TO: Mayor and Council

FROM: Jim Baird, Police Chief
Derek Delacourt, Community Services Area Administrator
Jen Lawson, Water Quality Manger, Systems Planning
Brett Lenart, Interim Director, Office of Community & Economic Development
Craig Hupy, Public Services Area Administrator
Nick Hutchinson, City Engineer
Cresson Slotten, Systems Planning Manager

CC: Tom Crawford, Interim City Administrator

SUBJECT: Council Agenda Responses

DATE: 3/10/16

CC-1 – Resolution to Appoint Karie Slavik to the Environmental Commission

Question: Are there current vacancies on Environmental Commission? (Councilmember Warpehoski)

Response: A commissioner is expected to leave the commission after April. That will leave an open public vacancy.

CA – Street Closures

Question: Could you please outline the process by which events that involve street closings are approved? I'm more interested in the broader trade-offs between the advantages (cultural, proximate economic benefits, health) and disadvantages (inconvenience, economic disadvantages for surrounding area due to traffic). Also, for events which benefit charities, is there vetting of the quality of these charities? (Councilmember Westphal)

Response: Staff's review of event applications are for feasibility and community impact, but not reviewed to evaluate their purpose. When applications for special event street closures are received, they are sent to a review team for comments and approval. The approval team includes Police, Fire, Solid Waste, Project Management (for construction conflicts) and the City Attorney's Office. Other parties on the distribution list include AAATA, DDA, UM and the Street Associations. While they have input, some of which may require the applicant to make some changes, the ultimate approval comes from Council. Any objections are noted in the memo text of the resolution.

If there are issues, a meeting is usually called to work them out. (Police disapproval usually means disapproval overall. The exception to that would be events like Oktoberfest last year on a UM Home Game weekend. It is Police practice not to approve events on those types of weekends. The disapproval was noted in the memo and Council considered it, but approved the resolution.) There is no vetting of the charities. Should Council have questions regarding the trade-offs, the applicant could be asked to come to the meeting to address this for a broader discussion with Council as a whole.

CA-4 – Resolution to Close Streets for the Townie Street Party – Ann Arbor Mile – Dart for Art - Monday, July 18, 2016

Question: This portion of State Street is often highly congested, what impacts were there on traffic last year for the race? (Councilmember Warpehoski)

Response: There have been no complaints regarding congestion received by the City, the Original Art Fair organizers, or Police for this event. Drivers have used alternate streets to navigate around the race and the event.

CA-6 – Resolution to Adopt FY 2016-18 Human Services Funding Process

Question: Is there a resolution text to go with the memo? (Councilmembers Warpehoski and Lumm)

Response: The technical problem has been resolved and the text is now available on the web.

Question: Do all seven human services partners have Living Wage requirements equal to, or greater than what is required by the City's living wage ordinance? (Councilmember Eaton)

Response: No, all seven Coordinated Funding Partners do not maintain living wage requirements that equal or exceed the City's. Only the City, Washtenaw County, and the Washtenaw Urban County have ordinances that apply such requirements.

Question: Are there any significant operational or process changes contemplated in this renewal? (Councilmember Lumm)

Response: No, there are not significant operational or process changes contemplated. While not a change to process one notable difference from last time is the addition of another funder, St. Joseph Mercy Ann Arbor, who is joining the collaboration for the first time this funding cycle.

CA-8 – Resolution to Approve a Professional Services Agreement with Burton and Associates for the Stormwater Rate and Level of Service Analysis (RFP No. 945; $172,615.00)

Question: The cover memo indicates that "the recommended rate increases needed to implement fully the Level of Service B have not been approved". I understand that the projected cost to achieve LOS B will be part of this study, but can you please provide the rate of increases by year that were recommended in 2007 to achieve LOS B and the actual rate increases that were adopted? (Councilmember Lumm)

Response: The recommendation from the report was for the City to maintain an 11% rate increase that had occurred, on average from 2003 to 2006, until revenues sufficient to support a Level of Service B program were raised.

The actual rate increases that were adopted are as follows:

2007	21.82%
2008	14.41%
2009	11.00%
2010	1.64%
2011	1.95%
2012	3.12%
2013	3.32%
2014	3.80%
2015	5.92%
2016	6.38%

CA-17 – Resolution to Authorize Professional Services Agreements with Orchard, Hiltz & McCliment, Inc. (OHM) for the Design of the Nixon/Green/Dhu Varren Intersection Improvement and the Nixon Road Corridor Traffic Study (RFP No. 955) ($538,076.00)

Question: Can OHM provide a copy of the proposed pedestrian/non-motorized "scoresheet" they refer to on page 69 of the proposal, or alternatively, provide a link to the form used by the city of Charlotte NC. (Councilmember Smith)

Response: Please refer to the attached documents from the City of Charlotte.

Question: Can OHM utilize either an in-house facilitator or partner with another contractor to provide public engagement and facilitation. (Councilmember Smith)

Response: Public Engagement was included in OHM's scope (Task 3 in their proposal, Page 71), and they have included a subconsultant to perform this work (see page 12 of the OHM proposal for more detailed information)

Question: Is it possible to provide the proposal cost breakdown by phase and by firm? It was not included in the RFP response. I'd like the cost breakdown for the OHM team. Specifically, I'd like to know how much Project Innovations is in the proposal for and to better understand the allocation of budget for both OHM and PI between the intersection design and the corridor traffic study. (Councilmember Smith)

Response: To clarify, OHM staff is performing the intersection design and the corridor study. Project Innovations is the community engagement subconsultant for both tasks. The breakdown of costs is as follows:

Task 1 – Intersection Improvement Design = $356,121 (OHM = $340,721; G2 = $15,400)
Task 2 – Nixon Road Corridor Study = $92,655 (OHM = $83,280; Traffic Data Collection = $9,375)
Task 3 – Community Engagement - $89,300 (OHM = $45,540; Project Innovations - $43,760)

Question: A contingency amount of $60K is proposed. Can you please confirm that is in addition to the $538K fee and that it's intended to cover the intersection design and the corridor study? Also, now that we know the engineering cost of the intersection improvement what is the latest total cost projection for the intersection improvements reflecting the current market/relatively high bid prices we're seeing? (Councilmember Lumm)

Response: The contingency amount is in addition to $538,000 contract amount. A contingency is commonly included to address items that may come up unexpectedly that are outside of the base scope of work. The contract would need to be administratively amended in order to make the contingency amount available, and would only be used for items related to the intersection design and/or corridor study. There is no revised cost estimate for the project available at this time. More data needs to be obtained from the current season's bid openings before a reasonable revision to the cost estimate can be made.

Question: On page 68 of the OHM proposal, it is indicated that all new traffic data will be collected for the corridor. That's appropriate and can you please confirm that the data will reflect Nixon Farms N&S, Woodbury Club, and North Sky impacts (as currently

proposed) as well as other potential developments that would impact traffic on the corridor? (Councilmember Lumm)

Response: Yes, it will.

Question: Page 69 of the OHM proposal includes the following "*We presume it is the city's goal to look at improvements that would represent the least needed to maintain a reasonable mobility for vehicles, while focusing on more significant improvements in mobility and safety for pedestrians and bicyclists*." Can you please clarify where this assumption came from and does 'the least needed for vehicles" with a "focus on more significant improvements for pedestrians and bicyclists" represent staff's priorities and perspectives on the study? (Councilmember Lumm)

Response: The intent of this language is to look at improvements that would be least impactful to the surrounding environment, while still moving traffic efficiently and cost effectively. The corridor study will encompass and evaluate all modes of transportation including vehicles, bicycles, and pedestrians; and will include a balanced analysis of all modes of travel.

Question: Regarding the community engagement aspect of the professional service agreements, Page 71 of the OHM proposal indicates there will be up to 18 stakeholder interviews (9 each for the intersection design and corridor traffic study) and four public meetings. Can you please clarify (1) who specifically the stakeholder groups are and (2) confirm that there will be public meetings related to the corridor traffic study (the general public meetings listed reference the design options and design selection which seems to suggest they're just the intersection)? (Councilmember Lumm)

Response: Staff and the consulting team will identify the stakeholder groups once work begins on the project, and will make use of the City's Community Engagement Toolkit to aid in this process. While the specifics of the pubic engagement process have yet to be worked out between City staff and the consulting team, public meetings will be held with discussion of both the intersection improvements and the corridor study.

Question: Finally, as proposed for tonight's meeting, the city will be engaging both OHM and Project Innovations in two major new projects - this project as well as the Stormwater Rate and Level of Service study – on top of work they are already doing for the city. Can you please speak to their capacity to deliver effectively on all of this work and whether the city is concerned about the concentration of work? (Councilmember Lumm)

Response: Staff is comfortable with the capability and capacity of the consulting team to effectively deliver the work product for this project.

CA-18 – Resolution to Award a Contract with CB&I Environmental & Infrastructure, Inc. for Organics Management Plan ($204,690.00) and Contingency ($20,469.00) (RFP No. 951) and Appropriate Funds form Solid Waste Fund Fund Balance ($125,159.00) (8 Votes Required)

DC- 6 – Resolution Directing the City Administrator to Develop a Budget and Timeline for a Pilot Organics Collection Program

Question: DC-6 directs staff to develop all of the budget and timeline-related information for 2 separate pilot programs (one with DDA and one with AAPS) and for an educational outreach program within 10 days. Can staff please comment on whether that's realistic timing (and if not what would be more reasonable) and whether it's staff's view this should be part of the larger FY17 budget discussion? (Councilmember Lumm)

Response: The March 21, 2016 completion date would likely not be achievable. A target date of April 8, 2016 to prepare the budget and timeline requested should be achievable. This would allow the findings to be included in the final FY17 budget discussions.

Question: Given that CA-18 is to conduct a detailed study of a comprehensive organics program, can staff please comment on the pros and cons of waiting until that study is completed before investing resources (staff time or money) on specific pilot programs and/or educational outreach programs? (Councilmember Lumm)

Response: An advantage of waiting until the study is completed before investing in specific pilot programs and/or educational outreach programs is that a more detailed examination of what would be involved in the pilot program implementation(s), such as: necessary resources, regulatory mechanisms, and service provisions will have been completed through the study. A disadvantage of waiting until the study is completed is that the anticipated interest and enthusiasm within the business community to undertake a broader organics program would not be utilized as quickly as desired.

An advantage of initiating these pilot programs before completion of the study is that lessons learned from the pilot program(s) during the study effort could shape or adjust the direction the study and its findings. A disadvantage of initiating these pilot programs before completion of the study is that aspects of the pilot program may need to be adjusted more during the study effort than if undertaken after the study.

Question: Resolution states that as much as 40% of solid waste is organic. I also remember seeing a news item that the glass that is collected under recycling is not being recycled anymore and that it is being diverted to solid waste due to low market prices that makes it non-profitable to recycle. Can you kindly confirm this? If it is indeed so, what percent of solid waste is this new glass "waste." Are we just moving the deck chair around? (Councilmember Kailasapathy)

Response: It is correct that the market is such that recovered glass is not currently recycled for glass production, however, the material is re-used as Daily Landfill Cover by the Woodland Meadows Landfill. As this material is recovered and re-used producing revenue, it is not classified as Solid Waste.

B-1 – An Ordinance to Amend and Replace Sections 1:271, 1:272, 1:273, 1:274, 1:275, 1:277, and 1:278 of Chapter 12 (Financing Local Public Improvements) of Title I, Sections 1:281, 1:282, 1:284, 1:286, 1:292, 1:293, 1:295, 1:299, 1:300 and 1:301 of Chapter 13 (Special Assessments) of Title I, Sections 2:21, 2:22b, 2:22c and 2:23 of Chapter 27 (Water Capital Recovery Charges) of Title II, and Sections 2:41.2f and 2:42.4 of Chapter 28 (Sanitary Sewer Capital Recovery Charges) of Title II of the Code of the City of Ann Arbor (Ordinance No. ORD-16-03)

Question: Regarding B-1, thank you for the March 8 memo providing the rationale for AA's rates (full cost recovery for new installations vs. burdening existing rate payers) – that was helpful. To help me dimension this though, can you please provide some sensitivity – in other words, if the proposed capital recovery rates were cut in half, what would the dollar revenue reduction be and how much does that translate into in terms of a percent of existing rate revenues? (Councilmember Lumm)

Response: A 50% decrease results in a water connection charge revenue reduction of $637,500 (projected), which would require an **additional** 3% revenue requirement increase. For sewer, the impact would be greater as the results from the study indicate the lack of full capital cost recovery is greater for sewer than water under our current fee structure.

B-2 – An Ordinance to Amend Chapter 55 (Zoning), Rezoning of 53.61 Acres from TWP (Township District) to R4A (Multiple-Family Dwelling District), Woodbury Club Apartments, Southeast corner of Nixon Road and M-14 (CPC Recommendation: Approval - 9 Yeas and 0 Nays) (Ordinance No. ORD-15-13) (8 Votes Required)

DB-1 – Resolution to Approve the Woodbury Club Apartments Planned Project Site Plan and Development Agreement, Southeast Corner of Nixon Road and M-14 (CPC Recommendation: Approval – 8 Yeas and 0 Nays)

DC-7 – Resolution to Approve the Purchase of 25.67 Acres of Parcel Tax ID Number I-09-325-008, Located at the Northeast Corner of Nixon and Dhu Varren Roads and Appropriate $277,000.00 from the Open Space and Parkland Preservation Millage Proceeds (8 Votes Required)

Question: Is the proposed sale price of the eastern half of the site in line with the City's assessment of the value of the land? (Councilmember Warpehoski)

Response: Yes. The sales price is consistent with the City's appraisal.

Question: Have any of the double-checking and verifying steps requested by David Friedrichs in his 1/14/2016 letter taken place? (Councilmember Warpehoski)

Response: The City's Urban Forest & Natural Resources Planning Coordinator, Kerry Gray indicated the following in a February 12, 2016 email response to Mr. Friedrichs: "When the Woodbury Club site plan was submitted, a wetland delineation was performed. The wetland delineation that was completed by the Developer was verified and agreed upon by both MDEQ and City staff per the requirements of Chapter 60. Under Chapter 60, information from a third-party wetland delineation would only be used as part of the decision-making process, if staff disagrees with the delineation provided by the Petitioner. For the Woodbury Club site, City staff and the DEQ agreed with the wetland delineation boundaries, as flagged by the Petitioner, therefore a third party wetland verification is not necessary."

Question: If for whatever reason the Woodbury Club Apartments project did not proceed, would the city still be obligated to make this purchase? (Councilmember Lumm)

Response: The decision to buy parkland is made by City Council and a willing seller. The City would be obligated to make this purchase if an agreement has been approved by Council and the seller is willing to sell the property. On execution of a Purchase and Sale Agreement both parties are obligated to complete the sale subject to the terms of the Agreement.

