Risks Involved with Helicopter Operations on a Remote Jobsite

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Running a jobsite in a remote location adds unpredictable challenges and such experience is difficult to find. In mountainous terrain where road access is limited, the most efficient way to transport materials from the laydown yard to the jobsite is with a helicopter and a longline. Having an active helicopter on site comes with many detailed plans and preparations for safety risks, emergency evacuations, and lifting procedures. Many variables must be accounted for when getting a helicopter usage plan approved, and everyone in the field must be trained appropriately for any potential hazards. Projects like these are unique and many project managers don’t have real experience working in these conditions. Mountainous locations often have seasonal weather swings, high winds, and limited access, adding more concern to the operation. By understanding the risk involved and having a plan for mitigation, project managers and pilots can reduce the chance of accidents on a remote jobsite.

Key Words: Helicopter, Remote, Mountainous, Risk

Introduction

Working on a remote jobsite has a lot of negatives when it comes to managing a construction site. These projects are in rough terrain, such as mountainous or desert areas, and are often far from management offices and material suppliers. Inexperience in rough terrain construction can cause contractors to be unprepared for the job. Helicopters are used in construction for unique situations, especially when road access is limited and when material size and weight is too large. Not many construction managers have experience working with helicopters either, so this combination of project elements creates a challenge. Project managers in the preconstruction phase must plan for the hazards that may be present, and the risks involved with helicopter operations can range from bad weather and malfunctioning communication, to rigging failures and aircraft rotor contact with surrounding structures. Along with knowing the risks and preparing yourself best for any situation, project managers should also have procedures in place for when an emergency takes place. An emergency
response plan should outline the steps required to take during any emergency, whether it’s due to an injury or a weather event.

*Risks Involved*

The following five points highlight the main themes that can impact the performance of the helicopter and the jobsite.

*Weather* – Rain, high winds, or other weather extremes causes an unsafe flying environment and helicopter work must stop if the pilot deems the weather to be too dangerous. Weather in remote locations can vary seasonally from high highs in the summer to low lows in the winter. Helicopters must also not operate if it is not visible further than half a mile. Continuing aerial work in the case of bad weather can be very dangerous for the pilot and field personnel. (Finan)

*Communication* – Communication between the pilot and the ground crew attaching and dissembling loads is important for the efficiency of the haul. Non-verbal head and hand signals are important for both people to understand for directing the load lift. Radio communication is needed between air and ground personnel to clarify what needs to be picked up, alert anyone if the helicopter has any malfunctions, and where material needs to be dropped off. (Finan)

*Load Rigging* – Daily inspections and proper rigging training must take place to ensure rigging procedures are safely followed. Ground crews should always know the load capacity of the helicopter and never attach anything too heavy. Rigging team must also ensure equipment and materials are strongly hooked up before signaling the pilot to lift the load. Rigging failures can lead to rework, damaged property, and/or serious injury or death. (Cost)

*Environmental* – The environmental directive on jobsites is to follow Federal, State, and Local ordinances and to always be looking to mitigate problems and find solutions. The fast-spinning rotor of the helicopter will cause problems such as dust control and the spreading of sediments. SWPPP protocols should include BMP’s relating to helicopter action. Personnel in the field should have proper PPE to protect their ears from the noise and dust from their eyes/mouths. (Finan)

*Emergency Response* - If an emergency occurs, all personal should have a copy of the emergency response that is accessible. Field personnel need to be trained on how to respond to different situations in the remote area. Most jobsites that need helicopter assistance have no infrastructure or cell phone service, so everyone needs to be on the same page without hesitation. Protocols will be listed in the response plan such as emergency landing zones, personnel rally points, evacuation plans, and more. (Cost)

**Literature Review**

**Background**

Helicopters were first introduced in the construction industry in the 1950’s and started to be used more in the 1960’s when companies noticed its crane-like capabilities could lift and deliver loads in unique situations. Helicopters were first popular in the logging industry because they could access areas in the wilderness that had no roads. That thought transferred into the construction industry when essential projects in remote locations had a lack of accessibility. The first helicopter used in this
practiced was the Bell 47, but due to its small size and lack of power, its load capacity was too low to keep up in the industry. There was a demand for a bigger machine that can lift heavier loads, and in 1962 Sikorsky released their new S-64 Skycrane which had a lifting capacity of 20,000 lbs. This machine is still being used today, and the biggest helicopters are now capable of lifting 45,000 lbs.

