

## Over the Edge

Although this testing and evaluation process has only just begun, we wanted to share our thoughts and findings thus far in an effort to gain perspective and ideas from the rescue community. There are many other tests that are needed such as different drop heights, different edge types and restraint methods. The following is an overview of what we have done so far and some of the preliminary results.

### The Test Set-up

All of the tests were conducted on an engineered drop testing tower owned by Jim Kovach of *All About Rope, Inc.* The tower has an intermediate beam with a welded clamp in the center to facilitate different testing materials such as the steel roofing and sandstone used in these tests. The test weights ranged from 150 lbs to 225 lbs. All of the tested materials were tied with a bowline at a chain anchor and attached to the test mass, suspended between 40 and 43 inches above the test edges.

### What was tested

We conducted four (4) drops on 3/8" PMI Static rope, six (6) drops on single 8mm PMI Prusiks, two (2) drops on tandem 8mm PMI Prusiks and five (5) drops on single 6mm Prusiks. Standing seam roofing material was used for four (4) of the drops and the other thirteen (13) drops were over a sandstone edge.

### Test Results

**#1** 3/8" PMI Static rope with a 200lbs test mass, dropped over Standing Seam steel roofing that had a 1" overhang from the 2x10 it was attached to. The test mass was suspended approximately 42" above the steel roofing and 20" from the steel edge to center of mass where the rope was attached. The steel roofing folded down and tore. The sheath of the rope was cut about one third of the way around but no core bundles were cut and the load was left hanging.

**#2** 3/8" PMI Static rope with a 200lbs test mass, dropped over Standing Seam steel roofing that had a 1" overhang from the 2x10 it was attached to. The test mass was suspended approximately 42" above the steel roofing and 20" from the steel edge to center of mass where the rope was attached. The steel roofing folded down and tore. The sheath of the rope was cut all the way around but no core bundles were cut and the load was left hanging.

**#3** 3/8" PMI Static rope with a 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 41" above the sandstone and 20" from the edge to center of mass where the rope was attached. The sandstone test edge slid backwards approximately 8" from the steel I beam. The rope was de-sheathed but no core bundles were damaged and the load was left hanging.

**#4 new** 8mm PMI accessory cord triple wrapped Prusik on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 20" from the edge to center of mass. The tail of the rope was not attached to the load. The sandstone test edge was tied in place to help prevent sliding. The Prusik missed the test edge and the rope contacted the edge behind the Prusik. The sandstone was pushed back 1-3/4" from the edge and the sheath of the rope was cut about 1/3 of the way through the load was left hanging.

**#5 new** extra-long (10' before tying) 8mm PMI accessory cord triple wrapped Prusik (to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the

Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 20" from the edge to center of mass. The sandstone test edge was clamped in place with two additional clamps to prevent sliding. The Prusik failed on the sandstone and the load went to the ground.

**#6 new** extra-long Tandem 8mm PMI accessory cord triple wrapped Prusiks (10' and 12' long to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 20" from the edge to center of mass. The short Prusik slipped 7/8" fused to rope and failed. The long Prusik slipped about 2-1/2" and held the load with minor sheath damage and did not fuse to the rope.

**#7 3/8"** PMI Static rope with a 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 20" from the edge to center of mass where the rope was attached. The sandstone test edge was held in place with the additional clamps to prevent sliding backwards. The rope was de-sheathed but no core bundles were damaged and the load was left hanging.

**#8 new** extra-long Tandem 8mm PMI accessory cord triple wrapped Prusiks (10' and 12' long to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. Both Prusiks slipped less than 1" and were de-sheathed. No core bundles were damaged and the load was left hanging. The peak force recorded at the chain anchor was 1365 lbs.

**#9 new** extra-long (10' before tying) 8mm PMI accessory cord triple wrapped Prusik (to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. The sandstone test edge was clamped in place with two additional clamps to prevent sliding. The Prusik slipped about 1/2" and fused to the rope. The Prusik was de-sheathed, had two failed core bundles and the load was left hanging. The peak force recorded at the chain anchor was 1415 lbs.

