

Snowdrift Control

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PIARC International Seminar

"Winter service on roads and other public places"

December 13-15, 2021

Snowstorm in Hokkaido, JAPAN



Photo by the Hokkaido Regional Development Bureau

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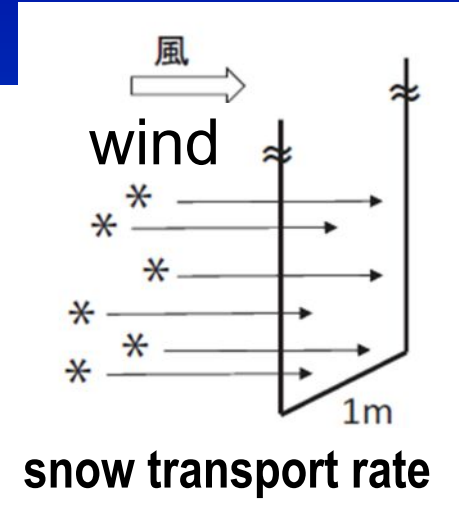
I. Characteristics of blowing/drifting snow

II. Snowdrift countermeasures



Snowdrift

Horizontal distribution of snow transport rate



Typical snowdrift formation

- Wind velocity decreases near obstacles, so the transport force is weakened and snow starts accumulating.
- Turbulent eddies cause snow particles to separate from the airstream. The particles accumulate to form snowdrifts.
- Snowdrifts often form around obstacles such as cuts, buildings, cars and so on.



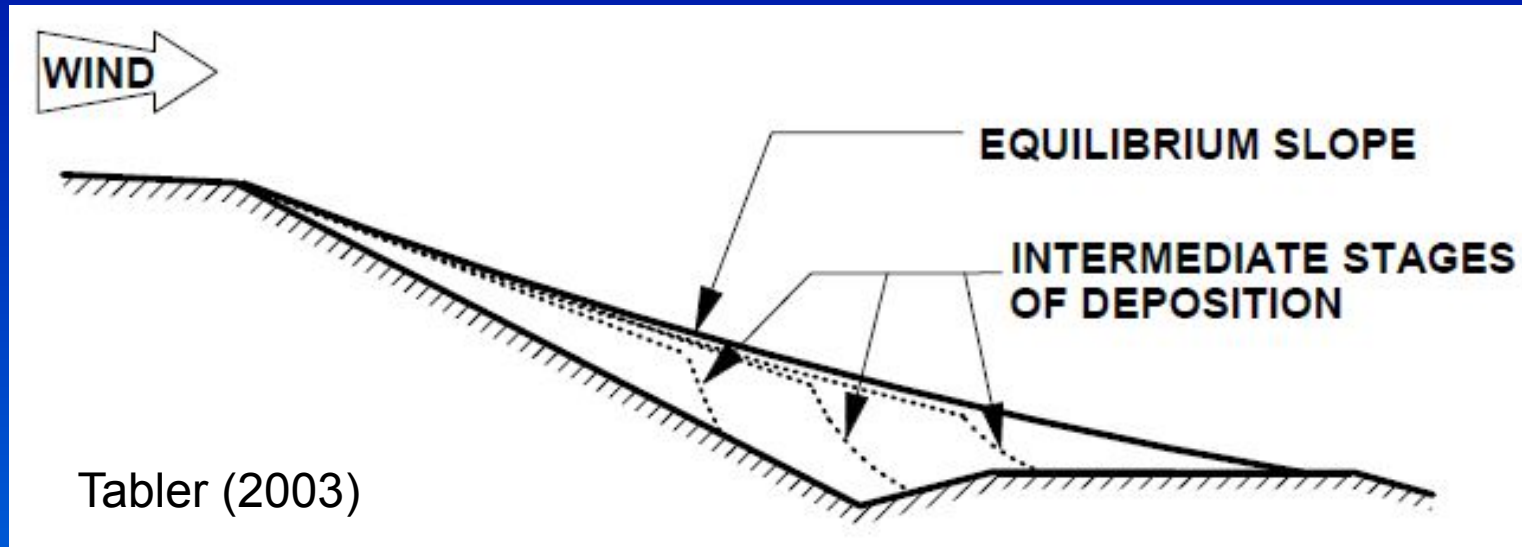
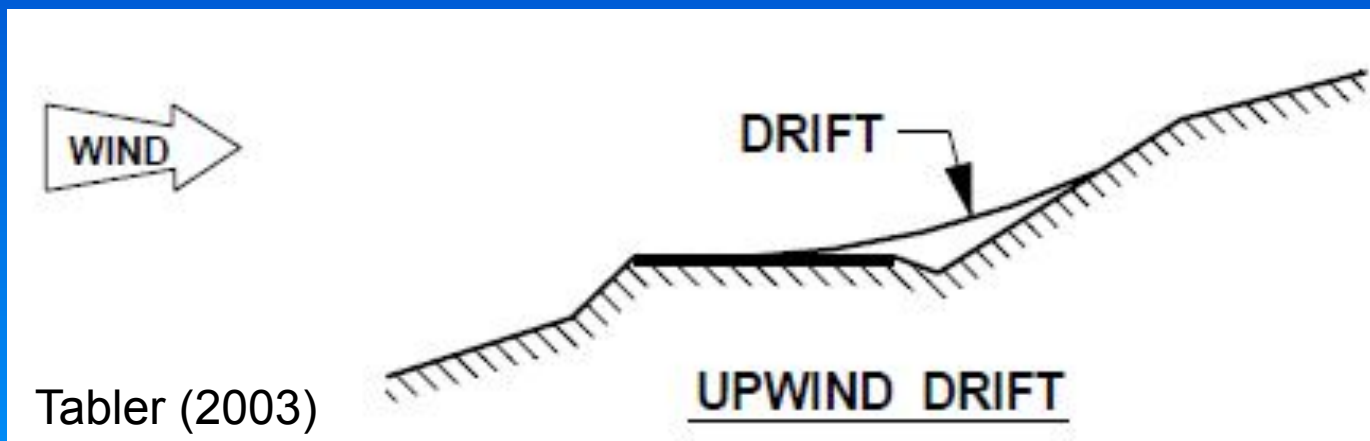
Snowdrift formed around vehicles

