# SAFETY HANDBOOK



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### SECTION A: GENERAL COMPANY SAFETY POLICIES

### A 1: Introduction to Precision Concrete Pumping's Safety Handbook

To all Precision Employees:

This handbook has been created and distributed to all Precision's employees as an important part of Precision's continual efforts to satisfy its most important goal: safety. We have set out to create a safety program that outlines the procedures and policies that will minimize risk while maximizing on-the-job safety. Adhering to this program will allow us as a company to be proactive in minimizing accidents and injuries that are debilitating to employee well-being as well as their ability to work and thus take care of their families.

Safety allows each employee to come to work healthy day in and day out and do their job to the best of their abilities. Committing to safety routines and operating safely on an everyday basis also works to foster healthy relationships among coworkers and colleagues, fellow contractors and their employees, and the community. Furthermore, these same procedures will allow us to protect Precision's and customers' equipment and property.

Education will be provided within this handbook as a resource, at annual safety meetings, during on-the-job training, at Toolbox Talks, among other efforts. If ever you are in doubt as to any of the suggested guidelines or policies in this handbook or have a question as to how to go about a certain on the job task safely, do not hesitate to reach out to management with questions and concerns. They are here to provide the support that will allow you to approach each task as safely as possible and to perform that task to the best of your abilities.

Your protection is our goal since your finger, limb, eye, ability to work and potentially your life is potentially at risk. Cooperation, focus, and communication are necessary for this success. Employees are expected to adhere to the safety rules of this company and management has been instructed to enforce them.

Everyone's first responsibility is to yourself. Watch out for your own safety and make sure that what you are doing is being done in a safe manner. The best safety device on the job is your own mind. Next, you must then watch for the workers next to you. Do not do anything that will jeopardize his or her safety in any way whatsoever.

Each employee's complete cooperation is extremely important. Familiarize yourself with all the safe practices pertaining to your job. The practices in this booklet are minimum and additional requirements may be necessary for special circumstances. As your own "Safety Person", your experiences are valuable. Do not devise any shortcuts or take any chances that will jeopardize you or your fellow workers. Stay alert and **THINK** about what you are doing at all times.

### A 2: Workplace Safety Policy

Your safety is a primary concern for this company. Jason Pino makes inspections and holds safety meetings to address this concern. Periodically Jason Pino and Dan O'Connor also meet with our current insurance provider NBIS to review our safety program. Common sense and personal interest in safety are still the greatest guarantees of your safety at work, on the road, and at home. We take your safety seriously and any willful or habitual violation of safety rules will be considered cause for discipline. Disciplinary actions may include the requirement of online classes with regards to the safety violation an employee may have been involved in. Contractors have also kicked off specific employees on job-sites due to safety violations, so please take note to the full consequences of violating safety policies of Precision Concrete Pumping and our customers.

The cooperation of every employee is necessary to make this company a safe place in which to work. Help yourself and others by reporting unsafe conditions or hazards immediately to your supervisor or to a member of the safety committee. Give earnest consideration to the rules of safety presented to you by poster signs, discussions with your supervisor, and regulations published in the safety booklet from the ACPA (American Concrete Pumping Association). Begin right by always thinking of safety as you perform your job, or as you learn a new one.

Prior to employment employees are required to view safety videos endorsed by the ACPA that are specific to concrete pumping. These videos address safety issues to the employee themselves, all other workers that may be on job sites, as well as safely mobilizing the concrete pump to and from jobsites on public roads.

Accident reporting. Any injury at work—no matter how small—must be reported immediately to your supervisor and receive first aid attention. Serious conditions often arise from small injuries if they are not cared for at once. Please contact our dispatchers or the safety officer Dan O'Connor to report any incident, and fill out an OSHA 300 form, C-2 Form, Internal Incident Report, along with any other forms that may be required.

**Drug Testing**. Precision adheres to Federal Motor Carrier guidelines for drug testing as well as self-imposed postaccident and reasonable suspicion drug testing. Our Federal Motor Carrier compliance is administered through Foley Carrier Service (For pre-employment and random drug testing) and after any workplace incident you will be required to perform a drug screening. The post-incident drug screening will be administered within 24-hours of the incident at a licensed facility most accessible to the employee. Reasonable suspicion may trigger a drug test after multiple first-hand observed and documented instances of suspicious behavior or appearance in the workplace such as slurred speech, bloodshot eyes, dilated pupils, or difficulty walking.

**Specific safety rules and guidelines.** To ensure your safety, and that of your coworkers, please observe and obey the rules and guidelines included in this safety handbook and the following:

- Observe and practice the safety procedures established for the job from the ACPA safety booklet on concrete pumping.
- Have a good understanding of the Federal Motor Carrier Safety Regulations to help drivers of Commercial Vehicles with CDL Licenses.

**ACPA Certifications.** Precision expects all operators to receive ACPA certification to help mitigate risk of accidents on the job, which could have been prevented from being knowledgeable in concrete pumping operations. Precision will pay for certifications but expects our employees to put in the time and effort to pass the exam.

**Toolbox Talks.** Precision will have safety meetings to refresh employees on the proper safety procedures and operations of concrete pumping, and to address any concerns/comments employees may want to bring to management's attention.

**Open-Door Policy.** If at any time an employee feels unsafe in the workplace environment, whether on Precision's property or at a jobsite for one of Precision's customers, please notify management immediately so the issue may be addressed.

### A 3: Emergency Action Plan

#### Policy

It is the policy of Precision Concrete Pumping to take every possible action to comply with all emergency regulations and protect employees in emergency situations.

#### Emergency Plan Coordinator

Daniel O'Connor, Safety Director, is responsible for making sure this emergency action plan is kept up to date, practices, and reviewed periodically. The Emergency Plan Coordinator can be reached at 518-435-9292 x113 and his office is at 90 Industrial Park Road, Albany, NY 12206.

#### **Reporting Procedures**

Type of Emergency	Report To:
Fire / Explosion	Dan O' Connor (518-435-9292 x113)
Concrete Pump Catastrophe	Jason Pino (518-573-1914)
Weather / Natural Disaster	Dan O' Connor (518-435-9292 x113)
Chemical Spill/Leak	Dan O' Connor (518-435-9292 x113)
Violence	Dan O' Connor (518-435-9292 x113)
Medical	Dan O' Connor (518-435-9292 x113)

Reporting procedures are posted at 90 Industrial Park Road, Albany, NY 12206

#### Emergency Escape Procedures and Routes

Emergency escape procedures and route assignments have been posted in each work area, and all employees have been trained by supervision in the correct procedures to follow. New employees are trained when assigned to a work area. A sample escape procedure and escape route sheet of the type posted in work areas is included with this plan.

#### Employee Accountability Procedures after Evacuations

Each supervisor is responsible for accounting for all assigned employees, personally or through a designee, by having all such employees report to a predetermined designated rally point and conducting a head count. Each assigned employee must be accounted for by name. All supervisors are required to report their head count (by name) to the Emergency Evacuation Coordinator. A summary of the evacuation rally points, together with the identities of supervisors and assigned employees who must report to each, is included with this plan.

#### Alarm System

Describe the alarm system to be used to notify employees (including disabled employees) to evacuate and/or take other actions. The alarms used for different actions should be distinctive and might include horn blasts, sirens, or even public address systems. Alarm systems for notifying all employees in case of an emergency are:

Action to be taken	Alarm system
Mass Text To All Employees	Payroll SMS System
Phone Call from Dispatcher	Dispatcher

#### Training

The following personnel have been trained to assist in the safe and orderly emergency evacuation of other employees.

Name	Title	Work Area
Dan O'Connor	Safety Director	Albany
Stephen Gladman	Lead Mechanic	Albany Shop
Jason Pino	Operations Manager	Various

Training is provided for employees when:

- 1. The plan was initiated
- 2. Responsibilities change
- 3. New employees are hired or transferred.

#### Employee Accountability Procedures Following an Emergency Evacuation

Each supervisor is responsible for accounting for each assigned employee following an emergency evacuation. The following procedures apply:

- 1. Rally points have been established for all evacuation routes and procedures. These points are designated on each posted work area escape route.
- 2. All work area supervisors and employees must report to their designated rally points immediately following an evacuation.
- 3. Each employee is responsible for reporting to his or her supervisor so that an accurate head count can be made. Supervisors will check off the names of all those reporting and will report those not checked off as missing to the Emergency Evacuation Coordinator.
- The Emergency Evacuation Coordinator will be located at one of the following locations: Primary Location: Albany Shop Secondary Location: New Jersey Shop
- 5. The Emergency Evacuation Coordinator will determine the method to be utilized to locate missing personnel in each situation.

#### Rescue and Medical Duties

It may become necessary in an emergency to rescue personnel and perform some specified medical duties, including first-aid treatment. All employees assigned to perform such duties will have been properly trained and equipped to carry out their assigned responsibilities properly and safely.

#### Employee Training

Employees will be properly trained on all aspects of the emergency action plan prior to employment, prior to transfer or change of responsibility, and when the plan is updated. Periodic drills will be conducted to test plan's effectiveness.

#### Contacts

For more information about this plan, contact the Emergency Action Coordinator. The following people should be contacted during off-hours emergencies:

1. Dan O'Connor518-435-9292 x 1132. Jason Pino518-573-1914

### A 4: General Work Rules

- ✓ Report unsafe conditions to your superior.
- ✓ The use, possession, or sale of alcohol or illegal drugs is prohibited.
- ✓ All injuries, regardless of severity, must be reported immediately to a supervisor.
- ✓ Proper clothing must always be worn. Be sure to wear work boots and long pants to protect your legs and shirts with at least four-inch sleeves. Wear snug-fitting work clothes prevent injury by avoiding loose clothing.
- ✓ All employees are cautioned about loose clothing, rings, bracelets, and other jewelry around moving equipment, appliances, and tools.
- ✓ Horseplay, including reckless driving of vehicles is strictly forbidden and those guilty will be severely reprimanded.
- ✓ Firearms and other weapons are forbidden.
- ✓ Seat belts will be used in all moving vehicles, in all occupied seats. No exceptions.
- ✓ "No smoking" rules will be adhered to in all posted areas.
- ✓ No employee other than the operator shall ride on any vehicle unless given specific authorization.
- ✓ No employee shall utilize any equipment or machinery unless given specific authorization.
- ✓ No more than three employees shall ride in the cab of a truck at any given time. All will wear seat belts. No one will ever ride in the back of the truck, employee or otherwise.
- ✓ Wait for the vehicle, machinery, or equipment to stop before getting on or off.

- ✓ Gasoline must be transported only in approved safety containers. Gasoline engines must be turned off prior to refueling. While refueling, always check the oil and other fluids.
- ✓ Be aware of the emergency response plan. Know the alarm signals, evacuation routes and locations of emergency numbers.
- ✓ If any potentially hazardous materials are encountered during operations, stop work immediately and notify your supervisor.
- ✓ All switches and drives on machinery shall be shut down prior to cleaning, greasing, oiling, or making any other upkeep, adjustments, or repairs.
- ✓ All machine guards shall be kept in place while the machinery is in operation. Any function that may require the machine guard to be altered in any way must be approved by a superior, including repairs. Immediately following the repair, the machine guard must be returned to its previous state.
- ✓ No employee shall work under lifted loads. Equipment operators should never carry loads over working employees.
- ✓ Hand tools should never be used for anything put their intended purpose. All damaged or worn tools should be reported for replacement or repair.
- ✓ Proper lifting procedures should be implemented. If a load is too heavy, ask for assistance.
- ✓ Keep out of restricted or barricaded areas unless told specifically otherwise. If you do continue, proceed with caution.
- $\checkmark$  Do not jump from any heights.
- ✓ No employee shall enter an unshored trench or excavation greater than five feet in depth unless the slopes are laid back to the appropriate angle of repose. No employee shall enter a trench without someone present at the surface.
- ✓ Using an airline to blow dust from yourself to others is strictly forbidden. Never, under any circumstances, "Goose" anyone with an air hose. It is extremely dangerous and has proven fatal.
- ✓ Do not fill metal gasoline cans that are resting on plastic pickup truck bed liners. The plastic serves as an insulator and prevents static electricity discharge, so a spark is created between the gas can and the fuel nozzle. If the spark happens in the flammable range in the gasoline vapor space near the open mouth of the gas can, a fire occurs. Only fill containers that rest on the ground, keeping the nozzle in contact with the can while filling.

### A 5: Driver Safety Rules & Accident Reporting

#### Driver Safety

- ✓ Drivers should be mentally and physically rested and alert prior to each trip.
- ✓ Driving under the influence of alcohol or restricted drugs in prohibited and will subject the employee to disciplinary action, up to and including termination.
- ✓ Drivers must also be aware of the effects that prescription and over the counter medications have on their level of alertness and must take appropriate action.
- ✓ Drivers must always have a valid driver's license for the type of vehicle to be operated and keep the license(s) with them while driving. Only authorized drivers are permitted to operate company vehicles.
- ✓ Drive defensively, courteously, and safely to the job. Obey all traffic regulations, including speed limits and travel restrictions. **DO NOT TAILGATE!** Know the right-of-way rules and always assume that the other drivers do not know them or will ignore them.
- $\checkmark$  If you know you are going to be delayed for some reason, contact your base to alert the job.
- ✓ While driving to and from the job, remember the principal causes of truck accidents:
  - 1. Following too closely
  - 2. Backing up without supervision
  - 3. Turning too sharply
  - 4. Hitting something overhead
  - 5. Inattentive driving (including talking on the phone)
- ✓ Remember to utilize your engine to control your speed when coming down a hill. You should use one gear lower than the gear required to climb a hill. Remember, concrete pumps are equal to a fully loaded truck. A 92-foot boom weighs approximately 55,000 pounds, a 118-foot boom about 65,000 pounds and 128-foot boom about 78,000 pounds. Most pumps are about 13 feet high. The federal limit is 13.5 feet.

- ✓ Speed shall never be faster than posted speed limits and should be reduced as road, traffic and weather conditions dictate. Always maintain at least a 2 second following distance. Increase your following distance if conditions are not ideal. Never follow another vehicle so closely that you will not be able to make a safe stop under any conditions. Always slow down in school zones and other congested areas.
- ✓ Keep to the right except when overtaking slow-moving vehicles, or when getting into a position to make a left turn. Never pass another vehicle on the right.
- ✓ Turn signals must be properly used.
- $\checkmark$  Seat belts shall always be worn by drivers and passengers.
- ✓ Check your vehicle daily before each trip and check the vehicle visually each time before driving. Check lights, tires, brakes, and steering particularly, an unsafe vehicle should not be operated until repairs are made.
- ✓ Drivers must report all accidents and traffic convictions as soon as possible.

#### Driver Quality Control & Improvement

All employees authorized to drive PCP, Inc.-owned or PCP, Inc.-leased vehicles or to rent vehicles for use in conducting PCP, Inc. business, must possess a current, valid driver's license and an acceptable driving record. Any change in license status or driving record must be reported to management immediately. If the license status or driving record of any employee whose job responsibilities include driving becomes unacceptable to management or PCP, Inc.'s insurance carrier, that employee may be restricted from driving, reassigned, suspended, or terminated, at management's discretion.

A valid driver's license must be in your possession while operating a vehicle off or on PCP, Inc. property. It is the responsibility of every employee to drive safely and obey all traffic, vehicle safety, and parking laws or regulations. Drivers must demonstrate safe driving habits.

Quarterly Driving Abstracts will be obtained for all employees who drive Precision Concrete Pumping company vehicles. The data provided on these abstracts will be used to determine if any drivers are at risk per the MVR Evaluation Tool below:

Profile Points/Risk Category	Corrective Action Guidelines*
1 to 2 Points	Generally, no action necessary
Low Risk	
3 to 4 Points	• Manager will discuss record and improvement with employee.
Minor Risk	• Employee will be advised of responsibility to drive in a safe and
	courteous manner in accordance with defensive driving principles.
	• Suggested Point and Insurance Reduction Program (PIRP) (Defensive Driving) will be recommended at the expense of the employee to reduce points.
	Verbal Warning
5 to 7 Points	• Manager will discuss record and improvement with employee.
Medium Risk	• REQUIRED Point and Insurance Reduction Program (PIRP)
	(Defensive Driving) at the expense of the employee to reduce points.
	Written Warning
8-9 Points	• Manager will discuss record and improvement with employee.
Elevated Risk	• Required Driving Training: (Structured) Behind the wheel with an instructor at the expense of the employee.
	• Possible loss of company vehicle driving privileges, to be determined on an individual basis.
	Written Warning
10+ Points High Risk	• Manager will advise employee that his or her driving record has resulted in "revoked" driving privileges.

•	If the employee can no longer perform the essential functions of his or her position, and other job assignments are not an option
	termination could result.

\*Corrective Action Guidelines are at the discretion of the management team of Precision Concrete Pumping. As stated previously, the President of the company has final say in all affairs, including corrective action.

Each quarter, employees whose driving abstracts indicates points more than 2, will receive a letter outlining their total points, and required corrective action needed. Employees will have until the next abstract review period to complete their corrective action. Proof of completion of PIRP Courses must be received by the office as soon as it becomes available. If the corrective action has not been completed by the next review period, the employee becomes at risk of losing company vehicle driving privileges, to be determined on an individual basis.

Precision Concrete will use the following tool when determining profile points and risk category:

Violation/Accident Guidelines		Points*
Speeding (MPH over posted limit)	1-10 mph	3
	11-20 mph	4
	21-30 mph	6
	31-40 mph	8
	Over 40 mph	11
Reckless or negligent driving, driving to endanger.		10
Leaving scene of an accident		
Fleeing an officer		
Driving with a suspended license		
Any alcohol related offense OR refusal to submit to a blood alcohol test (DUI/DWI)		
Failing to stop for a school bus		5
Railroad crossing violation		
Improper cell phone use, Use of Portable Electronic Device (Texting)		
Following too closely (tailgating)		
Inadequate brakes (Private Car)		
Preventable accidents (other than backing & parking lot accidents)		
Failing to yield right-of-way.		
Disobeying traffic control, STOP or YIELD signs		
Improper passing, changing lanes unsafely, Driving left of center, in wrong direction.		
Leaving scene of property damage incident		
Child safety restraint violation		
Failure to use restraint system		
Inadequate brakes (Employer's Vehicle), Any other moving violation		2
Warning, Preventable accidents (backing & parking lot accidents)		1

\*At any point during the year, employees are welcome to contact the office Safety Officer to determine how many points are on their license, as well their corresponding profile points.

