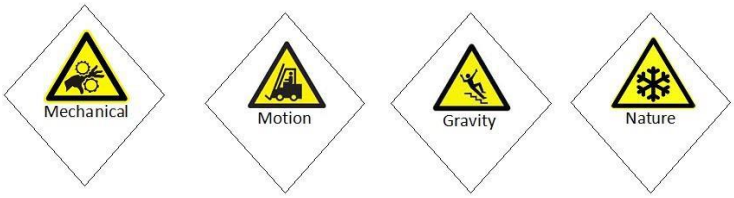
PURPOSE/APPLICATION

Working on steep slopes increases the likelihood of reduced machine stability which can result in the potential for rollovers of equipment and sliding/slippage of equipment and pipe. Additionally, there is an increase for the potential for serious worker injuries, significant environmental damage, lost production, falling object resulting in injury or fatal outcome, and equipment repairs.

For purposes of these guidelines, steep slopes are typically categorized as having a measured gradient of 30% (16.7 degrees), or greater. Some shorter length or lower gradient slopes may meet the criteria and require the same qualifications and mitigation measures due to other conditions (e.g., soil types, environmental factors, etc.).

PPE	▪ CPES minimum requirements ▪ Spotter high visibility vest where required	▪ Air horn ▪ Ice cleats as required for spotters
TRAINING	▪ Review of the OEM for the care and use of all specialized rigging and equipment	▪ Minimum CPES and Site Requirements ▪ Spotter Training
HAZARDS & CONCERNS	▪ Gravity (run-away equipment, Falling debris, stones boulders, slip / falls ▪ Roll over ▪ Traction loss	▪ Mud slides or Avalanches ▪ Uneven ground and/or work surfaces ▪ Ground workers in area ▪ Worker fatigue (working on hills)



PRECAUTIONS

Working on hills and slopes is an integral part of pipeline/construction activity, requiring proper planning prior to work. The following needs to be considered when planning work activities on hills and slopes.

Perform hazardous terrain/steep slope hazard assessments (possibly including 3rd Party Geophysical evaluation) prior to commencement of the applicable work/operations. The hazard assessment should identify steep slope-related exposures, develop appropriate controls, and lead into the creation of work plans.

Review and update the hazard assessment prepared for steep slopes when:

- There is a change in how a task is performed. Note: "Minor" changes are managed in the field while "Major" changes should be managed more formally and include revising the work plan, (e.g., Management of Change (MOC) process).
- Modifications are made to equipment, tools or the product being installed.
- Any time there is a change or modification to the composition of the crews/personnel.
- Changes in work site conditions occur (e.g., weather, extreme temperatures, etc.).
- A specific need or concern is identified (e.g., a previously unidentified hazard that could cause harm to personnel, property, etc.).

STEEP SLOPE IDENTIFICATION, ASSESSMENT AND EVALUATION

For each location identified as a hazardous terrain, a safe work planning meeting should be held to formulate a plan based on site-specific conditions. Steep Slope Identification and Assessment should be conducted before and during the clearing process, at as many locations along the right-of-way as possible. After clearing, a reassessment should be conducted to confirm or adjust the site-specific measurements (daily or multiple times per day if conditions are changing the ground conditions) using a Daily Steep Slope Assessment form.

The purpose of the Steep Slope Identification and Assessment is to:

- Identify terrain/slopes that may be hazardous.
- Assess the slope and conditions contributing to potentially hazardous terrain.
- Determine locations, gradients, lengths, and other relevant conditions.
- Determine access requirements.
- Designate required control measures.
- Designate the appropriate equipment and rigging.
- Establish procedures and methods for safe execution.
- Identify the line of fire if equipment does roll or tip.

To establish appropriate safety measures, the following general factors should be considered:

- Degree of slope(s)that exist (as noted in topographical maps, LiDAR, fly overs, and/or job walks) and length of slope(s) present. Do not average the slope gradient and length.
- Soil conditions, general moisture content (e.g., muddy conditions, snow, and ice) and presence of rock. If rock is present assess its condition and the underlying material.
- Roughness or irregularity of the terrain, including the presence of boulders or stumps.
- Terrain and formations off ROW that may reveal conditions not detectable along the ROW.
- Environmental conditions at the site, such as weather (e.g., snow, heavy rainfall), water, and the possibility of flash floods (e.g., storm runoff). Consider current weather conditions, and upcoming weather conditions, as related to the work task. *NOTE: Operations are to be halted during periods of heavy rain or if the soil is saturated with water)
- Review weather forecasts prior to starting work to identify the potential for afternoon melts
- Anticipated duration of exposure (i.e., slope facing the sun in the morning or afternoon).
- The nature of the tasks to be performed and the equipment and rigging to be used.
- Equipment connection points (point on machine) and factors that could affect traction and/or rolling resistance.
- The experience of the Operators on the crew (e.g., previous experience working in the same area or in similar conditions).
- Project Owner’s specific requirements.
- When analyzing hazardous terrain / steep slopes, you must recognize that soil types, other slope conditions and specific equipment (e.g., tracked or rubber tired) being used can greatly affect traction on steep slopes.

