION AND AUDIT OF CRANE AND RAILROAD TRACKAGE

SECTION 1. GENERAL

1.0 Railroad and crane trackage inspections, certifications and audits shall be performed at the frequencies and in the detail specified in this instruction. Where not specifically described in this instruction, the inspection and maintenance management program for trackage shall comply with appropriate NAVFAC Maintenance Manuals, including MO-321, MO-322, MO-103 and UFC 4-860-03 "Railroad Maintenance & Safety Track Standards". In general, inspections shall consist of observing the functioning of the trackage as related to safety, maintenance and design parameters. Examination will be by sight, sound, feel, instrumentation and non-destructive testing. Inspection, certification and audit of trackage includes rails, ties, subgrade, supports, foundations, drainage appendages and accessories. Primary emphasis shall be given to ensuring maximum safety by maintaining all facilities in a safe and sound condition. Since there is a difference in program or procedure, trackage is divided into three Major Trackage Systems as defined below and discussed separately herein.

1.0.1 RAILROAD TRACKAGE. Railroad trackage applies to all track systems used by engines/locomotives, railcars, locomotive cranes, or hi-rail trucks including narrow gage systems.

1.0.2 GROUND-LEVEL CRANE TRACKAGE. Ground-level crane trackage applies to tracks for all weight handling equipment that operates at an activity. This includes but is not limited to trackage systems for portal, gantry, and the ground level rail for semi-gantry cranes.

1.0.3 ELEVATED CRANE TRACKAGE. Elevated crane trackage applies to all trackage systems attached to or suspended from side walls, columns, buildings, roofs or separate superstructures. This includes trackage for overhead or bridge cranes, wall cranes, and semi-gantry cranes.

NOTES: 1. Rail inspections for monorails; jib crane rails; "H" Beam, "I" Beam, or other structural steel shape rail supporting underhung crane systems; and trolley trackage for jib or other type hoists are conducted by the crane inspector in accordance with NAVFAC P-307. Guidelines for inspection, certification and audit for these types of rail systems are not included in this instruction. Top running cranes using rubber tires running directly on I-beam or other steel shapes are also not covered.

2. Top running bridge cranes with single or double flanged steel wheels operating on steel shapes such as square, rectangular or triangular rails shall be inspected and certified in accordance with this instruction, but specific inspection requirements for the rail fastening and joining shall be developed locally based on the engineering design guidance.

3. When there is a Navy crane, that requires certification in accordance with NAVFAC P-307, operating on track that is not on Navy plant account, the trackage system will be inspected and certified in accordance with the provisions of this instruction.

4. Rail systems used for stacker cranes are not included in this program. Stacker cranes and associated runway systems are procured as Class 3 property. Large cab operated stacker cranes are inspected and certified in accordance with MO-118, “Vertical Transportation Equipment”.

5. Rail systems used by fixed load bridge systems, typically X-ray units, may be part of the Class 2 property plant account but the bridge is not a considered weight handling equipment in accordance with P-307. These trackage systems shall be inspected and certified in accordance with this instruction.

1.1 INSPECTION. Inspection and testing of trackage shall be performed by qualified activity personnel or by contract with assistance of Naval Facilities Engineering Service Center (NAVFAC ESC) personnel when requested. The responsibility for providing qualified trackage inspection is typically assigned to a Public Works Department of a Regional Facilities Engineering Command (FEC) or a weight handling department of commands not aligned with NAVFACENGCOM. Inspectors may designate a proposed degree-of-hazard (catastrophic, critical, or marginal) of a section or subsystem based on criteria contained herein and their judgment. Where there is any doubt regarding the seriousness of a defect, or a questionable safety condition, all use shall be stopped over the section of trackage involved until the deficiencies are corrected or until safe use is determined (see paragraph 1.3). Deficiencies designated as "catastrophic" or "critical" by inspection personnel shall be evaluated by the cognizant engineering or facilities management organization to determine corrective action and interim precautionary measures including "non-certification" or "restricted certification." Inspections shall be conducted according to the interval stated herein or more often when deemed necessary by the work supervisor or as directed by the Certifying Official.

1.2 TRACK INSPECTORS QUALIFICATIONS. Track Inspectors are responsible for conducting safety inspections (paragraphs 2.1.3, 3.1.3 and 4.1.3) and detailed inspections (paragraphs 2.1.4, 3.1.4, and 4.1.4) including visual and operational inspections. These inspections are more inclusive and exacting than scheduled maintenance inspections and shall be conducted by trained personnel. The Certifying Official shall designate qualified persons to inspect track for defects. Each person designated must have:

(1) At least -

(a) 1 year of experience as an inspector working under the tutelage of a qualified experienced inspector performing normal track inspection duties at assigned activity.

and

(b) Attended NAVFACENGCOM Trackage Inspector Training Course or any equivalent course offered by the private industry or other government agencies. Activities with local crane training programs may offer an elevated crane trackage inspector training course for their track inspectors, if the course training plan is approved and the instructor is authorized by NAVFAC ESC OP64. The course instructor shall have attended the NAVFACENGCOM

elevated crane trackage course at least every five years. Activities providing local elevated crane track inspector training shall provide a list of attendees (name/position/code/telephone number) at the completion of each course to NAVFAC ESC.

(2) Attend a refresher course in 1b above at least once every five years.
(3) Demonstrates to the Certifying Official that as an inspector -
  (a) Knows and understands the requirements of this instruction and the Federal Railroad Administration (FRA) Track Safety Standards.
  (b) Can detect deviations from those requirements; and
  (c) Can prescribe appropriate remedial action to correct or safely compensate for those deviations.
(4) The designation of the track inspector(s) by the Certifying Official shall be in writing and include the basis for each designation. Basis of designation, as a minimum, shall include number of years of experience and dates the training course was attended to show that qualifications have been met and are current. In addition, the Certifying Official shall provide written authorization to the track inspector to prescribe remedial actions to correct or safely compensate for deviations from the requirements of this instruction.

1.3 CERTIFICATION. All in-service trackage shall have a current certification according to one of the classifications shown herein, signed and dated by the Certifying Official. All out of service trackage shall be documented as non-certified for use or documented by the Certifying Official that it is inactive status. Certification shall be made and documented at intervals not to exceed two years. The two year interval for track certification and operational inspection (paragraph 4.1.4.3) for elevated crane trackage may be based on the crane certification date at the discretion of the Certifying Official as long as it does not exceed the track certification date by over 45 days. The track certification shall indicate the date of crane certification. Also see paragraph 1.3.1 regarding extension of certification. Current and previous certification for each section of trackage shall be readily maintained on file. Restrictions for restricted certification shall be documented and on file. Inspection methods and tests described or referenced herein shall be used as the basis for trackage certification. At any time during the two year period of the certification, the annual visual or two/five year operational inspections become over due, the certification will be cancelled in accordance with paragraph 1.3.4. At which time overdue inspection(s) are accomplished, certification/recertification will be in accordance with paragraph 1.3.4. Attachments (2-2), (3-2) and (4-2) provide minimum requirements for a certification documents for each of the three major trackage systems and may be used; however, activities have the option to use locally developed forms. For inactive trackage or trackage used infrequently, certification may be performed just prior to use. When there is any doubt as to the degree-of-hazard over a given section of trackage, a certification shall not be given until a detailed investigation and engineering evaluation have been completed to determine whether or not the section of trackage involved can be certified safe, or whether or not restricted operations may continue pending restoration.

1.3.1 Extension of Certification. Tracks with a Full Certification may have the certification extended for a period not to exceed 30 days for railroad and ground level crane track and a

period not to exceed 45 days (corresponds with extension allowed for cranes in accordance with the P-307) for elevated crane track. The Certifying Official shall document the length of certification extension in writing. In addition to requiring a full certification for track certification to be extended, the following shall apply:

a. Track shall have a current detailed inspection within two weeks prior to extension;

b. Elevated crane track shall receive a "No load test" in accordance with paragraph 4.1.4.3.2 of this document and Appendix E, NAVFAC P-307.

c. Track shall have been active and seen normal use during the certification period and

d. There shall be no indication of subgrade or support structure degradation.

1.3.2 Certifying Official. The Certifying Official shall:

(1) Be designated as responsible for the sustainment/restoration and inspection of trackage, in writing, by the Commanding Officer of the regional FEC or local activity Commanding Officer. Alternate Certifying Official(s) may also be designated, in writing to act in the absence of the Certifying Official. Routinely, certification shall be made by the Certifying Official. The alternate Certifying Official should only certify track due to lengthy absence of the Certifying Official or when production delays would occur. The Certifying Official shall be made aware of all certifications performed during the Certifying Official's absence

(2) Approve all certifications.

(3) Be responsible for safety and shall insure the visual supervision of each operation over the defective sections when necessary to use non-certified trackage.

(4) Insure a visual examination of the cause of non-certification is accomplished prior to use to determine if the trackage can be used for emergency or temporary traffic.

(5) Indicate, in writing, mandatory precautions and restrictions to be enforced when a section of restricted or non-certified trackage is used.

(6) Delegate the authority to visually supervise movement on noncertified trackage, except for movement of hazardous or nuclear material, provided that defects have been examined to ensure they have not progressed or changed and that occasional movements can be made safely. The Certifying Official shall supervise movement on non-certified trackage of hazardous or nuclear material.

1.3.3 Certification Classifications

1.3.3.1 Full Certification. Trackage systems with minor deficiencies classified as "marginal" (paragraph 1.4.3) or no defect may be fully certified for all operations. These sections shall be repaired, when practical, during regularly scheduled track work operations. Records of un-repaired marginal rail defects and substandard trackage shall be kept current and the trackage

continually observed during all future inspections to identify any further degradation which might result in "critical" defects.

1.3.3.2 Restricted Certification. Trackage systems with "Critical" rail defects (paragraph 1.4.2) or potentially dangerous sections of trackage may be scheduled for restricted operation at the discretion of the Certifying Official, provided FRA Trackage Safety Standards Paragraph 213.113 is complied with or all of the following actions are taken:

(1) Replacement or repair is scheduled.

(2) Deficient areas are clearly and specifically marked with warning signs when practical, or specified in written instructions and restrictions.

(3) Operators are informed to proceed with extreme caution.

(4) Reduced speed operation is approved following an engineering inspection.

(5) Defect or defects are carefully reinspected during safety inspections at intervals prescribed by FRA or intervals of not more than every six months, whichever is less. (For infrequently used trackage, inspections may be made just prior to use.)

1.3.3.3 Non-Certification. Trackage systems which have "catastrophic" rail defects (paragraph 1.4.1) or dangerous sections of trackage shall not be certified. Usage shall be stopped until the section or sections of trackage have been repaired or replaced and certified. Emergency use of non-certified trackage is discussed in paragraph 1.3.2. Sections of trackage that are defective, damaged, misaligned or otherwise failing to meet the standards established in the FRA Track Safety Standards or this instruction shall be barricaded or marked with warning signs when practical and service shall be discontinued. When a catastrophic defect is found which cancels the certification of a specific section of track, service shall be discontinued over the defect and the problem area shall be isolated with barricades when practical. In addition to discontinuing service and isolating the problem area, the following actions shall be done to ensure maximum safety:

(1) Advise all concerned.

(2) When repaired, re-examine the specific section of trackage. An operational inspection is not a mandatory action. (See paragraphs 2.1.4.2.4, 3.1.4.2.3, and 4.1.4.3.3)

(3) Recertify the repaired section. (See paragraph 1.3.4)

(4) Update documentation to reflect defects, repair(s) made, reinspection, and recertification.

1.3.4 Cancelled Certification. Tests or inspections made between certifications that indicate previously unreported catastrophic defects, critical defects or other unsafe conditions shall automatically cancel certification over the specific section of trackage involved. The term "specific section" refers to the immediate area in which a defect occurs and not to the entire section of trackage certified. The certification of trackage on either side of such a defect may remain as classified at the discretion of the Certifying Official. If the new defect does not change the certification classification, the certification should not be changed. For example: If a critical

defect is discovered in a section of trackage with restricted certification, the certification remains the same and is not cancelled. If the defect found would require a more restrictive certification than the entire section of trackage under certification, the certification over the specific section would change and appropriate actions, as discussed above, taken. This change in certification shall be documented and made known to the Certifying Official. The method used to remove the specific section of trackage from service is an activity option, provided all defects are recorded in history files and users of subject trackage are apprised of trackage defects and special precaution to take while using. Upon completion of investigation and temporary or permanent restoration, the specific section shall be reinspected. If the classification of certification is the same as for the entire section, the exception for the specific section involved may be cancelled and the original certification used.

1.4 Trackage Defect Classification. Defect hazards are grouped into three categories - (1) Catastrophic, (2) Critical, and (3) Marginal. These categories are as recommended in MIL-STD 882D. Defects are listed in the hazard category in which they normally occur. Exceptions and variations are expected; therefore, experience or engineering judgment must be used to determine the degree of hazard for each defect. Guidelines to assist inspectors and certifying officials in determining the degree of hazard of a defect are described below and summarized in Attachments (2-1), (3-1) and (4-1).

1.4.1 "Catastrophic". Sections of trackage with catastrophic defects involved shall not be used until repaired, except as noted in paragraph 1.3.3.3. Catastrophic defects include unsafe track conditions based on engineering judgment and experience, and defects requiring immediate change out of rail. The following defects are considered catastrophic and all traffic shall be stopped until repairs are made:

(1) Any breakout in the railhead.
(Exception as detailed in Note 6, Attachment (3-1), for ground level crane rail.)
(2) Rail defects accumulating three feet or more in any l0 feet.
(3) Broken base exceeding six inches.
(4) For railroad trackage any defect exceeding FRA Class 1 Track Safety Standards, catastrophic defects listed in Attachment 2-1, or “no operation” defects listed in UFC 4-860-03.

Specific criteria for evaluating the consequences of defects outside the range designated as critical for crane rail are not available. The activity shall evaluate the severity of each such defect and shall classify the degree-of-hazard based on engineering judgment and experience. Temporary or emergency repair of defective rails may reduce the degree-of-hazard to critical, marginal or no defect depending on the severity of the defect.

1.4.2 "Critical". Trackage with critical defects may continue in use provided that all actions addressed in paragraph 1.3.3.2 are complied with. Any defect exceeding FRA Class 2 Track Safety Standards or “restricted operation” defects addressed in UFC 4-860-03 are considered critical. Guidelines for classifying critical defects are provided in Attachments (2-1), (3-1) and (4-1).

1.4.3 "Marginal". Marginal defects are deficiencies that will not cause damage to the trackage system or operating equipment, or endanger personnel safety and that should be scheduled for routine sustainment and restoration. The intent in recording marginal or minor defects is to ensure that defects which may grow are monitored. In accordance with Note 8, Attachment (2-1) and Note 5, Attachments (3-1) and (4-1), certain internal rail defects may be categorized as marginal provided the defect is inspected six months after discovery and annually thereafter to ensure that the defect is not progressing.

1.5 AUDIT. Naval Facilities Engineering Service Center (NAVFAC ESC) shall schedule and conduct audits of maintenance management of trackage at each activity.

1.5.1 Purpose. The audit evaluates the effectiveness of trackage management at each activity, including Sustainment, Restoration, and Modernization (SRM), to ensure the safety and reliability of the facility's trackage and to furnish the activity and claimant with an appraisal of the track management program. The audit team shall review procedures and make recommendations for improving trackage management. Portions of the trackage system shall be inspected and results compared with the activity's inspections. The audit will be directed to affirm that the trackage management, including certification programs, is being conducted in a satisfactory manner and that activity instructions on implementation are adequate.

1.5.2 Frequency and Method,

1.5.2.1 On-site audits shall be conducted at two-year intervals for trackage in any of the following categories:
- Railroad trackage that does not have RAILER implemented and used for trackage management.
- Railroad trackage that handles nuclear material or ordnance.
- Trackage supporting Category 1 cranes with curves.
- Trackage supporting Category 1 cranes with critical or catastrophic defects at the last audit.

1.5.2.2 On-site audits shall be conducted at four-year intervals for trackage in any of the following categories:
- Railroad trackage that does not require audits at two-year intervals under paragraph 1.5.2.1.
- Trackage supporting Category 1 cranes that does not require audits at two-year intervals under paragraph 1.5.2.1.
- Trackage supporting Category 2 cranes.
- Trackage supporting Category 3 cranes handling nuclear material.

1.5.2.3 Paperwork review only audits, shall be scheduled at six-year intervals and conducted at NAVFAC ESC for trackage supporting Category 3 cranes that do not require audits at four-year intervals under paragraph 1.5.2.2. On-site audits shall be scheduled when any of the following criteria are met:
- The activity is new to the trackage program or has never had an audit for any reason.
- The activity has only one inspector and the inspector has not had one year of experience under a designated inspector at that activity.
- The audit records review indicates there are significant documentation errors such as

- 20% of cranes have had a defaulted certification within the last four years.
- 20% of records are missing signatures, inspections are not recorded or similar defects
- The NAVFAC Crane Center notes they have concerns with the rail system.

1.5.2.4 Activities with trackage supporting a mixture of Category 2 and Category 3 cranes shall be audited at the required Category 2 frequency unless their Category 2 inventory is less than 20% of the total inventory, the Category 2 cranes are infrequently used and an activity requests the lower frequency.

1.5.2.5 NAVFAC ESC may conduct audits more frequently when requested by the cognizant Navy Region or systems command, when previous audits recommend additional follow-up, or when any audit reveals that the trackage maintenance management program at an activity is not satisfactory.

1.5.3 Reports. A report on the effectiveness and adequacy of the program shall be forwarded to the cognizant Navy Region, FEC, activity Commanding Officer and system command within 45 calendar days after completion of the audit.

1.5.4 Non-Certification of Trackage. If during the performance of an audit or other track inspection the auditor determines that a serious catastrophic defect exists in any portion of the trackage and the activity is not taking appropriate measures and/or the trackage maintenance and inspection program is so poor that continued operation of the trackage is unsafe, the auditor shall issue a Trackage Audit Non-Certification form covering the affected portion, segment, track or system. The activity shall cease all operation over the identified trackage until repairs are made and the activity certifies to NAVFAC ESC that the track is now safe for use.

1.5.5 Activity Coordination. Schedules of audits will be coordinated with the activity to be audited and the activity formally notified. The activity's cognizant Navy Region, FEC, Commanding Officer and system command shall be advised of the dates that the audit will be conducted. Activities shall submit the following records in PDF format not less than 30 days before the audit to NAVFAC ESC: mishap reports, inventory, inspection reports, certification documents and other related information. Refer to NAVFAC BMS B15.21 Trackage Audits or NAVFAC ESC for the most current and complete list. To establish credibility of documents involving inspections and tests, a representative from the audit team may be present to observe a portion of the activity's operational and visual inspections and tests. The activity’s inspectors shall accompany the track auditor during portions of the field examination. Activities shall ensure that all audit team findings are correct before the team members depart. The activity shall review preliminary recommendations and provide the audit team with reclamas or disagreements prior to the departure conference.

1.5.6 Response. The activity audited shall forward a plan of action to its cognizant Navy Region or systems command within 30 days after receipt of the audit report with a copy to NAVFAC ESC. Reports on the corrective actions taken on the audit report recommendations shall be submitted annually until the actions are complete.

1.5.7 Report Records. The activity shall maintain on file previous audits and activity responses until all actions on findings are complete and shown as complete on a subsequent audit report.

