HUMAN FACTORS AND SYSTEMS ANALYSIS FOR ROPE RESCUE - A CASE STUDY
Human

- Level of skills or training
- Command & Communication Structure
- Mindset
- Physical Limitations

Environmental

- Sharp edges
- Rock Fall/Avalanche
- Chemical
- Lightning

Material

- Strength
- Abused
- Worn/Defective
- Durability/resilience

Method/Technique

- Competence
- Capability
- Equipment suitability

ROPE RESCUE SYSTEMS ANALYSIS

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Two Rope Systems
Dual Capability, or
Mirrored Systems:

Each rope system must be fully capable and competent as both a mainline and a back-up line, at the same time.
Environmental Factor: Sharp Abrupt Edges

HOW IS THE RISK BEING MANAGED?
Stumbles, falls or pendulums can expose ropes to damage.
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Vector the Ropes

Edge Protection

Equal Tension???
**Risk:**
A *tensioned* rope is more likely to get damaged from a *sharp edge* than an *un-tensioned* rope.

**Strategy:**
Keep one rope hand-tight during edge transitions. This limits risk to mostly the tensioned line.
Critical Evaluation – Systems Analysis:

How do we know which is a better strategy for managing sharp edges?

A) Dedicated Mainline with Un-tensioned Back-Up Rope

or

B) Both ropes equally share the load
Risk management must be based on the best data. To that end we should take an informative look at the evidence\(^1\).

\(^1\)Helmet Use for Ski Guiding – Further Analysis; Dr. Jeff Boyd 2014
COMPARE HAND-TIGHT BACK-UP TO TWO-TENSIONED ROPE SYSTEM

• drops over unprotected level sharp edge
• drops over protected non-level sharp edge
• drops over protected non-level sharp edge

VIDEO

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HAND-TIGHT BACK-UP, OR TWO TENSIONED ROPE SYSTEM?

There was no evidence in any of the tests that a hand-tight back-up rope offered any obvious risk benefit advantages over two-tensioned rope techniques for transitioning over sharp edges.
EDGE PROTECTION IS MANDATORY

Dedicated main & back-up

Two tensioned Rope system
Two-tensioned ropes performed better than dedicated main & back-up rope systems.

Less tensioned ropes are less likely to be damaged/cut from sharp edges.

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Environmental Factor: Sharp, Abrupt Edges

METHOD/TECHNIQUE FACTOR: TWO TENSIONED ROPE SYSTEMS

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Deflect Both Ropes - Equally
ROPE RESCUE SYSTEMS ANALYSIS

- Edge Protection
- Two Tensioned Ropes
- Deflect both ropes equally
- Sharp edges

Human

Environmental

Material

Method/Technique

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Two Tensioned Rope Systems: (dual capability)

Human Factor Problem!
The Devices auto-locks are being defeated while lowering.