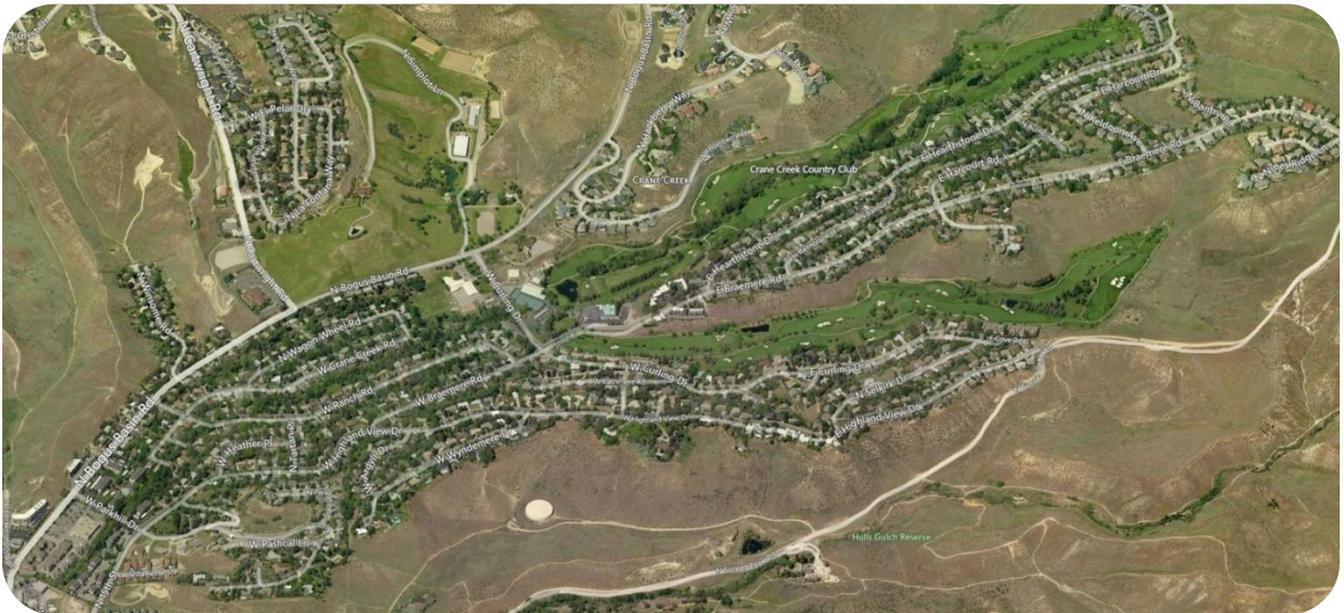


Peer Review of Highlands Neighborhood Traffic and Pedestrian Safety Plan

DRAFT REPORT

February 28, 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 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, 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 to reduce cut-through traffic on Lower Braemere Road (the segment of Braemere Road located southwest of Curling Drive)
- Stop signs to implement all-way stop control and reduce vehicle speeds were installed 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 (the segment of Braemere Road located northeast of Curling Drive) at the Balmoral Road and Harcourt Road/Chardie Road intersections

The mitigation measures formed 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, altered or augmented to improve their function. The 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.

The peer review findings are:

- Prior to installation of mitigation measures, the estimate volume of cut-through traffic on Lower Braemere Road exceeds ACHD's threshold requirements for cut-through traffic mitigation (ACHD Policy Manual Section 5104.2.4)
- ACHD developed 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 through traffic from Upper Braemere Road to Lower Braemere Road and limiting access to right-turn traffic from Curling Drive. This mitigation measure was installed in August 2016.

- 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 vpd, from 1,350 to 420 vpd, a reduction of nearly 70 percent.
- 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.
- 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.
- 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.
- The stop signs on Upper Braemere Road at the Balmoral Road intersection have helped reduce speeds by 3 mph, but the performance of the stop signs at the Harcourt Road/Chardie Road intersection are unknown. Pedestrians were rarely observed using the new stop-control to cross Upper Braemere Road.
- 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.

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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, findings and recommendations.



Figure 1-1. Highlands neighborhood

1.1 Highlands Safety Plan Background

Traffic issues in the Highlands neighborhood have been a concern for more than 25 years. According to a December 7, 1992, article in the Idaho Statesman titled, “Residents Put Brakes on Traffic Problems,” 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 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 the approximately one-quarter mile length of sidewalk 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 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 on Lower Braemere Road 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: 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 all-way stop control 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.
- 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 diverter at intersection of Braemere Road and Curling Drive was installed to divert cut-through 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 by the *Highlands Safety Plan* mitigation measures.

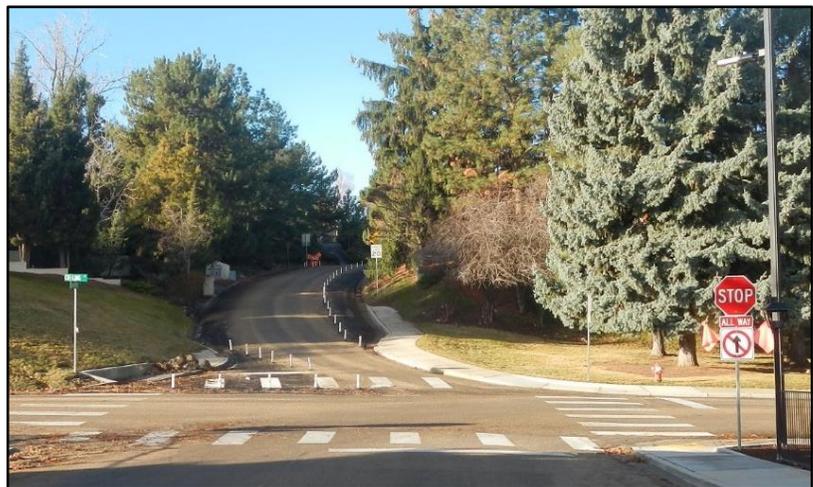


Figure 1-2. Traffic diverter at the intersection of Braemere Road and Curling Drive

- October 2016: ACHD initiated traffic counts to quantify the after mitigation conditions and solicited Six Mile Engineering to conduct this peer review.

