Future Signalization and Access Evaluation

October 2005

KAI Project #: 6241.01
ITD Project #: NH-5110(126)
Key #: 7039
Agreement #: 5579
US 95, North Coeur D’Alene Corridor Study

Future Signalization and Access Evaluation

Coeur D’Alene, Idaho

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Section 1

Executive Summary
Executive Summary

This report presents a summary of the signal spacing evaluation, access management strategies, and recommendations for the US 95 corridor. The key findings and recommendations are identified below.

FINDINGS

South Section (Ironwood Drive to Honeysuckle Avenue)
- The south section of US 95 is currently operating near capacity and will require intersection improvements and an additional through lane in the future in order to substantially improve traffic flow.
- The existing signals at Bosanko Avenue and Canfield Avenue are located ¼ mile from congested intersections and exacerbate the slow speeds and high delays currently experienced along the corridor.

North Section (Orchard Avenue to State Highway 53)
- Due to existing and future traffic congestion along the US 95 corridor, use of microscopic simulation is the best method for evaluating future traffic conditions.
- Traffic signal spacing of ¼ mile results in over a 40 percent increase in through traffic delay, in comparison to the ½ mile signal spacing under the 30 percent and 60 percent traffic growth scenarios.
- As traffic demand rises and intersections reach capacity, close signal spacing near congested intersections could result in queues extending to upstream signalized intersections, further reducing the capacity of individual intersections and the corridor.
- Joint planning efforts between ITD and the local jurisdictions of Coeur D’Alene and Hayden will be crucial to ensure adequate east-west access to existing and future development is provided at the same time as acceptable signal and access spacing.
- The proximity and recent improvements to Government Way provide the opportunity for local circulation options on the east side of US 95 to be used to reduce the need for additional local access on US 95.

RECOMMENDATIONS
- Construct capacity improvements on the south section of the US 95 corridor (specific improvements are identified in Report #2: Near-Term Analysis and Improvements) and review options for improving signal spacing at locations such as Bosanko Avenue and Canfield Avenue.
- Work with local jurisdictions to identify local circulation enhancements and key east-west corridors to limit signal spacing to ½ mile for new signals.
- New signal locations throughout the corridor should be identified and adopted in local transportation plans.
- Work with the City of Hayden to pursue completion of other north-south parallel roadways on the west side of US 95 that can be used as alternate routes for local traffic.
Section 2

Introduction
Introduction

The US 95 corridor is a major north-south roadway running throughout Idaho. Rapid commercial development along the US 95 corridor and growth in population and tourism throughout Kootenai County, specifically in Coeur D’Alene and Hayden, has resulted in substantial growth in traffic along the US 95 corridor. As a result of the growth in the area, the Idaho Transportation Department (ITD) has experienced an increase in requests by local jurisdictions and developments for access and improvements on US 95. In addition, local jurisdictions, such as Coeur D’Alene and Hayden rely on US 95 for access to substantial sections of their cities. Therefore, identifying future access locations along US 95 is critical to planning the local street systems and land uses along the corridor.

A corridor study was completed for US 95 in 2001 identified the need for a new high-capacity corridor to accommodate traffic growth over the next 20 years. While the need for a high-capacity corridor remains a long-term goal for Kootenai County, a near-term plan for access and improvements along the current US 95 corridor is needed. Identification of future signal locations and local access strategies are key components of extending the operational life and supporting community development along a corridor. ITD retained Kittelson & Associates, Inc. (KAI) to review the existing and future traffic conditions and identify optimal future signal locations and local access strategies along the US 95 corridor between Ironwood Drive and SH 53. Figure 1 illustrates the study corridor. Table 1 summarizes the study intersections between Ironwood Drive and SH 53.

