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SYNTHETIC VS WOODEN SNOW FENCE

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Final Report
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Prepared in cooperation with the
U.S Department of Transportation
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16. Abstract

To investigate the effectiveness of synthetic snow fences against the traditional wooden snow fence, a site was selected on S. H. 14's right-of-way at milepost 18.1. The synthetic snow fences were easier to install than the wooden fences because they were lighter (approximately one-fourth of the weight of the wooden fences), and because they stretched easier. They required substantially less room to haul. The snow trapping efficiency of the synthetic snow fences was comparable to that of wooden fences.

Implementation

The result of this study has demonstrated the use of synthetic snow fences as an alternative to the traditional wooden snow fences. However, their installation close to a ranch with grazing bulls is not recommended. Bulls have tendencies to either lean against them or chew on them.

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I. Literature Review And Problem Discussion

Blowing and drifting snow is a major problem associated with the land transportation during the winter months in Colorado. Drifting snow not only creates hazardous driving conditions for the motorist but its removal, which normally involve plowing, and sanding is a costly operation. Varieties of snow fences are used to control ice and snow and to provide safer roads for the travelling public during winter.

Many Colorado's highways are equipped with wooden snow fences. Their primary function is to prevent snow accumulation on the highways, to reduce snow removal costs, and to provide safer road for the motorist. However, many of these wooden fences lose their effectiveness within a few years, Maintaining them as they rot, sag, and topple incurs additional maintenance costs. A literature review on the subject of snow fences revealed that synthetic snow fences has been considered as an attractive alternative over the traditional wooden fences by many states and countries. Wyoming and Alaska are the pioneers in using variety of Synthetic snow fences in America.

Synthetic snow fences are made of high-density polyethylene with a laminar setting which possesses a very high tensile strength (8000 pounds per four foot roll width). Their apertures are designed to decelerate the wind as it carries snow particles through the fence and drops them onto drifts (1). they have 1/4th of the weight of wooden fences (approximately 40 pounds per 100 linear foot), and require substantially less room to be stored or hauled. They will not rust or corrode, and they are ultraviolet and heat resistant (2). Synthetic snow fences has no jagged edges or splinters and can be safely installed by one person (1).

II. <u>Objective</u>

A) The primary objective of this study was to compare and to demonstrate the economic and functional practicability of several types of synthetic snow fences against the traditional wooden snow fences.

b) A second objective was to demonstrate the procedures for installing the synthetic snow fences to maintenance personnel.

