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STRETCH AND FLEX GUIDEBOOK

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TxDOT Project 0-6805: Stretch and Flex Program for TxDOT Operations

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Executive Summary

Strain/sprain-related incidents account for 40% of the total injuries of Texas Department of Transportation (TxDOT) employees. Over the past 5 years the most common strain/sprain injury was of the lower back; 50% of these injuries were caused by lifting tasks. Research studies have shown that muscle strengthening exercises can reduce workplace strain/sprain-related incidents. However, most of the Stretch and Flex programs currently being implemented involve more stretching than flexing. Thus, current Stretch and Flex programs may not be as beneficial as they could be. Since injury of the low back is the most common work-related injury, strengthening the core musculature is the best preventative strategy. The goal of this project was to create a guidebook presenting a set of ergonomic recommendations for common TxDOT workplace tasks and a Stretch and Flex program designed to reduce strain/sprain-related incidents for both office and field workers. The challenge that current Stretch and Flex programs face in achieving this goal may be that traditional core-strengthening exercises are performed on the ground, which may not work well for employees who work outdoors or are not dressed for being on the ground. Thus, the Stretch and Flex program created for TxDOT involves exercises done in the standing position to strengthen the core musculature as well as target other muscles and joints susceptible to work-related injuries. The guidebook for TxDOT employees contains ergonomic recommendations for TxDOT field and office workers as well as a Stretch and Flex program. This guidebook is specifically intended for Safety Officers to enhance their understanding of the Stretch and Flex program. It is not intended for the actual workers who will be performing the exercises. The guidebook is a more in-depth supplement to the user-friendly booklets and videos that were developed in conjunction with TxDOT's Occupational Safety Division Workers' Compensation section and TxDOT Communications. The Stretch and Flex program aims at helping TxDOT employees reduce their risk of injury through specific work-related ergonomic strategies and injury-prevention exercises designed to improve strength and flexibility. This program is expected to reduce the incidence of TxDOT strain/sprain-related incidents and substantially reduce associated costs, which have exceeded $3.7 million over the past 5 years.

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Stretch and Flex Guidebook

Use this guidebook to teach TxDOT field workers how to most appropriately and effectively use tools in the workplace in order to reduce injury. These guidelines are meant to provide general recommendations for basic tasks that field workers may perform. Note that the guidebook contains only recommendations—the authors realize that specific tasks may require more instruction. In these instances, many of the principles described in this guidebook can be carried over to various specific construction work-related tasks.

1.1 Introduction

Proper technique for any daily task should be accomplished with minimal effort and proper movement strategies. This is essential for the demands of a job that requires movement under heavy loads, such as construction. Construction workers may be required to lift heavy material, apply rapid load to an object (such as hammering a nail), as well as stabilize pieces of equipment that are not only dangerous, but extremely heavy (such as a jack hammer). Moving in a safe way to fulfill these requirements requires dynamic stability. *Dynamic stability* is the ability to accomplish a task despite kinetic, kinematic, or control disturbances. It is important to maximize the amount of loads being moved while putting the body in a safe position.

This guidebook provides ergonomic advice to field workers to help prevent injuries. The recommendations are designed to enhance dynamic stability during functional tasks to prevent injuries.

1.2 Facts

- Construction field work is one of the most dangerous industries in the United States.
- The injury rate among field workers is roughly 50% higher than in any other industry in the United States.
- The most common injury sites on field workers are the back, shoulders, neck, arms, and hands.
- Musculoskeletal injuries can cause both temporary and permanent damage and thus affect job productivity and quality of life.
- Between 2003 and 2010, construction accounted for 6% of the Texas workforce but 26% of the workplace fatalities (OSHA, 2013).

The rate of deaths for Texas construction workers is 10.7 per 100,000 workers, more than the national average (OSHA, 2013).

