PRELIMINARY SCREENING EVALUATION REPORT

IDAHO FALLS TRAFFIC SIGNAL REMOVAL STUDY

ITD PROJECT NO. A013(134), ITD KEY NO. 13134

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April 5, 2016

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INTRODUCTION

The City of Idaho Falls retained Six Mile Engineering to conduct this traffic signal removal study at 12 signalized intersections located on key transportation corridors in the city. The intent of study is to recommend whether to retain or remove traffic signals to improve corridor traffic operations by reducing vehicle stops, delay and fuel consumption, without sacrificing safety.

The 12 signalized intersections in this study are shown in Figure 1:

- 17th Street and June Avenue
- 17th Street and Jennie Lee Drive
- 17th Street and Ponderosa Drive
- 17th Street and St. Clair Road
- Holmes Avenue and 12th Street
- Holmes Avenue and 9th Street
- Holmes Avenue and 7th Street
- Holmes Avenue and Elva Street
- Broadway Street and Lindsay Boulevard
- Broadway Street and Shoup Avenue
- Yellowstone Avenue and A Street
- Yellowstone Avenue and B Street

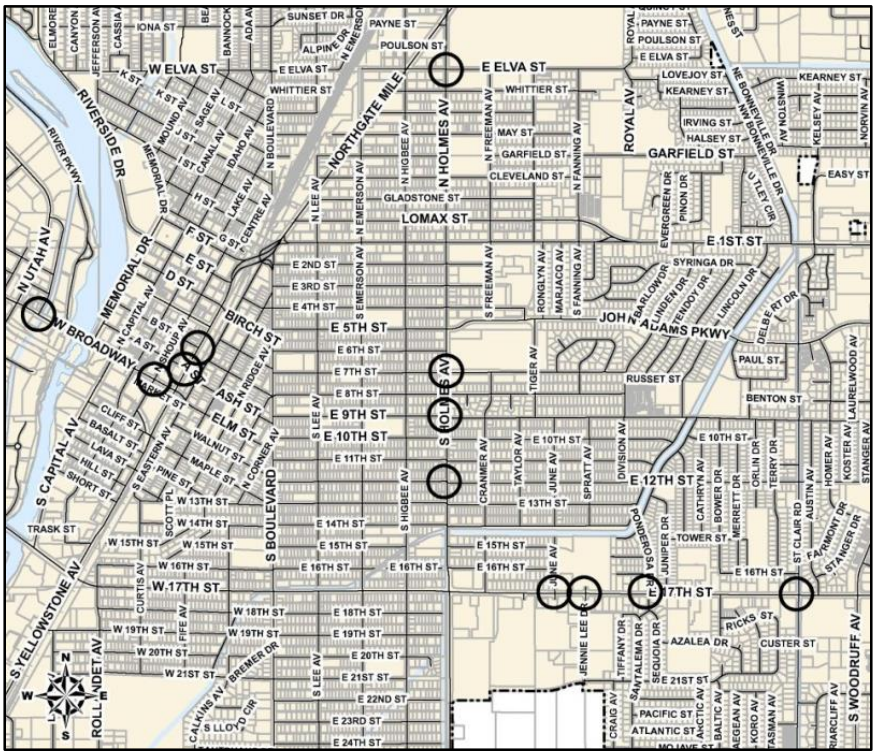

Figure 1. Potential traffic signal removal locations

STUDY PURPOSE

With over 60 signalized intersections within the City's network that require continual maintenance and monitoring, 12 of the lowest-volume signalized intersections were selected to evaluate whether they were still beneficial to the transportation system. Removal of one or more unnecessary traffic signals will reduce traveler stops on the main street corridor, which in turn lowers travel time, fuel consumption and vehicle emissions, in addition to reducing the city's maintenance costs. Many of the existing signalized intersections are located at irregular intervals along the major street coordinated corridors. The irregular spacing makes two-way coordinated progression on the major street difficult, resulting in increased stops and delays. In addition, the average delay for *all* vehicles traveling through the intersection may be increased with traffic signal control, and the frequency of some types of crashes are sometimes greater under traffic signal control than under stop control.

WHAT ARE THE STEPS TO REMOVE A TRAFFIC SIGNAL?