1.2 Peer Review Study Purpose

The purpose of this peer review is to:

- Assess the performance of the following mitigation measures 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 to reduce cut-through traffic on Lower Braemere Road
 - Stop signs to implement all-way stop control and reduce vehicle speeds were installed 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
- Provide an opinion on whether the mitigation measures should be removed, altered or augmented to improve their function

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 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 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. For example, the standard deviation of the average weekday counts that ACHD provided for this review varied up to plus or minus 12 percent. The after traffic counts also include construction vehicles for Highlands Cove construction on Highland View Drive, Upper

Braemere Road, Curling Drive and 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. For example, Bogus Basin Road was expected to see an increase in traffic 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 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 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).

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.

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 reviewing the before and after traffic data available for Lower Braemere Road, Curling Drive, southeast of Braemere Road, and Whidden Street – it was apparent that the added cost of an origin-destination study was not warranted for this peer review.

Chapter 2 Highlands Neighborhood

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.

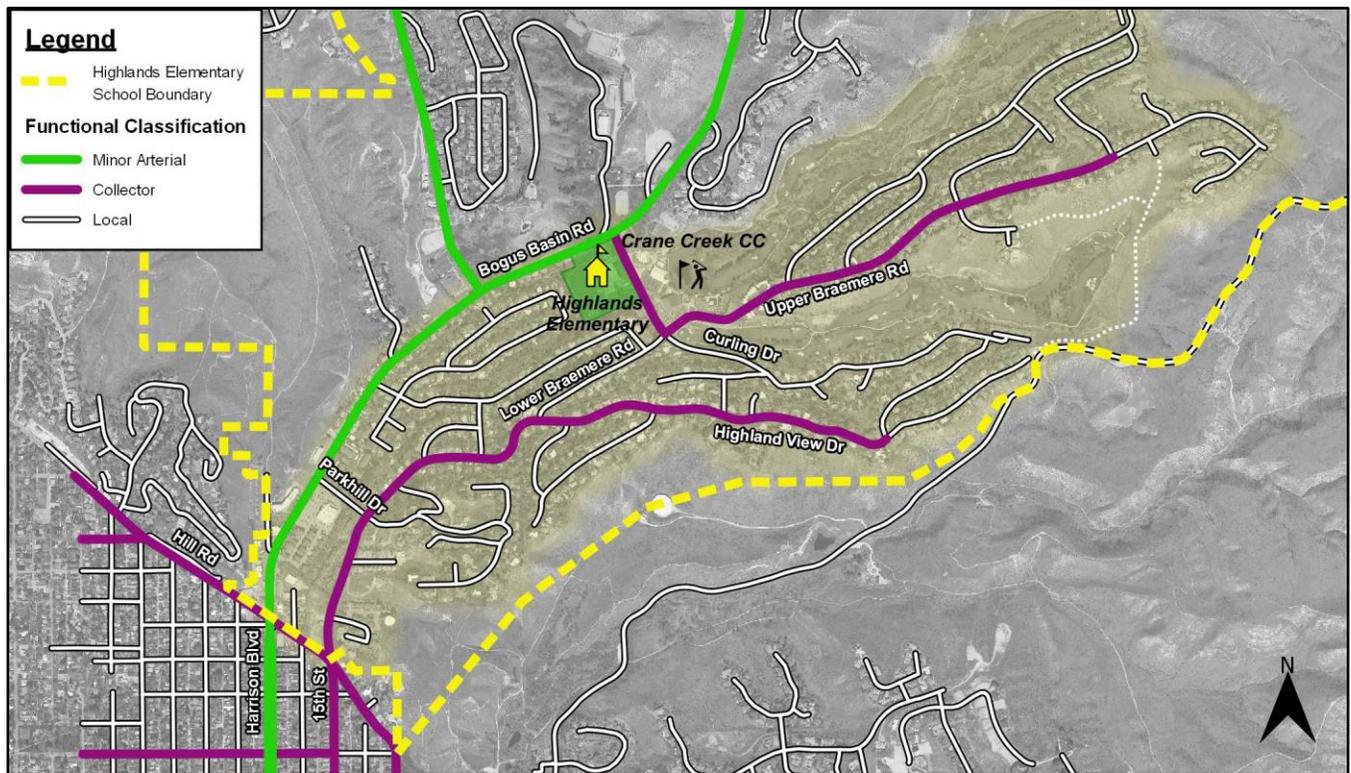


Figure 2-1. Study area, roadway functional classifications and Highlands Elementary boundary

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

The neighborhood minor arterial is Bogus Basin Road. It has a posted speed limit of 30 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, sidewalk is continuous on both sides of the street and on-street parking is prohibited.

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

- Curling Drive – from Bogus Basin Road to Braemere Road (25 mph, 20 mph school zone)
- Upper Braemere Road – from Curling Drive to Keldoon Avenue (25 mph, 20 mph from Curling Drive to 300 north of Crane Creek clubhouse driveway)
- Highland View Drive – from Parkhill Drive to Selkirk Drive (25 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 remainder of the neighborhood streets one travel lane in each direction and on-street parking. None of the local streets have designated bike lanes. Upper Braemere Road from Keldoon Avenue to its end, Curling Drive from Braemere Road to its end, and Highland View Drive from Selkirk Drive to its end all have a posted speed limit of 25 mph. The rest of the local streets have a speed limit of 20 mph (posted or statutory),

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

Highlands Elementary, 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-only, year-round recreational facility with an 18-hole golf course, clubhouse and other amenities.

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 installed – are shown in Figure 2-2. Note that the volumes shown are weekday averages for the traffic counts taken, excluding holidays and early school release days. Daily counts varied by up to plus or minus 12 percent from the weekday average.