1.3 Work-Related Musculoskeletal Disorders

Back pain, carpel tunnel, rotator cuff problems, elbow tendonitis, and chronic neck pain are all musculoskeletal disorders. Work-related musculoskeletal disorders (WRMD) occur when musculoskeletal problems occur as a result of a work-related activity. Examples include low back pain, pulled muscles, muscle strains, rotator cuff injury, etc.

1.3.1 Musculoskeletal Disorders

Definition: A musculoskeletal disorder is an injury or dysfunction involving the muscles, tendons, bones, ligaments, cartilage, and/or vertebral discs.

These disorders can occur due to a blunt trauma (macro trauma) or repetitive motion (micro trauma). For example, a shovel hitting the arm of another coworker and causing a shoulder dislocation is an example of a macro trauma, whereas neck pain due to hammering overhead all day is clearly due to repeating one motion in a certain way. WRMD symptoms can range from mild and occasional to severe and chronic. These symptoms often occur in very specific parts of your body. For example, a construction worker who has been lifting heavy boxes overhead all day may feel pain just above his right shoulder, pointing to the upper inside edge of his shoulder blade. This is a muscle attachment for the levator scapula, which has been overworked due to the position of the arms, in addition to the constant load.

To perform field work activities, an individual must carry, lift, bend, pull, and hold. These movements are common for activities that can lead to WRMD and include the following:

- Working from your knees
- Lifting heavy objects
- Maintaining prolonged positions (particularly under load)
- Twisting the hands and wrists
- Performing overhead work
- Working with vibrating tools
- Performing repetitive movements
- Twisting the body

By examining the way people work and their job demands, we can provide effective solutions to help prevent WRMD. Throughout the manual, specific tasks will be highlighted to indicate when injuries frequently occur. Practical safety recommendations will be presented as well to make field work easier to perform.

1.3.2 Muscles

Muscles in the body connect to various bones via tendons that allow both movement and force to be generated. A *force* is defined as either a push or a pull. When the muscle activates or contracts, the fibers of the muscle squeeze together. The various types of contractions are concentric (shortening of the muscle belly under load), eccentric (lengthening of the muscle belly under load), or isometric (no length change to the muscle belly under load). An example of each can be related to a worker carrying a box. To lift the box, he/she has to squat down and grasp the box. As he/she lifts the box, the thigh muscles are working CONCENTRICALLY to bring the box up. If the worker stands and holds the box in his/her arms without moving, the biceps muscles are now working ISOMETRICALLY. While they are contracting they are not moving, but rather supporting the weight of the box. As the worker sets the box down on the floor, the thigh muscles have to lengthen but they are still under the stress applied by the weight of the body and the box. These muscles are now contracting ECCENTRICALLY. Taking the science one step further, we will classify muscle activity into static and dynamic.

Based on what you just read, can you guess is static or dynamic? If you guessed static, then you are correct! *Static activity* would be standing in the same position or staying in a seated position for a prolonged period of time. *Dynamic activity* involves any movement required to complete an activity. This is where you would see movement occurring. The interesting point is that if you do not maintain a static position efficiently, or if you maintain it for a prolonged period of time, then you could possibly risk injury. Conversely, if you move (dynamically) too much in one particular pattern (i.e., lifting and lowering boxes the same way repetitively), you also risk an overuse injury. What's the solution? There is a two-part answer that we will continue to remind you of throughout the guidebook:

1. **Take frequent mini-breaks.** This does not mean stop and sit down. It means CHANGE YOUR MOVEMENT. Doing so will help relax the muscles that have been working and help fresh blood to circulate through those tired muscles; proper blood flow and oxygen delivery are needed for continued work. For example, after lifting boxes for a while, make sure to take a few minutes to stretch or rotate your torso a few times and shake out your hands. We have provided a booklet with several stretches and exercises to do on these mini-breaks. Choosing one or two of these movements will help you use these 2–3 minute mini-breaks as efficiently as possible, making you a more productive member of your crew and reducing your rate of muscle fatigue. Regardless of the exercise and/or stretch that you choose on these mini-breaks, the important thing right now is that you take them.
2. **Maintain proper position.** Proper position is going to equal proper muscle function. This principle cannot be stated enough, as it will allow you to lift more load with less effort. Understanding good form and proper technique during lifting is vital, particularly during tasks with high load.