**PLEASE NOTE:** It is highly recommended that any PIRP course be completed immediately upon notification. The PIRP course sponsor will notify the DMV within 10 weeks after you complete the course. DMV will then reduce the active points on your driving record by up to 4 points. Due to the 10-week timeline, it is imperative that this course gets completed in a timely manner to reflect on the following review period driving abstract.

Completing a Point and Insurance Reduction Program (PIRP) course does not remove a violation, conviction, or the number of points from your driving record. Even after you complete the course, most violations, convictions, and points will continue to show on your driving record for up to 4 years. "Point reduction" means the number of points on your driving record used to calculate the number of total points received within 18 months will be reduced by 4 points and may help you avoid a suspension.

#### Vehicle Inspections

- ✓ Visually inspect your unit each day before it is put into operation. If any problem is found that will affect the safe operation of the pump, do not use the pump until it is repaired.
- ✓ If safety decals are faded, missing, damaged, or otherwise unreadable, they must be replaced immediately. Contact the manufacturer of your unit to obtain replacements.
- ✓ If safety devices or guards are removed for inspection purposes, they must be replaced before someone uses the machine.
- ✓ Pay attention to the operation manual and manufacturers service bulletins regarding maintenance and inspection procedures and intervals.
- ✓ If inspection reveals something that looks wrong, or even suspicious, report it to the manufacturer for consideration. Do not just assume that it's okay.
- ✓ Visual inspection of the concrete pump circuits and safety devices should be done daily. Hands-on inspection and documentation of results should be done weekly, or at least when preventive maintenance is scheduled.
- ✓ Do not neglect the delivery pipeline, claims, or hoses. Check them often for wear, dents, and frays. Never send a unit to a job with a worn or damaged delivery system. For single wall pipes, ultrasonic thickness tester are more accurate than the tap method.

#### Accident Reporting and Investigation

- ✓ Drivers are required to report any collision, immediately. Failure to report even minor collisions may result in disciplinary action, including a verbal warning, written warning, and dismissal. Even a relatively minor incident may result in severe legal consequences for the company.
- ✓ We consider every incident as an opportunity to improve ourselves. Every incident should be promptly report and investigated. Most traffic collisions are preventable, and we need to learn from our mistakes. A prompt and thorough investigations will often identify the need to retrain the driver or modify the equipment to prevent future, similar losses.
- ✓ Precision will review all incidents. Precision will investigate each incident and determine whether the collision was preventable on the part of our driver. Precision will also seek to identify what the driver should have done differently. The driver will be advised of the findings. Precision may develop corrective actions including driver counseling, restriction of driving and disciplinary action.
- ✓ If you are involved in a collision, keep calm. Your actions can significantly affect the ultimate consequences of the incident.
- ✓ Your first priority is to prevent further damage. Pull of the road as far as you can. The best choice is to pull off the road into a parking lot or a side road. Turn on your four-way flashers and place warning signals promptly and properly.
- ✓ Call the police or emergency service personnel. If qualified, assist any injured person, but do not move them unless they are in danger of further injury.
- ✓ Write down the facts of the incident as soon as feasible, so that they are fresh in your mind. The accident reporting kit in your glove box provides a convenient way to record the information. Exchange information with other involved parties and secure the names and addresses of any witnesses.
- ✓ Call the company immediately in the event of any collision. Complete an incident report as soon as feasible. The company will report the incident to the insurance company.
- ✓ Please note that according to our drug/alcohol testing, if you are involved in an accident or event, you will receive a mandatory drug/alcohol test within 24 hours.

### A 6: Substance Abuse Policy

#### **Drugs and Alcohol**

- Possession or use of unauthorized drugs or alcoholic beverages is strictly prohibited on Precision Concrete Pumping's premises or while working for Precision Concrete Pumping.
- Reporting to work while under the influence is prohibited. Any person arriving in such a state will be severely reprimanded.
- Possession, use or transfer of controlled substances is forbidden.

#### **Drug and Alcohol Testing**

Precision adheres to Federal Motor Carrier guidelines for drug testing as well as self-imposed post-accident and reasonable suspicion drug testing. Our Federal Motor Carrier compliance is administered through Foley Carrier Service (For pre-employment and random drug testing) and after any workplace incident you will be required to perform a drug screening. The post-incident drug screening will be administered within 24-hours of the incident at a licensed facility most accessible to the employee.

Reasonable suspicion may trigger a drug test after multiple first-hand observed and documented instances of suspicious behavior or appearance in the workplace such as slurred speech, bloodshot eyes, dilated pupils, or difficulty walking.

### A 7: Safety Incentive Program

#### PER QUARTER

•	TOTAL PER QUARTER	100% = \$75.00	
	in by Saturday, 12:00am (Midnight) to be considered on time	33% = \$25.00	
•	Time sheets correctly completed per paymaster, job slips, and fuel receipts must be turned		
•	Perfect attendance - scheduled days and 100% On Time Attendance	33% = \$25.00	
•	NO recordable injury and safety violations/accidents	33% = \$25.00	

• YEAR END TOTAL

Employees will be rewarded with a VISA gift card to use as they desire. Under our new program, employees "lose" \$25 for each item that they do not successfully complete.

100% = \$300.00

If an employee is injured on the job, only the injured employee "loses" part of his incentive unless, the injury was caused by another employee. An employee can lose \$25 for a recordable injury and/or safety violation/accident.

Attendance on the employee is tracked. We have a zero tolerance for unscheduled day(s) off. We base the 100% on time attendance as part of not showing up on time to a job. If you are late to a job, Precision is back charged costing the company money.

One of the purposes of this program is to encourage our employees to be aware of their surroundings, ask yourself, what is the safest way to proceed. Safety is a team effort, such as communicating with each other about possible safety issues and consequences. Please report any safety issues to Management.

It should be emphasized that this is a program designed to reward you for doing your job in a safe and appropriate manner.

### A 8: <u>Return to Work Program</u>

The health and welfare of our employees is a top priority for Precision Concrete Pumping. When one of our employees experiences a work-related injury or illness, we are committed to assisting employees to return to work as soon as possible.

We have implemented a Return-to-Work program that is designed to help return injured employees back to productive work quickly and aid in the healing process. The program depends on the team effort of the employee, supervisors, our insurance company, the treating healthcare provider, and company management.

Our Return-to-Work program incorporates temporary, transitional-duty jobs that consist of some type of modification to the original job, a different job, or several part-time tasks combined into one job. At management's discretion,

and to the extent the employee's physical limitations and company operations permit, a transitional-duty job will be provided until the treating healthcare provider releases our employee to his or her full, regular work.

Through this program, the company will help the injured employee recover at a more rapid rate and minimize employee wage loss. At the same time, Precision benefits from having our employees providing a service and contributing to the overall productivity of our business.

For additional information regarding our Return -To-Work Program, contact Jason Pino - 518-573-1914.

### SECTION B: GENERAL JOB SITE & CONSTRUCTION SAFETY GUIDELINES AND PROCEDURES

### B 1: Personal Protective Equipment

#### **Eye Protection**

- Employees shall be provided with eye and face protection equipment when machine or operations present potential eye or face injury from physical, chemical, or radiation agents, such as sawing, sandblasting, welding, cutting, striking metal, or exposure to heavy dust.
- Additional protection, such as face shields or goggles, shall be worn while performing high hazard tasks.
- Gas and electric welding or cutting requires the use of burning goggles or a welder's hood with lenses having the proper color density.
- Employees whose vision requires the use of corrective lenses, when required in regulation to wear eye protection, shall be protected with goggles or safety glasses that does one of the following:
  - Provide protective lenses with optical correction
  - o Can be worn over the worker's normal corrective eyewear
  - o Incorporate corrective eyewear built into, and behind, the safety equipment

#### Hard Hats

- Approved hardhats in good condition will be worn at all times by all employees during all work hours at a job site to protect from head injuries.
- Burncaps may only be worn by mechanics and welding personnel (when not welding and not immediately working on equipment).
- Metal hard hats are prohibited.
- Welding helmets are mandatory for welders.

#### Hearing Protection

- Wherever it is not feasible to reduce the noise levels or duration of exposures to noises loud enough to potentially danger the employee's hearing, ear protection shall be used.
- Ear protective devices inserted in the ear shall be fitted or determined individually be competent personnel.
- Plain cotton is not an acceptable protective device.

#### Full Body Harnesses, Lifelines and Lanyards

- Lifelines, safety harnesses, and lanyards shall be used only for employee safeguarding. Any lifeline, safety harness or lanyard subjected to in-service loading, as distinguished from static load testing, shall be immediately removed from service, and shall not be again used for employee safeguarding.
- Fall protection will be always worn whenever worksite conditions involve a potential risk for a fall greater than six feet. The appropriate fall protection equipment shall be designated and distributed by the highest-ranking employee at the job site.

#### Life Jackets (Working Over or Near Water)

- Employees working over or near water, where the danger of drowning exists, shall be provided with US Coast Guard approved life jackets or buoyant work vests and shall wear them at all times.
- Prior to and after each use, the work best or life preserver shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

#### Respirators/Dust Masks

- Respirators are required in certain areas, designated by the highest-ranking employee at the worksite, and while performing tasks that could risk the wellbeing of the employee's respiratory system. The type of respirator will be based on the job and designation.
- Dust masks/breathing masks will be worn when working on any task that could cause respiratory damage without such protection, such as cement dust

#### Selection, Issuance, Use, and Care of Respirators

- Employees required to use respiratory protective equipment approved for use in atmospheres immediately dangerous to life shall be thoroughly trained in their use. Employees required to use other types or respiratory protective equipment shall be instructed in the use and limitations of such equipment.
- Dust, fog, fumes, mists, gases, smokes, sprays, and vapors all can risk damage to the respiratory system, and as a result, all employees with risk of exposure to these must wear a dust mask or respirator.

#### Safety Shoes/Boots

- Approved safety shoes in good condition will be worn at all times.
- Steel toe shoes are required for any quarry work by Federal regulations.
- Employees working for private projects must wear steel toe shoes.
- Inspect work shoes before use at a work site. If they are not in good condition, use of other better condition shoes is required.
- When working in concrete or water, rubber boots should be worn.

#### Work Gloves/Hand Protection

- Work gloves in good condition and suitable for the task to be performed will be worn to protect your hands whenever you are subject to harm without them.
- General guidelines for glove selection are as follows:
  - Use metal mesh gloves to help protect from sharp instruments.
  - o Use leather gloves against rough objects, chips, sparks, or moderate heat.
  - Use cotton fabric gloves for protection against splinters, slippery objects, or abrasion.
  - Use rubber, neoprene, vinyl, or similar materials to protect against chemicals.
  - o Insulated liners or other special gloves must be worn when working with electricity.
  - o Fire retardant gloves should be used when working near an open flame.
  - Reflective material gloves should be used when working around radiant heat.
- Gloves should not always be used. Not all jobs require them. Sometimes, gloves can be more of a liability than protection. If working with machinery that can catch a glove you're using, use your judgement. If you are unsure whether to use a glove or not, or what glove type to use, check with a superior.

### B 2: Hazard Communication (HazCom)

#### Policy

The OSHA Hazard Communication Standard is also known as the RIGHT TO KNOW LAW. It was designed to reduce the number of injuries and illnesses from chemicals. By law, all employees have the right to know about the chemicals, gases, and compounds that may cause injury or illness at the worksite.

The Hazard Communication Standard required that manufacturers and distributors of chemical, gases, and compounds provide their customers with detailed information as to the potential health and safety hazards of their product

when used in manufacturing or the contracting environment. This information is always available and provided through the Material Safety Data Sheets (M.S.D.S.) and product labels.

In tandem with this law, Precision Concrete Pumping Services would like to make sure all employees are knowledgeable in their surroundings. This would help those working at sites make more informed decisions for their safety and reduce the likelihood of injury or illness.

#### M.S.D.S. (Material Safety Data Sheet)

The MSDS (as described above) is a form that provides information to employees about the chemicals, gases, and compounds they may be dealing with. It is in the shop at the offices and always available for review. By law, the MSDS must contain:

- The identity of the chemical: The manufacturer's name and address and/or the supplier's information, emergency phone number and date prepared.
- Hazardous ingredients: Worker exposure limits to the chemical and other limits.
- Physical and chemical characteristics of the chemical:
  - o Boiling Point
  - Vapor Pressure
  - Vapor Density
  - o Melting Point
  - o Evaporation Rate
  - o Water Solubility
  - o Reactivity
  - o Appearance and Odor under normal conditions
- Known acute and chronic health effects and related health information
- Physical hazards such as flammability and explosive potential along with ways to combat those hazards
- Exposure limits
- Whether the chemical is a known carcinogen
- Precautionary measures for how to handle the chemical
- Emergency and first aid procedures in the event of an accident
- Control measure and how to prevent the escalation of an accident

#### Warning Labels

Each container of hazardous chemicals on a jobsite will have a warning label on it containing the following information:

- Identity of the hazard: The common, chemical, and/or product name.
- Appropriate hazard warning or physical hazard: Risks associated with improper handling, such as flammability, combustibility, explosive, high pressure gas, level of reactivity.
- Health hazard: If there is a risk of overexposure, the risk will be provided. Any known potential harm that can come from handling the chemical.
- Storage and handling instructions: While not required, frequently, suggested means of transportation and storage to protect the handler is listed.
- List of basic protective clothing, equipment, and procedures: Also, not required, but many companies list suggested means of handling and using the chemical while protecting the user
- Emergency First Aid: In the event of an emergency pertaining to this chemical, follow the instructions to provide proper first aid treatment to limit injuries.

#### Color/Number Labels

Two of the most common methods of identifying hazards are the color-bar system and the NFPA (National Fire Protection Association) system.

In both systems, each color has a different hazard associated with it.

• BLUE = health hazard

- RED = fire hazard
- YELLOW = reactive hazard
- WHITE (color-bar) = protective equipment required
- WHITE (NFPA) = special hazard; also, in addition to one or more of the following identifiers
  - OX = Oxidizer
  - $\circ$  ACID = Acid
  - o ALK = Alkali
  - COR = Corrosive
  - o A radioactive symbol is radioactive
  - o Nothing noted means to use no water

In both systems, numbers are used to show the degree of hazard in an uncontrolled situation.

- $0 = \min \max hazard$
- 1 = slight hazard
- 2 = moderate hazard
- 3 = serious hazard
- 4 = severe hazard

#### General Guidelines in Hazcom:

- Be aware of all hazardous chemicals being used on site.
- Know where the MSDS is located, along with the hazardous materials list.
- Employees should not work with any chemicals they are not familiar with.
- Be knowledgeable of appropriate work practices, emergencies procedures, and personal protective equipment when working with chemicals.
- Employees should be willing to share what they learn with other employees and superiors.
- Always notify a superior if you bring a hazardous material onto a work site.
- All personnel should maintain the integrity of labels on the worksite.
- Recognize and utilize labels and MSDS sheets.
- Read the labels and follow the instructions and warnings on the MSDS sheets.
- Assemble the protective clothing and equipment you'll need for the job. Inspect it for rips, tears, and make sure it's a good fit.
- Remove flammable objects and any other risks from areas you are working with hazardous materials.
- Remove food and street clothing from the work area to prevent contamination.
- Know where the emergency numbers are posted.
- Know where all nearby first aid kits and eyewash stations are located.
- Make sure the proper fire protection equipment is nearby before using any potentially flammable chemicals.
- Know whom to contact and what to do in an emergency.
- Always make sure someone knows where you are and what you're doing at all times.
- Remember, each job is different, always make sure the correct protective equipment is prepared for that job.
- Always follow pertinent company and MSDS safety procedures.

### B 3: Material Handling

#### By Hand

- Know the weight of any object to be handled. If it is too heavy or bulky, get help.
- Establish a firm footing, keep your back straight, and lift with your legs. Lift gradually, and do not jerk or twist.
- Reverse the motion when setting objects down.

• When placing beneath a raised load, be sure that the object beneath has the capacity to withstand the weight of the load safely. Additionally, ensure that the load is not released until all employees have cleared safely away.

#### Storage

- Store materials so as not to block exists, aisles, and passageways and access to fire extinguishers and electric panels.
- Materials should be secured when stored in tiers to prevent sliding, falling, or collapsing.
- Materials stored inside should be kept at least six feet away from any hoist way or storage area and at least ten feet away from an exterior wall that does not extend above the materials stored.
- Bags and bundles should be stacked by stepping back the layers and cross keying the bags at least every ten feet.
- Drums, barrels, and kegs should be stacked symmetrically. If stacked on their sides, be sure that the bottom tier is blocked to prevent rolling. If stacked on their faces, put a firm, flat, surface between each tier.

#### **Mechanical Equipment**

- Both at the shop and on the jobsites, a variety of types and sizes of mechanical equipment, including pump trucks, may be used by qualified employees. Those that use the equipment should always be aware of their surroundings and be mindful of those who may not be able to see them.
- When working around heavy machinery, employees must:
  - 0 Never walk under suspended loads
  - o Never walk in front of or behind moving heavy equipment
  - Always wear a hard hat and proper footwear
  - Be aware of nearby ignitable or flammable materials
- When using smaller equipment, employees should:
  - Be sure of all machine guards in place
  - o Never surpass recommended speeds without permission from their superior
  - o Only use equipment for their designed purpose
  - o Keep loose clothing away from moving parts
  - Use only non-sparking tools and be sure to ground equipment and containers in a non-flammable atmosphere
  - Check fluid levels before using and periodically during use
  - 0 Never add fuel to a running machine

### B 4: Ladders & Stairways

#### General

A stairway or ladder should be provided at all points of access where there is a change in elevation of 19" or more and no ramp, runway, sloped embankment, or personal hoist is provided.

#### Stairways

- 1. Stairways should be kept free of hazardous projections such as nails and screws.
- 2. Slippery conditions on stairways should be eliminated before the stairways are used.
- 3. Stairways greater than 30" high or with four or more risers should be equipped with a handrail and a stair rail on unprotected sides or edges.
- 4. Stair rails, which also serve as handrails, should be between 36 and 37 inches high in line with the face of the riser at the forward edge of the tread and be capable of withstanding a 200-pound load. Also, handrails should have a minimum clearance of 3 inches between the wall and the handrails.
- 5. A platform should be provided wherever a door opens directly into a stairway. The platform should extend 20" beyond the swing of the door and be protected by a standard guardrail system. This includes doors to field offices and storage trailers.

