

Sample Year 1 and Year 4, Vehicle Trip Estimation and Vehicle Miles Traveled Techniques

Purpose

As a part of the Regional Mobility Grant (RMG) program, applicants are required to provide year 1 (Y1) and year 4 (Y4) estimates for the quantity of vehicle trips (VT) and vehicle miles traveled (VMT) that will be reduced as a result of the project. These estimated VT and VMT reductions factor into a project's overall scoring.

What is required surrounding the estimates?

Estimates should follow industry standards, as applicable, and must include underlying assumptions and rationale behind those assumptions. WSDOT must approve your estimates. We reserve the right to request additional information, clarification, and may work with you to update application estimates for reasonableness.

Is assistance available to help develop estimates and assumptions?

Three common project examples are available below: a park and ride; new bus service; and projects that decrease travel times. As a starting point, we recommend you read these. If the nature of your project does not align with one of the examples, feel free to contact PTdata@wsdot.wa.gov or call Paul Mason (360.705.7929) to discuss the specifics of your project. While it is your responsibility to estimate the benefits of your project and to justify your estimates, we are happy to assist.

Constant Growth Rate Formula

One common desire is to use a constant assumed growth rate between the year 1 and year 4 estimates. To calculate what this factor is, use the following formula, where "r" is equal to the annual growth rate and "t" is equal to time in years (which will be three years for our purposes):

$$\text{Multiplying Factor} = \left(1 + \frac{r}{100}\right)^t$$

For example, if a constant growth rate of 4% is assumed, the multiplying factor would be calculated as:

$$\text{Multiplying Factor} = \left(1 + \frac{4}{100}\right)^3 \approx 1.125$$

Note

Please note in the examples below, there are some clarifying statements presented as footnotes. These footnotes would not need to be included with your application. However, any assumptions do need to be documented and justified.



Project Description:

An existing park and ride contains 50 stalls and is regularly at full capacity. This project will add 100 stalls, bringing the total number of stalls to 150.

Estimates:

This park and ride is known to serve three primary destinations:

- Destination 1 – 6 miles (one-way) from the lot
- Destination 2 – 11 miles (one-way) from the lot
- Destination 3 – 15 miles (one-way) from the lot

Based on our annual survey of existing users, 48% of users travel to Destination 1, 13% of users travel to Destination 2, and 39% of users travel to Destination 3. With this expansion project, we anticipate the same destination split as represented by this survey. The resulting weighted average one-way trip distance is calculated as follows:

$$\begin{aligned} \text{Weighted average one-way trip distance} &= \text{rate}_1 * \text{distance}_1 + \text{rate}_2 * \text{distance}_2 + \text{rate}_3 * \text{distance}_3 \\ &= 0.48 * 6 + 0.13 * 11 + 0.39 * 15 \\ &= 10.16 \text{ miles} \end{aligned}$$

This lot fills most mornings and we regularly observe vehicles getting turned away due to unavailability of parking stalls. Based on a similar park and ride expansion project five years ago, we estimate year 1 utilization will be 30% of the added capacity¹, or 30 new parked vehicles per day.

Weekday-only service is provided to this park and ride, with no assumed benefits for the weekend. We will assume 260 working days per vehicle per year. Based off of our surveys, most users drive alone, therefore we will assume only one occupant per vehicle.

$$\begin{aligned} Y1_{VT \text{ Estimate}} = \text{One-way Trips} &= \frac{\text{Used days}}{\text{year}} * \text{New daily roundtrips} * 2 \frac{\text{one-way trips}}{\text{roundtrip}} \\ &= 260 \frac{\text{work days}}{\text{year}} * 30 \text{ new daily roundtrips} * 2 \frac{\text{one-way trips}}{\text{roundtrip}} \\ &= 15,600 \text{ one-way trips} \end{aligned}$$

$$\begin{aligned} Y1_{VMT \text{ Estimate}} = VT * \text{Trip Distance} &= 15,600 \frac{\text{one-way trips}}{\text{year}} * 10.16 \frac{\text{miles}}{\text{one-way trip}} \\ &= 158,496 \text{ miles} \end{aligned}$$

Year 4 estimates calculated on next page.