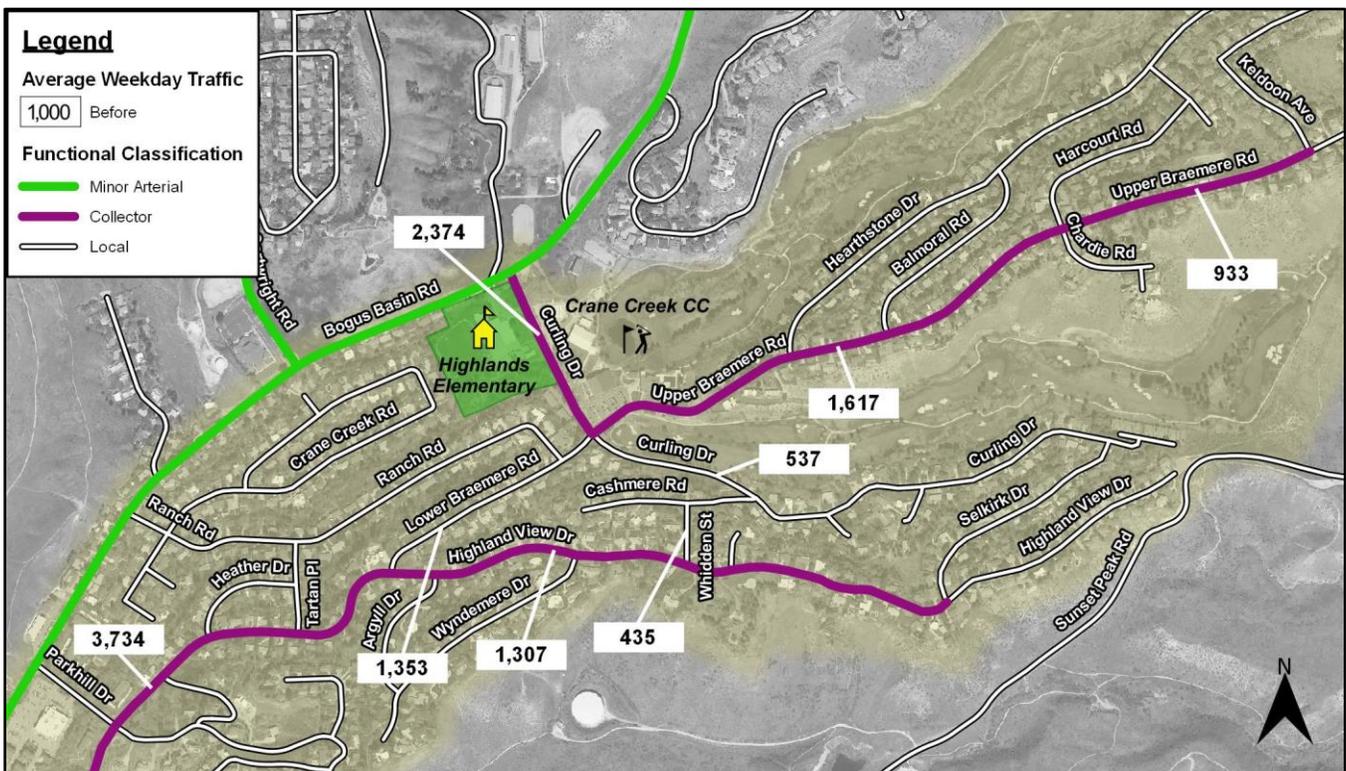


Figure 2-2. Vehicle volumes before mitigation measures

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

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

Speed counts were not collected on Highland View Drive prior to the mitigation installation; however, ACHD documentation shows that residents have voiced concerns over excessive speeds.

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

2.4 Crash History

The most recent five-year history of reported crashes available is from 2011 to 2015. 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 speeding as a contributing factor.

