

TECHNICAL MEMORANDUM

DATE: October 12, 2006

TO: Bill Hoffman, City of Portland

FROM: Peter Coffey, P.E.
Alan Snook, AICP

SUBJECT: Burnside/Couch One-way Street Grid Extension

P05092-005

The purpose of this memorandum is to provide additional supportive narrative to the proposed Burnside/Couch extension of the downtown one-way street grid system. The supporting narrative is focused on the safety (pedestrian and motor vehicle) and functionality of the proposed project. It is meant to supplement the prior work completed to date and serve as a reference document to enhance the analysis and description of the proposed project.

Functionality

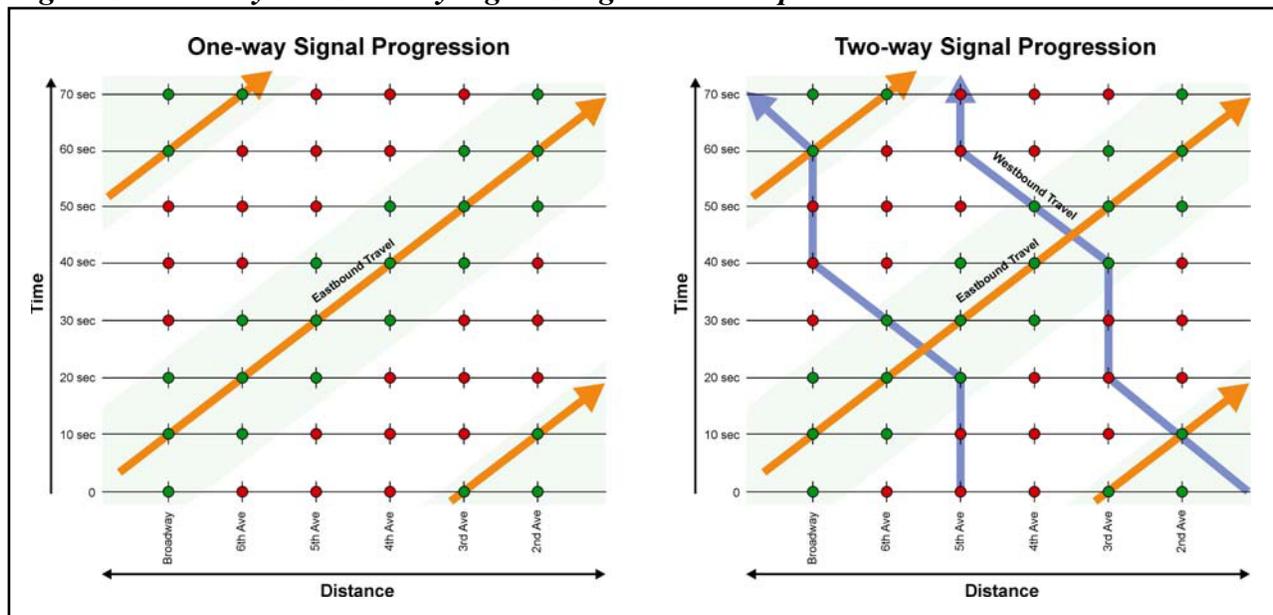
Currently W Burnside is a two-way street with minimal left turn opportunity. The two-way operations on W Burnside (and minimal left turn opportunity) create a barrier within the downtown separating the downtown business area (south of W Burnside) from Old Town/Chinatown and the Pearl District (north of W Burnside). The extension of the one-way grid network of the downtown Portland street system to include W Burnside and NW Couch Street would allow for a more contiguous and seamless street network for the downtown.

There are more benefits to the conversion from two-way operation to two one-way streets than just enhanced left turning opportunity and continuity in the street network. One additional benefit is the opportunity to reclaim right-of-way along W Burnside and utilize it for additional common space for pedestrians and/or development. This is accomplished by removing the two westbound through travel lanes on W Burnside. The westbound travel would then divert to NW Couch Street, which currently has two travel lanes and would be converted to one-way travel (currently NW Couch has two-way operations). The westbound travel lanes on W Burnside now become additional usable space for expansion of development and/or wider sidewalks.

