January 11, 2010

To: Brad Rockwell
From: Susan Handy, PhD
Re: Grand Parkway Segment E FEIS

In reviewing the Final EIS and supporting material for Segment E of the proposed Grand Parkway project in Harris County, I find that:

1. The purpose and need for the project have been defined in unreasonably narrow terms that preclude all alternatives.
2. The analysis of the ability of alternatives to meet the purpose and need uses overly simplistic assumptions and flawed reasoning. The conclusions are unreasonable and contrary to facts. Alternatives that may make the proposed action unnecessary have not been adequately considered. The best alternatives are downplayed, and others are not considered at all.
3. The re-evaluation of the FEIS does not adequately account for changes in economic conditions that reduce the need for the project, and the consequences of this failure are significant.

The bases for my findings on these interrelated points are as follows.

1. Definition of Purpose and Need

The FEIS defines the need for and purpose of the project as comprising four elements: expanded capacity, safety, system linkage, and economic development. This is a broad array of needs, but the FEIS implicitly or explicitly defines each of them narrowly, particularly expanded capacity and safety. These narrow definitions do not adhere to standard transportation planning practice, nor even to basic logic. As a result, only the preferred alternative, the construction of Segment E, meets the stated purpose and need, although other alternatives would meet less narrow definitions.

The FEIS expresses the concern that current and future transportation demand exceeds capacity, thereby resulting in growing levels of congestion. According to accepted practice, traffic congestion is defined as a function of the volume of traffic on a roadway relative to the capacity of the roadway: congestion occurs when volume approaches capacity. But rather than defining the purpose of the project to address or reduce traffic congestion, the FEIS defines the need as “capacity expansion” (pg. 1-1). This eliminates from consideration all alternatives that do not involve capacity expansion. Had the purpose and need been defined with respect to traffic congestion, alternatives that addressed volume rather than capacity could have been considered. Indeed, the FEIS dismissed travel demand management (TDM) policies, which aim to reduce volume, as not addressing “expanded capacity” (pg. 2-12) even though they are a well established strategy for addressing congestion. In other words, as is accepted practice in the field, capacity is one means for reducing congestion but it is not the only means and it is not an end in itself.
Furthermore, the FEIS fails to demonstrate a significant congestion problem in the future, as discussed below. The existing and projected levels of congestion are not severe by the standards of metropolitan regions; a significant majority of roadways within the area are projected to be at tolerable or moderate conditions, even a decade from now, with optimistic assumptions about development. This failure to establish a congestion problem makes the focus on capacity expansion even more unjustified: the one reason to expand capacity is to reduce congestion, but if congestion is not a problem then there is no reason to expand capacity (and even if there is congestion, there may be no reason to expand capacity, as explained above). The supposed need for more capacity is not supported by the data, as shown below.

The definition of need and purpose with respect to safety is also problematic. The FEIS expresses concern over a high level of accidents (or crashes) in the area and notes that accident rates in Houston are higher than for Texas as a whole (pg. 1-1). It implicitly defines limited-access facilities as the need, rather than safety improvements more generally, by assuming that limited-access facilities are always safer than non-limited-access facilities (as I discuss below). Thus, any alternatives that do not involve the construction of a limited-access facility are excluded from consideration. Indeed, no other safety improvements are considered in the FEIS. In addition, the FEIS has not provided direct evidence that the facilities in the area of the proposed Parkway have a significant safety problem that would warrant action irrespective of the proposed Parkway. Table 2-6 shows the number of crashes on each facility but does not present crash rates nor provide a standard against which to judge whether these rates are excessive. While any number of crashes above zero could be considered unacceptable, the safety problems do not appear to be dire. Indeed, an earlier analysis showed that the number of crashes per 100 million vehicle miles of travel was considerably lower for facilities in the vicinity of Segment E than for the region overall from 1998 to 2000.\textsuperscript{ii}

Requiring any one project alternative to simultaneously meet all of four of the defined needs – system linkage, expanded capacity, safety, and economic development – also represents an unreasonably narrow definition of need. It is possible that an alternative is better at meeting one of the four needs separately than is the preferred alternative. For example, selected safety improvements could do more for safety than the preferred alternative, even if it doesn’t address congestion or linkage. The Smart Streets strategy is arguably better at addressing congestion (as I discuss below) than the preferred alternative, though it does not directly address safety. An alternative that combines the best solutions for each of the needs might prove more effective than the preferred alternative. By requiring each of the alternatives considered to meet all four needs simultaneously, the FEIS favors the preferred alternative.

