Climate Technical Memorandum

North Sheridan Interchange

Sheridan County

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Wyoming Department of Transportation

and

Federal Highway Administration

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North Sheridan Interchange Environmental Assessment

Climate Technical Memorandum

Section 1: Project Background

Project Overview

The Wyoming Department of Transportation (WYDOT), in coordination with the Federal Highway Administration (FHWA), is studying improvements to the North Main Street/Interstate 90 (I-90) Interchange, also known as the North Sheridan Interchange. The project is located along I-90 in the City of Sheridan in Sheridan County, Wyoming.

The proposed project includes reconstructing and potentially relocating the North Sheridan Interchange, improvements to I-90, and improvements to North Main Street. This is the first interchange serving Sheridan for eastbound vehicles on I-90. The project is needed to improve traffic operations and safety at the interchange and along the corresponding segments of I-90 and North Main Street. The existing interchange has sharp curves, steep ramps, and limited space for traffic to merge with I-90 traffic, all of which result in safety and operational issues on the interchange, along I-90, and along North Main Street. The selected location of the North Sheridan Interchange must be consistent with the FHWA access requirements for another interchange between the proposed North Sheridan Interchange and the port-of-entry interchange.

The project is being proposed to provide safe, direct regional access from I-90 to the north Sheridan area in support of local land use plans, to improve deteriorating segments of I-90 and North Main Street, and to comply with the FHWA's interstate access policy.

Study Area

Three distinct study areas were defined to correspond with the three types of improvements associated with the North Sheridan Interchange project.

The study area for improving or relocating the existing interchange extends from the center of the existing interchange to a point along I-90 approximately 1.5 miles west. The width of this area is one half mile on each side of I-90. This study area includes an area for the potential realignment of Decker Road, which is under consideration. The study area for improvements to the mainline of I-90 extends to approximately 1.5 mile east of the existing interchange and to approximately 2.0 miles west, within existing I-90 right-of- way. The study area for improvements along North Main Street includes the existing interchange south to Fort Road within existing WYDOT right-of-way. The limits were selected to represent the areas that could be directly or indirectly affected by potential improvements.

The City of Sheridan has identified the north Sheridan area as a primary growth area, and a large tract of land west of Decker Road was annexed into the City. The City has developed plans for the Sheridan High-Tech Business Park, and a subdivision plat for Phase I of the Wrench Ranch development area has been approved. Additionally, the West Corridor is a planned north-south transportation facility that will

traverse the western part of Sheridan. The West Corridor was proposed in a citywide traffic study conducted by the City in 2001. It is intended to provide new roadway capacity independent of the proposed North Sheridan Interchange improvements. Funding for the West Corridor has not been identified.

Proposed Alternatives

WYDOT developed and screened a range of alternatives as part of the North Sheridan Interchange environmental assessment (EA). As described in the *Alternatives Technical Memorandum* (HDR Engineering 2012),[1] after screening WYDOT has two remaining build alternatives—Alternative 2 and Modified Alternative 4—in addition to the No-Build Alternative that will be carried through the EA for further analysis. More information on these alternatives, including location figures, can be found in the *Alternatives Technical Memorandum*.

Alternative 1: No-Build: This alternative represents the conditions if major improvements are not completed as a result of this study. This alternative would not improve the existing geometric deficiencies, regional connectivity shortcomings, or deteriorating roadway segments within the three study areas.

Alternative 2: Rebuild at the Existing Interchange: This alternative would construct a tight diamond interchange about 750 feet north of the existing interchange and within the same general interchange footprint. The crossroad would connect with Decker Road using a free-flow T-intersection. The existing interchange would be demolished in order to build the new interchange. This alternative would include demolition of residences (including rental properties) and, potentially, relocation of a small business. This alternative would necessitate acquisition of land from the KOA tent site as well.

Modified Alternative 4: Diamond Interchange Close to Decker Road: This alternative would construct a diamond interchange about 2,300 feet west of existing Decker Road and about 4,560 feet northwest of the existing interchange. The "straight through" alignment of Decker Road would be eliminated and traffic would flow along a realigned North Main Street / Decker Road that would cross perpendicular to I-90. The existing North Sheridan Interchange would continue to carry traffic until construction of the proposed interchange is complete. Right-of-way would be required from currently undeveloped land. There would be no residential or commercial relocations.

Section 2: Existing Conditions

A review of existing regional climate conditions and known science relating to local and global climate change was completed as a part of the environmental assessment of the North Sheridan Interchange project in Sheridan, Wyoming. The purpose of this analysis was to qualitatively evaluate the impact of the proposed project on climate change.

[1] Alternatives at Decker Road and farther north of Modified Alternative 4 were considered but were screened out because they did not meet purpose and need. These interchange locations were not considered in the air quality analysis.