Question: As restated in the development agreement (P-17), Woodbury Club's contribution to the intersection improvement is $200,000, and this contribution "shall be used by the City or its agents or contractors, solely for improvements to the intersection." The Nixon Farms development agreement indicated other developer's contributions would flow to Toll Bros. Assuming Toll Bros. will contribute $1,025,460 to the intersection improvement, can you please clarify how the Woodbury Club contribution will ultimately be allocated. (Councilmember Lumm)

Response: As stated in paragraph (P-17) of the *Woodbury Club Development Agreement*, "The City intends to use the DEVELOPER'S Intersection Contribution to complete the improvements to the intersection no later than January 1, 2018." Therefore, the Woodbury Club contribution will be utilized by the City for the intersection improvement project. Paragraph (C-5) of the Nixon *Farm Traffic Mitigation Agreement* states that "should the City receive additional private contributions to the cost of the Intersection, the City will credit and pay those amounts back to the Proprietor." Thus, a portion of the funds contributed by Toll Bros. will be credited back to Toll Bros.; but, the Woodbury Club contribution will not flow directly to Toll Bros.

Question: It's my understanding, from neighborhood/petitioner meetings, that the developer has indicated the architecture firm that provided the building plans is no

longer under contract with the developer and the buildings, as proposed, will be different. (P-19) of the development agreement indicates that the site plan as submitted must be followed with respect to building elevations, setbacks, aesthetics, or materials and that changes must be submitted to council for consideration. Can staff please clarify its understanding of any proposed building changes that are proposed that would require council reconsideration and how the necessary understandings should be validated (i.e., site plan modifications, development agreement language changes, etc.)? (Councilmember Lumm)

Response: The petitioner has indicated that after the site plan is approved, they will finalize a contract with an architectural firm. (P19) in the development agreement requires that any substantive changes proposed to the approved elevations requires City Council approval. Any proposed changes to setbacks or building size/shape would require the site plan to be amended.

Question: With yesterday's addition of DC-7 (recommended acquisition of the 25.67 acres on the eastern tax parcel), would taking action on DC-7 prior to DB-1 be preferable in order to reflect the park purchase in the amendment to the development agreement (P-12)? (Councilmember Lumm)

Response: No. A decision on the site plan should be made prior to the decision on the acquisition of parkland. Language has been added to the development agreement that would accommodate the park acquisition after it is approved.

Question: With regard to the recommended rezoning the eastern parcel (parcel 2) R4A, given that the 25.67 acres is now recommended to be dedicated city park land, should not this land be zoned PL, and not R4A? Can language be suggested for amending the zoning ordinance for parcel 2 to reflect this change? (Councilmember Lumm)

Response: The City would not want to zone property PL until it is within public ownership. The acquisition of the eastern parcel would take place after the site plan has been approved which would be consistent with past practices. A Resolution requesting the acceptance of the donation by City Council would be submitted for action and the necessary deed transferring title recorded after which appropriate zoning and other administrative actions will be completed.

Question: In a 3/3/16 Barclay Park and Nixon area neighbors email to staff and city council, an update on efforts by neighbors to address various zoning and site plan concerns was provided. I did question in a follow-up note if responses would be provided prior to the council meeting, and am not aware that responses to concerns and questions raised in that update have been provided. Staff's assistance with these questions is also appreciated. (Councilmember Lumm)

Response: Staff read the 3/3/16 email from the representative of Barclay Park and made note of the comments provided.

Question: With regard to stormwater control and management concerns and the proposed development agreement language to address the on-site system and plan (paragraphs 14, 15, 16), it has been suggested that the multi-unit apartment buildings be required to have green roofs and that the south parking areas closest to Barclay Park be engineered as permeable paved surfaces. These suggestions were shared with the Woodbury Club development team on March 2nd, and, as described by the neighborhood representatives who met with the developer, the developer's representative(s) indicated that green roofs and permeable pavements might be viewed favorably by the developer. Has staff followed-up on these recommendations, and if these recommendations are acceptable, how best can these recommendations be incorporated in the site plan development agreement? (Councilmember Lumm)

Response: Staff informed the petitioner that code allows pervious pavement and green roofs and that they should consider installing systems such as these. The petitioner indicated that they would evaluate the feasibility of installing such systems. Pervious pavement needs no change to the site plan. If the petitioner chooses to install a green roof, they may need to amend the site plan to reflect changes to the roofs depending on the type of green roof system. Code does not require green roofs or pervious pavement.

Question: Questions have been raised about the proposed two new curb cuts on the east side, North of the Barclay Park entrance, of Nixon, and the impacts the new curb cuts will have on Nixon Rd. traffic flow as Woodbury Club residents exit and enter their development. Can you please speak to this, and have the impacts been modeled? (Councilmember Lumm)

Response: A traffic impact study was submitted as part of this petition and reviewed by staff. The developer's traffic engineer was required to verify sight distance on the driveways and those requirements are met. Future LOS (Level of Service) at the driveways is expected to be an "A" during AM and PM peak hours. The need for auxiliary turn lanes on Nixon Road was investigated and found to not be warranted.

Question: What is the timeline for acquisition of parkland vis-a-vis rezoning the eastern parcel? (Councilmember Westphal)

Response: The acquisition of the parkland will be presented to City Council for action at or after the date the Site Plan/Development Agreement is presented to Council for action. The rezoning of the eastern parcel will happen on after City Council has accepted the donation and the deed transferring the title to property has been recorded.

DC-3 – Resolution to Accept Human Rights Commission's Report Entitled: Civilian Police Review: Recommendation for Strengthening Police-Community Relations in Ann Arbor

Question: Will the results of the staff review be released to the public? (Councilmember Warpehoski)

Response: If the City Attorney prepares a report, portions of it may be privileged and not released to the public. If Police prepares a separate report, that would likely be released to the public.

Question: The report recommends contracting for services for the establishment of a commission, but the June 6 deadline for this report is after the deadline for approving a budget. Will the City Council be informed of budget needs to implement the recommendations prior to the approval of the budget (even if the full review and comment is not completed by such time)? (Councilmember Warpehoski)

Response: Yes, staff is investigating costs in time for the Administrator's recommended budget.

DC-5 – Resolution to Improve Pedestrian Crosswalk on Huron Parkway Near Huron High School (8 Votes Required)

Question: Please elaborate on the clause, "The Alternative Transportation Fund is an eligible funding source for pedestrian crosswalk improvements and the FY16 capital expenditure budget includes a $50,000 provision in the Alternative Transportation fund for RRFB Installations-STPU Matching Funds" Does this mean we would be re-directing funds for STPU matching to a project ineligible for STPU funds? If so, will we not have adequate nonomotorized matching funds for STPU projects in the current funding cycle? (Councilmember Warpehoski)

Response: There are currently no STPU non-motorized project programmed for FY16. However, it is important to note that in forecasting to FY17 and beyond, there is a large, $1M plus, non-motorized investment on the horizon. It is the pedestrian tunnel under the Wolverine Line associated with the Allen Creek Berm Opening storm water project. Council has already approved the grant request for the storm water aspect. As this project moves forward, funding will need to be found for the associated pedestrian link – currently an unfunded project.

Question: Has staff considered the potential for the creation of a school zone in the area and factored this into the budget already? (Councilmember Westphal)

Response: If there is interest in a reduced speed school zone, then that can be included in the already planned/underway speed study for Huron Parkway, but that analysis can and should be separate from the crosswalk project.

DB-2 – Resolution to Approve Banyan Court Site Condominium Site Plan and Development Agreement, 1654 South Maple Road (CPC Recommendation: Approval – 7 Yeas and 0 Nays)

Question: The initial planning review noted, "All four (4) submitted home models show a projected garage. The applicant should offer a nonprojected garage model to be consistent with the Master Plan." While the new site plan offers a nonprojected garage model, it appears that the majority of the units will have a projected garage and violate the master plan guidance that "garages should not be the dominant feature along the streetscape." Are there ways we can strengthen the master plan goal of streetscapes that are not garage-dominated? (Councilmember Warpehoski)

Response: The Zoning Ordinance is the regulatory document to implement the Master Plan. One way to strengthen the Master Plan recommendations regarding streetscapes are to adopt residential building form regulations in the Zoning Ordinance. While such amendments are not explicitly stated in the Master Plan, they would implement the recommendations that are clearly articulated.

Pedestrian & Bicycle Level of Service
(for Signalized Intersections)

The worksheets that follow are designed to easily calculate pedestrian and bicycle levels of service (LOS) for signalized intersections, according to the methodology described in Appendix B of Charlotte's Urban Street Design Guidelines. This methodology, developed by Charlotte DOT, identifies and evaluates key intersection design features according to their affect on the comfort and safety of pedestrians and bicyclists.

Intersection features that reduce pedestrian and bicyclist conflicts with turning traffic, minimize crossing distances, slow traffic speeds and raise user awareness are rated highly. Conversely, intersection features that encourage high traffic speeds, provide long crossing distances, permit numerous traffic conflicts and do not raise user awareness rate poorly. The methodology assumes that all crossing features are adequately designed, implemented and maintained, in order to make fair comparisons between features. The methodology rates only features that directly impact user comfort and safety while crossing streets. It does not deal with the quality of the environment away from the crossing. Those elements and their importance in creating pedestrian and bicycle environments are addressed in the Urban Street Design Guidelines.

The methodology is intended to be used as a diagnostic tool to assess and improve pedestrian and bicyclist comfort and safety by selecting design and operational features that help achieve desired levels of service. Results can be compared with those for traffic levels of service and weighed according to user priorities.

PEDESTRIAN LEVEL OF SERVICE Worksheet

(to be used for Signalized Intersections)

Intersection:

Date:

Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Speadsheet calculates approach leg PED LOS and overall intersection PED LOS.

Table 1. **POINTS**

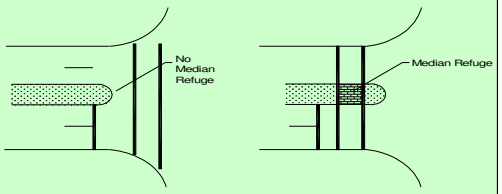
CROSSING DISTANCE (Total travel lanes to cross)	No Median Refuge (< 4')	Median Refuge (< 6')	Median Refuge (≥ 6')
2 lanes	80	80	80
3 lanes	78	78	78
4 lanes	65	65	68
5 lanes	50	52	55
6 lanes	37	40	44
7 lanes	24	28	33
8 lanes	8	12	20
9 lanes	-5	0	10
10 lanes	-15	-10	0

Wide Crossing Adjustment (applies to streets 8+ lanes wide)

If a median refuge is provided and the distance to this refuge requires pedestrians to cross 6+ lanes and there is:

- 2nd refuge island (≥4') provided to breakup the 6+ lanes crossing distance 5
- NO 2nd refuge island (≥4') provided 0

Note: Pedestrian crossing must extend into median to be a refuge (see Figure below)



POINTS:

*** CORNER ISLAND Adjustment**

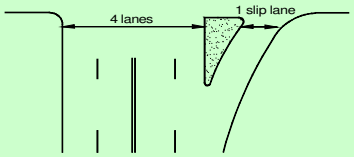
Number of lanes crossed that are corner refuge island lanes:

Corner refuge island lane traffic controlled by:

Signal	5
Yield	-3
Free Flow (uncontrolled)	-20

Corner Refuge Island Adjustment

Example: 5 lane Crossing, with corner refuge island



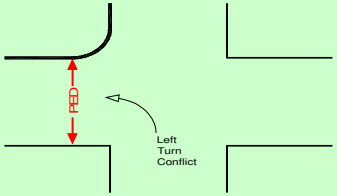
Crossing of **NB Approach** (….. Street)	Crossing of **SB Approach** (…. Street)	Crossing of **EB Approach** (…. Street)	Crossing of **WB Approach** (…. Street)
0	0	0	0
0	0	0	0

* Travel lanes are assumed to be within the range of 10' to 13' wide. If a lane is much wider, consider entering the equivalent number of lanes (based on 10 to 13' widths) for that extra crossing distance.

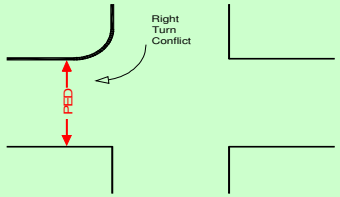
** Painted islands (without curbs) within a crossing that are a travel lane wide should be considered as a travel lane. (see PED LOS Example # 4)

Table 1 POINTS:		0	0	0	0

Table 2.

SIGNAL FEATURES		NB Approach	SB Approach	EB Approach	WB Approach
2A. LEFT TURNS (into pedestrian crossing path)					
					
Made on Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
• from 2+ left turn lanes, no PED phase	-10				
• from 2+ left turn lanes, PED phase	-5				
Made on Green Arrow & Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
Made on Green Arrow Only					
• from 1 left turn lane, no PED phase	5				
• from 1 left turn lane, PED phase	15				
• from 2+ left turn lanes, no PED phase	0				
• from 2+ left turn lanes, PED phase	15				
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15				
Table 2A POINTS:		0	0	0	0

2B. RIGHT TURNS (into pedestrian crossing path)



		NB Approach	SB Approach	EB Approach	WB Approach
Made on Green Ball					
• from shared thru-right lane, no PED phase	0				
• from shared thru-right lane, PED phase	0				
• from 1 right turn lane, no PED phase	0				
• from 1 right turn lane, PED phase	0				
• from 2+ right turn lanes, no PED phase	-10				
• from 2+ right turn lanes, PED phase	-7				
Made on Green Arrow & Green Ball					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	0				
Made on Green Arrow Only					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	10				
• from 2+ right turn lanes, no PED phase	-15				
• from 2+ right turn lanes, PED phase	10				
Made from corner refuge island lane	7				
No Turn Conflict (e.g. "T" intersection, one-way street, prohibited)	15				
Table 2B POINTS:		0	0	0	0

2C. PEDESTRIAN PHASE

		NB Approach	SB Approach	EB Approach	WB Approach
• No pedestrian phase	-5				
• Raised Hand/Walking Person Display	0				
• Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	5				
→ crossing time based on walk speed ≤ 3.5 ft/s	8				
• LEADING PED Phase & Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	8				
→ crossing time based on walk speed ≤ 3.5 ft/s	12				
Table 2C POINTS:		0	0	0	0
Table 2 POINTS:		0	0	0	0

Table 3.