#### Ladders

Ladders are placed into three categories: fixed, portable and job made. The following rules are for all ladders whereas the labeled rules are only for that specific type of ladder.

- 1. To help prevent slipping, the rungs and steps of metal ladders must be treated. Treatment can include corrugated, knurled, dimpled, or coated with skid-resistant material.
- 2. Ladder parts must be surfaced to prevent slinters or other injuries or snagging of clothing.
- 3. Ladders must always be free of oil, grease, and other slipping hazards.
- 4. Ladders must have nonconductive side rails if they are used where the worker or the ladder could contact energized electrical conductors or equipment.
- 5. Ladders with structural defects, such as broken or missing rungs, cleats, or steps, broken or split rails, corroded, components, or other faulty or defective components:
  - a. Must not be used
  - b. Must be immediately tagged 'DO NOT USE' or marked so they are clearly identified as defective.
  - c. Repairs must restore the ladder to its original condition before use.
- 6. Ladders must be inspected by a competent person for visible defects on a periodic basis and after any occurrence that could affect their safe use.

#### Ladder Use:

- Ladders should be erected using a 4:1 ratio. That means that for every four feet of working length of ladder, the base must be placed one foot from the vertical.
- Ladder rungs, cleats, and steps must be parallel, level, and uniformly positioned for use.
- Ladders must be placed on stable and level surfaces unless "tied off" to prevent accidental movement.
- A ladder must not be places on slippery surfaces unless it has slip-resistant feet or it is secured. However, slip-resistant feet cannot be used as a substitute for care in placing, lashing, or holding a ladder on a slippery surface. Both are better.
- Unless designed to do so, ladders must never be tied or fastened together to make them longer.
- The area around the top and bottom of ladders must be kept clear.
- Ladders must not be moved, shifted, or extended while someone is on it.
- While on a ladder, you must:
  - Face the ladder
  - Use at least one hand to grasp the ladder
  - Always have three contact points
  - Not carry any object or load that could cause you to lose balance and fall.
- Make sure ladders are free from ice, snow, mud, or other slippery materials before use
- Never use a ladder in a horizontal position as a platform or scaffold
- A double cleated ladder or two or more separate ladders should be provided if ladders are the only means of access or exit from a working area of 25 employees, or the ladder serves simultaneously two-way traffic.
- Wooden ladders should never be painted
- Metal ladders should never be used for electrical work
- Ladders should only be used for the purpose for which they were designed. Ladder rungs should not be used to support wooden planks or other work platforms.

#### **Fixed Ladders**

- Fixed ladders must have cages, wells, ladder safety devices, or self-retracting lifelines when the climb is less than 24 feet, but the top of the ladder is at a distance greater than 24 feet above lower levels.
- Where the total length of a climb equals or is greater than 24 feet, fixed ladders must have at least one of the following:
  - o Ladder safety devices
  - o Self-retracting lifelines, and rest platforms at intervals not exceeding 150 feet
  - A cage or well and multiple ladder sections, each ladder section not to exceed 50 feet in length. Ladder sections must be offset from adjacent sections and landing platforms must be provided at maximum intervals of 50 feet.

- Ladder safety devices and related support systems for fixed ladders must:
  - Permit you to ascend or descend without continually having to hold, push or pull any part of the device, leaving both hands open for climbing.
  - Be activated within two feet after a fall occurs.

#### Portable Ladders

- When portable ladders are used to get to an upper working level, they must be angled so the horizontal distance from the wall or top support to the foot of the ladder is approximately one-fourth the working length of the ladder.
  - The ladder side rails must extend at least three feet above the upper landing surface. If this is not possible because of the ladder's length, the ladder must be "tied off" at the top to a rigid support that will not bend.
- A grab rail at the top must be provided to help employees on and off the ladder.

#### Job-Made Ladders

- Job-made ladders must be constructed for their intended use. Cleats must be spaces between 10 and 14 inches apart and be uniform.
- Wood job-made ladders with spliced side rails must be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.

#### Step Ladders

- Do not use ladders in the folded position.
- Do not stand on the top step of a step ladder

### B 5: Elevated Platforms & Fall Protection

#### General

All employees will be protected from falling when working on a surface that has an unprotected side, edge, etc. **6 feet or more** above an adjacent lower level; when working from aerial lifts or other elevated work platforms; and when working above dangerous equipment.

Fall hazards will be evaluated by the Program Administrator to determine the best method to protect the employee. When selecting what type of fall protection to use, the Program Administrator will consider the hierarchy of hazard control, which organizes risk control techniques from most- to least-effective (examples are show below in order of decreasing effectiveness and preference).

- 1. Elimination of the fall hazard by bringing the work down to safe ground level.
- 2. Passive fall protection systems, such as guard rails, that do not require active participation by the worker
- 3. Fall restraint that prevents a person from reaching a fall hazard
- 4. Fall arrest that utilizes equipment to stop a fall after it occurs
- 5. Administrative controls such as work practices or procedures to signal or warn a worker to avoid approaching a potential fall hazard

#### Fall Hazards

<u>Leading Edges</u> - Each worker working on or near a leading edge **6 feet or more** above a lower level will be protected by guardrail systems, safety net systems or personal fall arrest systems.

<u>Wall Openings</u> - All wall openings 4 feet or more above an adjacent surface will be guarded. A rail, picket fence, half door or equivalent barrier will be placed across the wall opening. If the wall opening extends to the floor, a toe board at least four inches high shall be installed to prevent materials accidental falling from the edge.

All workers working on, at, above or near wall openings (including those with chutes attached), where the bottom edge of the wall opening is less than 39 inches above the walking /working surface, must be protected by a guardrail system, safety net system or personal fall arrest system.

Floor Openings - All floor holes two inches in diameter or more will be guarded by one of the following:

- A standard railing with toe board on all exposed sides
- A covering of sufficient strength and construction to handle the heaviest load that could be placed on it (*Note: While the cover is not in place, the floor hole must be constantly attended by someone or protected by a standard railing*)

<u>Excavations -</u> Excavations 6 feet or more deep shall be protected by a guardrail system, fence, or barricade when the excavation cannot be readily seen because of plant growth or another visual barrier. Workers at the edge of a well, pit, shaft, or similar excavation 6 feet or more deep will be protected from falling by a guardrail system, fence, barricade, or cover.

<u>Dangerous Equipment or Materials</u> - When working at any height above dangerous equipment or materials, each worker will be protected from falling into or onto the dangerous equipment or materials by a guardrail system, equipment guards, safety net system or personal fall arrest system.

<u>Loading docks</u> - Loading docks will be protected by a guardrail system. The guardrail will have removable sections to provide access for loading vehicles, but rails must remain in place when loading is not in progress.

<u>Skylights -</u> Skylights are considered an opening when present on a roof. A standard guardrail or skylight screens capable of supporting at least 200 pounds must be provided around the opening. Skylights constructed at least 42 inches above the roof deck with sides capable of supporting 200 pounds do not require additional protection.

<u>Aerial Lifts and Self-Powered Work Platforms -</u> Body harnesses must be worn with a lanyard, not to exceed 3 feet in length, or a self-retracting lifeline when working from all elevated mobile work platforms. The point of attachment must be the anchor point installed and designated by the equipment manufacturer. Personnel will not attach lanyards to adjacent poles, structures, or equipment while they are working from the aerial lift. Personnel will not move an aerial lift while the boom is in an elevated working position and the operator is inside the lift platform. Scissor lifts and telescoping lifts that can only move vertically do not require the use of a harness and lanyard as long as the work platform is protected by a proper guardrail system.

#### Fall Protection Systems

#### **Guardrail Systems**

After eliminating the elevated work, guardrails are the preferred method for the protection of fall hazards. Typical locations that require guardrails include floor openings, wall openings, open-sided floors, platforms, and runways.

All guardrail systems used by Precision Concrete Pumping, Inc. will meet the following criteria:

- Toprail is 42 inches, +/- 3 inches above the walking/working level.
- Midrail is located midway between the top rail and the walking/working level.
- Toprails and midrails will be constructed of materials at least one-quarter inch in thickness or diameter. If wire rope is used for toprails, it must be flagged with a high-visibility material at least every 6 feet and can have no more than 3" of deflection.
- The toprail must be capable of withstanding a force of 200 pounds when applied in any downward or outward direction.
- The midrail must withstand a force of 150 pounds applied in any downward or outward direction.
- Toeboards are required for all guardrails on elevated walking or working platforms where employees working below are exposed to falling objects.
- Toeboards must be 4 inches in height and must be securely fastened.
- The system will be smooth to prevent punctures, lacerations or snagging of clothing.

- The ends of the top rail should not overhang the terminal posts, except when such overhang does not present a projection hazard.
- When a hoisting area is needed, a chain, gate or removable guardrail section must be placed across the access opening when hoisting operations are not taking place.

#### Safety Nets

When safety nets are the appropriate option for fall protection, they will be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet below such level. Safety nets must meet the following criteria:

- Pass a 400-pound drop test or certified by employer or competent person before being used as a fall protection system, whenever relocated, after major repairs or at 6-month intervals if left in place
- Extend sufficiently from outer edge of the walking/working surface to catch a falling employee
- Have a maximum mesh size not exceed 6 inches by 6 inches
- Be inspected at least weekly for wear, deterioration, and damage
- All objects must be removed from net by the end of the shift
- Have a 5000 pounds minimum breaking strength of border rope
- Have an unobstructed fall area

#### Personal Fall Arrest Systems

If a fall occurs, the employee must not be able to freefall more than 6 feet, nor contact a lower level. To ensure this, the Program Administrator will add the height of the worker, the lanyard length, and an elongation length of 5.5 feet to determine the anchorage point. All personal fall arrest system components that are subjected to an impact load must be removed from service immediately. Personal fall arrest systems will be inspected prior to each use, and damaged or deteriorated components removed from service and destroyed.

There are three main components to a personal fall arrest system:

- Anchorage point
- Body harness
- Connecting devices

All personal fall arrest system components must meet the requirements of the ANSI Z359 Standards.

#### Anchorages

Secure anchor points are the most critical component when employees must use fall arrest equipment. Some Precision Concrete Pumping, Inc. buildings have existing identified anchor structures. Other work locations may require the installation of a temporary or permanent anchor.

All anchor points will be:

- Sound and capable of withstanding a 5000 lb. static load per employee attached and independent of any anchorage used to support or suspend platforms.
- Easily accessible by employees to avoid fall hazards during hook-up.
- Free of sharp edges that could reduce breaking strength when tying off. Chafing pads or abrasion-resistant straps must be used on any sharp-edged structures to prevent cutting of safety lanyards or lifelines.
- At the worker's shoulder level or higher to limit freefall to 6 feet or less and prevent contact with any lower level (except when using a self-retracting lifeline or 3-foot lanyard).
- Able to prevent or limit swing fall hazards. Horizontal lifelines will be used to keep the attachment point overhead and limit the fall vertically.
- Guardrails and hoists cannot be used as anchorage points.

In addition to all the criteria listed above, permanent anchor points will be inspected annually and re-certified to meet static load requirements. They will be visibly labeled as permanent anchors and all anchors must be immediately removed from service and re-certified if subjected to fall arrest forces.

#### Body Harness

- A full body harness is required. The use of body belts is prohibited.
- The only attachment point allowed on the body harness is the center D-ring on the harness back.
- Employees must always tie off at or above the D ring of the harness except when using lanyards 3 feet or less in length.
- Fall protection equipment will never be load tested.

#### Connecting Devices

- Allowable devices include rope or web lanyards, rope grabs or retractable lifelines.
- All snap hooks must be self-locking.
- Horizontal lifelines will be designed by a qualified person and installed in accordance with the design requirements.
- Lanyards and vertical lifelines must have a minimum breaking strength of 5,000 pounds.
- The length of a single lanyard will not exceed six feet.
- The use of steel lanyards is prohibited.
- A lanyard may not be clipped back to itself (e.g., around an anchor point) unless specifically designed to do so.
- If vertical lifelines are used, each employee must be attached to a separate lifeline.
- Lifelines must be protected against cuts and abrasion.

#### Warning Line Systems and Controlled Access Zones

Warning line systems and work in controlled access zones will be developed, based on the task, in accordance with OSHA regulation 1926.502 and must be approved by the Program Administrator before employees are exposed to fall hazards.

Control zone systems must comply with the following:

- Controlled access zones will be defined by a control line or other means that restricts access.
- Control lines will extend the entire length of the unprotected or leading edge and be approximately parallel to the unprotected or leading edge.
- Control lines must be connected on each side to a guardrail system or wall.
- Control lines may consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions.
- Control lines must be flagged or otherwise clearly marked at 6-foot intervals (maximum) with high-visibility material.
- Control lines must be rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches from the walking/working surface and the highest point is not more than 45 inches above the walking/working surface.
- Control lines must have a minimum breaking strength of 200 pounds.

#### Ladders

All ladders used by Precision Concrete Pumping, Inc. employees or contractors will meet the following requirements:

- Rated greater than the weight of the worker and any tools or equipment carried by the worker
- Appropriate ladder style for the job (i.e., step ladders will not be used in a folded position, step ladders will be tall enough to perform work without standing on the top step, extension ladders will extend a minimum of three feet above the discharge point, etc.)
- Metal ladders will not be used near electrical lines or sources
- All safety feet must be in place, secure and in sound condition

Ladders must be set up on a surface that is firm, flat and is not slippery. The top of extension ladders must be against a solid, fixed surface and extend at least three feet above the landing surface. Extension ladders will be set up using the 4-to-1 principal (base of the ladder placed at a distance from the wall that is equal to one fourth of the height that the ladder is extended). When employees are on extension ladders at heights of 20 feet or higher, either a second person must steady the ladder base, or the top of the ladder must be effectively tied off to a sound anchor point.

#### Scaffolds

Scaffolds are complex systems with multiple connection points, subject to several factors that could affect their stability and reliability. Precision Concrete Pumping, Inc. will use only a competent person/company who has received specific training to erect scaffolds.

#### Basic requirements:

- The working edge of the scaffold will be placed no more than 14 inches from the front of the building or structure.
- Platforms will extend over the end supports by at least 6 inches, and not more than 12 inches, unless cleated or restrained.
- All components that are supplied by the manufacturer will be used unless they are parts specifically designed for optional uses and are not being used at the time.
- All parts, including casters, pipes/poles, rails, toe boards, platforms, cams, locking pins and all connection devices must be inspected and found to be in good condition prior to each use.
- A workplace inspection will be conducted and documented prior and during the erection of the scaffolding, as well as prior to each use.
- Guardrails are to be placed between 36 and 45 inches high and placed at the open ends and sides of the platform and must be able to withstand a force of 200 pounds. Midrails will be placed halfway between the toprail and the toeboard. Toeboards must be in place where employees working below are exposed to falling objects.
- Cross bracing and railings should not be used as a means of climbing to or accessing the platform. Workers will only use the installed ladders.
- For mobile scaffolds, the caster wheels must be locked and all locking pins in place prior to use.
- Fall protection systems are required when employees erect and disassemble scaffolding.
- Hard hats are to be worn at all times while working on or around scaffolding.

#### Personal Fall Arrest System Inspection

Employees must visually inspect their entire personal fall arrest system prior to every use The inspection will follow the manufacturer's recommendations. Any damaged components must be removed from service immediately.

**Webbing -** The entire surface of webbing must be inspected for damage. Beginning at one end, bend the webbing in an inverted "U." Holding the body side of the belt toward you, grasp the belt with your hands six to eight inches apart. This surface tension makes the damaged fibers or cuts easier to see. Watch for frayed edges, broken fibers, pulled stitches, cuts, burns and chemical damage. Check the tongue for loose, distorted, or broken grommets. The webbing cannot have any additional punched holes.

**D-Rings/Back Pads -** D-rings will be checked for distortion, cracks, breaks, and rough or sharp edges. The D-ring should pivot freely. D-ring back pads should also be inspected for damage.

**Buckles -** Buckles will be inspected to identify any unusual wear, frayed, or cut fibers or distortion. Buckle tongues must be free of distortion in shape and motion. They should overlap the buckle frame and move freely back and forth in their socket. The roller should turn freely on the frame. Friction and mating buckles must be inspected to ensure the outer bars and center bars are straight. Pay special attention to corners and attachment points of the center bar.

**Snaps -** Must be inspected closely for hook-and-eye distortions, cracks, corrosion, or pitted surfaces. The keeper (latch) should seat into the nose without binding and should not be distorted or obstructed. The keeper spring should exert sufficient force to firmly close the keeper. Keeper locks must prevent the keeper from opening when the keeper closes.

**Thimbles -** The thimble must be firmly seated in the eye of the splice, and splice should have no loose or cut strands. The edges of the thimble must be free of sharp edges, distortion, or cracks.

**Web Lanyard -** Inspect the lanyard by bending the webbing over a curved surface, such as a pipe, observing each side of the webbed lanyard for any cuts or breaks. Examine the webbing for swelling, discoloration, cracks or burns. Check closely for any breaks in the stitching.

**Rope Lanyard** - Rotate the rope lanyard while inspecting from end to end. This will make any fuzzy, worn, broken, or cut fibers more apparent. The rope diameter should be uniform throughout, following a short break-in period. Weakened areas from extreme loads will appear as a noticeable change from the original diameter. Make sure the rope has no knots tied in it. Knots can reduce the strength of the rope by up to 60 percent.

**Shock-Absorbing Lanyard -** Shock-absorbing lanyards should be examined similarly to a web lanyard. However, also look for signs of deployment. If the lanyard shows signs of having been put under load (e.g., torn out stitching), remove it from service.

**Self-Retracting Lanyard/Lifeline -** The lanyard housing must be inspected to ensure that casing bolts are tight and that there are no loose fasteners, missing parts, cracks or excessive wear or corrosion. Webbing must be inspected for cuts, nicks, or tears as well as for any broken fibers, stitching or fraying. Steel lanyards will be inspected for cuts, fraying, broken wires, overall deterioration, and excessive wear. Check fittings for wear or cracks and obvious damage. Employees will follow manufacturer's recommendations for additional inspection tasks and for any requirements that the unit be sent in to the manufacturer for periodic inspection.

### B 6: Fire & Fire Extinguishers

#### There are four different types of fires:

Class A Fire: Normal combustible material, like wood or paper. Common open flames.

Class B Fire: Flammable liquids such as gasoline or oil.