¹ The Y1 and Y4 utilization rates can be challenging to estimate and justify. Whatever figures are selected, there needs to be rationale behind the figures.

We estimate that park and ride utilization will increase 6% per year, consistent with annual utilization increases observed at our other park and ride facility².

$$\begin{aligned}
 Y4_{Utilization} &= Y1_{Utilization} * \left(1 + \frac{6}{100}\right)^3 \\
 &= (50 + 30) \text{ parked vehicles} * 1.19 \\
 &\approx 95 \text{ parked vehicles} = 50 \text{ original stalls used} + 45 \text{ new stalls used}
 \end{aligned}$$

$$\begin{aligned}
 Y4_{VT \text{ Estimate}} = \text{One-way Daily Trips} &= 260 \frac{\text{work days}}{\text{year}} * 45 \text{ new daily roundtrips} * 2 \frac{\text{one-way trips}}{\text{roundtrip}} \\
 &= 23,400 \text{ one-way trips}
 \end{aligned}$$

$$\begin{aligned}
 Y4_{VMT \text{ Estimate}} = VT * \text{Trip Distance} &= 23,400 \frac{\text{one-way trips}}{\text{year}} * 10.16 \frac{\text{miles}}{\text{one-way trip}} \\
 &= 237,744 \text{ miles}
 \end{aligned}$$

² Since the park and ride was at capacity prior to the completion of this project, it is reasonable to apply the growth rate to the original 50 stalls, as this growth (in the absence of the project) would otherwise have not occurred.



Project Description:

The City of Mineral Harbor will create a new route between a park and ride, city center, and the region's mall, with one bus servicing this route with a capacity of 30 passengers. Bus service will operate hourly between 7 am and 7 pm on weekdays (no weekend service) and will service six bus stops.

Estimates:

The route has a roundtrip distance of 18 miles. Based on the travel market and customer feedback, we will assume that riders will travel an average of half of the one-way trip distance, equating to 4.5 miles.

The creation of new bus routes in recent years has seen first-year ridership at about 40% utilization.

Over the course of the first four years, we anticipate seeing a 10% increase in ridership year over year, which is typical for newer routes.

With hourly service from 7 am to 7 pm, the bus will make 26 one-way trips (13 round trips).³

$$\begin{aligned} Y1_{Ridership} &= \text{Capacity} * \text{utilization} \\ &= 30 \text{ passenger capacity} * 40\% \text{ utilization} \\ &= 12 \text{ passengers per one-way trip} \end{aligned}$$

$$\begin{aligned} Y1_{VT \text{ Estimate}} &= \frac{\text{One-way bus trips}}{\text{day}} * \left(\frac{\text{passengers}}{\text{one-way trips}} - \frac{\text{bus trips}}{\text{one-way trip}} \right) * \frac{\text{working days}}{\text{year}} \\ &= 26 \frac{\text{one-way bus trips}}{\text{day}} * \left(12 \frac{\text{passengers}}{\text{one-way trip}} - 1 \frac{\text{bus trip}}{\text{one-way trip}} \right) * 260 \frac{\text{working days}}{\text{year}} \\ &= 74,360 \text{ one-way trips} \end{aligned}$$

$$\begin{aligned} Y1_{VMT \text{ Estimate}}^4 &= \text{annual passenger trips} * \frac{\text{passenger miles}}{\text{trip}} - \text{annual bus trips} * \frac{\text{bus miles}}{\text{trip}} \\ &= (26 * 12 * 260) \text{trips} * 4.5 \frac{\text{miles}}{\text{trip}} - (26 * 1 * 260) \text{trips} * 9 \frac{\text{miles}}{\text{trip}} \\ &= 304,200 \text{ miles} \end{aligned}$$

$$\begin{aligned} Y4_{Ridership} &= Y1_{Ridership} * \left(1 + \frac{10}{100} \right)^3 \\ &= 12 \frac{\text{passengers}}{\text{one-way trip}} * 1.331 \\ &\approx 16 \frac{\text{passengers}}{\text{one-way trip}} \end{aligned}$$