Photo by the Hokkaido Regional Development Bureau



A cut section filled up with snowdrift

Snowdrift formation at a cut section



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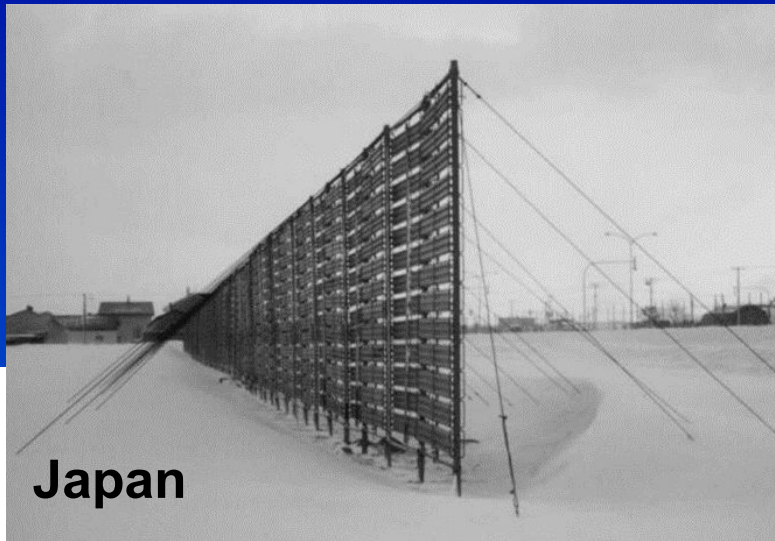
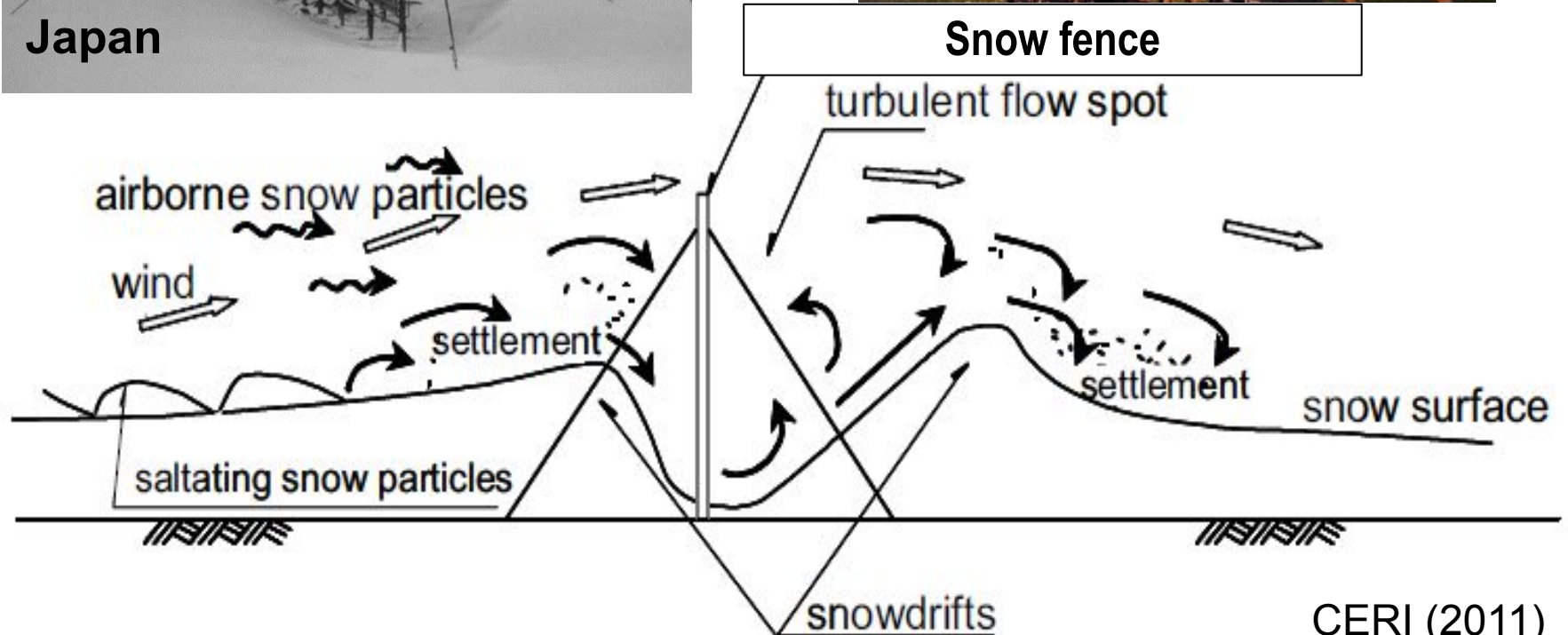
I. Characteristics of blowing/drifting snow

