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March 4, 2009

Transmitted via email to hobackcomments@dot.state.wy.us

Mr. Lee Potter, P.E.
Federal Highway Administration
2617 E. Lincoln Way, Suite D
Cheyenne, WY 82001-5662

RE: Comment on Jackson South Draft Environmental Impact Statement (FHWA Project: FHWA-DEIS-08-01)

Dear Mr. Potter:

On behalf of the Teton County Board of Commissioners, thank you and staff from the Wyoming Department of Transportation (WYDOT) for meeting with us on February 26 to discuss the alternatives contained in the Jackson South Draft Environmental Impact Statement (DEIS) and the County's preferred alternative.

The Board believed the County's alternative had been submitted in an appropriate manner when it was delivered to John Eddins in December 2006. To now be told that it was not "formally" submitted is a surprise and a disappointment. At no time were we informed that a specific submission process was required. We relied on WYDOT, as the lead agency, to advise us on procedural matters and to incorporate our input in the appropriate manner. Additionally, at no time was the alternative vetted through the Interdisciplinary Team or the Core Team, as was the case with all other alternatives proposed for consideration. For these reasons we believe the County's alternative did not receive the consideration it was due two years ago.

As you recommended, please consider this letter a formal request for consideration of the County's alternative as a third option for reconstruction of the highway. The analysis of the alternative prepared by Felsburg Holt and Ullevig (FHU) is included, as are WYDOT's response, a follow-up response from FHU, and the FHU presentation made during the February 26 meeting (Attachments 1-4).

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Because we have been asked to comment on the DEIS, we view the County's alternative as a critique of the build alternatives contained in the document. It is the opinion of the Board that the draft inadequately represents the options that should be considered and that our alternative demonstrates this.

As I stated during our meeting, there is much that we agree on regarding the content of the DEIS (Attachment 5). Central to this is the Board's concurrence that the road is in need of reconstruction to improve safety and provide additional capacity. Other areas of agreement were enumerated during our meeting and include:

- Three-lane cross-section immediately north of Hoback Junction.
- Four-lane cross-section through the Horse Creek area.
- Five-lane cross-section through the Hog Island area.
- Construction of a pathway facility.
- Wildlife crossing facilities.
- Implementation of the mitigation measures suggested in the United States Forest Service White Paper on the Snake River Wild and Scenic River Eligibility Analysis.
- Use of Best Management Practices to protect water quality, aquatic habitats, and fisheries resources during construction.
- Acknowledgement that visual impacts must be mitigated.
- Avoidance and minimization of impacts to waters of the U.S. and wetlands.
- Coordination with the Teton County Floodplain Administrator to ensure compliance with floodplain regulations.

Safety and Capacity

The principal area of disagreement is the extent to which safety and capacity needs warrant a five-lane highway from Horse Creek to the existing five-lane section at South Park Loop Road. It is the opinion of the Board that neither the accident data nor the capacity analysis support six miles of five-lane highway, and that the DEIS has not provided sufficient empirical analysis to justify this cross-section.

The secondary screening criteria contained within the DEIS include two safety related indicators, one of which is "potential to reduce crashes". The Board agrees that widening to five lanes has the potential to reduce crashes. However, we contend that a lesser cross-section meets this criterion through the provision of 12-foot travel lanes, construction of adequate roadway shoulders, correction of horizontal and vertical alignment deficiencies, adequate clear zone areas, removal of / protection from exposed hazards and pavement drop-offs, wildlife crossings, alternating passing lanes and a five-lane passing section. To date, WYDOT has not provided an analysis that clearly and empirically demonstrates otherwise. In fact the

DEIS states that analysis of the crash data indicates that "most crashes could be attributed to roadway deficiencies" such as those enumerated above. To invest taxpayer money for a more expensive and less context sensitive highway absent a comprehensive safety analysis is not an approach the Board can support. The National Environmental Policy Act requires systematic, rigorous evaluation that has not been undertaken in the DEIS with regard to this element of the document.

With regard to meeting capacity needs, the DEIS states that the level of service (LOS) C requirement contained in the document is consistent with County plans. In fact, the County established LOS D as the standard to be met on all arterials within Teton County. The DEIS does not acknowledge this nor does it discuss the difference between the LOS goal adopted by the community and that contained in the DEIS. The document should be updated where necessary to reflect this difference.

As discussed on February 26th, the FHU analysis demonstrates that the County's alternative meets the desired level of service LOS C with the exception of a one-hour period in the southbound direction at the peak travel period during the summer. In the year 2026 this translates into an additional 15 seconds of travel time, which we contend is negligible and not worthy of the associated impacts – both financial and environmental. If the broader context of the utility of the highway and its associated logical termini were considered, it would seem reasonable to expand the LOS analysis to the north to encompass the five-lane section, which would raise the LOS to an acceptable level.

Environmental Considerations

The County's current Comprehensive Plan and Land Development Regulations reflect an abiding commitment to protection of the valley's natural resources. This commitment has been re-affirmed and strengthened through comment from the public on the Comprehensive Plan update currently under way. For these reasons, the Board appreciates the attention given to avoidance and minimization of environmental resource impacts in the DEIS.

Where the Board believes the DEIS is inadequate on this point is in the absence of a commitment to constructing a wildlife crossing in the northeast portion of the South Park Wildlife Management Area. The DEIS identifies wildlife roadway crossings as a contributing factor in the above average crash rate within the study corridor. Specific reference is made to the one-mile section that encompasses Game Creek (MP 146 to MP 147) where half of all crashes are attributed to collisions with wildlife. Along the entire study corridor, 93 of the 202 total crashes involved animals.

It is the contention of the Board that for both traveler safety and environmental reasons the DEIS should include a commitment to the construction of a wildlife crossing within the MP

146 to MP 147 section of highway. As currently written, the DEIS states that a crossing is "being considered" in this area. The Board is not comfortable with this language or the representation that construction of a crossing is dependent on "technical and financial feasibility", as stated by WYDOT staff on February 26th. There are many studies that document the technical feasibility of constructing wildlife crossings. Further, if safety of the traveling public is the primary consideration for WYDOT (as stated by John Eddins on February 26), financial feasibility should not be the guiding factor in determining feasibility.

Multi-modal Transportation

The County's Comprehensive Plan has a strong multi-modal theme, as reflected in Chapter 8. Central to this theme is our bus system (START), which continues to expand and achieve ever higher ridership levels that meaningfully offset vehicle trips. The DEIS includes a discussion of the importance of transit to the community and the various studies that have been conducted regarding transit service. The DIES also describes the commuter bus service from Star Valley to Jackson. What is missing is a discussion of potential roadway facility modifications that would support or promote bus ridership within the corridor.

The inclusion of a separate pathway system is enthusiastically supported by the Board. The construction of a pathway through this section continues the logical connection of the existing pathway to areas of the community in the southern end of the valley. More specifically, the Board has the following comments on the proposed pathway facility:

1. **County recommended alternative.** We support the provision of a pathway along the full length of the corridor, including between Game Creek and Horse Creek, due to the significant populations that would be served by the pathway in the Evans Trailer Park, Hog Island, Riverfront, and other neighborhoods and destinations along this section. This meets the goals of improving system linkage, providing system continuity, and accommodating non-motorized transportation modes stated in the project purpose and need. A pathway adjacent to the highway would be the most direct connection between Hoback Junction and Jackson, and would thereby be more likely to shift trips to non-motorized modes. The fact that the majority of the residential density between Game Creek and Horse Creek is located on the east side of the highway could favor an east-side pathway alignment in this section, which the Board asks WYDOT to consider.

   If Henry's Road is determined to be the primary north/south access for the pathway system between Game Creek and Horse Creek, we recommend making significant improvements to the infrastructure. This could include pathway paving, retaining wall stabilization, and protection from periodic landslides.

2. **Separated grade crossings.** The Board supports the provision of separated grade crossings at Game Creek Road and Horse Creek because of the significant existing and expected non-motorized traffic volumes crossing at these locations. Game Creek is a

popular non-motorized recreation destination, and many cyclists currently utilize the Von Gontard pathway to access Game Creek. Similarly, Henry's Road is a popular destination for recreational horseback riding, biking, and walking. Pathway users accessing Henry's Road from Hoback Junction will need a safe crossing at Horse Creek (or some other location near the south terminus of Henry's Road). With a pathway connection on the west side of the highway between South Park and Hoback Junction, the number of people crossing at both Game Creek and Horse Creek will increase, as will the need for safe, preferably separated grade, crossings.

3. **Pathway width.** The Board is opposed to narrowing the proposed pathway from 10' to 8' in certain portions of the project. This is inconsistent with published guidelines for this type of facility, including the 1999 AASHTO Guide for Development of Bicycle Facilities. One potential option to provide the recommended pathway width is to eliminate one (1) foot of shoulder from each side of the highway where environmental resources issues take precedence. This would require narrowing the overall paved roadway section by only 2.6% versus narrowing the desired pathway width by 20%. The reduction in shoulder width would not deviate from acceptable design guidelines and would not affect the roadway alignment or perceived roadway width nearly as much as reducing the pathway width by the same amount.

4. **Raised bridge walkways.** The DEIS proposes that non-motorized users utilize the 8' bridge shoulder when crossing bridges within the corridor. Given the anticipated vehicular traffic volume and non-motorized user volume, this is dangerous, especially for contra flow (northbound) non-motorized users. Forcing bikers and pedestrians into contra flow travel on the roadway could force them to violate state statutes, including 31-5-201, 31-5-704 (a), and 31-5-605 (b), a situation that could be avoided by providing a separated multi-use facility. The Board recommends that a 10' wide raised, shared walkway with appropriate barriers be included on the west side of the bridges to facilitate non-motorized modes.

5. **Road / pathway horizontal separation.** To maximize non-motorized user safety and experience, as well as minimize pathway sweeping issues, the final design should allow for the maximum amount of separation between the roadway and pathway. There is a substantial difference in user perception and safety between a 10' separation and a 20' separation, not to mention the additional benefit of reduced maintenance by keeping the pathway free of highway debris. For maintenance reasons, vertical separation should also be taken into consideration where maximum horizontal separation distance cannot be maintained.

6. **Pathway alignment.** Where possible, the pathway alignment should slightly meander and provide opportunities for river access. Distancing the path from the road, and providing a more interesting bike/pedestrian experience will increase the use of the facility for recreation.

7. **Interpretive and natural resource access opportunities.** At the south end of the corridor between Horse Creek and Hoback Junction, the Board supports providing opportunities

for appropriate non-motorized access to the Snake River and other natural resources. There are several publicly owned parcels where the pathway could be routed to increase separation from the roadway and provide interpretive and scenic opportunities, or access to the Snake River. Appropriate closure periods must be established and enforced to minimize impacts to wildlife.

South Park River Access

The Bureau of Land Management (BLM) owns parcels on each side of the highway and a new boat ramp facility is being planned on the south side of the Snake River. The BLM retained OTAK, a Colorado consulting firm, to prepare a conceptual site plan for these parcels in 2004 (Attachment 6). The BLM plan depicts modifications to the highway necessary to support safe ingress and egress. The plan also includes a new underpass south of the bridge, which would create a separated grade crossing for vehicular and non-motorized traffic.

The Board recommends the inclusion of a roadway cross-section that supports the creation of this recreational facility. Additionally, accommodations should be made to provide a non-motorized crossing that would permit users to access the Snake River on both sides of the highway without having to cross the highway at grade.