Methodology

Known climate characteristics were described, and historical data were reviewed to provide a record of the climate in the study area. A discussion of the known science regarding local and global climate change is included. Due to the inherent uncertainties associated with long-term projections from global and regional climate change models, the analysis is qualitative. The qualitative analysis considers the impact of the project on climate and the impact of climate change on the project, in accordance with draft recommendations of the Council on Environmental Quality.

Regulatory Overview

The United States Environmental Protection Agency (USEPA) and the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) have proposed and finalized regulations to reduce greenhouse gas (GHG) emissions through improvements in fuel economy.

In May 2010, USEPA and NHTSA finalized a joint rule to establish new fuel economy standards for model year 2012 through 2016 light-duty vehicles. This rule projects tailpipe carbon dioxide (CO_2) compliance levels (for cars and light-duty truck combined) ranging from 295 grams of CO_2 per mile (g/mi) for model year 2012 to 250 g/mi for model year 2016. These compliance levels equate to 30.1 miles per gallon (mpg) and 35.5 mpg, respectively (OTAQ 2010). In November 2011, USEPA and NHTSA issued a joint proposal to extend this effort to model years 2017 through 2025. The compliance levels continue the trend stated in the final rule out to a combined car and light-duty truck compliance level of 163 g/mi for model year 2025, corresponding to 54.5 mpg (OTAQ 2011a).

In August 2011, USEPA and NHTSA finalized a joint rule to establish new fuel economy standards for model year 2014 through 2018 medium- and heavy-duty trucks and buses. The adopted standards are either payload-dependent g/mi (and gallon per 100-mile) for pickups and vans or gram per ton-mile (g/ton-mi) (and gallon per 1,000 ton-mile) for vocational vehicles and combination tractors. The standards represent reductions for the various classes of heavy-duty vehicles ranging from 6 to 23 percent by model year 2017, compared to a 2010 baseline. A second phase of regulations is planned for model years beyond 2018, but no formal announcement of proposed rulemaking has been made (OTAQ 2011b).

These final and proposed rules are intended to reduce fuel usage by the fleet of motor vehicles. CO_2 emissions are dependent only on the carbon content of the fuel and fraction oxidized, so GHG emissions would be reduced as fuel usage is reduced. Additionally, the rules set standards for nitrous oxide (N_2O) and methane (CH_4) emissions from light-duty passenger vehicles (tailpipe emissions) and from heavy-duty pickup trucks and vans, and semi-trucks (tailpipe emissions and air conditioning leakage).

Description of the Existing Condition

Climate

As a result of its location east of the Bighorn Mountains in northern Wyoming, Sheridan's climate – like much of Wyoming – can be described as semi-arid. Summers are generally hot and dry, with temperatures occasionally exceeding 100 degrees Fahrenheit (F). Thunderstorms can occur several times throughout the summer, regionally, with locally heavy rainfalls. Severe weather associated with these thunderstorms, when it occurs, typically takes place in the form of hail, though tornados are possible as well. Winters are generally mild and dry, with occasional blasts of frigid arctic air resulting in temperatures well below zero. Snowstorms can result in blizzard or near blizzard conditions when significant wind occurs either during or shortly after a snowfall (NOAA 1985).

At the Sheridan Airport meteorological station, the average annual temperature from 1981 to 2010 was 45.2 F, and the average annual precipitation was 14.16 inches. The average annual snowfall for these same years was 71.4 inches. Also at the Sheridan Airport meteorological station, the maximum and minimum temperatures for the period of record from 1948 through 2011 are 107 degrees F (on July 14, 2002) and –37 degrees F (on December 24, 1983), respectively. The average number of days with a high temperature greater than 90 degrees F was approximately 29 per year, and approximately 22 days per year had a low temperature below 0 degrees F. The highest 1-day precipitation for the period was 2.76 inches, and the highest 1-day snowfall was 26.7 inches.

Urban Heat Island Effect

In larger metropolitan areas, there is a recognized urban heat island (UHI) effect. The UHI effect is used to describe situations in which urban and suburban areas are warmer than the surrounding area. On an annual mean basis, air temperatures in large cities can be 1.8 to 5.4 F warmer than their rural surroundings (USEPA 2008). Heat islands form when cities replace natural land cover with pavement, buildings, and other infrastructure. These changes can contribute to higher urban temperatures in the following ways (USEPA 2008):

- The displacement of trees and vegetation minimizes the natural cooling effect of shading and evaporation of water from soil and leaves
- Tall buildings, roads, and parking ramps absorb and reradiate heat
- Waste heat from vehicles, factories, and air conditioners may add warmth to their surroundings

Because heat is retained in roads, buildings, and other structures longer than in surrounding rural areas, the UHI effect often is greatest after sunset, though the timing depends on the specific surfaces, the season, and weather conditions (USEPA 2008).

The population of Sheridan, WY (17,444 in 2010) (U.S. Census Bureau 2012) is sufficiently small so as to not create a large heat island effect.

