CLIMBING INCIDENT ANALYSIS-
MAZAMAS CASE STUDY

DOUG WILSON
MAZAMAS: 1894 – today

The Party from Cloud Cap Inn, as it reached the Summit of Mt. Hood, Thursday, July 19, 1894
• ~3400 members, ~ 600 volunteers

• Mission: The Mazamas promotes mountaineering through education, climbing, hiking, fellowship, safety and the protection of mountain environments.

• ~250 climbs / year, beginning through advanced
• Climbing classes, beginning through advanced, youth / adults
• ~ 900 hikes, backpacks, evening rambles
• Outings (domestic and international)
• Nordic and Ski Mountaineering classes

• Conservation grants- $18500
• Research grants- $16000
• Expedition grants
• Local community youth programs

WWW.MAZAMAS.ORG
AGENDA

• Some background on why and how we developed this analysis

• 3 Key Learnings
  1. Identify top 3 -5 incident types
  2. Brainstorm root causes and factors affecting severity
  3. Test those causes for commonalities that you will share with your leaders/participants

• Mazama analysis findings and challenges

• Brainstorming root cause exercise (20 min)
Initial Mazama incident reporting system (1999) was modeled after *Accidents in North American Mountaineering*

- Published yearly by American Alpine Club
- Compilation of first person reports, SAR analysis, and news reports for US and Canada
ANAM incident types and contributing causes

- We needed to expand these types and causes specifically for our organization.
We wanted to answer these questions:

• What are our most frequent climbing incidents?
  • Are this year’s incident types similar to previous years?
  • What is the amount of near misses, minor injuries, etc. by incident type?

• What are the root cause variables that affect each major incident type and are there any variables that are affecting severity?
  • Do we need to add any new fields to our incident report and database?

• What are the commonalities we need to report to our leaders?
  • Specific mountains / routes?
  • Specific education classes with higher incidents?
  • Are our climbing school graduates having more incidents? If so, are we teaching something incorrectly?
  • Any indication of leader decision making improvements?
Mazama Climbing Incident Analysis

1. ID top incident types
2. Brainstorm root causes and severity variables
3. Look for commonalities within those categories

Share commonalities with leaders and come up with solutions together

Update incidents every year and repeat commonality analysis—has anything changed?

Add categories to incident database

Leader observations / recommendations from incident reports

DEVELOPMENT

YEARLY UPDATES
KEY LEARNING #1: IDENTIFY YOUR TOP 3 – 5 INCIDENTS

• Often done with pie charts
• Prefer a horizontal bar chart sorted by highest to lowest # of occurrences (Pareto)
• Can provide a comparison of current year to previous years
• Can also provide a look at incident categories (near misses, minor injuries, etc.)
MAZAMA CLIMBING INCIDENTS 1998 - 2015

Cautions
- Consistent incident definition
- Sample size
MAZAMA CLIMBING INCIDENTS 1998 - 2015

Observations:
+ minor injuries > major injuries
- Low near miss reporting
- Most of our major injuries occurring with lead falls

Assisted non-Mazama Party
Behavioral
Fatalities
Major injury
Minor injury
Near Miss
Search and rescue

Failure to follow route
Faulty use of crampons
Fall into crevasse / moat
Lead fall (rock, snow or ice)
Other
Avalanche
Illness / pre-existing condition
Exceeding abilities
Behavior
Fall on snow / ice (following)
Loss of control / glissade
Rappel failure / error
Anchor failure
Other

raw # of incidents
KEY LEARNING #2 BRAIN STORM ROOT CAUSES / SEVERITY VARIABLES FOR EACH INCIDENT TYPE

- What known causes are there?
- What other possible issues could have caused the incident?
- What conditions made the incident worse or better?
FISHBONE (ISHIKAWA) DIAGRAM EXAMPLE

- shows the possible causes of a problem logically arranged by categories

Categories can become new fields in your database.
KEY LEARNING #3 TEST VARIABLES FOR COMMONALITIES

- Add the new category fields in your database and fill in the data using report narratives or interview people that submitted the report.

