

Avalanche accidents involving people along transportation corridors and the implications for avalanche operations

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- * How many people are involved in transportation corridor accidents?
- * How much of a factor are delayed avalanches for accidents along transportation corridors?
- * Do avalanche programs make a difference?



D.Hamre

- * DATA

- USA 1902-2014

- Canada 1904-2014

- Switzerland 1909-2014

- Italy 1978-2014

- * Parameters
 - road/railroad
 - user/worker
 - open/closed
 - delayed avalanche
 - worker activity
 - damage to people

Data Summary

Country	Accidents	Fatal Accidents	Persons involved	Fatalities
Canada 1904-2014	91	19	192	87
Italy 1978-2014	69	15	117	28
Switzerland 1909-2014	142	54	537	115
U.S. 1902-2014	106	35	411	152
all	408	123	1257	382

Parameters Examined

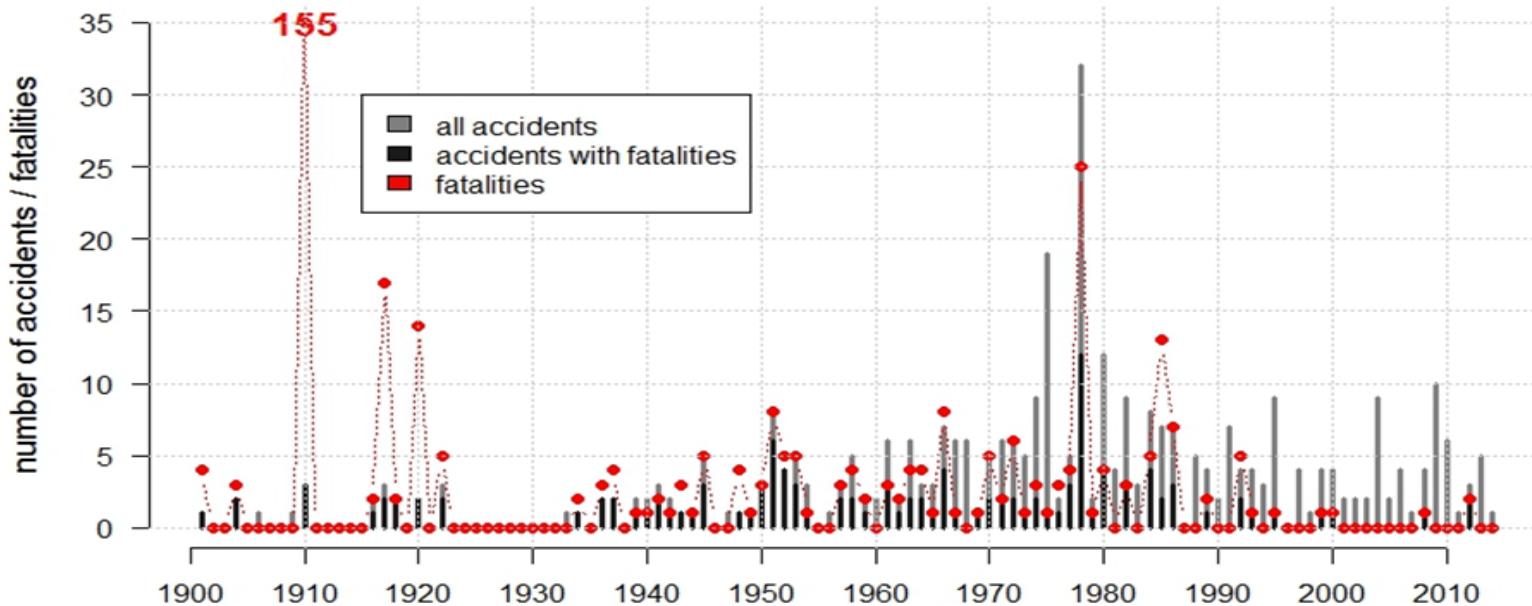
User (1978-2014)