Following these two basic principles can help save your back, shoulders, legs, hips, ankles, and neck from undue stress and injury.

1.3.3 The Spine

One of the most common sites for injuries within field work is the low back. The most common ways to injure the low back is by lifting. We will be providing a more in-depth review of proper ergonomic lifting technique later but for now we will explain the basic anatomy of the spine. The spine allows us to maintain an upright position and protects our spinal cord (which sends and receives signals from the brain to our legs and arms and trunk). It is made up of a series of 24 bones called *vertebrae*. Starting from the top, there are 7 cervical vertebrae, 12 thoracic vertebrae, and 5 lumbar vertebrae. The most efficient standing position of the spine is called *neutral*—where the natural curves of the spine rest. Looking from the side, there is a slight inward curve of the cervical spine, a slight outward curve of the thoracic spine, and then a slight inward curve of the lumbar spine.

Between each of the vertebrae is a shock-absorbing structure known as an *intervertebral disc*. The disc prevents the vertebral bones from rubbing against one another and—most importantly—decreases impact on these bones. The disc is made up of layers of cartilage with a gelatinous structure known as the *nucleus pulposus*. Water and proteins flow in and out of the disc to keep it hydrated and mobile internally. Fluid is pushed out of the disc on compression. During periods of unloading and rest (such as sleep), the disc is able to rehydrate—which is why

your spine may feel stiffer when you get up in the morning. The discs in your spine are pumped up with water, and throughout the day this fluid gets pushed out of the disc, allowing for your spine to be more mobile. Proper hydration of the disc is important.

Proper exercise of the back is also important to take care of these discs. Repetitive motion due to excessive flexing and twisting of the spine under load can cause damage to the disc. One of the most common issues in field work is when the disc deforms and starts to bulge. If this bulge (known as a *herniation*) pushes on a nerve, it can be very painful and debilitating and may require a high-cost surgical intervention. These pains can occur anywhere, from localized at the point of herniation all the way to nerve pain radiating down to the leg or arm.

Wear and tear to the disc can result in a dehydrated fibrotic disc, and symptoms from the vertebrae pressing against one another due to decreased disc height can arise. If proper disc health is not maintained, the disc can fail to rehydrate. Proper technique and neutral positioning of the spine will help to maintain adequate disc health.

1.3.4 Summary

- Neutral posture keeps the natural curves of the spine; maintaining this posture when lifting a heavy object is important.
- Dynamic activity involves the movement of the body, whereas static activity involves maintaining a specific position.
- Muscular support of the body and its function is determined by the body's position.
- Disc health is important to prevent injuries.
- Mini-breaks are 2–3 minute breaks to be used for stretching muscles being used and exercising muscle that are not being used. Several of these breaks should be taken throughout the day.

1.4 Field Work Ergonomic Positioning Principles

1.4.1 Proper Ergonomics

Ergonomics is the study of body position in the work environment. Proper ergonomics promotes maximal efficiency with minimal risk and/or injury. Therefore, ergonomics considers the interdependent relationship of four things:

- Task
- User
- Equipment
- Environment

Proper body position for the work task will determine how efficiently the body will be used. This involves the users' relationship to the equipment and the task within the given environment. Improper body position can result in WRMD.

1.4.2 Head and Cervical Placement

As covered earlier, the cervical spine (neck) is made up of seven vertebrae that act as a shock absorber for the skull. This area of the body has a large range of motion and therefore an awkward position under load can be compromising. Many small muscles surround the neck area and many neurological structures pass through as well. Improper positioning of the neck can lead to tightness and achiness throughout this area and all the way down to tingling of the fingers.

Neck pain can often result from maintaining a particular position or being subjected to a rapid jarring movement (i.e., whiplash). Therefore, taking frequent breaks during work activities such looking up at a nail or holding a jackhammer is vital for neck health.