Traffic operations typically function better in a one-way street environment. This is due to the ability to progress traffic along one-way streets better than trying to benefit both directions of

travel on a two way street. Under one-way operations there is only one direction of travel that are trying to progress along a street. Under two-way operations there is an opposing travel direction that is trying to progress up the street, but has difficulty doing so because the signal progression is favoring the opposing direction. Figure 1 helps to demonstrate these types of operations.

Figure 1: One-way and Two-way Signal Progression Comparison



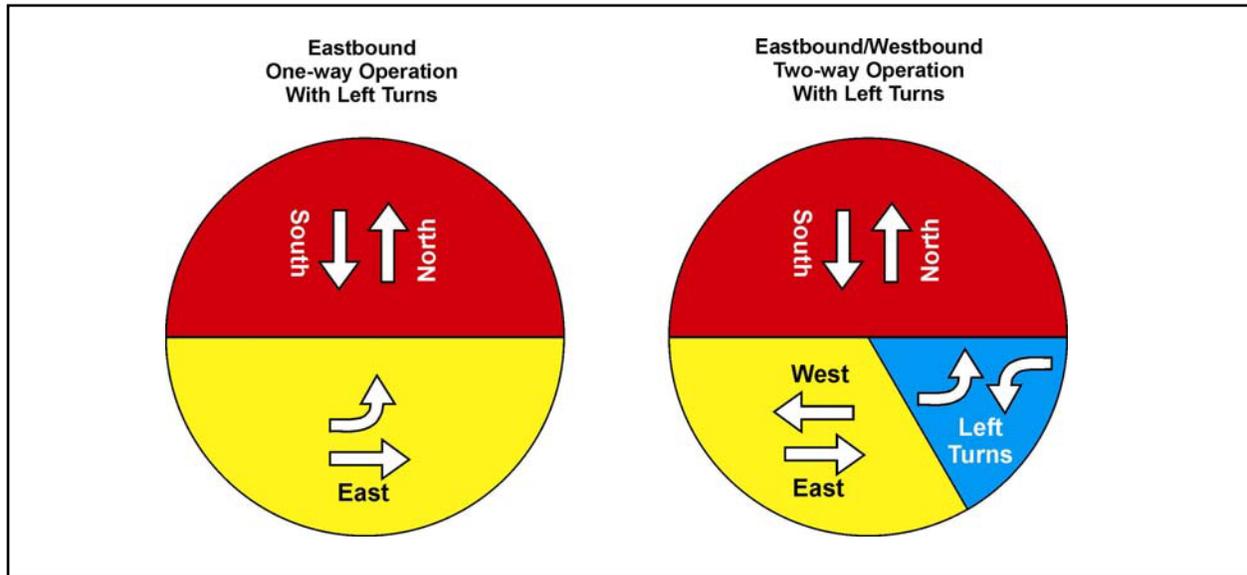
As Figure 1 depicts, the one-way signal progression favors one direction of travel and allows vehicles to progress along a roadway with minimal delay. The two-way signal progression would still favor one direction of travel, however the opposing direction of travel can result in additional delay by not being in the “green band” (green signal time in the opposite direction). The opposing direction must then wait at a red light until the favored travel direction turns green again.

One of the potential issues with implementing a one-way street system is that since the progression of signals would favor increased vehicle speeds on the roadway. Implementing coordinated signal timing that is progressed at a specific speed can minimize the speed of vehicles. For example, the currently vehicle progression speed of the downtown roadway network is approximately 10-12 miles per hour. This favors the progression of bicycles utilizing the roadway as well as keeps the speeding of vehicles to a minimum.

In addition to signal progression being a benefit to the functionality of one-way streets versus two-way streets, there is a benefit of enhanced capacity at intersections with one-way operation in comparison to streets with two-way operation if the two way street allows left turns. Studies have indicated that converting two-way streets (with left turns) to one-way operation (with the same number of travel lanes) allows for 20-50% more vehicles to move through the intersection

due to fewer potential turn delays.¹ If left turns are removed from an intersections operation this allows for green time to serve opposing through vehicles rather than delay the vehicles. Therefore more vehicles can be serviced. Figure 2 helps to illustrate this.

