

# 防雪柵の端部・開口部対策に関する研究

## Study on Measures for the End and Apertures of Snow Fences

積雪寒冷地の北海道では、吹雪による通行止めは国道の通行止め要因の4割を占めており、防雪柵など吹雪対策の整備が進められています。しかし、防雪柵の整備区間であっても柵端部や開口部における局所的な視程障害により追突事故等が発生しています。この対策として防雪柵のうち吹き止め柵では、防雪柵の設置方向を変えた副防雪柵や空隙率を大きくした防雪板の設置などが行われています。

寒地土木研究所では、局所的に視程が極端に低下する視程急変メカニズムを解明し、視程急変箇所における障害の程度や気象などの条件に応じた対策方法を示すことで、防雪柵の端部・開口部における吹雪災害の被害軽減に寄与することを目指しています。

In Hokkaido, which is a cold, snowy region, blowing snow is responsible for 40% of national highway closures. Measures against blowing snow, such as the construction of snow fences, have been implemented. However, even on road sections where snow fences have been installed, accidents such as rear end collisions resulting from localized poor visibility have occurred at the ends and open parts of the fences. To improve visibility at the road sections, where the ends or open parts of collector snow fences are located, supplementary snow fences have been installed that are oriented at angles different from those of the main fences or that have snowbreak slats with a high void ratio.

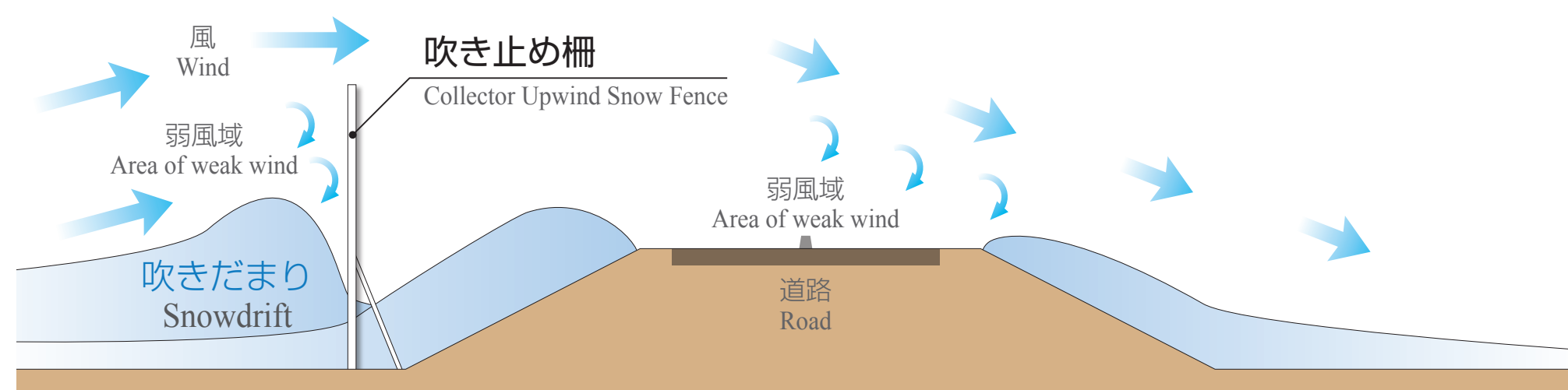
The Civil Engineering Research Institute for Cold Region aims at contributing to the mitigation of damage from blowing snow disasters that occur at the ends and open parts of snow fences. To realize this aim, the institute has been working on elucidating the mechanism of sudden, severe, localized decreases in visibility by proposing countermeasures that suit the conditions at such locations, including the degree of visibility reduction and the weather conditions.

## 防雪柵の特徴

### Characteristics of collector snow fences

吹き止め柵は風上側に飛雪を堆積させるため、風下側の吹きだまり雪丘は小さくなります。道路敷地内に設置できることから道路上の防風効果も期待でき、吹きだまり防止と視程障害緩和の両方に対応します。また、広幅員道路(多車線道路)にも対応しています。

The collector snow fence collects drifting snow on its windward side, thereby keeping the snowdrifts that form on its leeward side relatively small. Such snow fences can be installed in the right-of-way of the road. The effect of protecting the road section from blowing winds can be expected. Collector snow fences are effective in controlling snowdrifts and mitigating visibility reductions. Collector snow fences are also useful for wide roads (multi-lane roads).