1.6 NON-DESTRUCTIVE TESTING (NDT).

1.6.1 Ultrasonic Testing. Ultrasonic inspection is a non-destructive test method for revealing internal discontinuities in dense homogenous materials by means of acoustic waves of frequencies above the audible range. Ultrasonic testing is the recommended method for non-destructive testing of readily accessible rail. Ultrasonic testing is an economical method of checking long lengths of trackage and rail encased in pavement. Generally ultrasonic testing of elevated crane rails is not required; however, elevated crane rails may be ultrasonically tested at the discretion of the Certifying Official.

1.6.1.1 Ultrasonic Equipment Operators. Operators of the ultrasonic equipment shall be certified to a Level I qualification in accordance with the American Standards Institute (ANSI)/American Society for Nondestructive Testing (ASNT) Standard CP189-2001 "ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel"

1.6.1.2 Ultrasonic Equipment. The ultrasonic equipment operated by qualified personnel (para. 1.6.1.1) shall be able to detect, but not be limited to, the following discontinuities in the rail.

Transverse fissures or other centrally located transverse defects representing approximately 10% of the cross-sectional area of the rail head.

Detail fractures representing approximately 15% of the cross-sectional area of the rail head and not masked from above by the shallow horizontal separations sometimes associated with shells.

Engine burn fractures or transverse separations developing from thermal cracks underneath the driver burns representing approximately 20% of the cross-sectional area of the rail head.

Horizontal split heads at least two inches in length, extending at least halfway through the rail head and located one-half inch or more below the running surface of the rail.

Vertical split heads so oriented as to interrupt an ultrasonic signal transmitted centrally through the rail section from above.

Head and web separations and split webs outside the joint bar limits at least two inches in length and progressing entirely through the rail web.

Joint defects (bolt hole cracks and head and web separations inside the joint bar limits) at least one-half inch in length and progressing entirely through the rail web.

Defective welds (plant or field) - with centrally located transverse defects, voids or inclusions in the rail head representing approximately 10% of the cross-sectional area of the rail head; with transverse head defects not centrally located representing approximately 15% of the cross-sectional area of the rail head; and with web defects in a generally horizontal plane at a rail weld approximately two inches in length or longer with penetration more than halfway through the rail web.

1.6.1.3 Calibration. Ultrasonic inspection equipment shall be calibrated to ensure reliable interpretation of responses. The approximate smallest indication that can be consistently detected include, but are not necessarily limited to, the following simulated, "marginal" defects.

(1) A one-quarter (1/4) inch diameter hole drilled horizontally through the rail head.
(2) A bolt hole through the web.
(3) A horizontal one-half (1/2) inch long sawn crack between the head and the web.
(4) A vertical one-half (1/2) inch long sawn crack in the web (optional depending on equipment available).

1.6.2 Sounding. Sounding with a hammer is one of the best and least expensive methods of testing rail, and is a practical way to inspect elevated crane trackage or relatively short sections (1,000 feet or less) of ground level trackage, where it was impractical to perform an ultrasonic inspection or inaccessible during the ultrasonic inspection and other trackage systems where ultrasonic testing is impractical. Light tapping with a 12 - 24 ounce steel hammer about every six inches will reveal looseness between rail and anchor plate, and defects before they become serious. Similar to ultrasonic testing, all non-standard responses should be investigated and recorded for future comparison. If sounding is used, rails shall be tested for defects upon activation and at annual intervals. This interval may be extended to a 2-4 year schedule based on an engineering analysis accomplished by the activity. The engineering analysis shall be in writing and take into account rail usage, age, history, and experience in determining a frequency other than an annual.

1.6.3 Other Non-Destructive Tests. Magnetic particle, dye penetrant, and other non-destructive test methods may be advantageous in investigating potential defects indicated by other inspections. Eddy current, x-ray or other approved, non-destructive test methods brought about by state-of-the-art advances may be used to supplement ultrasonic testing or sounding based on local conditions, availability, economics, experience and engineering judgment.

1.7 MISCELLANEOUS INSPECTIONS AND TESTS. Other inspections may be used to determine the safe condition of trackage under unique or unusual circumstances or to make a detailed engineering investigation of specific, critical components of a trackage system. Prior to use, the availability, limitations and practicability of any special investigation shall be evaluated. Special inspections, such as the following, may assist in determining the condition of trackage.

1.7.1 Seismograph. Under certain conditions seismographic instruments may be beneficial in determining voids in fill material or embankments, level of water tables or location of slippage planes in the foundation below trackage systems.

1.7.2 Increment Bore. Timber trestles, piling and other wood structures should be examined for soundness when deterioration is suspected or when necessary to make an engineering analysis. In addition, this test may be required to help determine adequacy of treatment of new material.

1.7.3 Strain Gages. When the structural analysis for the anticipated maximum loading of a structure indicates certain members may be overstressed or marginal, a load test (duplicating or

exceeding maximum total moment and shear experienced in-service) with stress and strain instrumentation is appropriate.

1.8 UNDERWATER INSPECTION. Underwater inspections of waterfront structures supporting crane or railroad trackage shall be conducted in accordance with guidelines contained in MO-104.2 Specialized Underwater Facilities Inspection, MO-311 Marine Biology Operational Handbook, and MO-322 Vol II Inspection of Shore Facilities. Inspections of piers, wharfs, quaywalls, and bulkheads shall include, but are not limited to: bearing or plumb piles, batter piles, pile caps, stringers, adjacent seawalls, riprap, sheet piling, abutments, and other subcomponents.

1.8.1 Frequency. Underwater and below deck inspections of support structures are required as follows:

(1) At intervals not to exceed six years. In historically polluted waters which are being radically cleaned, all wood structures should be inspected every three years. An engineering analysis of each structure should be made to determine the appropriate inspection interval.
(2) After obvious overload or structural damage
(3) After a major storm.
(4) Following a ship collision.
(5) When recommended by other investigations, evaluations, and engineering judgment based on age of the structure, material condition, deterioration rate, biofouling growth, and suspected damage or deficiencies.

1.8.2 Assistance. The NAVFAC ESC will provide technical guidance, specifications, and assistance when requested for in-house or contract underwater inspections.

1.9 MISHAP INVESTIGATION. Activities shall investigate and keep records of all trackage related accidents, incidents or minor mishaps including derailments, safety violations, personal injury, and property damage. Activities shall keep investigation records for all accidents and incidents related to trackage until data is verified during an audit review. When necessary, investigations and reporting shall be made in accordance with OPNAVINST 5102.1D, Mishap and Safety Investigation, Reporting, and Record Keeping Manual and OPNAVINST 5100.23G, Navy Safety and Occupational Health (SOH) Program Manual and reported to the Naval Safety Center. Additional guidelines for detailed investigation of trackage systems are included in NAVFAC MO-103, Change 1. Completed mishap reports shall be forwarded to NAVFAC ESC (CIFSI) within 30 days of mishap. Based on information learned from mishap reports, recommended sustainment and changed procedures to enhance mishap prevention shall be discussed at track conferences or distributed to all concerned. Investigation records shall include, but are not limited to:

(1) Date and time.
(2) Location and weather.
(3) Description of event.
(4) Type system and property involved.

(5) Type of operation and speed.
(6) Estimated cost of damage.
(7) Reported injuries.
(8) Track conditions.
(9) Factors leading to mishap.
(10) Corrective action(s) taken.
(11) Investigators

1.10 RECORDS.

1.10.1 In order to manage and administer trackage inspections, sustainment/restoration programs, and design, the following information should be available in a usable condition so that it may be referred to easily and readily. Where documents do not exist, a program with milestones for establishing missing data should be initiated to obtain data on trackage systems. Generally, missing information is obtained simultaneously with repairing or upgrading sections of trackage. It is expected that the information required in this section will be obtained routinely with minimal disturbance of operations. Activity needs and priority for production and manpower should be considered prior to scheduling any survey work. In addition, track geometry information should be obtained when any of the conditions noted in paragraphs 2.2.3, 3.2.3 and 4.2.3 exist and when spot check measurements are required to verify the visual observations discussed in paragraphs 2.1.4.3, 3.1.4.3 and 4.1.4.3. Specific requirements for maintaining records of required inspections are addressed in specific paragraphs related to those inspections.

1.10.2 TRACK CHARTS. Track charts, plans, maps or plats shall be maintained as part of the real property records. They shall be kept up to date and used for programming future work, scheduling current work, indicating abnormal conditions and recording maintenance and inspection data. Track charts can be in any format, filed to suit activity needs, and shall be usable as a working document.

1.10.3 PLAN AND PROFILE. Detailed plan and top of rail profile or grades of crane and railroad track systems shall be kept current and may be shown on the track chart or separately. Size and type of rail, switches, degree of curvature for RR trackage alignment, frogs and other rail appurtenances should be indicated on the plan. Structures and other features which control or mandate alignment or grade, and reference points for location and elevation checks should be accurately referenced.

1.10.3.1 Top of Rail Profile. A detailed top of rail profile has a very low priority except where grades approach the allowable limits. In most cases the grade may be determined using a hand level and rod. The resulting estimated profile may be considered adequate until an accurate survey is required. A long range program to accomplish profile surveys is not required provided they are conducted when related problems are investigated or when new rail is installed.

1.10.3.2 Elevated Crane Rail Systems. The profile of elevated crane trackage may be considered level and the plan may be assumed to be a straight line provided the system alignment is straight and none of the conditions listed in paragraph 4.2.3 exist. A long range program to

accomplish surveys is not required; however, when detailed surveys are conducted they shall be recorded.

1.10.3.3 Rail Identification. When rail is encased in pavement or otherwise unidentifiable, the size and type of rail should be estimated based on random uncovering or activities' experience. When positive identification cannot be made, that fact should be documented on the records. When an unidentified rail is repaired or replaced, the size and type of rail should be obtained and recorded on the plan or track chart and in the historical records file.

1.10.4 CROSS SECTION. Cross sections of substructures shall be maintained, when known and available, especially the substructures under tracks around piers, drydocks, trestles, and wet areas.

1.10.5 HISTORICAL DATA. Historical data on each system shall be retained and shall include the following:

(1) Dates that the system was installed.

(2) Weight of rail, gage of track.

(3) History of sustainment, restoration, major replacement and realignment.

(4) Replacement of rail and major tie replacement.

(5) Methods of accomplishing previous work.

(6) Design information, justification and background:

(a) Maximum capacity - where designs do not exist, load limits may be established based on engineering judgments and weight tests.

(b) Engineering calculations to establish maximum loading. When available, original or updated design calculations shall be maintained. If not available, original engineered structural drawing(s) that indicates the capacity/load limit the design was based on may be used. When none of these are available, a statement describing the basis used to determine the maximum load limit should be included in the historical data.

(c) Supporting Structures. Valid structural analysis for all supporting structures based on or exceeding current maximum loading. Structural safety verification shall be on file for supporting substructures. When original or updated design calculations are not available, original engineered structural drawing(s) of the support structure that indicates the capacity/load limit the design was based on may be used. As a minimum, especially for massive structures, an engineering certification based on visual observations, historical performance, and, when necessary, basic calculations on critical components should be available.

(d) For trackage encased in pavement, an accurate as-built description, certification or pictures shall be obtained. Tie spacing including number and pattern of spikes or tie down bolt spacing shall be verified.

(7) NAVFACENGCOMHQ approval of railroad curves and turn-outs.

(8) Justification or exceptions to standards (waivers).

(9) Other pertinent information.

1.10.6 PROPOSED PROJECTS. Maintain a list of pending work including: major sustainment and restoration projects (approved, submitted and needed), minor work to be accomplished with local funding and major replacement projects which are being considered for MCON funding. Use "multi-year" renewal programs for rail or tie replacement when practical.

SECTION 2. RAILROAD TRACKAGE

2.1 INSPECTION.

2.1.1 CONTINUOUS OPERATOR INSPECTION. Daily or prior to use safety checks listed in activity regulations shall be conducted. In addition, on-the-job observations shall be performed in accordance with P-301 at all times when equipment is working. Railroad operations personnel (engineers, brakeman, conductors, trackmen, etc.) shall be encouraged to observe and report track problems, deficiencies, obstructions and the "feel" of the track.

2.1.2 PREVENTIVE MAINTENANCE (PM) - PM SERVICE AND PM INSPECTION.

2.1.2.1 PM is a continuous working inspection, examination of component parts, lubrication, adjustment, and minor repair. NAVFAC manuals MO-103 "Maintenance of Trackage" and MO-322 "Inspection of Shore Facilities" Volumes I and II contain instructions on performing maintenance service and inspection and provide lists of check points. PM service and inspection are normally conducted by the crews assigned to or operating the equipment, by the track walkers, by Maintenance Shop personnel, and/or by contract. The PM Inspections and Services are scheduled as directed by the Public Works Officer or Activity Commander. Flexibility exists in the frequency of PM inspections based on usage, climatic conditions, history, and experience; therefore, the Public Works Officer or Activity Commander shall establish PM schedules. On systems where lubrication of moving parts, adjustments to electrical or mechanical systems, tightening of loose bolts, and other minor repairs are minimal, the PM service requirements may be identified during the safety inspection and annual detailed inspection and PM service and repair work scheduled. When possible, deficiencies are corrected during the inspection and recorded. Uncorrected deficiencies shall be reported to the supervisor for action, inclusion in the repair work schedule, adjustment of operating speed and consideration for closure of a section of trackage. Minimum information to be provided in PM reports is detailed in paragraph 2.1.2.2. PM inspections are visual inspections which include, but are not limited to, such items as loose or missing bolts, broken ties, defective switch points, loose spikes, loose or misaligned plates or rail anchors, inoperative switches, operator reported rough or soft spots, poor drainage, substructure failure, defective rail, and settlement. The most important sections to be checked are the switches, curves and any area where a derailment has occurred.

2.1.2.2 PM Inspection Reports. Local formats in existence may be used. As a minimum PM Inspection reports should include:

(1) Date.
(2) Sections of trackage inspected.
(3) Corrected and uncorrected deficiencies.
(4) Number of and size of broken or missing parts.
(5) Suspected misalignment or defect.
(6) Guides and instructions used for the inspection.

The current PM Inspection report and the one for the preceding period shall be retained. Work Authorization Documents or Shop Repair Orders, usually the action following PM Inspections, shall be kept for five years.

2.1.3 SAFETY INSPECTION. Safety inspection is that inspection of railroad track performed in accordance with paragraphs 213.233, 213.235 and 213.239 of the FRA Track Safety Standards, Attachment (1), paragraph 2-3.c of UFC 4-860-03 and as modified herein. The purpose of this inspection is to identify critical and catastrophic defects affecting the safety of the track being inspected. Safety inspection can be accomplished in conjunction with preventive maintenance if performed by designated inspectors and proper documentation of inspection is performed. The annual detailed inspection can be considered as a safety inspection when accomplished at the specific period of the required safety inspection. See paragraph 2-3.c of UFC 4-860-03 for details on scheduling, inspection methods and documentation.

2.1.3.1 Schedule. Track shall be inspected at the interval determined from category of track and frequency of use in accordance with the table provided in paragraph 2-3.c of UFC 4-860-03. For track infrequently used, the safety inspection may be accomplished just prior to use. Track use should be looked at periodically (at least annually) to determine inspection frequency. Average use rates should be based on the previous six months use. If an inactive track is returned to use, inspection frequency will be established on expected use. Based on the schedule provided in UFC 4-860-093, the following intervals between safety inspections shall apply.

* Interval between inspections will be as follows:

Inspection Frequency	Minimum Interval Between Inspections
Weekly	3 calendar days
Monthly	20 calendar days

Quarterly, semi-annual, and annual inspection will be accomplished in the month scheduled (i.e. Jan, Apr, Jul, Oct).

Note (1) Off-Station track is defined as that track belonging to the Navy that extends outside the main station through residential and/or commercial public areas. If track is infrequently used, safety inspection may be performed just prior to use.

2.1.3.2 Special Safety Inspections. See paragraph 2-3.g of UFC 4-860-03 for requirements on providing special safety inspections for infrequently used tracks, mass rail movements and for unusual occurrences such as derailment, accident, flood, fire, earthquake, hurricane, severe storm, or other occurrence that could have an adverse effect on the track structure.

2.1.4 DETAILED INSPECTION SUPPLEMENTED BY ENGINEERING EVALUATIONS. Inspection checklists and guidelines are contained in UFC 4-860-03 and supplemented in this instruction. Detailed Inspections are to be conducted annually or more frequently when required by climatic conditions or other unusual circumstances. Annual inspection shall mean that sections of trackage are scheduled as part of the facilities inspection program. Inspection for each track section shall be scheduled and accomplished during a specific month each year and routinely scheduled in a 12 month period. Annual inspection exceeding a 13 month period since

the previous annual inspection on the particular track section will cause the existing certification to be default and result in the track section being non-certified for use. Engineering evaluations shall be conducted whenever there is any doubt of physical condition. In addition, Detailed Inspection or Engineering Evaluation criteria shall be used to supplement investigations and evaluations after any derailment. Additional testing or inspection shall be conducted when the condition of any portion of the trackage system is doubtful.

Based on the development over the past 10 years of the railroad safety inspection, the annual detailed inspection in the year between the two year certification inspections may be deferred until the second year. This deferral will be based on one of the two following items:

a. RAILER has been implemented and the TSCI for the specific track is 80 or above and no individual track segment's RJCI, TCI or BSCI is less than 80. No critical or catastrophic defects exist. See paragraph 2.1.6 for full RAILER description.

b. Track has recently been repaired, traffic is light and there are no severe marginal, critical or catastrophic defects in the track.

Deferral will be typically on a whole track basis. If the individual track is very long and has five or more segments, deferral can be on a segment basis. It is not the intent that every other segment be deferred, rather as an example: segments 1-5 require a detailed inspection and segment 6-10 have a safety inspection in lieu of a detailed inspection. All deferrals will be approved in writing by the Certifying Official. In lieu of a detailed inspection, a safety inspection will be performed in accordance with paragraph 2.1.3, except that the inspection will be a walking inspection. No inspection from a vehicle is allowed. Inspection documentation will specifically address that the inspection is "in lieu of a detailed inspection".

2.1.4.1 Visual Inspection. Visual inspections during the detailed inspection should include PM inspection checkpoints and observations of all trackage system components including rails, ties, rail accessories, switches, crossovers, ballast, roadbeds, support structures and appurtenances. Checkpoints for railroad trackage inspection are listed in MO-103, UFC 4-860-03, MO-322 Volume II and FRA Track Safety Standards.

2.1.4.1.1 Piers, Trestles and Other Support Structures. All subgrades, ballast, foundations, and bridges or trestles shall be inspected for signs of settlement or failure. Special attention should be given to looking for openings in quaywalls, bulkheads or other waterfront retaining structures that may permit fill material to wash out and cause trackage settlement and failure. For bridges and trestles spanning roadways open to vehicular traffic see paragraph 2.1.4.1.2. All other bridges, trestles and piers supporting railroad rail shall be inspected in accordance with criteria outlined in MO-322 and the following criteria. The prescribed minimum inspection frequency for piers and trestles is two years. Inspection of the support system for the biennial control inspection shall be performed by facilities planner & estimators or inspectors, as long as they meet the minimum qualifications provided by MO-322. Indicators of settlement, misalignment or deflection shall be recorded. Deflection, movement, or settlement under routine in-service loading exceeding the limits shown in Attachment (2-1) shall be investigated and analyzed, the degree of damage documented, and the classification of hazard determined. Structural

conditions leading to restricted certification of a section of trackage shall be based on a review of the structural analysis and on a condition survey conducted by qualified engineer in sufficient detail to establish the safety of the structure.

