

ERGONOMICS DEMONSTRATION PROJECT



# CANAM Steel

**Manufacturer of steel products for the  
construction industry**

**December, 2002**

# CANAM Steel. Ergonomics demonstration project report

## Introduction

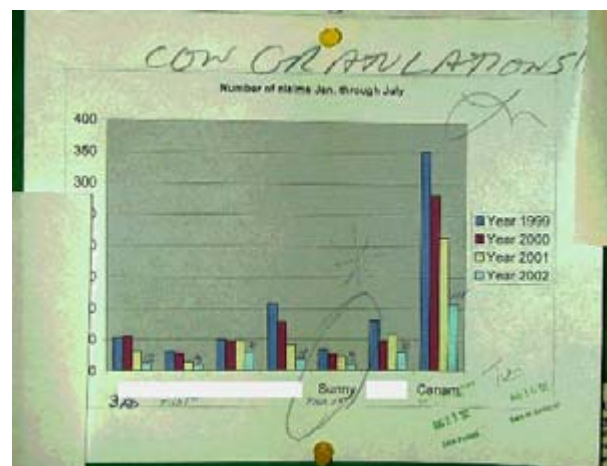
In August 2002, CANAM Steel and the Department of Labor and Industries (L&I) of the State of Washington began an ergonomics demonstration project. The purpose of this project is to share with the business community several applications of ergonomics principles and their benefits to the employees' health and safety at work.

CANAM Steel designs and manufactures structural steel components for the construction industry. The ergonomics applications shown in this report belong to the plant located in Sunnyside, Washington. The company's Standard Industrial Classification (SIC) code is 3441 'Fabricated structural metal' and it has reported 157 full time employees (FTEs) in the last four quarters. This plant's compliance date for completing hazard analysis and employee awareness education is July 1, 2003.

In the past two years, CANAM Sunnyside reduced its injury rate by 66%. These improvements strengthened their impetus for health and safety. The plant is applying to be in the Voluntary Protection Program (VPP). Participants in the VPP are a select group of businesses that have designed and implemented outstanding safety and health programs.



**Photo 1.** Charts posted in the informational boards in CANAM, Sunnyside, WA show substantial improvements in injury prevention and cost reduction by the implementation of strong safety and health principles.



In 1999 the Sunnyside plant registered 38 claims; costing over \$483,000. In 2002, eleven claims have been registered so far, and the cost has been around \$15,500. The frequency as well as the severity of the injuries has dropped substantially in the past three years.

Inherent in the manufacturing of big steel structures are the highly hazardous processes of welding, lifting heavy metal structures, operating metal cutting equipment and tools.

Because of the proactive approach, CANAM Sunnyside started implementing ergonomics before the ergonomics rule became mandatory. There is a wide variety of jobs like materials handling, metal cutting and welding, machine operation, quality control, computerized design of the steel structures and general office work. These jobs have several tasks, creating a variety of postures and motions

This report shows ergonomics applications to materials handling, work surfaces and hand tools. Included are some ergonomics applications beyond the scope of the ergonomics rule, which improve the general well being and comfort of the employees. Some jobs that had risk factors covered by the ergonomics rule are also documented, as well as some ideas to reduce the hazards.

The application of the ergonomics principles included in this report could help in reducing risk factors such as lifting heavy materials; lifting frequently; lifting in awkward postures; forceful gripping and back bent.

Table 1. Summary of ergonomics improvements in CANAM

Activity	Risk factor	Ergonomics @ work*
Handling heavy metal parts and components	Lifting > 90 pounds	Overhead cranes Magnetic hoists Mechanical hoists Wall-mounted jigs
Cleaning welding seams by hammering	Highly repetitive motions combined with forceful gripping	Hammer with a wider grip and “spring” handle reduces the grip force
Transferring metal sheets from work surfaces to process lines	Lifting > 90 pounds Lifting frequently > 10 pounds	Rolling work surfaces bring work to waist level and prevents awkward postures and heavy lifting
Painting and visual quality control inspection of products	Kneeling > 2 hours per day Squatting > 2 hours per day Back bending > 2 hours per day Neck bending > 2 hours per day	-Work stands (“saw horses”) bring work to waist level  -Neck bending needs to be assessed further
Picking waste and inserting cardboard into the slitter machine.	Back bending	Extended handle tool
Other activities:		
-Welding	-Working posture, neck bent < 2 hours per day, intermittently	-Sliding, height adjustable chair
-Flipping trusses to weld both sides	- Push / pull	- Automated flipper

