Comment 941

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Name: Rob Dubuc
Location: Salt Lake City

Comments:

<See email attachments on next page, titled 00941_Rob_Dubuc_1_9-6-13 through 00941_Rob_Dubuc_3_9-6-13>

Subject: Shared Solution Coalition Comments

Please see attached comments and exhibits. I am sending the comments and exhibits as separate PDFs, along with a combined PDF. I am also mailing a copy of the comments, without the exhibits, to Mr. Ziman and Mr. Jeffries. Please let me know if you have any problems with these files.

Rob Dubuc

Staff Attorney
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[redacted]

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WESTERN RESOURCE ADVOCATES

September 6, 2013

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Gentlemen:

Thank you for this opportunity to provide you with comments relative to the Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation for the West Davis Freeway (WDF). I make these comments on behalf of the Coalition for a Shared Solution (Shared Solution Coalition or Coalition) comprised of: Utahns for Better Transportation, Save Farmington, Sierra Club, Citizens for a Better Syracuse, FRIENDS of Great Salt Lake, Farmington Ranches Homeowners Association, Breathe Utah, National Audubon Society, Utah Audubon Council, Great Salt Lake Audubon, Utah Physicians for a Healthy Environment, Great Salt Lake Yacht Club, Utah Waterfowl Association, Wasatch Clean Air Coalition, Utah Rivers Council, Western Wildlife Conservancy, Utah Airboat Association, Bike Utah, Utah Mud Motor Association and Utah Birders.

These organizations have thousands of members who reside in the State of Utah, including many members who live along the Wasatch Front and will be affected by decisions made about the proposed WDF. This transportation decision will affect the range of regional transportation options that these members will have well into the future and the quality of transportation services to which they will have access. This decision will also affect the quality of their air, in addition to the amount of open space, wetlands, wildlife habitat and other environmental amenities they will be able to enjoy. This decision will have a major impact on the health, individual and community economic welfare, and environmental quality that these members will experience. Because of this, the organizations and their members have a strong interest in ensuring that they and the public at large are fully and fairly informed about all reasonable alternatives to meeting the area's transportation needs, and about the environmental impacts of those alternatives.

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I. **Introduction**

As outlined in the DEIS, the Utah Department of Transportation (UDOT) initiated the WDF project to address the expected population growth in western Davis and Weber Counties through 2040 by improving regional travel options, and at the request of local governments who identified the need for additional transportation structure in the affected area. According to the DEIS, road congestion due to population growth will increase by 229 percent by the year 2040, resulting in lost productivity of $277,866 per day. This compares to congestion loss of $125,388 per day in 2009.

In order to address the expected increase in congestion, UDOT and the Federal Highway Administration (FHWA) have proposed a narrow range of alternatives consisting of either a No-Action Alternative, or construction of a four-lane highway. In contrast to these two options, Shared Solution has been strongly encouraging UDOT and FHWA to consider a multi-modal alternative to the construction of a highway – something that these agencies have rejected to this point.

A. Origin of the Shared Solution

The idea of a Shared Solution originated in 1995, when the Future Moves Coalition sponsored a conference to identify transportation options for the 21st Century. The focus of the conference was to identify a way to achieve balanced transportation modes as a way of meeting future travel needs. In 2000, the DEIS for Legacy Highway (Legacy) showed that even with Legacy built and I-15 in Davis County expanded, in addition to other transportation management strategies, 10 percent of the predicted peak hour demand could not be met simply through road expansion. From that came the notion that transit had to share the load by providing a convenient, reliable and affordable alternative to single-passenger cars, especially during peak travel hours. In response to this, in 2004 UDOT commissioned a study entitled: *Sequencing of the North Corridor Shared Solution.*

Since 2010, Utahns for Better Transportation (UBET) and other groups have been meeting with UDOT and encouraging UDOT to take a more balanced transportation mode approach and consider a Shared Solution alternative to the WDF. On March 25, 2011, UBET and others noted recent discussions that they had with UDOT regarding a Shared Solution and encouraging UDOT to include a multi-modal, Shared Solution as part of the WDF package. *See* March 2011 UBET Comments, attached as Exhibit A. In those comments, UBET encouraged UDOT to follow the principles and objectives of the Wasatch Front Regional Council's (WFRC) *Wasatch Choice for 2040: A Four County Land-Use and Transportation Vision* (Vision for 2040), and specifically to develop a balanced multi-modal transportation system and support actions that reduce growth in per capita vehicles miles of travel during the WDF process. *Id.* Further, UBET noted that the alternatives advanced to the DEIS must include: 1) a Shared Solution that provides convenient transportation alternatives as a way of reducing the growth of vehicle miles traveled (VMT), especially during peak hours, which would comply with WFRC's Vision for 2040 that says that VMT should not grow a faster rate than population growth;

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2) incentives for alternatives to reduce automobile congestion, improve air quality and provide more viable mobility choices for Davis County residents; 3) utilize performance criteria that optimizes east-west access to I-15 and FrontRunner; and 4) study the sequencing of transportation investments in order to recommend the most efficient and cost effective way to meet future travel needs, reduce the rate of growth of VMT and improve air quality. *Id.*

Since that time, members of the Shared Solution Coalition have regularly met with UDOT officials in an attempt to encourage them to consider a Shared Solution alternative to WDF. In spite of public assurances that such an alternative will be considered, UDOT has refused the Coalition's appeal that the Shared Solution be thoroughly analyzed and included as a formal alternative in the DEIS.

B. Outline of the Shared Solution Concept

The Shared Solution includes a wide array of strategies that, when combined, are likely to add up to an effective means of satisfying the DEIS' purpose and need. The Shared Solution is likely to provide significant congestion relief in addition to providing community-building and economic development benefits. While UDOT considered such things as arterial widening as part of the DEIS process – and found that such widening would satisfy the purpose and need of the WDF – the agency found that the impacts of such widening would be overly destructive to both residential and business properties. However, UDOT took a broad-brush approach to the topic of widening existing roads, and modeled the widening of 6-10 times more roads than were necessary to achieve the desired results. Therefore, UDOT's claim that such an alternative is too destructive is greatly exaggerated. The Shared Solution, on the other hand, offers a more nuanced approach to the issue of "arterial widening." For instance, some locations require widening more than others, and strategies such as innovative intersections create similar congestion relief benefits as widening, but with much less destruction. Additional strategies, such as transit and connectivity are less disruptive and less expensive but could also have a strong aggregate effect providing congestion relief.

Although outlined in more detail below, the Shared Solution concept generally consists of the following aspects:

- Innovative Intersections Development and Analysis;
- 7D Boulevard Communities and Activity Centers. The 7D strategies are designed to bring prosperity, renewed economic development and major private development into a designated area. The 7Ds include Density, Diversity, Design, Destinations, Distance to Transit, Demographics, and Demand Management;
- High Frequency, High Visibility, Low Cost Transit Circulators;
- Making I-15 More Efficient: Aggressive Ramp Metering and Demand Management; and,
- Attracting Jobs as a Congestion Management Strategy;
- The proper phasing-in of these innovations only as needed.

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A very important part of the Shared Solution concept is the sequencing of its elements. Solutions should only be implemented as needed, while also preserving options for the future. In other words, build things in the right order, for maximum effectiveness. For instance, while the Coalition recognizes that there may be a need for the WDF at some point in the future, the models indicate that the road, if constructed, would be significantly underutilized in 2040. Given that, it makes more sense to implement aspects of the Shared Solution as they are needed in order to provide relief for traffic congestion, while also selecting and preserving a corridor for the WDF for future generations.

II. Legal Framework

The National Environmental Policy Act (NEPA) requires federal agencies to prepare an Environmental Analysis or Environmental Impact Statement (EIS) prior to taking major federal action with the potential to have significant environmental consequences. 42 U.S.C. §§ 4321-4370(d). The purpose of NEPA is to require agencies to consider environmentally significant aspects of a proposed action, and, in so doing, inform the public of the environmental concerns and considerations that could influence the agency's decision-making process. In conducting the EIS, FHWA, as the lead federal agency, must create an administrative record that demonstrates that it followed NEPA procedures. As part of these procedures, FHWA is required to take a "hard look" at the direct, indirect and cumulative environmental consequences of the WDF, including all actions connected to the proposal. 40 C.F.R. § 1508.25(a)(1). In this case, almost all aspects of transportation in the North Salt Lake, Davis and Weber County area must be considered. Therefore, FHWA must incorporate into the EIS a detailed analysis of all of the environmental impacts of regional transportation impacts and not just within the area directly impacted by the WDF. *Id.* As discussed in detail below, this analysis must include impacts from the associated with air quality, water consumption, surface water quality, ground water quality, and land disturbance.

In line with this approach, the U.S. Environmental Protection Agency (EPA) also requires a complete analysis of the purpose and need for the proposed project, 40 C.F.R. § 1502.13, along with a full and fair analysis of all reasonable project alternatives. 42 U.S.C. § 4332(2)(C)(iii), (E); 40 C.F.R. § 1502.1. In fact, the regulations implementing NEPA refer to the comparison of alternatives as the "heart of the environmental impact statement." 40 C.F.R. § 1502.14. Agencies must "rigorously explore and objectively evaluate all reasonable alternatives," then "[d]evote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits," and explain why other alternatives were eliminated from detailed consideration. *Id.*

An EIS must provide detailed explanation and "rigorous analysis" of "all reasonable alternatives" and comparative analysis of the environmental impacts of all alternatives considered. 40 C.F.R. § 1502.14. FHWA may not dismiss alternatives, without the required rigorous analysis simply by saying that the proposals failed to "substantially reduce" congestion. FHWA must rigorously evaluate all reasonable

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alternatives, determine their viability, and place that information in the record. The final decision to grant or deny the permit should be informed by the record produced through such scientific analyses. As discussed in detail below, in not considering or providing a rigorous analysis of the Shared Solution, FHWA failed to meet these requirements.

III. Comments on Individual DEIS Sections

A. The DEIS inaccurately portrays the need for, and exaggerates the benefits of, the WDF.

As noted in the DEIS, the need for the WDF is based on the No-Action conditions of the road and transit system within the immediate WDF area in 2040. Based on the modeling cited by UDOT/FHWA, total lane miles of congestion will increase by 229 percent over 2009, resulting in lost productivity per day of $277,866. DEIS at 1-21. In support of these assumptions, UDOT/FHWA claims that it independently modeled demand using the Wasatch Front Regional Transportation Plan 2011-2040 (WFRC) to confirm the need for transportation improvements. *Id.* at 1-25.

However, an independent review of the transportation model files shows: 1) Most of the roadways in the study are forecast to be uncongested in 2040; 2) Areas that are congested are far to the east of the WDF; 3) Congestion is mostly during the PM peak hours; 4) the WDF does not remove all of this congestion; and, 5) the WDF increases congestion north of the WDF. WDC Concerns and Alternatives at 2, attached as Exhibit B. Based on this review, most residents in existing housing would save little time in 2040 on an afternoon return trip from Salt Lake City, and the primary time savings would come from those living in future housing further west near the proposed WDF route. *Id.* at 6, 9. The DEIS analysis is biased towards exaggerating the amount of usage by these future residents, thereby exaggerating the benefits of the WDF. *Id.* at 9. The transportation model used for the WDF analysis is based on a 1992 household survey and 2009 traffic volumes. *Id.* at 10. In fact, per capita VMT peaked in 2004 and has continued to decline since then, something not accounted for in the DEIS. *Id.* There are a number of reasons for this decline, including the aging population, revitalization of urban cores, higher energy prices, and investments in alternate modes of transportation. *Id.* There is a particularly large downward trend in VMT by young adults compared to past generations. *Id.* Therefore, the uncertainty associated with the WFRC model is mostly in the direction of overestimating future traffic volumes, particularly during peak hours. *Id.*

Both common sense and research demonstrate that the construction of the WDF would influence future growth in the impacted area. *Id.* at 11. This induced growth would in turn increase average trip lengths, and thus additional VMTs that would undermine the potential benefits of the project. *Id.* This type of feedback reaction – between land use and transportation infrastructure – is not accounted for in the DEIS. *Id.* As a result, the DEIS exaggerates the benefits of the WDF. *Id.*, *see also id.* at 13.

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The DEIS also does not take into account the tendency for businesses to react to increased congestion by relocating in order to take advantage of attracting labor and customers traveling in the off-peak direction. *Id* at 11. Over time, this tendency leads to a leveling out of travel times in each direction. *Id*. In contrast, the DEIS assumes that there will remain a strongly directional traffic flow and peak direction congestion. *Id*.

The fact of the matter is that not building the WDF would encourage an improved jobs/housing balance in the study area. *Id*. at 12. Further, not building the WDF would help achieve the *Growth Principles for a Bright Future* outlined in the *Wasatch Choice for 2040 Greater Wasatch Vision for 2040* document. *Id*. These principles include: 1) maximizing efficient infrastructure; 2) regional mobility (transportation choice); 3) housing choice; 4) health and safety; and 5) securing jobs and services closer to home. *Id*. While the WDF is inconsistent with these smart growth principles, the Shared Solution is completely in sync with them.

B. The DEIS fails to consider a reasonable range of alternatives as required by NEPA.

NEPA requires federal agencies to "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternate uses of available resources." 42 U.S.C. § 4332(E). "The alternative analysis is characterized as 'the heart' of the environmental impact statement." *Colorado Envtl. Coalition v. Dombeck*, 185 F.3d 1162, 1175 (10th Cir. 1999) (*citing* 42 C.F.R. § 1502.14). Courts apply a "rule of reason" analysis to determine whether the range of alternatives an agency considered, "and the extent to which it discuss[ed] them," was adequate. *Utahns for Better Transportation v. U.S. Dept. of Transportation*, 305 F.3d at 1152, 1166-67 (*citing City of Grapevine v. Department of Transp.*, 17 F.3d 1502, 1506 (D.C. Cir. 1994)). A reasonable alternative is one that is "non-speculative . . . and bounded by some notion of feasibility." *Id.* at 1172 (*citing Vermont Yankee Nuclear Power Corp. v. Natural Resources Defense Council*, 435 U.S. 519, 551 (1978)) (additional citations omitted).

According to the Seventh Circuit, if "NEPA mandates anything, it mandates this: a federal agency cannot ram through a project before first weighing the pros and cons of the alternatives." *Simmons v. U.S. Army Corps of Engineers*, 12 F.3d 664, 670 (7th Cir. 1997). Moreover, "in examining alternatives to the proposed action, an agency's consideration of environmental concerns must be more than a *pro forma* ritual. Considering environmental costs means seriously considering alternative actions to avoid them." *SUWA v. Norton*, 237 F.Supp.2d 48, 51 (D.D.C. 2002) (*citing Calvert Cliffs Coordinating Comm., Inc. v. U.S. Atomic Energy Comm.*, 449 F.2d 1109, 1128 (D.C.Cir. 1971)).

The detailed analysis of alternatives is essential to NEPA's statutory scheme and its underlying purpose to "provid[e] a clear basis for choice among options by the decision-maker and the public." 40 C.F.R. 1502.14; *see also* 42 U.S.C. § 4332(2)(E); 40 C.F.R. §§ 1507.2(d) & 1508.9(b); *CEC v. Dombeck* at 1174 ("What is required is

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information sufficient to permit a reasoned choice of alternatives as far as environmental aspects are concerned") (quotation marks and citation omitted). Ultimately, NEPA's alternatives mandate means that "no major federal project should be undertaken without intense consideration of other **more ecologically sound** courses of action . . . ." *Environmental Defense Fund v. Corps of Engineers*, 492 F.2d 1123, 1135 (5th Cir. 1974)(emphasis added); *Bob Marshall Alliance v. Hodel*, 852 F.2d 1223, 1228 (9th Cir. 1988), *cert. denied*, 489 U.S. 1066 (1989) (the alternatives requirement guarantees that agency decision-makers "[have] before [them] and take[] into proper account all possible approaches to a particular project . . . which would alter the environmental impact and the cost-benefit balance); *Alaska Wilderness Recreation & Tourism Ass'n v. Morrison*, 67 F.3d 723, 729 (9th Cir. 1995).

So important is the alternatives requirement that "the existence of a viable but unexamined alternative renders an environmental impact statement inadequate." *Alaska Wilderness v. Morrison*, 67 F.3d 723, 729 (9th Cir. 1995); *see also, Dubois v. U.S. Dept. of Agriculture*, 102 F.3d 1273, 1288 (1st Cir. 1996) (EIS invalid because agency did not consider alternative of using artificial water storage units instead of a natural pond as a source of snowmaking for a ski resort); *Friends of the Boundary Waters Wilderness v. Dombeck*, 164 F.3d 1115, 1128 (8th Cir. 1999) (*quoting Dubois*, 102 F.3d at 1287).

Of particular importance to the WDF DEIS is the obligation that "[a]s one aspect of evaluating a proposed course of action under NEPA, the agency has a duty to study all alternatives that appear reasonable and appropriate for study, as well as **significant alternatives suggested by other agencies or the public during the comment period**." *Dubois*, 102 F.3d at 1286 (citing numerous others) (emphasis added). As discussed above, UBET and other members of the Coalition have been in discussions with UDOT for years prior to the release of the DEIS, attempting to persuade this agency to seriously consider the inherently reasonable and viable Shared Solution alternative prior to release of the DEIS. Unfortunately, these efforts were rebuffed and, as a result, the DEIS as currently written fails to comply with the requirements of NEPA.

1. The DEIS did an inadequate job at evaluating a non-freeway alternative.

Although one of the non-freeway alternatives, Alternative 8, outperformed the preferred WDF alternative, the DEIS fails to advance this option because of what the DEIS labels as enormous impacts on land use and other resources. WDC Concerns and Alternatives at 15; DEIS 2-14 to 17. However, these impacts were greatly exaggerated due to a combination of including too many roadway sections for widening, and assuming much larger cross-sections than are standard practice in the study area. WDC Concerns and Alternatives at 15. First, the DEIS incorrectly assumes that I-15 would have to be widened substantially in combination with improving east-west corridors. *Id.* at 15-16. The DEIS makes the assumption that without a new freeway I-15 must be widened, but never tests this assumption. *Id.* at 16. In fact, the modeling conducted by UDOT/FHWA fails to consider the presence of non-congested express lanes. *Id.*

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Second, not all of the widening projects considered under Alternative 8 are necessary to achieve the desired results. *Id.* at 15-16. In the two versions modeled by the DEIS, the first version includes approximately six times as much widening of local streets as would be necessary to address 2040 congestion , and the second version includes about 10 times as much widening as necessary. *Id.* As a result, only a small portion of the widening assumed in Alternative 8 is needed, and the WDF alternative does very little to address the congested section. *Id.* at 17. As a result, by assuming a widening of the east-west roads that is 6 to 10 times more than is necessary to achieve the desired results, the DEIS analysis of the impacts of Alternative 8 grossly overstates the impacts of that option.

Third, the widths assumed for the cross-sections of the roadways are much wider than are necessary. Id. Further, even the inclusion of a center turn lane should be a block-by-block decision and turn lanes may not be necessary throughout. *Id.* at 18.

In short, the DEIS modeling demonstrates that there are practicable east-west alternatives to construction of the WDF. However, the DEIS presents an east-west expansion alternative that does not selectively widen the east-west corridors only where required to achieve the desired results. Instead, the east-west alternative considered in the DEIS models an expansion footprint that is 6-10 times larger than is necessary, along with a corresponding exaggerated portrayal of the impacts that such an expansion would bring. Because of this, the DEIS inaccurately skews the modeling results away from consideration of any east-west alternatives, and towards construction of a north-south freeway. What should have been considered in the DEIS – but was not – is the Shared Solution alternative described below.

2. The DEIS fails to consider the Shared Solution.

The Shared Solution is not a single approach to addressing the 2040 congestion concerns outlined by the DEIS, but is rather a wide array of strategies that attempt to satisfy the need for improving congestion without construction of a freeway in west Davis County. The DEIS argues that while the widening of east-west roadways are sufficient to meet the purpose and need outlined by UDOT/FHWA, the impacts of such widening are unacceptable. However, as noted above, the DEIS takes a broad-brush approach to widening of the east-west corridors and assumes an amount of widening that is 6 to 10 times more than is necessary. As would be expected, the corresponding impacts associated with such an approach will be grossly exaggerated.

Instead, the Shared Solution is a much more nuanced and targeted approach to the subject of widening of the east-west roadways and provides other benefits to impacted communities that also were not considered in the DEIS. *See* Shared Solution for Future Livability, attached as Exhibit C. As outlined in the attached document, the Shared Solution Coalition suggests a detailed iterative process for the development and analysis of aspects of the Shared Solution. *Id.* at 3-5.

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First, regarding specific aspects of the development of the Shared Solution, the first component is the development of innovative intersections. *Id.* at 5-6. This strategy involves the elimination of left-turn lanes where appropriate as a cheaper, safer and more effective alternative to widening arterials. Next, is the development of 7D boulevard communities and activity centers. *Id.* at 6-9. 7D refers to the concepts of Density, Diversity, Design, Destinations, Distance to Transit, Demographics, and Demand Management. Density refers to the concept that as the activity center increases in density, VMT per capita decreases. *Id.* at 7. Diversity refers to the diversification of business centers in the affected area which have their regional "fair share" of quality retail, office, entertainment and other types of development which reduces the need to commute to obtain access to these businesses. *Id.* Design refers to the street system within an Activity Center making it easier for people to use transit, or to walk, bike or make short drives to their destination. *Id.* Destination refers to the place or Activity Center which contains adequate jobs, shopping and entertainment to attract people from surrounding neighborhoods. *Id.*

Distance to transit refers to the principle that people will use transit if transit is convenient. *Id.* This concept could include free, frequent transit shuttles that act as "moving sidewalks" thus extending the reach of regional transit. Id. Demographics refers to the concept that many people prefer to live in higher density, walkable, mixed-use areas where they can take transit and won't have to drive as much. *Id.* at 7-8. Finally, Demand Management refers to the concept that when vehicle demand is too high we can either match supply to demand or demand to supply, or we can just live with the unhappy situation. *Id.* at 8.

Second, as outlined in Exhibit C, UDOT/FHWA should make 7D boulevards and centers part of the Shared Solution alternative. *Id.* at 8. This is because while the 7D principles will certainly enhance road performance, many of the benefits of 7D are found outside of just congestion relief. *Id.* at 9.

The third major concept of the Shared Solution is the development of high frequency, high visibility, low cost transit circulators. *Id.* at 10-11. Because 7D Activity Centers generate a lot of internal trips, providing low cost or free transit, with a short wait time, will provide an attractive alternative to driving and will thus decrease congestion. Boulder, Colorado's "Hop, Skip and Jump" route system shares many of the aspects of the circulation strategy outlined in this document and highlights the low-cost, high-ridership gains that are possible. *Id.* at 11.

The fourth major concept is making I-15 more efficient with aggressive ramp metering and demand management. *Id.* at 11-13. This strategy includes such things as making it costly to use the convenience of I-15, either through the use of money or time. *Id.* It includes the steps for including the management of I-15 into the Shared Solution. *Id.* at 13.

The fifth major concept is the effort to attract more jobs to the affected area as a congestion management strategy. *Id.* at 13-14. To the degree that it is possible to attract

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jobs to the affected area as a means of offsetting the need to commute in order to go to work, that effort will result in less congestion and reduce the need to expand the commuting transportation system. *Id.*

The sixth major concept of the Shared Solution is determining appropriate sequencing of the Shared Solution elements. *Id* at 15-16. This approach calls for sequencing in the most cost-effective components based on their ability to address existing congestion and their likelihood of helping communities in the affected area achieve their land use and economic development objectives. *Id.* This also acknowledges the wisdom of setting aside a corridor for the future construction of the WDF, should that prove necessary down the road.

C. The DEIS Does Not Adequately Examine the Impacts of the Proposed Freeway on Local and Regional Air Quality.

1. At its Most Fundament Level, the DEIS is Flawed Because it Fails to Analyze and Compare the Disparate Air Quality Impacts of the Shared Solution Alternative.

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The DEIS is unlawful because it does not include an analysis or comparison of the air quality impacts of the Share Solution alternative. While this critique applies equally to each issue addressed in the environmental document, it is particularly germane in the context of air quality. This is because the Shared Solution alternative would reduce both local and regional air quality impacts in several important ways.

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First, as explained in Section III(A) of these comments, the proposed freeway-based alternatives will increase traffic volume above and beyond the volume that would occur without the construction of a freeway. In contrast, the Shared Solution and no action alternatives will reduce traffic volume on a regional and local basis. Plainly, to the extent that traffic volume is reduced, it is probable that air quality impacts will be reduced proportionally. In any case, any air quality benefits from the Shared Solution must be put before the decision maker before any decision on the freeway is made.

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Second, unlike the proposed freeway, the Shared Solution alternative does not entail high speed travel and therefore is unlikely to result in an increase of MSATs associated with freeway use. In any case, any air quality benefits relating to reduced MSATs that would result from the Shared Solution must be put before the decision maker before any decision on the freeway is made.

Third, the proposed freeway and its alternatives will bring the air pollution created by high speed freeway traffic to an area characterized by relatively clean air that is currently not subject to this type of pollution. The Shared Solution alternative avoids this impact and it is exactly these types of differences in air quality impacts that must be fully addressed and considered by the FHWA before the agency reaches any conclusions concerning the planned freeway project.

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2. The FHWA Analysis of Air Quality Impacts is Necessarily Inaccurate as it Is Based on Unsupportable Assumptions that Underestimate Increases in VMT as a Result of the Project.

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Not surprisingly, a critical component in determining the impact that the proposed freeway will have on air quality is an accurate prediction of the increase in VMT that will occur as a result of the project and its alternatives. As established in Section III(A) of these comments, the planned freeway and its freeway-based alternatives will result in increased traffic volumes beyond those predicted by the FHWA in the DEIS. As a result, the FHWA has not adequately described the individual and cumulative, local and regional adverse health and environmental impacts of the project – nor of the various freeway-based alternatives. Rather, as the agency has underestimated the increase in traffic volumes that will result from the freeway, the agency has underestimated the resulting adverse health and environmental impacts of the project due to increases in air pollution and reductions in air quality.

3. The FHWA Air Quality Impact Analysis is Based on Further, Unsupportable Assumptions.

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The comparison in the DEIS between the build and no-build options is deeply flawed. The DEIS improperly assumes that if the no-build option is adopted, there will be no change in future transportation choices by consumers in response to congestion. For example, no more use of mass transportation, carpooling and other alternative means of transportation, and that there will be no future change in public policy regarding mass transit, such as fare subsidy and broad expansion of service and infrastructure.

Similarly, in analyzing the freeway and non-freeway based alternative, the DEIS fails to address the severe air pollution problems existing along the Wasatch Front, the overwhelming scientific consensus on the existence of a global greenhouse gas, human-caused climate crisis, the rising rate of poverty nationwide, the evidence that younger drivers are more inclined to reject the personal automobile as their priority means of transportation.[1] The DEIS also fails to address telecommuting options, the shift in urban planning away from long commutes and urban sprawl, and even the way young people seek entertainment, all of which are starting to affect automobile use. Nationwide, vehicle miles traveled per person have dropped eight years in a row, and are now at 7.5 percent below their peak in 2004.

Nationwide vehicle purchases peaked in 2000, dropped significantly during the recession and have only partially recovered since 2009. Traffic congestion itself deters automobile use. None of these trends is reflected in the modeling used in the DEIS to generate comparisons of air quality under build options compared to no-build options. The combination of all of these trends, and long term nature of many of them, would significantly reduce the need for the proposed freeway, and simultaneously, significantly overestimates the adverse air quality impacts of the no-build option.

