TriMet Banfield Light Rail Transit Project: Civil and Construction Safety Manual

Banfield Risk and Insurance Managers
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STATEMENT OF SAFETY POLICY

Tri-Met is committed to a safety program for the Banfield Light Rail Transit Project which will accomplish substantially better than average safety results. It is the policy of Tri-Met to maintain a safe working environment for all project employees and the public.

The active support of and participation in the project safety program by all Tri-Met project personnel, project consultants, contractors, sub contractors and work force is mandatory. Each is responsible and will be held accountable for his own safety, that of his co-workers, workers under his supervision, visitors on the project, and that of the public. The Construction Safety Manual is one of Tri-Met's construction contract documents and noncompliance with safety specifications will be treated the same as noncompliance with any contract item.

Workers' on the project are expected to maintain safe work habits, observe known and posted safety rules, and generally conduct themselves in a manner which will not place themselves, fellow employees or the public in danger.

No job must ever become so routine or so urgent that every safety precaution is not observed. Prevention of personal injury and damage to property and equipment must always remain upmost in the minds of every employee.

Donald MacDonald
Project Manager

Q.E. Cowen
Tri-Met General Manager
The CONSTRUCTION SAFETY MANUAL is one of the Tri-Met Contract Documents. Contractors are required to assure that all employees, subcontractors, and their suppliers/vendors, while on the Work Site and in the conduct of Tri-Met contracts, comply with the provisions of this Manual.

The Occupational Health and Safety Act, the Oregon Safe Employment Act (and future revisions or additions thereof) are required by law to be followed on all work. These regulations are MINIMUM standards.

In an effort to maintain the highest standard of safety possible to both the public and project employees, these standards have been supplemented by safety and health provisions contained in this Manual.

It is fully realized these additional provisions may not address some unforeseen work site hazards, or may be impractical for a contractor to comply in every situation. Revisions to the Manual's safety and health section will be made as required to meet the changing needs of the Project - As Long As the total loss control objectives are not compromised and meet with the approval of the Coordinated Safety Committee.

The provisions of this manual do not negate, abrogate, alter, or otherwise change any requirements of OSHA, OSEA, or any other applicable laws.

The Contractor will be expected to familiarize himself with the contents applicable to his operations. The provisions of the Safety Manual will be strictly enforced. Noncompliance with the Safety Manual will be treated the same as noncompliance with any Contract provision. Willful or repeated noncompliance shall result in suspension of part or all work.
DEFINITIONS

The following definitions apply for the purposes of this Construction Safety Manual.

1. ACCIDENT - Any unexpected event that interrupts or interferes with the orderly progress of the production activity or process that results in bodily injury or property damage.

2. ACCIDENT CONTROL PROGRAM - A program designed to provide safety control for the protection to life and health of employees and other persons, for the prevention of damage to property, materials, supplies and equipment.

3. ACT - The Oregon Safe Employment Act (ORS 654.001 to 654.295 and 654.991).

4. APD - The Accident Prevention Division of the Workers' Compensation Department.

5. APPROVED - A method, equipment, procedure, practice, tool, etc., which is sanctioned, consented to, confirmed, or accepted as good or satisfactory for a particular use or purpose by a person or organization authorized to render such approval or judgement.

6. AUTHORIZED PERSON - A person approved or assigned by the employer to perform a specific type of duty or to assume a specific responsibility.

7. BANFIELD LIGHT RAIL TRANSIT PROJECT (BLRT) - The development of a 15 mile light rail transit line along the Banfield/Burnside corridor upon which light rail vehicles travel on two rail tracks and are powered from overhead electrical wires.

8. BANFIELD RISK AND INSURANCE MANAGERS (BRIM) - A joint venture composed of Fred. S. James & Co., Inc. of Oregon; the Azumano Insurance Agency; known as Banfield Risk and Insurance Managers, Tri-Met's authorized agents to secure insurance coverages for the Coordinated Insurance Program and administrators of the Accident Control Program.

9. BRIM PROJECT DIRECTOR - The representative so designated by Banfield Risk and Insurance Managers to manage the Coordinated Insurance Program (CIP).

10. CATASTROPHE - An accident in which two or more employees are fatally injured, or five or more involved employees go to, or are each sent to, or admitted to, a hospital or an equivalent medical facility.
11. CIP - The Coordinated Insurance and Safety Program which is administered by BRIM.

12. COMPANY - The designated insurance underwriter of Tri-Met, also referred to as the insurance carrier.

13. COMPETENT PERSON - A person who by training and/or experience is capable of performing specifically assigned duties and responsibility. Further, he is capable of recognizing existing and predictable hazards or conditions which are unsanitary, hazardous, or dangerous, and is authorized to initiate prompt corrective action.

14. CONSTRUCTION SAFETY SUPERVISOR - A contractor's employee or subcontractor's employee who is responsible for job site safety, safety education of job site employees and for the reporting of all insurance claims.

15. CONTRACTOR - The individual, firm, partnership, or corporation, or combination thereof, private, municipal, or public, including joint ventures, which, as an independent contractor, has entered into a contract with Tri-Met, who is referred to throughout the Contract Documents by singular number and masculine gender.

16. COORDINATED SAFETY COMMITTEE - A committee consisting of the BRIM Safety Director (Chairman), the Resident Engineer, the Contractor's Designated Safety Supervisor, and the Insurance Carrier. The committee will review and approve Contractor's safety program, qualifications of Contractor's safety representatives, and overall project safety progress.

17. EMERGENCIES - For the purpose of the Accident Control Program, emergencies are classified as follows:

   a. Any serious accident involving one or more workmen.
   b. Any serious accident involving a member of the public.
   c. Any other occurrence which would require immediate protection of life or property.
   d. Collapse of a substantial part of any permanent structure upon the work site.
   e. Collapse of equipment used in the course of construction.
   f. A fire requiring the response of the local fire department.
18. FIRST AID - Any one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, or similar injuries, which do not ordinarily require medical care. Such one-time treatment and subsequent observation is considered first aid even though provided by a physician or registered professional personnel. (Formerly 46-700[5])

19. HIGH VOLTAGE - Refers to all voltages of 600 volts or greater, unless otherwise defined in the text of this manual.

20. IMMINENT DANGER - A condition, practice or act which exists in any place of employment and could reasonably be expected to cause death or serious physical harm immediately or before the imminence of such danger can be eliminated through the enforcement procedures otherwise provided by the Act.

21. INCIDENT/OCCURRENCE - An unplanned event that interrupts the orderly completion of an activity, that may or may not include property damage or bodily injury.

22. INSURANCE ADMINISTRATOR - See BRIM.

23. LOST WORKDAYS - The actual number of days after, but not including, the day of injury or illness during which the employee would have worked, but could not perform all or any part of his/her normal assignment during all or any part of the employee's next regular workday or shift because of the occupational injury or illness. (Formerly 436-46-700[6])

24. MEDICAL TREATMENT - Treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered professional personnel, nor does it include treatment ordinarily considered diagnostic or preventative in nature. (Formerly 436-46-700[4])

25. OREGON SAFE EMPLOYMENT ACT (OSEA) - An act to assure as far as possible safe and healthful working conditions for every working man and woman in Oregon through the development, administration and enforcement of safety and health laws and standards in accordance with the Federal Occupational Safety and Health Act of 1970.

26. REPORTABLE OCCUPATIONAL INJURIES OR ILLNESSES - For the purpose of this project a reportable accident will be one which requires more than one visit to the first aid facility, or which requires one or more trips to a doctor, clinic or hospital.

27. PROJECT ENGINEER - Tri-Met Engineer assigned to act as its authorized agent in the administration of the specific contract.
28. SAFETY DIRECTOR - The representative so designated by the Banfield Risk and Insurance Managers (BRIM).

29. SUBCONTRACTOR - Any person, firm or corporation, other than the employees of the Contractor, who contracts with the Contractor to furnish labor, materials or labor and materials, under this Contract.

30. SUPPLIER/VENDOR - Those entities whose sole responsibility to the project is the delivery of goods or materials, exclusive of direct labor.

31. TRI-MET - The Tri-County Metropolitan Transportation District of Oregon, a municipal corporation organized pursuant to Chapter 267 of Oregon Revised Statutes.

32. UNSAFE CONDITION - Any physical state which deviates from that which is acceptable or correct in terms of its past production or potential future production of personal injury, illness, and/or damage to property. Also, any physical state which contributes to a reduction in the degree of safety normally present.

33. WORK SITE - The area enclosed by the Limit of Work indicated in the Project Drawings and boundaries of local streets and public easements in which the Contractor is to perform the work under the Contract. It shall also include areas obtained by the Contractor for use in connection with the Contract, when contiguous to the Limit of Work.
Chapter 1

SAFETY PROGRAM RESPONSIBILITIES

A. TRI-MET:

1. Insofar as the Accident Control Program is applicable, Tri-Met Project Engineers, through the Tri-Met Safety Coordinator and/or BRIM Safety Director will provide general assistance as requested to guide all other participants in fulfilling the objectives of the Accident Control Program for the Project.

2. No requested advice from any representative of Tri-Met, BRIM or the Insurance Carrier in any way relieves, alters, changes or amends any expressed, implied, or inherent agreements of legal responsibilities of any other participant to adequately and effectively provide all necessary means for public and employee safety or health that are responsible and prudent measures and recognized by responsible members of the construction industry as a whole or part or required or suggested by provisions of applicable governmental regulations or standards that are germane to the construction industry and are specifically relative to the Project in whole or part.

3. The Tri-Met Safety Coordinator and/or BRIM Safety Director, Tri-Met's Project Engineer or his designee will take, at any time, all necessary action required when situations are reported or observed which create or could create substantial hazards to life or property.

B. CONTRACTORS WILL BE REQUIRED TO:

1. Comply with all the safety requirements established by this program which exceed applicable federal and state safety and health requirements.

2. Comply with all applicable work site safety rules subsequently established by the Coordinate Safety Committee.

3. Provide a written safety program which must be in compliance with this program within three (3) weeks following award of contract. The written safety program will:

   a. Detail the control program they intend to use for all health and safety hazards peculiar to his work at his work site.
b. Designate the supervisory person who will be responsible for job site safety, job site safety inspections, safety education of job site employees, and for the reporting of all insurance claims.

c. Require attendance of the designated supervisor at the pre-construction conference for a formal presentation and review of the coordinated insurance, safety, and claims reporting program.

d. Require the designated supervisor to attend coordinated safety committee meetings at least monthly, or more often as may be required. Additional meetings will be scheduled as needed by the changing conditions of the job site, or to control specific hazards or accident types.

e. Require all Contractors' supervisory employees to hold monthly, or more often as may be required, safety meetings with the contractors' designated safety supervisor. These may coincide or be a portion of regular staff meetings. Minutes shall be maintained showing meeting dates, attendance, and safety subject matter covered. The Tri-Met Safety Coordinator and/or BRIM Safety Director shall be advised of the time and location for these scheduled meetings at least two days in advance.

f. Schedule weekly "tool-box" safety meetings to be held by job foremen or supervisors with all employees. Records shall be kept of these meetings showing date, attendance, and subject matter covered. The Tri-Met Safety Director and/or BRIM Safety Director shall be advised of the time and location for these scheduled meetings at least two days in advance.

g. Require each new employee, before he starts work, to be oriented by his supervisor on the safety and health requirements for the work task to be performed. "Tool-box" safety meetings are not an acceptable substitute for this requirement. Documentation shall be maintained showing name of employee and orientation date.

h. Establish a visitor hazard control/protection program and job site security.

i. Establish and conspicuously post an emergency procedure which will contain appropriate names and telephone numbers for personnel injuries, fire, and severe weather related conditions.

j. Comply with the program for prompt completion of injury claim reports.
k. Comply with the program for formal supervisory accident investigation reports on employee injuries requiring off site medical attention, and property or personal injury involving nonemployees.

1. Comply with the program established for first aid treatment and recordkeeping for all employees on the Project.

C. TRI-MET PROJECT ENGINEER (OR AUTHORIZED DESIGNEE) WILL:

1. Authorize prompt remedial action to correct violations of the Safety Program reported to it or observed by its representative.

2. Require that all Contractors have adequate fire protection equipment to be maintained in ready-operating status at all times.

3. Require of each Contractor that temporary lighting and power systems be controlled during the construction phase in such a manner as to reduce hazards to a minimum.

4. Require Contractor to furnish trained first aid personnel at work site to Tri-Met Safety Coordinator and/or BRIM Safety Director.

5. Require that good housekeeping procedures are maintained at all times by all Contractors.

6. Require Contractor to conduct frequent safety inspections of their work area.

7. Advise each Contractor who has been awarded a contract on the Project that he must set up an for all employees at the Project.

8. Require all Contractors to investigate and report all accidents, injuries, or incidents and to file a full report as established.

D. THE TRI-MET SAFETY COORDINATOR AND/OR BRIM SAFETY DIRECTOR WILL:

1. Review the Contractors' Safety Program after receipt of the contract.

2. Verify that the Contractor plans and executes the work in compliance with the state objectives of the Accident Control Program and applicable laws.

3. Actively participate in pre-construction conferences to discuss safety considerations of job site hazards, planned construction activities, vehicle traffic control, etc., with contractor(s) and engineering staff.
4. Have the authority to take immediate action, including stoppage of work, to correct conditions involving imminent danger.

5. Schedule and preside at safety meetings to be held at least monthly, or as needed, at which appropriate supervisory staff of the Contractor and subcontractors will be required to attend.

6. Periodically attend foremen's "tool-box" safety meetings and evaluate effectiveness.

7. Direct prompt remedial action to correct substandard or illegal safety and/or health conditions reported or observed.

8. Review investigation reports of injuries and/or accidents and recommend corrective action to the Contractor.

9. Verify that the Contractor has adequate fire protection equipment and is maintained in ready-operating status at all times.

10. Verify that the Contractor has temporary lighting and power systems controlled during the construction phase in such a manner as to reduce hazards to a minimum.

11. Ascertain that trained first aid personnel are certified for their work.

12. Verify that good housekeeping procedures are maintained at all times by the Contractor and subcontractors.

13. Make periodic safety inspections and surveys of the Project site.

14. Be available to the Contractor's designated safety supervisor to advise in the selection of personal protective clothing, safety equipment, guards, etc., to assist in the solving of safety problems, as requested.