1.4.3 Shoulder Girdle Stability

The shoulder girdle is composed of the humerus (upper arm), scapula (shoulder blade), and the clavicle. Small muscles that protect the shoulder, known as the *rotator cuff*, support the bone structures.

These muscles also help to support the neck. Under maximal load and/or given poor movement strategies, this region is susceptible to rotator cuff problems, nerve damage, and head and neck pain. Common movements that can aggravate these structures are hammering overhead, operating a jack hammer, using a sledge hammer, and carrying large and heavy objects. Proper local strengthening of the smaller shoulder girdle muscles is necessary to provide optimal motion and stability for the shoulder girdle. Since the upper arm sits in such a shallow joint, shoulder dislocation is a common occurrence due to awkward positioning under intense load to the individual; Figure 1.1 depicts one example of improper positioning. One important note is that the position of the shoulder and mid-back will affect the muscles and support of the head and neck. Strong and flexible shoulder girdle and mid-back muscles (rhomboids and middle/lower trapezius) are essential to facilitate support for the neck and cervical spine regions. Furthermore, neurological issues such as carpel tunnel, radial nerve entrapment, and ulnar nerve entrapment can occur due to repetitive strain on the shoulder girdle. Learning how to position and move this area of the body with efficiency is a key component to prevention of neck pain, shoulder pain, and even low back pain.

Figure 1.1: Incorrect shoulder placement

1.4.4 Foot and Ankle Motion

The foot is the first point of contact for load transfer in the body. If force is imposed during walking or running in an inefficient way, then other areas such as the knee and hip position and motion can be compromised. For example, consider a normal walking pattern. The movement of the ankle to help point the toes is called *plantar flexion*. The movement of the foot upward towards the shins is called *dorsiflexion*. There are two main phases to walking: stance phase and swing phase. Basically the ankle needs to plantar flex during the stance phase and dorsiflex on the swing phase. The dorsiflexion of the ankle allows the foot to clear the floor. If this does not happen properly, the hip will have to flex more to position the foot. This can cause undue strain on the hips. Limited dorsiflexion is common among individuals who wear boots that restrict ankle motion. This can cause excessive low back extension and hip flexion. Thus, it is important to stretch the calf muscles.

Issues such as plantar fasciitis (aggravation to the bottom of the foot that causes intense pain) and bunions (a dysfunction that results from poor biomechanics of the great toe) can be the result of poor range of motion through the ankle due to tight calf muscles. In addition to intense pain, debilitating injury and/or deformity can occur.

The foot and ankle can also cause many issues seen in other areas of the body. Therefore, during mini-breaks it is always a good idea to stretch out the muscles of the foot and ankle and to wear comfortable footwear that fits properly and provides support for the foot.

1.4.5 Hip and Knee Placement

The hip is composed of the pelvis and the femur (long bone of the upper leg). As the point of load transfer between the upper and lower body, substantial force runs through the hip.

Due to the amount of compressive (push) and tensile (pull) forces that pass through the hip, both the position and the strength of the hip muscles are significant factors. The hip is a ball and socket joint, giving it motion on all three planes. It is unique in that it is designed for tremendous mobility tasks and, unlike the shoulder, can take on immense loads. Dysfunction of the hip can cause pain in the low back and/or knee. Nerve pain such as *sciatica* (where the sciatic nerve is trapped either at the low back or in the lower leg by muscles) can develop. In addition, faulty mechanics can lead to pathologies such as hip osteoarthritis. Incorrect movement of the hip under load can cause pain if adequate mobility is not possible (Figure 1.2). The body is like water in that it will always move in the path of least resistance. If the hip is resistant, areas such as the knee and the low back may compensate, potentially resulting in pain and injury.