2.1.4.1.2 Bridge/Trestle Inspection. Bridges and trestles that span over roadways open to vehicular traffic shall be operated and maintained in accordance with National Bridge Inspection Standards (NBIS) mandated by 23 CFR Section 650, Subpart C. As specified in NBIS, all bridges 20 feet in length or longer are required to be inspected above the waterline at a regular intervals not to exceed two years and below the waterline at a frequency not to exceed five years. NBIS provides minimum qualifications for bridge inspectors for inspection of these types of bridges. This inspection is directed by CNO ltr 11000 Ser N442/9U594244 of 22 Dec 99 and details are provided in NAVFAC ltr of 24 Dec 02. NAVFAC ESC administers this program and assists activities in performing these inspections.

2.1.4.1.3 Program for Inspection of Paved and Covered Areas.

2.1.4.1.3.1 Paved Areas. Inspection of trackage encased in asphalt, concrete, grout or road crossing material shall include visual inspections and operational observations (para 2.1.4.2) for exposed rail defects, trackage movement, and signs of distress in adjacent pavement. To verify visual inspections, activities shall establish a program to remove small sections of pavement and spot check trackage encased in pavement based on indication of defects with consideration taken for age and usage. Types of defects which would require pavement removal would include pumping joints, wide gage, deflecting rail, settlement of track and surrounding area. Pavement shall be maintained so that it does not interfere with railroad operation and to ensure safe vehicle movement.

2.1.4.1.3.2 Covered Areas. In areas where trackage systems (any portion of the track system from the top of the tie up) are covered with ballast, earth, coal or other material and where excess ballast or other material serves no functional purpose, it shall be removed to permit thorough and complete inspections. In areas where ballast or other material is installed to meet operational requirements, sufficient ballast shall be removed to spot check trackage. Spot checks shall be made of areas where suspected defects are indicated and at randomly selected points established by the Certifying Official based on time in service, usage, knowledge of track condition, and visual observations. At U. S. Naval shipyards, spot checks shall be made at randomly selected points such that a minimum of 5 percent of the covered portions of the trackage system shall be inspected each year. A representative portion of the tie plates, spikes, crossties, joints, rail and accessories shall be inspected each year. Ballast may be replaced to permit continuous operations.

2.1.4.1.3.3 Documentation. In order to document the inspection of trackage in paved and covered areas, an inspection report shall be prepared indicating defects noted, as well as description and general condition of track components for future reference. Pictures should be used to document conditions as necessary. Any defects detected affecting the certification of the section of trackage inspected shall be handled in accordance with paragraph 1.3.

2.1.4.2 Operational Inspection. The purpose of an operational inspection is to supplement the detailed inspection and to assist in the identification of problem areas which could develop into unsafe trackage. Conditions which may be discovered include the following:

(1) Soft spots in the ballast.
(2) Weak or disintegrated ties.
(3) Looseness, binding or vibration.

2.1.4.2.1 Frequency. Operational inspections with loads prescribed in paragraph 2.1.4.2.2 shall be performed at intervals not to exceed two years on active trackage systems to ensure that the trackage systems will sustain the prescribed load in a safe manner. Railroad sidings, storage trackage and sections of trackage blocked or seldom used (less than six movements per year) shall have operational inspections within a maximum interval of five years. Operational inspection exceeding the two/five year requirement will cause the existing certification to be default and result in the track section being non-certified for use. All trackage serving hazardous loads, such as ordnance or fuel, shall have had an operational inspection within a period not to exceed two years. See paragraph 1.3.1 regarding 30 day extension of certification.

2.1.4.2.2 Loads. Loads should be moved over track systems slowly enough so that observations can be made. Loads on rails shall be provided by routine rail traffic that normally operates on the track. If a typical train is not observed, the load on the rail may be provided by a locomotive, engine or test car. Certifying Official shall designate loads to be used other than a typical train. When a test car is used, it shall be loaded to give the maximum anticipated load on at least one axle and as close to the total anticipated load as practical. Operational inspection reports shall describe the load used to perform the operational inspection.

2.1.4.2.3 Observations. A Track Inspector shall conduct or supervise the operational inspection. Trackage shall be inspected during load test or while equipment is operating. Observations for looseness, binding, deflection, or vibration shall be made by sight, sound, and feel. In addition, rail joints, ties, tie plates, ballast or grout, general alignment, rail condition, supporting structures (see paragraph 2.1.4.1.1), and other accessories may be observed for deficiencies during and after the load test or operational inspection. There is no requirement for physical measurements of rail or trackage systems under load; however, when practical and accessible, rail systems shall be observed for deflection. Guidelines for maximum allowable deflections as determined by visual judgment are shown on Attachment (2-1). In the event unusual movement is observed or felt, deflections appear to be larger than the guideline limits established, or the cause of deficiency cannot be immediately determined, an investigation and engineering analysis of the immediate vicinity shall be made prior to certification. Results of the investigation and engineering evaluation, not the deflection limit per se, shall determine when use of a section of trackage must be discontinued.

2.1.4.2.4 Long Sections. When the operational inspection is performed on board a train or engine, supplemental observations of passing rail traffic at randomly selected and suspected defective areas shall be made by an inspector walking alongside the trackage system.

2.1.4.2.5 After Repair. Operational Inspection for certification following major restoration or reconstruction is not a mandatory action required by this instruction; however, as a minimum a visual observation of trackage under routine traffic loading during or after repair shall be performed to ensure proper movement. In addition, it is recommended that, when practical, in-house work orders and contract documents require compliance with the following procedures prior to final acceptance. Equipment shall be operated over railroad trackage after major repair or reconstruction and prior to final track surfacing to ensure there are no defects and to stabilize ballast, rail alignment and track surface. Whenever fill material is added and compacted, ties or rails are installed and aligned, preliminary tamping of ballast is completed, or other work is accomplished, the section of trackage involved shall be inspected for safety and compliance with specifications prior to conducting an operational inspection. Rail traffic shall be run over the repaired or reconstructed section several times. Following this operation, defects shall be corrected, the trackage shall be realigned and surfaced, and the ballast shall be retamped. After final track resurfacing, tamping and alignment, gage, elevations, profile, cross level, and other specifications shall be rechecked for compliance in accordance with acceptance criteria for trackage repair or construction (NOT LISTED IN THIS INSTRUCTION) prior to final acceptance, certification and routine operation. Unified Facilities Guide Specification (UFGS) 34 11 00 and UFC 4-860-03 provide acceptance criteria which should be included in the contract specification.

2.1.4.3 Measurements. The Detailed Inspection shall include visual observations and spot check measurements of grade, track gage, cross section elevation, horizontal alignment, vertical mismatch, supports and other features to insure that criteria in this instruction are met. Instrument surveys may be requested by the Certifying Official or his representative to verify visual observations or spot check measurements, establish new alignment, investigate problem areas and determine deviation from the established standards.

2.1.4.4 Detailed Inspection Documentation. All inspections performed under paragraph 2.1.4 shall be properly documented. Inspection records must specify track inspected, date of inspection, location and nature of deviation from requirements and remedial action taken. Detailed inspection documentation should address all marginal, critical and catastrophic deficiencies existing in the track system at the time of inspection. In addition to detailing defects detected during the annual visual inspection, outstanding defects detected during safety inspections, operational inspections, non-destructive test inspection and other inspections and engineering investigations should be included. Deficiencies not exceeding marginal criteria are recorded, as necessary. A blank example record is provided as Attachment (2-3). Instructions for completion and a sample filled in inspection report are provided in Appendix B of UFC 4-860-03. Attachment (2-4) provides a sample of a "Turnout Inspection Checklist" form. The turnout inspection checklist is provided for use, but is not a required document. Instructions for completion and a sample filled in report are provided in Appendix B of UFC 4-860-03. As a minimum, activity track files shall contain the current and previous complete detailed inspection report. Engineering evaluations and all engineering investigation reports shall be retained until invalidated by trackage repair or other actions. Current and previous operational inspection records shall be kept on file.

2.1.5 NON-DESTRUCTIVE TESTING (NDT).

2.1.5.1 Frequency. All active railroad rails shall be tested for defects upon activation and at five year intervals, unless maintenance problems or visual inspection dictate a necessity for more frequent testing. The term "upon activation" refers to sections of trackage which have been inactivated or not used and that have not had a non-destructive test within the preceding five years. Rail shall be tested by ultrasonic inspection in accordance with paragraph 1.6.1, except short section of rail may be tested by hammer sounding as allowed by paragraph 1.6.2. All trackage that has not been non-destructively tested within the five year period from the previous NDT shall have a restricted certification or may be non-certified. Nondestructive testing of relay rail or used rail may be deferred until the next regularly scheduled five year test interval, at the discretion of the Certifying Official, however any such deferral should be based on an engineering evaluation that considers age, expected use, and experience. During the interim period, the rail may be given full certification based on other tests, observations, and inspections required by this instruction. Criteria for unacceptable rails are included in Attachment (2-1) and in UFC 4-860-03. Appendix C, UFC 4-860-03, provides a brief description and illustration of common rail defects. New rail and accessories shall be accepted according to the latest government specifications or standard industry practice. The NDT results shall be used to establish a base line for future inspection and to identify areas requiring observation.

2.1.5.2 Test Results. Rail NDT inspection records must specify the date of inspection, the location and nature of any internal rail defect found, and the remedial action taken and the date thereof. Current rail NDT inspection records shall be retained until after the next NDT inspection is performed or for one year after remedial action is taken, whichever is longer. All discontinuities shall be reported; the nature and size of defect estimated, and responses compared with standards or past test results. Rejection or degree-of-hazard of all potential defects shall be based on assessment of ultrasonic inspection results, visual inspection, experience, engineering judgment, the criteria shown in Attachment (2-1) and the FRA Track Safety Standards. In-place welded joints and welded repairs may have confused or erratic responses when ultrasonically tested; therefore, interpretation requires experience and engineering judgment to preclude an erroneous classification of defect. Data collected from the ultrasonic or induction tests shall be retained as necessary for base line and defect growth comparisons. A narrative report should be included to explain any unusual observations

2.1.6 RAILER.

2.1.6.1 General. The RAILER Engineered Management System (EMS), developed by the U. S. Army Construction Engineering Research Laboratory(CERL) helps inspectors, engineers, certifying officials and managers evaluate railroad track and plan effective, economical railroad track sustainment and restoration (S&R) programs. RAILER provides a computerized database and analysis procedures for storing data on railroad track inventory, inspection results, track conditions, S&R costs and policies, work history and other essential items. Safety, detailed, operational and non-destructive test inspection data can be inputted, stored and utilized by RAILER. Track certifications can be manually or electronically produced for each track segment. All active Navy railroad track shall be inventoried using RAILER and have a baseline inspection within 4 years of the effective date of this instruction. Activities shall ensure that the RAILER database is updated as required to reflect changes in the inventory.

2.1.6.2 Condition Assessment. RAILER utilizes both track condition indexes and track standards for condition assessment.

2.1.6.2.1 Track Condition Indexes. A Track Structure Condition Index (TSCI) based on the Rail and Joints Condition Index (RJCI), Tie Condition Index (TCI) and Ballast and Subgrade Condition Index (BSCI) are developed from the track inspection data. These indexes measure track segment and component "health" on a 0-100 rating scale. The indexes reflect the ability of a track segment to support routine traffic, and they indicate the S&R actions necessary to restore or sustain acceptable track condition. Track indexes (RJCI, TSI, BSCI and TSCI) are developed for each track segment. Track segment indexes are rolled up into a Track Structure Condition Index for individual tracks. Overall Track Structure Condition Index (TSCI) are provided for areas, which include a number of specific tracks (all tracks on a pier or all tracks in a classification yard) and for the total network. The indexes are also used to determine track deterioration rates. In the future, these condition indexes may be used to justify S&R funding requirements.

2.1.6.1.2 Track Standards. Both sustainment and safety standards addressed in the FRA Safety Standards and Attachment (2-1) are used by RAILER. RAILER quickly identifies defects recorded as "Restrict Ops" (Critical) or "Close to Traffic" (Catastrophic). These standards are then used for documenting track certification.

2.1.6.3 Sustainment/Restoration Management. RAILER can be used for both network-level and project-level management. Network-level management includes assessing current overall track network condition and trends, developing S&R strategies, budgeting, developing short and long range S&R plans, and justifying budgets and S&R projects. These tasks involve the use of track standards, Attachment (2-1), and the Track Structure Condition Indexes (TSCI). Project-level management includes the detailed analysis of specific track segments that may be needed for problem diagnosis and typically involve complete track reconstruction, turnout replacement or other major modernization project.

2.2 STANDARDS. The FRA Track Safety Standards; UFC 4-860-03; Summary of Inspection Criteria, Attachment (2-1); and this section provide descriptions of tolerances and defects for guidance in deficiency classification. Deviation from the standards in the FRA Track Safety Standards or in this section may require immediate corrective action to provide for safe operations over the trackage involved. In addition, in accordance with paragraph 213.1 of the FRA Safety Standards, the requirements prescribed in the FRA Track Safety Standards and in Attachment (2-1) apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from these requirements, may require remedial action to provide for safe operations over that track. In general, on heavily used sections of trackage, work planning should start when a deficiency on a section of trackage exceeds one-half (1/2) of the allowable deficiency so that repairs can be accomplished before deficiencies exceed the allowable standards for restricted certification. Additional maintenance standard guidance is provided in UFC 4-860-03. Selection, installation, inspection and maintenance of trackage systems shall be in accordance with documents referenced herein, except where criteria in this instruction provides more stringent or restrictive

criteria. The summary of inspection criteria and defect classifications shown in Attachment (2-1) are guidelines establishing minimum standards allowed based on normal or average conditions.

2.2.1 RAILROAD TRACKAGE. The term "trackage" includes rails, ties, rail accessories, switches, crossovers, ballasts, roadbeds, support structures, subgrade, foundations, cut and fill slopes, ditches, road crossings, culverts, bridges, trestles, overpasses and underpasses, grade separations, tunnels, signals, snow protection, signs, and markings. In accordance with NAVFAC MO-l03 and Department of Defense Standards, all military trackage systems shall be classified using the guidelines established by FRA standards. The FRA Track Safety Standards provide minimum safety requirements that apply to specific track classifications. Changes or additions to the Safety Standards shall apply to Navy trackage when issued by the Federal Railroad Administration.

2.2.1.1 Railroad Classification. Paragraph 213.9 of the FRA Track Safety Standards establishes maximum operating speeds for Class 1 through 5 track based on requirements of the standards. Military railroad trackage systems are generally classified and sustained to Class 2 or better standards; however, if higher speeds are utilized, a corresponding higher classification with better standards may be assigned, provided that the section of track meets all requirements for that classification as shown in the FRA Track Safety Standards. Activities establish speed limits based on industrial density, alignment restrictions, and other local requirements. Reduced maximum speed or slow orders do not reduce or change the track safety standard requirements or the FRA track class. If a section of track does not meet the standard in all requirements for Class 2 track, the section may be temporarily reclassified to a Class 1 track. Infrequently used, dead-end trackage, except trackage used to move nuclear or hazardous materials, may be permanently classified as Class 1 trackage. All Class 1 tracks shall have Restricted Certification, see paragraph 1.3.3.2. Sections of trackage that do not meet the standards for Class 1 tracks shall have a "non-certification" status as described in paragraph 1.3.3.3.

2.2.1.2 Mobilization. Inactive trackage required for immediate mobilization should be sustained at a standard to meet FRA Class 1 Track Safety Standards (Restricted Certification). To support trackage required by M-day plus 30, an adequate stockpile of material (e.g. crossties) should be sustained to bring track up to FRA Class 2 Track Safety Standards, if necessary. Trackage required after M-day plus 30 requires minimum sustainment consisting of vegetation control, sustainment of adjacent drainage areas and sustainment of roadbed right-of-way free of encroachment by new facilities.

2.2.1.3 Railroad Categories. Railroad Trackage systems are divided into six categories according to their principal use. Overall maintenance policies and detailed guidance for maintaining these categories are covered in UFC 4-860-03.

Railroad Categories

Category	Service or Use
Running or Access	Primary line, Industrial and Special Purpose
Classification Yard	Receiving, Sorting and Holding
Sidings	Auxiliary (other than for meeting or passing) and House Trackage (along or entering a building).
Team Tracks	Freight transferred directly to highway vehicles
Storage	Hold Purposes - Low use Spur
Temporary	Generally to facilitate construction

2.2.2 RAIL. Standards for rail type, acceptable defects and replacement are discussed in this section and in paragraph 213.113 of the FRA Track Safety Standard. The identification and terminology of different parts of a typical rail are shown in Appendix (C), UFC 4-860-03.

2.2.2.1 Rail Type - General. In cases of individual rail replacement, where the existing rail does not meet the standard criteria listed herein and where the remaining track is performing satisfactorily, the same size rail may be installed. Rails must be connected at the joints so that the rails will act as a continuous girder with uniform surface and alignment.

2.2.2.2 Rail Size. Existing rail, less than 115 pound rail for mainline and 90 pound for spurs and sidings, shall remain in service if performing satisfactorily. An engineering evaluation should be performed, if necessary, to determine if an upgrade to meet the standard criteria listed is required, based on age, condition and use (present and projected). The use of 115 pound AREA rail is recommended as a minimum for new installations and for major replacement projects. Heavier sections should be used when required by heavy loads or when necessary to meet minimum requirements of the serving railroad, especially if their locomotives are used on the activity track. For individual rail replacements, the same size as existing rail may be used. The use of 90 pound relay or used rail is recommended as a minimum on low use spurs. Requirements for minimum size rail shall be in accordance with the latest issue of UFC 4-860-02N, Chapter 1 "Railroad Trackage".

2.2.2.3 Rail Defects. All irregularities in top or side rail wear, differences in elevation at breaks or joints, deflections, and movement exceeding 1/4 inch should be investigated. Common rail defects are illustrated and described in Appendix C, UFC 4-860-03, described in Enclosure (A) and categorized according to operational hazard or risk in Attachment (2-1). Sustainment and safety standards for rail defects, as well as remedial action, are provided in Chapter 7, UFC 4-860-03.

2.2.2.4 Replacement. Defective rails shall be repaired or replaced according to NAVFAC MO-103 and UFC 4-860-03, as necessary to meet certification criteria, or as required by the FRA Track Safety Standards.

2.2.2.4.1 Jointed Rail. Remedial action for defective rail shall be in accordance with Chapter 7 and Table 7-2 of UFC 4-860-03. The minimum "rail length", when installing new rail or repairing/replacing existing rail, is thirteen (13) feet. The existence of a short piece of rail (less than 13 feet) is not considered a defect. The existing rail should not be shorter than that necessary to allow for proper application of joint bars to adjoining rails on both ends and allow for proper alignment of rail. The condition of the track or defect in the rail would constitute a defect. There may be some instances where it may be economical to reduce the existing rail length; for example: replacing one rail length with two lengths of an old, standard rail before the entire section is replaced. This may be done provided the minimum length of thirteen (13) feet is maintained, and maximum lengths of rail are used when the section is upgraded. In some special cases such as short closure rails and short rails between turnouts and crossovers the rail length may be less than thirteen (13) feet provided only one piece of rail is used between the controlling features.

2.2.2.4.2 Welded Rail. In continuous welded rail, the standard minimum length of ten (l0) feet shall be maintained between welds or joints. This length is required to ensure proper alignment of rails prior to welding. Existing shorter rail lengths between welds will be maintained as is. The thermite welding instruction per UFGS 34 11 19.00 or a welding procedure approved by NAVFAC ATLANTIC (CIENG) should be used. Proper maintenance practice is to crop (remove) the ends of rail with bolt holes prior to welding joints. Existing welded joints with bolt holes for joint bars in either piece of rail are considered no defect unless the weld or bolt holes contain critical defects. Existing rail holes, such as old gage rod holes, may be maintained as is, provided there are no other critical defects in the immediate area.