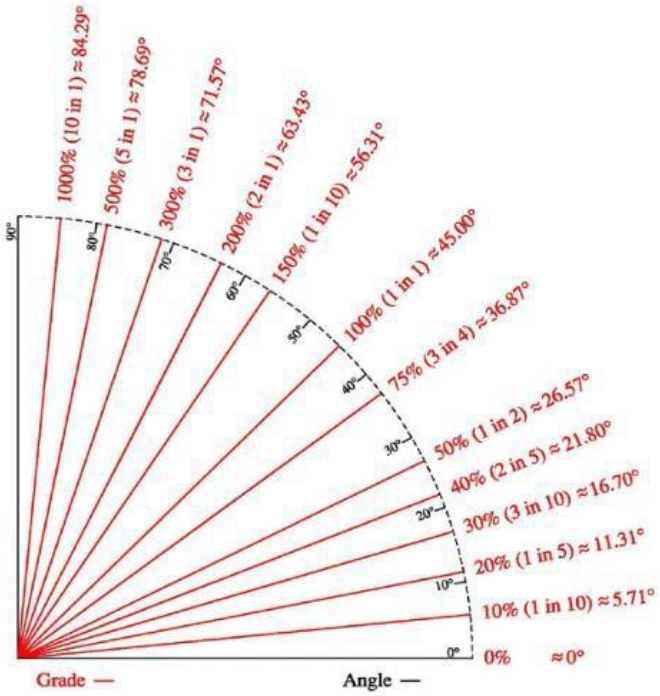


Illustration of grades (percentages) and angles in degrees.

GENERAL DO' S AND DON' TS

THE DOs

- **DO** Have Access routes to the top and bottom of steep slopes clearly defined and restricted to equipment designated for work in steep slope areas.
- **DO** Inspect all slopes prior to beginning work each day. If slope conditions change during the shift (e.g., due to weather conditions, newly exposed rock, etc.), work should be interrupted and the HIAC modified to reflect the changed conditions.
- **DO** Only allow essential personnel and equipment to be present while work is taking place on steep slopes.
- **DO** Have workers use ice cleats (traction aids) when winter weather conditions are encountered.
- **DO** Take extra care when operating during severe weather events (e.g., moderate to high winds, heavy rainfall that impacts visibility or ground competency, snow accumulations or extreme heat).
- **DO** Review and follow CPES's SJP-19 Towing.
- **DO** Develop site-specific procedures and identify in the HIAC when the work activity requires personnel or equipment to work beneath others (e.g., at a lower elevation along the same slopes).
- **DO** Consider the use of 2-way radios in all steep slope equipment.
- **DO** Allow temporary equipment activities on a slope if workers who are below that activity can retreat to an established and identified safe zone during these activities.
- **DO** Ensure workers always have an escape route.
- **DO** Remove mud and snow from the slope prior to winching/towing or moving equipment and vehicles on a slope to ensure the best traction possible.

THE DON'Ts

DON'T Never position yourself between two pieces of equipment.
DON'T Position workers below active equipment operations unless suitable barriers have been established to protect the workers from falling debris.
DON'T Allow unnecessary ground personnel on the slope or near the operation when equipment is moving, or winch lines/rigging are under load.
DON'T Conduct equipment winching operations when workers are below or near active the activity.
DON'T Cross over or under cables when the cables are under load.

