To: Clair Bowman – Sr. Transportation Planner
City of Nampa; Public Works Department - Engineering Division

From: Joe Samer, P.E. – Transportation Project Manager, AECOM
Dave Butzier, P.E. – Program Manager, AECOM

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Subject: SH-45 Realignment Project – Benefit/Cost Technical Memorandum

1.0 INTRODUCTION

1.1 Purpose

This memorandum (memo) documents work completed to estimate travel time benefits and update the concept level project costs associated with a proposed realignment of State Highway 45 (SH-45) within the City of Nampa. A realignment of SH-45, which is owned by the Idaho Transportation Department (ITD), was explored as part of the *Downtown Traffic Alternatives Analysis* (November 2010) and later refined in the *SH-45 Realignment Concept Study* (June 2014). The project cost and Synchro networks developed as part of the previous projects were updated and future travel time estimated to develop a "benefit" of the realignment in hours of delay and user costs (2025 dollars).

1.2 Background

SH-45 (12th Avenue South in Nampa) connects Owyhee County and southern Canyon County to Interstate 84 (I-84) by way of the I-84 Business Loop (I-84B) which utilizes a 2nd and 3rd Street South one-way couplet, 11th Avenue North, and Garrity Boulevard through Nampa. Growth in the region is driving economic development in downtown Nampa, the heart of which is currently served by 2nd and 3rd Street South, 11th Avenue South, and 12th Avenue South. The desire for a more bicycle and pedestrian friendly downtown moved the Nampa Development Corporation and the City of Nampa to explore several options to connect SH-45 to the interstate without using the current I-84B route through the city. The *Downtown Traffic Alternatives Analysis* (November 2010) selected the option – one of more than a dozen that were examined - that proposes to realign SH-45 along 7th Street South, Yale Street, and Northside Boulevard to connect with I-84 at the Northside Boulevard interchange. A subsequent effort, the *SH-45 Realignment Concept Study* (June 2014) provided more detailed information on what the project could cost given specific alignment and concept-level design elements. It also listed steps needed to advance the proposed project from concept phase into design and construction.

Ongoing discussions between the City and ITD regarding utility of I-84B led to a request from ITD for an evaluation of the benefits and costs (B/C) associated with the proposed SH-45 realignment. In April 2019, the City began working with AECOM to accomplish this evaluation with primary tasks of updating and/or verifying project cost estimates contained in the *SH-45 Realignment Concept Study* and estimating the benefits, in dollars, of the realignment. AECOM took on the tasks associated with updating/verifying the conceptual cost estimates, while WCE, Inc. estimated travel time benefits. Updating conceptual cost estimates is discussed in Section 2. A description of the work completed to estimate differences in travel time and the associated user cost benefits (in dollars) is provided in Section 3.

2.0 Cost Estimate Updates

Realigning SH-45 within the City of Nampa has been a topic within the City for decades. A first serious discussion with ITD occurred in 2008-2009 when Nampa Development Corporation planned and constructed a new City Library and parking garage on the block surrounded by 11th Avenue South, 3rd Street South, 12th Avenue South and 2nd Street South. The most significant and far-reaching explorations began with the *Downtown Traffic Alternatives Analysis* (November 2010) and later refined in the *SH-45 Realignment Concept Study* (June 2014).

The project cost estimates developed by the *SH-45 Realignment Concept Study* were reviewed and updated (where warranted) based on changes to the following:

- Material and construction unit cost assumptions.
- Demolition costs assumptions.
- The cost per square foot of right-of-way (ROW) assumptions.
- The costs of acquiring access rights.
- Reconstruction of property access and driveways cost assumptions.
- Personal property damage cost assumptions.
- Residential relocation cost assumptions.

In the *SH-45 Realignment Concept Study*, two "bookend" estimates were originally developed, based on a "High" and "Low" number of relocations. Assumptions utilized in updating these cost estimates were as follows:

1. The estimates of the number of potential property relocations (high/low) will not be re-evaluated.
2. Excavation, cut-fill, and material quantities estimates will not be re-evaluated. These quantities were developed for the *SH-45 Realignment Concept Study* using the conceptual cross section for the preferred alternative.
3. No survey or preliminary design will be conducted to develop cost estimates.

2.1 Material and Construction Unit Cost Assumptions

Without re-evaluating conceptual level excavation, cut-fill, and material quantities, construction and material cost increases will be governed by a growth or inflation factor. At this conceptual stage in estimating the project, the annual inflation rate was utilized. In the United States, the inflation rate for the 12 months ending in July 2019 was **1.8%.** Material and construction unit costs provided in the *SH-45 Realignment Concept Study* were adjusted by this inflation rate and projected out to 2025, the targeted project construction year as described in Section 3.