It is worth particular mention that the world has now entered the stage where the

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climate impacts of global warming are becoming obvious to everyone but a cohort of extreme anti-science politicians, almost all of which live in the U.S. As the science continually becomes more robust and alarming, it is inevitable that the public, and especially the younger generations – the ones for whom the WDF is primarily designed to serve – will become more active in adjusting their habits, lifestyles and support for public policy to reduce greenhouse gas emissions and will be far less likely to support expensive facilitation of more individual car travel. Therefore it is inevitable that building the WDF will be looked at in retrospect, by the majority of the population, as an enormous, regressive mistake in public policy, and serious blight on UDOT's legacy of public service.

4. The DEIS Fails to Acknowledge, Much Less Analyze the Adverse Public Health Impacts of the Proposed Freeway.

32.11.2A

The general message of the DEIS is that construction of the proposed freeway will have little effect on local or Wasatch Front air quality and by implication, health outcomes. As an initial matter, that message is thoroughly contradicted by hundreds of medical studies and the conclusions of virtually all the nation's public health experts.

Linda Birnbaum, Director of the National Institute of Environmental Health Sciences, has publicly stated, "Living near major roads is hazardous to your health, Period."[2] One of the reasons that this statement is true is that the most dangerous component of air pollution, ultrafine particular matter, is heavily concentrated near freeways at 25-30 times higher than background concentrations.[3] Dr. Frank Gilliland, Director, Southern California Environmental Health Sciences Center, concluded, "Lung function is about 10 percent lower in kids who grow up near the freeways, where there are high levels of ultra-fine particles."

Penetration into nearby homes can be as high as 70-90 percent depending on the size of the particles. For an average home, the indoor air exchanges completely with outdoor air every two hours.[4] People living near a freeway are unquestionably breathing more pollution.

Wasatch Front air pollution is already a serious public health hazard. Our air pollution is sometimes the worst in the nation and typically we rank in the top ten worst cities in the country for acute spikes in air pollution. All of the health consequences of air pollution are found at even higher rates among people who live near freeways or other high traffic locations, including heart and lung diseases, strokes, shortened life spans, higher mortality rates, poor pregnancy outcomes, multiple types of cancer and even autism. Freeways are literally cancer and autism corridors.

The DEIS contains not a single reference to any of the hundreds of medical studies published in the mainstream medical literature demonstrating the adverse health outcomes among populations who live near heavily trafficked roads and freeways. A small sampling of conclusions from the medical literature is offered below.

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The rate of progression of hardening of the arteries, the cause of strokes, heart attacks and generalized aging is double for those living within 100 meters of a freeway.[5] Children who live within 500 meters of a major highway are not only more likely to develop asthma and other respiratory diseases, but to have their lung development stunted permanently.[6] Living within 1,000 feet of a freeway doubles the risk of a child being born with autism.[7] Children growing up with more traffic pollution have significantly lower IQs and impaired memory and attention deficit disorders.[8]

Pregnant mothers exposed to more air pollution, give birth to children with lower intelligence, and behavioral and attention deficit disorders, even if the children breathe clean air themselves.[9] Pregnant women who lived close to high-traffic roadways during pregnancy were more likely to give birth prematurely or have a low-weight baby, putting the child at risk for multiple, life-long chronic diseases.[10] Living within 100 meters of a freeway increases the risk of childhood leukemia 370 percent; living within 300 meters increases the risk 100 percent.[11]

Pregnant mothers breathing higher rates of air pollution give birth to children who have higher rates of several types of rare childhood cancers.[12] Women exposed to more traffic-related air pollution have higher rates of breast cancer and decreased survival if they get breast cancer. Background Wasatch Front levels correlate with an increased risk of about 125%, living near a freeway increases that much more.[13]

Chronic exposure to traffic air pollution increases the risk of lung cancer.[14] High traffic air pollution exposure more than doubles the rate of cervical and brain cancer, and increases the risk of prostate cancer and stomach cancer.[15]

People exposed to more traffic related air pollution have more DNA damage, a trigger for multiple chronic diseases including cancer.[16] Traffic related air pollution shortens telomeres (a critical part of chromosomes). Shortened telomeres are highly correlated with reduced life expectancy.[17] Residential proximity to major roadways is associated with decreased kidney function.[18] Long term exposure to traffic-related air pollution is associated with insulin resistance in children and type II diabetes in adults.[19]

Based on this analysis, it is evident that the DEIS fails to examine with legal sufficiency the potential individual and cumulative adverse impacts of the proposed freeway on public health. At the most basic level, the document does not put before the decision maker the degree to which the WDF will harm the health of the individuals who will be living near the freeway, as well as those impacted by the regional effects of the project. As a result, the DEIS will not foster well informed decision making and is necessarily inadequate.

5. Assertions that the Health Impacts of MSATs Are Unknown or Uncertain Are Completely Without Foundation.

32.11.2A

The DEIS is incorrect to contend that:

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> information is incomplete or unavailable to credibly predict the project specific health impacts due to changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment…would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into actual health impacts directly attributable to MSAT exposure associated with a proposed action.

DEIS at 11-16 to18. This statement suggests that it is not possible to know the health impacts associated with building a freeway. Yet, the above referenced health studies provide an abundance of evidence indicating the adverse health consequences that would be expected. Moreover, additional studies and meta-studies establish beyond a doubt that exposure to traffic-related air pollutants near highways is associated with adverse health effects including cardiopulmonary disease, asthma and reduced lung function. *See*, Exhibits D and E, attached.

It is also incorrect to state that, "[a]mong the adverse health effects linked to MSAT compounds at high exposures are cancer in humans in occupational settings, cancer in animals, and irritation to the respiratory tract, including the exacerbation of asthma. Less obvious is [sic] the adverse human health effects of MSAT compounds at current environmental concentrations." *Id.* In fact the medical literature is robust and definitive. Neither high exposures nor occupational settings are required for the purposes of the present analysis; nor are adverse health effects in humans less obvious.

The DEIS goes on to state that "[i]nformation is incomplete or unavailable to establish that even the largest of highway projects would result in levels of risk greater than those deemed acceptable." *Id.* However, this statement fails to address the question of risks of what and acceptable to whom. The health consequences of air pollution, including MSAT compounds, have been every bit as firmly established as the health consequences of smoking cigarettes. For a more complete detailing of those risks, see "The Health Consequences of Air Pollution," compiled by the Utah Physicians for a Healthy Environment, available at: http://www.uphe.org/general-research/health-consequences-of-utahs-air-pollution.

Moreover, to be legally sufficient, the DEIS must adequately describe the potential individual and cumulative adverse impacts of the proposed project and its alternatives, including the possible consequences to the health of the persons living or spending substantial time in close proximity to the planned freeway. For example, the FHWA must predict the number of individuals who will be living and working in close proximity to any proposed freeway and estimate the degree to which these individuals will be exposed to ultrafine, fine and coarse particulate pollution, as well as any additional MSATs. It is not necessary to this critical exercise that the DEIS make conclusions concerning the "acceptability" of these adverse impacts – just as it is necessary for the DEIS to analyze in depth the negative impacts of the project on wildlife even where there may be no consensus on what constitutes an unacceptable impact or risk to wildlife. Rather, the DEIS must quantify and qualify those risks and present them to

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32.11.2D

the public and the decision maker so that a well-informed decision can be made.

6. The FHWA May Not Rely on its MSAT Policy to Avoid an In Depth Analysis of the Local Air Quality Impacts of the Proposed Freeway.

Rather than acknowledging that its MSAT policy is just that – a policy – that may or may not be applicable to a particular situation, the FHWA follows this guidance blindly and without support in the record. As a result, the decision to truncate its MSAT analysis is unlawful.

Initially, the MSAT policy suggests and the DEIS contends that there is little discernible difference in the impact of MSATs on public health and the environment among freeway alternatives. In the present context, this position cannot be defended. First, the proposed freeway will bring significant adverse air quality impacts to a new, distinct area characterized by relatively good air quality, particularly in the spring and the fall, when neither ozone nor $PM_{2.5}$ concentrations in the region are as problematic. Therefore, there are stark differences between, on the one hand, the freeway-based alternatives and, on the other, the no action alternative and the Shared Solution alternative, which will not expose a new community to the harmful health effects of MSATs and other air pollutants that result from freeway traffic. What is more, because the proposed freeway alternatives will increase traffic volume in this relatively pristine area, adverse localized impacts will be multiplied. At the same time, it is likely that new development will be clustered close to any new freeway, thereby ensuring that a high percentage of the people living and working in these communities will be exposed to dangerous levels of air pollution.

The issue of bringing increased concentrations of air pollution to a new area is of particular concern because the health effects of air pollution exposure are not linear. In fact, plotting the signature outcome of air pollution (sudden death) against particulate concentrations yields a curve that is supralinear and shows that the greatest impact per unit dose of exposure is at low background pollution levels.[20] Adding a new source of pollution to a relatively undeveloped area where pollution levels are undoubtedly lower than nearby more developed areas will mean that the health impacts to those individuals living and working near the proposed roadway will be even greater than if the freeway were constructed in a more developed corridor or if traffic were added to existing roadways.

Second, the FHWA policy and the DEIS seem to be based on two ill-founded assumptions – assumptions that are not supported by the record. The first is that MSATs and other highly harmful air pollutants that result from highway use are at issue only when traffic volume reaches 140,000 to 150,000 AADT. Rather, existing studies confirm that what matters is peak hourly traffic, or even the average vehicles per minute – and that elevated levels of dangerous air pollutants are found near freeways when traffic volumes per hour or minute are relatively low. What this means then is that the FHWA determination that MSATs and other pollutants have a "low" effect when traffic volumes are less than 140,000 to 150,000 AADT is without foundation in the literature or the

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record and must be dismissed as arbitrary and capricious.

The further incorrect assumption is that the only factor relevant to MSATs and other localized air quality impacts is traffic volume. Actually, the studies attached hereto indicate that not only is it short term use that matters, but also weather. *See* Exhibits D and E. Therefore, for example, wind direction and speed are important factors in accessing localized air quality impacts, as well as atmospheric stability and mixing height. *Id.* What this means for the present analysis is that exactly the type of weather patterns that lead to both the formation of dangerous levels of $PM_{2.5}$ and ozone are the same patterns that will result in the greatest localized impacts from use of any new highway. Therefore, the FHWA's failure to take a hard look at MSATs and other pollutants associated with freeway use is not justified by reference to mere predicted average daily use. Rather, proper analysis must address peak, short term use of the highway, particularly when weather patterns favor the formation and persistence of harmful air pollution on a local level.

7. Reliance on the Tier III Rules is Premature.

32.11.2E

The record is not clear on the extent to which the FHWA relies on the proposed Tier III Motor Vehicle Emission and Fuel Standards to suggest that future air quality impacts from the freeway-based alternatives will be minimal. Similarly, it is unclear, for example where future baseline conditions, such as the 2019 concentration of $PM_{2.5}$ assume that the Tier III regulations will be adopted. While we support the Tier III standards, it is premature to base any analysis on the promulgation of these standards or based on the current proposal regarding the phasing in of these standards – it is just too soon to rely on these regulations as they may be modified, rejected or delayed.

8. The Local and Regional Citizenry Are Entitled to the Benefits of New Rules.

32.11.2E

The DEIS justifies the conclusion of low air quality impact of the WDF primarily on the basis of anticipated improvements mandated by the EPA regarding fuel efficiency and cleaner fuel standards. The DEIS implies that because national fuel efficiency standards will be steadily improving, it is acceptable for the FHWA to offset these pollution reductions with a project that will undermine the public health benefit of those reductions. In other words, because of the proposed freeway project, the local and regional citizenry will be rob of the health benefits Tier III, or any other new standards designed to reduce air pollution. Baring in mind the previously mentioned severe air pollution circumstance that currently exists in this general area, for the FHWA to use possible new Tier III standards as justification for introducing a new, significant source of air pollution is indefensible. As a result, the FHWA's failure to characterize the air quality benefits of the no action alternative or the Share Solution Alternative, even in the context of improving air quality on a regional level is inappropriate. By the same token, it is inappropriate to assume that increased emissions in the overall context of improved air quality is not an environmental impact that need not be analyzed as part of the NEPA process.

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9. The DEIS Does Not Adequately Address Greenhouse Gases.

32.11.3A

Moreover, the DEIS fails to adequately to address the issue of greenhouse gases. DEIS at 11-19 to 23. The DEIS trivializes the contribution of this project to planet-wide atmospheric greenhouse gases with the statement that, "the WD[F] team estimates that the WD[F] could cause an increase in global CO_2 emissions in 2040 of 0.0001191%." By this logic, no entity, be it an individual, city, state, or country should do anything other than what has always been done, because by itself, any given change in behavior will not have an impact on climate change. Such an attitude leads to the rationalization inherent in the DEIS that it is perfectly appropriate to continue to emit as much CO_2 as we find convenient. To look at this differently, if the climate harm of this project must be viewed in a global context, then so must the benefits. While the benefits of the WDF are minor, they amount to a costly convenience to only an extremely small fraction of the entire human population.

32.1.2H

The same arguments that apply to the calculation of the air pollution consequences of the no-build option a. Specifically, the DEIS overestimates the greenhouse gases secondary to the no-build option because it fails to consider the extension of current trends suggesting a future decrease in per capita vehicle use. Equally bewildering is the statement that "at present there is no scientific methodology that can identify causal connections between individual source emissions and specific climate impacts at a particular location." Simply because locally-released CO_2 cannot be tied to local climate impacts does not mean that those releases do not contribute to the global problem, and it is the global problem that will result in a locally-adverse climate impacts.

32.11.3A

Inexplicably, the DEIS then goes on to "excuse" the greenhouse gases from the project because "the U.S. Department of Transportation is committed to reducing GHG emissions from vehicles traveling on highways." *Id.* This seems to suggest that if some entity, somewhere is taking action to reduce greenhouse gases, then emissions from the WDF can be overlooked. The science is very clear that every reduction in greenhouse gases globally must be pursued, and building the WDF contradicts that scientific imperative.

10. The FHWA's Failure to Examine Impacts to Short-Term NAAQS – Particularly the 1-Hour NO_2 Standard, is Unlawful.

32.11.1D

Although vehicle use is a significant source of NO_2, the FHWA failed to examine the cumulative and individual, local and regional impacts of the project on the one hour NO_2 NAAQS. As a result, the DEIS is fatally flawed.

11. By Failing to Look at Localized Impacts, the FHWA Failed in its Effort to Undertake Mircoscale Analysis.

32.11.4A

In section 11.4.3, the DEIS fails to address any local impacts on air quality

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because the modeled traffic volumes would fall under a completely arbitrary threshold established by "transportation conformity regulations." DEIS at 11-24 to 25. This conclusion amounts to nothing more than a dismissal of the well-known serious air pollution that frequently plagues the entire Wasatch Front and is therefore legally inadequate. Moreover, the requirements under NEPA are distinct from and constitute an obligation beyond the mandate of a conformity showing. As a result, just because a particular analysis is not required under the conformity rules does not mean that that that analysis is not required under NEPA. Indeed, under NEPA, the FHWA must consider, in detail and using the best science and information, all the ways in which the freeway-based alternatives will impact air quality and compare these impacts to those that will result from no action alternative and the Shared Solution Alternative. Reference to conformity requirements does not relieve FHWA of this burden.

The DEIS asserts that "none of the WD[F] action alternatives would produce CO levels that would exceed the NAAQS," DEIS at 11-26, and that "the modeling did not predict that PM_{10} and $PM_{2.5}$ levels would exceed the NAAQS." Id. at 11-29. However, simply because these pollutants do not exceed the NAAQS in no way means that public health would not be adversely affected. The clear message from the medical literature of the last 15 years is that all criteria air pollutants, at any level, including below the NAAQS standards, have adverse health consequences. For the DEIS to justify the freeway based on the prediction that the models do not show a violation of NAAQS is to ignore the bulk of medical research on the relationship between air pollution and health. Moreover, the FHWA fails to address localized levels of CO in contrast to an analysis of regional CO concentrations.

32.11.4H

In section 11.4.5, the DEIS claims that "[p]opulation growth in the WD[F] study area has had little effect on overall air quality, as demonstrated by the continuing improvement in air quality throughout the region" DEIS at 11-30. Such an assertion defies the facts. While the national average levels of $PM_{2.5}$ have dropped 27 percent during the decade from 2000 to 2010, the Salt Lake/Ogden area has seen virtually no decrease. During the two decades from 1990 to 2010, national PM_{10} levels dropped 38 percent, but the Salt Lake/Ogden area actually trended upwards for the last several years.[21] During the decade 2000 to 2010 national ozone averages decreased 11 percent, while the levels in the Salt Lake/Ogden area are virtually flat.[22]

The DEIS also states that "[t]he increase in emissions [from the WDF] would be somewhat offset by lower MSAT emission rates due to the increased speeds of vehicles on the WD[F]." DEIS at 11-30 to 31. Fuel efficiency drops precipitously after 40-60 mph depending on the type and size of vehicle. Therefore, there is no justification within the DEIS for the claim that MSATs decrease with increased speeds.

12. The FHWA Did Not Adequately Address Ozone Pollution.

32.11.4I

During the summer of 2013, ozone levels along the Wasatch Front exceeded the 8-hour ozone standard. As a result, it is almost certain that the freeway-based alternatives will cause or contribute to future violations of this NAAQS. Yet, the FHWA failed to

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examine the likely outcome or deal with this eventuality. As a result, the DEIS is inadequate.

13. The DEIS Fails to Consider Air Quality Impacts from Construction.

32.20E

In neglecting to consider the individual and cumulative, local and regional air quality impacts from the construction of the proposed project and its alternatives, the FHWA has failed its NEPA duties. These potential air quality impacts include fugitive dust, fugitive emissions, non-road mobile source emissions of criteria and hazardous air pollutants, diesel emissions and black carbon. Such analysis is of particular importance because the project will be located in an area that is non-attainment for $PM_{2.5}$ and because emissions from the construction of the freeway-based alternatives could cause or contribute to a violation of the NAAQS. Such analysis is further warranted because the air quality impacts from the construction of any of the freeway-based alternatives will differ markedly from those of the Shared Solutions and no action alternative.

14. By Limiting its Estimate of Emissions to the Year 2040, the FHWA has Failed to Take a Hard Look at the Air Quality Impacts of the Proposed Freeway.

32.11.4C

Throughout its analysis of air quality impacts, the FHWA limits its analysis to estimating emissions in 2040 – presumably because this is when the agency predicts the **use** of the planned freeway will be at a maximum. However, as the FHWA also predicts that emissions will decrease as a result of the phasing in of various federal rules regulating vehicle emissions, the agency cannot, without evidence in the record, assume that in 2040, emissions resulting from use of the highway will likewise be at a maximum. Therefore, rather than confining its analysis to 2040, the agency must estimate and model emissions from the proposed freeway – including the increased traffic volume that will attend the construction and use of the highway – in intervening years – particularly shortly after the freeway is slated to be construction.

15. The FHWA Does Not Properly Assess Potential Impacts to Regional Air Quality.

32.11.4A

As it did with MSATs, the FHWA claims that it need not undertake "project level quantitative analysis" for $PM_{2.5}$ because its conformity policy requires this analysis only for projects anticipating increased traffic volumes of 125,000 vehicles per day. This approach is ill-conceived. As has been stated repeatedly, NEPA requires analysis above and beyond conformity and therefore policy associated with conformity does not relieve the agency of its NEPA obligation to examine in detail the air quality impact of the project, nor of its Clean Air Act responsibility to ensure that the project will not cause or contribute to a violation of air quality standards. As the FHWA has not complied with these legal duties, the DEIS is inadequate.

For example, the DEIS does not properly model the contributions of emissions from the proposed highway to regional concentrations of $PM_{2.5}$. This is because the

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32.11.4J

32.11.4A

agency uses predicted baseline emissions at the Bountiful monitor and focuses on emissions at one particular interchange. This analysis is necessarily incomplete. Rather, DAQ and EPA have determined that emissions throughout the Salt Lake City nonattainment area – the area that includes the proposed project – all contribute to violations in that nonattainment area. This is the basis for including the entire area in a single airshed for the purposes of the nonattainment designation. Therefore, the FHWA may not limit its review to the impact on or addition to baseline concentrations at the Bountiful monitor, but must undertake modeling based on concentrations at all the monitors in the nonattainment area. This modeling must properly account for the long term and stagnant conditions that are present during winter inversions. In addition, such analysis is particularly warranted because the freeway project will increase, or has the potential to increase traffic volumes in and around those other monitors and other impact air quality throughout the Salt Lake City Nonattainment Area.

16. The FHWA's Refusal to Undertake "Hot Spot" Analysis of the Project is Not Supported by the Record.

In any case, the agency is wrong to suggest that the conformity regulations only require project level quantitative analysis when a project anticipates traffic volumes of 125,000 vehicles per day. While it is true that in its preamble, EPA gives this traffic volume as an example – the regulation itself does not reference the example and instead states that analysis is required for projects which are "of air quality concern." In the present context, this includes the proposed freeway. This is because the same emissions of $PM_{2.5}$ and its precursors during winter inversions are considerably more potent than the same emissions in New York or Connecticut.

Thus, when it finalized its 24-hour $PM_{2.5}$ nonattainment designations, EPA determined that although the Salt Lake City Nonattainment Area has but a fraction of the population and density of the New York City Nonattainment Area, the Salt Lake City Nonattainment Area is characterized by considerably worse short-term $PM_{2.5}$ air pollution. Salt Lake City's design values (49, 55) are much higher than New York's (39 and lower). Index 612, JA0461 (Table A.3-3); Index 586, JA0333 (Table 2).

Therefore, it plainly takes significantly fewer emissions from vehicles along the Wasatch Front to violate the $PM_{2.5}$ standard – something like a tenth as many – than it does in the New York City metropolitan area. The concentration of emissions from Salt Lake's relatively small and less dense population is clearly magnified, if not created, by topography and meteorology. Similarly, due to topography and meteorology, the impact of driving in the Salt Lake City Nonattainment Area is equivalent to the impact of many, many more cars emitting significantly more air pollution in the New York City nonattainment area. Comparatively, then, Salt Lake City Nonattainment Area drivers pack a much more significant polluting punch than do the drivers in other nonattainment areas. Therefore, the fixation on traffic volumes cited in a general example are not applicable to the specific and unique situation created by the topography and meteorology of the area of the proposed project.

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32.11.4G

32.14.2C

32.14.2H

17. In Failing to Assess the True Magnitude of Even Small Increases in $PM_{2.5}$ and its Precursors, the FHWA has Failed its NEPA Obligations.

Similarly, the FHWA's dismissal of emission increases of criteria pollutants of 1.8 to 4.5 percent fails to acknowledge that during inversions, even small increases in $PM_{2.5}$ and its precursors can have significant adverse impacts on air quality and can cause or contribute to violations of the NAAQS both regionally and locally. This is because, as EPA recognized, during inversions, it takes considerably less air pollution in the Salt Lake Valley to create harmful conditions than it does elsewhere in the nation. Because the FHWA does not acknowledge this reality, it has not accurately examined or characterized the public health and environmental impacts of the proposed project and its freeway-based alternatives and therefore has failed its duties under NEPA.

D. The DEIS fails to adequately consider the impacts of the WDF on noise.

The DEIS improperly concludes that the noise effects on wildlife due to the construction of the WDF are predominantly neutral. As outlined by Dr. John Cavitt in his report for The Nature Conservancy, because the Legacy Avian Noise Research Program (LANRP) conducted by Bio-West was fundamentally flawed, any conclusions based on the LANRP are without basis. Cavitt, Review of the "Legacy Avian Noise Research Program: Final Report" (hereinafter Cavitt Review), July 2013, attached as Exhibit F. As the Cavitt Review notes, because of the significant problems in the design, implementation and analysis of the LANRP, any conclusions based on the study are problematic. *Id.* at 10. Further, the lack of attention to the factors identified in the Cavitt Review calls into question the results of the LANRP. *Id.*

Specific criticisms of the LANRP include:

- Little attention was given to the possibility of sampling errors, and the authors of the LANRP did not use matching or adjustment to limit the effects of confounding variables. *Id.* at 3. For that reason the value of the study and the conclusions drawn from it are greatly reduced.
- No results from the analysis related to either compounding noise or variations in noise levels are provided. *Id.* Without this, no understanding of the impact of non-highway noise is possible.
- No information is provided which would allow an analysis of the degree to which observer bias played a role in the LANRP, thus making it impossible to determine whether or not bias was accounted for. *Id.*
- No information is provided that indicates whether both visual and auditory clues were used to detect species-specific density and noise effects. *Id.* Additionally, no information is provided to indicate whether the same process was used uniformly in the analysis of species richness and diversity, nor was information provided regarding what species and portions of observations were not included in the analysis. *Id.*
- The authors of the LANRP improperly used point counts versus line transects when comparing the diversity, richness and abundance of wetland birds. *Id.* at 6.

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- No information was provided regarding whether the timing of the surveys were properly randomized. *Id.*
- Regarding nest productivity data, the authors fail to provide justification for the species selected for that portion of the study or for the actual study objectives. *Id.* The Cavitt Review brings up a number of concerns related to this aspect of the LANRP that must be addressed. *Id.* at 6-7.
- No information was provided regarding the temporal aspects of the nest termination portion of the study – either in relationship to when the test termination occurred or the time of day these observations were made. *Id.* at 7.
- The exceptionally high level of nests (~21 percent) with unknown fates makes it impossible to make inferences from this portion of the study and calls into question the nesting success analysis. *Id.*
- Because the LANRP does not account for the annual cycle of Great Salt Lake breeding populations, it is possible that the study may have missed the most sensitive time for aquatic birds using the Lake. *Id.* at 7-8.

Regarding the analysis of the data collected, the statistical techniques used in the LANRP assume a level of independence between the data points that isn't justified given the flaws within the study. *Id.* at 8-9. Further, the study did not consider the importance of the annual variation in diversity, richness, density and productivity, nor did it consider the variation in vertical structure of wetland habitats within the Great Salt Lake ecosystem. *Id.* at 9. Both of these factors would impact the study results. It is also unclear why the authors of the LANRP did not examine the density of each species studied, rather than singling out two of those species or computing a combined density estimate. *Id.*

E. The DEIS fails to adequately consider the impacts of the WDF on ecosystem resources.

1. General Comments

32.14.2H

The report has noted resource values outside the proposed project but fails to tie that together with the overall impacts to long-term system health. This approach fails to capture the big picture and is missing a quality of life loss measure. Alternatively, the process of reducing the measure of the impacts to wildlife within or adjacent to the project area loses the nexus between the magnitude of migratory bird value and the impacts to those values.

The Great Salt Lake and its surrounding wetlands are an international, national, state and local natural treasure. In the area just north of Farmington Bay Wildlife Management Area to Gentile Street the proposed West Davis Freeway would directly impact roughly seven miles of the shoreline of the Great Salt Lake. The shoreline for the eastern portion of Great Salt Lake is roughly sixty miles and the shoreline in Farmington Bay – from the Antelope Island Causeway to the southern mainland close to Antelope Island is roughly 25 miles. In other words, this proposed freeway impacts roughly 12

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percent of the eastern shoreline of the Great Salt Lake and 28 percent of eastern shoreline of Farmington Bay.