2.2.3 TRACK GEOMETRY. Horizontal alignment, vertical alignment (grade or profile), cross section elevation and gage shall be investigated when any of the following conditions exist:

(1) There are indications of abnormal wear on the rail heads or on wheel flanges.

(2) New rails are being installed or any portion of a rail is realigned.

(3) Railroad engine binds on trackage, has difficulty in starting or has trouble with movement.

(4) When a potential deficiency of trackage can be observed, heard or felt.

(5) There are indications of substructure settlement, failure or other structural changes.

(6) Visual observations indicate that the acceptable limits may exceed those shown in Attachment (2-1).

(7) Tests, inspection, experience or engineering judgment indicate operation or rail alignment problems.

2.2.3.1 Installation and Realignment. UFC 4-860-02N provides criteria for design and alignment of all trackage systems and shall be used for all new installations and major replacement projects. Existing systems, not conforming to grade and curvature standards, may be maintained as is, provided a record is on file describing each deviation from the standard and necessary operating restrictions are imposed. Restrictions shall be tailored to each specific situation and may include such items as maximum speed, use of auxiliary couplers and maximum car/engine combination. When major replacements are necessary, the new work shall comply with the grade; turnout and curvature standards outlined in UFC 4-860-02N, or shall have an engineering justification and NAVFAC ATLANTIC (CIENG) approval on file for each deviation from the standard.

2.2.3.2 Horizontal Alignment. Maximum out of line limits for railroad trackage shall be according to those shown in Attachment (2-1). All curves shall have a designated degree(s) of curvature. Curves installed prior to November 1981 with radii less than 300 feet (19 degrees or larger) shall have approval by NAVFACENGCOMHQ on file as required by the previous issue of DM-5.6, October 1979. Single rail replacement may be made without obtaining a new approval; however, when replacing a section of trackage, new approval is required prior to awarding a contract or beginning in-house work. For all new construction or major rehabilitation projects with curves of less than 350 feet radius (16 degrees or larger), NAVFAC ATLANTIC (CIENG) approval shall be obtained as required by the current issue of UFC 4-860-2N. The radius established by the activity is the base line, design, theoretical radius, or the radius that best fits the overall existing condition. Curved alignment that deviates from established uniformity more than the amount shown in Attachment (2-1) is considered defective. Spirals, as designated or as developed, shall have a smooth transition.

2.2.3.3 Grade. Profile grades shown on Attachment (2-1) are the maximum allowable, except as noted below. Grades may be spot checked at random intervals with a hand level and rule. Switches may be installed on grade; however, no part of the switch should extend into a vertical curve or grade change.

2.2.3.4 Cross-Section Elevation. Vertical differences between rails shall be within the limits shown herein or in accordance with the FRA Track Safety Standards. On curved trackage in industrial areas traversed at low speeds, superelevation is not required. On all other track, 1/2 - 1 inch of superelevation is recommended as a minimum. Maximum elevation is 4 inches. On curved trackage, the outside rail shall not be more than 1/2 inch lower (reverse superelevation) than the inside rail. Design elevation should be based on the degree of curvature and speed as shown in UFC 4-860-02N. Maximum operating speeds shall be based on the 3-inch unbalanced formula in accordance with FRA "Track Safety Standards", paragraph 213.57(b).

2.2.3.5 Gage. Gage for railroad trackage is measured between the heads of the rails at right angles to the rails in a plane 5/8 inch below the top of the rail head. The standard gage for railroad trackage is 4' - 8 ½” except on sharper curves where the inside rail is widened to allow cars to track properly. The rate of change from standard to widened gage is 1/4 inch in 31 feet

along the spiral curve or tangent adjacent to the curve, unless physical conditions do not permit the normal transition. The 1/4 inch in 31 feet rate of change from standard gage to widened gage for curves is a design standard and not trackage inspection criteria. Variations in gage within the limits shown on Attachment (2-1) are not a defect for Class 2 trackage, provided there are no alignment, surface, or foundation defects which would cause the train to start excessive or abnormal rocking or bouncing. Normally the average gage should not change between the minimum allowable and the maximum allowable, more than one time within two standard rail lengths. Specific criteria for "relatively uniform and constant" gage transition is not available; therefore, the activity shall evaluate each suspected section and shall classify the degree-of-hazard based on engineering judgment and experience.

2.2.4 FROGS AND SWITCHES. Criteria for acceptable frogs and switches are shown in the FRA Track Safety Standards and Attachment (2-1). The maximum horizontal or vertical misalignment between the top or head of frog or switch rail and the stock rail is the same as for rail end mismatch; however, it is recommended that corrective action be taken in the vicinity of frogs and switches on running or access trackage before the critical limits are reached. Existing frogs and switches of types not recommended, which are performing satisfactorily, shall be retained. Replacement of frogs and switches shall be in accordance with UFC 4-860-2N, MO-l03 and the latest specifications.

2.2.4.1 Frogs. The identification and terminology of different parts of typical bolted rigid frogs for railroad trackage are shown in Chapter 8, UFC 4-860-03. The use of number 4 or below frogs is prohibited by UFC 4-806-2N for new construction or major rehabilitation work. Standard rigid frogs are preferred; however, self guarded frogs may be used. Existing frogs number 4 or below and existing spring rail frogs should be replaced as soon as practicable and whenever the entire switch or turnout is being reworked. If the number 5 or larger frogs can not be used, design considerations and justification shall be submitted to NAVFAC ATLANTIC (CIENG) for approval prior to installation. When using standard rigid frogs, guard rails shall be installed to protect the frog point and assist in the prevention of derailments.

2.2.4.2 Switches. The identification and terminology of different parts of a typical switch are shown in Chapter 8, UFC 4-860-03. For selection of proper switches, use UFC 4-860-02 or MO-l03 manual criteria.

2.2.4.3 Cast Switches and Frogs. The following additional criteria are provided for classifying critical defects in cast railroad switches and frogs. For track fixtures fabricated from rail, rail defect classification will apply.

1. Deformation in the head of the switch rail exceeding ¼ inch in depth and cracks in the exterior of the railhead exceeding ½ inch in length will be classified and treated as critical defects. Deformation is defined as flattening or crushing of rail head.

2. Cracks less than ½ inch in length will be punched to mark their location and length and they shall be monitored. Monitoring should start at a 30-day interval and can be increased to 6 months if growth of crack does not occur.

3. Cracks in the casting outside the railhead will be considered marginal defects unless deformation in the casting exceeding ¼ inch in depth occurs. Deformation in this instance is defined as opening of the crack causing a measurable widening of casting.

4. Inspection of the underside of switch tongue casting is not required, as the defect limits classified above will identify the need for further investigation and repair.

2.2.5 MISCELLANEOUS. Classification of defects listed in this section shall be made based on evaluation by the Activity and appropriate action shall be taken.

2.2.5.1 Tie Plates, Joint Bars, Angle Bars, Cleats and Other Accessories. Cracked, broken, loose or otherwise defective accessories that do not permit excessive rail movement and which meet the FRA acceptance criteria may be considered as no defect and repaired according to normal work schedules.

2.2.5.2 Safety Items. Safety features apply to all trackage systems and may also be included in other inspection reports. There shall be no missing, loose or broken components, bad welds, accumulation of debris, heavy corrosion or severe deterioration of the following trackage appurtenances:

(1) Rail Stops/Bumpers. (Rail stops/bumpers are not required where local standards or engineering evaluation preclude use. i.e. rail stop in middle of road or paved area. NAVSEA OP 5 requires wheel stops on railroad track carrying ordnance.)
(2) Guard Rails and Fences.
(3) Crossing Signs and other warning signs or signals.
(4) Any other features that could cause a mishap.

2.2.5.3 Bolts. Missing, broken, deteriorated or worn bolts which permit movement of rails may be considered a marginal defect, provided that the criteria in paragraphs 213.115 and 213.121 of the FRA Track Safety Standards are complied with. All joint bolts loose is considered a critical defect. Track bolts should be oiled when installed and each time they are tightened. The recommended frequency for bolt tightening, for trackage not encased in pavement, is three months after installation and once a year after that. Tightening of loose bolts should be an ongoing task. Loosening of bolts is somewhat directly related to traffic and loading and may also be caused by defects; therefore, a more frequent program for bolt tightening and PM based on usage and experience may be required by the Certifying Official. It is conceivable that where there is a good PM and inspection program, annual tightening of all bolts may be unnecessary. Annual tightening of bolts in paved areas may be waived based on engineering judgment and provided that non-destructive test (paragraph 2.1.5), operational inspection (paragraph 2.1.4.2), and visual inspection in paved areas (paragraph 2.1.4.1.2) are satisfactory. All fasteners in turnouts and track crossings must be intact and maintained so as to keep the components securely in place. All turnout switch and frog bolts and joints connecting rail to switch point and frog will be fully bolted as designed. All switch and operating rod bolts shall be installed with nut on top and cotter pin installed. All switch point bolts shall be in place with cotter pin, if so designed. Missing or improperly installed bolts and cotter pins shall be considered critical defects.

2.2.5.4 Spikes. Missing or loose spikes will cause a tie to be classified as defective. The recommended number of track spikes per rail per tie for Class Two tracks is as follows:

- Tangent Track and Curved Track with not more than 4^{o} of Curvature (Radius 1432 feet or larger) - TWO Spikes
- Curved Track with less than 4^{o} of Curvature (Radius 1432 feet or larger) that has some superelevation and heavy loads operating at slow speeds - THREE Spikes
- Curved Track with more than 4^{o} of Curvature (Radius 1432 feet or smaller) - THREE Spikes
- Curved Track with more than 36^{o} of Curvature (Radius less than 162 feet) that has superelevation or supports heavy loads - FOUR Spikes

Curved track with more than 6^{o} (Radius 955 feet or larger) of curvature which is not spiked per this paragraph shall have a restricted certification. Existing curves more than 4^{o} and less than or equal to 6^{o} that only have 2 spikes per rail per tie shall be upgraded to 3 spikes as ties or rail is replaced.

2.2.5.5 Housekeeping. Keep trackage systems clear of obstructions that could cause derailment. Accumulations of debris, dirt, grease, paint, etc., shall be removed. Flangeways and switches shall be kept reasonably free of debris and silt. Flangeways for road crossing, other paved areas, and frogs that are “full of compacted” dirt, rocks, debris and silt shall be considered a critical defect.

2.2.5.6 Clearances. Impaired clearances shall be recorded and corrective actions taken to insure safety when the minimum clearances shown in MO-103, UFC 4-860-03, or American Railway Engineering and Maintenance of Way Association (AREMA) Manual for Railway Engineering are violated. Clearances less than minimum clearance required shall be considered a critical defect if it presents a clear hazard to rail traffic. New encroachments should be reported by inspectors for further investigation and measurement.

2.2.6 SUBSTRUCTURE. Foundation deficiencies which upon failure could cause dropping, shifting, movement or derailment shall be considered critical or catastrophic.

2.2.6.1 Ballast. Ties shall be fully supported. Ties not fully supported are considered defective. Occasionally, heaving of track in the winter and spring will create deficiencies in track grade or rail levels. This usually indicates poor drainage, dirty ballast, inadequate subgrade or a combination of these conditions. Temporary corrections to this condition shall be accomplished so that the condition of trackage can be considered not defective. The use of track shims should be avoided; however, when shimming is necessary, it should be done in accordance with instructions outlined in NAVFAC MO-103. When weather conditions stabilize, appropriate corrective actions shall be taken to correct any deficiencies in ballast or subgrade.

2.2.6.2 Drainage. Lack of drainage is a major contributing factor in the cause and acceleration of defects. Water on, in, under or anywhere near trackage shall be controlled. Culverts, ditches and drains shall be kept open, free flowing and in good repair. Drainage with restricted or fully blocked flow which could result in a washout in the track shall be considered a critical defect.

2.2.6.3 Utility Lines. Utility lines passing under or adjacent to trackage should be noted on the plans and observed for signs of failure during all inspections. Ballast and subgrade do not have to be removed for inspection unless there is a suspected failure or defect in the distribution line or tunnel. Historical records of material and construction details shall be recorded and maintained when installed, repaired, or dug out for inspection.

2.2.7 CROSSTIES. The identification and terminology of different parts of a typical railroad crosstie system are shown in UFC 4-860-03. Replacement ties should be adequately treated to ensure long, reliable life and to minimize replacement cost. New wood ties should be inspected as discussed in NAVFAC MO-312.2 and MO-103, Appendix G.

2.2.7.1 Tie Spacing. Tie quantity and spacing are based on roadbed conditions, trackage category, rail size, anticipated load and experience or engineering judgment. Installation criteria for new construction and rework trackage should be specified for each section of trackage based on current instructions, design standards, need and economics.

2.2.7.2 Skewed Ties. A skewed tie is one having an axis other than perpendicular to the rails (except turnout rails). Measurements of skew distance may be made while checking gage; however, a visual check at any trackage system is adequate. Spotting ties that are over half the width of the tie out-of-line can be easily done while walking or riding over the trackage system. Single skewed ties are not a defect. Sections of trackage with skewed ties indicate a problem area that should be investigated.

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
"A"	GENERAL		See Note 1 & 2			1.0 and 2.2
213.9	Speed		over 25 MPH			1.3.3 and 2.2.1.1
213.13	OPERATIONAL TEST DEFLECTION Flexible Support (wood ties and gravel ballast)	Note 2	over 1 1/2 inches see Note 3	Over 3 inches	3-1	2.1.4.2 2.1.4.2.2
	Rigid Support (concrete beam or slab - incld. bridges, trestles and buildings	Note 2	over 1/2 inch See Note 3	Over 3 inches		2.1.4.2 and 2.1.4.1.1
"B"	ROADBED					
213.33	Drainage	obstruction to flow	blocked See Note 2	See Note 2	3-2	2.2.6.2
213.37	Vegetation	See UFC 4-860-03 para 3-3	Interferes with track inspection or train operations	See Note 2	3.3	
"C"	TRACK GEOMETRY					
213.53	Gage	Under 56 1/8" 57 1/2"	Over 57 1/2"	Under 56" Over 57 3/4"	12-2	2.2.3.5
213.55	Alignment (per 62')					
	Tangent, Mid-Offset	over 2"	over 3 inches	over 5 inches	12-6	2.2.3.2
	Curve, Mid-Ordinate	over 2"	over 3 inches	over 5 inches	12-6	
	Profile Grade	See Note 2	more than 3%	See Note 2	None	2.2.3.3
213.57	Curve elevation				12-4	
	Outside rail on industrial trackage	See Note 2	over 4 inches See Note 4	See Note 2	12-4.c	2.2.3.4

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.57	Curve elevation Cont'd Reverse Superelevation	Over 0 inch	Over 1/2 inch	See Note 2	12.4.b	2.2.3.4
	Superelevation - based on degree of curvature and speed	1.5-inch unbalanced formula	3-inch unbalanced formula	See Note 2	12-4.f	2.2.3.4
	Superelevation runoff per 31 feet	exceeds 1 inch	Exceeds 1.75”	See Note 2	12.4.e	
213.63	Trackage Surface					
	Runoff per 31 feet	over 1 1/2"	over 3"	over 3 1/2"	None	2.2.3.3
	Profile @ Mid-ordinate of 62' chord	over 2 1/4"	over 2 3/4"	over 3"	12-7	2.2.3.3
	Cross level deviation	over 1 1/4"	over 2"	over 3"	12-3	2.2.3.4
	Cross level difference in 62 feet	over 1 3/4"	over 2 1/4"	over 3"	12-5	2.2.3.3 and 2.2.3.4
"D"	TRACK STRUCTURES					
213.103	Ballast	Track moves laterally, longitudinally or vertically. See track geometry	See Note 2	See Note 2	4-3	2.2.6

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.109	Crossties Quantity - number per 39' of trackage	Less than 20	Less than 18	See Note 2	5-6	2.2.7 2.2.7.3
	Spacing - Face to face distance between two ties	see Note 2	over 18 inches See Note 5	See Note 2	5-6.d	2.2.7.1
	Skew - Deviation of ties from right angles to rails	3 or more consecutive ties skewed greater than 8".	over 8" or standard tie width. See Notes 3, 5 and 7	See Note 2	5-6.f	2.2.7.2
	Missing Ties	1	Greater than 48”	Greater than 48” at joint	5.6.e	
	Condition - number of sound ties per 39 ft Tangent and curves less than 2°	Less than 12.	Less than 8. See Notes 6 and 7.	Less than 7	5-6.c.(1)	2.2.7.3
	Turnout/Curves greater than 2°	Less than 13	Less than 10. See Notes 6 and 7.	Less than 9	5.6.c.(1)	2.2.7.3
	Consecutive defective ties - See Note 6 Tangent and curves less than 2°	3	4	5 or more	5.6.c.(1)	2.2.7.3
	Turnouts/Curves greater than 2°	2	3	4 or more		
	Joint ties - required number of sound ties	Less than 2 sound ties within 24" of joint.	-----	No sound ties within 24" of joint.	5-6.c.(2)	2.2.7.3
213.123	Tie Plates	Indication of more than 1/2 " of movement. See Note 7.	See Note 2	See Note 2	5-2.c	None

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.127	Rail Fastenings -				6-3	2.2.5.4
	Spikes per rail per tie					
	on tangent & curves 4° or less	Less than 2. See Note 5.	See Note 2 & 5	See Note 2 & 5		
	on curves over 4°	Less than 3. See Note 5.	See Note 2 & 5	See Note 2 & 5		
	on curves over 6°		Less than 3			
213.133	Defective Rails				7 & Appendix C Table 7-1	2.2.2.4
	Transverse Fissure Compound Fissure Detail Fracture Engine Burn Fracture Ordinary Break Defective Weld	10% - 20% of railhead weakened by defect.	More than 20% of railhead weakened by defect. See Notes 2 & 8	More than 40% of railhead weakened by defect or Breakout in the railhead		
	Horizontal Split Head Vertical Split Head Split Web Piped Rail Head Web Separation	1" - 4" in length	More than 4" See Note 2 & 8	Breakout in the railhead Defects accum-mulating 3 feet or more in any 10 feet.	Table 7-1	
	Bolt Hole Cracks	1/2" - 1 1/2" in length	More than 1 1/2" See Note 8	Breakout in the railhead	Table 7-1	
	Broken Base	0"- 6" in length	See Notes 2 & 8	Exceeding 6"	Table 7-1	
	End batter	Depth over 1/8”	Depth over 3/8”	Depth over 1/2” See Note 2	7-1.e Table 7-1	

