

# Ergonomic Study

## Increasing Productivity and Safety in Manual Overhead Bridge Crane Operation

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A C L A S S A B O V E

# Executive Summary

## Safety and Productivity Improvements in Bridge Cranes: A Comparative Study of Force Requirements and Productivity for I-Beam and Gorbel® Work Station Overhead Bridge Cranes

### Introduction

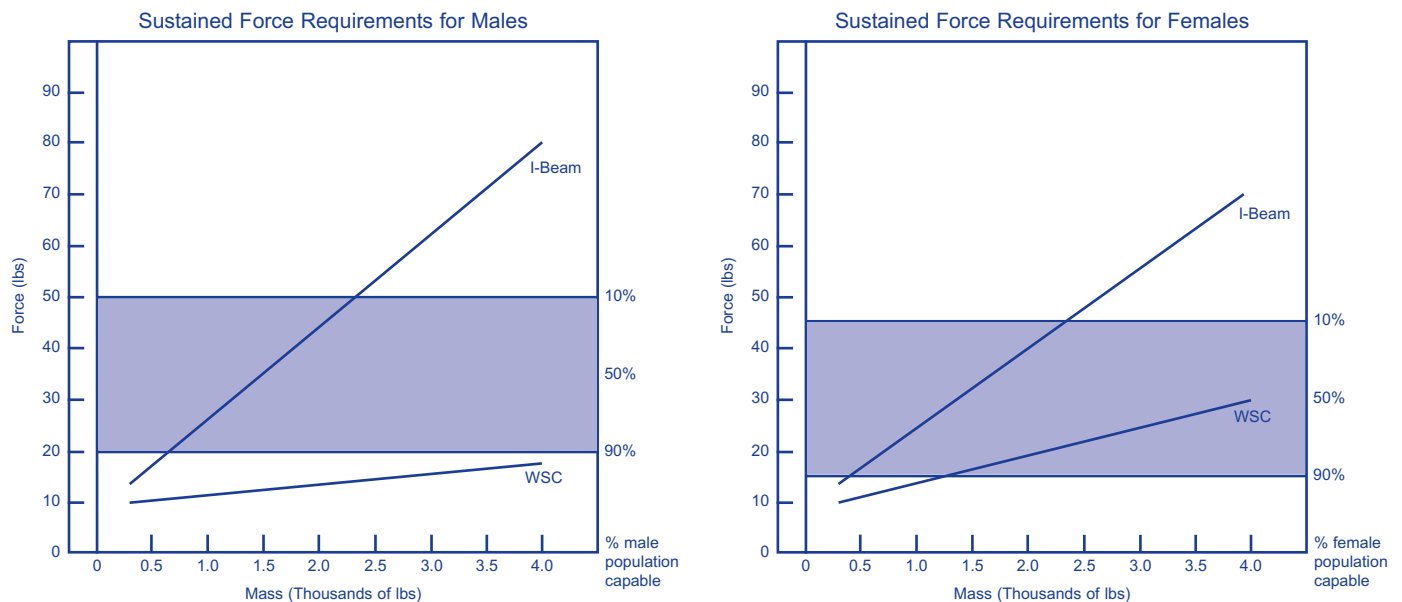
In a study performed by the Rochester Institute of Technology, manually operated, traditional I-Beam cranes were compared to Gorbel® Work Station Cranes (WSC) in relation to push and pull standards developed by Snook and Cirello (1991) for consideration by NIOSH. This study consisted of two parts:

- **Part One** compared the Snook and Cirello guidelines with the type of push/pull forces experienced in industrial conditions on I-Beam and WSCs.
- **Part Two** determined the difference in productivity for both types of cranes.

### Part One (Push/Pull Forces)

#### Results

The first part of the study determined the gross force required by an average male and an average female to keep a load in motion (sustaining force) while safely\* performing work at a sustainable rate on both types of cranes. The graphs below illustrate the sustaining forces for the subjects.



Comparing the sustaining forces with the proposed NIOSH guidelines, it was determined that:

