



## REPORT

### **Fail-Safe Activations of Automatic Warning Devices (AWD)** **in the Barrhaven Area**

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**Presented to :**

**VIA Rail Canada Inc.**

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## **Introduction**

This report presents the findings and action plan with regards to an in-depth technical review of fail-safe occurrences at six (6) Barrhaven area automatic warning devices (AWD) at public at-grade crossings on the VIA Rail Smiths Falls Subdivision, namely:

1. MP 3.28 Woodroffe Avenue
2. MP 3.30 OC Transpo Southwest Transitway
3. MP 3.88 Fallowfield Road
4. MP 5.10 Greenbank Road
5. MP 5.73 Jockvale Road
6. MP 6.81 Strandherd Road

It should be noted that although this report is being presented at this time, a number of actions have already been completed or are on-going and are indicated as such in the following.

## **Background**

An AWD functions normally for train movements when a tuned electronic track circuit value is modified by the wheels and axles of a train within the approach to a crossing and identifies the track circuit changes as an approaching train. In areas of high crossing density (overlapping crossing approach circuits) and depending on circuit lengths, individual track circuits are separated by using circuits with different frequencies. This prevents them from overwhelming each other or interfering with each other. Furthermore, at the six (6) locations that are the subject of this report, specialized computerized operating systems called grade crossing predictors (GCP), with a constant warning (CW) feature, are installed in the control housings. These systems process the information that is received when the train modifies the track circuit on the approach to a crossing. The speed of a train is calculated by the GCP operating system software and it then determines when to activate the AWD, for a predetermined and constant amount of warning time (CW), in advance of the train arriving at the roadway crossing. The GCP then indicates to the AWD control system when to activate the AWD lights, bells and gates. Because GCPs determine train speeds, they are able to provide for constant warning times even in an environment of varying train speeds.

Once activated, the lights begin to flash, the bell begins ringing and then the gates start to descend from a vertical position to a horizontal position 9-12 seconds after the lights have started to flash. Total

warning time is measured between the time the lights begin to flash until the time the train occupies the travelled portion of the roadway crossing, with the gate arms being horizontal for a minimum of 5 seconds. Normal total warning times are in the range of 24-35 seconds and are dependent upon the physical layout of the roadway and other parameters, such as roadway traffic light pre-emption requirements. Once the train is clear of the crossing, the gates begin to ascend back to their vertical position while the lights remain flashing. Once the gates have reached their vertical position the lights stop flashing. At this point road traffic may resume.



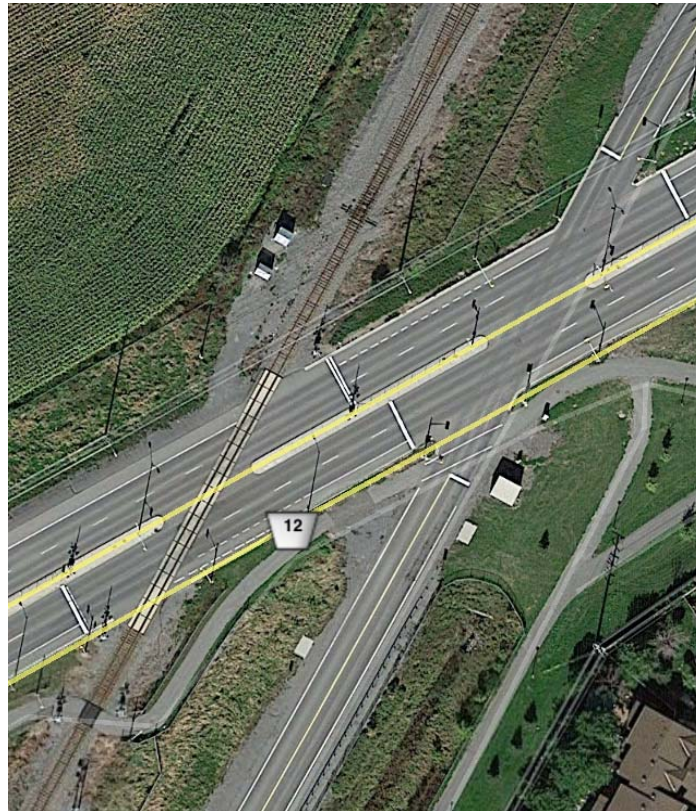
***Activated AWD at OC Transpo Southwest Transitway***