Class C Fire: Electrical fires.

Class D Fire: Combustible metals.

#### Extinguishers

Most extinguishers should be aimed at the base of the first closest to you and work into the fire from toward the rear.

At least one fire extinguisher will be placed and properly mounted no more than 75 feet from any outside storage unit. In addition, at least one fire extinguisher will be mounted on each vehicle used for transportation of flammable liquids.

#### Other

- Suitable fire extinguishing equipment shall be maintained in the immediate work area.
- Firewatchers shall be required whenever welding or cutting is performed in locations where a fire might develop.
- Cutting or welding shall not be performed unless the atmosphere is nonflammable and unless combustibles are removed from the area.
- All employees should know the location of fire extinguishers and how to operate them.
- Only approved containers and portable tanks should be used for the storage and handling of flammable and combustible liquids.
- Firefighting equipment should be obvious and easily noticeable in the event of an emergency.
- One fire extinguisher should be present for every 3,000 square feet of protected building area and the travel distance to the nearest extinguisher should never exceed 100'.

- Fire extinguishers should be easily accessible in the event of an emergency; no items should be placed in front of them.
- Fire extinguishers should be inspected on a regular basis.
- No more than 25 gallons of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. No more than 60 gallons of flammable liquid or 120 gallons of combustible liquid per storage cabinet.
- Flammable liquids must be kept in closed containers when not actively being used.
- Conspicuous and legible signs prohibiting smoking should be posted in service and refueling areas.

### B 7: Housekeeping Policy

- During the course of construction, alteration or repairs, form or scrap lumber with protruding nails and all other debris, shall be kept cleared from work areas, passageways, stairs, as well as in and around buildings or other structures.
- Combustible scrap and debris shall be removed at regular intervals during construction. Safe means shall be provided to facilitate such removal.
- Containers shall be provided for the collection and separation of waste, trash, oily and used rags, and other refuse. Containers used for garbage and another for oily, flammable, or hazardous wastes.
- Garbage and other waste shall be disposed of frequent and regular intervals. Good housekeeping practices shall be strictly adhered to daily. The worksite shall be kept clean and orderly.
- Good housekeeping practices shall be strictly adhered to daily. The worksite shall be kept clean and orderly.
- Boards with protruding nails shall not be left lying around. All nails will be withdrawn or hammered down.
- No one shall block access to exits or safety equipment.
- Materials should be kept in neat stockpiles for easy access and to prevent clutter.
- Lunch scraps and papers will not be left at the job site. Dispose of them properly.
- Stairways, ladders, ramps, scaffolds, platforms, walkways, jobsite trailers, and containers shall be kept clear of all obstructions.
- Keep cords, lines, welding leads, hoses, etc., off walkways and scaffold platforms to prevent tripping.
- Oil and grease spills or other liquids shall be removed at once or covered with an absorbent material until the cleanup can occur.
- Store and stack material until it can be properly cleaned up.
- Jobsite trailers will be kept clean and free of clutter.

**REMEMBER!** You are representing the company and you never know who may stop to check in on you. Always be ready to make a good first impression, and cleanliness is essential in doing so.

### B 8: Inspecting, Tying Down, and Securing Cargo

#### Pre-Trip

A driver is not permitted to operate a commercial motor vehicle, nor can a motor carrier require the driver to operate a commercial motor vehicle unless the following requirements are met. To be compliant, prior to transporting cargo you should always ensure that:

- The cargo you're transporting is properly distributed
- The cargo is adequately secured according to the regulations
- The vehicle's tailgate, tailboard, doors, tarp, spare tire, and other equipment used in its operation, and in the securement of the vehicle's cargo, are secured
- You must also ensure that neither the cargo, nor any other object, obscures your view ahead or to the right and left sides

- Cargo cannot interfere with the free movement of your arms or legs, prevent your free and ready access to accessories requires for emergencies, or
- Prevent the free and ready exit of any person from the vehicle from either the vehicle's cab or the driver's compartment

#### **50 Mile Inspection**

The driver then had responsibilities once the transporting of the cargo begins, including the requirement to:

- Inspect the cargo and the devices used to secure the cargo within the first 50 miles of beginning a trip or as soon as practicable
- As the result of this inspection, you must adjust the cargo and/or securement devices as necessary
- Add more securement devices when necessary
- And again, ensure that the cargo cannot shift or fall from the vehicle

#### Additional Re-Examination of Cargo

Following the 50-mile inspection, drivers must also perform a reexamination of the cargo and securement devices:

- Whenever the driver makes a change of duty status such as changing shifts or coming on or off duty, or
- After the vehicle has been driven for three hours or 150 miles, whichever comes first

#### **General Requirements**

Keeping public safety in mind, drivers and motor carriers must ensure that their cargo remains on or within their vehicle while in transport under all conditions, which can reasonably be expected to occur.

#### Prevention Against Loss of Load

To prevent against the loss of cargo, vehicles must be loaded and secured in a manner compliant with the FMCSA (Federal Motor Carrier Safety Administration) regulation to prevent the cargo from:

- Leaking
- Spilling
- Blowing
- Falling from the Vehicle

#### Prevention Against Shifting of Load

And, to prevent the shifting of cargo, cargo must be contained, immobilized, or secured in a manner complaint with the FMCSA regulation to prevent shifting upon or within the vehicle to such an extent that the vehicle's stability or maneuverability is adversely affected.

#### Performance Criteria

The device you use to secure your cargo must meet minimum performance standards. The performance standards established by FMCSA require securement devices and systems to be capable of withstanding the following three forces:

- 0.8 g deceleration in the forward direction
- 0.5 g acceleration in the rearward direction
- 0.5 g acceleration in the lateral direction

These forces represent the forces that cargo is subject to when the commercial motor vehicle transporting it is braking in forward or reverse, accelerating or turning.

Securement devices for cargo that is not fully contained within the structure of a vehicle must meet a stricter performance criteria. These securement devices must provide a downward force equivalent to at least 20 percent of the weight of the article of cargo.

#### Vehicle Structure Standards

All vehicle structures, systems, parts, and components used to secure cargo must be in proper working order.

The use of damaged, weakened, cut, or cracked components- conditions that will adversely impact the performance of such components- is prohibited.

#### Securement Device Standards

The following securement devices must not be damaged or defective in any way that would compromise the effectiveness of the overall securement system. These include:

- Dunnage or dunnage bags
- Chocks
- Cradles
- Shoring Bars
- Materials used for blocking, and
- Materials used for bracing

#### Tie Down Standards

- Tie downs must not contain knots
- If a tie down is repaired it must be done so compliant with the manufacturer's instructions,
- Each tie down must be attached and secured in a manner that prevents it from becoming loose, or from unfastening, opening, or releasing while the vehicle is in transit
- All tied owns and other components of a cargo securement system used to secure loads on a trailer equipped with rub rails, must be located inboard of the rub rails whenever practicable
- Edge protection must be used whenever a tiedown would be subject to abrasion or cutting at the point where it touches an article of tiedown
- The edge protection must resist abrasion, cutting and crushing

#### Working Load Limits

The Working Load Limit is the maximum load that may be applied to a component of a cargo securement system during normal service.

The Aggregate Working Load Limit is the summation of the Working Load Limits or restraining capacity of all the devices used to secure an article of cargo on a vehicle.

• This is determined by summing ½ of the Working Load Limit of Each associated connector or attachment mechanism used to secure a part of the article of cargo to the vehicle and ½ of the Working Load Limit for each end section of a tiedown that is attached to an anchor point.

The Aggregate Working Load Limit of any securement system used to secure an article or group of articles against movement must be at least <sup>1</sup>/<sub>2</sub> times the weight of the article or group of articles.

#### Determining the Minimum Number of Tiedowns Needed

FMSCA, based on accident data, has determined that most cargo-securement related accidents involve either an inadequate number of tiedown or the improper placement of tiedowns.

The minimum number of tiedowns required to safely secure an article or group of articles against movement depends on the length and weight of the articles being secured.

#### **One Tiedown Required**

• One tiedown is required for article five feet or less in length and 1,100 pounds or less in weight

#### **Two Tiedowns Required**

- Two tiedowns are required for articles five feet or less in length and more than 1,000 pounds in weight, or
- Two tiedowns are required for articles longer than five feet, but less or equal to ten feet in length irrespective of the weight
- Two tiedowns are also required if the article is longer than ten feet. There must be one additional tiedown for every ten feet of article length, or fraction thereof, beyond the first ten feet of length.

#### Note!

The tiedown requirements do not apply to vehicles transporting one or more articles of cargo such as, but not limited to, machinery or fabricated items such as steel or concrete beams, cranes, booms, girders, and trusses, which because of their design, size, shape, or weight must be fastened by special methods.

These articles must, however, be securely and adequately fastened to the vehicle.

### B 9: Maintenance Safety

#### Safety Rules Regarding Scheduled Maintenance

- Proper and timely maintenance is important to the safe operation of a concrete pump. The proper procedures are outlined in the operation manual supplied with the pump. Do not put if off. Do not treat it lightly. Do not fudge results. The lives of the operator, oiler, and workers on the job are depending on it.
- Keep the machine clean! Oil spills, grease, loose tools, and displaced accessories are hazards.
- Pins should be used on all delivery system clamps. Clamps that will hang over workers, and clams used on system that will be dragged shall be pinned.
- Be sure that you are installing the correct clamps for the types of pipe ends used. Never try to mate dissimilar pipes ends unless using a clamp specifically made for this purpose.
- When using new pipe and/or hose on the machine, be sure that it can handle the maximum concrete pressure of the pump
- If safety devices or guards or removed for servicing, they must be replaced before the machine is put back in service.
- Do not change the maximum relief valve setting on any hydraulic circuit without permission from the manufacturer. Never change an accumulator circuit pressure setting with specific instruction from the manufacturer.
- Never make unauthorized modifications to structural members or pressure circuits.
- You must replace, not repair damaged hydraulic or concrete hoses or pipes.
- Never try to repair a machine using worn, damaged, or defective components.
- Never allow welding current to travel through bearings or hydraulic cylinders. Keep the ground cable on the component that is being welded.
- Electronic components can be destroyed by welding current. Before welding on the unit, you must disconnect the battery cables, and unplug all radio remote control power wires. If in doubt, contact the Service Department of the manufacturer for instructions before proceeding.

#### Safety Rules When Servicing Machinery

- Repairs should be carried out by qualified workshop personnel only.
- Never work on a hot hydraulic system
- If you cannot work at the ground level, you must find and use a suitable work platform, a tie-off harness system, or otherwise secure yourself from falling
- If maintenance work requires that you use a crane, hoist, fork truck, or similar machine, read and understand the safety regulations for that equipment.

- Only operators should operate the unit. If work on the machine requires that it be operated and you are not qualified as an operator, you must get someone who is qualified to assist you.
- Repair work on electrical systems over 28 volts must be done by qualified electricians
- Be sure that you understand the potential danger of spring-loaded or compressed-gas components before you service them.
- If you will be working in a hidden area inside the machine, lock it out as follows.
  - With a gas or diesel engine, remove the ignition key and place a *Do Not Operate* sign on the controls. Carry the key with you.
  - With an electrically driven pump, lock out the main break and tag the controls.
- Never activate the system hydraulics without checking if another workman is in a hidden position. Always yell "clear" before starting the engine or electric motor and allow time for a response.
- Never work on a pressurized hydraulic system. Stop the engine or electric motor, relieve the accumulator circuit, and verify zero pressure on the gauge (if so equipped), and be sure that not hydraulic components are loaded, (i.e., outrigger supporting the unit) before you open the hydraulic system.
- Never use gasoline or diesel fuel as a cleaning solvent. This is critical to remember when using hydraulic oil reservoirs, because gas and diesel fuels are highly explosive, and traces left in the oil may ignite when compressed.
- Remember to mount and dismount the unit using the 3-point rule.
- Always use the correct tools for the job. Tools should be kept in clean and in good condition.
- If you see a coworker engaging in an unsafe practice, warn him about the dangers.
- After any repair is completed, test the function of the repaired part to be sure that repairs were done correctly.

### SECTION C: CONCRETE & MATERIAL PLACEMENT SAFETY GUIDELINES AND PROCEDURES

### C 1: General Concrete Pump Safety Guidelines

#### Pre-Job Checklist

- Safe operation and familiarization of concrete pumps and booms is most important before any person is to operate a concrete pump without supervision.
- Be on time and be prepared to work.
  - This is very important, as being late may cause an operator to hurry or take shortcuts in safety procedures
  - The safe operation is then extended to:
    - the pre-job inspection of the concrete pump before leaving the yard.
    - driving to the job site safely.
    - setting up and safely operating the concrete pump on site.
    - cleanup and driving back to the yard or on to the next pumping job.
    - The last part of a safe operation is checking and cleaning the pump to prepare for the next safe

#### Before Leaving the Yard

- Inspect delivery pipes, concrete delivery hoses, and end hoses for wear. Never use a hose or pipe that is dented or worn out. Know the maximum pressure that your machine can exert on the concrete, and be sure that the pipes, hoses, and clams can handle the pressure.
- If you will need to use compressed air to clean out the system pipeline, be sure that you have proper training, equipment, and attachments to do this procedure safely.
  - Proper attachments include:
    - A blowout head with properly sized air discharge regulator valve and separate water/ air inlet. The openings should be spaced apart far enough that a blowout ball could not cover both openings at once.
    - A go-devil, or a hard sponge ball. Regardless of which is used, it must fit into the pipeline tight enough that air cannot escape ahead of it.
    - A ball of go-devil catcher or ball when the line has been purged of all concrete, unless another method of controlling the outlet is used.
    - A hose that is rated for the pressure of the air compressor you will use and that is able to connect with both air compressor and the blowout head. The hose must be in good working condition and must be free of cracks, frays, tears, or damage. Do NOT improvise on this. Make sure you have the right part.
- Be sure that the unit is equipped with all the pipes, clamps, gaskets and hoses, blowout adapters, ball catchers, and other accessories that you will need for the day's work.
- On trailer-mounted units, check the oil and cooling system of the pump drive engine. Accidents could occur when lack of maintenance is causing a distraction while operating the equipment.
- Be sure the battery has enough charge to start the pump drive engine.
- If an unsafe condition exist, work must not begin until necessary repairs have been complete, or until the machine can be operated safely
- Inspect the tires and brakes of the truck.
- A D.O.T. pre-check inspection must be performed on all trucks equipped with air brakes. Drain moisture from the air tanks that supply the unit's brakes (if so equipped).
- Mount or dismount the pump or truck using the 3-point Rule (i.e., always keep two hands and one foot or one hand and two feet in contact with a secure surface)
- Be certain that all loose items on the unite are secured for travel before driving.

#### At the Job

- Check engine oil, hydraulic oil and radiator water, and yell "CLEAR" before starting engine.
- Inspect all safety covers, instruments, gauges, grates, tires, outriggers, etc. for safety and proper operation.

- A pump operator should verify proper cleanout equipment is available and verify proper number of safety slings, cables or chains is available for any system which can fall or drop.
- All clamps, if so designed, should be always pinned, including boom system.
- A general rule is: one safety sling for every item hanging from the boom, because a sling must be installed each suspended piece of system. The anchor point for a safety sling should be the boom itself, not pipeline.
- Before operating any piece of concrete pumping equipment, the operator should read and understand the manufacturer's operating manual.
- It is important for a pump operator to know who will be giving the directions for the movement of the boom. Therefore, you must determine who this person is. Only ONE PERSON is to give direction to the pump operator.

#### Water-Box Safety

• To prevent serious injury, never reach into the valve or the water box. The water box covers must be in place when the machine is in operation. When removed, the transmission must be out of gear and the accumulator bled to zero pressure.

### C 2: Technical Pump Tips

#### Knowing and Monitoring the Mix You are Pumping

- When pumping, the maximum size of the coarse aggregate is limited to one-third of the smallest inside diameter of the pump or placing line. For example, 1-1/2 inch aggregate would require a minimum placing line diameter of 4-1/2 inches.
- The properties of the fine aggregate or sand are more important in the proportioning of pumpable mixes than are those of the coarse aggregate. If the sand is overly coarse, it will make a normally pumpable mix design difficult to pump while fine sand will make coarse mixes pumpable.
- The fineness modulus of sand meeting ASTM C 33 gradation specifications will fall between 2.30 and 3.10 with the median being 2.70. The higher the fineness modulus, the coarser the sand. Pumpability of mixtures is generally improved with a decrease in the fineness modulus, or in other words, with the use of finer sands. However, sands having a fineness modulus between 2.40 and 3.00 are generally satisfactory. Sands with a fineness modulus more than 3.00 are difficult to pump.
- Lightweight coarse aggregate for pumping must be pre-soaked in stockpiles or bunkers prior to use. Generally, a minimum of three to five days of sprinkling is recommended. It is important to turn the stockpile during soaking to insure uniform and complete saturation.
- Reducers and bends in the placing line, such as elbows or hoses, create turbulence inside the line. A well-graded mix with the proper mortar (cement paste) will move easily through the pipeline, while a lean or poorly graded mix may not. A reducer is usually the first place to look when a plug occurs. (Remember: Always relieve pressure in the placing line by pumping a few strokes in reverse before opening a coupling.)
- Tests by the National Ready Mixed Concrete Association have determined that entrained air can be lost when concrete is allowed to slide down the five-inch diameter pipeline of long truck booms under its own weight. To prevent air loss when pumping, it is advisable to prevent the concrete from "free falling" by keeping the tip section level, by adding a smaller diameter discharge hose or laying a discharge hose on the deck. When testing labs take samples, the tester should get the sample from the normally placed concrete. They should not stop the pump and place a small quantity dropped from the boom into a wheelbarrow. Concrete must not be allowed to free fall into the tester's container.
- Both steel fiber and synthetic fiber reinforced concrete can be pumped.
- Concrete mixes often contain a variety of admixtures. Any admixture that improves the workability, generally will improve the pumpability. Some of these admixtures are water-reducing admixtures. Most water-reducing admixtures will improve the pumpability of the mix if sufficient free water remains. High-range water reducers (super-plasticizers) increase the slump dramatically and improve the pumpability, especially on high-rise jobs, lightweight jobs, or long-distance pushes. However, remember super-plasticizers are only effective for a limited time. Once the time has run out, the concrete returns to the state it would have been had the super-plasticizers not been added. At that time, the slump may drop rapidly.
- Another common admixture is air entrainment. Air entrainment is added to concrete to keep the concrete from breaking down and spalling during freeze/thaw cycles, so it is more common in harsh-winter regions. Air entrainment up to six percent will generally make the mix more pumpable. However, low slump mixes with high air content (above eight

percent), are difficult to pump. It could be compared to trying to push a beach ball through a hole. Air-entrained mixes are generally more plastic and more workable than non-air entrained mixes and less inclined to separate or bleed.

