Appalachian National Scenic Trail	**1. WORK PROJECT/ACTIVITY** **Rigging Operations**	**2. LOCATION** **TRAIL WIDE**	Includes work performed on lands of National Park Service, and various states' park and lands
JOB HAZARD ANALYSIS (JHA) **References-FSH 6709.11 and -12** **OSHA** **(Instructions on Reverse)**	**3. NAME(S) OF ANALYST(S)** **Keith Stegall**	**4. Work Supervisor** **Various**	**5. DATE PREPARED** **7/24/2020**
Required Standards and General Notes:	**Training is required prior to rigging, highline, and/or Griphoist use.**		
Required Personal Protective Equipment	Hard hat, gloves, long pants, long sleeves, eye protection, sturdy boots with lugged soles		
Tools and Equipment	Includes first aid kit, Griphoist, straps, chains, chain basket, web baskets, round slings, wire rope, shackles, tripod, snatch block, wire rope grippers, come along, rope puller.		
Available Training	Rigging Workshop		

7. TASKS/PROCEDURES	**8. HAZARDS, POTENTIAL HAZARDS / INJURY SOURCE**	**9. ABATEMENT ACTIONS OR PROCEDURES** **Engineering Controls * Substitution * Administrative Controls * PPE**
Rigging Pre-Operations	Injury due to lack of equipment inspection prior to operation	• Always wear leather gloves prior to handling and/or inspecting wire ropes. • Straps must be checked for cuts, abrasions, unraveling, exposed cores, broken stitching, dirt, stains, and discoloration • Wire rope should be checked for burring, broken wires, kinks, etc. • Griphoist should be checked for wear and play in the shear pins, dirt in the working parts, lubrication of proper parts, functioning of hook gates, anchor shank safety cotter pins, etc. • Wire rope grippers, snatch blocks, shackles and all other rigging accessories should be checked for smooth and proper operation of moving parts, threading, bends, cracks, operational safety gates. safety cotter pins, etc. • Wire rope and slings should be checked for cuts, abrasions, unraveling, exposed cores, broken stitching, dirt, stains, and discoloration • Ensure no cracks or fractures are present in rigging equipment. • If defects are found in any rigging equipment, they must be removed from service and entered into the lockout tagout program until repaired or disposed of. • Ensure a fully equipped First Aid kit is on site.

	Injuries from lack of training, and/or supervision	● Prior to operation, read/review operators manual. ● One onsite master rigger shall be identified as the Rigging System Leader. Leader must be previously trained and have a full understanding of all rigging equipment, their safety requirements, hazards, limitations, and related load bearing mathematics. ● Leader will ensure all other workers are provided adequate orientation, PPE, equipment, and training per their rigging duties and responsibilities.
Rigging Transportation	Injury due to improper loading / packing of equipment	● If carrying equipment by foot - ensure that load weights are within safe range for individuals, ensure that loads are secured with no loose ends or dangling parts that can get caught on limbs, staubs, trail structures, etc. or that can become tripping hazards ● If carrying equipment by truck, utility vehicle, wheelbarrow, power carrier or other conveyance, ensure that loads are secured in the payload area without protruding or otherwise risking catching parts of the equipment on stationary objects, or having parts fall from the vehicle
Planning / Preparing / Setting Up Rigging Systems.	Injuries resulting from poor planning	● Rigging Leader shall develop and communicate to coworkers a rigging plan for the project site ● Key Planning Considerations: ○ Determine Safe and Dead zones ○ Determine flight-lines, travel route, direction of pull. ○ Needed/number of guards, flaggers, lookouts ○ Potential obstacles/hazards in travel route ○ Identify most useful location for the system ○ Ensure that anchors are sound and adequate in number for anticipated loads. ○ Determine appropriate angles between anchors, or between anchors and spar trees. And the anchors are equalized and/or independent. ○ Consider consequences of anchor failure. ○ Ensure that spar trees are of adequate size and anchored if needed. ○ Evaluate all trees along the route and work area for overhead hazards. ○ Ensure that anchor straps will not damage trees. ○ Ensure that loads clear high spots/natural obstacles ○ Make provision for belaying loads at any point of travel. ○ Determine the heaviest load the system can safely handle and do not exceed that load