As an added complexity, at Fallowfield Road, the AWD are interconnected with City of Ottawa road traffic lights that control road movements over the crossing and through the adjacent OC Transpo Bus Transitway. This means that upon detection of a train on the long crossing approach, the system has built-in time to allow for the road traffic to clear from the crossing surface, to cycle the traffic lights through amber and then to red, and then to activate the AWD to allow for the safe passage of a train. The road traffic lights remain at red during this movement.

While the other crossings through the Barrhaven area are not quite as complex as Fallowfield Road, there are still a number of moving parts that are involved, as follows:

	Road		Pedestrian	
	Gates	Lights	Gates	Lights
Woodroffe Ave	4	16	-	8
Transitway	2	8	-	-
Fallowfield Rd	4	16	2	8
Greenbank Rd	2	8	-	-
Jockvale Rd	2	8	2	8
Strandherd Rd	2	16	-	-
<b>Total</b>	<b>16</b>	<b>72</b>	<b>4</b>	<b>24</b>

*AWD Components at six (6) Barrhaven area crossings*



*Complex Interconnected Rail/Road Crossing and Transitway at Fallowfield Road, MP 3.88 Smiths Falls Sub  
 (Source: Google Earth, 2014)*

Electronic track circuits and the systems that react to the detection of movement are extremely reliable for the detection and provision of warning time at AWD for trains. **It must be noted that at no time has public safety or the safety of train operations been at risk. There have not been any late activations or non-activations of AWD at the six (6) crossings through the Barrhaven area.**

## **Fail-Safe Activations**

**Unfortunately, since electronic track circuits are quite sensitive they are susceptible to effects from other sources and other factors.** Because of this AWD can activate when no train is present, when the system is shorted or shunted, when a component fails, when the detection system senses something wrong or when a mechanical part sends a message back to the system that it cannot function properly. By design, when these issues occur the system falls into activation to ensure that everything remains safe until repairs can be undertaken – this is the fail-safe principle. These issues can also cause the AWD to remain activated for a longer period of time than normal or to be re-activated following the passage of a train. While it is not feasible to totally eliminate fail-safe activations, efforts are focused on reducing the frequency and the number of fail-safe activations as well as the impact of them on road users and train operations. Causes of fail-safe activations can include, but are not limited to:

- lightning damage
- defective rail
- track circuit wire or rail bond breakage
- contaminants in the track (water, salt)
- circuit board failure
- controlling device failure
- loose contact or connection
- termination shunt failure
- gate motor problem
- misalignment of gate
- broken or damaged gate
- failed or deteriorated insulated joint
- frost in gate contacts
- interference on electrical signals from outside sources (hydro power)

Since early January 2014 an increased number of fail-safe activations have occurred at the six (6) Barrhaven area AWD. To add to these confirmed events, there have also been a number of misperceptions of normal AWD functionality and train operation as well as false reports of malfunctions that have increased the number and frequency of “perceived” events. This report focuses on:

- the confirmed fail-safe activation issues
- contributing factors to those fail-safe issues
- actions completed, on-going actions and further actions planned/recommended, with the objective:
  - to improve reliability and to reduce fail-safe activation frequency
  - to reduce the impact of future fail-safe activations on road users, pedestrians and train operations and to report fail-safe occurrences in a much more proactive and prompt way
- actual completion dates as well as target completion dates

## **Action Plan**

In line with the above, the attached action plan has been developed by RailTerm in cooperation with VIA Rail Canada, Siemens (manufacturer of the AWD operating and control equipment) and Hatch Mott MacDonald (VIA's engineering services provider and signal systems designer). As previously mentioned, many actions have already been completed, addressing many of the contributing factors and in order to improve the situation through the Barrhaven area. The action plan also includes planned or recommended actions with target completion dates. In essence, the action plan addresses the following questions:

- **What changes are necessary to reduce the likelihood of a fail-safe event?**
  - The action plan lists the changes that have been completed, are on-going, are planned or recommended, and that have as their objective to reduce fail-safe occurrences.
- **What changes are necessary to reduce the duration (impact) of a fail-safe event if it happens?**
  - The action plan lists the changes that have been completed, are on-going, are planned or recommended, and that have as their objective to reduce the impact of fail-safe occurrences on road users and to report fail-safe occurrences in a much more proactive and prompt way.
- **What technical changes are necessary to report a fail-safe event in a much more proactive and prompt way than the current system without depending on visual observations from staff and citizens?**
  - The action plan lists the changes that have been completed, are on-going, are planned or recommended, and that have as their objective to reduce the impact of fail-safe occurrences on road users and to report fail-safe occurrences in a much more proactive and prompt way.
- **Does the preventative maintenance program need to be changed to reduce fail-safe operation?**
  - The action plan lists the changes that have been implemented and are planned to be implemented within the preventative maintenance program.
- **What work has already been performed, when was it performed, how is it working, how do we know?**
  - The action plan lists all work that has been performed along with associated completion dates. Work that has been completed has been tested and AWD performance has been monitored to ensure that everything is functioning as intended. Since April 14, 2014, all fail-safe occurrences have been reduced to only two (2) known issues that continue to be addressed, as described below.
- **What work still needs to be done to ensure low fail-safe incidents?**
  - The action plan lists, in detail, all work that is on-going, planned or recommended along with target completion dates. In general, focus remains on:

- Resolving grade crossing predictor errors at Woodroffe Ave and the Transitway causing excessive activation following the passage of an eastbound train.
    - Completing the change out of wind brackets and shear bolts at Fallowfield Road, Woodroffe Ave and the Transitway.
  - In addition, although the following issues have been mitigated, further investigation is required to determine long term solutions for:
    - Varying ballast conditions, moisture levels and effects of road salt
    - Interference from AC hydro power in the vicinity of AWD track circuits
- **What is the timing for all work still to be performed?**
  - The action plan lists all work that is on-going, planned or recommended along with target completion dates.

**Summary of Action Plan**

The action plan contained herein consists of mitigation measures that address a number of contributing factors that have led to fail-safe activations and impact on road users. These mitigation measures address issues that can be classified in categories as follows:

- Electrical issues
- Mechanical issues
- Software issues
- Train operations in a complex environment (closely spaced and interconnected crossings, Fallowfield Station stop)
- Communications / reporting issues

The status, by category, of the 131 mitigation measures that have been identified is as follows:

	Technical			Train Operations	Communications	Total
	Electrical	Mechanical	Software			
<b>Completed</b>	46	5	13	6	4	<b>74</b>
<b>On-Going</b>	8	4	1	-	-	<b>13</b>
<b>Planned</b>	20	3	3	-	-	<b>26</b>
<b>Recommended</b>	6	2	-	4	6	<b>18</b>
<b>Total</b>	<b>80</b>	<b>14</b>	<b>17</b>	<b>10</b>	<b>10</b>	<b>131</b>

With 56% of the identified mitigation measures completed, the remaining 44% are on-going, planned or recommended measures. As identified in the action plan for each individual mitigation measure, the target completion dates fall into either the short-term or mid-term timeframe, as follows:

- Short-term completion (by July 1, 2014): 50 measures
- Mid-term completion (by December 31, 2014): 7 measures

### **Conclusion**

The action plan that is included is based on a thorough and in-depth technical review by RailTerm with the assistance of Siemens and Hatch Mott MacDonald. Although the frequency of fail-safe occurrences at the subject six (6) AWD through the Barrhaven area from January to April 2014 can be considered as being higher than normal, the situation has drastically improved through the month of April to the present due to the actions that have been implemented to date. Further improvement of reliability as well as a significant reduction in impact on road users and train operations is expected as the on-going, planned and recommended elements of the action plan are completed.

Please do not hesitate to contact the undersigned should any questions or concerns arise.

Regards,



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