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2-5 MOBILE CRANES

2-5.1 Scope

This Hanford Site Hoisting and Rigging Manual (HSHRM) chapter applies to the construction and characteristics, inspection, testing, maintenance, and operation of crawler cranes, locomotive cranes, wheel-mounted cranes, and other crane types that retain the same fundamental characteristics. This scope includes only cranes of the above type that are powered by internal combustion engines or electric motors. The proper and safe use of these crane types is governed by the American Society of Mechanical Engineers (ASME) standards and the Occupational Safety and Health Administration (OSHA) regulations. This chapter implements required criteria from applicable national standards and/or mandatory federal specifications, including ASME B30.5, *Mobile and Locomotive Cranes*; OSHA 29 CFR 1910.180, *Crawler Locomotive and Truck Cranes*, and OSHA 29 CFR 1926 Subpart CC, *Cranes and Derricks in Construction*.

2-5.2 Accessing Requirements

- a. To access ASME standards, choose one of the following options:
 - [IHS Engineering Standards, Regulations and Technical Specifications](#). The contractor must have paid for access to the specific standard.
 - Purchase standards directly from [ASME](#).
- b. To access OSHA standards, go to:
 - [OSHA 29 CFR 1910.180, Crawler Locomotive and Truck Cranes](#)
 - [OSHA 29 CFR 1926, Subpart CC, Cranes and Derricks in Construction](#), or Chapter 3-7

2-5.3 Implementation

Contractors shall comply with OSHA, ASME, this HSHRM, and manufacturers' requirements. Users of this HSHRM are responsible to implement all applicable requirements. If standards conflict, the user shall adhere to the standard containing the most stringent requirements. In most cases, ASME standards provide the most comprehensive information.

Users should contact a Hanford Site Hoisting and Rigging Committee (HSHRC) representative or send an [email](#) requesting a formal interpretation. See Chapter 1-10, *Interpretations*, for process to be followed. Notify the HHRC if any inconsistent standards are identified.

This HSHRM does not intend to require retrofitting of existing equipment. However, when any hoisting or rigging equipment is modified, its performance requirements shall be reviewed relative to the requirements within the current HSHRM. The need to meet the current requirements shall be evaluated by a qualified person selected by the owner (user).

2-5.4 Inconsistent Standards

Chapter 1-3, *Responsibilities*, delineates responsibilities to personnel and organizations involved in hoisting and rigging (H&R), as does ASME B30.5, *Mobile and Locomotive Cranes*. The HSHRM will take precedence over ASME B30.5. If the responsibility is not covered or assigned in the HSHRM, then ASME B30.5 applies.

2-5.5 Hanford-Specific Requirements and Practices

Follow ASME B30.5, *Mobile and Locomotive Cranes*, requirements and the following Hanford requirements:

- Direction provided in Chapter 3-4, *Freight Container Lifting Standard*, when lifting freight containers and/or Conex boxes.
- Directions provided in Chapter 3-5, *Lifting Requirements for Concrete Blocks*, when lifting concrete blocks (e.g., ecology, landscaping blocks).
- Fall protection requirements as specified in DOE-0346, *Hanford Site Fall Protection Program*, when performing assembly/disassembly, maintenance, repair, or inspection of mobile cranes.
- Electrical safety requirements as specified in DOE-0359, *Hanford Site Electrical Safety Program*, when operating mobile cranes near overhead lines.
- When working near transmitter/communication towers where the equipment is close enough for an electrical charge to be induced in the equipment or materials being handled, the transmitter shall be de-energized or the following precautions shall be taken:
 - The equipment shall be provided with an electrical ground
 - If tag lines are used, they shall be non-conductive

2-5.5.1 CAUTION: Ground and Bearing-Pressure Considerations

It is important to ensure that no underground installations exist that could be compromised, such as electrical vaults, conduit banks, tanks, and piping. When crane load foundations and bearing pressure are a concern to crane stability and underground installation integrity, site utility layout, crane manufacturer's ground-loading information, crane configuration, and load and travel path information shall be evaluated and analyzed by a qualified person. The qualified person shall determine if ground scans, soil stability tests, and structural analysis of underground structures are necessary. If analysis is performed, a documented plan to ensure crane stability and integrity of underground installations shall be provided to the supervisor of the lift operation and discussed with involved or affected personnel.