Figure 1.2: Lack of hip mobility leads to low back pain (incorrect: left, correct: right)

1.4.6 Hand/Wrist/Elbow Position

The purpose of the shoulder is to position the hand. If the shoulder is compromised, then the hand/wrist/elbow position may be compromised. Pathologies that result from poor wrist flexor use (i.e., gripping objects for prolonged periods of time) can lead to medial epicondilitis or "golfer's elbow"—essentially, overuse of the wrist flexors. In addition, overuse of the wrist extensors can cause a painful condition known as lateral epicondilitis or "tennis elbow." Either of these chronic injuries can limit the ability to grip objects effectively and can therefore be debilitating in almost any kind of manual labor. The position of the wrist and hand is particularly important given the neurological structures that run all the way down to the fingers. A straight wrist or neutral grip position should be used whenever possible to prevent compression of these structures that can cause neural tension.

1.4.7 Summary

- Proper ergonomics must take into account the position of the spine and the extremities and their relationship to the environment as well as the task being performed.

- Position of the head, neck, shoulder, wrist, elbow, hip, foot, and ankle are crucial when considering proper ergonomic recommendations.
- The shoulder girdle has a large range of motion; if put in an awkward position under load, it can become injured easily. An example of this scenario is working with the arms overhead.
- The hip has a large range of motion but can take on substantial load. If the muscles at the hip are compromised, then the low back and knees can become compromised too.
- Tight calves can have adverse effects on any other part of the lower extremity.

1.5 Ergonomic Hazards

One of the goals of good ergonomics is to fit the job to the laborer. Following proper ergonomic principles can help to prevent injury and thus preserve health. Using the proper positions will help to lessen the physical demands of the job. When dangerous or hazardous conditions exist, they must be identified and addressed immediately to ensure the safety of the worker. To determine whether a situation or task is hazardous, consider the following:

- Materials and tools being used for the task
- Work techniques to address the task
- Safety of the working environment
- Types of injuries the worker has experienced in the past.
- The task itself
- Possible solutions

ONCE YOU IDENTIFY AN ERGONMIC HAZARD,
LOOK FOR WAYS TO CHANGE IT!

The following tasks will be reviewed and proper ergonomic recommendations will be made regarding each task.

- Shoveling and digging
- Power tools
- Cutting and sawing
- Lifting technique
- Large material handling
- Getting on/off trucks
- Stripping forms
- Flagging
- Cleaning

1.5.1 Shoveling and Digging

Shoveling and digging are common tasks among field workers. It is common for a field worker to spend a whole working day (which can range between 8 to 12 hours) doing one of these tasks. Depending on the material and the type of shovel used, this activity can be very hard on the body. The most common type of materials shoveled are concrete, dirt, sand, and asphalt. Most shovels tend to have shorter handles and require more bending of the knees, flexing of the hips, and dorsiflexion of the ankles to perform the task efficiently. In addition, shoveling is a unilateral task (with all the movement occurring on one side of the body). This can cause asymmetrical differences in the body, which can eventually cause pain. If proper technique is not maintained and adequate breaks taken, this can lead to injury.

<u>Shoveling Risks and Solutions</u>

- Take a mini-break every 15–20 minutes to stretch out the hands, hips, and torso. Lateral side bends, trunk rotations, and forearm stretches are very effective.
- Ensure that the hand holding the end of the shovel is in the palm position.
    - Try to find a shovel with a diameter that that fits comfortably in your hand.
- Make sure that you are using your whole body to shovel, not just one part. Bend the knees, flex the hips, and relax the ankles on the way down and then extend these areas on the way up.
- Face the direction in which you will be throwing dirt, as opposed to keeping your feet planted in one direction and then twisting the body in the opposite direction.
    - This is particularly true when rotating towards the direction of the front leg in a split stance.
- Don't pick up everything at once! "Skim" the top. Try not to pick up too much for your size. A good rule of thumb is to have no more than 10 pounds worth of material at a time. Remember, SKIM OFF THE TOP.
- Select the right shovel for the right job. If you need a sharper edge to cut through the material, then use one.
    - Flat blade: shoveling material
    - Sharp blade: digging

  Also, use a shovel with a handle length that will allow you to keep your spine as neutral as possible. This may vary based on hip and ankle mobility. You may have to try several.
- If shoveling wet concrete, always wear protection on the skin, as concrete can burn on contact.
- If shoveling ballast:
    - Use a long-handed pointy shovel.
    - Step on the end of the blade and push it in.
    - Wear shock-absorbing shoe inserts when walking on ballast.
- Wear gloves to prevent blisters.