Again, thank you for taking the time to meet with the Board and for considering our comments on this critically important project.

Sincerely,

Hank Phibbs, Chairman
Teton County Board of Commissioners

Attachments:

1. Wyoming Highway 89 Alternative Laneage Analysis (August 29, 2006)
2. US 89 Laneage Analysis (January 18, 2007)
3. Wyoming Highway 89 Alternative Laneage Analysis (February 12, 2008)
4. FHU presentation made during the February 26, 2009 meeting
5. Handout from February 26, 2009 meeting
6. Recreation Project Plan, South Park River Access

cc: Tim Stark, P.E., Wyoming Department of Transportation
Steve Foster, Teton County/Jackson Parks and Recreation Department
Jeff Hermansky, Teton County Engineering
Brian Schilling, Jackson Hole Community Pathways
Paula Stevens, Teton County Planning & Development
Michael Wackerly, Southern Teton Area Rapid Transit (START)

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ULLEVIG

engineering paths to transportation solutions

MEMORANDUM

TO: Ms. Paula Stevens, Teton County Planning Department

FROM: Jeff Ream, P.E., PTOE, Felsburg, Holt & Ullevig

DATE: August 29, 2006

SUBJECT: Wyoming Highway 89 Alternative Laneage Analysis
FHU Reference No. 06-140

FHU has prepared this memorandum summarizing the results of the transportation analysis conducted for Teton County's alternative roadway laneage concept for Wyoming State Highway 89 (WY 89). The Wyoming Department of Transportation is in the process of conducting an Environmental Impact Statement (EIS) for an approximately eight mile stretch of WY 89 from South Park Road on the south end of the town of Jackson to just beyond the intersection of WY 189 at Hoback Junction. It also includes improvements to approximately 1.5 miles of WY 189 east of WY 89, but that section is not a part of this analysis.

BACKGROUND

The WY 89 EIS explored several potential roadway laneage options, including: improving but not widening the existing two lane road; constructing a rural three-lane road with alternating passing lanes; constructing a four lane road with no center turn lane; constructing a five lane road; and maintaining a two lane road but accommodating demand with expanded START commuter bus service. The EIS analysis concluded that the only option that would provide satisfactory levels of service and safety along the corridor (LOS C or better) was the five lane option, and carried forth a preferred alternative that extended the existing five lane cross section at South Park Road further south to just north of Horse Creek Road, transitioned to a four lane cross section for a half mile, then transitioned to a three lane cross section through Hoback Junction (Figure 1). The existing three WY 89/WY 189 intersections would then be replaced by a roundabout (Figure 2).

Teton County residents have already expressed concerns that the existing five-lane section north of South Park Loop Road is inconsistent with the rural nature of that part of the county, and would like to avoid extending that type of roadway cross-section further south, if possible. After reviewing the preferred alternative, Teton County staff felt that while it certainly addressed safety and capacity issues for the highway, it may not be an acceptable answer to residents concerns, and developed an alternative laneage concept that limits the five lane cross section to a much shorter segment in the middle of the study area. Figure 3 shows the Teton County alternative.

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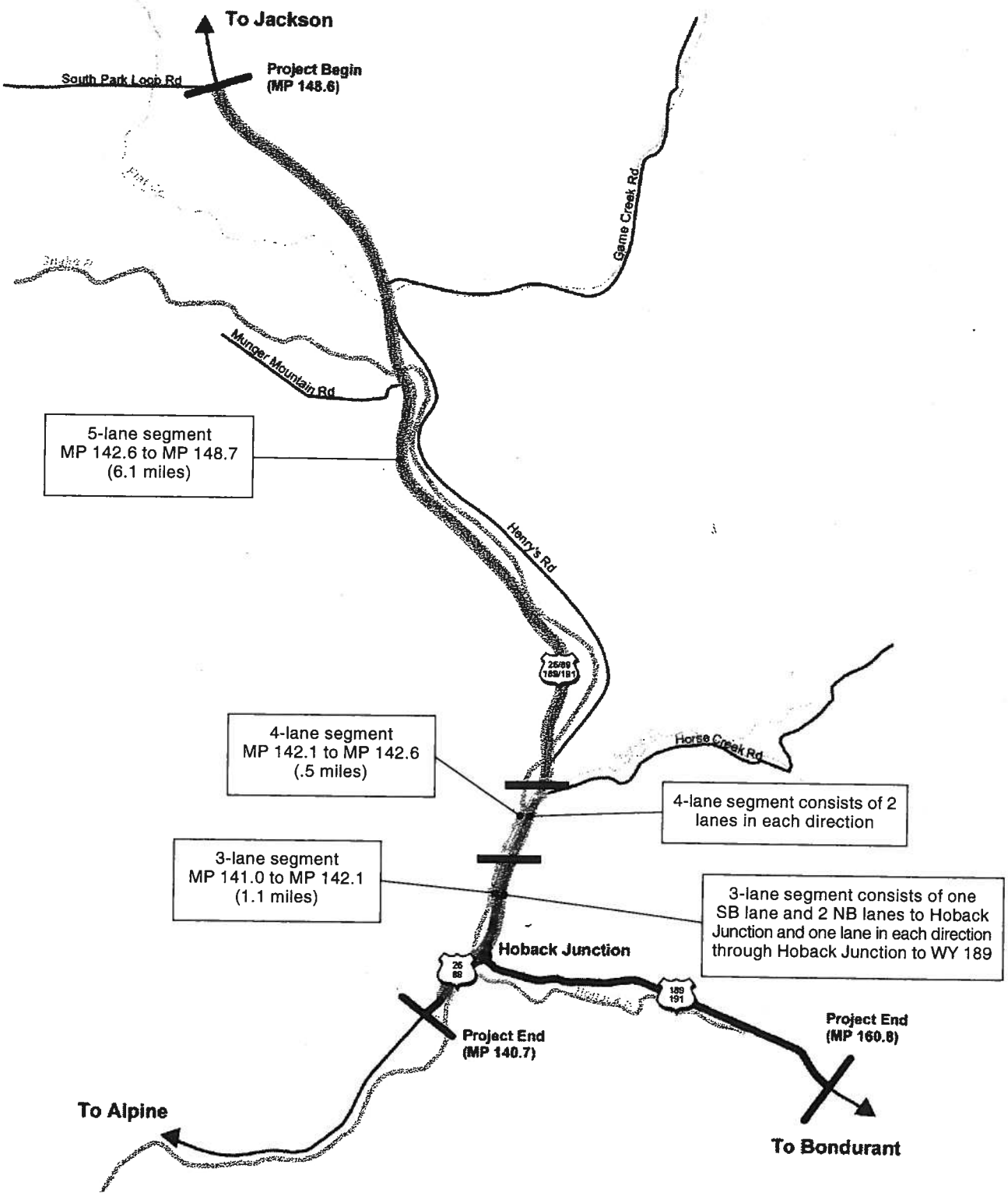

Figure 1

WY 189 Preferred Alternative

North

WY89 EIS 06-140 08/29/06

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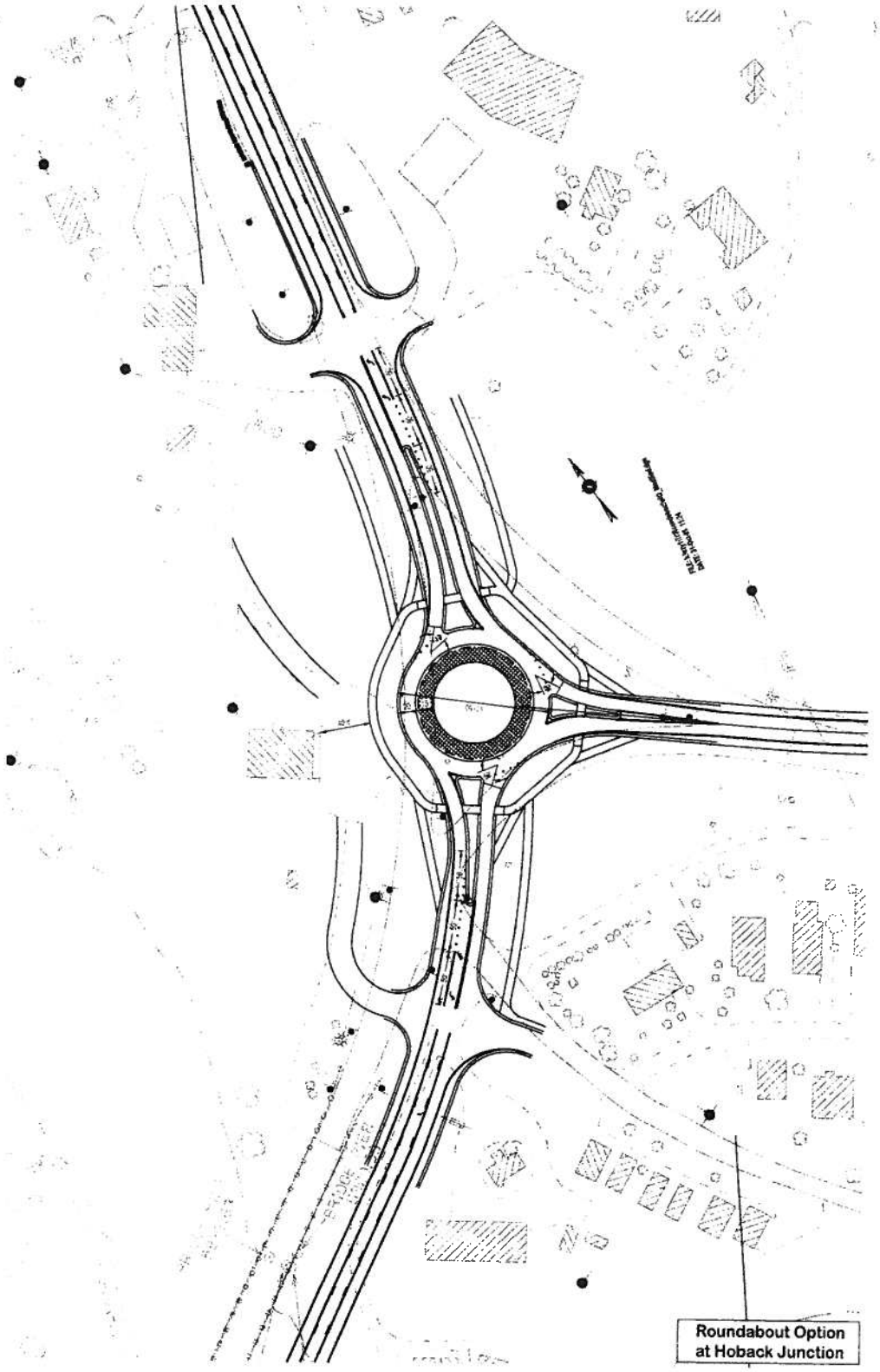