▲吹き止め柵の防雪機構  
Snow control mechanism of the collector snow fence

## 防雪柵端部・開口部の問題

### Problems from the ends and open parts of snow fences

防雪柵端部・開口部においては、風の収束に伴う飛雪によって局所的な視程障害(エンドエフェクト)が発生することがあります。局所的に視程が極端に低下する場合には走行が困難になることがあり、多重衝突事故を誘発することがあります。

At the ends and open parts of snow fences, localized visibility reductions may occur (the "end effect") from drifting snow that is deposited at such locations by converging winds. The localized extremely poor visibility may hinder driving at such locations and may contribute to multiple-vehicle collisions.



▲防雪柵端部のふきだまり  
Snowdrift at the end of a fence



▲防雪柵端部の視程障害  
Visibility reduction at the end of a fence

## 視程障害移動観測車による移動気象観測

### Mobile meteorological observation by a visibility observation vehicle



▲視程障害移動観測車  
Visibility Observation Vehicle

視程急変メカニズムを明らかにするため、視程障害移動観測車を用いて、防雪柵の端部や開口部を含めた防雪柵設置区間の視程急変画像の取得と気象状況等の観測を行っています。

右記の観測事例は、札幌近郊の国道231号での観測事例です。

防雪柵開口部終点側では風速13m/s前後の西風が吹き込んでいます。防雪柵に対して斜風であるため、開口部より風下側まで路面上の雪が道路全幅で吹き払われており、舗装面が露出しています。

一方、防雪柵開口部起点側では風速15m/s前後の北西風が吹き込んでいます。防雪柵に対してほぼ直角であるため、道路上の雪は開口部とほぼ同じ位置で吹き払われています。

