

PBOT

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Companion to City Traffic Engineer Directive LW-003 - Half Signals

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PURPOSE:

This document provides supplemental information not contained in *City Traffic Engineer Directive LW 003 - Half Signals*, including informing documents, half signal design guidelines, ADA implications, asset documentation info and references.

INFORMING DOCUMENTS:

A 2006 analysis by Fitzpatrick et al, detailed in ***TCRP REPORT 112/NCHRP REPORT 562 Improving Pedestrian Safety at Unsignalized Intersection***, included six sites from Portland and Seattle and shows similarly high (i.e. above 95 percent) motorist compliance (yielding or stopping when required) at red beacons, including half signals, midblock signals, and Pedestrian Hybrid Beacons (HAWK signals) on high-volume, high-speed arterial streets. The authors note that crash analyses in Seattle “have documented that, with consistent operation, half signals can actually reduce vehicle-vehicle crashes and pedestrian-vehicle conflicts.”¹

A 2015 Master’s Thesis from Portland State University, ***Safety at Half-Signal Intersections in Portland, Oregon***, provides a robust evaluation of half signals.² Crash data at half signals from 2002-2011 (442 crashes, 16 of which involved pedestrians), in addition to crash data from matched comparison groups of minor stop-controlled and fully signalized intersections were analyzed. Conflict analysis was performed using 24-hr video analysis of five intersections. Highlights from the findings are provided as follows:

- Overall crash rates
 - Crash rates for half signals did not differ significantly from the minor street stop controlled and signalized comparison groups.
- Crashes involving pedestrians

¹ Fitzpatrick, K., et al. 2006. TCRP REPORT 112/NCHRP REPORT 562. Improving Pedestrian Safety at Unsignalized Crossings. <https://nacto.org/wp-content/uploads/2010/08/NCHRP-562-Improving-Pedestrian-Safety-at-Unsignalized-Crossings.pdf>

² Johnson, (2015).



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- Pedestrian crashes were more likely to be the fault of motorists departing from the minor road who collided with pedestrians crossing the major street (than motorists departing the major street).
- Left-turn crashes
 - Crashes involving left-turns from the minor street may pose a greater risk at half signalized intersections than fully signalized or minor street stop-controlled intersections. However, the study did not have enough data to test this hypothesis.
 - In an analysis of conflicts, no conflicts were observed that reflect the crashes involving left-turning vehicles from the minor street and pedestrians.
- Rear-end crashes
 - Results suggest that half signals have higher rear-end crash rates compared to minor stop controlled intersections, but are similar to fully signalized locations.
- Compliance
 - Compliance of the half signal by vehicles and pedestrians was comparable to compliance at fully signalized intersections found in other studies with one exception - left turn on red violations from the major street occurred late into the red phase, presumably because there is a low risk of colliding with a vehicle on the minor street.
 - Previous research indicates concern over minor street stop non-compliance and not giving adequate attention to pedestrians crossing major streets. In this study, when pedestrians were present, a motorist on the minor street was four times more likely to stop at the sign.
- Methodological issues
 - Cross-sectional studies cannot fully account for different contextual factors between studied locations.
 - Pedestrian volumes are not accounted for in many before/after studies.
 - Regression to the mean effects may exist (e.g. when signals are installed as reactionary responses to recent crashes).
 - Interactions between drivers and other drivers/pedestrians at half signals are not well researched.

The **City of Seattle Department of Transportation’s Traffic Operations Manual – Pedestrian Half Signals section**³ served as a key reference for the guidelines contained in this document. According to Seattle’s City Traffic Engineer, their half signals policy will be updated to reflect neighborhood greenway policy goals of enhancing bicycle and pedestrian prioritized street crossings.⁴ The document notes that Seattle-based “reports and data from 1974, 1988, and 2000 have shown a significant reduction in pedestrian collisions at locations with half signals, and a smaller reduction in vehicle collisions.”

A 2017 memorandum from the Northwest Region Traffic Engineer at Washington State Department of Transportation to the Director of Transportation Operations at the City of Seattle Department of Transportation notes the approval of a signal permit application for a half signal at the SR99/N 92nd St

³ City of Seattle Half Signal Traffic Manual, 2010. (sent in personal communication from D. Chang, October 23, 2017)

⁴ D. Chang (personal communication, October 23, 2017).

intersection contingent upon several conditions, including (a) interconnection and coordination with adjacent traffic signals and (b) follow-up evaluations of traffic volumes, travel times speed, transit ridership, parking utilization and pedestrian and bicycle crossing volumes.⁵

DESIGN GUIDELINES:

PBOT designs and installs pedestrian half signals as funding allows by adapting the appropriate elements from our Standard Drawings & Details to each individual intersection.⁶ Additional design details are provided in PBOT's Signals, Street Lighting & ITS Division Traffic Signal Design Guide.⁷

Left turns and/or through movements to and from minor street approaches may be prohibited in cases where there are safety concerns due to crash history or features such as offset intersections, crosswalk placement, or visibility obstructions. There is also concern with motor vehicles turning left from a major multilane (i.e. four or more lanes) roadway onto the side street in conflict with people walking and biking across the side street intersection. To accommodate a half signal in those cases, the minor street should be restricted to right-in, right-out motor vehicle movements only. Motor vehicle left-turns to and from the minor street should be prohibited with physical barriers such as concrete median islands. To maintain left-turn motor vehicle access at multi-lane locations, a full signal with protected left-turn phasing should be considered.