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.113	**Damaged Rail Cont'd** Shelling, Head Checks, Engine Burns, Mill Defect Flaking-Slivered Corrugated-Corroded	Depth over 1/4"	Depth over 3/8"	Depth over 1/2" See Note 2	Table 7-1	2.2.2.3
	Crushed Head Flowed Rail	Not allowed Exceeding 3/16" from gage face.	Depth over 3/8" Exceeding 5/16" from gage face.	Breakout See Note 2	7 & Appendix C Table 7-1	2.2.2.3
None	**Worn Rail**				7-1.c Table 7-1	2.2.2.4
	Web Thickness Reduction	See Note 2	Over 1/8"	See Note 2		
	Base Width Reduction	1/4" See Note 9	Over 1/4" See Note 9	See Note 2	7-1.d & Table 7-1	
	Vertical head Wear: Rail Section (lbs per yard) up to 90 lb 100 lb - 119 lb above 119 lb	 3/8" 3/8" 1/2"	 Over 3/8" Over 3/8" Over 1/2"	See Note 2	7-1.c & Table 7-1	
	Horizontal Side Wear Rail Section (lbs per yard) up to 90 lb 100 lb - 119 lb above 119 lb	 3/8" 1/2" 5/8"	See Note 10 Over 1/2" Over 5/8" Over 3/4"	See Note 2	7-1.c & Table 7-1	
213.115	**Rail End Mismatch**				6-4.f	None
	On tread or running surface	over 1/8 inch	-----	over 1/4 inch		
	On gage side	over 1/8 inch	over 3/16 inch	over 1/4 inch		

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.121	**Joints** Joint gap	over 3/4 inch See Note 11	over 1 1/4" See Note 11	Over 2”	6-4.g	2.2.5.1
	Bolt holes - torched or burned (applies to any torch cut hole in rail)	Not allowed	Not allowed	See Note 2	Table 7-1	None
	Joint bars	Any crack or break	Torch cut/modified	any crack or break btwn the middle two bolt holes	6-4.c	None
	Track Bolts	Loose or damaged	less than two per rail All loose in joint	less than one per rail	6-4.d	2.2.5.3
213.133	**Turnouts and Rail Crossings** Flangeway Width	1 5/8"	less than 1 5/8"	less than 1 1/2"	9-2.6 Table 8-1	2.2.4
213.135	**Switches** Point Closure Gap	Locked with 1/4” spacer or any gap	over 1/4 inch See Note 12	Over 3/8 inch	8-3 Fig 8-1 & 8-3 8-3.b	2.2.4.2
	Point Condition	Broke/worn greater than 1/2 inch down & 6" back from point	Worn/damaged beyond marginal criteria	See Note 2	8-3.c.(1)	
	Switch Point Rail	Metal flow preventing proper closure	Point – higher than stock rail	Point rail beyond taper higher than stock rail See Note 2	8.3.c.(2) & (3)	

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.135	Switches					
	Switch Stand	Not fully secured	Not fully secured	Lateral movement of switch stand or point gap	8-3.e	
	Switch stand latches	Loose or Damaged	Loose or Damaged	Missing, damaged , insecure, inoperative	8-3.d	
	Connecting Rod, Switch Rods, and Switch clips	Does no allow unobstructed motion	Improper washers or spacers behind switch clips	Insecurely fastened or damaged	8-3.f	
	Connecting Rod Bolts, Switch Rod Bolts, and Clip Bolts		Improper size or loose. Nut on top and cotter pin in place.	See Note 2	8-3.h	
	Switch Heel		Bolts loose or missing. Heel not secure	Less than one bolt per rail	8-3.i	
	Rail Braces	All tight and secure	Less than 4 – tight and secure		8-3.j	
	Point rail stop		Bent or missing		8-3.k	
	Cast switch					2.2.4.3.1
	Head of switch rail	Cracks less than 1/2 inch in length	Over 1/4 inch deformation and crack exceeding 1/2 inch in length	See Note 2		2.2.4.3.3
	Outside of rail head		Deformation exceeding 1/4 inch	See Note 2		

Attachment (2-1)

SUMMARY OF IN-SERVICE RAILROAD TRACKAGE INSPECTION CRITERIA

FRA Paragraph	TRACK SAFETY STANDARDS	DEFECTS			UFC 4-860-03 Railroad Track Maintenance & Safety Standards	INSTRUCTION Reference
		MARGINAL	CRITICAL	CATASTROPHIC		
213.137	Frogs				8-4	2.2.4.1
	Flangeway depth	Less than 1-5/8"	less than 1-1/2" See Note 13	less than 1-3/8"	8-4.g	
	Flangeway width	1-5/8 ”	less than 1-5/8"	less than 1-1/2"	8-4.f	
	Point	more than 1/2" down and 6" back	more than 5/8" down and 6" back	See Note 2	8-4.a	
	Tread Wear	more than 5/16"	more than 3/8"	See Note 2	8-4.b	
	Cast frog					2.2.4.3.1
	Head of frog point rail	Cracks less than 1/2 inch in length	over 1/4 inch deformation and crack exceeding 1/2 inch in length	See Note 2		
	Outside the rail head		Deformation exceeding ¼ inch	See Note 2		2.2.4.3.3
213.141	Self-guarded frogs Raised guard wear	over 5/16"	over 3/8"	See Note 2	8-4.c	2.2.4.1
213.143	Frog guard rails					None
	Check gage	less than 54 3/8"	less than 54 1/4"	less than 54 1/8"	8-6	
	Face gage	more than 53"	more than 53 1/8"	more than 53 1/4"	Table 8-1	
213.133	Turnout Bolts	Loose or Damaged	Missing, incorrect position/size, missing cotter pins	Less than one per rail. See Note 2		2.2.5.3

Attachment (2-1)

Note l. Criteria shown is based on FRA safety standards for Class Two (2) trackage. If higher or lower standards of trackage are involved, corresponding FRA Track Safety Standards shall apply. In addition, in accordance with paragraph 213.1 of the FRA Safety Standards, the requirements prescribed in the FRA Track Safety Standards and in Attachments (2-1) apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from these requirements, may require remedial action to provide for safe operations over that track. Restricted speed or slow orders do not change or reduce the class of track. The classification of marginal defects is based on maintenance standards for Track Category A, as defined in paragraph 1-5 of UFC 4-860-3. See Appendix E of UFC 4-860-3 for corresponding standards for Track Category B.

Note 2. The following defects are considered catastrophic and all traffic shall be restricted until repairs are made: (l) Any breakout in the railhead, (2) Defects accumulating three feet or more in any l0 feet, (3) Broken base exceeding six inches, (4) Defects exceeding FRA Class 1 Track Safety Standards. Specific criteria for evaluating the consequences of certain defects outside the range designated as critical is not available. However, when the FRA Safety Standards for Class One track are exceeded, the trackage shall be non-certified. The activity shall evaluate the severity of each such defect and shall classify the degree-of-hazard based on engineering judgment and experience.

Note 3. Guidelines are for visual observation only. Deviations may be estimated, and measurement is not required unless it is necessary for supplemental investigation. Deviations exceeding the criteria shown shall be investigated to determine cause. Defects for flexible supported rail shall be evaluated according to trackage surface standards (FRA Para 213.63). Defects for rigidly supported rail shall be evaluated based on engineering investigation.

Note 4. Maximum superelevation for high speed mainline or running trackage, with corresponding higher classification and better standards, leading into or passing through the activity is six (6) inches.

Note 5. An individual tie not fully supported, having missing or loose spikes, having excessive spacing, or other type tie defect will cause the tie to be classified as defective. See FRA paragraph 213.109 for handling of defective ties. Track on curves exceeding 6 degrees that do not have the third spike shall have a restricted certification in accordance with para. 1.3.3.2. On track with curves over 4 degrees and equal to 6 degrees, the third spike shall be added as ties or rail are replaced.

Note 6. See FRA Standards for description of defective ties and for tie requirements under joints. Generally the maximum center to center distance between sound ties should not exceed 70 inches; however, the centerline of a sound tie shall be within 24 inches of a rail joint. The criteria for consecutive defective ties is based on 21 ties/39 feet of track or greater. Tie spacing of less than 21 ties/39 feet dictates more restrictive criteria.

Attachment (2-1)

Note 7. Indications on tie plates or ties of movement exceeding one-half (l/2) inch shall be considered a defective tie. "Kicked" tie plate with shoulder under the rail should be considered defective (marginal or critical)

Note 8. Defects smaller than those noted may be classified as marginal provided the defect is inspected six months after discovery and annually thereafter to ensure that the defect is not progressing.

Note 9. Rail shall be scheduled for replacement if the base is corroded such that more than 0.25 inch play is allowed in the rail. See paragraph 7-1.d, UFC 4-860-3

Note 10. Railroad rail may be transposed or interchanged if the horizontal wear on one side does not exceed 3/8 inch.

Note 11. Joint gaps measuring over 3/4 inch when the air temperature is over 30^{o}C (86^{o}F) shall be remeasured when the air temperature drops below 0^{o}C (32^{o}F) to ensure that marginal defects do not exist. Joint gaps over 3/4 inch and less than 1-1/4 inch may be classified as marginal. Joint gaps over 3/8 inch and 3/4 inch or less are not a defect.

Note 12. Switch points must fit stock rails properly. Lateral and vertical movement and any gap that adversely affects the fit of the switch points to the stock rail is considered a defect.

Note 13. Criteria for Railroad or Crane trackage crossings shall be developed locally based on design, float and safety.

Attachment (2-1)

RAILROAD TRACKAGE
CERTIFICATION DOCUMENT

TRACKAGE AREA: _____

Detailed
Inspection Date: _____

Date of current
Operational Inspection: _____

Date of current
Non-Destructive Test: _____

ITEM	COMPONENT	SAT	RESTRICTED	UNSAT	N/A
1.	RAILS				
2.	RAIL JOINTS				
3.	SPIKES/BOLTS/TIE PLATES				
4.	GAGE				
5.	CROSS SECTION				
6.	SWITCHES				
7.	FROGS				
8.	CROSSINGS				
9.	TIES				
10.	BALLAST				
11.	SUPPORT STRUCTURES				
12.	RAIL STOPS				
13.	CLEARANCES				
14.	SIGNS AND APPURTENANCE(S)				

REMARKS:

CERTIFICATION

A. This section of trackage meets the applicable standards and is recommended for _____ certification

INSPECTOR'S SIGNATURE	DATE

B. The section of trackage covered by the attached inspection report is certified as follows:

FULL CERTIFICATION **RESTRICTED CERTIFICATION** **NON-CERTIFICATION**

CERTIFYING OFFICIAL'S SIGNATURE	DATE

Attachment (2-2)

TRACK INSPECTION RECORD			TYPE OF INSPECTION: [ ] PREVENTIVE MAINTENANCE [ ] SAFETY INSPECTION [ ] DETAILED INSPECTION [ ] OPERATIONAL INSPECTION		
ACTIVITY			TRACK NAME OR ID		REPORT DATE
INSPECTOR PRINT OR TYPE & SIGN			INSPECTION ORGANIZATION		
DEGREE OF HAZARD	LOCATION MILEPOST OR STATION	DEFICIENCY DESCRIPTION	PROPOSED CORRECTIVE ACTION AND TIMEFRAME	FOLLOW-UP ACTIONS ACTION TAKEN	 DATE COMPLETED
LEGEND: Degree of Hazard CAT - Catastrophic CRIT - Critical M- Marginal					Page __ of

Attachment (2-3)

TURNOUT INSPECTION CHECKLIST

ACTIVITY		REPORTING ORGANIZATION	INSPECTOR (PRINT OR TYPE/SIGNATURE)	
TRACK IDENTIFICATION	TURNOUT IDENTIFICATION	TURNOUT SIZE	SWITCH POINT LENGTH	DATE

GENERAL

Are All Materials Proper Size?	YES	NO		NOTE____
Is Rail Same Weight and Section?	YES	NO		NOTE____
Are Flangeways Clear of Debris?	YES	NO		NOTE____
Are Crib Areas Clear of Debris?	YES	NO		NOTE____
Surface	GOOD	FAIR	POOR	NOTE____
Alignment	GOOD	FAIR	POOR	NOTE____

FROG

Point	OK	WORN_____"	CHIPPED	BROKEN	NOTE_____
Top Surface	OK	WORN_____"	BROKEN	DAMAGED	NOTE_____
Bolts:	OK	_____ LOOSE	_____ MISSING	_____DAMAGED	NOTE_____
Guarding Face (Self guarded Frog Only):	OK	WORN	BROKEN	DAMAGED	NOTE_____

TIES

Total Number Defective:	_____	NOTE____
Maximum Number of Consecutive Defective:	_____	NOTE____
Number of Occurrences of Defective Joint Ties	_____	NOTE____

GUARD RAILS

Position - Straight	OK	IMPROPER	NOTE ____			
Turnout	OK	IMPROPER	NOTE ____			
Condition - Straight	OK	WORN	INSECURE	BROKEN	DAMAGED	NOTE____
Turnout	OK	WORN	INSECURE	BROKEN	DAMAGED	NOTE____
Clamps/Fillers - Straight	OK	LOOSE		BROKEN	DAMAGED	NOTE____
Turnout	OK	LOOSE		BROKEN	DAMAGED	NOTE____
Bolts - Straight	OK	____ LOOSE	____ MISSING	____ DAMAGED	NOTE____	
Turnout	OK	____ LOOSE	____ MISSING	____ DAMAGED	NOTE____	

SWITCH AND STAND

Switch Operates Without Difficulty?	YES	NO (Describe Problem)				NOTE____
Switch Stand:	OK	INSECURE	DAMAGED			NOTE____
Point Lock/Lever Latches:	OK	MISSING	DAMAGED	LOOSE		NOTE____
Point Gap - Left	NONE	LESS THAN 1/8"	1/8" OR GREATER		1/4" OR GREATER	NOTE____
- Right:	NONE	LESS THAN 1/8"	1/8" OR GREATER		1/4" OR GREATER	NOTE____
Point Condition - Left	OK	WORN	CHIPPED	BROKEN		NOTE____
- Right:	OK	WORN	CHIPPED	BROKEN		NOTE____
Is Point LOWER Than Stock Rail?		Left: YES NO			Right: YES NO	NOTE____
Is Point Rail Beyond Taper HIGHER Than Stock Rail?		Left: YES NO			Right: YES NO	NOTE____
Connecting Rod	OK	BENT	DAMAGED	LOOSE	BINDING	NOTE____
Jam Nut:	OK	NONE	DAMAGED	LOOSE	MISSING	NOTE____
Switch Rods:	OK	__BENT	__DAMAGED	__LOOSE	__BINDING	NOTE____
Switch Clips:	OK	__BENT	__DAMAGED	__LOOSE	__BINDING	NOTE____
Connecting Rod Bolt:	OK	___LOOSE	_____DAMAGED		____MISSING	NOTE____
Nut On Top?	YES	NO	Cotter Key In Place?		YES NO	
Switch Rod Bolts:	OK	___LOOSE	_____DAMAGED		____MISSING	NOTE____
Nut On Top?	YES	NO	Cotter Key In Place?		YES NO	
Slide Plates:	OK	___LOOSE	___DIRTY	____DAMAGED	____MISSING	NOTE____
Rail Braces - Straight Side:	OK	___LOOSE	____DAMAGED	____MISSING	NOTE____	
Turnout Side	OK	___LOOSE	____DAMAGED	____MISSING	NOTE____	
Heel Filler:	OK	____ INSECURE	_____CRACKED/BROKEN		____MISSING	NOTE____
Heel Bolts:	OK	___LOOSE	____DAMAGED	____MISSING	NOTE____	
Heel Joint Bars/Shoulder Bars: :	OK	___LOOSE	____DAMAGED	____MISSING	NOTE____	

MEASUREMENTS (Inches)

	Straight Side	Turnout Side
SWITCH		
Gage Just Ahead of Points:	_____	
Gage @ Switch Heel	_____	_____
CURVED CLOSURE RAILS:		
Gage at Joints:	_____	_____
		_____
FROG:		
Gage at Point:	_____	_____
Flangeway Width:	_____	_____
Flangeway Depth:	_____	_____
GUARD RAILS		
Guard Check Gage:	_____	_____
Guard Face Gage:	_____	_____
Flangeway Width:	_____	_____

NOTES: _____
_____
_____
_____
_____

Attachment (2-4)

SECTION 3. GROUND LEVEL CRANE TRACKAGE

3.1 INSPECTION

3.1.1 CONTINUOUS OPERATOR INSPECTION. Daily or prior to use safety checks listed in activity regulations shall be conducted. In addition, on-the-job observations shall be performed in accordance with P-307 at all times when equipment is working. Crane operations personnel (operators, riggers, etc.) shall be encouraged to observe and report track problems, deficiencies, obstructions and the "feel" of the track.

3.1.2 PREVENTIVE MAINTENANCE (PM) - PM SERVICE AND PM INSPECTION.

3.1.2.1 PM is a continuous working inspection, examination of component parts, lubrication, adjustment, and minor repair. PM service and inspection are normally conducted by the crews assigned to or operating the equipment, by the track walkers, by Maintenance Shop personnel, and/or by contract. The PM Inspections and Services are scheduled as directed by the Public Works Officer or Activity Commander. Flexibility exists in the frequency of PM inspections based on usage, climatic conditions, history, and experience; therefore, the Public Works Officer or Activity Commander shall establish PM schedules. On systems where lubrication of moving parts, adjustments to electrical or mechanical systems, tightening of loose bolts, and other minor repairs are minimal, the PM service requirements may be identified during the annual detailed inspection and PM service and repair work scheduled. When possible, deficiencies are corrected during the inspection and recorded. Uncorrected deficiencies shall be reported to the supervisor for action, inclusion in the repair work schedule, adjustment of operating speed and consideration for closure of a section of trackage. Minimum information to be provided in PM reports is detailed in paragraph 3.1.2.2. PM inspections are visual inspections which include, but are not limited to, such items as loose or missing bolts, defective switch points, loose fasteners, if accessible, inoperative switches, operator reported rough or soft spots, poor drainage, substructure failure, defective rail, and settlement. The most important sections to be checked are the switches, curves and any area where a derailment has occurred.

3.1.2.2 PM Inspection Reports. Local formats in existence may be used. As a minimum PM Inspection reports should include:

(1) Date.
(2) Sections of trackage inspected.
(3) Corrected and uncorrected deficiencies.
(4) Number of and size of broken or missing parts.
(5) Suspected misalignment or defect.
(6) Guides and instructions used for the inspection.

3.1.3 SAFETY INSPECTION. The purpose of this inspection is to identify critical and catastrophic defects affecting the safety of the track being inspected. Scheduled safety inspection of crane trackage is not required due to the rigid support structure involved. If condition(s) prevail in the crane trackage that dictate the need for a more frequent inspection (see paragraph 1.3.3), a scheduled

safety inspection program may be established. If a safety inspection is required, guidance provided in paragraph 2.1.3 shall be followed.

3.1.3.1 Special Safety Inspections. The Certifying Official shall determine the requirements on providing special safety inspections for unusual occurrences such as derailment, accident, flood, fire, earthquake, hurricane, severe storm, or other occurrence that could have an adverse effect on the track structure.

3.1.4 DETAILED INSPECTION SUPPLEMENTED BY ENGINEERING EVALUATIONS. Detailed Inspections are to be conducted annually or more frequently when required by climatic conditions or other unusual circumstances. Annual inspection shall mean that sections of trackage are scheduled as part of the facilities inspection program in accordance with MO-322. Inspection for each track section shall be scheduled and accomplished during a specific month each year and routinely scheduled in a 12 month period. Annual inspection exceeding a 13 month period since the previous annual inspection on the particular track section will cause the existing certification to be default and result in the track section being non-certified for use. Engineering evaluations shall be conducted whenever there is any doubt of physical condition. In addition, Detailed Inspection or Engineering Evaluation criteria shall be used to supplement investigations and evaluations after any derailment. Additional testing or inspection shall be conducted when the condition of any portion of the trackage system is doubtful.

3.1.4.1 Visual Inspection. Visual inspections during the detail inspection should include PM inspection checkpoints and observations of all trackage system components including rails, fasteners, if accessible, rail accessories, switches, support structures and appurtenances.