15. Assist in establishing procedures for the reporting of all accidents, injuries and incidents.

16. Assist in establishing an identification program for all employees at the work site.

17. Verify that the Contractor reports all accidents immediately.

18. Advise in the implementation of the emergency procedures outlined herein.

19. Provide monthly reports to Tri-Met and the Coordinated Safety Committee on safety status and effectiveness based upon accident causes, severity and frequency.

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E. INSURANCE UNDERWRITER WILL:

1. Make accident prevention surveys. The findings of the accident prevention surveys shall be reported to the designated safety supervisor of the Contractor with a copy to the BRIM Safety Director, Tri-Met Safety Coordinator and the Tri-Met Project Engineer. Such surveys and findings shall be made at sufficiently frequent intervals to provide BRIM's Safety Director, Tri-Met's Safety Coordinator and the Tri-Met's Project Engineer with adequate information as to accident trends, health conditions and any unusual safety conditions at the Project, as the work progresses.

2. Make analysis of injuries to determine causes, trends and corrective measures for preventing recurrences. A copy of all findings are to be sent to the Tri-Met Safety Coordinator and/or BRIM Safety Director.

3. Attend and participate in safety meetings.

4. Supply technical support as required by the Tri-Met Safety Coordinator and/or BRIM Safety Director.

5. Assist in implementing the Accident Control Program, as needed.
Chapter 2

ACCIDENT REPORTING AND FIRST AID PROCEDURES

The contractor and all other participants on the construction project shall instruct their employees and all other concerned personnel in the following procedures to be used if a worker is injured.

SERIOUS INJURY OR FATALITY

Except in the case of overriding danger to the life of such worker, do not move him if:

1. He has suffered a fall;
2. There is an indication of a broken bone.
3. There may be injury to the back or to the head.

Report the matter immediately to the immediate supervisor who shall arrange for first aid treatment or other required emergency medical treatment.

In the event of serious injury or death, the supervisor of the employee concerned is to arrange for the necessary treatment. The incident shall be reported promptly to the Project Engineer and to the Tri-Met Safety Coordinator and/or BRIM Safety Director's office, at (503) 238-4943 or 239-6446.

The emergency telephone number is: 911.

Note: The emergency number will be applicable for police, fire, and ambulance response.

The Contractor nor his employees should make any statements to the press. Refer all inquiries to the Light Rail Transit Community Relations office at (503) 238-5878.

MEDICAL TREATMENT

The employer, his responsible supervisor, and foremen, shall assure that any of his employees who suffer a job-related injury shall receive first aid and medical attention consistent with and as required by law.
ACCIDENT REPORTING PROCEDURES

The employer of any injured employee shall be required to complete the First Report of Injury Form (801) as required by the Workers' Compensation Laws of the State of Oregon.

The supervisor of the injured employee shall be required to fill out the Supervisor's Accident Investigation Report form for an accident requiring medical treatment. Such form shall be submitted to the BRIM Safety Director.

The contractor and other participants in the Accident Control Program shall instruct employees and all other concerned personnel in the following procedures if there is loss or damage to property of others, including damage to equipment or tools being used at the work site.

1. Promptly report the loss or damage to the Tri-Met Safety Coordinator and/or BRIM Safety Director.

2. In the event of substantial loss or damage to the property of others, the contractor is to immediately notify BRIM Safety Director and the Project Engineer.

3. The contractor shall complete a liability claim form concerning such loss or damage.

4. In the event of property damage, the contractor shall complete the Property Loss Notice.

All participants in this Accident Control Program shall cooperate fully in the investigation of any and all accidents, whether to persons or property.
Chapter 3
SUPERVISOR'S ACCIDENT INVESTIGATION PROCEDURES

For the purpose of this project a reportable accident will be one which requires more than one visit to the first aid facility, or which requires one or more trips to a doctor, clinic or hospital.

SUPERVISOR RESPONSIBILITY

A log of first aid treatment will be maintained for all other injuries occurring on the project. When a reportable accident occurs it is the responsibility of the injured employee's immediate supervisor to properly investigate the accident, complete a Supervisor's Accident Investigation Report, and take that immediate action necessary to prevent a recurrence of an accident of a similar type.

COMPLETION OF FORM

The Supervisor's Accident Investigation form must be completed in its entirety.

1. Description of Accident - The supervisor must be specific and report honestly the sequence of events involved. The description need not be lengthy in nature, but must contain sufficient information to adequately describe what happened.

2. Accident Causes - Unsafe Act - are the human elements of accidents. There may be no unsafe acts involved in an accident, one, two, or any number of unsafe acts involving the injured person and/or other workers.

Some examples of unsafe acts are: disregard of safety instructions; fails to tie off safety lanyard; failure to wear personal protective equipment - did not wear safety glasses; unsafe lifting - should have obtained help or assumed proper position.

Unsafe Conditions - These are the physical elements of accidents involving tools, equipment, materials or facilities.

Examples of unsafe conditions are: unprotected floor hole or unprotected floor opening; defective ladder; insufficient lighting; rough or uneven walking or working surfaces; poor housekeeping.
3. **Explanation of Corrective Action Taken** - This portion of the Supervisor's Accident Investigation Report, when properly completed, is developed as the result of the supervisor's careful and thorough investigation of the accident.

In order to apply the proper corrective measure to eliminate an unsafe act, a supervisor must know why the employee or employees performed unsafely.

The supervisor must also know when the unsafe condition was present or what circumstances allowed the unsafe condition to exist in the first place.

It is important that the investigating supervisor be specific as to the corrective action taken by him if future accidents of this type are to be prevented.
Chapter 4

LOG OF FIRST AID TREATMENT

All injuries requiring first aid treatment at the job site will be recorded on the Log of First Aid Treatment form. (See Exhibit I)

Each contractor and subcontractor will submit a copy of the first aid log to the Project Safety Director.

The data from this record will be used to prepare a monthly Project Accident Summary.

The log will also provide accident trend, type and cause data which may prove useful in preventing future accidents and injuries on this project.
Chapter 5

CONTRACTOR'S MONTHLY REPORT TO SAFETY DIRECTOR

This report form (See Exhibit J) is to be completed by each individual contractor and subcontractor and submitted to the Tri-Met Safety Coordinator and/or BRIM Safety Director no later than five days after the end of the month being reported. (For instance, the June report would be due by July 5th.)

Report using a separate line for each craft or trade group.

Provide all information requested. Actual lost time days should be reported -not estimated figures.

Note: A lost time injury is one in which the employee did not return to work during the next regular work day or shift because of the occupational injury or illness.

Lost work days is the actual number of days after, but not including the day of injury or illness, during which the employee would have worked. (See Lost Workdays in definition of terms.)
SAFETY

STANDARDS AND PRACTICES
Chapter 6.1

GENERAL SAFETY AND HEALTH PROVISIONS

1. The contractor shall adopt a program for the performance of his work designed to promote its orderly and expeditious progress, and to insure its safe completion within the prescribed time.

2. Employees of the contractor and subcontractors who are found to be intoxicated or who have been found partaking of or who appear to be under the influence of intoxicating or alcoholic beverages or dangerous drugs while engaged in the performance of their duties, or during their meal periods, shall be removed from the work site by the contractor for the duration of the contract. Employees who are under the care of a doctor and taking prescription drugs should inform their supervisor of same to determine if restrictions should be imposed.

3. Prior to the start and during the course of any work in a new area, the contractor shall make a thorough survey of the entire work site to determine all potential hazards on the job. Employees shall be made aware of these potential hazards and shall be instructed in procedures and the use of equipment for their protection. The contractor must verify the location and condition ("live" or "dead") of all utilities on or near his work site, and take the necessary precautions to protect his employees, the general public, and the utility.

4. Each Contractor shall inspect his work area on a daily basis.

5. At least one person who has valid certificates in first aid training from either the U.S. Bureau of Mines, the American Red Cross, or equivalent training that can be verified by documentary evidence, shall be available at the work site to render first aid. Further, a minimum ratio of one such qualified person to 50 employees shall be maintained throughout the course of construction. A suitable emblem shall be affixed to the rear of hard hats or other location for identification.

6. First aid supplies approved by a physician licensed to practice in the State of Oregon shall be accessible for immediate use.
7. A telephone shall be made available at the work site before construction begins. The telephone number and locations of emergency facilities including, but not limited to emergency hospitals, physicians, ambulance service, police and fire departments, shall be posted in conspicuous locations at the work site and all telephone locations.
Chapter 6.2
PERSONAL PROTECTIVE EQUIPMENT

1. All persons on the work site shall wear protective helmets. Helmets for the protection of employees against impact and penetration of falling and flying objects shall meet the specifications contained in ANSI Z89.1-1969 (Class A) Safety Requirements for Industrial Head Protection. Bump caps are not acceptable.

2. All work sites shall have posted at entrance gates signs alerting all persons that hard hats are required on the site.

3. The contractor shall issue approved hearing equipment devices for employees required to work where excessive noise levels are encountered.

4. Employees whose work exposes them to falls from heights exceeding 6 ft. and who are not protected by fixed scaffolding, guard rails, or safety nets, shall be secured by safety belts and lifelines. The contractor shall provide instruction for employees in the safe use of safety belts and lines. The anchor end of the lanyard shall be secured at a level not lower than the worker's waist. Lanyards shall be secured to a substantial member of the structure or to securely rigged lifelines.

5. Approved eye and face protection shall be provided and worn when engaged in the following:

   a. Blowing with compressed air or steam.
   b. Boring, drilling, or reaming with hand tools.
   c. Chopping with hatchet or axe.
   d. Cranking gasoline engine with rope or cable.
   e. Cutting or breaking asphalt, cemented ballast, concrete, grass, stone or procelain.
   f. Driving tie plug or wooden wedge.
   g. Gas cutting, welding or heating.
   h. Holding up end of tie being spiked.
   i. Operating power saw, lathe, cutter, punch, drill, riveter or driver.
   j. Thermit Welding.
   k. Working with or in the area of a grinding wheel or band saw.
   l. Grinding with power tools.
6. Employees involved in welding operations shall be furnished with filter lenses of the proper shade number.

7. Employees exposed to laser beams shall be furnished suitable laser safety goggles which will protect for the specific wave length of the laser and be of optical density adequate for the energy involved.

8. Lineman's body belts and safety straps shall be used when working above ground levels on wood poles, communication towers, and other transmission line structures.

9. Safety nets shall be provided to protect employees erecting structures where scaffolds, platforms, temporary floors, or the use of safety belts is impractical. Where nets are required, operations shall not be undertaken until the net is in place and has been tested.

10. Suitable approved personal protective equipment shall be used whenever required by instructions or when it provides greater safety.

11. Employees shall use the personal protective equipment, protective devices, and special tools provided for their work. Before starting work, these items shall be inspected by the employee to insure that they are in safe condition.

12. Protective goggles and/or clothing must be worn when bodily contact with acids, corrosives, or other chemically active substances may occur.

13. Respirators, masks, or supplied-air equipment shall be used on job which require respiratory protection, as determined by the contractor or the Tri-Met Safety Coordinator and/or BRIM Safety Director. Employees shall not use respiratory protection equipment until they have been trained in the use and limitations of such equipment.

14. Safety devices worn by employees which contact the skin of the wearer shall not be interchanged among employees until properly cleaned.

15. Safety shoes are recommended for use by all construction workers.
Chapter 6.3

HOUSEKEEPING

1. The contractor shall, at all times, maintain the premises free from accumulations of waste material, trash, and debris caused by his work.

2. Pre-job planning shall include consideration of housekeeping plans and will include methods and equipment or tools necessary.

3. Supervisors will be instructed by the contractor to maintain good housekeeping.

4. Each work area shall be cleaned by the contractor as often as necessary to remove fire and safety hazards discovered through regularly scheduled inspections.

5. Stored and stacked materials shall be kept orderly, properly stacked, chocked, and secured.

6. Any protruding nails, etc., shall be bent, removed, or clinched immediately.

7. Oil, grease, and water spills shall be cleaned up immediately or covered with approved absorbent material.

8. All tools, scaffolding, rubbish and materials shall be removed from the work area at the completion of the work.

9. Walkways, vehicles travelways, ramps, railings, and stairways shall be kept free from debris, properly installed and maintained. Depressions and pot holes in vehicles travelway or walkway surfaces on the work site shall promptly be filled and graded.

10. Adequate lighting shall be provided in or around all work areas, passageways, stairs, ladders, and other areas used by personnel.
Chapter 6.4
SAFE PRACTICES FOR THE USE OF LADDER

LADDERS

1. Ladders that are defective, have broken or split parts, or are otherwise defective shall not be used.

2. All damaged or defective ladders shall be removed from service and tagged "out of service" until repaired.

3. All damaged or defective ladders which cannot be properly repaired shall be destroyed.

4. Ladders, when in use, will be secured at top, bottom, or both to prevent displacement.

5. Ladders will extend at least 36 in. above the top landing or grab rails will be installed where a 36 in. protrusion cannot be maintained.

6. Ladders shall be placed on substantial footing and be positioned at the proper pitch (see fig. 1).

7. Portable metal ladders shall not be used where there is a danger of contact with electrical conductors, nor for electrical work.

8. Ladders shall be inspected daily by a competent supervisor and those found defective shall be removed from service.

9. All ladders must be safely and properly stored when not in use.
FIG. 1

Ladders Made On The Job

<table>
<thead>
<tr>
<th>Approved construction</th>
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<tr>
<td>Dapped cleat</td>
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<tr>
<td>Blocked cleat</td>
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<tr>
<td>Wired cleat</td>
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<tr>
<td>1&quot; x 2&quot; strip over</td>
<td></td>
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<tr>
<td>cleat</td>
<td></td>
</tr>
</tbody>
</table>

Secured Ladders

- Nailed
- Non-slip feet
- Top wired or nailed

36°
Chapter 6.5
ENTERING AND WORKING IN MANHOLES (UNDERGROUND)

DEFINITION OF MANHOLE

As used in these rules manhole shall (where the context permits) be construed to include any confined space which has a limited means of egress and where the atmosphere may be deficient in oxygen content or is subject to the accumulation of toxic or flammable contaminants. Examples of confined spaces are tanks, ducts, underground utility vaults, tunnels, and open top spaces more than 4 feet deep such as pits, trenches, tubs and vessels.

(A) DUTY OF PERSON IN CHARGE

(1) The person in charge of work in manholes shall be:

   (a) Thoroughly familiar with the hazards that may be encountered.

   (b) Adequately trained in fire control, accident prevention, first aid, and rescue procedures.