32.14.2H

As shown on Figure 14-3, Wildlife Management and Conservation Areas, most of the areas west of the proposed freeway south of Gentile Street are managed for wildlife or under conservation easement. Therefore, the freeway would have a large direct footprint in the area and have large direct and indirect impacts but at the same time would provide no or very limited value as a buffer. In contrast to the claim in the DEIS that the cumulative impact to wetlands and wildlife habitat would decrease by 1 percent as a result of the freeway, see DEIS at 14-114, the freeway would alter and impair an intact shoreline. The Davis County Clipper discussed the conservation easements in Farmington City in a August 21, 2013 article titled, "Farmington to Challenge UDOT over West Davis Corridor." The Davis County Clipper said that "The Farmington council's disagreements are in regard to four large conservation easements through which the proposed freeway would run, if UDOT gets its way." Further, the article stated, "Farmington officials believe that UDOT did not adequately consider the four conservation agreements, which total hundreds of acres, according to Millheim." The proposed freeway would also have major impacts on The Nature Conservancy Shoreland Preserve and Mitigation Commission properties.

32.3F

32.14.2D

From the western edge of the proposed freeway from just north of Farmington Bay Waterfowl Management Area until just south of Gentile Street there are no houses west of the proposed freeway, except for one house at approximately 2950 West and 200 North in Kaysville. Besides the substantial losses to the shoreline habitat, the costs and losses associated with this freeway to the local communities to the east of this proposed roadway in regards to noise, air and light pollution as well change in the somewhat rural nature of the area would be substantial.

32.2.13C

Although the Great Salt Lake is a major ecological resource, it is not easily visited nor well understood. There are two areas specifically designed for nature education that would be heavily and negatively impacted by the West Davis Freeway. The Robert N. Hasenyager Great Salt Lake Nature Education Center at Farmington Bay Waterfowl Management Area would be approximately one-quarter mile from the proposed Freeway. The Shorelands Nature Preserve managed by The Nature Conservancy has a visitor's center that includes a parking lot, a main pavilion, a walkway and an observation deck. The main pavilion at the visitors center is roughly three-quarter miles away from the proposed freeway. The proposed freeway would directly impact the visitors to both nature centers by increasing noise, air and light pollution and visual disturbance. The wildlife nearby the visitor centers would also likely decrease due to the pollution and disturbances.

32.14.2H

2. Indicator species

32.14.2M

While the indicator species selected by the WDC team are good indicators of the habitat types found in the impacted area, some representative species chosen for this evaluation, such as Bobolink and Yellow-billed cuckoo, are relatively rare in the area and their primary continental population core is located elsewhere.

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It is more logical to choose representative area habit species that are uniquely important to the area than species that are rare and less important geographically to the study site. Absence or sparseness of species largely reduces the capacity of measuring life history to literature citations instead of real examples with species on the ground literally using the habitats. With this in mind, appropriate choices for wet meadows might be Greater Sandhill crane or White-faced ibis. White-faced ibis are the most conspicuous water bird in the agricultural areas near the proposed WDF in the spring and summer months. Typically, these birds commute from breeding and rest areas near the shore to foraging sites in fields and pastures. Due to the location of the WDF, this pattern will be disturbed. Franklin's gulls have a similar annual and daily pattern. The impacts of the proposed freeway on both of these birds should be considered.
Riparian representatives for the kind of riparian habitat within the study site might be Black-billed Magpie, Western Kingbird or Black-crowned Night-Heron.

Regarding Bobolinks, while similar habitat has been used by foraging White-faced ibis along with flood irrigated pasture in the study area, Bobolink habitat may differ because of their preference for more permanent wet meadow as opposed to intermittent flooded agriculture fields. White-faced ibis will use both permanent wet meadows and irregular flooded pastures that are present in the study area for foraging and therefore a better habitat representative.

Although the representative species can act as umbrella species for habitat neighbors, as noted above, several of the species are rare to the study area and there may be subtle but important differences in habitat requirements. With regard to the Bobolink and Yellow-billed cuckoo, the study area is marginal to their actual major range of geographic distribution. For the wildlife species that are more typically present in this area, we know the kinds of habitat that they use on a finer scale. For example, we know the foraging habitat types of White-faced Ibis within the Davis/ Weber County Complex. In some cases we know the exact areas of foraging preference. The same is true for many of the species that are locally important in the study area.

While the DEIS made several good choices for other representative species e.g., Long-billed curlew, Brewer's sparrow, American avocet (although Black-necked stilt would be more appropriate for this study because it uses fresher wetland habitats more often than avocets, especially in the late summer), Ring-necked pheasant might be a better choice than Mule deer for mixed cover of trees, grasses, and shrubs.

3. Road Effects

32.14.2P

Regarding road effect consequences of the WDF, Jacobson (2005) documents mechanisms of negative impacts to birds caused by road noise. See also, Cavitt (2013) below. On page 7 of Memo 17 it states, "The WDC team will review existing literature on wildlife deaths from new roads…." There is high potential for excessive road kills of some species on this roadway, which will yield in a net increase of annual mortality and threaten population persistence in that area. This issue is not considered in sufficient

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detail in the DEIS. Wetlands and adjacent uplands of the east shore of Great Salt Lake host a concentration of short-eared owls and barn owls whose populations escalate in the fall and peak in mid-winter. Owls are especially vulnerable to vehicle impact because they are attracted to the mowed landscape of highway shoulders and medians where forage species are exposed (Boves and Belthoff 2012; Jacobson 2005). Because owls are protected by the Migratory Bird Treaty, the risk of take and the potential for additive take should be evaluated. This would require winter surveys for owls in the study area.

The DEIS acknowledges the importance of Great Salt Lake to migratory birds (Memorandum 9 section 3.0). The proposed highway corridor will run near the shore line between two large wetland complexes on the east shore of the lake: the Jordan River delta and the Weber River delta. A highway built in such proximity will have negative impacts upon resident and migratory birds attracted to those wetlands. Examples of those impacts and measures to mitigate them are documented by Jacobsen (2005).

4. Migration

32.14.2V

Another road effect that is not addressed in the Draft EIS is the impact on migration. Terrestrial animals such as deer, rodents, weasels, reptiles, and amphibians are especially vulnerable to highway barriers when their migratory corridor intersects a road. The intersection of roadways and migratory corridors is a significant cause of mortality for deer (Kassar and Bisonette 2005) and snakes (Shine and Mason 2004).

5. Noxious Weeds

32.14.2H

The dispersal of noxious weeds is one of the largest landscape scale problems of our time. Both urban and rural communities in the state of Utah and surrounding states have aggressive policies to limit the spread of noxious weeds (Whitesides 2004). The disturbance caused by road construction will facilitate the growth and dispersal of noxious weeds (Whitesides 2004). The expansion of weeds in Davis County will have a negative impact on agriculture and wildlife habitat (Whitesides 2004). This is an important impact to wildlife left unaddressed by the Draft EIS.

6. Habitat Types

32.14.2M

The Draft EIS quantifies impact based on habitat type and quality and defines cropland as low quality habitat. Memo 17 Section 4.1.2. This definition does not adequately reflect the value of cropland to wildlife. Table 1 of Memo 17 indicates that a score of 0 is lowest quality habitat and 6 indicates highest quality habitat, and the DEIS has assigned cropland a value of 0.25 on this scale. This score and the description of cropland as low quality habitat significantly undervalues cropland as wildlife habitat. These lands are important to upland game, seasonal waterfowl use and foraging. Many species of wildlife use cropland including: white-faced ibis, Franklin's gull, Canada goose, mallard, a variety of passerine birds, hawks and owls, mule deer, long-billed curlew, sandhill cranes, bobolink, and chorus frogs. Waste grain, brush lines, woodlots, irrigation ditches and other features provide important nesting cover and shelter for a

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wide variety of wildlife including migratory birds such as bobolink and lark sparrow. Flooded fields may have the highest agricultural value to wildlife in the study area and provide seasonal habitat for chorus frogs and are important foraging areas for sandhill cranes, white-faced ibis, raptors, and waterfowl. Small, untilled areas adjacent to farmland are very important for many species of wildlife and allow the cropland to sustain diverse and abundant wildlife.

Memo 9 states that "very little if any areas" will be considered high quality wetlands and lake shore migratory bird habitat." We disagree with this assessment of these areas. For instance, ducks, geese, ibis, cranes, and herons are all lake shore migratory birds that will actively seek and use cropland at some point during their life cycle. Further, such an assessment does not consider habitat value as lake level changes. Should the lake level approach West Davis Corridor in a high water cycle, there would be the potential for nesting colonies of American avocet and snowy plover and other waterbirds. It also does not consider the value of small landscape features such as irrigation ditches and tree rows which are well known to attract wildlife.

32.14.3M

Memo 17 section 4.1.2 states, "Urban land was assigned a habitat value of zero. Even though farmed and urban lands are occasionally used by wildlife, they are not considered native habitats." This statement is inaccurate because, first, urban landscapes have the potential to attract a variety of birds and other wildlife, especially as landscaping plants mature. Tree lined streets attract a variety of migratory birds including songbirds, owls, and hawks. Second, wildlife readily use landscape that is not native so long as cover, forage, and other resources are available. Restricting the definition to "native habitats" does not accurately represent the importance of developed land to wildlife. "Urban" designations deserve closer assessment and higher habitat designation than "zero."

In most cases, buffering east of the proposed alternatives is less important than buffering west, especially near the Great Salt Lake. A larger buffer should be applied to wetlands and uplands that lie west of the WDF rather than buffering small, fragmented sites east of the proposed freeway.

32.14.2W

Lake level dynamics is the major reason not to support the B2 alternative. This route potentially truncates the option to allow the GSL to expand naturally. For all practical purposes if a road is built within the 4,217-foot floodplain, the state will do what is necessary to protect the road in the event of flooding. Avoiding this scenario by planning for a functional ecosystem by protecting GSL resources up front will better insure long-term sustainability.

32.23A

Concerning the no-action alternative, the DEIS should consider the possibility that the construction of the project may in fact accelerate the conversion of farm land into residential and commercial use. Given the no-action scenario of a bleak outlook for the future of farms and wildlife habitat, an appropriate question is what will be done to conserve open space values of farms and wetlands should the freeway be built. This is especially important to the White-faced ibis within the greater Weber/Davis/Box Elder

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county area. The GSL wetlands provide the emergent wetlands for its breeding habitat, but the farm lands provide a significant foraging habitat for both nest bound young and foraging adults. Farmers in the area have been known to describe the flocks of "black snipes" that constantly fly back and forth from field to marsh. The flood irrigated pastures and fields are key habitats for this species. The GSL has the world's largest breeding population of this species, often tens of thousands. Often Franklin Gulls, California Gulls, Killdeer and egrets can be found foraging alongside these ibis in the farmlands of the Wasatch Front. It also is a species that forages along the wetland-upland fringe that lies directly below the west side of the proposed B2 corridor through the Shorelands Preserve and west Davis County. This is one of those species for which we have stewardship responsibility.

32.24J

Assumptions that the amount of any habitat and habitat quality lost will be very small do not consider the fact that the size of the Great Salt Lake ecosystem, and its capacity to persist through time, is why it is so important. Each proposal makes the same assumption relative to the Lake – that it is large and is able to absorb the punishment.

The statement that higher Lake levels would make shoreline habitat unavailable – regardless of whether or not one of the alternatives is constructed – does not take into account the fact that the Lake does not have a major land barrier west of Bluff Road. During the 1980s we had water table increase east of I-15 in Davis County where wetlands improved and there were standing ponds of water year round. The Jordan River backed up enhancing fresh water marshes east of Redwood Road up to the footprint of the oil refineries for several years.

32.14.2R

Large areas of wildlife habitat that characterize the impact analysis area are <u>not</u> found throughout the Great Salt Lake ecosystem during higher lake elevation periods. At high lake level of 4207-8' most waterfowl management area dikes and privately operated managed wetland systems are at or under salt or brackish water. The analyzed project wetlands do not properly characterize other GSL wetlands, especially at high Lake levels. When the Lake is that high, wetland shoreline characteristics are the wetland types being impacted and this is the major wetland type that characterizes the impact analysis area. Low gradient shoreline is a critical habitat component at any Lake level and at high Lake levels it is scarce around the lake. Therefore, during times of rising levels, the "wider availability of habitats" conditions considered in the DEIS do not exist.

32.14.2S

Although the DEIS properly considers Utah Sensitive Species, the Great Salt Lake ecosystem warrants a priority list of sensitive species that is much more robust than what the State can bring to bear with its limited resources. For this reason, species with continental and hemispheric importance at the GSL are left off the Sensitive Species List as an artifact of the prioritization process. This should be accounted for in the EIS process. For instance, during the late 1980s and early 90s, Snowy Plovers were nesting on the eastern edge of the Lake where vegetation had been killed by salt water. This included the 1987 Great Salt Lake shoreline of the current Nature Conservancy property. Many nest sites were close to the Gayle access road. [Paton, Peter W.C. Breeding Ecology of Snowy Plovers Utah Coop. Fish and Wildlife Research Unit, Dept. of

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Fisheries and Wildlife, Utah State University, Logan, UT. (November 18, 1999)]. Because Snowy Plover nesting sites move with the shoreline where fresh water enters the Lake, during high Lake years, these nesting sites could fall within the affected zone for the WDF. According to the Paton study, the Layton wetland complex was one of the most important Snowy Plover breeding sites on Great Salt Lake.

32.14.2I

Regarding impacts to the Shorelands Preserve from this proposal, development of this sort affects the very reason the Preserve exists. This is why it is intended to be a preserve and why it is inappropriate for the WDF to be allowed to impact it in any way. The Great Salt Lake wetlands that remain have a greater need for protection from this type of development because of their diminishing size.

7. Vegetation and Wetland Comments

The quantity of wetlands designated in the DEIS is inconsistent with its source documents. In the Wetland Assessment Methodology 2010 report the wetland study area is delineated as 15,646 acres. In the 2011 Supplement to the Preliminary Wetland Study Results Report the wetland study area is delineated as 33,700 acres. The Supplement also states that the 33,700 acres is 4,700 acres larger than in the 2010 report. In the DEIS, the wetland study area is delineated as 8,265 acres. What is the actual size of the wetland study area and what percentage is it of the size of the actual project study area?

32.14.3X

The DEIS cites the use of National Wetlands Inventory (NWI), Legacy, and recon-level field surveys to identify potential wetland areas. DEIS at 14-9. Why wasn't National Agricultural Imagery Program (NAIP) imagery used as stated in the Wetland Assessment Methodology 2010 report? This would have been second best to the multispectral imagery.

32.14.3Y

The altered wetlands along the eastern shore of GSL discussed in this section provide a buffer between developed areas and higher quality wetlands. DEIS at 14-11. These should not be looked at as low quality wetlands that serve very little function. Additional development in this area will push the buffer even further west, destroying or diminishing existing high quality wetlands.

32.14.2H

Weedy encroachment into the 300 feet wetland buffer needs to be addressed in addition to the water quality impacts, DEIS at 14-35, because changing the plant communities in wetland areas can be detrimental.

32.14.3L

The B alternatives would remove approximately twice as many acres of wetlands as the A alternatives. DEIS at 14-83. How can the U.S. Army Corps of Engineers consider any of the B alternatives as least damaging practicable alternatives when the A alternatives are viable options?

32.14.2T

Please be more specific about a revegetation and weed management timeline. DEIS at 14-108. Identifying it as "immediate" is not sufficient.

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32.14.3P

There is no sufficient mitigation for the irretrievable loss of 60 acres of wetlands in the Great Salt Lake Shorelands Preserve. DEIS at 26-18. The WDF Team must at least attempt to identify how it intends to attempt to mitigate for such loss.

32.14.3Z

Please state the source of the "previously surveyed wetlands" outlined in Figure 14-1. Use a different color from that assigned to the NWI. This information would be more effective in a series of 4 maps zoomed in so the wetlands are actually visible in relation to the proposed alternatives.

32.14.3X

There is no justification for not using the multispectral imagery to determine the location of wetlands in the study area within the Wetland Assessment Methodology report. UDOT could hire a consultant with this expertise.

32.14.3Z

It is likely that the shape and size of wetlands identified in 2010, 2011, and 2012 will have changed by the time construction begins on this project. How will the project address the dynamic nature of wetlands in the survey area?

32.13G

F. The DEIS fails to adequately consider the impacts of the WDF on water quality.

The DEIS is deficient because it does not contain a section related to Hydrology. The document is content to speak in generalities with regard to water quality, water rights and drinking water sources throughout the project area, but any data needed to make a determination of the impacts on these subjects is missing.

Although in Section 13.3.2.4 the DEIS discusses a drinking water source within .25 miles of the preferred alternative, the inclusion of this source in the document is without meaning. In order to make an informed decision regarding the impacts of the WDF on local water quality and flow systems, a formal Hydrology section must be included. Within the Hydrology section, the following information should be contained:

1. Potentiometric map showing the direction of groundwater movement.
2. Inventory of wells showing the actual depth to groundwater in the project area.
3. Local and regional groundwater transmissivity.
4. Contour maps showing existing water quality with contaminants of concern for the construction and long term operation of the project.
5. Possible short and long term contaminants of concern from the project. Current water quality trends for any wells in the project area.

32.13D

Contaminate spills can occur much close to Great Salt Lake within the proposed footprint. The potential safety catchments upstream that are available in other watershed components of the greater Great Salt Lake area will be absent due to proximity of potential spills to the Lake. Wetlands are at an immediate risk when disaster is in close. The Great Salt Lake is a closed system requiring elevated concerns for contamination and contaminants that can't flow through the system but remain until breakdown.

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32.13G

32.14.2R

Distribution points of water to the Lake are key habitat components of the Lake for many aquatic bird species. During the 1997-2002 GSL Waterbird Survey (Paul/ Manning 2002) aquatic bird shoreline counts at water inflow sites to the GSL in Davis and Weber counties always provided the highest population and species diversity counts. These sites are rich in part because of the abundance and diversity of macro invertebrate food as fresh water mixes with salt water.

- Hydrology potential impacts.
  - During wet cycle's water table and drainage conditions have created ponding east of I-15 that was used extensively by waterbirds. This condition was especially evident between Farmington and Centerville.
  - This condition was especially evident between I-15 west to the frontage road that runs along the east boundary of Farmington Bay WMA. This area even in non-wet cycles remains important to waterbirds and would be more so minus some present development conditions.
  - Potential impacts may occur on the opportunity to manage water in the WMA. This may be a reduction in the opportunity to choose where to establish drainage distribution points, or a matter of timing and of use. Depending on the road design, there may be a reduced opportunity to apply certain water management scenarios such as deep water management, drainage or seasonal flooding because of their threat to the roadway.
  - Road base mass and /or, compaction may cause a change in the dynamics of ground and surface water that otherwise would occur at points in the system where it would provide wildlife habitat.
- Disruption of riparian transition between foothills and wetland complexes would be expanded. Development adds distance of interruption and additional hazards to wildlife using a linier pattern of movement along the riparian string. Areas of interest are, Ricks Creek, Barnard Creek, and Steed Canyon.

- During wet cycles wildlife activity and wildlife management is pushed east by rising lake levels. This is the case within the greater Farmington bay area including the duck clubs. For example, during the 1980s a breeding population of Canada geese, California gulls and other species nested within or near the 1000' of the proposed highway focus area. The power line dike that protected the line easement east of Farmington Bay WMA had water lapping at its west foot in the 1980s and the dike was used by Canada geese and a large California gull colony at that time. All Farmington Bay wetlands were under water during that period. All wetland values available were shifted east between the East Farmington Bay dike mentioned here and I-15.

G. Impacts to Section 4(f) Properties

The Department of Transportation Act (DOT Act) of 1966, implemented in part by 23 C.F.R. § 774.17, prohibits FHWA and other DOT agencies from approving the use of land for highway projects from publicly owned parks, recreational areas, wildlife and

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32.27L

32.27L

waterfowl refuges, or public and private historical sites unless: 1) there is no feasible and prudent alternative to the use of that land; **and**, 2) the action includes all possible planning to minimize harm to the property resulting from use. While the DEIS correctly recognizes many properties in the preferred B1 alignment as protected under Section 4(f), the DEIS makes the general disclaimer that "[i]n the macro-level analysis, UDOT and FHWA did not identify any route that would avoid all Section 4(f) properties while also meeting the purpose of and need for the WDC Project." DEIS at 27-25. In other words, according to the DEIS no matter which route UDOT prefers and ultimately recommends in a Final EIS, the WDF will negatively impact Section 4(f) properties. This purported analysis is inadequate to meet the 4(f) requirements.

The B1 route, selected by UDOT as its preferred local alternative, impacts more Section 4(f) wetlands than any other route. *See* Table 27-18 at DEIS 27-45. As a result, selection of this alternative is illegal under 4(f). Moreover, during the past few years, UDOT worked to reclassify certain properties on the B1 route which were formerly classified as wetlands. *See* UDOT Wetland Update Summary, October 2012, attached as Exhibit G. By systematically reclassifying property to remove it from wetland classification, UDOT has eliminated even more acres of wetlands from consideration than is portrayed in the DEIS. As a result, if those declassified wetlands were included, the acreage of wetland impacts resulting from the B1 alignment would far exceed all other proposed routes. UDOT already has some past legal experience with determining impacts on wetlands along the eastern shore of the Great Salt Lake, in the context of the global importance of this area for migratory birds.

> The Great Salt Lake ("GSL") and the wetlands surrounding its shoreline serve as an important habitat for a variety of birds, reptiles, amphibians, and mammals, some of which are endangered. The wetlands of the GSL account for 75 percent of all wetlands in the State of Utah, whose total land area consists of only 1.5 percent wetlands. The shores of the GSL are internationally important because they are a link of the Pacific Flyway for migratory waterfowl and a link of the Western Hemisphere Shorebird Reserve Network ("WHSRN"). Some two to five million birds use the GSL yearly and 90 percent of that use is concentrated in the eastern shore.

Utahns for Better Transportation v. UDOT, 305 F.3d 1152 (10th Circuit, 2002).

Having previously established the global environmental importance of the eastern shore of the GSL, the FHWA cannot deny that the damage caused by WDF's negative impact on bird habitat will outweigh any minimal benefit that WDF may have to reduce traffic congestion at the PM peak hour. The wetlands of the eastern shore of the GSL are unique in the Western Hemisphere, and in the world. Utah is an arid, desert state, and the freshwater wetlands of the GSL remain the largest oasis for migratory birds in this area of the world. Because of this scarcity of wetlands, wetlands that do exist in Utah should receive different treatment and analysis under Section 4(f) review and analysis. Also, because of residential, commercial and agricultural development along the eastern shore of the GSL, the number of acres of wetlands in the State of Utah has decreased even more

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in the past ten years. Rapid commercial and residential development in Davis County has magnified the importance of the few remaining uplands and wetlands which serve as a vital stopover for millions of migrating birds. The Migratory Bird Treaty Act of 1918 (MBTA),[23] protects 1,007 species of birds.[24] Almost all of the birds that inhabit or migrate along the GSL are protected under the MBTA.[25]

The DEIS identifies several Section 4(f) wetlands, uplands and migratory bird habitats along eastern shore of the GSL. The B1 route impacts Section 4(f) wetlands at certain key areas along the shoreline:

32.27C
32.27A
32.27B

1. Farmington Bay Waterfowl Management Area (WMA) and the Great Salt Lake Nature Center under the jurisdiction of Utah Division of Natural Resources (DNR);
2. Buffalo Ranch Conservation Easement, Buffalo Ranch Trail and Great Salt Lake Shoreline Trail, all under the jurisdiction of Farmington City, Utah; and,
3. The Great Salt Lake Shorelands Preserve, under the joint management and collaborative but separate ownership of The Nature Conservancy and the Utah Reclamation Mitigation and Conservation Commission, a U.S. government agency established for conservation purposes.

UDOT identifies these impacted areas and states a preliminary finding that there is only "*de minimis* impact" to these properties. According to the DEIS, "[f]or parks, recreation areas, and wildlife/waterfowl refuges, a de minimis impact is one that would not adversely affect the features, attributes, or activities that qualify the property for protection under Section 4(f)." DEIS at 27-46. The DEIS states further, "[a] final finding will appear in the final Section 4(f) evaluation after the public and agencies have an opportunity to review and comment on the Draft EIS and Section 4(f) evaluation. Officials with jurisdiction must concur in writing with FHWA's intent to make a *de minimis* impact finding [23 CFR 774.5(b)]." DEIS at 27-46. By itself, this approach violates both 4(f) and NEPA by preventing the public from participating fully in the review processes by denying citizens access to the information they need in order to make meaningful comments on the 4(f) implications of the proposal and its alternatives. In any case, it is clear that the relevant agencies and entities with jurisdiction over the lands at issue do not concur with UDOT's *de minimis* determination and therefore that the de minimis finding must be rejected.

32.27M

During past years – even before the WDF DEIS process began – the federal, state, and local city officials having jurisdiction over these three areas have all participated as stakeholders in the DEIS process. Throughout the DEIS process, each of those officials rejected UDOT's attempts to use their respective Section 4(f) properties for a freeway alignment, instead asserting that the properties should be protected under Section 4(f). In spite of this, UDOT ignored these efforts and selected the alignment most damaging to Section 4(f) properties. Each of these three Section 4(f) properties is discussed below.

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1. Farmington Bay WMA and Great Salt Lake Nature Center

With regard to Section 4(f) wildlife and waterfowl refuges, the DEIS makes the bold and unsubstantiated claim that "[t]here would be no Section 4(f) uses (non–de minimis) of wildlife and waterfowl refuges." DEIS at 27-29. The State of Utah has designated Farmington Bay WMA and Great Salt Lake Nature Center as Section 4(f) properties. *See* Letter to UDOT from the Utah Public Lands Policy Coordination Office (PLPCO), dated April 26, 2011 (the "PLPCO Designation Letter"), which is attached as Exhibit H. The PLPCO coordinated a review of the WDF project with the Utah Division of Water Rights, Division of Drinking Water and Division of Wildlife Resources. UDOT also recognizes Farmington Bay WMA and GSL Nature Center as Section 4(f) properties. *See* Table 27-6, DEIS 27-23.

The PLPCO cautioned UDOT that the B1 route (also known as the Glovers Lane alignment) "will impact 124 acres of wildlife habitat, 8.6 acres of wetland and 90 acres of floodplain […]" PLPCO Designation Letter at 2. Therefore, this expert opinion is at complete odds with UDOT's unsupported *de minimis* contention, further establishing that the agency's 4(f) analysis is legally deficient. With regard to all of the WDF alignment alternatives, the PLPCO also listed, *inter alia*, negative impacts such as "[d]irect, indirect and cumulative impacts to wetlands and wildlife and their habitat including fragmentation of wetlands and wildlife habitats, hydrological impacts to GSL, noise impacts and lighting impacts." *Id.* at 3. The Great Salt Lake Nature Center (GSL Nature Center) "serves the needs of over 20,000 students and visitors from along the Wasatch Front and numerous states and foreign countries." Letter to UDOT from Utah Wildlife Conservation Foundation, dated March 25, 2011, attached as Exhibit I. The GSL Nature Center property consists of 60 acres of mitigation property previously acquired by the Utah Transit Authority (UTA) to mitigate for wetlands that the agency impacted elsewhere.