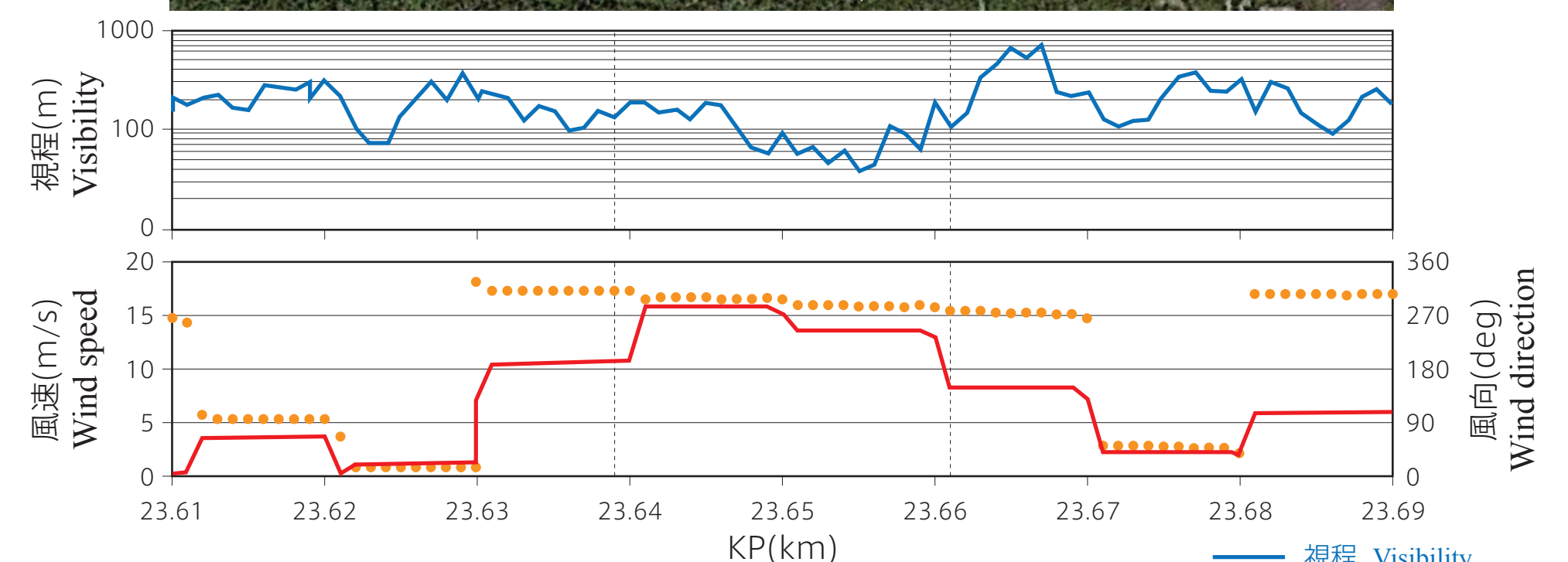
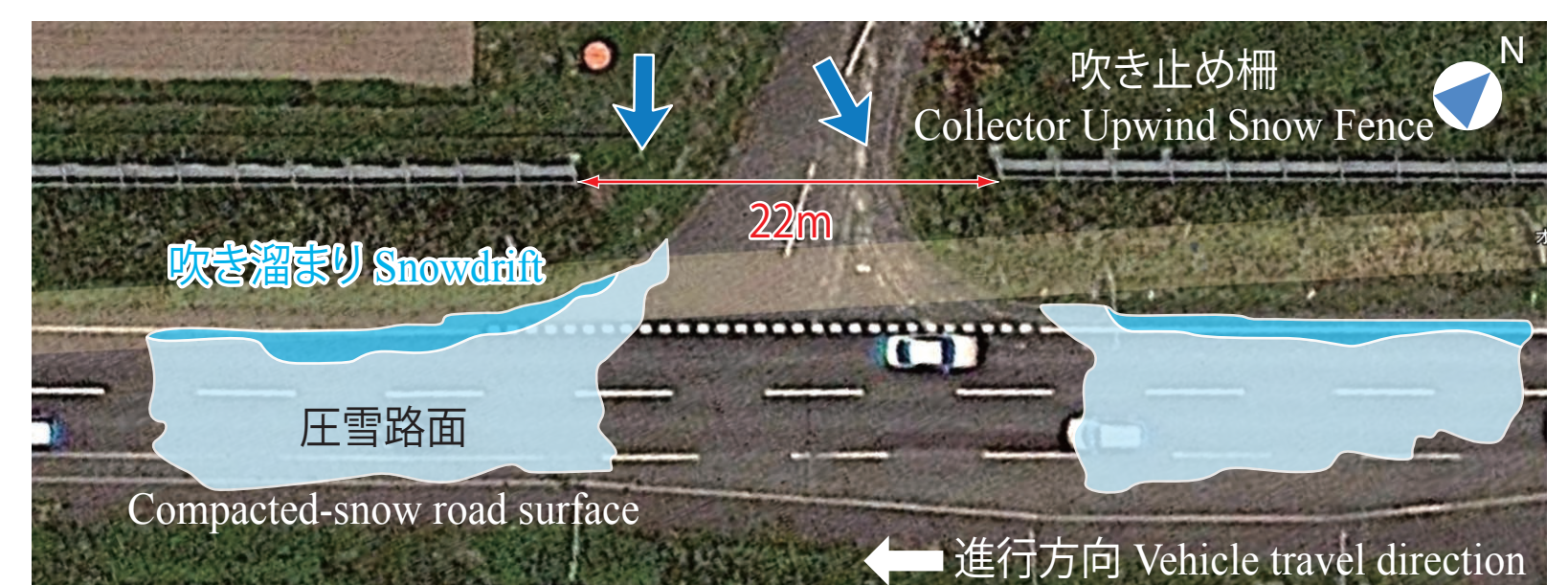
また、直交風と比べて斜風の場合には、防雪柵開口部より風下側の視程が悪化しやすい傾向が見られています。

To clarify the mechanism of sudden visibility change, surveys using a visibility observation vehicle have been done on road sections that include the ends and open parts of snow fences. In the surveys, images of sudden visibility changes have been obtained and the weather conditions have been observed. The right-hand example of observation was done along National Highway 231 in the suburbs of Sapporo. A westerly of about 13m/s is blowing in at the end of the snow fence (the end of the open part). The wind is oblique to the fence, and the road surface is totally exposed on the road section at the open part of the fence and further leeward.

A northwesterly of about 15m/s is blowing in at the start of the snow fence (the start of the open part).

The wind is almost perpendicular to the fence; therefore, the area where the snow has been blown off the road ends at the end of the open part of the fence.

For an obliquely incident wind, the visibility reduction tends to be greater leeward of the open part than it would be for a perpendicularly incident wind.



▲移動気象観測事例(上:平面図、青矢印は風向、下:気象観測結果)  
Example of mobile meteorological observation (Top (plan view): The blue arrow shows the wind direction. Bottom: The result of weather observation.)



▲観測時の道路状況(左:開口部手前、中:開口部、右:開口部通過後)  
Road surface condition at the time of observation  
(Left: before the open part; Middle: at the open part; Right: after the open part)