### Table 1
**Study Intersections Along US 95**

<table>
<thead>
<tr>
<th>Signalized Intersections</th>
<th>Unsignalized Intersections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ironwood Drive/US 95</td>
<td>Haycraft Road/US 95</td>
</tr>
<tr>
<td>Interstate 90 EB Ramp/US 95</td>
<td>Cherry Lane/US 95</td>
</tr>
<tr>
<td>Interstate 90 WB Ramp/US 95</td>
<td>Wilbur Avenue/US 95</td>
</tr>
<tr>
<td>Appleway Avenue/US 95</td>
<td>Aqua Avenue/US 95</td>
</tr>
<tr>
<td>Neider Avenue/US 95</td>
<td>Orchard Avenue/US 95</td>
</tr>
<tr>
<td>Bosanko Avenue/US 95</td>
<td>Dakota Road/US 95</td>
</tr>
<tr>
<td>Kathleen Avenue/US 95</td>
<td>Miles Avenue/US 95</td>
</tr>
<tr>
<td>Dalton Avenue/US 95</td>
<td>Lacey Avenue/US 95</td>
</tr>
<tr>
<td>Hanley Avenue/US 95</td>
<td>Wyoming Avenue/US 95</td>
</tr>
<tr>
<td>Canfield Avenue/US 95</td>
<td>Lancaster Road/US 95</td>
</tr>
<tr>
<td>Prairie Avenue/US 95</td>
<td>Boekal Road/US 95</td>
</tr>
<tr>
<td>Honeysuckle Avenue/US 95</td>
<td></td>
</tr>
<tr>
<td>Hayden Avenue/US 95</td>
<td></td>
</tr>
<tr>
<td>SH 53/US 95</td>
<td></td>
</tr>
</tbody>
</table>
GOALS AND OBJECTIVES
US 95 is the key north-south corridor for regional traffic as well as local traffic from Coeur D’Alene, Hayden, and Hayden Lake. The goals and objectives for this evaluation of signalization and access strategies are to:

- Identify the operational impacts of ½ mile and ¼ mile signal spacing along the US 95 corridor.
- Review strategies for improving operations on US 95 and for providing access to future developments.
- Develop recommendations for future access and signal spacing along US 95 between Ironwood Drive and State Highway 53.

This report summarizes the following information associated with the future signalization and access evaluation along US 95:

- Access and Signal Spacing Research
- Evaluation Methodology
- Results of Analysis
- Implementation Strategies
- Conclusions and Recommendations

Detailed analysis information and technical memoranda associated with this project have been compiled in the Technical Appendix: US 95, North Coeur D’Alene Corridor Study.
Section 3
Access and Signal Spacing
Research
Access and Signal Spacing Research

This section provides a brief overview of some research that has been completed on the effects of access and signal spacing on corridor operations.

**IMPACT OF ACCESS ON MOBILITY**

Intersection and signal spacing play a significant role in determining the safety, congestion, and appearance of any roadway. Traffic signal location significantly impacts the way a corridor operates with respect to travel speed, delay, and progression of traffic through coordination of the traffic signals. While limiting access can have many positive impacts, it can involve trade-offs between competing objectives which include:

- Maintaining speed and capacity;
- Access to the local street system;
- Ability to meet land-use planning objectives; and
- Livability issues such as speed and pedestrian accessibility along the corridor.

Figure 2 shows some examples of the trade-offs between access and mobility.

![Figure 2 - Access Versus Mobility Needs](image-url)
The trade-offs between access and mobility are evident on US 95. The need for traffic signals to access local streets with large commercial developments on the section of US 95 between Interstate 90 and Hayden Avenue has resulted in inconsistent traffic signal spacing and high side-street traffic volumes. The high side-street volumes have caused the demand to exceed capacity during peak conditions at many of the intersections including Appleway Avenue, Kathleen Avenue, and Hanley Avenue. Additionally, vehicle progression has been impacted during the peak traffic conditions due to the close signal spacing at the following locations:

- Kathleen Avenue and Bosanko Avenue;
- Hanley Avenue and Canfield Avenue; and
- Interstate 90 Ramps and Appleway Avenue.

**RESEARCH FINDINGS**

Traffic signal and access spacing is a critical element in determining the safety, operations, and capacity of an arterial corridor. Several research projects have been conducted to evaluate the effects of traffic signals and access spacing on the safety and operations of a corridor. The following is a short summary of some of the findings from these research projects.

The *Colorado Access Demonstration Project* (*Colorado Department of Transportation, June 1985*) compared roadways in the Denver metropolitan area that had ½ mile signal spacing with right turn access at ¼ mile with roadways that had ¼ mile signal spacing with full median openings and found that the delay decreased by nearly 60 percent with the higher access control.