SNOW FENCES
SITE LOCATION

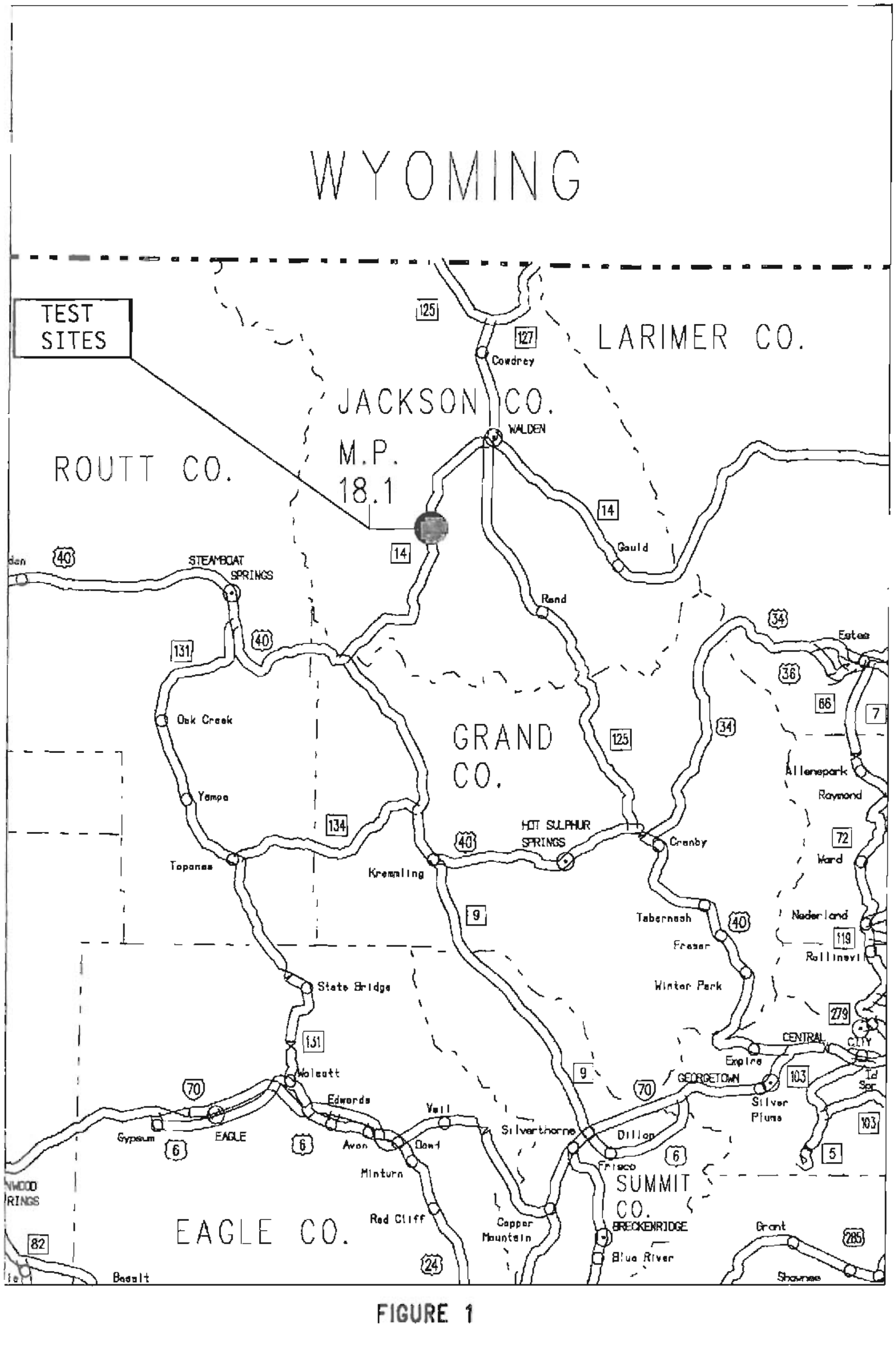


FIGURE 1

III. **Site Selection**

A site was selected for this study on S.H 14's right-of-way north of Muddy Pass at mile post 18.1 (Figure 1). S.H 14 is a secondary facility, which lies on a gently rolling terrain with an average elevation of 7500 feet. The average annual snow fall is approximately ten feet at this location.

There are many areas prone to strong gusty wind along this stretch of highway, which has required constant plowing and sanding during the winter months. The wind can gust up to 100 miles per hour creating a hazardous driving condition for the motorist during a snow storm (photograph 1 and 2). On occasions the maintenance crew close the highway at this location due to poor visibility caused by ground blizzards.

Wooden snow fences have been used effectively to control the formation of snow drifts at this location. However, they lose their effectiveness after a few years, and require maintenance or replacement (Photograph 3 and 4).

IV. **Installation**

The research project " Synthetic Snow Fences vs. Wooden Fence "

Photograph 1 & 2: Poor visibility caused by blowing snow even when it was not snowing.

Photograph 3 & 4: Wooden fences lose their effectiveness within a few years.

was initiated by installing three rolls of synthetic snow fences and two rolls of wooden snow fences. These snow fences were installed at a predetermined location in the S.H. 14 right of way at milepost 18.1. Among the snow fences installed were: Tenex, Tensar, Fence-It-Plus, and the traditional wooden fence. The following table shows the description of the individual fences.

Table 1

Product	Tenex	Tensar	Wooden	Fence-It-Plus
Material	High Density Polyethylene	High Density Polyethylene	Wood slat and wire	Not Known
Weight	40 pounds	39 pounds	85 pounds	17 pounds
Size	100' X 4' Roll	100' X 4' Roll	50 X 4' Roll	150' X 4' Roll
Roll Diameter	10 inches	10 inches	21 inches	12 inches
Prosity	50 %	50 %	60 %	50 %
Price	$124.50	$99.60	$40.00	$115.00

The installation of the fences began with the erection of wooden and steel "T" posts every seven feet. The heavy wooden posts were used at either end of the fences mainly for proper tensioning. The fences were stretched in two ways, using a hand stretcher and a truck. However, for most part a truck was used, because of the ease of its operation and proper stretching capability.

A bottom gap of six inches was established for all the fences. According to Dr. tabler "leaving a space between the bottom of a fence and the ground surface reduces the tendency for the fences to become buried in the drift". Burial reduces effective fence height, with a commensurate loss in effectiveness, and often cause structural damage to the fence because of the large forces exerted by snow settlement and creep (3). After stretching, the fences were sandwiched between a wooden slat and the flat side of a post. The wooden slat was used to prevent abrasion of the fence by the tie wire.

The synthetic snow fences were easier to install than the wooden fences because they were lighter (approximately one-forth of the weight of the wooden fences), and because they stretched easier. Fence-It-Plus, which was donated by the Weather Shade Corporation, was the lightest of the fences installed (weighing approximately 17 pounds per 150-foot roll). Photographs in Appendix A demonstrate the installation of these snow fences, and show their designs.

V. Performance Evaluation

To properly investigate the performance of the snow fences, it was decided to examine the size and the geometry of their drifts after a heavy snow fall during the winter, and their appearance and integrity during the summer. The investigation was initiated on January 5, 1989 after a heavy snow fall.