<table>
<thead>
<tr>
<th>INCIDENT LOCATION / MOUNTAIN</th>
<th>ROUTE / TRAIL</th>
<th>MAZAMA PROGRAM (select ONE)</th>
<th>ACTIVITY</th>
<th>WHAT KIND OF INCIDENT?</th>
<th>SOURCE OF FALLING OBJECTS</th>
<th>ACTIVITY</th>
<th>TERRAIN</th>
<th>KNOWN CAUSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinnacle Peak</td>
<td>South Route</td>
<td>CLIMB- A</td>
<td>CLIMBING- ROCK</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Ascending</td>
<td>3rd class</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>Mt. Stuart</td>
<td>Cascadian Couloir</td>
<td>CLIMB- B</td>
<td>CLIMBING- ROCK</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Ascending</td>
<td>scree</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>Mt. Shuksan</td>
<td>Big Creek</td>
<td>CLIMBING- ROCK</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Ascending</td>
<td>3rd class</td>
<td>knocked down by party member</td>
<td></td>
</tr>
<tr>
<td>Mt. Jefferson</td>
<td>South Ridge</td>
<td>CLIMB- B</td>
<td>CLIMBING- ROCK</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Ascending</td>
<td>3rd class</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>Unicorn Peak</td>
<td>Snow Lake</td>
<td>CLIMB- B</td>
<td>CLIMBING- ROCK</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Ascending</td>
<td>snow / ice</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>Mt. Hood</td>
<td>West Crater Rim</td>
<td>CLIMB- C</td>
<td>CLIMBING- SNOW</td>
<td>Injury, illness, or fatality</td>
<td>Natural- ice</td>
<td>Ascending</td>
<td>snow / ice</td>
<td>natural</td>
</tr>
<tr>
<td>Mt. Jefferson</td>
<td>South Ridge</td>
<td>CLIMB- C</td>
<td>CLIMBING- SNOW</td>
<td>Injury, illness, or fatality</td>
<td>Natural- ice</td>
<td>Ascending</td>
<td>trail</td>
<td>natural</td>
</tr>
<tr>
<td>Multinoma Falls Trail</td>
<td>n/a</td>
<td>AYM</td>
<td>BACKPACKING</td>
<td>Near miss or close call</td>
<td>Natural- rock</td>
<td>Traversing</td>
<td>natural</td>
<td>natural</td>
</tr>
<tr>
<td>Mt. Hood</td>
<td>West Crater Rim</td>
<td>CLIMB- B</td>
<td>CLIMBING- SNOW</td>
<td>Injury, illness, or fatality</td>
<td>Natural- ice</td>
<td>Ascending</td>
<td>snow / ice</td>
<td>natural</td>
</tr>
<tr>
<td>Mt. Jefferson</td>
<td>n/a</td>
<td>CLIMBING SCHOOL- ASI</td>
<td>CLIMBING ICE</td>
<td>Injury, illness, or fatality</td>
<td>Natural- ice</td>
<td>Ascending</td>
<td>snow / ice</td>
<td>natural</td>
</tr>
<tr>
<td>Broken Top</td>
<td>Northwest Ridge</td>
<td>CLIMB- B</td>
<td>CLIMBING- ALPINE</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Descending</td>
<td>scree</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>Sahale Peak</td>
<td>Sahale Arm</td>
<td>CLIMB- B</td>
<td>CLIMBING- ALPINE</td>
<td>Near miss or close call</td>
<td>Mazama Party- rock</td>
<td>Waiting</td>
<td>5th class</td>
<td>rope (belay, rappel, team)</td>
</tr>
<tr>
<td>Sahale Peak</td>
<td>Sahale Arm</td>
<td>CLIMB- B</td>
<td>CLIMBING- ALPINE</td>
<td>Near miss or close call</td>
<td>Mazama Party- rock</td>
<td>Ascending</td>
<td>4th class</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>Mt. Washington</td>
<td>North Ridge</td>
<td>CLIMB- C</td>
<td>CLIMBING- ALPINE</td>
<td>Injury, illness, or fatality</td>
<td>Mazama Party- rock</td>
<td>Descending</td>
<td>scree</td>
<td>knocked down by party member</td>
</tr>
<tr>
<td>MMC</td>
<td>Climbing wall</td>
<td>CLIMBING SCHOOL- AR</td>
<td>CLIMBING- ROCK</td>
<td>Injury, illness, or fatality</td>
<td>Equipment</td>
<td>Ascending</td>
<td>MMC Wall</td>
<td>falling equipment</td>
</tr>
</tbody>
</table>
KEY LEARNING #3: FALLING OBJECTS- COMMONALITY ANALYSIS

- Start analysis with bar charts for individual category fields from your fish bone diagram.