Traffic Signal Removal Process

The evaluation to determine whether an existing traffic signal should be retained or removed is a two-stage process. The first stage conducts a preliminary screening (prescreening) of the traffic volumes, sight distance and crash history to determine the specific intersections that require further analysis and the intersections where the traffic signal should be retained (Figure 2). The second stage conducts a detailed analysis which includes a traffic analysis with and without signalization, field delay studies of the intersection operations with and without signalization, and public outreach (Figure 3).

This portion of the study evaluates the prescreening step to determine what signalized intersections can potentially be removed and should be considered for the detailed analysis step.

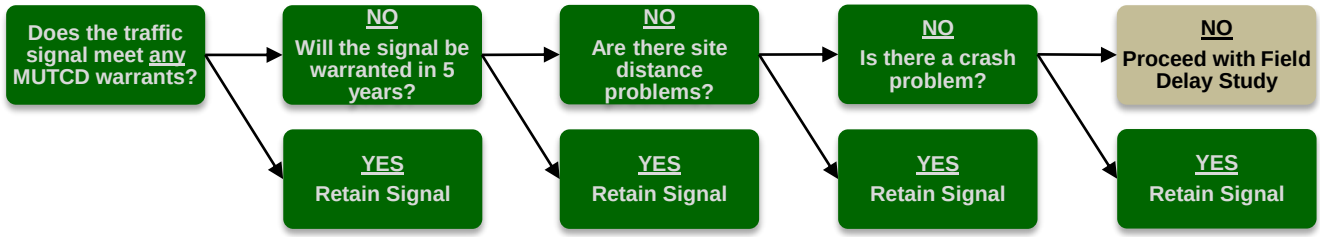

Figure 2. Prescreening process for traffic signal removal

Figure 3. Detailed analysis process for traffic signal removal

Traffic Signal Removal Methodologies

Two signal removal methodologies were used for this study – **Section 301.06 Signal Removal from the Idaho Transportation Department (ITD) Traffic Manual** and **Document STS-PRO-040.TRN from the City of Dallas**. The ITD method provides a decision tree for the prescreening steps (sight distance, warrant analysis, future traffic, etc.) and provides some broad guidance for the detailed analysis, which includes intersection delay impacts. The Dallas method re-iterates ITD's prescreening steps but provides more detailed guidance for evaluating sight distance, assessing crash data, and conducting the field delay studies with and without signalized operations. Documentation of both methodologies are included in Appendix A.

The cornerstone of the prescreening step is evaluating traffic signal warrants from the **2009 Manual of Uniform Traffic Control Devices (MUTCD)**. The MUTCD prescribes standards and guidance to investigate the need to *install* a traffic signal. This includes an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions. To evaluate *removal* of an existing signal, a similar MUTCD evaluation is conducted to determine if the operations and safety are expected to be maintained or improved without the traffic signal. Both installation and removal evaluations consider vehicle volumes, pedestrian volumes, crashes, geometric characteristics, and impacts to corridor operations.

HOW WERE THE SIGNALIZED INTERSECTIONS EVALUATED?

The prescreening step evaluates the pedestrian and vehicle volume-based MUTCD traffic signal warrants and recent historical crash data, and conducts a high-level sight distance review. The volume-based warrants were evaluated with existing traffic, and also evaluated with future 2020 traffic if the intersection was not warranted with existing traffic.

MUTCD Traffic Signal Warrants

The warrant analysis follows the standards and guidance prescribed in Chapter 4C – Traffic Control Signal Needs Study of the 2009 MUTCD (included in Appendix B). The methodology includes a total of nine warrants. The following four warrants were evaluated for the prescreening step:

- *Warrant 1 – 8-hour Vehicular Volume*
    - Condition A – Intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic signal.
    - Condition B – Intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor street suffers excessive delay or conflict entering or crossing a major street.
- *Warrant 2 – 4-hour Vehicular Volume*
    - Intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic signal.
- *Warrant 4 – Pedestrian Volume*
    - Intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

- *Warrant 9 – Intersection Near a (Railroad) Grade Crossing (applies only at Yellowstone Avenue/A Street)*
    - Intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a railroad grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Warrant 1 and Warrant 2 consider only vehicle volumes on both the minor side street and major main street. Warrant 4 considers the volume of pedestrians crossing the major main street and the main street vehicle volume and Warrant 9 considers the proximity of the signal to a railroad grade crossing.