(2) Before and during the course of work the person in charge shall make certain that:

   (a) All required tests and re-tests have been made.

   (b) All tools are of the proper type.

   (c) Fire control is established as necessary.

   (d) All necessary protective equipment is available and used properly.

   (e) Adequate ventilation is maintained or the air supply remains sufficient.

   (f) All employees required to work in the manhole are advised of the hazards they may encounter.

   (g) An entry permit is signed and issued to employee(s) working in manholes and available for inspection upon request.
(B) PREPARATION BEFORE ENTERING MANHOLES

Before any manhole is entered it shall, where appropriate, be prepared as follows:

(1) When covers of manholes, pits or vaults are to be removed, warning signs and barricades appropriate for the nature and location of the hazards involved shall be placed promptly to warn and protect the public and to protect employees from traffic. However, when a cover is removed for momentary inspection from the street level, guards need not be used provided traffic is properly warned.

(2) Before an employee enters a street opening, such as a manhole, it shall be protected with a barrier or other suitable guard.

(C) TESTING ATMOSPHERES OF CONFINED SPACES

(1) Tests of the atmosphere of the manhole for possible hazards shall be made by a trained person using approved instruments and testing devices. Records of all tests shall be made on the entry permit form.

(2) The first test for presence of combustible gas in the manhole shall be made before the entrance cover is removed by using available vent holes or pry holes, or by lifting or opening the entrance cover just enough to admit the probe or sensing element. If the initial test indicates that the concentration of combustible gas 10% LEL or less, the entrance cover may be removed.

(3) If the first test indicates the presence of combustible gas in a concentration above 10% LEL, a guard against all sources of ignition shall be established before the entrance cover is removed. The guard shall be maintained while the manhole is ventilated until the concentration of combustible gas is reduced to 10% LEL or less.

(4) Atmospheric conditions shall be termed hazardous if the tests show any of the following:

   (a) A percentage of combustible gas or vapor greater than 10% of the lower explosive limit (LEL).

   (b) The presence of oxygen below 18% by volume.

   (c) The presence of any toxic substance in a concentration above the established threshold limit value (TLV).
away from the work area. Sufficient dry powder fire extinguisher equipment to cope with the hazards which may be encountered shall be kept readily available.

(d) Where the atmosphere in a manhole is found by test to contain a concentration of combustible gas in excess of 20% LEL, the enclosure may not be entered, except in the event of an emergency. Continuous forced ventilation or other means must be utilized to reduce the concentration of combustible gas below 20% LEL before entry is permitted.

(e) If any toxic substance is found in a concentration above its established threshold limit value (TLV), respiratory protection suitable for the exposure shall be worn.

(E) LADDERS

(1) A ladder shall be used when going down into or coming up out of a manhole, pit, or vault. Cables or pipes located in manholes shall not be used to assist in climbing into or out of manholes. When a ladder is not practical, an employee wearing a safety harness may be lowered in to the manhole by mechanical hoist.

(F) MATERIAL HANDLING

(1) Before lowering materials, the men in the manhole shall be warned to stand aside and the man on top shall not proceed to lower any material until he is given clearance from those below to do so.

(G) FIRE CONTROL

(1) Employees shall not smoke in manholes or vaults and shall avoid, insofar as is practicable, open flames or torches in or near manholes. When a torch or other open flame must be used in a manhole continuous forced ventilation shall be used.

(2) When using furnaces, torches or heated tools a dry powder type fire extinguisher shall be readily available in close proximity.

(3) Compressed air tanks shall not be permitted in confined spaces. Torches shall be removed during breaks.

(H) MANHOLE COVERS

(1) Manhole covers shall be properly seated when replaced.
(5) Forced ventilation equipment, having a rated capacity in cubic feet per minute numerically equal to or greater than one half the volume of the manhole expressed in cubic feet, should be used wherever feasible. Equipment should be located on the windward side and out of range of probable vapor travel.

(6) A non-conductive probe shall be used when testing with aspirator type instruments or devices within reach of live electrical cables or equipment.

**D WORK IN MANHOLES**

(1) Non-hazardous Atmosphere

(a) If the tests before entry show the atmosphere of the manhole to be non-hazardous, entry shall be made only after five (5) minutes of natural or forced ventilation. The atmosphere shall then be retested.

(b) When forced ventilation is used it is recommended that monitoring of the atmosphere for combustible gas and oxygen deficiency be utilized.

(c) When natural ventilation is depended upon either continuous monitoring shall be utilized or the atmosphere of the confined space shall be tested hourly for combustible gas, oxygen deficiency and toxic gases.

(2) Hazardous Atmosphere

(a) If the tests before entry show the atmosphere to be hazardous. The confined space shall be force ventilated for at least 5 minutes.

(b) If subsequent to five minutes of natural or forced ventilation the atmosphere of the manhole is still found to be deficient in oxygen, the enclosure may be entered only by a person using supplied air respiratory protective equipment and wearing an approved safety harness with an attached and tended lifeline secured outside of the manhole.

(c) Where the atmosphere in the manhole contains a concentration of combustible gas in excess of 10% LEL a continuous guard against all sources of ignition must be carefully maintained. Continuous forced ventilation shall be utilized. No torches, lanterns, or open flames shall be used. There shall be no smoking. The area shall be barricaded to keep others a safe distance
(2) The bearing surfaces shall be freed from dirt or ice which might prevent them from fitting properly.

I REQUIRED EMERGENCY PERSONNEL

(1) While work is being performed in a manhole at least one (1) designated person shall be immediately available to secure or render assistance in the event of an emergency.

(a) This requirement shall not preclude the employee in the immediate vicinity from occasionally entering a manhole for brief periods of time to provide assistance in the performance of the work, other than emergency assistance.

(b) This requirement does not preclude a qualified employee, working alone, from entering a manhole for brief periods of time for the purpose of inspection, housekeeping, taking readings, making a simple adjustment, or similar work provided the atmosphere has been tested and found non-hazardous.

(2) Entry into manholes for rescue purposes shall not be made without the doning of appropriate protective equipment, i.e., supplied air respirators equipment, etc.
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<th>EFFECT (NOTE 2)</th>
<th>LOWER EXPLOSIVE LIMIT (GRAM MOLECULAR WEIGHT)</th>
<th>UPPER EXPLOSIVE LIMIT (GRAM MOLECULAR WEIGHT)</th>
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</table>

NOTES: 1. Reference molecular weight of oxygen is 32 grams. Those gases with weights less than 32 grams are lighter than oxygen, and those with weights greater than 32 grams are heavier than oxygen.
2. T = Toxic, I = Irritant, E = Explosive, S = Suffocating.
3. The exact weight varies with the manufacturer, but the gas is slightly heavier than air.
Remember: The purging of manholes must be done COMPLETELY.

Shown below are examples of complete and incomplete ventilation of manholes:

The initial purging of a manhole is usually incomplete. Once the manhole has been entered, however, every effort should be made to ensure a complete ventilation (in order to prevent the formation of gas pockets in the corners of the manhole).

You must also make certain that the inspection and maintenance check of the blower has occurred before safe operation of the blower can be assumed.
Chapter 6.6
HAND TOOLS, POWER TOOLS AND JACKS

GENERAL

1. At the beginning of each work period, make visual inspection of tools. Hand tools, power tools and jacks shall be maintained in safe operating condition and used only for the purpose for which they were designed. Damaged and defective tools shall be repaired or removed from service. Any striking tool that has a cracked or mushroomed striking surface is considered defective and must not be used.

2. Tools shall not be left on scaffolds or elevated work spaces, and containers shall be provided for hand tools on the job site.

3. Tools designed to accommodate guards shall be operated with such guards in place. Belts, gears, shafts, pulleys, sprockets, spindles, drums, and other type moving drives shall be isolated or guarded.

4. Electric-powered tools shall be double-insulated type or effectively grounded.

5. Hand and power tool operators shall be provided with and use respective type(s) of personal protective equipment as required.

6. Only non-sparking tools shall be used in locations where sources of ignition may cause an explosion or fire. Gasoline-powered tools shall not be used underground or in locations where toxic exhaust gases can accumulate. Impact tools, including drift pins, wedges and chisels, shall be kept in a dressed condition or equipped with non-mushrooming heads.

PNEUMATIC TOOLS

7. Pneumatic impact tools shall be operated with safety clips or retainers installed to prevent tools being accidentally discharged from the chuck.

8. The manufacturer's safe operating pressure for hoses, pipes, valves and fittings shall not be exceeded. Defective hoses, valves, and fittings shall be removed from service.
9. Compressed air shall not be used for cleaning purposes unless pressure is 30 psi or below and the operator is protected by personal protective equipment. The 30 psi requirement does not apply to sand blasting, green cutting, removal of mill scale, cleaning concrete forms, and similar cleaning operations.

10. Air hoses shall not be used for hoisting or lowering tools. Hoses shall not be laid on ladders, steps, scaffolds or walkways in a manner creating a tripping hazard.

11. When using pneumatic tool or equipment place the control switch or valve in the 'OFF' position before connecting or disconnecting; then bleed-off excess pressure.

GRINDING TOOLS

12. Grinding tools shall not be used without the safety guards, protective flanges, and tool rests installed and maintained in proper adjustment.

13. Abrasive wheels and scratch brush wheels shall not be operated in excess of their rated safe speed. Cracked or defective abrasive wheels shall be removed from service immediately.

WOODWORKING TOOLS

14. Switches shall be located to enable the operator to cut off the power without leaving his operating position. Fixed power driven tools shall be provided with a disconnect switch that can be locked in the off position.

15. A push stick, block, or similar safe means shall be used for all operations close to high speed cutting edges.

16. Planer and jointers shall be equipped with cylindrical cutting heads and fully guarded.

17. Band saw blades shall be fully enclosed except at the point of operation.

18. Work areas shall be kept clean and a brush provided at each machine to remove sawdust, chips and shavings.

POWER SAWS

19. Bench-type circular saws shall be equipped with spreaders, anti kick back devices, and guards that automatically enclose the exposed cutting edges.
20. Radial arm saws and swing cut-off saws shall be equipped with limit stops which prevent the leading edge of the blade from traveling beyond the edge of the table. These saws shall also be equipped with automatic brakes or automatic return devices.

21. Power saws shall not be left running unattended.

POWDER-ACTUATED TOOLS

22. Powder-actuated tools shall be operated and serviced only by persons who have been trained and certified in the safe use of such tools. Operators must possess an operators card issued by a firm or person authorized to issue such cards.

23. Safeguards shall be taken to prevent the possession or use of these tools and their discharge by unauthorized persons.

24. High velocity tools are prohibited. Only low velocity piston drive tools are permitted.

25. Only powder charges, studs, or fasteners specified by the manufacturer for the specified tool shall be used.

HAND-POWERED WINCHES AND HOISTS

26. Hand-powered winches and hoists shall be used within the manufacturer's rated capacity, and the capacity shall be legibly marked on the winch or hoist.

LEVER AND RATCHET, SCREW AND HYDRAULIC JACKS

27. The manufacturer's rated capacity shall be legibly marked on all jacks and shall not be exceeded.

28. Jacks, of any type, shall have a positive stop to prevent overtravel.

29. Jacks shall be set on a stable and firm footing, and cribbed or blocked where necessary to prevent settlement or dislodgement. Where there is a possibility of slippage, a wood block shall be placed between the jack and the load.
Chapter 6.7
TEMPORARY ELECTRICAL INSTALLATIONS

1. Electrical installations, temporary or permanent, shall comply with the applicable provisions of the National Electrical Safety Code, National Electrical Code, and applicable State Codes.

2. Electrical wire, conduit, apparatus and equipment shall be approved or listed by the Underwriters Laboratories, Inc. or Factory Mutual Laboratories, for the specific application.

3. The contractor shall not permit an employee to work in such proximity to an electrical circuit that he may contact it in the course of his work, unless the employee is protected against electrical shock by deenergizing the circuit and grounding it, or by guarding it by effective insulation or other means.

4. Work on electrical circuits and equipment shall be performed only by personnel familiar with the code requirements and qualified to perform the type of work to which they are assigned.

5. No electrical work shall be done hot when it can be done cold. When it is necessary to work with hot lines, only qualified personnel, properly equipped with rubber gloves and blankets which have been tested regularly in accordance with the American National Standards Institute, shall do so. Foremen shall see that adequate tools are provided.

6. Temporary lighting strings shall consist of nonconductive lamp sockets and connections permanently molded to the connector insulation. Bulbs attached to festoon lighting strings and extension cords shall be protected by lamp guards, unless deeply recessed in a reflector. Broken or defective bulbs shall be promptly replaced.

7. Extension cords shall be 3-wire grounded type listed by the Underwriters Laboratories, Inc.; the rated load shall not be exceeded.

8. Switches, fuses, and automatic circuit breakers shall be plainly marked, labeled, or arranged to permit identification of circuits or equipment controlled by them.

9. Switches shall be of the enclosed safety type, with the enclosures grounded, and installed so as to minimize the possibility of accidental operation.
10. Switches and breakers, rated 440 volts or greater, shall be provided with a means of locking in the Off position. Also, fuse cabinets and circuit breaker cabinets shall be equipped with lock-type doors.

11. All 115 and 120 volt, single phase, 15 and 20 ampere receptacle outlets used for construction operations, shall be protected by a ground-fault circuit interrupter program or an equipment grounding conductor program to protect employees.

12. If a ground-fault circuit interrupter system is used it shall be installed in strict compliance with the manufacturer's specifications and shall be tested prior to use.

13. If an equipment grounding conductor program is elected, the following provisions shall be adhered to:

   a. The program shall apply to all cord sets, receptacles, and equipment connected by cord and plug which are available for use by employees.

   b. A written description of the program, including type of electrical equipment and wiring and safety precautions, shall be submitted to the Tri-Met Safety Coordinator and/or BRIM Safety Director.

   c. The contractor shall designate one or more qualified persons familiar with the Code requirements to supervise the installation of the program.

   d. Each cord set, attachment cap, plug and receptacle or cord sets, and any equipment connected by cord and plug, except cord sets and receptacles which are fixed and not exposed to damage, shall be visually inspected before each day's use for external defects such as deformed or missing pins or insulation damage, or for indication of possible internal damage. Equipment found to be defective or damaged shall be removed from service and not used until repaired.

   e. The following test shall be made on all cord sets, receptacles which are used for construction operations, and cord and plug connected equipment required to be grounded:

      (1) All equipment grounding, conductors, and receptacle outlets shall be tested for continuity and shall be electrically continuous.