All four types of snow fences (Tenex, Tensar, Fence-It-plus, and the wooden fence) were visually inspected and photograph showing their appearances were taken. The height and length of the drifts behind individual fences were measured using a steel rod. The amount and the geometry of snowdrifts formed behind all the fences measured to be approximately the same, ranging from 3.5 to 4.5 feet in height and 90 feet in length (Figure 2). The bases of all the fences were nearly clear with the exception of the Fence-It-Plus, which was buried about one foot into the snow and was badly sagged.

The wooden fence showed a small amount of lateral sagging,

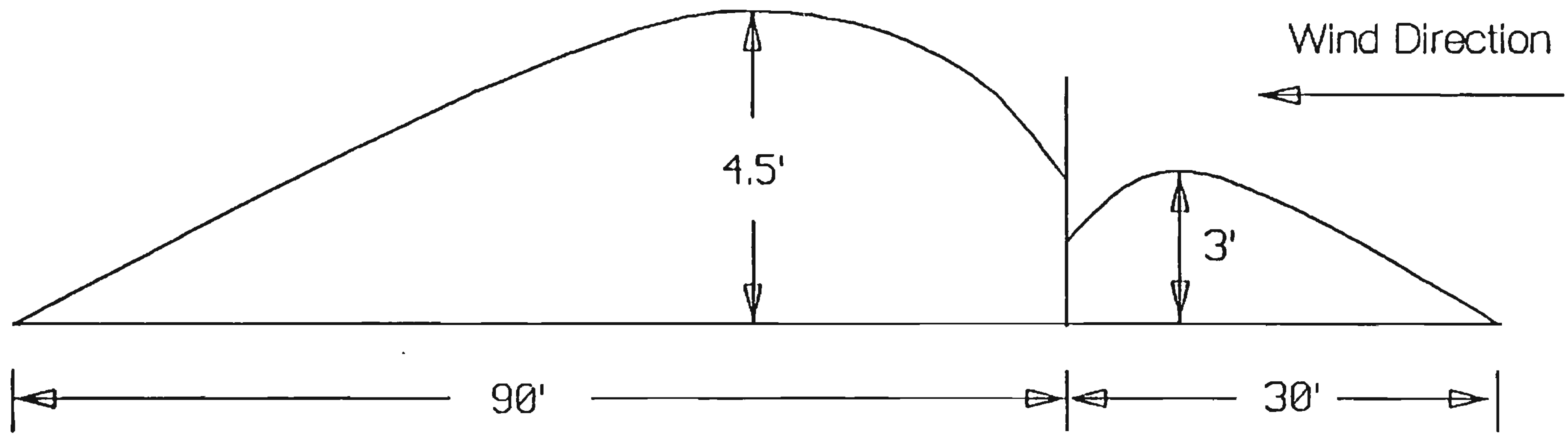
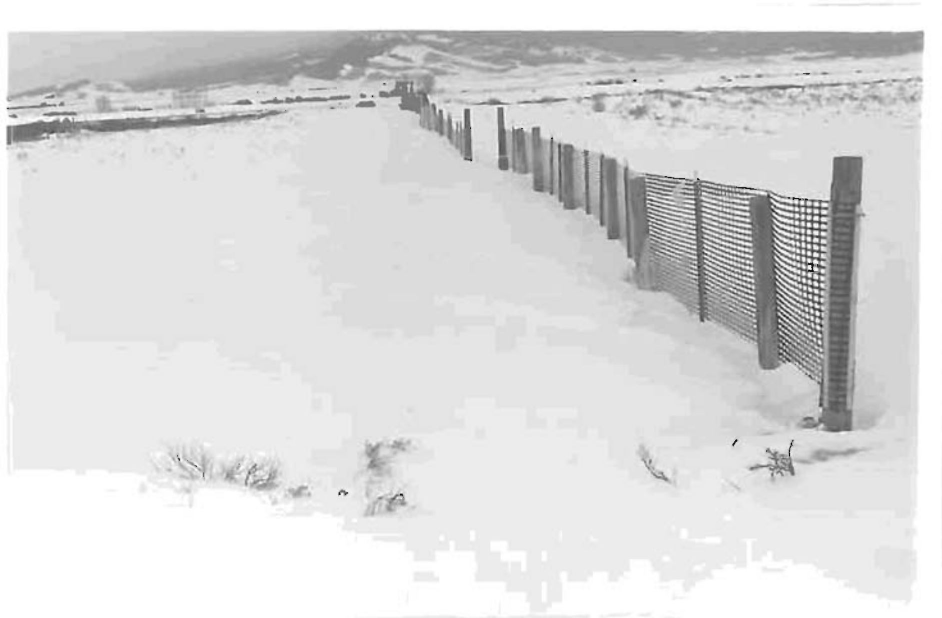