Warrant 6, Coordinated Signal System, and Warrant 8, Roadway Network, will be evaluated in the detailed analysis step after the unwarranted traffic signals are identified. The remaining three warrants (3, 5 and 7) do not apply to the study intersections and will not be evaluated. Warrant 3, Peak Hour Volume, only applies in unusual cases such as near manufacturing plants or industrial complexes that service large numbers of vehicles over a short time. Warrant 5, School Crossing, only applies near schools, and the only intersection near a school is Holmes Avenue/7th Street which meets vehicular warrants so Warrant 5 evaluation is not needed. Warrant 7, Crash Experience, can only apply if a traffic signal is not currently installed; however, the crash evaluation conducted during the prescreening step effectively addresses the intent of Warrant 7.

MUTCD Guidance

The MUTCD gives general guidance on two items that have the potential to affect the results of the vehicle volume warrants (Warrants 1 and 2): right-turn volume reductions and the number of minor street lanes.

Right-turn Reductions

Section 4C.01.08 of the MUTCD states, "*Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants…*"

Many practitioners and agencies rely on engineering judgment to estimate right-turn reductions, which is highly subjective. Because of the importance and sensitivity of this study, an objective and reproducible methodology was desired. A search of the state-of-the-practice methods for right-turn reduction yielded few documented objective methods. For the two main methods used in practice, information regarding the underlying methodology and development is not available. However, one potentially useful method was discovered, and although it is relatively new, its underlying methodology is understandable, objective and reproducible. After coordinating with the City, the newer methodology was applied for this study.

The objective right-turn methodology was developed by the University of Nevada Reno (UNR), and sponsored by the Nevada Department of Transportation (NDOT). It is based on delay equivalence of the minor street right-turn traffic versus the minor street through/left-turn traffic. Thousands of scenarios were modeled to develop reduction factors that adjust the right-turns to volumes that experience the same delay as the through/left-turn traffic. Minor street turning movement distribution and major street directional splits are factored into the modeling process. The methodology has been available since 2015

and is currently being applied by NDOT. Furthermore, the NDOT delay-based right-turn reduction method is consistent with Section 4C.01.10 of the MUTCD which states "*…the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict.*"

The NDOT equivalent factors (reduction factors) are unique for different minor street lane configurations and vary by time of day because the reductions are dependent on the major street volume and directional split which vary by time of day. Equivalent factors were developed for all traffic scenarios, utilizing application limitations described in the UNR technical paper for the 8-hour Vehicle Volume Warrant.

Minor Street Lanes

Section 4C.01.09 of the MUTCD states, "*Engineering judgment should also be used in applying various traffic signal warrants to cases where approaches consist of one lane plus one left-turn or right-turn lane. The site-specific traffic characteristics should dictate whether an approach is considered as one lane or two lanes…*"

Warrant 1 and Warrant 2 have set vehicle volume thresholds for the minor side street and major main street to determine whether a traffic signal is warranted. These thresholds vary by number of lanes on the minor and major street. Where left-turn or right-turn lanes exist on the minor street, the approach can be evaluated as a one-lane versus two-lane approach, which affects the warrant threshold and results.

For minor street left-turn lanes, the following guidance was applied for this study from Section 4C.01.09 of the MUTCD, "*The approach should be considered two lanes if approximately half of the traffic on the approach turns left and the left-turn lane is of sufficient length to accommodate all left-turn vehicles.*" If less than half of the approach traffic turns left, the approach is evaluated as one-lane.

For minor street right-turn lanes, Section 4C.01.10 of the MUTCD provides the following guidance, "*…engineering judgment and rationale should be applied to a street approach with one through/left-turn lane plus a right-turn lane. In this case, the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict. The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.*" The NDOT method yields a right-turn volume that enters the major street with an equivalent delay (conflict) as the through/left-turn vehicles; this effectively removes the right-turn vehicles that have minimal conflict as prescribed in the MUTCD. Therefore, the minor street approaches are evaluated as one-lane for this study in cases where right-turn lanes are present.

MUTCD Data Analysis

The vehicle and pedestrian MUTCD warrants (Warrants 1, 2 and 4) require extensive traffic count data. Counts were collected between October 10, 2013, and April 3, 2016, and consisted of 24-hour approach counts on all four approaches, plus peak hour turning movement and pedestrian crossing counts for the AM, midday and PM peak periods.