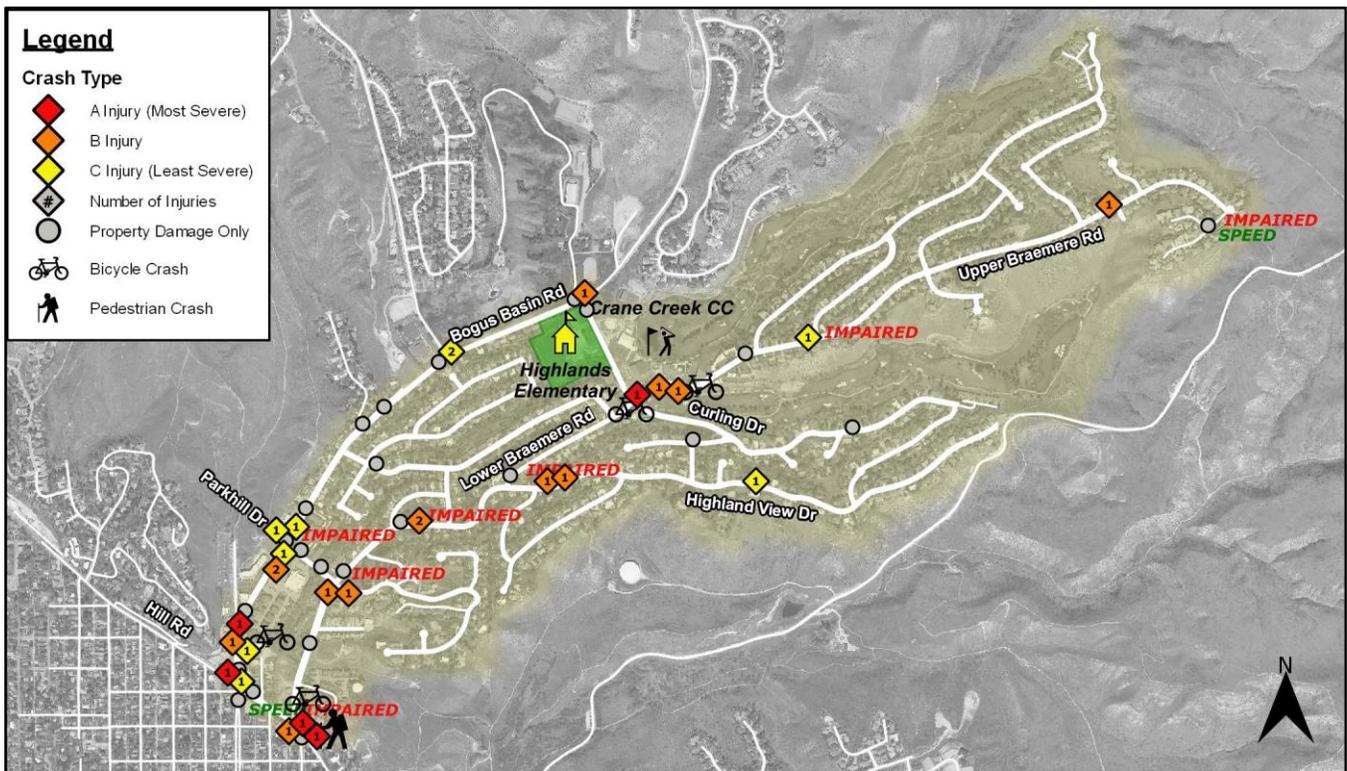


Figure 2-4. Reported crashes from 2011 to 2015

2.5 Safety Issues

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 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 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 Lower Braemere Road.

On Lower Braemere Road, the estimated cut-through traffic is shown in Figure 2-5 on page 13. During the average weekday, traffic 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.

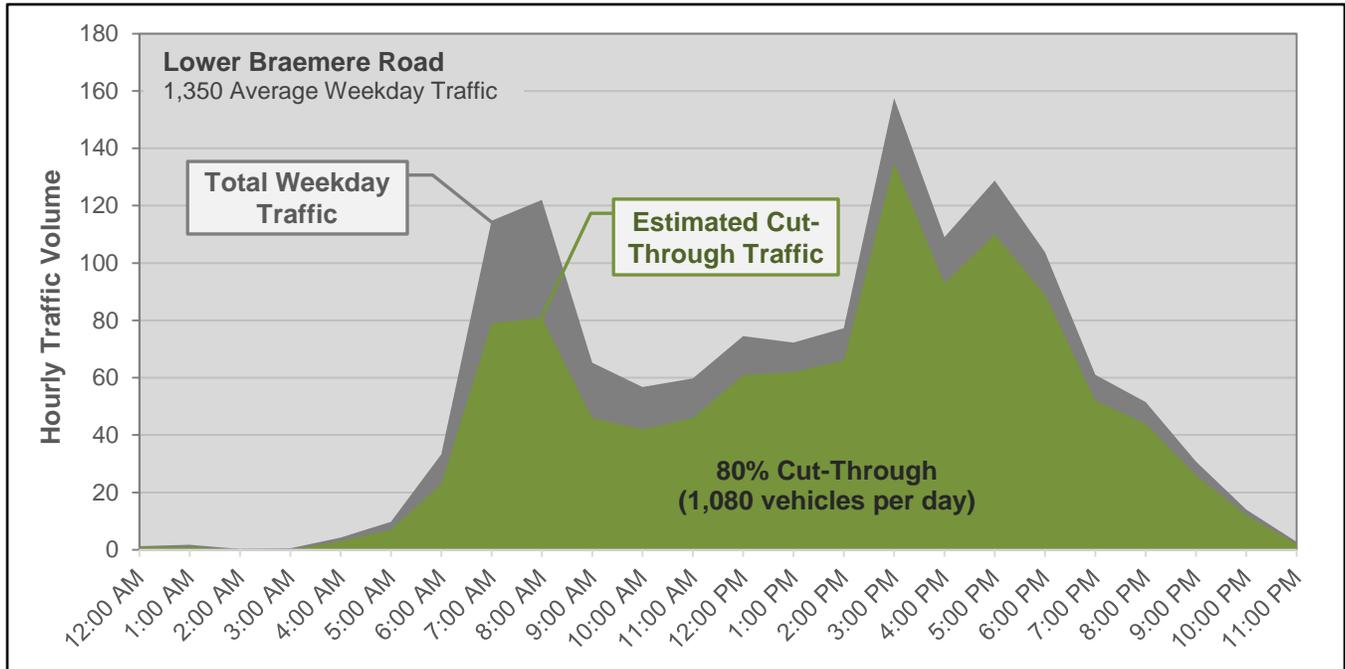


Figure 2-5. Estimated cut-through traffic on Lower Braemere Road before mitigation

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, the street’s cross-section is narrower than other collectors 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



Figure 2-6. Cross-section view of Lower Braemere Road

would be necessary for opposing vehicles to pass between parked cars, causing 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 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 contributing factor to excessive speeds is the steep grade on Upper Braemere Road (Figure 2-7).