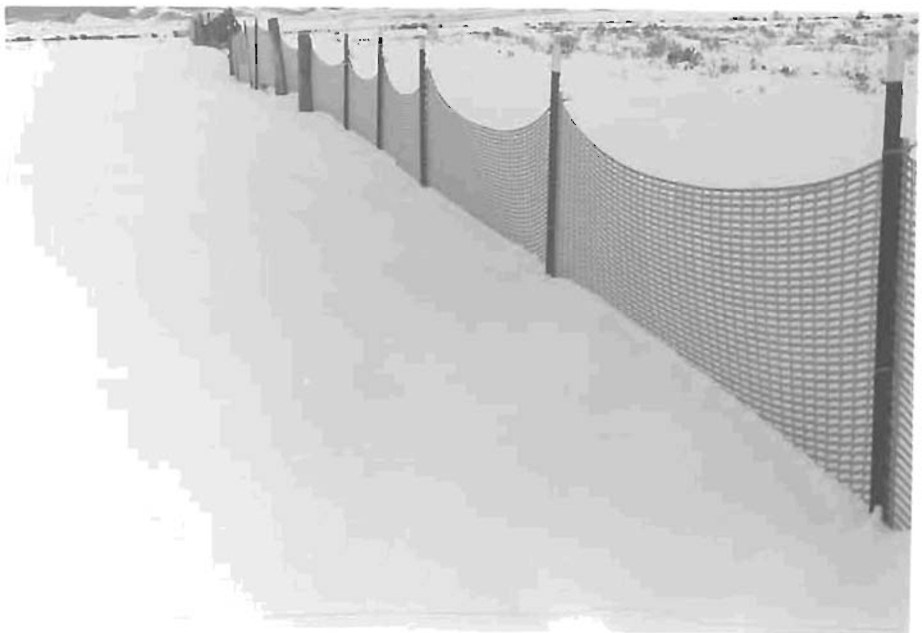
Figure 2: Drift Geometry For All The Fences.

Not to scale

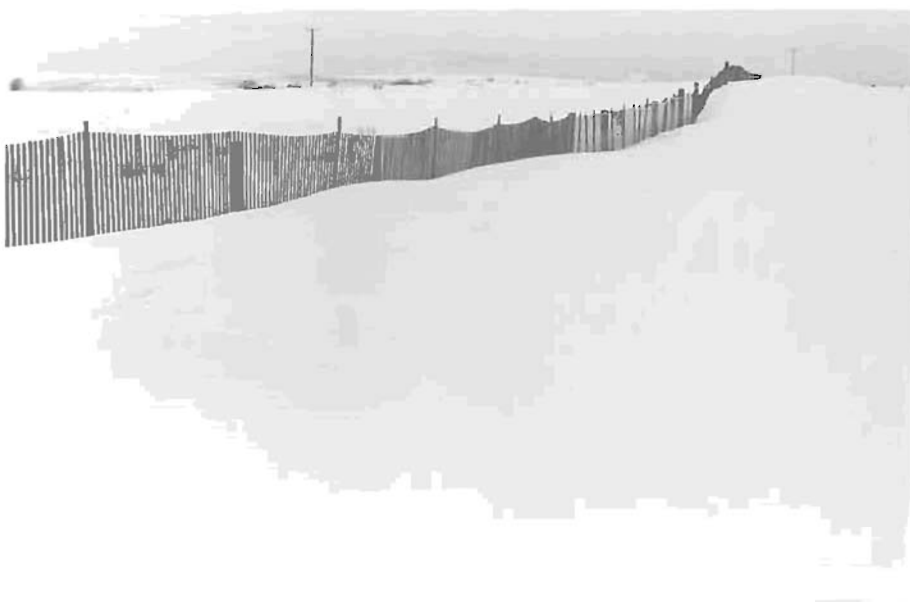


Photograph 5: The geometry of snow drifts formed behind all fences were approximately the same.

Photograph 6: The bases of all the fences were nearly clear with the exception of the Fence-It-Plus.



Photograph 7: Fence-It-Plus was buried one foot into the snow and was badly sagged.

