

Peer Review of Highlands Neighborhood Traffic and Pedestrian Safety Plan

~~DRAFT~~ **FINAL** REPORT

~~February 28,~~ March 14, 2017



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Ada County Highway District



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Executive Summary

The *Highlands Neighborhood Traffic and Pedestrian Safety Plan (Highlands Safety Plan)* developed by the Ada County Highway District (ACHD) was prompted by the proposed Highlands Cove development ~~consisting~~ of 57 single-family homes on 54 acres that border the eastern limits of the Crane Creek Country Club golf course. During the development process, residents of the Highlands neighborhood expressed ~~to ACHD~~ concern to ACHD that traffic from the proposed subdivision would exacerbate the neighborhood's current safety issues caused by cut-through traffic and excessive vehicle speeds. Developed in coordination with the residents, the *Highlands Safety Plan* identified a list of improvements to mitigate the ~~current~~ safety issues ~~in the neighborhood~~. ~~In July and August of 2016,~~ In 2016 ACHD installed the following mitigation measures from the list ~~were installed by ACHD~~:

- A traffic diverter at the intersection of Braemere Road and Curling Drive was installed in August 2016 to reduce cut-through traffic on Lower Braemere Road (~~the segment of~~ Braemere Road ~~located~~ southwest of Curling Drive).
- Stop signs ~~to implement~~ for all-way stop control ~~and reduce vehicle speeds~~ were installed in July 2016 on Curling Drive at the Braemere Road intersection to provide stop-controlled pedestrian crosswalks for safety.
- Stop signs for all-way stop control were installed in July 2016 to reduce vehicle speeds, according to the Highlands Safety Plan, on Highland View Drive at the Selkirk Drive and Whidden Street intersections, and on Upper Braemere Road (~~the segment of~~ Braemere Road ~~located~~ northeast of Curling Drive) at the Balmoral Road and Harcourt Road/Chardie Road intersections.

The mitigation measures ~~formed~~ created a new traffic pattern that ~~has~~ received mixed reviews from neighborhood residents. In response, ACHD initiated this peer review of the mitigation measures to assess their performance and provide an opinion on whether they should be removed, or should be altered or augmented to improve their function. ~~The~~ This review evaluated traffic volumes and speeds obtained before and after implementation of the mitigation measures, estimated cut-through traffic, conducted travel time runs, and observed driver compliance ~~after implementation of the measures~~. Traffic impacts of the Highlands Cove subdivision were not evaluated in this review.

~~The~~ Following are the key findings of this peer review ~~findings are~~:

1. Installation of traffic diverter on Lower Braemere Road at Curling Drive:

- 1.1. ~~Prior to installation of mitigation measures, the estimate~~ The estimated volume of cut-through traffic on Lower Braemere Road ~~exceeds ACHD's~~ prior to installation of the diverter exceeded ACHD Policy Manual Section 5104.2.4 minimum threshold requirements for cut-through traffic mitigation ~~f~~.
- 1.2. ACHD followed the process directed by ACHD Policy Manual Section 5104.2.4) ~~ACHD developed to develop~~ options for ~~the~~ cut-through traffic mitigation in coordination with the neighborhood. Following a public open house meeting, ACHD selected an option to divert ~~traffic from Lower Braemere Drive to Curling Drive by prohibiting~~ cut-through traffic from ~~Upper Braemere Road to~~ Lower Braemere Road and ~~limiting access to right turn traffic from~~ Drive to Curling Drive. This mitigation measure was installed by ACHD in August 2016.
- 1.3. ~~The diverter at the intersection of Braemere Road and Curling Drive~~ worked as intended, reducing cut-through traffic on Lower Braemere Road by approximately 930 vehicles per day (vpd), from 1,350 to 420 vpd, a reduction of nearly 70 percent.
- 1.4. ~~The diverter re-routed traffic to other streets in the neighborhood, resulting in estimated cut-through traffic on Whidden Street, Cashmere Road and Curling Drive, southeast of Braemere Road, that exceeds ACHD's threshold requirements for cut-through traffic mitigation.~~ cut-through traffic from Lower Braemere Road to Curling Drive. The increase in travel time for the re-routed traffic to drive from the intersection of Braemere Road and Curling Drive to the intersection of Hill Road and 15th Street along the diverted route is approximately 40 seconds on average during the peak hours compared to traveling the cut-through route.
- ~~Traffic re-routed from the diverter increased congestion on Curling Drive at Highland Elementary. Several mitigation measures that should be considered are listed in Chapter 4, including coordinating with Highlands Elementary on a formal plan for student drop-off and pick-up by buses and parents.~~
- 1.5. Traffic re-routed by the diverter to Curling Drive increased vehicle congestion at Highlands Elementary School during student arrival and release times. The increase in congestion highlights the need to improve the method of student drop-off and pick-up. Even though the estimated cut-through traffic volume does not exceed ACHD minimum thresholds for mitigation on a collector street, ACHD should consider the following measures to improve pedestrian safety along the school frontage:
- 1.5.1. Improve pedestrian crossing safety on Curling Drive at the school crosswalk by implementing crossing beacons, which was an improvement identified in the

Highlands Safety Plan.

- 1.5.2. Improve pedestrian visibility at the school crosswalk by adding bulb-outs, similar to the bulb-outs on 15th Street at Washington Elementary School, and signing parking restrictions.
- 1.5.3. Improve traffic flow by working with the school to improve student pick-up and drop-off operations. For example, improvements could be considered to provide a designated area for student pick-up and drop-off for parents and for buses, similar to improvements constructed at Ustick Elementary, as part of the Cloverdale Road and Ustick Road intersection project, or constructed at Lowell Scott Middle School, as part of the Eagle Road and McMillan Road intersection project.
- 1.6. The diverter also re-routed traffic to other streets in the neighborhood resulting in an increase in cut-through traffic on Whidden Street, Cashmere Road and Curling Drive southeast of Braemere Road. However, the increased cut-through traffic volumes on these streets do not exceed ACHD Policy Manual Section 5104.2.4 minimum thresholds for cut-through traffic mitigation.

2. Installation of stop signs on Curling Drive at the Braemere Road intersection:

- 2.1. The stop signs implement all-way stop control at the intersection of two collector streets. However, the intersection does not meet the *Manual on Uniform Traffic Control Devices* (MUTCD) guidance for installation of all-way stop control based on vehicular traffic volumes. ACHD staff reports indicate the signs were installed to implement stop-controlled pedestrian crossings of Curling Drive, and using engineering judgment to make this decision to improve pedestrian safety is allowed by the MUTCD.
- 2.2. The stops signs provided a secondary benefit of reducing vehicle speeds on Curling Drive (2 to 4 mph reduction). During our field observations, 5 percent of drivers did not stop at the intersection.
- 2.3. ACHD should consider installing speed limit signs on the Curling Drive approaches within 100 to 200 feet downstream of the intersection. There are currently no speed limit signs on Curling Drive southeast of Braemere Road and only one sign on the west approach for eastbound traffic.

3. Installation of stop signs on Upper Braemere Road:

- 3.1. ~~The stop signs on Curling Drive at Braemere Road reduced 85th percentile speeds by 2 to 4 mph. Pedestrians were observed using the new stop control to cross Curling Drive.~~ Stops signs were installed on Upper Braemere Road with the intended purpose of

reducing vehicle speeds, according to the *Highlands Safety Plan*. However, according to the MUTCD, “stop signs should not be used for speed control.” ACHD should consider this guidance when identifying permanent traffic calming treatments.

- 3.2. The stop signs ~~on Upper Braemere Road~~ installed at the Balmoral Road intersection have helped reduce speeds by 3 mph, ~~but the performance of the stop signs in the roadway segment between Balmoral Road and Hearthstone Drive. During our field observations, 12 percent of drivers did not stop~~ at the ~~Harcourt Road/Chardie Road intersection are unknown. Pedestrians were rarely observed using the new stop-control to cross Upper Braemere Road~~ intersection.
- ~~-On Highland View Drive, speed measurements before the stop signs were installed were not available. As a result, we cannot determine if the stop signs reduced free flow speeds. Pedestrians were rarely observed using the new stop-control to cross Highland View Drive.~~
- ~~-The stop signs on Curling Drive should remain as a traffic calming measure. They have helped reduce speeds and provide a stop-controlled pedestrian crossing.~~
- ~~-The performance of the stop signs on Upper Braemere Road and Highland View Drive could not be determined so we do not have an opinion whether they should remain as permanent traffic calming measures. We recommend that the stop signs remain as temporary measures on Upper Braemere Road and Highland View Drive until the majority of the homes in Highlands Cove subdivision are constructed to slow contractor and heavy vehicle traffic in the vicinity of the stop-control intersections. We also recommend installing additional speed limit signs on both roadways to remind visitors and contractors of the maximum speed.~~
- 3.3. Speed measurements in the vicinity of Harcourt Road/Chardie Road intersection after stop sign installation were obtained too close to the Keldoon Avenue intersection to be comparable to measurements taken prior mitigation so the speed control performance cannot be determined. During our field observations, 19 percent of drivers did not stop at the intersection.
- 3.4. ACHD should re-evaluate the use of stop signs as a permanent measure for traffic calming. Permanent traffic calming measures identified in the *Highlands Safety Plan* and presented to the public at the open house meeting should be re-considered. ACHD should consider retaining the stop sign installations as a temporary measure during construction of Highlands Cove subdivision or until a permanent measure is implemented.
- 3.5. ACHD should consider installing speed limit signs within 100 to 200 feet downstream of all approaches at the current all-way stop-controlled intersections to remind drivers of

the speed limit.

3.6. ACHD should consider increasing the 20 mph posted speed limit to 25 mph on Upper Braemere Road from Curling Drive to east of the Crane Creek Country Club, a length of approximately 800 feet. The increase would better reflect the speed that motorists are currently driving on this segment of road – 85th percentile speeds of 31 mph – and would be consistent with the 25 mph posted speed on the remainder of Upper Braemere Road and Curling Drive. In considering the speed limit change, an evaluation of sight distance for the golf cart crossing and ball-bank indicator test results for the roadway curves should be conducted.

4. Installation of stop signs on Highland View Drive:

4.1. Stops signs were installed on Highland View Drive with the intended purpose of reducing vehicle speeds, according to the *Highlands Safety Plan*. However, according to the MUTCD, “stop signs should not be used for speed control.” ACHD should consider this guidance when identifying permanent traffic calming treatments.

4.2. Speed measurements near the Selkirk Drive intersection prior to stop sign installation are not available so the speed control performance cannot be determined. During our field observations, 18 percent of drivers did not stop at the intersection.

4.3. Speed measurements near the Whidden Street intersection prior to stop sign installation are not available so the speed control performance cannot be determined. During our field observations, 9 percent of drivers did not stop at the intersection.

4.4. ACHD should re-evaluate the use of stop signs as a permanent measure for traffic calming. Permanent traffic calming measures identified in the *Highlands Safety Plan* and presented to the public at the open house meeting should be re-considered. ACHD should consider retaining the stop sign installations as a temporary measure during construction of Highlands Cove subdivision or until a permanent measure is implemented.

4.5. ACHD should consider installing speed limit signs within 100 to 200 feet downstream of all approaches at the current all-way stop-controlled intersections to remind drivers of the speed limit.

5. Highlands neighborhood:

5.1. ACHD plans to install additional mitigation measures in 2017 that were identified in the *Highlands Safety Plan*, including delineating walking paths by adding pavement markings on several local streets and adding extruded curbing on Highland View Drive. Developers

of the Highlands Cove subdivision are obligated to fund additional traffic calming measures as part of their development requirements. ACHD should consider monitoring traffic volumes and speeds on neighborhood streets as the subdivision approaches full build-out to assess the performance of all of the traffic calming mitigation measures working holistically. Particular attention should be paid to cut-through traffic on Whidden Street, Cashmere Road and Curling Drive southeast of Braemere Road, and excessive speeding on Upper Braemere Road, Highland View Drive and Curling Drive.

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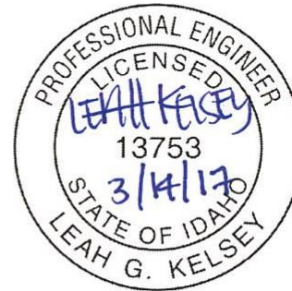
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Chapter 1 Introduction

The Ada County Highway District (ACHD) retained Six Mile Engineering, PA (Six Mile) to conduct this peer review of mitigation measures installed in conjunction with ACHD's *Highlands Neighborhood Traffic and Pedestrian Safety Plan (Highlands Safety Plan)*. This report is a summary of the peer review approach, ~~and~~ findings ~~and recommendations~~.

