

Memorandum

To: Mike Haley, Rob Crittenden and Bruce Newman, City of Redmond

From: Michael Lapham and Sessyle Asato, KPG

Date: 2/15/2012

Re: Final Traffic Analysis for the Redmond Central Connector Trail

Project No: 11030

The Redmond Central Connector (RCC) Trail will travel through downtown Redmond and connect with the Sammamish River Trail and the Bear Creek Trail. Through the majority of downtown, the RCC Trail will be located on the north side of NE 76th Street and will cross Leary Way, 166th Avenue NE and 170th Avenue NE. In the west end of downtown, the RCC trail will travel through the signalized intersection of 161st Avenue NE/Bear Creek Parkway and over Redmond Way via the railroad trestle. These two locations already have safe crossings and are not addressed in this analysis. This memo focuses on the operations and safety of the three trail crossings at Leary Way, 166th Avenue NE and 170th Avenue NE, and recommends improvements for each crossing. The project will also include a parking lot for the RCC Trail users, and we analyze the operations and safety of the parking lot design.

Background Projects

In late 2012, a separate project, the 164th Avenue NE Extension Project, will connect Cleveland Street and NE 76th Street, and construct a mini-roundabout at the 164th Avenue NE/NE 76th Street intersection. The 164th Street Avenue Extension Project will address the RCC Trail operations and safety issues related to crossing 164th Avenue NE.

In 2014, the Downtown East-West Corridor Study (DEWCS) will convert the Redmond Way and Cleveland Street one-way couplet to two-way operations.

Traffic Analysis and Forecasts

All traffic analysis and forecasts were done for the afternoon peak hour. We used multiple SimTraffic simulation runs to analyze intersection operations and trail crossings. The short range forecasts from 2011 to 2012 and 2014 assume a one percent annual growth rate. The 2030 forecast from the DEWCS was used as the basis for the RCC 2030 volumes with minor adjustments to account for recent traffic counts. We used a straight line growth rate to interpolate the years between 2014 and 2030.

The Toole Design Group forecast 107 pedestrians/bicyclists during the afternoon peak hour for all RCC Trail crossings in the downtown area, which we assume would travel in 60 groups, which



would correspond to 60 calls per hour. The Toole Design Group memorandum documenting their pedestrian forecasting methodology and results is included as an attachment to this memorandum.

Leary Way/NE 76th Street Crossing

The Leary Way/NE 76th Street intersection does not meet traffic signal warrants under existing 2011 conditions. To address the pedestrian and bicycle safety at the trail crossing of Leary Way, a rectangle rapid flash beacon (RRFB) system will be installed at the crosswalk on the north leg of the intersection. The RRFB crossing will have one travel lane in each direction with a center median.

The Leary Way/Cleveland Street intersection operates at LOS C under existing conditions. The RRFB will be located 200 feet south of the intersection and it will impact northbound operations of the intersection. When northbound traffic has the green light and the upstream RRFB is engaged at the same time, the signal will not operate at full capacity. While the RRFB will increase delay at the Leary Way/Cleveland Street intersection, the intersection will continue to operate at LOS C in 2014 with the RRFB.

The westbound left-turn from NE 76th Street to southbound Leary Way is projected to operate at LOS F during the 2014 afternoon peak hour. To improve operations of this movement, City staff recommend adding an exclusive westbound left-turn lane on NE 76th Street that will be channelized to enter a southbound add lane on Leary Way. This "flying T" design, similar to the 159th Avenue NE/ Leary Way intersection, will allow westbound left-turns to not yield to southbound Leary Way traffic. This improvement will upgrade the westbound left-turn operations from LOS F to LOS C during the 2014 afternoon peak hour.

166th Avenue NE/NE 76th Street Crossing

The opening of the 164th Avenue NE extension in 2012 will divert traffic from 166th Avenue NE. During the 2012 afternoon peak hour, we forecast traffic volumes on the section of 166th Avenue NE between Cleveland Street and NE 76th Street will be reduced from 770 vehicles to 520 vehicles, a 32 percent reduction. This traffic reduction will allow the 166th Avenue NE/NE 76th Street intersection to be changed from two-way stop control to all-way stop control, providing a safe crossing for the RCC Trail at the crosswalk on the north leg of the intersection.

The intersections of 166th Avenue NE/NE 76th Street and 166th Avenue NE/Cleveland Street are located 145 feet apart. The all-way stop control at 166th Avenue NE/NE 76th Street will perform well in 2012 and in 2014 with the DEWCS. By 2020, the overall operations of the 166th Avenue NE/NE 76th Street and the 166th Avenue NE/Cleveland Street intersections is forecast to be LOS B, but select north and south movements would operate at LOS D. Periodically, southbound traffic exiting the signalized 166th Avenue NE/Cleveland Street intersection will not have sufficient storage length approaching the stop sign at NE 76th Street, and may block traffic on Cleveland

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Street. The northbound approach to the Cleveland Street/166th Avenue NE intersection would operate at LOS D and queues from this movement would extend into the NE 76th Street/166th Avenue NE intersection.