Figure 2
Hoback Junction Roundabout

North

WY89 EIS 06-140 08/29/06

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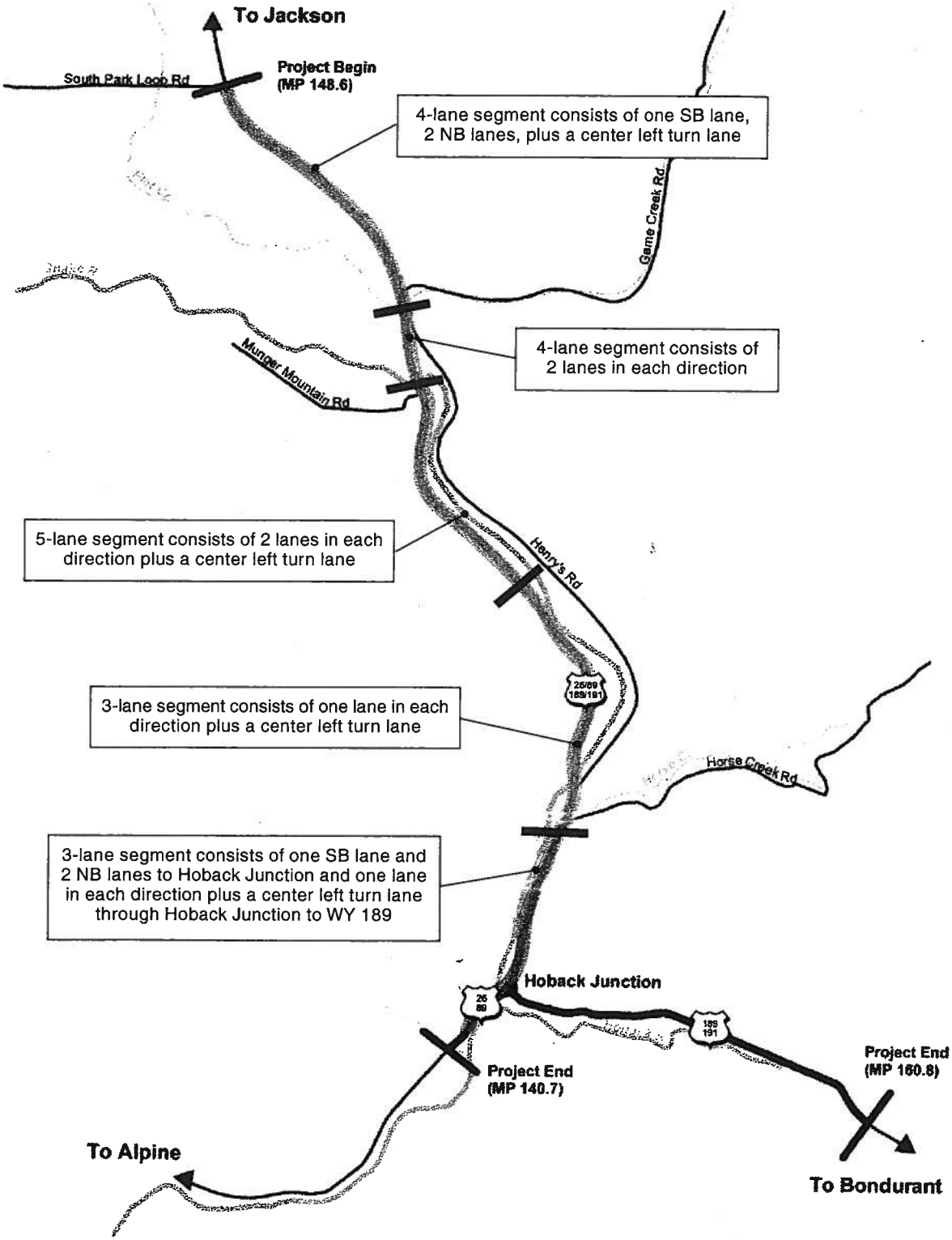

Figure 3
Teton County Alternative

North

WY89 EIS 06-140 08/29/06

As the figure indicates, the alternative would provide one southbound and two northbound lanes plus left turn lanes at each intersection from the end of the current five lane section to Game Creek Road, two lanes in each direction from Game Creek Road to the south side of the first Snake River Bridge (no left turn lanes would provided because only three low volume access points are located along this section), two lanes in each direction plus a center two way left turn lane from the bridge to just north of the Ross Gravel Pit Road, one lane in each direction plus a center two way left turn lane from there to just south of Horse Creek Road, and the Preferred Alternative three lane cross section from there through Hoback Junction (two northbound lanes and one southbound lane north of Hoback Junction, and one lane in each direction plus a center two way left turn lane through Hoback Junction to the intersection with WY 189).

ANALYSIS

Level of Service

The methodologies outlined in Chapter 20 - Two Lane Highways of the *Highway Capacity Manual* (HCM), were used to analyze the Teton County alternative for WY 89. The analysis examines levels of service in each direction of a two lane facility, and includes adjustments to account for the presence of passing lanes. To properly account for these adjustments, the northbound analysis was broken into two segments, one extending from Hoback Junction to Ross Gravel Pit Road to analyze the southernmost passing lane, the other from Horse Creek Road to South Park Road to analyze the northernmost passing lane. The two segments overlap by approximately one mile because each was selected to cover the entire two lane section before and after the passing lane in order to capture the vehicle interaction prior to the lane (where the most vehicle platooning would occur) and after the lane (where platooning is initially minimized but increases as the road approaches the next passing lane). The southbound direction was analyzed as one segment because it consists of only one passing lane. Figure 4 shows the locations of the passing lanes, as well as the segments used in the analysis.

The traffic volumes used in the analysis were taken from the 2026 traffic forecasts in the EIS. Because the EIS developed forecasts for five segments (Table 1) that did not match up with the passing lane segments, the analysis selected volumes that were representative of the traffic conditions in the middle of the passing lane segment (Table 2).

Table 1. 2026 EIS Traffic Forecasts

EIS Segment	From	To	Distance	Peak Direction[1]	Off-peak Direction[1]	Total
Hoback Junction South	Fall Creek	Hoback Junction	0.84 mi.	626	418	1,044
Hoback Junction North	Hoback Junction	WYDOT	4.34 mi.	878	586	1,464
Munger Mountain	WYDOT	Horsethief Canyon	1.59 mi.	958	639	1,597
Horse Thief Canyon	Horsethief Canyon	Horsethief Canyon II	0.07 mi.	1014	676	1,690
South Park Road	Horsethief Canyon II	South Park Road	1.30 mi.	1142	762	1,904

1. Assumes a 60/40 peak/off-peak directional split, with the northbound beak occurring in the morning and the southbound peak occurring in the afternoon.

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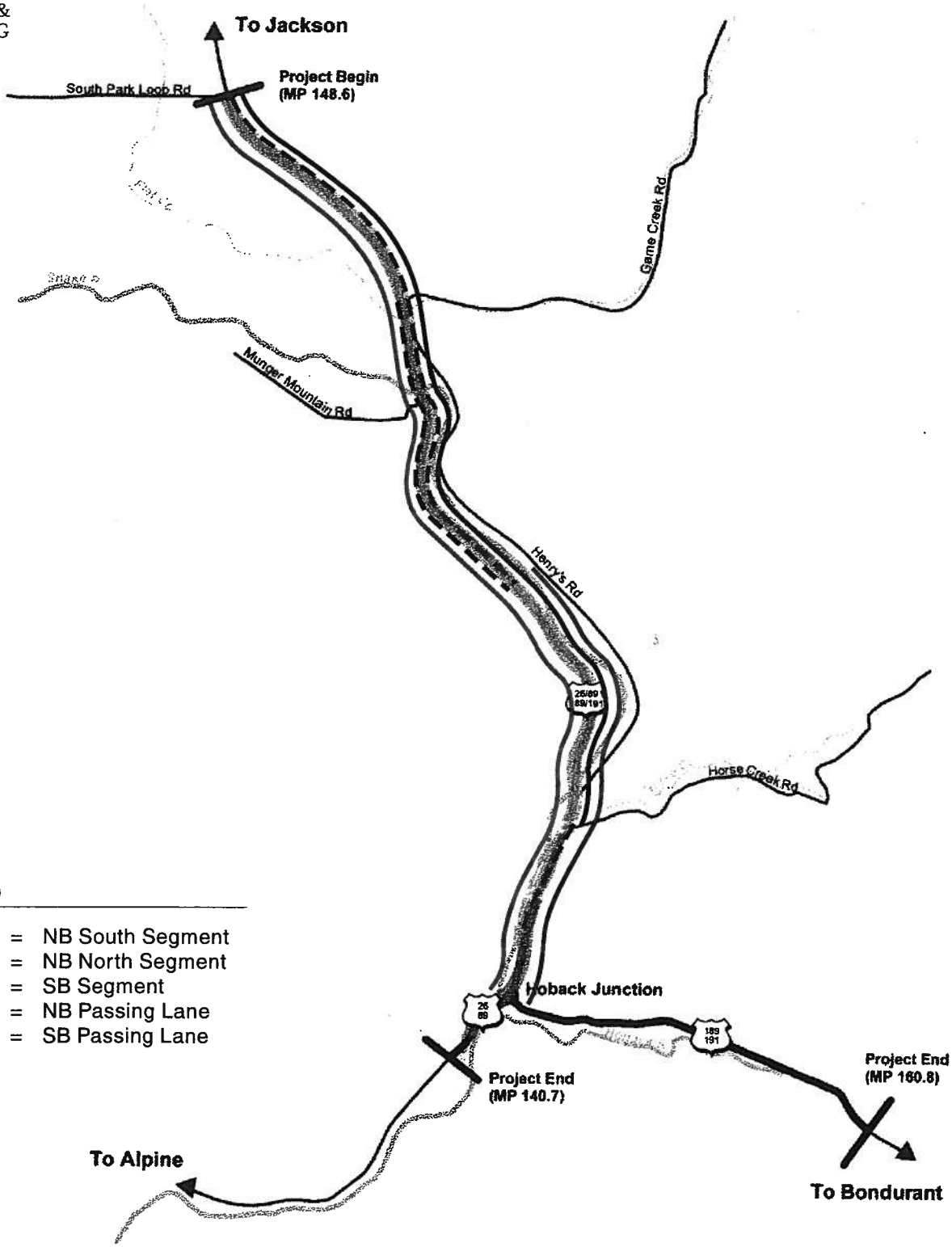

LEGEND

- = NB South Segment
- = NB North Segment
- = SB Segment
- = NB Passing Lane
- = SB Passing Lane

Figure 4

Locations of Passing Lanes & Segments Used For Highway Analysis

North

Table 2. Traffic Volumes Used in Passing Lane Segment Analysis

Passing Lane Segment	From	To	Distance	Peak Direction	Off-peak Direction	Total
NB South Passing Lane	WY 189	Ross Gravel Pit Road	3.5 mi.	878	586	1,464
NB North Passing Lane	Horse Creek Road	South Park Road	5.5 mi.	958	639	1,597
SB Passing Lane	South Park Road	WY 189	7.5 mi.	878	586	1,464

Table 3 summarizes the results of the highway level of service analysis. Level of service (LOS) is a qualitative measure of traffic operational conditions, based on roadway capacity and vehicle delay. Levels of service are described by a letter designation ranging from LOS A to LOS F, with LOS A representing the best possible conditions and LOS F representing congested conditions. For two lane highways, levels of service are presented in terms of both average travel speed and percent time spent following for the facility. As the table indicates, both the northbound and southbound laneage would operate at LOS C during the peak directional period (northbound in the morning and southbound in the afternoon). This would meet the minimum acceptable level of service criteria for the roadway as outlined in the EIS (LOS C).