Figure 2: Two-way Left Turn Phasing Compared to One-way Phasing



As shown in Figure 2, the left turns on a two-way street take time away from the eastbound/westbound through movements. However, on a one-way street the left turns can be made with the eastbound through movement. By removing the left turn phasing additional capacity can be utilized at the intersection by allowing the opportunity for more through vehicles to be served. The westbound travel direction would be serviced on the adjacent parallel one-way roadway (NW Couch Street).

Safety Enhancements

In addition to the functional benefits of the extension of the one-way street network to include W Burnside and NW Couch Street, there are also potential safety benefits to consider. The key benefactors for this one-way street operation are pedestrians and motor vehicles. The following describes the potential benefit(s) for both pedestrians and autos via a one-way street network in comparison to a two-way network.

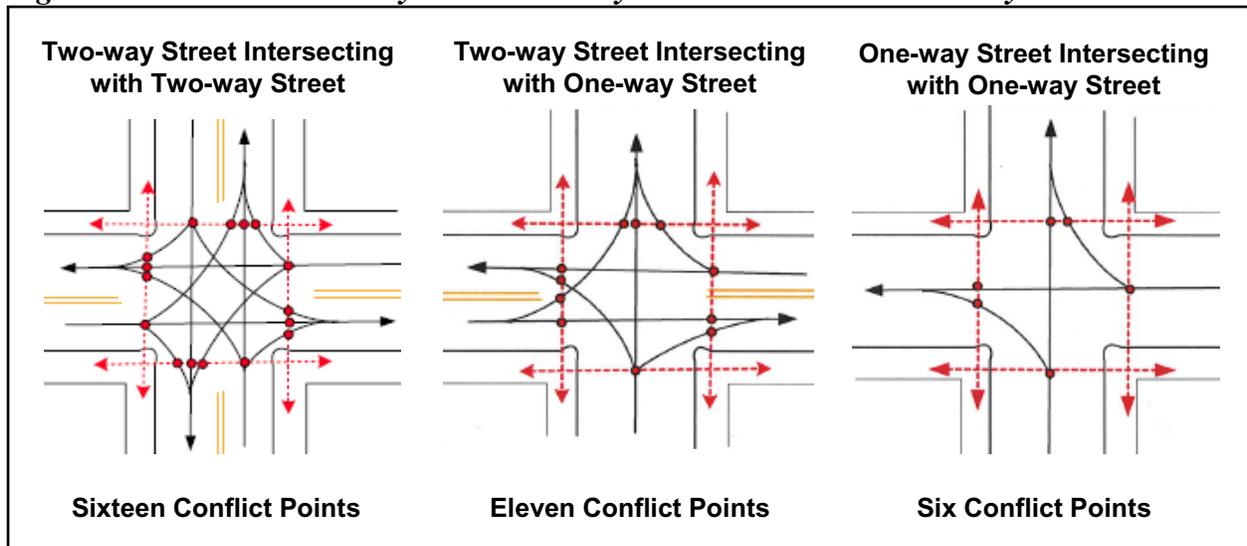
Pedestrian Safety

The conversion of W Burnside from two-way to one-way operation would allow for a shorter crossing distance for pedestrians (north/south) across W Burnside. This is an immediate safety benefit for crossing. W Burnside has some of the highest related pedestrian/motor vehicle accidents in the City of Portland. Any benefit to pedestrian safety would be beneficial along this roadway.

¹ *No Two Ways About It: One-Way Streets Are Better Than Two-Way Streets*, by Michael Cunneen and Randal O'Toole, Issue Paper 2-2005, February 2005, page 6.