Although this type of work has been performed for over fifty years, the abilities to mitigate risks is still a very challenging task and experience in this field is limited. This could be because pipeline and electrical line work is a difficult, dirty sector of construction and running a job like this in a remote area would require someone with experience. Running this job for the first time could be intimidating and stray project managers away. The ability for new PMs to learn the complexity of helicopter jobs is difficult, thus allowing access to experienced information is hard to find. Risks involved with remote helicopter work include many uncharacteristic variables such as weather and radio failure, making them difficult to mitigate and control.

Goals

The main purpose of this analysis is to discuss the unique challenges applied to this field and discover measures of mitigation for major components of remote helicopter construction. Methodologies and information regarding risk mitigations are to be suggested to new project managers working in this field or to other professionals in construction. Since information pertaining to this field is difficult to find, the approaches discussed are to serve as a means-and-methods for mitigating hazards on the jobsite.

Methodology

Different forms of research were performed on this project to analyze the risks involved with remote helicopter construction. Broad research on the subject was performed to get an overview of the topic and get a good idea of what the interviews should look like. Interviews were set up with established people in the industry who have experience in these unique conditions. Questions were organized before each interview took place to ensure an open-ended structure to the conversation and to ensure the analysis was done not for a specific project, but the field in general. Each interview followed the same structure with the goal of listing all the risks involved and categorizing them into major risk groups. Common responses from the interviewee’s were pulled aside for a deeper analysis. These groups of hazards were then discussed further to account for mitigating measures. After the interviews were complete, online journals, research papers, and different info graphs were looked at for further information on potential hazard mitigations.

Analysis and Discussion

Information derived was separated and categorized into five major risk categories involved with remote helicopter construction. Each category was analyzed using qualitative and quantitative research. Each category sums up a collection of risks that will need to be assessed before construction begins.

Weather

Weather affects not only the helicopter work but the performance of the whole project. Helicopters have manufactured restrictions on when the helicopter can fly in different weather conditions, and these operating restrictions are precautions to extreme weather conditions. The figure below
represents the weather range in each month of the year for the San Gorgonio Mountain Range in San Bernardino, California. Summer months consist of very hot days and most days in the summer hit triple digits. Winter months reach cold highs in the 50-degree range and see months of snowfall, rain, and big wind gusts. Drastic weather conditions come in the winter months and that timespan sees the highest potential for project impacts. These conditions can halt helicopter operations and without a bird in the sky, the project could be stopped and delayed.

![Maximum Temperatures for San Gorgonio Mountain, CA (AIL)](image)