      (2) Each receptacle and attachment cap or plug shall be tested for correct attachment of the equipment grounding conductor, and to insure that the grounding conductor is connected to its proper terminal.

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f. The tests specified in subparagraph e. shall be performed before first use, before equipment is returned to service following repairs, before equipment is used following an accident which could have damaged the grounding system, and at intervals not to exceed three months, except that the intervals may be six months for cord sets and receptacles which are fixed and not exposed to damage.

g. A color coding system or other system shall be implemented. The contractor shall maintain a written record of tests and inspections and such record shall indicate the last date it was tested or the interval for which it was tested. This record shall be kept by means of log, color coding, or other effective means.
Equipment Grounding Conductor
PROGRAM

1. Written Description
2. Competent Person to Implement
3. Inspection and Tests
4. Record of Tests

INSPECTIONS

Visual inspection of following:
1. cord sets
2. cap, plug and receptacle of cord sets
3. equipment connected by cord and plug

Exceptions:
- receptacles and cord sets which are fixed and not exposed to damage

Frequency of Inspections:
- before each day's use

TESTS

Conduct tests for:
1. continuity of equipment grounding conductor
2. proper terminal connection of equipment grounding conductor

Frequency of Tests:
- before first use
- after repair, and before placing back in service
- before use, after suspected damage
- every 3 months, except that cord sets and receptacles that are fixed and not exposed to damage can be tested every 6 months
Chapter 6.8
HANDLING AND STORAGE OF MATERIALS

The overall purpose of this portion of the Project Safety Program is to provide for the safe and orderly receipt, storage, and dispensing of materials and products necessary to each contractor and subcontractor operations.

Recognizing that proper storage and material handling procedures and methods will provide for conservation of materials and equipment, and increase productivity by providing a smooth flow of materials to the project areas as needed, the following is necessary:

1. Each storage structure or area shall be provided with properly installed and maintained fire extinguishing equipment.

2. One responsible supervisor shall be designated and held responsible for maintenance of the designated storage area provided to each contractor. These responsibilities will include the following:
   a. Proper storage methods and designated areas for flammable and combustible liquids.
   b. Proper stacking of materials with regard to size, type and length, in piles, shelves, racks or bins as necessary.
   c. Maintenance of good housekeeping procedures throughout the facilities or areas at all times.
   d. The proper disposal of waste and scrap materials.
   e. The segregation of noncompatible materials.
   f. The material handling methods and procedures which will provide safe and orderly storage in accordance with recognized practices.
   g. The posting of warning signs, tags, or bulletins as may be required.
   h. Provision of the necessary grounding and bonding required for specific materials.
i. Proper receiving and dispensing of incoming and outgoing materials which will include chocking and blocking of trucks or other vehicles during loading and unloading operations.

j. Provision of proper personal protective equipment that may be necessary for given products.

k. Assuring that only properly trained personnel are used in the handling of hazardous materials, and to assure that proper materials handling methods are used.

l. The prompt reporting of any unsafe condition or practice which may not be corrected within the scope of his authority.

3. Loose material on open decks or other exposed locations shall be removed or secured at the end of each day to eliminate dislodgment by wind or other causes.

4. All personnel engaged in handling materials of any type shall have been instructed by their supervisor in the proper method of lifting heavy objects.

a. Proper lifting procedures:

   (1) Consider the size, weight and shape of the object to be carried. Do not lift more than can be handled comfortably. If necessary, get help.

   (2) Set feet solidly; one foot can be slightly ahead of the other for increased effectiveness. Feet should be far enough apart to give good balance and stability (approximately the width of the shoulders).

   (3) Get as close to the load as practical. Bend legs about 90 degrees at the knees. Crouch; do not squat. It takes about twice as much effort to get up from a squat.

   (4) Keep the back as straight as practical. It may be far from vertical but it should not be arched. Bend at the hips, not from the middle of the back.

   (5) Grip the object firmly. Maintain that grip while lifting and carrying. Before changing or adjusting this grip, set the object down again.

   (6) Straighten the legs to lift the object, and at the same time bring the back to a vertical position. A good tip is to look up at the sky or ceiling when beginning to lift.
(7) Never carry a load that you cannot see over or around. Make sure the path of travel is clear. Carry the object close to the body.

(8) Never turn at the waist to change direction or put an object down. Turn the whole body and crouch down to lower the object. Grip the object firmly, keep it close, and keep the back straight (not arched). To keep hands from being pinched against the floor or ground, put one corner of the object down first, so that the fingers can be removed from under the sides.

(9) When lifting an object with another person, employees must insure that they both lift at the same time and get the load down together. One person should give the signals or orders.
### SOME INCOMPATIBLE CHEMICALS

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<td>Ammonium nitrate</td>
<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
</tr>
<tr>
<td>Benzene</td>
<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
</tr>
<tr>
<td>Barium peroxide</td>
<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
</tr>
<tr>
<td>Barium and its salts</td>
<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
</tr>
<tr>
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<tr>
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<tr>
<td>Carbon</td>
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### Some Compatible Chemicals

<table>
<thead>
<tr>
<th>Chemical</th>
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</thead>
<tbody>
<tr>
<td>Ammonium nitrate</td>
<td>Barium peroxide; barium oxide; and barium hydroxide</td>
</tr>
<tr>
<td>Barium oxide</td>
<td>Ammonium nitrate; barium peroxide; and barium hydroxide</td>
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### Some Incompatible Chemicals

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Acetic acid</td>
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</tr>
<tr>
<td>Acetone</td>
<td>Acetic anhydride; nitric acid; perchloric acid; and peracids</td>
</tr>
<tr>
<td>Acetone peroxide</td>
<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
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</tr>
<tr>
<td>Benzene</td>
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<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
</tr>
<tr>
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<td>Chrome acid; hydrochloric acid; thionyl chloride; hydrogen peroxide; acetic anhydride; perchloric acid; nitric acid; and peracids</td>
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<th>Compatible Chemicals</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Barium peroxide; barium oxide; and barium hydroxide</td>
</tr>
<tr>
<td>Barium oxide</td>
<td>Ammonium nitrate; barium peroxide; and barium hydroxide</td>
</tr>
<tr>
<td>Barium hydroxide</td>
<td>Ammonium nitrate; barium peroxide; and barium oxide</td>
</tr>
<tr>
<td>Barium peroxide</td>
<td>Ammonium nitrate; barium oxide; and barium hydroxide</td>
</tr>
</tbody>
</table>

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**2/1/83**
Chapter 6.9
HAZARDOUS MATERIALS INFORMATION SHEET

A Hazardous Material Information Sheet or Material Safety Data Sheet or other document containing the essential information, is required to be on file in the contractor’s office with one copy provided to the Tri-Met Safety Coordinator and/or BRIM Safety Director, for materials which when used without special precautions and controls will constitute a health hazard to workers.

Usual or special precautions as indicated will be used for the protection of workers and property.

Note: If the hazards of a given product are unknown but suspected by the contractor, the material manufacturer or supplier should be contacted and the necessary information developed.
Chapter 6.10
HEAVY EARTH MOVING AND HANDLING EQUIPMENT

1. Vehicles and mobile equipment shall be operated only by authorized individuals who are qualified to operate the equipment to which they are assigned.

2. Vehicles and mobile equipment shall not be operated at speeds greater than are reasonable and safe considering other conditions, traffic, road conditions, type and condition of equipment, etc. The operator must have the equipment under control at all times and be able to stop it within the clear-sight distance.

3. No vehicle or equipment shall be stopped, parked, or left standing on any road or in any location in such a manner to endanger personnel or property. Vehicles and equipment shall not be left unattended unless the motor has been shut off, brakes set securely, and the gears engaged. When parked on a hill or grade, the wheels shall be turned into the curb or the wheels chocked.

4. All equipment left unattended on or near a roadway shall have appropriate lighted barricades placed around the location of the equipment.

5. Loaders, backhoes, bulldozers and other similar equipment shall have their blades and buckets fully lowered and engines shut off when left unattended.

6. All vehicles and equipment shall be checked at the beginning of each shift to insure that the equipment is in proper operating condition and that accessories that affect safe operations are free from defects.

7. Heavy equipment, machinery, or parts thereof, shall be blocked to prevent falling or shifting before employees are permitted to work under or between them.

8. All equipment and vehicles with cabs shall have safety glass or equivalent windshields that are free of cracks and defects. Broken or cracked glass shall be replaced.

9. No person shall be allowed to ride in or on any equipment or vehicle except in seats which are provided by the manufacturer.
10. On all rubber-tired or crawler scrapers, bulldozers, front end loaders, backhoes, motor graders, industrial tractors, and forklift tractors, Rollover Protective Structures (ROPS) and Falling Object Protective Structures (FOPS) are required.

11. If equipment is provided with seat belts, seat belts shall be worn.

12. All bi-directional earth moving, haulage, or compacting equipment shall be equipped with automatically operated reverse signal alarm.
Chapter 6.11
CRANE OPERATIONS

1. Only Competent, trained and qualified employees shall be permitted to operate crane equipment.

2. The manufacturer's specifications and limitations must be adhered to.

3. A contractor-designated competent person must be assigned to inspect all machinery and equipment prior to each use and during each use. The contractor shall maintain records of such inspections. Appended is a sample inspection report.

4. Rated load capacities, speeds, and special hazard warnings must be posted on each piece of equipment.

5. Hoisting equipment shall not be loaded in excess of the posted maximum load, considering boom angle, outrigger support, and other limiting factors.

6. All reciprocating or rotating parts of machinery which expose employees to injury must be guarded.

7. The swing radius at the rear of the crane superstructure shall be guarded.

8. Fire extinguishing equipment shall be mounted in or near cab of operator's station.

9. Prior to any crane setup, the ground shall be inspected to determine if it is sufficiently strong and stable to take static and dynamic loads.

10. When setting any mobile crane in place to make a lift, the outriggers shall be fully extended.

11. Outrigger floats shall rest on firm, level, smooth surfaces which will support the load placed on them. Holes, rocks, and soft ground shall be avoided.

12. If soft ground is encountered, mats, steel plates, timber pads, etc., shall be used to distribute loads under the crane to insure that the bearing strength of the ground is not exceeded.
13. Outrigger floats shall be checked before and during operation for settling into ground. Floats shall be reset, if necessary.

14. Safe distance from energized equipment and electrical lines as published, must be maintained. At no time will a boom be allowed to come closer than 10 ft., from any angle, to a power line, regardless of voltage.

15. Standard operating signals shall be used to direct all operations.

16. A person shall be designated to observe clearance of boom, load, or loadlines whenever the crane is within boom length of the safe approach limits to energized equipment or lines.

17. Slings shall be adequate for the load being lifted.

18. Hoisting Operators shall be instructed not to lift or carry loads over other persons. Employees or other trades shall not be allowed under suspended loads.

19. Tag lines or guide ropes shall be used on loads that may swing or must be guided through a restricted space. Dry polypropylene rope shall be used wherever there is danger of accident contact with energized equipment or electrical lines.

20. No person will be allowed to ride on a suspended load or hook for any reason.

21. The operator of the crane shall not leave his position at the controls while a load is suspended.

22. Only the signalman will give signals to the operator. The Stop signal shall be recognized by the operator by anyone giving it.

23. Cranes shall be moved only when directed by a signalman. Workmen on the ground shall keep away from the machine.

24. A checklist shall be prepared and submitted to the Engineer by the Contractor for any lift where the load exceeds 80% of the load chart capacity for the crane or derrick, or, where the lift involves the use of two or more cranes. (See Exhibit "Checklist for Critical Lifts").

   a. No lifts meeting the above criteria will be made without prior submission of a Critical Lifts Checklist.

   b. Where erection drawings are prepared for submittal to the Engineer, Exhibit D will not be required if all the information contained therein is shown on the drawing submitted.
c. Prior to making the lift, the conditions shown on the drawing submitted will be verified by the Contractor's representative at the work site. Any deviations from the erection drawing submitted will be reviewed and verified as safe by the Contractor's representative.
CRANE SIGNALS

HOIST LOAD
LOWER LOAD
BOOM UP
BOOM DOWN
SWING

STOP SIGNALS
STOP
EMERGENCY STOP
DOG EVERYTHING
SHORTEN BOOM
EXTEND BOOM

TELESCOPING BOOMS

SLOW SIGNALS
MAKE MOVEMENTS SLOWLY
RAISE LOAD SLOWLY
LOWER LOAD SLOWLY
LOWER BOOM SLOWLY
RAISE BOOM SLOWLY

FLEX FINGERS FOR LOAD MOVEMENT
LOWER THE BOOM AND RAISE THE LOAD
RAISE THE BOOM AND LOWER THE LOAD

SELECTING SINGLE or MULTIPLE REEVED LINES
MULTIPLE OR MAIN LOAD LINE BY TAPPING HEAD BEFORE DIRECTION
SINGLE LINE OR LIGHT LOAD BY HOLDING ELBOW BEFORE SIGNALLING DIRECTIONS

CLAM BUCKET SIGNALS
OPEN
CLOSE

CRAWLER or TRACK SIGNALS
TRAVEL BOTH CRAWLER BELTS IN DIRECTION INDICATED BY REVOLVING FISTS
LOCK THE CRAWLER BELT ON THE SIDE INDICATED BY RAISED FIST...
TRAVEL OPPOSITE CRAWLER BELT IN DIRECTION INDICATED BY REVOLVING FIST

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Chapter 6.12
ROBES, SLINGS, CHAINS AND ACCESSORIES

1. The use of ropes, slings and chains shall be in accordance with the safe usage recommendations of the manufacturer, and the recommendations of the equipment manufacturer when used in conjunction therewith.

2. The safe working load of ropes, slings, chains, accessories and rigging equipment shall be determined prior to use. The safe working load shall be observed and shall not be exceeded. For items of rigging used in combination, the safe working load shall be that of the weakest item.

3. Use of job fabricated rigging hardware is prohibited unless designed and certified by a licensed engineer, qualified in this field, and tested at 125% of the rated safe working load.

4. The installation, maintenance, and repair of ropes, chains, slings, and rigging accessories shall be repaired only by the manufacturer or in accordance with the manufacturer's instructions, and tested at 125% of the rated load prior to use.

5. Rigging used for material handling shall be inspected prior to use on each shift to insure that it is in good repair and safe to use. Defective equipment shall be immediately removed from service.