2-5.5.1.1 Ground Conditions

The equipment shall not be assembled or used unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials, the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.

The controlling entity shall:

1. Ensure that ground preparations necessary to meet the requirements in Chapter 1-3, Section 1-3.3.3, *Controlling Entity*, Item (a) are provided.
2. Inform the user of the equipment and the operator of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, and soil analyses) that are in the possession of the controlling entity (whether at the site or off-site) or the hazards are otherwise known to that controlling entity.

If there is no controlling entity for the project, the Requirement #2 above shall be met by the employer that has authority at the site to make or arrange for ground preparations needed to meet ground condition requirements.

If the assembly/disassembly (A/D) director or the operator determines that ground conditions do not meet the requirements, that person's employer shall have a discussion with the controlling entity regarding the ground preparations that are needed so that, with the use of suitable supporting materials/devices (if necessary), the ground conditions requirements can be met.

This section does not apply to cranes designed for use on railroad tracks when used on railroad tracks that are part of the general railroad system of transportation that is regulated pursuant to the Federal Railroad Administration under OSHA 49 CFR Part 213, *Track Safety Standards*, and that comply with applicable Federal Railroad Administration requirements.

2-5.5.2 Operating Cranes near Energized Transmitters or Electrical Power Lines

Requirements for operating cranes near energized transmitters or electrical power lines can be found in DOE-0359, *Hanford Site Electrical Safety Program*.

2-5.5.3 Adverse Weather

Adverse weather conditions such as, but not limited to wind, wind gusts, rain, snow, and extreme temperatures, that may inhibit the operator's or the equipment's ability to safely handle loads, shall be evaluated by supervision and the crane operator prior to any lifting operation.

Limitations and conditions imposed by the equipment manufacturer for adverse weather shall be implemented. Mobile crane operations shall be suspended when lightning is within 50 miles of the work location, as determined by the Hanford Meteorological Station. The Hanford Meteorological station can be contacted at (509) 373-2716.

2-5.5.4 On-Rubber and Pick-and-Carry Operations

Mobile crane pick-and-carry and on-rubber operations may be performed at Hanford when the crane manufacturer has an approved operating chart for that specific purpose. Manufacturer's requirements and conditions for on-rubber or pick-and-carry pre-operational checks shall be followed, such as, but not limited to, axle oscillation lockout system pre-checks and proper tire inflation validation. This information can be found in the operators or crane maintenance service manual provided with the crane. These requirements shall be addressed in the work planning process or other implementing documents and addressed in pre-job meetings.

2-5.5.5 Multiple Load Line Operation

Multiple load line operation shall only be permitted when the equipment and procedures required by the crane manufacturer or qualified person are applied. This information may be found in the operator's service manual provided with the crane. These requirements shall be addressed in the work planning process or other implementing documents and addressed in pre-job meetings. Read ASME B30.5, Section 5-3.2.3, *Multiple Load Line Operation*.

2-5.5.6 Outrigger Lift-Off

Mobile crane outrigger lift-off may occur under certain loaded conditions when working within the limits of the load chart. If this condition has not been addressed in the planning process and a pre-job meeting, operations shall be stopped and a qualified person shall be consulted prior to continuing operations.

2-5.5.7 Rigging Requirements

CAUTION: *Working on or under a suspended load is prohibited, except when the load can be supported by blocking or cribbing, can be securely braced, or can be supported substantially by some other means that would prevent the load from moving. Some loads being lifted and set in place may require special handling control measures such as inspecting, landing, setting, or controlling the load, that may require personnel to position their hands or other body parts under the load when no other method is feasible. These special handling control activities MUST BE APPROVED by management and industrial safety PRIOR TO BEING PERFORMED.*

2-5.5.8 Swing Radius—Pinch Point Clearance and Swing Radius Hazards

When the crane is in operation, maintain a minimum clearance of 30 inches (76 centimeters) between the swing radius of the crane superstructure or counterweights and any stationary object.