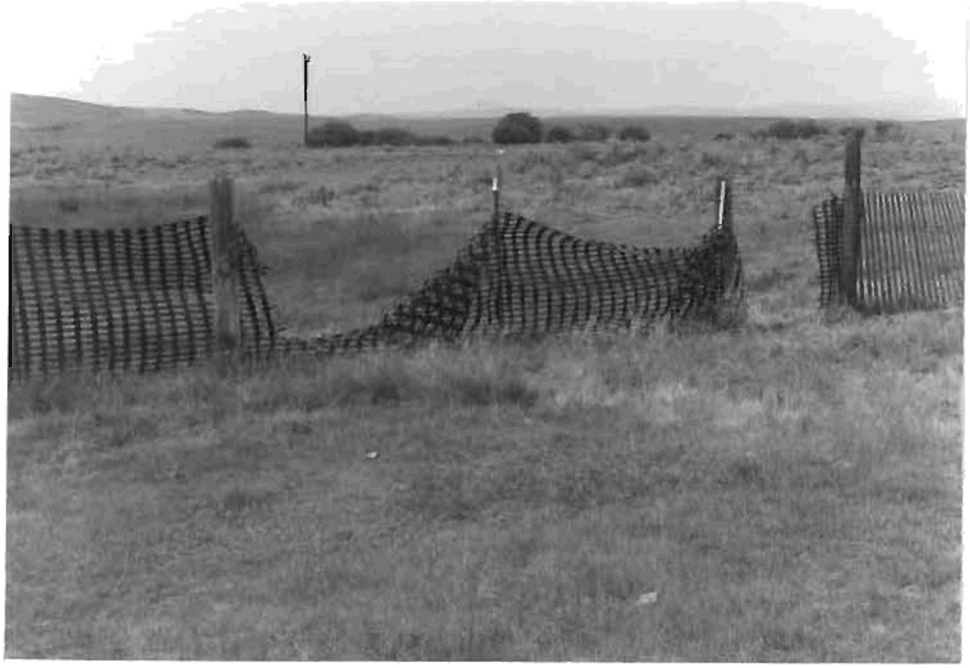


Photograph 8: The wooden fence showed a small amount of lateral sagging.

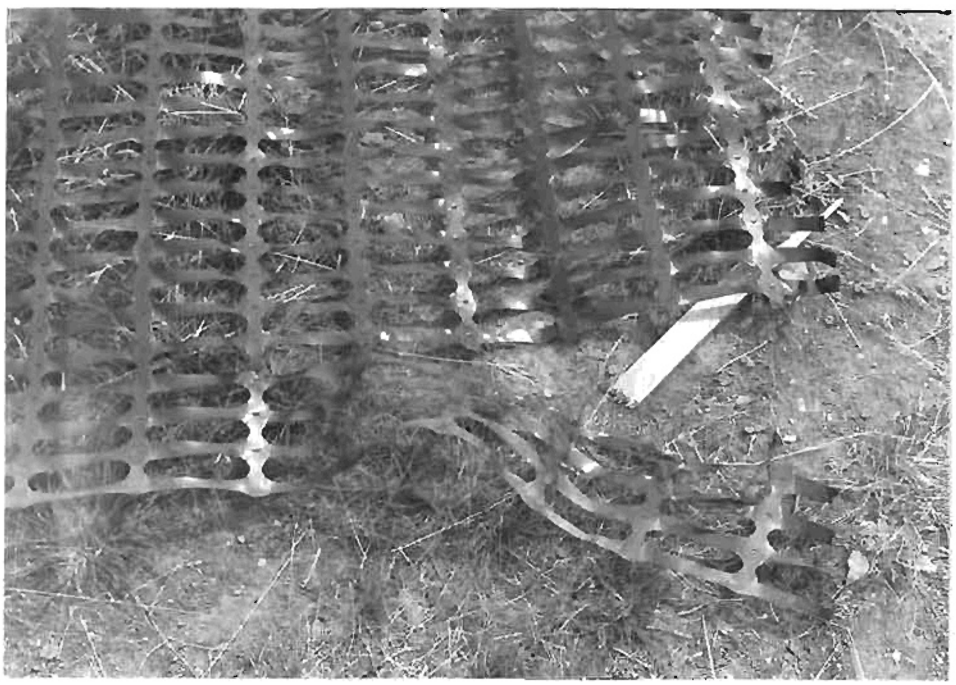
however, it was still performing well. Tensar and Tenex were among the best, retaining their original tension with no apparant distress. Photograph 5 through 8 show the drift formation behind all these fences, and illustrate their appearances.

The summer evaluation of the snow fences was performed during the first week of August. The primary reason for this investigation was to examine the appearance and the integrity of all the snow fences after the winter months. the Fence-It-Plus fence was already replaced by a wooden fence because it was totally torn up by the cattle in the area. This fence, which was donated by the Weather shade Corporation was actually a shading fence, and was not designed to be used as a snow fence. Nevertheless, since it was donated to the department, it was decided to examine its practicability as a snow fence. This fence did not perform as well as the others during the snow season, and was buried into the snow and was badly sagged.