3.1.4.1.1 Support Structures. All foundations and piers shall be inspected for signs of settlement or failure. Special attention should be given to looking for openings in quaywalls, bulkheads or other waterfront retaining structures that may permit fill material to wash out and cause trackage settlement and failure. Piers supporting ground level rail shall be inspected in accordance with criteria outlined in MO-322 and the following criteria. The prescribed minimum inspection frequency for is two years. Inspection of the support system of the crane for the biennial control inspection shall be performed by facilities planner & estimators or inspectors, as long as they meet the minimum qualifications required in MO-322. Biennial support structure inspection reports shall be reviewed and random observations made of rail supports for indications of movement, deterioration, or stress. Broken and defective components shall be scheduled for repair or replacement. Indicators of settlement, misalignment or deflection shall be recorded. Deflection, movement, or settlement under routine in-service loading exceeding the limits shown in Attachment (3-1) shall be investigated and analyzed, the degree of damage documented, and the classification of hazard determined. Structural conditions leading to restricted certification of a section of trackage shall be based on a review of the structural analysis and on a condition survey conducted by qualified engineer in sufficient detail to establish the safety of the structure.

3.1.4.1.2 Program for Inspection of Paved Areas. Because of the weight of portal cranes used in operational observations and the type of foundation existing, removal of pavement for investigation may be minimal or not required based on engineering judgment and Certifying Official approval. Inspection of trackage encased in asphalt or concrete shall include visual inspections and operational

observations (para 3.1.4.2) for exposed rail defects, trackage movement, and signs of distress in adjacent pavement. To verify visual inspections, if determined to be necessary by the Certifying Official, activities shall establish a program to remove small sections of pavement and spot check trackage encased in pavement based on indication of defects with consideration taken for age and usage. Types of defects which would require pavement removal would include pumping joints, wide gage, deflecting rail, settlement of track and surrounding area. Pavement shall be maintained so that it does not interfere with crane operation and to ensure safe vehicle movement. In order to document the inspection of trackage in paved and covered areas, an inspection report shall be prepared indicating defects noted, as well as description and general condition of track components for future reference. Pictures should be used to document conditions as necessary. Any defects detected affecting the certification of the section of trackage inspected shall be handled in accordance with paragraph 1.3.

3.1.4.2 Operational Inspection. The purpose of an operational inspection is to supplement the detailed inspection and to assist in the identification of problem areas which could develop into unsafe trackage. Conditions which may be discovered include looseness, binding or vibration.

3.1.4.2.1 Frequency. Operational inspections with loads prescribed in paragraph 3.1.4.2.2 shall be performed at intervals not to exceed two years on active trackage systems to ensure that the trackage systems will sustain the prescribed load in a safe manner. Operational inspection exceeding the two year requirement will cause the existing certification to be default and result in the track section being non-certified for use. See paragraph 1.3.1 regarding 30 day extension of certification.

3.1.4.2.2 Loads. Loads should be moved over track systems slowly enough so that observations can be made. Loading of cranes being certified is prescribed in NAVFAC P-307. For trackage systems not inspected during crane certification, an operational inspection shall be conducted by using the heaviest crane or a crane with a wheel load of at least 90 percent of the largest wheel load of cranes that can operate on the track. The inspection may be conducted with no load on the hook. The boom should be elevated to minimum radius when conducting the operational inspection; however, the boom may be parallel to the track except when a defect is suspected. (Note: With the boom elevated to its minimum radius, maximum loading and therefore observation of load is under the counterweight.) If these cranes are not available or wheel loads of lighter cranes are not 90% of the largest wheel load, lighter cranes maybe used by rotating the counterweight over the rail being observed. As such, the crane will have to travel over the section of track twice, each time with the counterweight positioned over a corner of each rail of the section of track being inspected. Where there is possibility of a crane wheel coming off the track or where there is the possibility of settlement, the maximum or minimum loading shall be created by positioning the boom relative to the trackage being tested. Operational inspection reports shall specify the crane used to perform the operational inspection.

3.1.4.2.3 Observations. A Track Inspector shall conduct or supervise the operational inspection. Trackage shall be inspected during load test. Observations for looseness, binding, deflection, or vibration shall be made by sight, sound, and feel. In addition, rail joints, grout, general alignment, rail condition, supporting structures (see paragraph 3.1.4.1.1), and other accessories may be observed for deficiencies during and after the load test or operational inspection. There is no requirement for physical measurements of rail or trackage systems under load; however, when practical and

accessible, rail systems shall be observed for deflection. Guidelines for maximum allowable deflections as determined by visual judgment are shown on Attachment (3-1). In the event unusual movement is observed or felt, deflections appear to be larger than the guideline limits established, or the cause of deficiency cannot be immediately determined, an investigation and engineering analysis of the immediate vicinity shall be made prior to certification. Results of the investigation and engineering evaluation, not the deflection limit per se, shall determine when use of a section of trackage must be discontinued.

3.1.4.2.4 After Repair. Operational Inspection for certification following major restoration or reconstruction is not a mandatory action required by this instruction; however, as a minimum a visual observation of trackage under routine traffic loading during or after repair shall be performed to ensure proper movement. In addition, it is recommended that, when practical, in-house work orders and contract documents require compliance with the following procedures prior to final acceptance. Ground level crane trackage shall have a crane successfully operate over the system repaired prior to encasing in concrete.

3.1.4.3 Measurements. The Detailed Inspection shall include visual observations and spot check measurements of grade, track gage, cross section elevation, horizontal alignment, vertical mismatch, supports and other features to insure that criteria in this instruction are met. Instrument surveys may be requested by the Certifying Official or his representative to verify visual observations or spot check measurements, establish new alignment, investigate problem areas and determine deviation from the established standards.

3.1.4.4 Detailed Inspection Documentation

All inspections performed under paragraph 3.1.4 shall be properly documented. Inspection records must specify track inspected, date of inspection, location and nature of deviation from requirements and remedial action taken. Detailed inspection documentation should address all marginal, critical and catastrophic deficiencies existing in the track system at the time of inspection. In addition to detailing defects detected during the annual visual inspection, outstanding defects detected during safety inspections, operational inspections, non-destructive test inspection and other inspections and engineering investigations should be included. Deficiencies not exceeding marginal criteria are recorded, as necessary. A blank example record is provided as Attachment (3-3). Instructions for completion and a sample filled in inspection report are provided in Appendix B of UFC 4-860-03. As a minimum, activity track files shall contain the current and previous complete detailed inspection report. Engineering evaluations and all engineering investigation reports shall be retained until invalidated by trackage repair or other actions. Current and previous operational inspection records shall be kept on file.

3.1.5 NON-DESTRUCTIVE TESTING (NDT).

3.1.5.1 Frequency: All active ground level crane rails shall be tested for defects upon activation and at five year intervals, unless maintenance problems or visual inspection dictate a necessity for more frequent testing. The term "upon activation" refers to sections of trackage which have been inactivated or not used and that have not had a non-destructive test within the preceding five years.

Rail shall be tested by ultrasonic inspection in accordance with paragraph 1.6.1, except short section of rail may be tested by hammer sounding as allowed by paragraph 1.6.2. All trackage that has not been non-destructively tested within the five year period from the previous NDT shall have a restricted certification or may be non-certified. Non-destructive testing of relay rail or used rail may be deferred until the next regularly scheduled five year test interval, at the discretion of the Certifying Official, however any such deferral should be based on an engineering evaluation that considers age, expected use, and experience. During the interim period, the rail may be given full certification based on other tests, observations, and inspections required by this instruction. Criteria for unacceptable rails are included in Attachment (3-1) and in UFC 4-860-03. Appendix C, UFC 4-860-03, provides a brief description and illustration of common rail defects. New rail and accessories shall be accepted according to the latest government specifications or standard industry practice. The NDT results shall be used to establish a base line for future inspection and to identify areas requiring observation.

3.1.5.2. Test Results. Rail inspection records must specify the date of inspection, the location and nature of any internal rail defect found, and the remedial action taken and the date thereof. Rail inspection records shall be retained until after the next rail inspection is performed or for one year after remedial action is taken, whichever is longer. All discontinuities shall be reported; the nature and size of defect estimated, and responses compared with standards or past test results. Rejection or degree-of-hazard of all potential defects shall be based on assessment of ultrasonic inspection results, visual inspection, experience, engineering judgment, the criteria shown in Attachment (3-1) and the FRA Track Safety Standards. In-place welded joints and welded repairs may have confused or erratic responses when ultrasonically tested; therefore, interpretation requires experience and engineering judgment to preclude an erroneous classification of defect.

3.2 STANDARDS: Summary of Inspection Criteria, Attachment (3-1), and this section provide descriptions of tolerances and defects for guidance in deficiency classification. Deviation from the standards in this section may require immediate corrective action to provide for safe operations over the trackage involved. In addition, in accordance with paragraph 213.1 of the FRA Safety Standards, the requirements prescribed in the FRA Track Safety Standards and in Attachment and (3-1) apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from these requirements, may require remedial action to provide for safe operations over that track. In general, on heavily used sections of trackage, work planning should start when a deficiency on a section of trackage exceeds one-half (1/2) of the allowable deficiency so that repairs can be accomplished before deficiencies exceed the allowable standards for restricted certification. Selection, installation, inspection and maintenance of trackage systems shall be in accordance with documents referenced herein, except where criteria in this instruction provides more stringent or restrictive criteria. The summary of inspection criteria and defect classifications shown in Attachment (3-1) are guidelines establishing minimum standards allowed based on normal or average conditions.

3.2.1 TRACKAGE. The term "trackage" includes rails, rail accessories, switches, frogs, crossovers, support structures, foundations, and signs, and markings. Operating speeds for cranes shall be initiated and promulgated by Activity Commanders to meet local safety requirements. Categories may be assigned by type or limiting size of equipment utilizing the trackage system.

3.2.2 RAIL. Standards for rail type, acceptable defects and replacement are discussed in this section and in paragraph 213.113 of the FRA Track Safety Standard. The identification and terminology of different parts of a typical rail are shown in Appendix (C), UFC 4-860-03.

3.2.2.1 Rail Type - General. In cases of individual rail replacement, where the existing rail does not meet the standard criteria listed herein and where the remaining track is performing satisfactorily, the same size rail may be installed. Rails must be connected at the joints so that the rails will act as a continuous girder with uniform surface and alignment.

3.2.2.2 Rail Size. A minimum of 135 CR rail is recommended when replacing or upgrading 132 pound rail in portal crane track systems. New portal crane systems should be designed considering larger crane rail sections to accommodate crane requirements. Other systems shall use rail specifically designed for the system. Welded joints shall be used whenever possible (see paragraph 3.3.3.2.).

3.2.2.3 Rail Defects. The basic rule of thumb or general guideline for determining the acceptability of a defective rail for continuing use at U.S. naval activities is one-quarter (1/4) inch of alignment variation or movement. All irregularities in top or side rail wear, differences in elevation at breaks or joints, deflections, and movement exceeding 1/4 inch should be investigated. Common rail defects are illustrated and described in Appendix C, UFC 4-860-03, described in FRA Track Safety Standards, and categorized according to operational hazard or risk in Attachments (3-1). Maintenance and safety standards for rail defects, as well as remedial action, are provided in Chapter 7, UFC 4-860-03.

3.2.2.4 Replacement. Defective rails shall be repaired or replaced, as necessary to meet certification criteria.

3.2.2.4.1 Jointed Rail. Remedial action for defective rail shall be in accordance with Chapter 7 and Table 7-2 of UFC 4-860-03. The minimum "rail length", when installing new rail or repairing/replacing existing rail, is thirteen (13) feet. The existence of a short piece of rail (less than 13 feet) is not considered a defect. The existing rail should not be shorter than that necessary to allow for proper application of joint bars to adjoining rails on both ends and allow for proper alignment of rail. The condition of the track or defect in the rail would constitute a defect. There may be some instances where it may be economical to reduce the existing rail length; for example: replacing one rail length with two lengths of an old, standard rail before the entire section is replaced. This may be done provided the minimum length of thirteen (13) feet is maintained, and maximum lengths of rail are used when the section is upgraded. In some special cases such as short closure rails and short rails between turnouts and crossovers the rail length may be less than thirteen (13) feet provided only one piece of rail is used between the controlling features.

3.2.2.4.2 Welded Rail. In continuous welded rail, the standard minimum length of ten (l0) feet shall be maintained between welds or joints. This length is required to ensure proper alignment of rails prior to welding. Existing shorter rail lengths between welds will be maintained as is. The thermite welding process per NAVFACENGCOM specification UFGS-34 11 19.00 or a welding procedure approved by NAVFAC ATLANTIC (CIENG) should be used. Proper maintenance practice is to crop (remove) the ends of rail with bolt holes prior to welding joints. Existing welded joints with bolt

holes for joint bars in either piece of rail are considered no defect unless the weld or bolt holes contain critical defects. Existing rail holes, such as old gage rod holes, may be maintained as is, provided there are no other critical defects in the immediate area.

3.2.3 TRACK GEOMETRY. Horizontal alignment, vertical alignment (grade or profile), cross section elevation and gage shall be investigated when any of the following conditions exist:

(1) There are indications of abnormal wear on the rail heads or on wheel flanges.

(2) New rails are being installed or any portion of a rail is realigned.

(3) Operating crane binds on trackage, has difficulty in starting or has trouble with movement.

(4) When a potential deficiency of trackage can be observed, heard or felt.

(5) There are indications of substructure settlement, failure or other structural changes.

(6) Visual observations indicate that the acceptable limits may exceed those shown in Attachment (3-1).

(7) Tests, inspection, experience or engineering judgment indicate operation or rail alignment problems.

(8) Cranes roll after stopping.

3.2.3.1 Installation and Realignment. UFC 4-860-02N provides criteria for design and alignment of all trackage systems and shall be used for all new installations and major replacement projects. Existing systems, not conforming to grade and curvature standards, may be maintained as is, provided a record is on file describing each deviation from the standard and necessary operating restrictions are imposed. Restrictions shall be tailored to each specific situation and may include such items as maximum speed, no load while moving, and crane boom position during movement. When major replacements are necessary, the new work shall comply with the grade; turnout and curvature standards outlined in UFC 4-860-02N, or shall have an engineering justification and NAVFAC ATLANTIC (CIENG) approval on file for each deviation from the standard.

3.2.3.2 Horizontal Alignment. Maximum out of line limits for tangent ground-level crane trackage shall be according to those shown in Attachment (3-1). Horizontal rail alignment of curved crane trackage shall be analyzed when any of the conditions listed in paragraph 3.2.3 exist. The NAVFACENGCOM computer program entitled "TRACKS" is capable of analyzing portal crane float requirements for traversing curved track. This analysis of required float can be compared to the float capabilities of all cranes and will clearly define the problem areas. The problems may result in limited restriction of crane operation, reworking the running gear on the crane or realigning the trackage. It should be noted that the available design float of a crane may not necessarily be operational. The most appropriate solution will be the responsibility of the Certifying Official. To request assistance with the "TRACKS" Program, contact NAVFAC ATLANTIC (CIENG).

3.2.3.3 Grade. Profile grades shown on Attachment (3-1) are the maximum allowable, except as noted below. On existing trackage with grades in excess of 1%, if cranes do not encounter acceleration or deceleration problems in traversing the tracks, no action is required. However, if problems are apparent or if other deficiencies dictate complete replacement of the track, the criteria of 1% maximum grade shall be followed. Curves, switches and frogs shall be on a near level grade in order to minimize the possibility of derailment. If existing grade is not level or if there is a difference in elevation between the inside rail and the outside rail, the position of the wheel flanges in relation to the top of the rail shall be observed to determine possible defective areas that may require a detailed engineering investigation. The stiffest crane(s) shall be operated over the area and if wheel treads lift from the top of the rail, extreme caution must be taken during operations and immediate action initiated to correct the deficiency. Inspectors should look for areas where wheels spin or try to climb the rail as opposed to normal rubbing. The area in question should be classified as critical and well marked so that all crane operators and crews will be cognizant of the deficiency. If the stiffest crane(s) is operated over the area and no wheel lift, binding or wheel spin occurs, the defect can be reclassified as marginal. If the cross level difference is over one inch, it must remain a marginal defect, it cannot be classified as no defect. It is noted for possible future correction and continued observations for degradation.

3.2.3.4 Cross-Section Elevation. Vertical differences between rails shall be within the limits shown in Attachment (3-1). When the difference in elevation between the elevation of the inside rail and the outside rail exceeds one inch the safety precautions discussed in paragraph 3.2.3.3 shall be made and appropriate action taken.

3.2.3.5 Gage. Gage for two rail crane trackage is measured center to center of railheads. Gage for four rail crane trackage systems is measured from the center points between the two sets of standard railroad tracks that comprise the system. The gage on curved trackage shall under no circumstances require more lateral float than the crane can provide. This can be analyzed using the NAVFACENGCOM computer program called "TRACKS" as described in paragraph 3.2.3.2.

3.2.4 FROGS AND SWITCHES. Criteria for acceptable frogs and switches are shown in Attachment (3-1). The maximum horizontal or vertical misalignment between the top or head of frog or switch rail and the stock rail is the same as for rail end mismatch; however, it is recommended that corrective action be taken in the vicinity of frogs and switches on running or access trackage before the critical limits are reached. Existing frogs and switches of types not recommended, which are performing satisfactorily, shall be retained. Replacement of frogs and switches shall be in accordance with UFC 4-860-02N and the latest specifications.

3.2.4.1 Frogs. The rigid frogs are preferred for all locations because of their maintenance free characteristics; however, the use of the turntable frog is mandatory for certain angles below 30 degrees, depending upon frog angle, curve radius, and flangeway width of crossing rail (see UFC 4-860-02N for details).

3.2.4.2 Switches. The rails in some switches will "bow-up." This is a not a defect unless it causes binding or other difficulty in operation of the switch or the passing of a crane. Insure that ample

flangeway is available in the vicinity of the point of switch and the stock rail, as controlled by flange width of crane wheels using the track system.

3.2.4.3 Cast Switches and Frogs. The following additional criteria are provided for classifying critical defects in cast crane switches and frogs. For track fixtures fabricated from rail, rail defect classification will apply.

1. Deformation in the head of the switch rail exceeding ¼ inch in depth and cracks in the exterior of the railhead exceeding ½ inch in length will be classified and treated as critical defects. Deformation is defined as flattening or crushing of rail head.
2. Cracks less than ½ inch in length will be punched to mark their location and length and they shall be monitored. Monitoring should start at a 30-day interval and can be increased to 6 months if growth of crack does not occur.
3. Cracks in the casting outside the railhead will be considered marginal defects unless deformation in the casting exceeding ¼ inch in depth occurs. Deformation in this instance is defined as opening of the crack causing a measurable widening of casting.
4. Inspection of the underside of switch tongue casting is not required, as the defect limits classified above will identify the need for further investigation and repair.

3.2.5 MISCELLANEOUS. Classification of defects listed in this section shall be made based on evaluation by the Activity and appropriate action shall be taken.

3.2.5.1 Joint Bars, Angle Bars, Cleats and Other Accessories. Cracked, broken, loose or otherwise defective accessories that do not permit excessive rail movement and which meet the FRA criteria may be considered as no defect and repaired according to normal work schedules.

3.2.5.2 Safety Items. Safety features apply to all trackage systems and may also be included in the crane or other inspection reports. There shall be no missing, loose or broken components, bad welds, accumulation of debris, heavy corrosion or severe deterioration of the following trackage appurtenances:

(1) Rail Stops or Bumpers
(2) Warning signs.
(3) Any other features that could cause a mishap.

