FEHR PEERS

FINAL MEMORANDUM

Date: November 9, 2020

To: Jeff Hamlin and Brian Krause – City of Snoqualmie Public Works Development

From: Emily Alice Gerhart, AICP and Chris Breiland, PE – Fehr & Peers

Subject: Truck Trip Distribution Analysis along Snoqualmie Parkway

SE20-0732

Over the past 20 years, the pavement condition on Snoqualmie Parkway has deteriorated and is now in need of substantial rehabilitation. Heavy trucks and buses are a major contributor to pavement degradation and this memorandum documents the degree to which heavy vehicles that use Snoqualmie Parkway are local or regional in nature. This issue is relevant because Snoqualmie may be seeking regional funding for pavement rehabilitation, but this funding requires justification that Snoqualmie Parkway serves regional trips.

The analysis in this memorandum estimates the number of heavy truck trips that start or end outside the City and translates the truck trip flows into an estimate for the regional versus local pavement degradation. In order to estimate this impact, we utilized the regional travel model to understand origins and destinations for traffic on Snoqualmie Parkway. Then, we reviewed available count information to estimate the approximate average number of trucks on an average weekday relative to cars.

These findings illustrate that the vast majority of the pavement degradation impacts on Snoqualmie Parkway are attributed to heavy vehicles and estimate that 81 percent of truck trip ends start or end outside the city limits.

Truck Trip Distribution

In order to approximate the origins and destinations of truck traffic, we utilized the base year model refined by Fehr & Peers, built off the Puget Sound Regional Council (PSRC) 4k framework. We ran a "select link" analysis on the base year model, which relies on 2015 regional land uses. The land

use is an input into the model, which follows the traditional travel behavior forecasting four-step model process: trip generation, distribution, mode choice, and assignment.

Every forecasting exercise requires the modelling team to review the outputs carefully. Because the PSRC model framework is at a regional scale with large traffic analysis zones (TAZs) and less detail of low volume roadways, it is essential to post-process the results to form conclusions at a local level. Therefore, we ran multiple time periods, including the AM, PM, Midday, Evening, and Daily time periods. Upon reviewing the results of the time period, the midday period proved to be the most conservative and we deemed it to be a reasonable estimate.[1]

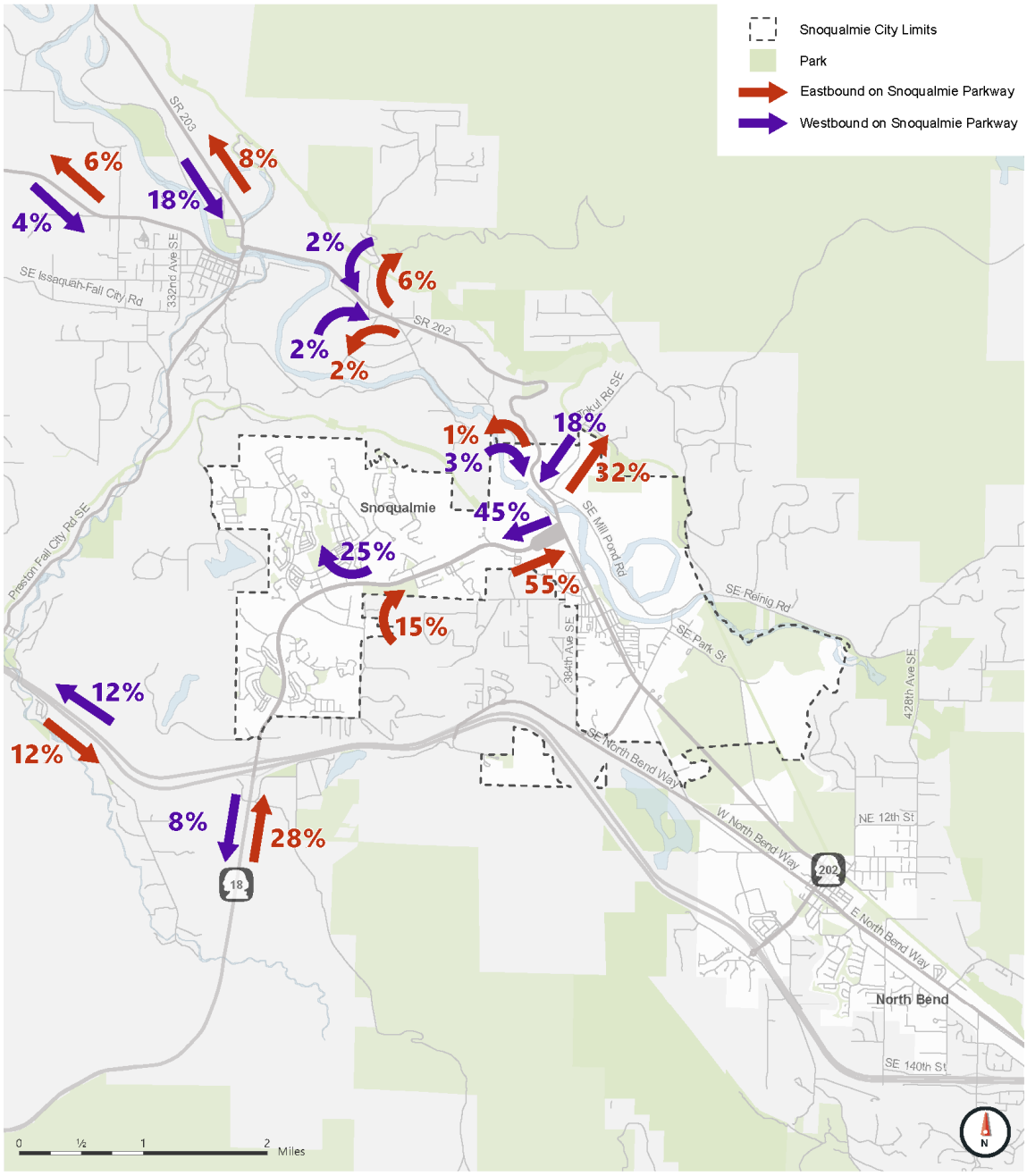
We reviewed the model outputs and our findings show that in the base year model, *81 percent of truck trip ends[2] on Snoqualmie Parkway near SR 202 start or end outside the city limits*. This is based on a calculation of total trip ends that remain internal in the City of Snoqualmie versus those that are outside of the city. As previously mentioned, because this is a regional model, it is more useful for regional distribution and origin-destination estimation, and less so for using raw model volumes directly, such as the total number of truck trips estimated by the model.