- Pumpers often want to add water to concrete to make it pump easier. Water should only be added by the contractor, or his designated representative. Excess water alters the mix design by increasing the water-cement ratio, which can lead to decreased strength and excessive shrinkage. Excess water can also cause segregation, which is the separation of the components of the concrete. Segregation can also be caused by dropping concrete which causes the lighter mortar and sand to separate from the rock.
- When priming, remember to pump the primer into the valve and placing line ahead of the concrete to keep the slurry from mixing with the concrete in the hopper. This could cause you to be short of primer resulting in a plug, and it could cause a problem if the primer is discharged into the forms. Use the prime port on the machine, if available.
- While modern concrete batch plants usually produce a consistent product, occasionally problems occur. It is possible that one component could be omitted or aggregate from certain areas of a stockpile could be different. Dramatic changes in pumping pressure from one load to another could signal a "problem" load. Sometimes a "problem" load can be blended with one or more loads, and therefore, not be wasted.
- The pump should be located as near the placing area as is possible and concrete placing should commence at the point most distant from the pump. This allows the entire placing line to be grouted before concrete placing begins.

#### Monitoring the Condition of Pump Equipment and Fluids

- The valve in a concrete pump must be kept in good repair. If the valve is allowed to wear excessively, mortar may be squeezed out of the mix causing plugs. Some valves require periodic adjustments to control the loss of mortar out of the valve.
- Badly worn piston heads in concrete cylinders can allow water from the water box to be admitted into the concrete, causing higher slumps and possibly separation and plugging, as well as lower concrete strengths.
- It is important to monitor the temperature of your hydraulic oil while pumping. If the oil gets hot, you should:
  - 1. Stop pumping.
  - 2. Check to see if your oil cooler is working. Some pumps have an override to turn on the cooler fan.
  - 3. Quickly attempt to locate the heat source, such as an outrigger valve or other valve left in the wrong position.
  - 4. Make certain the water box is full of water.
  - 5. Spray a mist of cool water over the hydraulic system and hydraulic oil tank.
  - 6. Slow down the pumping speed.

\* If you are consistently overheating you possibly are developing a problem with the concrete pump, such as worn piston rings or a low-pressure relief valve setting. You could be running the wrong grade of hydraulic oil. The problem should be corrected as soon as possible. Many of the gauges are in metric or European values.

Temperature in Celsius can be converted to Fahrenheit by the formula:

C = (F - 32) / 1.8 --or--  $F = (C \ge 1.8) + 32$ 

Take the Celsius reading, multiply by 1.8 and add 32.

EXAMPLE: 60-degree Celsius x 1.8 = 108 + 32 = 140 degrees Fahrenheit.

- Your machine's oil temperature should not exceed 180 degrees Fahrenheit or 82 degrees Celsius. If your oil temperature gauge is suspect or inoperative, you can get an idea of how hot the oil is by carefully touching the oil tank. If you can hold your hand on the tank for five seconds, the oil is probably not too hot. If you must immediately remove your hand, the oil is too hot.
- Pressure is often given in bar. To convert bar to PSI, multiply by 14.5. For example, 100 bar = 1450 PSI. Remember, the pressure on the hydraulic system is not the pressure on the concrete. You would have to calculate the area of the hydraulic piston head, calculate the total force, and then divide that by the area of the concrete piston head. Most boom pumps have a piston face pressure from between 700 PSI and 1000 PSI. High-pressure trailer pumps can have piston face pressures of over 2000 PSI.

### C 3: Safety Hand Signals



- 1. Start Pump- Speed Up
- 2. Slow Pump down
- 3. Stop Pump
- 4. Little bit
- 5. Relieve Pressure- 2 taps
- Add water- 4 gallons
   All done- clean up
   Boom up
   Boom down
   Boom left

- 11. Boom right
- 12. Open or extend boom
- 13. Close or retract boom
- 14. Stop boom

### C 4: Concrete Burns

When working around fresh, wet concrete there is always the potential for concrete to come into direct contact with your skin and eyes. Contact of the skin with fresh concrete, mortar, or grout can lead to severe burns and are a hidden danger to anyone who works with, or around these materials.

#### Causes

- Abrasive sand contained in fresh concrete is abrasive to bare skin
- Basic and Portland cement is alkaline in nature, so wet, caustic concrete and other cement mixtures are strongly basic (pH of 12 to 13). Strong bases like strong acids are harmful, or caustic to skin
- Drying Portland cement is hygroscopic it absorbs water. In fact, Portland cement needs water to harden. It will draw water away from any material it contacts, including skin.
- The lime in concrete can cause serious burns.
- The combination of wetness, chemical corrosiveness and abrasiveness can result in Dermatitis.

#### Effects

- Burns or a minor rash may result caused by the lime in fresh concrete and prolonged contact can be quite severe including third degree burns.
- Irritant or contact dermatitis can result from the combination of wetness, chemical corrosiveness, and the abrasiveness of concrete. Allergic dermatitis can result when operators become sensitized to the chromium salts in cement or some other additives.
- Eye damage from chemical burns can be very serious causing the alkaline to gradually damage the inside of your eyelids or your eyes.

#### Protect Yourself

- Always wear appropriate Personal Protective Equipment (PPE). Especially proper eye wear. Concrete being pumped, dumped, or poured from the back of a concrete truck is subject to splattering.
- Wear waterproof gloves when handling or placing concrete.
- Avoid getting wet concrete inside your gloves or boots.
- Wear a long sleeve shirt and full-length pants.
- Wear rubber boots when standing in concrete.
- Clothing worn to protect from fresh concrete should not be allowed to become saturated with the moisture from the concrete because saturated clothing can transmit alkaline or hygroscopic effects to the skin.

#### First Aid

- The first few minutes after contact with an alkaline substance are the most important in managing the burn, once the alkaline penetrates the skin it progressively kills tissue even though you think nothing is there.
- If fresh concrete comes into contact with your skin immediately flush skin with cool, clean water seek medical advice is irritation persists.
- For deep burns or large affected skin areas, seek medical attention immediately.
- A recent study published in the official journal of the American Society of Plastic Surgeons (ASPS) by Dr S. Milner released in April 2003 shows that common "Household Vinegar" can minimize Alkaline Burn Injuries. The area should initially be cleansed with clean water and then apply the vinegar which helps neutralize the substance 15 minutes faster than water alone.
- In all cases of eye contact with chemicals, flood with cool, clean water for at least 15 minutes. Hold the head under the tap or pour water into the eye using a clean container and keep the eye open as widely as possible during flooding. Do not use an eye cup or bandage the eye and do not apply ointment, oils, or salves.

#### **Be Proactive!**

- Contact with wet (unhardened) concrete, mortar, cement, or cement mixtures can cause SKIN IRRITATION, SEVERE CHEMICAL BURNS (THIRD-DEGREE), or SERIOUS EYE DAMAGE.
- Frequent exposure may be associated with irritant and/or allergic contact dermatitis.
- Always wear the proper personal protection equipment when working with these materials.
- Seek immediate medical attention if you have persistent or severe discomfort.

### C 5: Double S-Bend Elbow (Ram's Horn)

Contractors may sometimes require or request the use a double-ended discharge hose and a double "S" shaped steel elbow when pouring concrete.



However, this device increases the potential for serious personal injury. Should the hose move laterally, or whip violently from the sudden release of trapped air, the double "S" elbow will have the mass and momentum to cause serious and even deadly injury to any person in its path. It is because of this potential danger that the ACPA does NOT recommend the use of either these devices or a double-ended discharge hose.

There are several alternative methods available that minimize the loss of entrained air in the concrete mix while pumping. These methods include (but are not limited to): boom configurations that minimize vertical drops (i.e., positioning the tip section horizontally), the use of a reducing end hose, the use of a steel reducer between the boom tip and the end hose, or using a double S elbow or Rams Horn at the end of the boom to which a single-ended discharge hose can be attached. These alternate methods are also effective, yet they do not pose a hazard to the workers.

### C 6: Clean Out Procedures

#### Plan Ahead

- Know where you need to clean out; and if you must move, survey the location using the same considerations you would if you were preparing for a pour.
- Anticipate the cleanout and get everything ready that you can.
- If you are required to clean out with air, make sure you have all the necessary accessories.
- Suck a sponge through the boom before folding up and moving to the cleanout area. The elements required for a hose-whipping incident are all in place when a sponge is sucked into a boom, so use extreme caution when pumping the ball out.

• Accidents could occur if the move is started before the boom and outriggers are secure, if you ignore safe procedures at the cleanout site because you are in a hurry, or if the delay of moving prevents the sponge from coming back.

#### Cleaning the Unit

- When you are cleaning the unit, watch for electrical wires if the boom must be moved.
- Suck a ball through the boom, if possible.
- If it is not possible, remember cleaning with water is safer than using air. If you use compressed air, you must be trained in the proper procedures.
- Never use air to blow through rubber hose or short sections of pipe under forty feet. Short sections of pipe will not have sufficient mass to allow the concrete to move slowly so there will be rapid expulsion of the material. In the case of rubber hoses, their flexibility will allow them to "whip" wildly with the force of the air and moving concrete.
- Never remove a clamp before all the pressure is removed from the pipeline. And never beat on a pipe with a hammer; it will dent, and the pipe will wear out at the dent.
- If there is limited water on the job, you can remove the pipe sections individually and rinse them with water. This method takes much less water. You will need help to get the pipe clean before it sets up so arrange for help before the pour is finished. However, this method is not recommended for long runs or vertical pipelines.
- A cubic foot of standard concrete weighs 150 pounds; a ten-foot section of five-inch pipe filled with concrete weighs 310 pounds—110 pounds for the pipe and 200 pounds for the concrete.
- To avoid a back injury always lift with your legs and not your back!

#### Cleaning a Separately Laid Pipeline

- When cleaning a separately laid pipeline, remember compressed air is dangerous and creates potential hazards. Serious injury or even death can occur if you do not adhere to specific safety points. Special accessories and special training are required. You must also have an adequately rated air compressor.
- Never try to remove a blockage with compressed air. Remember, the pump can produce over 1,200 PSI on the material while an air compressor generates only 150 PSI. So, if the pump can't push it, air never will. The primary difference is that air is compressible while concrete is not, which creates the potential for a very dangerous release of energy.

#### Cleaning with Compressed Air

- Cleaning with compressed air should only be done when no other method is practical and then only under the supervision of a qualified person.
- This procedure requires two trained persons; one trained person to administer the air and another on the opposite end to monitor the discharge point.
- No hoses or unsecured pipe bends may be connected to the pipeline when blowing out—this is deadly serious.
- From the time you're ready to turn on the air until all air is removed from the pipeline, the discharge area must be clear of all personnel. Do not allow anyone to enter the area for any reason.

#### The Outlet must be controlled when blowing out with air.

- The discharge end must be routed to a safe location such as inside a ready-mix drum or a crane bucket. A catch basket should be used when possible, and the end should always be properly secured. Select the correct catch basket for your method.
- With catcher type one, the go-devil stops, but air is still trapped behind it. The advantage is prevention of the sometimes-violent expulsion of air at the end of the pipe. The disadvantage is the air must be drained from the blowout head before the pipeline is safe to open. The pipeline must be controlled; allow no one to open it until all compressed air is relieved as it could cause serious injury.
- Catcher type two is long enough that the compressed air escapes behind the go-devil so when the plug reaches the end, all the air is expelled from the pipeline. The advantage of this type is once the go-devil is expelled, there is no pressurized air remaining in the line, and the line may be opened immediately. The disadvantage is the turbulent expulsion itself.

- You should always cover the discharge with reinforced poly or other durable protective blankets or shields and keep all personnel a safe distance away due to the potential for flying concrete and aggregate. Both types of catchers can be safely used if care is given to the hazards involved.
- Both the catch basket and outlet must be elevated enough so they will be clear of the concrete discharge pile when you are done.
- The air blowout head must have an air regulator valve for air inlet as well as one for air discharge.
- The two openings must be far enough apart that if the ball were to move backward, it couldn't block them both at once.
- Make sure no one disassembles the pipeline until the air is out and pressure has been relieved. This is extremely dangerous.
- Do not blow out short sections of pipe less than forty feet.
- When you are blowing out the pipe, you will see the air pressure begin to fall; this means the concrete is accelerating. Shut off the air as soon as the pressure begins to drop and bleed air from the pipeline to slow down the ball and/or plug as it is discharged.

#### **Cleaning a Vertical Pipeline**

- When cleaning a vertical pipeline, you must observe the same rules for cleaning a horizontal pipeline, plus a shut-off valve must be used at the bottom of the vertical run.
- Why is a shut-off valve needed? If the pipe is disconnected from the pump before the ball and cleanout head are installed, gravity forces much of the concrete out of the vertical sections resulting in pockets of air. When the ball is inserted and air pressure is introduced, the air pockets trapped in the pipe will compress. This is an extreme safety hazard because the air cannot be captured by the ball catcher and expulsion can be excessive. In addition, segregation may occur and cause a rock jam.
- Here is the procedure for cleaning out a vertical pipeline:
- First, close the shut-off valve so the concrete will not be allowed to free fall (A). At the top of the line, insert the ball and secure the blowout head, but do not turn on the air yet (B).
- At the bottom end (C), disconnect the pump, unless using a diversion valve; divert the building line to the discharge locations such as the ready-mix drum or wherever you are going to put the concrete from the line (D).
- Install the ball catcher and lubricate the discharge line (E). In some cases, you may have a diversion valve, while in others you may simply be attaching a goose-neck pipe to the existing line.
- After you have routed and secured the discharge line from moving, clear the discharge area of personnel (F).
- Open the shut-off valve and allow gravity to start the concrete flowing (G).
- Turn on the air using only enough to keep the concrete moving at a steady pace (H).
- As soon as the concrete begins to accelerate in the pipeline (indicated by falling pressure), turn off the air and begin to bleed off the air pressure.

#### <u>Summary</u>

- Cleanout with compressed air requires two trained people and will get easier with experience.
- Cleanout can be one of the most hazardous jobs of a pump operator so you should never take it for granted, and always assume no one else knows the safety rules.

### C 7: Cleaning Concrete Valve, Hopper, and Water Box

#### **Concrete Valve and Hopper**

- Wear protective clothing and equipment when cleaning the concrete pump because the lime in concrete can burn your skin. Protect against concrete buns and concrete poisoning by wearing rubber boots and gloves during cleanout and during any other time that you will be in contact with concrete.
- Crushing and amputation hazard! Never put your hands or any other body part into the concrete valve. Instead, use water jet and the supplied rake.

- Never put your hands or any other part into the machine when the hydraulic system is operational. If you must remove the grate to chip at hardened concrete, you must first disable the system by taking the transmission out of gear and locking the cab door, or stopping the engine, relieving pressure in the accumulator circuit (if so equipped), and securing the controls against unintended operation. Reinstall the grate before restarting the engine.
- Never put a bar or other solid tool into the hopper, water box, or other working system while the hydraulics are operational.

#### Water Box

- Stop the concrete pump before removing the water box covers. If your unit has bolt-down guards, do not remove them from cleaning. If there is not a bolt-down guard over the water box, then stop the pump and activate the emergency stop (E-stop) so the pump cannot be restarted until you are finished cleaning and the covers are back in place. If a bolt-down grate is installed, you may simply stop the pump from stroking before removing the water box covers. Replace the covers before restarting the pump.
- Be sure of your footing when cleaning the water box.
- Do not remove the water box guards for cleaning. Clean the water box with water jets only. Do not put your hands or any other body part into the water box for cleaning or at any other time when the hydraulic system is operational.

### C 8: Environmental Conditions that Affect Safety

#### **Pumping Near Power Lines**

- You MUST maintain 20 feet clearance from any power line carrying up to 350,000 volts and maintain 50 feet of clearance for any power line carrying more than 350,000 volts. When working around wooden or concrete power line poles like the ones shown in Example A, maintain 20 feet of clearance.
- If the wires are mounted to a steel pole, such as the ones in Example B, maintain 50 feet of clearance. This distance accounts for high humidity, wind, lapses, poor vision, and equipment malfunctions.
- If electricity enters your boom from contact OR arcing, you were too close and you were breaking the law.
- When power lines are in the boom movement area of a pour, you must use a spotter whose only job is to warn you if the boom approaches the danger zone —which is either 20 feet or 50 feet of distance as described above.
- You need to make sure the spotter fully understands the responsibility and can judge distance. You might help him judge distance with some visual aids such as flags or cones placed beneath the wires. Position the spotter below the beginning of the danger zone so the closing gap can be easily seen.
- Do not allow yourself to be coerced into pumping without a spotter when power lines are within the danger zone. It is the policy of the ACPA that if power lines are within 20 feet (50 feet above 350kV) of the area to be poured, a spotter MUST be employed whose only job is to observe the movements of the boom and warn the operator if the boom approaches the danger zone. The spotter must understand his responsibilities and be able to judge 20 or 50 feet.
- If no spotter is available, the operator should not use the boom and contact his or her office for further instructions.
- You must know how to disable your boom in the event of an emergency; for an example, use an E-stop. If that doesn't work, another method is to disengage the PTO; however, if the boom is moving towards the power lines you must get everyone away from the pump, ready mixed truck, and tip hose; and do not attempt to get into the cab or approach the pump.
- Never boom over wires even if it's possible to maintain the 20 feet of safety clearance. If your boom fails while you are over the power lines, or if a holding valve starts leaking, or if you'd have a tipping incident, there's no control and the boom will fall into the energized line.
- If you are close enough to high-voltage wires that an OSHA inspector takes notice, you are too close. If you break these rules, he can read you your rights and haul you to jail.
- If your unit becomes energized, anything that is touching the unit will also be energized. Many times, the operator is on a radio remote with no connection to the unit, so it is usually not the operator who is injured or killed; it is the co-workers around the pump. Electricity will arc off the wire—but not very far—only zero point four inches per 1,000 volts. After the arc has formed, however; it may be drawn out on the superheated, ionized air for quite a distance. If you injure or kill someone, you simply got too close and had been breaking the law.