The FAA (Federal Aviation Association) classifies wind as one of the three major factors that affect performance, and in rough mountainous terrain, high winds can be more dangerous. For example, “the pilot of a Robinson R44 II was flying close to a ridge line near Carcross, Yukon, Canada, on July 10, 2012. A strong wind gust pushed the helicopter into a leeside mountain wave. A rapid, uncontrollable descent resulted in a crash that killed the pilot and injured the two passengers” (Government of Canada). Wind restrictions apply to helicopter work and pilots know to oblige. During a water pipeline operation in the San Bernardino Mountains, pilot Cost mentions that “flights at or above 500 feet above ground level can fly in steady state winds up to 50 knots, and flights below 500’ above ground level are allowed to fly in up to 40 knots” (Cost). Another factor the FAA classifies as sources affecting helicopter performance is air density and the altitude of the jobsite. Working in mountainous high-density altitudes opens the door for problems revolving takeoffs and landings. In an article on weather impacts regarding aerial, meteorologist Ed Brotak gives his perspective on the risks involved with weather conditions. He states that in higher altitudes, “lift generation can be greatly reduced, and the risk of rotor blade stall may increase greatly. High-density altitudes can also affect tail rotor aerodynamic performance. Thrust and efficiency are reduced by the thin air. LTE (Loss of Tail Rotor Effectiveness) can occur especially with heavy loads” (Brotak). When working in mountainous, remote locations, it is best to always be aware and analyzing weather patterns coming up. Important schedule days regarding helicopter use should be keyed in and made sure weather delay doesn’t impact the activities scheduled. Projects performed in the non-winter months will lead to less weather hazards and safer flight plans regarding the helicopter.
Communication

Communication is the most important aspect of any jobsite, and it’s especially important when working on a remote jobsite where cell service and other amenities aren’t around. Failure to communicate with others will result in project issues and ambiguities between project players. Project personal need to communicate the helicopters plan for the day and inform the ground crew what materials need to be transported. The pilot should be communicating with the ground crew on issues such as fuel tank amount, weather conditions, or anything that stands out. Pilot will need air communications to speak to other pilots incase other aircrafts enter the jobsite airspace. The most important form of communication in helicopter construction is ground-to-air communication regarding the pilot and ground personnel. If radio communications are not working, the helicopter should return to ground until the issue is fixed. Operating a jobsite with an active helicopter and no communication can lead to many dangerous events. Ground crew members could be unaware of what the pilot intends to do and get hit by the loaded material, leading to injury. The ground crew needs to remind the pilot when to land for fuel and being too low on fuel while flying could lead to trouble. Other than radio communication, non-verbal communication needs to be understood between ground personnel and pilot. The figure below shows a variety of signals with their meanings below.

![Hand signals for communication](Hundseth.ca)

Hand signals are a great way to continue the communication process with or without radio connections. Ground personnel and the pilot should be thoroughly trained on the hand signals and how they relate to rigging. These signals go through multiple people on the jobsite and understanding them well ensures a fast transition between loads. Failure to accurately signal to the pilot can lead to
unsecure equipment or ground crew injury. The pilot will be relying on these communications, so it’s important for the safety of others that communication plans are understood.

**Load Rigging**

Rigging loads to a longline is the easiest way to deliver material and structures from one place to another, especially in remote locations. Longline construction provides many advantages when used properly, but it comes with lots of preparation. Personnel need an understanding of the helicopter weight, longline limitations, staging area, and surrounding environment. According to the Department of National Defense, “90% of accidents occur during pickup and laydown”, and “79% of accidents are caused by either sling failure, improper load preparation, or inadvertent load release” (IHSA). Most of these accidents are avoidable with good preparation of the load capacities and helicopter limitations. Rigging plans and devices need to be approved and stamped for the load types involved. Ground personnel should be informed on a lifting plan to add direction to the lifting process. Ground personnel will need to be able to identify loads, understand the lifting sequence, and inspect the rigging equipment for wear-and-tear. Longlines, slings, and equipment used for lifting loads should be marked with its SWL (Safe Working Load) and/or lifespan in an identifiable spot, and a record or use should be maintained. The type of rigging used for the material or equipment should be identified, as certain weights and shapes will need different rigging strategies. The figure below shows how you would properly rig up equipment requiring a six-point lift.