*NCHRP 420: Impacts of Access Management Techniques* (*Transportation Research Board, 1999*) reported a 16 percent increase in travel time associated with ¼ mile signal spacing versus ½ mile signal spacing.

Other studies identified in the *Access Management Manual* (*Transportation Research Board, 2003*) have concluded that divided four-lane arterials with uniform signal spacing of ½ mile have a similar capacity to a six-lane arterials with ¼ mile signal spacing and less access management. Additionally, uniform signal spacing of ½ mile is generally desirable, as it allows for accommodating various traffic flows along the corridor and improving travel time, safety, and fuel consumption compared with more aggressive signal spacing options. Figure 3 illustrates uniform signal spacing as it relates to speed and cycle length. As shown in Figure 3, the speed range decreases from 35 to 60 miles per hour for ½-mile signal spacing to 15 to 40 miles per hour for ¼ mile signal spacing. The remainder of this report will demonstrate the impacts of short signal spacing, especially under congested traffic conditions along US 95.

![Figure 3 Effects of Uniform Signal Spacing on Speed and Cycle Length](image)
Section 4

Evaluation Methodology
Evaluation Methodology

This section provides a brief summary of the traffic data and methodology used for analyzing the effects of signal spacing along the US 95 corridor.

TRAFFIC DATA
ITD provided eight-hour weekday turning movement counts (manual surveys) and 24-hour roadway link traffic counts (tube counts) along the US 95 corridor. The eight-hour weekday turning movement counts were taken intermittently throughout the months of March and April 2004. The March/April timeframe represents average traffic volumes when compared to an annual, monthly profile along US 95. Turning movement count data was collected at each of the US 95 study intersections (signalized and unsignalized) during the weekday p.m. peak time period (3:30 p.m. – 6:30 p.m.). The turning movement count data revealed that the system peak hour for the weekday p.m. time period occurred at 3:45 p.m. to 4:45 p.m. The traffic analysis was performed for the peak season, weekday p.m. peak hour traffic conditions.

EVALUATION METHODOLOGY
The methodology used for evaluating future access and signal spacing strategies included the following steps:

1. Identification of the Study Scenarios
2. Development of Access Options Assumed for ½ Mile and ¼ Mile Signal Spacing
3. Forecasting Future Traffic Growth
4. Evaluation of the Study Scenarios

I. Study Scenarios
The evaluation of signal spacing along the US 95 corridor focused in the section of US 95 between Orchard Avenue and SH 53. The purpose of focusing on the north section was to ensure a fair comparison of equally achievable options. The south section of US 95 between Ironwood Drive and Honeysuckle Avenue was not included in the comparison of signal spacing options. This section of the corridor is built-out and it was determined that it is unrealistic to assume closely spaced signals such as Ironwood Drive, Appleway Avenue, Bosanko Avenue, and Canfield Avenue could all be removed or relocated to obtain consistent ½ mile spacing. The US 95 north section is approximately 4-miles in length and is illustrated in Figure 4.

In order to evaluate the impacts of signal spacing on the US 95 corridor, three signal-spacing scenarios were reviewed which included ¼ mile signal spacing, ½ mile signal spacing, and 1-mile signal spacing. While 1-mile signal spacing was initially considered for evaluation, a review of the possible development potential on the corridor revealed that by limiting full access to US 95 to every mile, the amount of traffic at each 1-mile intersection would increase to the level where an urban interchange should be considered. Figure 5 illustrates this concept.
Future Signalization and Access Evaluation  

Figure 5 depicts how, as signal spacing increases along a corridor, the amount of traffic entering the intersection increases and therefore the size and number of lanes must increase to accommodate the additional traffic. In areas with commercial zoning and moderate development density, like the US 95 corridor, 1-mile intersection spacing can require a grade separation or an abnormally large intersection with special high-capacity design features. For this reason, 1-mile signal spacing was not evaluated along the US 95 corridor.

**II. Signal and Access Locations**

As mentioned earlier, US 95 has a Type 3 access control designation. The minimum intersection spacing allowed under Type 3 is ¼ mile. Based on the roadway classification and discussions with ITD, signal and access locations were identified for the ¼ mile and ½ miles signal spacing scenarios between Orchard Avenue and SH 53.