- The insulation of the remote cable is good for up to 600 volts, but the cable is energized to 8,000 volts. At that voltage, the insulation is ineffective, so the cable acts as a path to ground.
- Until the pump and all system are de-energized, anyone who touches it or gets too close will be injured or killed there's no limit. You should also be aware power lines may sometimes de-energize and then reset through the action of a self-resetting fuse!

#### Setting Up Around Power Lines

- Whenever possible, choose a location where power lines will not be a concern. Finding that impossible, here are the safety rules for setting up your unit when electrical wires are present.
- Avoid locations where wires are within the radius of the boom, but not directly over the pour. This situation leads to deaths every year because when the wires are away from the pour, the operator and everyone else on the job will tend to forget, and then the operator inadvertently moves the boom into them.
- Stay alert and remember where the power lines are NEVER let down your guard.
- Be especially careful in the dark.
- Do not rely upon depth perception when working around the power lines. In multiple studies, the limit of human depth perception regarding wires has been established at about 25 feet. All booms are longer than 25 feet. Brighter objects are perceived by the human eye as closer than darker objects, which can distort your ability to judge distance. Using visual references such as cones or flags can help remind you where the danger zone begins.

#### What to Do if You Contact Power Lines

- In the unfortunate event you contact the wires, remain calm. Now it becomes critical to think about how to get out of the situation without injury.
- If possible, use the remote to move the boom out of the wires, but NEVER get off the machine to get a wired remote, which would be electrically connected to the pump and NEVER get on an energized machine to get anything including the remote.
- If you are not on the truck or pump unit, DO NOT touch anything connected to the truck or pump. It is possible that the electrical and hydraulic systems will no longer function, meaning the boom cannot be moved from the wires. In that case, call for help if you have a cell phone, or yell for assistance from others nearby. Do NOT let them touch the pump or anything connected to the pump. If you are on the pump and it's not on fire, you are in no immediate danger.
- If you are on the pump and it starts to burn, you will have to get off. Jump clear with your hands at your sides and your feet together.
- Once you are on the ground, get away from the unit by hopping (with your feet together) or shuffling your feet.
- The reason for this is the high voltage is entering the ground through the outrigger legs; if you take a large step away from the outrigger, you can change the voltage between your feet. This is called residual voltage. If you separate your feet far enough, it will give you enough of a jolt to knock you down.

#### Working Near Traffic or Nighttime Construction Requirements

- If in or near traffic, a working employee must wear an orange safety vest and hard-hat.
- If we are performing night construction, you must have reflective tape on each side of your hard-hat and must wear a reflective vest.

#### **Railroad Safety:**

- When working around railroad tracks and train stations, you must be properly trained in the hazards involved in working on or near tracks over which trains move.
- The rules and work practices that you must follow to help you avoid these hazards.
- The rules requires by the governing owner of the tracks are the law and a condition of our authorization to work on their property.
- The two biggest dangers involved with working on or near railroads/tracks are:
  - o Moving trains, and

- o Electric power lines
- You must expect movement at any time on any track in any direction.
- You must not rely on others to notify you of the approach of a train.
- Do not cross, step on, sit on or foul tracks.
- If you must be on the tracks working, face the flow of traffic and look behind you often. Always be ready to clear the tracks.
- Always stay at least 10 feet away from a train, when required to pass in front of or behind it.
- Your clothing must fit well and not be so loose that it would be easily snagged or become a safety danger.
- You must proper work shoes (at least 6" high), preferably leather, and completely laced, bucked, zipped, or otherwise fastened. The sole must have a definite heel.
- Hard hat, safety glasses with side shields and a florescent orange vest must be worn at all times.
- Do not place materials or equipment within 25 feet of the centerline of the outside track. A 25-foot foul line must be established before starting work.
- All electrical lines near the railroad are very dangerous and should be considered energized.
- If you must work within 15 feet of electric lines, you must make certain that the lines are de-energized and properly grounded.
- You should use the buddy system when working near or around railroad tracks.

### C 9: Setting of Outriggers

Tipping accidents have occurred because of:

- Inadequate cribbing
- Misjudging the soil
- Soil not compacted
- Setting up too close to excavations or backfilled areas
- Hidden voids
- Wash outs
- Natural or man-made voids

Setting the outriggers of a concrete pump with placing boom is one of the most critical jobs of the concrete pump operator and should always be done in accordance with the manufacturer's recommended procedure. If not done properly, it can lead to a serious accident.

#### Setting Outriggers

- When arriving at the jobsite, always check-in with the contractor. Talk with the superintendent or foreman regarding where to set up safely. The contractor needs to supply a safe set-up area where the soil can support the outriggers and there are no voids, pipes, or other hidden dangers.
- Always use the factory-supplied cribbing pads or more, no matter what the surface, even if it is on concrete.
- If jobsite conditions do not allow full extension of all outriggers and you are required to short rig, be sure that you understand all the rules. If you do not understand the rules, do not set up!
- When laying cribbing, spread the load. Use as practical, especially on the side that will feel the weight of the boom.
- Walk around the unit and center the outrigger pads and cribbing directly under each outrigger foot pad.

#### Do's and Don'ts of Outrigger Stabilization

- Do not set the outrigger on uneven soil. If necessary, reposition the unit or level the soil.
- Do not set the outrigger on a hill. The force of the machine weight must be transmitted straight down. If you were to set up as shown in this example, the outrigger load would be partially down and partially sideways, putting undue strain on the outrigger leg.
- Do not bridge a hole with outrigger cribbing. If there is no soil contact over the hole, the pressure on the ends of the pad is much greater. The soil could give way, or the cribbing could break.

- If you determine that you need five pieces of cribbing to support the load, but the foot only touches three of them, the outrigger will sink into the soil. To avoid this problem, lay dunnage the opposite direction on top of the first layer. The top layer of dunnage must contact all pieces that are supporting it.
- When jacking, put the full weight of the truck on each outrigger, one at a time, and if the pad starts to sink, retract the foot and supply more cribbing. Continue this process until the outrigger appears stable and the pad shows no sign of sinking. Only then are you ready to unfold the boom.
- If you are unable to get the outriggers to stabilize, do not unfold the boom. Relocate the pump to a location that will support the weight of the outriggers.

#### Watch for Warnings

- As you unfold the boom, always test the stability of the unit. Slowly slew the extended boom over each outrigger. If you see that an outrigger is sinking into the soil, immediately slew the boom back to the position it came from and fold it up.
- Adjust the amount of dunnage under the cribbing pads until you have enough soil contact to hold the unit without sinking. Repeat the procedure for each outrigger. Stability of the unit must be ensured.
- While pumping, continue checking the outriggers throughout the day to be sure they are not sinking.
- Other warning signs to watch for during your initial set-up include:
  - Very green grass in a circular shape
  - Pipes sticking out of the ground
  - Signs of excavation
  - Sprinkler heads
  - Backfilled ditches
  - Ditches with water in the bottom

#### Get As Much Cribbing as You Need

- Safety and stability of the pump is everyone's concern. Most people will be happy to provide you with whatever you need especially if they know their own safety is at stake.
- Wood dunnage is very common and works well for well compacted, flat soil.
- If you are on soft soil or near the edge of an excavation, it may be necessary to ask for a large, flat, steel plate to help distribute the weight.

#### **Retracting Outriggers**

- An outrigger may suddenly jump when weight is removed, because the center of gravity on the truck has shifted.
- Never stand behind the outrigger or between it and another fixed object when it is being retracted.
- Clear the outrigger area of personnel before retracting outriggers.
- Partial extension of telescoping outriggers is not acceptable at any time. Jacking the outriggers while they are in any position other than fully extended or fully retracted could cause structural damage to the outrigger outer box and/or the inner box.
- Remember that the boom must never be extended over a retracted outrigger.

#### **Excavations and Cliffs**

- If set-up will be done near an excavation, the one- to-one rule must be applied. The outrigger force emits pressure as a 45° cone below the surface, so it is very important to be aware of washouts at the base of an embankment. Engineered support walls can be treated differently than excavations, and the operator may follow the advice of the contractor or engineer on the job if he believes the advice to be sound.
- **NOTE!** Measurement for the one-to-one rule shall be made from the edge of the outrigger pad nearest the excavation, and the distance from the edge should be increased if soil conditions appear unstable, if the jobsite authorities indicate the soil conditions are unstable, or if the manufacturer's recommendation is more restrictive.

#### Hidden Voids

• There is no way an operator can tell if he is setting up over a hidden void. Some voids, like septic systems, may have a pipe protruding from the ground. Sprinkler heads would give some indication that there might be buried hazards. But some voids, like a buried box, leave no clues for even the safest-minded operator. His only chance is spreading the load.

#### Inadequate cribbing

- The formula for determining the load imposed on the soil is to divide the total outrigger force (pounds) by area of soil contact (square inches).
  - Soil pressure = total outrigger force ÷ area of soil contact
- The following chart shows a few of the different soil types and their approximate load-bearing capacities:

Soil Type and Approx. Load-bearing Capacity:

Virgin ground	22 PSI
Asphalt	29 PSI
Compressed, crushed stone	36 PSI
Clay/silt soil, fırm	43 PSI
Mixed granular soil	51 PSI
Firm, compacted gravel	58 PSI
Brittle, weathered rock	145 PSI

#### Misjudging the soil

• Operators rarely have access to the compaction data of a jobsite and will generally have to make judgment calls. Because of this, they should make the cribbing base as large as is practical.

An example:

- The decal on a pump outrigger shows a maximum force of 32,600 pounds. The soil is firm, compacted gravel, which has an approximate load bearing capacity of 58 PSI. If an outrigger was placed on the manufacturer's supplied cribbing pad, which has 576 square inches of surface, it could technically support the unit.
   32,600 ÷ 576 = 56.59 PSI
- It is easy to misjudge the soil material or compaction, and the information is often not available. The best-case scenario would be to spread out the load considerably more than the 576 square inches by placing a larger base under the supplied pad. For example, ten 36" long 4x4's (1260 square inches) or a 4-foot x 8-foot (4608 square inches) sheet of strong material (like steel) would lower the outrigger pressure dramatically, reducing the chance of an outrigger sinking or dropping.
  - \*\*Operators are not expected to make calculations such the one shown above while on a jobsite. This information is given only to show that the ground has many different load bearing capacities, and boom trucks all impose a different force on the soil. The bottom line is this, the greater the force imposed on the soil, the larger the dunnage area must be.

#### Summary

#### Prevention

- Tip-over accidents can be avoided if people take precautions when the unit is set up.
- Both operators and contractors must be aware of the potential danger that exists when a large boom is unfolded and extended over outriggers.
- If the contractor remembers to offer additional cribbing and if the operator remembers to ask for it when it isn't offered, the problem can be minimized even before the boom is extended.

#### Cribbing: More or Less?

- More is better
- The stronger the material the better
- Pay close attention to the type of soil where you're setting up the unit

#### **Responsibilities**

#### Dispatcher

- The dispatcher can help by communicating with the contractor when he calls to order the pump, and:
  - Send the size pump that is needed, if available
  - If availability causes you to send a unit that is too big or too small, warn of possible complications
  - Ask about soil conditions or underground obstructions

#### Operator

- The operator is ultimately in charge and must make good decisions regarding set up including:
  - Use as much cribbing as practical, too much is better than too little
  - Watch for warning signs prior to set up
  - Watch for sinking outriggers while unfolding the boom, and continue to recheck them throughout the day
  - Keep people from under the book whenever practical

### C 10: Boom Pump Safety

Operating a truck-mounted boom concrete pump requires tremendous responsibility and having a clear strategy for each day's pour to provide for your own safety and that of your co-workers.

#### Safety Regulations - Mobile Concrete Pumps Equipped with Placing Boom:

Read the operation manual for the machine. It describes the safe, proper, and most efficient way to operate. Know your machine!

The following are some supplementary recommendations:

- 1. All safety devices and provisions against accidents, such as warning labels and information signs, etc. must be in place. Do not tamper with them. If they are missing, replace them.
- 2. Check the operational reliability of the machine each time before it is put into operation. Any serious defects found must be repaired immediately.
- 3. Allow the machine to be operated and maintained by qualified personnel only.
- 4. Make use of handles and steps when ascending or descending. Use the "THREE-POINT RULE".
- 5. Keep steps, platforms, control, and monitoring devices in good working condition as well as free from dirt, oil, snow, and ice.
- 6. Before leaving the machine, protect it from unauthorized use and unintentional movements.
- 7. Unauthorized presence in the immediate area of the concrete pump and the placing boom is NOT allowed. Warn persons who are in the immediate area. Stop work if person(s) do not leave the area after having been warned.

- 8. Wear personal protective clothing and equipment when operating the machine.
- 9. The placing boom may only be operated up to a maximum wind speed of 48 MPH (77KPH) wind force, or per manufacturer's instructions.
- 10. Under all circumstances, keep sufficiently away from obstacles such as: boom cranes, scaffold, buildings, etc.
- 11. The placing boom must NEVER be used as a crane for lifting objects or material repeat NEVER.
- 12. MAXIMUM PERMISSIBLE APPROACH TO POWER LINES IS 20 FEET (SIX METERS) (50 feet when the voltage exceeds 350kv). Electrocution is extremely hazardous and could lead to loss of life.
- 13. Only 1 (one) tip hose may be safely hung from the tip of any placing boom. The weight of the end of the hose must not exceed the weight specified in the operation manual of the manufacturer. The end hose MUST NOT be kinked during pumping operations. The safety cable or strap between the boom and the end hose must be in place, attached and in good condition. The anchor point for a safety sling should be the boom itself, not pipeline.
- 14. If the end hose is replaced with any combination of reducer, hose, or adapter (for example, a five-to-four reducer and a four-inch hose), then all hoses, reducers, etc. must be fastened with safety cables or straps and may not exceed the weight recommended by the manufacturer. All the above-mentioned items must be capable of handling the pumping pressures of the specific pump used. All snap clamps used to secure a placing line that will hang above workers must be locked with a pin.
- 15. The tip of a placing boom should never be connected to a pipeline without using an approved concrete delivery hose between them.
- 16. When pumping, the placing boom should never be tied down or placed on the deck.
- 17. If the placing boom starts to bounce, you should slow down the concrete pump, adjust the stroke limiter or adjust the throttle valves.
- 18. Perform all maintenance and lubrication of the boom at the manufacturer's prescribed intervals.
- 19. Using the manufacturer's recommendations, do a complete boom and tower inspection annually.
- Responsibility for a safe and successful day begins when the operator arrives at work on time, rested and with a clear head. One of the most important items for a safe workday is: **ALWAYS ARRIVE ON TIME** so that a proper equipment inspection can be performed. Before starting your engine, check all fluid levels, engine oil, hydraulic oil, coolant level, and if so equipped, power steering and hydraulic brake fluid. If the pump has a separate engine, also check fluid levels before starting. It is now possible to start your engines. While climbing into the cab, always remember the "THREE-POINT" RULE" Always have one hand and two feet, or two hands and one foot in contact with a secure step or handle. The three-point rule also applies to climbing on or off the pump deck or any other piece of equipment.
- Just prior to starting your engine yell "CLEAR" after assuring that no one is near or close to the engine being started.
- After starting the engine, feather the throttle but do not "rev" the engine, as this may cause permanent damage to a turbocharger or other components on the pump. Check that all onboard systems like oil and air pressures are reading normal and the electrical system is charging.
- After you are satisfied your power train is properly functioning, you should make certain the pump system is operational. Check with suggested procedures outlined in the operations manual of your pump for the details of pre-job check.
- While still in the yard, walk around the vehicle and check for loose wires, proper operation of lights and tire condition, even if you checked it the night before. Also check to make certain the concrete pump hydraulic oil, water and grease levels are all at proper capacity. Always check the outriggers to ensure they are properly pinned for travel.
- Check and restock all emergency spare parts, hoses, fittings, elbow, and pipes. Ensure all safety equipment is in place before leaving the yard. (Safety glasses, hard hats, fire extinguisher, road flares and first-aid kit.) Check all documentation:
  - 1. Current registration
  - 2. Insurance card
  - 3. Driver's license/health card
  - 4. Permits fuel/operation/overweight
  - 5. Business license

\*If anything is missing, or is not in order, report this to the supervisor immediately.

• If you have not done so already, make sure you have all necessary system, safety straps, clamps, reducers, and cleanout supplies on the pump. Do a mental inventory of what you may need to complete the job properly and effectively. Try to visualize the anticipated job conditions and any potential problems you may need to overcome. Always consult with the dispatcher and/or your supervisor for any information they may have on the job. It's better to be prepared than caught short. Always get proper directions to the job, ones that you can understand. Consult a map, if necessary. Don't forget your job ticket(s). It's your job and responsibility.

- When you arrive at the job, securely park the vehicle and report to the job superintendent. Go over the pour plan with the superintendent or designated foreman. Make sure you have a safe designated area for cleaning up the pump. Point out any safety problems, access problems or potential operating difficulties, such as power lines, when you walk the job prior to set up. The ACPA has adopted the position that if electrical wires are within 20 feet of the area to be poured (50 feet when the voltage exceeds 350kv); a dedicated spotter will be employed. His only job is to monitor the movement of the boom and warn the operator if the boom approaches closer than 20 feet (50 feet when the voltage exceeds 350kv) to the wires. Remember the most common cause of fatal accidents involving concrete pumps is electrocution. It is important to note the ACPA recommendations never supersede local, state/provincial, or national law. DO NOT set up in an unsafe situation, even if the superintendent directs you to do so. Call your office for help.
- Remember the ready-mix trucks with repeated deliveries to an off-street construction area tend to tear up your access when leaving. This may also affect discharge into the hopper.
- No person is allowed on the pump except yourself
- NOBODY is to stand on your hopper grate for any reason, whether the pump is in operation or not. This is called the "NO POINT RULE".
- Clean the potential setup area of all debris and position pump so that any obstructions (power lines, ditches, walls, columns, etc.) do not interfere with safe and proper set up and operation. Once in position, set parking brake, select the proper gear, engage the PTO, or start up the auxiliary engine (if so equipped).