32.27L
32.27C

As PLPCO states, the WDF B1 route would negatively impact this 4(f) mitigation property by taking the abutting uplands and wetlands located to the north that currently make up part of the Buffalo Ranch Conservation Easement held by Farmington City. (That public easement is discussed more fully in the subsection below). These wetlands and uplands are located in the 100-year floodplain along the northern border of the GSL Nature Center. The B1 alignment therefore essentially "double dips" by impacting land which is already set aside as mitigation property for other highway projects. Noise and vehicle traffic from the WDF along the B1 route will impact the uplands and floodplain of the WMA and the Buffalo Ranch Conservation Easement, and thus the hundreds of thousands of birds that utilize these areas. Further, the WDF will almost entirely eliminate the existing agricultural buffer zone between the residential development of Farmington City on one side, and the Farmington Bay WMA and GSL Nature Center on the other.

32.27A
32.14.2H

The ponds at the GSL Nature Center, which are located immediately to the south of the B1 alignment, would be less than 500 feet from the elevated freeway. Thousands of migratory birds in the area regularly fly at very low altitudes over the agricultural

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32.2.13C

32.14.2H

fields and uplands between the GLS Nature Center ponds and the Buffalo Ranch Conservation Easement pond. The DEIS fails to recognize this fact, and fails to acknowledge the adverse consequences which stem from the proximity of the WDF to this important habitat. Migratory shorebirds fly at low altitude above the ground, "puddle jumping" between these ponds. The elevated WDF, with a height between 14 and 30 feet, would dissect these floodplain, upland and wetland habitats by creating physical barrier to block the route of the migratory birds. The DEIS contains nothing to address the wildlife vehicle collisions which would occur in this area where hundreds of thousands of birds take flight throughout each day, and travel along the floodplain, and over the very fields where UDOT plans to construct the B1 route.

Additionally, some of the migratory birds, such as Canada geese, barn owls and killdeer, are attracted to roadsides where they graze, hunt and nest. These species are even more likely be involved in wildlife vehicle collisions as the parents and young wander into lanes of oncoming traffic on WDF. The DEIS also fails to mitigate damage caused to these species. While there are no adequate methods to fully mitigate the damage caused by highways and construction to migratory birds and their habitat, some mitigation efforts could include, but are not limited to:

32.12A
32.2.1H
32.14.2U
32.2.1H
32.14.2X
32.2.1H
32.18B
32.14.2N

- sound walls to reduce noise and light pollution and prevent collisions between low flying shorebirds or waterfowl and vehicles;
- noise reducing pavement, such as what is currently used on Legacy Parkway, to reduce noise pollution;
- curbing to prevent wildlife and bird vehicle collisions from surface travel of birds, geese, and goslings. For example, some birds like Canada geese often nest along the sides of highways, or graze along the sides of highways, and they will walk into oncoming traffic;
- reduction of speed limit to 40 mph or less to reduce noise and decrease the possibility of bird-vehicle collisions;
- culverts and wildlife underpasses to prevent wildlife-vehicle collisions;
- prohibiting commercial vehicles, such as semi-truck trailers, from using the WDC;
- elimination of streetlights to prevent light pollution;
- prohibiting construction during the nesting season of migratory birds in or near migratory bird habitat areas.

The DEIS considers none of these mitigation measures.

32.27C

Because it would be constructed only a few hundred feet from Farmington Bay WMA and the GSL Nature Center, the B1 alignment makes "constructive use" of those Section 4(f) properties, as set forth in 23 C.F.R. § 774.15(a). Section 774.15(a) provides that

> when the transportation project does not incorporate land from a Section 4(f) resource, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify a property for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes are substantially diminished.

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32.27C

32.27V

32.27C

The Utah DNR prohibits vehicle traffic and motorized vehicles in Farmington Bay WMA and GSL Nature Center because of the disturbance vehicles cause to the migratory birds during the nesting season. Ironically, UDOT proposes to construct a four lane freeway in the same area, entirely disregarding the restrictions imposed on vehicle traffic by the Utah DNR. Despite the PLPCO Designation Letter, UDOT nonetheless plans to construct the WDF only a few hundred feet from the protected area, without acknowledging as part of its 4(f) analysis, the negative impact to the properties and without a proposal to mitigate any damages to the properties. *See* DEIS Section 27-6.6.1, with Tables 27-2 and 27-26, DEIS 27-67 through 27-70. The WDF will allow thousands of vehicles each day to travel through important uplands and floodplain and within a few hundred feet of the ponds at Farmington Bay WMA and GSL Nature Center. An area that was once quiet and secluded agricultural fields and wetlands would instead be dominated by a noisy, elevated four lane freeway that will produce air, noise and light pollution. Thus, the WDF will substantially impair the beneficial features and attributes of Farmington Bay WMA and GSL Nature Center and the agency's failure to acknowledge and address this "constructive use" of protected lands undermines its 4(f) analysis.

32.27A

2. Buffalo Ranch Conservation Easement, Buffalo Ranch Trail, and the Great Salt Lake Shoreline Trail

Located immediately to the north and adjacent to Farmington Bay WMA and GSL Nature Center, is the privately owned Buffalo Ranch over which Farmington City holds a conservation easement. During the past 15 years, west Farmington has seen marked growth with residential development of over 600 homes[26] spreading to the western edge of the city boundaries, and up to the 100-year floodplain along the border of Farmington Bay WMA and GSL Nature Center. Farmington City, as part of its Master Plan, recognized the importance of a buffer between residential development and the Section 4(f) wetlands and bird refuge located to the west and south of the city. Consequently, Farmington City conditioned authorization of any residential development in the area on the establishment of a conservation easement on the westernmost portion of any development and thus limiting the land to agricultural use by Buffalo Ranch.

Additionally, because of the scenic and environmentally sensitive nature of this area, Farmington City created public trails, which the city maintains, and over which the city holds a public easement. The two trails, Buffalo Ranch Trail, and the Great Salt Lake Shoreline Trail form a loop around Buffalo Ranch. The trails and conservation easement form an important recreation area for the more than 600 families that invested in homes in western Farmington as well as for the general public. Only one city park exists in west Farmington and so the Buffalo Ranch Trail and Great Salt Lake Shoreline Trail, with their combined open space and scenic views of Great Salt Lake provide the public with an important recreation resource.

UDOT asked Farmington City to identify any Section 4(f) properties that would be impacted by the various alignments proposed in the DEIS. *See* Letter from UDOT to

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Farmington City, dated April 27, 2012, attached as Exhibit J. In response, Farmington City identified the Buffalo Conservation Easement and the trail system. *See* Letter from Farmington City to UDOT, dated May 11, 2012, (Farmington Designation Letter) attached as Exhibit K. Farmington City specified that the conservation easements were used for: "[r]ecreation [trails], natural scenic open space, wildlife habitat, farmland, floodplain and wetland preservation, and green space, preservation of stream corridors, and water courses." Farmington Designation Letter, at 2. Additionally, Farmington City stated:

> The lands are significant due to their location along the shore of the Great Salt Lake, and their unique conservation values previously mentioned, and the lands are identified on the City's Resource and Site Analysis Plant (an element of the City's general Plan), and must be preserved for such things as parks, recreation areas or wildlife/waterfowl refuges. The lands are also significant because of the magnitude of the size of area that they encompass. They cover hundreds of acres.

Farmington Designation Letter, at 2.

The FHWA guidelines recognize recreational trails, with public easements, on private land as Section 4(f) properties. UDOT also recognizes Buffalo Ranch Trail and the Great Salt Lake Shoreline Trail as Section 4(f) properties. *See* Table 27-5, DEIS at 27-18. However, UDOT recognizes only the approximately eight (8) foot wide trail as protected, and not the surrounding land or conservation easement.

> FHWA considered these easements carefully to determine whether any part of them constitutes a wildlife refuge and determined that they did not. However, the Great Salt Lake Shoreline Trail and the Buffalo Ranch Trail (which together form a loop trail) are part of the Farmington Ranches conservation easement, and FHWA has determined that only the recreational trails are subject to Section 4(f) protections as a recreation area.

Section 27.4.4.2 "Conservation Easements", DEIS at 27-24.

Additionally, UDOT recognizes in the DEIS that the B1 alignment would substantially diminish the property in the Buffalo Ranch Conservation Easement, because the alignment would run through the center of the easement parcels.

> Alternatives A1, A2, B1, and B2 would use about 61 acres of the Farmington area conservation easement parcels (total about 359 acres, including a large pond). The alignments for these four alternatives are identical in this area. The alignments pass through the center of the easement parcels, leaving more land on the shoreline side than on the inland side. A large pond on the western side of the easement area would be preserved intact. Some wetland areas, especially at the north end of this area, would be lost or separated from the coastal area. Horse pasture and other agricultural lands located in the central and southern portions of

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> the easement area would be partly used and partly retained. Developed facilities at Buffalo Ranch would be minimally affected, but surrounding open agricultural lands would be substantially diminished. A trail connection would be retained.

DEIS at 27-88.

UDOT proposes to mitigate any negative impact to the Section 4(f) recreational trails by merely constructing tunnels under the 30 foot elevated freeway and 250 feet wide right of way, where WDF would pass over the trails. UDOT states in the DEIS that FHWA made the "preliminary determination that there would be no adverse effect to the activities, features, or attributes of the trail." This myopic and legally indefensible view of the WDF's negative impact on the public recreational trails and surrounding wetlands and conservation easement is consistent with UDOT's treatment of other Section 4(f) wetlands and wildlife refuge areas along the preferred WDF alignment and fails to acknowledge that Section 4(f) also protects eligible properties from constructive use. Farmington City declared that the sole purpose of creating the Buffalo Ranch Conservation Easement and public trail system is to provide Farmington residents with a recreation area on the western border of the city, away from development in an area already saturated with residential development. Farmington City created the conservation easement and trails expressly because of the "natural scenic open space, wildlife habitat, farmland, floodplain and wetland preservation," all of which UDOT and FHWA consciously ignore in the DEIS.

The 250 foot wide, four lane, elevated freeway will irreparably harm and destroy the "features, attributes, or activities" related to the Conservation Easement and public trail system that Farmington City's residents' tax dollars have created and preserved. Instead of a rural, recreation area, protected from development for the past ten years, the WDF will take and use this area to construct an elevated freeway which will broadcast noise, light and air pollution into the quiet residential neighborhoods. Hundreds of families in Farmington bought or built homes subject to the Farmington Ranches HOA covenants, conditions and restrictions, which are also subject to the recorded Buffalo Ranch Conservation Easement. These Farmington homeowners bought or built homes in this area specifically because of the preserved open space and public trail system which make up an important attribute of the quality of life enjoyed by Farmington residents. Farmington City and its thousands of families and residents receive no benefit from the WDF. There are no entrance or exit ramps from Farmington City to the WDF; rather, the proposed WDF only takes public recreation areas from Farmington. Farmington residents do not want or need another freeway, since two freeways, I-15 and Legacy Parkway already cut Farmington City in half, running through the middle of the city. These two major freeways are easily accessible from either east or west Farmington, so residents have no need for a third freeway, which would encircle the small community by freeways. In other words, with regard to the WDF's impact on Farmington City, WDF only takes, and does not give. Consequently, Farmington City recently announced its intention to contest the decision made in the DEIS through official comments, and mentioned that the City Council considered litigation to enforce the law under Section 4(f). *See* Palmer, Rebecca, "Farmington to challenge UDOT over West Davis Corridor"

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32.27B

The Davis Clipper, Aug 21, 2013. ("We think we're on strong legal grounds to challenge UDOT on some of the EIS points," said City Manager Dave Millheim. "Rather than do it formally, we're going to do a detailed and public comment.").[27]

3. Great Salt Lake Shorelands Preserve

Approximately twenty-five years ago, The Nature Conservancy (TNC) recognized that westward commercial and residential development would jeopardize the globally important wetlands and uplands of the eastern shore of GSL. Over the years, TNC has worked cooperatively with the Utah Reclamation Mitigation and Conservation Commission (URMCC) to purchase and jointly manage contiguous parcels of land along the eastern shore of GSL, assembling the Great Salt Lake Shorelands Preserve (Shorelands Preserve). Some of the parcels purchased by TNC used Federal funds. A color coded map showing parcels of land and ownership by TNC and URMCC is attached as Exhibit L. Throughout the EIS process for the WDF, TNC and URMCC, have repeatedly taken the position that the Shorelands Preserve remains a single ecological unit, whether portions of the preserve consisted of individual parcels and regardless of ownership of the individual parcels. The Shorelands Preserve is significant because of its high quality wetlands and uplands, and because of its size – stretching approximately eleven miles along the eastern shore of the GSL.

For purposes of Section 4(f) analysis however, UDOT only considers that portion of the Preserve owned in fee by URMCC as qualifying for Section 4(f) protection. *See* Table 27-6, DEIS at 27-23 ("Total acreage (4,400 acres) is owned in part by The Nature Conservancy (TNC; private entity) and in part by the Utah Reclamation, Mitigation, and Conservation Commission (URMCC or Mitigation Commission) (public: 1,750 acres))"; *see also id.* ("Only public land portions are subject to Section 4(f)"). URMCC and TNC disagree with UDOT's position in this matter and have repeatedly maintained that UDOT must consider the entire Shorelands Preserve as a single ecological unit protected under Section 4(f). *See* Letter from Mitigation Commission to FHWA regarding impact to Shorelands Preserve, dated February 11, 2010, attached as Exhibit M ("activities that would diminish the wetland and wildlife values of proximal lands within the GSLSP [Great Salt Lake Shorelands Preserve] would also affect the wetland and wildlife values of the mitigation and conservation lands owned by the Mitigation Commission."); *see also* Letter from The Nature Conservancy to Randy Jeffries of UDOT, March 25, 2011, attached as Exhibit N ("The preserve is a key migratory stopover for tens of thousands of migratory birds and is the largest naturally-functioning wetland/upland complex on the eastern shore of Great Salt Lake.... The acquisition and management of the Preserve has been made possible by generous contributions from URMCC, other federal and state agencies, major Utah foundations, corporations, individuals and members."); Meeting notes from the UDOT, TNC, Mitigation Commission/Stakeholder Wildlife Working Group, dated October 6, 2011, attached as Exhibit O ("the Mitigation Commission considers the entire Shorelands Preserve as a single ecological unit and that FHWA and UDOT should consider all lands within the Preserve as 4(f), not just those in the name of the United States."); Letter from the Mitigation Commission to Randy Jeffries of UDOT, dated January 26, 2012, attached as Exhibit P ("As we have stated repeatedly, the

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Preserve is a dynamic natural ecosystem that must be viewed as a single management unit. Its value, and the impact of the highway corridor, cannot be calculated on an acre-by-acre basis. The Federal government would not have invested millions of dollars in mitigation and conservation of isolated parcels of habitat; the benefit to the Federal government is in conserving and maintaining the full ecological value of the entire Preserve."). This approach lacks any basis in the record and is unlawful.

All of the proposed WDF alignments would use significant and important parcels of the Shorelands Preserve. For example, the B1 alignment would directly and constructively use agricultural uplands with corn fields owned in fee by TNC. During winter months, those parcels provide valuable grazing habitat for the 50,000 to 60,000 tundra swan which utilize the Shorelands Preserve. During the unseasonably harsh winter months of 2012-2013, tundra swan that wintered at the nearby Farmington Bay WMA starved to death because of the unusually cold winter temperatures, thick ice, and lack of food in the Farmington Bay WMA. However, the tens of thousands of tundra swan wintering on the TNC parcels survived the winter because of the adequate food available on the corn fields and uplands. Rather than conduct a proper analysis of the impacts of its preferred alternative, UDOT cherry picked the TNC parcels from the whole of the Shorelands Preserve in order to contend that any impact to the Preserve would be *de minimis*. *See* Table 27-9, DEIS at 27-33 (claiming that no avoidance analysis is necessary on TNC parcels). Such an approach by UDOT is improper under Section 4(f), and the DEIS must fully consider impacts to the Shorelands Preserve as a whole.

In addition to directly using and occupying federally-owned parcels of the Preserve, which are clearly protected under Section 4(f), the WDF would also make constructive use of portions of the Preserve because the WDF alignments abut, and in some cases dissect, Preserve parcels. Because of the proximity of the alignments to the Section 4(f) parcels, the negative impacts of the WDF on the Shorelands Preserve are similar to those described above for Farmington Bay WMA and GSL Nature Center. Additionally, as with Farmington Bay WMA and GSL Nature Center, the DEIS makes no attempt to mitigate the damage and impact of the freeway on these parcels. TNC, URMCC and the Shared Solution Coalition agree with the position of the U.S. Fish and Wildlife Service and the Department of the Interior that these Section 4(f) wetlands, uplands and refuges represent irreplaceable habitat for millions of migratory birds. *See* Comments of US Department of Interior and US Fish and Wildlife Service, dated August 14, 2013, attached as Exhibit Q ("The GSL ecosystem is an irreplaceable and immitigable resource due to its location within an arid region, large size, diversity of habitats for migratory birds, and the sheer number of birds, estimated at 7.5 million per year").[28] Therefore, it is not possible to adequately mitigate for the damage to the Section 4(f) properties, or the wildlife that depend on those properties, that the preferred alternative will adversely impact.

32.14.2H

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32.14.2I

32.2.1G

4. UDOT Must Include the Shared Solution in its 4(f) Analysis.

The intent of Section 4(f) and the policy of FHWA is to avoid and, where avoidance is not feasible and prudent, minimize the use of significant public parks,

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recreation areas, wildlife and waterfowl refuges and historic sites for freeway projects. Based on this policy, and given that 4(f) prohibits the use of protected properties where there is a feasible and prudent alternative that avoids the use of Section 4(f) property, UDOT must undertake a thorough 4(f) analysis of the Shared Solutions alternative. This alternative is likely to avoid the use of 4(f) properties altogether and will certainly minimize the use of these lands. This is particularly true here where the record is replete with expert opinion and information underscoring the significant direct and constructive use of protected properties that would occur under each of the freeway-based alternatives.

In addition, this 4(f) analysis **would be** a significant differentiating factor between alternatives because the net harm resulting from the impact to protected properties is far from negligible. As a result, this analysis must occur contemporaneously with both NEPA and 404 analyses of the proposed project and its alternatives. Only in this way can decision makers make a well-informed and legal decision. Finally, the failure of UDOT to analyze the Share Solution and similar alternatives – which are plainly feasible and prudent – as part of its examination of the 4(f) requirements means that the agency has violated the law.

5. **Given the Existence of the Shared Solution and Other Alternatives that Do Not Require Construction of a New Freeway, any Decision to Authorize the WDF and its Freeway-Based Alternatives is Illegal.**

Similarly, should it fail to adopt the Shared Solution or a similar non-freeway-based alternative, UDOT would be in violation of the law. Section 4(f) requires UDOT to avoid the use of 4(f) properties where prudent and feasible alternatives exist and further requires the agency to minimize impacts to protected lands where use of 4(f) properties is legally necessary. Given that the record clearly establishes that the Shared Solution or a similar alternative is both prudent and feasible and given that such an alternative would avoid the use of 4(f) properties and would minimize the impact to these lands, UDOT may not authorize the WDF or other freeway-based alternative as doing so would violate the law.

32.2.1G

6. **Conclusion**

32.27M

UDOT incorrectly contends that the negative impacts on Section 4(f) properties resulting from the B1 and similar alignments are *de minimis*. In stark contrast to UDOT's unsupported contention that the freeway-based projects would not "adversely affect the activities, features, or attributes qualifying a park, recreation area, or refuge for protection under Section 4(f)," the federal, state and local government agencies with expertise and jurisdiction over those areas have clearly determined otherwise – that the proposed freeway alternatives would "use" 4(f) properties and that this use would have more than *de minimis* impacts.[29] As a result, the DEIS illegally fails to acknowledge and assess the impacts of the WDF on these properties and therefore fails to guarantee, as it must, that there is there is no feasible and prudent alternative to the WDF or its freeway-based alternatives or that the WDF includes all possible planning to minimize harm to the property resulting from the use of the 4(f) properties. Said another way, given that the *de*

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minimis determination is without support in the record and otherwise unlawful, the 4(f) analysis is inadequate because it does not develop and evaluate alternatives that would avoid using the Section 4(f) property, much less choose the project that does not impact 4(f) properties or that results in the least overall harm.

UDOT may not sidestep its obligations to avoid using 4(f) properties or to mitigate or minimize harm to these lands. The DEIS fails to acknowledge the obvious negative impacts to the Section 4(f) parcels in spite of repeated input to the contrary from officials with jurisdiction over these properties and the expertise to assess direct and constructive use of these lands of special value. Moreover, because of the failure to include an adequate discussion of any efforts to mitigate or minimize harm to these properties in the DEIS, the public and government agencies are improperly denied the opportunity to provide meaningful comments on this important topic. Therefore, the DEIS fails to comply with 23 U.S.C. § 138, 49 U.S.C. § 303 and 23 C.F.R. § 774.

32.27M

Finally, UDOT's current 4(f) effort is legally insufficient in that: 1) UDOT maintains its *de minimis* finding despite an obvious lack of concurrence from the agencies and entities with jurisdiction over the "used" lands; 2) UDOT has failed to explore evidently prudent and feasible alternatives alongside its NEPA and 404 analysis, that would avoid using 4(f) properties and would minimize harm to such lands; and, 3) UDOT has failed to adopt the Shared Solutions or similar alternative precisely because such an alternative would avoid using 4(f) properties and would minimize harm to such lands. In any case, as it currently stands, the 4(f) and alternatives analysis simply cannot provide the basis for a legal and well informed decision on the freeway proposal.

32.2.1V

32.2.1G

H. Cumulative Impacts

The DEIS makes it clear that cumulative impacts that must be addressed in an EIS include the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes those actions. *See* 40 C.F.R. § 1508.7; *see also* DEIS 24-1-2. Cumulative impacts can result from individually minor but collectively significant actions that take place over time. *Id.*

Contrary to the position taken in the DEIS, these past, present and future actions must include both transportation and other actions that have impacts on the resources that will be affected by the WDF. Instead, the DEIS focuses only on the past, present and future actions within the confines of the WDF study area. For instance, rather than acknowledging that the WDF is part of a much larger, interconnected transportation system, the DEIS states that "[f]or this project, an example of a past action in the WDC study area is the historic farming operations." DEIS at 24-2. As justification for this approach, the DEIS states that "[t]he geographic scope of the cumulative impacts analysis was determined by establishing the area of project impacts and determining the geographic areas occupied by each affected resource." *Id.* at 24-5.

32.24K

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The courts have held that a comprehensive EIS, including an analysis of cumulative impacts, is needed when related proposals "will have cumulative or synergistic environmental impacts." *Kleppe v. Sierra Club*, 427 U.S. 390 (1976); *Environmental Defense Fund v. Higginson*, 655 F.2d 1244 (10th Cir. 1981). "Only through comprehensive consideration of pending proposals can the agency evaluate different courses of action." *Kleppe* at 409-10.

The importance of addressing cumulative impacts fully, along with detailed methods for doing so, are discussed in a CEQ document entitled "Considering Cumulative Effects under the National Environmental Policy Act" (1997) (CEQ Report), a project in which FHWA was a consulting and contributing agency (along with many other federal agencies). The CEQ Report emphasizes the increasing evidence that the most devastating environmental impacts occur not from individual project segments, but from "the combination of individually minor effects of multiple actions over time." *Id.* at 1.

32.24K

The cumulative impacts analysis in the DEIS is deficient in two ways. First, the DEIS ignores the cumulative negative impacts on the Great Salt Lake ecosystem as a whole and focuses instead only on individual factors as a justification for the conclusion that the impacts for the project are insignificant. Second, the DEIS has limited its cumulative impacts analysis to this single road segment and makes no attempt to study cumulative impacts of transportation systems outside the study area.[30]

32.24L

Instead, consistent with the requirement to address cumulative impacts at the watershed, airshed or ecosystem scale, the analysis should have addressed the cumulative effects of past, present and future transportation projects along the Wasatch Front, including any future segments of the freeway to the north. The cumulative impacts analysis should also analyze the impacts of other forms of growth that have accompanied or that are likely to accompany these transportation developments – especially on the wetlands and associated hydrological and ecological resources along the fringes of Great Salt Lake. Such an analysis will require a baseline identification and description of those resources, an attempt to identify a threshold of impacts beyond which the resource will degrade to the point where it is no longer sustainable, a quantitative analysis of the magnitude of impacts that will occur as a result of each of the identified projects, including the proposed project, and an objective analysis of the magnitude and nature of growth that is likely to occur both with and without the proposed project.

I. Mitigation

32.14.3Q

1. FHWA Failed to Merge the NEPA/404 Processes as Required by Policy

Contrary to its stated policy, during the WDF environmental review process FHWA failed to merge the NEPA and Clean Water Act Section 404 permitting processes. As stated by FHWA, the NEPA/404 merger is designed to improve the efficiency of the FHWA NEPA process through early coordination with the U.S. Army Corps of Engineers (Corps). *See* http://www.environment.fhwa.dot.gov/projdev/tdmnepa404.asp; see also 23 C.F.R. § 771.105(a). The reason that FHWA states for merging these

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processes is that both involve the evaluation of alternatives that must be viewed in light of the different agency mandates. *See id.*; *see also* http://environment.fhwa.dot.gov/projdev/tdmpdo.asp. By failing to follow FHWA's stated policy on this matter, UDOT and FHWA are unnecessarily and wastefully duplicating the permitting process and depriving the public and the decision maker of the information they need to evaluate the proposed project.

FHWA's policy of merging the NEPA/404 processes has been in place for over 20 years. On May 1, 1992, the U.S. Department of Transportation and the Corps issued a Memorandum of Understanding that made the "Red Book" official policy for these agencies as a way of improving efficiencies in the permitting process. *Id.* That FHWA failed to follow this policy, especially given the need for finding cost saving measures within the federal government, is inexplicable. As the DEIS notes, under Section 404, no discharge of dredged or fill material is permitted in waters of the U.S. if there is a less environmentally damaging practicable alternative. DEIS at 14-5. By failing to merge these two processes, UDOT and FHWA have neglected to consider the preferred alternative in light of the Section 404 criteria. As a result, the DEIS does not consider whether a less environmentally damaging practicable alternative – such as the Shared Solution – exists, and therefore the document is necessarily deficient.

32.2.1G

Further, because of this improper bifurcation of the NEPA/404 processes, not only do UDOT and FHWA attempt to sidestep the fundamental requirement to select the least damaging practicable alternative, but there is an assumption on their part that the only action needed to fulfill their 404 obligations is to inform the Corps what wetlands are impacted by the selected alternative and what will be necessary to mitigate for those impacts. DEIS at 26-18 ("UDOT will submit a formal wetland delineation for the selected alternative in compliance with Section 404 of the Clean Water Act and will assess the functional value of the affected wetlands."). Such a perverse interpretation of the Section 404 requirements effectively flips the process on its head and fails to recognize the very reason that the FHWA and the Corps have an MOA requiring the two agencies to merge their processes. Should the Corps go along with UDOT's proposed approach to the 404 permit, the action would be arbitrary, capricious and in violation of the law.[31]

32.14.3Q

2. There is No Effective Mitigation that is Possible for the Impacts of the WDF

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32.14.3A
32.14.3R

The fact of the matter is that it not possible to fully mitigate for the costs to communities, the roughly seven miles of impacts to shoreline, the loss of wetlands, the impacts to wildlife, and the impacts to the ecosystem from this freeway. The DEIS states that some coordination has occurred to discuss mitigation for wetlands, DEIS 26-3, and that those present did discuss and seem to find possible mitigation possibilities for losses of wetlands. However, nothing of substance on possible mitigation measures is put forth in the DEIS for public comment.

