

# Test Results Show >50% Reduction in Lower Back Torque

*A traditional backboard lift starts in the Danger Zone for Lifting – Below the Knees*



**Situation:** Firefighters and Emergency Medical Services (EMS) personnel must perform a wide array of potentially hazardous emergency rescue procedures that often include lifting patients at trauma scenes from the ground to the gurney. The use of traditional backboards requires that FIRE / EMS personnel lift from a position that places them at risk for injury from muscle strain caused by poor body positioning, poor lift mechanics, and maximum torque applied to the lower back and knees. When lifting from the ground, the natural tendency is to bend at the waist and use upper body strength. Conversely, when properly positioned for protecting the lower back, a tremendous amount of torque is placed on the knees putting them at risk for injury (Note the knee angle in the first image).

**Rationale:** The Federal Emergency Management Association (FEMA) Fire and Emergency Medical Service Ergonomics Handbook states; "One of the best ways to reduce lifting injuries is to avoid lifting heavy objects in the lifting danger zones. The critical danger zone, where most back injuries occur, is lifting from a point below the knees."

**Methodology:** Independent ergonomic experts measured the ground reaction forces underfoot and estimated low back joint movements during backboard lifts with both a standard backboard and the EZ LIFT Rescue System to assess the kinematic lift forces for both a 165 lb. and 220 lb. patient. An 8 camera, real-time motion analysis system was used to record 3-D movements of 56 reflective markers attach to body segments that comprise arms, legs and trunk.

**Results:** The EZ LIFT Rescue System backboard extendable handles allow FIRE / EMS responders to lift from a safe lifting position close to the knees which dramatically reduces torque on the lower back where most injuries occur.



*EZ LIFT Rescue Systems allows Rescuers to lift from the Safety Zone – close to the knees*

The report summarized; "There are striking differences in magnitude of the joint/trunk angles and low back torques at the start of the lifting task." The report concluded "...it is very apparent from the kinematic and torque data that the EZ LIFT Rescue System prototype tested dramatically reduces loads on the lower back."

## Estimated Sagittal Plane Hip and Low-Back Torques

Measure	Standard Backboard	EZ LIFT Rescue System
Low-back (Nm)	-245.3 (32.5)	-120.5 (8.9)
L Hip (Nm)	+122.4 (7.2)	+58.5 (6.5)
R Hip (Nm)	+126.4 (10.2)	+64.2 (7.3)

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*Stephen Swanson, Ph.D. Orthopedic Specialty Hospital*