

吹き払い柵の防雪機能に関する研究

Study on the Snow Control Performance of Blower Snow Fences

北海道内の道路では吹雪による視程障害が多く発生しており、この対策として防雪柵の整備が行われてきました。吹き払い柵は2車線道路向けに開発された路側設置型の防雪柵で、基本的に用地取得が不要なため、視程障害への対策に多く用いられています。しかし、積雪や吹きだまりにより下部間隙が埋まった場合に防雪機能が大幅に低下することが指摘されていますが、その防雪機能については定量的に明らかとはなっていません。このため、寒地土木研究所では、吹き払い柵の防雪機能の定量化に向けて、実物大フィールド実験や風洞実験を行っています。

Snow fences have been developed and installed in Hokkaido, where blowing-snow-induced visibility hindrance often occurs on roads. A blower snow fence is a snow fence that was developed for installation along two-lane roads. It has frequently been employed to mitigate poor visibility, because installation is basically possible on the existing right-of-way without extra land acquisition. However, it has been pointed out that when the bottom gap at the base of the fence is buried by snowdrift or other snow cover, the snow control performance greatly decreases. Quantitative clarification of the fence's snow control performance has not been done. The Civil Engineering Research Institute for Cold Region has been conducting full-scale field experiments and wind tunnel experiments on blower snow fences to quantify its snow control performance.

吹き払い柵の特徴

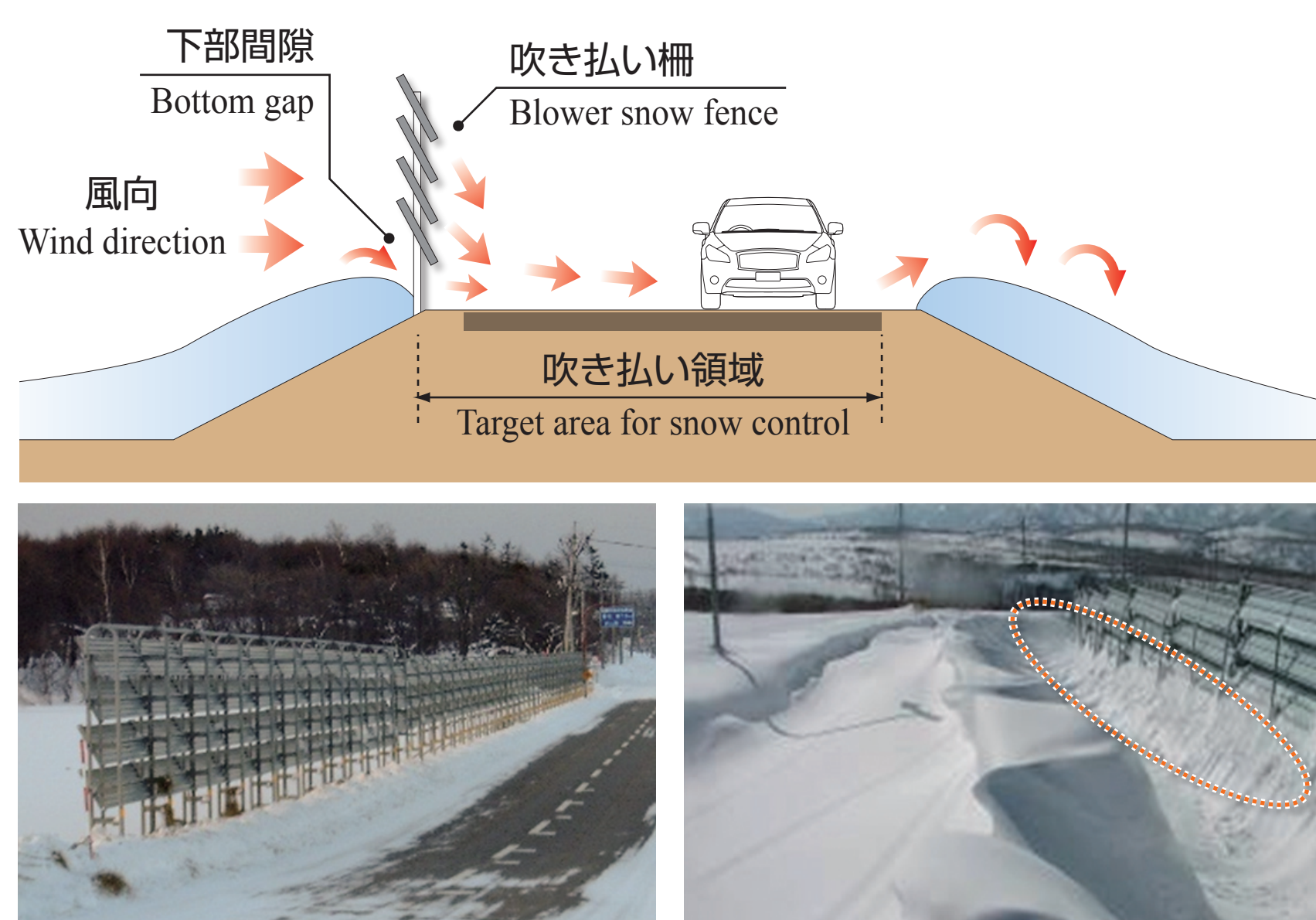
Characteristics of the blower snow fence