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Furthermore, most of the area west of the proposed freeway and south of Gentile Street is already set aside. Specifically, as discussed above there are already conservation easements in Farmington City, there are areas already managed for wetlands and wildlife at The Nature Conservancy Shoreland Preserve, and there are mitigation areas owned by The Mitigation Commission. What the DEIS suggests is that it would be appropriate to pursue mitigation for areas set aside as mitigation, without the recognition that the impacted areas are irreplaceable.

In summary, truly mitigating for the losses of the proposed freeway is not possible. If the freeway proposal moves forward the residents of Weber and Davis County would be robbed of a major positive aspect of their local environment and Great Salt Lake would lose roughly seven miles of the upper portion of a mostly functioning shoreline to a roadway that would also negatively impact surrounding wetlands, uplands and wildlife/bird habitat.

Yours,

Rob Dubuc
Joro Walker
Attorneys for the Shared Solution Coalition

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[22] http://www.epa.gov/airtrends/ozone.html.
[23] 16 U.S.C. § 703-712; Ch. 128; July 13, 1918; 40 Stat. 755, as amended.
[24] Source: http://www.fws.gov/migratorybirds/RegulationsPolicies/mbta/43603%20QA%201013%20rule.pdf , (last visited August 25, 2013).
[25] *See*: FWS "Birds protected by the Migratory Bird Treat Act." http://www.fws.gov/migratorybirds/regulationspolicies/mbta/mbtandx.html (last visited August 25, 2013); *and see*, "Farmington Bay Waterfowl Management Area Field Checklist From the bird list compiled by the Utah Division of Wildlife Resources" http://www.utahbirds.org/PrintCenter/cklistfarmbay.pdf, (last visited August 25, 2013).

Comment 941 (continued)

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[26] It should be noted that the number of homes designated in the DEIS as being impacted by the Glovers Land and Shepard Lane alternatives is inaccurate and must be corrected.
[27] The Coalition hereby references and incorporates any and all comments raised by Farmington City, attached as Exhibit R, and thereby gives notice to the FHWA of the existence of these issues and the need for the agency to respond to them in a legally sufficient manner.
[28] The Coalition hereby references and incorporates any and all comments and legal arguments made in the comments of US Department of Interior and US Fish and Wildlife Service, dated August 14, 2013.
[29] It is plain that the agencies with jurisdiction over the affected parks, recreation areas, and wildlife and waterfowl refuges do not concur with UDOT's *de minimis* finding. As a result, this finding is not appropriate and UDOT must proceed with an alternatives evaluation, which must be subject to public notice and comment.
[30] Similarly, the scope of the analysis is too narrow. For example, the DEIS fails to address impacts on Salt Lake City caused by changes and increases in traffic to and from the city and the bedroom communities the WDF is intended to serve.
[31] Plainly, regardless of any protestations regarding preferred alternatives, if FHWA does not complete the analysis in the DEIS, it must undertake a subsequent 404 alternatives analysis before the proposed project can be properly be evaluated. In undertaking this analysis, the agency may not argue that the alternatives analysis in the DEIS is sufficient for the purposes of 404 or that the Shared Solution or similar non-freeway-based alternative are not practicable or prudent.

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Comment 941 (continued)

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Exhibit List

Exhibit A - March 2011 UBET Comments
Exhibit B - WDC Concerns and Alternatives
Exhibit C - Shared Solution for Future Livability
Exhibit D - Short-Term Variation in Near-Highway Air Pollutant Gradients
Exhibit E - Near Roadway Exposure and Ultrafine Particles
Exhibit F - LANRP Review
Exhibit G - UDOT Wetland Update Summary
Exhibit H - PLPCO Designation Letter
Exhibit I - WIN GSL Nature Center
Exhibit J - Letter from Vincent Izzo to Farmington City
Exhibit K - Letter from Farmington to UDOT
Exhibit L - GSL Shoreland Preserve Map
Exhibit M - Letter from URMCC to UDOT
Exhibit N - Letter from TNC to UDOT
Exhibit O - WWG Meeting Notes
Exhibit P - Letter from TNC to UDOT
Exhibit Q - USDOI-USFWS Comments
Exhibit R - Farmington City West Davis EIS Evaluation

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Exhibit A

Comment 941 (continued)

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32.2.1G

Date: March 25, 2011

To: West Davis Corridor Environmental Impact Statement (EIS)

Re: Alternatives Advanced to the EIS

From: Sierra Club
Utahns for Better Transportation
FRIENDS of Great Salt Lake
Breathe Utah

These comments follow our submittal June 10, 2010 on the draft Purpose and Need Chapter and our submittal September 15, 2010 on Screening and Performance Criteria for the West Davis Corridor Environmental Impact Statement.

Our groups have appreciated the recent discussions with both UDOT and UTA exploring a multi-modal, shared solution to be included in the overall West Davis Corridor package. We look forward to meeting with these agencies again in the near future to observe the results of their shared solution analysis. This added information will have a major influence on our position on a roadway alignment. We don't feel we can make substantive comments on alternatives until we have seen mode share, VMT projections, and air quality outcomes of a shared solution to future mobility needs in the West Davis and Weber County areas. We have developed limited comments based upon certain wetlands and wildlife issues, but would appreciate the opportunity to supplement our comments when this new information becomes available.

In previous comments we highlighted the need to follow the principles and objectives of the *Wasatch Choices 2040: A Four County Land-Use and Transportation Vision* which was developed by elected officials, governmental agencies, and private and nonprofit businesses and organizations to ensure that we will continue to "enjoy an unparalleled quality of life along the Wasatch Front" as our area grows in population. Two of the key principles for transportation planning from that visioning effort are to:
"Develop a balanced multi-modal transportation system" and to
"Support actions that reduce growth in per capita vehicle miles of travel."

We also highlighted the Balanced Transportation, Principle of Agreement #4, in the *Mountain View Vision Voluntary Agreement*. This agreement was signed March 10, 2004 by the stakeholders convened to participate in the Mountain View Corridor Growth Choices study that was making recommendations for the Salt Lake County portion of the proposed "Legacy Highway" that is also part of the West Davis Corridor planning background.

Balanced Transportation

We desire a balanced transportation system for our future that will involve more transportation choices. The phasing and implementation of transportation investments over the next decade will affect land use development patterns and

Comment 941 (continued)

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therefore affect future travel needs and the availability and effectiveness of other viable transportation choices. The sequencing of transportation investments needs to be studied to recommend the most effective and cost efficient way to meet future travel needs, reduce the rate of growth of vehicle miles traveled, improve air quality through a better balance between auto, transit, walk and bike trips, and to recommend the best way to encourage the types of land uses throughout the corridor that will support these improvements. (Mountain View Vision Voluntary Agreement, March 2004)

The alternatives advanced to the Draft EIS must include the following:

- A shared solution that will provide convenient travel alternatives for some trips (walk, bike, transit) thereby reducing the rate of growth of vehicle miles traveled (VMT) especially at the peak hours of travel demand
- Incentives for alternatives to reduce automobile congestion, improve air quality, and provide more viable mobility choices for Davis County residents
- Utilization of performance criteria that optimizes east/west access to I-15 and FrontRunner commuter rail as the main north-south facilities for needed transit or automobile trips
- A study of the sequencing of transportation investments in order to recommend the most effective and cost efficient way to meet future travel needs, reduce the rate of growth of vehicle miles traveled, and improve air quality through a better balance between auto, transit, walk, and bike trips

Focusing our investments in ways to stimulate a better balanced mode share between single occupant cars, carpooling, transit, bike, and walk trips will benefit us all by reducing automobile congestion, improving air quality, and supporting active life styles.

32.11.1A

Air Quality

The Wasatch Front has a particular air quality challenge in its geography and climate. With high pressure zones concentrating over our mountain valley we are particularly vulnerable to high levels of air pollution both summer and winter. The January 11, 2010 *Salt Lake Tribune* headline, "Northern Utah Air Worst in Nation" did not help our individual health nor our future economy. Even with improvements in automobile technology the VMT growth predicted to be accommodated with new highways could well wipe out the benefits of automobile improvements. The Environmental Protection Agency has determined that Davis County is at risk for violating the National Ambient Air Quality Standards for PM 2.5 and Ozone.

32.2.1A

Transit

Our transition to a more balanced transportation system depends on shared solutions to meet the future mobility needs in our growing metropolitan area. If we continue our past patterns of growth and behavior we will grow the number of vehicle miles we travel each day in our region even faster than our population growth. This is the prediction that we need to avoid if we are to maintain our high quality of life in this wonderful metropolitan area.

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The first phase of the proposed "Legacy Highway" that would run through Weber, Davis, Salt Lake, and Utah counties—the Legacy Parkway and Preserve—was an integrated, shared solution. Indeed the courts found that the Final Environmental Impact Statement on the Legacy Parkway was inadequate because there was "failure to consider alternative sequencing of the Shared Solution; and, failure to consider integration of the Legacy Parkway and transit."

The "Shared Solution" for the Legacy Parkway involved integration of our overall transportation system that was based on the recognition that we don't want to grow up to be like Los Angeles. The transit investments we have made along the Wasatch Front in the past ten years should be optimized by providing convenient connections for its use, especially at the peak hours. The primary need in Davis County should focus on improving east/west travel connections and efficient access to the north/south FrontRunner commuter rail as well as the I-15 Freeway and other north/south roadways and trails.

Wetlands Impacts

32.14.3A

As we have stated in our previous comments, the wetlands system of Great Salt Lake is of vital importance to millions of migratory birds. The Great Salt Lake has been designated as a Western Hemisphere Shorebird Reserve Network (WHSRN) site for its critical breeding and staging habitat for 5-7 million shorebirds each year. The Great Salt Lake wetlands are also utilized by 3 million ducks along with hundreds of wintering American Bald Eagles. The Great Salt Lake wetlands have provided for migratory birds a reliable and unique habitat oasis in the Great Basin desert for tens of thousands of years. It is certainly not an ordinary wetlands issue. Impacts to this system will have negative repercussions to wildlife across the entire western hemisphere.

The wetlands of the Great Salt Lake are protected waters of the United States under section 404 of the Clean Water Act. Wetlands and habitat of this magnitude require the utmost effort to avoid impact and require that less damaging alternatives be selected. Our groups are concerned that this process to avoid wetlands was not properly followed, as all the proposed eastern alignments of the northern portion of the proposed West Davis Corridor were screened out and only the more wetlands-impacting western alignments were selected. Not only do the western alignments impact more wetlands, but they increase habitat fragmentation and negative wildlife impacts near the lake. We understand this is a difficult process, but these results present the appearance that favor was given to preventing human impacts over avoiding wetlands of hemispheric significance.

On the southern portion of the proposed West Davis Corridor, our groups were impressed by the avoidance of impacts to wetlands by the proposed Shepard Lane connection. We also see this alignment making better transportation sense with stronger connectivity to the Farmington FrontRunner station. The proposed Glovers Lane connection needlessly targets many acres of sensitive wetlands and key wildlife areas of Farmington Bay. Our groups are directly opposed to this alignment. We believe it to be in violation of section

Comment 941 (continued)

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404 of the Clean Water Act, for the Shepard Lane connection avoids these wetland impacts while meeting project purpose and need. The Glovers Lane option is also more expensive to the taxpayers. In addition, we believe the Glovers Lane connection would negatively impact the public amenities of the Legacy Parkway and is incongruent with the spirit of Legacy Parkway design agreement.

Respectfully,

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Exhibit B

Comment 941 (continued)

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Executive Summary (placeholder to be expanded)

1) The Draft Environmental Impact Statement (DEIS) for the West Davis Corridor (WDC) published in April 2013 shows modest "potential" benefits of the proposed WDC.
2) The actual benefits of the WDC would be substantially less because of a set of flawed assumptions made in the DEIS analyses.
3) The DEIS shows that widening existing streets would lessen future congestion more than the WDC would but then the DEIS analysis of this alternative greatly exaggerates the impacts.
4) The smarter "Shared Solution" approach that combines increasing capacity on local streets with transit and land use strategies is a much better approach than the WDC.

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32.1.2J

Putting the Potential Benefits of the WDC in Perspective

In addition to reviewing the DEIS documentation, we also reviewed the regional transportation model files on which the DEIS traffic analysis is based. Examination of the model files show:

1) Most roadways in study area are forecast to be uncongested in 2040
2) Areas that are congested are far to the east of the WDC
3) Congestion is mostly in PM peak period
4) WDC does not remove all of this congestion
5) WDC increases congestion north of WDC

AM Peak Period 2040 No Build

Red=volume/capacity > 0.9 (1 direction or both)
Green = volume/capacity < 0.5 in both directions
Gray = volume/capacity between 0.5 and 0.9
Purple = roadways not in model

AM Peak Period 2040 Alternative B-1

Red=volume/capacity > 0.9 (1 direction or both)
Green = volume/capacity < 0.5 in both directions
Gray = volume/capacity between 0.5 and 0.9

In the model, a volume/capacity ratio of 1.0 is intended to be the point where a roadway is carrying as much traffic as it can. The DEIS uses a lower threshold of 0.9 to indicate streets which are congested. The graphics above use a threshold of 0.5, i.e. 50% of the maximum possible traffic, to highlight how much of the future roadway network is expected to be very uncongested even during peak periods of the day in 2040. In the graphics, there are a lot of uncongested links (green), a relatively few congested

2

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links in the AM peak period (red) and some links (including most of I-15) where the volume/capacity ratio is forecast to be between 0.5 and 0.9 during the peak traffic periods in 2040.

PM Peak Period 2040 No Build

Red=volume/capacity > 0.9 (1 direction or both)
Green = volume/capacity < 0.5 in both directions
Gray = volume/capacity between 0.5 and 0.9
Purple = roadways not in model

PM Peak Period 2040 Alternative B-1

Red=volume/capacity > 0.9 (1 direction or both)
Green = volume/capacity < 0.5 in both directions
Gray = volume/capacity between 0.5 and 0.9

As shown in figures above, the WDC is modeled as reducing the extent of congestion in 2040 but not eliminating it. It even increases congestion north of the WDC in the PM peak period. Much of the congestion shown in the model is on east-west streets far to the east of the proposed WDC. By diverting some traffic from I-15 to the WDC, some of the east-west streets are modeled as carrying less traffic at their eastern end with the WDC than without. However, the new routes using the WDC often will be longer in distance. Therefore, even with the higher speeds on the WDC, any time savings generally will be small except for long trips from the western part of the study area to Salt Lake City and beyond.

The figure below illustrates the area that would see time savings of two minutes or more for travel from the Salt Palace in Salt Lake City in the afternoon peak period (i.e. the most congested time period in the peak direction).

3

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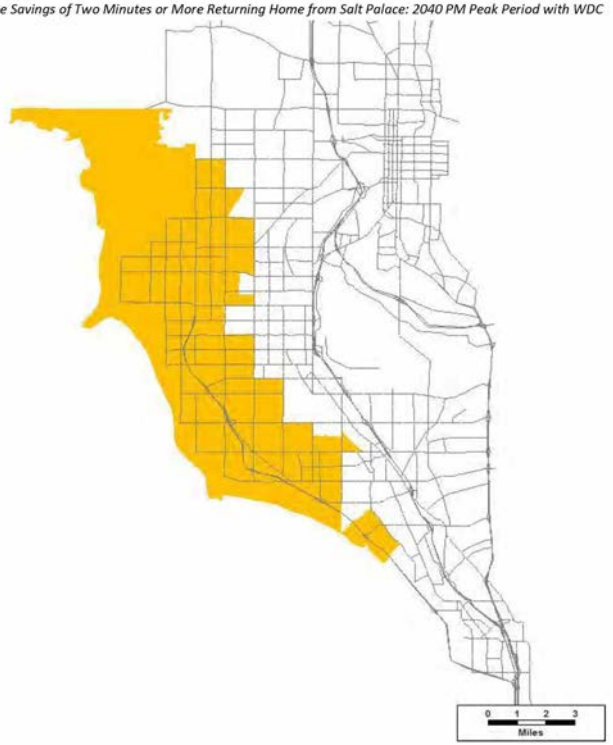
Time Savings of Two Minutes or More Returning Home from Salt Palace: 2040 PM Peak Period with WDC



The graphic above shows a large area of potential time savings (based on the modeling) but that area is relatively unpopulated today as illustrated in the figure below with the base year model data (2009) where each dot represents 100 households.

4

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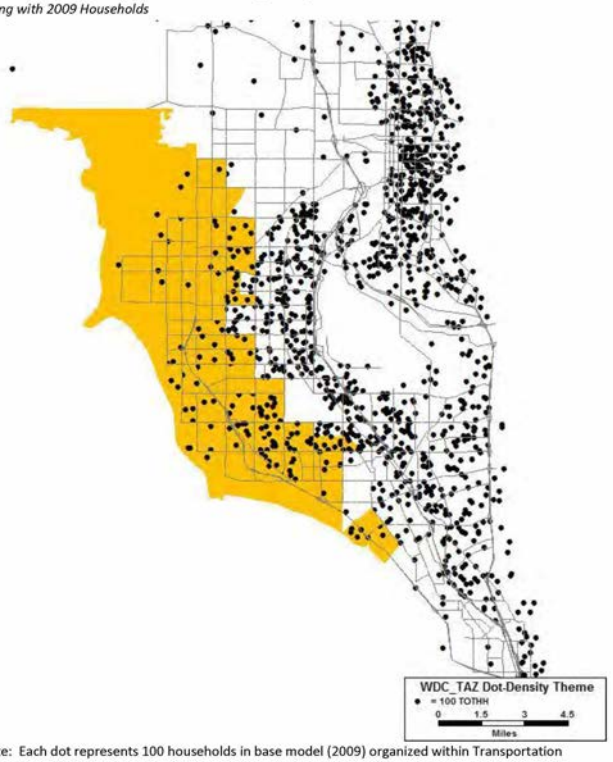
Time Savings of Two Minutes or More Returning Home from Salt Palace: 2040 PM Peak Period with WDC Along with 2009 Households



Note: Each dot represents 100 households in base model (2009) organized within Transportation Analysis Zones (TAZs).

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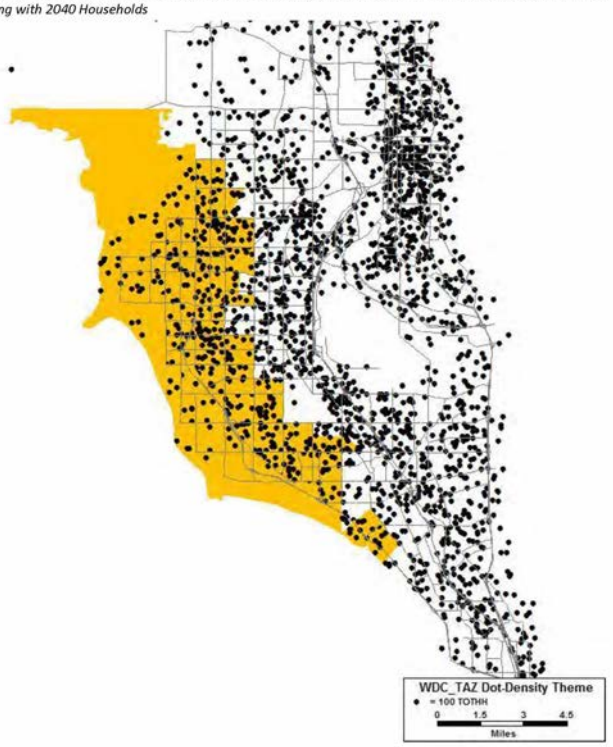
As shown in the graphic above, most housing that already exists would save little time – even in 2040 – for trips returning from Salt Lake City during the afternoon peak period. The primary time savings would be for future housing as shown in the figure below.

Time Savings of Two Minutes or More Returning Home from Salt Palace: 2040 PM Peak Period with WDC Along with 2040 Households



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Note: Each dot represents 100 households in future model (2040).

Even for these future households, the time savings are most pronounced for trips from Salt Lake City and beyond. The figure below illustrates the area that would see time savings of two minutes or more for travel from the Davis Hospital and Medical Center in the afternoon peak period (i.e. the most congested time period in the peak direction).

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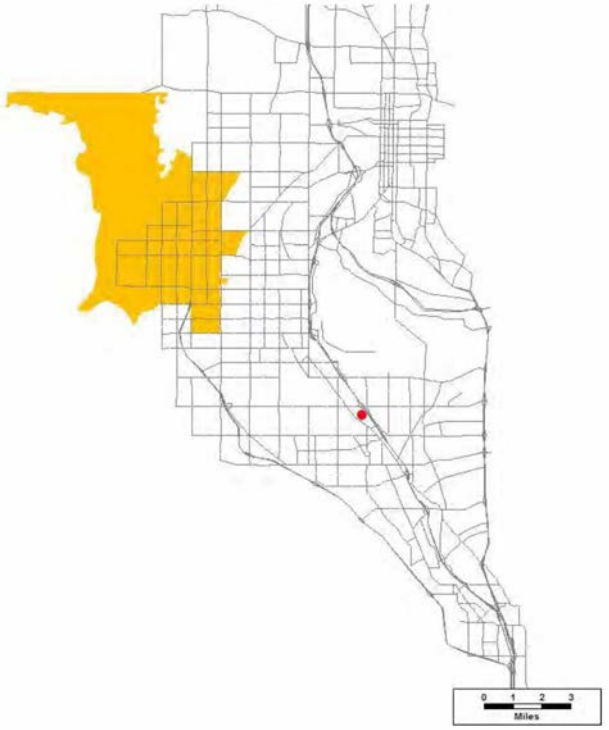
Time Savings of Two Minutes or More Returning Home from Davis Hospital and Medical Center: 2040 PM Peak Period with WDC



Note: Red dot shows location of Davis Hospital and Medical Center

For shorter trips in a north-south direction, the area that the modeling shows benefits from the WDC is much smaller than for the long-distance trips. For east-west trips in the study area, there is very little

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benefit. The figure below illustrates the area that would see time savings of two minutes or more for travel from the Weber State College.

Time Savings of Two Minutes or More Returning Home from Weber State College: 2040 PM Peak Period with WDC

Note: Red dot shows location of Weber State College

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32.1.2J and 32.2.1T

As shown in the graphic above, the modeling is showing only a small area where people could save more than 2 minutes traveling home from Weber State College during the PM peak period in 2040 with the WDC. People traveling in these areas may not even choose to use the WDC because this would entail driving further south on I-15 and then returning back north on the WDC, increasing trip lengths by 3 to 10 miles.

These Potential Benefits are Overstated

Summarizing the potential travel time savings maps, the WDC would primarily benefit people living in the western part of the study area living in housing that has not yet been build today who are traveling long distances from Salt Lake City and beyond during the afternoon peak hour. While some such travel is inevitable, the future level of such travel is highly uncertain. Furthermore, it is not in public interest to encourage this pattern or to subsidize it by building an expensive new roadway and making travel on it free. For the areas showing the 2 minute or more savings for PM peak period travel from the Salt Palace, the travel distances range from 23-40 miles one way, or 46-80 miles round trip. In an age when we are increasingly concerned with climate change and rising fuel prices, making such trips daily is undesirable both for the individuals involved and for the community as a whole.

The DEIS analyses are biased toward exaggerating the amount of this sort of travel and therefore exaggerating the benefits of the WDC. Regional transportation models are the best tool we have for quantitative analysis of future traffic conditions. Nevertheless, any future travel forecasts are subject to a large margin of uncertainty. Good practice is to acknowledge this uncertainty and to avoid overreaching conclusions based on small differences between alternatives. A 2007 report on modeling by the Transportation Research Board (TRB) states:

> Most travel forecasting models produce a single answer, although the model is estimated, calibrated, and validated on the basis of data sets that are subject to many sources of error and uncertainty. The data used are based on sampling and include sampling errors, as well as other types of errors due to survey methodology. Errors also are made, for example, when data are aggregated and entered into databases. The models themselves may suffer from misspecification. When models are used for prediction, additional errors are necessarily introduced because the values of parameters in the future are always estimates and thus subject to error.
>
> Some degree of error is unavoidable. Within reason, moreover, the presence of errors does not prevent effective applications. It is necessary and appropriate, however, to develop sampling and modeling strategies that are informed by the patterns in which errors occur and especially by understanding of the ways in which errors are propagated through sequences of models. Errors should be discussed in the course of normal practice; their influence understood and disclosed; and proper account taken of the variation that necessarily occurs in the use of models for forecasting purposes,

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32.1.1B
32.1.1D
32.1.2J

particularly when forecasts are used to evaluate alternatives that differ only modestly or to produce point estimates of travel to meet regulatory requirements.[1]

It is highly likely that the regional transportation model is overestimating future travel. It is based on a 1992 household survey and 2009 traffic volumes. In the U.S. as a whole, per capita vehicle miles traveled (VMT) peaked in 2004 and has declined each year since for a total decline of 7.5%.[2] While highway advocates often try to explain the decline in terms of the economic downturn beginning in 2008, it is important to emphasize that the decline began 4 years before that. Contributing factors to the decline include the again population, revitalization of urban cores, higher energy prices, andinvestments in walk, bicycle and transit infrastructure. There is a particularly large shift in behavior by young adults in comparison to past generations. For many in this generation, cars no longer represent freedom but instead get in their way of social media connections, and they prefer transit. Peak hour VMT per capita has likely declined even more due to the aging population, more flexible work schedules, and other social changes. Therefore the model "uncertainty" most likely is mostly in the direction of overestimating future traffic volumes, particular in the peak hour.

Future Households and Jobs

Uncertainty about future households and jobs is particularly relevant to the WDC modeling work. As shown above, the proposed WDC especially serves housing that does not exist today. Modeled future traffic volumes on the WDC and other roads are based on estimates of future land use and this is a weak foundation as discussed in the 2007 report:

> An inherent weakness of the aggregate trip-based modeling approach is reliance on demographic forecasts that are independent of the travel forecasting system. With few exceptions, travel forecasting procedures make use of data that are developed independently, often with no input from or feedback to transportation system attributes. These data—forecasts of population, households, and employment, both in total magnitude and as allocated to specific geographic subareas—are significant drivers of travel forecasts. Errors or uncertainties in these data may introduce errors of unknown magnitude into the travel forecasts. In metropolitan regions that are growing slowly or are stable, regional errors in demographic forecasts are likely to be small; in more rapidly changing regions, greater errors in demographic forecasts would be expected. There may be considerably more uncertainty in allocating regional demographic forecasts to subareas. If an area is undergoing steady or even dramatic growth, one can predict future regional population and employment with some

[1] Transportation Research Board (TRB) Committee for Determination of the State of the Practice in Metropolitan Area Travel Forecasting. Special Report 288: *Metropolitan Travel Forecasting Current Practice and Future Directions*, p. 71. 2007

[2] Sundquist, Eric. State Smart Transportation Insitiative, http://www.ssti.us/2013/02/per-capita-vmt-ticks-down-for-eighth-straight-year/, 2013.

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> confidence; where those people and jobs are going to go within the region is far more uncertain.[3]

The excerpt above emphasizes "feedback", i.e. modeling transportation and land use together. As illustrated in the graphics above, the WDC would offer reduced travel times to Salt Lake City from the western part of the study area. Both common sense and extensive research demonstrate that construction of the WDC would influence future growth in this area. This induced land use would in turn increase average trip lengths, adding vehicle miles of travel that would undermine the potential benefits of the project. This feedback between land use and transportation is not accounted for in the DEIS, and therefore the DEIS exaggerates the benefits of the WDC.