\***Ergonomics @ work.** Applications of ergonomics in real work settings. Term used by the L&I ergonomics team.

## Materials handling

Manufacturing steel structures requires extensive material handling tasks of metal raw materials. Metal parts of different sizes, shapes and weights, take part in the structure being built. The weights vary from smaller parts weighing a few (10-20) pounds to large steel beams weighing several (as much as 10) tons a piece.

The above-mentioned materials handling, if done manually, would bring most of the material handling jobs into the hazard zone for lifting. Unless it occurs so rarely that the job is not covered by the rule, the ergonomics rule limits lifting materials manually to a maximum of 90 pounds for an infrequent lift with the hands close to the body and between knee and waist level. Lifts done more frequently, for long durations, and in awkward postures have reduced weight limits.

The first approach to solve the problem in the Sunnyside plant was to install wall-jibs. With this equipment, the handling of large metal pieces had to be moved from wall-jib to wall-jib, disconnecting and reconnecting the load each time in order to move them down the line. No manual material handling was required, but the disconnecting / reconnecting task was time consuming and had safety hazards such as the material falling and injuring the worker. Later, the company installed overhead, high capacity bridge cranes to move the material anywhere within the building without disconnecting the load.

The photos below show before and after material handling equipment in use. Actually there is little to no observable manual material handling.



**Photo 3. AFTER.** The use of high capacity, overhead bridge cranes eliminates disconnecting / reconnecting the load and the inherent risk of fall and push/pull forces. There is no need for manually lifting the materials in the process.

**Photo 4.** A cart with multiple levels is used to transport smaller, angled pieces of different lengths from the metal cutter to the assembly (welding) line. Each single part is slid from the cutter to the cart, where no lifting is required. They use a crane to move the cart from one place to another.

Risk factors eliminated:

- Heavy lifting > 90 lbs
- Frequent lifting > 10 lbs

Other risk factors:

- Pushing; pulling
- Heavy parts falling



**Photo 5.** The worker slides the parts from the machine onto the cart, avoiding the lifting. Once the cart is loaded, by means of an overhead crane, the cart is placed onto the floor on rail tracks.

Other risk factors:

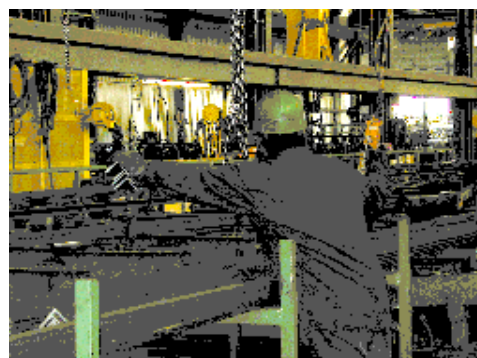
- Pushing; pulling
- Heavy parts falling



**Photo 6.** To unload and place the metal angles, of different lengths and weights, the worker uses an overhead hoist with chains. No manual lifting was observed during this operation. There is still some reaching above shoulder height but the duration is brief.

Risk factors eliminated:

- Frequent lifting > 10 lbs
- Awkward lifting > 25 lbs above the shoulders below the knees



**Photo 7.** To move the heavy cart loaded with metal parts, the worker uses an overhead bridge crane with chains, operated by remote control. No manual lifting was observed during this operation.

Other risk factors:

- Pushing; pulling
- Heavy parts falling



**Photo 8.** Magnet hoists are used to handle big, heavy metal sheets within the manufacturing process. No manual lifting was observed during this operation. An arm guide supports the hoist.