Table 3. WY 89 Peak Direction Levels of Service

Direction	Average Travel Speed	Percent Time Spent Following	Level of Service
NB South Passing Lane	51.5	59.2%	LOS C
NB North Passing Lane	51.0	59.3%	LOS C
Northbound Total	**51.2**	**59.2%**	**LOS C**
Southbound Total	**51.3**	**61.1%**	**LOS C**

Since the southbound direction is forecast to have a higher percent time spent following value, a sensitivity analysis of that direction was performed using traffic volumes from the next section north (Munger Mountain). These higher volumes cause the section to drop to LOS D with a percent time spent following of 65.7 percent, just over the LOS C/D percent time spent following threshold of 65 percent. Extending the passing from a length of 2.5 miles to 2.8 miles improves the level of service back to LOS C, so Teton County may want to consider adding 0.3 to 0.5 miles to the south end of the passing lane to provide a facility that can better serve higher volumes. It also should be noted that if traffic volume projections for the Horse Thief Canyon segment are used in the southbound analysis, the southbound passing lane would need to be extended to 3.2 miles to meet the LOS C criteria, and if projections for the South Park Road segment are used the lane would need to be extended to 3.8 miles. Extending the passing lane to those lengths is not recommended, however, because it would be based on applying the traffic volume projections for the northernmost 1.4 miles of the roadway to the entire corridor.

The conclusion in the EIS that the roadway would not rise above LOS D even with passing lanes was not able to be replicated in this analysis. In addition, when the EIS alternative is analyzed as a four lane road, the analysis indicates LOS A, but when it is analyzed as a two lane road with continuous passing lanes north of Hoback Junction, the analysis indicates LOS C, with an average travel speed of 53.7 mph northbound and 53.8 mph southbound.

Additional Operational Analyses

In addition to the HCM analysis, operational analyses of the facility were conducted using the Synchro and SimTraffic traffic analysis software packages. The first step in the analysis process was to create two scale models of the corridor using Synchro, one with the EIS preferred alternative laneage, the other with the Teton County alternative laneage. Each model included all 59 access points along the highway that are located within the study area.

Next, land use information was obtained for each access point, and trips were generated for each using the Institute of Transportation Engineers Trip Generation, Seventh Edition (2003). Starting with the through traffic on WY 89 at the south end of the corridor from the EIS (626 vph southbound, 418 vph northbound) and working north, the volumes were first balanced based on entering and exiting traffic at the roundabout, and then each access points' traffic was added to or subtracted from the WY 89 through volume, using a distribution of 60 percent to/from the north, and 40 percent to/from the south (from the EIS). This assignment resulted in through volumes at the south end of the corridor that were somewhat higher than those estimated in the EIS and volumes at the north end of the corridor that were somewhat lower (Table 4). These differences were a result of a combination of the volume balancing process at the roundabout (which resulted in higher volumes on the south end), and no additional growth assumptions for each of the access points as the corridor progressed northward (which resulted in lower volumes on the north end). A higher north/south split (65/35 or 70/30) may have also helped balance north end volumes, but it was decided to adhere to the EIS assumptions as best as possible.

Table 4. 2026 Synchro Volumes versus EIS Traffic Forecasts

EIS Segment	EIS			Synchro		
	Southbound	Northbound	Total	Southbound	Northbound	Total
Hoback Junction South	626	418	1,044	834	688	1,522
Hoback Junction North	878	586	1,464	874	710	1,584
Munger Mountain	958	639	1,597	901	734	1,635
Horse Thief Canyon	1,014	676	1,690	903	734	1,637
South Park Road	1,142	762	1,904	935	792	1,727

Next, the volumes were input into the two Synchro networks and arterial Measures of Effectiveness (MOE) analyses was performed on each. Table 5 shows a comparison of the results. As the table indicates, the EIS preferred alternative offers slightly better travel times, speeds and overall performance, while the Teton County alternative provides slightly better fuel economy. These results are to be expected, as the EIS alternative offers much longer passing lanes that allow vehicles to move at higher speeds throughout the corridor, but these higher speeds come at the expense of fuel economy. Nevertheless, overall the Teton County alternative appears to offer reasonable performance compared to the EIS alternative.

Table 5. Synchro Arterial Measures of Effectiveness

Measure of Effectiveness	EIS Preferred Alternative	Teton County Alternative
Total Delay (hours)	3	4
Stops/Vehicle	0.03	0.03
Stops (Total)	2,747	2,746
Average Speed (mph)	64	55
Total Travel Time (hours)	204	234
Distance Traveled (miles)	12,948	12,948
Fuel Consumed (gal)	526	500
Fuel Economy (mpg)	24.6	25.9
CO Emissions (kg.)	36.8	35.0
NOx Emissions (kg.)	7.2	6.8
VOC Emissions (kg.)	8.4	8.1
Performance Index	11.0	11.4

Performance Index is a combination of the delays, stops and queuing penalty. The lower the value, the better the performance.

Shaded cells indicate the better performance value.

The final analysis consisted of corridor operations simulations for both alternatives using the SimTraffic traffic simulation program. Each network was simulated for one hour to determine the average speed and delay for the road system. The results are presented in Table 6. As with the Synchro analysis, the simulation indicated that the EIS alternative would operate with slightly higher speeds and less delay than the Teton County alternative, but both offered reasonable performance overall.

Table 6. SimTraffic Arterial Measures of Effectiveness

Measure of Effectiveness	EIS Preferred Alternative			Teton County Alternative		
	Northbound	Southbound	Total	Northbound	Southbound	Total
Delay/Vehicle (sec)	69.2	98.3	86.7	92.3	124.2	111.4
Average Speed (mph)	53	50	51	47	44	45

Safety

Both the preferred alternative and the Teton County alternative include a center two way left turn lane along the majority of the roadway, improving safety for left turning vehicles at nearly all of the access points. The only difference between the two is that the Teton County alternative does not include a center lane from south of Game Creek Road to the south end of the north Snake River Bridge. This approximately 0.65 mile section includes three low volume accesses; two river accesses and an access to both the river and the National Forest. None of the three are anticipated to generate significant traffic volumes throughout the day, so the impact on safety of not having a center turn lane at each is minimal.

CONCLUSIONS AND RECOMMENDATIONS

Based on the above analysis, it would appear that the alternative proposed by Teton County would provide reasonable overall performance compared to the preferred alternative outlined in the WY 89 EIS. While the alternative alignment would not operate at as high of travel speeds as that proposed in the EIS, it would operate at LOS C in the peak direction during both the morning and afternoon peak periods, which meets the minimum level of service criteria outlined in the EIS. By way of comparison, the EIS preferred alternative operates at LOS A when analyzed as a four lane road, but LOS C when analyzed as a two lane road with continuous passing lanes north of Hoback Junction, with travel speeds 2.5 mph faster than the Teton County alternative). Further analysis using the Synchro and SimTraffic traffic analysis software packages confirmed that the Teton County alternative offers reasonable overall performance as compared to the EIS alternative; all three analyses indicated it would take somewhere between 30 and 60 seconds longer to travel the eight mile corridor under the Teton County alternative. From a safety standpoint, the only difference between the two alignments is that the Teton County alternative does not include a center lane from south of Game Creek Road to the south end of the north Snake River Bridge; a section that includes only three low volume river and forest access points.

Given this, it is recommended that Teton County pursue the revised cross-section concept with WYDOT. The county should consider extending the southbound passing lane an additional 0.3 to 0.5 miles south, however, to ensure that the southbound direction would operate at LOS C under higher traffic conditions.

I trust the above information is sufficient for you to make an informed decision on the alternative cross section. If you have any questions or need further clarification, please give me a call at (303) 721-1440.

HCS+: Two-Lane Highways Release 5.2

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Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	PM Peak
Highway	WY 89
From/To	Hoback/Ross Gravel Pit Road
Jurisdiction	Teton County
Analysis Year	2026
Description	2026 PM Peak Teton County Section - NB South Passing Lane AM

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 878 veh/h
Opposing direction volume, Vo 586 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	931	pc/h	621	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	48.5	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	924	pc/h	617	pc/h
Base percent time-spent-following,(note-4) BPTSFd	71.8	%		
Adjustment for no-passing zones, fnp	25.1			
Percent time-spent-following, PTSFd	81.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	809	veh-mi
Peak-hour vehicle-miles of travel, VMT60	3073	veh-mi
Peak 15-min total travel time, TT15	16.7	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	3.5	mi
Length of two-lane highway upstream of the passing lane, Lu	0.2	mi
Length of passing lane including tapers, Lpl	0.8	mi
Average travel speed, ATSd (from above)	48.5	mi/h
Percent time-spent-following, PTSFd (from above)	81.9	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	0.80	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	51.0	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	4.13	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-1.63	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	59.3	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	15.9	veh-h

Notes:

1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

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Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	PM Peak
Highway	WY 89
From/To	Horse Creek Road/South Park
Jurisdiction	Teton County
Analysis Year	2026

Description 2026 PM Peak Teton County Section - NB North Passing Lane AM

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	5.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 958 veh/h
Opposing direction volume, Vo 639 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	1015	pc/h	677	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	47.6	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	1008	pc/h	673	pc/h
Base percent time-spent-following,(note-4) BPTSFd	75.3	%		
Adjustment for no-passing zones, fnp	22.8			
Percent time-spent-following, PTSFd	84.4	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.60	
Peak 15-min vehicle-miles of travel, VMT15	1387	veh-mi
Peak-hour vehicle-miles of travel, VMT60	5269	veh-mi
Peak 15-min total travel time, TT15	29.1	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	5.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.5	mi
Length of passing lane including tapers, Lpl	3.9	mi
Average travel speed, ATSd (from above)	47.6	mi/h
Percent time-spent-following, PTSFd (from above)	84.4	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	51.3	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	3.60	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-3.50	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	61.1	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	27.1	veh-h

Notes:
1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

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Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	PM Peak
Highway	WY 89
From/To	South Park/Hoback
Jurisdiction	Teton County
Analysis Year	2026
Description	2026 PM Peak Teton County Section - Southbound Passing Lane

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	7.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 878 veh/h
Opposing direction volume, Vo 586 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	931	pc/h	621	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	48.5	mi/h

Percent Time-Spent-Following

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	924	pc/h	617	pc/h
Base percent time-spent-following, (note-4) BPTSFd	71.8	%		
Adjustment for no-passing zones, fnp	25.1			
Percent time-spent-following, PTSFd	81.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	1733	veh-mi
Peak-hour vehicle-miles of travel, VMT60	6585	veh-mi
Peak 15-min total travel time, TT15	35.7	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	7.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.9	mi
Length of passing lane including tapers, Lpl	2.5	mi
Average travel speed, ATSd (from above)	48.5	mi/h
Percent time-spent-following, PTSFd (from above)	81.9	
Level of service, (note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	1.40	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane, (note-2) ATSpl	50.8	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	4.13	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-1.03	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane, (note-3) PTSFpl	63.5	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	34.1	veh-h

Notes:

1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

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Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	PM Peak
Highway	WY 89
From/To	South Park/Hoback
Jurisdiction	Teton County
Analysis Year	2026