6. Chains shall not be subjected to impact loading or jerking.

7. Hooks, rings, links or other attachments when used with alloy steel chains shall have a rated capacity at least equal to that of the chain. Job made hooks, links, or makeshift fasteners formed from bolts, rods, etc. shall not be used.

8. When U-bolts are used for eye splices on wire ropes, the U-bolt shall be applied so that the "U" section is in contact with the dead end of the rope.

9. Protruding ends of strands and splices on slings and bridles shall be covered or blunted.

10. Except for end fasteners, wire rope used in hoisting, lowering, or pulling loads shall consist of one continuous run without knots or splices.
11. The eyes of rope slings should be properly spliced and should have thimbles in them to withstand wear.

12. Wire rope with one or more of the following defects shall be removed from hoisting or load carrying service immediately:
   a. Corrosion - which results in pitting or loss of more than \( \frac{1}{3} \) of the original wire diameter.
   b. Broken wire - one or more valley breaks, six randomly broken wires in one wire rope lay, or three broken wires in one strand in any one lay.
   c. Abrasion - abrasion, scrubbing, flattening, or peening resulting in a loss of more than \( \frac{1}{3} \) of the original diameter of the outside wires.
   d. Kinking - which results in distortion of the rope structure.
   e. Heat damage.
   f. Reduction in diameter.

13. Slings shall be protected from sharp, rough or square corners by appropriate means in order to prevent damage to the strands, wires, or links.

14. Loads lifted with multiple slings shall be arranged so as to equalize the weight of the load as much as possible.
WIRE ROPE

Standard-link chains for hoisting or similar purposes should not be subjected to loads greater than shown in the tables below.

<table>
<thead>
<tr>
<th>Diameter in inches</th>
<th>Weight per foot in lbs.</th>
<th>Safe Load in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>1.050</td>
<td>1</td>
</tr>
<tr>
<td>4/16</td>
<td>1.500</td>
<td>1.500</td>
</tr>
<tr>
<td>3/16</td>
<td>2.250</td>
<td>2.250</td>
</tr>
<tr>
<td>5/16</td>
<td>3.070</td>
<td>3.070</td>
</tr>
<tr>
<td>7/16</td>
<td>4.030</td>
<td>4.030</td>
</tr>
<tr>
<td>9/16</td>
<td>4.840</td>
<td>4.840</td>
</tr>
<tr>
<td>1/4</td>
<td>8.170</td>
<td>8.170</td>
</tr>
<tr>
<td>3/8</td>
<td>11.670</td>
<td>11.670</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter in inches</th>
<th>Weight per foot in lbs.</th>
<th>Safe Load in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2</td>
<td>1.60</td>
<td>1.60</td>
</tr>
<tr>
<td>4/16</td>
<td>2.03</td>
<td>2.03</td>
</tr>
<tr>
<td>3/16</td>
<td>2.50</td>
<td>2.50</td>
</tr>
<tr>
<td>5/16</td>
<td>3.03</td>
<td>3.03</td>
</tr>
<tr>
<td>7/16</td>
<td>3.60</td>
<td>3.60</td>
</tr>
<tr>
<td>9/16</td>
<td>4.23</td>
<td>4.23</td>
</tr>
<tr>
<td>1/4</td>
<td>4.90</td>
<td>4.90</td>
</tr>
<tr>
<td>3/8</td>
<td>5.62</td>
<td>5.62</td>
</tr>
<tr>
<td>1/2</td>
<td>6.40</td>
<td>6.40</td>
</tr>
</tbody>
</table>

A chain is no stronger than its weakest link and should be discarded when it shows evidence of having stretched. Stretching can be distinguished by small checks or cracks in the links, links binding on each other or elongation of links.

Protect sharp corners on chain slings.

Wrought iron chains frequently may be restored to full usefulness by annealing. This process eliminates metal fatigue, restores the chain's cohesive properties, and may lengthen the life of the chain.

<table>
<thead>
<tr>
<th>Diameter in inches</th>
<th>Weight per foot in lbs.</th>
<th>Safe Load in Pounds</th>
</tr>
</thead>
<tbody>
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<td>1.60</td>
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<td>2.03</td>
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<tr>
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<td>2.50</td>
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<td>5.62</td>
</tr>
<tr>
<td>1/2</td>
<td>6.40</td>
<td>6.40</td>
</tr>
</tbody>
</table>

When ropes are galvanized deduct 10% from strength shown above.

Avoid angles less than 45°.
**WIRE ROPE CONNECTIONS**

- **Socket Type**
  - Zinc Type—properly attached 100%
  - Wedge Socket 70%
  - Clips—Crosby type 80%

- **Knot and Clip (contractor knot)**
  - Knot and Clip 50%
  - Plate Clamp Three bolt type 80%
  - Smooth Clamp 80%

- **Spliced Eye and Thimble**
  - 1/16" and smaller 100%
  - 1/8" to 1/4" 95%
  - 1/4" to 1/2" 88%
  - 1/2" to 1 82%
  - 1 to 2' 75%
  - 2' and larger 70%

- Percentages shown equal the connection's efficiency as compared to unaltered wire rope. For example, a smooth clamp on wire rope is 80% as strong as unaltered wire rope.

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**APPLYING WIRE ROPE CLIPS**

A correct method of attaching U-bolt wire rope clips to rope ends is shown in the illustration below. The base of the clip bears against the live end of the rope, while the "U" of the bolt presses against the dead end.

The clips are usually spaced about six rope diameters apart to give adequate holding power.

Before ropes are placed under tension, the nuts on the clips should be tightened. It is advisable to tighten them again after the load is on the rope to take care of any reduction in the rope's diameter caused by the weight or tension of the load.

A wire rope thimble should be used in the loop eye to prevent kinking when wire rope clips are used.

The correct number of clips for safe application, and spacing distances, are shown in the table below.

<table>
<thead>
<tr>
<th>Number of Clips and Spacing for Safe Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rope Diameter in inches</strong></td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
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</tr>
<tr>
<td>3/32</td>
</tr>
<tr>
<td>1/16</td>
</tr>
<tr>
<td>5/32</td>
</tr>
<tr>
<td>3/32</td>
</tr>
<tr>
<td>7/64</td>
</tr>
<tr>
<td>1/8</td>
</tr>
<tr>
<td>5/64</td>
</tr>
<tr>
<td>3/32</td>
</tr>
<tr>
<td>1/8</td>
</tr>
<tr>
<td>7/64</td>
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<tr>
<td>1/8</td>
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<tr>
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</tr>
<tr>
<td>3/32</td>
</tr>
<tr>
<td>1/8</td>
</tr>
<tr>
<td>7/64</td>
</tr>
<tr>
<td>1/8</td>
</tr>
<tr>
<td>5/64</td>
</tr>
<tr>
<td>3/32</td>
</tr>
</tbody>
</table>
SOCKETING WIRE ROPES

Recommended Procedure for Socketing Wire Ropes

1. Measure from the end of rope a length equal to tapered basket of the socket
2. Tie at this point with not less than three sheetings (Fig. A)
3. Cut out hemp center, but do not cut wire rope when used as a center
4. Separate wire in strands, straightening each wire (Fig. B)
5. Clean wires thoroughly with cleaning fluid from ends to seizing. Wipe dry
6. Dip wires for three-quarters of length to first seizing in a solution containing equal parts of water and sulfuric acid. Keep wires in solution long enough to be thoroughly cleaned. Do not let acid contact hemp core
7. Knock the acid from the wires, then rinse in hot water, to which has been added 1 teaspoonful of baking soda to 2 quarts of water
8. Seize ends so that they will pass into socket (Fig. C)
9. Remove seizing and fan out wires
10. Seal bottom of socket with clay (Fig. D)
11. Pour in teaspoonful of rosin
12. Be sure the wires are evenly distributed and socket is in line with axis of rope
13. Heat socket until warm or until all moisture has disappeared
14. Pour in molten zinc heated to 800°F (427°C) just hot enough to set life to a newspaper (Fig. E)
15. Use high grade zinc. Do not use brass or other alloys
16. While pouring, tap the socket gently with light hammer to remove air bubbles and jar zinc into crevices of wires
17. Remove fire clay and seizing wires (Fig. F)

SEIZING WIRE ROPE

The end of an ordinary wire rope should have at least three sheetings to prevent unl cartoons unlaying—unlaying can make the rope useless. Annealed iron wire should be wound tightly in a close helix around the rope.

Any annealed low carbon steel wire may be used for sheetings. A guide for selecting the correct size of seizing wire is shown below.

<table>
<thead>
<tr>
<th>Diameter of Rope (inches)</th>
<th>Size Seizing Wire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16</td>
<td>No. 13</td>
</tr>
<tr>
<td>1/16</td>
<td>No. 13</td>
</tr>
<tr>
<td>1/16</td>
<td>No. 13</td>
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<tr>
<td>1/16</td>
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<td>No. 13</td>
</tr>
<tr>
<td>1/16</td>
<td>No. 13</td>
</tr>
</tbody>
</table>

Recommended Procedure for Seizing Wire Rope

1. Wind the seizing wire on the wire rope by hand, keeping the coil together with considerable tension on the wire, winding OVER from left to right
2. Twist the ends of the wire together counter-clockwise by hand, so that the twisted portion of the wires is near the middle of the seizing
3. Using "Carew" cutters, tighten the twist just enough to take up the slack. Do not try to tighten the seizing by twisting
4. Tighten the seizing by pulling the twist away from the axis of the rope with the cutters
5. Tighten the twist again and repeat as often as necessary to make the seizing tight. Cut off the ends of the wire and pound the twist flat against the rope.

Example of a Finished Seizing
**MANILA ROPE**

Warning: Inspect all fiber ropes carefully. The lay of the rope should be opened and examined. If there is evidence of broken or rotten fiber, harmful deformation or reduction in diameter, the rope should not be used.

**Safe Load for New Manila Rope—3 Strand**

<table>
<thead>
<tr>
<th>Diameter in Inches</th>
<th>Safe Load in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4</td>
<td>85</td>
</tr>
<tr>
<td>1/2</td>
<td>185</td>
</tr>
<tr>
<td>1</td>
<td>360</td>
</tr>
<tr>
<td>1 1/2</td>
<td>780</td>
</tr>
</tbody>
</table>

**Safety Factor F**

- 3
- 1 1/2
- 2
- 2 1/2

**Manila Rope Sling**

- Spliced for Hook at One End and Hook or Ring at Other End
- Safety Factor 10—Splice Efficiency 80 Percent

<table>
<thead>
<tr>
<th>Circumference in Inches</th>
<th>Single Rope Sling Vertical Lift</th>
<th>Double Rope Sling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>60° Angle</td>
<td>45° Angle</td>
</tr>
<tr>
<td>1 1/4</td>
<td>520</td>
<td>340</td>
</tr>
<tr>
<td>4 1/2</td>
<td>210</td>
<td>135</td>
</tr>
</tbody>
</table>

**Avoid angles less than 45°**

When sisal rope is used, the weight of the load should be one-third less than shown in the table above, or rope the next size larger shown in the table above should be used.

**Safe Load in Pounds for New Standard 3-Strand Manila Rope Sling**

<table>
<thead>
<tr>
<th>Circumference of Rope in Inches</th>
<th>Safe Load in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>475</td>
</tr>
<tr>
<td>1 1/2</td>
<td>850</td>
</tr>
<tr>
<td>2</td>
<td>1,200</td>
</tr>
<tr>
<td>3</td>
<td>1,500</td>
</tr>
<tr>
<td>3 1/2</td>
<td>2,700</td>
</tr>
<tr>
<td>4</td>
<td>3,300</td>
</tr>
</tbody>
</table>

**M. ALI A ROPE AND TACKLE**

1. The tables below are for new manila rope.
2. For sisal rope, the values below should be reduced by one-third or rope the next size larger should be used.
3. Tackle values shown allow for one snatch block snatching lead line to engine spool.
4. It is advisable to use the fewest snatch blocks possible.
5. If more than one snatch block is necessary, one extra part should be added for each additional snatch block. This is in addition to the number of parts shown for the weight listed.

<table>
<thead>
<tr>
<th>Diameter of Rope in Inches</th>
<th>Load Line Pull in Pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>475</td>
</tr>
<tr>
<td>3 1/2</td>
<td>850</td>
</tr>
<tr>
<td>2</td>
<td>1,200</td>
</tr>
<tr>
<td>3</td>
<td>1,500</td>
</tr>
<tr>
<td>3 1/2</td>
<td>2,700</td>
</tr>
<tr>
<td>4</td>
<td>3,300</td>
</tr>
</tbody>
</table>

**Manila Rope Knots**

- Squared Reel Knot 43%
- Bowline (outside) 50%
- Bowline (inside) 53%
- Clove Hitch 75%
- Timber Hitch and Half Hitch 72%
- Sheepshank 35%
- Short Splice 85%
- Long Splice 66%
- Eye Splice 85%

Percentages shown equal the knot's efficiency as compared to unknotted new manila rope. For example, a clove hitch is 75% as strong as unknotted new manila rope.
MATERIAL HANDLING GEAR

EYE HOOKS

Strength of Manufactured Eye Hooks — Drop Forged Steel, Weldless

<table>
<thead>
<tr>
<th>Inside Diameter of Eye in inches</th>
<th>Thread Opening in inches</th>
<th>Safe Working Load in pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>1/8</td>
<td>1,200</td>
</tr>
<tr>
<td>1/4</td>
<td>1/8</td>
<td>2,400</td>
</tr>
<tr>
<td>1/2</td>
<td>1/8</td>
<td>3,600</td>
</tr>
<tr>
<td>5/8</td>
<td>1/2</td>
<td>4,800</td>
</tr>
<tr>
<td>1/2</td>
<td>3/8</td>
<td>5,000</td>
</tr>
</tbody>
</table>

If the throat opening of any hook exceeds the dimensions given above for the corresponding diameter of the eye, the hook has been overstressed and should not be used.