**¼ Mile Signal Spacing Scenario**

Under this scenario, traffic signals were located at every ¼ mile between Orchard Avenue and SH 53. No mid-block accesses (i.e., unsignalized intersections) were assumed for this scenario. This scenario resulted in a total of fifteen signalized intersections. The arterial speed was assumed to be 45 miles per hour for both scenarios. However, under the ¼ mile scenario, it is likely that the posted speed and operating speed would be lower due to the close proximity of traffic signals along the corridor. Figure 6 illustrates the lane configuration under this scenario.

**½ Mile Signal Spacing Scenario**

Under this scenario, traffic signals were located at every ½ mile between Orchard Avenue and SH 53. Mid-block accesses (i.e., right-in/right-out/left-in unsignalized intersections) were assumed for this scenario. This scenario resulted in a total of nine signalized intersections. The arterial speed was assumed to be 45 miles per hour for both scenarios. Figure 7 illustrates the standard lane configuration under this scenario. Figure 8 shows the signal locations for each scenario that was studied.

ITD is currently planning for an interchange to be constructed at the US 95/Lancaster Road intersection. The interchange is a recent project that was proposed to accommodate a large residential development.
1/2 MILE AND 1/4 MILE SIGNAL SPACING SCENARIOS
COEUR D'ALENE, IDAHO

1/2 MILE SIGNAL SPACING

1/4 MILE SIGNAL SPACING
on the northside of Lancaster Road at Government Way. In order to provide a consistent comparison between ¼ mile and ½ mile signal spacing, the proposed interchange at Lancaster was not assumed in the evaluation.

III. Growth Forecasts

Traffic growth and the resulting need for new access and signals on a corridor occurs due to normal growth in through traffic on the corridor as well as development of specific land along the corridor. While the travel demand models, such as the model maintained by the KMPO, can provide traffic forecasts 20 years in the future, they are not detailed enough to the level required to evaluate access and signal operations or to predict what development on the corridor will occur in five or ten years. Therefore, the traffic growth forecasts used for this evaluation were developed based on fixed percentages of growth and not tied to a specific year. Three growth forecasts were developed:

- **Base Year Forecast** - Assumes a fixed amount of traffic at each potential signal location such that a signal will be needed. This resulted in an increase of approximately 10 to 20 percent of traffic on the corridor. The intersection volume-to-capacity ratios ranged from 0.65 to 0.80 along the corridor.

- **30 Percent Growth Forecast** - Assumes a global growth in traffic of 30 percent along the study section of the corridor. The intersection volume-to-capacity ratios ranged from 0.75 to 0.95 along the corridor.

- **60 Percent Growth Forecast** - Assumes a global growth in traffic of 60 percent along the study section of the corridor. The intersection volume-to-capacity ratios ranged from 0.90 to 1.20 along the corridor.

Figure 9 illustrates the three growth scenarios compared to the existing traffic conditions along US 95.

![Figure 9Projected Traffic Growth On US 95](image-url)
IV. Evaluation Tools

The evaluation of the signal spacing scenarios was performed using the software programs, Synchro 6.0 and SimTraffic. In the Synchro model, traffic volumes and intersection geometry were inputted to develop the network for each scenario. The signal timings were optimized for each scenario. Additionally, the Synchro model was used to check intersection capacities between the two scenarios under the base growth scenario to ensure that each scenario had the same capacity. Figure 10 illustrates a section of the Synchro network for each scenario.

![Synchro Network for ¼ Mile and ½ Mile Scenarios](image)

The SimTraffic software is a microscopic traffic simulation software that provides visual display of the simulation results. A microscopic model simulates vehicular-to-vehicular interaction and therefore can be used to evaluate special operational conditions. The purpose for using a microscopic simulation software (SimTraffic) versus the macroscopic software (Synchro) along US 95 is to be able to evaluate congested traffic conditions, close signal spacing, and the impacts of queue spillback at closely spaced intersections. Therefore, SimTraffic was used as the evaluation tool in this study.