Global Climate Change

In contrast to the localized temperature differences caused by the UHI effect, global climate change is a term used to describe the gradual increase or decrease in worldwide average surface temperatures, or changes in precipitation, wind, or other climate variables. The level of human vs. natural contribution to global climate change is the subject of much debate and is necessary to consider in environmental documents.

The Council on Environmental Quality (CEQ) has provided draft guidance on the ways in which federal agencies can improve their consideration of the effects of GHG emissions and climate change (February 18, 2010). The guidance explicitly states that, with regard to the effects of climate change on a project, agencies should "focus on aspects of climate change that may lead to changes in the impacts, sustainability, vulnerability, and design" of the project. The CEQ guidance goes on to state that "agencies should recognize the scientific limits of their ability to accurately predict climate change effects" and "not devote effort to analyzing wholly speculative effects." Further, the CEQ guidance states "agencies should consider the uncertainties associated with long-term projections from global and regional climate change models." CEQ guidance also recommends that environmental documents consider both how a project could impact climate change and how climate change could impact a project.

The main human contributions to global climate change are attributed to the emissions of what are commonly referred to as GHGs, such as CO_2, and to changes in land cover and land use that can affect the amount of carbon dioxide taken up or released by the land surface. There are no GHG rules that would potentially affect the proposed project.

Section 3: Project-Related Climate Impacts for all Alternatives

Urban Heat Island Effect

Larger metropolitan areas experience a recognized UHI effect, which occurs when cities replace natural land cover with pavement, buildings, and other infrastructure. Urban sources of fuel combustion also release heat to the urban environment, thus contributing to the urban heat island. The population of the Sheridan area and in the area affected by the proposed project is sufficiently small so as not to create a discernible heat island effect or a change in heat island effects under Alternative 2 or Modified Alternative 4.

Global Climate Change

Global climate can be affected by many factors, including changes in atmospheric composition due to GHG emissions. Other factors include solar variation, volcanic activity, ocean current cycles, variations in earth orbit, and orientation of the earth on its rotational axis. Concerns expressed in recent years are that mankind's emissions of greenhouse gases may warm the climate, possibly affecting precipitation patterns as well.

The proposed project's main potential contribution to global climate change would be through the emissions of GHG, primarily CO_2. As discussed in the air quality section, under Alternative 2, vehicle-miles travelled (VMT) are expected to decrease compared to the No-Build Alternative, due to a more direct route. Consequently, fuel use is expected to decrease under this Alternative. To the degree that GHG emissions have any impact on global climate, a reduction of fuel usage would result in a reduction of GHG emissions and, therefore, lessen the impact to global climate change.

Conversely, under Modified Alternative 4, VMT are expected to increase compared to the No-Build Alternative or Alternative 2, due to a more indirect route, with associated fuel use increases. To the degree that GHG emissions have any impact on global climate, an increase of fuel usage would result in an increase of GHG emissions and, therefore, would tend to increase the impact to global climate change. However, based on recently finalized and proposed fuel economy standards for on-road motor vehicles, the increase in VMT under Modified Alternative 4 (13 percent over No-Build) and resulting GHG emissions will be offset by improvements in fuel economy of the motor vehicle fleet by the design year.

Construction of either build alternative would require the use of heavy equipment, which would consume fuel, releasing GHG emissions.

Global climate change is a term used to describe the gradual increase or decrease in worldwide average surface temperatures, or changes in precipitation, wind, or other climate variables. The nature of the project and its geographic location dictate that the project would not be significantly impacted by moderate increases or decreases in temperature or precipitation, should they occur in the long-term. The project's sustainability, vulnerability, and design would not be significantly different under future scenarios of climate change within the expected lifetime of the project infrastructure.

Section 4: Mitigation Measures

During construction, idling construction equipment would consume fuel. Where possible and practical, shutting off equipment instead of allowing engines to idle would decrease fuel usage. To the degree that GHG emissions have any impact on global climate, a decrease of construction fuel usage would result in a reduction of GHG emissions and, therefore, lessen the impact to global climate change.

Over the life of the proposed project, on-road motor vehicles would be required to meet stringent fuel economy standards. These standards would tend to mitigate increases in VMT under Modified Alternative 4 and would further minimize emissions under other alternatives.

Section 5: Summary of Findings

A qualitative climate change analysis has been conducted for the North Sheridan Interchange project. Based on an expected decrease in VMT for Alternative 2 (compared to the No-Build), it can be concluded that, under Alternative 2, the project is not expected to contribute to global climate change, in comparison to current conditions as represented by the No-Build Alternative.

Based on an expected increase in VMT (compared to the No-Build or to Alternative 2), it can be concluded that, under Modified Alternative 4, the project would tend to increase the impact to global climate change, to the degree that GHG emissions impact global climate.

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