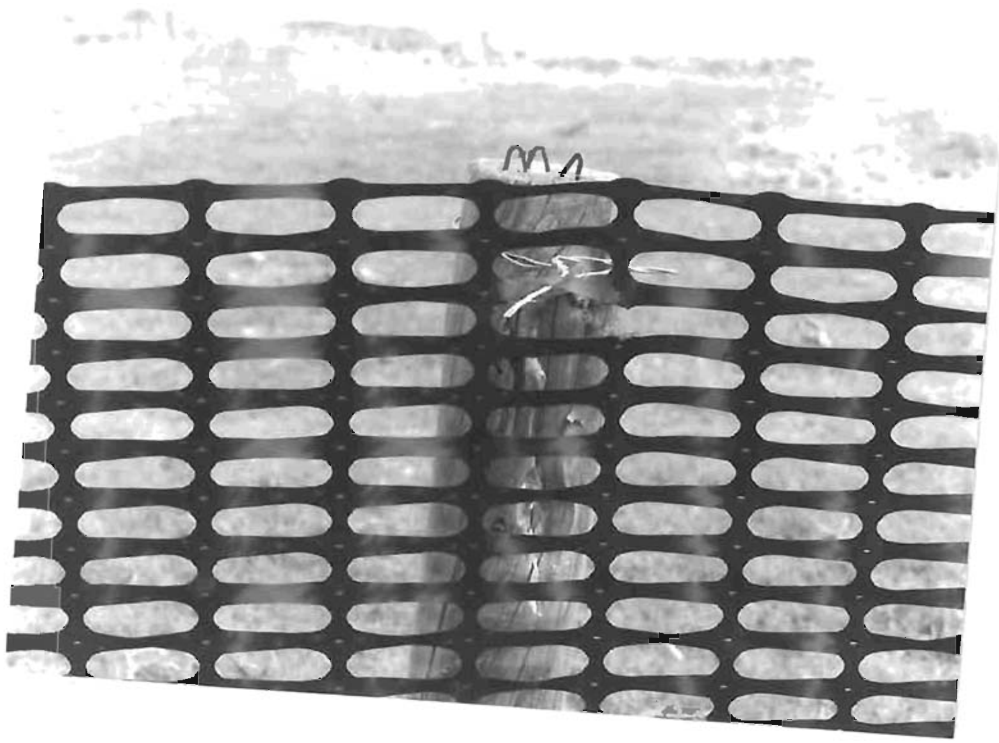
Even though Tensar, and Tenex were quite effective in controlling snow during the winter, they were susceptable to damage by the grazing bulls in the summer. Photograph 9 through 11 demonstrate sections of these fences that have been chewed or disturb by the bulls in the area. on occasion, bulls fur were found on the wooden slat indicating that maybe the bulls were scratching



Photograph 9: Badly torn Tenax fence



Photograph 10: Torn Tensar fence.



Photograph 11: Abrasion caused by the tie wire due to absence of the wooden slat.

their bodies against the fence.

In one case, the fence was abraded by the wire that was used to tie the fence to the pole. However, it is believed that the abrasion could have been prevented if a wooden slat was used to sandwich the fence against the pole.

The wooden fence appeared to be in good condition. However, the 6-inch bottom gap that was established for the fence was no longer there. This was caused by the weight of the wooden fence. The wooden fence is approximately four times heavier than the synthetic snow fences. The bottom gap is quite essential in creating long drift (as much as 35 times the height of the fence), and increasing the storage capacity of a fence.

VI. Recommendations and Conclusions

- The use of synthetic snow fences for controlling snow drifts looks promising; however, close attention must be paid in selecting a proper site. Sites with close proximity to a ranch with grazing bulls may not be suitable for synthetic snow fences. Bulls have tendencies to either lean against the synthetic snow fences or to chew on them.

• The snow trapping efficiency of the synthetic snow fences were comparable to wooden fences. The amount and the geometry of the snowdrifts formed behind all the fences were approximately the same, ranging from 3.5 to 4.5 feet in height and 90 feet in length downstream of the fence.

• The synthetic snow fences were much easier to install than the wooden fences, because they were lighter (approximately one-forth of the weight of the wooden fences), and because they stretched easier. The synthetic snow fences require substantially less room to store or to haul. They will not rust or corrode, and they are ultraviolet and heat resistant.

VII. **<u>Implementation Statement</u>**

The result of this study has demonstrated the use of synthetic snow fences as an alternative to the traditional wooden snow fences. They are lighter, easier to install than the wooden fences, and they require substantially less room to store of haul. However their installation close to a ranch with grazing bulls are not recommended. Bulls have tendencies to either lean against them or to chew on them.

When installing any snow fence the following factors should be considered.

- The maximum length of a snowdrift downstream could reach 35 times the height of the fence. Therefor a 4-feet snow fence should be installed 140 feet upwind of a roadway.

- A gap of six inches between the bottom of a four-foot fence and the top of the vegetation allows the wind to scour a depression around the fence helping to prevent the fence from becoming buried and losing its efficiency. The optimum bottom gap is equal to 10-15 percent of total fence height (4).

- Because the capacity of a fence increases in proportion to $H^{2.2}$ (fence height), it is more economical to use a single tall fence than multiple rows of shorter fences having the same capacity. This generalization is supported by data from construction contracts in Wyoming by Dr. Ron Tabler (5).

- There are numerous publications in regard to snow and ice control by Dr. Ronald Tabler, formerly project leader and research hydrologist with U.S. Forest Service. His research on the control and management of drifting snow has been the subject of more than 40 technical papers. It is strongly recommended to use Dr. Ronald Tabler's notes as a technical guidelines for controling snow and ice.