The southbound approach to the 166th Avenue NE/NE 76th Street intersection currently has a channelized right-turn lane, a shared through- and left-turn lane, and a center median island. The intersection design will allow the center median island to be removed to add an exclusive left-turn lane. This additional lane will increase the storage capacity of the southbound approach.

During the November and December holiday season, 166th Avenue NE will experience higher traffic volumes as it provides access to the Redmond Town Center. During this season, the NE 76th Street/166th Avenue NE intersection may require additional traffic control such as a uniformed police officer.

170th Avenue NE/NE 76th Street Crossing

The 170th Avenue NE/NE 76th Street intersection currently has two-way stop control with 170th Avenue NE traffic having free flow conditions. The intersection does not meet traffic signal warrants with existing 2011 conditions, but it is close to meeting the 8-Hour Vehicle Volume Warrant. By 2014, we project the intersection will meet the 8-Hour Vehicle Volume Warrant. A signal would create a safe crossing for the RCC Trail and promote NE 76th Street as another viable east-west street through the downtown. With stop control, the eastbound left-turn from NE 76th Street to northbound 170th Avenue NE is forecast to operate at LOS F during the 2014 afternoon peak hour. A traffic signal would improve the eastbound left-turn operations to LOS C.

Parking Lot Design and Operations

The RCC Trail will be served by a parking lot located north of Bear Creek Parkway and east of Leary Way. The parking lot will have 83 spaces and is designed to serve the RCC Trail users, as over flow parking for the Saturday Market and the surrounding businesses, and possibly future civic buildings.

The parking lot is designed per City of Redmond Parking Standards. The parking lot driveway will have a 30-foot throat length, and the driveway design will meet the City of Redmond sight distance triangle requirements for an arterial street. The sight distance triangle calculations are shown in Exhibit A on the following page. The parking lot will include landscaping, a 24-foot wide travel aisle, and paths connecting to the RCC Trail.



Exhibit A. Parking Lot Sight Distance Triangle





MEMORANDUM

| Date: | 12/15/11 | |
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| То: | Michael Lapham | |
| Organization: | KPG | |
| From: | Michael Hintze, AICP | |
| Project: | Redmond Central Connector | |
| Re: | Trail User Volume Estimation | |
| | | |

Introduction

For the purposes of modeling the expected impacts of the Redmond Central Connector (RCC) on traffic operations of roadways intersecting the trail, user volumes along the trail corridor have been estimated. Estimates take into account the two major generators of traffic on the RCC: proximate land uses, which primarily would generate pedestrian users, and bicycle and pedestrian (including runners and other user types) users diverting from the Sammamish River Trail (SRT) and Break Creek Trail (BCT) to either access the Redmond Downtown or Town Center, or take what might be considered a short-cut route between the two trails.

Diversion Factor

The Sammamish River Trail, and to a lesser extent, the Bear Creek Trail are major regional trails that bookmark either end of the RCC. Trail user count data is available for the SRT and BCT at points within a quarter mile of the RCC. Table 1 provides two-way volumes of each type of trail user for both trails. Volumes for the weekday peak period (4:00 to 5:45 pm) are based on trail user counts, which were conducted by Quality Counts on September 27-29, 2011. The weekend peak volume is derived using data available from FHWA's Shared Use Path Level of Service Calculator, which features the SRT as a case study. Volumes are calculated by multiplying actual trail volume counts (conducted in July 2006) by a peak-hour factor (PHF), which is based on the observed one-way volume for the peak 15 minutes within the 1-hour volume count. This factor was developed to reflect the typical flow peaking conditions found on trails.

For the purposes of modeling, assumptions were made about how many users from the SRT may decide to access the RCC. Table 1 provides a summary. It was assumed that no more than 30% of weekday bicyclists observed on the SRT and BCT would access the RCC, as most users of these trails at this time are commuters seeking the route with the least delay, e.g. signals or other locations where they are forced to stop or slow down. There are no on-street bicycle facilities currently connecting to the RCC, therefore it is assumed that the number of bicyclists accessing the RCC from the street network would be relatively low.

Because pedestrians are generally drawn to areas with more activity, it is assumed a higher percentage of pedestrians on the SRT and BCT would divert to the RCC at all times. Therefore, it was assumed that 50% of pedestrians on the SRT and BCT would access the RCC during the weekday and weekend peak periods.

It was assumed that runners and skaters, similar to bicyclists, may prefer to stay on the SRT and BCT to minimize delay and avoid traffic. Since the number of runners and skaters on the SRT and BCT is very low during the weekday peak, these users are not factored into the RCC user volume.