吹き払い柵は、道路敷地内に設置可能な防雪柵として開発された形式で、傾斜した複数の防雪版により風の流れを下向きに変え、高さ1m程度の隙間(下部間隙)から吹き出す強風により道路上の雪を吹き払います。

The blower snow fence was developed as a facility that can be installed in the right-of-way. Multiple tilted snowbreak slats divert the wind downward. The snow on the road is blown away by the strong wind that blows through the roughly 1-m clearance at the bottom of the fence.

吹き払い柵の防雪機能のイメージ

Diagram of how a blower snow fence controls snow



▲吹き払い柵
Blower snow fence

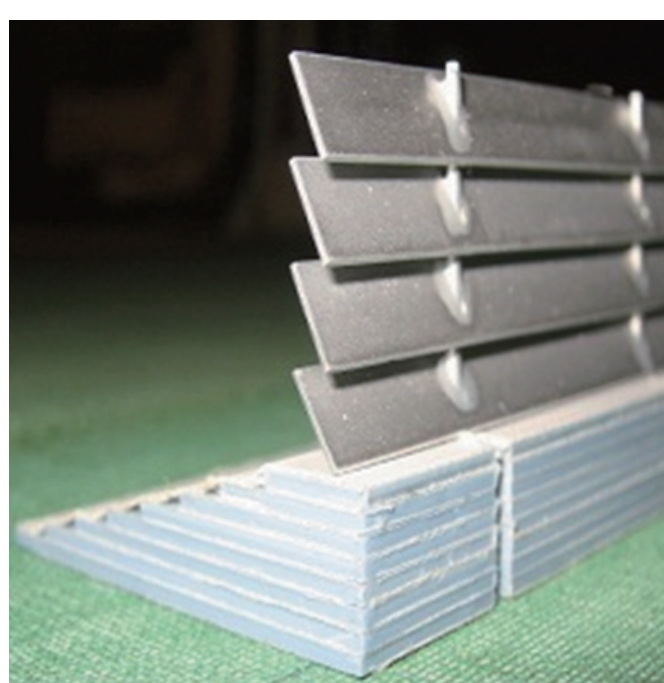
▲下部間隙閉塞時の吹きだまり
Snowdrift created when the bottom gap is blocked

風洞実験

Wind tunnel experiment

実物大フィールド実験の場合、現地の気象条件により観測する機会が限られます。より多様な条件での防雪機能を調べるため、風洞実験による調査を行っています。これまでの調査により、下部間隙の閉塞が50%までの場合、十分な防雪機能を確保できるものの、75%以上閉塞した場合には、風に逆流を生じ、防雪機能が低下することが判りました。

For full-scale field experiments, chances for observation are limited; they depend on the weather conditions of the location. Wind tunnel experiments have been conducted to investigate the snow control performance of these fences under more varied conditions than those possible in field experiments. The investigations revealed that it is possible to secure sufficient snow control performance when the bottom gap has a blockage of up to 50%; however, when the bottom gap blockage equals or exceeds 80%, the snow control performance of the fence decreases with adverse winds.