SHACKLES

Safe Load in Pounds — Drop Forged Steel, Weldless

<table>
<thead>
<tr>
<th>Diameter of Pin in inches</th>
<th>Maximum Working Load in pounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8</td>
<td>5/60</td>
</tr>
<tr>
<td>1/2</td>
<td>1,400</td>
</tr>
<tr>
<td>5/8</td>
<td>2,700</td>
</tr>
<tr>
<td>1/2</td>
<td>3,600</td>
</tr>
<tr>
<td>5/8</td>
<td>5,600</td>
</tr>
<tr>
<td>1/2</td>
<td>7,800</td>
</tr>
<tr>
<td>1/2</td>
<td>10,600</td>
</tr>
</tbody>
</table>

All shackles pins should be straight and all pins of screw pin type should be screwed in all the way if width between the eyes is greater than listed above. The shackle has been overstressed and should not be used.
G **OOD AND BAD RIGGING PRACTICES**

<table>
<thead>
<tr>
<th>Eye Splices</th>
<th>Hoisting Structural Steel</th>
<th>Hook Slings</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Good Use of Thimble in Eye Splice" /></td>
<td><img src="image2" alt="Good Use Space Blocks and Pad Corners" /></td>
<td><img src="image3" alt="Good Hooks Are Turned Out" /></td>
</tr>
<tr>
<td><img src="image4" alt="Good Use of Thimble in Eye Splice" /></td>
<td><img src="image5" alt="Bad Can Bend Flanges and Cut Rope" /></td>
<td><img src="image6" alt="Bad Hook Openings Should Be Turned Out" /></td>
</tr>
<tr>
<td><strong>Bad Wire Rope Knot with Clip</strong> Efficiency 50% or Less</td>
<td><strong>Bad Thimble Should Be Used to Increase Strength of Eye and Reduce Wear on Rope</strong></td>
<td><strong>Double Slings Should Be Used When Hoisting 2 or More Pieces of Material Over 12 Feet Long</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use of Chokers</th>
<th>Suspending Needle Beams or Scaffolds</th>
<th>Right Load Over 12 Feet Long</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image7" alt="Good No Cutting Action on Running Lines" /></td>
<td><img src="image8" alt="Good Sharp Corners Padded" /></td>
<td><img src="image9" alt="Wrong Load Over 12 Feet Long" /></td>
</tr>
<tr>
<td><img src="image10" alt="Bad Because of Cutting Action of Eye Splice on Running Line" /></td>
<td><img src="image11" alt="Bad Steel Can Cut Rope" /></td>
<td><img src="image12" alt="Wrong Load Over 12 Feet Long" /></td>
</tr>
<tr>
<td><img src="image13" alt="Bad Bolt on Running Line Can Work Loose" /></td>
<td><strong>Bad-Lifting on Eye Bolts from an Angle Reduces Safe Loads as Much as 90%</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Good-Vertical Lift on Choker Sling</strong></td>
<td><strong>Suspension Needle Beams or Scaffolds</strong></td>
<td><strong>Right Load Over 12 Feet Long</strong></td>
</tr>
</tbody>
</table>

*Note: The images are placeholders and should be replaced with actual diagrams.*
Chapter 6.13
WELDING AND CUTTING

1. Contractors shall instruct employees in the safe and proper use of cutting and welding equipment prior to use of that equipment.

2. Eye protection is required for both the welder and helper.

3. Hard hat - welding helmet combinations or other protection which protects the head and eyes shall be used.

4. Respirators and/or local ventilation must be used where required and on metals that are galvanized, cadmium coated, chrome bearing, lead-based or mercury bearing.

5. Airline respirators shall be used when welding or cutting in confined spaces on metals of recognized toxicity.

6. A minimum of one 10 lb. all purpose (A-B-C) dry chemical fire extinguisher shall be kept within 10 ft. of any cutting or welding operation. The extinguisher shall be kept in a conspicuous place, free of any obstructions.

7. Screens, shields or other safeguards shall be provided for the protection of workers or combustible materials below or otherwise exposed to sparks, arc rays, or falling objects.

8. Areas containing combustibles and located within 30 feet of any welding/cutting operation shall be inspected 1/2 hour after work is completed and 1/2 hour after work is done for the day.

9. All welding leads, cables, and hoses must be safely positioned and secured to prevent tripping hazards and/or damage to the cables, leads or hoses. Hoses must be kept clear of passageways, ladders, and stairs.

ARC WELDING

10. Only manual electrode holders specifically designed for arc welding and cutting and of sufficient current rating shall be used.

11. Any current carrying parts held in hands of the welder or cutter must be fully insulated and maintained in good repair.

12. Welding leads (whips) must be free of repairs for a distance of 10 ft. minimum from the electrode holder.
13. Welding cables in need of repair shall not be used.

14. The frames of welding and cutting machines shall be grounded.

15. Ground returns must be of safe current carrying capacity, and be bonded where necessary, and be inspected periodically for soundness.

16. Piping containing gases or flammable liquids shall not be used for ground returns.

17. Conduits containing electrical circuits shall not be used as ground returns.

18. Electrodes must be removed from the electrode holders when holders are to be left unattended.

19. Electrode holder must be safely placed or protected so they cannot make electrical contact with objects or employees.

20. Hot electrode holders shall be dipped in water.

21. When arc welding or cutting operations are to be stopped for any appreciable length of time, or when a machine is to be moved, the power supply switch to the machine shall be open.

22. Defective equipment must be tagged "out of service" until properly repaired or replaced.

23. Any faulty or defective equipment shall be reported to the supervisor.

**COMPRESSED GAS WELDING**

24. Both full and empty cylinders must be segregated in storage.

25. Distance between oxygen and flammable gas storage must be at least 20 ft., or a 5 ft. high wall with at least 1/2 hour fire resistance rating must be installed between the cylinder storage areas.

26. Storage areas for cylinders shall be at least 35 ft. from any building.

27. Smoking shall not be permitted within 20 ft. of the storage area. Signs must be posted.

28. A roof or cover to protect the cylinders should be constructed where practical.
29. Cylinders must be secured in an upright position at all times. Cylinders shall be stored with caps in place.

30. When transported by truck, cylinders must be secured in a vertical position and caps must be on all cylinders which are equipped to receive them.

31. When hoisting by crane or other device, a rack designed for hoisting purposes must be used. Chokers must not be used.

32. Cylinder valves must be closed at any time cylinders are moved.

33. Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use. Each regulator shall be provided with an anti-flashback device for protection against excessive oxygen backpressure in the fuel gas supply.

34. All oxygen cylinders and fittings shall be kept free of grease and oil.

35. Oxygen and fuel gas regulators and hoses shall be maintained and in proper working order while in use.

36. Torches shall be lighted by friction lighters or other approved devices and not by matches or from hot work.

37. An arc shall not be struck on a gas cylinder.

38. Cylinders that leak or have leaky valves or are otherwise defective shall be immediately removed from service.

39. Oxygen shall not be used to blow off clothing, for ventilating, for comfort purposes, or for cleaning work area.

40. Before each shift all valves, torches, regulators and gauges, and hoses and couplings shall be inspected.
Chapter 6.14
LAYING TRACK

1. All locomotives, locomotive cranes, shovels, and on track equipment shall be periodically inspected and maintained at all times in a safe condition.

2. All locomotives, locomotive cranes, and railway cars shall be equipped with standard automatic couplers. The use of rolling equipment with link and pin couplers shall not be permitted, except with the approval of the Project Engineer. If approved, only equipment having extension drawheads shall be used.

3. Only designated personnel shall be permitted to ride on locomotives or cranes.

4. Workers shall not be permitted to ride on the front, rear, or top of loaded rail cars.

5. Footboards, grab rims, and steps on locomotives and cars shall be maintained in good condition.

6. Equipment shall come to a full stop for employees to get on/off.

7. Employees must utilize handrail when riding boarding or departing any equipment.

8. Do not project any portion of body beyond side or rear of any moving piece of equipment.

9. Employees shall not go between or in front of moving engines or cars to couple or uncouple, or connect or disconnect hose.

10. Care shall be taken to see that signals are not given to move the engine or car while an employee is between or under them.

11. Cars shall be uncoupled only with the pin lift lever. If the lever does not work, full protection shall be secured before pulling the pin by other means.

12. All coupler release levers on cars carrying rails shall be wired down or removed to avoid inadvertent use.
13. Radio communication between the supervisor of the unloading crew and the conductor or locomotive engineer shall be maintained. Signals shall be established and understood between the unloading crew and the train crew prior to the start of all unloading operations.

14. An effective communications system shall be established between the person guiding the strings of rail onto/off of flat cars and the operator of the winch or pulling mechanism.

15. Workers shall be kept clear of all wire ropes during the pulling of welded rail.

16. Employees must expect the movement of trains, engines or cars at any time, on any track, in either direction. They are warned they must not rely on others to notify them of approaching trains, engines or cars.

17. Do not walk, step, 'rest foot on', or sit on rail, frog, switch, guard rail, pipe, interlocking apparatus or electrical connections. In crossing track do not walk close to engines, cars, motors, trailers or push cars as they are liable to be moved.

18. When using lining bars, claw bars, jack bars, or tools of similar nature:
   a. Place bar/lever securely under or against object being moved.
   b. Assume a braced position while maintained a firm footing.
   c. Have all parts of body in a safe position in order to avoid being caught between the bar/lever and the object being moved.
   d. Grip bar/lever securely and use a slow and steady movement.

19. In order to prevent a track lining jack from kicking out from between a hydraulic rail bender and rail, utilize a bender equipped with a cable or chain.

20. Stand or walk a safe distance outside the arc of swing of spike mauls, sledges, tamping picks, and similar tools used by other workmen. When practicable, do not work closely together.

21. When rails or track bolts are being cut, if not actually engaged in the holding of chisel, or sledge, face the other way. Do not stand in front of bolts or rivets being chiseled.

22. Under no circumstances will track maintenance equipment be left on live tracks.
23. When Thermit Welding:

a. Make sure that molds or other items are free of defects; promptly replace any molds or items that are damaged or unsafe.

b. Make sure that cable, wire ends, molds or other items are dry and free of any protective coatings before placing contents of cartridge into crucible.

c. If a mold cover is provided, close mold tightly before igniting powder.

d. After weld is made, allow sufficient length of time for metal to solidify before opening mold cover.
Chapter 6.15
EXCAVATION AND TRENCHING OPERATIONS

1. Prior to the start of any excavation work, the site shall be carefully inspected for conditions, particularly soil conditions which require precautionary measures.

2. The location of underground utilities shall be predetermined. If any utility is to be removed or have service interrupted, arrangements shall be made with the utility owner beforehand.

3. If utilities are left in place, protection against damage shall be provided. Exposed piping, cables, etc. shall be supported by shoring or suspension.

4. Every precaution shall be taken to prevent falls of people, materials, equipment, and tools into the excavation. Open cuts in or adjacent to thoroughfares shall be adequately barricaded and posted. Lighting shall be provided during hours of darkness. Pedestrian traffic shall be protected by guard rails or fences. Sidewalks shall not be undermined if used by the public during construction, unless properly shored.

5. Temporary walkways, extending past the curb lines, shall be substantial and provided with protection at both ends and overhead, if needed. Pedestrian traffic shall not be routed into the street without protection. Walkways and passageways shall be lighted if used during hours of darkness.

6. Plank walkways shall be built with lumber which is free of nails, large knot holes, and splinters. Planking shall be parallel to the movement of traffic and shall be securely fastened down. Butt-joining shall be used to avoid tripping hazard. Exposed ends shall be beveled.

7. Pipes, hoses, power lines, etc. crossing sidewalks and walkways shall be covered by troughs with beveled-edge boards.

8. Trucks or other equipment routed across walkways or into public thoroughfares shall be directed into traffic by a posted signalman. Trucks and pedestrians shall not be on the walkway at the same time.

9. Structures adjacent to excavations shall be braced to prevent settlement and lateral movement. Consideration of moving traffic loads shall be taken into account when excavations are located adjacent to sidewalks, streets, or other pavements.
10. Unsupported excavations shall be sloped at an angle equal to or smaller than the natural angle of repose. The angle of repose varies with different soil types and must be determined on each individual project. A 45 degree slope is recommended for average soils.

11. In those instances where excavations cannot be sloped to the recommended angle, shoring shall be used to support the excavation walls.

12. The support system shall be designed by a qualified person and meet accepted engineering requirements.

13. A competent person shall be held responsible for frequent inspection of the shoring system, and each workman shall be instructed to report at once any indication of weakness.

14. Shoring and walls shall be protected against damage from swinging loads being hoisted. Care shall be taken to see that sole pieces of shoring are on solid ground. On diagonal bracing, it is important that adequate bearing is provided at the lower end to resist the thrust of the bank above.

15. Special precautions shall be taken to guard against damage from vibration of machinery or traffic.

16. Jacks shall be inspected and known to be of sufficient strength for the load they are to carry before being placed into position. Workmen shall be cautioned when using screw jacks to avoid the bar slipping and throwing them. The load shall be properly centered so the jack will not kick out.

17. Workmen shall not be allowed to work under an object supported by jacks alone. Blocking shall be carried forward with jacking in order to minimize hazards due to failure or slipping of jacks.

18. Ground water, where encountered, shall be controlled to minimize any disturbance of moisture content which may cause subgrade movements.

19. Excavated materials shall be set at least one-half the depth of the cut from the excavation wall so as to minimize soil failure.

20. A soil support system shall be placed in every trench over five feet in depth, regardless of soil type, unless banks are sloped to the angle of repose.

21. The support system shall be applied starting from the top of the trench or excavation and working down.
22. In installing the shoring, care shall be taken to place the cross beams or trench jacks into horizontal position and space them vertically at appropriate intervals.

23. Braces shall be secured to prevent sliding, falling, or kick-outs.

24. All materials used for shoring shall be in good condition, free of defects, and of the proper size.

25. Properly designed and constructed trench shields or boxes may be used in lieu of shoring or sloping if such device provides equal or greater protection than required protection.

26. Care shall be used in locating excavating equipment. Mats or heavy planking shall be used on soft ground to distribute a load.

27. Workmen shall stay clear of the swing of the bucket and or the cab. The bucket shall not be swung over the men at work.

28. When mobile equipment is allowed adjacent to an excavation, stop logs or barricades shall be installed. Ramps to provide access to the excavation cannot be sloped more than 15 degrees. Where ramps or runways are steeper than 15 degrees, a towing wrench shall be provided to prevent trucks from slipping backwards, with potential damage to equipment and injury to personnel.

29. Runways for shovels, tractors, bulldozers, etc. are subject to hard usage and require frequent inspection and repair. Guard rails or curbs shall be placed along the edge of ramps. One-way traffic ramps shall be construction with a minimum width of 12 feet. For two-way traffic, the minimum width shall be 22 ft.