		○ Determine how much tension is required to lift loads. Ensure system is not overloaded. ○ Determine what is the weakest link in the system, and where the greatest strain placed on the system. ○ Determine the worst case scenario, and how can it be prevented/mitigated ○ Determine if there is anyway to retain safety and function, yet reduce the system to fewer components. ○ Identify escape route(s) ○ Determine need and plan for temporary public closures, signs, and/or detours. ● All workers should take an active role in hazard identification, analysis, and mitigation.
	Injuries resulting from poor communication.	● Instructions should come from one person (Rigging Leader) when working in teams of two or more. ● Rigging Leader shall assign onsite rigging assignments and communicate roles and responsibilities to coworkers. ● Rigging Leader shall walk the entire team through the rigging site and communicate the entire plan, paying special attention to identifying potential dead zones and other related safety hazards. ● Crew members should constantly be aware of their surroundings, the location of other crew members, and trail visitors while setting up, operating, and dismantling rigging equipment. ● Communication methods and/or jargon should be discussed and agreed upon prior to rigging setup and moving of materials. ● Rigging crew has the authority to temporarily restrict access to the work site to protect trail visitors.
	Injury to back from improper lifting	● Do not twist. Use your feet to turn your body. ● Carry the load as close to your body as possible. ● Keep your back straight. ● Stand close to object, with feet solid and shoulder-width apart. Do not reach over an obstacle to lift the load. Move whatever is in your way. ● Squat down, bending your knees. Keep your back straight and upright. ● Grip the object firmly and pull it close to you. ● Tighten your abdomen. ● Lift with your legs in a gradual and smooth movement. Keep your back straight. Keep the load close to your body.

		● Do not twist your body while lifting. ● Do not lift objects over your head.
	Slips, Trips, & Falls Crush Injury	● Inspect the area immediately around the load and the route for clearance and tripping hazards. ● Clear movable objects from the route. Check for uneven terrain. ● Clean up spills that could affect foot traction. ● Use caution and approved ladders or climbing gear to set overhead rigging points in trees. ● Climbing gear may only be used by qualified individuals.
	Cuts, abrasions, pinching, from setting up rigging systems	● Always wear all required PPE when setting up, operating and dismantling rigging system equipment ● Keep hands away from pinch points on equipment and materials. ● Communicate with coworkers before tensioning gear.
	Injuries resulting from poor route selection / preparation	● Explore options, fill holes, build temporary structures to maximize safety and efficiency in moving materials, especially on steep or loose slopes. ● Clear the route of hazards and debris before moving materials. ● Consider using chocks, skids, or logs to ease moving materials.
Operating Rigging Systems (Griphoist, Come Along, etc.)	Injuries from misuse or overloaded equipment.	● Workers using rigging and highline systems must be familiar with the working load limits (WLL) and safety features of all components in the system. ● Use only shear pins provided by manufacturer. Do not substitute nails, bolts, threaded rod, etc. ● It is recommended that a load calculation be done before every new or major lift, to ensure loads are within WLL. ● Rigging system components should be lubricated per manufacturer's instructions - use 90 to 120 weight motor oil or other recommended lubricant. ● Workers should never: ○ step, sit, straddle, or stand on the wire rope ○ enter or occupy the 'dead man zone' ○ needlessly touch a wire rope under tension. ● When moving materials or applying tension, workers need to remain aware of direct and potential hazards, and position themselves in such a way to minimize their exposure. ● Apply tension slowly to system

		• Never use pipe or other object to extend the handle of rigging equipment, come along or other motive device. • All personnel in close proximity to highline operations need to wear PPE. • Manage work site to protect hikers, visitors and non-rigging crew members from entering work areas when loads are being moved. • Ensure load is belayed and under control at all times. Workers should never put their body between load and destination point.
	Injury to back from improper lifting	• Do not twist. Use your feet to turn your body. • Carry the load as close to your body as possible. • Keep your back straight. • Stand close to object, with feet solid and shoulder-width apart. Do not reach over an obstacle to lift the load. Move whatever is in your way. • Squat down, bending your knees. Keep your back straight and upright. • Grip the object firmly and pull it close to you. • Tighten your abdomen. • Lift with your legs in a gradual and smooth movement. Keep your back straight. Keep the load close to your body. • Do not twist your body while lifting. • Do not lift objects over your head.
	Slips, Trips & Falls Crush Injury	• Inspect the area immediately around the load and the route for clearance and tripping hazards. • Clear movable objects from the route. Check for uneven terrain. • Clean up spills that could affect foot traction. • Notify co-workers before tensioning system or components.
	Cuts, abrasions, pinching, from setting up rigging systems	• Always wear all required PPE when setting up, operating, and dismantling rigging system equipment • Keep hands away from pinch points on equipment and materials. • Notify co-workers before tensioning system or components.
Operating Rigging System Accessories	Injuries from misusing or overloading Chains/Anchors, Straps, Shackles, Cleveses, etc.	• Leader must know WWL limits of straps and chains when oriented vertically (WWL = 1X), as a basket (WWL = 2X), or girth-hitched (WWL = approx. ¾ X). • Workers must be trained in basic chain, webbing, sling, and basket techniques. • Workers installing anchor straps must be trained in basic wrapping techniques.