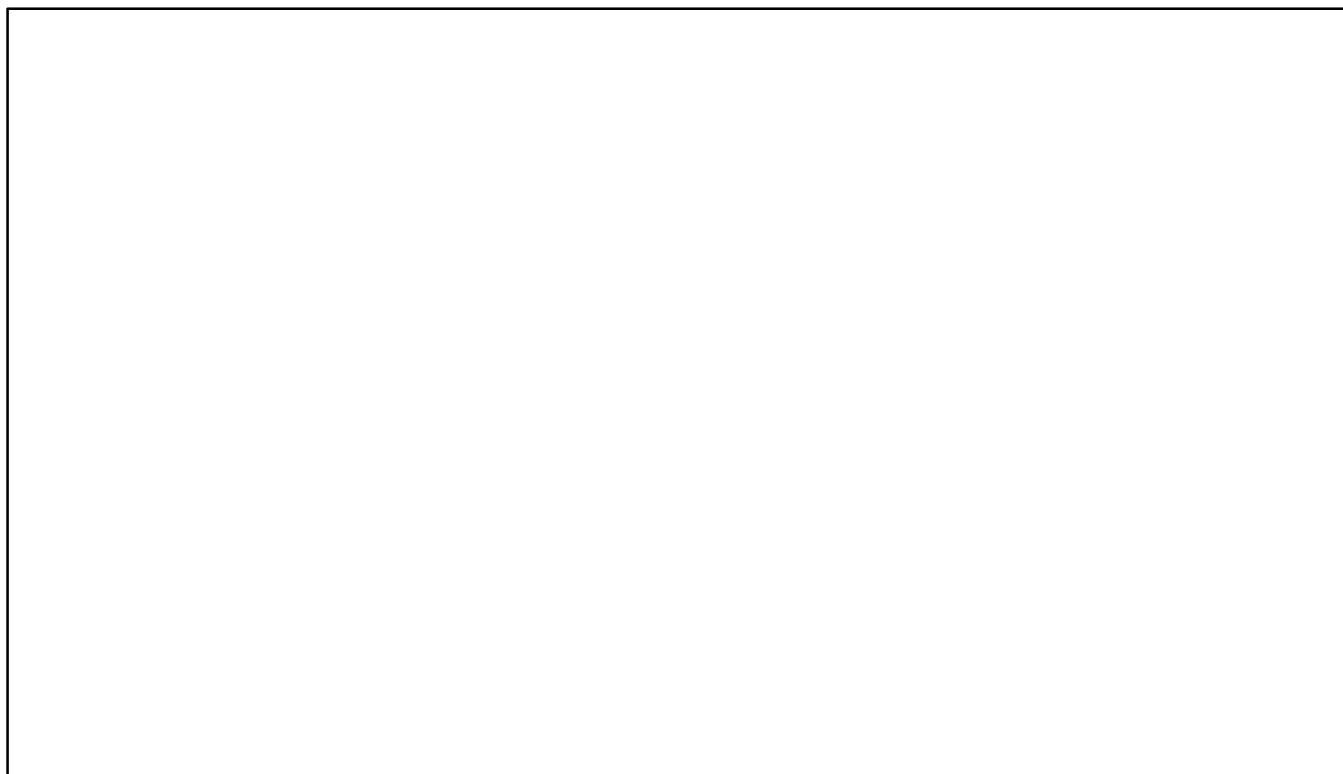


Figure 1-1. Highlands neighborhood

1.1 ~~1.1~~ Highlands Safety Plan Background

Traffic issues in the Highlands neighborhood have been ~~a concern~~ present for more than 25 years. According to a December 7, 1992, article in the Idaho Statesman titled, "Residents Put Brakes on Traffic Problems," cut-through traffic was an issue on Lower Braemere Road (the segment of Braemere Road located southwest of Curling Drive) ~~was the neighborhood's focus of traffic and safety issues in 1990. Residents at that time were concerned with cut-through traffic~~ from drivers using ~~Lower Braemere Road, a~~ the residential street, without sidewalks, as a short cut to downtown Boise. Residents felt that the excessive speed of the cut-through traffic was endangering children walking to and from Highlands Elementary School. After working with ACHD for two years, 20 of the 28 homeowners agreed to share in the cost of five speed humps on ~~Lower~~ Braemere Road that were installed in 1992.

In 2011, ACHD's project scoping team evaluated a potential project on Lower Braemere Road to construct sidewalk, with vertical curb, on the north side of the street. The project purpose was to "increase safety of students walking to and from Highland Elementary School". The estimated cost to construct [sidewalk on one side of](#) the approximately one-quarter mile length of [sidewalk street](#) was \$755,000. The scoping team concluded the project had a "disproportionately high cost per linear foot for a project on a local road with relatively low ADT (average daily traffic)".

In 2015, developers presented plans for the Highlands Cove subdivision, a residential development ~~consisting~~ of 57 single-family homes on 54 acres that border the eastern limits of the Crane Creek Country Club golf course. The subdivision is expected to generate approximately 550 vehicle trips per day when all of the homes are ~~completed and~~ [constructed](#). [The subdivision](#) includes ~~constructing~~ a street to connect Highland View Drive to Upper Braemere Road (the segment of Braemere Road located northeast of Curling Drive) as shown in Figure 1-1 on page 1. During the development process, residents expressed concern that traffic from Highlands Cove would exacerbate existing safety issues on the neighborhood streets. These issues consisted primarily of ~~cut-through traffic~~ [pedestrian safety](#) on Lower Braemere Road [due to cut-through traffic](#) and ~~concern for~~ pedestrian safety on ~~Lower Braemere Road, as well as on Curling Drive,~~ Highland View Drive and Upper Braemere Road due to excessive vehicle speeds. In response to the residents' concerns, ACHD initiated the *Highlands Safety Plan* to develop a list of potential short term and long term improvements to mitigate the current safety issues in the neighborhood.

Key milestone dates for the *Highlands Safety Plan*, obtained primarily from ACHD Commission Meeting notes, follow:

- June 24, 2015: The preliminary plat for Highlands Cove subdivision was presented at the ~~ACHD~~ Commission Meeting. After receiving testimony from 44 residents, the Commission delayed a decision on the preliminary plat and directed staff to identify measures to mitigate the current safety issues within the Highlands neighborhood.

August 5, 2015: At the ~~ACHD~~ Commission Meeting, ACHD staff presented the list of potential mitigation measures that were requested at the June 24, 2015, Commission Meeting. The Commission directed staff to work with the neighborhood residents to develop short term mitigation measures. The Highlands Cove subdivision preliminary plat application was approved, with one resident testifying.

- December 1, 2015: [The](#) Boise City Council approved the Highlands Cove subdivision preliminary plat application.
- February 10, 2016: ACHD staff presented preliminary mitigation measures at the ~~ACHD~~ Commission Work Session. No action was taken by the Commission.

- April 6, 2016: ACHD held a public open house meeting to present the *Highlands-Neighborhood Traffic and Pedestrian Safety Plan*. A variety of potential short term and long term improvements to mitigate existing safety issues in the neighborhood were presented for public input.
- June 15, 2016: ACHD staff presented the *Highlands Area Interim Measures Plan* at the ~~ACHD~~ Commission Work Session. No action was taken by the Commission.
- July 2016: ACHD implemented mitigation measures identified by the *Highlands Safety Plan* to reduce vehicle speeds ~~by installing stop signs to implement~~ on Highland View Drive and Upper Braemere Road by implementing all-way stop control at two intersections on each street. All-way stop control was also implemented on Curling Drive at the Braemere Road intersection, ~~on Highland View Drive at the Selkirk Drive and Whidden Street intersections, and on Upper Braemere Road at the Balmoral Road and Harcourt Road/Chardie Road intersections~~ for pedestrian safety.
- July 27, 2016: ACHD staff presented the *Highlands Area – Recommended Traffic & Safety Improvements Report* at the Commission Meeting. After receiving testimony from 30 residents on the proposed mitigation measures, the Commission approved the report.
- August 2016: ACHD implemented measures from the *Highlands Safety Plan* to reduce cut-through traffic on Lower Braemere Road. ~~A by~~ installing a diverter at the intersection of Braemere Road and Curling Drive ~~was installed to divert cut through~~ to route traffic to Curling Drive (Figure 1-2).
- September 28, 2016: The *North Boise Pedestrian and Bicycle Plan* was presented at the ~~ACHD~~ Commission Meeting. Testimony was received from 23 Highlands residents regarding the new traffic pattern ~~initiated~~ created by the *Highlands Safety Plan* mitigation measures.
- October 2016: ACHD initiated traffic counts to quantify the after mitigation conditions and solicited Six Mile Engineering to conduct this peer review.

Figure

The purpose of this peer review is to:

- Assess the performance of the following mitigation measures installed by ACHD that were identified in the *Highlands Safety Plan* ~~as short term improvements~~ to address current safety issues ~~and were installed in July and August of 2016 by ACHD~~:
 - A traffic diverter at the intersection of Braemere Road and Curling Drive was installed in August 2016 to reduce cut-through traffic on Lower Braemere Road.
 - Stop signs ~~to implement for~~ all-way stop control ~~and reduce vehicle speeds~~ were installed in July 2016 on Curling Drive at the Braemere Road intersection to provide stop-controlled pedestrian crosswalks for safety.
 - Stop signs for all way stop control were installed in July 2016 to reduce vehicle speeds, according to the Highlands Safety Plan, on Highland View Drive at the Selkirk Drive and Whidden Street intersections; and on Upper Braemere Road at the Balmoral Road and Harcourt Road/Chardie Road intersections.
- Provide an opinion on whether the mitigation measures should be removed, or should be altered or augmented to improve their function.

1.3 ~~1.3~~ Peer Review Study Approach and Limitations

This peer review consists of reviewing and comparing traffic counts and vehicle speeds obtained before and after installation of the mitigation measures, and observing driver compliance and conducting travel time runs in the after condition to assess performance of the mitigation measures. This review does not evaluate potential traffic impacts from the Highlands Cove subdivision.

This report presents an overview of the data and analysis, focusing primarily on the key corridors of Upper and Lower Braemere Roads, Curling Drive and Highland View Drive. A summary of the technical data and ~~analysis~~ conducted for this peer review are included in the Appendix.

1.3.1 ~~1.3.1~~ Traffic Count Variations

When comparing the before (before mitigation) and after (after mitigation) traffic counts for this peer review, consideration was given to the dynamics of traffic. Traffic counts vary by day, season and school session, and there is considerable variation in traffic volumes throughout a typical week. For example, ~~the standard deviation of the average weekday~~ our analysis of counts ~~that ACHD provided by ACHD~~ for this review found that the

individual weekday counts at a given location varied ~~up to~~ by as much as plus or minus 12 percent.

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from the average of those counts for the entire week.

The difference in before and after counts also has to consider that the after traffic counts ~~also~~ include construction vehicles for Highlands Cove construction on Highland View Drive, Upper Braemere Road, Curling Drive and other streets in the neighborhood that were not present in the before traffic counts.

An additional consideration in the count comparison is that the decision to evaluate the before and after conditions was made after installing the mitigation measures. As a result, the before traffic counts and speed measurements are limited to those available from historic data. The majority of the before counts were obtained in 2016, but some counts date back to 2014 and as early as 2006. The majority of the after counts were obtained in October through December of 2016 and were supplemented by counts from January and February 2017. ~~See Appendix for count data, locations and dates.~~

~~The street function was also a consideration in the count comparison~~ Bogus Basin Road is another illustration of traffic count variations. For example, ~~Bogus Basin Road was~~ we expected to see an increase in traffic on Bogus Basin Road that was approximately equivalent to the traffic increase on Curling Drive after the diverter installation. However, the available historic counts on Bogus Basin Road north of Curling Drive dated to 2006. South of Curling Drive on Bogus Basin Road, the available counts were obtained in August 2014, before school was in session. With these before counts, it was difficult to assign differences in the after counts to the diverter. As a result, our evaluation of impacts to Bogus Basin Road focused on changes to travel time and intersection traffic operations. A few of the other count locations in the neighborhood were also not comparable due to similar issues or differences in the locations of the before and after counts, and are noted in the Appendix.

1.3.2 ~~1.3.2~~ **Cut-Through Traffic**

~~Work on this peer review included verifying that cut through traffic on Lower Braemere Road exceeds ACHD's threshold requirements for cut-through traffic mitigation, and evaluating the magnitude and impact of cut-through traffic. The remaining neighborhood local streets were evaluated to identify streets that exceed ACHD's cut-through thresholds and require further evaluation by ACHD.~~

Cut-through traffic is defined as vehicle trips, excluding exceptions for neighborhood school traffic, traveling on a street that do not originate from residents of that street or from residents in the neighborhood connected by streets that are functionally classified as local streets. For example, vehicle trips from residents of Balmoral Road (local street) traveling to Upper Braemere

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Road (collector street), then to Lower Braemere Road (local street) and to Highland View Drive (collector street) are defined as cut-through traffic on Lower Braemere Road because traffic travels from a collector street (Upper Braemere Road), to a local street (Lower Braemere Road) and to a collector street (Highland View Drive).

By comparing before and after traffic counts throughout the Highlands neighborhood, routes with cut-through traffic were identified and evaluated according to ACHD Policy Manual Section 5104.2.4. This policy compares traffic volumes, vehicle speeds and estimated cut-through traffic volumes on local streets to threshold values. ACHD Policy Manual Section 5104.2.3 provides policy direction for the threshold analysis results:

~~One other local street route was identified to have a large percentage of cut-through traffic: Whidden Street to Cashmere Road to Curling Drive, southeast of Braemere Road. Before the Lower Braemere Road diverter was installed, the estimated cut-through traffic volume on this route was close to exceeding ACHD's threshold requirements for mitigation. After the diverter was installed, the estimated cut-through traffic volume increased to the point that it exceeds ACHD's thresholds for cut-through traffic mitigation on Curling Drive, southeast of Braemere Road, Whidden Street and Cashmere Road.~~

When the cut-through traffic threshold established in 5104.2.4 and 5104.2.5 is exceeded, ACHD will conduct a study to determine appropriate traffic calming measures, perform the design, conduct the public information process, fund the construction in accordance with available funds and priorities, administer the construction contract, and place all supplementary traffic controls. When the cut-through criteria is not met but traffic volume and/or speed thresholds are exceeded, the neighborhood is responsible for the construction costs. ACHD will provide the other services.

The volume of cut-through traffic was estimated using traffic counts and trip generation and distribution methods used for traffic impact studies. An alternate method of estimating cut-through traffic is an origin-destination study. They are typically conducted using driver surveys to obtain the origin, destination and route for each trip. An origin-destination study can also be conducted with a license plate survey, but it must be done for both the before and after conditions. After estimating cut-through traffic and reviewing the before and after traffic data that was available ~~for Lower Braemere Road, Curling Drive, southeast of Braemere Road, and Whidden Street—it was apparent that the added cost of,~~ it was apparent that results from an origin-destination study would not alter the conclusions from the cut-through traffic mitigation analysis, and as a result, an origin-destination study was not ~~warranted for this peer~~ review conducted.

Chapter 2 Highlands Neighborhood

2.1 ~~2.1~~ Highlands Neighborhood Overview

The Highlands neighborhood study area is bounded by Bogus Basin Road to the west and Hill Road to the south (Figure 2-1). Land uses within the study area are primarily residential, with the exception of Highlands Elementary School and Crane Creek Country Club located on Curling Drive.