Country (N)	Corridor status = open	Transport type = road	Delayed avalanche = yes
Canada (39)	100%	100%	3%
Italy (29)	96%	100%	0%
Switzer-land (46)	87%	93%	9%
U.S. (35)	100%	97%	22%
all (149)	95%	97%	8%

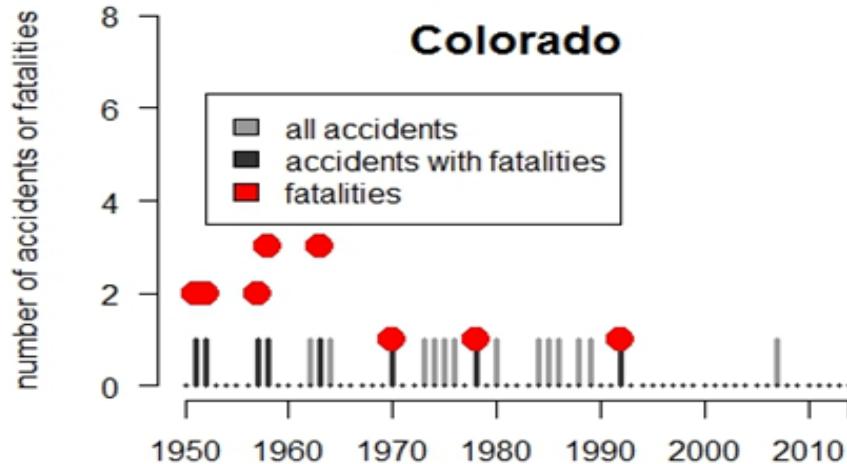
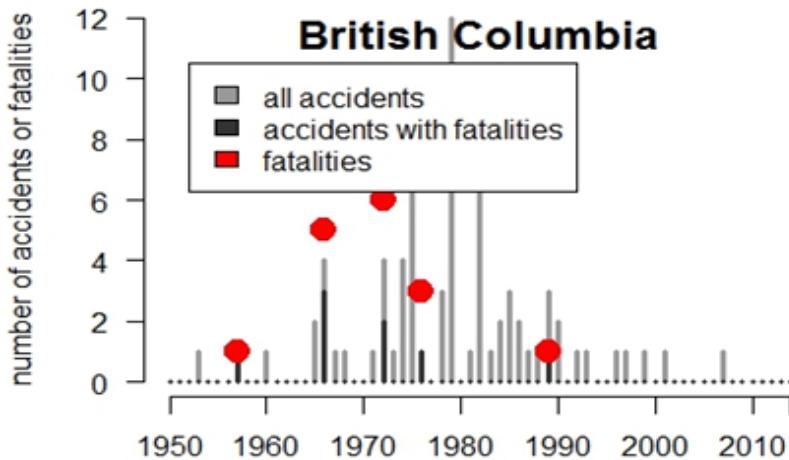
Worker (1978-2014)

Country (N)	Corridor status = open	Trans-port type = road	Activity = snow clearing	Delayed avalanche = yes
Canada (8)	75%	75%	50%	33%
Italy (11)	22%	91%	100%	0%
Switzer-land (14)	25%	79%	92%	36%
U.S. (17)	47%	94%	50%	41%
all (50)	41%	86%	79%	29%

Temporal Trends



Case Studies



Limitations

- * Various sources, different recording methods
- * Fatal vs nonfatal accident reporting
- * Not a complete study

Applications

- * Workers

- Industry standards and continuous quality training

- Right equipment for the job



Applications

- * Workers

- Eliminate uncertainty

Conclusions

- * Since 1995 majority of fatalities have been workers clearing snow or debris
- * Delayed Avalanches pose a serious threat to workers and users
- * Significant decrease in avalanche accidents and fatalities with avalanche safety programs

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- * Alaska Railroad Corporation
- * WSL Institute for Snow and Avalanche Research SLF
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