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Snowdrift

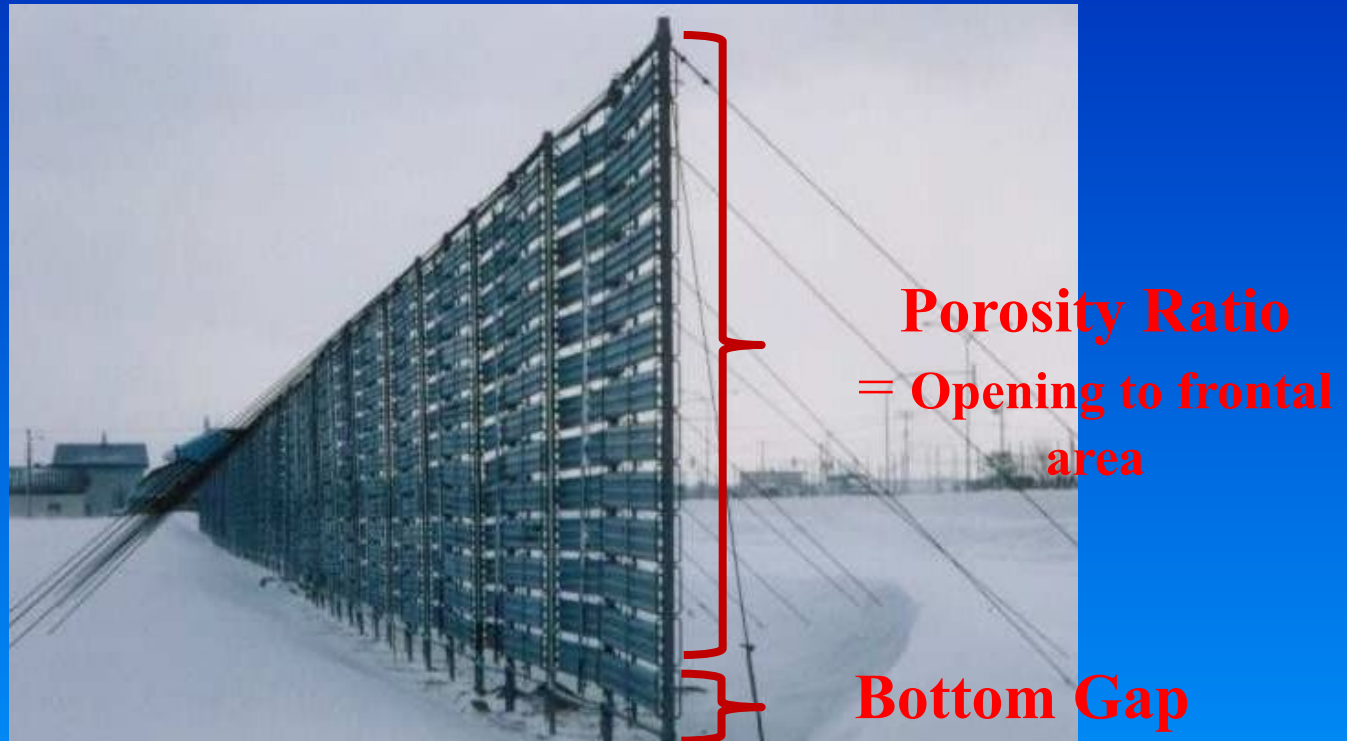
1. Snow fence



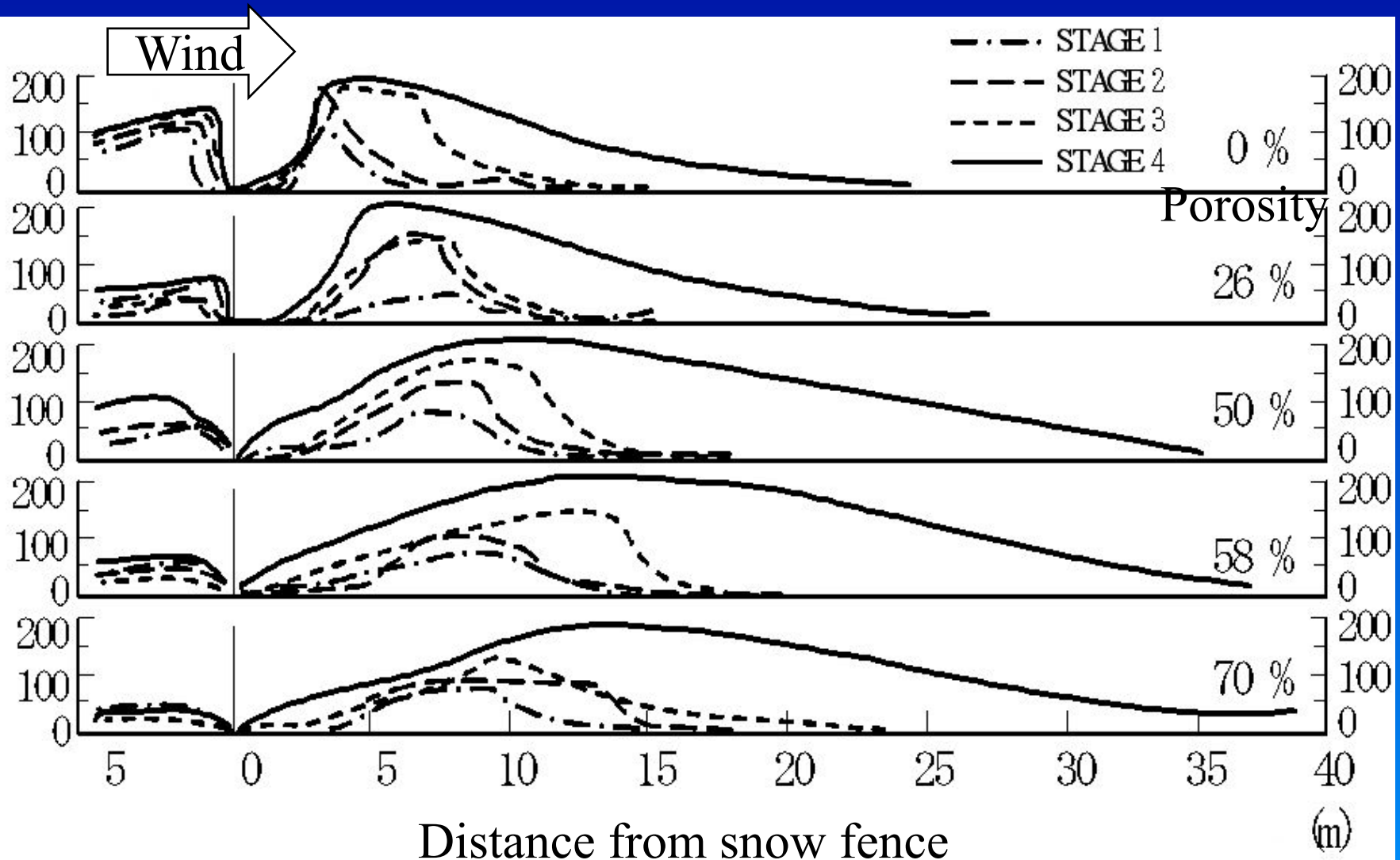
Characteristics of a snow fence

Bottom Gap: the space between the ground and the bottom of the slats

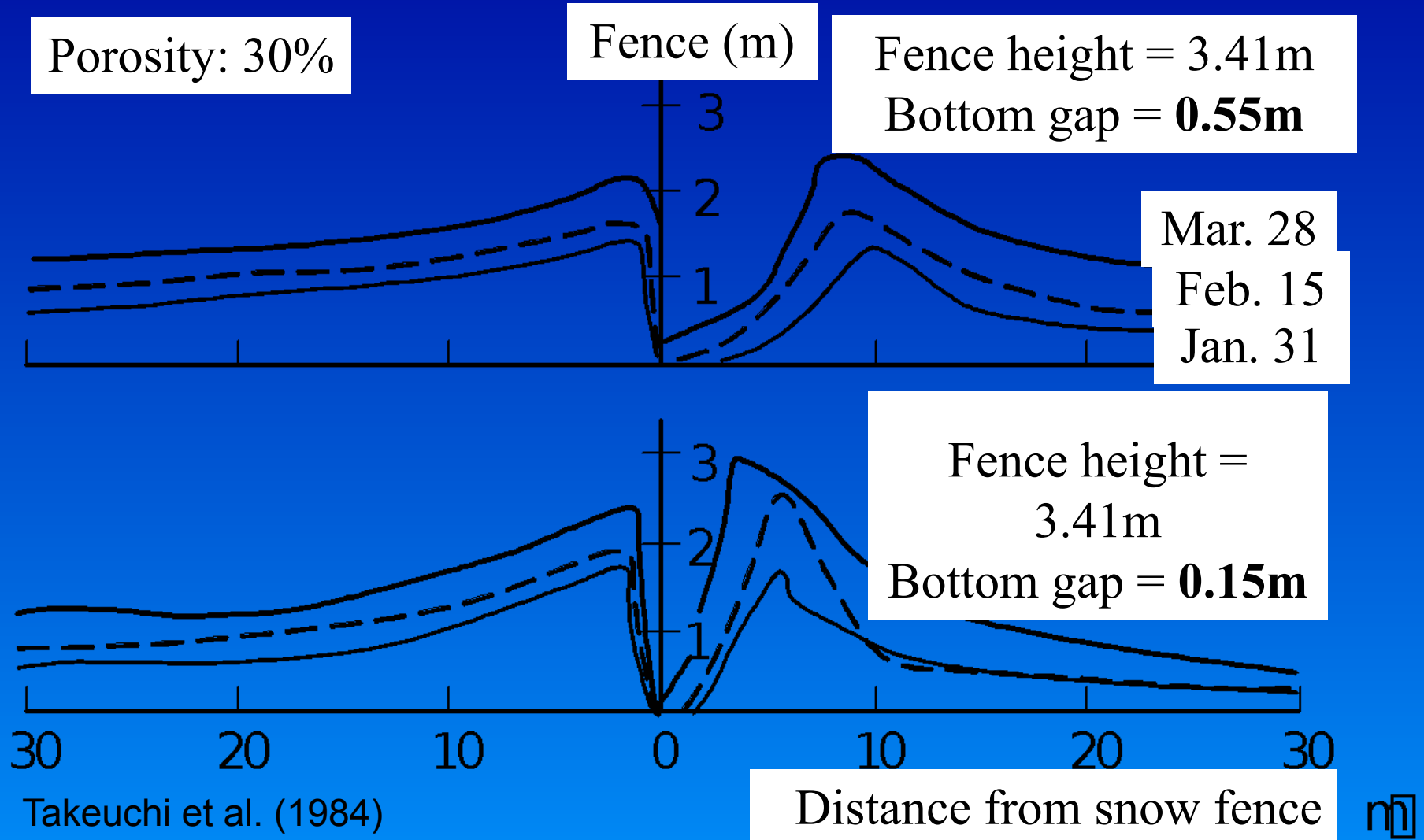