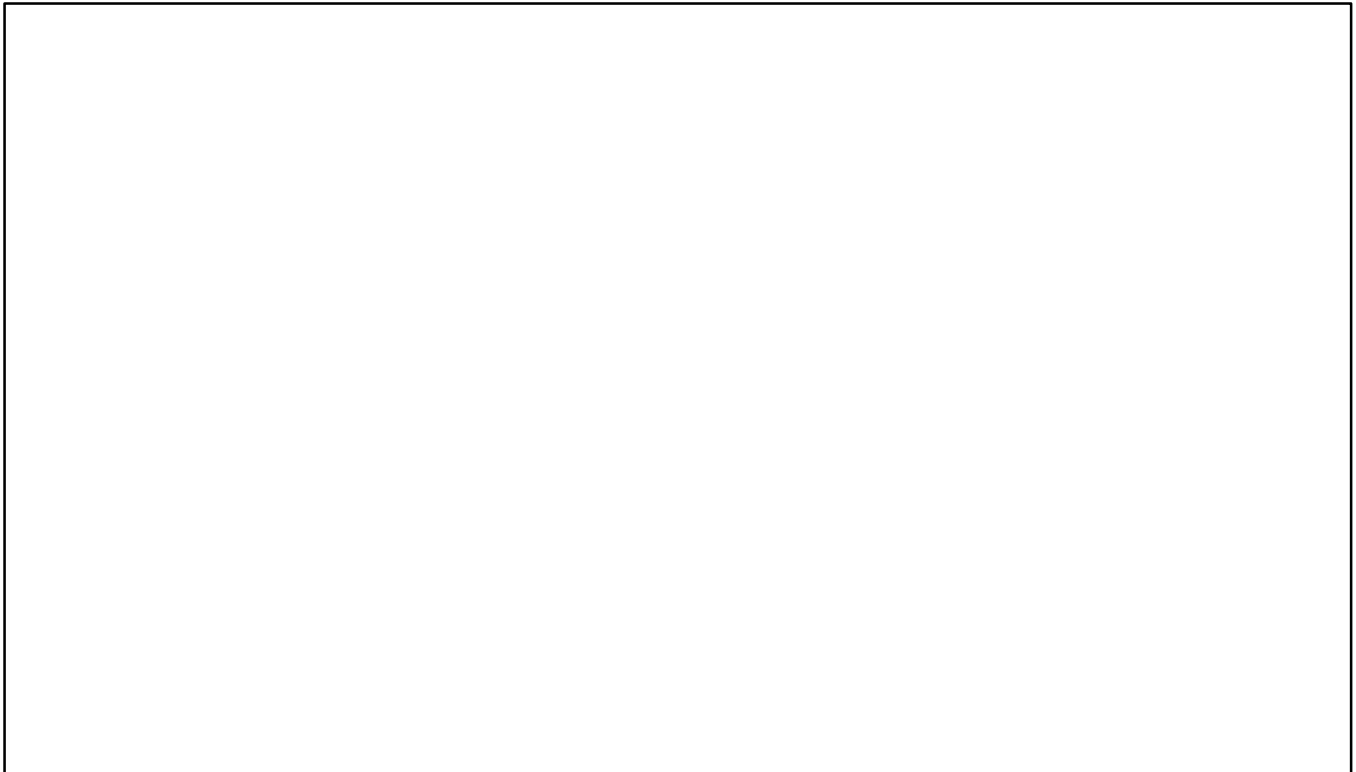


Figure 2-1. Study area, roadway functional classifications and Highlands Elementary boundary

~~Neighborhood~~ The neighborhood roadways are functionally classified as local ~~streets~~, collector ~~roads~~ or minor arterial ~~roads~~ streets. Local streets are low-speed, low-volume ~~roads~~ roadways that provide access to residences; collector ~~roads~~ streets are low-speed, low-to-moderate-volume ~~roads~~ roadways that move traffic from local streets to arterial ~~roads~~ streets; minor arterial ~~roads~~ streets are low-to-moderate-speed, moderate-volume ~~roads~~ roadways that move traffic from collector ~~roads~~ streets to major arterial ~~roads~~. ~~All local streets, collector roads and minor arterial roads streets.~~ All roadways in the neighborhood have front-on housing.

~~The~~ only neighborhood minor arterial street is Bogus Basin Road. It has a posted speed limit of 30

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mph, with one travel lane in each direction and bike lanes from Curling Drive to Hill Road. From

Curling Drive to north of Parkhill Drive, on-street parking is allowed on both sides of the street and sidewalk is located on the west side. South of Parkhill Drive, on-street parking is prohibited and sidewalk is continuous on both sides of the street ~~and on-street parking is prohibited.~~

The neighborhood collector ~~roads~~streets have one travel lane in each direction and on-street parking on both sides. With the exception of Highland View Drive, all of the collector streets have sidewalk ~~facilities~~on both sides. None of the collector streets in the neighborhood have designated bike lanes. The collector ~~roads~~streets and posted speed limits (20 mph statutory speed limit if not posted) are:

- Curling Drive – from Bogus Basin Road to Braemere Road (25 mph, with 20 mph school zone)
- Upper Braemere Road – from Curling Drive to Keldoon Avenue (25 mph, with 20 mph from Curling Drive to 300 north of Crane Creek clubhouse driveway)
- Highland View Drive – from Parkhill Drive to Lower Braemere Road (25 mph)
- Highland View Drive – from Lower Braemere Road to Selkirk Drive (2520 mph)
- Parkhill Drive – from Bogus Basin Road to Highland View Drive/15th Street (20 mph statutory)
- 15th Street – from Parkhill Drive to Hill Road (30 mph)
- Hill Road – from Bogus Basin Road to 15th Street (30 mph)

~~Local streets compose the~~The remainder of the neighborhood roadways are local streets with one travel lane in each direction and on-street parking on both sides. None of the local streets have designated bike lanes. Upper Braemere Road ~~from northeast of~~ Keldoon Avenue ~~to its end, and~~ Curling Drive ~~from southeast of~~ Braemere Road ~~to its end, and Highland View Drive from Selkirk Drive to its end all have a~~have posted speed ~~limit~~limits of 25 mph. The rest of the local streets have ~~a speed limit of 20 mph (posted or statutory),~~speed limits of 20 mph. Lower Braemere Road is the only roadway in the neighborhood with speed humps.

The upper Highlands ~~residential area~~neighborhood serviced by Upper Braemere Road has sidewalk on both sides of all roadways, including Curling Drive between ~~Upper~~ Braemere Road and Bogus Basin Road. ~~For the~~The remaining lower Highlands ~~residential area, which includes~~neighborhood, including Curling Drive ~~east~~southeast of ~~Upper~~ Braemere Road, no ~~sidewalks exist~~sidewalk exists, with ~~a few~~the exceptions: of on portions of Parkhill Drive and all on

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portions of the newer residential roadways ~~south~~off of Parkhill Drive and off of 15th Street to the southwest.

Highlands Elementary School, located on Curling Drive between Bogus Basin Road and Braemere Road, serves the entire Highlands neighborhood study area described above, plus residences on Cartwright Road and Bogus Basin Road. The school has an enrollment of approximately 350 students. Crane Creek Country Club, located on ~~Curling Drive and~~ Upper Braemere Road, is ~~a member~~ members-only, year- round recreational facility with an 18-hole golf course, clubhouse and other amenities.

2.2 ~~2.2~~ Vehicle Volumes Before Mitigation Measures

Average weekday traffic volumes on the key neighborhood roadways ~~—~~collected before ~~the diverter and all-way stop control~~ mitigation ~~was~~measures were installed – are shown in Figure 2-2. ~~Note that the~~The volumes shown are weekday averages for the traffic counts taken, excluding holidays and ~~early~~ school early-release days. ~~Daily~~Individual weekday counts varied by up to ~~plus~~ ~~or minus~~ 12 percent from the weekday ~~average~~averages.

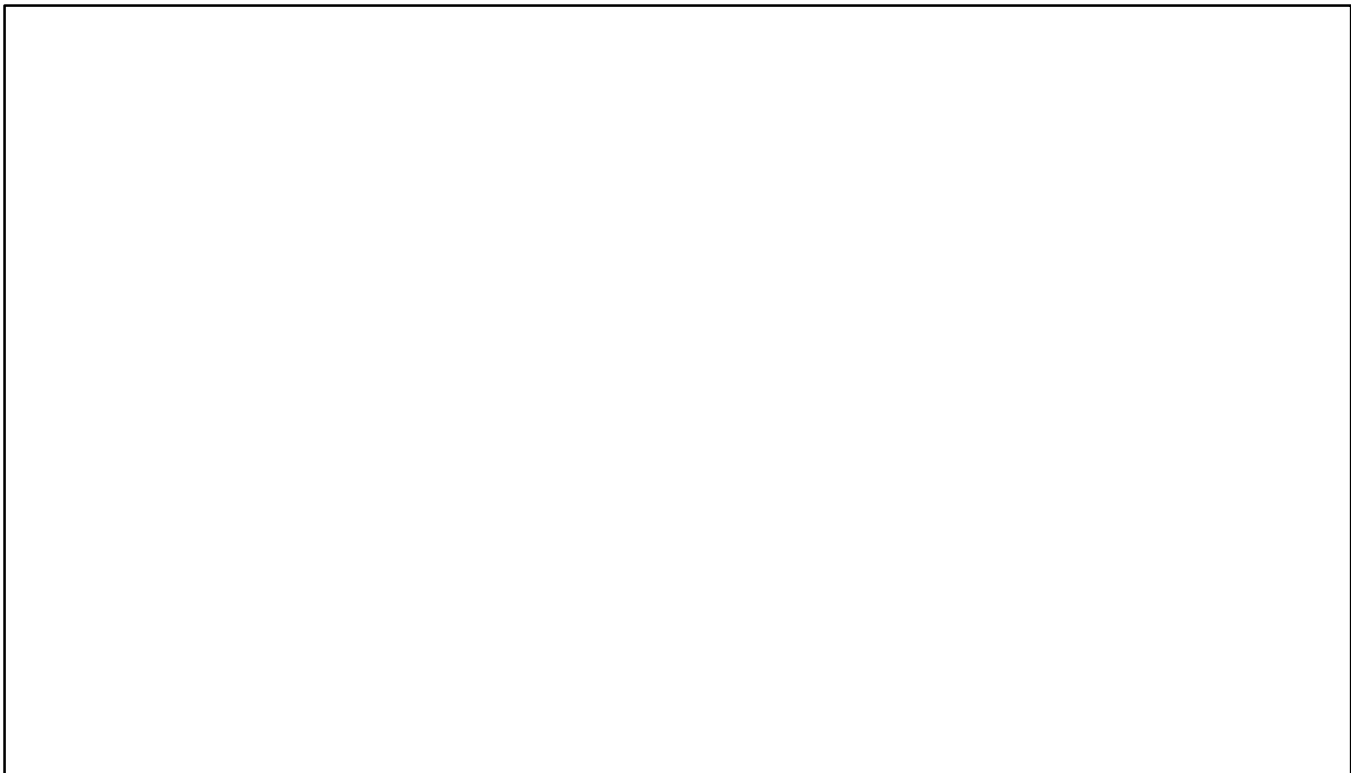


Figure 2-2. Vehicle volumes before mitigation measures

None of the neighborhood local or collector streets ~~or collectors~~ exceed ACHD’s planning-level capacity thresholds of 2,000 vehicles per day (vpd) for local streets and 5,000 vpd for

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~~collectors~~ collector streets. Also, none of the neighborhood ~~collectors~~ collector or minor ~~arterials~~ arterial streets exceed ACHD's peak-hour level of service (~~LOS~~) thresholds of 425 vehicles per hour (vph) for two-lane ~~collectors~~ collector streets and 550 vph for two-lane minor ~~arterials~~ arterial streets.

2.3 ~~2.3~~ **Vehicle Speeds Before Mitigation Measures**

Vehicle speeds at key locations ~~was~~were collected before the diverter and all-way stop control mitigation ~~was~~were installed ~~are~~ are shown in Figure 2-3. Speed measurements were collected for an average of seven days, during a week when school was in session and without adverse weather conditions. ~~The~~Each ~~measured speed reported in the figure is the~~ 85th percentile speed ~~is reported~~, which is the speed that 85 percent of traffic does not exceed. It is used as the starting point for determining speed limits before adjustments are made to account for safety factors. The ~~locations where the~~ actual speed ~~measurements were taken~~measurement locations are indicated by the measured speed values shown in ~~Figure 2-3.~~the figure.

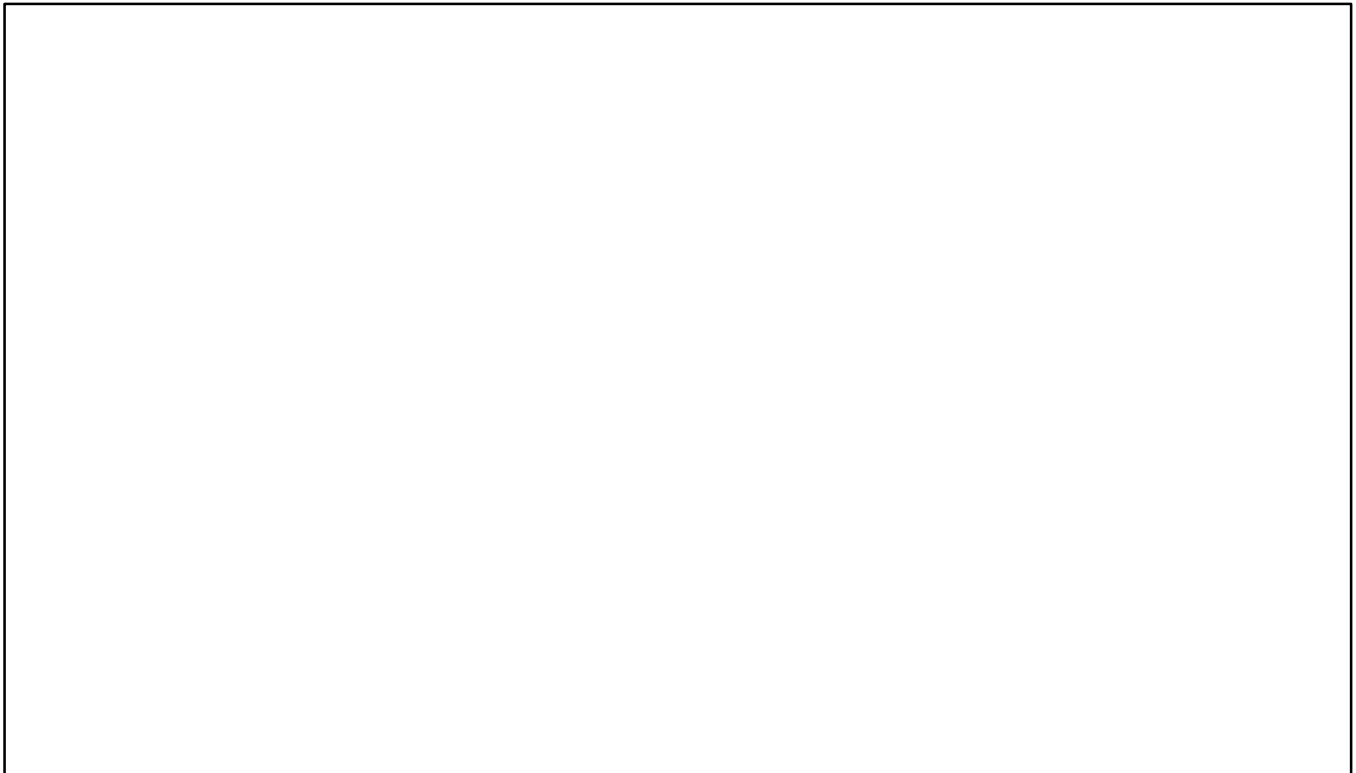


Figure 2-3. 85th percentile speeds before mitigation measures

The 85th percentile speeds on Upper Braemere Road, ~~Lower Braemere Road~~ and Curling Drive ~~exceed the~~exceeded their respective posted speed ~~limit, with Upper Braemere Road and Curling Drive speeds exceeding the speed limit~~limits by 5 mph or more. In general, downhill speeds were 2 to 3 mph faster than uphill speeds.

