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Evaluation of a Switch Point Windbreak System

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Summary

Transportation Technology Center, Inc. (TTCI) is testing a system designed to be installed in the switch point area of any size turnout exposed to potentially detrimental environmental conditions that lend themselves to accumulating windborne particulate matter. The system consists of a series of vertical nylon brushes that are installed to the field side of the stock rails in the switch of the turnout. The system is designed to create a windbreak that diverts windborne particles up and over the switch points, or will simply capture material in the brushes themselves, thereby preventing their entry into the switch points.

The system was installed at two locations at the Transportation Technology Center (TTC) located near Pueblo, CO. Both locations, one at the Facility for Accelerated Service Testing (FAST) High Tonnage Loop (HTL) and the other on the Railroad Test Track (RTT), have a history of excessive windborne material buildup. The brush systems have been monitored for performance since installation, and the results so far indicate that the brush system does create a windbreak effect and prevents the accumulation of windborne material such as sand, dust, dirt, or other environmental debris in the switch point area. Initial findings show:

- The system is successful at decreasing the visible accumulation of windborne material.
- The system is relatively low maintenance. It is easy to install and requires very little upkeep, providing potential budgetary and operational efficiency advantages.
- The brushes do not pose potential obstruction issues during train or hi-rail vehicle movements through a turnout with the system installed.

The initial results indicate the system has the potential to be effective in a revenue service location with a history of becoming clogged with windborne particulates. TTCI plans to continue monitoring the two windbreak systems currently installed on turnouts at the TTC and will provide an updated *Technology Digest* discussing additional findings at a later date.

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INTRODUCTION

TTCI conducted a study to evaluate the performance of a system designed to create a windbreak in the region of the switch points. The system was originally developed and marketed in Europe before being introduced in the U.S. Two locations were selected at the TTC near Pueblo, Colorado for the evaluation. The sites were selected based on a survey of operational employees who work on the site and interact with turnouts on a regular basis as part of their normal duties.

Site Selection

TTC is located on the southeastern high plains of Colorado. This part of the state is classified as a cold, arid steppe region and is characterized by warm summers, mild winters, and relatively little precipitation.[1] The soil in this area generally consists of loamy sands. Research conducted in 1977 indicates that this type of soil poses an increased risk for erosion by sustained winds.[2] Given the lack of annual precipitation in this region, the soil is often extremely dry and therefore especially susceptible to wind erosion. Two separate turnouts, a No. 10 and a No. 20 turnout, were selected for the installation of the brush system. The two turnouts are in areas prone to windborne material accumulation and have historically required regular routine cleaning to keep the switches functioning at an optimum level.

Windbreak System

The system installed on the two turnouts consists of nylon brushes that snap together and are lagged into place with holding brackets. The brushes come in uniform lengths and are color-coded for correct installation. White brushes are intended to be on top, with the black brushes on the bottom. When installed, the brushes extend above the top of the running rail surface and become flush with the surrounding surface of the ballast at the bottom, pictured in Figure 1. Installation of the system is relatively simple. A No. 20 turnout installation can be completed in several hours with the only tool required being a battery powered drill for assembling the brackets and affixing them to the switch timbers. It should be noted that the brushes are not intended to be installed directly adjacent to the running rails, but rather sit back toward the edge of the tie. This is a deliberate design feature intended to keep them away from dragging equipment or hi-rail vehicle wheelsets.

Figure 1. Brush System Installed with Holding Bracket

No. 10 Right-hand Turnout

The turnout shown in Figure 2 is located at FAST on the HTL. The turnout is primarily used to move the Heavy Axle Load (HAL) test train used for testing at FAST on and off of the test loop. It is a highly critical switch which must operate as intended to ensure ongoing testing at FAST. The switch is located approximately 200 feet from a heavily trafficked, unpaved, at-grade crossing that enables access to the test loop and is elevated from the surrounding terrain in the vicinity.

Figure 2. No. 10 Right-hand Turnout at FAST Looking East

This turnout has several sibling turnouts in the immediate area that are of the same hand and size. The switches in this area of the HTL are especially vulnerable to a wind out of the north or south. Wind out of these directions will blow directly across the switch points and any windborne material has a chance to accumulate in the open switch point. These were monitored alongside the test turnout and served as a baseline comparison point.