Vehicle Warrants 1 and 2 were evaluated on three days – a typical weekday (Tuesday, Wednesday or Thursday), a Friday that the Idaho National Laboratory (INL) has off (which generally increases traffic

around the city), and a Saturday. Pedestrian Warrant 4 was evaluated during a typical weekday. All counts were collected when school was in session.

Vehicle approach counts were not collected by approach lane, so to apply the right-turn reduction, the right-turn percentage required an estimate based on the existing turning movement counts. Using six hours of turning movement counts from the AM, midday and PM peak periods on a typical weekday, the daily-averaged right-turn percentage was calculated and applied to all 24 hours of approach counts for all three evaluation days.

Sight Distance

A high-level evaluation of the existing sight distance was conducted for the prescreening step using aerial imagery, Google Street View and field observations. Prior to removing traffic signals, a field sight distance evaluation will be conducted to determine if there are obstructions that need to be relocated or adjusted.

Crashes

Five years of crash data from 2010 to 2014 was evaluated to determine if increased crashes are occurring as a result of signal operations. The crashes were reviewed to compile the types of crashes occurring at the intersections and to see if the intersection as a whole is experiencing a higher than expected number of crashes by completing an ITD-2658 Safety Evaluation.

The ITD-2658 Safety Evaluation compares the existing crash rate to the intersection base rate. The base rate is the crash rate expected to occur at similar intersections in Idaho with similar volumes. If the crash rate is below the base rate, this suggests that there may not be a negative crash impact if the signal is removed; however, specific crash type trends also need to be considered.

The Dallas removal study method prescribes that right-angle crash trends and rear-end crash trends specifically should be evaluated. Both right-angle and rear-end crashes can be attributable to the traffic signal. Conversely, the method requires analysis of permissive movements crash trends (right-turns and major street left turns), which can potentially be correctable with changes in the traffic signal operation or with turn restrictions. If there is a trend of permissive movement crashes, the traffic signal should be retained.

WHAT ARE THE PRESCREENING RESULTS?

MUTCD Traffic Signal Warrants

Thresholds

General information regarding the MUTCD warrant threshold is described below. Warrant 1 and 2 use the total volume of both approaches on the major street and the higher volume of either minor street approach. On the minor street, the higher volume is not required to be on the same approach during each hour period. Warrant 4 considers pedestrian volume crossing the major street only, and combines pedestrians at both major street crossings. Warrant 9 considers the distance from the railroad crossing and combination of volumes from both the major street and minor street approaches.

For Warrant 1, the vehicular thresholds to meet the warrant for a one-lane minor street approach and two-lane major street approach are 150 vph and 600 vph, respectively, for Condition A. For Condition B, the minor street and major street thresholds are 900 vph and 75 vph, respectively. All traffic signals on 17th Street, Broadway Street, and Yellowstone Avenue have one-lane minor street approaches and two-lane major street approaches, with the exception of the Yellowstone Avenue/A Street intersection which has a two-lane minor street approach. For two-lane minor street approaches, the threshold increases to 200 vph and 100 vph for Condition A and B, respectively. On Holmes Avenue, the one-lane major street approach has a threshold of 500 vph and 750 vph for Condition A and B, respectively.

For Warrant 2, the vehicular thresholds to meet the warrant vary depending on the relative volumes of the minor street and major street volumes. In general, the traffic signal warrant is met if there are more than 80 vph on the minor street approach and 1,100 vph on the major street approach for any minor street and major street lane combination. Higher minor street volumes are needed to meet the warrant if the major street volume is below 1,100 vph.

For Warrant 4, the pedestrian thresholds to meet the warrant vary depending on the volume of major street traffic. In general, the traffic signal warrant is met if there are more than 107 pedestrians per hour (pph) crossing the major street and 1,100 vph on the major street for the 4-Hour Volume criteria, and more than 133 pph crossing the major street and 1,450 vph on the major street for the Peak Hour Volume criteria. Higher pedestrian volumes are needed to meet the warrant if the major street vehicular volume is below the 1,100 vph or 1,450 vph threshold.

For Warrant 9, the thresholds to meet the warrant vary depending on the volume of major street traffic, the equivalent volume of minor street traffic, and the distance between the railroad crossing and the intersection stop bar. In general, the traffic signal warrant is met if there are more than 25 vph on the minor street approach and 500 vph on the major street approach for any crossing distance (0 to 140 feet). The equivalent volume of minor street traffic is calculated by adjusting the volume of minor street traffic to account for the amount of rail traffic, buses and tractor-trailer trucks. The adjustment factors were based on the following assumptions: 12 or more daily rail crossings (1.33 factor), 2 percent buses (1.09 factor), and 7.6% to 12.5% trucks (1.00 factor). This warrant applies only at the Yellowstone Avenue/A Street intersection.