![Figure 3: Proper rigging of a Load with Six Lift Points (US Department of Defense)](image)

Improper rigging can lead to decreased air stability for the helicopter and increased chance of sling failure. Failure to safety secure equipment can injure project personnel, damage equipment, or lead to helicopter issues. Ground crews should know to never overload the helicopter and never take chances to get the job done faster can be dangerous. Ground crews need to be trained and experienced, and members should know their responsibilities. Workers should be equipped with secure PPE to deal with helicopter’s high wind and noise creation. Hoisting loads on a jobsite can seem like an easy task, but the activity it creates leads to a big challenge. When well prepared, project managers can safely complete projects and deliver loads in a smooth fashion.
Environmental

While running a jobsite in a remote undisturbed location, it’s very important to preserve the surrounding environment and respecting the quality of the environment. Contractors know to follow Federal, State, and Local ordinances and to follow their approved SWPPP plan active for the project. When using a helicopter on a jobsite, “the two biggest issues for the environment are fuel spillages and dust control” (Cost). Projects will need to have a hazardous material spillage prevention and control plan, highlighting what to do in the event of a fuel spill. In case of a fuel spillage on site, project managers need to contact the local environmental health division or any other authorities. The spill site will need to be contained, and any water drains will need to be blocked. Field personnel will need to be evacuated to prevent health issues. Any sources of ignition will need to be removed and the competent personnel will need to create a spill removal plan. Since fuel spills on a jobsite are most often caused by an improper or careless fueling operation, these spills can be avoided.

Dust control is another issue that arises when working in remote areas. Since the natural ground will serve as the staging area, pieces of debris and dirt are vulnerable to blow and spread everywhere. Maintaining dust will decrease the spread of sediments and remove visibility issues for the pilot and ground crew. The helicopter staging and loading areas shall be treated with water, soil binders, or other ways to maintain a hard surface and mitigate dust emissions. Other alternatives can be to lay gravel over the landing zone to cover and contain the earth. The pilot and designated personal shall agree on a flight path that reduces the time flying over vulnerable areas. If strategies to maintain dust are difficult, ground crews shall be equipped with PPE to prevent dust from getting in their eyes, ears, and mouths. Construction contractors are always doing their best job to mitigate environmental hazards and leave jobsites cleaner than how it previously was. Helicopter construction can add environmental challenges that wouldn’t be present in urban areas but being prepared and aware of the challenges involved can help alleviate these issues.

Emergency Response

Responding to a sudden emergency on a jobsite can be alarming and confusing, and it’s dangerous to have personnel wondering what to do next. Designing an emergency response plan allows all project parties to have a protocol to follow and instruction designed for any emergency. Rally points shall be designed for ground crews to respond to incase of an emergency. In the case that an emergency evacuation takes place, rally points shall be prepared to serve as a “designated landing zone”, making it easy for crew members to board. In the event of a flash flood where laborers need to be evacuated, a headcount will need to take place prior to getting in the helicopter as well as at the drop-off point. Helicopter shall be already equipped with seats and seatbelts for passengers. In the event where a person needs to be lifted to the hospital, protocols shall be set to follow. A designated hospital shall be lifted, and pilot shall know where to go/land when the occurrence happens. Project personnel should have direct lines to the fire and police departments, as well as a direct line to the medical hospital assigned. The main goal on a jobsite is to keep everyone safe and having emergency measures will help ensure field personnel safely respond to any event.

Conclusion

Helicopter operations in a remote location can add unpredictable challenges to any jobsite, and experience in this sector is limited. Most of the pipelines and electrical towers spanning across deserted and mountainous areas are reaching their lifetime limit, and helicopter construction will be needed to replace these essential utilities. As remote challenges make these projects much more
difficult to complete, examining how we can make these jobsites safer for field personnel and what we can do moving forward is essential to the industry. The goal of this paper is to provide mitigation measures for helicopter complications on any jobsite, taking means and methods from experienced professionals in the industry. By looking at the major categories of risk involved with helicopters on a remote jobsite, project managers can feel confident in the safety of their jobsite.

Works Cited

26 Helicopter Lifting 2. General Information - IHSA.


Cost, J. (2022, Nov). Phone Interview

Finan, M. (2022, Nov). Phone Interview