Risk factors eliminated.

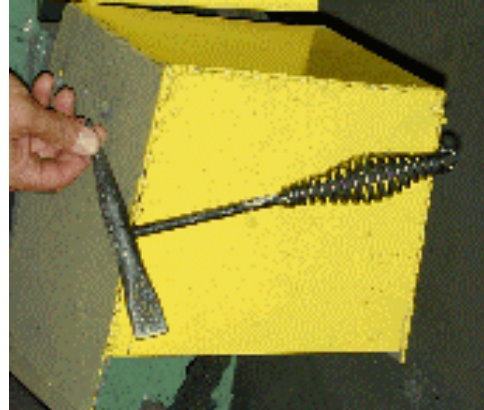
- Heavy lifting > 90 lbs
- Heavy parts falling



## Hand tools

Throughout the steel manufacturing process, several hand tools are used for specific purposes. In welding, it is necessary to use a metal hammer to clean the welding seam by striking on the welded section. The workers have been using a hammer with a handle that will allow a comfortable wide-grip shape as well as some shock absorbing properties.

**Photo 9. Metal hammer used to clean welding seams. The employees refer to the “spring handle” as comfortable. The spring action may absorb the impact forces to the palm and decrease grip force required. The grip is thicker than a normal handle reducing the need to use fine manipulations to handle the tool.**



Risk factors eliminated.

- Forceful gripping, combined with repeated impact

Other benefits.

- Increased comfort
- Reduced transmission of the impact forces to the palm of the hands

**Photo 10. An extended handle manipulator, like the one shown in the photo, is used for inserting cardboard scraps into the slitter machine.**



Risk factors eliminated.

- Back bending > 30°

Other risk factors

- Cuts and bruises to the hands

Other benefits.

- Increased comfort
- Task easier to do
- Less fatigue



## Work surfaces

**Photo 11. BEFORE.** Visual inspection for quality control and painting is an important part of the process. An employee doing a quality control inspection is required to be in an awkward posture.

Risk factors covered by the rule:

- Kneeling / squatting
- Lifting awkward >25 lbs

Other problems.

- Visual task difficult to do
- Manipulation of the final product cumbersome



**Photo 12. AFTER.** Worker doing quality control inspection with the parts up on “horses.” The parts are easy to handle and the body posture has improved. The inspection task is at waist height and the heavy parts are placed onto the horses with forklifts. The horses are custom made in the plant maintenance shop. The cost of each horse is approximately \$200.



The employee still needs to work with the neck bent, but less than 2 hours per day. Nonetheless, the company is studying some ideas to improve his posture. One option could be the use of a stool.

## Rolling work surfaces

In the Steel Building, Siding and Roofing processes, varied metal sheets are used in the manufacturing of these structures. Two employees lift the metal sheets and stack them in piles onto the working tables. To avoid further manually lifting the metal sheets, the work surfaces roll closer to the assembly line where they will be used. Because these carts can be heavy to push, they hook the carts with a chain from the overhead cranes, and move them by remote control.

### Photos 13 and 14.

Transportable working surfaces. Notice the wheels to move them around without lifting the metal sheets. Because of the weight the wheels support, periodic maintenance is required.

Another idea they are considering is the use of wheels with a larger diameter, which reduces the effort of pushing or pulling.

Risk factors covered by the rule:

- Lifting heavy > 90 lbs
- Lifting awkward >25 lbs

Other risk factors not covered by the ergonomics rule

- Pushing / pulling



## Other improvements for risk factors not covered in the rule.

Under this category of ideas, are included some improvements for risk factors or conditions that are not part of the ergonomics rule requirements. Nonetheless, these improvements are good ideas and add to the comfort and well being of the workers in the plant.

**Photo 15.** Sliding, height and tilt adjustable chair for welding trusses. This chair provides the worker with alternative working postures, between standing and sitting. When sitting, the neck is not bent as much. The chair slides laterally following the direction of the materials flow. Also notice the footrest along the working area that provides alternate rest for the legs.