2-5.5.8.1 Swing Radius Hazards

1. The requirements of this section apply where there are accessible areas in which the equipment's rotating superstructure (whether permanently or temporarily mounted) poses a reasonably foreseeable risk of:
 - a. Striking and injuring an employee; or
 - b. Pinching/crushing an employee against another part of the equipment or another object.
2. To prevent employees from entering these hazard areas, the employer shall:
 - a. Train each employee assigned to work on or near the equipment ("authorized personnel") in how to recognize struck-by and pinch/crush hazard areas posed by the rotating superstructure.
 - b. Erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas.

EXCEPTION: *When the employer can demonstrate that it is neither feasible to erect such barriers on the ground nor on the equipment, the hazard areas shall be clearly*

marked by a combination of warning signs (such as “Danger – Swing/Crush Zone”) and high visibility markings on the equipment that identify the hazard areas. In addition, the employer shall train each employee to understand what these markings signify.

Where any part of a crane/derrick is within the working radius of another crane/derrick, the controlling entity shall institute a system to coordinate operations. If there is no controlling entity, the employer(s) shall institute such a system.

2-5.5.9 Load Test Weight

The load-test weight or testing device shall be traceable to a recognized standard or verified by engineering calculations. The load test shall never be less than minimum requirements defined in the applicable ASME B30 standard. Any one of the following options will meet this requirement:

- Use a calibrated Load-Indicating Device (LID) ($\pm 2\%$ of the maximum rated load) during the load test
- Determine the test load with a calibrated LID before the test
- Calculate the test load based on known unit weights and dimensions of the test fixture. Dimensions and calculations shall be checked (signed and dated) by a qualified engineer

2-5.5.10 Load Test Report

After the test is completed, the load-test report shall be signed and dated by the person in charge of conducting the load test. The person in charge shall ensure that the test is placed in the maintenance file.

2-5.5.11 Crane Maintenance Files

The crane maintenance file is a compilation of various documents and records relating to operation, maintenance, inspection, testing, evaluation, and repair of the equipment. The file may be centrally located or proportioned into satellite holding areas. The method(s) selected for establishing adequate information retention shall be determined by the equipment custodian. It is expected that the maintenance files be retrievable within three work days. The equipment custodian is responsible for ensuring that a safe and reliable maintenance program is in place.

2-5.5.11.1 Intent of Crane Maintenance Files

The crane maintenance file shall contain, as a minimum, the required current dated periodic inspection records and other documentation to provide the user with evidence of a safe and reliable maintenance program. Inspection records should be retained in a format and location that provides for ease in accessibility. Maintenance file information should provide a source for comparing present conditions with past conditions to determine whether existing conditions show a trending pattern of wear, deterioration, or other comparable factors that may compromise safe, continued use of the equipment. Length of record retention shall be determined by the equipment custodian’s established maintenance program.

2-5.5.11.2 Maintenance File Contents

Crane maintenance files shall contain the following documentation, as applicable, and should be retained as long as the crane is assigned to a Hanford Site DOE contractor.

1. Monthly and periodic inspection records (The most recent records shall be retained in the file and the past records should be retained for trending)
2. Load test reports
3. Operational test reports
4. Documentation of altered, replaced, or repaired load-sustaining parts
5. Records of special inspections on safety-related items such as brakes, crane hooks, ropes, hydraulic and pneumatic cylinders, and hydraulic and pneumatic relief pressure valves.
6. Copies of waivers, exemptions, hostile environment plans, or similar documentation applicable to the crane (to include manufacturer's safety bulletins, safety alerts, and product recall information)
7. Documentation for replacement ropes (see Chapter 2-30, *Ropes*)
8. Rope manufacturer's certification for replacement ropes
9. Records of inspection on load indicating devices, anti-two block, two-block warning, and two-block damage prevention systems

2-5.5.11.3 Previously Owned Cranes Maintenance Files

Although complete maintenance information for previously owned cranes may not be available, the equipment custodian shall acquire as much of the pertinent information as possible. If efforts fail to obtain the required information, the following actions, at a minimum, shall take place:

- Perform a periodic inspection by a qualified inspector, including inspection of hooks and ropes
- Inspect for evidence of past repairs, alterations, or modifications. Note the results of this inspection on the inspection report
- Resolve deficiencies noted by the inspector before placing the crane into service. Perform repairs and retests as needed. If there is evidence of past repairs, replacement, or alterations of load-bearing parts and load test records are unavailable, a load test shall be performed in accordance with Section 2-5.5.9, *Load Test Weight*.