Land Use Factor

The effect that land use and site design has on pedestrian volumes is well-documented in research. The factors effecting pedestrian volumes include population and employment density, income, land use distribution and intensity, block size and the presence of pedestrian facilities, i.e. sidewalks, lighting, safe and convenient roadway crossings, etc. Without having access to residential population and employment density data, or the square footage of retail space in the immediate area, it is difficult to calculate expected pedestrian volumes based on these measures. However, some assumptions may be made based on the neighborhood site design characteristics, i.e. block sizes, and sidewalk network.

All of the land uses in the vicinity of the RCC can be expected to generate pedestrian traffic. Whether it is residents walking to a nearby restaurant or taking an evening stroll, office workers taking a lunchtime walk, or shoppers who arrived by car, but are making multiple trips on foot, it can be expected that a portion of the pedestrians in the area will access and use the RCC throughout the day. The Redmond Town Center and Downtown area is rated a 95 out of 100 by Walkscore, which classifies it as a "walker's paradise." The number of businesses and services, and the relatively dense street network (the majority of streets have sidewalks on both sides) are major contributors to this high score. There are a number of existing and planned high and medium density residential developments within a half mile of the RCC with the majority located on the north side of the RCC around 161st Ave. In addition, there are a significant number of office uses within a half mile of the RCC. While the area is currently dominated by auto-oriented commercial uses, efforts have been made to make the area more pedestrian-oriented. Given that there are parallel facilities, i.e. sidewalks on NE 76th St and Cleveland St, it is expected that only a portion of utilitarian-related pedestrian trips would occur along the RCC. It is more likely that a majority of utilitarian-related trips movements would be north-south, thus crossing the trail to get between uses in the Downtown and Town Center. The RCC is more likely to attract recreational walking trips with peaks likely occurring during lunch time and in the early evening.

Research indicates that for every 1,000 residents within a suburban town center type context, 8 to 16 people per hour walk into the commercial center. The recently developed residential buildings towards the west end of the RCC together contain over 1,000 units. Many of the residents in this building are likely going to use the RCC either to access commercial uses such as the Town Center, or for recreational purposes. As mentioned, there are numerous other residential developments within a half mile of the RCC. Many of these residents will likely access the RCC for recreational purposes, possibly to connect to the SRT and BCT, or to access retail businesses. Again, without knowing precisely the population density and commercial square footage of the surrounding area, it is difficult to estimate the number of pedestrians using established methodologies. However, it is assumed that the majority of residents in the immediate vicinity would access the RCC during the evening peak hour (and later during daylight savings months) and during the weekend. Professional judgment assumes that the number of pedestrians accessing the trail from proximate land uses (residential, retail, office) would not exceed 30/hour during the weekday peak and 40/hour during the weekend peak in the year 2012. This number can be expected to increase over time as adjacent parcels redevelop, and the RCC becomes more established as a "place".

Some land uses such as restaurants and coffee shops may attract bicyclists, particularly weekend recreational riders. The RCC will also likely attract weekend utilitarian riders by allowing these cyclists to access the Downtown and Town Center without having to go on-street. These bicycle users, as well as runners and skaters, were captured in the SRT diversion assumptions discussed above.

Table 1

| | | Bikes | Peds | Land Use Factor | TOTAL USERS |
|-----------------|-------------------------------------------|-------|------|--------------------|----------------|
| Weekday Peak | Sammamish River Trail* | 20 | 25 | N/A | 45 |
| | Bear Creek Trail** | 15 | 8 | N/a | 23 |
| | RCC Expected Weekday Peak Volume | 35 | 33 | 30 | 98 |
| Weekend Peak | RCC Expected Weekend Peak Volume*** | 98 | 7 | 40 | 145 |

^{*} Source: Quality Counts 9/28/11. Includes 30% of southbound bicyclists and 50% of southbound pedestrians counted at location north of NE 85th St and northbound users counted south of Leary Way **Source: Quality Counts 9/29/11. Includes 30% of total bicycle volumes (all directions) and 50% of total pedestrian volumes (all directions)

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^{***}Source: Shared Use Path Level of Service Calculator 7/06, percentage mode split based on actual two-way trail volumes collected on Sammamish River Trail. 30% of bicyclists, and 50% of pedestrians assumed to from SRT to RCC.

¹ Site Design and Pedestrian Travel. Paul M Hess, Anne Vernez Moudon, Mary Catherine Synder, and Siril Stanilov. *Transportation Research Record* 1674, Paper No. 99-0424.

Groups

Research involving counts on two urban multiuse greenways in Indianapolis indicates that between 42% and 58% of users may be in groups of two or more. ² These two trails, while located in an urban area, have a more natural character with few abutting or proximate commercial uses. Because the land uses surrounding the RCC may generate more individual utilitarian trips than a purely recreational greenway would, it might be assumed that the percent of trail users in groups of 2 or more may trend toward the lower end of this range.

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² Using Pedestrian Count Models to Estimate Urban Trail Traffic. Patrick Lindsey and Greg Lindsey. *Journal of Regional Analysis & Policy*, 34:1, 2004.