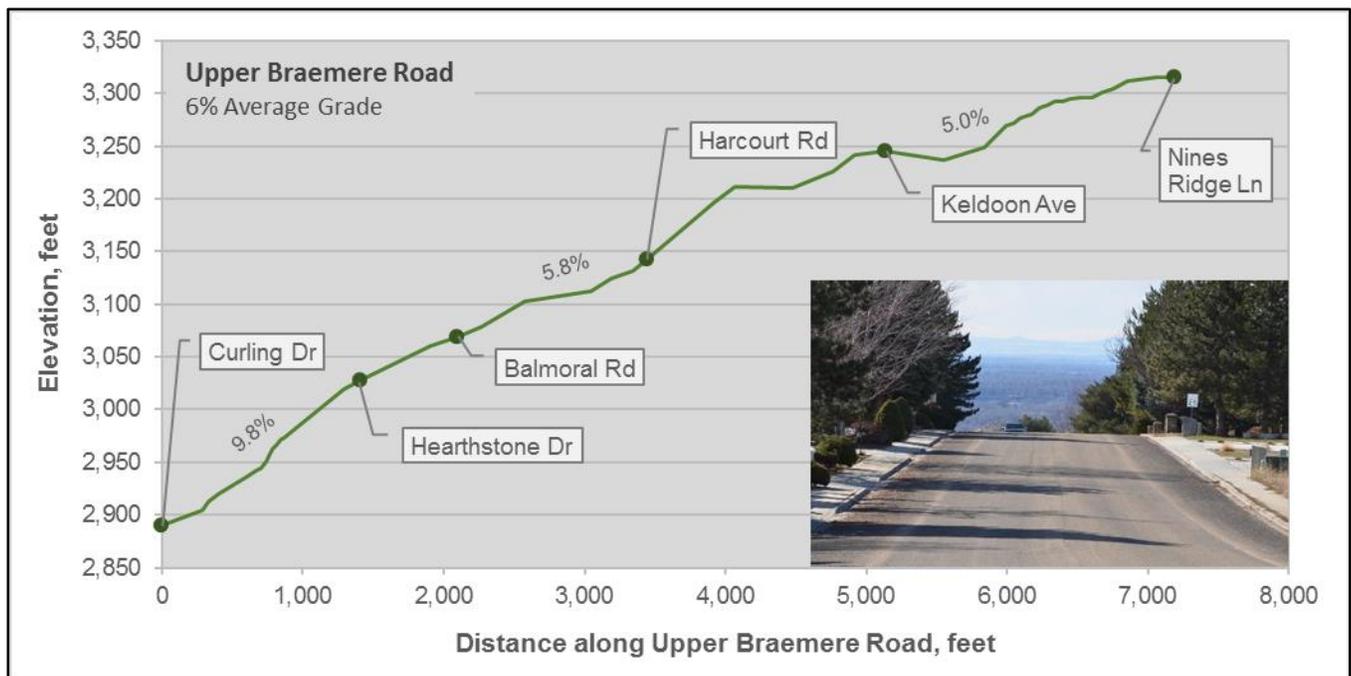


Figure 2-7. Upper Braemere Road cross section and grades

Speed counts on Highland View Drive prior to the mitigation were not available for this study, but speeding issues have been identified by ACHD and Highlands residents. Highland View Drive has a similar roadway typology and grade as Upper Braemere Road, so similar excessive speeds may have occurred in the before condition (

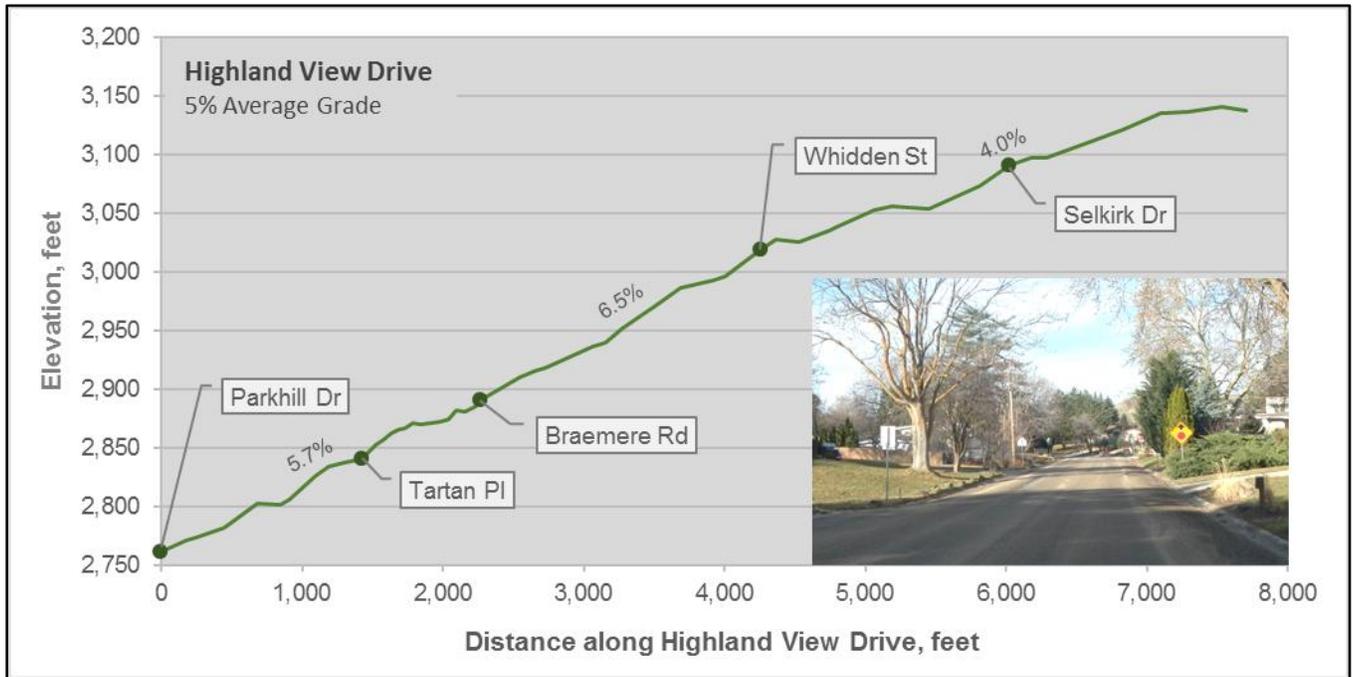


Figure 2-8).