Porosity: the ratio of open area to total frontal area excluding the bottom gap



Snow fence porosity and snowdrifts

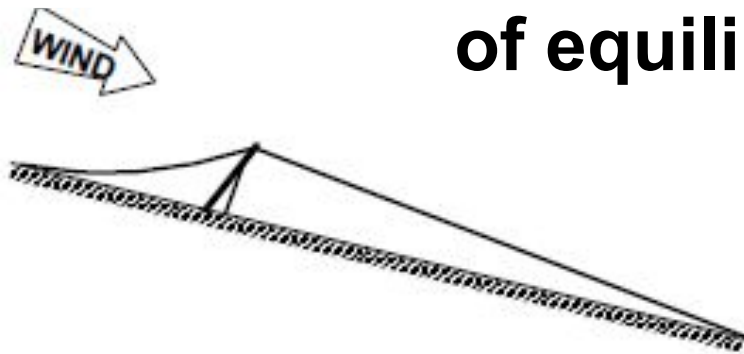


Bottom gap and snowdrift



Bottom gap: 0.5 - 0.6m, to prevent burial, to maintain effectiveness

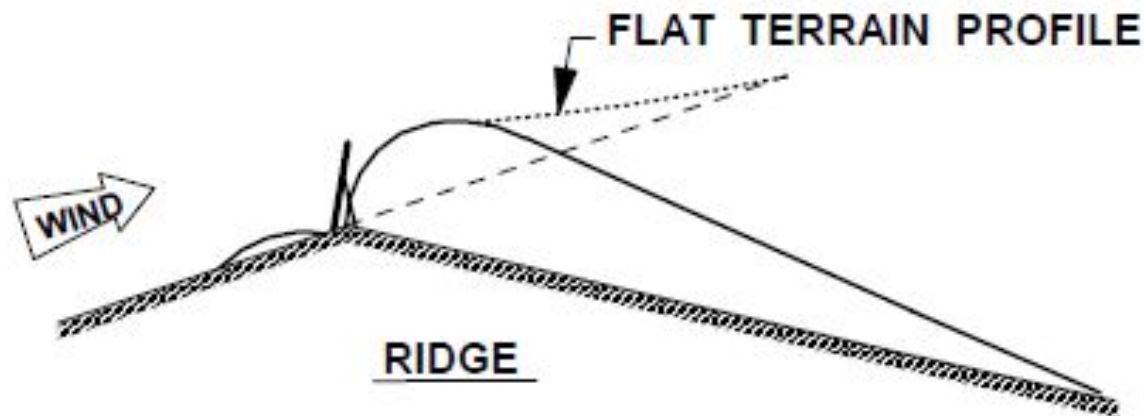
Effects of ground slope on the shape of equilibrium snowdrifts