Each scenario was simulated five times for one hour. The five simulation runs were averaged to report the measures of effectiveness. The measures of effectiveness used in this analysis include travel time (minutes), arterial speed (miles per hour), and signal delay (minutes) for the corridor. Figures 11 and 12 illustrate an intersection from the SimTraffic network for the ¼ mile and ½ mile signal spacing scenarios, respectively.
Figure 11  SimTraffic Network for ¼ Mile Signal Spacing Scenario

Figure 12  SimTraffic Network for ½ Mile Signal Spacing Scenario
Section 5
Results of Analysis
Results of Analysis

This section provides a summary of the analysis results for the US 95 corridor. The summary is presented in three sections, which includes existing conditions, future conditions (Ironwood Drive to Honeysuckle Avenue) and future conditions (signal spacing analysis between Orchard Avenue and SH 53).

EXISTING CONDITIONS

As described in previous sections of this report and throughout the study, the operational characteristics of US 95 vary substantially between Ironwood Drive and SH 53. Most of the signalized intersections in the southern section of US 95 (Ironwood Drive to Canfield Avenue) currently operate at a volume-to-capacity ratio (V/C) of approximately 90 to 95 percent indicating they are near capacity. At Prairie Avenue, Honeysuckle Avenue, and Hayden Avenue, the V/C ratio drops to between 70 and 80 percent. The near-capacity operations and close signal spacing translates to slow travel speeds for through traffic on the southern end of US 95. Figure 13 shows the measured travel speeds for the northbound through traffic during the evening peak hour along US 95 and the approximate signal spacing. The travel time data was collected during the off-peak season and are likely slower during the peak summer months.

![Figure 13: Measured Off-Peak Season Travel Speeds on US 95](image-url)
As shown in Figure 13, the average travel speed for the northbound direction significantly increases in the section north of Canfield Avenue. Generally, the speeds are slowest in sections with close signal spacing but the relationship is not consistent. Therefore, while the general trend is that travel speed increases with greater signal spacing, there are many other factors that impact travel speed and delay for through vehicles. The most important factor that impacts travel speed along the US 95 corridor is the amount of traffic on the corridor and at the signalized intersections, as well as maintaining a V/C ratio of less than 80 percent at the signalized intersections. When traffic volumes are not approaching the capacity of the roadway, the vehicles at intersections experience less delay and speeds increase. As traffic volumes increase and intersections approach capacity, the delay increases exponentially and vehicle queues grow rapidly along the roadway. This results in substantially lower travel speeds.

Figure 14 illustrates this concept.

As shown in Figure 14, once an intersection reaches capacity, queues can grow that extend back into upstream intersections, which can result in traffic congestion or “grid lock” at which time travel speeds drop to very low levels. This operation is typically associated with level of service (LOS) F, when traffic demand exceeds short-term capacity. Table 1 shows the speeds associated with each level of service as described in the Highway Capacity Manual 2000 (Transportation Research Board, 2000).

<table>
<thead>
<tr>
<th>Level of Service (LOS)</th>
<th>Average Travel Speed (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>&gt;42</td>
</tr>
<tr>
<td>B</td>
<td>&gt;34-42</td>
</tr>
<tr>
<td>C</td>
<td>&gt;27-34</td>
</tr>
<tr>
<td>D</td>
<td>&gt;21-27</td>
</tr>
<tr>
<td>E</td>
<td>&gt;16-21</td>
</tr>
<tr>
<td>F</td>
<td>&lt;=16</td>
</tr>
</tbody>
</table>

As shown in Figure 13, many of the segments south of Canfield Avenue are operating at LOS E or F and experience periodic traffic congestion and very low speeds.

Signal timing is the second factor impacting travel speed. Signal timing can be used to progress traffic through traffic signals to reduce delay. Signal operation is most effective when an intersection is operating under capacity. Once an intersection or roadway section reaches capacity and drops to LOS F, the ability to progress traffic is substantially reduced due to the congestion between adjacent
intersections, and the effective capacity can be reduced because vehicles are not able to move during portions of the green due to downstream congestion.