Results

Applying the right-turn reductions and one-lane versus two-lane criteria for the vehicular volumes, Warrants 1 and 2 were evaluated for a typical weekday, Friday and Saturday. Warrants 4 and 9 were evaluated for the typical weekday. A condensed summary of the MUTCD analysis results are shown in Table 1 on page 8. The table includes the number of lanes on the major street and minor street, the highest volume day, warrant analysis result and the number of hours the warrant was met to provide a gauge of how strongly the traffic signal is warranted. Detailed warrant analysis reports are located in Appendix C.

Eight intersections meet one or more warrants and per ITD and Dallas signal removal methodologies, the traffic signals should be retained and no further analysis is necessary. For the four intersections that do not meet any of the warrants, further analysis is needed to determine if the traffic signal should be removed.

Table 1. Summary of MUTCD warrant analysis

Corridor	No.	Intersection	Major Street Lanes/ Minor Street Lanes	Highest Volume Day	Warrant 1 8-Hour Vehicular Volume		Warrant 2 4-Hour Vehicular Volume		Warrant 4 Pedestrian Volume		Meets One or More Warrants (No = unwarranted)
					Warr-anted	# Hours Met (8 req'd)	Warr-anted	# Hours Met (4 req'd)	Warr-anted	# Hours Met (varies)	
17th Street	1	June Avenue	2/1	Fri	No	1	No	0	No	0	**No**
	2	Jennie Lee Drive	2/1	Thur	Yes	12	Yes	11	No	0	Yes
	3	Ponderosa Drive	2/1	Thur	No	2	No	0	No	0	**No**
	4	St. Clair Road	2/1	Fri	Yes	12	Yes	10	No	0	Yes
Holmes Avenue	5	12th Street	1/1	Wed	Yes	9	Yes	7	No	0	Yes
	6	9th Street	1/1	Thur	Yes	8	Yes	4	No	0	Yes
	7	7th Street	1/1	Thur[1]	No	5	Yes	5	No	0	Yes
	8	Elva Street	1/1	Thur	Yes	9	No	0	No	0	Yes
Broadway Street	9	Lindsay Boulevard	2/1	Fri	No	0	No	0	No	0	**No**
	10	Shoup Avenue	2/1	Fri	No	0	No	0	No	0	**No**
Yellowstone Avenue	11	A Street[2]	2/2	Wed	No	5	Yes	4	No	0	Yes
	12	B Street	2/1	Fri	No	6	Yes	6	No	0	Yes

[1]Friday count not available. Friday may be highest day.

[2]Warrant 9, Intersection Near a (Railroad) Grade Crossing, is met at Yellowstone Avenue/A Street intersection.

The high vehicle volume days occurred most frequently on a Thursday or a Friday where the INL is off. Saturday was not the highest volume day at any intersection.

At the Yellowstone Avenue/A Street intersection, the distance between the railroad crossing and the intersection stop bar is approximately 85 feet and the minimum threshold distance is 25 feet for the given vehicular volumes for Warrant 9; therefore, the traffic signal is warranted with the grade crossing warrant in addition to vehicular Warrant 2.

At the four intersections that do not meet any warrants, the 2020 traffic forecasts were reviewed to determine if a traffic signal may meet warrants in the near future. All four intersections are not expected to have significant growth on the minor streets in five years; therefore, the intersections are not expected to meet warrants in the immediate future.

Sight Distance

Horizontal sight distance for the minor street movements and major street left-turn movements appear to meet the minimum stopping sight distance at all 12 intersections, and the intersection locations do not have significant vertical grades that would obstruct the minimum vertical stopping sight distance. The corner clearance sight distance for the minor street appears sufficient from the field review and Google Street View at all study intersections.

Crashes

The crash evaluation for the most recent 5-year crash history from 2010 to 2014 is summarized in Table 2 on page 10. The table summarizes total crashes, results of the ITD-2658 evaluation, and the number of crashes that may be caused by the traffic signal or crashes that may require additional traffic signal mitigation. Crash data and ITD-2658 Forms are included in Appendix D.