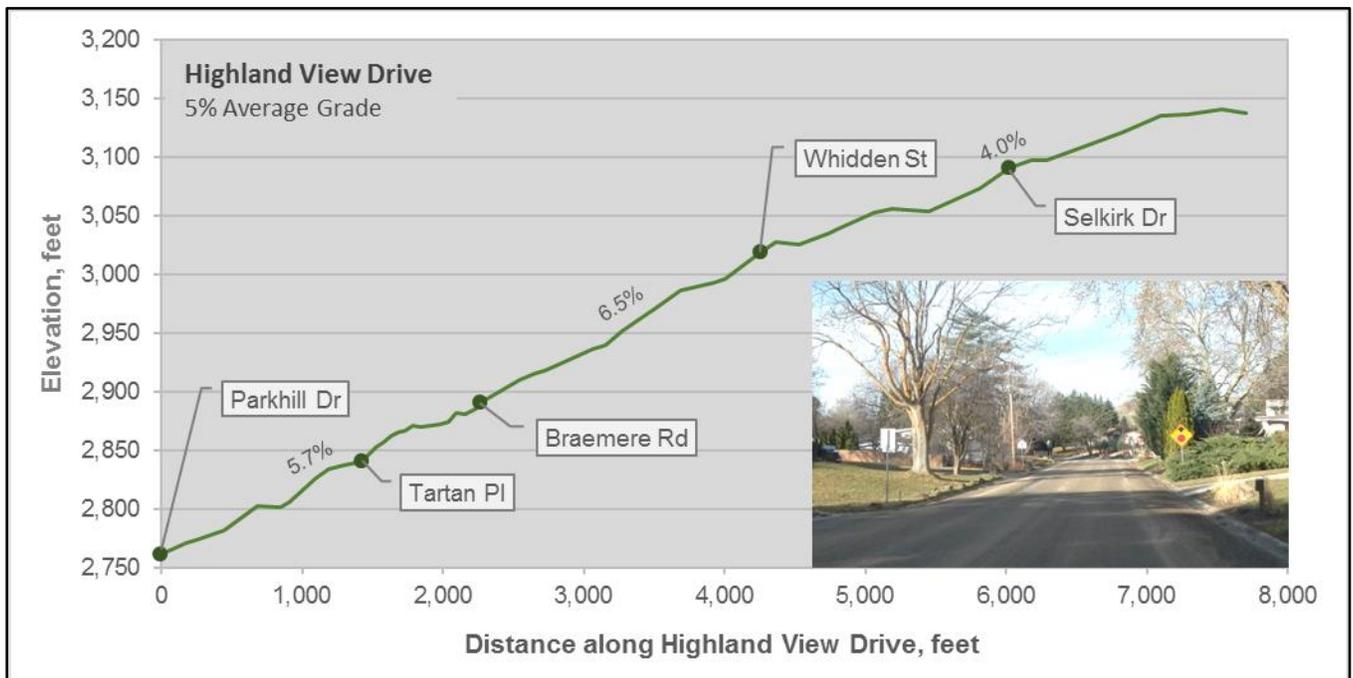


Figure 2-8. Highland View Drive cross section and grades

Despite existing speed humps on Lower Braemere Road, the 85th percentile speeds were 23 mph, exceeding 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 arrival and release – increase the potential safety risk for pedestrians.

Chapter 3 Mitigation Measures

3.1 Cut-Through Traffic Mitigation

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.

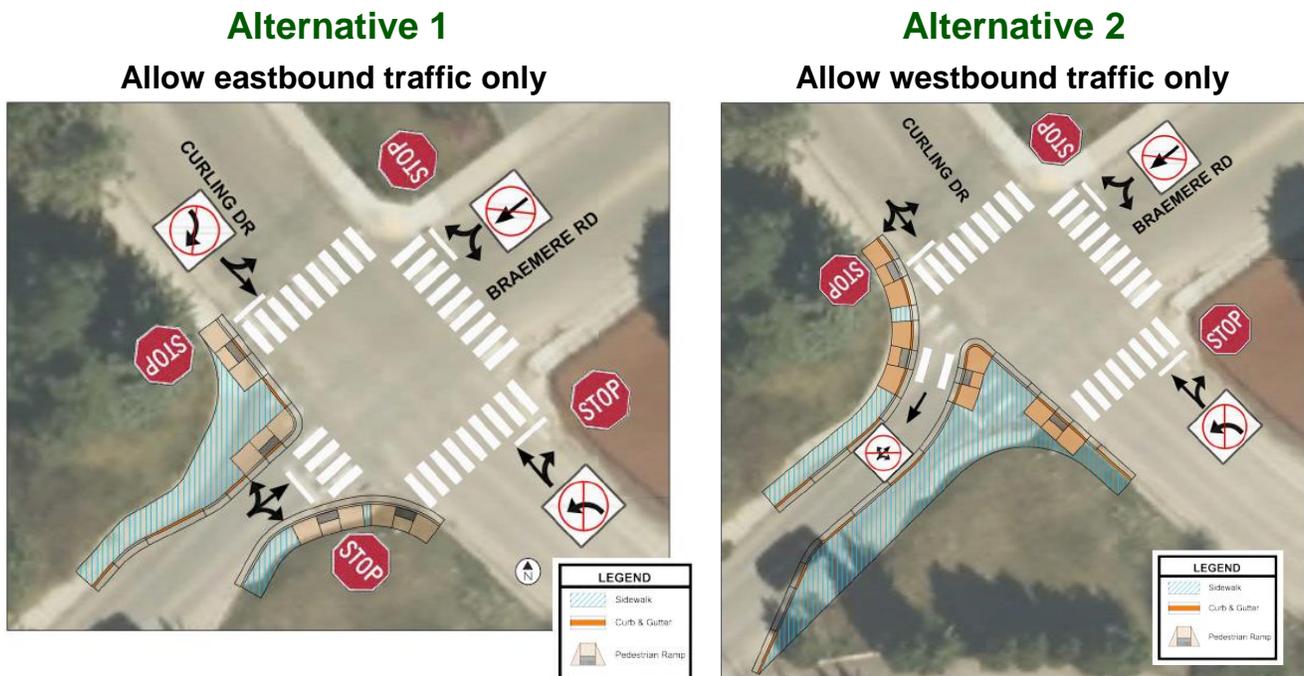


Figure 3-1. Cut-through traffic mitigation measures developed by ACHD

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 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 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. 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 3-3. Delineated pedestrian path on Lower Braemere Road

3.1.2 Diverter Performance

Traffic Re-Distribution

After Highlands neighborhood residents and visitors had several months to learn their new route through the neighborhood, traffic volumes were collected and compared to the before volumes to evaluate the traffic re-distribution patterns (Figure 3-3). As expected, the diverter has reduced the majority of cut-through traffic on Lower Braemere Road by approximately 930 vpd.