DOWNWARD - SLOPING TERRAIN



UPWARD - SLOPING TERRAIN



FLAT TERRAIN

I-80: Site of 5 fences



Copyright © 2001 Tabler & Associates

Before snow fence installation (1971)



I-80 Wyoming, U.S.A.

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Associates*

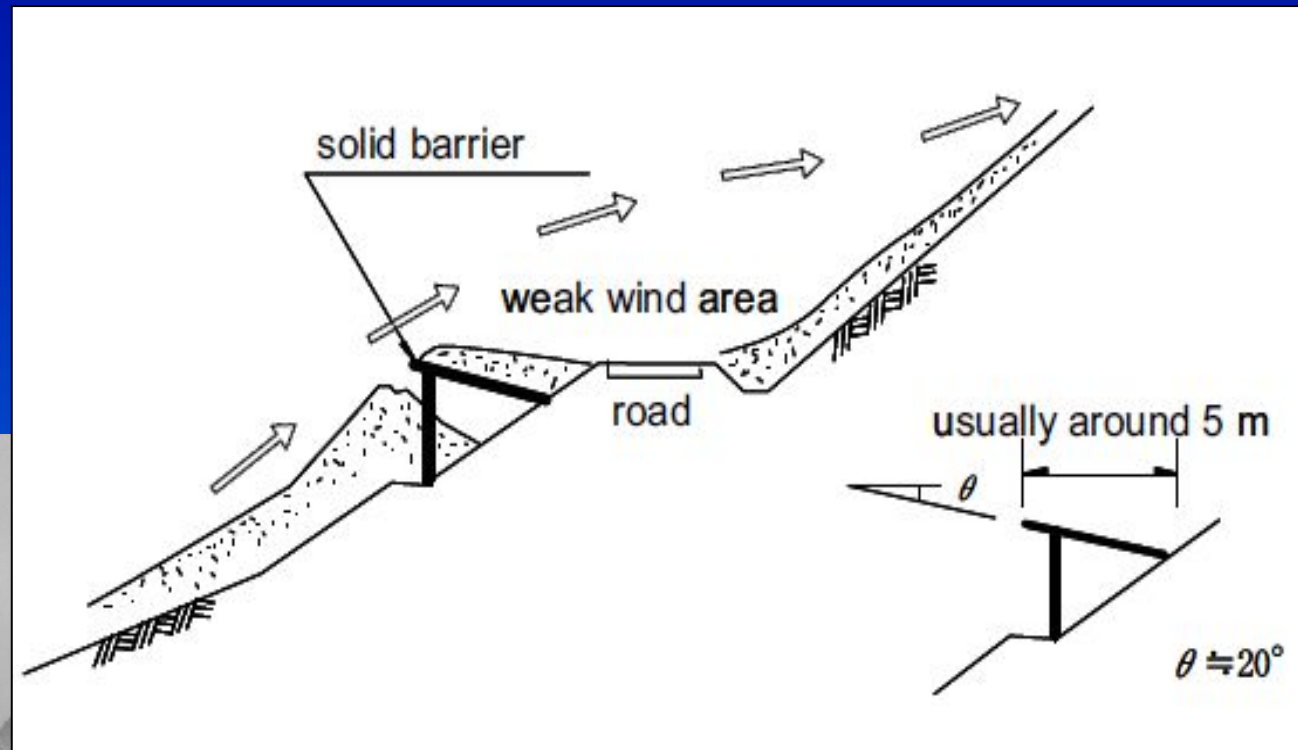
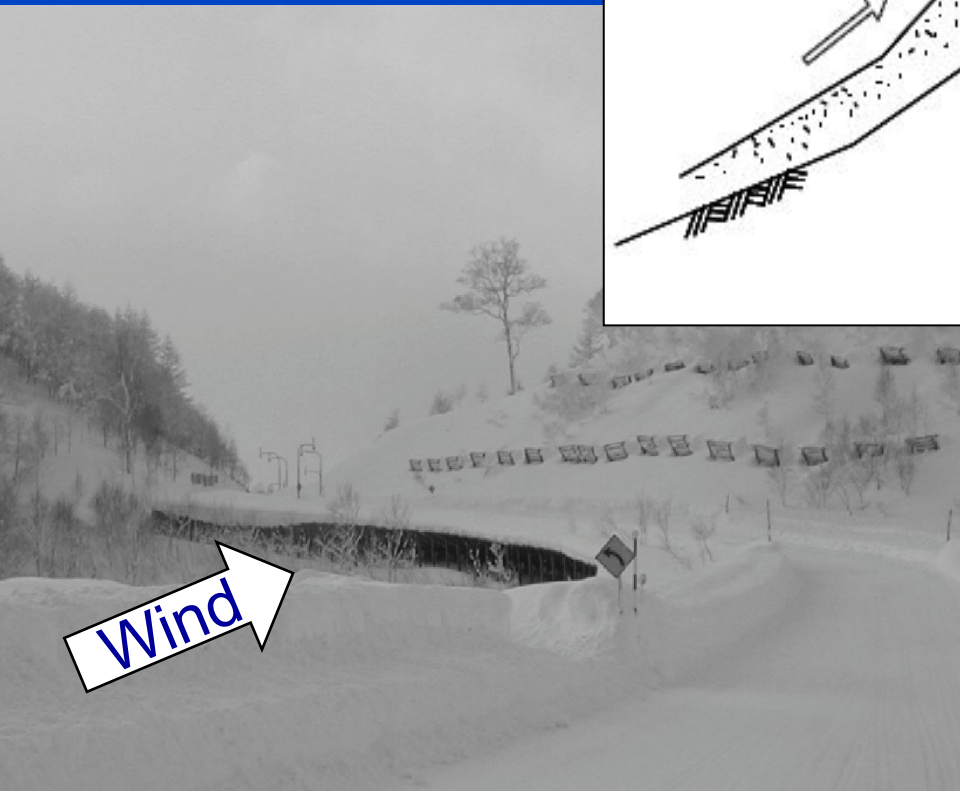