$$\begin{aligned} Y4_{VT \text{ Estimate}} &= 26 \text{ one-way trips} * \left(16 \frac{\text{passengers}}{\text{one-way trip}} - 1 \text{ bus trip} \right) * 260 \frac{\text{working days}}{\text{year}} \\ &= 101,400 \text{ one-way trips} \end{aligned}$$

$$\begin{aligned} Y4_{VMT \text{ Estimate}} &= (26 * 16 * 260) \text{passenger trips} * 4.5 \frac{\text{miles}}{\text{trip}} - (26 * 1 * 260) \text{bus trips} * 9 \frac{\text{miles}}{\text{trip}} \\ &= 428,880 \text{ miles} \end{aligned}$$

³ Since bus trips and bus miles are being added with this new service, these should be accounted for in the overall VT and VMT reduction calculations.

⁴ Calculating this way accounts for the difference between the miles per one-way trip for the bus as compared to miles per one-way trip for the passenger.



Project Description:

Palmerson City is installing technology giving signal priority to buses traveling through downtown, with upgrades being installed at seven intersections. These upgrades will benefit bus routes 45 and 150.

Estimates:

Using the industry standard from the [Transit Cooperative Research Program's report 118](#) exhibit 3-19 (on page 3-19), we will assume that ridership will increase by 0.4% for every 1% decrease in travel time.

Annual ridership, average trip distance, existing roundtrip travel times, and estimated time savings are provided in table 1 below. Annual ridership and average passenger trip distance figures are based on our latest annual route performance report.

Table 1: Route Characteristics

Route	Annual Ridership (trips)	Average Passenger Trip Distance (miles)	Existing One-way Travel Time (minutes)	Time Savings per One-way (minutes)
45	213,450	7.4	25	2
150	185,220	10.8	40	3

$$\begin{aligned}
 VT_{Estimate [by route]} &= \frac{route\ time\ savings}{route\ roundtrip\ time} * \frac{0.004\ ridership\ increase}{0.01\ decreased\ travel\ time} * Ridership \\
 &= \frac{route\ time\ savings}{route\ roundtrip\ time} * 0.4 * Ridership
 \end{aligned}$$

$$\begin{aligned}
 Y1_{VT\ Estimate [Total]} &= [Y1_{VT\ Estimate [Route 45]}] + [Y1_{VT\ Estimate [Route 150]}] \\
 &= \frac{2\ minutes\ saved}{25\ minutes\ roundtrip} * 0.4 * 213,450\ trips + \frac{3\ minutes\ saved}{40\ minutes\ roundtrip} * 0.4 * 185,220\ trips \\
 &= 6,830 + 5,557 \\
 &= 12,387\ trips
 \end{aligned}$$

$$\begin{aligned}
 Y1_{VMT\ Estimate\ Total} &= Trips_{Route\ 45} * Distance_{Route\ 45} + Trips_{Route\ 150} * Distance_{Route\ 150} \\
 &= 6,830\ trips * 7.4 \frac{miles}{trip} + 5,557\ trips * 10.8 \frac{miles}{trip} \\
 &= 50,542 + 60,016 \\
 &= 110,558\ miles
 \end{aligned}$$

Year 4 estimates calculated on next page.



Routes 45 and 150 have experienced 2% annual growth over the past few years. We will assume this same 2% annual growth rate will be observed around the trips resulting from this project⁵.

$$Y4 \text{ Expansion Factor} = \left(1 + \frac{2}{100}\right)^3$$
$$\approx 1.061$$

$$Y4 \text{ VT Estimate}_{Total} = Y1 \text{ VT Estimate trips} * Y4 \text{ Expansion Factor}$$
$$= 12,387 \text{ trips} * 1.061$$
$$= 13,145 \text{ trips}$$

$$Y4 \text{ VMT Estimate}_{Total} = Y1 \text{ VMT Estimate} * Y4 \text{ Expansion Factor}$$
$$= 110,556 \text{ miles} * 1.061$$
$$= 117,323 \text{ miles}$$

⁵ Even though it is anticipated that the base ridership will also grow at the same 2% rate per year, this growth would have occurred with or without this project and therefore should not be included as a part of the year 4 estimates, in the same way that the base ridership does not count towards the year 1 estimates.