Other risk factors:

- Standing long periods
- Static load in the hips and legs

Other benefits

- Reduce neck bending
- Employee comfort

**Photo 16.** Electric golf cart. Because of the long distances between plant buildings, supervisors need a timely and energy efficient manner to respond to the different requests for their presence. The use of the golf cart has made this task easier and more efficient, especially for supervisors with special needs.



Other benefits

- Task is easier
- Task is completed in less time
- Less fatiguing
- Helps employees with special needs

**Photo 17.** Height adjustable drawing board. The board shown in the photo is height adjustable. May accommodate employees of different heights. Moreover, may provide alternative working postures for a single employee, between sitting and standing.

Other benefits

- Less fatiguing
- Reduces static loading in the lower back and legs
- May help employees with special needs



### **Welding, building trusses**

When welders build trusses, the long and heavy structures need to be flipped to weld the opposite side. Formerly, the welders had to lift trusses with chains from a crane, then manually push and pull to weld on the other side. A new method has been installed that eliminated the need for the overhead crane in order to flip the joist and girders. Major improvements to worker safety, along with quality and production, have been experienced since the installation of these new tools.

Other risk factors eliminated

- Pushing / pulling

## Jobs that require further assessment

This last section of the report presents other requirements of the ergonomics rule that CANAM needs to assess. The activities needed to reduce the remaining exposures require the participation of both employees and employers. Employee involvement and participation is required by the ergonomics rule. Usually, employees actually doing the jobs are experienced and have practical ideas to improve the jobs.

### Shipping

A possible lifting hazard may be present in this operation, since they need to handle steel beams weighing over 150 pounds. A further assessment is recommended. The use of a wheeled scissor lift could prevent the employees from handling the heavy steel beams.

### Welding

Employees working in welding operations were observed working with the neck bent more than 30 degrees, for several seconds each time. It may fall under the definition of a caution zone job for neck bending. Further assessment is recommended.

### Lifting lengthy metal parts

Employees working in flash welding and flat iron work station are required to manually lift one end of long pieces of iron that weigh between 150 to 300 pounds many times a day, bringing the job into the hazard level. The operation needs some changes to protect the worker from the heavy lifting. The company is working with their employees to develop a solution.



### Office/computer operations

In the engineering department, intensive and extensive use of mouse and keyboard was observed. Some of these jobs may require 4 or more hours of keying and mouse use, on a regular basis. The workstations where engineers use computerized aided design (CAD) software are the most likely to have these exposures. This risk factor may be addressed with some principles such as job specific training; scheduled breaks; ergonomic adjustment of the existing office equipment and furniture.

Another job identified in the office that eventually could have a lifting risk is the manual handling of paper blueprints of the projects (“rolls”). Those heavy rolls (5 to 25) pounds are stored in a special shelving section, contiguous to the office floors where they would be used. This risk factor may be addressed by using a height adjustable cart to load / unload the rolls of paper from the shelves and the desktops where they will be used.

Table 2. Summary of Jobs that need further ergonomic assessment in CANAM

Activity	Risk factor	Ergonomics principles
Shipping final products that weigh over 150 lbs	Lifting > 90 pounds	Use mechanical assist. for example, scissor lift cart
Flash welding and flat iron stations. Workers lift manually one end of 150 to 300 lbs metal pieces	Lifting > 90 pounds	- Use mechanical assist. - Use gravity conveyors or other sliding equipment
Welding operations require employees to look regularly downward at the welding point	Neck bent > 30 degrees; more than 2 hours a day	Raise and tilt the work piece
Office activities: -Computer assisted design (CAD). Extensive use of mouse and keyboard	- Keying more than 4 hours a day with awkward postures	- Rearrange workstations; schedule breaks
-Rolls of plans manually lifted	- Awkward lifting, > 25 pounds above the shoulders, below the knees	- Store objects at 30 inches off the floor - Use a height adjustable cart

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