Figure 3-3. Signs notifying drivers of new traffic pattern

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 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 Crane Creek parking lot and after counts were 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.

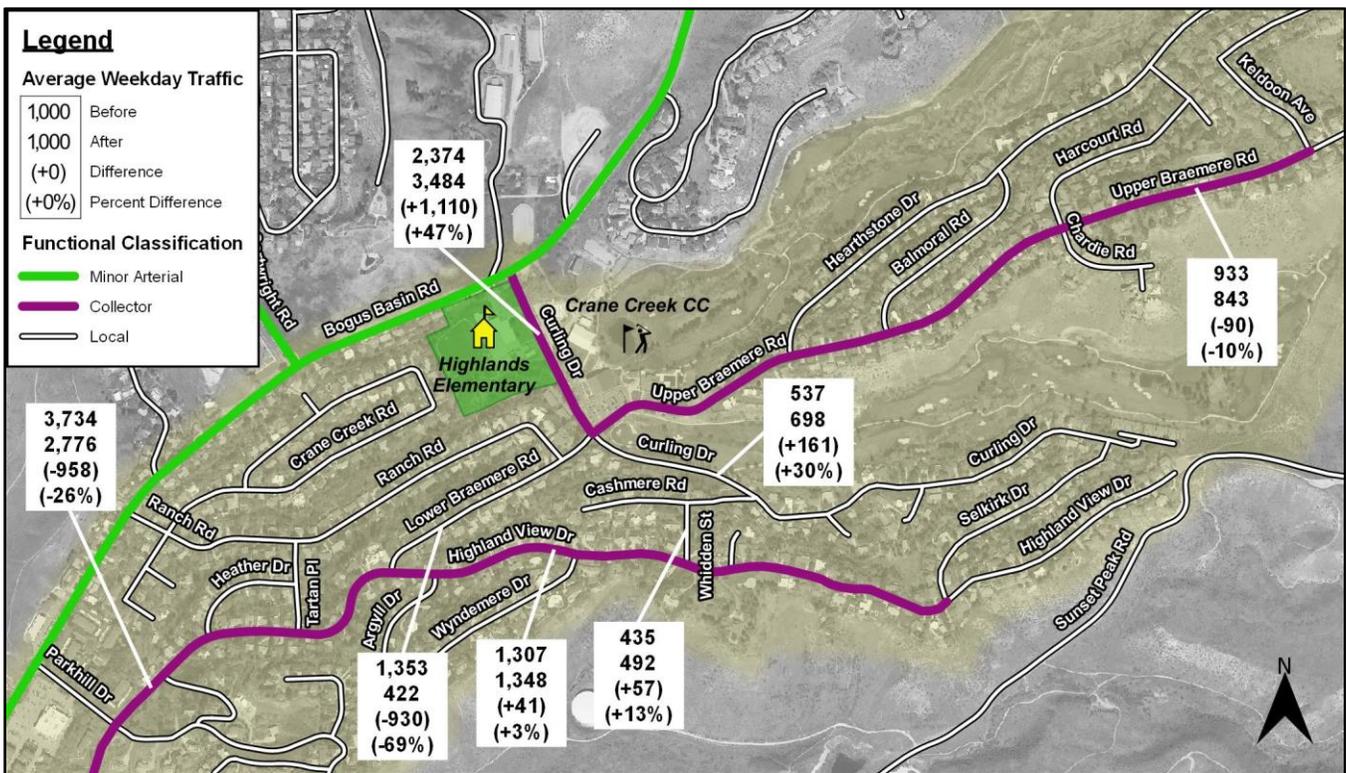


Figure 3-4. Average weekday volumes – before, after, difference and percent difference

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 vehicles per day (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.

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 route) and Bogus Basin Road route (post-diverter route) as shown in **Error! Reference source not found.** On average, the Bogus Basin Road route is 24 seconds longer than the Lower Braemere Road cut-through route.



Figure 3-5. Travel time comparison averaged for three peak periods

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, which is a LOS C.

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; 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 of the PM school release period was not requested.

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). 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. Speed mitigation measures evaluated by ACHD

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 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 on page 22). A secondary potential benefit of the stop sign installations is that they provide pedestrian crossing opportunities across the collector streets.