After snow fence installation (1972 – present)

I-80 Wyoming, U.S.A.

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Solid barrier



Civil Engineering Research
Institute (2011)

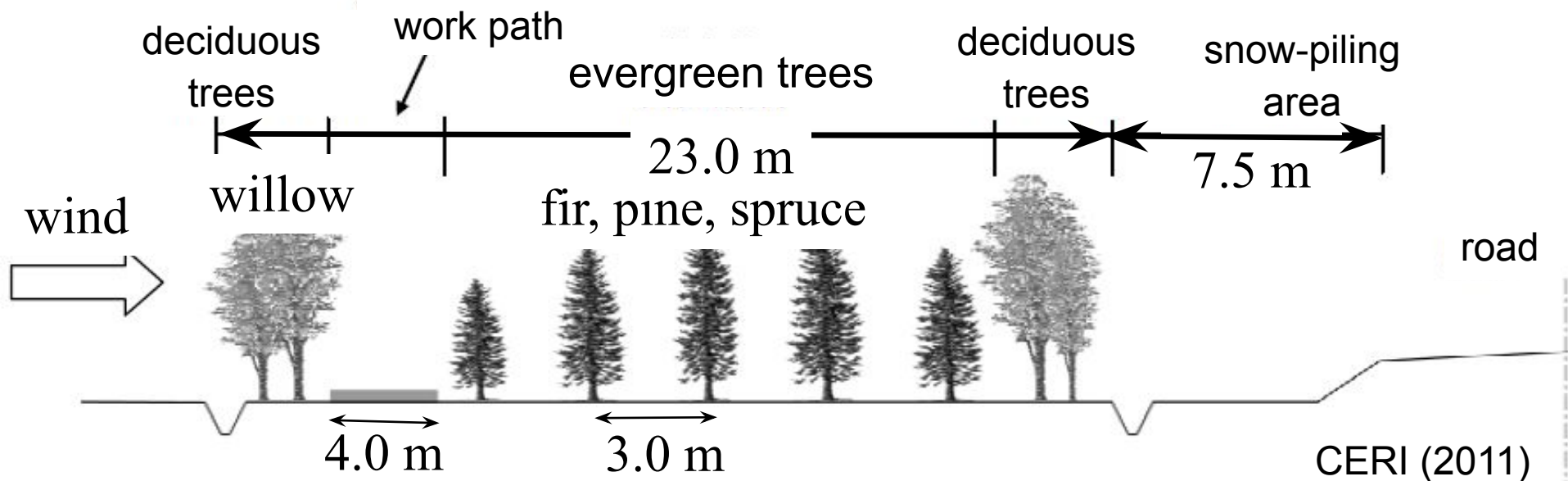
2. Snowbreak woods



<http://international.fhwa.dot.gov/Pdfs/SnowbreakForest.pdf>

Basic structure of snowbreak woods in Japan

The Highway Snowstorm Countermeasure Manual (2011 edition), Japan



CERI (2011)

Mean annual snow transport	Width of woods
20 - 30m ³ /m (7.0-10.5t/m)	11.0m
30 - 50m ³ /m (10.5-17.5 t/m)	23.0m
50m ³ /m or more (17.5t/m -)	32.0m