#### Setting Up Outriggers

- Extend all outriggers fully and lock into place. Use outrigger pads supplied by the manufacturer even if setting up on concrete.
- The ground beneath the pads must be level. If it is not, you must make it so.
- After the outrigger pads are in place, put the full weight of the unit on each outrigger as you jack it down. If the pad begins to sink, retract the outrigger, and use cribbing to increase the size of the pad. Repeat this procedure until the cribbing doesn't sink. Keep away from any open cut ditches, box culverts, curbs, and unsupported sidewalks. If you are close to an open cut, make sure your outriggers are set back from the base edge at least the same distance that the ditch is deep. For example, if the ditch is five feet deep the outrigger pad should be back a minimum of five feet from the bottom edge of the ditch. This is known as the "ONE-TO-ONE RULE". Be sure the bank is not under cut. If you cannot stabilize the outriggers, you must relocate the pump or not set up!

**The One-to-One Rule:** For every one foot of vertical drop, stay back from the base edge one foot. (Distance "B" must be equal to or greater than Distance "A")

Outrigger force is transmitted at a 45-degree angle from the center of the outrigger pad. If the area is cramped, it may not always be possible to fully extend all the outriggers. This situation should be avoided, if possible, but if there is no other way, the outriggers that will feel the weight of the boom must be fully extended and jacked down. The outriggers on the side away from the pour should also be jacked down. The boom must not rotate beyond an extended outrigger toward a non- extended outrigger unless specifically approved by the equipment manufacturer.

If your outriggers are unstable when the boom is folded, the negative effect will be multiplied when the boom is deployed. Next, insure you unload the truck carrier springs by bringing up the pump frame into a horizontal and level condition. It is important the truck springs are unloaded, and the pump is within three degrees of level, (no tension or weight on them), otherwise the boom bounce can be a nuisance to the placing crew. Depending on the make and model of the pump, different manufacturers have different procedures for suspending the pump. For those designed to incorporate the truck and pump as a counterweight, refer to manufacturer's recommendation. Others, whose pump, and truck are the boom's ballast, do not require that the truck tires be suspended. In either case, the tires should be blocked to prevent any unnecessary bounce or rolling action. Always consult the operator's manual for each specific pump before on-site operation. All truck-mounted boom pumps are required to be level within three degrees for safe operation.

It is important to follow proper manufacturer's procedures for unfolding the boom. Make certain all boom sections are unfolded in proper sequence and safety hooks or straps used for transport are not bent or binding. NEVER force the boom if it is in a bind. First, relieve the pressure off the cylinders by actuating the opposite control which possibly placed the boom into a bind. Next, check to see which area is binding or what is causing the boom to rub or bind. Eliminate that problem before attempting to further unfold the boom. You could be seriously injured if you attempt to spring the boom or manually unhook it. Remember the hydraulic cylinders will store energy and in combination with the structural mass of the boom, can react like the fishing pole of a fly caster. If in doubt - ask for help. If the end hose is replaced with a combination of reducers and hose, (for example: five-to-four reducer and four-inch hoses) then all hose, reducers, etc. should be fastened with safety cable or straps and may not exceed the weight of the recommended end hose. Any of the above- mentioned items should be capable of handling the pumping pressures of the specific equipment.

Before rotating your boom, always remember to note the location of boom stops and limit switches. Never over-rotate the boom as you may easily rupture a hydraulic line in or on your turret. This could create additional work, expenses and could create a safety problem.

Once the boom is unfolded, carefully rotate, and extend the boom over each outrigger. If the outrigger pad sinks or is unstable, place the boom over the other side of the truck or refold the boom, lift the outrigger and increase the size of the cribbing. Repeat this procedure until all outriggers are stabilized. If you are unable to stabilize the unit, you must relocate or not do the pour. Continue to check the outriggers for sinking throughout the pour.

When priming or restarting the pump after a move, keep all personnel a safe and prudent distance from the discharge. If a plug occurs, the hose can whip violently. Any time air is introduced into the line, you must keep all personnel a reasonable and prudent distance from the end hose when the pump is being restarted.

Air will be present in the system:

- 1. When priming at the beginning of the pour
- 2. When restarting after a move
- 3. When removing system from the placing line
- 4. When opening the line to remove a blockage
- 5. When adding extra system to the line
- 6. When pumping and the hopper goes empty
- 7. When reversing the pump for any reason

Whenever air has been introduced into the line for any reason, warn everyone to stay away from the discharge until material runs steadily. Personnel should move a prudent and reasonable distance beyond the end-hose movement area or the point of discharge, and personal protective equipment (PPE) should be worn.

**Do not let the concrete level in the hopper become low!** If air is sucked into the material cylinders, the pump will compress the air. Compressed air always poses a hazard as it is expelled from the hopper or the delivery pipeline. If air is taken into the material cylinders, take the following steps to minimize the hazard:

- 1. Stop the pump immediately. Hit the emergency stop button if that is the quickest way to stop the pump. There will be an expulsion of compressed air the next time the concrete valve shifts, which can be safely absorbed by filling the hopper with concrete.
- 2. If possible, fill the hopper with concrete to just below the grate, then pump slowly in reverse for several strokes. This will not remove all the air, but it should minimize the amount left in the pipeline.
- 3. Persons standing at the discharge end, or near the delivery line, must be warned to move away until all the air has been purged.
- 4. Personnel should move a prudent and reasonable distance beyond the end-hose movement area or the point of discharge, and personal protective equipment (PPE) should be worn.
- 5. When the pump is restarted, pump forward slowly until all air is removed from the pipeline. Don't assume the first little air bubble is the end of the compressed air.
- 6. Do not allow anyone near the discharge until concrete runs steadily from the end and there is no movement of the delivery system.
- 7. If workers are positioned in high or precarious places, warn them to expect a loud sound as the air escapes the pipeline. (Warn them even if they are well away from the discharge.) That way, we can prevent the worker from falling because of being startled by the noise.

It is best to prime outside of the pour as the contractor may not want the primer in the pour, and the primer may be slippery - creating a slipping hazard.

Hose whipping can also be caused when you encounter a mix that is difficult to pump and is causing unusual hose movement. When this happens, you must stop pumping and correct the problem. Some solutions are:

- 1. Removing reducers and smaller hoses from the tip of the boom
- 2. Try a different load of concrete
- 3. Ask the contractor to add some Portland cement, water, or plasticizer
- 4. Change the mix to a more suitable mix design

If you are unable to correct the problem and there is still unusual hose movement, you must discontinue pumping until the problem is solved. Frequently inspect all boom clamps and pipe before, during and after each pour. In all cases, use safety straps, cables, chains or other restraining devices on any hoses or reducers suspended from the boom's end. **NEVER DRAG HOSES SIDEWAYS WITH THE BOOM** as it causes undue stress to the boom; it may catch or cause a clamp to open and may cause machine instability.

NEVER hook the boom tip directly into pipeline. Always use a high-pressure rated concrete delivery hose when you hook your boom into a line. This gives the flexibility the boom needs to move up and down a little. Be sure the tip of your boom does not touch the deck. If your boom starts bouncing too much, check your outriggers to be sure they are firm and level on their pads. If the boom still bounces too much, adjust the pump speed with the throttle or volume control until the boom smooths out.

If a lightning storm approaches, lower or fold your boom and seek shelter.

NEVER turn your controls over to any non-qualified individual, and if you are momentarily away from your pump, make certain your hydraulic system is disabled by engaging the emergency stop switch or taking the pump out of gear.

If your pump stops or breaks down, first:

- 1. Notify the job superintendent
- 2. Notify your office
- 3. After notification, attempt a repair. If you cannot complete the repair quickly, then;
- 4. Clean out the placing line
- 5. Clean out the pump
- When you are finished and moving your boom to the cleanout position, make sure everyone stands clear so they are not hit with any loose rock that may spill out of your tip section. It is important that you NEVER move the concrete pump without folding the boom and outriggers to the proper travel position.
- To clean out your boom, make sure your concrete level in the hopper is low, place a ball or sponge into the tip section and stand the boom straight up, reverse the pump and suck concrete back into the hopper until the sponge returns to the hopper. In all cases, follow the recommended cleanout procedures prescribed by each manufacturer. When you wash out the hopper, be sure to do so in an approved location. Before moving to the cleanout area, open the transition to prevent accidentally pumping the sponge back into the deck pipe. After the boom is folded up, attach your tie-down safety strap (if your machine has one). **NEVER REACH INTO THE VALVE OR WATER BOX** unless the transmission is out of gear, and you have verified zero pressure on the accumulator!
- There are several things to remember regarding job-site courtesy. You are Precision's representative on the job. The way you handle yourself, any problems which may arise or the way you interface with other job site personnel will play a critical role in the successful performance on the job.
- Keeping a level head when things go wrong will yield better results and gain respect for you and Precision. Your efforts, cooperation and attitude will determine if you as an operator or Precision as a company will be called back to the job or to some future projects.
- Before you leave any job, make certain all your hoses, clamps and tools are replaced and properly stowed on your equipment. Don't leave a mess and always **GET YOUR TICKET SIGNED**.

### C 11: 50-Meter and Larger Boom Pump Safety

- Operating a 50-meter or larger boom requires more experience, more caution, and more attentiveness from the moment you step inside the cab until you shut off the engine at the end of the day. Because of the sheer size, larger turning radius, length and weight, more caution is required driving to the job. More stopping distance is required, so it is more important to arrive on time, plan your route and know your exit. The decks have less storage room, so more time is required to secure your load before departure. It is recommended that you arrive on the job at least one hour before concrete time to allow for a safe set up.
- When you arrive on the job, stop in a safe area before driving into unknown soil conditions. A 50- meter or larger concrete pump weighs more than 105,000 pounds. The twin and triple front axle trucks have a greater plowing action so you must drive slowly and carefully. Always check in with the job superintendent and discuss the setup area and review the ground conditions in the setup area before moving off the maintained road.
- When you arrive at the setup location because your reach is so much greater, you must check even closer for power lines, overhead obstructions, and other obstacles both around the pour and behind the pump as the extra reach makes it easier to get into trouble.
- It is recommended that a 50-meter or larger boom never be short-rigged without an integrated short-rig detection system. Always fully extend and jack all outriggers. Always use the large outrigger pads supplied by the manufacturer for this purpose, even when setting up on concrete. A 50-meter or larger boom can exert over 60,000 pounds on any one outrigger. The small swivel foot pad could punch through solid concrete when used without proper cribbing. Many soil types require more cribbing than the manufacturer's pads. In those cases, use the manufacturer's pads on top of your cribbing base.
- One of the most common problems with a 50-meter or larger boom occurs when an outrigger punches through the cribbing or the cribbing sinks into the soil allowing the pump to tip over. Before setting up, find out if the setup area has been backfilled or is adjacent to a backfilled area. Also find out if any underground tanks, plumbing or other disturbed soil exists. If you are setting near a backfilled trench, you must consider the trench as an excavation and use the one-to-one rule by setting the outrigger back from the edge of the backfilled trench at least the depth of the trench. Outriggers must be set back from the bottom of any excavation a distance at least equal to the depth of the excavation.
- If you cannot stabilize the outriggers, you must relocate the pump or not set up!
- When setting your cribbing, it is important to level the area before starting. Many of the outriggers have a swivel pad that can allow the outrigger to slide off un-level cribbing. After the outrigger pads are in place, put the full weight of the unit on each outrigger as you jack it down. If the pad begins to sink, retract the outrigger, and use cribbing to increase the size of the pad. Repeat this procedure until the cribbing doesn't sink. Keep away from any open-cut ditches, box culverts, curbs, and unsupported sidewalks. Once the boom is unfolded, carefully rotate, and extend the boom over each outrigger. If the outrigger pad sinks or is unstable, place the boom over the other side of the truck or refold the boom, lift the outrigger and increase the size of the cribbing. Repeat this procedure until all outriggers are stabilized. If you are unable to stabilize the unit, you must relocate or not do the pour. Continue to check the outrigger back three feet from the edge. The pump can "rock" or "surge" forward and slip off the edge of the slab. Also, the slab can break easier near the edge and can allow the outrigger to sink or tip.
- When the operator is requested to operate the boom from a position away from the closest point of the outrigger structure, it is imperative to have a competent person to monitor the concrete pumping operations as well as the outrigger structure. This person must be trained in the operation of the emergency stop, be able to guide the concrete delivery trucks safely and correctly to the concrete hopper, to not let the hopper run low or empty, to watch for mechanical problems, and very importantly, to watch the stability of the outrigger structure. This person should be instructed that it is not acceptable to leave the concrete pumping operation unattended. It is recommended that this person have two-way verbal communications with the concrete pump operator.
- When priming the boom, proper grouting techniques are critical. Grouting techniques may vary by company, by the geographic area that you are working in and/or by the concrete mix design that you are to pump. In most cases, a yard of pre-mixed primer grout is considered the most dependable method and therefore recommended. Although plugging up during the priming process of any size boom is not desirable, with a 50-meter or larger boom it is even more important to prime up successfully for each pour. Be aware the boom can sag up to 10 feet when being loaded with concrete. Sagging can also occur when restarting the flow of concrete into the boom during the pour. Use caution when restarting because if the end of the boom comes down and kinks the tip hose while pumping, a serious accident could occur. If extra hoses or pipe are added to the end of the boom beyond the tip hose, the weight must not impose an additional load on the end of the boom as it may cause tipping or damage to the boom.

- During the pour, frequently check the stability of the outrigger pads. If they are sinking or tipping, fold up the boom and reset the cribbing. As you retract the boom, watch the area behind you because the boom can extend far behind the pump.
- Some booms have restricted areas in which the boom cannot be operated because too much weight is exerted behind the turret. You must be aware of these limitations. While pumping, you may experience some boom bounce, which can be minimized by adjusting the pumping speed.
- If you end up with a completely full boom, you will end up sucking back nearly one yard of concrete. It is important to end up with an empty hopper and have somewhere to discharge the excess concrete. You must be extra careful when unfolding the boom from the travel position or returning it to the travel position as some four-section booms can hit the cab of the truck during this process. It is recommended that an extra person be available to stay with the operator after the pour and guide him off the site.

### C 12: Short Rigging

"Shortrigging" describes the act of not extending the outriggers on the side away from the pour. Shortrigging is not recommended, but under certain conditions it may be required, and can be done safely if proper procedures are followed. If it is not possible to extend the outriggers on the side away from the pour, the unit can be set-up with the outriggers jacked down but not extended.

#### To avoid a tipping accident while short rigged, you must follow a few rules:

- Have a qualified person document that short rigging is required.
- Whenever possible, completely extend the outriggers.
- Never short rig the machine on the side of the pour.
- Do not position the boom outside the center lines of the extended outriggers. The unit can tip when the center of gravity is beyond the extended outriggers.
- The manufacturers or a qualified person's documented procedures are to be followed.
- Remember that not all the outriggers are extended. Forgetting this fact is the most frequent cause of accidental tipping.

#### The following steps will help you to short rig in the safest possible manner:

- Before extending any outrigger, check which way the hydraulic hoses are wrapped in the turret. You must be able to unfold to the side with fully extended outriggers without moving the boom to the side with retracted outriggers.
- If the boom is folded up on the wrong side you will need to fully extend the outriggers while you raise the boom and swing it around 360° to put it back in the cradle, then retract the outriggers which require short rigging. Move the pump to a safe area to do this, if necessary.
- Fully extend and jack the outriggers on the side of the pour. Use proper cribbing for the soil conditions.
- Do not partially extend the outriggers on the side of the unit opposite the pour. They should, however, be jacked to provide stability.
- After raising the boom from the cradle, do not unfold the boom until you have rotated to the area between the fully extended and jacked outriggers. The boom may then be unfolded, and the tip hose released or attached.
- At no point during the pour should the boom be moved outside the area between the center lines of the fully extended outriggers.
- Upon completion of the pour, the cleanout ball should be inserted and sucked back, and the boom should be folded up completely, all the while staying on the same side as the fully extended outriggers, before slewing back toward the cradle.
- Do not retract the extended outriggers until the boom is in the travel position.

\*Partial extension of telescoping outriggers is not acceptable at any time. Jacking the outriggers while they are in any position other than fully extended or fully retracted could cause structural damage to the outrigger outer box and/or the inner box

#### \*Remember that the boom must never be extended over a retracted outrigger.

\*With any boom that can go over center, you must be careful to not retract #1 so far that the center of gravity will shift to the short rigged side. In addition to the tipping hazard, the boom should never be placed in an area that will obstruct traffic.

The operator is ultimately in charge and must make good decisions regarding set-up including:

- Know restrictions of boom movement caused by short rigging and never exceed them.
- Partial extension is not allowed on extendable outriggers.
- Keep people out from under the boom whenever practical.

### C 13: Hose Whipping

Air ingression to concrete pumping delivery pipelines has revealed itself as a considerable hazard under certain circumstances. Injuries to placing crew personnel have been sustained when trapped air is momentarily compressed, then released, causing the end hose to whip violently. The list of circumstances leading to hose whipping continues to evolve as knowledge is gathered from the field. Presently, we know there are three factors that must come together for a hose-whipping hazard to exist:

- There must be air in the delivery system,
- There must be something pushing on the air, and
- There must be restriction near the hose causing the air to compress.

Air in the delivery system by itself poses no hazard, e.g., whenever delivery system is cleaned out, it's full of air. It's only when the air is compressed, thereby storing energy, that the hazard may exist.

#### **Avoiding Hose-Whipping Accidents**

- To avoid injury by a hose moving from release of trapped air, personnel must be out of the end hose movement area.
- Because the conditions creating the hazard (air is being pushed by the material being pumped) don't usually result in hose whipping, knowing when the hose will whip is not feasible. It is possible, however, to be aware that the conditions creating the hazard are present and warn personnel in the discharge area to remain away until the conditions no longer exist.
- Debris coming from the hose during release of trapped compressed air can also be a hazard. To protect against the debris, personnel should move a prudent and reasonable distance beyond the end- hose movement area or the point of discharge, and Personal Protective Equipment (PPE) should be worn.
- The end-hose movement area is defined as the area within the radius of the last flexible (non-steel) piece of delivery system. For example, if ten feet of rubber hose is attached to a pipeline, personnel standing more than ten feet away from the point of attachment are outside the end-hose movement area.
- If there is only ten feet of flexible delivery system attached, personnel positioned eleven feet away should not be hit by the hose, although the hazard of flying debris remains for some distance around the point of discharge.

#### How Air Gets in the Delivery System

Listed below are the ways air can be introduced into the delivery system. These are situations making the hazard possible, and it is when these situations are encountered that personnel should be warned to clear the discharge area.

#### 1. The delivery system is void of concrete and is therefore full of air.

Examples:

- . when first starting, or
- . when restarting after moving.