30. Excavations 4 feet or more in depth shall be equipped with ladders or steps whereby no more than 25 feet of travel is necessary to reach each means of exit.
### APPROXIMATE ANGLE OF REPOSE

**FOR SLOPING OF SIDES OF EXCAVATIONS**

- **Soil**: Clay, silt, loam, or non-homogeneous soil.
- **Note**: Shoring or bracing may be required for sloping or sloped sides.
- **The Presence of Ground Water Requires Special Treatment**

---

**TRENCH SHORING—MINIMUM REQUIREMENTS**

<table>
<thead>
<tr>
<th>Depth of Trench</th>
<th>Kind or Condition of Earth</th>
<th>Uprights</th>
<th>Stringers</th>
<th>Cross Braces</th>
<th>Maximum Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Minimum Dimension</td>
<td>Maximum Dimension</td>
<td>Minimum Maximum</td>
<td>Width of Trench</td>
</tr>
<tr>
<td>Feet</td>
<td></td>
<td>Feet</td>
<td>Feet</td>
<td>Feet</td>
<td>Feet</td>
</tr>
<tr>
<td>5 to 10</td>
<td>Hard, compact</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td></td>
<td>Likely to crack</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td></td>
<td>Soft, sandy, or filled</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td></td>
<td>Hydrostatic pressure</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td>10 to 15</td>
<td>Hard</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td></td>
<td>Likely to crack</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td></td>
<td>Soft, sandy, or filled</td>
<td>3 x 4 or 2 x 6</td>
<td>3</td>
<td>4 x 6</td>
<td>6 x 8</td>
</tr>
<tr>
<td></td>
<td>Hydrostatic pressure</td>
<td>3 x 6</td>
<td>8 x 10</td>
<td>4</td>
<td>4 x 6 6 x 6</td>
</tr>
<tr>
<td>15 to 20</td>
<td>All kinds or conditions</td>
<td>3 x 6</td>
<td>8 x 10</td>
<td>4</td>
<td>4 x 6 6 x 6</td>
</tr>
<tr>
<td></td>
<td>Close</td>
<td>3 x 6</td>
<td>8 x 10</td>
<td>4</td>
<td>4 x 12 8 x 8</td>
</tr>
<tr>
<td>Over 20</td>
<td>All kinds or conditions</td>
<td>3 x 6</td>
<td>8 x 10</td>
<td>4</td>
<td>4 x 12 8 x 8</td>
</tr>
</tbody>
</table>

1. **Note**: Trench splices may be used in lieu of, or in combination with, cross braces.
2. Shoring is not required in solid rock, hard shale, or hard clay.
3. Where desirable, steel sheet piling and bracing of equal strength may be substituted for wood.
EXCAVATION BOTTOM BELOW WATER LINE
SHEETING SHOULD BE DRIVEN BELOW BOTTOM

TRENCH JACKS IN TRUE HORIZONTAL POSITION AND SPACED VERTICALLY

AVOID DANGEROUS OVERHANGS!

ONE EXAMPLE OF SEVERAL TYPES OF SHEETING

WHEN SUBSIDENCE OR TENSION CRACKS ARE APPARENT-STOP ALL WORK AND CORRECT PROBLEM
Chapter 6.16
CONCRETE CONSTRUCTION

1. All equipment, tools and materials used in concrete construction and masonry work shall meet the applicable requirements for design, construction inspection, testing, maintenance and operations as provided in OSEA.

2. Employees working more than 6 ft. above adjacent working surfaces, placing and tying reinforcing steel in walls, piers, columns, etc., shall be provided with and use a safety belt.

3. Employees shall not be permitted to work above vertically protruding re-bars which have not been covered or otherwise protected to eliminate the hazard of impalement.

4. Reinforcing steel, when erected and during erection, must be guyed or supported to prevent collapse.

5. Wire mesh rolls shall be secured at each end to prevent dangerous recoiling action.

6. Rigging for handling and placement of reinforcing steel, forms and material, must be properly employed under the direction of competent and skilled supervision.

7. Concrete buckets, when positioned by crane shall be suspended from shackles or approved type safety hooks.

8. Riding of concrete buckets for any purpose is prohibited.

9. Bundles of reinforcing steel moved by crane shall be securely tied together to prevent slipping.

10. Tag lines shall be used when moving panels or other large sections of forms by crane or hoist.

11. Concrete trucks and similar mobile equipment shall be equipped with automatic backup alarms and a competent signalman shall control backing operations.

12. Concrete trucks and similar mobile equipment shall be choked (blocked) and the brake set when positioned on a slope.

13. Concrete workers must be required to wear shirts and gloves to protect against concrete burns, dermatitis, and skin irritation.
14. Any form, regardless of size, shall be planned, designed, and constructed with an adequate factor of safety.

15. Stripped lumber and materials intended for reuse must promptly be cleaned of nails and wire and removed from the immediate work area.

16. Pumpcrete or similar systems using discharge pipes shall be provided with pipe supports designed for 100% overload. Compressed air hose in such systems shall be provided with positive fail safe joint connectors to prevent separation of sections when pressurized. Safety chains shall be provided on all lines 2 in. in diameter or larger.

17. Vibrator crews shall be kept out from under concrete buckets suspended from cranes.
Chapter 6.17
NON-IONIZING RADIATION
(LASER)

1. The Tri-Met Safety Coordinator and/or BRIM Safety Director must be notified of the intended use of lasers and a pre-use hazard survey of exposed areas must be performed by the contractor.

2. Only trained and qualified persons shall set up, adjust, and operate laser equipment.

3. Proof of operator qualification must be in possession of the laser operator at all times.

4. Operator proof of qualification must be reviewed by the contractor prior to laser setup.

5. Standard laser warning placards must be posted to warn workers or laser hazards at area affected.

6. Laser equipment must have a label attached indicating maximum output.

7. All manufacturer warnings and instructions for setup, adjustment and use must be adhered to.

8. Laser beams shall not be directed at employees.

9. Beam or shutter caps must be used or the laser turned off when laser use is completed, and at any time the laser is to be left unattended.

10. Whenever possible, laser beams shall be set up to such levels so as to be above the head level of workers.

11. When raining or snowing, or when fog or dust exists in the air, laser operation shall be suspended.

12. Employees shall not be exposed to light intensities above:
   a. Direct staring: 1 micro-watt per square centimeter;
   b. Incidental observation: 1 milliwatt per square centimeter;
   c. Diffused reflected light: 2.5 watts per square centimeter.
13. Personal protective equipment must be provided and used when exposures exist.
Chapter 6.18
OUT-OF-DOORS FUEL STORAGE AND DISPENSING

1. Only approved containers and portable tanks will be used for storage and dispensing of flammable and combustible liquids.

2. Approved safety cans must be used for small quantities of flammable and combustible liquids.

3. All tanks must be equipped with emergency venting devices.

4. Storage areas used for the placement of fuel tanks must be graded to divert possible spills from buildings or other exposures, or shall be curbed or diked (minimum 12 inches high) to contain possible spills.

5. Tank storage areas must not be less than 20 ft. from any building or structure.

6. Storage areas must be maintained free of wees and combustible materials.

7. Within 200 ft. of each portable tank, a 12 ft. fire equipment accessway must be maintained.

8. At least one portable fire extinguisher not less than 20-B units shall be located and properly mounted not more than 75 ft. or less than 25 ft. from any outside storage area.

9. At least one 20-B unit fire extinguisher shall be mounted on each vehicle used for transporting or dispensing flammable liquids.

10. Dispensing areas shall be located at least 25 ft. from any operation.

11. Bonding wires and slips must be provided and used for transferring of flammable or combustible liquids.

12. Only approved dispensing nozzles, automatic closing type, without a latch-open device shall be used for dispensing liquids.

13. All dispensing units, including hoses, must be protected against collision damage.

14. Each tank and container must be legibly labeled, identifying the contents.
15. Each storage area must be posted with the following warning signs:

DANGER - FLAMMABLE LIQUIDS
NO SMOKING

16. Each dispensing area must be posted as follows:

NO SMOKING
DANGER - FLAMMABLE LIQUIDS
ENGINE MUST BE SHUT DOWN WHILE REFUELING

17. Inventory records must be maintained of Class I flammable liquids (gasoline) storage amounts.

18. No open flames or other sources of ignition must be permitted within 50 ft. of dispensing or storage areas.

19. Only properly trained and designated persons shall be allowed to handle or dispense flammable or combustible liquids.
Chapter 6.19
PUBLIC SAFETY AND TRAFFIC CONTROL

1. All traffic signs or devices used for protection of construction workers or the public shall conform to State of Oregon Manual on Uniform Traffic Control Devices for Streets and Highways.

2. A traffic control plan, in detail appropriate to the complexity of the work project shall be prepared and submitted to the Project Engineer before the site is occupied. The contractor shall notify the Tri-Met Safety Coordinator and/or BRIM Safety Director of any changes in the traffic control plan.

3. Barricades, cones, and/or similar protective devices shall be used whenever workers or equipment are exposed to traffic or similar hazards. Devices to be left overnight shall be inspected at the end of the workday and a log maintained of such inspection. (See Exhibit F)

4. When traffic lanes are closed due to work activity, advance warning signals and eye level warning devices shall be used as described in the manual on uniform traffic control devices with permission from proper authorities.

5. In carrying on the work, the contractor shall interfere as little as possible with traffic. Contractor shall provide and maintain ingress and egress for all residences and places of business located along the construction route.

6. Materials stored upon the highway shall be placed so as to cause as little obstruction to the traveling public as possible. If this is not possible barricades or similar protective devices shall be used to warn the public. Materials shall be secured so as not to permit displacement.

7. The following general rules shall apply to the use of all traffic signs:

   a. Before any new route or detour is open to traffic or before any work creating a hazardous condition is begun, all necessary signs shall be in place.

   b. Signs required by road conditions or restrictions shall be immediately removed when these conditions cease to exist. Guide signs directing traffic to temporary routes should be removed when no longer applicable.

-77- Revised 3/28/83
c. All signs having any application at night shall be reflected or illuminated by a white light.

d. All signs shall be mounted at approximately right angles to the direction of traffic and at least five feet above the road surface. Signs should normally be places six to ten feet to the right of the traveled lane and never less than one foot.

e. Special care shall be taken to see that piled supplies, stored equipment, parked vehicles, etc. are not permitted to obscure any sign.

8. Flagmen shall be used whenever traffic passing through the project may be required to stop because of conflicts with construction equipment or because the safe travel path cannot accommodate two way traffic.

9. Flagmen shall not be expected to guard more than one single conflict point. Where one way traffic is required for a distance of over 100 feet, a flagman shall be assigned to each end.

10. Flagmen and signalmen shall be properly trained in appropriate traffic control procedures.

11. Flagmen and all employees working adjacent to traffic shall be required to wear an orange vest, shirt, or jacket. Vest shall be reflectorized for night work.

12. Whenever and wherever possible and necessary, protected lights shall be used to mark fences and barricades and other such encroachments onto public streets or sidewalks.

13. Where covered sidewalks are required, they shall be provided with permanent lights to provide sufficient illumination for safe use by the public, day or night. All bulbs shall be cage-protected.

14. Public walkways shall be kept clean and free of hazards at all times.

15. Where the contractor is required to provide public walkways, they shall have abrasive, non-slip surface.

16. When steel plates or similar covers are used on public ways to cover excavations, they shall be subsequently secured to prevent movement imposed by traffic. Covers shall have non-slip surface.

17. When such covers are located where there is pedestrian exposure, they shall be tapered at all sides with cut-back cold mix or similar material to eliminate tripping hazards. Covers shall have a non-slip surface.
18. Buildings, trees, or other structures shall be protected from damage by materials or equipment stored adjacent to them.

19. Free access shall be maintained to every fire hydrant, fire alarm box, fire escape and standpipe connection, street and traffic light control box. When required, hydrants shall be extended by simple tube or piping to an accessible point as provided by the Engineer. No obstructions shall be allowed at any time within 15 ft. of a fire hydrant.

20. The contractor shall erect and maintain fences and barricades to enclose the contractor's work area and provide security where required to prevent unauthorized access.
CLOTHING AND EQUIPMENT

During warm weather flaggers should always wear shirts. Abbreviated clothing should never be worn.

BASIC SIGNALS

Stopping traffic:
1. Face the traffic.
2. Display the stop side of the paddle.
3. Extend the free arm with the palm raised toward approaching traffic.

Moving traffic:
1. Turn the paddle to the slow side.
2. Motion traffic through by slowly swinging your free arm across the front of the body at shoulder height.

Slowing traffic:
1. Display the slow side of the paddle.
2. Raise and lower your free arm at the elbow with palm down.

When traffic control is not necessary flaggers should position themselves on the shoulder of the road with the paddle turned parallel to the traffic flow.

The paddle is held in a stationary position away from the body with the arm extended horizontally. Keep the signals uniform and concise and look directly at the motorists. A sloppy signal could be confusing.
CHANNELIZING DEVICES

CONES

The most convenient and commonly used channeling device is the cone. They are generally orange in color and the minimum height shall be 18 inches.

Cones must be kept clean and bright. If they are used at night they must be reflectorized or equipped with a reflective stripe, collar, or lighting device.

DRUMS

Drums are another effective tool used for traffic control. They are an especially fast method of channeling and are used on long term construction projects. Appropriate advance warning signs shall be placed when drums are used.

Normally, drums are approximately 36 inches high and a minimum of 18 inches in diameter with at least two, four to eight inch, reflectorized, orange and white stripes around them. A single drum used at night should not only be reflectorized but have a flashing warning light. A steady burning light warns of a series of reflectorized drums. Drums should never be weighted beyond the point where they will damage a vehicle.

TUBULAR CONES

Tubular cones are another device used for channeling. They are frequently used in areas where traffic control must be adhered to on a continuing and long term basis. Posts are more difficult to set up and take down.
There are three types of barricades used to warn drivers of hazards near the roadway and guide them safely past. These barricades must conform to the specifications stated in the Manual on Uniform Traffic Control Devices. Barricade rails should be supported in a manner that will allow them to be seen and provide a stable support not easily blown over by wind or traffic.

At night flashing warning lights are used with single barricades. Steady burning low intensity lights are used with a series of channeling barricades. These lights should be yellow.

**TYPE I BARRICADE**

Type I barricades are normally used on conventional roads, urban streets, and arterials. They are usually six to eight feet in length. A convenient feature of Type I is the ability to set up and take down quickly.

**TYPE II BARRICADE**

Type II barricades should be of an "A" frame structure with a hinge at the top to permit convenient folding and stacking. They have more reflective area and are intended for use on expressways, freeways and other high speed roads. This type is also normally used by utilities.