VEHICLES AND EQUIPMENT

- All workers involved in winching operations should be familiar with the principles relating to safe winching practices (Certified winching package).
- Operators should be consulted when planning the work. They can have the best understanding of specific equipment capabilities; and may be likely to identify additional hazards.
- Prior to starting work in the area review the Steep Slope Plan with the Supervisor and/or person who conducted the risk assessment. A copy of this plan should be available to all workers.
- Equipment should never be operated beyond the maximum slope limitations established by the manufacturer. *Note: This may require consideration of special lubrication requirements such as additional fluids.
- Communication with the Operator must occur prior to anyone approaching the equipment. Only approach after the Operator acknowledges your presence and gives permission.
- In the event there are blind spots, Operators should not proceed without being given directions from a Spotter who is on the ground and has a clear view of the equipment's surroundings.
- Consider the use of multiple taglines when moving equipment on slopes.
- When a machine is moving pipe on steep slopes, ground personnel should always stay to the side of the ROW until the pipe is in place and the machine has stopped.
- Inspect each piece of equipment daily and throughout the day. Give special attention to slings, winches, cables, pins, shackles, fuel and oil levels.
- Always stay on the side of safety regarding equipment operating limits. Do not operate near the maximum stated limits.
- Use of tire chains where icy or slippery conditions exist or the slope is 10^{o} or greater.
- Excavators, dozers, and side booms may require lugs/corks to be added on the tracks depending on the time of year and slope condition.
- Only vehicles with 4X4 capacity should be utilized for work on steep slopes.
- When operating equipment on a hillside, all motions should be deliberate and conducted at the proper rate of speed (i.e. proper rate of speed to maintain the center of gravity of the machine).
- When parking and leaving vehicles or equipment:
    - Park on level areas, whenever practical.
    - Engage emergency brake, "chock" or "block" the tires and leave the vehicle in park.
    - Turn the front tires in a direction that will prevent unintentional movement (e.g., at an angle or perpendicular to the incline, against a berm, placing buckets or blades on the ground, setting parking brake) and/or if the brakes/wheel chocks fail, the vehicle will roll away from the direction of the workers (e.g., angled into spoil and off ROW).

EXCAVATORS

- Create a level area where excavators are excavating along slope areas, if possible.
- Avoid travel across slopes as much as practical and travel straight up and down slopes.
- Where turning is unavoidable while ascending or descending, turn as gradually as possible to maintain stability.
- Under no circumstances should an Operator exit the excavator while positioned on the steep slope. If required, the excavator should track to the nearest platform for the Operator to dismount.
- For uphill travel, extend the boom and half full bucket forward to maximize stability and traction.
- For downhill travel, bring the boom and empty bucket in close to maximize stability and traction.
- When descending a slope, use the same (low) gear range required to climb it.
- When parking an excavator, the bucket should be placed on the ground.
- Inspect all corks on tracked equipment to verify they are secure (follow corking specs. /Procedures and re-cork as required).
- Inspect the seat belt and escape hatch to ensure they are in working order.

DOZERS

- Avoid traveling across slopes as much as practical and travel straight up and down slopes.
- When working on steep slopes, dozers should avoid travelling diagonally across the slope at less than a 45-degree angle.
- Keep the dozer blade as close to the ground as possible while travelling up or down a slope.
- If the machine starts to slide sideways when working across a slope, turn the machine downhill and drop the blade.
- Debris and loose rocks along dozer breaks should be stabilized before personnel can work below them.
- When parking a dozer, the blade should be placed on the ground.

SIDEBOOMS

- A thorough analysis must be conducted to verify lifting capacities of the sidebooms while operating on slopes.
- Choose the shortest boom available to accomplish the task.
- Carry the load as low as possible (without comprising safety) to the ground. Make every effort to control the load. The load should be attached to a winch tractor to prevent the load from cantilevering downhill.
- During the lift and lay process, keep loads below the maximum allowable load weight. *Note: Hazardous terrain often requires adjustments down from the maximum load weight.
- Under no circumstances should Boom Operators get off their machine while an active load is being worked on by personnel on the ground.
- When parking a side-boom tractor, weight should be positioned uphill.
- Watch the positioning of the snatch block rigging to ensure cables are not rubbing or stuck.

LIGHT DUTY WHEELED VEHICLES/UTV

- Wheeled vehicles may be prohibited along identified hazardous terrain.
- Gear down when driving down hills. Do not ride the brakes more than is required.
- Towing may be necessary on steep or otherwise hazardous ROW or access roads. Use sufficiently sized tow rigging and/or tow anchor bolts for the vehicle (e.g., heavy duty tow mounts may be needed) and inspect prior to use.
- All towing must be done in accordance with SJP-19 Towing.