Description 2026 PM Peak Teton County Section - SB Sensitivity 2.5 MILE LANE

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	7.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 938 veh/h
Opposing direction volume, Vo 639 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	994	pc/h	677	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	47.7	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	987	pc/h	673	pc/h
Base percent time-spent-following,(note-4) BPTSFd	74.6	%		
Adjustment for no-passing zones, fnp	23.1			
Percent time-spent-following, PTSFd	84.0	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.58	
Peak 15-min vehicle-miles of travel, VMT15	1851	veh-mi
Peak-hour vehicle-miles of travel, VMT60	7035	veh-mi
Peak 15-min total travel time, TT15	38.8	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	7.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.9	mi
Length of passing lane including tapers, Lpl	2.5	mi
Average travel speed, ATSd (from above)	47.7	mi/h
Percent time-spent-following, PTSFd (from above)	84.0	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	1.40	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	50.0	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	3.69	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-0.59	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	65.7	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	D	
Peak 15-min total travel time, TT15	37.0	veh-h

Notes:

1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

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Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	PM Peak
Highway	WY 89
From/To	South Park/Hoback
Jurisdiction	Teton County
Analysis Year	2026

Description 2026 PM Peak Teton County Section - SB Sensitivity 2.8 MILE LANE

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	7.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 938 veh/h
Opposing direction volume, Vo 639 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	994	pc/h	677	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.8	mi/h
Average travel speed, ATSd	47.7	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	987	pc/h	673	pc/h

Base percent time-spent-following,(note-4) BPTSFd	74.6	%
Adjustment for no-passing zones, fnp	23.1	
Percent time-spent-following, PTSFd	84.0	%

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.58	
Peak 15-min vehicle-miles of travel, VMT15	1851	veh-mi
Peak-hour vehicle-miles of travel, VMT60	7035	veh-mi
Peak 15-min total travel time, TT15	38.8	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	7.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.9	mi
Length of passing lane including tapers, Lpl	2.8	mi
Average travel speed, ATSd (from above)	47.7	mi/h
Percent time-spent-following, PTSFd (from above)	84.0	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	1.10	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	50.2	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	3.69	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-0.89	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	64.7	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	36.9	veh-h

Notes:
1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

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Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	PM Peak
Highway	WY 89
From/To	South Park/Hoback
Jurisdiction	Teton County
Analysis Year	2026
Description	2026 PM Peak EIS Cross Section - Southbound

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	7.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 878 veh/h
Opposing direction volume, Vo 586 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	931	pc/h	621	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	48.5	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	924	pc/h	617	pc/h
Base percent time-spent-following,(note-4) BPTSFd	71.8	%		
Adjustment for no-passing zones, fnp	25.1			
Percent time-spent-following, PTSFd	81.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	1733	veh-mi
Peak-hour vehicle-miles of travel, VMT60	6585	veh-mi
Peak 15-min total travel time, TT15	35.7	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	7.5	mi
Length of two-lane highway upstream of the passing lane, Lu	0.1	mi
Length of passing lane including tapers, Lpl	7.2	mi
Average travel speed, ATSd (from above)	48.5	mi/h
Percent time-spent-following, PTSFd (from above)	81.9	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.50	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	53.8	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	4.13	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-3.93	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	51.2	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	32.2	veh-h

Notes:

1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

HCS+: Two-Lane Highways Release 5.2

Felsburg Holt & Ullevig
6300 S. Syracuse Way
Suite 600
Centennial CO 80222
Phone: (303) 721-1440 Fax: (303) 721-0832
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	JMR
Agency/Co.	FHU
Date Performed	6/28/2006
Analysis Time Period	AM Peak
Highway	WY 89
From/To	Hoback/South Park Road
Jurisdiction	Teton County
Analysis Year	2026
Description	2026 AM Peak EIS Cross Section - Northbound

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	7.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 878 veh/h
Opposing direction volume, Vo 586 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.993		0.993	
Grade adj. factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	931	pc/h	621	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed volume,(note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access points,(note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	48.5	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	924	pc/h	617	pc/h
Base percent time-spent-following,(note-4) BPTSFd	71.8	%		
Adjustment for no-passing zones, fnp	25.1			
Percent time-spent-following, PTSFd	81.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	1733	veh-mi
Peak-hour vehicle-miles of travel, VMT60	6585	veh-mi
Peak 15-min total travel time, TT15	35.7	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	7.5	mi
Length of two-lane highway upstream of the passing lane, Lu	0.2	mi
Length of passing lane including tapers, Lpl	7.2	mi
Average travel speed, ATSd (from above)	48.5	mi/h
Percent time-spent-following, PTSFd (from above)	81.9	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.60	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	53.7	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	4.13	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-4.03	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	51.6	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	C	
Peak 15-min total travel time, TT15	32.3	veh-h

Notes:
1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

THE STATE OF WYOMING

Dave Freudenthal, Governor

John F. Cox, Director

Department of Transportation

P.O. BOX 1260 ROCK SPRINGS, WYOMING 82902

January 18, 2007

Paula Stevens, Planning Director
Teton County Planning and Development
P.O. Box 1727
Jackson, WY 83001

RE: US 89 Laneage Analysis
Felsburg Holt & Ullevig
Teton County

Dear Paula:

Attached for your review and information is a memorandum from Mike Gostovich, State Traffic Engineer, Wydot to myself which summarizes the results of the Wydot Traffic Programs review of the above noted traffic analysis for the section of US 89 from Hoback Junction to South Park.

Also attached for your review and infromation are two Highway Capacity Software runs that were performed by Wydot Traffic with explanations for the inputs used. I noted that in both cases a level of service D is the result.

In summary, there are flaws in FHU's analysis that need to be addressed before the FHU recommended lane alternatives can be called valid.

TETON COUNTY PLANNING OFFICE
JAN 24 2007

Respectfully,

John B. Eddins, P.E.
District Engineer

JBE/jbe

pc: Mike Gostovich, P.E., State Traffic Engineer, Wydot, Cheyenne
Ted Wells, P.E., District Construction Engineer, Wydot, Rock Springs
Tory Thomas, P.E., District Traffic Engineer, Wydot, Rock Springs
Pete Hallsten, P.E., Resident Engineer, Wydot, Jackson
file

attachment: Memo dated 1/10/07 from STE to DE, explanation of HCS runs, HCS runs

WYDOT
ROCK SPRINGS
JAN 16 2007

MEMORANDUM

To: John Eddins, DE

From: Mike Gostovich, STE MG

Subject: Felsburg Holt & Ullevig (FHU) memo to Teton County Planning Aug 29, 2006

Date: January 10, 2007

Per your request, the WYDOT Traffic Program comments below pertain to the transportation study from FHU for Teton County analyzing the lane needs for the US 89, 191 corridor between Hoback Junction and the five lane section south of Jackson.

The report issued to Teton County from FHU contains analysis flaws that were found in the Highway Capacity Software analyses. Since FHU had access to the draft EIS, the consultant had to have seen the writeup for screening out a three lane section consisting of one lane in each direction plus a continuous center left turn lane for a high speed rural section. This section becomes unsafe since passing is not allowed in the left turn lane and one slow vehicle can easily platoon traffic. Impatient drivers will risk hitting left turners by using the left turn lane as a passing lane. This section is useful in low speed urban areas only.

1. One flaw in FHU's HCS (Highway Capacity Software) analysis was in using a free flow speed of 65 mph to analyze the lowest volume section immediately north of Hoback Junction. The speed limit is 55 mph and will be used as the free flow speed. Changing this one parameter puts the LOS (level of service) at D or lower for all roadway sections between Hoback Junction and the current 5 lane section south of Jackson in either a two lane analysis or a passing lane analysis and in a north or south direction. Using Figure 3, the lowest volumes on the north section, approximating distances, and even using 65 mph, WYDOT could not get the LOS above D. As per the Green Book (AASHTO's 'A Policy on Geometric Design of Highways and Streets) the LOS for a rural principal arterial should be B and will be designed no lower than LOS C.
2. As noted above, FHU inserted a 3 lane urban section (not sure of the length since mileposts and lengths were not shown in Figure 3) of approximately 2 miles. This is a major design flaw that leads to unsafe operation. This was already screened and dismissed as an option by the interdisciplinary (ID) team.
3. Driver expectations and design consistency are also important design factors. Drivers do not expect a rural high speed road to have different cross sections that require tapers and shifts to stay in the same lane. This becomes worse when snow covers the pavement markings and drivers are unsure of where they need to be on the road.
4. WYDOT does not understand the use of Synchro software to model an unsignalized rural two lane high speed road. Synchro is an urban signalization model. The Highway Capacity Manual (Highway Capacity Software is the computer modeling) is the nationally accepted standard for traffic modeling and LOS, and in this case, is the model to use for a rural high speed roadway.

Explanation of the HCS Runs

NB Passing Lane Analysis

- The NB passing lane is the 3 lane section in the combo alternative just north of Hoback Junction. The segment length includes 1.7 miles for the passing lane length and 1.8 miles for FHU's proposed 3 lane section with a lane in each direction and a center two way left turn lane.
- 878 vehicles per hour (vph) in the NB direction, 586 vph in the SB direction.
- Free flow speed was left at 65 mph.
- Length of upstream two lane highway was entered as 1.5 miles. This is the length through the junction and portions of the highways from Pinedale and Alpine entering the junction.
- LOS D.

SB Passing Lane Analysis

- The SB passing lane includes FHU's 4 lane segment (2 lanes in each direction) plus their proposed 5 lane segment. The total length of segment was approximated at 7.1 miles.
- 878 vph SB and 586 vph NB.
- Free flow speed was left at 65 mph.
- Length of the upstream two lane highway was entered as 2.0 miles. This is FHU's approximate length of the 4 lane section (2 lanes NB, continuous left turn lane, 1 lane SB) south of the present 5 lane section and preceding the 2 lanes in each direction 4 lane section.
- Length of SB passing lane was 2.1 miles and included the 4 lane (2 lane in each direction) and 5 lane section.
- LOS D.