An additional pedestrian safety benefit with operating a one-way street grid network is the reduced number of potential pedestrian/motor vehicle conflict points. A traditional two-way street intersecting with a two-way street has up to sixteen pedestrian/motor vehicle conflict points. Even a two-way street intersecting with a one-way street has up to eleven conflict points. However, when these configurations are converted to two intersecting one-way streets the number reduces to six conflict points. Figure 3 illustrates these conflict point locations.

Figure 3: Pedestrian Two-way versus One-way Intersections with a One-way Side Street



Research has indicated that two-way streets (in comparison to one-way streets) “produced 163 percent more pedestrian accidents in Sacramento, and 100 percent more pedestrian accidents in Portland OR, Hollywood FL, and Raleigh NC.”²

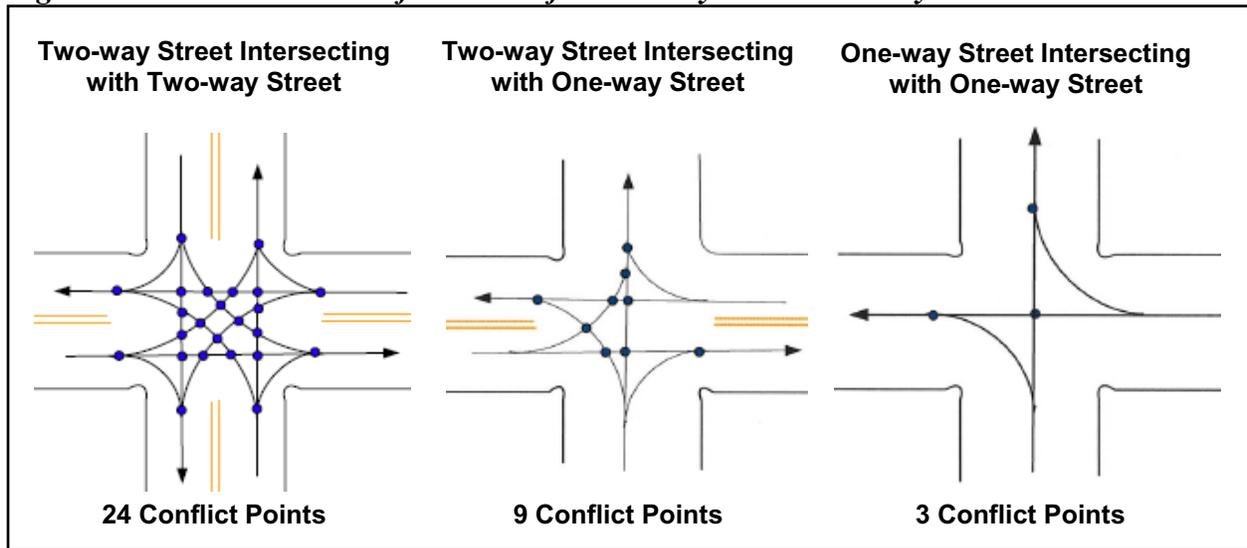
Another potential safety benefit for pedestrians crossing streets in a one-way grid system is the ability to focus the attention of the pedestrian crossing on vehicles approaching in only one direction of travel rather than two directions of travel.

Auto Safety

Similar to the reductions in pedestrian conflict point, conversion from two-way to one-way creates a reduced amount of potential motor vehicle to motor vehicle conflict points. The number of conflict points for motor vehicles reduces from 24 with the intersection of two two-way streets to three with two one-way streets. Figure 4 illustrates these conflict point locations.

² *No Two Ways About It: One-Way Streets Are Better Than Two-Way Streets*, by Michael Cunneen and Randal O’Toole, Issue Paper 2-2005, February 2005, page 7.

Figure 4: Motor Vehicle Conflict Points for Two-way versus One-way Intersections



The reduced number of potential conflict points does in fact reduce the potential for collisions. One study indicated that the conversion of two-way streets to one-way operation reduce the potential for collisions between motor vehicles by up to 38%.³ Another study in Portland OR found that the conversion from two-way to one-way operations reduced collisions by 51% at intersections themselves, and reduced collisions by 37% between intersections.⁴ Additionally, the Oregon Department of Transportation has studied the effect of the conversion of streets/highways from two-way to one-way in a number of Oregon towns from Astoria to Eugene, and have found there to be a potential collision reduction of 10%.⁵ Clearly there are safety benefits in the realization of fewer potential motor vehicle collisions with a one-way grid street network.