**FUTURE CONDITIONS (IRONWOOD DRIVE TO HONEYSUCKLE AVENUE)**

The section of US 95 between Ironwood Drive and Honeysuckle Avenue currently operates near capacity during the afternoon peak hours. As described in Report #2: Near-Term Analysis and Improvements, improvements are needed at many of the intersections to accommodate current traffic demands. These intersection improvements are outlined below:

- **Ironwood Drive** – Add a westbound right-turn lane and a second southbound left-turn lane.
- **Interstate 90 EB Ramp** – Add protected-permissive phasing for the southbound left-turn lane.
- **Interstate 90 WB Ramp** – Add an additional westbound right-turn lane and protected-permissive phasing for the northbound left turn lane.
- **Appleway Avenue** - Add westbound and southbound right-turn lanes and add a second southbound left-turn lane.
- **Kathleen Avenue** – Add a westbound right-turn lane and convert to two westbound through lanes and an exclusive left-turn lane and add a second southbound left-turn lane.
- **Hanley Avenue** – Add an eastbound right-turn lane and convert the westbound approach to dual left-turn lanes, single through lane, and single right-turn lane.
- **Prairie Avenue** – Add westbound and eastbound right-turn lanes.

The current capacity constraints at the intersections listed above and the close signal spacing between Ironwood Drive and Appleway Avenue are the primary factors creating the slow speeds and congestion on the US 95 corridor. In addition, signal-timing improvements were identified and implemented to minimize delay and congestion on US 95 in April 2005.

It is unlikely that the signal spacing can be improved between Ironwood Drive and Appleway Avenue without reconstruction of the Interstate 90 interchange and major circulation changes between US 95 and Government Way. Therefore, the only signal spacing improvements that were identified as part of this study as possibilities for removal or relocation of the signals were at Bosanko Avenue and Canfield Avenue. A review of these signals revealed that the incremental impact on delay and travel speed by the signals at Bosanko Avenue and Canfield Avenue was approximately 5 percent. The minimal impact is primarily because travel speeds are already at LOS E or LOS F conditions and key intersections such as Kathleen Avenue and Hanley Avenue are near capacity with high delays, which overshadow the problems associated with the signal spacing. The most significant concern is that queues from Kathleen Avenue will frequently extend through Bosanko Avenue and queues from Canfield Avenue will extend through Hanley Avenue. These queues have an impact on capacity more so than speed.

In order to accommodate future growth on the US 95 corridor, an additional northbound and southbound through lane will be needed between Honeysuckle Avenue and Ironwood Drive. This improvement is identified in Report #2: Near-Term Analysis and Improvements. Removal of the Bosanko Avenue signal and relocation of the Canfield Avenue signal should be reviewed with the City of Coeur D’Alene and adjacent developments to identify if options for maintaining good access to properties can be accomplished without the close signal spacing at these locations.
FUTURE CONDITIONS (ORCHARD AVENUE TO SH 53)
In order to assess the impact of traffic signal spacing on future traffic operations along US 95, the section of US 95 between Orchard Avenue and SH 53 was evaluated under two scenarios: ½-mile signal spacing and ¼-mile signal spacing. This section of US 95 was chosen due to its under capacity operations under the future baseline traffic condition. Therefore, both signal scenarios can be evaluated equally under each of the growth levels. The key performance measures identified for the evaluation were:

- Delay to peak hour through traffic in the northbound and southbound directions; and
- Average speed for peak hour through traffic in the northbound and southbound directions.

Figures 15 and 16 show the delay for northbound and southbound through vehicles, respectively, for each signal spacing scenario under baseline, 30 percent, and 60 percent traffic growth. The V/C ranges shown for each growth scenario reflect the approximate V/C range in which the intersection on corridor operated.
As shown in Figures 15 and 16, the difference in delay for through traffic for the ¼ mile spacing versus the ½ mile signal spacing is small for the base condition, but substantially increases as the traffic volume increases to 30 percent and 60 percent and as the study intersections approach or exceed capacity. The trend lines were developed to further illustrate the divergence as traffic growth is projected to occur.

Figures 17 and 18 show the average travel speed for northbound and southbound through vehicles, respectively, for each signal spacing scenario under baseline, 30 percent, and 60 percent traffic growth.
Figure 17  Northbound Through Speed Versus Growth and Signal Spacing

Figure 18  Southbound Through Speed Versus Growth and Signal Spacing
As shown in Figure 17, the speed difference between the two signal spacing scenarios in the northbound direction is very small under the base scenario but increases to a difference of approximately 5 miles per hour at 30 percent growth. The difference in average speed then begins to converge as the corridor reaches capacity, due to both scenarios approaching gridlock.