- Consider bringing your own shovel to work if there is not one of appropriate length for you.
    - Usually the problem is that the shovel is too short.
- When shoveling, keep your arms in close to carry material more efficiently. The further away your arms are from your body, the heavier the material will be.

Ergonomic Recommendations for Shoveling

1. Use correct shoveling technique based on the material you are shoveling.
2. Use the correct shovel for the job.
3. Avoid twisting the back when throwing the shovel load, especially towards the front leg.
4. Stand with your feet apart with one foot in front of the other for a stable base of support.
5. Wear gloves.
6. Take mini-breaks every 15–20 minutes to perform stretching and exercises.

Remember that shoveling with a handle that is too short forces the worker into an extreme forward bent position and places too much strain on the low back. This is particularly the case with tight hips and/or calves. As with all tools, make sure to select an appropriate length for not only the task but especially for you as the worker.

Example of Shoveling with Proper Technique (Figure 1.3)

Figure 1.3: Worker on left is incorrect; right is correct.

- The individual on the left is more likely to experience back pain as she is not flexing her hips or bending her knees enough (both of which are required even though she is merely holding a bag). Over time, this improper position can create a macro trauma.

- The male worker (on the right) is bending his knees more and therefore can keep his spine more neutral.
- The male worker should probably be closer to the material (in this case, an animal) he is lifting as being further away can make the load heavy on the shoulders and neck.
- The male worker has a nice wide base of support to lift the material.
- The male worker should probably use a larger shovel to lift this dead animal. The shovel in use is not an appropriate size for the task at hand.
- Make sure that both hands are grasping the shovel. Notice the left hand of the male worker not fully grasping the handle. The palm and fingers should wrap around the shovel handle.

1.5.2 Power (Pneumatic) Tools

Pavement breakers, jackhammers, and chipping guns weigh anywhere from 15 to 90 pounds. Due to the cost of these tools, sometimes the worker will have to use what's available regardless of whether it is the appropriate size tool for the worker. Further, operation will involve prolonged maximal squeezing to control the tool. Prolonged vibration creates repetitive strain on the body, and tasks involving these tools may be done for the entire workday. The worker's height and strength will often determine posture while operating this equipment, so following the recommendations for ergonomic positioning is particularly important. Also essential is wearing ear plugs to prevent damage to the inner ear.

<u>Ergonomic Recommendations for Power Tools</u>

- These are heavy pieces of equipment. Working in pairs to lower and lift these tools in and out of trucks and/or transport them through the job site is recommended. Use a dolly or cart to move heavy tools around the work site.
- Allow the tool to do what it should. Do not tense up and try and "manhandle" the tool.
- Use your body. Allow your thigh to help guide the tool and stand with your legs far apart enough to give yourself a wide, solid base. Keep your knees bent and body weight over the feet.
- Monitor your neck and shoulder muscles, keeping them relaxed. Press down on the tool from underneath your arm.
- Be sure to use sharpened drill bits to make the work easier.
- Make sure the equipment is cleaned properly when the task is finished to ensure proper functionality in the future.
- Take mini-breaks throughout the day. Due to the vibration of these tools, take breaks with greater frequency, possibly every 15 minutes.
- Make sure to stretch during the mini-breaks.
- If you experience pain from holding the trigger for a prolonged period of time, consider tapping the trigger.

- When using these tools in an overhead manner or horizontal position, make sure to use a sling that is held by a coworker to support the weight of the power tool.
- Position yourself as close to the work as possible, which allows your muscles to relax more.
- If required to operate equipment for a prolonged period of time, discuss the possibility of a frequent rotation among workers with the foreman.
- Make sure that you use personal protective equipment, including but not limited to a hard hat, hearing protection, breathing protection, goggles, ear plugs, and anti-vibration gloves.