Figure 1 shows the truck trip distribution from the model analysis that isolated the paths of truck trips on Snoqualmie Parkway near SR 202. As shown in Figure 1, a TAZ near the quarry outside city limits, generates a substantial number of the truck trips on the Parkway, while other truck trips continue through the city to other parts of the region.

[1] Based on truck trip counts collected throughout the Puget Sound Region, most truck trips occur during the midday (outside of the commuting peak periods).

[2] Each trip has two "trip ends," (an origin and a destination). Trip ends are used in impact calculations so that the jurisdictions/land uses generating the trips can be fairly assessed responsibility for sharing costs of mitigating the impact or fixing the deficiency.

Figure 1 – Distribution of Truck Traffic Traveling on Snoqualmie Parkway near SR 202



Data Source: PSRC Travel Demand Model (2015)

Distribution of Truck Trips Traveling on Snoqualmie Parkway (Near SR 202)

Truck Trip Estimates

In order to estimate average truck traffic on Snoqualmie Parkway, we reviewed Snoqualmie Parkway counts conducted in March 2020, historic counts, and available research on COVID-19 impacts to travel patterns.

We first reviewed the comparison between the roadway counts conducted in March 2020 and counts from 2018. Because the difference between the two counts includes potential growth between 2018 to 2020, we also reviewed more recently available data, including research conducted in the Seattle region comparing counts from March 2020 to the same day the week of February 22, 2020 (link). We reviewed a few different scenarios, and the most reasonable average daily traffic (ADT) volumes are between:

a) Estimate using March 2020 peak period counts (7-9am and 4-6pm) scaled by a factor of 1.9 (comparison with historic counts), with all non-peak period counts scaled by a factor of about 1.4 (from COVID-19 research); and
b) Average counts scaled by a factor of 1.9 (includes potential growth between 2018 to 2020 counts).

Based on these sources, we estimated a mid-week average daily traffic volume of 11,800 – 14,700 on Snoqualmie Parkway west of SR 202.

Then, we reviewed historic heavy vehicle volumes on Snoqualmie Parkway west of SR 202. The total daily heavy vehicle volumes fell between seven to fourteen percent of total trips. When adjusting for discrepancies between historic counts, recent counts, recent logging and quarry activity, and COVID-19 travel impacts, it is reasonable to conclude ten percent of average daily traffic on Snoqualmie Parkway near SR 202 is attributed to heavy vehicle traffic.

After applying this percentage to the range of total traffic (ADT), we concluded that approximately 1,200 to 1,500 trucks travel along Snoqualmie Parkway near SR 202 on a typical weekday.

According to the American Association of State Highway and Transportation Officials (AASHTO—a consortium of state departments of transportation), "heavy trucks and buses are responsible for a majority of pavement damage."[3] This assertion is based on the definition of an "18,000 pound

[3] Considering that a typical automobile weighs between 2,000 and 7,000 lbs. (curb weight), even a fully loaded large passenger van will only generate about 0.003 ESALs while a fully loaded tractor-semi trailer can generate up to about 3 ESALs (depending upon pavement type, structure and terminal serviceability). Source: "Equivalent Single Axle Load." https://pavementinteractive.org/reference-desk/design/design-parameters/equivalent-single-axle-load/. Accessed on October 26, 2020.

Equivalent Single Axle Load" (ESAL) from AASHTO, which is used as the primary loading input to determine pavement design in its *Mechanistic-Empirical Pavement Design Guide: A Manual of Practice, 3rd Edition*, which is the most commonly-used pavement design resource in the Country (WSDOT's Pavement Policy is based on AASHTO research and resources).

Based on data from WSDOT, the average number of ESALs per heavy vehicle ranges from 0.26 for a FHWA Class 5 truck (similar to a UPS package delivery truck) to 1.36 for a FHWA Class 13 truck (which include dump trucks). These two truck classifications are the most common on Snoqualmie Parkway, with substantially more Class 5 than Class 13 trucks. Based on the distribution of trucks by classification from our March 2020 counts, we estimate that the average ESAL per truck is 0.5. Compared to the average ESAL for a passenger vehicle of 0.003, we estimate that truck traffic results in 95% of the pavement damage on Snoqualmie Parkway, with 81 percent of all truck trip ends being outside of Snoqualmie. This result demonstrates the impact of regional travel patterns on pavement degradation on Snoqualmie Parkway.