On Curling Drive near Highlands Elementary, the posted speed limit is 20 mph during the school-~~AM~~ arrival and ~~PM~~ release times. At all other times the posted speed limit is 25 mph. During

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non- school zone periods, the 85th percentile speed ~~is~~was 31 mph, ~~exceeding~~which exceeded the posted speed limit by 6

mph. During both ~~AM and PM~~ school arrival and release times, the 85th percentile speeds ~~exceed~~ is were 24 mph, ~~exceed~~ which exceeded the school ~~speed~~ zone limit by 4 mph.

Speed counts ~~were not collected~~ on Highland View at Argyll Drive were collected prior to the mitigation installation; ~~however, ACHD documentation shows that residents have voiced concerns over excessive speeds~~ an 85th percentile speed of 30 mph, exceeding the 20 mph posted by 10 mph.

On Lower Braemere Road, with the speed humps installed in 1992, the 85th percentile speed was 23 mph, which exceeded the posted ~~20 mph~~ speed limit by 3 mph.

2.4 ~~2.4~~ **Crash History**

The most recent five-year history of reported crashes available ~~is was~~ from 2011 to ~~2015~~ 2015 (Figure 2-4). During that period, 48 crashes were reported in the Highlands neighborhood, with 25 injury crashes and no fatalities (~~Figure 2-4~~). There were no discernible trends in high crash frequency locations or contributing factors for crashes. Only one ~~reported~~ crash ~~had~~ report in the Highlands neighborhood listed excessive speeding as a contributing factor.



Figure 2-4. Reported crashes from 2011 to 2015

2.5 ~~2.5~~ **Safety Issues**

2.5.1 ~~2.5.1~~ **Cut-Through Traffic**

Cut-through traffic in a residential neighborhood is defined as vehicle trips, excluding exceptions for neighborhood school traffic as noted below, traveling on a street that do not originate from residents of that street or from residents in the neighborhood connected by streets that are functionally classified as local streets. For example, vehicle trips from residents of upper Curling Drive (local street) traveling on Cashmere Road and Whidden Street (local streets) to Highland View Drive (collector street) are not cut-through traffic on Whidden Street or Cashmere Road because they are functionally classified as local streets. However, vehicle trips from residents of Balmoral Road (local street) traveling to Upper Braemere Road (collector street), then to Lower Braemere Road (local street) and Highland View Drive (collector street) are defined as cut-through traffic on Lower Braemere Road because traffic travels from a collector street (Upper Braemere Road), to a local street (Lower Braemere Road) and back to a collector street (Highland View Drive).

Vehicle trips to and from Highlands Elementary School for residents of the Highlands neighborhood are not considered cut-through traffic. However, school trips that originate and end outside of the Highlands neighborhood that travel to or from the school on a local street in the Highlands neighborhood would be considered cut-through traffic on that local street.

The volume of cut-through traffic prior to mitigation was estimated using traffic counts and trip generation and distribution methods used for traffic impact studies. ACHD's threshold requirements for cut-through traffic mitigation on local streets are listed in the ACHD's Policy Manual, Section 5104.2.4, *Thresholds for Local Residential Streets*. Before the diverter installation, the only street to exceed the threshold requirements for cut-through traffic mitigation in the Highlands neighborhood ~~is~~was Lower Braemere Road.

On Lower Braemere Road, the estimated cut-through traffic is ~~shown in Figure 2-5~~shown in Figure 2-5 on page 13. ~~During~~Based on traffic counts, the average weekday, traffic volume on Lower Braemere Road was ~~counted at~~ approximately 1,350 vpd. At the count location, approximately, 270 vpd are estimated to be non-cut-through trips, resulting in the estimated cut-through traffic of approximately 1,080 vpd, or 80 percent of the daily traffic.

Non-cut-through traffic on Lower Braemere Road was estimated by ~~using~~ distributing 95 percent of trips routed south on Lower Braemere and 5 percent north to and from Highlands Elementary,

Crane Creek Country Club, destinations on Bogus Basin Road, and a few trips to residences in the upper Highlands. Eastbound cut-through traffic on Lower Braemere Road is slight higher than westbound, which is consistent with the directional average weekday traffic where eastbound volumes are over 10 percent higher than westbound.

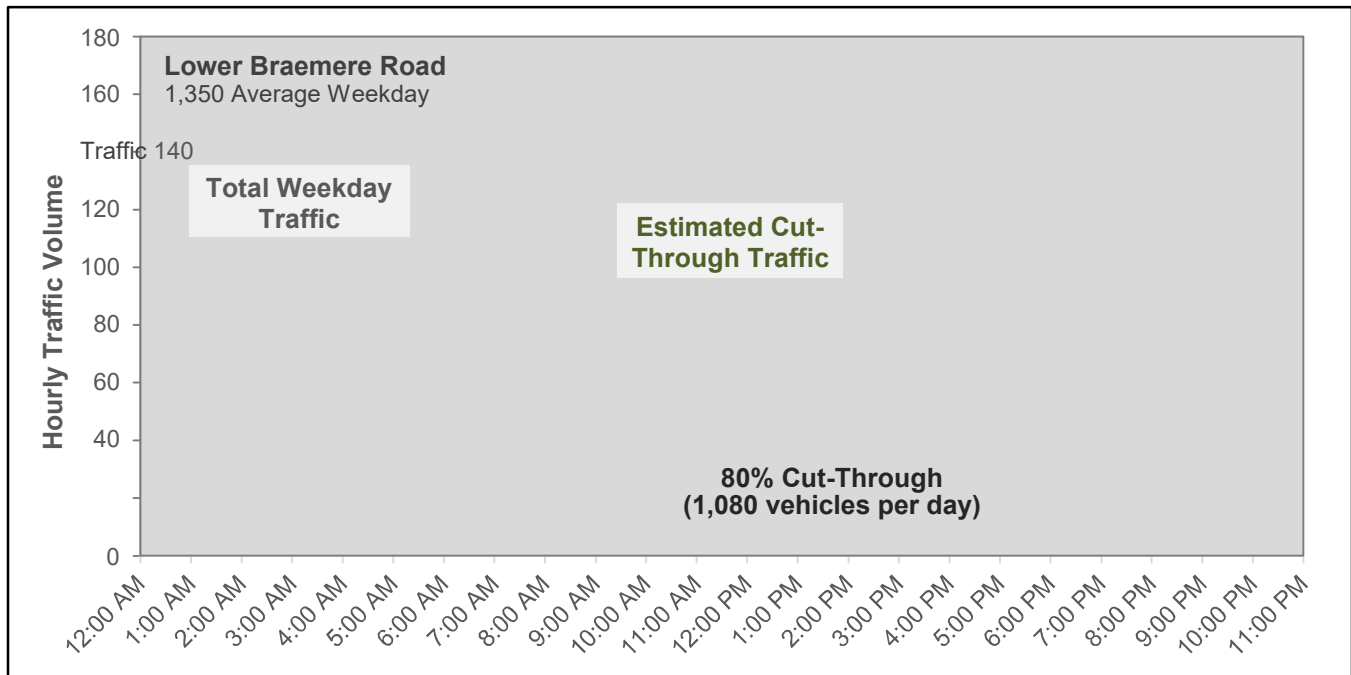


Figure 2-5. Estimated cut-through traffic on Lower Braemere Road before mitigation

With the traffic circulation pattern before implementation of the mitigation measures, Lower Braemere Road was operating as a collector street rather than a local street.

Measured at approximately 27 feet ~~from lip to lip~~ of pavement, the street's cross-section is narrower than other ~~collectors~~ collector streets in the neighborhood (Figure 2-6).

Assuming that vehicles are parked adjacent to each other on opposite sides of the street, the remaining roadway width would only accommodate a single travel lane, with little buffer distance from the parked vehicles. As

a result, yielding would be necessary for opposing vehicles to pass between parked cars, causing



Figure

encroachment into the pedestrian travel way near the roadway edge. Without sidewalks, pedestrian exposure is increased, making them more than twice as likely to be struck by a vehicle than if sidewalks were present on both sides of the street (*FHWA Investigation of Exposure-Based Pedestrian Accident Areas: Crosswalks, Sidewalks, Local Streets, and Major Arterials, 1987*).

Increased traffic on Lower Braemere Road due to the cut-through vehicles increases the potential for pedestrian-vehicle conflicts, as well as vehicle-vehicle crashes.

2.5.2 ~~2.5.2~~ Excessive Speeds

Speeding in neighborhoods increases the potential for crashes and crash severity, with the likelihood of injury increasing as speeds increases. Backing out of driveways on roadways with speeding traffic is more difficult and dangerous. Both Upper Braemere Road and Highland View Drive have front-on housing, requiring many residents to back out. In addition, pedestrians are particularly vulnerable, with serious injuries and fatalities increasing with increased speeds.

On Upper Braemere Road between Curling Drive and Keldoon Drive, the 85th percentile speeds were 7 to 10 mph over the posted speed limits. ~~Near the Crane Creek clubhouse driveway and golf cart crossing, the 85th percentile speed for westbound traffic was 35 mph which is 15 mph over the 20 mph posted speed limit at that location. A~~ The steep grade is likely a contributing factor to excessive speeds ~~is the steep grade~~ on Upper Braemere Road (Figure 2-7).



Figure 2-7. Upper Braemere Road cross section and grades

~~Speed counts on~~ On Highland View east of Argyll Drive ~~prior to the mitigation were not available~~

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for this study, but speeding issues have been identified by ACHD and Highlands residents. Highland View Drive has a similar roadway typology and, the 85th percentile speed was 30 mph, exceeding the 20 mph posted by 10 mph. It has a similar grade as Upper Braemere Road, so similar which is likely a contributing factor to excessive speeds may have occurred in the before condition on Highland View Drive (Figure 2-8).

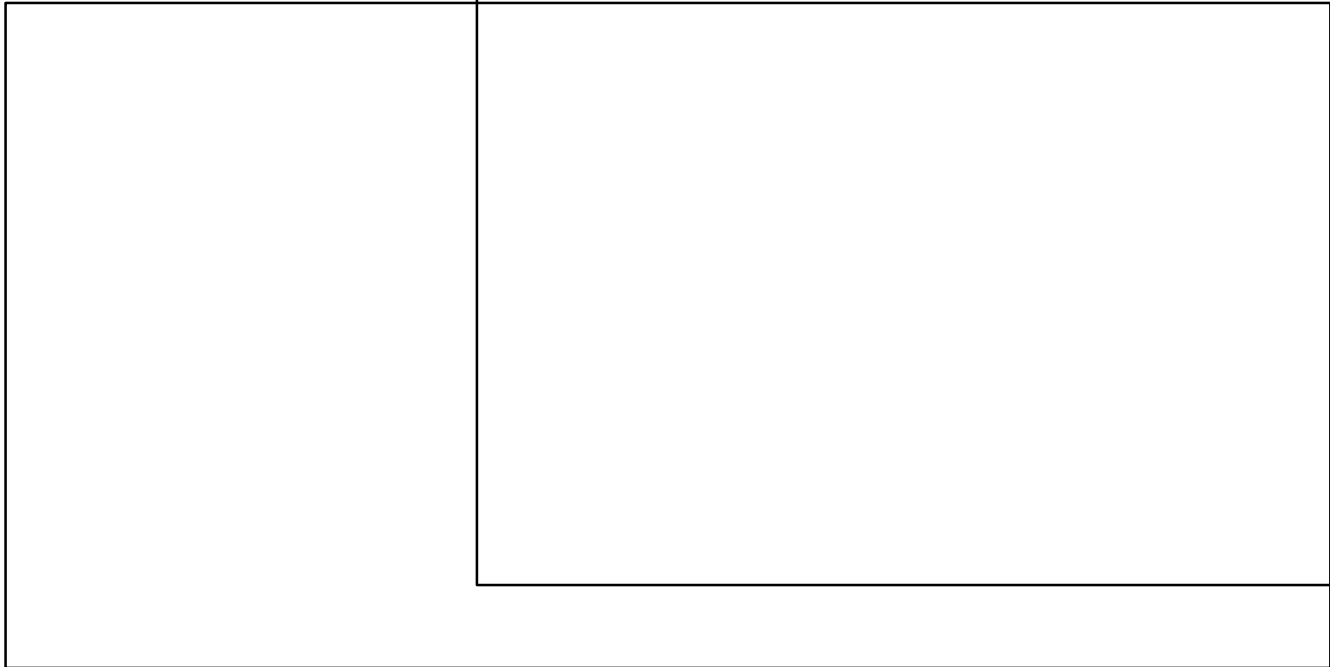


Figure 2-8. Highland View Drive cross section and grades

Despite ~~With~~ existing speed humps on Lower Braemere Road, the 85th percentile speeds were 23 mph, ~~exceeding~~ compared to the 20 mph posted speed limit. Westbound vehicle speeds are consistently higher than eastbound vehicle speeds. Excessive speeds – especially during peak pedestrian activity coinciding with the ~~elementary school~~ Highlands Elementary School arrival and release periods – increase the potential safety risk for pedestrians.

Chapter 3 Mitigation Measures

3.1 ~~3-1~~ Cut-Through Traffic Mitigation

3.1.1 ~~3.1.1~~ Lower Braemere Road Diverter at Curling Drive

To reduce the estimated 1,080 daily cut-through trips on Lower Braemere Road, ACHD considered several mitigation ideas at the Curling Drive and Braemere Road intersection and developed two alternatives (Figure 3-1). The alternatives were presented at the April 2016 public open house

meeting for consideration by residents who were also solicited for additional ideas to mitigate Lower Braemere Road cut-through traffic.