The Wasatch Front Regional Council (WFRC) has invested hundreds of thousands of dollars beginning in the late 1990s to develop integrated transportation/land use modeling capability that includes feedback, first with UrbanSim and now with its successor OPUS model.[4] If projects like the WDC have no effect on future land use, all this money has been spent for nothing. After 15 years of development, the WDC should have used either UrbanSim or OPUS to develop separate No Build and Build land use forecasts. If for some reason this was not possible, The National Cooperative Highway Research Program (NCHRP) has published a *Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects* (Special Report 466, 2002). This reference describes several methods for evaluating land use changes from a major transportation project. It is hard not to take a cynical view and conclude that the WDC DEIS instead assumes a single land use forecast for both No Build and Build alternatives simply in order to make the benefits look as great as possible.

When Portland, Oregon region does integrated land use and transportation modeling, the modelers report:

> Under conditions of increasing congestion, nonresidential land uses increase their decentralization in order to take advantage of attracting labor and customers traveling in the off-peak direction. Over a period of time, this leads to equivalent travel times over a link in both directions of travel. As a result, the capacity of the transportation system is much greater than traditional modeling procedures indicate.[5]

In contrast, all the 2040 WDC shows strongly directional traffic on all roadways in the study area, even with peak period, peak direction congestion. These strong directional flows out of the study area in the morning and back in the afternoon is bad for a host of reasons. In addition

[3] TRB 2007, p. 76.

[4] Wasatch Front Regional Council. Final Draft WFRC Unified Planning Work Plan (UPWP) Fiscal year 2013 and Fiscal Year 2014, p. 60, May 2012.

[5] Conder, Sonny and Keith Lawton. Alternative Futures for Transportation and Land Use – Integrated Models Contrasted with "Trend-Delphi" Methods: The Portland Metro Results. Metro: Portland, OR, July 2001.

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to poor utilization of roadway investments, it causes the local residents to have long commutes and long trips for services. Not building the WDC would help encourage an improved jobs/housing balance in the study area.

More generally, not building WDC would help the study area better achieve the Growth Principles for a Bright Future set out in the regionally-adopted *Wasatch Choice for 2040 Greater Wasatch Vision for 2040*.[6] These include:

- Efficient Infrastructure
  Maximizing existing infrastructure and building more compactly and contiguously conserves green space, saves taxpayer dollars, and makes high-quality, lower-cost services available to us all.

- Regional Mobility (Transportation Choice)
  With a balanced multi-modal transportation system, more transportation options, and jobs and services closer to home, we reduce the growth in per capita vehicles miles traveled, we spend less time in traffic and have more time for friends, family, and doing what we enjoy.
- Housing Choice
  Encouraging a variety of housing options, especially near transit and job centers, addresses market demand and makes living more affordable for people in all life stages and incomes.
- Health and Safety
  When our streets are walkable, interconnected, and safe, we lead healthier lives by walking and biking more and driving less. These streets also provide efficient access for emergency services. Trails and access to nature provide healthy recreational opportunities.
- Regional Economy
  Strategic transportation investments and land use decisions can encourage business investment and help secure jobs closer to home, so we can provide for our families and keep our dollars in our region.

The vision described includes: "maximizing existing infrastructure" and "jobs and services closer to home." The single land use future assumed in the DEIS is inconsistent with the Wasatch Choice Growth Principles. The WDC also is inconsistent with the Growth Principles. As discussed below, the *Shared Solution* described alternative in the final section of these comments is completely in sync with the Growth Principles.

32.2.1T

Induced travel

In addition to land use changes that would result from construction of the WDC, there are other reasons why the WDC would increase future traffic volumes. These effects can be captured in good modeling. When high speed roadway capacity is built in urban areas, regional vehicle miles of travel (VMT) will be

[6] Wasatch Front Regional Council and Mountainland Association of Governments, FinalPoster_TheWasatchChoice2040_20Dec2010_Update_Reduced-2.pdf, 2010.

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higher than if the capacity were not constructed. Model accuracy requires sensitivity to induced travel. UDOT commissioned a sensitivity analysis of the 2003 WRFC model with regard to induced travel.[7] This analysis evaluated the induced travel effects of four different freeway projects with Version 2.1 of the WFRC model. The elasticities of regional VMT to regional lane miles[8] were 0.70 for I-15 improvements, 0.68 for US 89 improvements, and 1.23 for addition of the Mountain View Corridor (Table 5.2, p. 5.5). The report concludes:

> Model elasticities fall within the expected range of acceptability based on comparisons with elasticities cited in a variety of research papers. (p. 7.1)

Since 2003, the WFRC model has changed significantly. For the WDC modeling, the elasticity of regional VMT to regional lane miles is only 0.17.[9] This is much lower than the general accepted range and indicates that the VMT for the WDC Build scenario should be significantly higher. This deficiency could be due to changes in the WFRC model and/or misapplication of the model by not properly feeding back congested travel times to earlier model stages[10]. Either way, the DEIS modeling is exaggerating the potential benefits of the WDC by not properly accounting for the impacts of induced travel from the WDC.

32.2.1T

The DEIS Did an Inadequate Job at Evaluating a Non-Freeway Alternative

Technical Memorandum 15 (TM15) evaluates the potential congestion benefits of Alternative 8 which combines widening both north-south and east-west roads in the study area. As shown in the figure below, this Alternative outperforms Alternative B-1, the construction of the WDC freeway.

[7] Cambridge Systematics, Inc. with Fehr and Peers Associates, Inc. *Wasatch Front Region Council (WFRC) Model Sensitivity Testing and Training Study Final Report*, Prepared for Utah Department of Transportation, November 2003.

[8] A basic tenet of economics is that the demand for goods vary as supply, and therefore price, changes. However, demand for some goods varies more widely with price than for others, depending on how important the good is to the consumer (milk to a family with children versus a luxury item), and whether other substitute goods are available at a lower price. This relationship—the degree to which demand varies with price—is known as "elasticity of demand." Similarly, the amount of travel (travel demand) will vary according to supply ,and therefore the "price" of travel in terms of the time it takes to make a given trip. The amount by which travel demand increases as the supply (e.g., road lanes) increases is also expressed as an elasticity of demand. A higher elasticity value indicates more induced demand as road supply (lane capacity) increases.

[9] Calculated from the WDC DEIS transportation model files.

[10] We requested All Cube input files, intermediate files, and output files for the 2009 base year, the 2040 No Action alternative and for alternatives A1, A2, A3, A4, B1, B2, B3 and B4 in 2040." We received only one set of 2040 intermediate files and it is unclear which scenario the intermediate files are for. It is impossible to determine how the modeling was done without these files and these questions also are not addressed in the DEIS or in the Technical Memoranda.

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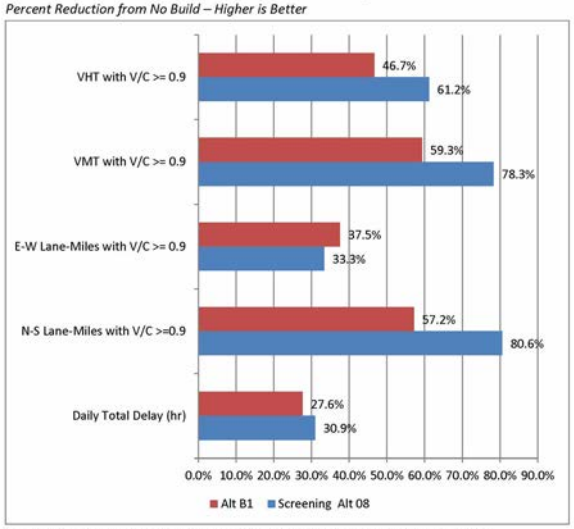
Afternoon Peak Period DESI Congestion Measures: Screening Alternative 08 vs. Selected Alternative B-1
Percent Reduction from No Build – Higher is Better



Sources: Technical Memorandum 15 Table 3-2, p. 23 an DEIS Table 7-16, p. 7-26

Despite this promising performance, the DEIS process quickly eliminated Screening Alternative 08 because of enormous impacts on land use and other resources. These impacts were greatly exaggerated due to a combination of 1) including too many roadway sections and 2) assuming much larger cross-sections than are standard practice in the study area. The most significant place where too much roadway widening is included involves I-15. TM15 includes this false statement:

> The screening analysis for Alternatives 05 and 08 showed that, to substantially reduce delay and congestion in the study area by improving existing facilities, additional capacity improvements beyond the planned improvements identified in the 2040 WFRC RTP would be needed on six east-west arterials in addition to capacity improvements on 17.5 miles of I-15. (p. 39)

This is incorrect. Alternatives 05 and 08 modeling demonstrates that widening existing roadways can "substantially reduce delay." The modeling does not demonstrate that all of the widening

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projects included are necessary to achieve this result because no other combinations of widening projects were tested. The inclusion of the I-15 widening, in particular, is a red herring because the 2040 No Build scenario shows volume/capacity ratios of greater than 0.9 only because the model is under-assigning the express lanes in the model so that their volume/capacity ratios are 0.2 to 0.4 in the AM and PM peak periods. If the express lanes and the general purpose lanes had the same density of traffic in the model, no section would show a volume/capacity ratio of greater than 0.9. In any case, the presence of the express lanes makes it somewhat less important to achieve a volume/capacity ratio of less than 0.9 on the general purpose lanes because there will be an uncongested choice. The DEIS makes a huge assumption that without a new freeway that I-15 must be widened. It never tests this assumption but instead presents it as demonstrated in the modeling of Alternatives 05 and 08. This is false. In fact the inclusion of I-15 widening Alternative 08 might be aggravating modeled congestion on the east-west roadways intersecting I-15.

I-15 is not the only road that was included in Alternative 08 unnecessarily. The extent of the widening including in Alternative 08 is ambiguous in the DEIS because TM15 defines it two different ways. There is one description in Table 2-2 (p. 15) and another description in figure 4-3 (p. 58). The first version includes about 6 times as much widening of local streets as is needed to address roadways that have volume/capacity ratios of greater than 0.9 in the 2040 No Build alternative. The second version includes about ten times as much widening as is needed. These statistics which were extracted from the DEIS modeling are summarized in the figure below.

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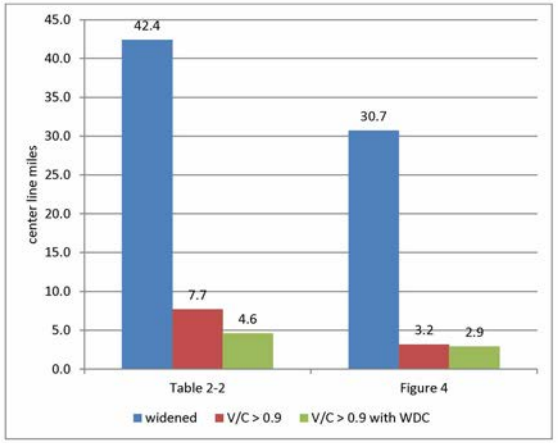
Local Street Widening in Alternative 08 Compared to Sections with Volume/Capacity > 0.9



As shown in the figure above, only a small part of the widening assumed in Alternative 08 is in the congested sections. As also shown in the figure, the WDC would do very little to address these congested street sections – in sharp contrast to widening which would address the congested sections.

As the DEIS assumes 5 to 10 times as much widening of local streets as necessary in Alternative 08 and also includes unnecessary widening of I-15, it enormously overstates the impacts of this alternative. However, the DEIS goes even further to overstate the impacts by assuming grossly unnecessary cross-sections for the widened streets.

The widths assumed for these cross-sections are:

- Four-lane divided highway: 250 feet wide
- Five-lane arterial: 112 feet wide
- Seven-lane arterial: 136 feet wide (TM15, p. 46)

These are referenced back to Technical Memorandum 14 where the arterial cross-sections are smaller: 104-110 feet for five lanes and 128-134 feet for seven lanes depending on whether or not bicycle lanes are included (TM 14, p. 4-5). All of these designs are suburban in nature, include large shoulders, and are fundamentally incompatible with the local street system in the

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existing built-out areas west of I-15. These areas already have a lot of 5-lane streets and the typical cross-section is about 80 feet, including 60 feet curb-to-curb and about 10 feet on each side to accommodate the sidewalks. All of the DEIS widths – 104 feet, 110 feet and 112 feet are way off the mark.

Even 80 feet is not necessarily required for the entire length of the street. In the model, streets are not 5 lanes or 7 lanes; they are 4 lanes or 6 lanes. The provision of a center lane is a block-by-block decision and may not be necessary throughout but instead only be necessary at intersections.

The DEIS demonstrates that increasing capacity on local streets can address future congestion in the study area, but only presents a bloated version of such an alternative, calculates unacceptable impacts based on the bloated version, and then returns to only new freeway options. The public deserves better than this. What is needed is a smarter, context-sensitive look at right-sized solutions to transportation in the study area. What is needed is the Shared Solution.

Shared Solution (placeholder – real section may just point elsewhere to work by Mike Brown and others)

Short modeling note to include somewhere:

Proper modeling of the Shared Solution will require that the benefits of mixed-use, walkable, moderate density land use be modeled accurately. It has been determined that the current regional transportation model does not account for how increased housing density reduces travel.

> Currently, the travel model predicts zones with higher residential densities have a proportionally higher number of vehicle trips, because more people imply more trips. However, it is recognized that areas with higher population and employment densities commonly have good pedestrian amenities and transit options that influence trip rates and mode choice. Also, the concentration of destinations, represented by both density and diversity, can have a significant effect on trip making characteristics. With an increase in density and/or diversity, it is generally expected that vehicle trip rates (per person) will decline. To improve the travel model's response to changes in residential density, WFRC/MAG may choose to employ "Placetypes." Placetypes can be used as a way to characterize the tangible and intangible built environment variables that influence travel. This approach may also be an opportunity to make a stronger

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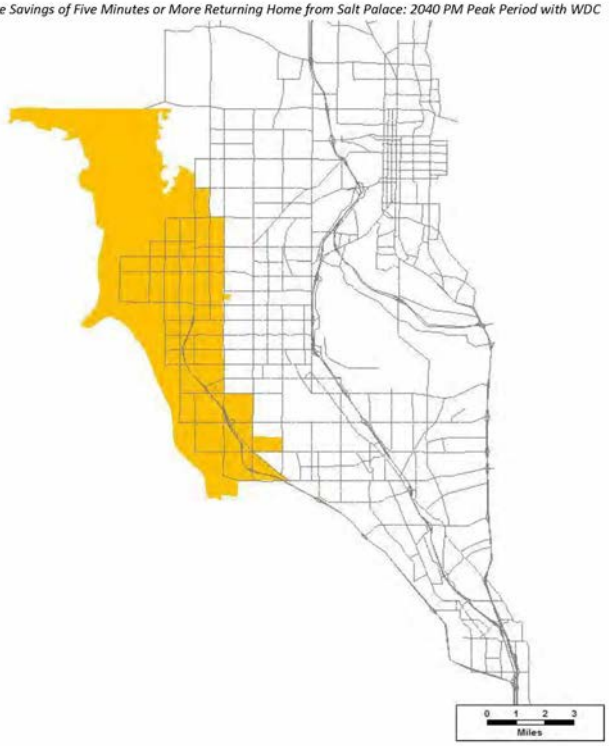
connection between WFRC/MAG travel modeling and land use planning/visioning efforts, such as *The Wasatch Choice for 2040.*[11]

Time Savings of Five Minutes or More Returning Home from Salt Palace: 2040 PM Peak Period with WDC



[11] Fehr and Peers. "D" *Sensitivity Enhancement Study for the WFRC/MAG Regional Travel Model*, p. 3. Prepared for Wasatch Front Regional Council, January 2013.

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Time Savings of Five Minutes or More Returning Home from Davis Hospital and Medical Center: 2040 PM Peak Period with WDC

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Exhibit C

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32.2.1G

A Shared Solution for Future Livability and Mobility in West Davis and Weber Counties:
An Alternative to the West Davis Highway

Roger Borgenicht and Ann Floor, Co-Chairs Utahns for Better Transportation

Major Tasks and Approach
Aug. 30, 2013

Executive Summary

Objective: To satisfy UDOT's Purpose and Need without a freeway, and also create vibrant places that communities will value more than the proposed freeway.

Strategy 1, Innovative Intersections:
Eliminating left-turn phases can be cheaper, safer, and more effective than widening arterials

- Create concept sketches of opportunities at potentially dozens of locations.
- Conduct fatal flaw analysis, refinement, cost estimation
- Micro-simulate to determine Level of Service, congestion relief

Strategy 2, 7D Boulevard Communities and Activity Centers:
Density, Diversity, Design, Destinations, Distance to Transit, Demographics, and Demand Management all play a role in reducing Vehicle Miles Traveled and creating great places where walking is commonplace, transit is attractive, and short drives replace long commutes.

- Create 7D projects that support WFRC's Wasatch Choice for 2040 vision
- Invest in non-vehicle Complete Street right-of-way and amenities.
- Artistic renderings of results, sufficient to estimate impacts and communicate benefits.

Strategy 3, High Frequency, High Visibility, Low Cost Transit Circulators:
Transit is usually for long trips, but people will use shuttles between FrontRunner and Activity Centers, as well as for circulation within Centers, as long as it is frequent, free, fast, familiar, focused, and fun.

- Identify circulation routes, attributes, ridership strategies, and cost minimization strategies, aiming for both impressive boardings per mile, and low costs per new rider
- Convert ridership gains to congestion reduction benefits; identify funding strategies

Other Strategies

- I-15 ramp metering and demand management
- Attract more jobs so there is less need to travel to Salt Lake
- Sequencing—build things in the right order, for maximum effectiveness

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Approach: Develop Shared Solution iteratively, selecting small projects with the most bang for the buck. Work in conjunction with experts and stakeholders primarily responsible for Shared Solution ideas.

Shared Solution Task List

Background

The Shared Solution includes a wide array of strategies that when combined, should add up to an effective means of satisfying purpose and need, ideally with lower costs and more positive than negative impacts. If in the end the Shared Solution has impacts in some categories, it may still prove viable and preferred by communities and stakeholders. Why? It will have significant congestion relief benefits, but also community-building and economic development benefits that the freeway solution lacks. It is these very other benefits, generally overlooked in the DEIS, that could result in communities and other stakeholders surmising that the overall benefits more than compensate for the impacts.

But it is not clear to many stakeholders who are interested in a thorough investigation of a non-freeway solution the extent to which UDOT has attempted to create a truly competitive non-freeway alternative. For example, UDOT tried an arterial widening alternative. They found that a general widening of many arterials would in fact reduce congestion significantly – even more so than the freeway itself – thus meeting purpose and need better than the freeway. But such indiscriminate widening (often widening streets that the model saw no need to widen) would also negatively impact far more adjacent properties, and would have virtually no landscaping or pedestrian amenities. With massive impacts and no community-building benefits, communities obviously agreed that a freeway solution was preferable over this rendition of an arterial widening solution.

But arterial widening can be better defined and more appealing than this. Some locations need widening more than others, and strategies such as innovative intersections create similar congestion relief benefits as widening, but with a lot less destruction. Other strategies, such as transit and connectivity, also have great opportunities for refinement to help them be both more effective and less costly and destructive. Small actions are also less disruptive and less expensive, so there is room to aggregate many together to form a Shared Solution. They then may have a strong aggregate effect on congestion not unlike the proposed freeway, but also prove more desirable due to other measures of effectiveness, besides just congestion relief.

We believe the bottom line is that communities have reluctantly supported the DEIS preferred solution because they have not yet seen a good-faith effort to develop an attractive non-freeway solution. When such an effort is finally made, it may well prove to be the preferred, least damaging, practicable alternative.

Context and Theme for Developing and Analyzing the Shared Solution

The Clean Water Act requires that when a significant amount of wetlands will be damaged by the proposed alternative, the sponsoring agencies must select the least damaging practicable alternative that meets their purpose and need.

Given the concerns of a large number of citizens who do not want the freeway and are not convinced it is necessary, as well as the requirement of conclusively demonstrating that there is no practicable

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alternative to the freeway, it is incumbent upon UDOT to truly demonstrate that they will make a serious effort to develop the best non-freeway alternative that can be developed. Our review of the DEIS leads us to believe no such serious attempt has yet been made, but many experts assure us that such an alternative can be developed, and if properly analyzed should result in something impressive for both congestion relief and acceptable impacts.

At present, our proposed Shared Solution has several specific categories of investigation, but within those categories actual project proposals and analysis methods are still largely undetermined. This document outlines what we see as important steps for both developing and analyzing a Shared Solution, but not necessarily a comprehensive list. Other potential strategies, analytical methods, and project refinements will likely emerge through the process, just as occurred during the process of arriving at the currently preferred freeway alternative.

Developing the Shared Solution should be approached as if avoiding the freeway and associated impacts to homes, wetlands, farms, etc., were the preferred idea in the first place. The freeway then becomes a secondary fallback if efforts to avoid it prove ineffective or unpopular. That way the development and analysis team will be more likely to approach each idea as if it might actually be a good idea, and hence put respectable effort into making each element into the best that they can.

Shared Solution Iterative Development & Analysis

1. Review the universe of non-freeway project types, policies, and operational management strategies that can in theory reduce congestion, even if just by a seemingly small amount.
2. Consult with experts well known for their knowledge of a given strategy to determine the potential costs, benefits, and impacts of each strategy.
3. Ask their opinion on best practice approaches for evaluating costs, benefits, and impacts in an apples-to-apples manner vs. the preferred alternative.
4. To the extent that a potential element in the Shared Solution might have other benefits not specifically sought for in the Purpose and Need, determine best practice methods of quantifying these other benefits for purposes of full disclosure of impacts (i.e., incidental benefits are positive impacts that need to be disclosed in an Environmental Impact Statement). This way communities and stakeholders can understand and appreciate both primary and secondary positive impacts just as they are informed of both primary and secondary negative impacts.
5. Secondary benefits, or impacts, of the Preferred Alternative that are not specifically sought for in the Purpose and Need should also be identified for consistency.
6. In light of expert opinions on evaluation strategies for all potential elements, both freeway and non-freeway, agree upon a general methodological approach for determining both positive contributions and negative impacts of each element.
7. From the universe of non-freeway general elements, identify as many specific project opportunities as possible. From the resulting projects list, select elements for inclusion in the 1st iteration of the Shared Solution based on a "low-hanging fruit" approach – i.e. project ideas likely to result in the most congestion relief, for the least amount of money/impacts, and with the strongest likelihood of community support would be added first.

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8. The cutoff for a project's inclusion in the first iteration Shared Solution is when the initial guess at the sum total cost of Shared Solution projects exceeds the cost of the DEIS Preferred Alternative, then remaining project ideas must wait for another iteration before further consideration.
9. Once first iteration projects are on the table, those projects can be more methodically evaluated to determine likely congestion relief, likely right-of-way (ROW) impacts, and a refined cost range. If a first iteration project seemingly would have significant congestion relief, but appears to have serious or maybe even fatal flaws, some effort should be made to correct its flaws or lower its costs in an acceptable way (i.e. don't just throw it out at the first obstacle).
10. The effects of each project might be classified according to the following five categories (potentially others?):
    a. Primary positive benefits: those specifically sought for by the Purpose and Need
    b. Secondary positive benefits: side-effect benefits, and also benefits intentionally sought after in order to help the project fit in better with UDOT's four strategic goals, or to make the project more palatable to affected communities and more in harmony with the Wasatch Choice for 2040.
    c. Primary negative impacts: As traditionally defined by NEPA—acres of wetlands consumed, acres of new right-of-way, number and nature of directly affected properties, etc.
    d. Secondary negative impacts: As traditionally defined by NEPA—air quality, sound, induced demand, land use affects, etc.
    e. Costs: What is a likely range for the overall price tag of the projects?
11. With a project's first iteration effects known in each of these categories, it is easy to rank projects according to weights placed on each of the five categories by a Steering Committee.
12. Projects with high negatives relative to positives should be assessed. Can negatives be minimized in some way to make the project attractive? If not, these projects could be excluded from the second iteration.
13. At the end of an iteration, the sum total of all categories can be compared against the sum total of the same categories for the preferred alternative. The ranking criteria used to screen small projects for the Shared Solution may also be used to evaluate the Preferred Alternative against the sum total of individual non-freeway projects as a single Shared Solution.
14. If first iteration costs were less than initially assumed, or if some project ideas fall off the list of attractive elements for the Shared Solution, then other project ideas previously passed over, or spin-off ideas that have occurred since the first iteration, could be evaluated and ranked to determine their attractiveness for inclusion in the second iteration.
15. If first iteration costs were more than initially assumed, which individual projects can have their scope scaled back without losing too much of the primary and secondary benefits that made it attractive in the first place? Which projects should be dropped from the second iteration?

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16. Use two or maybe three iterations for a fully developed Shared Solution, complete with a fair estimate of each individual project's benefits, costs, and impacts, to see how well the sum of the parts meets purpose and need, and stacks up as a practicable alternative to the preferred alternative. If it appears competitive, or at least has many attractive, competitive elements, it can then be advanced through any remaining required NEPA analysis and public input, to determine if it can emerge as the new Preferred Alternative.

Even if the Shared Solution can be shown to be technically superior to the Freeway Solution, the public, stakeholders, communities, and agencies may still reject certain projects or elements that were proposed for the Shared Solution for political or other reasons. If this "Partial Shared Solution" occurs to an extent that would render the Shared Solution ineffective at meeting the Purpose and Need, then perhaps a hybrid solution could be created, whereby the most effective and popular elements of the Shared Solution are sequenced first, while a highway corridor, perhaps of lesser width and design criteria, is preserved to be implemented last, if the next generation determines it to be useful at that time.

Or even if enough of the full Shared Solution is embraced by the public, sufficient that it would be an effective replacement for the freeway, the public may still desire to preserve the option to build something someday within the freeway alignment, but defer to the next generation to decide if a roadway be built at all, and if so, whether it should it be a full freeway or something else. That case seemingly would produce a similar outcome, where non-freeway elements are sequenced first, along with corridor preservation, but roadway construction within the corridor is intentionally required to be after 2040 so that the next generation can determine its value at that point.

Innovative Intersections Development & Analysis

An "Innovative Intersection" is a general term used to describe any intersection strategy that is able to eliminate left-turn phases from a major intersection by handling lefts in some other way than traditional left-turn pockets and arrows. The result in every case is greater efficiency, which translates into more capacity and less delay given the same number of approach lanes. We anticipate that Innovative Intersections will be a significant element of the emerging Shared Solution. Designs that are more compatible with multi-modal environments should be top priority, reverting secondarily to the more auto-oriented solutions. Here are the general steps involved in developing and analyzing locations for these designs.

1. Locate all signals in the study area that have, or are likely to have, dedicated left-turn phases.
2. Are any of these locations failing now? Would the default traffic forecast cause them to fail? Is the location within a designated Activity Center or Boulevard Community? If so, would the growth potential of that area cause intersections to fail?
3. For candidate locations, study each situation. Create concept sketches for Quadrants, Town Center Intersections, and Bowties, which are all highly compatible with mixed-use, multi-modal environments. If preferred concepts won't work, move on to continuous flow intersections (CFI), Super Streets, Thru-Turns, etc., which all reduce congestion, but are less compatible with multi-modal environments.
4. Initial concept sketches can be as simple as drawing lines with a felt-tipped pen or in Google Earth, meant only to prompt operational and design engineers to think about the implications,

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looking for flaws and for ways to correct the flaws, and communicating their thoughts back to the concept originators to see if together they can find workable solutions or not.