**SOURCE OF FALLING OBJECTS**
- Mazama Party-rock
- Natural rock
- Natural ice
- Equipment

Clearly our own party members are the root cause of most falling rock incidents.

**KNOWN CAUSE OF FALLING OBJECTS**
- Knocked down by party member
- Natural
- Rope (belay, rappel, team)
- Falling equipment

**FALLING OBJECTS- TERRAIN**
- Scree
- 3rd class
- 4th class
- 5th class
- Snow / ice

Primarily on terrain where the party is moving together un-roped.

**FALLING OBJECTS- ACTIVITY**
- Ascending
- Descending
- Rappelling
- Waiting
KEY LEARNING #3: FALLING OBJECTS- COMMONALITY ANALYSIS

- Use your expertise to investigate interactions that make sense
Comparisons of sub-groups of different sizes / total time in the field need to be normalized for an apples to apples comparison- e.g. mountain to mountain, climbs vs climbing classes.
SHARING WITH LEADERS

FINDINGS

• Rock fall is the #1 climbing incident
• 77% of rock fall incidents are caused by Mazama party members themselves
• ~38% occur on scree (primarily descending), 42% on 3rd / 4th class (primarily ascending)
• Occurs on B and C climbs with moderate to experienced party members
• No clear contributing causes- 33% are party members not following leader directions, and 25% are party members not paying attention to their position

RECOMMENDATIONS

• Ascend / descend narrow gullies and scree 2-3 climbers at a time rather than as a group and use islands of safety for group members below to wait outside the fall line
• Spread out parallel when ascending / descending wide scree fields
• Leaders need to constantly remind team members of potential high rock fall areas
• Individual team members have to have situational awareness of their surroundings- are there people above them or below them?
• Add specific rock fall discussions in both BCEP and ICS curricula
FALLS ON SNOW- COMMONALITY ANALYSIS

EQUIPMENT- ICE AXE

- Ice axe: 18
- Ski poles: 2

EQUIPMENT- CRAMPONS

- No crampons: 12
- Crampons: 6

EQUIPMENT- ROPED / UN-ROPED

- Unroped: 18
- Roped: 2
- Handline: 2

Roped injury vs un-roped injury (roped near misses not reported)

SNOW CONDITIONS

- Soft: 10
- Neve: 8
- Icy: 5
- Glacial ice: 2
FALLS ON SNOW- COMMONALITY ANALYSIS

Leader discussions- weighing party member experience and the potential / severity of a fall vs time saved when deciding to rope up and/or wear crampons.
Summary of Mazama learnings

<table>
<thead>
<tr>
<th>INCIDENT / PROBLEM</th>
<th>WHAT WE FOUND</th>
<th>WHAT WE DID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falling objects (rock)</td>
<td>77% of incidents caused by Mazama party members on scree / scrambling terrain</td>
<td>Involved climb leaders to rethink group management in rock fall environments</td>
</tr>
<tr>
<td>Falls on snow</td>
<td>primarily un-roped and/or w/o crampons</td>
<td>Leader discussions- weighing party member experience and the potential / severity of a fall vs time saved when deciding to rope up and / or wear crampons.</td>
</tr>
<tr>
<td>Lead falls</td>
<td>Intermediate Sport climbing class 8x higher than actual climbs</td>
<td>Safety review of class- rock gym to outside training</td>
</tr>
<tr>
<td>Falls on rock</td>
<td>Primarily un-roped, 50% were failure to test holds</td>
<td>Leader discussions- weighing party member experience and the potential and severity of a fall vs time saved when deciding to rope up on 3rd / 4th class terrain.</td>
</tr>
<tr>
<td>Lack of near miss reporting</td>
<td>Near misses &lt; 15% incidents of total reported</td>
<td>leader education of the importance of near miss reporting</td>
</tr>
</tbody>
</table>

Challenges / To Do

- getting leaders to file reports
- trending results with a small data set to see if fixes are working
- customize online incident report by type?
SUMMARY: 3 KEY LEARNINGS

1. Identify top 3-5 incident types
   • Use a consistent incident definition and adjust reports if necessary
   • Sample size
2. Brainstorm root causes and factors affecting severity
3. Test those causes for commonalities.
   • Share findings and work with your leaders/participants to reduce future occurrences
BRAINSTORMING EXERCISE (20 min)

• Pick an incident type from your organization that you want to understand root causes
• Work by yourself or with others
• Identify your known causes
• Brain storm other possible causes
• Generate a fishbone diagram