1.5.3 Sawing

Sawing and cutting tools are used to cut steel, pipe, wood, concrete, and sometimes asphalt. This task is usually done in a forward bend, positioning both hands on the saw. In addition to the ergonomic position, care must be taken for the eyes and ears as noises can be loud and debris can spray from the material being cut.

Ergonomic Recommendations for Sawing

- Avoid cutting on the ground whenever possible. Try to create a waist-high work surface.
- Rounding the spine will create back pain.
- Keep the shoulders relaxed and the elbows held in close to the body.
- If you are performing the work in a forward-bent position, then remember to take mini-breaks every 20–30 minutes.
    - Stretch the hands, arms, and back during these breaks.
- Due to the noise, vibration, and stress on the body, we recommend that the foreman rotate workers until the task is completed.
- Maintain tools, keeping them properly clean and sharpened.
- Wear anti-vibration gloves or at the very least protective gloves to increase the comfort level of the forearms and hands.
- Always wear a hard hat.

1.5.4 Lifting and Carrying

Lifting large and heavy objects is an important part of construction work. It is important to make sure that your body is in the most appropriate position to lift. While strength is important, remember that body position dictates muscle function. We want to put the body in the most efficient position to accomplish the given task.

Rebar is one material often used during road work; it can awkward to move because of its flexibility and length. Rebar pieces can be as long as 16 feet and may weigh as much as 30 pounds per piece. Usually rebar is carried on the shoulders and shared between one or two workers, but smaller pieces can be carried by one worker. In lifting and carrying a common

material like rebar, the shoulder girdle can be injured if weight is placed directly over the shoulder, as it is a shallow joint. Carrying larger objects may cause the shoulder to pull out further away from the body. This is why maximal loads should be carried with a coworker's assistance.

Ergonomic Recommendations for General Lifting

- Place a pad on the shoulder and the object being loaded to protect soft tissue.
- If picking objects up off the ground, make sure to keep the spine as neutral as possible and flex the knees, hip, and ankles.
- Assess the load properly. If it's too heavy for you, then get help from another coworker.
- Always avoid twisting when lifting, carrying, or lowering a heavy load.
- Keep the load close to you while you walk.
- Keep the load well balanced on the shoulder to maximize body efficiency.
- Try to store materials off the ground when possible to make lifting these objects easier.
- Always wear gloves to prevent blisters and provide help with gripping.
- Take mini-breaks of 15–20 minutes.
    - Remember to stretch the back, shoulders, and hands during this time.

To carry these heavy loads without injury, maintain strong hip muscles and core muscles. Exercises that focus on these areas are indicated to condition the worker for these tasks. Strong hip and core muscles will help reduce the load on the low back.

1.5.5 Handling Materials

Proper technique to lift and move materials involves bending the knees and the hips rather than rounding the back. As a general guideline, use dollies or carts whenever possible to move these common types of materials around the work site:

- Rock and road debris
- Rebar
- Beams
- Sheeting
- Tools of all sizes
- Bags of cement
- Manhole covers
- Cement blocks and boxes

In addition, having the materials delivered close to the work site is an easy way to reduce the amount of handling required.

Ergonomic Recommendations for Handling Materials

1. Reach for the load by bending and squatting, thus lifting the weight safely.
2. Transfer the weight of the load to a carrying position.
3. Walk the load to the needed location.
4. Lower the load to the ground, throwing it or handing it off to another worker.

Ergonomic Recommendations for Lifting Objects

1. Plan the lift by first assessing the weight: how big is it? How heavy is it?
2. Get as close as possible. Remember, the further away you are from the load, the heavier it will be.
3. Face the load. Approach the load from the front.
4. Bend your knees and flex your hips! This step will influence the position of the back.
5. Wear protective clothing.
6. Avoid twisting your back.
7. Take a mini-break!