Other Efforts

There are many other efforts currently underway related to converting existing two-way streets to one-way networks, and/or converting one-way grid networks to two-way operations. It is useful to explore some of these other efforts to detail the reasons why a one-way grid system is either being implemented or not. The following is a description of some recent examples:

Seattle South Lake Union, Seattle WA: The South Lake Union project is a large scale development encompassing approximately 14 city blocks to the south of Lake Union. The developments include mixed use, commercial, retail, bio-tech and residential units with over 3 million square feet of development. The majority of the streets are currently one-way, and the project is currently proposing to convert them to two-way operations. Included as transportation projects in this area is light rail, monorail, streetcar and a number of bus routes. Typically the

³ *Transportation and Traffic Engineering Handbook* 2nd Edition, W.S. Homburger (Englewood Cliffs, NJ: Prentice Hall 1982).

⁴ "One-Way Grid System of Portland, Oregon," by Fred T. Fowler, *Traffic Engineering*, April 1953, p. 231.

⁵ *No Two Ways About It: One-Way Streets Are Better Than Two-Way Streets*, by Michael Cunneen and Randal O'Toole, Issue Paper 2-2005, February 2005, page 6.

conversion of streets from one-way to two-way focus on one or two corridors. This development is addressing a grid system nearly 8 city blocks square (almost 65 city blocks). The conversion of streets from one-way to two-way in this development is addressing circulation not only for motor vehicles, but also for a multitude of alternative modes of travel as well.

Vancouver City Center Vision, Vancouver WA: Similar to the south Lake Union project, the City of Vancouver has recently undertaken a downtown visioning analysis to address potential for development and circulation. The area being analyzed was over 100 city blocks in size and relied on the conversion of one-way streets to two-way operations to enhance circulation to/from the freeway access points of Interstate 5 as well as SR 14. In addition, planning for light rail being two-way on one of the roadways was also considered, which coincided with creating a two-way grid system in the downtown.

Belmont/Morrison Decouple Relocation Study, Portland OR: A study of SE Belmont and SE Morrison Streets from SE 7th Avenue to SE 25th Avenue was conducted in October 1998 to determine if decoupling the roadways (creating two two-way streets from two one-way streets) would be beneficial. The outcome/analysis revealed that it was more beneficial to traffic operations to retain these streets in their existing one-way configuration. Based on the higher volumes on the roadway (approximately 20,000 average daily vehicles at the time) the corridors would operate more efficiently for transportation as two one-way streets. Conversion to two-way with left turning opportunities created additional delay.

Findings and Potential Recommendations

It is clear that a one-way street network could operate better than a two-way street network in the ability to progress vehicles and enhance operations at intersections. It is also beneficial for pedestrian and motor vehicle safety to implement a one-way street network in comparison to a two-way street network. The extension of the downtown one-way street network to include W Burnside and NW Couch Street has the potential to enhance pedestrian safety by shortening crossing distances on W Burnside and reducing the number of potential conflict points between pedestrians and automobiles. The grid extension also has the potential to enhance safety for motor vehicles by reducing the number of motor vehicle to motor vehicle conflict points in comparison to a two-way street network.

Other cities have pursued converting existing one-way street networks to two-way systems with mixed results. Many cities have found that the two-way street network increased the potential for collisions, and had the potential to decrease traffic volumes on that roadway (while surrounding roadways took on the diverted traffic). The one-way vs. two-way debate is a complex issue that relies heavily on the functional integrity of the roadway being considered, and the nature/size of the land use currently in place along the roadway or the land use being considered for potential redevelopment along the roadway. Prior findings within the City of Portland have indicated that roadways with higher volumes that are currently one-way systems and have evaluated converting to two-way circulation have retained the one-way operation due to better operations.