2-5.5.12 Assembly/Disassembly – Selection of Manufacturer or Employer Procedures

When assembling or disassembling equipment (or attachments), the employer shall comply with all applicable manufacturer prohibitions and shall comply with either:

1. Manufacturer procedures applicable to assembly and disassembly, or
2. Employer procedures for assembly and disassembly. Employer procedures may be used only where the employer can demonstrate that the procedures used meet the requirements

in OSHA 29 CFR 1926, Subpart CC, Section 1926.1406, *Assembly/Disassembly - Employer Procedures - General Requirements*.

The employer shall follow manufacturer procedures when using synthetic slings during assembly or disassembly rigging. (See 29 CFR 1926.1404(r), *Rigging*)

2-5.5.12.1 Assembly/Disassembly – General Requirements (Applicable to all Assembly and Disassembly Operations)

Assembly/Disassembly requires a qualified/competent director who is responsible to direct both the assembly and/or disassembly of equipment (cranes) covered under OSHA [29 CFR 1926, Subpart CC, *Cranes and Derricks in Construction*](#), and ASME B30 series standards. With regard to tower cranes, “erecting and climbing” replaces the term “assembly,” and “dismantling” replaces the term “disassembly.” Regardless of whether the crane is initially erected to its full height or is climbed in stages, the process of increasing the height of the crane is an erection process. See Chapter 1-4, *Personnel Qualifications and Training Requirements*, for A/D Director qualification requirements and Chapter 3-7, *OSHA [29 CFR 1926 Subpart CC](#)*, for Assembly/Disassembly requirements.

Upon completion of assembly, the equipment shall be inspected by a qualified person to assure that it is configured in accordance with manufacturer equipment criteria.

1. Where manufacturer equipment criteria are unavailable, a qualified person shall:
 - a. Determine if a registered professional engineer (RPE) familiar with the type of equipment involved is needed to develop criteria for the equipment configuration. If an RPE is not needed, the employer shall ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer shall ensure that they are developed by an RPE.
 - b. Determine if the equipment meets the criteria developed in accordance with paragraph (a) above.
2. Equipment shall not be used until an inspection demonstrates that the equipment is configured in accordance with the applicable criteria.

2-5.5.12.2 Assembly/Disassembly – Employer Procedures – General Requirements

When using employer procedures instead of manufacturer procedures for assembly/disassembly, the employer shall ensure that the procedures:

1. Prevent unintended dangerous movement, and prevent collapse, of any part of the equipment.
2. Provide adequate support and stability of all parts of the equipment.
3. Position employees involved in the assembly/disassembly operation so that their exposure to unintended movement or collapse of part or all of the equipment is minimized.

Employer procedures shall be developed by a qualified person.

2-5.5.13 Equipment Modifications

Modifications or additions which affect the capacity or safe operation of the equipment are prohibited except where any of the following requirements are met.

1. Manufacturer review and approval:
 - a. The manufacturer approves the modifications/additions in writing.
 - b. The load charts, procedures, instruction manuals, and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.
 - c. The original safety factor of the equipment is not reduced.
2. The manufacturer is provided a detailed description of the proposed modification/addition, is asked to approve the modification/ addition, but it declines to review the technical merits of the proposal or fails, within 30 days, to acknowledge the request or initiate the review, and all of the following are met:
 - a. An RPE who is a qualified person with respect to the equipment involved:
 - i. Approves the modification/addition and specifies the equipment configurations to which that approval applies, and
 - ii. Modifies load charts, procedures, instruction manuals, and instruction plates/tags/decals as necessary to accord with the modification/addition.
 - b. The original safety factor of the equipment is not reduced.
3. The manufacturer is unavailable and the requirements of Paragraph 2 of this section are met.
4. The manufacturer is provided a detailed description of the proposed modification/addition, is asked to approve the modification/ addition, agrees to review the technical merits of the proposal, but fails to complete the review of the proposal within 120 days of the date it was provided the detailed description of the proposed modification/addition, and the requirements of Paragraph 2 of this section are met.
5. The equipment is designed for marine work sites, contains major structural components from more than one manufacturer, and the requirements of Paragraph 2 of this section are met.