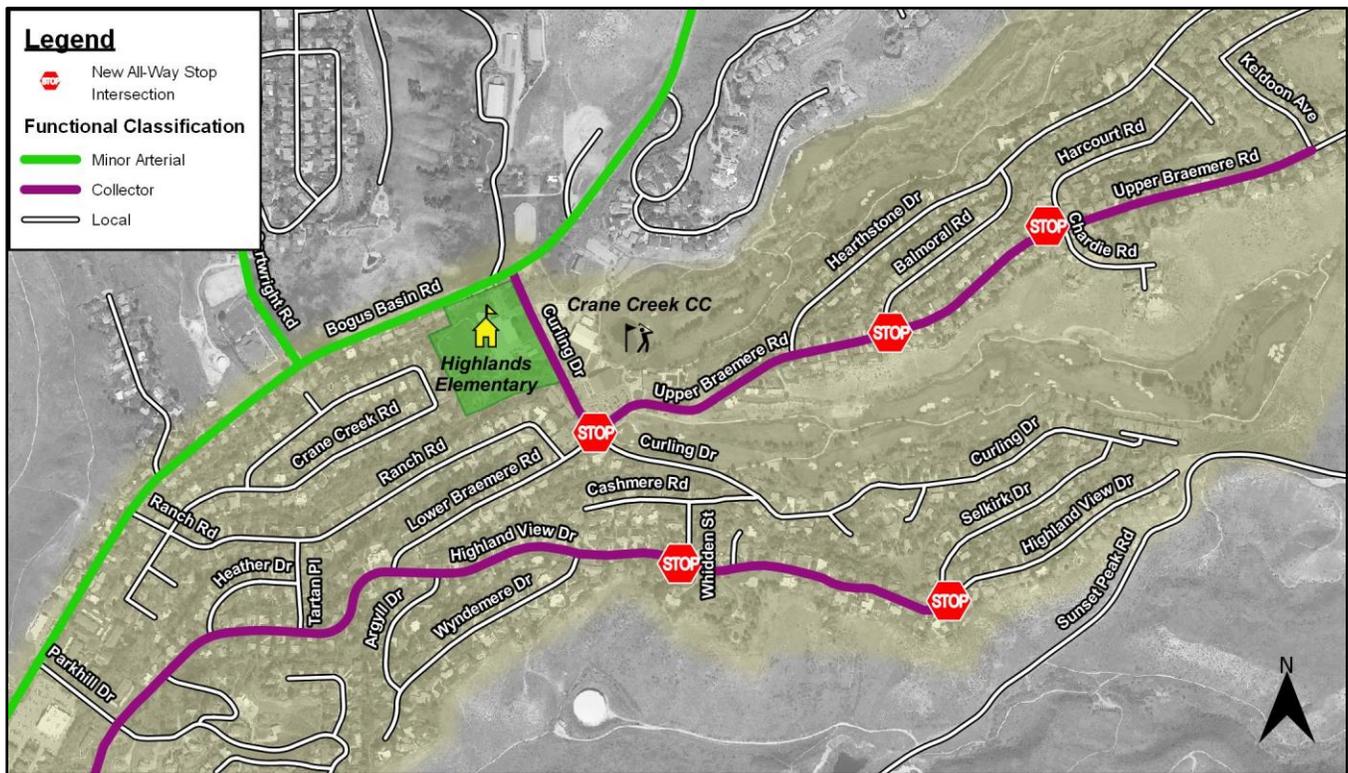


Figure 3-7. New all-way stop intersections

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 on page 21. 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 of Keldoon 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 Keldoon 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 before speed data was not collected. 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 speed counts were not collected to determine if a reduction occurred. The Lower Braemere Road 85th percentile speed 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. 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 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 arrival and release periods. No collector street pedestrian crossings were observed in the AM. In the PM period, two intersections had no crossings, one intersection had two crossings, and one had three crossings.

Driver Compliance

Driver compliance at the five new all-way stop locations was observed during the AM 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
- Upper Braemere Road and Harcourt Road/Chardie Road – 25 percent compliant, 75 percent non-compliant
- Highland View Drive and Selkirk Drive – 39 percent compliant, 61 percent non-compliant
- Highland View Drive and Whidden Street – 58 percent compliant, 42 percent non-compliant
- Curling Drive and Braemere Road – 57 percent compliant, 43 percent non-compliant

Chapter 4 Findings and Recommendations

4.1 Lower Braemere Diverter at Curling

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 minimum threshold requirements for cut-through traffic mitigation. Functionally classified as a local street, it received 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 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. 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 Is the diverter an appropriate mitigation measure for the cut-through traffic?

To reduce potential pedestrian-vehicle conflicts, sidewalk could be added, the roadway could be widened to collector street standards or measures could be implemented to reduce cut-through traffic.

Adding sidewalk to Lower Braemere Road to improve safety would be expensive. In 2011, ACHD estimated the project cost to construct sidewalk on one side of the street at \$755,000, without widening the street. ACHD's current standard width for a residential collector is 40 feet from curb to curb, with sidewalks on both sides of the street. The cost and property impacts to upgrade the street to meet current residential collector standards would be difficult to justify with the relatively low traffic volume.

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 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 Lower Braemere Road to Parkhill Drive.

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 to 700 vpd after, an increase of approximately 160 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 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 mitigation.

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

On **Curling Drive, between Braemere Road and Bogus Basin Road**, the average weekday traffic increased by 1,110 vpd to approximately 3,480 vpd, an increase of approximately 47 percent. Up to 930 vpd of this increase is potentially due to the diverter, with the remaining increase potentially due to daily or seasonal variations or 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. 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 congestion occurs in front of the school, resulting in increased queuing on Curling Drive and Bogus Basin Road.

School area 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. 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 congestion 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 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.

Parkhill Drive and **Bogus Basin Road** both experience increased traffic after installation of the diverter. However, as a collector street and minor arterial street, 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 Should the diverter be removed, altered or augmented to improve its function?

In our view, 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) to arterial streets (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.

On **Curling Drive at Highlands Elementary**, the school drop-off and pick-up congestion is an operations and safety concern that ACHD and the school should mitigate 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.

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.
- Move the No Parking zone farther away from the pedestrian crossing to improve drivers' visibility of pedestrians.

- 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).
- 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.

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:

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.

4.2 Stop Sign Installations

4.2.1 Why is mitigation needed for speeding on Highlands neighborhood streets?

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

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

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 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

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.

4.2.3 Did the stop sign installations perform as intended?

On **Curling Drive**, the stop 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 speeds were reduced.

Speeds at the two count locations on Upper Braemere Road near Balmoral Road and Keldoon Avenue still exceed the 25 posted speed 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.

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. We only know that slowing occurs in the immediate vicinity of the stop-controlled intersections.

Speeds on Highland View Drive exceed the 25 mph posted speed by 5 mph.

The all-way stop intersections were rarely used as collector street pedestrian crossings, with the exception of the Curling Drive and Braemere Road intersection.

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.

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 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.

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.

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