▲下部間隙閉塞率を変化させた風洞実験(閉塞率100%の例)
Wind tunnel experiment with various rates of bottom gap blockage (blockage rate of 100%)

実物大フィールド実験

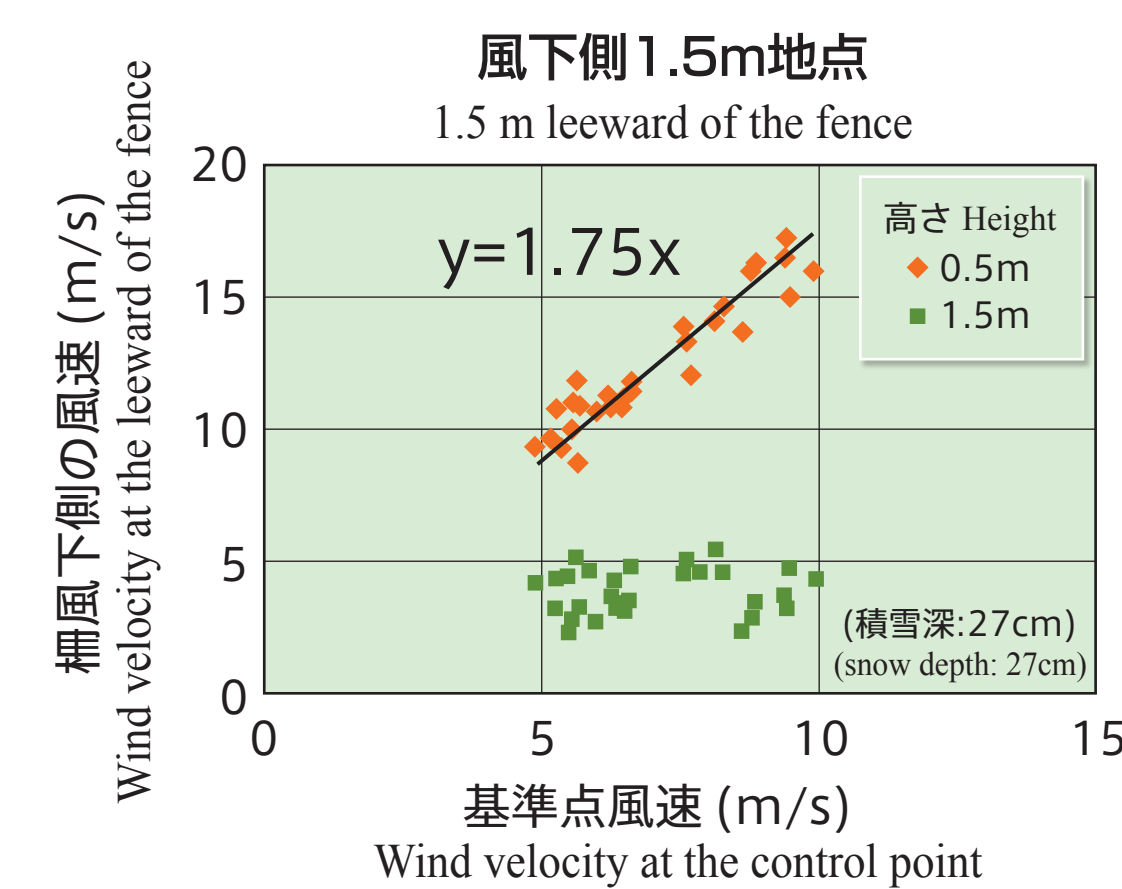
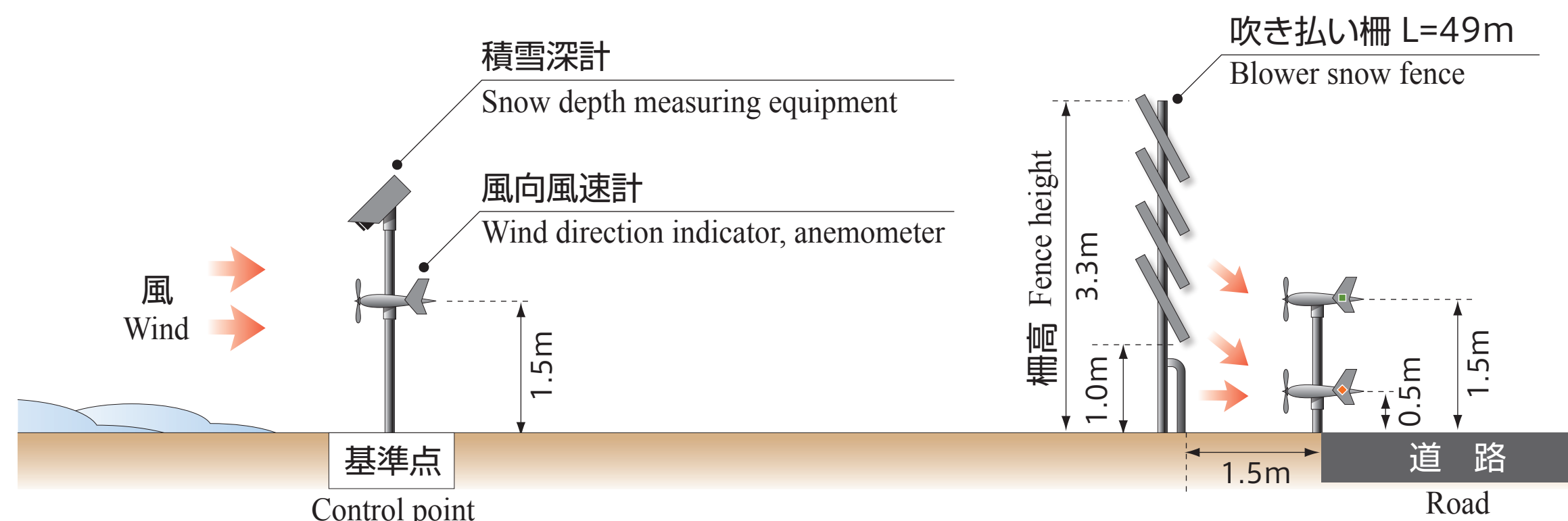
Full-scale field experiment