2.2 Demolition Cost Assumptions

In the *SH-45 Realignment Concept Study,* a value of $30,000 per property was utilized to estimate demolition costs. Since quantities remain unchanged, the unit cost of demolition will be conservatively adjusted using the annual inflation rate of 1.8%.

2.3 Cost per square foot of ROW Assumptions

In the *SH-45 Realignment Concept Study*, a value of $4.25/sq. ft. was utilized to estimate the cost of ROW based on the City of Nampa's recent experience on similar projects. The 2014 ROW costs for the low and high number of relocations were calculated at $6,064,000 and $7,675,000 respectively.

In an email from Clair Bowman, Senior Transportation Planner for the City of Nampa dated August 27, 2019, the limited number of residential appraisals in 2019 averaged $4.50/sq. ft ($196,020/acre) and commercial/industrial appraisals averaged slightly over $6/sq. ft ($261,360/acre).

ROW costs for the low and high number of relocations utilizing the new per square foot estimates were calculated as $6,167,972 and $7,787,172 respectively and are shown on ITD's ROW Cost Estimate Form (ITD-2839) in the attachments. Between 2014 and 2019, ROW costs increased at approximately 0.4% per year. With the limited amount of appraisal cost information as well as the conceptual nature of the project, there is a risk of underestimating ROW costs when projecting out to 2025 using a growth rate of 0.4%. Therefore, to provide a reasonable yet conservative estimate of ROW costs in 2025, estimated ROW costs for the low and high number of relocations calculated in 2019 were projected out to 2025 using the inflation rate of 1.8%.

As stated above, the ROW cost for the low number of relocations in 2019 was $6,167,972. In 2025, this cost is projected at $6,743,437. The ROW cost for the high number of relocations in 2019 was $7,787,172. In 2025, this value becomes $8,513,706.

2.4 Costs of Acquiring Access Rights Assumptions

In the *SH-45 Realignment Concept Study,* a 2014 cost of $500,000 for purchase of access was estimated based on professional judgement. We chose to utilize this same value of $500,000 for the revised estimates, projected to 2025 using an annual inflation rate of 1.8%.

2.5 Reconstruction of Property Access and Driveways Cost Assumptions

In the *SH-45 Realignment Concept Study,* a value of $10,000 per property to reconstruct property access and driveways was utilized. This same value was used in the updated cost estimates, projected to 2025 using an annual inflation rate of 1.8%.

2.6 Personal Property Damage Cost Assumptions

In the *SH-45 Realignment Concept Study,* a value of $26,000 per site improvement was utilized based on a lump sum estimate provided by ITD District 3. This same value was used in the updated cost estimates, projected to 2025 using an annual inflation rate of 1.8%.

2.7 Residential Relocation Cost Assumptions

In the *SH-45 Realignment Concept Study,* a value of $100,000 per relocation was utilized. As the number of relocations varies on how access control is implemented along the corridor, this same value was used in updated cost estimates, projected to 2025 using an annual inflation rate of 1.8%.