5. Feasible concepts should be micro-simulated, to determine congestion relief. A software modeling program such as Synchro can probably be used most of the time (Synchro is much less time consuming than complex software like Vissim). While it is difficult to truly model many designs in Synchro, there are still good ways to use it for approximating benefits, such as removing lefts completely from the intersection (Quadrants and CFIs), or routing them as throughs, then rights (Bowties, Thru-Turns).
6. There are also strategies for approximating benefits within the WFRC model. That model is not well suited to the task of evaluating Innovative Intersections (nor of evaluating many other Shared Solution strategies). But it is a convenient means of summing area-wide benefits. Still, some thought should be invested into determining congestion-relief benefits of all Shared Solution strategies, and totaling those benefits individually to compare against the benefits of the Preferred Solution. If the WFRC model is used for cross-comparison of alternatives, then effort should be made to ensure that the model can adequately account for delay reductions of Shared Solution proposals.

7D Boulevard Communities and Activity Centers

Boulevard Communities and Activity Centers use "7D Place-Making" strategies for bringing lively prosperity, renewed economic development, and catalyzing major private investment into the designated area. Concepts can be applied to new developments, such as Daybreak in South Jordan, but more commonly they are applied to aging and hap-hazard commercial areas that decades ago were new and lively, but have since plateaued or stagnated. There are many major benefits of such 7D Places—transportation benefits are significant, but not necessarily the most important. Transportation benefits include incidence of walking, biking, and transit—especially valuable for youth and the emerging wave of seniors who may not want to drive much, or shouldn't drive much. Reduced Vehicle Miles of Travel (VMT), and reduced Vehicle Hours of Travel (VHT) are also likely.

Delay and congestion may still exist within these Centers—there is a lot of activity packed into a fairly small space, after all. But with good connectivity, innovative intersections, and transit circulation, delay can be minimized. Reduced delay, as measured by traffic engineers is not necessarily an ideal goal anyway, but it is what UDOT has set as a primary target in this DEIS. Would you rather have to travel 40 miles in 40 minutes on freeways to your job in Salt Lake with zero delay, or travel three miles in 10 minutes down beautiful arterial streets, experiencing 2-minutes of delay? The latter has more "delay," but also takes a lot less time. Isn't that better? Not by the math that engineers often use to rank projects. This "shorter trip" scenario is more possible when 7D Activity Centers emerge, and thus are locally able to provide goods, services, and high-paying jobs that otherwise you'd have to travel huge distances to reach.

We request that the Purpose and Need of the DEIS be revisited to include other performance measures in the target. If not, then such measures of beneficial impacts should at least be disclosed and included in weighting criteria for selection of a preferred alternative. The 7Ds are summarized below, after which is an outline for how to encourage the creation and success of such "Places."

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What are the 7Ds?

1. **Density**—as an activity center increases in density, VMT per capita decreases. When there are more things close together, you are more likely to walk, bike, or ride transit. Or if you do drive, it is more likely to be a short drive.
2. **Diversity**—When most houses are in Davis County, and most jobs, entertainment, and many necessary items are in Salt Lake, the result is an extreme lack of diversity that induces more driving. But if the business districts of Layton, Clearfield, and other West Davis business corridors can be diversified with their regional fair share of quality retail, office, entertainment, premium condominiums, and a general diversity of uses, many people will end up very close to goods and services they need.
3. **Design**—If the local street system within an Activity Center has more connections (less circuitous and fewer cul-de-sacs), it will be easier for more people to use transit, or to walk, bike, or take short drives. Also, Complete Street design features such as large-canopy trees, on-street diagonal parking, planted medians with pedestrian refuge, street furniture, wall-to-wall ground-floor retail with mixed uses on upper floors—all of these things create market momentum that results in fantastic, walkable places over the years.
4. **Destinations**—Part of what helps define a Place or an Activity Center, is that it has lots of great jobs, great shopping, and great entertainment—popular destinations that attract people from all the surrounding neighborhoods. Transit then has a target to aim for, and there is less need to drive far if great destinations are close by.
5. **Distance to Transit**—It does little good to build expensive transit infrastructure, and then put used car lots and gas stations as the first uses next to transit stations. People use transit if transit is close, so communities are wise to adopt minimum zoning standards within a quarter mile of a transit station (such as at least 40 units per acre if residential, or at least four-story office buildings with ground-floor retail, if commercial). Free, frequent transit shuttles can act as "moving sidewalks"—extending the reach of regional transit, and making it easier to circulate within the Center without a car. For more square footage near transit, it is also good to relax or eliminate parking standards (perhaps in trade for something). Developers know they must provide adequate parking anyway, even in transit-oriented areas, so why force them to install empty spaces? High density doesn't have to mean cheap, problematic apartments that degenerate quickly. Form-based zoning can require all buildings in the area to meet a certain architectural and quality standard.
6. **Demographics**—Many people want to live in higher density, walkable, mixed-use areas where they can take transit and won't have to drive as much—growing numbers of seniors need to, and many who are not yet raising families want to. But if the only quality places available are single family homes designed for raising kids, they'll end up in those even if they'd prefer something else. If we design Activity Centers with our changing demographics in mind, then our parents and children can stay close by and need not contribute to congestion, and the elderly can avoid "white-knuckle" driving conditions.
7. **Demand Management**—When vehicle demand is too high, we have three options: 1) Increase supply to match demand, usually by widening roadways; 2) Manage demand to available supply,

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by making it easy and desirable to choose something else; and 3) just accept the misery (which by default limits demand to supply, but in an unhappy way). If widening isn't an attractive option, there are a number of policies such as helping transit get out of congestion, installing paid-parking in specific locations, congestion pricing, and aggressive ramp metering that can give people incentives and options to avoid contributing to the problem.

Making 7D Boulevards & Centers Part of the Shared Solution

1. For study area locations that are shown on WFRC's Wasatch Choice for 2040, identify important locations for improved bikeways, on-street diagonal parking with frontage access roads, sidewalk bulb-outs into intersections, planted medians, greater connectivity, and quality transit stops. Also identify potential transit shuttle circulation routes and frequencies.
2. Rate parcels in the general vicinity based on likelihood or desirability of potential change. Invite city officials to participate in the rating. Some locations, such as single-family homes, will be unlikely to intensify regardless of the investments. Vacant parcels or struggling commercial may be very desirable to change and intensify.
3. Lay out potential locations in SketchUp (computer design program) for two purposes: 1) allows impacts from needed right-of-way to be determined and compared with the desirability of change parcel map, to reflect that some impacts and resulting changes may not be so onerous, if changes are desirable anyway; 2) allows affected communities and stakeholders to envision the potential outcome and see the affected right-of-way slivers in order to have an informed opinion on the tradeoffs.
4. Work in conjunction with operational and design engineers. 7D features would often be included as part of Innovative Intersection proposals, so engineers should review Complete Street proposals for necessary adjustments.
5. Convene local/national 7D and economic development experts to weigh in on the range of potential market responses to the package of investments at the various sites. What mix and density of uses would probably occur? Would it attract new jobs and services that might otherwise end up elsewhere in the region or country? If 7D sites achieve the mid-range of potential market responses, what kind of affect would it have on VMT, VHT, Congestion, Delay, Walk/Bike trips, Transit Ridership, Farmland consumption, and other measures of effectiveness? Would it have a positive or negative outcome on a municipality's balance between tax receipts and required expenditures?
6. The Shared Solution should dedicate funds to assist communities with creating form-based code development in key locations, and with funds for planning the architectural and operational layout of a Complete Street plan that will work well for each situation.

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Why include 7D Centers in the Shared Solution?

Many and perhaps most of the benefits of 7D Boulevards and Centers are found in performance measures outside of just congestion relief. So why spend money and create impacts to get Complete Streets when the benefits may have only marginal effectiveness for the official purpose and need of reducing auto congestion?

Because reducing auto congestion is only part of what citizens care about. We believe they also care about a legacy of beautiful, livable corridors with thriving businesses, healthy lifestyles, reduced consumption of farms and wildlife, and a wider array of mobility options for all citizens—especially for the growing numbers who cannot drive safely in white-knuckle, high-speed conditions.

Thought Experiment

Suppose the end result of the Shared Solution is that it meets Purpose and Need in that it reduces VMT in congestion by an impressive amount, but say that amount is only 80% of the level that the DEIS freeway achieves for this primary objective.

But suppose that on secondary objectives the Shared Solution will achieve far better results for economic development, multi-modal usage, reduced farmland and wetland consumption, and property impacts that are usually in harmony with desired redevelopment anyway.

Is it then correct to conclude that the freeway should be preferred over the Shared Solution because it was slightly better at achieving a narrowly defined purpose and need? We contend that both solutions should be presented to the communities that have to live with the result to see what weight they place not only on benefits directly included in purpose and need, but also other beneficial side-effects of each scenario. In this case, they may well favor the Shared Solution, because a healthy, thriving community is about more than simply reducing congestion.

Crafting a solution with Complete Streets that is in harmony with the Wasatch Choice for 2040 is an essential element of presenting the public with an alternative vision. That way, the non-freeway alternative may well prove to be the least damaging practicable alternative—practicable because communities decide beautiful, multi-modal streets are the future they'd rather have, even if only 80 percent as effective at reducing congestion.

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WEST DAVIS CORRIDOR

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High Frequency, High Visibility, Low Cost Transit Circulators

Why do so few people ride regular buses? Many reasons, but a significant reason is unfamiliarity with the system. People see buses here and there, but few know where they came from or where they are going unless they actively seek out the route map and schedule. Part of the reason light rail and Bus Rapid Transit gets good ridership is because the vehicles are unique, and there is a visible track. Virtually everyone passively knows the path, and can then easily elect to use it for trips along that path.

But these systems require dedicated right-of-way and expensive construction, which makes them poor investments unless they can offset the costs by attracting huge numbers of riders. UDOT and UTA have already determined that the cost and impacts of dedicated right of way and construction for either light rail or BRT is inappropriate at this moment.

Dedicated right-of-way creates visibility and speed advantage, but there are other very low cost strategies that create great visibility and speed advantages as well. These strategies will work even better when supported by WFRC's Boulevard Community and Urban Center land use visions.

7D Activity Centers generate a lot of internal trips. Many will be walking and biking, and if not that then short drives, but if there is too much need to drive then streets will be excessively congested. People will be willing to ride transit shuttles for short trips, if the trip is low-cost or free, the wait time is not excessive, and generally incorporates strategies for attracting high-ridership at a low cost. Circulators can also help reduce regional and I-15 congestion, by connecting more people to FrontRunner and other UTA services. With strategies like queue jumping, branding, and HOV lanes at peak hours, circulators can achieve impressive ridership with very low capital investment, thus helping them achieve good cost per new rider ratios potentially more impressive than either light-rail or BRT, and thus making them highly competitive for federal funds and attractive as another great UTA-UDOT joint project.

Steps involved in making Transit Circulation Part of the Shared Solution

1. Identify potential circulation routes, aiming to connect FrontRunner to the action primarily at Freeport, Layton, Main Street, and Hill AFB.
2. Determine service attributes for two target markets – those connecting to FrontRunner and other UTA routes, and those desiring only to circulate within the Activity Center itself.
3. Determine a branding strategy that will increase the likelihood that citizens will become passively aware of the origins and destinations connected by the circulators.
4. Determine appropriate vehicles—smaller, more nimble, efficient shuttles can carry more people than full-sized buses, if those shuttles are coming by more frequently.
5. Determine appropriate phasing—on one hand, circulation within Activity Centers will be more widely used in later phases when the market has successfully transitioned to a 7D place, but on the other hand the presence of good circulation early can help catalyze such 7D places.
6. Determine likely ridership. Because this type of transit has never really existed on the Wasatch Front, the WFRC model may not be adequate for predicting ridership. Estimates may need to be created or supplemented by 7D or other evaluation strategies. The 2012 Travel Study results should be incorporated into evaluation strategies.
7. Convert ridership gains into equivalent congestion reduction benefits.

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8. Determine funding strategies—will costs per new rider be impressive enough for UTA and federal funds? Are there other strategies to make up any shortfalls in costs?

A primer called "Making Buses More Like Trains" is available at MetroAnalytics.com in the Downloads section, which would form much of the basis for our ideas on devising popular-yet-affordable transit. An excellent video of Boulder, Colorado's hop-skip-and-jump routes can be seen at http://vimeo.com/12472216. Boulder's system shares many aspects with the circulation strategy described here, and highlights the low-cost, high-ridership gains that are possible.

Making I-15 More Efficient:
Aggressive Ramp Metering & Demand Management

Free = Parking Lot – Free freeways are a long-standing American tradition – especially in the West. Who hasn't loved the ability to travel long distances very quickly? But like free food at a grand-opening, the resulting huge demand and long lines leave many concluding they'd have been better off to just buy lunch. Free roads are great while they last, but the entitlement of providing everyone who wants it with a 5 p.m. space on the freeway becomes so expensive, that everyone simply ends up "entitled" to be equally miserable on a multi-billion-dollar parking lot, because it's too hard to build our way out of congestion one more time.

Managing freeways is technically easy, *politically difficult*, but pays!—Expanding freeways is politically popular, partly because it is how things have always been done. Everyone hates freeway congestion and the obvious way to reduce it is to make more and bigger freeways. But it is getting so expensive it would be wise to at least consider other options. Society usually instructs engineers to increase supply, but it is relatively simple for engineers to instead devise systems where demand will not exceed existing supply. You simply require people to pay something, either with their money or their time, to have access to the freeway at 5:00 pm, and you improve their options for avoiding the freeway.

That encourages just enough people to do something else—take transit, car pool, travel before or after peak times, or stay on arterial streets if their trip is relatively short. And it not only starts delivering revenue that can be used for alternatives, it also helps recover billions of dollars of value from existing infrastructure. How? Whenever freeways collapse to stop-and-go because demand exceeds supply, their throughput drops by about 30 percent. That means we have 100 percent efficiency at 3 p.m. when there is only 70 percent demand, but sadly we also have just 70 percent efficiency at 5 p.m. when there is 100 percent demand. Or in other words, if we spent $3 billion for the freeway like I-15, we lose $1 billion of its value when we inadvertently allow it to fail—not to mention the billions in lost productivity.

So why is congestion pricing politically difficult? Largely because it seems like a tax increase, but it's really just selling a service to those who are able and willing to pay, just like any business would do. It is less about the revenue, and more about ensuring maximum value from the money we already spent – asset management. It is also politically challenging partly because paying for freeways in this fashion is not part of our Western tradition. It takes a long time for enough people to appreciate the benefits of managing freeways through our long-standing business traditions. It is challenging to raise awareness of benefits, but does that mean we shouldn't try?

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Paying with Time—Aggressive Metering—Is it possible to reduce congestion on I-15 without adding capacity, and without congestion pricing? Yes, by requiring people to pay for their 5 p.m. slot on the freeway with their time instead of their money. If on-ramps are widened to 2, 3, or 4+ lanes, then people can wait in line for the ramp meter to let them on without stacking back so far that they'd impede traffic on the arterial cross-street. It turns out that in many cases, spending more time waiting to get on the freeway actually saves time. How so? With the existing system, you get on the freeway quickly, but then lose 20 minutes stuck in stop-and-go traffic. With aggressive metering, you might spend 4-6 minutes waiting to get on, but then it is 65 mph all the way. So you save time, even if the up-front time was painful.

But skeptics ask, "Wouldn't that make a lot of people move over to parallel arterials, congesting those?" Yes, it would encourage people making short trips to stay off the freeway. That is good because freeways aren't designed for short trips. But on the flip-side, there are already a lot of other drivers on arterials because they couldn't fit on the freeway. Since the freeway can move 30 percent more traffic at 60 mph than at 30 mph, a system that ensures 60 mph will have more overall capacity, and will bring many back to the freeway. The net effect is that more come back to the freeway than spill over to arterials, so both arterials and the freeway are less congested. We believe people will be willing to spend five minutes on the ramp if they come to understand they can save 20 minutes on the mainline.

Paying with Money—In addition, you can also make a way for people to avoid spending their time on the ramps if they car pool or are willing to spend a dollar or so to bypass the ramp meters. Transponder towers on the ramps automatically add a few cents to a bill you receive at the end of the month, making it possible for anyone willing to pay to have a guaranteed 60 mph 5 p.m. slot on the freeway without having to wait in line.

Economic Boon?—Time is money, and high-value business activities should be willing to pay a little when they come to appreciate just how much they are saving in time. If Utah adopted this strategy, it would create a competitive advantage over other states. Managing access to the freeway via extra time on the ramp or bypassing the ramp with HOV and/or tolled access helps motivate many people to take transit, alternative routes, or travel at less congested times.

Lexus Lanes?—Critics would say, "Congestion pricing unfairly burdens blue-collar families by creating Lexus Lanes." Those blue-collar families would indeed be more likely to stay off the freeway at 5 p.m.: transit, alternative routes, travel at other times, or just wait on the extra-wide ramp rather than pay the bypass fee. They might even move closer to their job, or take a new job closer to home. Most people end up saving time, so it's hard to argue they're worse off even if they choose to wait their turn at the meter.

Can we attract great businesses?—So is it true that making a way for people to tax themselves in trade for fast freeway travel will result in "Lexus Lanes?" Probably a little—the people most willing to tax themselves will usually be the people with the most money. But what's wrong with providing the best service to those most willing to pay? Every American business does it. It is simply a wise way to manage a limited resource. Utah consistently ranks among the most business-savvy states. Imagine how attractive it will look if we can say to wealthy entrepreneurs seeking to relocate their high-paying jobs, "We've got beautiful, uncongested, pedestrian friendly streets, excellent transit circulation, and for a

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few bucks we can also guarantee that you can use your car to get anywhere you need to go at 65 mph, 24-7—facts that exist in no other large city in the world."

I-15 Management: Steps for Inclusion in the Shared Solution

1. As I-15 management will likely be politically less popular than other aspects of the Shared Solution, first see how well Purpose and Need is addressed by other parts of the Shared Solution.
2. If there is still a need, identify study-area segments of I-15 that are failing, and identify key on-ramps that could be widened for more aggressive peak-hour storage and metering, to prevent those segments from failing.
3. Provide digital signs of ramp wait times at on-ramp decision points so that people can decide whether to wait on the ramp, take an alternative route, or just go shopping another hour until congestion clears up.
4. Evaluate Shared Solution's effectiveness as an alternative to I-15: Are innovative intersection strategies improving the ability for short-trips to avoid I-15? Are transit circulation strategies improving the number of people who have good access to FrontRunner? How does traffic screenline capacity compare with demand?
5. Determine the new amount of VMT that would occur in congestion. Ramps will be more congested, but overall VMT in congestion and resulting delay should go down considerably. The WFRC model could potentially be used for this exercise, as well as other evaluation techniques to be determined by a group of technical experts.
6. What are the economic benefits and social costs of the proposed strategy?
7. If it is an effective and important aspect of the Shared Solution, develop informational materials, videos, etc. so that people can quickly and easily comprehend the pros and cons of the I-15 Demand Management strategy. Introduce such pros/cons as part of public educational outreach.

Attracting Jobs as a Congestion Management Strategy?

Where jobs choose to locate seems at first glance to have little to do with the features of our transportation infrastructure, but in reality job location is greatly affected. Why are there relatively few jobs in Davis County? Largely because it has always been fast and easy to get to Salt Lake. The West Davis Freeway will continue to make it fast and easy to work in Salt Lake, and that will continue the pattern of encouraging businesses that may have come to Weber/Davis to instead end up in Salt Lake, just as they always have. Lack of jobs creates heavy and imbalanced freeway usage (congestion). If there is more resistance in getting to Salt Lake (either by congestion or congestion pricing), then instead of us going to far away jobs, jobs will come closer to us. This is a known contributing factor in the development of "Edge Cities." The Layton/Clearfield area is perfectly positioned to emerge as an Edge City, and it will do so faster when businesses come to us because we chose to invest in more sustainable, local congestion relief rather than short-lived freeway congestion relief.

With the freeway, over time the result will be tens of thousands of additional residents dependent on getting to Salt Lake, and eventually the freeways won't be able to accommodate them anymore. But a

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good focus on creating beautiful and excellent multi-modal mobility in support of our existing and emerging Activity Centers will result in a lot more jobs coming to those centers. Many more residents will then be able to work, shop, and play much closer to home. Not only is that a good thing for building up existing communities, but it will also have a side benefit of reducing Vehicle-Miles Traveled, and subsequent congestion on I-15. The Shared Solution and 7D Activity Centers should result in far more jobs within the study area. Those very jobs reduce the need to travel to Salt Lake, and the Shared Solution should get credit for the resulting transportation benefits, both within and outside of the study area.

1. Estimate the number of new jobs likely to be attracted to Weber/Davis from Salt Lake and even from other states – perhaps using land-use/economic modeling programs such as UrbanSim, TREDIS, and/or a Delphi panel of experts.
2. Once new jobs are determined, test the results within the WFRC model and with the 7D methodology to then see what the analytical tools say about resulting overall congestion. Reductions within the Study Area can be counted toward Purpose and Need. Reductions outside the study area should be disclosed as a beneficial side-effect, and counted as part of the ranking strategy that considers other measures of effectiveness outside of those sought for specifically by the purpose and need.

Localized economic development may be able to kill two birds with one stone – supporting the local economy, which in turn reduces regional congestion. That's a lot fewer birds killed than the freeway alternatives. ☺

Study Area

UDOT's goal is to reduce congestion generally in the most effective and palatable way possible. Whether those reductions occur on I-15 or on arterials is irrelevant for alternatives analysis. So far, UDOT has concluded that the best bang for the buck is the new freeway, which reduces delay on I-15 indirectly via diversion, but does almost nothing for arterial streets. The Shared Solution focuses first on the arterial streets themselves. Many arterials, such as Hill Field Road and Antelope Drive, are substandard experiences today, let alone in 2040. Other aspects that might be included in the Shared Solution would also reduce delay on I-15 itself by managing access to I-15, and by reducing the incentive and need to travel to Salt Lake. Thus the Shared Solution is more holistic in its congestion reduction approach, and benefits will accrue far beyond the study area.

The arterial congestion in northern Davis County is on both the west and east side of I-15. The largest single Activity Center shown in the Wasatch Choice for 2040 vision is centered in the Layton commercial areas, which span both sides of I-15. Because the Shared Solution primarily aims first at reducing arterial congestion in support of community and economic development consistent with the Wasatch Choice, it will have benefits on both sides of I-15. The existing study area of the DEIS is west of I-15, and includes I-15. It does not include any areas east of I-15 because the proposed action, a western freeway, was not expected to have much effect on anything east of I-15.

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1. Because there are significant effects of the Shared Solution on the east side of I-15, the study area should include those areas.
2. Revisit the Study Area only for purposes of comparing direct effects of the Preferred Alternative to the Shared Solution.
3. Also compare regional effects of both, but more for informational disclosure than for comparing benefits related to purpose and need in the study area.

The Future is Changing – Addressing Shared Solution Sequencing

The WFRC model used by UDOT for this study relies on survey data acquired in 1992 – 21 years ago. This inherently assumes that the nature of people in 2040, and the technologies they have available then, will be largely the same as it was nearly 50-years earlier. The model has no knowledge of the higher proportion of seniors between 1992 and 2040. It does not understand their needs and desired modes of travel. It likewise does not know about how wireless and computer technology has affected and will yet affect travel – a large and growing share of the workforce rarely leaves their home. Yet the models used to justify the DEIS preferred alternative assume 2040 will be just like 1992.

The desire and willingness to walk, bike, and take transit is increasing all the time, and the model may well be under estimating the 2040 impact of alternative modes. Driverless cars are proving successful, and may soon be legal in some states—a technology with potential to nearly double capacity of existing freeway lanes. Even congestion pricing, a challenging political sell at the moment, but a potential aspect of the Shared Solution as we get closer to 2040, could easily become commonplace and widely accepted in urban areas nationwide by 2040. Why? As more and more cash strapped regions discover that they simply cannot afford mega-billion Big Dig solutions to congestion, they will also start recognizing that pricing can eliminate congestion better than Big Digs. Plus they'll make money at the same time with user fees, and gain economic efficiencies and competitive advantages through restored mobility – true win-win.

Sequencing

An important aspect of the Shared Solution is determining appropriate sequencing of its elements. The approach recommended herein anticipates that there will never be a need for a freeway in the West Davis corridor. However, the public may still find it wise to preserve land to keep future options open—thus enabling a future generation to decide.

1. Identify all non-freeway projects that were cost-effective in their contribution to the purpose and need, had acceptable impacts (which sometimes could mean that positive resulting side-effects outweigh even large negative impacts in the public mind), and were generally found to be favorable when presented to public and agency stakeholders.
2. Then with non-freeway elements identified, sequence them based on their ability to address existing congestion, and their likelihood of helping the region and communities achieve their land use and economic development objectives.
3. If a roadway corridor is to be preserved, enable preservation purchases and activities to occur immediately, but require that roadway construction itself be denied until either: 1) a certain

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share of other aspects of the Shared Solution have been implemented; and/or 2) an agreed upon year has been reached.

Will a West Davis highway be helpful in 2100 when Utah has 10 million people rather than today's nearly 3-million? Maybe so, and for that reason alone preserving space may be wise. It is hard to make a solid case that the West Davis Freeway is needed today, but easier to make a case that it might someday be needed, or at least that a corridor could be preserved for a future generation to decide what to do with it. This sequencing exercise can help ensure that non-freeway elements of the Shared Solution will gain the time they need to help catalyze the Wasatch Choice Activity Centers, and will help ensure that the fast-changing needs of our society can be addressed at appropriate times without eliminating options.

Shared Solution vs. Preferred Alternative, Comparisons and Analysis

Any development and analysis of a new alternative also implies comparisons with the preferred alternative. In many cases, this will require generating new data about the preferred alternative that may not have been generated before. It also could require regenerating existing statistics, if the study area is expanded to include effects just east of I-15, or for other reasons.

It is also critical for public awareness to show the pros and cons of both concepts side by side, so they can have an informed opinion of the differences.

Funding the Shared Solution

To satisfy stakeholders and resource agencies that they've done everything in their power to create a less damaging, practicable alternative to the freeway, UDOT ideally will fund both the development and analysis of the Shared Solution. While UDOT has expressed willingness to do this, they have also expressed reluctance to pay for our identified experts out of concern that it could set a precedent and later encourage anyone with any complaint to insist that UDOT pay for additional study from a never-ending array of "additional experts," at no cost to themselves. They say it is not the amount of money – they will incur similar costs whether the original Shared Solution inventors are at the table or not – but more the precedent.

We appreciate the predicament, but there is also an onerous predicament in not involving the inventors of the Shared Solution's general strategies. If citizen stakeholders must break their own piggy-banks, odds are they simply will not be able to raise enough funds to ensure Shared Solution inventors can be at the table in a meaningful way. Then citizens and resource agencies will worry that the best project ideas may still remain obscured. Why? How can the existing consultant team be trusted to refine the details of general ideas they know little about, as evidenced from the fact that they failed to see the opportunities in the first place? Thus there is a risk that UDOT will not have truly identified the least damaging practicable alternative if they cannot create a path for those experts most capable of the attempt to make their attempt.

Perhaps the best solution to this predicament is a "Shared-Solution" where we both share in the cost of outside experts. Perhaps if we could agree to a matching formula, that would insulate UDOT in the future from those who insist on never-ending outside experts, but have no "skin in the game" in hiring them. That way, if citizen stakeholders are willing to put skin in the game, then UDOT can leverage what

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they can raise to help ensure stakeholders feel well-represented in the development and defense of their ideas.