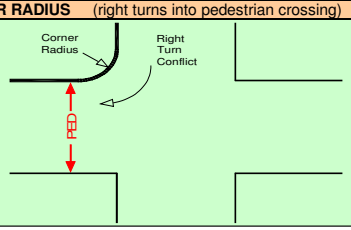
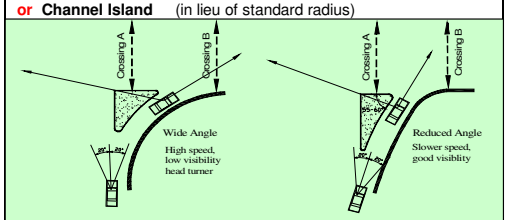
CORNER RADIUS (right turns into pedestrian crossing)	NB Approach	SB Approach	EB Approach	WB Approach
				
Standard Radius				
• ≤ 20' 10				
• > 20' and ≤ 30' 5				
• > 30' and ≤ 40' 0				
• > 40' and ≤ 60' (or equivalent compound curve) -10				
• > 60' (or equivalent compound curve) -15				
or Channel Island (in lieu of standard radius)				
 (A) Standard channel island (B) Modified slip lane design				
• Painted Channel Island (Fig. A)				
→ Uncontrolled turns (free flow turns) -20				
→ Turns made on yield or signal control -10				
• Curbed Channel Island (Fig. A)				
→ Uncontrolled turns (free flow turns) -20				
→ Turns on Yield, Green Ball or Green Arrow/Ball				
(& PED crossing @ location **B**) -10				
(& PED crossing @ location **A**) 0				
→ Turns Green Arrow Only				
(& PED crossing @ location **B**) 0				
(& PED crossing @ location **A**) 5				
• Curbed Low Speed Slip Lane (Fig. B)				
→ Turns on Yield, Green Ball or Green Arrow/Ball				
(& PED crossing @ location **B**) 0				
(& PED crossing @ location **A**) 5				
→ Turns Green Arrow Only				
(& PED crossing @ location **B**) 5				
(& PED crossing @ location **A**) 10				
• No Corner Radius (e.g., "T" intersection) 10				
Table 3 **POINTS:**	0	0	0	0

Table 4.

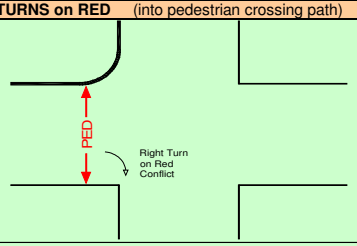
RIGHT TURNS on RED (into pedestrian crossing path)		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0				
• Prohibited (or no conflict possible)	5				
Table 4 **POINTS:**		0	0	0	0

Table 5.

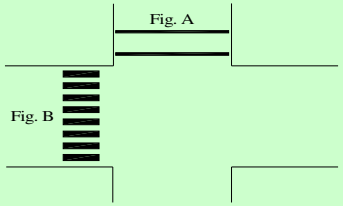
CROSSWALK TREATMENT		NB Approach	SB Approach	EB Approach	WB Approach
					
• No crosswalk	-5				
• Painted crosswalk					
→ Transverse Markings (Fig. A)	0				
→ LADDER Style (Fig. B)	5				
• Textured/Colored Pavement	5				
Table 5 **POINTS:**		0	0	0	0

Table 6.

ADJUSTMENT FOR ONE-WAY STREETS Intersected by Two-Way Streets (Departure Leg Only)		NB Approach	SB Approach	EB Approach	WB Approach
Crossing of 4+ lanes & conflicting LEFT TURNS made on:					
• Green Ball Only (with or without PED phase)	-10				
• Green Arrow & Ball (with or without PED phase)	-10				
• Green Arrow Only (without PED phase)	-5				
• Green Arrow Only (with PED phase)	-2				
• Condition does not Apply	0	0	0	0	0

Adjustment for One-Way Streets

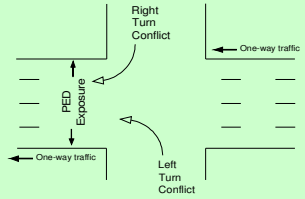


Table 6 **POINTS:**	0	0	0	0

	NB Approach	**SB Approach**	**EB Approach**	**WB Approach**
Approach Total:	0	0	0	0
Approach LOS:	F	F	F	F

Intersection Average:	**0**
Intersection LOS:	**F**

BICYCLE LEVEL OF SERVICE Worksheet

(to be used for Signalized Intersections)

Intersection:

Date:

Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Speadsheet calculates approach leg BIKE LOS and overall intersection BIKE LOS.

Table 1.

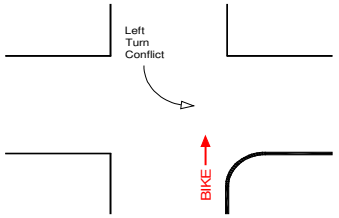
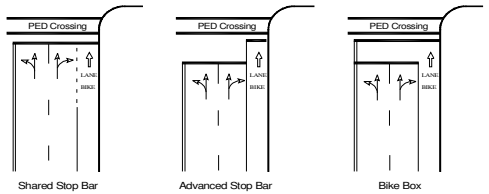
SIGNAL FEATURES	NB Approach (…. St.)	SB Approach (…. St.)	EB Approach (…. St.)	WB Approach (…. St.)
A. Auto Left Turn Phase (opposing cyclists)				
				
• Made on Green Ball only 0 • Made on Leading Green Arrow/Green Ball 5 • Made on Green Arrow Only 15 • No Left Turn Conflict 15				
Table 1A **POINTS:**	0	0	0	0
B. STOP BAR LOCATION				
				
• Shared stop bar for bikes & autos 0 • Advanced stop bar for bikes or bike box 10				
Table 1B **POINTS:**	0	0	0	0
Table 1 POINTS:	0	0	0	0

Table 2.

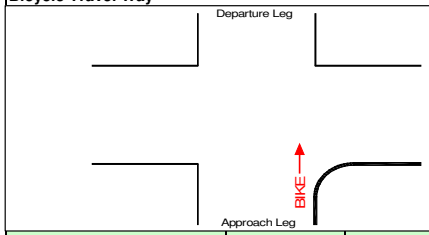
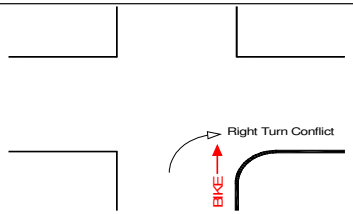
Bicycle Travel Way			NB Approach	SB Approach	EB Approach	WB Approach
						
Bike Travels in: (Approach/Departure Legs)	Speed Limit					
• **Shared Auto Lane to Shared Auto Lane** (lanes ≤ 12' wide)	≥ 40 mph	5				
	30 to 35 mph	30				
	< 30 mph	50				
• Shared Auto Lane (lane ≤ 12' wide) to Wide Curb Lane (13' to 14' wide)	≥ 40 mph	20				
	30 to 35 mph	40				
	< 30 mph	55				
• Shared Auto Lane (lane ≤ 12' wide) to Bike Lane	≥ 40 mph	35				
	30 to 35 mph	50				
	< 30 mph	60				
• Shared Wide Curb Lane (13' to 14' wide) to Shared Auto Lane (lane ≤ 12' wide)	≥ 40 mph	15				
	30 to 35 mph	35				
	< 30 mph	50				
• **Shared Wide Curb Lane to Wide Curb Lane** (lanes 13' to 14' wide)	≥ 40 mph	30				
	30 to 35 mph	50				
	< 30 mph	60				
• Shared Wide Curb Lane (13' to 14' wide) to Bike Lane	≥ 40 mph	45				
	30 to 35 mph	60				
	< 30 mph	70				
• Bike Lane to Shared Auto Lane (lane ≤ 12' wide)	≥ 40 mph	30				
	30 to 35 mph	45				
	< 30 mph	55				
• Bike Lane to to Wide Curb Lane (13' to 14' wide)	≥ 40 mph	40				
	30 to 35 mph	55				
	< 30 mph	65				
• **Bike Lane to Bike Lane**	≥ 40 mph	60				
	30 to 35 mph	70				
	< 30 mph	80				

Table 2 POINTS:	0	0	0	0

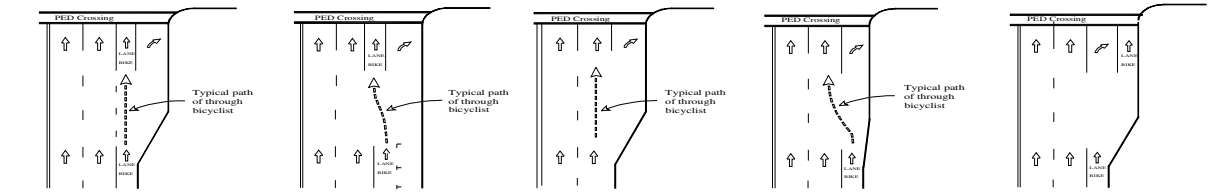
Table 3.

Right Turn Conflicts	NB Approach	SB Approach	EB Approach	WB Approach



• No Conflict with Right Turning Motorists (e.g., "T" intersection, one-way street)	15
• Bike in Shared Thru-Right Lane	0
• Bike Lane Right of Shared Thru-Right Lane	
→ Bike lane drops prior to intersection	-5
→ Bike lane extends to intersection	0
• Separate Right Turn Lane Provided (see figure below)	
→ Bike lane is left of right turn lane (Condition A in Figure below)	10
→ Curb lane becomes right turn lane, bike lane left of (Condition B in Figure below)	5
→ No bike lane (Condition C in Figure below)	0
→ Curb lane becomes right turn lane, no bike lane (Figure D in PED & BIKE LOS Methodology)	0
→ Bike lane right of right turn lane (Figure E in PED & BIKE LOS Methodology)	-20

Bike Treatments at a Right Turn Lane



(A) Bike lane aligned so that cylist travels straight ahead - turning motorist yields to bicyclist (BEST)

(B) Bike lane alignment shift, cyclist merges left and turning motorist merges right

(C) No bike lane, cyclist uses auto travel lane

(D) Bike lane ends in advance of intersection - bicyclist shifts into auto travel lane

(E) Bike lane placed right of right-turn-only lane (Worst)

Table 3 POINTS:	0	0	0	0

Table 5.

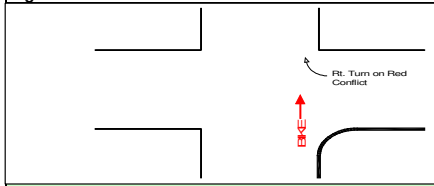
Right Turn on Red Conflict		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0	0	0	0	0
• Prohibited (or there is no right turn conflict)	5				
Table 5 POINTS:		0	0	0	0

Table 6.

Intersection Crossing Distance (for thru cyclist)		NB Approach	SB Approach	EB Approach	WB Approach
• ≤ 3 motor vehicle travel lanes	0				
• 4 to 5 motor vehicle travel lanes	-5				
• ≥ 6 motor vehicle travel lanes	-10				
Table 6 POINTS:		0	0	0	0

	NB Approach	**SB Approach**	**EB Approach**	**WB Approach**
Approach Total:	0	0	0	0
Approach LOS:	F	F	F	F

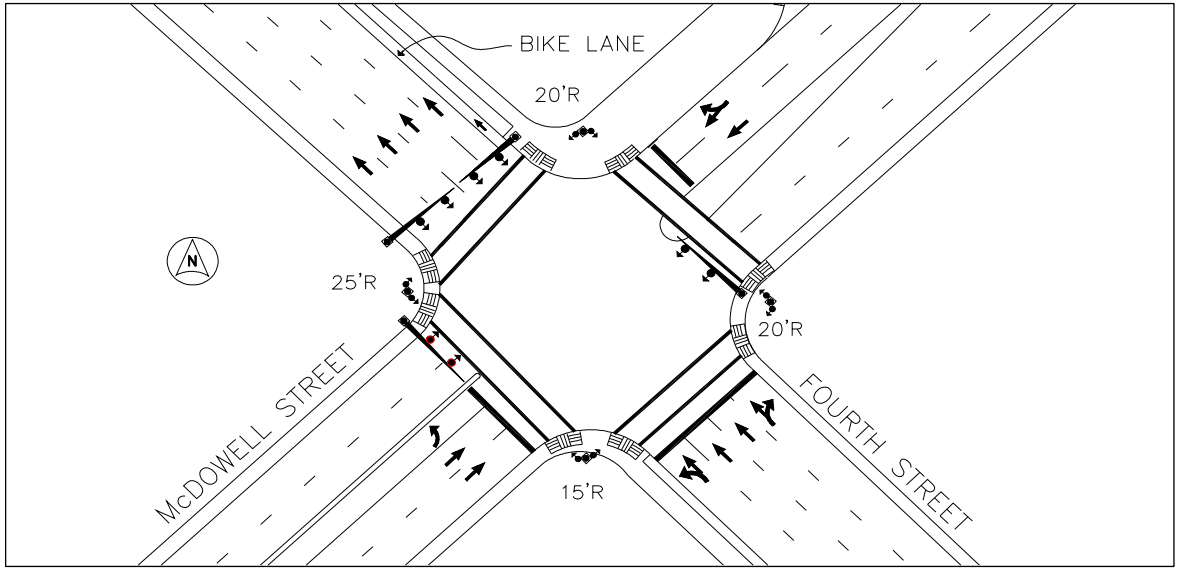
Intersection Average:	**0**
Intersection LOS:	**F**

PEDESTRIAN LEVEL OF SERVICE Worksheet
(to be used for Signalized Intersections)

Example # 1

Intersection: 4th St. & McDowell Street

Date: 2/23/2007

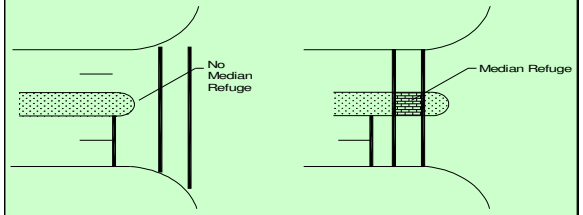


Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Speadsheet calculates approach leg PED LOS and overall intersection PED LOS.

Table 1.