PBOT's new citywide pedestrian plan, PedPDX, requires more closely spaced traffic control devices to provide pedestrian crossings on arterial streets.⁸ Half signals are a tool for these corridors so that drivers will have a more consistent experience seeing standard signal indications as they travel between closely spaced pedestrian crossings and to maintain signal progression along busy arterials.

The FHWA will consider removing the guidance against installing Pedestrian Hybrid Beacons within 100ft of an intersection in the next edition of the MUTCD as described below:

"Q: Why does Section 4F.02 say that Pedestrian Hybrid Beacons should not be installed at or within 100 feet of side streets or driveways that are controlled by STOP or YIELD signs? Sometimes the only reasonable place to install a hybrid pedestrian beacon is at the intersection.

A: The FHWA has been discouraging "half signals" for several decades because of the issues such designs cause when the interruption of the major-street traffic flow by a pedestrian actuation is used by side-street drivers as their opportunity to turn onto the major street, in conflict with the crossing pedestrians. Hybrid beacons placed at or adjacent to an intersection with a STOP or YIELD sign controlled side street is a half

⁵ Memorandum from M. Bandy, Northwest Region Traffic Engineer at Washington State Department of Transportation to M. Leth, Director of Transportation Operations at the City of Seattle Department of Transportation Re Signal Permit application SR 99, MP 37.80, N 92nd Street. May 16, 2017.

⁶ Portland Bureau of Transportation. Standard Drawings & Details. P-600 through P-699 Signals and Street Lighting. <https://www.portlandoregon.gov/transportation/article/668195>.

⁷ Portland Bureau of Transportation Signals, Street Lighting & ITS Division. *Traffic Signal Design Guide*. January 2017. <https://www.portlandoregon.gov/transportation/article/643224>.

⁸ Portland Bureau of Transportation. PedPDX: Portland's Citywide Pedestrian Plan <https://www.portlandoregon.gov/transportation/72504>.

signal with the same operational and safety issues. The provision in Section 4F.02 is also consistent with the half-signal prohibitions that were adopted in Sections 4C.05 and 4C.06. Please note that these provisions in 4C.05, 4C.06, and 4F.02 are Guidance, not Standards. Thus, based on an engineering study or engineering judgment, a jurisdiction can decide to install the device at such an intersection if it determines that is the best location for it, considering all pertinent factors, and/or there are mitigating measures, such as blank-out No Right Turn/No Left Turn signs for the side street or making the side street one-way away from the intersection. The decisions should be documented in the jurisdictions' files as basis for deviating from a Guidance statement in the MUTCD. It should also be noted that the National Committee on Uniform Traffic Control Devices (NCUTCD) has recommended to the FHWA that the Section 4F.02 guidance against installing pedestrian hybrid beacons within 100 feet of an intersection should be removed from the MUTCD, because a study of hybrid beacons at intersections in Tucson, Arizona, did not find significant operational or safety issues. The FHWA will give consideration to proposing the removal of the 100 feet guidance for the next edition of the MUTCD.”⁹

ADA IMPLICATIONS:

Pedestrian half signals improve access for all pedestrians, including those with mobility challenges. ADA access at the crossing location is addressed during design. More information on how PBOT's Signals, Street Lighting & ITS Division meets ADA requirements are provided in our Traffic Signal Design Guide.¹⁰

ASSET DOCUMENTATION:

Pedestrian half signals are assets owned and maintained by PBOT. Asset information is captured as part of the design and installation process and the asset data is maintained by PBOT's Signals, Streetlighting & ITS Division.

REFERENCES:

City of Portland Charter, Code and Policies. 16.10.200 Duties of the City Traffic Engineer.
<https://www.portlandoregon.gov/citycode/article/227045>.

Fitzpatrick, K., et al. 2006. TCRP REPORT 112/NCHRP REPORT 562. Improving Pedestrian Safety at Unsignalized Crossings. <https://nacto.org/wp-content/uploads/2010/08/NCHRP-562-Improving-Pedestrian-Safety-at-Unsignalized-Crossings.pdf>

Johnson, Todd Robert, "Safety at Half-Signal Intersections in Portland, Oregon" (2015). Dissertations and Theses. Paper 2200.

⁹ Manual on uniform Traffic Control Devices (MUTCD) Frequently Asked Questions – Part 4 – Highway Traffic Signals: Pedestrian Hybrid Beacons. https://mutcd.fhwa.dot.gov/knowledge/faqs/faq_part4.htm.

¹⁰ Portland Bureau of Transportation Signals, Street Lighting & ITS Division. *Traffic Signal Design Guide*. January 2017. <https://www.portlandoregon.gov/transportation/article/643224>.

https://pdxscholar.library.pdx.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=3201&context=open_access_etds.

Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition Part 4 Figure 4F-2. Guidelines for the Installation of Pedestrian Hybrid Beacons on High-Speed Roadways.

<https://mutcd.fhwa.dot.gov/hm/2009/part4/part4f.htm>.

Manual on Uniform Traffic Control Devices (MUTCD) 2009 Edition Chapter 4D. Traffic Control Signal Features. Section 4D.34. Use of Signs at Signalized Locations.

<https://mutcd.fhwa.dot.gov/hm/2009/part4/part4d.htm>.

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Portland Bureau of Transportation, 2015. Neighborhood Greenways Assessment Report.

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