Shared cost is win-win, and solves both predicaments. It is a good investment that will create good will with a large group of concerned citizens. It ensures this alternative can be well articulated, detailed, and defended by those experts who have helped us all envision the possibilities in the first place. If UDOT "wins" by minimizing the Shared Solution inventor's role in development, then citizens and resource agencies lose. That could mean these stakeholders will then have no path to win, unless through court action – and that would be lose-lose for everyone.

This is Important

We believe a solid apples-to-apples comparison of the pros and cons of the Shared Solution, along with graphics and renderings aimed at assisting the public and officials to understand the two divergent futures, will be worth the effort given the magnitude of the effect on and cost to the entire region for generations to come.

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Exhibit D

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32.11.2A
32.11.4J
32.11.4G

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Atmospheric Chemistry and Physics

Short-term variation in near-highway air pollutant gradients on a winter morning

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Abstract. Quantification of exposure to traffic-related air pollutants near highways is hampered by incomplete knowledge of the scales of temporal variation of pollutant gradients. The goal of this study was to characterize short-term temporal variation of vehicular pollutant gradients within 200–400 m of a major highway (>150 000 vehicles/d). Monitoring was done near Interstate 93 in Somerville (Massachusetts) from 06:00 to 11:00 on 16 January 2008 using a mobile monitoring platform equipped with instruments that measured ultrafine and fine particles (6–1000 nm, particle number concentration (PNC)); particle-phase (>30 nm) NO_3^-, SO_4^{2-}, and organic compounds; volatile organic compounds (VOCs); and CO_2, NO, NO_2, and O_3. We observed rapid changes in pollutant gradients due to variations in highway traffic flow rate, wind speed, and surface boundary layer height. Before sunrise and peak traffic flow rates, downwind concentrations of particles, CO_2, NO, and NO_2 were highest within 100–250 m of the highway. After sunrise pollutant levels declined sharply (e.g., PNC and NO were more than halved) and the gradients became less pronounced as wind speed increased and the surface boundary layer rose allowing mixing with cleaner air aloft. The levels of aromatic VOCs and NO_3^-, SO_4^{2-} and organic aerosols were generally low throughout the morning, and their spatial and temporal variations were less pronounced compared to PNC and NO. O_3 levels increased throughout the morning due to mixing with O_3-enriched air aloft and were generally lowest near the highway reflecting reaction with NO. There was little if any evolution in the size distribution of 6–225 nm particles with distance from the highway. These results suggest that to improve the accuracy of exposure estimates to near-highway pollutants, short-term (e.g., hourly) temporal variations in pollutant gradients must be measured to reflect changes in traffic patterns and local meteorology.

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1 Introduction

Exposure to traffic-related air pollutants near highways is associated with adverse health effects including cardiopulmonary disease, asthma and reduced lung function (Brugge et al., 2007; Brunekreef et al., 1997; Gauderman et al., 2007; Hwang et al., 2005; McConnell et al., 2006; Nicolai et al., 2003; Van Vliet et al., 1997; Venn et al., 2001). These findings have motivated research to better understand the kinds and amounts of pollutants in the near-highway environment as well as the factors governing the temporal and spatial variations in pollutant concentrations. Much attention has been focused on ultrafine particles (UFP; diameter <100 nm) because they are more toxic per unit mass than particles with larger diameters (Dockery et al., 2007; Oberdörster et al., 1995). Studies have shown that concentrations of UFP as well as other primary vehicular emissions are elevated near highways but then decrease to background within several hundred meters primarily as a result of dilution (see Table 1). The factors that impact the magnitude and extent of these gradients include traffic conditions, temperature,

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Table 1. Summary of near-highway air pollution monitoring studies.

Study	Location; highway	Distance from highway (m)	Time and season of measurement	Vehicles counts[a]	Pollutants measured[b]
Zhu et al., 2002a	Los Angeles; I-710	17–300[c]	10:00–16:00; summer, fall	12 180 h^{-1}	UFP + FP (6–220 nm), BC, CO
Zhu et al., 2002b	Los Angeles; I-405	30–300[c]	10:30–16:00; spring, summer	13 900 h^{-1}	UFP + FP (6–220 nm), BC, CO
Zhu et al., 2004	Los Angeles; I-405 + I-710	30–300 (I-405); 17–300 (I-710)	10:00–16:00; winter	200–270 min^{-1} (I-405); 280–230 min^{-1} (I-710)	UFP + FP (6–220 nm), BC, CO
Zhu et al., 2006	Los Angeles; I-405	30–300 [c]	23:30-05:00; winter	20–70 min^{-1}	UFP + FP (6–220 nm), BC, CO
Hu et al., 2009	Santa Monica, CA; I-10	30–2600[c]	1–2 h before sunrise; winter, summer	715 5-min^{-1} (winter); 340 5-min^{-1} (summer)	UFP, $PM_{2.5}$, BC, CO, NO_x
Hagler et al., 2009	Raleigh, NC; I-440	20–300[c]	00:00-23:59; summer	125 000 d^{-1}	UFP + FP (20–1000 nm), $PM_{2.5}$, PM_{10}, BC, NO_x, CO
Beckerman et al., 2008	Toronto; Highway 401	0–1000	Continuous and peak daily traffic periods; summer	~400 000 d^{-1}	UFP + FP (10–2500 nm), $PM_{2.5}$, NO_x, NO_2, O_3, BC, VOCs
Kittleson et al., 2004	Minneapolis – St. Paul, MN; I-494, Hwy 62	0, 10, 700	13:00–17:00; fall	NR	UFP + FP (3–1000 nm), NO_x, CO_2, CO
Birmili et al., 2008	Berlin; Highway A100	4, 80, 400	Continuous; summer	180 000 d^{-1}	UFP + FP (10–500 nm),
Hitchins et al., 2000	Brisbane; Gateway Motorway + Wynnum Rd	15–375[c]	NR	2130–3400 h^{-1}	UFP, FP, + CP (15–20 000 nm), $PM_{2.5}$
Morawska et al., 1999	Brisbane; Southeast Freeway	10–210[c]	06:00–17:15; spring, summer	NR	UFP + FP (16–626 nm)
Gramotnev + Ristovski, 2004	Brisbane; Gateway Motorway + Wynnum Rd	25–307	11:00–15:00; spring	3700–5000 h^{-1}	UFP (4–163 nm)
Shi et al., 1999	Birmingham, UK; A38, A441	2–100[c]	12:02-18:24; winter	30 000 d^{-1}	UFP, FP, + CP (10–10 000 nm)
Roorda-Knape et al., 1998	South Holland, Netherlands; A4, A12, A13, A20	15–330[c]	NR	80 000–152 000 d^{-1}	$PM_{2.5}$, PM_{10}, BC, VOCs, NO_2
Kerminen et al., 2007	Helsinki; Highway Itävätylä	9, 65	00:00–12:00; winter	300–400 h^{-1} (night); ~3000 h^{-1} (morning)	UFP + FP (7–1020 nm)
Pirjola et al., 2006	Helsinki; Highway Itävätylä	0–140[c]	07:00–09:30, 15:00–18:30; winter, summer	40–70 min^{-1} (winter); 60–90 min^{-1} (summer)	UFP, FP, + CP (3–10 000 nm), NO_x, CO
This study	Somerville, MA; I-93	27–395[c]	06:00–11:00, winter	6020–8770 h^{-1}	UFP + FP (6–1000 nm), NO_x, CO_2, O_3, NO_3^-, SO_4^{2-}, organics

[a] As reported in the article cited. [b] UFP = ultrafine particles (<100 nm); FP = fine particles (100–2500 nm); CP = coarse particles (>2500 nm); $PM_{2.5}$ = mass of particles with aerodynamic diameter ≤2.5 μm; PM_{10} = mass of particles with aerodynamic diameter ≤10 μm; BC = black carbon; [c] Pollutant measurements were made along a transect(s) measured perpendicular to highway. NR = not reported.

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relative humidity, topography, wind direction and speed, atmospheric stability, and mixing height.

The effects of wind direction and speed on near-highway pollutant gradients have been demonstrated in several studies. For example, Beckerman et al. (2008) reported that UFP and NO_2 levels decreased to background within 300–500 m on the downwind side of Highway 401 in Toronto, while on the upwind side UFP and NO_2 levels decreased to background within 100–200 m of the highway. Similar upwind-downwind differences have been reported for other highways by Hitchens et al. (2000), Zhu et al. (2002a, 2002b, 2006), and Hagler et al. (2009). Of these, the findings of Zhu et al. (2006) are particularly noteworthy. Zhu et al. showed that upwind-downwind UFP gradients near I-405 in Los Angeles were reversed following a 180-degree change in prevailing wind direction. Also, they showed that UFP levels varied inversely with wind speed: UFP levels decreased by a factor of 2.5 following a 2.4-fold increase in wind speed.

Atmospheric stability and mixing height also strongly influence pollution gradients near highways. Jänhall et al. (2006) showed that peak concentrations of UFP, CO, NO and NO_2 measured during the morning rush hour at a fixed site in Göteborg, Sweden, were between 2- and 6-fold higher on days with surface temperature inversions compared to days without inversions. Furthermore, they found that once the surface boundary layer lifted by late morning and surface air layers were able to mix with those aloft, traffic-related pollutant concentrations decreased to the same levels observed on days without inversions. In a year-long study of polycyclic aromatic hydrocarbons (PAH) and other traffic-related pollutants in Quito, Ecuador, Brachtl et al. (2009) found that pollutant levels increased sharply after 05:00, peaked at around 06:00–07:00, and then decreased sharply thereafter despite the relative constancy of traffic flow. This pattern was attributed to near-daily surface temperature inversions that are most pronounced just before sunrise.

Two studies from the Los Angeles Basin further demonstrate the importance of atmospheric stability. Zhu et al. (2006) found that UFP concentrations at 30 m from I-405 were only 20% lower at night (22:30–04:00) than during the day despite a 75% decrease in nighttime traffic flow. This apparent discrepancy was attributed to a combination of higher vehicle speeds, lighter winds, decreased air temperature, and increased relative humidity during the nighttime. Hu et al. (2009) found that pre-sunrise UFP levels were elevated above background as far as 600-m upwind and 2600-m downwind from I-10 despite relatively low traffic flow. Also, pre-sunrise pollutant concentrations were much higher during the winter than summer. These observations were attributed to surface temperature inversions and low wind speeds that are characteristic of the LA Basin in pre-sunrise hours. Seasonal differences in pollutant concentrations may be due in part to differences in boundary layer heights. Hu et al. reported that temperature inversions occurred at a lower elevation in the atmosphere in winter compared to summer, and that this, combined with relatively low nighttime winds in winter, resulted in shallower surface mixed layers during winter monitoring.

Knowledge of the causes of variations in the magnitude and extent of traffic-related pollutant gradients near highways has relevance for minimizing exposure assessment errors in health effects studies. Because pollutant levels at a given location can vary significantly throughout the day, repeated measurements must be made to properly characterize this variation. With the exception of a few recent studies (e.g., Jänhall et al., 2006; Hu et al., 2009), relatively little work has been done to measure the rates of change of near highway air pollution gradients. Therefore, the objective of our study was to measure hourly variations in near-highway air pollutant gradients. We did this using a mobile monitoring platform equipped with rapid response instruments. The pollutants studied included ultrafine and fine particles, gas-phase volatile organic compounds, CO_2, NO, NO_2, O_3, and particle-phase NO_3^-, SO_4^{2-}, and organic compounds. The study was conducted on a weekday morning in winter to capture near-highway air pollutant gradients under heavy traffic conditions during the transition from relatively light pre-sunrise winds to stronger winds following sunrise.

2 Methods

2.1 Study area

The study was performed near Interstate 93 (I-93) in the eastern part of Somerville, Massachusetts (Fig. 1). I-93 has four north-bound and four south-bound lanes, is 40-m-wide, and carries an average of ~150 000 vehicles per day (MA Highway Dept., 2008). The highway is elevated 4.5–6 m above street level in the study area and is filled underneath except at crossing points for local roads. The northbound lane is flanked on its east side by a 3-m-high concrete sound barrier. Sound barriers are of significance as they tend to impact pollution levels near highways (Baldauf et al., 2008). Massachusetts Route 38, a four-lane highway carrying ~20 000 vehicles/day (MA Highway Dept., 2008), runs parallel to I-93 through the study area; Massachusetts Route 28, a six-lane highway that carries ~50 000 vehicles/day (MA Highway Dept., 2008), runs at a 60° angle to I-93 southeast of the study area (Fig. 1). Neither Routes 38 nor 28 are elevated above grade. The study area is bordered by the Mystic River to the north, Massachusetts Route 28 to the south and east, and Winter Hill (elevation=40 m) to the west. The area is relatively flat with the exception of a small hill (elevation=18 m) located near the intersection of Putnam Road and Temple Road. The study area is thickly settled with many single- and two-family houses and two- and three-story apartment buildings within 25–400 m of the highway. Other than highway and street traffic (particularly on the west side of I-93), the study area contains no other known significant sources of

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Fig. 1. Map of monitoring area.

air pollution. Only one day of monitoring was performed. Our goal was to characterize a relatively typical weekday morning in winter when the combination of light pre-sunrise winds (< 4 m/s), rush hour traffic, and cold-temperature combustion conditions would yield high concentrations of traffic-related air pollutants near the highway. 16 January 2008 met those requirements. Monitoring was done between 06:00 and 11:00, before, during, and after morning rush hour.

2.2 Data collection

Real-time measurements of particle size distribution and particle number concentration (PNC), CO_2, NO, NO_2, O_3, aromatic volatile organic compounds (AVOC; the sum of benzene, toluene, xylene isomers, ethyl benzene and C_3-benzene isomers), and particle-bound nitrate, sulfate, and organics were made using the Aerodyne Research Inc. (ARI) mobile laboratory (AML) (Kolb et al., 2004). The AML is a walk-in panel truck equipped with a suite of air-monitoring instruments, a GPS receiver, computers, a power generator, batteries, and a video camera. NO_2 was measured with a quantum cascade tunable infrared laser differential absorption spectrometer (QC-TILDAS; ARI, Billerica, MA) operating at 1606 cm^{-1}. CO_2 was measured with a non-dispersive infrared sensor (Model 6262, LI-COR, Lincoln, NB), NO was measured with a chemiluminescence analyzer (Model 42i, Thermo Fischer, Waltham, MA), O_3 was measured with an ultra-violet absorption monitor (Model 205, 2B-Tech, Boulder, CO), and AVOCs were measured with a proton-transfer mass spectrometer (PTR-MS, Ionicon Analytik, Austria). Size distributions of airborne particles (6–225 nm) were measured using a scanning mobility particle sizer (SMPS; Model 3076, TSI, Shoreview, MN), and total particle number concentration (7–1000 nm) was measured using a condensation particle counter (CPC; Model 3022A, TSI).

An Aerodyne aerosol mass spectrometer (AMS) (Jayne et al., 2000; Canagaratna et al., 2007) with a C-ToF spectrometer (Drewnick et al., 2005) was used to measure chemical composition of size-resolved submicron particles. The AMS measures chemically-speciated mass loadings of aerosol particles in the 50–1000 nm size range. A collection efficiency of 0.5 (Canagaratna et al., 2007 and references therein) was used in the calculation of the reported mass concentrations. Contributions from inorganic species were identified according to the method published by Allan et al. (2004). Mass spectra were analyzed using positive matrix factorization (Lanz et al., 2007; Ulbrich et al., 2009).

The chemiluminescence sensor and the PTR-MS were both calibrated by successive dilution of air from cylinders containing concentration standards as described elsewhere (Wood et al., 2008; Rogers et al., 2006), leading to uncertainties of 10% for NO (2σ) and 25% for AVOC (1σ). The NO_2 measurements were calibrated with a similarly diluted standard (NO_2 produced via ozonolysis of 30 ppm NO in nitrogen) with an uncertainty (2σ) of 12%. The CO_2 sensor response was checked with a two-point calibration at 0 and 400 ppm CO_2 in air (Scott Specialty Gases) with an estimated uncertainty (2σ) of 5%. The manufacturer-stated uncertainty (2σ) of the O_3 measurements was 2%.

The particle inlet manifold was made from stainless steel and copper tubing – to minimize particle loss due to electrostatic deposition – and equipped with a cyclone separator to remove coarse (>2.5 µm) particles. The gas inlet manifold was made from perfluoro-alkoxy Teflon™ tubing and

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contained a 0.45-µm Teflon filter. All instruments were operated at a frequency of 1 Hz with the exception of the SMPS and the AMS, which reported measurements every 110 and 15 s, respectively.

Continuous measurements were recorded throughout the monitoring period as the AML was repeatedly driven along roadways on either side of I-93 (Fig. 1). The wind blew primarily from the northwest throughout the monitoring period (Fig. 2); therefore, Memorial Road, Temple Street, and Mystic Avenue (Route 38) on the west side of I-93 were selected as the upwind transects, while Shore Drive, Bailey Road, Putnam Road, and Temple Road on the east side of I-93 were used as the downwind transects (Fig. 1). The AML was driven as slowly as traffic allowed (2.2–11 m/s) to capture local-scale changes in pollutant levels. It took 45–60 min to cover all of the transects depending on traffic. The downwind transects were monitored 5 times and the upwind transects 3 times throughout the morning. There is a gap in the data from 08:07 and 09:22 when the AML was monitoring in a different part of the neighborhood (data not shown). Wind speed, wind direction, and air temperature data were recorded at the Hormel Stadium light tower (height=40 m) in the city of Medford, ~0.5 km north of the study site. Hourly vehicle counts for I-93 station 8449 were provided by the Massachusetts Highway Department.

2.3 Data reduction

Unusually high concentrations of AVOC – defined as values higher than the upper quartile + 1.5-times the interquartile range based on box plot analysis (Devore, 2004) – were considered indicative of self-sampling or encounters with nearby vehicle exhaust plumes; therefore, they (< 10% of the total) were removed from the dataset along with corresponding measurements from the other instruments. Self-sampling episodes and plumes from nearby vehicles were confirmed by the on-board video record and/or the written log. GPS data were analyzed using ArcGIS 9.2 (ESRI, Redlands, CA). Data from the SMPS was adjusted following a laboratory calibration of the instrument after sampling. Due to the frequency of data acquisition by the monitors and the slow speed at which the AML was traveling, several measurements of each pollutant (with the exception of SMPS and AMS measurements) were taken at approximately the same location during a given run. These measurements were averaged prior to data analysis. For example, the "08:07" run took place from 08:06 to 08:10 as the AML was driven from 395 to 35 m from the highway. Each data point for this run represents 10 (±5) 1-s measurements that were averaged together. Also, for times when the AML was not moving (e.g., when it was at a traffic light or had stopped to measure wind speed and direction), data are presented as the mean and standard deviation of the stationary measurements. The averaged data were not significantly different than non-averaged data according to the Wilcoxon Rank Sum Test with $p < 0.05$.

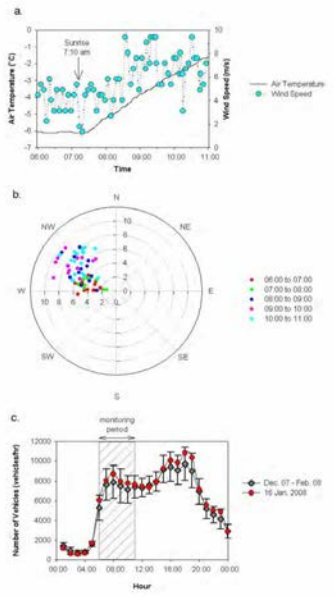

Fig. 2. Weather and traffic data from 16 January 2008. **(a)** Time-series of air temperature and wind speed; **(b)** 5-min average of wind speed and wind direction data collected between 06:00 and 11:00 at the Hormel Stadium light tower in Medford, ~0.5 km from monitoring area; **(c)** time-series of traffic flow on I-93 in both the north and south lanes measured at Somerville-Medford line. Weekday hourly average traffic volume (± one SD) on I-93 during the winter of 2008 are also shown.

3 Results and discussion

3.1 Meteorological and traffic conditions

On 16 January 2008 it was partly cloudy from 06:00 to 09:00 and mostly clear thereafter. There was no precipitation during the monitoring period (06:00–11:00); the 24-h mean barometric pressure and relative humidity were 30.20 inches

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of Hg and 53%, respectively (http://www.wunderground.com, accessed: 29 June 2008). The air temperature was relatively constant (−6.1 °C) between the start of monitoring and sunrise, and rose steadily thereafter to −1.7 °C at 11:00 when monitoring ended (Fig. 2a). The wind was very light (2–5 m/s) before sunrise, and then increased after sunrise to 5–9 m/s by 11:00. The wind direction (WNW) was relatively constant over the 5-h monitoring period (Fig. 2b). These wind conditions are fairly typical for winter (December–February) in the Boston area. In the winter of 2008, the average wind speed one hour before sunrise in our study area was 3.6–5.4 m/s (gentle breeze) 31% of the time and <6.2 m/s (light wind) 82% of the time. On 16 January 2008 the average wind speed in our study area for the hour preceding sunrise was ~4 m/s. The predominant wintertime wind direction in the Boston area is northwesterly, which it was on 16 January 2008.

Traffic on I-93 changed modestly over the monitoring period as shown in Fig. 2c. The traffic flow rate was about 6000 (vehicles/h) at the start of monitoring at 06:00, peaked at 8800 vehicles/h at 08:00, and decreased gradually to 7800 vehicles/h by 11:00. These rates are typical of wintertime, weekday conditions in our study area (Fig. 2c). The fleet composition and average vehicle speed were not measured.

3.2 Spatial and temporal variation of CPC and SMPS measurements

Changes in highway traffic flow rate, wind speed, and surface boundary layer height greatly impacted pollutant gradients near I-93. Particle number concentrations (PNC) were highest early in the morning but then decreased rapidly after sunrise as the surface boundary layer lifted between 08:07 and 09:20 (see Sect. 3.3) and wind speed increased (Fig. 3). Between 06:00 and 08:00 downwind PNC was highest (7×10^4–9×10^4 particles/cm^3) at 34 m from I-93, the nearest point at which measurements were made, but decreased ~2-fold within 100–250 m from the highway. Beyond 250 m downwind, PNC values were relatively constant at ~3×10^4 particles/cm^3. After 09:00 the highest downwind PNC values again occurred nearest to I-93, but were 2-3-fold lower (~3×10^4 particles/cm^3) compared to measurements made between 06:00 and 08:00. Upwind of I-93 the highest PNC values, measured nearest to the highway (40 m), were about 40% lower than the highest downwind concentrations, and dropped off sharply at 60–70 m. Beyond this distance, the profiles were relatively flat, indicative of well-mixed conditions. It is likely that the PNC spikes immediately upwind of the highway were caused by traffic on Rt. 38. As was observed in the downwind profiles, PNC levels in the upwind profiles were also generally higher early in the morning (06:37) compared to later in the morning (08:15 and 09:47). Our observations are in agreement with those of Hu et al. (2009) who found that above-background UFP levels

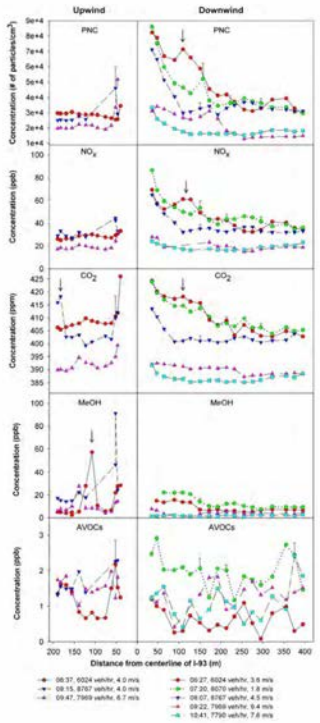

Fig. 3. Spatial and temporal variation of particle number concentration (7–1000 nm), NO_x, CO_2, methanol (MeOH), and aromatic VOCs (AVOC) along transects perpendicular to I-93. Legend shows vehicles per hour on I-93 (both directions) and average hourly wind speed. Pollutant spikes indicated with arrows likely represent the plumes from vehicles passing nearby the AML; spikes immediately upwind of the highway were likely due to traffic on Rt. 38. Error bars (one SD) are shown at locations where the AML stopped briefly and multiple measurements were made.

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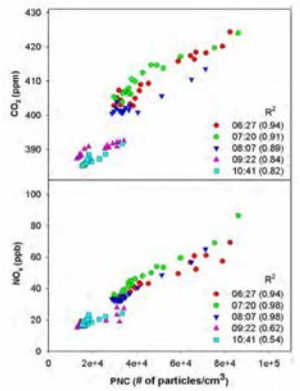

Fig. 4. Relationship between CO_2 and PNC and between NO_x and PNC measured downwind of I-93 throughout the morning on 16 January 2008. Correlation coefficients (R^2) are shown in the legends.

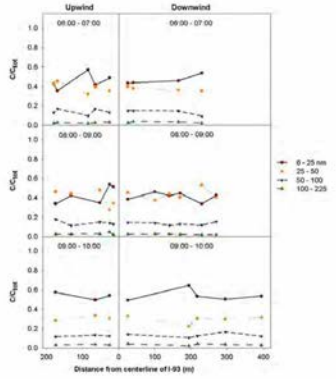

Fig. 5. Spatial and temporal variation of particle size distribution along upwind and downwind transects perpendicular to I-93.

extended much further from highway I-10 in LA (both upwind and downwind) before sunrise compared to after sunrise.

We did not observe significant particle evolution with distance from the highway. The nearly linear relationship between PNC and CO_2 (Fig. 4) suggests that PNC attenuation with distance was largely due to dilution. The slight convex curvature in the 06:27 and 07:20 data suggests some net particle formation (i.e., from nucleation and condensation into the >7-nm window of the CPC), which would be expected given the cold air temperature (−6.1−−1.7 °C), but the overall trend of these two plots is linear (R^2 was >0.91 for both datasets), indicating that if evolution was occurring it was indistinguishable from noise in the dataset. This is consistent with Zhang et al. (2004) who compared the effects of particle dynamics (i.e., condensation and evaporation) and dilution on PNC near highways in LA and found that the effects of particle dynamics were generally much lower in winter than summer.

Particles <50 nm in diameter dominated the particle size distribution measurements throughout the morning; nearly 80% of particles counted in the 6–225 nm size range were <50 nm (Fig. 5). Between 06:00 and 09:00 there were roughly equal number concentrations of particles in the 6–25 and 25–50 nm size ranges at each distance from I-93; however, after 09:00 there was an apparent shift toward relatively more particles occurring in the smallest size range. The relative number concentrations of >50 nm particles did not substantially change either with distance from the highway – which is consistent with other near-highway studies (Zhu et al., 2006; Hu et al., 2009) – or with time.

3.3 Spatial and temporal variation of gaseous pollutant measurements

Profiles of CO_2 and NO_x measured downwind of I-93 showed the same general spatial and temporal differences as were observed for PNC (Fig. 3). Between 06:00 and 08:00, CO_2 and NO_x were highest near I-93 and then decreased to background within 200–300 m downwind of the highway. After 09:00 near-highway concentrations were much lower compared to earlier times and the profiles were generally much flatter. Spatial and temporal variations in CO_2 and NO_x levels upwind of the highway were generally consistent with upwind variations in UFP. Figure 4 shows the relationships between CO_2 and PNC and between NO_x and PNC downwind of I-93. As expected, the early morning correlations are much stronger – as indicated by higher R^2 values – compared to later in the morning when mixing is greater.

O_3 levels were nearly three-fold higher (>25 ppb) after 09:00 compared to pre-sunrise levels (<10 ppb), both