Modifications or additions which affect the capacity or safe operation of the equipment are prohibited where the manufacturer, after a review of the technical safety merits of the proposed modification/addition, rejects the proposal and explains the reasons for the rejection in a written response. If the manufacturer rejects the proposal but does not explain the reasons for the rejection in writing, the employer may treat this as a manufacturer refusal to review the request under Paragraph 2 of this section.

The provisions in the above paragraphs of this section do not apply to modifications made or approved by the U.S. military.

2-5.5.13.1 Modified Equipment Inspection

Equipment that has had modifications or additions which affect the safe operation of the equipment (such as modifications or additions involving a safety device or operational aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) or capacity shall be inspected by a qualified person after such modifications/additions have been completed and prior to initial use. The inspection shall meet all of the following requirements:

1. The inspection shall assure that the modifications or additions have been done in accordance with the approval obtained pursuant to OSHA 29 CFR 1926, Subpart CC, Section 1926.1434, *Equipment Modifications*.
2. The inspection shall include functional testing of the equipment.

The equipment shall not be used until an inspection demonstrates that the above requirements of this section have been met.

2-5.5.13.2 Repaired/Adjusted Equipment Inspections

Equipment that has had a repair or adjustment that relates to safe operation (such as a repair or adjustment to a safety device or operator aid, or to a critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism), shall be inspected by a qualified person after such a repair or adjustment has been completed and prior to initial use. The inspection shall meet all of the following requirements:

1. The qualified person shall determine if the repair/adjustment meets manufacturer equipment criteria (where applicable and available).
2. Where manufacturer equipment criteria are unavailable or inapplicable, the qualified person shall:
 - a. Determine if an RPE is needed to develop criteria for the repair/adjustment. If an RPE is not needed, the employer shall ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer shall ensure that they are developed by an RPE.
 - b. Determine if the repair/adjustment meets the criteria developed in accordance with Paragraph 2.a of this section.
3. The inspection shall include functional testing of the repaired/adjusted parts and other components that may be affected by the repair/adjustment.

Equipment shall not be used until an inspection demonstrates that the repair/adjustment meets the requirements of Paragraph 1 above (or, where applicable, Paragraph 2 above).

Equipment shall not be used until an inspection demonstrates that the equipment is configured in accordance with the applicable criteria.

2-5.5.14 Leaving the Equipment Unattended

The operator shall not leave the controls while the load is suspended, except where all of the following are met:

1. The operator remains adjacent to the equipment and is not engaged in any other duties.
2. The load is to be held suspended for a period of time exceeding normal lifting operations.
3. The competent person determines that it is safe to do so and implements measures necessary to restrain the boom hoist and telescoping, load, swing, and outrigger or stabilizer functions.
4. Barricades or caution lines, and notices, are erected to prevent all employees from entering the fall zone. No employees, including those listed in OSHA 29 CFR 1926, Subpart CC, 1926.1425, *Keeping Clear of the Load*, Sections (b)(1) through (3), (d), or (e), are permitted in the fall zone.

The provisions in OSHA 29 CFR 1926, Subpart CC, Section 1926.1417(e), *Leaving the Equipment Unattended*, Item (1) do not apply to working gear (such as slings, spreader bars, ladders, and welding machines) where the weight of the working gear is negligible relative to the lifting capacity of the equipment as positioned, and the working gear is suspended over an area other than an entrance or exit.

2-5.5.15 Tag-out

Where the employer has taken the equipment out of service, a tag shall be placed in the cab stating that the equipment is out of service and is not to be used. Where the employer has taken a function(s) out of service, a tag shall be placed in a conspicuous position stating that the function is out of service and is not to be used.

If there is a warning (tag-out or maintenance/do not operate) sign on the equipment or starting control, the operator shall not activate the switch or start the equipment until the sign has been removed by a person authorized to remove it.

If there is a warning (tag-out or maintenance/do not operate) sign on any other switch or control, the operator shall not activate that switch or control until the sign has been removed by a person authorized to remove it, or until the operator has verified that the sign has been removed by a person authorized to remove it.

If equipment adjustments or repairs are necessary:

1. The operator shall, in writing, promptly inform the person designated by the employer to receive such information and, where there are successive shifts, to the next operator; and
2. The employer shall notify all affected employees, at the beginning of each shift, of the necessary adjustments or repairs and all alternative measures.