Alternative 1

Allow eastbound traffic only

Alternative 2

Allow westbound traffic only

Figure 3-1. Cut-through traffic mitigation measures developed by ACHD

Both of the ~~ACHD~~ alternatives eliminate one direction of travel on Lower Braemere Road at the Curling Drive intersection. Alternative 1 would have a smaller impact on altering neighborhood circulation, but would not reduce as much cut-through traffic as Alternative 2. Alternative 1 restricts westbound cut-through traffic but does not prohibit eastbound cut-through traffic, potentially reducing cut-through traffic by 45 to 50 percent, which equates to a 35 to 40 percent reduction in total traffic on Lower Braemere Road. Alternative 2 restricts eastbound traffic but allows westbound right-turns from Curling Drive to Lower Braemere Road, potentially reducing cut-through traffic by 85 to 90 percent, which equates to a 70 to 75 percent reduction in total traffic.

Completely eliminating cut-through traffic on Lower Braemere Road would require closing vehicle access to Lower Braemere Road from Curling Drive but would cut off important connectivity between the lower Highlands neighborhood and Highlands Elementary. Alternative 2 still allows one-way connectivity to ~~Highlands Elementary~~[the school](#) and would reduce the highest volume of cut-through traffic.

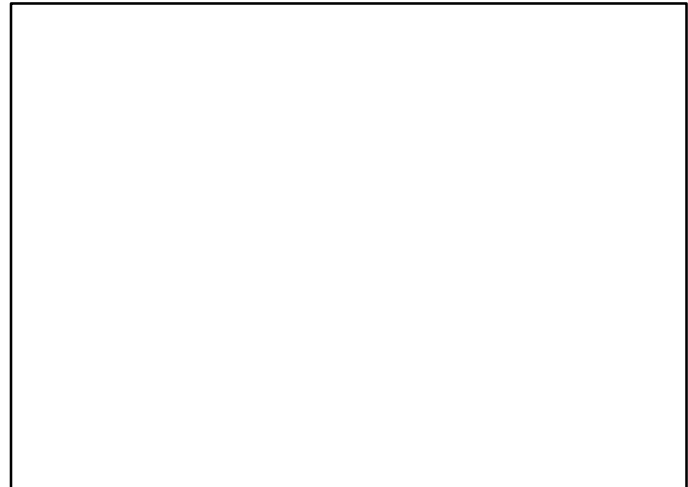
This alternative also encourages a better drop-off and pick-up pattern on the school side of Curling Drive, than Alternative 1. Alternative 1 encourages a drop-off and pick-up pattern on the opposite

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side of the school on Curling Drive, forcing school children to cross Curling Drive. Alternative 1 would also not reduce total traffic on Lower Braemere Road below 100 vehicles in the PM peak hour, which is one of ACHD's threshold requirements for cut-through traffic mitigation.

Alternative 2 was the better of the two alternatives when considering cut-through traffic reduction and school circulation.

ACHD installed Alternative 2 in August of 2016 prior to the start of the school year. Stop signs on Curling Drive were installed ~~plus additional signage on 15th Street, Bogus Basin Road, and Upper and Lower Braemere to notify motorists of the traffic pattern changes~~ in July 2016. The reduction to one southbound lane on Lower Braemere Road between Curling Drive and Ranch Road provided width to delineate a pedestrian pathway with channelizers (~~Figure 3-2~~ [Figure 3-2](#)).



Figure

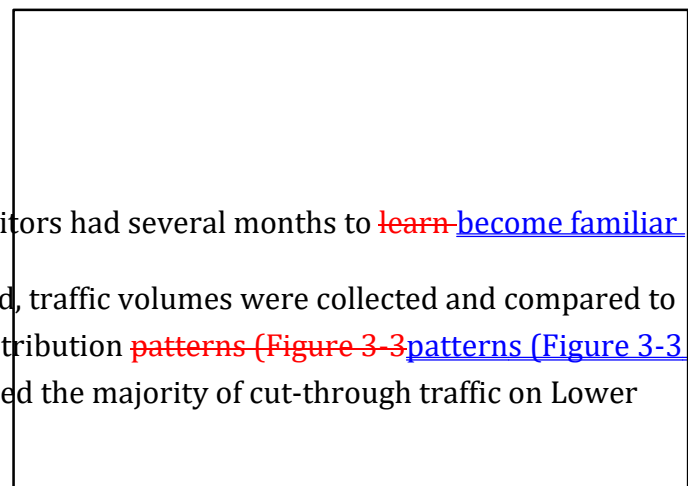
The stop sign installations on Curling Drive do not meet the MUTCD guidance for installation of all-way stop control based on vehicular traffic volumes. ACHD staff reports indicate the signs were installed to implement stop-controlled pedestrian crossings of Curling Drive. Using engineering judgment to make this decision to improve pedestrian safety is allowed by the MUTCD.

3.1.2 Diverter

Performance Traffic

Re-Distribution

After Highlands neighborhood residents and visitors had several months to ~~learn~~ become familiar with their new ~~route~~ routes through the neighborhood, traffic volumes were collected and compared to the before volumes to evaluate the traffic re-distribution ~~patterns (Figure 3-3)~~ patterns (Figure 3-3 on page 18). As expected, the diverter has reduced the majority of cut-through traffic on Lower Braemere Road by



Figure

approximately 930 vpd. Daily cut-through trips were reduced from an estimated 1,080 vpd to 150 vpd, for an 86% reduction in cut-through traffic.

The majority of the 930 ~~vehicles per day~~ vpd re-routed from Lower Braemere Road now travels on the collector segment of Curling Drive between ~~Upper~~ Braemere Road and Bogus Basin Road. On this segment ~~of Curling Drive~~, the before and after counts were not collected at the same location. ~~Before counts were obtained near~~ The before count location was near the Crane Creek parking lot and the after ~~counts were~~ count location was approximately 500 feet north, near the school pedestrian crossing. As a result, the increase in traffic volume on Curling Drive may be overestimated because the before count may be low by potentially not capturing some school drop-off and pick-up traffic originating and returning to locations outside the Highlands neighborhood.

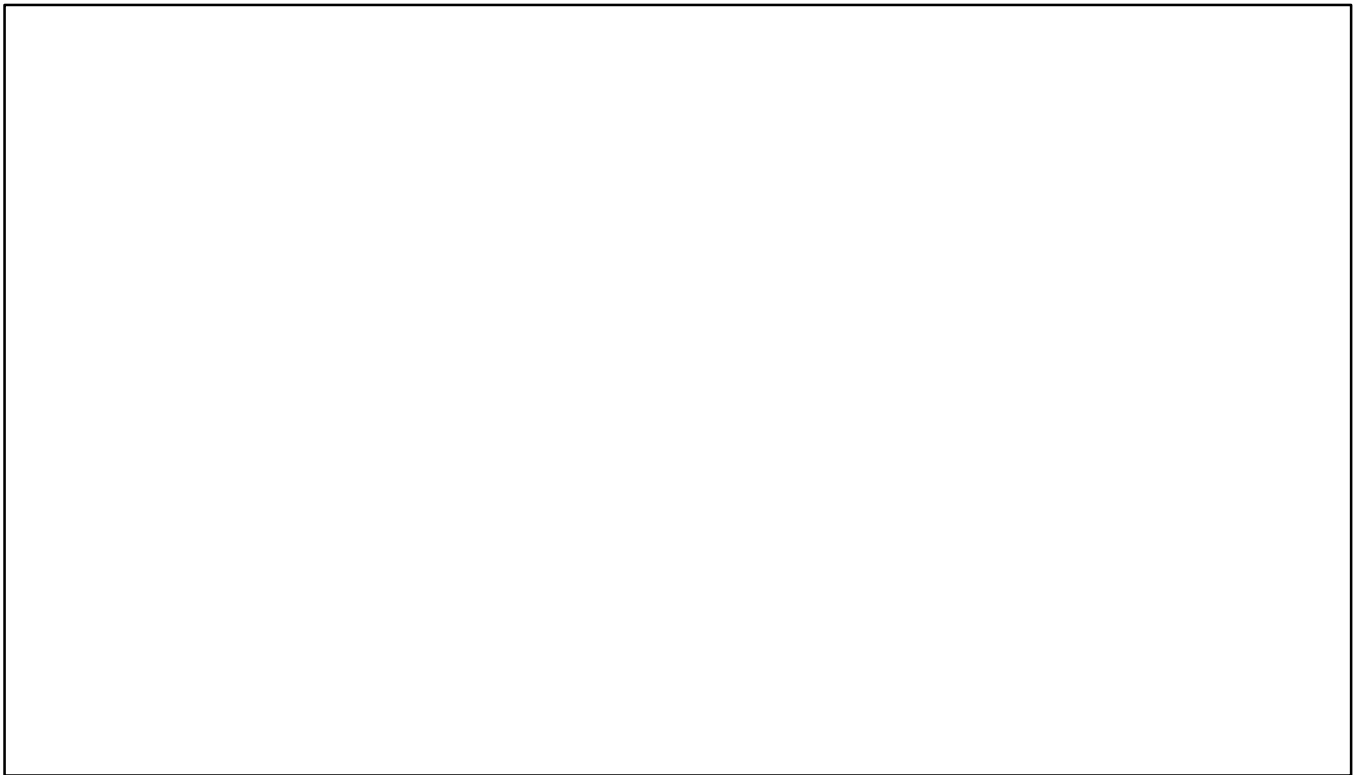


Figure 3-4.3. Average weekday volumes – before, after, difference and percent difference

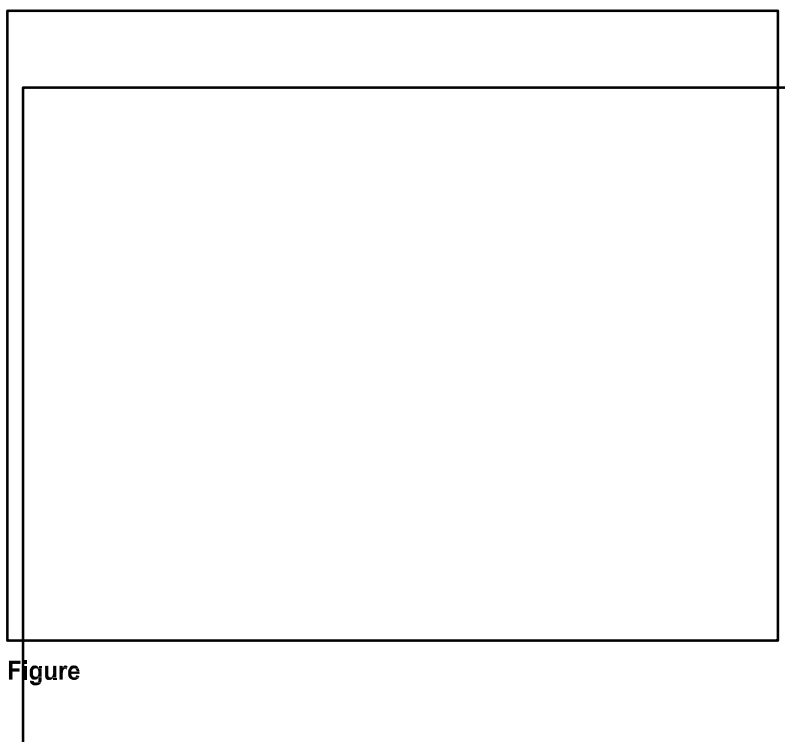
Traffic was reduced on Highland View Drive between Lower Braemere Road and Parkhill Drive by approximately the same amount as the traffic reduction on Lower Braemere Road. Small increases in re-routed traffic occurred on other local streets such as Whidden Street and Ranch Road, but were less than ~~60~~ 70 vehicles per day (a maximum of 10 additional vehicles in peak periods).

~~Some other local streets had a negligible increase or even decreased slightly such as Selkirk Drive and Tartan Place—see Appendix.~~

Traffic increased on several local streets in the Highlands neighborhood following the diverter installation. With a few exceptions, the traffic increase can be attributed to re-routing of cut-through traffic. However, even with the additional cut-through traffic, none of the local streets in the Highlands neighborhood exceed ACHD Policy Manual Section 5104.2.4 minimum thresholds for cut-through traffic mitigation.

Travel Time

The travel times during the three peak periods (AM peak hour/ school arrival, PM school release, and PM peak) were measured on the Lower Braemere Road route (~~pre-diverter~~cut-through route) and Bogus Basin Road route (~~post-diverter~~diverted route) as shown in **Error! Reference source not found**. On average, the Bogus Basin Road route ~~is 24, from the~~ Bramere Road and Curling Drive intersection to the 15th Street and Hill Road intersection, is approximately 40 seconds longer than the Lower Braemere Road cut-through route.



Figure

Figure

Intersection Delay

With the new traffic pattern, the average vehicle delays during the AM and PM peak hours increased by 10 seconds at the Bogus Basin Road and Hill Road/Harrison Boulevard intersection. Overall, the intersection is currently operating (after mitigation) with less than 35 seconds of average vehicle delay, (level of service C) which is ~~a LOS C~~ below the ACHD policy threshold of 55 seconds (level of service E).

At the Bogus Basin Road and Curling Drive intersection, before counts were not collected so a delay increase could not be calculated. However, it is currently operating with 11 seconds or less of average vehicle delay during the AM peak hour/school arrival and PM peak periods.

Intersection turning movement counts were not provided for the PM school release peak period;

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however, because delay was so minimal during the other peak periods and because the daily counts showed less traffic during PM school release than the other periods, a ~~re-count~~ recount of the PM school release period was not requested.

3.2 ~~3.2~~ Excessive Speed Mitigation

To reduce speeding on Upper Braemere Road and Highland View Drive, ACHD proposed several options to the Highlands residents (Figure 3-6 on page 21 residents (Figure 3-5)). The speed mitigation options for both roadways included radar speed signs, speed humps, and all-way stop control. On Upper Braemere Road, mitigation options also included chicanes and medians which physically narrow the roadway to reduce speeds.