		● Identify and designate which straps and/or webbing baskets are used only for lifting and which are used for dragging operations. Never use lifting straps or lifting webbing baskets for any other use. ● If anchor straps will damage trees, adjust under slack, and pad. ● Place anchor straps as low on the tree as possible. ● Place spar straps just above a fork when possible. ● Ensure that attached components are seated correctly in the shackle before applying loads. ● When in doubt, wire or cable-tie shackle pin to ensure it will not back out. ● When belaying loads from a shackle, make sure the vibration or friction from the rope will not back the pin out. ● Use cotter pins of the same sizes as provided by the manufacturer. ● Ensure that any hook keepers/gates are functioning correctly and load is correctly positioned in the hook/shackle/clevis before applying force to the system. ● Blocks with hooks should be equipped with operational gates. ● When using multi-part pulls, make sure the additional mechanical advantage does not exceed the safe working load limits of anchors, shackles, or other system components. ● Always know where the death zone(s) are, and stay clear of them. ● Inspect equipment periodically during use.
	Injuries from misusing / overloading modular spar towers.(Tripods)	● Workers using towers and their components need to be familiar with their WLL, and basic setup and operation. ● Inspect towers and components prior to use and/or periodically during use. ● Note that each tower is unique and each piece is labeled to indicate which parts go together. ● Direction of pull should strike through the center of each tower. ● Ensure each leg is securely planted. Be extra careful on exceptionally hard (slick rock) or soft ground, as legs can slip or become buried under tension. ● Make sure weight is evenly distributed between each leg. ● When in doubt, anchor tower and/or secure legs, perform test lift, always take initial load slowly until stability is confirmed ● Check towers and system often.
	Foot injuries.	● Workers need to maintain constant awareness of their feet in relation to objects being moved and avoid placing them under materials.

	Hand injuries.	● Workers need to maintain constant awareness of their hands in relation to objects being moved and avoid placing them under materials.
	Injuries from materials- cuts, scrapes, pinches, etc.	● Clear work area often to reduce the chance of tripping or falling. ● Be prepared for sudden or unexpected shifting or settling of loads when tension is introduced, especially when using chains and chain baskets. ● Freshly cut stone is extremely sharp, and workers need to exercise caution while handling or moving this material.
	Injuries from overhead hazards.	● Hardhats are mandatory for all rigging system use. ● Check for and anticipate overhead hazards. Special attention to tree limbs and tops. Look up!! Shock loads especially can snap branches.
	Injuries due to lack of knowledge of working load limits of Griphoists and common hardware	**Griphoist Cheat Sheet - Working Load Limits** (self-weight**)** **TU-17** = 2,000 lbs capacity (19 lbs) - pins shear at 3,000 lbs 5/16" wire rope (4x26) = 10,000 lbs (0.185 lbs/ft) 3" dia. Snatch block = 4,000 lbs (4 lbs) 4.75" dia snatch block = 3,000 lbs (8 lbs) **TU-28** = 4,000 lbs capacity (40 lbs) - pins shear at 6,000 lbs Griphoist handle weights 3 lbs 7/16" wire rope (4x26) = 20,000 lbs (0.35 /lbs/ft) 4.5" snatch block = 8,000 lbs (12 lbs) 6.875" snatch block = 5,000 lbs (15 lbs) **Tripods** - recommended max load = 600 lbs **Hardware:** ● ½" screw-pin shackle = 4,000 lbs (>2 lbs) ● ⅝" screw-pin shackle = 6,500 lbs (> 2 lbs) ● ¾" screw-pin shackle = 9,500 lbs (3 lbs) ● ⅞" screw-pin shackle =13,000 lbs (3 lbs) ● Chain saddle grab link = 7,300 lbs ● "Little Mule" wire grip = 5,000 lbs (3 lbs) ● "Sauerman" ⅜" cable clamp = 4,000 lbs (5 lbs) ● "Sauerman" ½" cable clamp = 7,000 lbs (5 lbs) ● Chain baskets = 9,000 lbs (~43 lbs) ● Grade 80 chain = 7,100 lbs (1.5 lbs/ft)