HCS+: Two-Lane Highways Release 5.21

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	CPJ
Agency/Co.	
Date Performed	12/19/2006
Analysis Time Period	2026 Peak
Highway	
From/To	
Jurisdiction	
Analysis Year	
Description	SB for FHU option

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	7.1	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 878 veh/h
Opposing direction volume, Vo 586 veh/h

Average Travel Speed

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor,(note-5) fHV	0.993		0.993	
Grade adj. factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	931	pc/h	621	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed,(note-3) S FM	-	mi/h
Observed volume,(note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed,(note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width,(note-3) fLS	0.0	mi/h
Adj. for access points,(note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	48.5	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	924	pc/h	617	pc/h
Base percent time-spent-following,(note-4) BPTSFd	71.8	%		
Adjustment for no-passing zones, fnp	25.1			
Percent time-spent-following, PTSFd	86.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	1640	veh-mi
Peak-hour vehicle-miles of travel, VMT60	6234	veh-mi
Peak 15-min total travel time, TT15	33.8	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	7.1	mi
Length of two-lane highway upstream of the passing lane, Lu	2.0	mi
Length of passing lane including tapers, Lpl	2.1	mi
Average travel speed, ATSd (from above)	48.5	mi/h
Percent time-spent-following, PTSFd (from above)	86.9	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	1.30	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	50.6	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	4.13	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-1.13	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	68.2	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	D	
Peak 15-min total travel time, TT15	32.4	veh-h

Notes:
1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

Phone: Fax:
E-Mail:

Directional Two-Lane Highway Segment Analysis

Analyst	CPJ
Agency/Co.	
Date Performed	12/19/2006
Analysis Time Period	2026 Peak
Highway	
From/To	
Jurisdiction	
Analysis Year	
Description	NB for FHU option

Input Data

Highway class	Class 1		Peak-hour factor, PHF	0.95	
Shoulder width	8.0	ft	% Trucks and buses	7	%
Lane width	12.0	ft	% Trucks crawling	0.0	%
Segment length	3.5	mi	Truck crawl speed	0.0	mi/hr
Terrain type	Level		% Recreational vehicles	0	%
Grade: Length		mi	% No-passing zones	100	%
Up/down		%	Access points/mi	10	/mi

Analysis direction volume, Vd 878 veh/h
Opposing direction volume, Vo 586 veh/h

Average Travel Speed

Direction	Analysis (d)		Opposing (o)	
PCE for trucks, ET	1.1		1.1	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adj. factor, (note-5) fHV	0.993		0.993	
Grade adj. factor, (note-1) fG	1.00		1.00	
Directional flow rate, (note-2) vi	931	pc/h	621	pc/h

Free-Flow Speed from Field Measurement:		
Field measured speed, (note-3) S FM	-	mi/h
Observed volume, (note-3) Vf	-	veh/h
Estimated Free-Flow Speed:		
Base free-flow speed, (note-3) BFFS	65.0	mi/h
Adj. for lane and shoulder width, (note-3) fLS	0.0	mi/h
Adj. for access points, (note-3) fA	2.5	mi/h
Free-flow speed, FFSd	62.5	mi/h
Adjustment for no-passing zones, fnp	1.9	mi/h
Average travel speed, ATSd	48.5	mi/h

Percent Time-Spent-Following

Direction	Analysis(d)		Opposing (o)	
PCE for trucks, ET	1.0		1.0	
PCE for RVs, ER	1.0		1.0	
Heavy-vehicle adjustment factor, fHV	1.000		1.000	
Grade adjustment factor,(note-1) fG	1.00		1.00	
Directional flow rate,(note-2) vi	924	pc/h	617	pc/h
Base percent time-spent-following,(note-4) BPTSFd	71.8	%		
Adjustment for no-passing zones, fnp	25.1			
Percent time-spent-following, PTSFd	86.9	%		

Level of Service and Other Performance Measures

Level of service, LOS	E	
Volume to capacity ratio, v/c	0.55	
Peak 15-min vehicle-miles of travel, VMT15	809	veh-mi
Peak-hour vehicle-miles of travel, VMT60	3073	veh-mi
Peak 15-min total travel time, TT15	16.7	veh-h

Notes:
1. If the highway is extended segment (level) or rolling terrain, fG = 1.0
2. If vi (vd or vo) >= 1,700 pc/h, terminate analysis-the LOS is F.
3. For the analysis direction only.
4. Exhibit 20-21 provides factors a and b.
5. Use alternative Equation 20-14 if some trucks operate at crawl speeds on a specific downgrade.

Passing Lane Analysis

Total length of analysis segment, Lt	3.5	mi
Length of two-lane highway upstream of the passing lane, Lu	1.5	mi
Length of passing lane including tapers, Lpl	1.7	mi
Average travel speed, ATSd (from above)	48.5	mi/h
Percent time-spent-following, PTSFd (from above)	86.9	
Level of service,(note-1) LOSd (from above)	E	

Average Travel Speed

Downstream length of two-lane highway within effective length of passing lane for average travel speed, Lde	1.70	mi
Length of two-lane highway downstream of effective length of the passing lane for average travel speed, Ld	-1.40	mi
Adj. factor for the effect of passing lane on average speed, fpl	1.11	
Average travel speed including passing lane,(note-2) ATSpl	51.4	

Percent Time-Spent-Following

Downstream length of two-lane highway within effective length of passing lane for percent time-spent-following, Lde	4.13	mi
Length of two-lane highway downstream of effective length of the passing lane for percent time-spent-following, Ld	-3.83	mi
Adj. factor for the effect of passing lane on percent time-spent-following, fpl	0.62	
Percent time-spent-following including passing lane,(note-3) PTSFpl	68.1	%

Level of Service and Other Performance Measures (note-4)

Level of service including passing lane, LOSpl	D	
Peak 15-min total travel time, TT15	15.7	veh-h

Notes:
1. If LOSd = F, passing lane analysis cannot be performed.
2. If Ld < 0, use alternative Equation 20-22.
3. If Ld < 0, use alternative Equation 20-20.
4. v/c, VMT15 , and VMT60 are calculated on Directional Two-Lane Highway Segment Worksheet.

FELSBURG HOLT & ULLEVIG

engineering paths to transportation solutions

MEMORANDUM

TO:	Ms. Paula Stevens, Teton County Planning Department
FROM:	Jeff Ream, P.E., PTOE, Felsburg, Holt & Ullevig
DATE:	February 12, 2008
SUBJECT:	Wyoming Highway 89 Alternative Laneage Analysis FHU Reference No. 06-140

FHU has reviewed the comments provided by the WYDOT Traffic Program on the August 29, 2006 Wyoming Highway 89 (WY 89) Alternative Laneage Analysis memorandum, and offers the following responses.

The report issued to Teton County from FHU contains analysis flaws that were found in the Highway Capacity Software analyses. Since FHU had access to the draft EIS, the consultant had to have seen the write-up for screening out a three lane section consisting of one lane in each direction plus a continuous center left turn lane for a high speed rural section. This section becomes unsafe since passing is not allowed in the left turn lane and one slow vehicle can easily platoon traffic. Impatient drivers will risk hitting left turners by using the left turn lane as a passing lane. This section is useful in low speed urban areas only.

1. One flaw in FHU's HCS (Highway Capacity Software) analysis was in using a free flow speed of 65 mph to analyze the lowest volume section immediately north of Hoback Junction. The speed limit is 55 mph and will be used as the free flow speed. Changing this one parameter puts the LOS (level of service) at D or lower for all roadway sections between Hoback Junction and the current 5 lane section south of Jackson in either a two lane analysis or a passing lane analysis and in a north or south direction. Using Figure 3, the lowest volumes on the north section, approximating distances, and even using 65 mph, WYDOT could not get the LOS above D. As per the Green Book (AASHTO's A Policy on Geometric Design of Highways and Streets) the LOS for a rural principal arterial should be B and will be designed no lower than LOS C.

65 mph was selected as the free flow speed because based on field observations it better represented the operating speed of the facility under free flow conditions. The 55 mph speed limit was not selected because, as noted on pg 20-5 of the Highway Capacity Manual, “the design speeds and speed limits for many facilities are not based on current operating conditions.”

6300 South Syracuse Way, Suite 600 Centennial, CO 80111 tel 303.721.1440 fax 303.721.0832
www.fhueng.com info@fhueng.com

FHU reviewed the WYDOT southbound HCS+ highway analysis provided in the memo and noted that the total segment length, length of the segment upstream of the passing lane, and length of the passing lane in the WYDOT analysis were different from those used in the FHU analysis. It is unclear as to why those values were changed. FHU also noted that a version of HCS issued in October 2006 was used in the WYDOT analysis (Release 5.21); this version was not issued until after the FHU analysis was complete (Release 5.2). When the FHU analysis was replicated in the newer release, the southbound level of service was reported as LOS D, as opposed to LOS C in the earlier version of the software. To achieve LOS C in the southbound direction the passing lane would need to be increased from 2.5 miles to 3.5 miles, but it is worth noting that while this additional length improves the corridor by one letter grade, it would only increase the travel speed on the corridor by 0.7 mph; to the typical user, this would be a generally imperceptible improvement.

FHU also reviewed the WYDOT northbound HCS+ highway analysis in the memo and noted that the length of the segment upstream of the passing lane and the length of the passing lane were different from those used in the FHU analysis. Again, it is unclear as to why those values were changed. FHU also replicated the northbound analysis in the newer release (Release 5.21) and obtained a result of LOS C, consistent with the results documented in the memo.

2. As noted above, FHU inserted a 3 lane urban section (not sure of the length since mileposts and lengths were not shown in Figure 3) of approximately 2 miles. This is a major design flaw that leads to unsafe operation. This was already screened and dismissed as an option by the interdisciplinary (ID) team.

The safety reasons cited previously for dismissal of the three lane section, namely driver impatience leading to use of the left turn lane as a passing lane, was interpreted to apply to providing that section exclusively along the 7.5 mile corridor, when both percent time following (80-85 percent) and actual time following (7.5 - 8 minutes of the 9.5 minutes it would take to travel the corridor) would be much higher than under the Teton County alternative. In the worst case scenario for the Teton County alternative (one vehicle begins following another at the end of the southern northbound passing lane), a vehicle would need to wait approximately two minutes until it arrives at the next passing lane, which would alleviate much of the impatience. Next Passing Lane XX Miles signs could also be used on the segment to further discourage aggressive driving behavior.

3. Driver expectations and design consistency are also important design factors. Drivers do not expect a rural high speed road to have different cross sections that require tapers and shifts to stay in the same lane. This becomes worse when snow covers the pavement markings and drivers are unsure of where they need to be on the road.

These are valid issues that would be addressed at an appropriate point during the design of the roadway, but are not relevant in a conceptual operational analysis such as that conducted here.

4. WYDOT does not understand the use of Synchro software to model an unsignalized rural two lane high speed road. Synchro is an urban signalization model. The Highway Capacity Manual (Highway Capacity Software is the computer modeling) is the nationally accepted standard for traffic modeling and LOS, and in this case, is the model to use for a rural high speed roadway.

The Highway Capacity Manual (HCM) methodology was used as the primary analysis tool for this effort and was presented as such in the memorandum. However, as noted in page 20-1 of the HCM, "some two-lane highways—particularly those that involve interactions among several passing or climbing lanes—are too complex to be addressed with the procedures of this chapter" and suggests the analyst apply simulation modeling for those situations.

Synchro provides a relatively easy-to-operate, easy-to-understand tool (SimTraffic) to conduct traffic simulations of roadway corridors using car-following theory (as opposed to HCM methodology) and therefore was selected as an appropriate software application for a supplemental analysis of the corridor. And since they were readily available, Synchro's arterial analysis results (based on HCM arterial analysis procedures) were presented in the memo as an additional assessment of corridor operations. As the memo notes, the Synchro and SimTraffic results were consistent with the indications of the HCM analysis; namely that the EIS alternative would operate with slightly higher speeds and less delay than the Teton County alternative, but both offered reasonable overall performance.

I trust the above information clarifies the decisions and thought processes used during the analysis of the corridor. If you have any questions or need further clarification, please give me a call at (303) 721-1440.