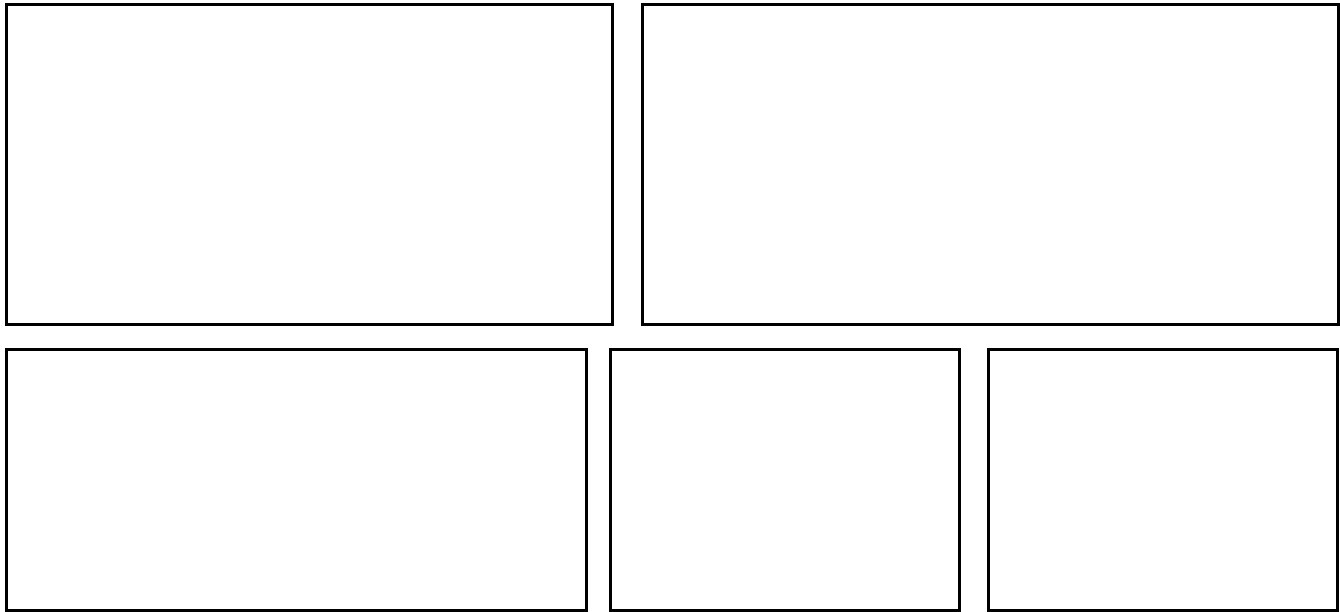


Figure 3-6.5. Speed mitigation measures evaluated by ACHD for Highlands Safety Plan

ACHD evaluated the speed mitigation options and recommended installing stop signs on both Upper Braemere Road and Highland View Drive, plus alternating the radar speed sign annually between both roadways. ~~They eliminated the other mitigation options—speed humps were unsupported, chicanes on Upper Braemere Road were hard to retrofit and reduced parking—and deferred installing medians on Upper Braemere Road to see if the all-way stop mitigation was effective.~~

3.2.1 ~~3.2.1~~ Stop Sign Installations

In July 2016, stop signs were installed on Curling Drive at the Braemere Road intersection, on Upper Braemere Road at the Balmoral Road and Harcourt Road/Chardie Road intersections, and on Highland View Drive at the Whidden Street and Selkirk Drive intersections (Figure 3-7 Figure 3-6 on page 22 21). A secondary potential benefit of the stop sign installations is that they provide pedestrian crossing opportunities across the collector streets.



Figure 3-7.6. New all-way stop intersections

3.2.2 ~~3.2.2~~ Stop Sign

Performance Speed Mitigation

The 85th percentile speeds after the stop sign mitigation was installed are shown in ~~Figure 3-8~~Figure 3-7 on page ~~21.22~~. The locations where the actual speed measurements were taken are indicated by the speed values shown in the figure.

On Upper Braemere Road, the 85th percentile speed decreased by 3 mph to 31 mph between Hearthstone Drive and Balmoral Drive. ~~East~~West of Keldoan Avenue, a 2 mph decrease was calculated. However, the after counter was located within 50 to 100 feet of the intersection and may have captured vehicles slowing to turn to and from Keldoan Avenue, so the before and after results are not comparable. On the steep 20 mph ~~(posted speed)~~ segment north of Curling Drive, the measured 85th percentile speed was 31 mph, or 11 mph over the limit. ~~The~~No before speed data was ~~not~~ collected at that location. A second speed study using a radar gun instead of tubes measured an 85th percentile speed of 29 mph in the 20 mph segment.

On Highland View Drive, ~~the after 85th percentile speed was 30 mph~~ east of Argyll Drive ~~—before~~

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~~speed counts were not collected to determine if a reduction occurred. The Lower Braemere Road 85th percentile speed~~ the before 85th percentile speed was 31 mph and the after was 30 mph, but the locations are too far from the Whidden Street stop signs to attribute to stop sign traffic calming. The 85th percentile speed on Lower Braemere Road was reduced by 1 mph to 22 mph. On the local street section of Curling Drive east of Braemere Road, the 85th percentile speed decreased by 4 mph to 30 mph.

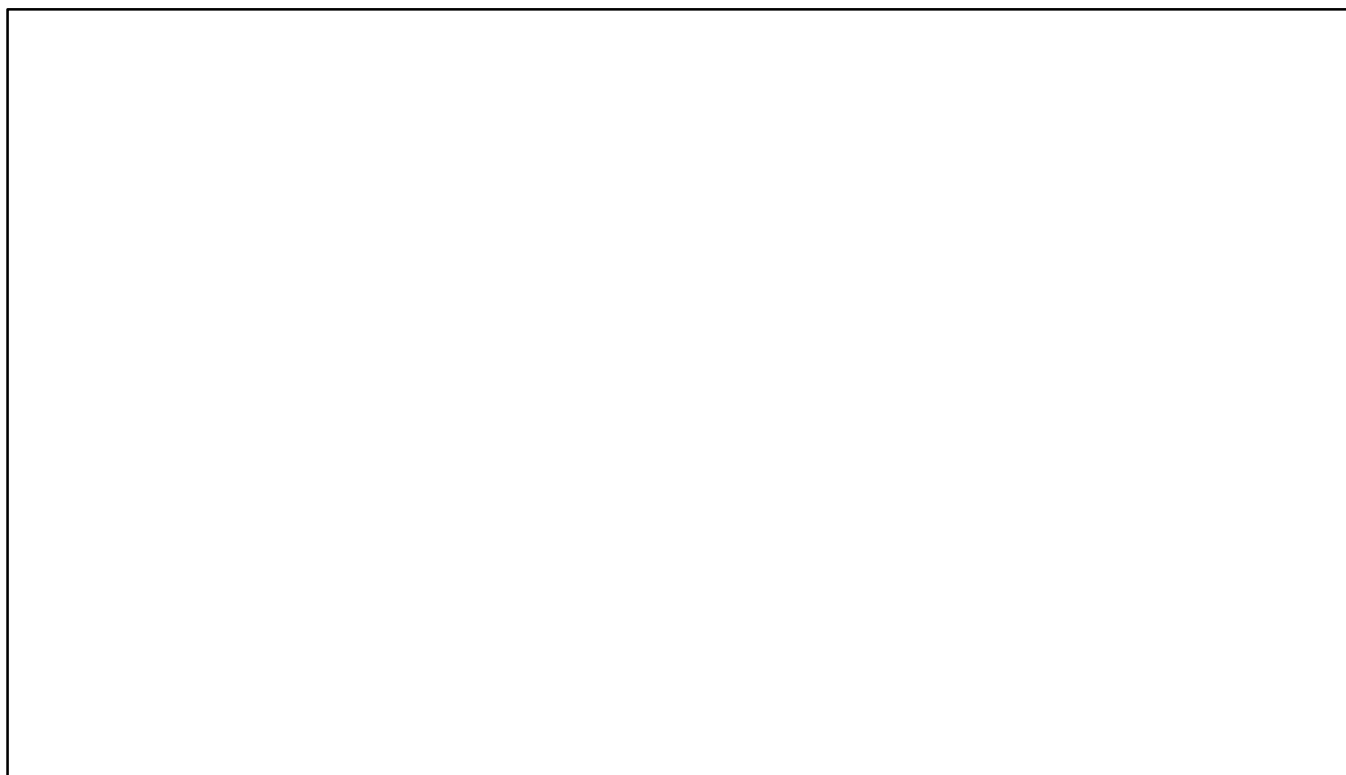


Figure 3-8.7. 85th percentile speeds after stop sign mitigation

At Curling Drive between Braemere Road and Bogus Basin Road, the AM and PM school zone speeds are not reported because the counters proximity to the pedestrian school crossing and school driveway resulted in ~~erroneous~~ misleading readings due to stop-and-go school traffic. The school zone data was removed from the remaining speed count data. For the non-school-zone hours, the 85th percentile speed decreased by 2 mph to 29 mph.

At the four new all-way stop locations on Upper Braemere Road and Highland View Drive, few pedestrians were observed crossing the major roadway during the ~~AM and PM~~ school AM arrival and PM release periods. No collector street pedestrian crossings were observed in the AM period. In the PM period, two intersections had no pedestrian crossings, one intersection had two crossings, and one had three crossings.



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Driver Compliance

Driver compliance at the five new all-way stop locations was observed during the school AM arrival and PM school-release-peak periods. A driver is considered compliant when they come to a complete stop or are forced to stop due to stopping or slowing of the leading vehicle or to stop to a pedestrian or bicyclist. A driver is considered non-compliant when they do not come to complete rest and either perform a slow rolling stop or a non-stop (slowing may or may not occur). The following summarizes the compliance results:

- Upper Braemere Road and Balmoral Road—
 - 46 percent compliant,
 - 54 percent non-compliant (42 percent rolling stop, 12 percent non-stop)
- Upper Braemere Road and Harcourt Road/Chardie Road—
 - 25 percent compliant,
 - 75 percent non-compliant (56 percent rolling stop, 19 percent non-stop)
- Highland View Drive and Selkirk Drive—
 - 39 percent compliant,
 - 61 percent non-compliant (43 percent rolling stop, 18 percent non-stop)
- Highland View Drive and Whidden Street—
 - 58 percent compliant,
 - 42 percent non-compliant (33 percent rolling stop, 9 percent non-stop)
- Curling Drive and Braemere Road—
 - 57 percent compliant,
 - 43 percent non-compliant (38 percent rolling stop, 5 percent non-stop)

Chapter 4 Findings ~~and Recommendations~~

4.1 ~~4.1~~ Lower Braemere Diverter at Curling

4.1.1 ~~4.1.1~~ Why is cut-through traffic mitigation needed on Lower Braemere Road?

Lower Braemere Road has been a route for cut-through traffic in the Highlands neighborhood for over 25 years, with drivers using the residential street as a shortcut to downtown Boise. Prior to installation of the traffic diverter at the Curling Drive intersection, it was the only street in the Highlands neighborhood to meet ACHD's Policy Manual Section 5104.2.4 minimum threshold requirements for cut-through traffic mitigation. Functionally classified as a local street, it received

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traffic from three collector streets in the neighborhood: Upper Braemere Road, Curling Drive and Highland View Drive. The average weekday traffic volume on Lower Braemere Road before ~~the~~ diverter installation was 1,350 vpd, with cut-through traffic estimated to be 80 percent of the total traffic, or approximately 1,080 vpd.

The primary concern with cut-through traffic on Lower Braemere Road is pedestrian safety. Although the residential street has no sidewalk, it is designated as a walking route for Highlands Elementary on the Boise School District's *Safe Routes to Schools* map for the school. The street cross-section is narrow, measured at approximately 27 feet in width, with parking on both sides. When parked cars are present, vehicles must encroach into the parking area – which is a shared space for pedestrians – in order to yield to or concurrently pass oncoming drivers Although there have been no reported pedestrian-vehicle crashes on Lower Braemere Road from 2011 to 2015, there is the increased potential of pedestrian-vehicle conflicts on this street because it is narrow, ~~it~~ has no sidewalks, ~~it~~ is a designated elementary school safe walking route, and ~~it~~ has a relatively high volume of cut-through traffic.

4.1.2 ~~4.1.2~~ Is the diverter an appropriate mitigation measure for the cut-through traffic?

The traffic diverter was developed in accordance with ACHD Policy Manual Section 5104.2.3 for cut-through traffic mitigation. ACHD worked with the residents to develop options to reduce the volume of cut-through traffic on Lower Braemere Road. Two of those options were presented at a public open house meeting in April 2016. After receiving public comment, ACHD elected to install Alternative 2 presented at the meeting. For an estimated cost of \$2,000, channelizers and signing were installed to prohibit all traffic on Lower Braemere Road at the Curling Drive intersection except for right-turning traffic from Curling Drive to Lower Braemere Road.

~~To reduce~~ The diverter improved pedestrian safety by reducing the potential pedestrian-vehicle conflicts, ~~sidewalk could be added, the roadway could be widened by reducing the number of vehicles on Lower Braemere Road.~~ Other options that would improve pedestrian safety include adding sidewalk to one or both sides of the street and widening the roadway to collector street standards ~~or measures could be implemented to reduce cut-through traffic.~~ Adding However, adding sidewalk to Lower Braemere Road ~~to improve safety~~ would be expensive. In 2011, ACHD estimated the project cost to construct sidewalk on just one side of the street at \$755,000, without widening the street. With widening, it would be even more expensive. ACHD's current standard width for a residential collector street is 40 feet from curb to curb, with sidewalks on both sides of the street. The cost and property impacts required to upgrade the street to meet current ~~residential collector~~ standards would be difficult to justify with the relatively low traffic volume.

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~~In coordination with the residents, two options were presented at a public open house meeting in April 2016 to reduce cut-through traffic on Lower Braemere Road. After receiving public comment, ACHD elected to install Alternative 2 presented at the meeting. For an estimated cost of \$15,000, channelizers and signing were installed to prohibit traffic traveling on Upper Braemere Road from continuing to Lower Braemere Road, prohibiting traffic on Lower Braemere Road from accessing Curling Drive, and limiting access to right-turn traffic from Curling Drive to Lower Braemere Road.~~

4.1.3 ~~4.1.3~~ **Did the diverter work as intended?**

The diverter worked as intended, reducing cut-through traffic on Lower Braemere Road by approximately 930 vpd, from 1,350 to 420 vpd, a reduction of nearly 70 percent. Traffic was also reduced by a similar amount on Highland View Drive, ~~from~~between Lower Braemere Road to Parkhill Drive.

4.1.4 ~~4.1.4~~ **Did the diverter negatively impact traffic on other streets in the neighborhood?**

Diverting traffic from Lower Braemere Road increased the traffic volume on the following streets in the neighborhood:

- Curling Drive, southeast of Braemere Road (local street)
- Whidden Street (local street)
- Cashmere Road (local street)
- Ranch Road (local street)
- Curling Drive, between Braemere Road and Bogus Basin Road (collector street)
- Parkhill Drive, between 15th Street and Bogus Basin Road (collector street)
- Bogus Basin Road (minor arterial street)

On **Curling Drive, southeast of Braemere Road**, the traffic volume increased from approximately 540 vpd before the diverter installation to ~~700~~610 vpd after, an increase of approximately ~~160~~70 vpd. A significant portion of this increase is attributed to cut-through traffic to and from Highland View to Whidden Street and Cashmere Road.