石狩吹雪実験場内に設置した実物の吹き払い柵を用い、積雪の深さが防雪機能に与える影響を調査しています。これまでの調査により、積雪が少ない場合には下部間隙から吹き出す強風(現地の風速の約1.8倍程度)により吹き払い効果を発揮しますが、積雪が深くなるに従い、防雪機能が低下することが判りました。従って、積雪の多い地域への適用には注意が必要です。

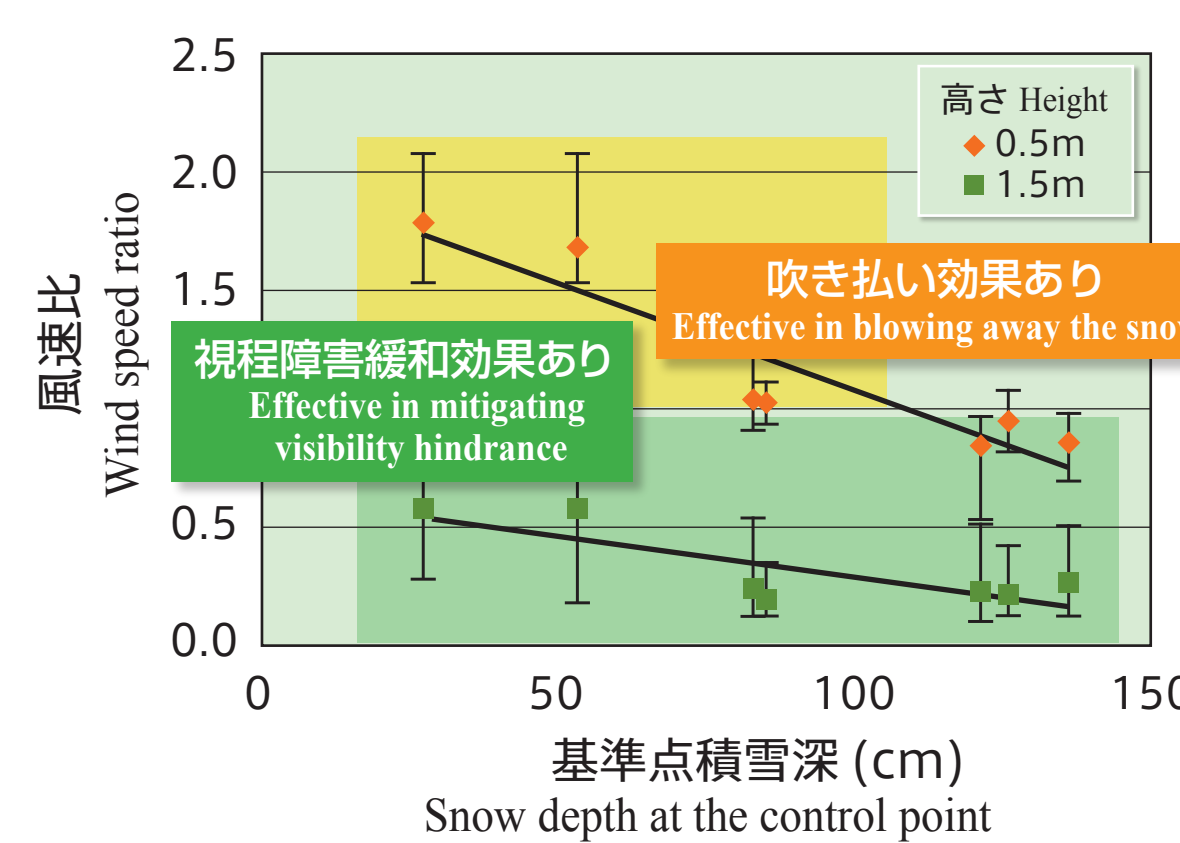
The influence of snow depth on snow control performance has been investigated at the Ishikari Blowing Snow Test Field by using full-scale blower snow fences. Surveys and other investigations revealed that the blower snow fence is effective in blowing the snow off the road when the snow depth is low and the wind that blows through the bottom gap of the fence is fast (i.e., about 1.8 times faster than wind measured at open areas of the subject location); however, the snow control performance decreases with increases in snow depth. Care should be taken when considering the application of blower snow fences in areas with deep snow cover.