**TYPE III BARRICADE**

Type III barricades are used on construction projects when a road section is closed to traffic. They are a permanent structure as they will remain in an area for a relatively long time. Type III barricades should be at least five feet high and mounted on a base or post. They may extend completely across the roadway and shoulders, or curb to curb on construction projects.

**HIGH LEVEL WARNING**

In urban dense traffic situations, three or more flags 16 inch square and orange in color are used to supplement traffic control as a high level warning device.

They can be seen over preceding vehicles and give advance warning to motorists.

These flags may be used with or without flashing warning lights.

Projects that commonly use this kind of traffic control are pavement repair, survey and utility and manhole work.

**VERTICAL PANELS**

Vertical panels are also used as channeling or warning devices. They may be used for traffic separation or shoulder barricading where space is at a minimum. They shall be reflectorized with orange and white stripes. The slope of the stripes directs the flow of traffic in the same manner as barricades. Back to back panels must be used for two directional traffic.

At night, individual flashing lights may be used on panels. A string of lights used for channeling must be steady burning.

**STRIPING**

The markings on barricade rails and panels are alternate orange and white stripes sloping downward at a 45 degree angle. The downward slope of the stripes designates the direction the traffic is to move.

The markings on barricade rails and panels are alternate orange and white stripes sloping downward at a 45 degree angle. The downward slope of the stripes designates the direction the traffic is to move.
SIGN PLACEMENT

Warning signs must be placed to convey their messages effectively and give the driver adequate time to respond.

As a general rule they are placed at right angles on the right-hand side of the road.

When necessary warning signs shall be placed opposite each other on both sides of the road.

On the open highway the advance warning sign should be placed approximately 1,500 feet in advance of the condition to which they are calling attention. Additional warning signs should be placed at 500 foot intervals in the direction of the work area.

In the city the situation is more restrictive, so the warning signs should be placed out as far as possible.

Signs in an urban district or located on a curb must be a minimum of two feet from the edge of the road surface and a minimum of 7 feet above the shoulder.

Freeway signs should be placed at least one-half mile in advance of the work area. If the flagging situation is dangerous, additional warning signs should be placed.

Signs may be mounted in several ways. In a rural district, road signs may be attached to a post or posts, they must be on the shoulder, 6 to 12 feet from the road with the bottom of the sign a minimum of 5 feet above the road grade. (Never attach a sign to a utility pole.)
During the placement of traffic control devices at the work site a dangerous condition exists for the workers and they must be protected.

A system, such as shown, for the placement of control devices should be established and followed. Each day, the last device set up should be the first taken down. Only signs that warn of hazards should remain when the job is not in progress.

Signs used at night must either reflect light or be illuminated.

At night, when visibility is sharply reduced, it may be necessary to supplement reflectorized signs and barriers for channeling with lighting devices. Three commonly used types of electric lights are: flood, flashing and low intensity yellow steady burning. Lighting units should be placed to illuminate the areas without glaring in the driver's eyes.

In order for a traffic control system to be effective certain practices should be observed. If the traffic control device is no longer needed it should be removed, covered or set aside.
NOTES

1. Formula
   \[ L = S \cdot W \]
   Where
   - \( L \): Minimum length of span
   - \( S \): Numerical value of posted speed
   - \( W \): Speed of traffic

2. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.

3. Flashing warning lights and or flags may be used to call attention to the early warning sign.

KEY:
- Channelizing devices
- Arrow Panel (Optional)
- Flare and Warning Light (Optional)

- Typical application—closing multiple lanes of a multilane highway.

Typical application—daytime maintenance operations of short duration on a 2-lane roadway and flagging is provided.
NOTES:

1. Taper Formula:
   \[ L = S \times W \] for speeds of 45 or more.
   \[ L = \frac{S^2}{60} \] for speeds of 40 or less.

   Where:
   \( L \) = Minimum length of taper.
   \( S \) = Numerical value of posted speed limit prior to work or 85 percentile speed.
   \( W \) = Width of offset.

2. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.

KEY:
- Channelizing devices

Typical application—daytime maintenance operations of short duration on a 4-lane divided roadway where half of roadway is closed.

Note:
1. Flood lights should be provided to mark flagger stations at night as needed.
2. If entire work area is visible from one station, a single flagger may be used.
3. Warning lights should be used to mark channelizing devices at night as needed.
4. Channelizing devices are to be extended to a point where they are visible to approaching traffic.

Typical applications of traffic control devices on 2-lane highway where one lane is closed and flagging is provided.
EXHIBIT A

SUPERVISOR'S ACCIDENT INVESTIGATION
REPORT FORM
EXHIBIT C

CRANE SAFETY INSPECTION CHECKLIST
EXHIBIT D

CHECKLIST FOR CRITICAL LIFTS
CHECK LIST FOR CRITICAL LIFTS

NOTE: THIS FORM IS TO BE COMPLETED WHEN THE LOAD EXCEEDS 80% OF THE LOAD CHART FOR THE CRANE OR DERRICK OR WHERE THE PICK INVOLVES THE USE OF TWO OR MORE CRANES.

DATE: ________________________

(1) SUPERVISOR RESPONSIBLE FOR LIFT: ____________________________________________

(2) DESCRIPTION OF ITEM TO BE LIFTED AND ESTIMATED WEIGHT: ____________________________

(3) EQUIPMENT AND LIFT RELATIONSHIP:

A) OPERATING RADIUS: ________________________________________________________________

B) BOOM LENGTH: ________________________________________________________________

C) ALLOWABLE LOAD (FROM LOAD CHART): ____________________________________________

D) RATIO OF LIFT TO ALLOWABLE LOAD: ____________________________________________

E) CLEARANCE TO SURROUNDING FACILITIES: ____________________________________________

F) SLING ANGLE: ________________________________________________________________

(4) CONDITION OF HOISTING EQUIPMENT AND RIGGING:

A) HAS ALL EQUIPMENT BEEN REINSPECTED FOR THIS LIFT? □ YES □ NO

(5) STABILITY OF GROUND AREA:

A) CHECK SOIL BEARING ALLOWABLE LOAD (COMMENTS) _________________________________________

B) WILL MATS BE NEEDED? □ YES □ NO

C) ANY UNDERGROUND INSTALLATIONS NEEDING SPECIAL ATTENTION? □ YES □ NO

D) WILL IT BE NECESSARY FOR THE CRANE TO WALK WITH THE LOAD? □ YES □ NO

IF THE ANSWER IS "YES", ANSWER QUESTIONS E,F, & G.

E) IS AREA SURFACE LEVEL AND STABLE WHERE THE CRANE WILL BE WALKING?

□ YES □ NO
F) HAVE FACILITIES BEEN PROVIDED TO KEEP THE LOAD RADIUS FROM CHANGING?

☐ YES  ☐ NO

G) HAVE ALL OVERHEAD FACILITIES BEEN CHECKED FOR CLEARANCE IN THE AREA WHERE THE CRANE WILL BE MOVING?

☐ YES  ☐ NO

(6) DOES THE OPERATOR HAVE THE NECESSARY EXPERIENCE ON THE CRANE AND ON THIS TYPE OF LIFT?

☐ YES  ☐ NO

(7) IF LIFT INVOLVES USE OF TWO CRANES ANSWER THE FOLLOWING:

A) HAVE OPERATORS WORKED TOGETHER BEFORE?  ☐ YES  ☐ NO

B) WHO WILL COORDINATE INSTRUCTIONS TO OPERATORS? __________________________________________

___________________________________________

___________________________________________

BY: _______________________________________

CONTRACTOR'S SUPERINTENDENT
EXHIBIT F

SIGNING, BARRICADING, AND LIGHTING LOG

-103-
### SIGNING, BARRICADING, AND LIGHTING LOG

**Contractor**

**Job Location**

**Sketch and/or photographs of Traffic Control Plan**

<table>
<thead>
<tr>
<th>No.</th>
<th>Legend</th>
<th>Min. Distance from Hazard</th>
<th>Ref. No.</th>
<th>Legend</th>
<th>Min. Distance from Hazard</th>
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<tbody>
<tr>
<td>1</td>
<td>&quot;Construction Ahead&quot;</td>
<td>1500'</td>
<td>E-7</td>
<td>&quot;Stop&quot;</td>
<td>50'</td>
</tr>
<tr>
<td>2</td>
<td>&quot;Slow to  MPH&quot;</td>
<td>1000'</td>
<td>E-8</td>
<td>&quot;Wait for Signal&quot;</td>
<td>varies</td>
</tr>
<tr>
<td>3</td>
<td>&quot;Begin Temp Route Ft.&quot;</td>
<td>1000'</td>
<td>E-9</td>
<td>Flare Pots or Flashers</td>
<td>varies</td>
</tr>
<tr>
<td>4</td>
<td>&quot;Barricade Ahead&quot;</td>
<td>5-300'</td>
<td>D-1</td>
<td>Advisory Speed Limit</td>
<td>With Warn. Signs</td>
</tr>
<tr>
<td>5</td>
<td>U. S. or State Route</td>
<td>75'</td>
<td>D-2</td>
<td>&quot;Low Clearance Ft. In.&quot;</td>
<td>350'</td>
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<tr>
<td>6A</td>
<td>Directional Marker</td>
<td>With Route Signs</td>
<td>D-3</td>
<td>Curve Arrow</td>
<td>300'</td>
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<tr>
<td>6B</td>
<td>&quot;Street Closed Ahead&quot;</td>
<td>100'</td>
<td>D-4</td>
<td>&quot;Narrow Bridge&quot;</td>
<td>300'</td>
</tr>
<tr>
<td>7</td>
<td>&quot;Detour&quot;</td>
<td>With Route Signs</td>
<td>D-5</td>
<td>&quot;Truck Crossing&quot;</td>
<td>300'</td>
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<tr>
<td>8</td>
<td>&quot;Road Repairs Ahead&quot;</td>
<td>1000'</td>
<td>D-6</td>
<td>&quot;Road Machinery Ahead&quot;</td>
<td>300'</td>
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<tr>
<td>9</td>
<td>&quot;One Lane Traffic&quot;</td>
<td>200'</td>
<td>D-7</td>
<td>&quot;Do Not Pass&quot;</td>
<td>varies</td>
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<tr>
<td>10</td>
<td>&quot;Danger&quot;</td>
<td>varies</td>
<td>D-8</td>
<td>&quot;Falling Rock&quot;</td>
<td>300'</td>
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<tr>
<td>11</td>
<td>&quot;Men Working&quot;</td>
<td>varies</td>
<td>D-9</td>
<td>&quot;No Parking on Pavement&quot;</td>
<td>varies</td>
</tr>
<tr>
<td>12</td>
<td>One Way Arrow</td>
<td>Intersection</td>
<td>D-10</td>
<td>&quot;Keep Right (Left)&quot;</td>
<td>varies</td>
</tr>
</tbody>
</table>

**NOTE:**

1. Minimum distances from hazard shown are suggested distances, and do not supersede local regulations. Where local regulations differ, change distances accordingly.

2. Blank spaces are for adding additional signs used.
3. Record inspections on reverse side.

*Maintain daily and keep...*
**DAILY INSPECTION RECORD**

Check for the following items:
1. All protection, as indicated, is clean unobstructed and clearly visible.
2. All protection is properly located, in good condition and well secured.
3. All flashers are operating.
4. All flares are lit and have an adequate fuel supply.
5. Equipment is properly parked.
6. Materials are properly stored.
7. Roadway open to traffic is free of holes, ruts or spillage.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Weather</th>
<th>I certify that all protection as shown has been personally inspected and it exits in satisfactory condition.</th>
<th>Comments: (Note any unsafe conditions corrected.)</th>
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EXHIBIT G

SAFETY ORIENTATION CHECKLIST
HAZARDOUS MATERIALS INFORMATION SHEET

(Please complete all applicable sections.)

1. Product Name, Number, Synonym _______________________________ Chemical Formula __________________

2. Manufacturer's Name ________________________________________

3. Manufacturer's Address ______________________________________

4. Chemical and Physical Properties: (a) Molecular Wt. __________ (b) Boiling Point ______°C
   (c) Melting Point ______°C (d) Specific Gravity (water = 1) or Bulk Density ______
   @ __________________°C (e) Vapor Density (air = 1) __________
   (f) Vapor Pressure (mm Hg) ________________________________
   @ __________________°C; __________________°C; __________________°C;

5. Flammability and Explosive Properties: (a) Flash Point, F, Closed Cup __________
   - Open Cup __________________________ If Flash point changes during evaporation give data __________
   (b) Explosive limits (% by vol. in air): LOWER ___________ UPPER __________
   (c) Susceptibility to spontaneous heating: YES __________ NO __________
   (d) Fire point, F __________ Auto-ignition temp., F __________
   (e) What products might be formed in the event of fire or abnormal temperatures? __________
   (f) Suitable extinguishing agents __________

NOTE: Please be specific. For example, it is important to know whether an alcohol is methanol; an aromatic hydrocarbon is benzene; a chlorinated material is carbon tetrachloride.

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<th>COMPOUND</th>
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</table>
6. Procedures in Case of Container Breakage or Leakage

7. Transportation and Storage Requirements

8. Physiological Properties (give animal tested, observation time, dosage value and range, dilution medium, etc.):

   (a) Acute oral toxicity
   (b) Acute local effects on eyes
   (c) Acute local effects on skin. Primary irritant? Sensitizer?
   (d) Acute inhalation toxicity (vapor, mist, fume, dust. Indicate effects of concentration and time.)
   (e) Chronic effects
   (f) Warning properties (odor; irritation of eyes, nose, throat)
   (g) Threshold limit value (estimate, if not on current list of ACGIH)

9. First Aid Treatment:
   (a) Skin contact
   (b) Eye contact
   (c) Inhalation
   (d) Antidote and treatment in case of swallowing

10. Recommended Pre-placement or Periodic Medical Examination (health standards, clinical tests, frequency, etc.)

11. Precautions for Normal Conditions of Use

12. Recommended Personal Protective Equipment

13. Suggested Method for Air Analysis

14. Pertinent Literature References

15. Information Furnished By: NAME ______________________ DATE ____________
    TITLE ___________________________________________________________
    COMPANY _________________________________________________________
    ADDRESS _______________________________________________________

(If more space is needed for comment, please attach an additional sheet. Please attach product information data sheets or other publications related to the safe handling and use of this material.)
EXHIBIT I

LOG OF FIRST AID TREATMENT
EXHIBIT K

TAILGATE SAFETY MEETING

LOG