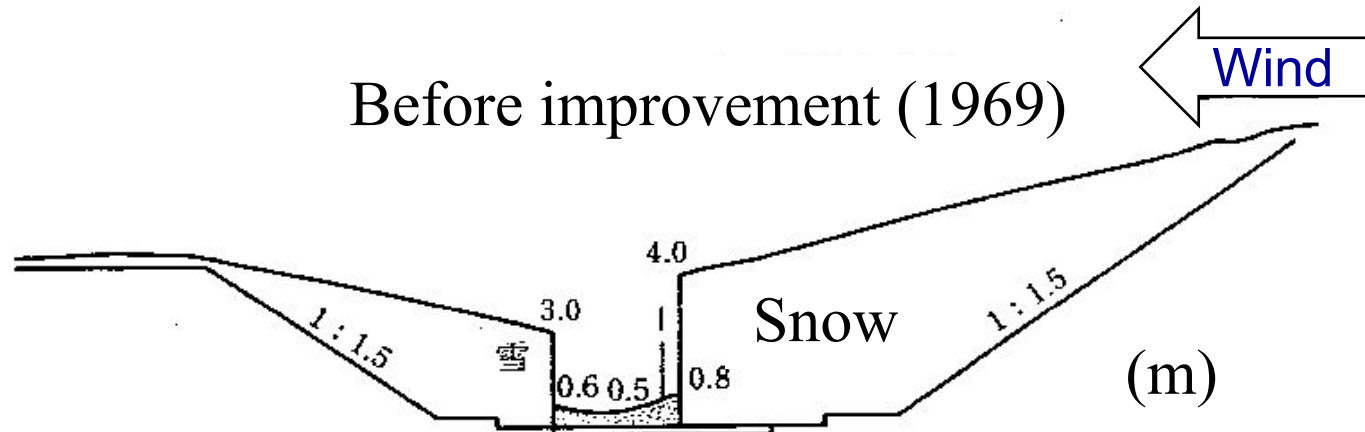
3. Drift-free cut

Provides a gradient of 1 : 3 on the windward slope

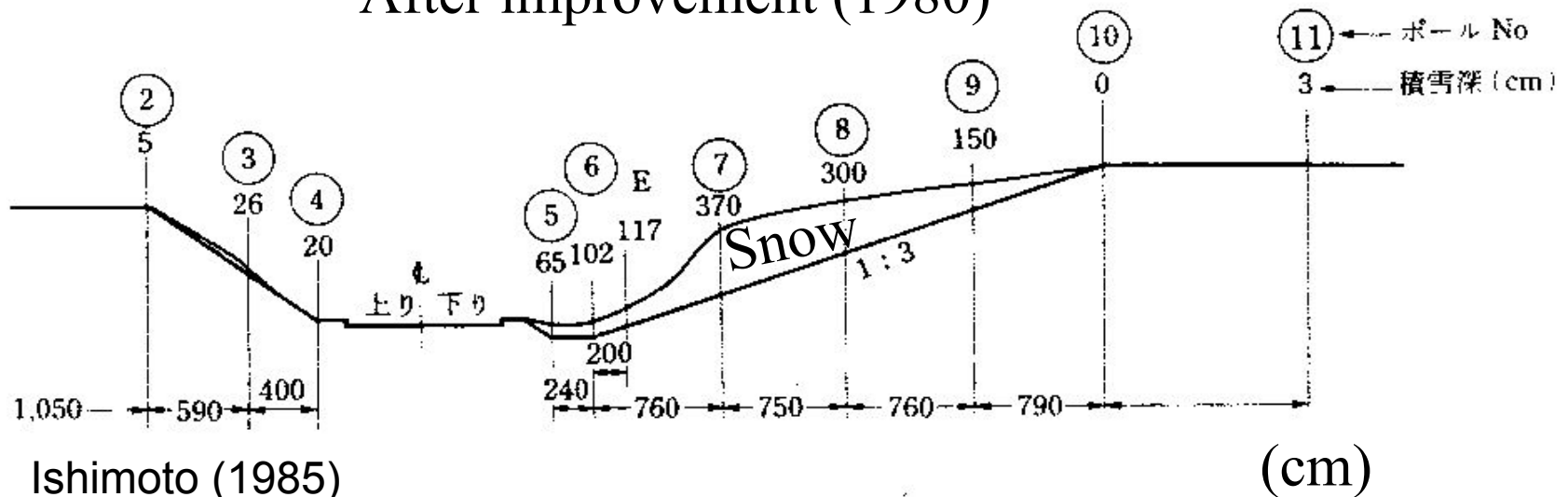


Drift-free cut

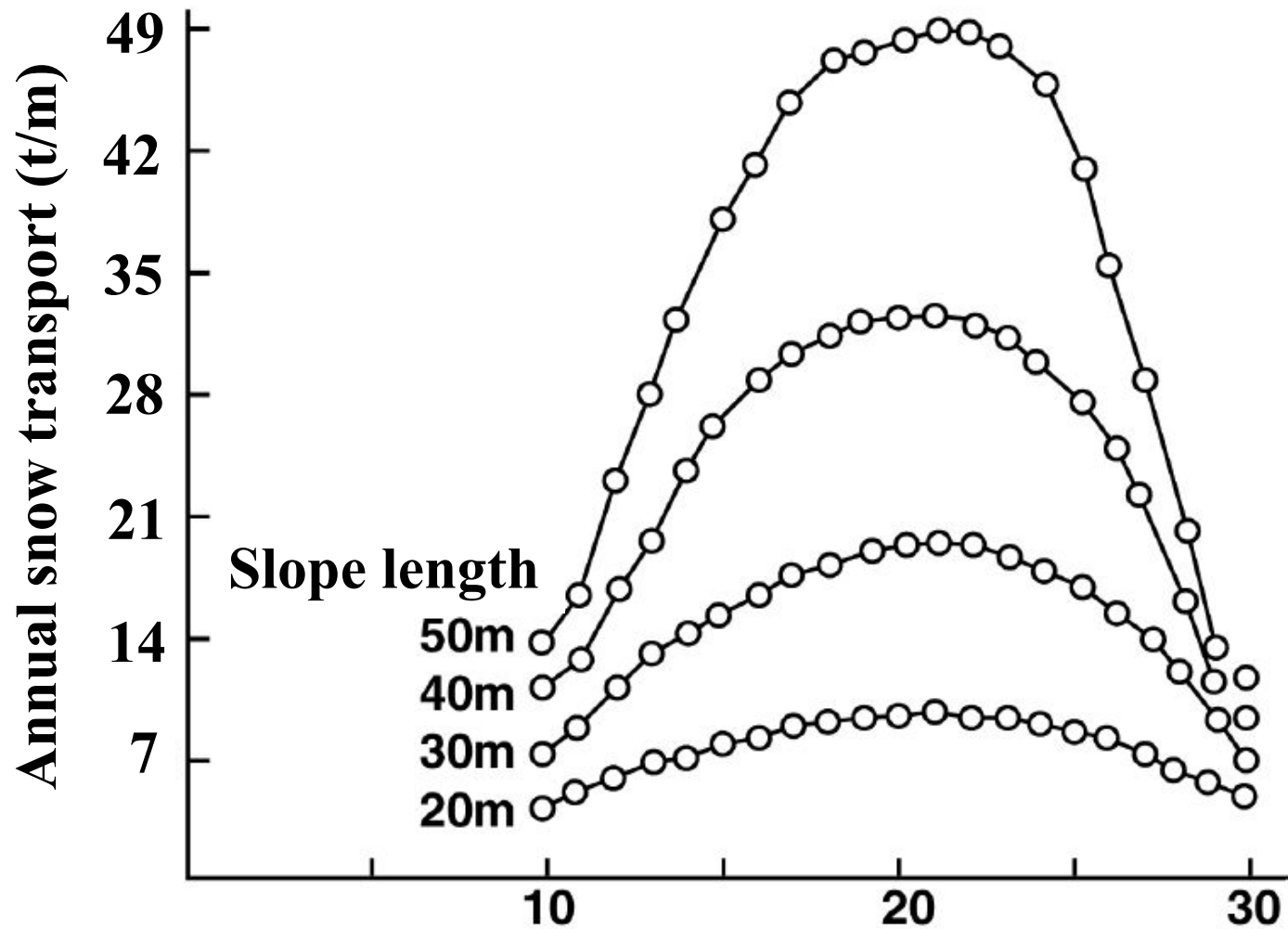
Before improvement (1969)