2.8 Updated Project Costs Estimates for 2025

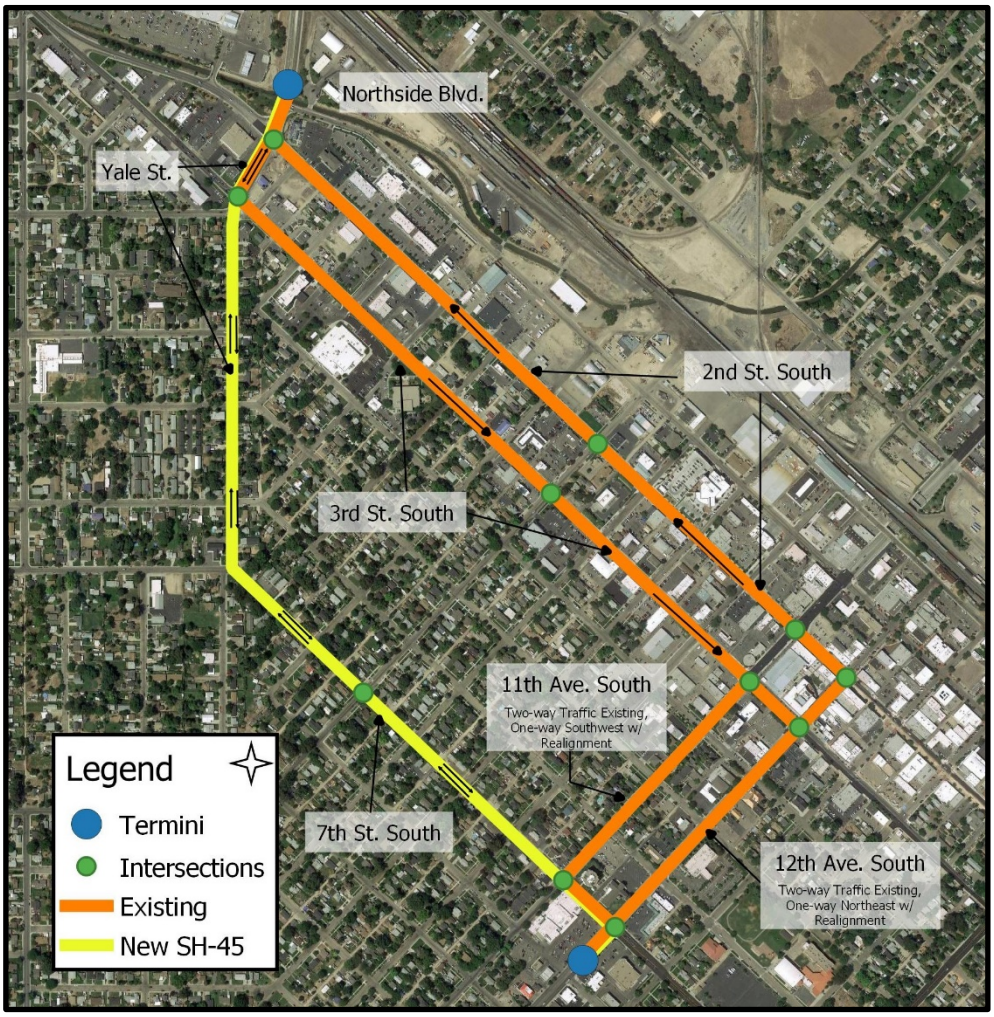
Values described in previous sections were input into ITD's Project Cost Summary Sheet (ITD-1150) (see attachments) for the low and high number of relocations. The total estimated project cost in 2025 for the low number of relocations was $29,803,000. The total estimated project cost in 2025 for the high number of relocations was $31,573,000.

3.0 Future Year Travel Time Estimates

Before travel time (user costs) benefits associated with the proposed SH-45 realignment could be estimated, a construction year (i.e. the year the project construction was complete) and design year (i.e. the year for which the project was designed to accommodate) were identified. A design year of 2045 and a construction year of 2025 were selected for the analysis based on discussions with the City of Nampa. Thus, benefits from the project will be considered starting in 2025 through 2045.

Additionally, termini for the travel path were identified along with primary travel route(s) between them. Termini selected for this analysis were north of the intersection of Northside Boulevard and 2nd Street South and south of the intersection of 12th Avenue South and 7th Street South. Two (2) northbound and two (2) southbound routes between the termini were selected representing the two primary travel routes, one of which includes the proposed SH-45 realignment route. Figure 1 shows the termini selected and routes chosen.

Figure 1. Termini and Routes Selected for the Analysis



A travel time comparison based on the routes identified, existing conditions and the "build" scenario proposed by the realignment project yields an increase or decrease in travel time measured in seconds per vehicle (s/veh). Travel times were developed for each condition and each year and because travel time varies from hour to hour and day to day, four distinct travel time periods were identified to account for this variability:

- Weekday morning rush (AM peak period),
- Weekday afternoon rush (PM peak period),
- Weekday off peak (from 6AM to 7AM, 9AM to 4PM, and 6PM to 9PM), and
- Weekend day (7AM to 9PM).

Outside of these periods, travel time was assumed to be "ideal" with no significant traffic delay. Ideal travel time was calculated by estimating the travel distance along each route and the posted speed limits. For the realigned SH-45 condition, a higher speed limit (40 mph) along 7th Street South and Yale Street was assumed.

Estimates of traffic control delay (in sec/veh) associated with each travel time period along each of the identified routes for both the construction year and design year were added to the "ideal" travel time estimates to develop travel times. For the weekday peak periods (AM and PM), this was accomplished using Synchro to conduct capacity analyses at each major intersection along each route. Existing AM and PM peak hour turning movement volumes at eleven major intersections along the identified routes were collected by the City of Nampa Public Works Department in September of 2019. These volumes were used along with traffic volume forecasts developed using the Community Planning Association of Southwest Idaho's (COMPASS') travel demand model and WinTurns software to produce future year turning volume movement forecasts at each intersection. COMPASS provided model forecasts for the existing (base) year, 2025, 2045, and for the build condition (2025 and 2045). Roadway tube count data collected in September 2019, along with automated traffic recorder (ATR) data and intersection counts, were used to adjust future year forecasts by comparing base year (2019) COMPASS model volume forecasts to existing traffic conditions.