3.2.5.3 Bolts. Missing, broken, deteriorated or worn bolts which permit movement of rails may be considered a marginal defect, provided that the criteria in paragraphs 213.115 and 213.121 of the FRA Track Safety Standards are complied with. Track bolts should be oiled when installed and each time they are tightened. The recommended frequency for bolt tightening, for trackage not encased in pavement, is 3 months after installation and once a year after that, for exposed ground level crane trackage. Tightening of loose bolts should be an ongoing task. Loosening of bolts is somewhat directly related to traffic and loading and may also be caused by defects; therefore, a more frequent program for bolt tightening and PM based on usage and experience may be required by the Certifying Official. It is conceivable that where there is a good PM and inspection program, annual tightening of all bolts may be unnecessary. Annual tightening of bolts in paved areas may be waived based on engineering judgment and provided that non-destructive test (paragraph 3.1.5), operational inspection

(paragraph 3.1.4.2), and visual inspection in paved areas (paragraph 3.1.4.1.2.1) are satisfactory. All fasteners in turnouts and track crossings must be intact and maintained so as to keep the components securely in place. All switch and frog bolts and joints connecting rail to switch point and frog (if bolted) will be fully bolted as designed. All switch mechanism connecting bolts shall be installed with cotter pin in place. Missing or improperly installed bolts and cotter pins shall be considered critical defects.

3.2.5.4 Housekeeping. Keep trackage systems clear of obstructions that could cause derailment. Accumulations of debris, dirt, grease, paint, etc., shall be removed. Flangeways and switches shall be kept reasonably free of debris and silt.

3.2.5.5 Clearances. Activities will develop and promulgate clearances for ground level cranes to prevent collisions between the crane and materials/equipment stored or parked adjacent to the track. New encroachments should be reported by inspectors for further investigation and measurement.

3.2.6 SUBSTRUCTURE. Foundation deficiencies which upon failure could cause dropping, shifting, movement or derailment shall be considered critical or catastrophic.

3.2.6.1 Drainage. Lack of drainage is a major contributing factor in the cause and acceleration of defects. Water on, in, under or anywhere near trackage shall be controlled. Drains shall be kept open, free flowing and in good repair.

3.2.6.2 Utility Lines. Utility lines passing under or adjacent to trackage should be noted on the plans and observed for signs of failure during all inspections. Pavement does not have to be removed for inspection unless there is a suspected failure or defect in the distribution line or tunnel. Historical records of material and construction details shall be recorded and maintained when installed, repaired, or dug out for inspection.

SUMMARY OF IN-SERVICE
GROUND LEVEL CRANE TRACKAGE INSPECTION CRITERIA

TRACK SAFETY STANDARDS	CRITICAL DEFECTS	INSTRUCTION REFERENCE
GENERAL	See Note 1	1.0 and 3.0
OPERATIONAL TEST DEFLECTION	Over 1/4 in. See Note 2	3.1.4.1.1 and 3.1.4.2
TRACK GEOMETRY		
ALIGNMENT:		
Tangent, Mid Offset per 62 ft.	Over 1/2 in.	3.2.3.2
Curves	See Note 3	3.2.3.2
Profile, Grade	Over 1%	3.2.3.3
TRACKAGE SURFACE:		
Profile @ Mid-ordinate of 62' chord, Cross level deviation, and Cross level difference in 62'	Over 1". See Note 3	3.2.3.3 3.2.3.4
TRACK STRUCTURES		
SUPPORT STRUCTURE	Deformation, Misalignment or movement exceeding 1/2 in. See Notes 2 and 4	3.1.4.1.1
RAIL FASTENINGS:		
Hold Down Fastenings	The distance between non-defective fastening on either side of the rail is more than 48 in.	
DEFECTIVE RAILS		
Transverse fissure Compound fissure	More than 20% of railhead cross section weakened by defect. See Note 5	3.2.2.3 and Appendix C, UFC 4-860-03
Detail fracture Engine Burn fracture Ordinary Break	Breakout in railhead with over 1/4 in. movement. See Note 6	

Attachment (3-1)

SUMMARY OF IN-SERVICE
GROUND LEVEL CRANE TRACKAGE INSPECTION CRITERIA

TRACK SAFETY STANDARDS	CRITICAL DEFECTS	INSTRUCTION REFERENCE
DEFECTIVE RAILS (Cont'd)		
Horizontal Split Head Vertical Split Head Split Web, Piped Rail Head Web Separation	More than 4". See Note 5	
Bolt Hole Cracks	More than 1-1/2 in. See Note 5	
Broken Base	More than 6 in.	
DAMAGED RAIL:		
Shelling, Head Checks, Engine Burn, Mill Defect, Flaking-slivered, Corrugated-corroded	Depth over 3/8 in.	3.2.2.3 and Appendix C, UFC 4-860-03
Flowed Rail	Roll exceeding 5/16 in.	
WORN RAIL:		
Rail section (pounds per yd)		3.2.2.2., and
Web-Base Thickness Reduction:		3.2.2.3
Up to 70	Over 1/8 in.	
Over 70	Over 1/4 in.	
Vertical Head Wear:		
Up to 70	Over 1/4 in.	
71 to 134	Over 3/8 in.	
135 and larger	Over 1/2 in.	
Horizontal Side Wear:		
Up to 70	Over 1/2 in.	
71 to 134	Over 5/8 in.	
135 and larger	Over 3/4 in.	
RAIL END MISMATCH:		
On tread or running surface	Over 1/4 in.	
On side of railhead	Over 3/16 in.	
RAIL JOINTS:		3.2.5.1
Gap Rail Joints	Over 1/2 inch, See Note 7	
Gap Expansion Joints	Over 1 inch, See Note 7	
Gap Rail to Switch or Frog Joint	Over 3/4 inch, See Note 7	

Attachment (3-1)

SUMMARY OF IN-SERVICE
GROUND LEVEL CRANE TRACKAGE INSPECTION CRITERIA

TRACK SAFETY STANDARDS	CRITICAL DEFECTS	INSTRUCTION REFERENCE
RAIL JOINTS: (Cont'd)		
Bolt Holes (applies to any torch cut hole in rail)	Torch cut or Burned	
Joint Bars	Broken between the middle two bolt holes Torch cut or modified	
Joint Bolts	Less than 2 /rail/joint All bolts loose	3.2.5.3
SWITCHES:		
Point/switch rail Closure/Mismatch	Loose over 1/4 in. of movement. See Note 4.	3.2.4.2
Point Condition	Unusually chipped, worn or flawed.	
Cast switch		
Head of switch rail	Over 1/4 inch deformation and crack exceeding 1/2 inch	3.2.4.3.1
Outside the rail head	Deformation exceeding 1/4 inch	3.2.4.3.2
FROGS:		
Flangeway depth and width	Develop locally for safe passage. See Note 3 and 8.	3.2.4.1
Point	More than 5/8 in. down and 6 in. back.	
Tread Wear	Over 3/8 in.	
Cast frogs		
Head of frog rail	Over 1/4 inch deformation in depth and crack exceeding 1/2 inch in length	3.2.4.3.1
Outside the rail head	Deformation exceeding 1/4 inch in depth	3.2.4.3.2
Switch/Frog Bolts	Missing, improper position/size, damaged. Missing cotter pin on connecting bolts.	3.2.5.3

Attachment (3-1)

NOTE 1. Criteria is shown for ground level systems that are rigidly supported, such as rails mounted on steel or concrete beams. If other types of support systems are involved, the severity of defects shall be determined based on local conditions. Specific criteria for evaluating the consequences of defects outside the range designated as critical are not available. The activity shall evaluate the severity of each such defect and shall classify the degree-of-hazard based on engineering judgment and experience.

NOTE 2. Guidelines are for visual observation only. Deviations may be estimated and measurement is not required unless it is necessary for supplemental investigation. Deflection for rail systems on flexible supports, such as wood ties and gravel ballast, should not exceed 3/4 inch.

NOTE 3. Determined locally for each specific case based on existing conditions and crane float.

NOTE 4. Building supports, pile foundations, caps, beams, etc. shall be investigated when movement, sag, deformation, or other alignment problems of component members exceeds one-half (1/2) inch. The final classification of defects shall be based on engineering evaluation.

NOTE 5. Defects smaller than those noted may be classified as marginal provided the defect is inspected six months after discovery and annually thereafter to ensure that the defect is not progressing. Defects accumulating three feet or more in any 10 feet are considered catastrophic.

NOTE 6. Fractures or Breaks at right angles to the rail may be classified as marginal provided the rigid foundation is solid; there is very little movement of the rail ends; the nearest joint, weld, or break is more than 6 1/2 feet away; and there is a program for continued surveillance.

NOTE 7. Joint gaps over 1/4 inch and less than 1/2 inch may be classified as no defect provided the joint is tight with no movement. Joint gaps between 1/2 inch and the defect limit indicated shall be classified as marginal or a more serious classification if the joint is loose or if there are other defects present. Gaps measured at defect limits when the air temperature is over 30 degrees C (86 degrees F) shall be remeasured when the air temperature drops below 0 degrees C (32 degrees F).

NOTE 8. For double-flanged wheels, flangeway depths in vicinity of flangeway width or gap of crossing rail are designed to be slightly less than the depth of flange so that wheels ride on flanges through ramped frogs. Flangeway depths equal to wheels' flanges are not a defect, provided wear on the frog point is not excessive. For single-flanged wheels on a 4 track system, requirements are the same as for railroad trackage, i.e., a flangeway depth less than 1 1/2 inches is a critical defect. For turntable frogs, the flangeway depth shall be greater than flange depth of the wheel.

Attachment (3-1)

GROUND LEVEL CRANE TRACKAGE
CERTIFICATION DOCUMENT

TRACKAGE AREA: _____

Detailed
Inspection Date: _____

Date of current
Operational Inspection: _____

Date of current
Non-Destructive Test: _____

ITEM	COMPONENT	SAT	RESTRICTED	UNSAT	N/A
1.	RAILS				
2.	RAIL JOINTS				
3.	SPIKES/BOLTS/TIE PLATES				
4.	GAGE				
5.	CROSS SECTION				
6.	SWITCHES				
7.	FROGS				
8.	CROSSINGS				
9.	TIES				
10.	BALLAST				
11.	SUPPORT STRUCTURES				
12.	RAIL STOPS				
13.	CLEARANCES				
14.	SIGNS AND APPURTENANCE(S)				

REMARKS:

CERTIFICATION

A. This section of trackage meets the applicable standards and is recommended for _____ certification

INSPECTOR'S SIGNATURE	**DATE**

B. The section of trackage covered by the attached inspection report is certified as follows:

FULL CERTIFICATION **RESTRICTED CERTIFICATION** **NON-CERTIFICATION**

CERTIFYING OFFICIAL'S SIGNATURE	**DATE**

Attachment (3-2)

TRACK INSPECTION RECORD			TYPE OF INSPECTION: [ ] PREVENTIVE MAINTENANCE [ ] SAFETY INSPECTION [ ] DETAILED INSPECTION [ ] OPERATIONAL INSPECTION		
ACTIVITY			TRACK NAME OR ID		REPORT DATE
INSPECTOR PRINT OR TYPE & SIGN			INSPECTION ORGANIZATION		
DEGREE OF HAZARD	LOCATION MILEPOST OR STATION	DEFICIENCY DESCRIPTION	PROPOSED CORRECTIVE ACTION AND TIMEFRAME	FOLLOW-UP ACTIONS	
				ACTION TAKEN	DATE COMPLETED
LEGEND: Degree of Hazard CAT - Catastrophic CRIT - Critical M- Marginal					Page __ of

Attachment (3-3)

SECTION 4. ELEVATED CRANE TRACKAGE

4.1 INSPECTION

4.1.1 CONTINUOUS OPERATOR INSPECTION. Daily or prior to use safety checks listed in activity regulations shall be conducted. In addition, on-the-job observations shall be performed in accordance with P-307 at all times when equipment is working. Crane operations personnel (operators, riggers, etc.) shall be encouraged to observe and report track problems, deficiencies, obstructions and the "feel" of the track.

4.1.2 PREVENTIVE MAINTENANCE (PM) - PM SERVICE AND PM INSPECTION.

4.1.2.1 PM is a continuous working inspection, examination of component parts, lubrication, adjustment, and minor repair. PM service and inspection are normally conducted by the crews assigned to or operating the equipment, by the track walkers, by Maintenance Shop personnel, and/or by contract. The PM Inspections and Services are scheduled as directed by the Public Works Officer or Activity Commander. Flexibility exists in the frequency of PM inspections based on usage, climatic conditions, history, and experience; therefore, the Public Works Officer or Activity Commander shall establish PM schedules. On systems where lubrication of moving parts, adjustments to electrical or mechanical systems, tightening of loose bolts, and other minor repairs are minimal, the PM service requirements may be identified during the annual detailed inspection and PM service and repair work scheduled. When possible, deficiencies are corrected during the inspection and recorded. Uncorrected deficiencies shall be reported to the supervisor for action, inclusion in the repair work schedule, adjustment of operating speed and consideration for closure of a section of trackage. Minimum information to be provided in PM reports is detailed in paragraph 4.1.2.2. PM inspections are visual inspections which include, but are not limited to, such items as loose or missing bolts or fasteners, defective rail, settlement, condition of supporting columns and misalignment.

4.1.2.2 PM Inspection Reports. Local formats in existence may be used. As a minimum PM Inspection reports should include:

(1) Date.
(2) Sections of trackage inspected.
(3) Corrected and uncorrected deficiencies.
(4) Number of and size of broken or missing parts.
(5) Suspected misalignment or defect.
(6) Guides and instructions used for the inspection.

4.1.3 SAFETY INSPECTION. The purpose of this inspection is to identify critical and catastrophic defects affecting the safety of the track being inspected. Scheduled safety inspection of crane trackage is not required due to the rigid support structure involved. If condition(s) prevail in the crane trackage that dictate the need for a more frequent inspection (see paragraph 1.3.3), a scheduled safety inspection program may be established. If a safety inspection is required, guidance provided in paragraph 2.1.3 shall be followed.

4.1.3.1 Special Safety Inspections. The Certifying Official shall determine the requirements on providing special safety inspections for unusual occurrences such as accident, flood, fire, earthquake, hurricane, severe storm, or other occurrence that could have an adverse effect on the track structure.

4.1.4 DETAILED INSPECTION SUPPLEMENTED BY ENGINEERING EVALUATIONS. Detailed Inspections are to be conducted annually or more frequently when required by climatic conditions or other unusual circumstances. Annual inspection shall mean that sections of trackage are scheduled as part of the facilities inspection program in accordance with MO-322. Inspection for each track section shall be scheduled and accomplished during a specific month each year and routinely scheduled in a 12 month period. Annual inspection exceeding a 13 month period since the previous annual inspection on the particular track section will cause the existing certification to be default and result in the track section being non-certified for use. The annual inspection during the biennial certification year may be based on the on the crane certification date at the discretion of the Certifying Official as long as it does not exceed the track certification date by over 45 days. The track certification shall indicate the date of crane certification. Engineering evaluations shall be conducted whenever there is any doubt of physical condition. In addition, Detailed Inspection or Engineering Evaluation criteria shall be used to supplement investigations and evaluations after any derailment. Additional testing or inspection shall be conducted when the condition of any portion of the trackage system is doubtful.

4.1.4.1 Visual Inspection. Visual inspections during the detailed inspection should include PM inspection checkpoints and observations of all trackage system components including rails, rail accessories, fasteners, joints, support structures and appurtenances. Checkpoints for elevated crane trackage inspection are provided on Attachment (4-2).

4.1.4.2 Support Structures. All foundations and support structures shall be inspected for signs of settlement or failure. Buildings/support structures for elevated crane rail shall be inspected in accordance with criteria outlined in MO-322 and the following criteria. The prescribed minimum inspection frequency for buildings is two years. In addition to the biennial inspection, supporting structures for elevated cranes shall be inspected when cranes are load tested to exceed the rated capacity of the system. This inspection maybe limited to only that portion of the support system affected by the load test. Inspection of the support system of the crane for both the biennial detailed inspection and crane load test inspection may be performed by facilities planner & estimators or inspectors or crane structural inspectors, as long as they meet the minimum qualifications required by MO-322. At activities where staffing is minimal and no one meets the qualifications required by MO-322, the Certifying Official shall assign the individual with the most structural experience/knowledge to perform the inspection. Biennial support structure inspection reports shall be reviewed and random observations made of rail supports, connections, braces, and beam to column joints for indications of movement, deterioration, or stress. Broken and defective components shall be scheduled for repair or replacement. For wood, steel or concrete columns, beams, braces, girders and other structural members, indicators of settlement, misalignment or deflection shall be recorded. Deflection, movement, or settlement under routine in-service loading exceeding the limits shown in Attachment (4-1) shall be investigated and analyzed, the degree of damage documented, and the classification of hazard

determined. Structural conditions leading to restricted certification of a section of trackage shall be based on a review of the structural analysis and on a condition survey conducted by qualified engineer in sufficient detail to establish the safety of the structure.

4.1.4.3 Operational Inspection/Load Test The purpose of an operational inspection is to supplement the detailed inspection and to assist in the identification of problem areas which could develop into unsafe trackage. Conditions which may be discovered include looseness, binding or vibration.

4.1.4.3.1 Frequency. Operational inspections shall be performed at intervals not to exceed two years on active trackage systems to ensure that the trackage systems will sustain the prescribed load in a safe manner. Every four years, a full load test shall be performed in accordance with paragraph 4.1.4.3.2 and as prescribed in Appendix E, NAVFAC P-307. The interim two year operational inspection shall consist of a "No load test" performed in accordance with paragraph 4.1.4.3.2 and as prescribed in Appendix E, NAVFAC P-307. Operational inspection exceeding the two year requirement will cause the existing certification to be default and result in the track section being non-certified for use. The two year requirement for operational inspection and track certification may be based on the on the crane certification date at the discretion of the Certifying Official as long as it does not exceed the track certification date by over 45 days. The track certification shall indicate the date of crane certification. Also see paragraph 1.3.1 regarding 45 day extension of certification.

4.1.4.3.2 Loads. Loads defined below should be moved over track systems slowly enough so that observations can be made. Loads for crane certification and test procedures are prescribed in Appendix E, NAVFAC P-307. "No load test" procedures are performed prior to the load test and during the two year interim operational inspection and will include operation of the crane on the track with no load on the hook and the trolley positioned adjacent to each rail for the full distance of the runway and slowly contacting the runway rail stops. "Load test" of the crane will include operation of the crane on the track with the test load on the hook and the trolley positioned adjacent to each rail for the full distance of the runway (if space is available). If multiple cranes on the runway, track need only be certified with the heaviest crane. Trackage support systems shall be inspected after completion of the crane load test in accordance with paragraph 4.1.4. Operational inspection reports shall specify the crane used to perform the operational inspection and description of what portion of track system received "Load test" versus "No load test".

4.1.4.3.3 Observations. A Track Inspector shall conduct or supervise the operational inspection. Trackage shall be inspected during load test or while equipment is operating. Observations for looseness, binding, deflection, or vibration shall be made by sight, sound, and feel. In addition, rail joints, general alignment, rail condition, supporting structures (see paragraph 4.1.4.2), and other accessories may be observed for deficiencies during and after the load test or operational inspection. There is no requirement for physical measurements of rail or trackage systems under load; however, when practical and accessible, rail systems shall be observed for deflection. Guidelines for maximum allowable deflections as determined by visual judgment are shown on Attachment (4-1). In the event unusual movement is observed or felt, deflections appear to be larger than the guideline limits established, or the cause of deficiency

cannot be immediately determined, an investigation and engineering analysis of the immediate vicinity shall be made prior to certification. Results of the investigation and engineering evaluation, not the deflection limit per se, shall determine when use of a section of trackage must be discontinued.