Ergonomic Recommendations for Carrying Uneven Loads

- Uneven loads (e.g., carrying a bucket with one hand) can place uneven stress on the upper body and case pain in the shoulder, neck, arms, and low back.
- Switch the loads to the opposite arm or hand frequently.
- Take mini-breaks.
- Wear gloves to decrease friction between the load and the body.

1.5.6 Getting On and Off Trucks

Jumping can increase forces on the body up to 20 times that of walking, and can put unwanted strain on the low back. Care must be taken when jumping onto and off of trucks and other high surfaces. The areas of risk during jumping down or climbing up are the back, knees, and feet.

Ergonomic Recommendations for Getting Off and On Trucks

- Organize the truck area to allow clear passage.
- When possible, use a ladder to get off and on.
- Take your time! Do not rush getting onto or off of the truck.
- Instead of jumping off of the truck, sit down first and then hop down.

- Make sure that you are wearing proper footwear to absorb the shock.
- When landing, make sure to bend your knees and hips to prevent jarring the low back and promote proper shock absorption.
- Wearing shock-absorbing shoes is indicated when performing this kind of activity with frequency.
- Keep your feet at least shoulder-width apart when coming down.
- Take mini-breaks!

1.5.7 Stripping Forms

After concrete is set, the form that it was poured into is removed using a pick or crowbar. The form is then thrown out of the trench, cleaned, and stacked in a truck. When stripping forms, work surfaces can be uneven and the area can be small. One foot may be in the trench and one foot may be out of the trench. The body parts at risk of injury are the low back, hands, knees, and feet. Stripping agents lessen the amount of force necessary to strip forms.

Ergonomic Recommendations for Form Stripping

- Make sure the concrete is set!
- If the forms are wooden, be careful of splinters and always wear gloves.
- Be careful of awkward walking surfaces, as they can be slippery.
- Wear shoes that can grip wet and slippery surfaces.
- Ask for help if you think the surface is too slick.
- Make sure to clear all unnecessary objects out of the way.
- Make sure to bend your knees and get as close to the load as possible to reduce the risk of injury. Maintain a wide base and face your target.
- Avoid twisting when lifting, carrying, or lowering the load.
- Keep the load close to you while carrying it.
- Work in pairs while lifting and stacking forms.
- Take mini-breaks!

1.5.8 Flagging and Holding Signs

Flagging requires standing for long periods of time and directing vehicles and traffic around the construction site, constantly paying attention. Dozing off can be very dangerous as traffic is constantly coming through. Thus, workers should be rotated frequently.

Ergonomic Recommendations for Flagging

- Train yourself to flag with each hand to prevent asymmetrical differences between both sides of the body. The shoulders and neck can become fatigued during flagging, so be sure to change hands frequently.

- Take mini-breaks and alternate with other workers every 30 minutes.
- Take a few steps when possible. Do not remain in one position or posture while flagging. Instead, periodically stretch and move around.
- Wear comfortable footwear.
- Don't lose focus! If you feel yourself "zoning out" while flagging, ask the foreman if you can take a break.
- If possible, use a handle that rests on the ground.
- Stand with the feet wide to increase balance and reduce the risk of falling into oncoming traffic.

1.5.9 Housekeeping

Keeping the work site as clean as possible is key to reduce hazardous situations. All tasks become much more difficult to perform when the construction site is messy and cluttered. Make sure to have a properly arranged and clean work environment for the workers.

Housekeeping Tips

- Organize and allow time for clean-up every day.
- Designate "debris" areas.
- Make sure to have a schedule for periodic clean-up and maintenance.
- Remember a work area can become extremely hazardous when unkempt. Make every attempt to ensure the safety of all involved by keeping the worksite as clean and organized as possible.

References

US Department of Labor, Occupational Safety and Health Administration (OSHA) (2013) "Commonly Used Statistics," accessed October 13, 2013, http://www.osha.gov/oshstats/commonstats.html.