Installing traffic signals at intersections lowers the crash frequency on average, so it is generally assumed that the crash rate will increase if a traffic signal is removed. However, if a traffic signal does not meet vehicular warrants, it may be possible that fewer crashes will occur if it is removed because less stops and slowing on the major street will occur. Limited research studying the safety of traffic signal removals has been conducted and no data is available for the crash increases or decreases that may occur when removing an unwarranted traffic signal on a multi-lane, two-way arterial. However, crash reductions of 24 percent have been recorded at one-lane, one-way minor street intersections where unwarranted traffic signals were removed (FHWA Crash Modification Clearinghouse).

The crash rates at all 12 intersections are well below the ITD base rate and are not expected to increase to a level that would meet the Warrant 8, Crash Experience, if crashes increase as a result of the signal removal. However, post-removal monitoring must be done to verify that a crash problem has not developed.

Permissive turn crashes, which may trigger the need for additional traffic signal mitigation and justify retaining the traffic signal, are relatively low. Conversely, the types of crashes that may be attributable to traffic signal control (rear-end and right-angle) comprise a majority of the crashes at eight of 12 intersections. However, because the overall intersection crash rates are so far under the base rate, there does not appear to be a crash problem that is attributed to the traffic signal.

Table 2. Crash evaluation summary (2010 to 2014 historical data)

Corridor	No.	Intersection	Total Crashes	Base Rate	Crash Rate	Rear-End and Right-Angle Crash Total (%)[1]	Permissive Turn Crash Total (%)[2,3]	Crash Problem (Yes/No)
17th Street	1	June Avenue	13	0.58	0.22	4 (31%)	4 (31%)	No
	2	Jennie Lee Drive	15	0.58	0.24	5 (33%)	6 (40%)	No
	3	Ponderosa Drive	8	0.58	0.15	6 (75%)	1 (13%)	No
	4	St. Clair Road	19	0.58	0.33	9 (47%)	3 (%)	No
Holmes Avenue	5	12th Street	12	0.65	0.36	10 (83%)	0 (%)	No
	6	9th Street	13	0.65	0.43	11 (85%)	2 (15%)	No
	7	7th Street	9	0.65	0.28	5 (56%)	2 (22%)	No
	8	Elva Street	9	0.65	0.33	5 (56%)	2 (22%)	No
Broadway Street	9	Lindsay Boulevard	2	0.58	0.05	0 (%)	0 (%)	No
	10	Shoup Avenue	9	0.58	0.35	6 (67%)	2 (22%)	No
Yellowstone Avenue	11	A Street	6	0.43	0.18	4 (67%)	1 (17%)	No
	12	B Street	9	0.43	0.29	8 (89%)	0 (%)	No

[1]Crashes potentially attributable to traffic signal control. Consider removing signal if trend exists.
[2]Crashes that may be correctable with changes in traffic signal operation or turn restrictions. Retain signal if trend exists.
[3]Permissive turns crashes are right-turn crashes and major street left-turn crashes with oncoming vehicles

Summary of Prescreening Step Results

The results of the warrant analysis, sight distance analysis and crash analysis were combined to determine the locations that are recommended to advance to the detailed analysis step, which includes a field delay study. As shown in Table 3 on page 11, the following four intersections do not meet any traffic signal warrants and do not have sight distance or crash problems, and as a result are **candidates for detailed analysis and delay study:**

- **17th Street and June Avenue**
- **17th Street and Ponderosa Drive**
- **Broadway Street and Lindsay Boulevard**
- **Broadway Street and Shoup Avenue**

Table 3. Abbreviated summary of warrant analysis

Corridor	No.	Intersection	Warranted (Yes/No)	Adequate Sight Distance[1] (Yes/No)	Crash Problem (Yes/No)	Candidate for Detailed Analysis and Delay Study
17th Street	1	June Avenue	No	Yes	No	Yes
	2	Jennie Lee Drive	Yes	Yes	No	No
	3	Ponderosa Drive	No	Yes	No	Yes
	4	St. Clair Road	Yes	Yes	No	No
Holmes Avenue	5	12th Street	Yes	Yes	No	No
	6	9th Street	Yes	Yes	No	No
	7	7th Street	Yes	Yes	No	No
	8	Elva Street	Yes	Yes	No	No
Broadway Street	9	Lindsay Boulevard	No	Yes	No	Yes
	10	Shoup Avenue	No	Yes	No	Yes
Yellowstone Avenue	11	A Street	Yes	Yes	No	No
	12	B Street	Yes	Yes	No	No

[1]Sight distance result based on high-level evaluation. Detailed field study will be conducted before signal removal.