4.1.4.3.4 After Repair. Operational Inspection for certification following major repair or reconstruction is not a mandatory action required by this pr; however, as a minimum a visual observation of trackage under routine traffic loading during or after repair shall be performed to ensure proper movement. In addition, it is recommended that, when practical, in-house work orders and contract documents require that elevated crane trackage shall have a crane successfully operate over the system prior to acceptance.

4.1.4.4 Measurements. The Detailed Inspection shall include visual observations and spot check measurements of grade, track gage, cross section elevation, horizontal alignment, vertical mismatch, supports and other features to insure that criteria in this instruction are met. Instrument surveys may be requested by the certifying official or his representative to verify visual observations or spot check measurements, establish new alignment, investigate problem areas and determine deviation from the established standards.

4.1.4.5 Detailed Inspection Documentation

All inspections performed under paragraph 4.1.4 shall be properly documented. Inspection records must specify track inspected, date of inspection, location and nature of deviation from requirements and remedial action taken. Detailed inspection documentation should address all marginal, critical and catastrophic deficiencies existing in the track system at the time of inspection. In addition to detailing defects detected during the annual visual inspection, outstanding defects detected during safety inspections, operational inspections, non-destructive test inspection and other inspections and engineering investigations should be included. Deficiencies not exceeding marginal criteria are recorded, as necessary. As a minimum, the inspection records shall be retained for at least two years after the inspection covered by the report. Inspections may be documented on either Attachment (4-2) or Attachment (3-3). Instructions for completion of Attachment (3-3) and a sample filled in inspection report are provided in Appendix B of UFC 4-860-3.

4.1.5 NON-DESTRUCTIVE TESTING (NDT).

4.1.5.1 Frequency: Routinely, rail shall be tested by hammer sounding in accordance with paragraph 1.6.2. Generally ultrasonic testing of elevated crane rails is not required; however, elevated crane rails may be ultrasonically tested at the discretion of the certifying official in accordance with paragraph 1.6.1. If sounding is used, all active elevated crane rails shall be tested for defects upon activation and at annual intervals or at the interval determined by an engineering analysis as discussed in paragraph 1.6.2. If ultrasonic inspection is used, rails shall be tested for defects upon activation and at five year intervals, unless maintenance problems or visual inspection dictate a necessity for more frequent testing. The term "upon activation" refers to sections of trackage which have been inactivated or not used and that have not had a non-destructive test within the frequency for each procedure stated in paragraph 1.6. All

trackage that has not been non-destructively tested within the appropriate time frame from the previous NDT shall have a restricted certification or may be non-certified. Non-destructive testing of relay rail or used rail may be deferred until the next regularly scheduled interval, at the discretion of the Certifying Official, however any such deferral should be based on an engineering evaluation that considers age, expected use, and experience. During the interim period, the rail may be given full certification based on other tests, observations, and inspections required by this instruction. Criteria for unacceptable rails are included in Attachment (4-1). Appendix C, UFC 4-860-03, provides a brief description and illustration of common rail defects. New rail and accessories shall be accepted according to the latest government specifications or standard industry practice. The NDT results shall be used to establish a base line for future inspection and to identify areas requiring observation.

4.1.5.2. Test Results. Rail inspection records must specify the date of inspection, method of testing (ultrasonic or sounding), the location and nature of any internal rail defect found, and the remedial action taken and the date thereof. Rail inspection records shall be retained until after the next rail inspection is performed or for one year after remedial action is taken, whichever is longer. All discontinuities shall be reported; the nature and size of defect estimated, and responses compared with standards or past test results. Rejection or degree-of-hazard of all potential defects shall be based on assessment of ultrasonic inspection results, visual inspection, experience, engineering judgment, the criteria shown in Attachment (4-1), and the FRA Track Safety Standards.

4.2 STANDARDS

4.2.0 The FRA Track Safety Standards Summary of Inspection Criteria, Attachments (4-1), and this section provide descriptions of tolerances and defects for guidance in deficiency classification. Deviation from the standards in the FRA Track Safety Standards or in this section may require immediate corrective action to provide for safe operations over the trackage involved. In addition, in accordance with paragraph 213.1 of the FRA Safety Standards, the requirements prescribed in the FRA Track Safety Standards and in Attachment (4-1) apply to specific track conditions existing in isolation. Therefore, a combination of track conditions, none of which individually amounts to a deviation from these requirements, may require remedial action to provide for safe operations over that track. In general, on heavily used sections of trackage, work planning should start when a deficiency on a section of trackage exceeds one-half (1/2) of the allowable deficiency so that repairs can be accomplished before deficiencies exceed the allowable standards for restricted certification. Selection, installation, inspection and maintenance of trackage systems shall be in accordance with documents referenced herein, except where criteria in this instruction provides more stringent or restrictive criteria. The summary of inspection criteria and defect classifications shown in Attachments (4-1) are guidelines establishing minimum standards allowed based on normal or average conditions.

4.2.1 TRACKAGE. The term "trackage" includes rails, rail accessories, support structures, stops, signs, and markings. Operating speeds for cranes shall be initiated and promulgated by Activity Commanders to meet local safety requirements. Categories may be assigned by type or limiting size of equipment utilizing the trackage system.

4.2.2 RAIL. Standards for rail type, acceptable defects and replacement are discussed in this section and in paragraph 213.113 of the FRA Track Safety Standard. The identification and terminology of different parts of a typical rail are shown in Appendix (C), UFC 4-860-03.

4.2.2.1 Rail Type and Size. In cases of individual rail replacement, where the existing rail does not meet the standard criteria listed herein and where the remaining track is performing satisfactorily, the same size rail may be installed. Rails must be connected at the joints so that the rails will act as a continuous girder with uniform surface and alignment. The section of rail to be used is that which has been recommended by the crane manufacturer or the equivalent to the existing rail. Rail sections shall accommodate all crane wheels.

4.2.2.2 Rail Defects. The basic rule of thumb or general guideline for determining the acceptability of a defective rail for continuing use at U.S. naval activities is one-quarter (1/4) inch of alignment variation or movement. All irregularities in top or side rail wear, differences in elevation at breaks or joints, deflections, and movement exceeding 1/4 inch should be investigated. Common rail defects are illustrated and described in Appendix C, NAVFAC UFC 4-860-03, and categorized according to operational hazard or risk in Attachment (4-1). Maintenance and safety standards for rail defects, as well as remedial action, is provided in Chapter 7, UFC 4-860-03.

4.2.2.3 Replacement. Defective rails shall be repaired or replaced according, as necessary to meet certification criteria, or as required by the FRA Track Safety Standards.

4.2.2.3.1 Jointed Rail. Remedial action for defective rail shall be in accordance with Chapter 7 and Table 7-2 of UFC 4-860-03. The minimum "rail length", when installing new rail or repairing/replacing existing rail, is ten (10) feet. The existence of a short piece of rail (less than 10 feet) is not considered a defect. The existing rail should not be shorter than that necessary to allow for proper application of joint bars to adjoining rails on both ends and allow for proper alignment of rail. The condition of the track or defect in the rail would constitute a defect. There may be some instances where it may be economical to reduce the existing rail length; for example: replacing one rail length with two lengths of an old, standard rail before the entire section is replaced. This may be done provided the minimum length of ten (10) feet is maintained, and maximum lengths of rail are used when the section is upgraded.

4.2.2.3.2 Welded Rail. In continuous welded rail, the standard minimum length of ten (l0) feet shall be maintained between welds or joints. This length is required to ensure proper alignment of rails prior to welding. Existing shorter rail lengths between welds will be maintained as is. The thermite welding process per NAVFACENGCOM specification UFGS-34 11 19.00 or a welding procedure approved by NAVFACENGCOMHQ should be used. Proper maintenance practice is to crop (remove) the ends of rail with bolt holes prior to welding joints. Existing welded joints with bolt holes for joint bars in either piece of rail are considered no defect unless the weld or bolt holes contain critical defects. Existing rail holes, such as old gage rod holes, may be maintained as is, provided there are no other critical defects in the immediate area.

4.2.3 TRACK GEOMETRY. Horizontal alignment, vertical alignment (grade or profile), cross section elevation and gage shall be investigated when any of the following conditions exist:

(1) There are indications of abnormal wear on the rail heads or on wheel flanges.
(2) New rails are being installed or any portion of a rail is realigned.
(3) Operating crane binds on trackage, has difficulty in starting or has trouble with movement.
(4) When a potential deficiency of trackage can be observed, heard or felt.
(5) There are indications of substructure settlement, failure or other structural changes.
(6) Visual observations indicate that the acceptable limits may exceed those shown in Attachment (4-1).
(7) Tests, inspection, experience or engineering judgment indicate operation or rail alignment problems.
(8) Cranes roll after stopping.

Minimum safety standards provided in Attachment (4-1) in association with tolerances provided for construction/replacement of new crane rail in Crane Manufactures Association of America (CMAA) Specification #70 “Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes” shall be used to assess track geometry.

4.2.3.1 Installation and Realignment. Existing systems, not conforming to grade standards, may be maintained as is, provided a record is on file describing each deviation from the standard and necessary operating restrictions are imposed. Restrictions shall be tailored to each specific situation and may include such items as maximum speed, use of auxiliary couplers and maximum car/engine combination. When major replacements are necessary, the new work shall comply with the standards of the CMAA Specification #70 “Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes”.

4.2.3.2 Horizontal Alignment. Maximum out of line limits for elevated crane trackage shall be according to those shown in Attachment (4-1). Alignment of elevated crane trackage including stops shall be investigated and corrections made when any of the conditions listed in paragraph 4.2.3 exist.

4.2.3.3 Grade. Profile grades shown on Attachment (4-1) are the maximum allowable, except as noted below. The rail should be kept near level grade. The rail gradient must be kept below the slope that will cause the crane to roll freely and present problems in starting or stopping the crane.

4.2.3.4 Cross-Section Elevation. Vertical differences between rails shall be within the limits shown in Attachment (4-1). The cross-sectional difference in elevation of rails shall not exceed the limits established by the activity based on engineering judgment for each specific trackage system or the tolerance recommended by the manufacturer when known. Cross-sectional elevation differences should be checked when the conditions described in paragraph 4.2.3 exist.

4.2.3.5 Span. Span for two rail elevated crane trackage is measured center to center of railheads. The span of trackage shall be held within the tolerances specified by the crane manufacturer or as computed from the existing crane wheel spacing. Span of elevated crane trackage only needs to be measured when circumstances listed in paragraph 4.2.3 are not caused by other problems.

4.2.4 MISCELLANEOUS. Classification of defects listed in this section shall be made based on evaluation by the Activity and appropriate action shall be taken.

4.2.4.1 Joint Bars and Other Accessories. Cracked, broken, loose or otherwise defective accessories that do not permit excessive rail movement may be considered as no defect and repaired according to normal work schedules.

4.2.4.2 Safety Items. Safety features apply to all trackage systems and may also be included in the crane, building, or other inspection reports. There shall be no missing, loose or broken components, bad welds, accumulation of debris, heavy corrosion or severe deterioration of the following trackage appurtenances:

(1) Ladders, Platforms and Hand Rails.
(2) Rail Stops or Bumpers.
(3) Warning signs.
(4) Any other features that could cause a mishap.

4.2.4.3 Bolts. Missing, broken, deteriorated or worn bolts which permit movement of rails may be considered a marginal defect, provided that the criteria in paragraphs 213.115 and 213.121 of the FRA Track Safety Standards are complied with. Track bolts should be oiled when installed and each time they are tightened. The recommended frequency for bolt tightening is once every two years after the three month tightening for elevated cranes. Tightening of loose bolts should be an ongoing task. Loosening of bolts is somewhat directly related to traffic and loading and may also be caused by defects; therefore, a more frequent program for bolt tightening and PM based on usage and experience may be required by the Certifying Official. It is conceivable that where there is a good PM and inspection program, annual tightening of all bolts may be unnecessary. Tightening of bolts will be accomplished, as required, based on condition noted during the annual detailed inspection

4.2.4.4 Housekeeping. Keep trackage systems clear of obstructions that could cause mishap. Accumulations of debris, dirt, grease, paint, etc., shall be removed.

4.2.4.5 Clearances. Impaired clearances shall be recorded and corrective actions taken to insure safety when the minimum clearances (vertical clearance of three inches and horizontal clearance of two inches between the crane and any obstructions) required by Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.179 are violated.

4.2.5 SUBSTRUCTURE. Foundation deficiencies which upon failure could cause dropping, shifting, and movement shall be considered critical or catastrophic.

SUMMARY OF IN-SERVICE
ELEVATED CRANE TRACKAGE INSPECTION CRITERIA

TRACK SAFETY STANDARDS	CRITICAL DEFECTS	INSTRUCTION REFERENCE
GENERAL	See Note 1	1.0 and 4.0
OPERATIONAL TEST DEFLECTION	Over 1/4 in. See Note 2	4.1.4.2 and 4.1.4.3
TRACK GEOMETRY	See Note 3	
ALIGNMENT:		
Tangent, Mid Offset per 62 ft.	Over 1/2 in.	4.2.3.2
Profile, Grade	Over 1%	4.2.3.3
TRACKAGE SURFACE:		
Profile @ Mid-ordinate of 62' chord, Cross level deviation, and Cross level difference in 62'	Over 1". See Note 3	4.2.3.3 4.2.3.4
TRACK STRUCTURES		
SUPPORT STRUCTURE	Deformation, Misalignment or movement exceeding 1/2 in. See Notes 2 and 4	4.1.4.2
RAIL FASTENINGS:		
Hold Down Fastenings	The distance between non-defective fastening on either side of the rail is more than 48 in.	
DEFECTIVE RAILS		
Transverse fissure Compound fissure	More than 20% of railhead cross section weakened by defect. See Note 5	4.2.2.2 and Appendix C, UFC 4-860-03
Detail fracture Engine Burn fracture Ordinary Break	Breakout in railhead with over 1/4 in. movement.	

Attachment (4-1)

SUMMARY OF IN-SERVICE
ELEVATED CRANE TRACKAGE INSPECTION CRITERIA

TRACK SAFETY STANDARDS	CRITICAL DEFECTS	INSTRUCTION REFERENCE
DEFECTIVE RAILS (Cont'd)		
Horizontal Split Head Vertical Split Head Split Web, Piped Rail Head Web Separation	More than 4". See Note 5	
Bolt Hole Cracks	More than 1-1/2 in. See Note 5	
Broken Base	More than 6 in.	
DAMAGED RAIL:		
Shelling, Head Checks, Engine Burn, Mill Defect, Flaking-slivered, Corrugated-corroded	Depth over 3/8 in.	4.2.2.2 and Appendix C, UFC 4-860-03
Flowed Rail	Roll exceeding 5/16 in.	
WORN RAIL:		
Rail section (pounds per yd)		4.2.2.1 and 4.2.2.2
Web-Base Thickness Reduction:		
Up to 70	Over 1/8 in.	
Over 70	Over 1/4 in.	
Vertical Head Wear:		
Up to 70	Over 1/4 in.	
71 to 134	Over 3/8 in.	
135 and larger	Over 1/2 in.	
Horizontal Side Wear:		
30 to 50	Over 3/8 in.	
60 to 70	Over 1/2 in.	
71 to 134	Over 5/8 in.	
135 and larger	Over 3/4 in.	
RAIL END MISMATCH:		
On tread or running surface	Over 1/4 in.	
On side of railhead	Over 3/16 in.	
RAIL JOINTS:		4.2.4.1
Gap Rail Joints	Over 1/2 inch, See Note 6	
Gap Expansion Joints	Over 1 inch, See Note 6	

Attachment (4-1)

SUMMARY OF IN-SERVICE
ELEVATED CRANE TRACKAGE INSPECTION CRITERIA

TRACK SAFETY STANDARDS	CRITICAL DEFECTS	INSTRUCTION REFERENCE
RAIL JOINTS: (cont'd)		4.2.4.1
Bolt Holes (applies to any torch cut hole in rail)	Torchcut or Burned	
Joint Bars	Broken between the middle two bolt holes Torch cut or modified	
Rail Joint Bolts	Less than two/rail/joint	

NOTE 1. Criteria is shown for elevated crane rail systems that are rigidly supported, such as rails mounted on steel or concrete beams. If other types of support systems are involved, the severity of defects shall be determined based on local conditions. Specific criteria for evaluating the consequences of defects outside the range designated as critical are not available. The activity shall evaluate the severity of each such defect and shall classify the degree-of-hazard based on engineering judgment and experience.

NOTE 2. Guidelines are for visual observation only. Deviations may be estimated and measurement is not required unless it is necessary for supplemental investigation. Deflection for rail systems on flexible supports, such as wood should not exceed 3/4 inch.

NOTE 3. Tolerances provided in Crane Manufactures Association of America (CMAA) Specification #70 "Specifications for Top Running Bridge & Gantry Type Multiple Girder Electric Overhead Traveling Cranes" for new construction/replacement and minimum safety standards provided herein shall be used to assess geometry condition.

NOTE 4. Building supports, pile foundations, caps, beams, etc. shall be investigated when movement, sag, deformation, or other alignment problems of component members exceeds one-half (1/2) inch. The final classification of defects shall be based on engineering evaluation.

NOTE 5. Defects smaller than those noted may be classified as marginal provided the defect is inspected six months after discovery and annually thereafter to ensure that the defect is not progressing. Defects accumulating three feet or more in any 10 feet are considered catastrophic.

NOTE 6. Joint gaps over 1/4 inch and less than 1/2 inch may be classified as no defect provided the joint is tight with no movement. Joint gaps between 1/2 inch and the defect limit indicated shall be classified as marginal or a more serious classification if the joint is loose or if there are other defects present. Gaps measured at defect limits when the air temperature is over 30 degrees C (86 degrees F) shall be remeasured when the air temperature drops below 0 degrees C (32 degrees F).

Attachment (4-1)

INSPECTION/CERTIFICATION DOCUMENT FOR ELEVATED CRANE TRACKAGE					
Building/Crane No:	Type:		Manufacturer:		Capacity:
Detailed Visual Inspection Date:	Operational (Check appropriate box) Date:	"No Load"	"Load"	Current NDT Date:	Type:

Item No.	Items to be Inspected	Condition			
		Satisfactory	Restricted	Unsatisfactory	Not Applicable
1	Rails				
2	Rail Joints				
3	Rail Bolts				
4	J-Bolts, Clips, Tie Plates, Misc. Fasteners				
5	Gage				
6	Rail Alignment				
7	Cross Section				
8	Rail Stops				
9	Clearances				
10	Signs and Appurtenances				
11	Support Structure				

Remarks (Item No.): Note any deficiencies and level (Marginal, Critical or Catastrophic) or "No defects noted."

This crane trackage support structure has been inspected in accordance with NAVFACINST 11230.1F, Paragraph 4.1.4.2. after 4 year load test and is ☐ Satisfactory ☐ Unsatisfactory (see Remarks)

Structural Inspector (signature)	Date:

This section of trackage covered by the inspection report above meets the applicable standards and is certified as follows:

☐ FULL CERTIFICATION ☐ RESTRICTED CERTIFICATION ☐ NON-CERTIFICATION

		Track Inspector (signature)	Date:
		Certifying Official (signature)	Date:

Attachment (4-2)