VIII. **References**

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2. Tabler, Ronald D., Tensar Snow Fence Study," The Performance of The Tensar snow Fences Over The 1985-86 Winter".

3. Tabler, Ronald D., " Snow Fence Technology State Of the Art" First International Conference On Snow Engineering, 1988.

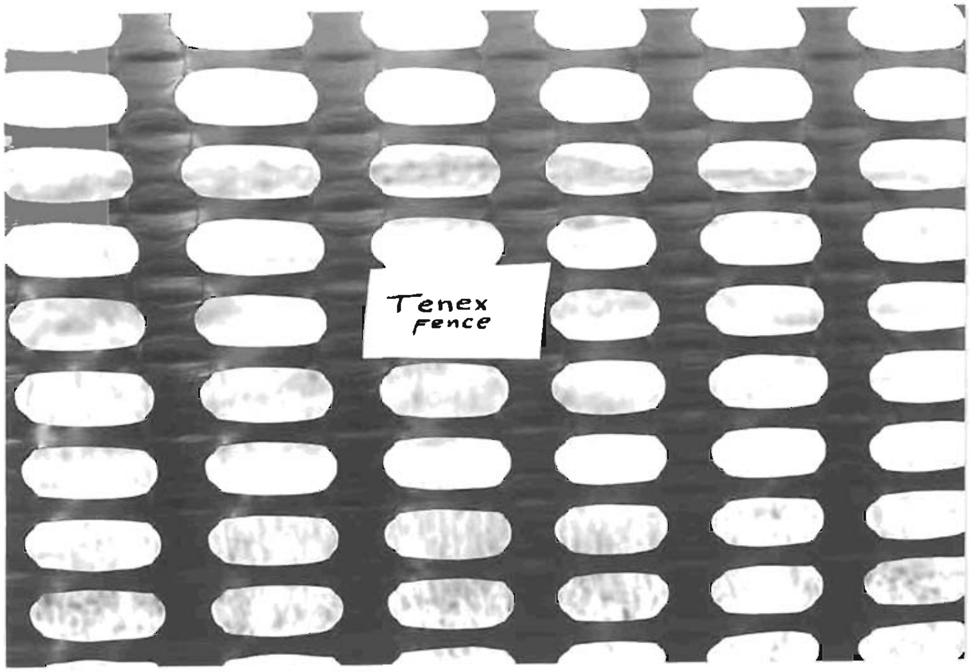
4. Tabler, Ronald D., "Snow Control Course Notes", 1988

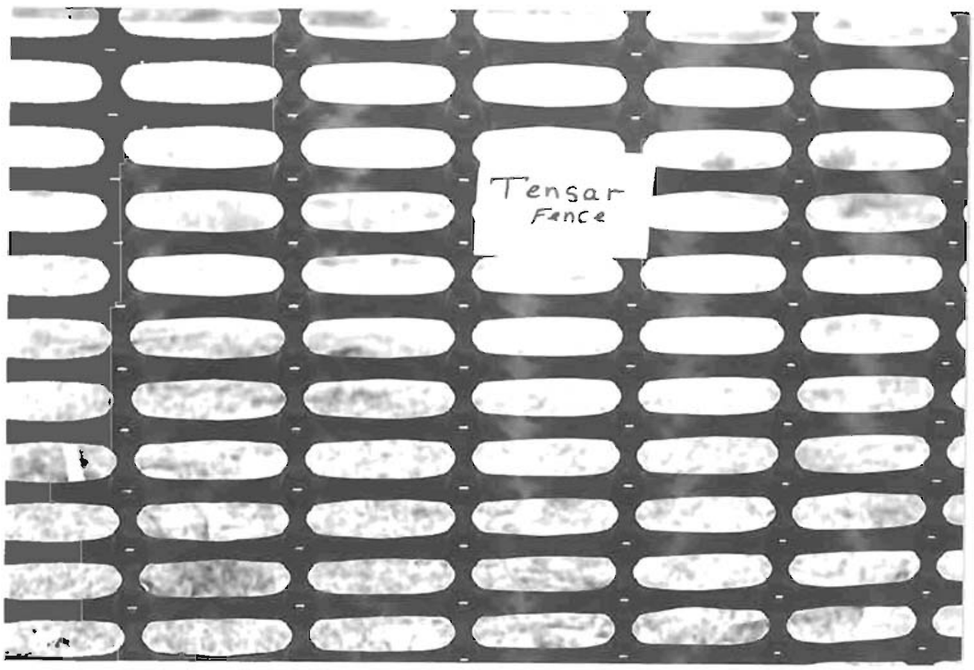
5. Tabler, Ronald D., "Geometry and Density of Drifts Formed by Snow Fences," 1979.

Appendix A

Potograph 1: Erection of wooden and steel posts prior to the installation of the fence

Photograph 2: Heavy wooden posts were used at each end of the fence for proper tensioning. Notice the size of the wooden fence vesus the si ze of other two fences.