CROSSING DISTANCE (Total travel lanes to cross)	**POINTS** No Median Refuge (< 4')	Median Refuge (< 6')	Median Refuge (≥ 6')	Crossing of **NB Approach** (McDowell Street)	Crossing of **SB Approach** (McDowell Street)	Crossing of **EB Approach** (4th Street)	Crossing of **WB Approach** (4th Street)
2 lanes	80	80	80				
3 lanes	78	78	78				
4 lanes	65	65	68		68	65	65
5 lanes	50	52	55	50			
6 lanes	37	40	44				
7 lanes	24	28	33				
8 lanes	8	12	20				
9 lanes	-5	0	10				
10 lanes	-15	-10	0				

Note: Pedestrian crossing must extend into median to be a refuge (see Figure below)



POINTS:	50	68	65	65

*** CORNER ISLAND Adjustment**

Number of lanes crossed that are corner refuge island lanes:	0	0	0	0

Corner refuge island lane traffic controlled by:

Signal	5
Yield	-3
Free Flow (uncontrolled)	-20

Corner Refuge Island Adjustment

Example: 5 lane Crossing, with corner refuge island

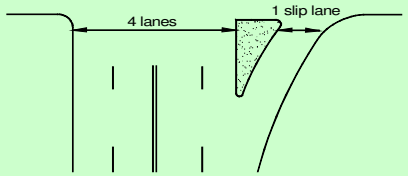
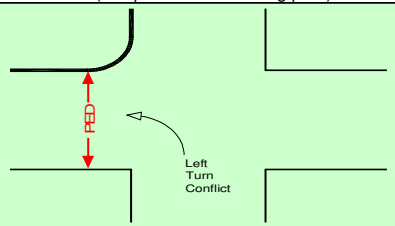
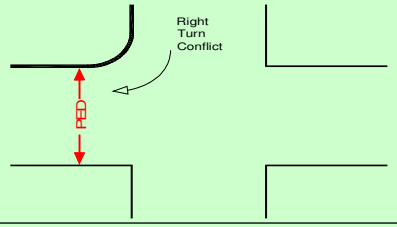


Table 1 POINTS:	50	68	65	65

Table 2.

SIGNAL FEATURES		NB Approach	SB Approach	EB Approach	WB Approach
A. LEFT TURNS (into pedestrian crossing path)					
					
Made on Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0	0			
• from 2+ left turn lanes, no PED phase	-10				
• from 2+ left turn lanes, PED phase	-5				
Made on Green Arrow & Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0			0	
Made on Green Arrow Only					
• from 1 left turn lane, no PED phase	5				
• from 1 left turn lane, PED phase	15				
• from 2+ left turn lanes, no PED phase	0				
• from 2+ left turn lanes, PED phase	15				
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15		15		15
Table 2A POINTS:		0	15	0	15

B. RIGHT TURNS (into pedestrian crossing path)



		NB Approach	SB Approach	EB Approach	WB Approach
Made on Green Ball					
• from shared thru-right lane, no PED phase	0				
• from shared thru-right lane, PED phase	0		0	0	
• from 1 right turn lane, no PED phase	0				
• from 1 right turn lane, PED phase	0				
• from 2+ right turn lanes, no PED phase	-10				
• from 2+ right turn lanes, PED phase	-7				
Made on Green Arrow & Green Ball					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	0				
Made on Green Arrow Only					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	10				
• from 2+ right turn lanes, no PED phase	-15				
• from 2+ right turn lanes, PED phase	10				
Made from corner refuge island lane	7				
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15	15			15
Table 2B POINTS:		15	0	0	15

C. PEDESTRIAN PHASE

		NB Approach	SB Approach	EB Approach	WB Approach
• No pedestrian phase	-5				
• Raised Hand/Walking Person Display	0				
• Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	5	5	5	5	5
→ crossing time based on walk speed ≤ 3.5 ft/s	8				
• LEADING PED Phase & Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	8				
→ crossing time based on walk speed ≤ 3.5 ft/s	12				
Table 2C POINTS:		5	5	5	5
Table 2 POINTS:		20	20	5	35

Table 3.

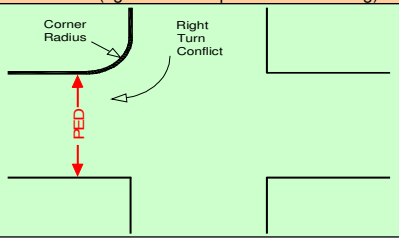
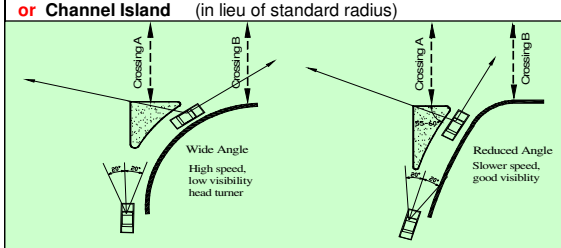
CORNER RADIUS (right turns into pedestrian crossing)		NB Approach	SB Approach	EB Approach	WB Approach
					
Standard Radius					
• ≤ 20'	10		10	10	10
• > 20' and ≤ 30'	5	5			
• > 30' and ≤ 40'	0				
• > 40' and ≤ 60' (or equivalent compound curve)	-10				
• > 60' (or equivalent compound curve)	-15				
or Channel Island (in lieu of standard radius)					
					
(A) Standard channel island					
(B) Modified slip lane design					
• Painted Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns made on yield or signal control	-10				
• Curbed Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	-10				
(& PED crossing @ location **A**)	0				
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5				
• Curbed Low Speed Slip Lane (Fig. B)					
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5				
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	5				
(& PED crossing @ location **A**)	10				
• No Corner Radius (e.g., "T" intersection)	10				
Table 3 **POINTS:**		5	10	10	10

Table 4.

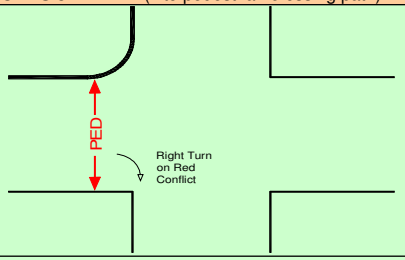
RIGHT TURNS on RED (into pedestrian crossing path)		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0				0
• Prohibited (or no conflict possible)	5	5	5	5	
Table 4 **POINTS:**		5	5	5	0

Table 5.

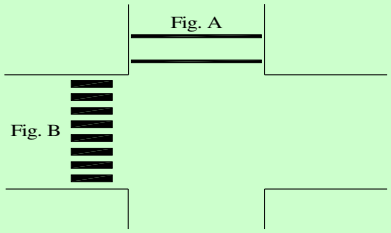
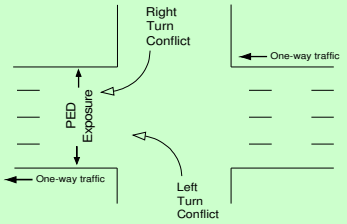
CROSSWALK TREATMENT		NB Approach	SB Approach	EB Approach	WB Approach
					
• No crosswalk	-5				
• Painted crosswalk					
→ Transverse Markings (Fig. A)	0				
→ LADDER Style (Fig. B)	5				
• Textured/Colored Pavement	5	5	5	5	5
Table 5 **POINTS:**		5	5	5	5

Table 6.

ADJUSTMENT FOR ONE-WAY STREETS Intersected by Two-Way Streets (Departure Leg Only)		NB Approach	SB Approach	EB Approach	WB Approach
Crossing of 4+ lanes & conflicting LEFT TURNS made on:					
• Green Ball Only (with or without PED phase)	-10				
• Green Arrow & Ball (with or without PED phase)	-10			-10	
• Green Arrow Only (without PED phase)	-5				
• Green Arrow Only (with PED phase)	-2				
• Condition does not Apply	0	0	0		0
Table 6 **POINTS:**		0	0	-10	0

Adjustment for One-Way Streets



	NB Approach	SB Approach	EB Approach	WB Approach
Approach Total:	85	108	80	115
Approach LOS:	B	A	B	A

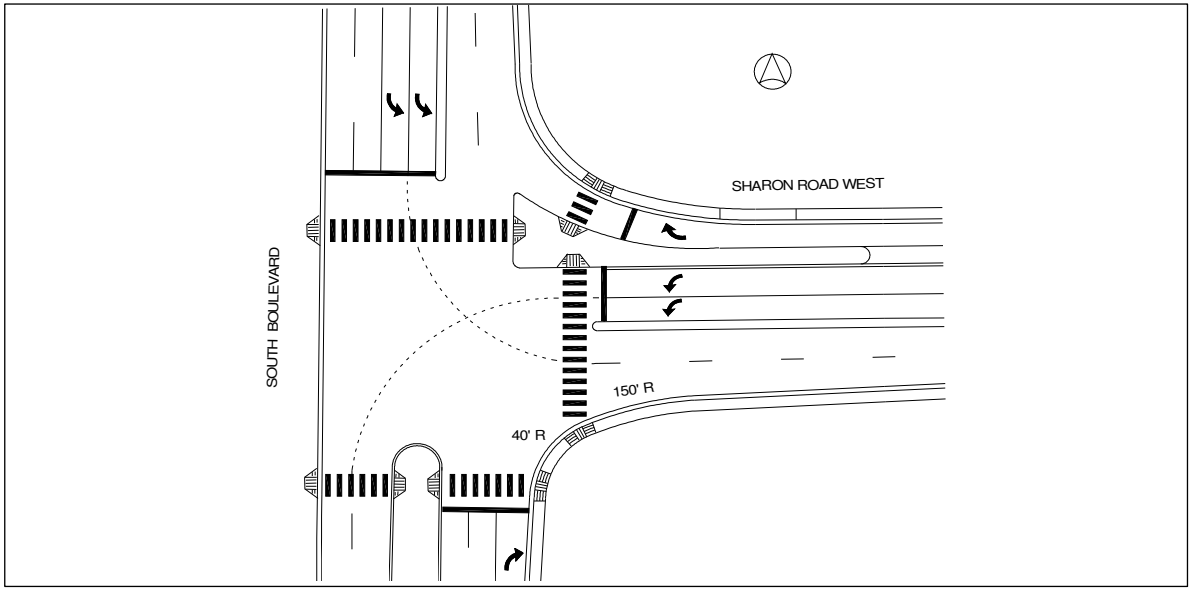
Intersection Average:	**97**
Intersection LOS:	**A**

PEDESTRIAN LEVEL OF SERVICE Worksheet
(to be used for Signalized Intersections)

Example # 2

Intersection: South Boulevard & Sharon Road West

Date: 2/23/2007

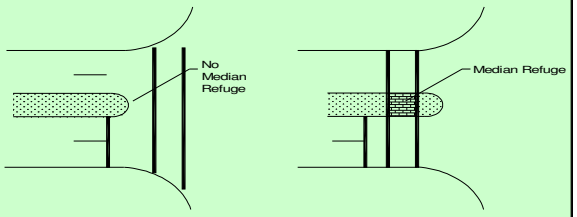


Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Speadsheet calculates approach leg PED LOS and overall intersection PED LOS.

Table 1.

CROSSING DISTANCE (Total travel lanes to cross)	**POINTS** No Median Refuge (< 4')	Median Refuge (< 6')	Median Refuge (≥ 6')	Crossing of **NB Approach** (South Bv.)	Crossing of **SB Approach** (South Bv.)	Crossing of **EB Approach**	Crossing of **WB Approach** (Sharon Rd. West)
2 lanes	80	80	80				
3 lanes	78	78	78				
4 lanes	65	65	68			NA	
5 lanes	50	52	55	55			50
6 lanes	37	40	44				
7 lanes	24	28	33		24		
8 lanes	8	12	20				
9 lanes	-5	0	10				
10 lanes	-15	-10	0				

Note: Pedestrian crossing must extend into median to be a refuge (see Figure below)



POINTS:	55	24		50

*** CORNER ISLAND Adjustment**

Number of lanes crossed that are corner refuge island lanes:	0	1		1

Corner refuge island lane traffic controlled by:

Signal	5			
Yield	-3	-3		-3
Free Flow (uncontrolled)	-20			

Corner Refuge Island Adjustment

Example: 5 lane Crossing, with corner refuge island

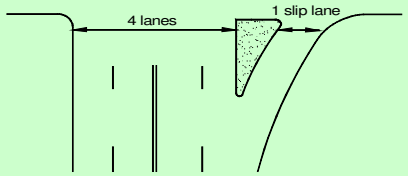
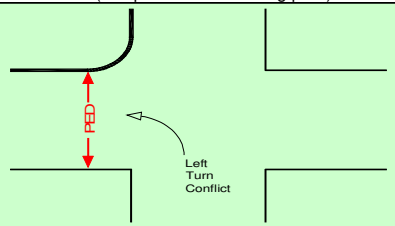
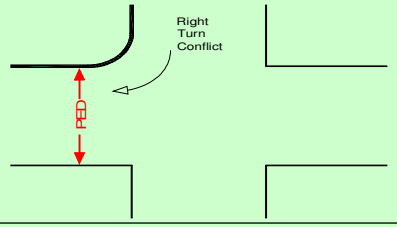


Table 1 POINTS:	55	27		53

Table 2.

SIGNAL FEATURES		NB Approach	SB Approach	EB Approach	WB Approach
A. LEFT TURNS (into pedestrian crossing path)					
					
Made on Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
• from 2+ left turn lanes, no PED phase	-10				
• from 2+ left turn lanes, PED phase	-5				
Made on Green Arrow & Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
Made on Green Arrow Only					
• from 1 left turn lane, no PED phase	5				
• from 1 left turn lane, PED phase	15				
• from 2+ left turn lanes, no PED phase	0				
• from 2+ left turn lanes, PED phase	15	15			15
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15		15		
Table 2A POINTS:		15	15		15

B. RIGHT TURNS (into pedestrian crossing path)



		NB Approach	SB Approach	EB Approach	WB Approach
Made on Green Ball					
• from shared thru-right lane, no PED phase	0				
• from shared thru-right lane, PED phase	0				
• from 1 right turn lane, no PED phase	0				
• from 1 right turn lane, PED phase	0				
• from 2+ right turn lanes, no PED phase	-10				
• from 2+ right turn lanes, PED phase	-7				
Made on Green Arrow & Green Ball					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	0				0
Made on Green Arrow Only					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	10				
• from 2+ right turn lanes, no PED phase	-15				
• from 2+ right turn lanes, PED phase	10				
Made from corner refuge island lane	7		7		
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15	15			
Table 2B POINTS:		15	7		0

C. PEDESTRIAN PHASE

		NB Approach	SB Approach	EB Approach	WB Approach
• No pedestrian phase	-5				
• Raised Hand/Walking Person Display	0				
• Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	5	5	5		5
→ crossing time based on walk speed ≤ 3.5 ft/s	8				
• LEADING PED Phase & Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	8				
→ crossing time based on walk speed ≤ 3.5 ft/s	12				
Table 2C POINTS:		5	5		5
Table 2 POINTS:		35	27		20

Table 3.