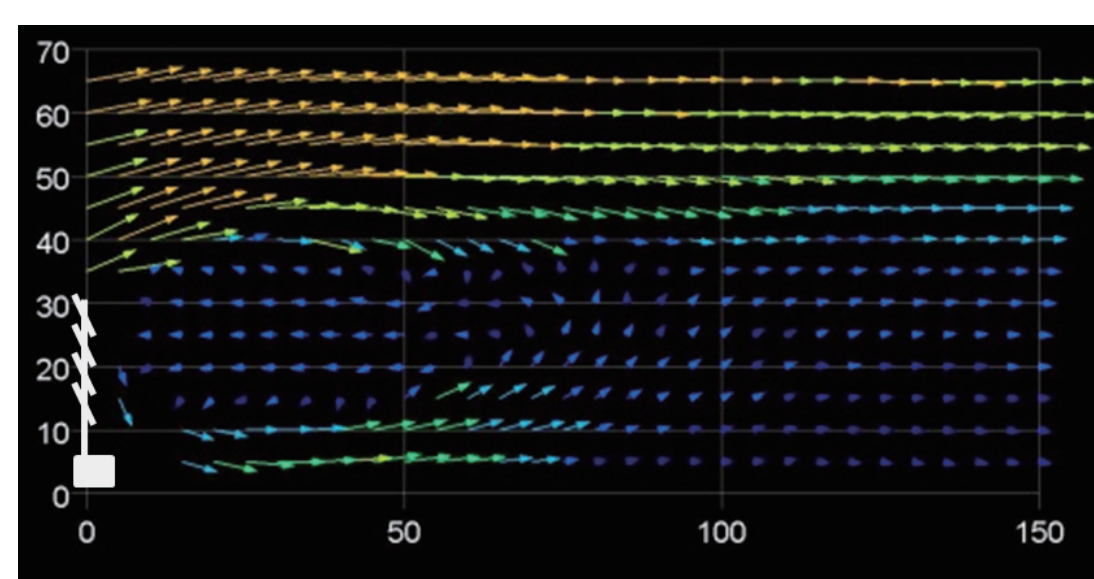
▲実物大フィールド実験
Full-scale field experiment



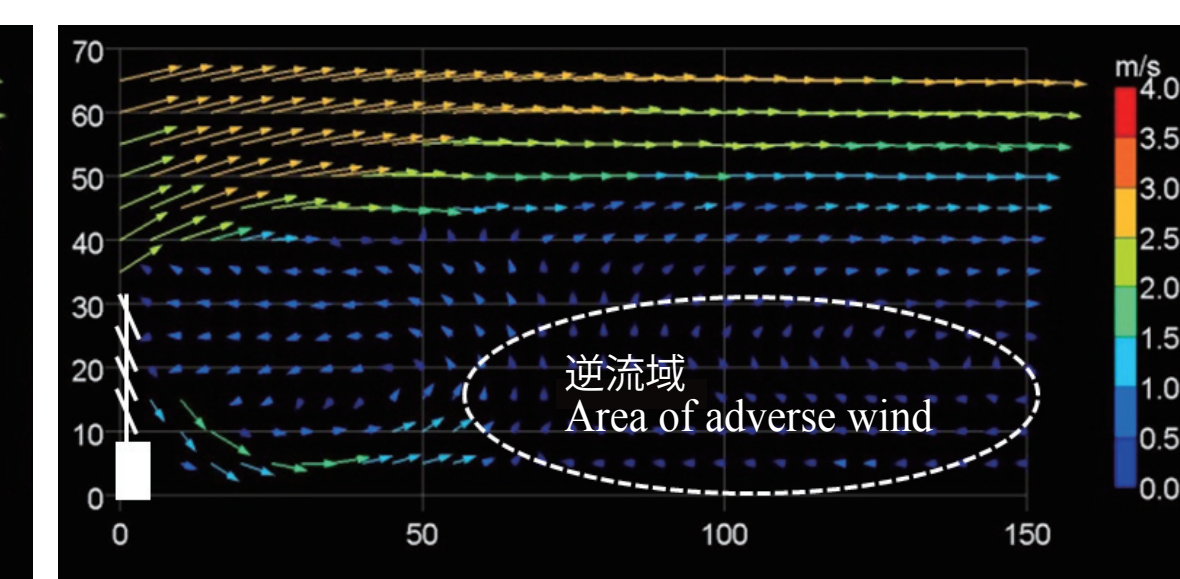
▲現地の風速と柵風下側の風速の比較
Comparison of wind velocity at an open space vs. that immediately leeward of the fence



▲積雪深と柵風下側の風速比の関係
Relationship between the snow depth and the wind speed ratio immediately leeward of the fence



▲柵風下側の気流分布
Distribution of airflow leeward of the fence



▲柵風下側の気流分布
Distribution of airflow leeward of the fence