For these reasons, the purpose and needs analysis pre-ordains the preferred alternative. This violates standard principles of transportation planning in which alternatives are fairly evaluated and compared. Comments by a TxDOT official at a Texas Transportation Commission meeting on March 5, 2009 suggest that the real undisclosed “need” motivating governmental decision makers to authorize Segment E is the desire to induce development in the relatively uninhabited area around Segment E,\textsuperscript{iii} though this purpose is not acknowledged in the FEIS. See Exhibit A.
2. Deficits in alternatives analysis

The many deficits in the alternatives analysis fall into two categories: unreasonable assumptions, and flawed analysis. The FEIS depends on many unreasonable assumptions, particularly with respect to the traffic and safety impacts of the preferred alternative. Assumptions are a necessary part of forecasting future conditions, but they should be founded on sound logic and on evidence when possible. These unreasonable assumptions have significant consequences for the analysis. In addition, I find several inconsistencies in the FEIS in the analysis of the alternatives with respect to the degree to which they meet the need and purpose of the project, particularly with respect to traffic conditions and safety. These inconsistencies, too, have significant consequences.

Traffic Impact assumptions

In establishing the need for the project and evaluating the preferred alternative to the no-build alternative, the FEIS depends on travel demand forecasts, produced by the H-GAC using the agency’s travel demand forecasting model. These models necessarily depend on assumptions: facts about the future on which to base the forecasts do not exist. The question, then, is how sound those assumptions are. One strength of the travel demand forecasts used in the FEIS is that different land use assumptions were used for the build and the no-build alternatives, reflecting the likelihood that the Parkway would influence the amount, location, and type of development in the area. iv

However, the land use assumptions were developed by an expert panel in the early 2000s. This method is based on the subjective judgments by the experts as to the development effects of the proposed Parkway. The use of expert panels has been shown to focus on effects near the facility, without accounting for “ripple effects” in development patterns over a wider area.” By at least 2003, the H-GAC was using the REMI and Urbansim models for land use forecasting. vi These models provide a more rigorous method that accounts for the impact of new highways on land development patterns. When such models are available, professional standards dictate that they be used in place of or in conjunction with expert panels. vii They were not used to develop the build and no-build land use assumptions in either the FEIS or the subsequent re-evaluation.

Indeed, the land use assumptions for the build and no-build alternatives as determined by the expert panel differ primarily in terms of the density and location of development rather than its extent (FEIS Vol. II, pg. 5-50). The build alternative is assumed to lead to higher density development along the parkway, particularly in the vicinity of ramps and along frontage roads (FEIS Vol. II, pg. 4-3). As shown in Figure 5-6, the build and no-build scenarios differ only marginally with respect to acres of developed land. The FEIS is silent on assumptions about the largest development project in the Segment E area, Bridgeland. It appears that the land use assumptions both include full build-out of Bridgeland, despite the fact that the owner of Bridgeland has publicly stated that full development of Bridgeland is dependent on Segment E. viii The FEIS does not analyze or discuss this point.

In addition, the land use assumptions were developed at a time when the economic conditions of the region and the nation were much better than now. It is likely that new development in the Houston region will occur at a much slower rate than assumed in the population and employment projections used in the FEIS analysis. Notably, the FEIS assumptions reflected full build-out of the Bridgeland development with over 20,000 households and 65,000 residents. The slowdown in the housing market in the Houston area and updated floodplain maps make this build-out unlikely, as discussed below. The FEIS thus overstates future traffic levels and the need for the project. If the assumptions of growth
under the no-build alternative are unreasonably optimistic, which in my opinion they are, then an accurate alternatives analysis meeting professional standards is likely to show the no-build alternative to be a better solution to the stated transportation problems than is acknowledged by the FEIS.

Furthermore, the FEIS assumes that any differences, no matter how small, between the build and no-build alternatives with respect to forecasts of traffic conditions are significant. For example, analysis presented in Table 2-5 of Volume II shows that the build alternative has 7% of roadway miles at serious conditions and 0% at severe, while the no-build alternatives has 8% and 1%, respectively; the build alternative reduces the share of roadway miles by only 1%. However, it is well accepted in the practice of travel demand forecasting that margins of error as great as 10% are considered good\textsuperscript{{ix}}, with even greater margins of error common for specific facilities\textsuperscript{{ix}}. Indeed, a 2008 comparison of two different H-GAC traffic forecasts for 2025 (one based on the 2025 forecasting model and one based on the 2035 model) concluded that the two forecasts were “the same” despite differences of over 10% in forecasted traffic counts for the largest facilities.\textsuperscript{{xi}} A difference of a few percent may be entirely meaningless, given the propagation of errors (such as inaccurate land use assumptions) through the model. Thus, there is no basis for preferring the build alternative over the no build alternative with respect to traffic projections, and the conclusions of the FEIS are not supported by the analysis.