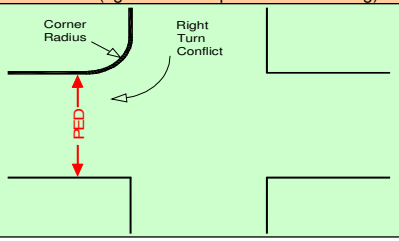
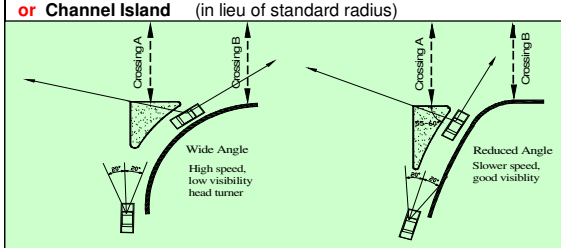
CORNER RADIUS (right turns into pedestrian crossing)		NB Approach	SB Approach	EB Approach	WB Approach
					
Standard Radius					
• ≤ 20'	10				
• > 20' and ≤ 30'	5				
• > 30' and ≤ 40'	0				
• > 40' and ≤ 60' (or equivalent compound curve)	-10				-10
• > 60' (or equivalent compound curve)	-15				
or Channel Island (in lieu of standard radius)					
					
(A) Standard channel island					
(B) Modified slip lane design					
• Painted Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns made on yield or signal control	-10				
• Curbed Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	-10				
(& PED crossing @ location **A**)	0				
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5				
• Curbed Low Speed Slip Lane (Fig. B)					
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5		5		
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	5				
(& PED crossing @ location **A**)	10				
• No Corner Radius (e.g., "T" intersection)	10	10			
Table 3 **POINTS:**		10	5		-10

Table 4.

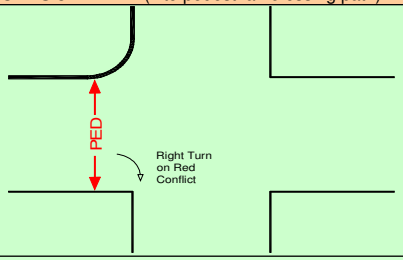
RIGHT TURNS on RED (into pedestrian crossing path)		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0	0			0
• Prohibited (or no conflict possible)	5		5		
Table 4 **POINTS:**		0	5		0

Table 5.

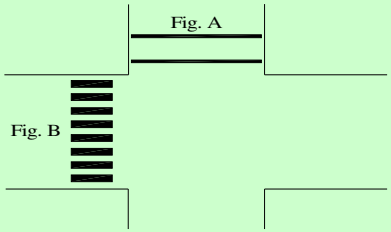
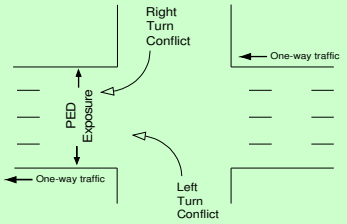
CROSSWALK TREATMENT		NB Approach	SB Approach	EB Approach	WB Approach
					
• No crosswalk	-5				
• Painted crosswalk					
→ Transverse Markings (Fig. A)	0				
→ LADDER Style (Fig. B)	5	5	5		5
• Textured/Colored Pavement	5				
Table 5 **POINTS:**		5	5		5

Table 6.

ADJUSTMENT FOR ONE-WAY STREETS Intersected by Two-Way Streets (Departure Leg Only)		NB Approach	SB Approach	EB Approach	WB Approach
Crossing of 4+ lanes & conflicting LEFT TURNS made on:					
• Green Ball Only (with or without PED phase)	-10				
• Green Arrow & Ball (with or without PED phase)	-10				
• Green Arrow Only (without PED phase)	-5				
• Green Arrow Only (with PED phase)	-2				
• Condition does not Apply	0	0	0		0
Table 6 **POINTS:**		0	0		0

Adjustment for One-Way Streets



	NB Approach	SB Approach	EB Approach	WB Approach
Approach Total:	105	69		68
Approach LOS:	A	C		C

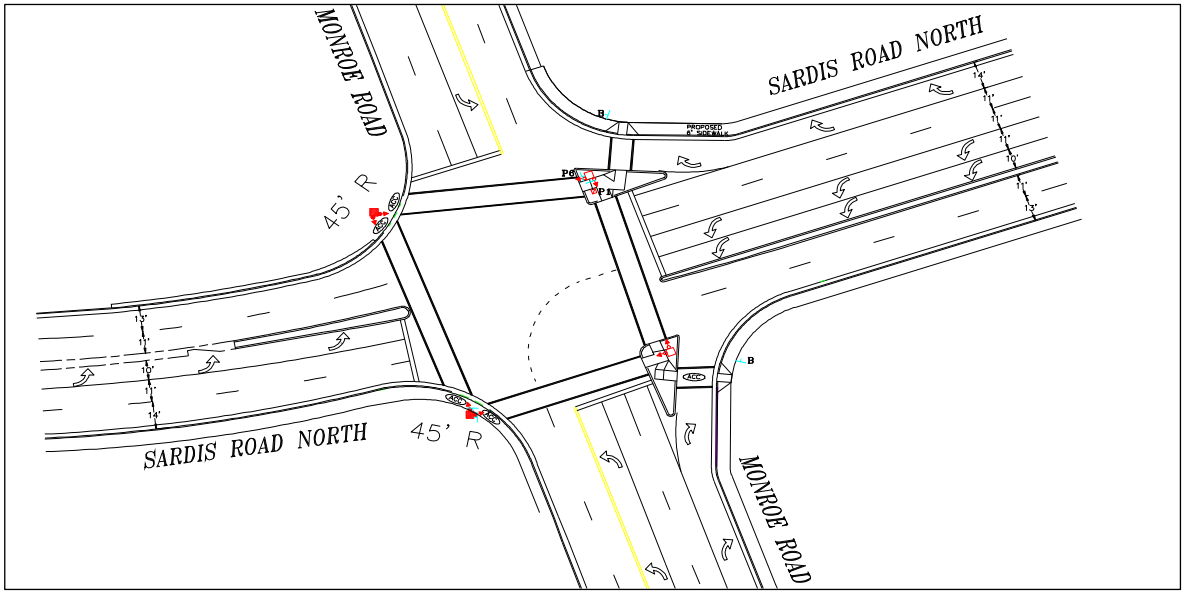
Intersection Average:	**81**
Intersection LOS:	**B**

PEDESTRIAN LEVEL OF SERVICE Worksheet
(to be used for Signalized Intersections)

Example # 3

Intersection: Monroe Road & Sardis North

Date: 2/23/2007

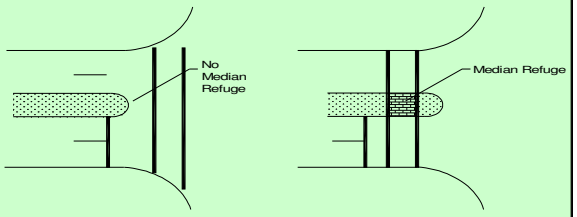


Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Speadsheet calculates approach leg PED LOS and overall intersection PED LOS.

Table 1. **POINTS**

CROSSING DISTANCE (Total travel lanes to cross)	No Median Refuge (< 4')	Median Refuge (< 6')	Median Refuge (≥ 6')	Crossing of **NB Approach** (Sardis Rd. North)	Crossing of **SB Approach** (Sardis Rd. North)	Crossing of **EB Approach** (Monroe Rd.)	Crossing of **WB Approach** (Monroe Rd.)
2 lanes	80	80	80				
3 lanes	78	78	78				
4 lanes	65	65	68				
5 lanes	50	52	55	50			
6 lanes	37	40	44			37	37
7 lanes	24	28	33				
8 lanes	8	12	20		8		
9 lanes	-5	0	10				
10 lanes	-15	-10	0				

Note: Pedestrian crossing must extend into median to be a refuge (see Figure below)



POINTS:	50	8	37	37

*** CORNER ISLAND Adjustment**

Number of lanes crossed that are corner refuge island lanes:	0	2	1	1

Corner refuge island lane traffic controlled by:

Signal	5			
Yield	-3	-3	-3	-3
Free Flow (uncontrolled)	-20			

Corner Refuge Island Adjustment

Example: 5 lane Crossing, with corner refuge island

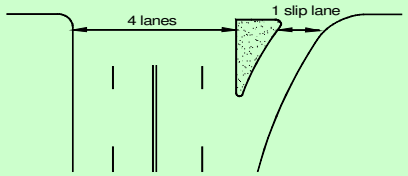
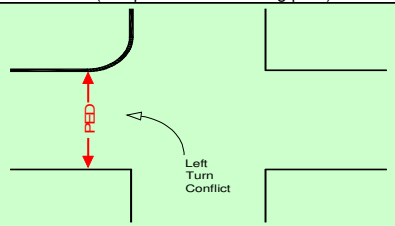
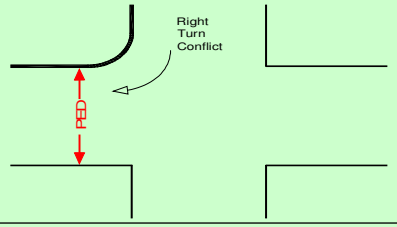


Table 1 POINTS:	50	17	40	40

Table 2.

SIGNAL FEATURES		NB Approach	SB Approach	EB Approach	WB Approach
A. LEFT TURNS (into pedestrian crossing path)					
					
Made on Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
• from 2+ left turn lanes, no PED phase	-10				
• from 2+ left turn lanes, PED phase	-5				
Made on Green Arrow & Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
Made on Green Arrow Only					
• from 1 left turn lane, no PED phase	5				
• from 1 left turn lane, PED phase	15	15	15	15	
• from 2+ left turn lanes, no PED phase	0				
• from 2+ left turn lanes, PED phase	15				15
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15				
Table 2A POINTS:		15	15	15	15

B. RIGHT TURNS (into pedestrian crossing path)



		NB Approach	SB Approach	EB Approach	WB Approach
Made on Green Ball					
• from shared thru-right lane, no PED phase	0				
• from shared thru-right lane, PED phase	0	0			0
• from 1 right turn lane, no PED phase	0				
• from 1 right turn lane, PED phase	0				
• from 2+ right turn lanes, no PED phase	-10				
• from 2+ right turn lanes, PED phase	-7				
Made on Green Arrow & Green Ball					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	0				
Made on Green Arrow Only					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	10				
• from 2+ right turn lanes, no PED phase	-15				
• from 2+ right turn lanes, PED phase	10				
Made from corner refuge island lane	7		7	7	
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15				
Table 2B POINTS:		0	7	7	0

C. PEDESTRIAN PHASE

		NB Approach	SB Approach	EB Approach	WB Approach
• No pedestrian phase	-5				
• Raised Hand/Walking Person Display	0				
• Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	5	5	5	5	5
→ crossing time based on walk speed ≤ 3.5 ft/s	8				
• LEADING PED Phase & Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	8				
→ crossing time based on walk speed ≤ 3.5 ft/s	12				
Table 2C POINTS:		5	5	5	5
Table 2 POINTS:		20	27	27	20

Table 3.

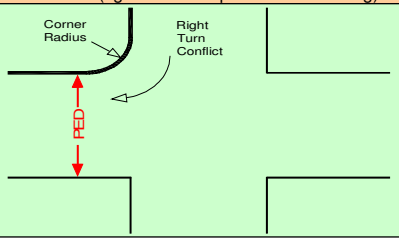
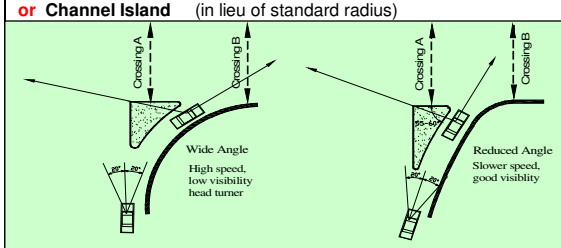
CORNER RADIUS (right turns into pedestrian crossing)		NB Approach	SB Approach	EB Approach	WB Approach
					
Standard Radius					
• ≤ 20'	10				
• > 20' and ≤ 30'	5				
• > 30' and ≤ 40'	0				
• > 40' and ≤ 60' (or equivalent compound curve)	-10	-10			-10
• > 60' (or equivalent compound curve)	-15				
or Channel Island (in lieu of standard radius)					
					
(A) Standard channel island					
(B) Modified slip lane design					
• Painted Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns made on yield or signal control	-10				
• Curbed Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	-10				
(& PED crossing @ location **A**)	0				
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5				
• Curbed Low Speed Slip Lane (Fig. B)					
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5		5	5	
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	5				
(& PED crossing @ location **A**)	10				
• No Corner Radius (e.g., "T" intersection)	10				
Table 3 **POINTS:**		-10	5	5	-10

Table 4.

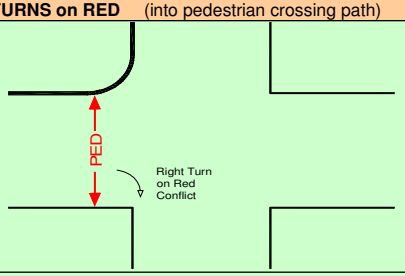
RIGHT TURNS on RED (into pedestrian crossing path)		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0	0	0	0	0
• Prohibited (or no conflict possible)	5				
Table 4 **POINTS:**		0	0	0	0

Table 5.

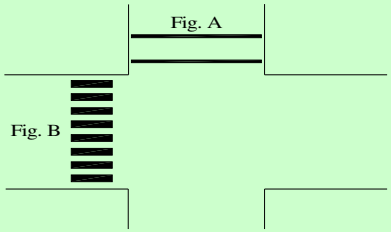
CROSSWALK TREATMENT		NB Approach	SB Approach	EB Approach	WB Approach
					
• No crosswalk	-5				
• Painted crosswalk		0	0	0	0
→ Transverse Markings (Fig. A)	0				
→ LADDER Style (Fig. B)	5				
• Textured/Colored Pavement	5				
Table 5 **POINTS:**		0	0	0	0

Table 6.