Jackson South DEIS Alternative Laneage Assessment

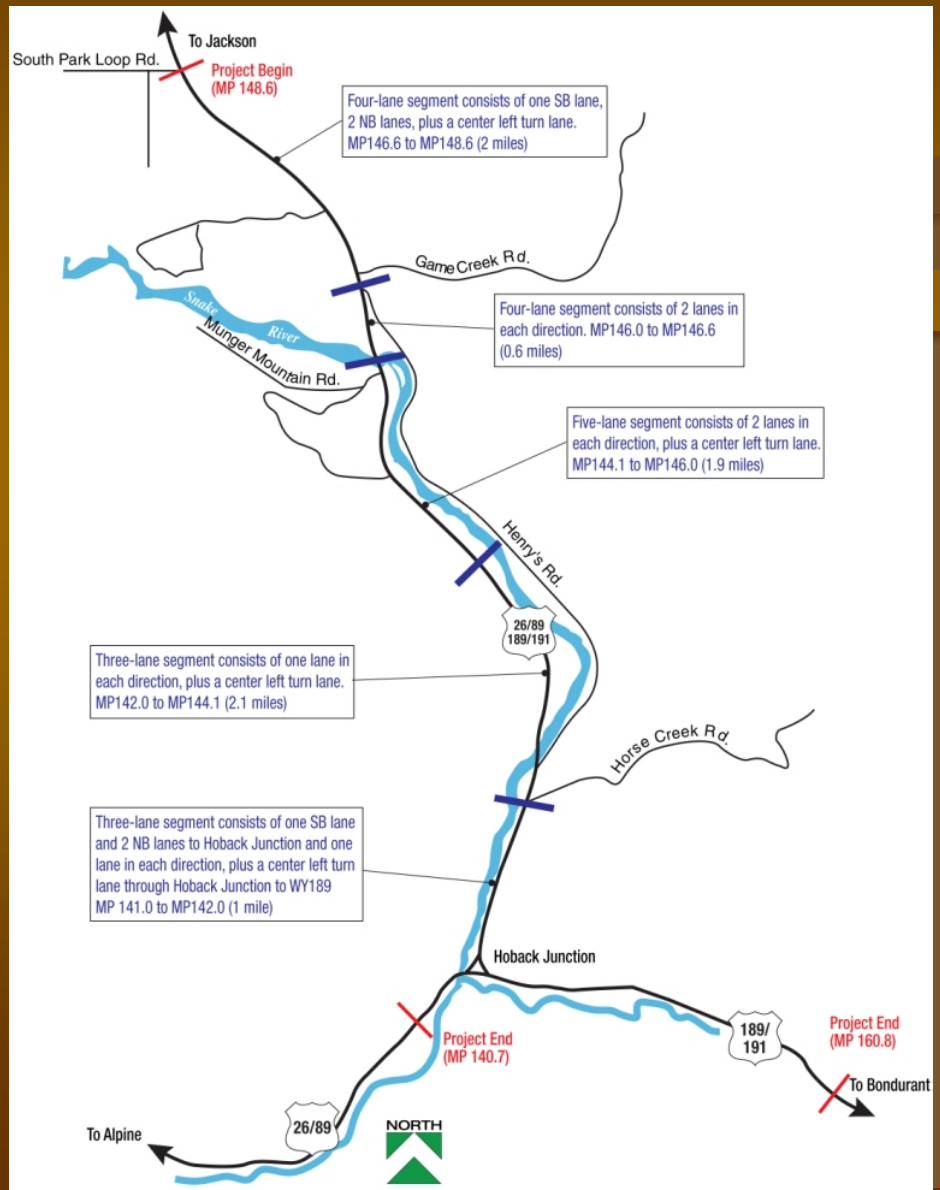
Presentation to Teton County Board of County Commissioners

February 26, 2009

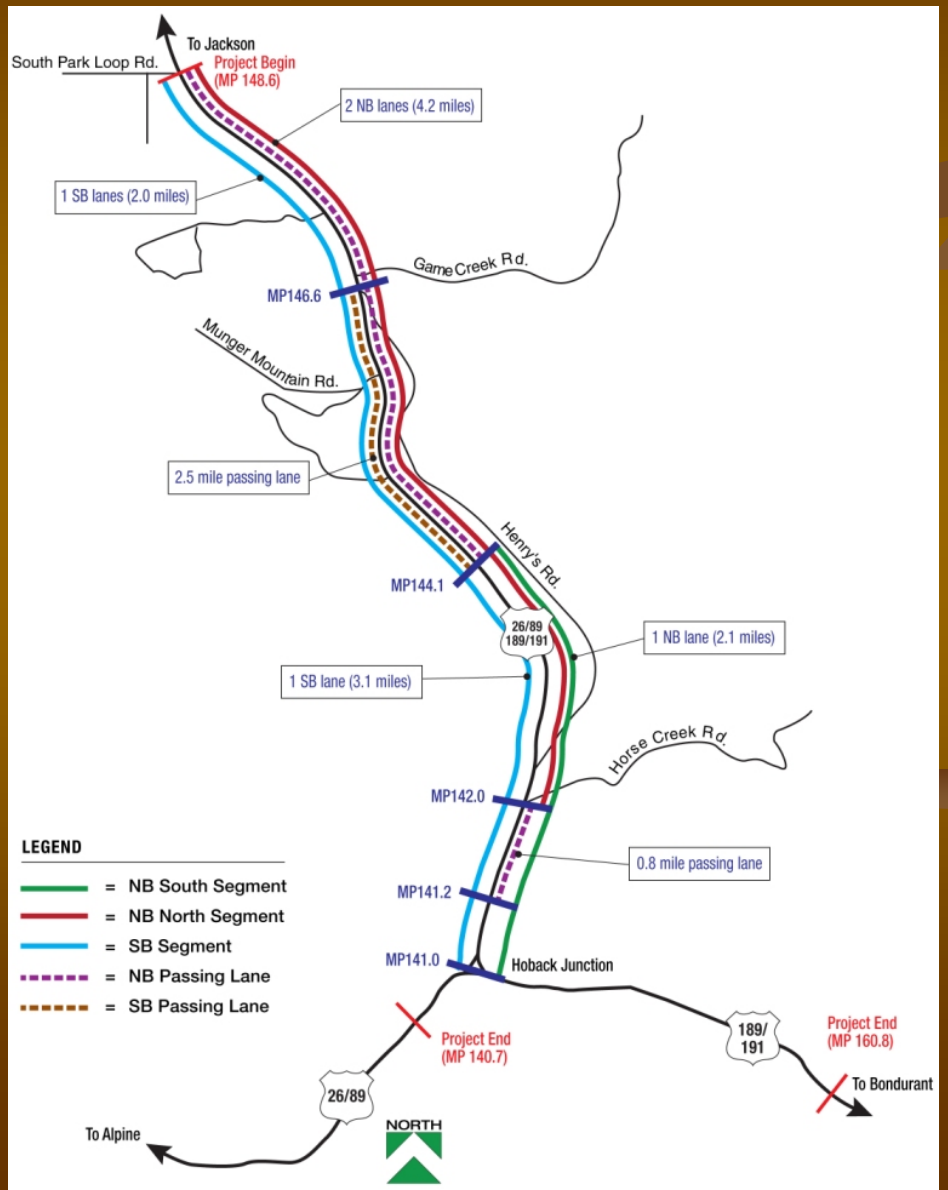
Teton County Laneage Alternative

- Developed by Teton County Staff in response to residents concerns with a 5-lane section
- Provides a narrower footprint than the 5-lane and combined alternatives proposed in the Jackson South Draft Environmental Impact Statement
- Balances traffic flow, safety and community desires

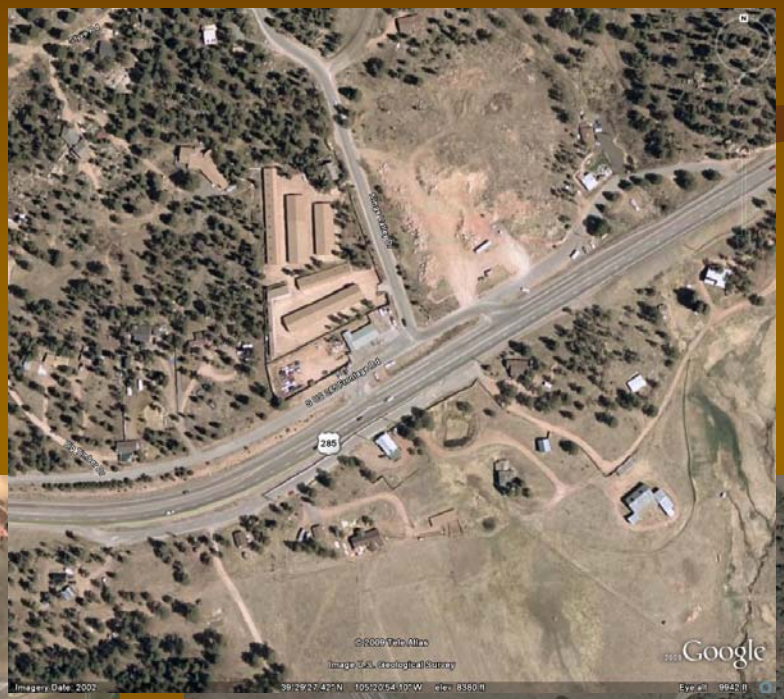
Teton County Laneage Alternative



Teton County Laneage Alternative



Other Similar Cross-Sections



Teton County Laneage Alternative

- Key Components
  - Separate left turn lane addresses safety
  - 4-lane North Snake River bridge
  - 3-lane South Snake River bridge

Traffic Operations: Level of Service

- Two level of service measures for 2-lane Highways:
  - Travel Speed
  - Percent Time Following

Traffic Operations: Level of Service

- Travel Speed

Level of Service	Travel Speed
LOS A	>55 mph
LOS B	50-55 mph
LOS C	45-50 mph
LOS D	40-45 mph
LOS E	<40 mph

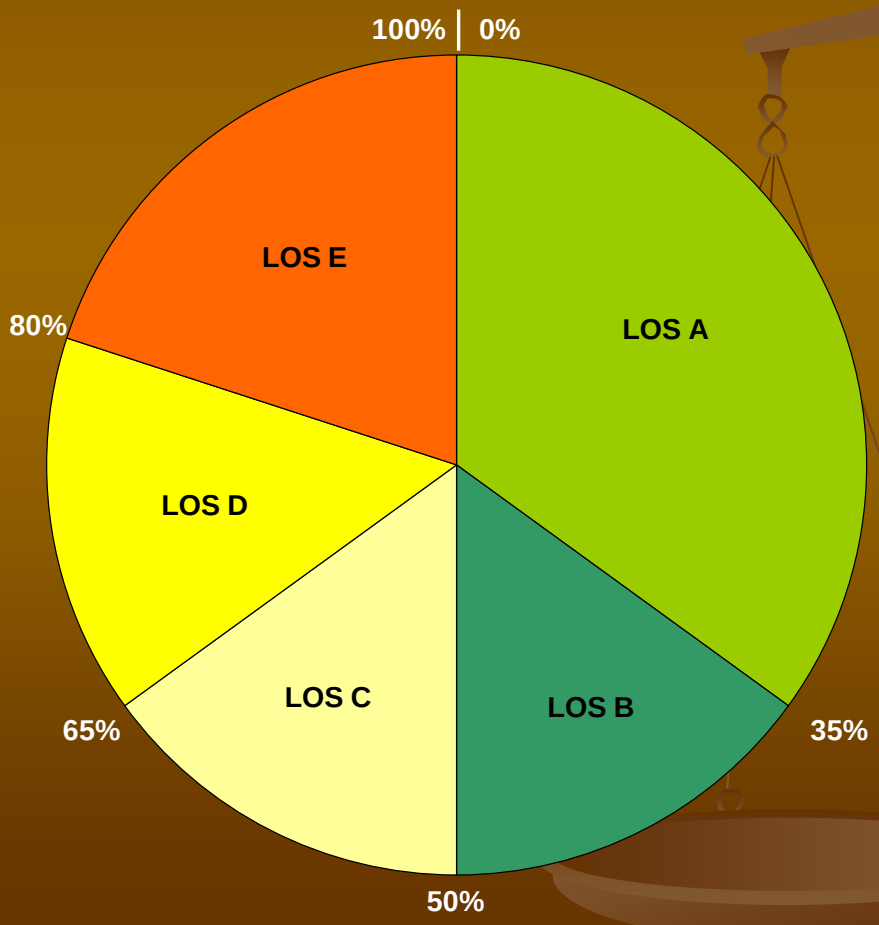
Traffic Operations: Level of Service

- Percent Time Following

VS.