As shown in Figure 18, the difference in speed for the southbound direction changes from a difference of approximately 3 miles per hour in the base scenario to approximately 5 miles per hour in the 30 percent and 60 percent growth scenarios. The more consistent differential in speed between the growth scenarios occurs because the southbound direction has lower traffic volumes during the weekday p.m. peak hour and does not experience the same level of queuing and congestion as traffic demand grows.

Table 3 illustrates relative delay increases and speed decreases associated with the 30 percent and 60 percent growth rates between the ¼ mile signal spacing and ½ mile signal spacing scenarios.

<table>
<thead>
<tr>
<th>Performance Measure</th>
<th>Base Projection</th>
<th>30% Growth</th>
<th>60% Growth</th>
</tr>
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<tbody>
<tr>
<td>Northbound US 95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay Increase</td>
<td>11%</td>
<td>43%</td>
<td>44%</td>
</tr>
<tr>
<td>Speed Decrease</td>
<td>4%</td>
<td>22%</td>
<td>18%</td>
</tr>
<tr>
<td>Southbound US 95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delay Increase</td>
<td>32%</td>
<td>51%</td>
<td>58%</td>
</tr>
<tr>
<td>Speed Decrease</td>
<td>15%</td>
<td>21%</td>
<td>25%</td>
</tr>
</tbody>
</table>

As shown in Table 3, the ¼ mile signal spacing has a substantial impact on delay and corridor travel speed for both growth scenarios.

**IMPACT OF SIGNAL SPACING IN CONGESTED OPERATIONS**

As traffic demand grows on the US 95 corridor, more intersections will approach capacity and congested traffic conditions will occur more often and with greater duration. As discussed earlier, once a section of the corridor approaches capacity, the impact of signal spacing is more pronounced. Once the demand exceeds the capacity at an intersection to process the traffic, the maximum end of queue grows in length during each traffic signal cycle. Therefore, after 15 minutes the queue might be 10 vehicles, but after 30 minutes the queue may be 20 vehicles long. Once a corridor exceeds capacity for extended periods of time, queues can extend over a ¼ mile and, in many corridors, extend over a ½ mile. Once the queues from one intersection extend into an adjacent signalized intersection, the capacity to process the demand is reduced at both intersections, further exacerbating the problem.

This situation currently occurs for short time periods during the peak days in the summer months on US 95 in the southern section between Ironwood Drive and Prairie Avenue. A roadway section, such as the one between Kathleen Avenue and Bosanko Avenue, is particularly vulnerable to this situation because Kathleen Avenue is currently operating near capacity during the summer evening peak hour and the signal at Bosanko Avenue is only ¼ mile away. As part of this project, special signal timing strategies were implemented to reduce the occurrence of queuing between the intersections on US 95. However,
as the area grows and the traffic demand increases along US 95, vehicle queuing will increase and queue spillback between intersections will be more frequent, resulting in substantial increases in delay at a few locations along the corridor.

Given the growth in population and recreation that is occurring in the area, it is likely that many sections of the US 95 corridor between Interstate 90 and SH 53 will reach capacity prior to a high-capacity corridor being developed. This will make the sections with ¼ mile or less than signal spacing, such as at the Interstate 90 interchange, even more vulnerable to frequent traffic congestion and high delays. Therefore, planning and coordination with local jurisdictions will be very important in identifying the primary east-west corridors to ensure signal spacing of ½ mile is achieved and ¼ mile signal spacing is not required due to lack of access to a specific development. In addition, signals at locations such as Bosanko Avenue and Canfield Avenue should be monitored by both the City and ITD to identify possibilities for moving the signals, consolidating the signals with other future signals with spacing closer to ½ mile, or removing the signals and providing additional local street access to ensure good access to properties and better corridor operations.
Section 6
Implementation Strategies
Implementation Strategies

This section of the report presents access management strategies that could be used along the US 95 corridor to improve the safety and operations, while still maintaining an acceptable level of access to adjacent properties.