ADJUSTMENT FOR ONE-WAY STREETS Intersected by Two-Way Streets (Departure Leg Only)		NB Approach	SB Approach	EB Approach	WB Approach
Crossing of 4+ lanes & conflicting LEFT TURNS made on:					
• Green Ball Only (with or without PED phase)	-10				
• Green Arrow & Ball (with or without PED phase)	-10				
• Green Arrow Only (without PED phase)	-5				
• Green Arrow Only (with PED phase)	-2				
• Condition does not Apply	0	0	0	0	0

Adjustment for One-Way Streets

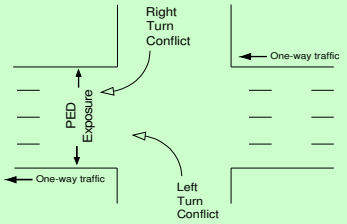


Table 6 **POINTS:**	0	0	0	0

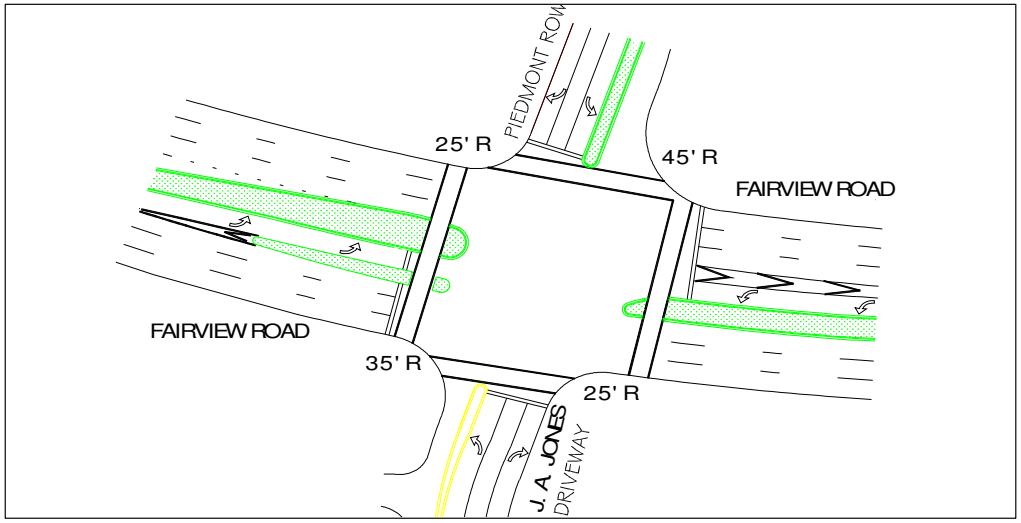
	NB Approach	**SB Approach**	**EB Approach**	**WB Approach**
Approach Total:	60	49	72	50
Approach LOS:	C	D	C+	D

Intersection Average:	**58**
Intersection LOS:	**C-**

PEDESTRIAN LEVEL OF SERVICE Worksheet
(to be used for Signalized Intersections)

Example # 4

Intersection: Fairview Road Road & Piedmont Row/JA Jones
Date: 2/23/2007



Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Spreadsheet calculates approach leg PED LOS and overall intersection PED LOS.

Table 1. **POINTS**

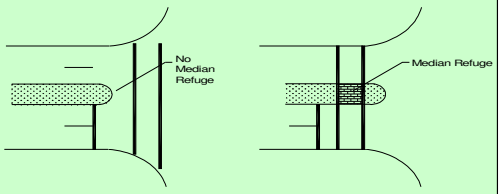
CROSSING DISTANCE (Total travel lanes to cross)	No Median Refuge (< 4')	Median Refuge (< 6')	Median Refuge (≥ 6')	Crossing of **NB Approach** (JA Jones Dwy)	Crossing of **SB Approach** (Piedmont Row)	Crossing of **EB Approach** (Fairview Rd)	Crossing of **WB Approach** (Fairview Rd)
2 lanes	80	80	80				
3 lanes	78	78	78				
4 lanes	65	65	68	65	65		
5 lanes	50	52	55				
6 lanes	37	40	44				
7 lanes	24	28	33			33	
8 lanes	8	12	20				20
9 lanes	-5	0	10				
10 lanes	-15	-10	0				
				no refuge	no refuge	6'+ refuge	6'+ refuge & painted out island one travel lane wide

Wide Crossing Adjustment (applies to streets 8+ lanes wide)

If a median refuge is provided and the distance to this refuge requires pedestrians to cross 6+ lanes and there is:

- 2nd refuge island (≥4') provided to breakup the 6+ lanes crossing distance 5
- NO 2nd refuge island (≥4') provided 0

Note: Pedestrian crossing must extend into median to be a refuge (see Figure below)



* Travel lanes are assumed to be within the range of 10' to 13' wide. If a lane is much wider, consider entering the equivalent number of lanes (based on 10 to 13' widths) for that extra crossing distance.

** Painted islands (without curbs) within a crossing that are a travel lane wide should be considered as a travel lane. (see PED LOS Example # 4)

POINTS:	65	65	33	20

*** CORNER ISLAND Adjustment**

Number of lanes crossed that are corner refuge island lanes:	0	0	0	0

Corner refuge island lane traffic controlled by:

Signal	5
Yield	-3
Free Flow (uncontrolled)	-20

Corner Refuge Island Adjustment

Example: 5 lane Crossing, with corner refuge island

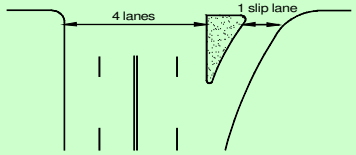
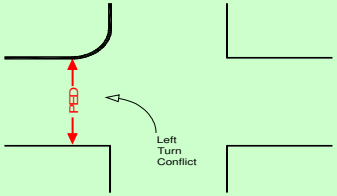
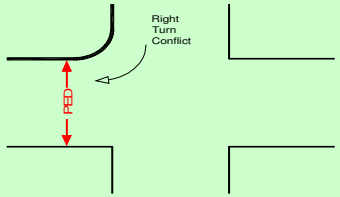


Table 1 POINTS:	65	65	33	20

Table 2.

SIGNAL FEATURES		NB Approach	SB Approach	EB Approach	WB Approach
2A. LEFT TURNS (into pedestrian crossing path)					
					
Made on Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0			0	0
• from 2+ left turn lanes, no PED phase	-10				
• from 2+ left turn lanes, PED phase	-5				
Made on Green Arrow & Green Ball					
• from 1 lane (left or thru/left), no PED phase	-5				
• from 1 lane (left or thru/left), PED phase	0				
Made on Green Arrow Only					
• from 1 left turn lane, no PED phase	5				
• from 1 left turn lane, PED phase	15	15	15		
• from 2+ left turn lanes, no PED phase	0				
• from 2+ left turn lanes, PED phase	15				
No Turn Conflict					
(e.g. "T" intersection, one-way street, prohibited)	15				
Table 2A POINTS:		15	15	0	0

2B. RIGHT TURNS (into pedestrian crossing path)



		NB Approach	SB Approach	EB Approach	WB Approach
Made on Green Ball					
• from shared thru-right lane, no PED phase	0	0	0	0	0
• from shared thru-right lane, PED phase	0				
• from 1 right turn lane, no PED phase	0				
• from 1 right turn lane, PED phase	0				
• from 2+ right turn lanes, no PED phase	-10				
• from 2+ right turn lanes, PED phase	-7				
Made on Green Arrow & Green Ball					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	0				
Made on Green Arrow Only					
• from 1 right turn lane, no PED phase	-10				
• from 1 right turn lane, PED phase	10				
• from 2+ right turn lanes, no PED phase	-15				
• from 2+ right turn lanes, PED phase	10				
Made from corner refuge island lane	7				
No Turn Conflict (e.g. "T" intersection, one-way street, prohibited)	15				
Table 2B POINTS:		0	0	0	0

2C. PEDESTRIAN PHASE

		NB Approach	SB Approach	EB Approach	WB Approach
• No pedestrian phase	-5				
• Raised Hand/Walking Person Display	0				
• Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	5	5	5	5	5
→ crossing time based on walk speed ≤ 3.5 ft/s	8				
• LEADING PED Phase & Countdown Display					
→ crossing time based on walk speed > 3.5 ft/s	8				
→ crossing time based on walk speed ≤ 3.5 ft/s	12				
Table 2C POINTS:		5	5	5	5
Table 2 POINTS:		20	20	5	5

Table 3.

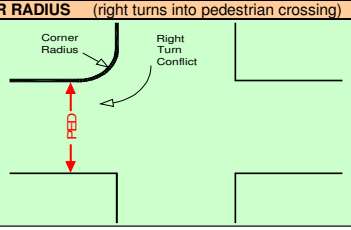
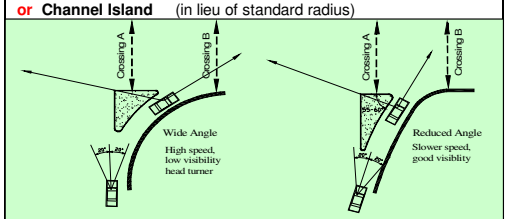
CORNER RADIUS (right turns into pedestrian crossing)		NB Approach	SB Approach	EB Approach	WB Approach
					
Standard Radius					
• ≤ 20'	10				
• > 20' and ≤ 30'	5			5	5
• > 30' and ≤ 40'	0	0			
• > 40' and ≤ 60' (or equivalent compound curve)	-10		-10		
• > 60' (or equivalent compound curve)	-15				
or Channel Island (in lieu of standard radius)					
					
(A) Standard channel island					
(B) Modified slip lane design					
• Painted Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns made on yield or signal control	-10				
• Curbed Channel Island (Fig. A)					
→ Uncontrolled turns (free flow turns)	-20				
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	-10				
(& PED crossing @ location **A**)	0				
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5				
• Curbed Low Speed Slip Lane (Fig. B)					
→ Turns on Yield, Green Ball or Green Arrow/Ball					
(& PED crossing @ location **B**)	0				
(& PED crossing @ location **A**)	5				
→ Turns Green Arrow Only					
(& PED crossing @ location **B**)	5				
(& PED crossing @ location **A**)	10				
• No Corner Radius (e.g., "T" intersection)	10				
Table 3 **POINTS:**		0	-10	5	5

Table 4.

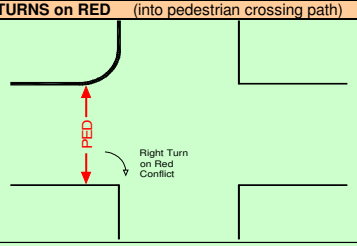
RIGHT TURNS on RED (into pedestrian crossing path)		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0	0	0	0	0
• Prohibited (or no conflict possible)	5				
Table 4 **POINTS:**		0	0	0	0

Table 5.

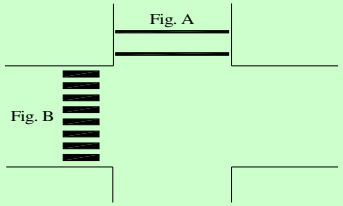
CROSSWALK TREATMENT		NB Approach	SB Approach	EB Approach	WB Approach
					
• No crosswalk	-5				
• Painted crosswalk					
→ Transverse Markings (Fig. A)	0	0	0	0	0
→ LADDER Style (Fig. B)	5				
• Textured/Colored Pavement	5				
Table 5 **POINTS:**		0	0	0	0

Table 6.

ADJUSTMENT FOR ONE-WAY STREETS Intersected by Two-Way Streets (Departure Leg Only)		NB Approach	SB Approach	EB Approach	WB Approach
Crossing of 4+ lanes & conflicting LEFT TURNS made on:					
• Green Ball Only (with or without PED phase)	-10				
• Green Arrow & Ball (with or without PED phase)	-10				
• Green Arrow Only (without PED phase)	-5				
• Green Arrow Only (with PED phase)	-2				
• Condition does not Apply	0	0	0	0	0

Adjustment for One-Way Streets

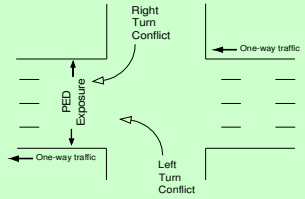


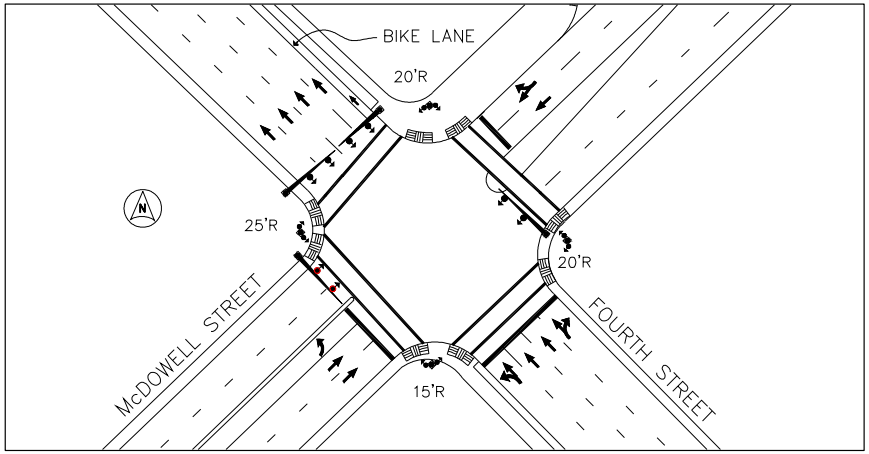
Table 6 **POINTS:**	0	0	0	0

	NB Approach	**SB Approach**	**EB Approach**	**WB Approach**
Approach Total:	85	75	43	30
Approach LOS:	B	B-	D	E

Intersection Average:	**58**
Intersection LOS:	**C-**

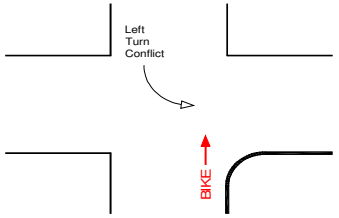
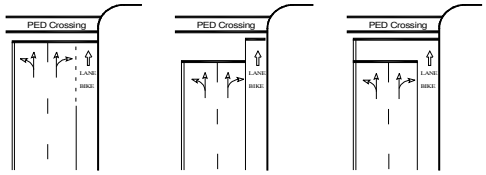
BICYCLE LEVEL OF SERVICE Worksheet
(to be used for Signalized Intersections)

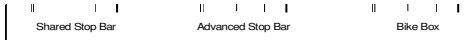
Intersection: Fourth Street & McDowell Street
Date: 2/23/2007



Select points from Tables 1-6 on the left hand side of speadsheet and enter the numerical value into the appropriate YELLOW highlighted cells on the right. Speadsheet calculates approach leg BIKE LOS and overall intersection BIKE LOS.

Table 1.

SIGNAL FEATURES	NB Approach (McDowell St.)	SB Approach (McDowell St.)	EB Approach (Fourth St.)	WB Approach (Fourth St.)
A. Auto Left Turn Phase (opposing cyclists)				
				
• Made on Green Ball only	0			
• Made on Leading Green Arrow/Green Ball	5	5		
• Made on Green Arrow Only	15			
• No Left Turn Conflict	15			15
Table 1A **POINTS:**	15	5		15
B. STOP BAR LOCATION				
				



• Shared stop bar for bikes & autos	0	0	0		0
• Advanced stop bar for bikes or bike box	10				
Table 1B **POINTS:**		0	0		0
Table 1 POINTS:		15	5		15

Table 2.

