

## Methods for Predicting Shallow-Rapid Landslide Delivery in Board Manual Section 16

Several methods and models have been developed by geologists for estimating shallow-rapid runoff distances in the Pacific Northwest. The following references are briefly discussed in Board Manual Section 16, *Guidelines for Evaluating Potentially Unstable Slopes and Landforms*. The links are provided below and can be assessed online, through other government websites or through the Washington Geology Library. Note - the URLs may change without notice.

Acme Watershed (1999). Crown Pacific Limited Partnership.

<http://www.dnr.wa.gov/watershed-analysis>

Benda, L. and T. W. Cundy (1990). Predicting deposition of debris flows in mountain channels. *Canadian Geotechnical Journal*. 27: 409-417.

[https://www.for.gov.bc.ca/hfd/library/ffip/Benda\\_LE1990CanGeotechJ.pdf](https://www.for.gov.bc.ca/hfd/library/ffip/Benda_LE1990CanGeotechJ.pdf)

Coho, Carol S. and Stephen J. Burges, Stephen J., (1994). Dam-break floods in low order mountain channels of the Pacific Northwest: University of Washington Department of Civil Engineering Water Resources Series Technical Report 138; Timber, Fish & Wildlife Program TFW-SH9-93-001, 70.

<http://www.dnr.wa.gov/programs-and-services/geology/washington-geology-library>

Corominas, J. (1996). The angle of reach as a mobility index for small and large landslides. *Canadian Geotechnical Journal*, 33: 260–271.

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Corominas, J., C. J. van Westen, P. Frattini, L. Cascini, J.P. Malet, S. Fotopoulou, F. Catoni, M. Van Den Eeckhaut, F. Mavrouli, F. Agliardi, K. Pitilakis, M.G. Winter, M. Pastor, S. Ferlisi, V. Tofani, J. Hervas, J. T. Smith (2014). Recommendations for the quantitative analysis of landslide risk. *Bulletin of Engineering Geology and the Environment*. 73: 209-263.

<http://link.springer.com/article/10.1007/s10064-013-0538-8#page-1>

Fannin, R.J. and Wise, M.P.W. (2001). An empirical-statistical model for debris flow travel distance, *Canadian Geotechnical Journal*, 38(5): 982-994.

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Guthrie, R.H., A. Hockin, L. Colquhoun, T. Nagy, S.G. Evans, and C. Ayles. (2010). An examination of controls of debris flow mobility: evidence from coastal British Columbia. *Geomorphology* 114: 601–613.

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- Hungr, O. (1995). A model for the runout analysis of rapid flow slides, debris flows and avalanches. *Canadian Geotechnical Journal*, 32(4): 610-623.  
<http://www.clara-w.com/DAN-W-Manual-Rel-10.pdf>
- Hungr, O., J. Corominas, E. Eherhardt (2005). Estimating landslide motion mechanism, travel distance and velocity. In *Landslide Risk Management*.  
[ftp://137.82.22.2/pub/ohungr/Support/OH\\_Recent\\_Papers/SOA-4\\_Hungr.pdf](ftp://137.82.22.2/pub/ohungr/Support/OH_Recent_Papers/SOA-4_Hungr.pdf)
- Hunter, G. and R. Fell (2003). Travel distance angle for “rapid” landslides in constructed and natural soil slopes. *Canadian Geotechnical Journal*, 40(6): 1123-1141.  
<http://www.dnr.wa.gov/programs-and-services/geology/washington-geology-library>
- Oregon Department of Forestry, Technical Note Number 2, High Landslide Hazard Locations, Shallow, Rapidly Moving Landslides and Public Safety: Screening and Practices  
<http://www.oregon.gov/ODF/Pages/Publications.aspx>
- Oregon Department of Forestry, Technical Note Number 6, Determination of Rapidly Moving Landslide Impact Rating  
<http://www.oregon.gov/ODF/Pages/Publications.aspx>
- Prochaska, A. B., P. M. Santi, J. Higgins, S. H. Cannon (2008). Debris-flow runout predictions based on the average channel slope (ACS). *Engineering Geology* 98: 29-40.  
<http://www.dnr.wa.gov/programs-and-services/geology/washington-geology-library>
- The Tolt Watershed Analysis (Ward 1993). Weyerhaeuser Timber Company.  
<http://www.dnr.wa.gov/watershed-analysis>
- UBCDFLOW (*University of British Columbia*) 2001  
The model, complete with a user guide and tutorial, is available at:  
<http://dflow.civil.ubc.ca/>.