#### 2. The pump sucks air into the material cylinders through the hopper.

Air ingression through the hopper happens when:

- . the pump is first started at the beginning of the job, or
- . the hopper goes empty because the pump is pumping faster than concrete is being delivered, or
- . the hopper goes empty because the pump continues to pump after the ready-mix truck stops delivery or after it's completely discharged, or
- . the concrete is so stiff that air is being taken into the material cylinders with the concrete. In this case the concrete must be so stiff that bridging is occurring.

#### 3. Air is introduced through the tip hose

This type of ingression happens when:

- . the pump is operated in reverse for any reason, or
- . the pump is shut off during pumping, and the boom's tip section is in a generally down position, or
- . a blockage has been successfully removed by performing the operation known as "rocking the concrete."
- . the concrete being pumped borders on "unpumpable," As the operator frequently changes between forward and reverse in an attempt to "rearrange the rocks", the concrete is coming out in jerks. In the time between squirts of concrete, air is filling the gaps.

#### 4. Air is introduced into the interior of the pipeline, other than at either end.

This happens when:

- . the pump is operated in reverse, or stopped while concrete is in the pipeline, and one or more pieces of pipe have a hole in them, or
- . the pump is operated in reverse, or stopped while concrete is in the pipeline, and gaskets at the clamp joints are missing or badly damaged, or
- . the pipeline is disassembled, then reassembled. This is a common occurrence when removing pieces of pipe from a horizontally laid pipeline during the course of a day. The hoses are disconnected, one or more pieces of pipe are removed, then the hoses are reattached, or
- . a blockage has been manually removed from a reducer, hose, pipe, or elbow, after which the pipeline is reassembled.

#### Pressurizing the Air Pocket

- How much pressure it takes to move concrete in a pipeline depends on several factors:
  - The distance the concrete must travel.
  - The diameter of the delivery line.
  - The composition of the delivery line (hose or pipe, how many elbows, radius of the elbows).
  - The pumping rate (100 yards per hour takes much more pressure than 50 yards per hour).
  - The composition of the concrete (pumpability and dryness).
  - The vertical level difference between the point of placement and the pump (each foot of level difference adds 1.1 PSI, regardless of the angle creating the level difference).
- Assuming a pipeline is laid horizontally, the pressure required to push concrete is a linear function of the distance the concrete must be pushed. In other words, at halfway to the end, it only requires half the pressure to move the concrete.
- Once inside the pipeline, the air is pushed by the concrete coming behind it, and, in turn, pushes the concrete in front of it. Within moments, the air pressurizes to the same pressure required to push the concrete in front of it. When the air pressurizes, it takes less space, in much the same way a spring takes less space when a force is applied.
- As the air travels through the pipeline, it takes less and less pressure to push the concrete in front of it, (because there's less and less concrete in front of it). As the pressure drops, the air expands, taking more space than it had a moment before. As it expands, the concrete in front of it must move faster to accommodate the ever-expanding air pushing it.

- Most of the time, concrete accelerating in front of the air pocket results in a harmless escape; the concrete squirts out rapidly, there's a small "puff" as the air escapes, and the concrete behind the air resumes flowing normally. Perhaps the hose gives a small jerk and there's some splattering by the air/concrete mixture. No one is at risk in this case.
- A small percentage of the time, the material accelerating in the delivery system gathers in the hose or reducer and forms a blockage. The fact that air is forcing the material to accelerate rapidly may cause some segregation of the material components, thereby increasing the chances of blockage formation. In addition, any folds or kinks in the delivery hose could create a blockage. Whatever

the cause, once a blockage has formed in front of air, the hazard is in place.

- In the best-case scenario, the blockage releases with minimal pressure increase, or the blockage is so complete that even when the pump reaches maximum pressure, it does NOT release. In the latter case, there is no expulsion, the pump stops moving material as the hydraulic relief systems are activated, and the operator can relieve the pressure before looking for the plug.
- In the worst-case scenario, high pressure is exerted on the air pocket before the blockage releases, and the reaction of the air escaping at high velocity causes the hose to whip violently.

#### **Remedial Measures**

Hose whipping accidents can be avoided if people take the proper precautions when air has been taken into the delivery system. Each person involved must know what to do and knowing is a matter of education. Everyone needs specific knowledge, and each person must heed the warnings to protect themselves. Communication between the personnel is crucial.

#### 1. Operators:

- Must know how air enters the delivery system, and the severity of the hazard to the placing crew.
- Must know to warn personnel to stay away from the discharge whenever air is known to be in the delivery system.
- Must communicate the hazard and its severity to the placing crew and laborers or verify that they already know it.
- Must communicate the hazard and its severity to the ready-mixed concrete truck drivers so they'll know to take preventive action if air enters the system through the hopper or verify that they already know it.
- Must know to minimize the chances of developing blockages when air is known to be in the system; for example, slowing the strokes per minute.
- Must know how to minimize the effects of air in the delivery system, such as reversing the pump if air was introduced into the system through the hopper and pumping slowly until the air is expelled.

#### 2. Laborers assigned to work at the pump:

- Must know the hazard, its severity, and the methods of air ingression.
- Must know how to alert the operator or stop the pump if they see that air has entered the system through the hopper.

#### 3. The placing crew:

- Must know the severity of the hazard.
- Must know how to recognize clues that air may be in the system. For example, they must know that every time they remove a piece of pipe from a system, air is introduced, and that there's always air when first starting or restarting after moving.
- Should know the telltale signs of a blockage in a hose and what to do if they suspect a blockage in a hose has occurred.
- Must heed the warnings from others and remain away from the point of discharge until the operator verifies that the hazard has been eliminated.
- Must not cause the delivery hose to kink.

#### 4. Ready-mixed concrete truck drivers:

- Must know to keep the hopper level full, and to alert the operator or stop the machine if air is taken into the pump.
- Must know the severity of the hazard if they are to be expected to take this responsibility seriously.
- Must know how the operator would prefer to be notified in an emergency, and how to activate the emergency stop switches if they cannot get the operator's attention.

• Must minimize mix segregation when feeding the concrete pump.

#### 5. Contractors:

- Must know how air enters the delivery system, and the severity of the hazard to the placing crew. Must know to warn personnel to stay away from the discharge whenever air is known to be in the delivery system.
- Must communicate the hazard and its severity to their foreman, the placing crew, and laborers, or verify that they already know it.
- Must know the contribution that mix composition, condition, and mix delivery intervals have in increasing the likelihood of blockages.

#### Summary

Every person in the chain of a pumping job has a responsibility to help protect the hose person and other nearby personnel from hose whipping accidents. Education is the key, followed closely by diligent watchfulness and PPE. Educational materials are available from the ACPA, but the people in the industry who know of the hazard must take steps to make the supervisors of the other industries aware that the problem exists and that there are materials available to teach avoidance

### C 14: Line Pump Safety

- Before your trailer pump leaves the yard in the morning, visually check the condition of the truck and the trailer. Verify the hitch is closed and secured; the safety chain is on; air and electric connections are working and double check all safety pins.
- Make sure all equipment on the bed of your truck is safely stowed. Be sure you have the correct driver's license, job ticket, registration, and proof of insurance. A truck equipped with air brakes, or having a GVWR over 26,000 pounds, requires a CDL license. Be sure you have the proper safety equipment including a hard hat, work boots, rubber boots (for washing out), work gloves and safety glasses. Be sure you have the necessary tools, including grease gun and an operator's manual for the pump. Check your job ticket to make sure you have all the system and clamps for each job that day and confirm that you know where you are going. Be sure you know the location of the emergency stop buttons, they operate properly, and you know exactly what they disable. When driving down a steep hill, use one gear lower than the gear you would use to go up the hill.
- At the job site, park safely off the road and contact the job superintendent or designated person, survey the work to be done; then set up your trailer pump. Locate your pump to provide good access for two ready mix trucks (if possible). When placing the pump, consideration should be given for repeated delivery by ready mix trucks. Now would be a good time to locate the washout water on the job site, if possible
- Make the placing line as short and straight as possible. A sweep 90-degree bend (one meter radius) creates as much pressure as nine feet of straight pipe, while a short 90 degree (250 mm radius) creates the same pressure as three and one-half feet of pipe. Whenever possible, move the pump until you can clamp the steel pipeline directly to the pump reducer. Avoid using a rubber hose between the pump and the placing line. Then run pipe as far as you can. Use as little hose as possible. It is three times as hard to pump through rubber hose as steel pipe. Ten feet of rubber hose equals 30 feet of pipe in pumping effort.
- Install your standpipe using proper gauge pipe at the bottom and only put thinner wall pipe near the top. Remember, a higher gauge number means a thinner pipe wall. A 7-gauge pipe is thicker than an 11-gauge pipe. All the concrete poured on a high-rise goes through the bottom of the standpipe first, creating the most wear, while the upper standpipe gets the least wear. For safety reasons, know pump piston face pressure and your placing line working pressure. The pressure is always highest at the back of the pump. That means line placed there must be able to tolerate the maximum pressure of the pump. Remember, smaller concrete cylinders produce higher concrete pressure. Always consult the manufacturer if in doubt.
- If you do not have a proper method to check the thickness of used pipes, it is suggested you use new pipe for a high-rise.
- Use raised ends on the placing line for greater safety as raised end placing line will withstand higher pressure. Try to finish the pour as close to the pump as possible. This reduces waste and mess. A useful rule of thumb is:
- 300 feet of four-inch placing line contains one yard of concrete

- 200 feet of five-inch placing line contains one yard of concrete
- Always prime the pump and placing line with a mixture of slurry ahead of the concrete. You can use cement and sand from the job site. You can have the contractor order a yard of two parts sand to one part cement or 9 sack slurry to be delivered by the first truck. In any case, do not attempt to start pumping without priming. Spraying water in the hopper and wetting up the first load is not acceptable, and 50 men will be standing around, on the clock, waiting for you to unplug the placing line. The ACPA does NOT recommend using the "just wetting" method.
- Make sure all your clamps are clean, complete with gasket and pinned. A clamp without a gasket leaks slurry and may cause a plug. It will also leak air, giving you trouble when you try to suck a ball back or blow out the line with compressed air
- Inspect your hoses daily. Any frayed or worn hoses should be taken out of service because of the increased danger of kinking. Kinking can be dangerous because it almost instantly builds pressure to the maximum pressure the pump can produce. It can cause a hose or pipe to rupture, spraying concrete everywhere. It can cause the hose to jerk violently. It can cause a hydraulic line to burst. It can blow the end of a hose or burst a clamp. Anyone near the placing line may be injured.
- During the pour, grease the pump's seals and bearings according to the manufacturer's prescribed intervals.
- Plugs usually occur in reducers, and sometimes in hoses because they have more friction than pipe. To remove a plug when reversing does not work, first relieve the line pressure, locate the plug, then disconnect the plugged system, elevate it, and tap on the plugged area with a hammer. Break down the plug and shake it out the end of the hose or pipe. Do not re-hook the system until the plug is removed.
- Any time air is introduced into the line, you must keep all personnel a reasonable and prudent distance from the end hose when the pump is being restarted. Air will be present in the system:
  - 1. When priming at the beginning of the pour
  - 2. When restarting after a move
  - 3. When removing system from the placing line
  - 4. When opening the line to remove a blockage
  - 5. When adding extra system to the line
  - 6. When pumping and the hopper goes empty 16
  - If your pump stops or breaks down, first:
    - 1. Notify the job superintendent
    - 2. Notify your office
    - 3. After notification, attempt a repair. If you cannot complete the repair quickly, then;
    - 4. Clean out the placing line
    - 5. Clean out the pump
- Proper safety gear on a high-rise project includes a hard hat. This is very important for the pump operator, who typically works right at the base of the building and is exposed to falling debris. Many local ordinances require a canopy for the operator. It is imperative to have a good communications system between the operator of the pump and the placement point of the concrete.
- Pressures in a standpipe can be very high. It should be noted that the pressure gauge at the concrete pump ONLY indicates hydraulic pressure not placing line pressure. Pressure in the concrete delivery placing line rises as the hydraulic pressure of the pump rises. (Use caution when high pressures are observed.) Remember the placing line pressure is always greatest at the back of the pump and decreases as you go up the standpipe. To help imagine the pressure, remember that pumping up 200 feet is equal to pumping 800 feet straight out. A cubic foot of standard concrete weighs 150 pounds, meaning that just one 10-foot section of five-inch pipe contains 200 pounds of concrete.

### C 15: Setting up a Line Pump and/or Separate Pipeline

- The job setup phase sets the stage for most accidents. Taking a few extra moments to correctly set up the job will improve your chances of having a safe, trouble-free day.
- The operator is responsible for the safe operation of the machine. Notify management of the job superintendent if you have been asked to set up in an unsafe manner. You are never required to take a chance with safety.
- Any power connections about 28 volts must be made by a licensed electrician.
- Electrical power on the job site may be taken only from a fused, grounded disconnect box with a disconnect switch that can be locked against activation.
- On the unites equipped with electric motors, check the power cables every day.
- Consider the safe approach and departure of the ready-mix trucks and adjust your setup accordingly.

- Secure the immediate area of the machine from public traffic in accordance with all applicable regulations
- Do not use a piece of pipeline, end hose, coupling, or any other material delivery component that is not in good condition. Replace, do not repair damaged pipes and hoses.
- When laying out a pipeline, it is preferable to use an elbow instead of a hose to make direction changes. Elbows have less resistance to flow than hoses and will therefore reduce the overall pressure required to push concrete.
- Always use the largest diameter pipeline that is practical and use steel pipe instead of rubber hose. This will keep the pressure required to push the concrete to a minimum.
- Support the delivery pipeline. Either an "S" transition pipe should be used to bring the pipe to ground level, or each section of the pipeline should be supported at the pump outlet level.
- The sections of pipe nearest the pump are subjected to the highest pressure and the greatest wear. Because of this increase of pressure near the pump, you should install only thick-walled pipe, in like-new condition there.
- The maximum concrete pressure of the pump must be the only factor used to determine what thickness of pipe and what type of ends are needed.
- If the pipeline remains on the job, the operator is responsible for checking the pipeline for dents, cracks, wear, and continuous connection each day before the pour begins.
- In vertical runs, the weight of the vertical sections of pipe must be supported by a thrust block or other load-bearing device. Each section of pipeline in a vertical run must be secured from lateral and horizontal movement.
- If you will be unable to see the point of placement, establish a system of communications with the workmen who will be there. Arrange for radio communications, a system of visual or auditory signals, or a signal person.
- Never leave the machine unattended when it is running or ready to run. If you must leave the area, you must leave someone to monitor the unit. This is especially critical if there are children in the vicinity.
- Watch for children! If spectators will be near the job, cordon off an area where they will be safe.

### C 16: Towing Trailer Pumps

- Be sure the towing vehicle is sized appropriately for the trailer. It must be heavy enough and have enough breaking ability to maintain control at highway speed and to stop- even on hills. If the trailer is heavier than the towing vehicle, braking distances will be greatly increased.
- Never tow a trailer that has concrete in the hopper. The extra weight in the back of the machine will remove weight from the tongue and cause the trailer to fishtail.
- Check the ties, tire pressure, and brakes on the trailer before towing. Never tow a vehicle with cracked or bald tires. A trailer tire blowout can cause loss of control in the towing vehicle.
- Be especially careful on ice or slippery roads when towing a trailer. A skid that would normal be easily correctable can be multiplies by the trailer, causing loss of control.
- Be sure the electrical connections between the towing vehicle and the trailer are sturdy and reliable, and that the lights on the towing vehicle and trailer are working.
- Always use safety chains and break-away protection when towing a trailer.
- Be aware of local or state regulation regarding mirrors, lights and maximum speed when towing a trailer.
- When towing a trailer, your stopping distance and turning radius are greatly increased. Be always aware of this.
- When towing a trailer long distance, it is important to frequently check the hitch, hitch pins, couplers, safety clips, towing eyes, wiring, emergency breakaway switch, safety chains, and other accessories, as equipped.
- Be aware of your length when towing a trailer. A common cause of trailer accidents is turning too close to curbs or objects.
- Never back up a trailer without a guide.
- Frequently observe the trailer and watch for unusual swerving indications of problems, such as a flat tire.

### C 17: High Rise Pumping

A pump capable of pumping high-rises typically is a pump that generates higher pressures. Extra care should be taken when operating a high-pressure pump.

- With vertical runs of 100 feet or more, a concrete thrust block should be used at the bottom of the standpipe, and you must securely fasten the placing line. This will keep the pipe from moving and causing damage.
- Be sure to use a shut-off or switching valve in the line right after the pump. This allows you to hold the concrete in the standpipe when you are done pumping, so you can disconnect the pump and hook up the cleanout pipe to direct the waste concrete into a trash area or back into a ready-mix truck. Sometimes a diversion valve is used instead of a shut-off valve. This allows the waste concrete in the standpipe to go in two directions: either back to the pump hopper or to the cleanout pipe. The pipe from the valve to the cleanout area must include a slurry tee.
- When the job is negotiated, it is important to clearly state who will be responsible for maintaining and checking the placing line, as well as cleanout procedures. This includes checking the wear and securing the pipeline. The concrete pump operator should be aware of this agreement.
- Take care when pumping lightweight concrete. Because it is porous, it may absorb water under the pressure of pumping. This reduces the slump of the concrete, which leads to higher pumping pressure and possible plugs. High-rise pours require one cubic yard of 9-bag grout for priming. The use of commercial primers or water is not recommended for high-rise pumping.
- If more water is needed, it should NOT be added by the concrete pump operator. Only the person(s) responsible for the pour should add water because this changes the mix design. Too much water in the mix can cause the rock and sand to separate, causing a plug. This is called segregation.
- Be aware of admixtures in the concrete. A commonly used admixture, calcium chloride, speeds up the setting of concrete. This has caught many a pumper unaware. Wear gloves and safety goggles when washing out. The lime in cement can cause concrete burns.

# NEVER - NEVER REACH INTO THE CONCRETE PUMP VALVE FOR ANY REASON, NEVER! ALWAYS USE THE SPECIAL TOOLS!

• Do not remove the grate from the hopper or operate the pump without a grate on the hopper. NEVER reach in the hopper for any reason when the pump engine is running, or the agitator is turning - steel cannot tell the difference between concrete and human hands. The agitator can kill you. Before you remove the hopper grate, you must turn off the engine and verify zero pressure on the accumulator gauge as well as utilizing a proper lockout/tagout procedure.