WHAT ARE THE NEXT STEPS?

The next tasks for the detailed analysis step include a field delay study, a detailed traffic analysis with and without the traffic signals that are not warranted, public involvement, and estimating the costs of signal removal versus the savings on signal maintenance.

Delay Study

The delay study evaluates the minor street delay using video of the intersection operations with and without the traffic signal to determine:

- If side street delay is significantly increased
- If there is a change in side street volumes
- If any other unintended negative operational or safety impacts arise.

The recommended delay study procedure specified by the Dallas method is to collect before data during the first week with the signal operational, then suspend traffic signal operations the beginning of the second week, and finally collect after data on the same day that the before data was collected. The study is conducted for three one-hour periods on the highest volume minor street approach. A Thursday is recommended for data collection because it is consistently the highest volume weekday at the intersections. Traffic signal operations should be suspended on a Monday or Tuesday morning.

To suspend traffic signal operations, the heads are bagged, stop signs with flags are installed on the minor street approaches, and "SIGNAL UNDER STUDY FOR REMOVAL" signs are installed on mast arms for all approaches (Figure 4). Additional signage alerting drivers that a new traffic pattern exists should also be considered.

Delay studies should not be conducted simultaneously at two signalized intersections that are in close proximity to each other, unless their unsignalized traffic patterns are independent of the other intersection. Signal suspensions on 17th Street at June Avenue and Ponderosa Drive should not occur at the same time because their suspensions could both affect operations at Jennie Lee Drive; however, signal suspensions on Broadway Street at Lindsay Boulevard and Shoup Avenue can be conducted at the same time because neither traffic signal impacts the operations or traffic patterns of the other.

Figure 4. Sign posted during traffic signal suspension

Detailed Traffic Analysis

Existing and forecasted traffic will be analyzed to calculate measures of effectiveness (stops, delay, fuel consumption) with and without traffic signals for the signalized corridors. Multiple traffic analysis scenarios will be modeled per corridor that will include all combinations of scenarios with and with traffic signals. The results of the delay study will provide information about how many vehicles will redistribute to other roadways, so the re-distributed traffic can more accurately model the traffic analysis scenarios. In addition, the results of the detailed traffic analysis are needed to evaluate the remaining two applicable warrants:

- *Warrant 6 – Coordinated Signal System*
  - Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.
- *Warrant 8 – Roadway Network*
  - Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Signal Removal Cost Estimate

Working with Idaho Falls Power, the estimated costs to removal the traffic signal will be compiled, reviewed and compared to the estimated traffic signal maintenance costs over the anticipated service life.

Public Outreach

Public outreach will consist of two steps – initial public notice and an open house public meeting. Prior to conducting the field delay study, the City will prepare a public notice of the study and upcoming traffic signal suspensions. It is anticipated that information on the project will be available on the City's web site, and the public notice will be provided to the media. Following the completion of the delay study, traffic and analysis and cost analysis, an open house public meeting will be held to inform the public of the study results and gather their input. City and Six Mile Staff will be available to answer questions and present before and after delay study videos and traffic simulations.

Signal Removal

If a traffic signal is approved for removal, a stepwise approach to removing the signal should be employed to ensure the intersection is operating as expected and there is not a pattern of increased crashes. The removal should consist of a short-term test period where the signal infrastructure remains intact followed by the final removal with additional monitoring.

During the test period, the signal operations are suspended for a short duration – one week per ITD and 30 days per Dallas – where all signal equipment is retained. For visibility, install flags on stop signs and add temporary signage to emphasize the new traffic pattern. If at any time significant crashes occur that are attributable to the traffic signal, signalized operation should be re-instated.

After the test period, all of the above ground equipment – signal heads, mast arms, signal poles, and controller cabinets – should be removed. The stop sign flags and temporary signage should also be removed. Changes to lane assignments and pavement markings to minor streets should be made, if necessary. Finally, consideration should be made to removing major street crosswalks and relocating obstructions in the curb corners to improve sight distance. The crash history and operations should be closely monitored for at least six months after the signal removal.