Traffic volumes on **Whidden Street** ~~and Cashmere Road~~ increased from approximately 440 vpd to 490 vpd, an increase of approximately 50 vpd. ~~With the additional traffic after the diverter installation, Whidden Street, Cashmere Road and Curling Drive, southeast of Braemere Road, exceed ACHD's minimum thresholds for cut-through traffic~~

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~~mitigation~~ After counts were not available on Cashmere Road to determine the change in traffic volumes.

On **Ranch Road**, the traffic volume increased by approximately ~~50 vehicles per day~~ 70 vpd after installation of the diverter, with the count taken between Tartan Place and Crane Creek Road. ~~The origin of this~~ This added traffic is estimated to be ~~from~~ residents of Ranch Road between Tartan Place and Lower Braemere Road that are re-routing so it is not considered to be cut-through traffic.

On **Curling Drive, between Braemere Road and Bogus Basin Road**, the average weekday traffic increased by ~~1,110~~ 1,060 vpd to approximately 3,480 vpd, an increase of approximately ~~4744~~ percent. ~~Up to~~ As much as 930 vpd of this increase ~~is potentially~~ may be due to the diverter, ~~with~~ while the remaining increase ~~potentially due~~ may be attributed to daily ~~or~~ and seasonal variations ~~or~~ and differences of the before and after counter locations.

This section of Curling Drive is 37 feet wide, has sidewalks and parking on both sides, and a pedestrian crossing in front of Highlands Elementary that is staffed with a crossing guard during ~~the student drop-off and pick-up periods.~~ The traffic impact from the diverter on Curling Drive near Highlands Elementary is increased congestion during school arrival and release times. The school does not appear to have a structured process for student drop-off and pick-up, and U-turns and wrong-direction parking were observed on Curling Drive. ~~Consequently, more,~~ all of which results in congestion ~~occurs~~ in front of the school, ~~resulting in~~ and increased queuing on Curling Drive and Bogus Basin Road.

School area The increase in traffic on Curling Drive near Highlands Elementary caused by the diverter worsens the congestion during school arrival and release. That congestion is further increased by traffic from other events that overlap the student drop-off and pick-up periods, such as recreation traffic on Bogus Basin Road to and from Bogus Basin ski area or traffic due to school events like basketball games.

Weekday ~~peak~~ ski traffic ~~is variable and unpredictable.~~ It is dependent on many factors like recent snowfall, road and weather conditions, and proximity to holidays, so its contribution to weekday peak hour volumes is unpredictable. However, average vehicle delays at the Bogus Basin Road and Curling Drive intersection are 11 seconds or less during peak hours (with the diverter) so the intersection currently has excess capacity to accommodate increased ski traffic surges ~~and~~. Therefore, when congestion occurs, it will be short-lived. Historic traffic counts on Bogus Basin Road north of Hill Road show that during weekdays and weekends there is no distinct morning

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ski peak, but there is a small late evening peak at the end of night skiing on all days, plus a late afternoon peak on

weekends. [A traffic count at the Bogus Basin Road and Curling Drive intersection, collected for a single weekday in February 2017, shows a peak 30-minute period of traffic heading north on Bogus Basin Road between 8:45 AM and 9:15 AM which lags the AM school commute.](#)

Parkhill Drive and Bogus Basin Road both experience increased traffic after installation of the diverter. However, as a collector street and minor arterial street, [respectively](#), both are functionally classified to accommodate this volume of traffic. Traffic counts on 15th Street (collector street) and Bogus Basin Road located near Hill Road show anomalies that are difficult to attribute to the diverter installation and are therefore disregarded in this review.

4.1.5 ~~4.1.5 Should the diverter be removed, altered or augmented to improve its function?~~ In?

[Based on](#) our [view evaluation](#), the diverter has improved safety for pedestrians on Lower Braemere Road by reducing ~~overall~~ traffic volumes to levels that are more appropriate for the roadway’s functional classification. By re-routing most of the cut-through traffic on Lower Braemere Road to Curling Drive, traffic from the upper Highlands neighborhood are driving the neighborhood’s roadways using the correct roadway hierarchy progression. Traffic is driving from local streets to collector streets (Upper Braemere Road and Curling Drive), [then to an](#) arterial ~~streets~~ [street](#) (Bogus Basin Road), instead of using a local street (Lower Braemere Road) to traverse ~~from collector to collector. Mitigation for the traffic impacts from the diverter installation should be considered on Curling Drive at Highlands Elementary, on Curling Drive, southeast of Braemere Road, and on Whidden Street and Cashmere Road between collector~~ [streets](#).

On **Curling Drive at Highlands Elementary School**, the school drop-off and pick-up congestion is an ~~operations~~ [operational](#) and safety concern that ACHD and the school should ~~mitigate~~ [address](#) regardless of whether the diverter is in place or not. By organizing a safe and efficient student drop-off and pick-up plan, conditions can be made safer for students while improving overall traffic conditions around the school. The plan should ~~establish strict operational requirements for vehicles, students and buses. For example, it could~~ designate student pick-up and drop-off zones and student waiting areas, vehicle loading protocol and waiting areas, and separate bus loading zones. ~~A well-designed plan could potentially be implemented with only minor pavement marking and signing changes instead of major changes to the school parking lot.~~

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Other improvements that should be considered for safety enhancements include:

- ~~-Construct curb bulb-outs that narrow the pedestrian crossing, thus slowing traffic and improving drivers' visibility of pedestrians.~~
- ~~-Install a pedestrian hybrid beacon (PHB) or rapid rectangular flashing beacon (RRFB) at the pedestrian crossing to improve driver awareness of potential pedestrian conflicts.~~

Traffic volumes on Curling Drive from Bogus Basin Road to Braemere Road after the diverter installation are within planning levels, and the estimated cut-through traffic volume does not exceed ACHD Policy Manual Section 5104.2.5 minimum thresholds for cut-through traffic mitigation on a collector street. However, with pedestrians walking to and from Highlands Elementary School and the increased vehicle congestion along the school frontage, ACHD should consider the following treatments to improve pedestrian safety:

- ~~• Move the No Parking zone farther away from the pedestrian crossing to improve drivers' visibility of pedestrians.~~Improve pedestrian crossing safety on Curling Drive at the school crosswalk by implementing crossing beacons, which was an improvement identified in the *Highlands Safety Plan*.
- ~~• Add a supplemental school zone flasher for southbound traffic on Curling Drive immediately south of Bogus Basin Road to remind motorists of the school zone (flashers are currently located on both Bogus Basin Road approaches).~~Improve pedestrian visibility at the school crosswalk by adding bulb-outs, similar to the bulb-outs on 15th Street at Washington Elementary School, and signing parking restrictions.
- ~~• Provide a designated U-turn location within the school property or as part of intersection treatments. For example, a mini-roundabout could be considered at the Braemere Road intersection to formally channelize the diverter, enhance safety as compared to an all-way stop intersection, and provide a facility for U-turns for passenger vehicles and school buses.~~Improve traffic flow by working with the school to improve the student pick-up and drop-off operations. For example, improvements could be considered to provide a designated area for student pick-up and drop-off for parents and for buses, similar to improvements constructed at Ustick Elementary, as part of the Cloverdale Road and Ustick Road intersection project, or constructed at Lowell Scott Middle School, as part of the Eagle Road and McMillan Road intersection project.

~~With traffic counts after the diverter installation, estimated cut-through traffic on **Curling Drive, southeast of Braemere Road, and on Whidden Street and Cashmere Road** exceed ACHD's minimum thresholds for cut-through traffic mitigation. We recommend that ACHD verify our estimates and if confirmed, follow ACHD Policy Manual Section 5104.2.3: Traffic increased on~~

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several local streets in the Highlands neighborhood following the diverter installation. With a few exceptions, such as Ranch Road, the traffic increases on local streets can be attributed to cut-through traffic. However, even with the additional cut-through traffic, none of the local streets in the Highlands neighborhood have traffic volumes that exceed ACHD Policy Manual Section 5104.2.4 minimum thresholds for cut-through traffic mitigation.

When the cut-through traffic threshold established in 5104.2.4 and 5104.2.5 is exceeded, ACHD will conduct a study to determine appropriate traffic calming measures, perform the design, conduct the public information process, fund the construction in accordance with available funds and priorities, administer the construction contract, and place all supplementary traffic controls

ACHD plans to install additional mitigation measures in 2017 that were identified in the *Highlands Safety Plan*, including delineating walking paths by adding pavement markings on several local streets and adding extruded curbing on Highland View Drive. Developers of the Highlands Cove subdivision are obligated to fund additional traffic calming measures as part of their development requirements. ACHD should consider monitoring traffic volumes and speeds on neighborhood streets as the subdivision approaches full build-out to assess the performance of all of the traffic calming mitigation measures working holistically. Particular attention should be paid to cut-through traffic on Whidden Street, Cashmere Road and Curling Drive southeast of Braemere Road, and excessive speeding on Upper Braemere Road, Highland View Drive and Curling Drive.

4.2 4.2 Stop Sign Installations

4.2.1 4.2.1 Why is mitigation Why are stop sign installations needed for speeding on Highlands neighborhood streets? The Boise School District's *Safe Routes to Schools* map for Highlands Elementary School shows a designated crosswalk across **Curling Drive** at the Braemere Road intersection. The painted crosswalk has been in place for several years. With the diverter installation, ACHD installed stop signs on Curling Drive to improve pedestrian safety at this crosswalk.

Excessive speeding on **Upper Braemere Road, and Highland View Drive and Curling Drive** were brought to ACHD's attention in 2015. ACHD conducted speed measurements ~~are verified~~ that confirmed the 85th percentile speeds exceeded the posted and statutory speed limits.

4.2.2 4.2.2 Are the stop sign installations an appropriate mitigation measure to reduce speed? Are the stop sign installations appropriate mitigation measures?

~~ACHD identified several potential traffic calming options and worked with the neighborhood to get their input. After gathering public input and further evaluating the options, ACHD approved~~

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~~the lowest-cost, easiest-to-implement option to install stop signs at the following locations:~~

- ~~-Curling Drive at the Braemere Road intersection~~
- ~~-Upper Braemere Road at the Harcourt Road/Chardie Road intersection~~
- ~~-Upper Braemere Road at the Balmoral Road intersection~~
- ~~-Highland View Drive at the Selkirk Drive intersection~~
- ~~-Highland View Drive at the Whidden Street intersection~~

The stop sign installations on **Curling Drive** at Braemere Road do not meet the MUTCD guidance for installation of all-way stop control based on vehicular traffic volumes. ACHD staff reports indicate the signs were installed to implement stop-controlled pedestrian crossings of Curling Drive. Using engineering judgment to make this decision to improve pedestrian safety is allowed by the MUTCD.

~~In addition to slowing speeds, a secondary potential benefit was that pedestrians would use the new all-way stop intersection to cross the collector street.~~

All-way stop control was one of several traffic calming measures presented at the *Highlands Safety Plan* public open house meeting to potentially reduce vehicle speeds on **Upper Braemere Road** and **Highland View Drive**. However, according to the current edition of the MUTCD, “stop signs should not be used for speed control.” We understand that ACHD uses all-way stop control for temporary traffic calming, but ACHD should consider other options for permanent traffic calming treatments.

4.2.3 4.2.3 Did the stop sign installations perform as intended?

~~On **Curling Drive**, the stops signs reduced 85th percentile speeds southeast of Braemere Road by 4 mph to 30 mph and between Braemere Road and Bogus Basin Road by 2 mph to 29 mph. The speed reduction suggests that stop control on Curling Drive has a positive traffic calming effect for vehicles within at least 1,500 feet of the Braemere Road intersection. Speeds on Curling Drive still exceed the 25 mph posted speed by 5-6 mph. On **Upper Braemere Road**, the only comparable before and after speed calculation was located between Hearthstone Drive and Balmoral Road, approximately 300 feet downhill from the Balmoral Road all-way stop. The 85th percentile speed in this 25 mph posted speed segment was reduced 3 mph from 34 mph to 31 mph. This result suggests that the all-way stop control at Balmoral Road has a positive traffic calming effect in the vicinity of the count location. It is unknown if slowing occurred in the uphill direction (towards Harcourt Road) and – if slowing did occur – how far along the roadway that the speeds were reduced.~~

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Speeds at the two count locations on Upper Braemere Road near Balmoral Road and Keldoon Avenue still exceed the 25 posted speed limit by 6 mph. Speeds at the steep segment between Curling Drive and the Crane Creek clubhouse ~~still~~ exceed the 20 mph posted speed by 9 to 11 mph.

During our field observations, 12 percent of drivers did not stop at the Balmoral Road intersection, and 19 percent of drivers did not stop at the Harcourt Road/Chardie Road intersection.

On **Highland View Drive**, speed measurements near the Whidden Street and Selkirk Drive intersections before the stop signs were installed were not available. As a result, ~~we~~it cannot ~~determine~~be determined if the stop signs reduced free flow speeds. ~~We~~The only ~~know~~determination that can be made is that slowing occurs in the immediate vicinity of the stop-controlled intersections. Speeds on Highland View Drive near the Argyll Drive intersection exceed the 25 mph posted speed by 5 mph.

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~~The all-way stop intersections were rarely used as collector street pedestrian crossings, with the exception of the Curling Drive and Braemere Road~~During our field observations, 18 percent of drivers did not stop at the Selkirk Drive intersection, and 9 percent of drivers did not stop at the Whidden Street intersection.

4.2.4 ~~4.2.4~~**Should the stop signs be removed, altered or augmented**~~to improve their function?~~

~~On Curling Drive, the signs should remain as a permanent traffic calming measure. They have helped reduce speeds and provide a needed stop-controlled pedestrian crossing of Curling Drive at Braemere Road.~~

The stop signs on Curling Drive should be retained to improve pedestrian safety by providing a stop-controlled pedestrian crosswalk as intended.

ACHD should re-evaluate the use of stop signs as a permanent measure for traffic calming on Upper Braemere Road and Highland View Drive. Permanent traffic calming measures identified in the Highlands Safety Plan and presented to the public at the open house meeting should be re-considered. ACHD should consider retaining the stop sign installations as a temporary measure during construction of Highlands Cove subdivision or until a permanent measure is implemented.

ACHD should consider installing speed limit signs within 100 to 200 feet downstream of all approaches at the current all-way stop-controlled intersections to remind drivers of the speed limit.