Traffic Operations: Level of Service

- Percent Time Following



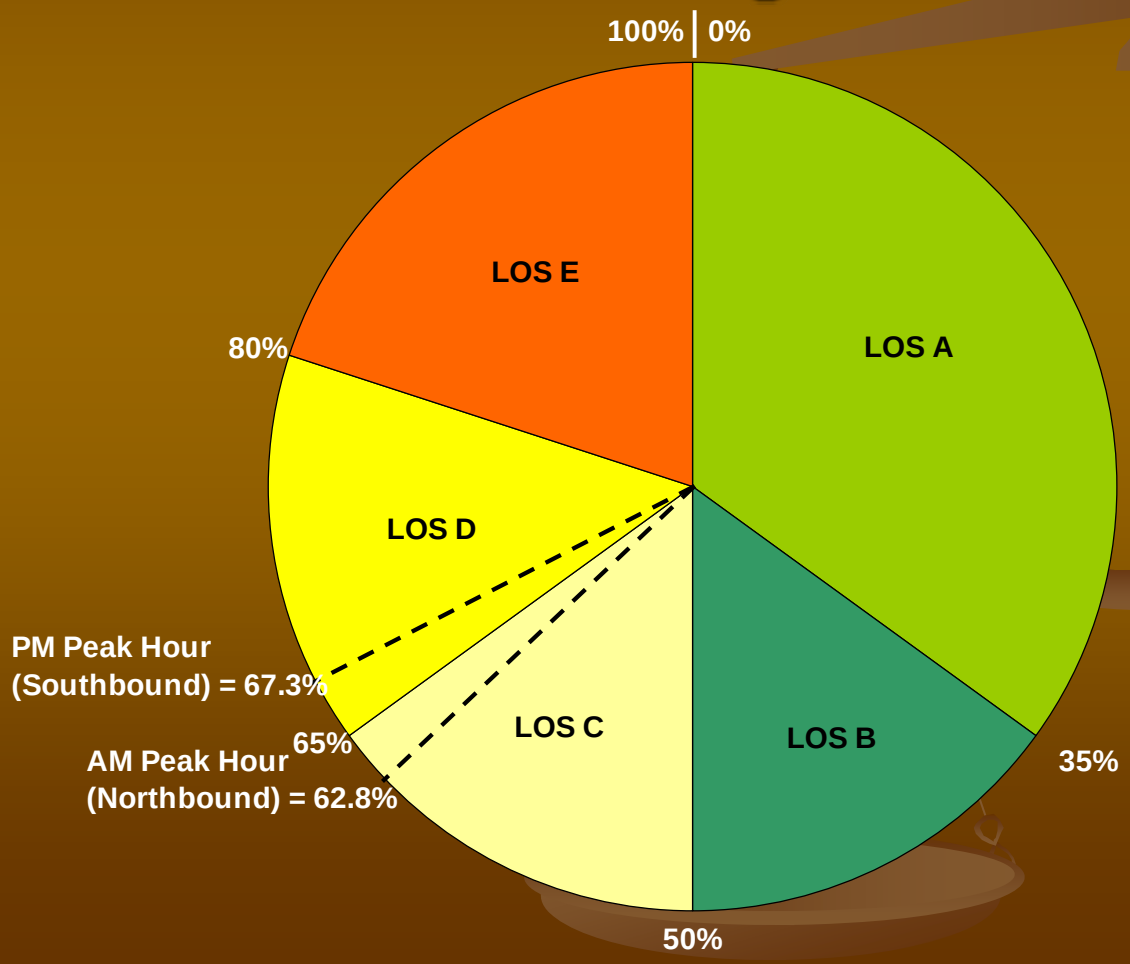
How Well Does the County Alternative Work?

- Speed –2026 Traffic Conditions

Level of Service	Travel Speed	Northbound in the morning	Southbound in the afternoon
LOS A	>55 mph		
LOS B	50-55 mph	51.0 mph	50.8 mph
LOS C	45-50 mph		
LOS D	40-45 mph		
LOS E	<40 mph		

How Well Does the County Alternative Work?

- Percent Time Following – 2026 Conditions



Does the County Alternative meet Level of Service Standards?

- Teton County Standard = LOS D

Standard	Northbound	Southbound
Speed	Yes LOS B	Yes LOS B
Time Following	Yes LOS C	Yes LOS D

Does the County Alternative meet Level of Service Standards?

- Jackson South DEIS Standard = LOS C

Standard	Northbound	Southbound
Speed	Yes LOS B	Yes LOS B
Time Following	Yes LOS C	1 hour of LOS D

Does the County Alternative meet Level of Service Standards?

- Southbound in the afternoon peak hour
  - 9 minute travel time
  - 67.3 percent time following = 6:05
  - LOS C percent time following = 5:50
  - 15 seconds more than the DEIS LOS Standard

Summary of County Alternative

- Proven concept on similar corridors
- Provides separate left turn lane to address safety concerns
- Narrower cross-section reduces bridge costs
- Balances traffic flow needs with community desires
  - Meets Teton County level of service standard
  - Meets 3 of 4 DEIS level of service standards and nearly meets the 4th
- Merits consideration for the preferred alternative for the corridor

POINTS OF AGREEMENT:

1. **Need for reconstruction**

2. **Hoback Roundabout**

3. **Highway north from Hoback to Horse Creek – 3 lanes**

4. **Middle five lane section from Henry's Road north to South Park Bridge**

5. **Inclusion of a pathway**

6. **Use of wildlife crossing improvements and associated fencing**

7. **Implementation of the mitigation measures suggested in the USFS White Paper on the Snake River Wild and Scenic River Eligibility Analysis.**

8. **Use of Best Management Practices to protect water quality, aquatic habitats, and fisheries resources during construction.**

9. **Acknowledgement that visual impacts must be mitigated.**

10. **Coordination with the Teton County Floodplain Administrator to ensure compliance with floodplain regulations.**

POINTS OF DISAGREEMENT:

1. **Horse Creek to Henry's Road – Teton County proposes three lanes, and Wydot proposes five**

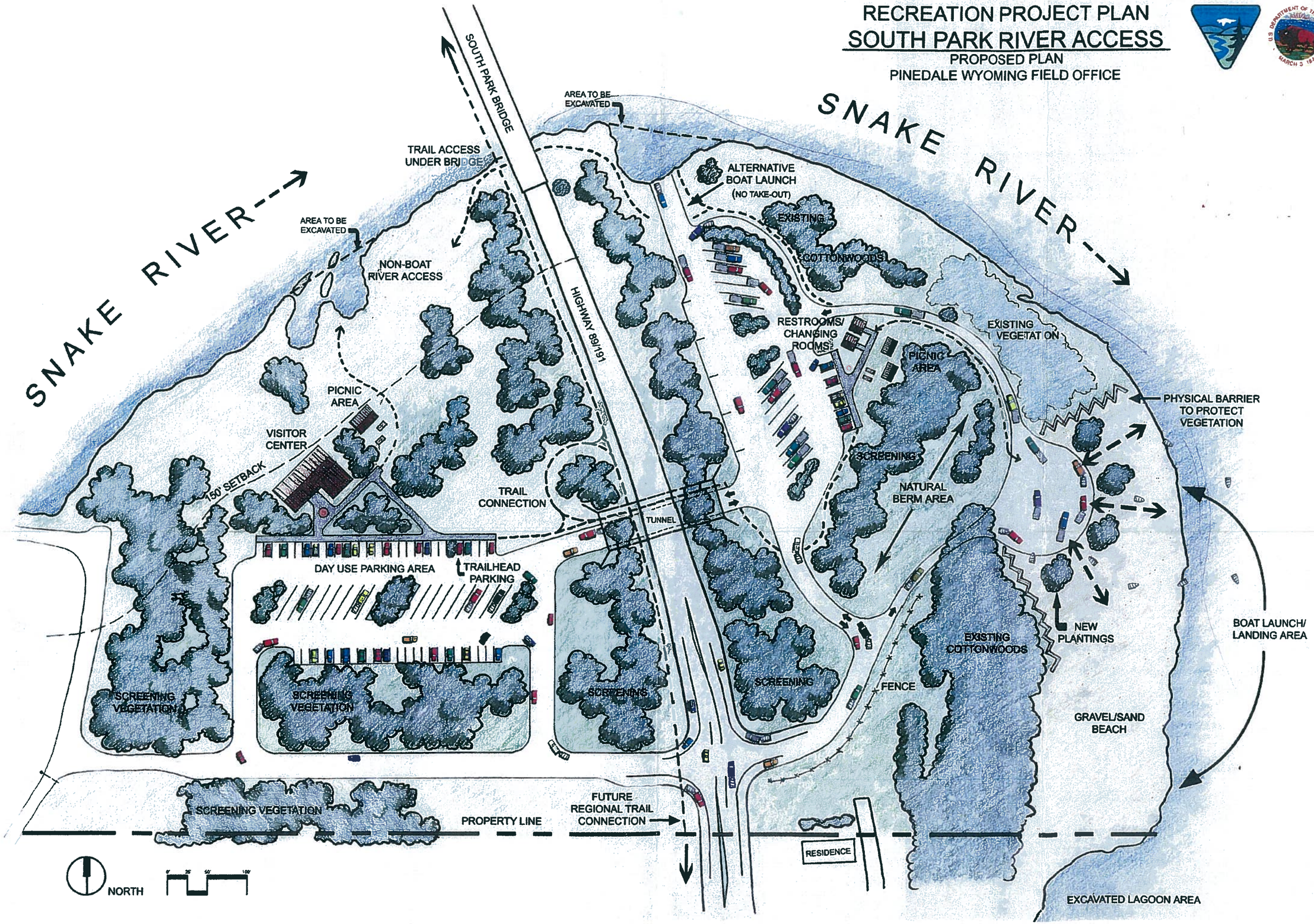
2. **South Park Bridge to Game Creek – Teton County proposes four lanes, two in each direction, and Wydot proposes five**

3. **Game Creek to South Park Loop – Teton County proposes four lanes, two northbound lanes, one southbound lane and one center left turn lane, and Wydot proposes five**

4. **The Teton County proposed alternative was excluded prior to vetting through the Interdisciplinary Team as was the case with all other alternatives proposed.**

5. **Cost considerations were excluded in the screening criteria.**

6. **Adherence to Level of Service C or greater (Teton County adopted LOS D in current Comprehensive Plan; Teton County's LOS goal of D isn't mentioned in the DEIS document at all).**

7. **The entire corridor is in either the County's Scenic or Natural Resources Overlays or both. A wider roadway cross-section imposes greater negative scenic and natural resource impacts than a narrower cross-section.**

RECREATION PROJECT PLAN
SOUTH PARK RIVER ACCESS
PROPOSED PLAN
PINEDALE WYOMING FIELD OFFICE