		Webbing slings: (10 ft = 3 lbs) <u>2" wide 3" wide</u> Vertical = 6,400 lbs Vertical = 8,600 lbs Choker = 5,000 lbs Choker = 6,500 lbs Basket = 12,800 lbs Basket = 17,200 lbs
	Injuries or failures due to a lack of knowledge or inaccurate load calculations.	**<u>Trails Rigging Standard Operating Procedures:</u>** ● **Size Up** ○ What is the Objective? ○ What are the Hazards? ● **Estimate Weights** ○ Weight X Volume ● **System Design** ○ Calculations ○ Anchors ○ Components ○ Attachments **Inspection, Safety Plan, Test** **Safety Factor: All Rigging = 5 : 1** ● Volume: Circles = πr^2; Cylinders = πr^2 x L(length) ○ Square/Rectangular solids = Length x Width x Height ● Approx. Weights: Granite = 170 lbs/ cubic foot ○ *Weight per linear foot:* Pines: 19.6 (green), 16.1 (dry) ○ *Based on 8-10" dia*. Oak: 24 (dry) ○ Coefficient of Friction: rock on dirt = 8%
Cleaning/Maintaining/Storage of System Components	Hidden defects or component wear	● Daily inspection and cleaning of system components: ○ Inspect wire, straps, chain or rope for damage. Remove from service if damaged or deformed. ○ Clean loose dirt and debris from load bearing straps/chains/wire rope ○ Check that all shackle pins are tight ○ Confirm correct operation of all wire rope grips
		● At conclusion of project: ○ Thoroughly clean all rope and straps with water and cleaning products approved by the manufacturer. ○ Maintain and update a use log of all rope and straps ○ Inspect and lubricate wire rope as recommended by manufacturer

		○ Clean and lubricate motive devices as recommended by the manufacturer ○ Clean and lubricate all wire gripping components as recommended by manufacturer. ○ Store components in a secure, dry and clean location. Store so to prevent damage to rope and straps from sharp objects, chemicals and rodents. Limit access to approved persons only.
	Exposure to cleaning/ lubricating chemicals	● Read and follow manufacturers instructions for using cleaning and lubricating components. ● Wear eye and hand protection as required.
10. OFFICIAL SIGNATURE *Kurt Speers*	***11. TITLE*** ***Kurt Speers*** ***Acting Chief Ranger - CDSO***	**12. DATE** **09/01/20**

JHA Instructions (References-FSH 6709.11 and .12)

The JHA shall identify the location of the work project or activity, the name of employee(s) involved in the process, the date(s) of acknowledgment, and the name of the appropriate line officer approving the JHA. The line officer acknowledges that employees have read and understand the contents, have received the required training, and are qualified to perform the work project or activity.

Blocks 1, 2, 3, 4, 5, and 6: Self-explanatory.

Block 7: Identify all tasks and procedures associated with the work project or activity that have potential to cause injury or illness to personnel and damage to property or material. Include emergency evacuation procedures (EEP).

Block 8: Identify all known or suspect hazards associated with each respective task/procedure listed in block 7. For example:

- **a. Research past accidents/incidents.**
- **b. Research the Health and Safety Code, FSH 6709.11 or other appropriate literature.**
- **c. Discuss the work project/activity with participants.**
- **d. Observe the work project/activity.**
- **e. A combination of the above.**

Block 9: Identify appropriate actions to reduce or eliminate the hazards identified in block 8. Abatement measures listed below are in the order of the preferred abatement method:

a. Engineering Controls (the most desirable method of abatement).
For example, ergonomically designed tools, equipment, and furniture.

b. Substitution. For example, switching to high flash point, non-toxic solvents.

Emergency Evacuation Instructions (Reference FSH 6709.11)

Work supervisors and crew members are responsible for developing and discussing field emergency evacuation procedures (EEP) and alternatives in the event a person(s) becomes seriously ill or injured at the worksite.

Be prepared to provide the following information:

- **a. Nature of the accident or injury (avoid using victim's name).**
- **b. Type of assistance needed, if any (ground, air, or water evacuation).**
- **c. Location of accident or injury, best access route into the worksite (road name/number), identifiable ground/air landmarks.**
- **d. Radio frequencies.**
- **e. Contact person.**
- **f. Local hazards to ground vehicles or aviation.**
- **g. Weather conditions (wind speed & direction, visibility, temperature).**
- **h. Topography.**
- **i. Number of individuals to be transported.**
- **j. Estimated weight of individuals for air/water evacuation.**

The items listed above serve only as guidelines for the development of emergency evacuation procedures.

JHA and Emergency Evacuation Procedures Acknowledgment

We, the undersigned work leader and crew members, acknowledge participation in the development of this JHA (as applicable) and accompanying emergency evacuation procedures. We have thoroughly discussed and understand the provisions of each of these documents:

SIGNATURE	**DATE**	**SIGNATURE**	**DATE**

c. Administrative Controls. For example, limiting exposure by reducing the work schedule; establishing appropriate procedures and practices.

d. PPE (least desirable method of abatement). For example, using hearing protection when working with or close to portable machines (chain saws, rock drills, and portable water pumps).

e. A combination of the above.

Block 10: The JHA must be reviewed and approved by a line officer. Attach a copy of the JHA as justification for purchase orders when procuring PPE.

Blocks 11 and 12: Self-explanatory.