Rectangular Rapid Flashing Beacon (RRFB) Findings of Field Trial

Technical Report

Roads - Traffic

The City of Calgary

July 22, 2015

EXECUTIVE SUMMARY

The Rectangular Rapid Flashing Beacon (RRFB) has proven to be an effective traffic control device and is recommended for continued installation in the City of Calgary. The RRFB has been shown to increase motorist yielding behaviour and provides an additional treatment to the current set of traffic control devices aimed at improving pedestrian conspicuity.

RRFBs have been accepted as a traffic control device by the Transportation Association of Canada (TAC). Until a national guideline has been developed through a TAC project which incorporates the RRFB into the Pedestrian Crossing Control Guide, the City of Calgary should continue to install these devices under a modified warrant criteria. Solar power continues to present reliability issues. Continued evaluation of solar and other power options will be undertaken to employ the most cost-effective power solution for each RRFB installation.

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1.0 INTRODUCTION

In 2013 (PFC2013-0780) solar powered Rectangular Rapid Flashing Beacons (RRFBs) were installed at eight locations to test the device under a pilot program. Devices were selected from various suppliers and installed at locations with various physical characteristics in order to measure driver behaviour in different applications. Before and after yielding studies were undertaken, the results of which indicated improvements in motorists yielding behaviour at locations with the RRFB devices. Maintenance of the solar devices was also tracked, revealing performance shortcomings with the solar reliability. Recommendations from this study were to further investigate power supply options to increase their reliability (including utilizing nearby streetlight power).

In 2014 the RRFB pilot was expanded with ten additional installations, in order to consider advancements in solar and RRFB technology and to review their implementation at specific suitable locations. A Request for Proposal (RFP) was initiated to seek vendors to provide RRFBs for the expanded trial, which included enhanced technical specifications. From this RFP, three vendors were selected and ten installations were completed in late 2014 and early 2015. Location selection was refined to include more detailed criteria, including high pedestrian demand indicated by pedestrian corridor warrant score and several other factors. In addition, one RRFB from the original eight installations was retrofitted to incorporate streetlight power to charge the batteries during non-daylight hours, in order to address the solar reliability limitations.

2.0 INVESTIGATION

2.1 Yielding Data

Yielding behaviour studies during the 2013 trial revealed that the RRFBs increased yielding compliance at all crosswalks where the devices were installed. Motorist yielding increased between 5 and 26 percent, depending on the site, with compliance increasing by an average of 14.1 percent. A follow up field compliance study conducted in June 2014 to examine the effectiveness of these devices after a year of operation revealed that the RRFBs continue to be highly effective in increased 'yield to pedestrian' compliance levels by motorists with an average increase of 12.0 percent. These results are shown in Table 1. The 2014 RRFB installations were completed between January and March 2015 and yielding data from these installations is not yet available.

Table 1: Yield compliance results before and after RRFB installations in Calgary

#	Location	Facility Type	Traffic Volume (24 hr)	Pedestrian Volume (24 hr)	Lanes	Posted Speed (km/h)	Median Type	Yielding Percentage Before RRFB	Yielding Percentage After RRFB (2013)	Yielding Percentage After RRFB (2014)
1	Glenmore Trail/18 Street SE	Freeway Interchange Loop Ramp	10,208	112	1	50	-	81	100	95
2	Crowchild Trail/Shaganappi Trail NW	Freeway Interchange Channelized Right Turn Ramp	4,776	106	1	60	-	77	90	85
3	Sun Valley Boulevard/Sun Harbour Road SE	Multi-lane Arterial near a recreation area	8,098	41	5	60	Concrete	87	98	100
4	18 Street/Riverview Close/Riverwood Circle SE	Multi-lane Arterial	14,565	162	5	50	Concrete	74	100	95
5	Radcliffe Drive/100 Radcliffe Place SE	Collector within School Zone	7,479	128	2	30	-	84	99	100
6	Douglasdale Boulevard/Douglas Ridge Close SE	Collector within School Zone	6,051	304	2	30	Boulevard	94	99	100
7	Harvest Hills Boulevard/harvest Oak Drive NB	Multi-lane Arterial	11,306	106	2 1-way	50	Grassy	87	98	95
8	Harvest Hills Boulevard/harvest Oak Drive SB	Multi-lane Arterial	8,999	106	2 1-way	50	Grassy	83	96	93

2014 Trial RRFB Locations:

1. Royal Oak Way – 200 Royal Oak Mews NW
2. Bowness Road – 79 Street NW
3. Saddleridge Drive – Saddletowne Circle NE
4. Taravista Drive – Saddletowne Circle NE
5. Hidden Creek Drive – Hidden Creek Heights/Hidden Creek Way NW
6. Temple Drive – 64 Street NE
7. Old Banff Coach Road – Patterson Hill SW
8. 9 Avenue – 14 Street SW
9. James McKevitt Road – Shannon Avenue SW
10. Sun Valley Boulevard – Suncrest Way SE

Citizen engagements were undertaken during both the original and extended pilots. The results indicated user satisfaction with the devices, and made recommendations on RRFB heights that have been incorporated into subsequent installations. Respondents to an on-site survey after the extended pilot indicated they see the benefit of another pedestrian-activated device.