Appendix

Peer Review Data

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Peer Review Data

ACHD collected and provided before and after data analyzed in this peer review. The following before and after data was reviewed for completeness and processed as briefly described below:

24-hour traffic counts – The before and after traffic count locations were verified to ensure data was obtained at approximately the same location. The typical weekday ADT for each location was derived from Monday to Thursday count data when schools were in session. The ADT does not include Fridays, weekends, holidays or days when schools were not in session. The before and after counts were also taken in different months but were not adjusted for potential seasonal variations because there were no reliable seasonal factors available.

Speed counts – The before and after speed survey locations were verified to ensure data was collected at approximately the same location. Before and after speed data was collected in 3-mph bins. All full-day speed survey data, including weekday and weekend, was used in calculating speed statistics for an average day and peak hours.

Crash data – The most current historical crash data (2011-2014) for the roadways within the study area was provided by ACHD.

Intersection turning movement counts – Before and after intersection turning movements were collected for assessing the level of service at the study area intersections during AM/school arrival and PM peak hours. School release peak hour was not collected.

Pedestrian and bicycle counts – Pedestrian and bicycle crossings were collected after the stop signs were implemented at the study area intersections for assessing pedestrian crossing needs.

Six Mile collected the following supplemental data in the after conditions:

~~On **Upper Braemere Road**, the stop signs at the Balmoral Road intersection have helped reduce speeds in the vicinity, but the performance of the stop signs at the Harcourt Road/Chardie Road intersection are unknown. Due to the limited comparison of before and after conditions, we do not have an opinion on whether stop signs on Upper Braemere Road should remain as permanent traffic calming measures. Likewise, we do not have an opinion on whether the stop signs on **Highland View Drive** should remain as permanent traffic calming measures. However, we recommend that the stop signs remain as temporary measures on Upper Braemere Road and Highland View Drive until the majority of the homes in Highlands Cove subdivision are~~



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~~constructed to slow contractor and heavy vehicle traffic in the vicinity of the stop-control intersections. We also recommend installing additional speed limit signs on both roadways to remind visitors and contractors of the maximum speed.~~

Stop sign compliance observations – Stop sign compliance at the study area intersections was collected during AM and PM peak hour for at least two hours or a minimum of 50 observations.

~~During Highlands Cove construction, ACHD should continue to monitor speeds at different locations on Upper Braemere Road and Highland View Drive, coordinate with residents to get their input whether speeding issues appear to have lessened or remained the same, and re-evaluate if the stop signs should remain as permanent measures. ACHD should also continue to evaluate if additional speed mitigation measures, such as radar speed signs, would be beneficial to reduce the 85th percentile speeds closer to the posted speed limits.~~

Travel time survey – Travel time was collected during the peak hours for two different routes starting at the Curling Drive and Braemere Road intersection to the 15th Street and Hill Road intersection. The cut-through route was on Lower Braemere Road to Highland View Drive to 156th Street, and the diverted route was on Curling Drive to Bogus Basin Road to 15th Street.

Traffic operations observations – General traffic operations at the Highlands Elementary School were observed during AM school arrival and PM school release hours.

The following tables summarize the data collection and date. The raw and processed data would generate hundreds of pages and were considered too voluminous to include in the appendix. Raw data and processed data are available in electronic format upon request.

24-Hour traffic counts (ACHD)

<u>No.</u>	<u>Roadway</u>	<u>Location</u>	<u>Before</u>	<u>After</u>
<u>1</u>	<u>15th St</u>	<u>N/O Hill Rd</u>	<u>2/3-6/2014</u>	<u>10/17-31/2016</u> <u>11/1-28/2016</u>
<u>2</u>	<u>15th St</u>	<u>S/O Hill Rd</u>	<u>8/11-14/2014</u>	<u>10/3-14/2016</u> <u>10/17-31/2016</u> <u>11/1-14/2016</u> <u>11/14-28/2016</u>
<u>3</u>	<u>15th St</u>	<u>S/O Lemp St</u>	<u>2/3-6/2014</u>	<u>10/11-31/2016</u> <u>11/1-28/2016</u>
<u>4</u>	<u>Balmoral Rd</u>	<u>N/O Braemere Rd</u>	<u>5/17-20/2016</u>	<u>10/3-14/2016</u> <u>10/17-31/2016</u> <u>11/1-9/2016</u> <u>11/9-28/2016</u>

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5	Bogus Basin	N/O Hill Rd	1/6-14/2016	10/17-31/2016 11/1-28/2016
6	Bogus Basin	S/O Curling Dr	8/11-14/2014	10/3-14/2016 10/17-31/2016 11/1-9/2016
7	Bogus Basin	N/O Curling Dr	6/26-29/2006	10/17-31/2016 11/1-9/2016
8	Braemere Rd	E/O Curling Dr	1/7-14/2016	10/3-14/2016 10/17-31/2016 11/1-28/2016
9	Braemere Rd	W/O Curling Dr	1/18-26/2016	10/3-14/2016 10/17-31/2016 11/1-28/2016
10	Braemere Rd	E/O Highland View Dr	10/8-13/2013	10/3-14/2016 10/17-31/2016 11/3-28/2016
11	Braemere Rd	W/O Keldoan Ave	1/6-14/2016 5/10-13/2016	10/3-14/2016 10/17-31/2016 11/1-9/2016
No.	Roadway	Location	Before	After
12	Curling Dr	E/O Braemere Rd	1/6-14/2016	10/3-14/2016 10/17-31/2016 11/3-28/2016
13	Curling Dr	N/O Braemere Rd	1/6-14/2016	10/3-14/2016 10/17-31/2016 11/1-28/2016
14	Curling Dr	S/O Bogus Basin Rd	1/6-14/2016	10/6-14/2016 10/22-31/2016 11/1-9/2016 11/9-28/2016
15	Curling Dr	W/O Cashmere Rd	Note Available	11/3-28/2016
16	Curling Dr	W/O Selkirk	1/5-14/2016	Not Available
17	Harcourt Dr	N/O Braemere Rd	5/17-20/2016	10/3-14/2016 10/17-31/2016 11/1-9/2016
18	Harrison Blvd	S/O Hill Rd	1/6-14/2016	10/3-14/2016 10/17-31/2016 11/1-28/2016
19	Hearthstone Rd	N/O Braemere Rd	5/17-20/2016	10/3-14/2016 10/17-31/2016 11/1-9/2016

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20	Heather Pl	N/O Highland View Dr	5/17-20/2016	10/3-14/2016 10/17-18,31/2016 11/1-3/2016
21	Highland View Dr	E/O Argyll DR	5/10-13/2016	10/3-14/2016 10/17-31/2016 11/1-3/2016 11/3-28/2016
22	Highland View Dr	N/O Parkhill Dr	5/10-13/2016	10/3-14/2016 10/17-31/2016 11/1-28/2016
23	Hill Rd	E/O 15th St	7/28-31/2014	10/11-17/2016 10/17-31/2016 11/1-28/2016
24	Parkhill Dr	W/O Highland View Dr	7/28-31/2015	10/3-14/2016 10/17-31/2016 11/1-3/2016 11/3-28/2016
25	Ranch Rd	E/O Bogus Basin Rd	1/7-14/2016	Not Available
No.	Roadway	Location	Before	After
26	Ranch Rd	E/O Crane Creek Rd	5/10-13/2016	10/3-14/2016 10/17-31/2016 11/1-3/2016 11/3-28/2016
27	Selkirk Dr	S/O Curling Dr	1/5-14/2016	10/3-14/2016 10/17-31/2016 11/1-3/2016 11/3-28/2016
28	Tartan Pl	N/O Highland View Dr	5/17-20/2016	10/3-14/2016 10/17-31/2016 11/1-3/2016 11/3-28/2016
29	Whidden St	N/O Highland View Dr	5/10-13/2016	10/3-14/2016 10/17-31/2016 11/1-28/2016

Speed counts (ACHD)

No.	Roadway	Location	Before	After
5	Bogus Basin	N/O Hill Rd	1/6-14/2016	Not Available
8	Braemere Rd	E/O Curling Dr	1/7-14/2016	Not Available
9	Braemere Rd	W/O Curling Dr	1/18-26/2016	Not Available
6	Braemere Rd	W/O Keldoan Ave	1/6-14/2016	Not Available

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12	Curling Dr	E/O Braemere Rd	1/6-14/2016	Not Available
13	Curling Dr	N/O Braemere Rd	1/6-14/2016	Not Available
14	Curling Dr	S/O Bogus Basin Rd	Not Available	10/17-28/2016
15	Curling Dr	W/O Cashmere Rd	Note Available	11/3-28/2016
16	Curling Dr	W/O Selkirk	1/5-14/2016	Not Available
17	Harcourt Dr	N/O Braemere Rd	5/17-20/2016	Not Available
18	Harrison Blvd	S/O Hill Rd	1/6-14/2016	Not Available
19	Hearthstone Rd	N/O Braemere Rd	1/7-14/2016	Not Available
20	Heather Pl	N/O Highland View Dr	5/17-20/2016	Not Available
21	Highland View Dr	E/O Argyll DR	11/16-23/2015	Not Available
25	Ranch Rd	E/O Bogus Basin Rd	1/7-14/2016	Not Available
No.	Roadway	Location	Before	After
26	Ranch Rd	E/O Crane Creek Rd	Not Available	10/17-11/28/2016
27	Selkirk Dr	S/O Curling Dr	1/5-14/2016	Not Available
29	Whidden St	N/O Highland View Dr	5/10-13/2016	Not Available

Crash data (ACHD)

No.	Area	5-Year Crash Data
1	Highlands area bounded by Hill Rd and Bogus Basin Rd	2011 - 2015

~~Appendix A Supporting Traffic and Safety Analysis Results~~ **~~(not included in Draft)~~**

Intersection turning movement counts (ACHD)

No.	Intersection	Before	After
1	Hill Rd and Bogus Basin Rd	1/6/2016-7-9 AM 1/5/2016-4-6 PM	10/5/2016-7-9 AM 10/12/2016-4-6 PM
2	Hill Rd and 15th St	1/6/2016-7-9 AM 1/5/2016-4-6 PM	10/13/2016-7-9 AM 10/12/2016-4-6 PM

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<u>3</u>	<u>Curling Dr and Braemere Rd</u>	<u>1/13/2016-7/9 AM</u> <u>1/12/2016-3-6 PM</u>	<u>1/17/2017</u> <u>7-9 AM</u> <u>4-6 PM</u>
<u>4</u>	<u>Curling Dr and Bogus Basin Rd</u>	<u>Not Available</u>	<u>10/25/2017</u> <u>7-9 AM</u> <u>4-6 PM</u>

Pedestrian and bicycle counts (ACHD)

<u>No.</u>	<u>Intersection</u>	<u>Before</u>	<u>After</u>
<u>1</u>	<u>Highland View Dr and Whidden St</u>	<u>Not Available</u>	<u>8/30/2016</u> <u>9/8/2016</u> <u>10/10/2016</u> <u>10/25/2016</u> <u>10/27/2016</u>
<u>2</u>	<u>Highland View Dr and Selkirk Dr</u>	<u>Not Available</u>	<u>9/1/2016</u> <u>10/11/2016</u> <u>10/26/2016</u> <u>11/3/2016</u>
<u>No.</u>	<u>Intersection</u>	<u>Before</u>	<u>After</u>
<u>3</u>	<u>Braemere Rd and Harcourt Dr</u>	<u>Not Available</u>	<u>8/30/2016</u> <u>8/31/2016</u> <u>10/12/2016</u> <u>10/13/2016</u> <u>10/27/2016</u> <u>11/2/2016</u>
<u>4</u>	<u>Braemere Rd and Balmoral Rd</u>	<u>Not Available</u>	<u>8/31/2016</u> <u>9/6/2016</u> <u>10/11/2016</u> <u>10/12/2016</u> <u>10/25/2016</u> <u>10/27/2016</u>

Stop sign compliance observation (Six Mile)

<u>No.</u>	<u>Intersection</u>	<u>After</u>
<u>1</u>	<u>Upper Braemere Rd and Balmoral Rd</u>	<u>2/14-15/2017</u> <u>7:30-9:15 AM</u> <u>2:45-4:45 PM</u>

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<u>2</u>	<u>Upper Braemere Rd and Harcourt Rd /Chardie Rd</u>	<u>2/14-15/2017</u> <u>7:30-9:00 AM</u> <u>2:45-4:45 PM</u>
<u>3</u>	<u>Highland View Dr and Selkirk Dr</u>	<u>2/14 & 22/2017</u> <u>7:30-9:00 AM</u> <u>2:45-4:45 PM</u>
<u>4</u>	<u>Highland View Dr and Whidden St</u>	<u>2/14 & 22/2017</u> <u>7:30-9:00 AM</u> <u>2:45-4:45 PM</u>
<u>5</u>	<u>Curling Dr and Braemere Rd</u>	<u>2/21/2017</u> <u>7:30-9:00 AM</u> <u>2:45-4:45 PM</u>

Travel time survey (Six Mile)

No.	Route	After
<u>1</u>	<u>Cut-through Route and Diverted Route – from Braemere Rd and Curling Dr intersection to 15th Street and Hill Rd intersection</u>	<u>12/15/2017</u> <u>7:00-9:00 AM</u> <u>2:00-6:00 PM</u>
<u>2</u>	<u>Cut-through Route and Diverted Route – from Braemere Rd and Curling Dr intersection to 15th Street and Hill Rd intersection</u>	<u>3/9/2017</u> <u>8:00 AM -12:00 PM</u>

Traffic operations observations (Six Mile)

No.	Location	After
<u>1</u>	<u>Highlands Elementary School</u>	<u>2/9/2017</u> <u>8:05-8:50 AM</u> <u>3:10-3:45 PM</u>
<u>2</u>	<u>Highlands Elementary School</u>	<u>3/13/2017</u> <u>3:10-3:45 PM</u>

Document comparison by Workshare 9 on Tuesday, March 14, 2017 12:24:24 PM

Input:	
Document 1 ID	file://C:\peter work\temp\downloads\draft.pdf
Description	draft
Document 2 ID	file://C:\peter work\temp\downloads\final.pdf
Description	final
Rendering set	Standard

Legend:	
Insertion	
Deletion	
Moved from	
Moved to	
Style change	
Format change	
Moved deletion	
Inserted cell	
Deleted cell	
Moved cell	
Split/Merged cell	
Padding cell	

Statistics:	
	Count
Insertions	945
Deletions	405
Moved from	10
Moved to	10
Style change	0
Format changed	0
Total changes	1370