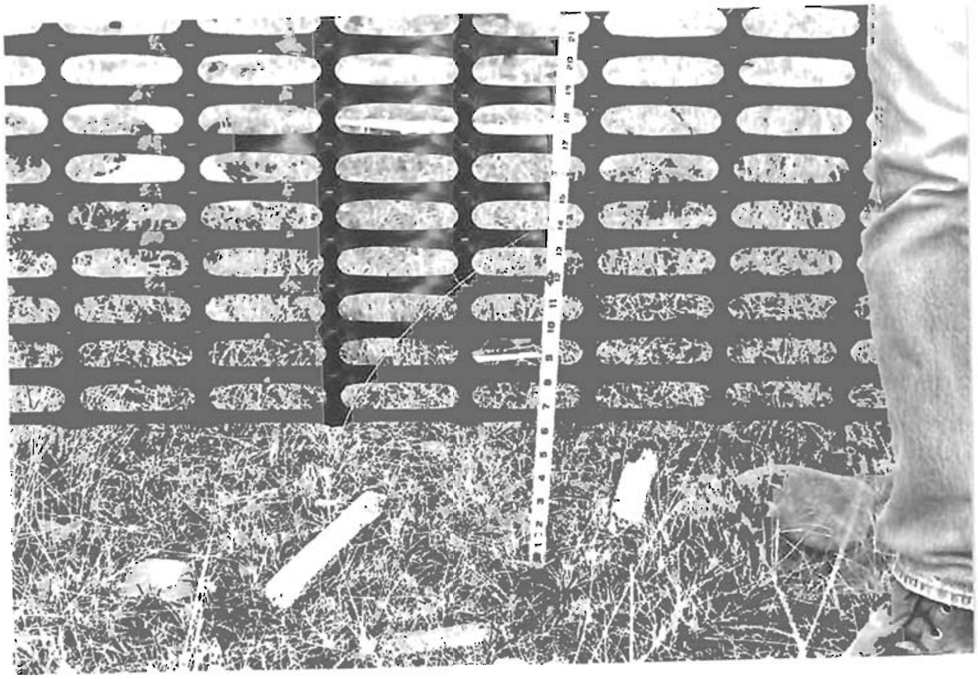




Photographs 3 and 4: Tensor and Tenex fences. Their prosity is the same (50%), but their designs are different.

Photographs 5 and 6: Wooden fence and Fence It-Plus

Photographs 7 and 8: The fences were stretched in two ways, using a stretcher and a truck.

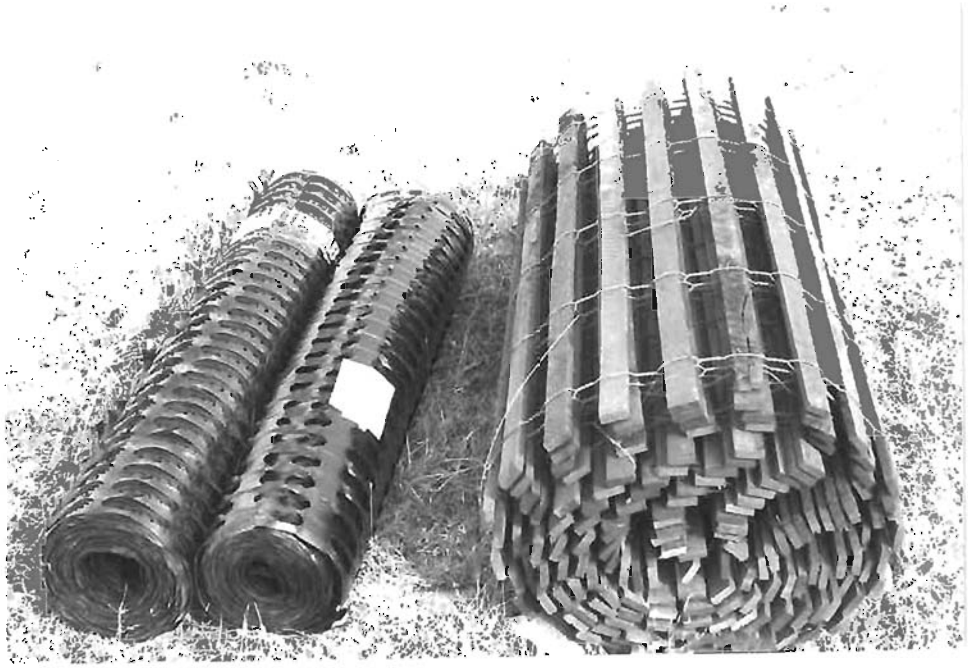


Photograph 9:

A bottom gap of six inches was established for all the fences.

Photograph 10:

After stretching, the fence was sandwiched between a wooden slat and the flat side of a post. The wooden slat was used to prevent abrasion of the fence by the wire.



Photograph 11: coparison of the 50'roll of wooden fence against 2 -100'rolls of industrial fences.