AM and PM peak hour traffic volume forecasts were input into Synchro networks representing each analysis year and condition. Network traffic volumes were then balanced along each route to remedy obvious discrepancies that result when turning movement volumes are forecasted for individual intersections. Cycle lengths and splits for the applicable signalized intersections were optimized using algorithms provided with Synchro and phasing adjusted as needed to resolve any conflicts. Control delays for AM and PM peak hours were then identified for specific movements required to travel each route given existing conditions and the realigned SH-45 (i.e. build) condition for 2025 and 2045. This delay (in sec/veh) was added to the ideal travel time (in sec/veh) to develop weekday AM and PM peak period travel times (in sec/veh).

It is assumed each weekday has a 2-hour-long AM and a 2-hour-long PM peak period during which the delay is equal to peak hour conditions. For the purposes of this analysis, both weekday off-peak and weekend day delay are assumed to be half (50 percent) of that experienced during the weekday PM peak hour.

Travel time estimates (in s/veh) were aggregated for each route and each period (AM peak, PM peak, off-peak and weekend day) given existing conditions and the realignment of SH-45. The aggregate travel times were then compared to determine if the build condition would result in a travel time savings or increase for a given route and period. This was done for both the construction year (2025) and the design year (2045).

3.1 Converting Travel Time Estimates into Benefit

The potential benefits (in hours) for each route and each analysis period were estimated by multiplying each travel time change by a traffic volume assumed to use each route during each period. These traffic volumes had to be assumed because the volume of traffic starting at one end of the route and ending at the other is not known. The only way to determine this would be to conduct an origin/destination study. Therefore, the lowest peak hour (AM and PM) volumes along each route were assumed to represent the volume of traffic that could conceivably travel the entire route. For the peak periods (AM and PM) the hourly volumes were multiplied by two (i.e. two hours per peak period). For the weekday off-peak period, the relationship between PM peak period traffic and weekday traffic was established using the 2018 hourly report for the Northside Boulevard automated traffic recorder (ATR). The relationship was then adjusted to only include those hours where travel time would be less than ideal (6AM-7AM, 9AM to 4PM, 6PM-9PM). These relationships were applied to the PM peak hour route volumes to provide the weekday off-peak traffic volumes. Similarly, the relationship of weekend day to weekday traffic was used to produce weekend day traffic volumes for each route.

Once the travel time benefits associated with each route and each period were converted to hours, they were aggregated to provide one benefit estimate for the construction year and one for the design year. Table 1 provides the overall benefits in hours estimated for the proposed realignment of SH-45. Benefits were converted to dollars by applying the average (mean) wage rate of $21.86 per hour for the Boise Metro Area as determined by the Idaho Department of Labor *Occupational Employment and Wages Survey* (May 2018) and aggregated to provide estimates of user costs savings provided in Table 1.

Table 1. Estimated Benefits of SH-45 Realignment

	Annual Benefit (hours)	Annual Benefit ($)
2025	1,101,954	$24,088,719
2045	3,540,127	$77,387,171

Note: The annual benefit increase between 2025 and 2045 is estimated at $2,664,923 per year

4.0 CONCLUSIONS

The proposed realignment of SH-45 along 7th Street South and Yale Street is estimated to have an annual travel time benefit of 1.1 million hours and $24.1 million in user cost savings in 2025. By 2045, that estimate increases to 3.5 million hours and $77.4 million in user cost savings. Extrapolating between 2025 and 2045, the benefit increases by approximately $2.7 million each year between the time the project is constructed (2025) and the project's design year (2045). Therefore, the total benefit over the 21-year period is estimated to be almost $1.1 billion in travel time savings to users of the system.

The total cost of the realignment project in 2025 is estimated between $29.8 million and $31.6 million, dependent upon the variables associated with ROW acquisition described in Section 2. Comparing the overall 21-year benefit estimate of $1.1 billion to the highest project cost estimate of $31.6 million provides a **benefit-to-cost ratio (B/C) of 34.8**. Thus, this project is estimated to provide 34.8 times the benefit to the traveling public when compared to the estimated cost between 2025 and 2045.

Attachments:
ITD-2839 (2)
ITD-1150 (2)