#### Males

**Over 99%** can safely\* handle 4000 lb. on a Gorbel® WSC.

**Under 10%** can safely\* handle 4000 lb. on an I-Beam.

**4000+ lb.** = maximum load on a WSC.

**2600 lb.** = maximum load on an I-Beam.

#### Females

**Over 65%** can safely\* handle 3000 lb. on a Gorbel® WSC.

**Under 10%** can safely\* handle 3000 lb. on an I-Beam.

**4000+ lb.** = maximum load on a WSC.

**2400 lb.** = maximum load on an I-Beam.

#### Discussion - Part One

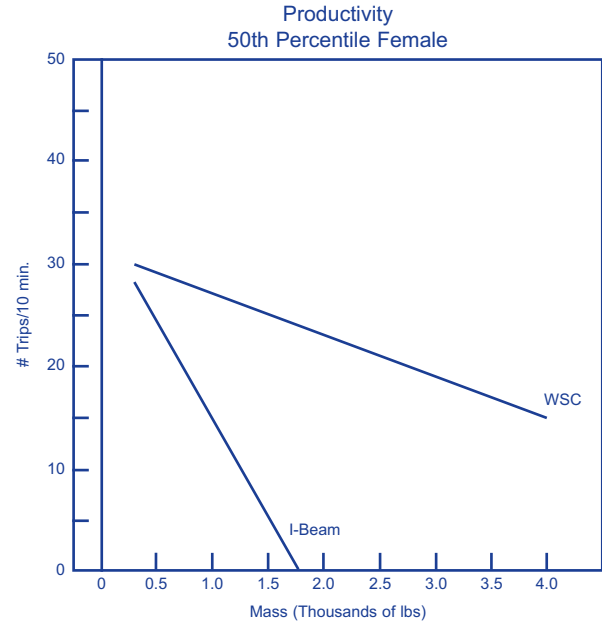
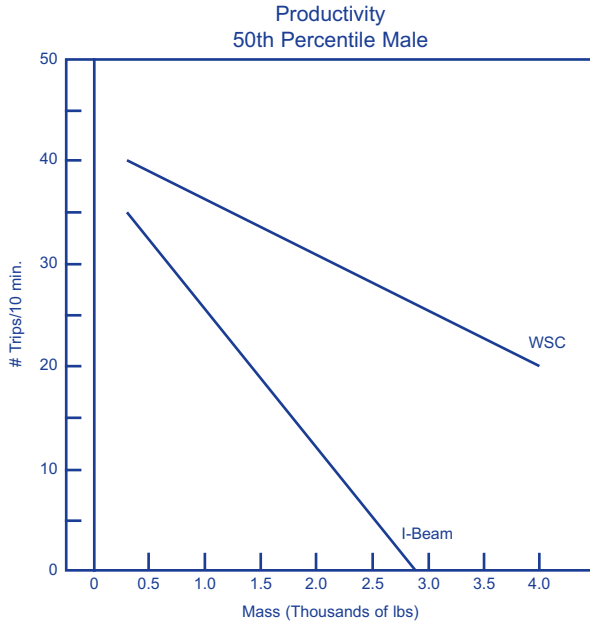
Given the data, it is evident that only a small portion of the workforce can handle a 4000 lb. load on an I-Beam crane, while almost any worker, male or female, can handle 4000 lb. on a Gorbel® WSC. Using Gorbel® WSCs instead of I-Beam cranes results in a more flexible workforce and a safer\* work environment.

\* "Safe," as it is referred to above, indicates that a worker should not exceed 33% of his or her work capacity. It is an accepted ergonomic principle that the human body should not be required to work for extended periods of time in excess of 1/3 of its aerobic work capacity. Exceeding this level heightens the risk of chronic fatigue, a condition where the body doesn't recover from the fatigue of one day's work before the next day's work begins. Chronic fatigue causes the overall work capacity of the worker to decline over time.

## Part Two (Productivity)

### Results

This part of the study determined whether an economically significant difference exists in the amount of work that an individual can accomplish in a typical work day using a Gorbel® WSC versus an I-Beam crane. By measuring an individual's work cycles (moving and positioning a load over a measured path) and keeping work intensity at a constant rate via a heartrate monitor, productivity could be accurately measured. Productivity of the male and female subjects is illustrated in the graphs below.



### Males

***In all cases***, were more productive with a Gorbel® WSC.  
***Averaged 27%*** productivity increase with a Gorbel® WSC.

### Females

***In all cases***, were more productive with a Gorbel® WSC.  
***Averaged 28%*** productivity increase with a Gorbel® WSC.

### Discussion - Part Two

Enhanced performance with a Gorbel® WSC results from the ease of movement associated with a WSC's design. Reduced dead weight and a design superior to that of the I-Beam crane result in reduced coefficients of friction and lower initial and sustained movement forces that allow workers to position and move loads on Gorbel® WSC's more easily than on I-Beam cranes. For example, moving a 500 lb. load, subjects averaged 7.5 additional work cycles with a WSC per ten minute time period. Translated to one hour, this would be 45 additional work cycles. Over a full eight-hour work day, an average worker would complete approximately 360 additional work cycles.

## Conclusion

The study revealed that workers using manually operated bridge cranes can safely handle significantly more weight with a Gorbel® Work Station Crane than with an I-Beam crane. In the workplace, this translates into reduced risk of job-related injury as well as significant increases in work productivity.

For more information on this study or on Gorbel's product line:

- Additional copies of this Executive Summary
- Video presentation of this Study
- 22-page comprehensive overhead crane Ergonomic Study
- Free Standing Work Station Bridge Cranes
- Ceiling Mounted Work Station Bridge Cranes
- Work Station Jib Cranes

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