No. 20 Left-hand Turnout

Figure 3 shows the second turnout, a left-hand No. 20 turnout located on the RTT. The RTT is a 13.5-mile loop configured for a maximum speed of 165 mph. It is used for high speed testing and has an overhead catenary system. This turnout provides access to a siding track that leads to the core area of the site where rolling stock and locomotives are serviced and have maintenance performed. It is also a routinely used turnout that poses high operational impacts if it fails to operate properly. It is elevated from the surrounding terrain and is also located adjacent to a heavily trafficked paved at-grade crossing. This turnout has a sister turnout immediately north of the previously mentioned road crossing. It is also a No. 20, left-hand turnout. This served as a control case to the test turnout, as both experience almost identical environmental conditions and see similar traffic.

Figure 3. No. 20 Left-hand Turnout on RTT Looking South

Condition Monitoring

To evaluate the performance of the system over time, two methods were utilized. Visual documentation during periodic inspections was conducted for both turnout locations, while a sand collection system was installed at the No. 10 turnout to provide quantifiable data on the amount of windborne material blowing through the area. Weather data for the testing period was also documented, and a plot of wind data for the TTC is shown in Figure 4 for a subset of the testing period.

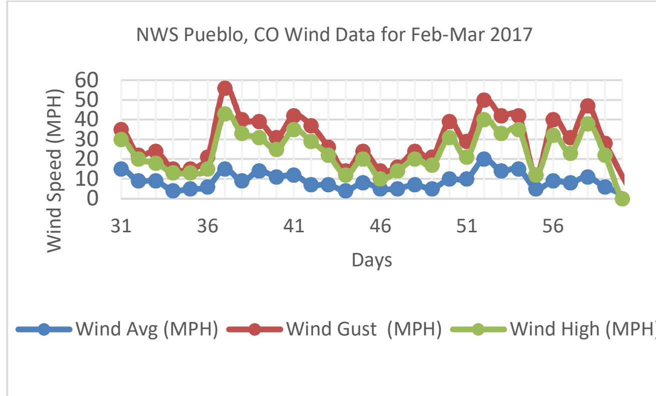

Figure 4. Wind Data for TTC in February 2017

The sand collection system consisted of a series of tubes oriented in the cardinal directions with vertical slots in them, shown in Figure 5. On one side, the tube was coated with a fine screen material so any particulate matter that was blown into the tube would be captured and fall down into a collection tube below. The tubes were cleared and reset several times over the initial 6-month monitoring period. The material from each of the collection tubes was then weighed. The data collected for several months is displayed in Figure 6. The visual inspection consisted of documenting the condition of the brushes for wear or damage and documenting any material present in the switch points.

Figure 5. Sand Collection Tube at No. 10 Turnout

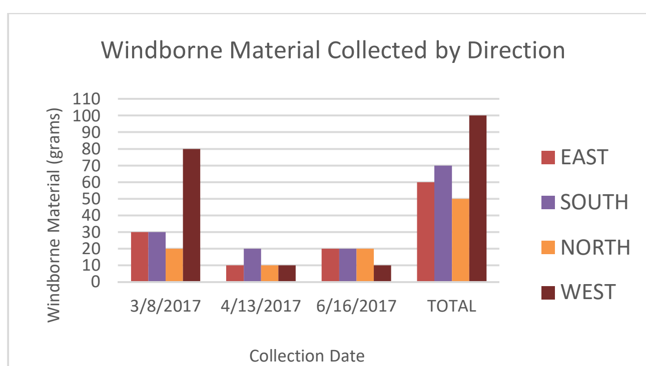

Figure 6. Windborne Material Collected at FAST

RESULTS

To date, the windbreak system has decreased the accumulation of windborne particulate matter in the switch point region of both turnouts. Figures 7 and 8 show a comparison between switch points with and without the brush system. The switch with the brushes had minimal fine particulate matter between the point and stock rail. The turnout without the brushes had a clearly discernible amount of fine particulate matter in between the point and stock rail. Both of the switches were in a dry state of lubrication; however, if switch lubricant had been used, it would have exacerbated the problem on the switch without brushes. The fine particulate materials often mix with the switch lubricant and form into clumps that can become lodged into the switch points, preventing proper operation of the switch.

Figure 7. Switch Points with Brushes

Figure 8. Switch Points without Brushes

CONCLUSION

Initial results indicate that the system of brushes does provide a shielding effect to the switch points, thereby reducing buildup of material. This system has the potential to be effective in a revenue service location with a history of becoming clogged with windborne particulates.

REFERENCES

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