Safety Impact Assumptions

Assumptions used in the analysis of safety impacts are unreasonable on several counts.

- First, the FEIS makes the simplistic assumption that because limited-access facilities have lower crash rates on average than non-limited access facilities, the Parkway would have lower crash rates than existing facilities in the area (pg. 1-15). This is an example of an “ecological fallacy”: the assumption that the relationship seen for the group (i.e. all limited-access facilities) necessarily holds for a specific case (the Parkway in particular).\textsuperscript{{xii}} It is possible, indeed likely, that some specific cases violate the group pattern, and it is not certain that the Grand Parkway would not be one of these cases. Standard transportation engineering practice is to examine the specific safety problems and devise appropriate solutions for that problem rather than assuming “one-size-fits-all”.

- Second, the FEIS implicitly assumes a linear, or one-to-one, relationship between traffic volumes and crashes. It presents the projected reduction in traffic on existing facilities as the basis for an estimate of the projected reduction in crashes (pg. 1-12; 2-28). However, evidence suggests that the relationship is not linear, meaning that “a simple crash rate computed as the ratio of crash count to volume is not proper for comparing the safety of sites with different traffic volumes,” according to a peer-reviewed study.\textsuperscript{{xiii}} For some types of crashes, crash rates are higher at lower volumes. Thus, the FEIS used invalid and overly simplistic assumptions to establish possible safety benefits of the proposal Parkway, thus favoring the build over the no-build alternative.

- Third, the FEIS implicitly assumes that all crashes are the same, when in fact their severity increases with speed.\textsuperscript{{xiv}} Even if crashes are less frequent on the Parkway, they could be more severe given the higher speed of travel than on existing facilities. If traffic levels decline on existing facilities, speeds are likely to increase and the severity of crashes is likely to increase,
even if the number of crashes declines. Again, the invalid assumption used in the FEIS favors the build over the no-build alternative.

- Finally, the FEIS implicitly assumes that the only way to improve safety is to build a limited-access facility, when targeted improvements at specific problem locations might prove equally effective. The FEIS offers no evidence of specific safety problems within the area or analysis of their causes. Indeed, the analysis of changes in average daily traffic (ADT) for existing facilities in the Segment E area shows that traffic will decrease only on FM529/Freeman Road (Table 2-6), meaning that, under the assumptions of the FEIS, only this facility will see safety improvements. But SH 6 had nearly four times the number of crashes as FM529/Freeman Road over a three year period.

The net effect on safety of building the Parkway is not simple to predict. The assumptions used in the FEIS are clearly overly simplistic. A more sophisticated analysis that used valid assumptions could show that the build alternative does no more than the no-build or other alternatives to improve safety.

Traffic Impact Analysis

The traffic impact analysis contains glaring and critical inconsistencies: in the evaluation of the impacts of the preferred alternative on traffic conditions, the numbers presented in the FEIS do not match the stated conclusions. For example, as stated on pg. 1-2 of Volume II, one of the needs for the project is that vehicle hours travelled (VHT) is expected to increase by 20 percent from 2000 to 2025. However, Table 2-3 in Volume II for Segment E shows both increases and decreases in VHT (vehicle-hours-travelled) for the build versus no-build alternatives: a 4% increase in 2010, a 1% decrease in 2015, and 3% increase in 2025. In other words, the preferred alternative results in more total driving time than the no-build, with implications for both the environment and quality of life. According to this analysis, the no-build alternative does a better job of meeting the stated need to reduce VHT than the build alternative.

The analysis of levels of mobility, a measure of congestion, is similarly inconsistent. The FEIS states that “Taking Grand Parkway out of the equation, planned and programmed transportation improvements alone will not be sufficient to accommodate the projected increase in congestion” (pg. 1-11). However, analysis presented in Table 2-5 of Volume II shows that traffic congestion is virtually the same for the build and no-build alternatives, with 7% versus 8% of roadway miles at serious conditions, and 0% versus 1% at severe conditions in 2025. In addition, the FEIS states that for the no-build alternative, “the year 2025 level of congestion is expected to be better than year 2000 even with an increase in traffic volumes” (pg. 1-11). This improvement is attributable to the implementation of the Smart Streets concept, currently scheduled for after 2020 in the Regional Transportation Plan (RTP). The analysis thus demonstrates the potential of the Smart Street approach to accommodate the increase in congestion and shifts the issue to one of implementation, as discussed below. Similarly, the Congestion Mitigation Analysis, presented in Appendix D, concludes that transportation control measures (TCMs), related to the concept of Smart Streets, “are not predicted to significantly improve congestion in 2015 or 2025” (pg. 8). Yet, the analysis shows that 1 of 3 facilities in the segment E area would improve by 5% as a result of the proposed TCMs, while the other two show no improvement because no TCMs are planned.
This 5% improvement, though labeled not significant, is greater than the difference between the build and no-build alternatives that the FEIS concludes is sufficient to recommend the build alternative.