2-5.5.16 Keeping Clear of the Load

Where available, hoisting routes that minimize the exposure of employees to hoisted loads shall be used, to the extent consistent with public safety.

While the operator is not moving a suspended load, no employee shall be within the fall zone, except for employees (See Chapter 1-10, *Interpretations*):

1. Engaged in hooking, unhooking or guiding a load;
2. Engaged in the initial attachment of the load to a component or structure; or
3. Operating a concrete hopper or concrete bucket

When employees are engaged in hooking, unhooking, or guiding the load, or in the initial connection of a load to a component or structure and are within the fall zone, all of the following criteria shall be met (See Chapter 1-10, *Interpretations*):

1. The materials being hoisted shall be rigged to prevent unintentional displacement
2. Hooks with self-closing latches or their equivalent shall be used.
EXCEPTION: *“J” hooks are permitted to be used for setting wooden trusses.*
3. The materials shall be rigged by a qualified rigger

Only employees needed to receive a load are permitted to be within the fall zone when a load is being landed. (See Chapter 1-10, *Interpretations*)

During a tilt-up or tilt-down operation:

1. No employee shall be directly under the load.
2. Only employees essential to the operation are permitted in the fall zone (but not directly under the load). (See Chapter 1-10, *Interpretations*.) An employee is essential to the operation if the employee is conducting one of the following operations and the employer can demonstrate it is infeasible for the employee to perform that operation from outside the fall zone.
 - a. Physically guide the load
 - b. Closely monitor and giving instructions regarding the load’s movement
 - c. Detaching the load from or initially attach it to another component or structure (such as, but not limited to, making an initial connection or installing bracing)

2-5.5.17 Crane Setup

When Mobile Crane is setup adjacent to a slope, excavation, or temporary structure (e.g., ecology blocks shoring) the minimum setback distance shall be as shown in Figures 1 through 3, unless otherwise determined in an analysis performed by a qualified engineer. This method for estimating setback distance from slopes, excavations, and retaining walls can be implemented by a qualified person, but is not intended to be applicable for every situation or substituted for analysis when conditions warrant.