Future research is being conducted by the University of Calgary with input from Roads Traffic Division to compare yielding compliance between side-mounted RRFBs and overhead pedestrian corridors. It is expected the results of this research will provide valuable information in determining the most suitable device for specific crosswalks as well as realizing cost efficiencies in these installations.

2.2 Technical Specifications

Refinements in the technical specs have lead to improvements in the performance of the RRFB devices from the initial trial to the extended trial. These refinements include adjustable solar panels, battery cabinets accessible from the ground, the ability to retrofit to continuous AC power or streetlight power, capability of using City of Calgary standard pedestrian push-buttons, solar sizing design for each specific location, and operating temperature range of -40°C to +40°C.

To address concerns over reliability of the solar devices, the requirement for a failure alarm notification in the event of low battery power was incorporated in the technical specifications. Of the 3 vendors in the extended pilot, only one possessed the capability of sending alert messages to the Traffic Management Centre through a cellular connection. This technology requires a solar panel designed to include the power to the alarm in the event of a battery failure, as well as upgraded battery sizing. It is currently on order for installation in summer 2015. Public notification through 311 and social media has also served as an effective failure alarm at all RRFB locations, as well as pedestrian corridors across the city.

Following a full year of operation of the 2014 RRFB installations, a determination will be made of a preferred vendor or vendors, based on the performance of these devices.

2.3 Costs

Installation costs of the RRFBs vary greatly, depending on location specifics. These include roadway geometrics, number of vehicle lanes, presence of a median, suitable visibility (based on roadway sight lines, tree cover, etc.), ability to install unobstructed solar panels, and existing devices along the roadway (it is undesirable to mix overhead and side-mounted devices). Design standards for RRFBs are being finalized to ensure consistency, ease of maintenance and minimize the cost of all installations. This includes standards for the base and pole type, sign and RRFB configuration, push-button type orientation/signage, intersection lighting upgrades and RRFB flash duration and frequency.

Advances in solar technology continue to be evaluated and have potential for cost savings, however since reliability is of the greatest concern when implementing any traffic control device, power decisions are best determined through the detailed design process. Each RRFB site will be assessed in regard to the cost-effectiveness of using solar power, streetlight power, or a dedicated power supply.

Collaboration with the City of Edmonton is underway to exchange RRFB experiences and to explore opportunities of joint infrastructure procurement to reduce costs.

Table 2 shows the range of costs from recent installations for different power options.

Table 2: RRFB installation costs in Calgary

RRFB Power Configuration	Cost Range*
Solar-powered	$25,000 - $45,000
Streetlight power	$45,000 - $75,000
Direct AC power	$55,000 - $75,000
Overhead Pedestrian Corridor (for comparison)	$85,000 - $110,000

*based on current installations

2.4 Transportation Association of Canada / Warrant Process Status

In November, 2014 the Transportation Association of Canada (TAC) approved the Rectangular Rapid Flashing Beacon (RRFBs) as a traffic control device and its inclusion in the Manual of Uniform Traffic Control Devices - Canadian Edition. The City of Calgary was the lead on this project to approve the RRFB and will be awarded the TAC Technical Excellence Award for Roads Safety Engineering, to be presented during the TAC Fall Conference in Charlottetown, PEI in September, 2015.

An essential component of RRFB adoption is to determine how the device fits into the spectrum of pedestrian crossing treatments. A funded TAC project has been established to incorporate RRFBs into the Pedestrian Crossing Control Guide in order to ensure the uniform application of the device across Canada. The City of Calgary is a major supporter in the process to develop this pedestrian crossing treatment review, with the aim of developing a national warrant for RRFB installation within the spectrum of available pedestrian treatments.

3.0 CONCLUSION AND RECOMMENDATIONS

A Rectangular Rapid Flashing Beacon (RRFB) installation at a pedestrian crosswalk is an enhancement that has shown to improve yielding compliance in multiple studies, at a reasonable cost.

It is recommended that the City of Calgary adopt RRFBs as a pedestrian crossing treatment. Until their inclusion in the Transportation Association of Canada's Pedestrian Crossing Control Guide is completed, Administration will use a modified pedestrian corridor warrant for the placement of RRFBs.