After improvement (1980)



Slope length of a drift-free cut

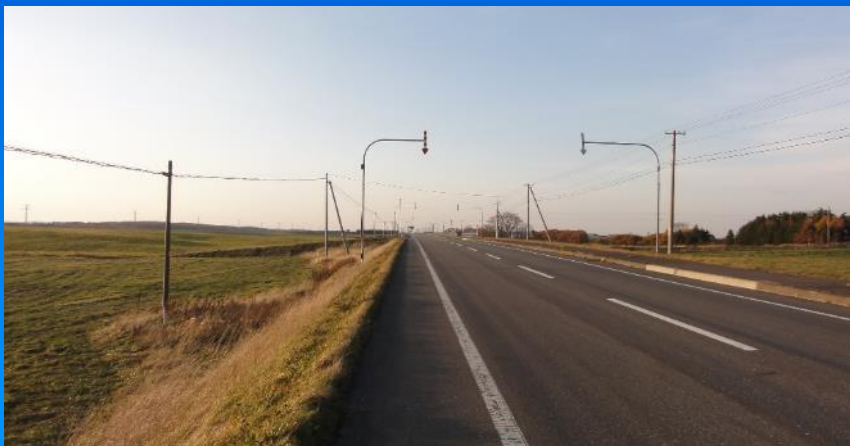


Ishimoto (1985)

Slope angle (degrees)

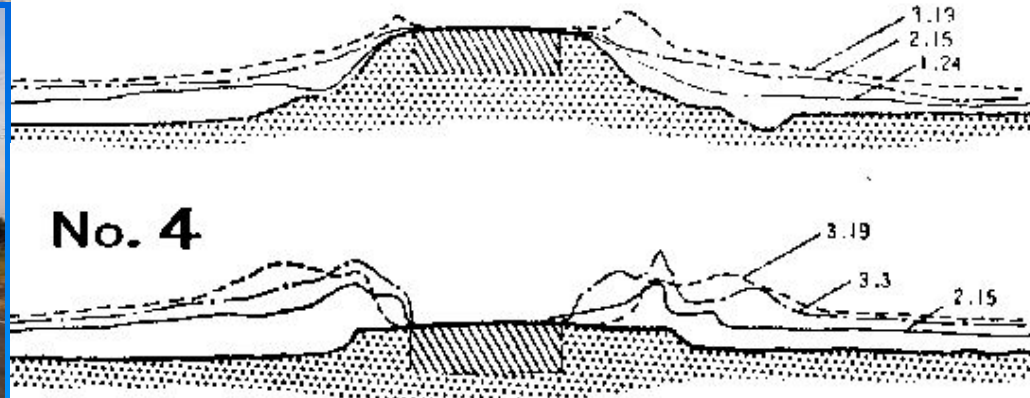
4. Drift-control fill

The fill height is 1.3 times the average maximum snow depth.

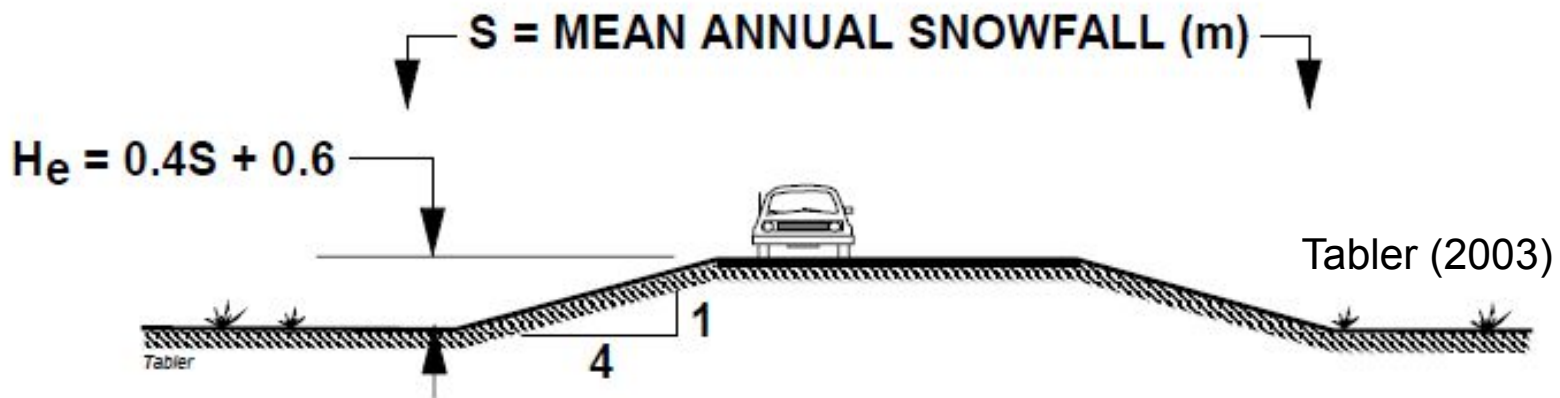


No. 1

Takeuchi(1973)



4. Drift-control fill (with a gentle slope)



References

- ***Controlling Blowing and Drifting Snow with Snow Fences and Road Design***; R. D. Tabler 2003.
<https://trid.trb.org/view/1481974>
- ***The Highway Snowstorm Countermeasure Manual (2011 Revised Edition -Abridged Edition-)*** ; Civil Engineering Research Institute for Cold Region(CERI), PWRI.
http://www2.ceri.go.jp/fubuki_manual/index_e.htm

Thank you for your attention!

Дякую за увагу!