Figure 1: Set-Back Distance For Sloping Ground

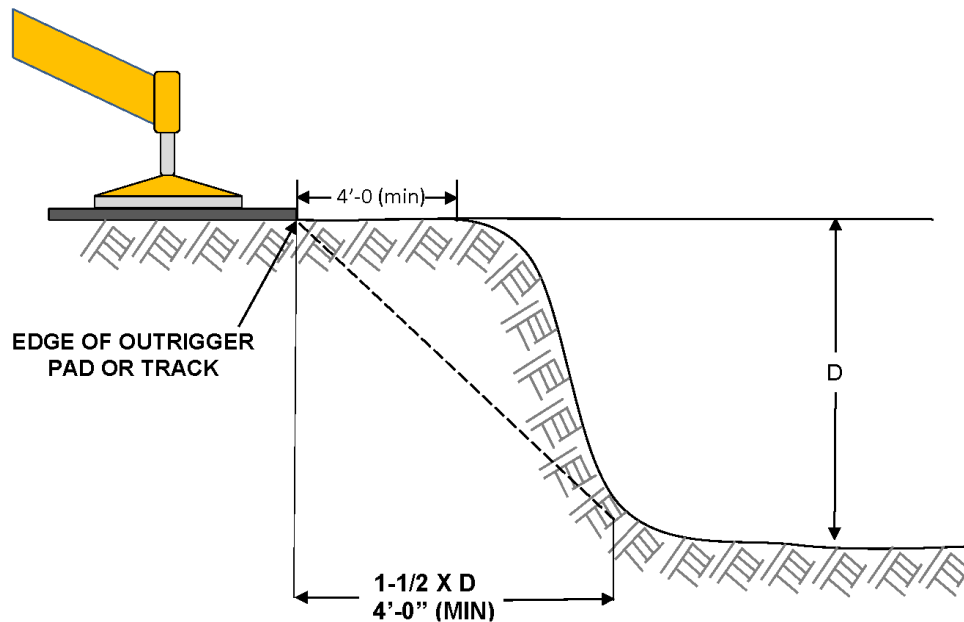


Figure 2: Set-Back Distance for 1-1/2 to 1 Slopes

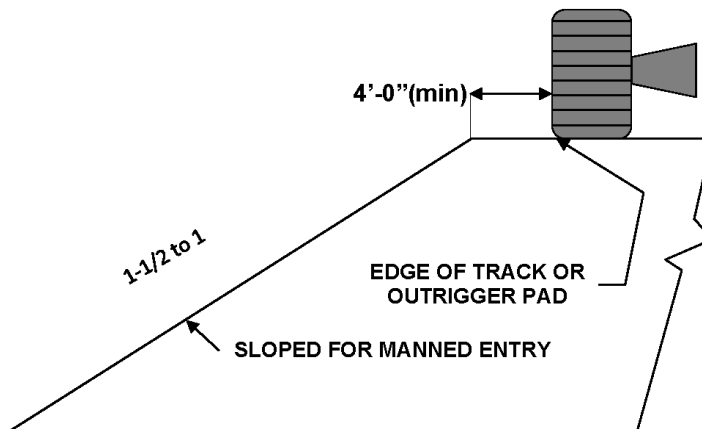
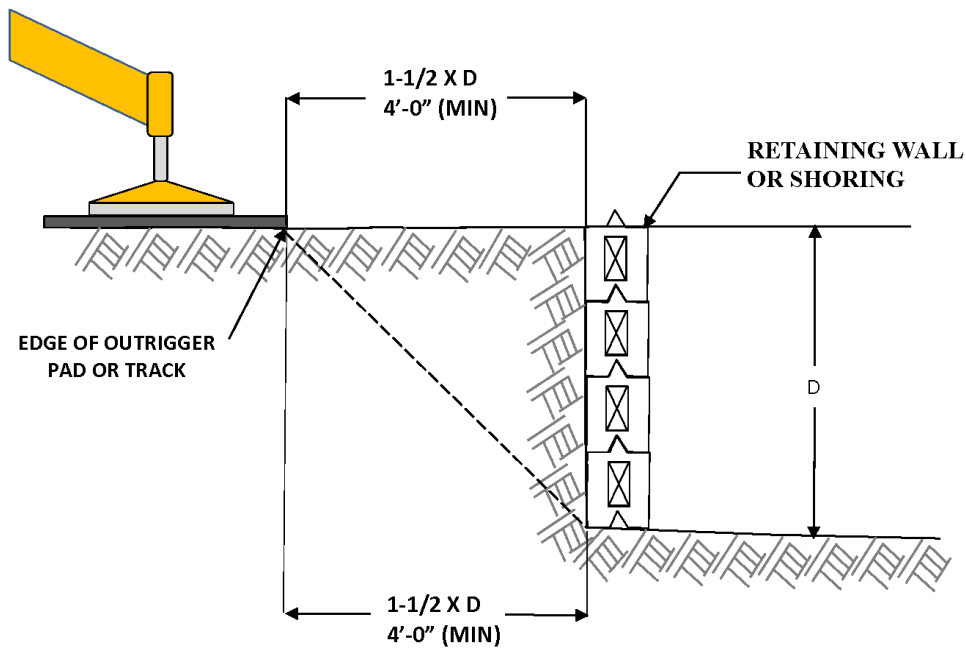


Figure 3: Set-Back Distance for Temporary Wall or Shoring



2-5.6 Boom Free Fall Prohibitions

The use of mobile cranes as defined in ASME B30.5, *Mobile and Locomotive Cranes*, in which the boom is designed to free fall (live boom), is prohibited on the Hanford Site.

2-5.7 Digger Derricks

Digger derricks fall within the cranes standards when used as a crane for other than augering holes for poles carrying electric and telecommunication lines, placing and removing the poles, and for handling associated materials to be installed on or removed from the poles. See Chapter 3-7, OSHA [29 CFR 1926, Subpart CC, Cranes and Derricks in Construction](#).

2-5.8 Unavailable Operation Procedures

Where the manufacturer procedures are unavailable, the employer shall develop and ensure compliance with all procedures necessary for the safe operation of the equipment and attachments. Procedures for the operational controls shall be developed by a qualified person. Procedures related to the capacity of the equipment shall be developed and signed by an RPE familiar with the equipment.

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