**#10 new** extra long (10' before tying) 8mm PMI accessory cord triple wrapped Prusik (to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. The sandstone test edge was clamped in place with two additional clamps to prevent sliding. The Prusik slipped about 1/2" and fused to the rope. The Prusik was de-sheathed, had four failed core bundles and the load was left hanging. The peak force recorded at the chain anchor was 1425 lbs.

**#11** extra long 6mm PMI accessory cord triple wrapped Prusik (two lengths tied together to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 225lbs test mass, dropped over a Sandstone edge. The test mass was suspended

approximately 43" above the sandstone and 15" from the edge to center of mass. The Prusik fused to the rope, failed over the sandstone and the load went to the ground. The peak force recorded at the chain anchor was 935 lbs.

**#12** extra long 6mm PMI accessory cord triple wrapped Prusik (two lengths tied together to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 200lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. The Prusik fused to the rope, failed over the sandstone and the load went to the ground. The peak force recorded at the chain anchor was 660 lbs.

**#13** extra long 6mm PMI accessory cord triple wrapped Prusik (two lengths tied together to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 150lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. The Prusik slipped about 3/4", fused to the rope with severe sheath and some core bundle damage in the wraps. The load was left hanging. The peak force recorded at the chain anchor was 1445 lbs.

**#14** extra long 6mm PMI accessory cord triple wrapped Prusik (two lengths tied together to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 150lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. The Prusik slipped about 1/2", fused to the rope. The load was left hanging for about 30 seconds then went to the ground. The peak force recorded at the chain anchor was 565 lbs.

**#15** extra long 6mm PMI accessory cord triple wrapped Prusik (two lengths tied together to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 175lbs test mass, dropped over a Sandstone edge. The test mass was suspended approximately 43" above the sandstone and 15" from the edge to center of mass. The Prusik slipped about 3/4", fused to the rope then failed over the sandstone and the load went to the ground. The peak force recorded at the chain anchor was 1270 lbs.

**#16** new extra long (10' before tying) 8mm PMI accessory cord triple wrapped Prusik (to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 200lbs test mass, dropped over a Steel roof edge with approximately a 1" overhang from the 2x8 it was attached to. The test mass was suspended approximately 43" above the Steel edge and 17" from the edge to center of mass. The roofing folded over and tore. The Prusik slipped 3/4", was de-sheathed with no damaged core bundles and the load was left hanging. The peak force recorded at the chain anchor was 1545 lbs.

**#17** new extra long (10' before tying) 8mm PMI accessory cord triple wrapped Prusik (to ensure contact with the edge) on PMI 3/8" Static rope. The rope was attached at the chain anchor with a bowline and the Prusik was attached to the test mass with a steel carabiner. The tail of the rope was not attached to the load. 200lbs test mass, dropped over a Steel roof edge with approximately a 1" overhang from the 2x8 it was attached to. The test mass was suspended approximately 43" above the Steel edge and 17" from the

edge to center of mass. The roofing folded over, the Prusik slipped 1" and had only minor sheath damage. The load was left hanging. The peak force recorded at the chain anchor was 1415 lbs.

### **Preliminary conclusions**

Although the data here is limited, it did validate some of our concerns and the need for further testing and review of the restraint and fall arrest systems we use and the edges we use them on. Some of the tests with a single 8mm Prusik failed. Maybe we will find that it is good practice to attach the host rope as a back-up. Most of the drops on 6mm Prusiks failed, which seems to validate the practice commonly used of attaching the host rope as a back-up, although in many cases that host rope is 8mm. We welcome your thoughts and ideas and we certainly plan to do more testing. Please use the contact information below with any ideas, questions or concerns you may have.

Larry Walters

[Larrywalters4190@gmail.com](mailto:Larrywalters4190@gmail.com)