WINCHING

- Slope angles of 30% (16.7°) or greater (or as specified by the Project Owner) should be analyzed to determine if winching is necessary for safe equipment usage on such work sites. Other hazardous terrains with less slope may also require winching.
- When working on a steep slope that requires winching, only one operation should be underway at a time.
- Prior to winch operations, remove any crew working on the downhill side of the winching operations.
- When installing large sections, use winches on both the pipe and the tractors. This will help prevent the pipe from slipping and turning the tractors when installing the sections of pipe.
- When multiple tractors are used in winching operations, radio or, hands free communications is recommended. If communications are unavailable, use a spotter to maintain contact to both machines.
- Install proper shielding on top of the blade and all other rough edges to protect against cable fray.
- Place winching equipment required to hold construction equipment on a flat and level area on the top of each hazardous terrain location and anchor it, if required.
- Always have at least 1 full layer plus 5 wraps of cable on the winch drum (or as per OEM).
- Winch Equipment Operators should not leave the seat of the machine while equipment is attached. If an Operator needs to leave the seat for any reason (e.g., bathroom break, shift change) cease all operations until the Operator returns to the seat of the machine.
- Before equipment is pulled or lowered, the qualified person should double check all attachments to ensure:
    - No rigging is hooked to the belly pan on any machine.
    - Tail chains should not be used when winching excavators, sideboom tractors, or dozers. When tail chains are used, a positive connection by way of shackle or similar device should be used. Open hooks or logging hooks should never be used.
    - Attachment to all equipment must be either to a manufacturer's attachment point rated for the expected forces or must be an engineered and inspected attachment point with sufficient capacity. Sideboom attachment points are on the tractor and are never on the boom.
    - All rigging must be inspected and have sufficient capacity for the winching load.
    - Hooking to the cast parts on a farm tractor is not allowed. Instead, install a pull eye to hook.
    - Use shackles and D-rings for all rigging connections. Direct hooking with pipe belts is not allowed.
    - Use draw bar pins that have a safety latch or serviceable safety keeper and inspect daily.

THE DON'Ts

DON'T Do not use chains as a method of towing or winching. Only straps, cable chokers, steel slings with certifications or belts should be used for towing or winching.

DON'T Winch if crew members are in the line of fire of falling debris or equipment. Personnel must stay 1.5X length of cable away.

DON'T Step over or stand on a hooked winch line or cable.

DON'T Leave the remote control plugged into the winch while free spooling, rigging, or sitting idle.

DON'T Engage or disengage the clutch if the winch is under load, wire rope is in tension, or wire rope drum is moving.

DON'T Touch the wire rope or hook while in tension, under load, while someone else is at the control switch, or during winching operation.

DON'T Touch wire rope or hook while a remote control is plugged into a winch.

DON'T Allow the cables/wire ropes to dig into the ground, surface rocks, sharps, or any other source of friction besides that of the winch drum. This includes the rubbing of the cable/wire ropes on the dozer blade.

COMMUNICATION AND SIGNAGE

Methods of communication and verification can include, but are not limited to:

- Use of Spotters at crest of hill.
- Signage placed at the crest and toe designating the presence of hazardous terrain locations and/or a blind crest or break over.
    - Signage should include slope percentage/degrees and could include a list of what equipment is not permitted to proceed any further.
    - Signage should be installed notifying workers of approach to the blind crest and identifying its location. This allows for effective communication over two-way radio (e.g., Pickup travelling up slope to 7+300 crest.).
- Radio checks and instructions as to channel to use, prior to approaching the break over.
- Operator visual ground verification prior to cresting.
- A designated person with an air horn should be put in place to warn of falling debris or other hazards if those conditions exist. Warning signals shall only be sounded if there is an immediate danger (e.g., dislodged rock, sliding equipment, material slide, broke winch line, etc.).

REFERENCES / ADDITIONAL INFORMATION

CPES DOCUMENTS

COP 07 Ground Disturbance

SWP 01 ATV/UTV Safety

SWP 14 Wildlife Awareness

SWP 75 Vehicle and Equipment Spotting

SJP 19 Towing (Stuck Vehicle and Recovery) Vehicle Towing Vehicle

SJP 28 ROW Preparation

Equipment/Vehicle Inspection forms

CF-S-18 Daily Pre-Start Inspections

CF-S-30 Competency Checklist(s)

REGULATIONS

Alberta OHS Code

- Part 2 Hazard Assessment, Elimination and Control
- Part 7 Emergency Preparedness and Response
- Part 19 Powered Mobile Equipment
- Part 32 Excavating and Tunneling

WorkSafe BC OHS Regulation

- Part 4 General Conditions Section
- Part 8 Personal Protective Clothing and Equipment Part 16 Mobile Equipment
- Part 20 Construction, Excavation and Demolition

Saskatchewan OHS Regulations

- Part 17 Excavations, Trenches, Tunnels and Excavated Shafts
- Part 11 Powered Mobile Equipment

Manitoba Workplace Safety and Health Act and Regulation

- Part 26 Excavations and Tunnels General Matters

Developed by:	1.	Ryan Obleman	2.	Dustin Jackson	Date:	Dec 23, 2021
	3.	Brian McConnell	4.	Allen Monk		
	5.	Steve Whynott	6.	Clint Hilhorst		
Approved by:	1.	Corporate HSE Committee			Date:	April 29, 2022