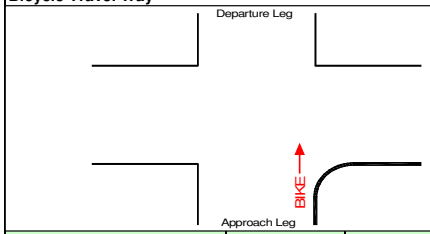
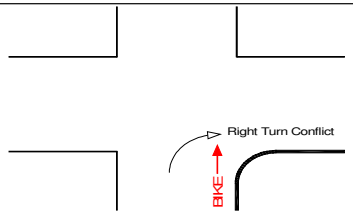
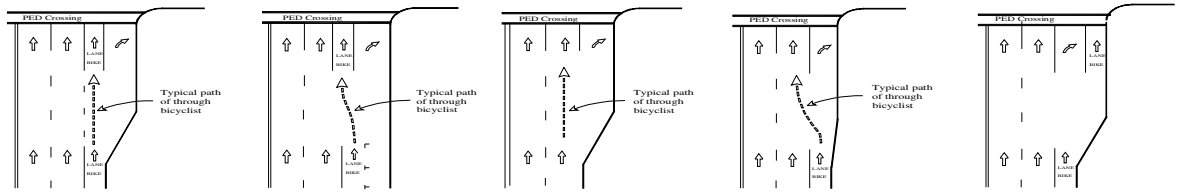
Bicycle Travel Way			NB Approach	SB Approach	EB Approach	WB Approach
						
Bike Travels in: (Approach/Departure Legs)	Speed Limit					
• **Shared Auto Lane to Shared Auto Lane** (lanes ≤ 12' wide)	≥ 40 mph	5				
	30 to 35 mph	30	30	30		
	< 30 mph	50				
• Shared Auto Lane (lane ≤ 12' wide) to Wide Curb Lane (13' to 14' wide)	≥ 40 mph	20				
	30 to 35 mph	40				
	< 30 mph	55				
• Shared Auto Lane (lane ≤ 12' wide) to Bike Lane	≥ 40 mph	35				
	30 to 35 mph	50				50
	< 30 mph	60				
• Shared Wide Curb Lane (13' to 14' wide) to Shared Auto Lane (lane ≤ 12' wide)	≥ 40 mph	15				
	30 to 35 mph	35				
	< 30 mph	50				
• **Shared Wide Curb Lane to Wide Curb Lane** (lanes 13' to 14' wide)	≥ 40 mph	30				
	30 to 35 mph	50				
	< 30 mph	60				
• Shared Wide Curb Lane (13' to 14' wide) to Bike Lane	≥ 40 mph	45				
	30 to 35 mph	60				
	< 30 mph	70				
• Bike Lane to Shared Auto Lane (lane ≤ 12' wide)	≥ 40 mph	30				
	30 to 35 mph	45				
	< 30 mph	55				
• Bike Lane to to Wide Curb Lane (13' to 14' wide)	≥ 40 mph	40				
	30 to 35 mph	55				
	< 30 mph	65				
• **Bike Lane to Bike Lane**	≥ 40 mph	60				
	30 to 35 mph	70				
	< 30 mph	80				

Table 2 POINTS:	30	30		50

Table 3.

Right Turn Conflicts		NB Approach	SB Approach	EB Approach	WB Approach
					
• No Conflict with Right Turning Motorists (e.g., "T" intersection, one-way street)	15	15			
• Bike in Shared Thru-Right Lane	0		0		0
• Bike Lane Right of Shared Thru-Right Lane					
→ Bike lane drops prior to intersection	-5				
→ Bike lane extends to intersection	0				
• Separate Right Turn Lane Provided (see figure below)					
→ Bike lane is left of right turn lane (Condition A in Figure below)	10				
→ Curb lane becomes right turn lane, bike lane left of (Condition B in Figure below)	5				
→ No bike lane (Condition C in Figure below)	0				
→ Curb lane becomes right turn lane, no bike lane (Figure D in PED & BIKE LOS Methodology)	0				
→ Bike lane right of right turn lane (Figure E in PED & BIKE LOS Methodology)	-20				

Bike Treatments at a Right Turn Lane



(A) Bike lane aligned so that cylist travels straight ahead - turning motorist yields to bicyclist (BEST)

(B) Bike lane alignment shift, cyclist merges left and turning motorist merges right

(C) No bike lane, cyclist uses auto travel lane

(D) Bike lane ends in advance of intersection - bicyclist shifts into auto travel lane

(E) Bike lane placed right of right-turn-only lane (Worst)

Table 3 POINTS:	15	0		0

Table 5.

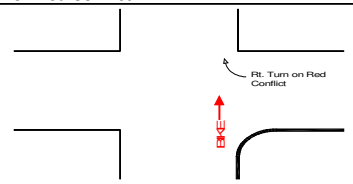
Right Turn on Red Conflict		NB Approach	SB Approach	EB Approach	WB Approach
					
• Allowed	0	0			
• Prohibited (or there is no right turn conflict)	5		5		5
Table 5 POINTS:		0	5		5

Table 6.

Intersection Crossing Distance (for thru cyclist)		NB Approach	SB Approach	EB Approach	WB Approach
• ≤ 3 motor vehicle travel lanes	0				
• 4 to 5 motor vehicle travel lanes	-5	-5	-5		-5
• ≥ 6 motor vehicle travel lanes	-10				
Table 6 POINTS:		-5	-5		-5

	NB Approach	**SB Approach**	**EB Approach**	**WB Approach**
Approach Total:	55	35		65
Approach LOS:	C-	E+		C

Intersection Average:	**52**
Intersection LOS:	**D+**

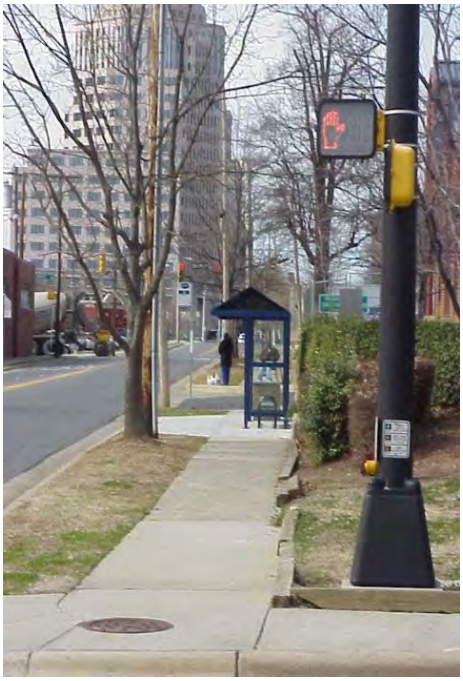
Connecting Charlotte

Charlotte Department of Transportation

PEDESTRIAN & BICYCLE LEVEL OF SERVICE

METHODOLOGY FOR CROSSINGS AT SIGNALIZED INTERSECTIONS

Updated February 2007



CONTENTS

TABLES AND FIGURES

INTRODUCTION

The Charlotte Department of Transportation has developed the following methodology to assess the important design features that affect pedestrians and bicyclists crossing signalized intersections. Referred to as Level of Service (LOS), this methodology identifies and evaluates features according to their influence on the comfort and safety of pedestrians and bicyclists. Among the key features identified and rated are crossing distance, roadway space allocation (i.e., crosswalks, bike lanes), corner radius dimension and traffic signal characteristics.

This methodology can be used as a diagnostic tool to assess and improve pedestrian and bicyclist levels of comfort and safety by modifying design and operational features of intersections. The results can be compared with those for traffic levels of service of an intersection and weighed according to user priorities. This methodology is intended to be used to select design and operational features that can help achieve desired levels of service for pedestrians and bicyclists.

SIGNALIZED INTERSECTION FEATURES AND THEIR RELATIVE IMPORTANCE TO PEDESTRIAN LEVEL OF SERVICE (LOS)

The primary impediments to comfort and safety for pedestrians crossing at signalized intersections are crossing distance and conflicts with turning vehicles. Vehicle volumes and speeds are factors as well, but are tempered by the presence of the traffic signal, its phasing, and/or physical characteristics of the intersection. For example, tight corner radii can slow the speeds of right-turning vehicles, and right and left turn conflicts can be reduced or eliminated by signal phasing, all design factors affecting comfort and safety between pedestrians and vehicles. So although volumes and speeds are not explicitly addressed by this methodology, they are implicitly dealt with.

This approach for assessing pedestrian level of service, therefore, identifies those key elements or features of intersections that enhance or reduce comfort and safety, and then weighs them relative to one another by a point system. Points are assigned to physical and operational features of intersections according to how well they achieve these objectives. These important features are discussed below.

Rated Intersection Features

Crossing Distance (Table 1) – As previously mentioned, crossing distance is the primary crossing component or obstacle for pedestrians traveling across intersections and therefore receives the greatest weight in this methodology. The less distance one has to walk to cross a street, the easier and more comfortable it is perceived to be. A crossing equivalent to two or three lanes, for example, rates a minimum LOS of B, exclusive of any other features. By contrast, a crossing of eight lanes or more falls in the LOS F range, exclusive of other features. For wide street crossings, where there is a greater probability that pedestrians might fail to make it across the entire roadway during a signal phase, level of service can be improved noticeably if there is a median wide enough to

serve as a refuge. Slip lanes and raised corner islands can also enhance pedestrian crossings by breaking long continuous distances into shorter, more manageable crossings. Crossing distance is determined based on the number of motor vehicle travel lanes that must be crossed to reach the far side of the intersection. Travel lanes are assumed to be within the range of 10' to 14' in width. If a lane(s) is much wider, one might consider the street crossing as wider than simply the number of delineated travel lanes. For example, the departure leg of an intersection is 20' wide and unmarked. In this case, the departure leg can be considered as two travel lanes to be crossed instead of one.

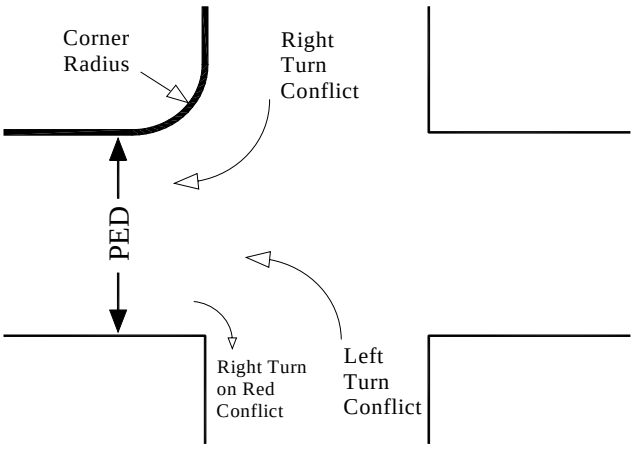
Signal Phasing & Timing (Table 2) – This is the most intricate of the design parameters and second most important in terms of points. It is rated according to the type and level of crossing information provided to the pedestrian and whether the signal phasing minimizes, eliminates or exacerbates conflicts between pedestrians and turning vehicles (Figure 1).

The signal phasing feature that rates best for reducing left turn conflicts across the pedestrian path is the Protected Only phase (when turns occur on a green arrow only), provided there are signals that inform pedestrians when they can cross without a conflict with left turning vehicles. Protected turn phases (e.g., green arrow only, green arrow/green ball) without accompanying pedestrian signals expose pedestrians to greater risks by adding an extra phase to the signal cycle that may not be perceptible to pedestrians. This condition, which may entice pedestrians into the street while motorist are turning on the arrow and not expecting to encounter pedestrians crossing, is viewed negatively. Also considered an increased risk, and rated accordingly, are lane arrangements that allow multiple lanes of traffic to turn across pedestrian paths, unless the signal phasing reduces or eliminates the conflict.

As with left turn conflicts, right turn conflicts are assessed according to lane configuration and signal phasing. Points can only be achieved in this category if the pedestrian conflict with turning traffic is eliminated by the signal phasing. Points are taken away if either the signal phasing creates a conflict similar to that discussed above for left turn phasing (overlap) or multiple lanes of traffic are allowed to turn concurrent with pedestrian crossings. Otherwise, no points are awarded or subtracted.

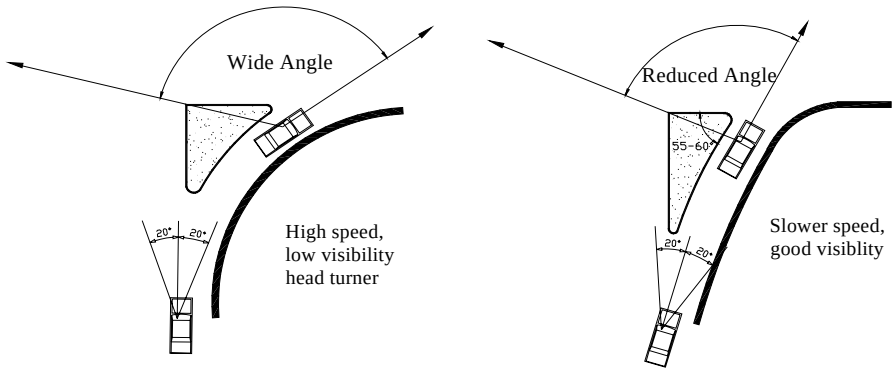
Points can also be attained by the use of pedestrian signals, provided vehicle conflicts are reduced and/or information is given by the signal that shows pedestrians how much time is available for them to cross the street (e.g., countdown signals). Additional points can be obtained within this subcategory by timing pedestrian phases for slower walk speeds, if countdown pedestrian signals are used. Pedestrian phase times based on slower walk speeds without countdown signals are not perceptible to pedestrians, and therefore do not receive extra points.

Figure 1. Pedestrian Crossing Conflicts



Corner Radius (Table 3) – Corner radius is rated according to its effect on right-turning vehicle speeds and any increased walking distance for pedestrians. The smaller the radius, the slower the turning speeds around it and the less additional distance to be walked. Radii of 20' or smaller rate best, while large radii (greater than 40') are considered detrimental enough to be assigned negative point values. If slip lanes or raised corner channel islands suitable in size to serve as pedestrian refuge are provided (Figure 2), then points are assigned according to the type of traffic control present (i.e., yield or signal control) and how this control manages the pedestrian-turning vehicle conflict. For simplicity, no distinction is made between corner radius and its effect on vehicle speeds for turns into a single lane or turns into multiple lanes. Also, the effect of intersection angle on vehicle speeds for a given radius is not directly incorporated. Corner radius ranks third for points among the rated intersection features.