Growth in Coeur D’Alene and Hayden and development along the US 95 corridor create many challenges maintaining adequate traffic flow on US 95. A city, such as Hayden relies on key east-west corridors, such as Honeysuckle Avenue, Hayden Avenue, and Lancaster Road for access. Access to commercial and residentially zoned property will be a driving factor to meet the land-use goals of the City’s comprehensive plans. Therefore, collaborative planning between ITD and the local jurisdictions to confirm which key corridors will have traffic signals on US 95 will be important, especially on the north section of the US 95 corridor where much of the area is undeveloped. Figure 19 shows an example of using local circulation on the east side of US 95 to provide access to properties.
Utilizing the local street system is typically the most efficient way to provide access to development while maintaining adequate intersection spacing on a major highway like US 95. Government Way provides a good parallel route to US 95 on the east side of US 95. Similar parallel routes, such as Ramsey Road on the west side of US 95 should be pursued jointly with the Cities of Coeur D’Alene and Hayden.

Figure 20 shows the corresponding access concept along US 95 for the local circulation option shown in Figure 19.

![Figure 20](image)

**Figure 20**

US 95 Access Concept (1/2 Mile Signal Spacing)

As shown in Figure 20, signals are located at ½ mile spacing with a limited access at a local street at a ¼ mile from the signals. The limited access at the unsignalized intersections would typically be left-in/right-in/right-out and u-turn movements allowed at locations with good intersection sight distance and speeds under 45 miles per hour.

Another alternative for providing access to properties are frontage or backage roads, which provide special roadways for the purpose of providing access to adjacent properties. Figures 21 and 22 illustrate frontage and backage road concepts, respectively.
Figure 21  Frontage Road Concept
As shown in Figures 21 and 22, frontage and backage roads are good options in locations where a parallel street system is not available. The most common issue with frontage and backage roads is the
distance on the side street from the highway intersection to the frontage or backage road intersection. The frontage and backage road options are most applicable on the west side of US 95 where only short sections of parallel roads currently exist. As mentioned earlier, Government Way currently provides a good parallel route on the east side of US 95.

In the long-term, grade separations may be needed at some intersections along US 95. Figure 23 shows an example of a local street system or backage road to provide access to adjacent properties. The benefit of grade separations is a substantial increase in speed and reduction in travel time for vehicles along the US 95 corridor. A disadvantage of constructing grade separations is that access at ½ mile intervals is usually not possible due to the entrance and exit ramps tapers. The lack of access locations requires a much more robust local circulation system or well designed frontage or backage road system.

![Figure 23](image_url)

**Figure 23** 1-Mile Grade Separation with Local Circulation or Backage Road Concept
Section 7

Conclusion
Conclusion

This report presented a summary of the signal spacing evaluation, access management strategies, and recommendations for the US 95 corridor. The key findings and recommendations are identified below.

**FINDINGS**

**South Section (Ironwood Drive to Honeysuckle Avenue)**
- The south section of US 95 is currently operating near capacity and will require intersection improvements and an additional through lane in the future to substantially improve traffic flow.
- The existing signals at Bosanko Avenue and Canfield Avenue are located ¼ mile from congested intersections and exacerbate the slow speeds and high delays currently experienced along the corridor.

**North Section (Orchard Avenue to State Highway 53)**
- Due to existing and future traffic congestion along the US 95 corridor, use of microscopic simulation is the best method for evaluating future traffic conditions.
- Traffic signal spacing of ¼ mile results in over a 40 percent increase in through traffic delay, in comparison to the ½ mile signal spacing under the 30 percent and 60 percent growth scenarios.
- As traffic demand rises and intersections reach capacity, close signal spacing near congested intersections could result in queues extending through signalized intersections, further reducing the capacity of individual intersections and the corridor.
- Joint planning efforts between ITD and the local jurisdictions of Coeur D’Alene and Hayden will be crucial to ensure adequate east-west access to existing and future development is provided at the same time as acceptable signal and access spacing.
- The proximity and recent improvements to Government Way provide the opportunity for local circulation options on the east side of US 95 to be used to reduce the need for additional local access on US 95.

**RECOMMENDATIONS**
- Construct capacity improvements on the south section of the US 95 corridor (specific improvements are identified in Report #2: Near-Term Analysis and Improvements) and review options for improving signal spacing at locations such as Bosanko Avenue and Canfield Avenue.
- Work with local jurisdictions to identify local circulation enhancements and key east-west corridors to limit signal spacing to ½ mile for new signals.
- New signal locations throughout the corridor should be identified and adopted in local transportation plans.
- Work with the City of Hayden to pursue completion of other north-south parallel roadways on the west side of US 95 that can be used as alternate routes for local traffic.