Safety impact analysis

In the safety impact analysis, the FEIS also contains inconsistencies. The FEIS claims that the Grand Parkway could “alleviate a portion of the congestion during mass evacuations” (pg. 1-2) and “would also provide an additional hurricane and emergency evacuation route for the greater Houston area…” (pg. 1-16). However, in arguing for the preferred alternative on these grounds, the FEIS states that radial routes leading to San Antonio, Austin, and other inland cities were extremely congested during the Hurricane Rita evacuation (pg. 1-16). How a circumferential route, that would make it easier for citizens to get to the radial routes but not provide additional radial capacity, would speed evacuations is not explained or analyzed, beyond a brief note that it would accommodate some circumferentially bound traffic that makes use of parts of the radial routes because of the lack of efficient circumferential routes (pg. 2-25). This might be true on normal days, but during a mass evacuation, everyone is radially bound. The statement that “Since radial facilities are congested during an evacuation, there is a need to connect them with an efficient circumferential roadway” (pg. 1-2) simply does not make sense.

3. Consideration of Alternatives

Given the narrow definition of need and purpose, as discussed above, it is not surprising that the preferred alternative is the only alternative given full consideration. Yet, as also noted above, the analysis in the FEIS demonstrates that the Smart Street concept offers even greater potential than the Grand Parkway itself for addressing concerns over traffic congestion. This alternative is rejected for two stated reasons, each of which is either flawed or insufficiently examined or both.

The analysis in the FEIS clearly demonstrates the potential of the Smart Street concept. Table 2-5 of Volume II shows the percentage of roadway miles operating at various conditions at various points in time for both the build and the no-build scenarios. In reading this table, two things are important to remember. First, the no-build and build alternatives differ only with respect to the construction of the Grand Parkway. Thus, comparing the results for these two alternatives shows the effect of the Parkway. Second, the Smart Street concept is implemented after 2020 in both the build and the no-build alternatives. Thus, comparing the results for 2015 and 2020 shows the effect of the Street Smarts concept, in addition to the effect of population growth. The results for total roadway miles show that the effect of implementing Street Smarts (i.e. the difference between 2025 and 2015, for either alternative) is significantly larger than the effect of building the Parkway (i.e. the difference between the build and the no-build alternatives, in either year), as shown in Table 1 and Figure 1, below. Building the Parkway results in a drop in roadway miles at serious or severe conditions from 25% to 19% in 2015 and from 9% to 7% in 2025. In contrast, the implementation of the Smart Streets concept between 2020 and 2025 results in a much larger decline in roadway miles at serious and severe conditions, regardless of whether the Grand Parkway is built or not: Roadway miles at serious or severe conditions drop from 25% to 9% for the no-build alternative and from 19% to 7% for the build alternative. In other words, the Smart Streets concept yields improvements of 12 to 16 percentage points, even with population growth, while Segment E yields improvements of just 2 percentage points in 2025.
The first reason the Smart Streets concept is discounted as an alternative is that it is not yet programmed in the H-GAC’s Transportation Improvement Program (TIP), in contrast to the Grand Parkway for which funds have already been committed. As a result, it is viewed as a long-term project, without identified funding, while the Grand Parkway is viewed as a near term project, with committed funding (pg. 1-14). However, as the FEIS notes, “long-range projects may be removed from further consideration or may move forward in the planning process...” In other words, just because the Smart Street concept is currently slated for funding in the RTP for 2023, it could be programmed sooner than that, even though the concept is not currently far along in the project development process. In effect the FEIS is arguing that because the Grand Parkway is already in the TIP, it is the only decision that now can be made. Furthermore, in acknowledging that the Smart Street concept once implemented leads to more improvement than the Grand Parkway itself, the FEIS is implicitly positioning the Grand Parkway as a temporary solution to traffic problems until the Smart Street concept is implemented. However, if forecasts overstate future traffic congestion, as is likely given the changed economic conditions, as discussed above, then the Smart Streets concept, even if not implemented until 2023, might be deemed wholly sufficient to meet mobility needs.

Another potential argument against the Smart Streets concept as an alternative to the Grand Parkway could be its limited ability to meet the other supposed project needs – system linkage, economic development, and safety. However, it is likely that the implementation of the Smart Street concept would have positive effects on each of these objectives. In addition, other strategies could be adopted in conjunction with the Smart Street concept to address these needs. For example, targeted improvements in specific problem locations could adequately address safety needs, while the strategic construction of new arterials segments could improve the efficiency of circumferential linkages. This sort of hybrid alternative, in which separate strategies targeting each of the state needs are combined into one project, was not considered in the FEIS, though it could prove as effective as the preferred alternative, with lower environmental impact as well as project cost. Here again the FEIS falls short of standard transportation planning practice, which aims for the inclusion and honest evaluation of all reasonable and promising solutions to the problem at hand.

### Table 1. Serious and Severe Conditions for Build vs. No-Build and 2025 vs. 2015

<table>
<thead>
<tr>
<th></th>
<th>Share of Total Roadway Miles at...</th>
<th>2015</th>
<th></th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Serious</td>
<td>Severe</td>
<td>Serious + Severe</td>
<td>Serious</td>
</tr>
<tr>
<td>2015</td>
<td>No Build</td>
<td>20%</td>
<td>5%</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Build</td>
<td>17%</td>
<td>2%</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td>Build – No Build</td>
<td>-3%</td>
<td>-3%</td>
<td>-5%</td>
</tr>
<tr>
<td>2025</td>
<td>No Build</td>
<td>8%</td>
<td>1%</td>
<td>9%</td>
</tr>
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<td></td>
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<td>7%</td>
<td>0%</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Build – No Build</td>
<td>-1%</td>
<td>-1%</td>
<td>-2%</td>
</tr>
<tr>
<td>2025-15</td>
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<td>-12%</td>
<td>-4%</td>
<td>-16%</td>
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<tr>
<td></td>
<td>Build</td>
<td>-10%</td>
<td>-2%</td>
<td>-13%</td>
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</table>

Source: Based on Table 2-5 in Volume II of the FEIS.

Note: Changes in italics.
4. Re-evaluation

The FEIS was re-evaluated in light of the adoption of a new regional transportation plan, specifically a proposed 2035 regional tolled roadway network. However, the re-evaluation did not revisit the land use assumptions used to generate the travel demand forecasts. These assumptions were developed in the early 2000s, at a time when the housing market was significantly stronger than now. For example, real estate reports show that sales of new homes dropped 21% from January 2008 to January 2009, mirroring national trends. In addition, if revised floodplain maps limit building on land within the Bridgeland development, population within the Parkway area is likely to be substantially less than forecast using the assumption that Bridgeland would ultimately accommodate 65,000 residents. The re-evaluation also failed to take into account changes in travel demand owing to the economic recession. Job losses and lower household spending combined with higher gasoline prices have contributed to a decline in miles of vehicle travel.

Given that errors in socio-demographic inputs are compounded over each step of the model, the resulting errors in the traffic forecasts could be substantial. Revised land use and travel demand assumptions, reflecting the realities of today’s housing market and economic outlook, would likely yield lower traffic forecasts. With lower traffic forecasts, the need for the project becomes even more questionable and the potential for alternatives to the Parkway, such as the Smart Streets concept, to meet whatever need exists even greater. The failure to revise traffic forecasts in light of these changed conditions unduly favors the preferred alternative over alternatives with more limited environmental impacts. The consequences with respect to environmental impacts are significant.

Conclusions
The FEIS does not live up to professional standards for quality of analysis or for honesty in the consideration of potential alternatives. For the reasons described in this report, I find the need and purpose of the project to be overly narrow, the alternatives analysis to depend on unreasonable assumptions and to contain critical inconsistencies, the consideration of alternatives to dismiss or overlook promising alternatives without foundation, and the re-evaluation to ignore significant changes in circumstances. It is my opinion that the FEIS is effectively a post-hoc rationalization of the preferred alternative.

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iii Texas Department of Transportation Special Commission Meeting, Thursday, March 5, 2009, Transcript.


vi AR Document 445, pg. AR10496.


viii HoustonTomorrow, “Harris County Commissioners Court Meeting Notes,” March 10, 2009.


xi Results of the 2025 Grand Parkway Traffic Forecast Comparison Analysis, Memo from David Gournet to Tom Couling, December 10, 2007.


xv Houston Real Estate Trends, February 2009.