Figure 2. Corner Channel Island Designs



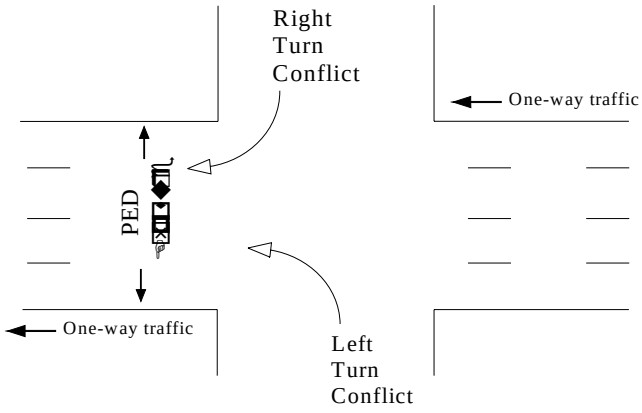
(A) Standard slip lane design (B) Modified slip lane design

Right Turns On Red (Table 4) – Prohibiting right-turns-on-red eliminates a possible conflict between pedestrians and motorists. The Right-Turns-On-Red and Crosswalk (below) features each account for about 5% of the possible points.

Crosswalk Treatment (Table 5) - The presence of and design features of crosswalks are both rated. Crosswalks help raise awareness to motorists of the possibility of pedestrians crossing the street. Enhanced crosswalks (e.g., textured/colored pavement or ladder style pavement markings) are more visible than simple transverse markings, and therefore are rated better.

Adjustment for One-Way Street Crossings (Table 6) – This parameter accounts for the increased risk to pedestrians caused by their exposure to left and right turning traffic while crossing the departure leg of a one-way street that intersects a two-way street. With this scenario, pedestrians are exposed to left and right turning traffic for the entire crossing distance of the road, instead of just a portion (such as is the case for crossing a two-way street with traffic stopped on the approach lanes by the signal).

Figure 3. Adjustment for One-Way Streets



SIGNALIZED INTERSECTION FEATURES AND THEIR RELATIVE IMPORTANCE TO BICYCLE LEVEL OF SERVICE (LOS)

The major impediments to the comfort and safety of bicyclists are somewhat different than those for pedestrians. Traffic signal features and potential conflicts with turning vehicles are still prominent issues, but crossing distance is less important and is surpassed by the desire for physical space in the roadway apart from automobile traffic. Because bicyclists share space with and travel alongside motor vehicles, the speed of traffic is also a significant factor.

As with the pedestrian level of service methodology, key elements or features of intersections that enhance or reduce comfort and safety are identified and assigned points according to how well they meet the objectives. These important features are discussed below.

Rated Intersection Features

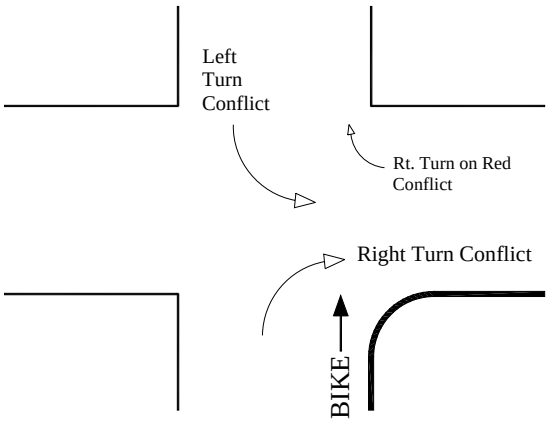
Bicycle Travel Way & Speed of Adjacent Traffic (Table 8) – Where bicyclists travel within the roadway and how fast motor vehicle traffic is moving next to them is the most important factor in accessing their comfort and safety.

For streets with moderate to high traffic speeds (30 mph or more), travel space beyond that provided for general traffic is highly desirable. This extra space may be in the form of separate bicycle lanes, or in the form of wide outside travel lanes (13' to 14'). Bicycle lanes rate best and are the preferred treatment. Conditions requiring bicyclists to share travel lanes with motorists rate poorly.

Bike lanes and wide outside lanes, on the other hand, do not provide as much benefit on low speed streets (less than 30 mph) because cyclists can better match the speed of adjacent traffic. Also, low speed streets generally carry low traffic volumes, which many cyclists prefer.

Signal Features – Left Turn Phasing & Stop Bar Location (Table 9) – Features that remove potential left turn conflicts from the path of bicyclists and features that place bicyclists before motorists (in space) are rated as desirable. Signal phasing and stop location rate as the second most important bicycle feature.

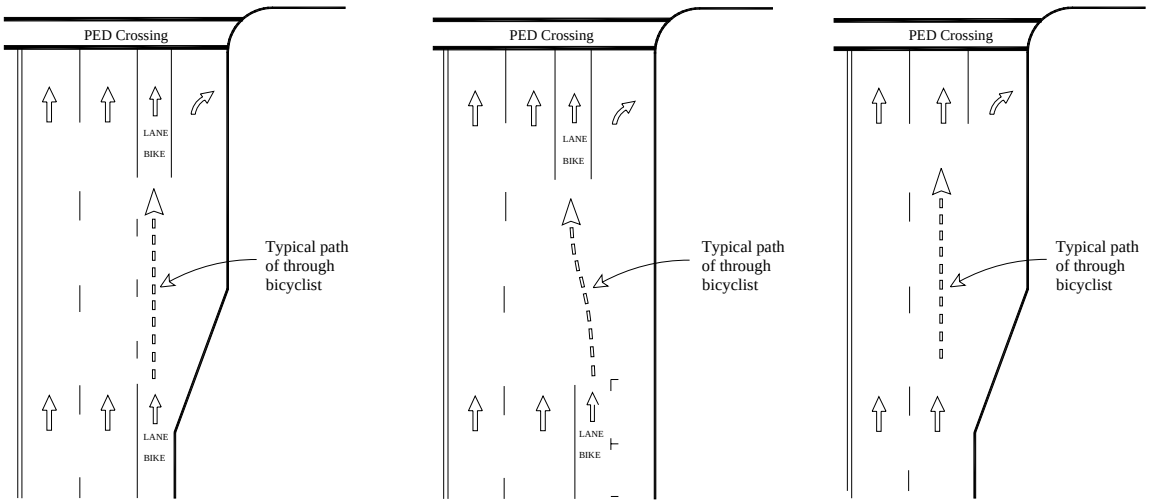
Figure 4. Bicycle Crossing Conflicts



Right Turn Traffic Conflict (Table 10) – This parameter addresses the potential conflict involving motorists turning right and bicyclists traveling straight ahead on an intersection approach. The preferred method of resolving this conflict is for bicyclists to 'take' the traffic lane if it is shared with traffic, or if there is a separate right turn lane (Figure 5), motorists should merge right in advance of the intersection while bicyclists travel straight-ahead. Points are awarded if there is no right turn conflict with motorists or if there is a bicycle lane that places bicyclists left of a right turn lane. Otherwise, points are

either not awarded at all or they are taken away, depending on whether the bicyclist or motorist is required to merge.

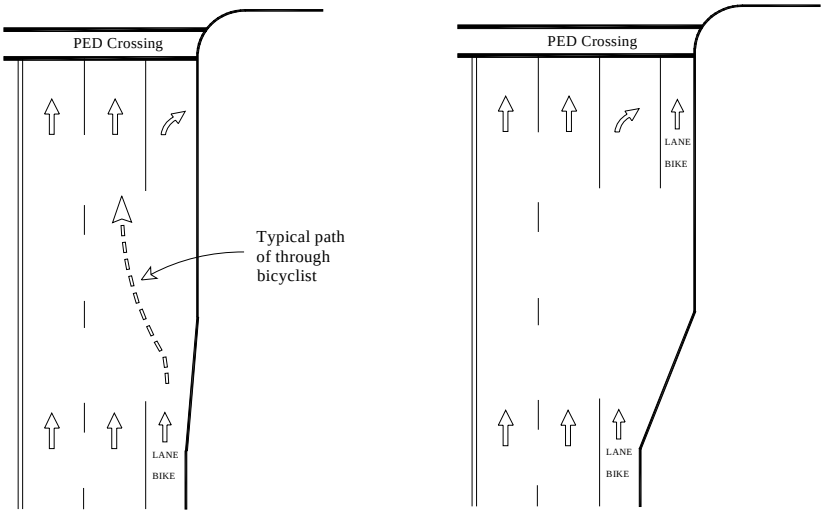
Figure 5. Bike Treatments at Exclusive Right Turn Lanes



(A) Straight alignment - Cyclists travel straight and turning motorists yield to cyclists (BEST CONDITION)

(B) Alignment shift - Cyclists merge left and turning motorists merge right

(C) No bike lane - Cyclists share lane with motorists



(D) Bike lane ends - cyclists shift into motor vehicle lane

(E) Bike lane right of turn lane (BAD CONDITION)

Right Turns On Red (Table 11) - This condition creates another conflict between bicyclists and motorists. Bicyclists can easily blend into the background when a motorist is looking to turn right on red because motorists are often looking for larger motor vehicles (Figure 4).

Crossing Distance (Table 12) – Wide street crossings increase the risk of exposure to bicyclists from motor vehicle traffic on cross-streets. Signal clearance times (the yellow and all-red signal phase portions) are timed for motor vehicle speeds and not the slower speeds of bicyclists; therefore, the wider the intersection, the greater the likelihood that cyclists will still be crossing when right-of-way changes to the cross-street.

Intersection Features Not Rated in the Pedestrian and Bicycle Methodologies

There are several other features not rated in these methodologies that also affect the comfort and safety of pedestrians and bicyclists and should be considered in intersection design. Among these features are sight lines, street lighting, pavement condition, signing, pedestrian and bike detection, curb extensions, and ADA features such as wheel chair ramps and accessible signals.

PEDESTRIAN AND BICYCLE LOS DETERMINATION

Level of service for an intersection crossing/approach is determined by adding points from Tables 1 through 6 (for Pedestrians) and points from Tables 8 through 12 (for Bicyclists). The accumulation of points is then compared to the points listed in Tables 7 (Pedestrians) and 13 (Bicyclists), which provides the threshold values for levels of service A through F. An overall intersection level of service for either pedestrian or bicycle features can also be determined by adding the total points from each crossing and dividing their sum by the number of intersection crossing legs (e. g., a three leg intersection's point totals would be divided by three). The higher the point total, the better the level of service.

SUMMARY

The level of service methodology is intended to be used to assess the most crucial, especially safety related, factors affecting pedestrians' and bicyclists' crossing signalized intersections. It attempts to identify and compare those design elements that help make intersection crossings safer and pedestrians and bicyclists feel more comfortable. The methodology is not concerned with the quality of the environment away from the intersection crossing, so those elements that make an area more inviting and attractive to pedestrians and bicyclists, such as visual stimuli, convenience, security, and noise are not considered. These other elements and their importance on creating a pedestrian and bicycle friendly environment are addressed through initiatives such as the Urban Street Design Guidelines

The focus of this methodology is on those intersection features that reduce traffic conflicts, minimize crossing distances, slow down traffic speeds and raise user awareness. The methodology assumes that all rated features are adequately designed and

implemented (e.g., signals are timed adequately and pedestrian signals are well placed), so that equivalent comparisons can be made between features. While important to the overall sense of safety and comfort, elements of risk (e.g., traffic volumes) are not directly evaluated in the methodology since design features are the focus and design features can be used to mitigate the effects of risks. Furthermore, design features such as cross-section distance, number and type of travel lanes, and signal-phasing schemes typically reflect varying traffic volumes.

This level of service methodology is expected to be applied in conjunction with the traditional level of service methodology for motor vehicles. The importance or relative weight given to each level of service (for motor vehicles, bicyclists or pedestrians) is expected to vary by intersection, depending on the planned function and context of each intersection.

The following pages provide additional detail of the pedestrian and bicycle level of service methodologies, along with example level of service calculations. As a companion piece to this document, Charlotte DOT has also developed an electronic spreadsheet that can be used to quickly calculate levels of service. The spreadsheet should be used when performing level of service calculations.

PEDESTRIAN LEVEL OF SERVICE CALCULATION

TABLE 1. PEDESTRIAN LOS: Crossing Distance

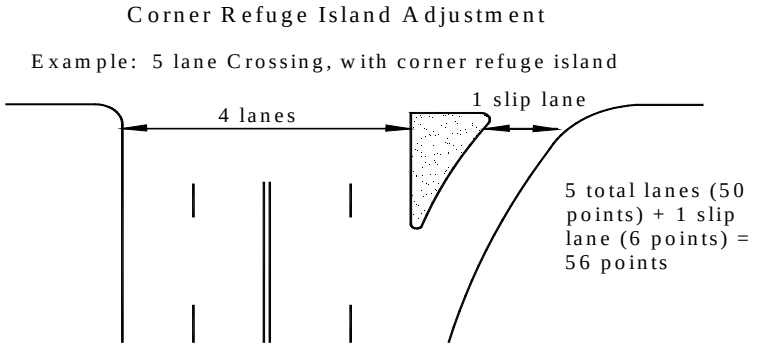
Crossing distance is determined based on the total number of motor vehicle travel lanes that must be crossed to reach the opposite side of the street. The added effect of corner radii on crossing distance is addressed in parameter number 3 (Corner Radius). When the number of travel lanes crossed includes the crossing of corner refuge island lane(s), an adjustment to the points in the table below should be made. This adjustment is described just below the table.

	Points		
Total Travel Lanes Crossed	**No Median Refuge (or less than 4')**	**Median Refuge (4' to 6')**	**Median Refuge (6' or more)**
2 Lanes	**80**	**80**	**80**
3 Lanes	**78**	**78**	**78**
4 Lanes	**65**	**65**	**68**
5 Lanes	**50**	**52**	**55**
6 Lanes	**37**	**40**	**44**
7 Lanes	**24**	**28**	**33**
8 Lanes	**8**	**12**	**20**
9 Lanes	**-5**	**0**	**10**
10 Lanes	**-15**	**-10**	**0**

Corner Refuge Island Adjustments:

- Crossing of corner refuge island lanes is not weighed as heavily as crossing other travel lanes, and therefore the points assigned based on crossing distance in the table above should be adjusted. Six points are assigned for each refuge island lane crossed. Refuge lane points are added to the points assigned for the total crossing distance from Table 1 above.

  Example: A crossing of 5 lanes (one of which is a refuge island lane) is adjusted as follows: 50 points (based on 5 lanes crossed) + 6 points (for refuge island lane) = 56 points.



- Adjustments are also made based on how slip lane traffic is controlled at the intersection. If slip lane traffic is under signal control then 5 points are added to the crossing total. If traffic is under Yield control then 3 points are subtracted from the crossing total, and if traffic is uncontrolled (i.e., free flow) then 20 points are subtracted.

TABLE 2. PEDESTRIAN LOS: Signal Phasing & Timing Features

Pedestrian Crossing Conflicts

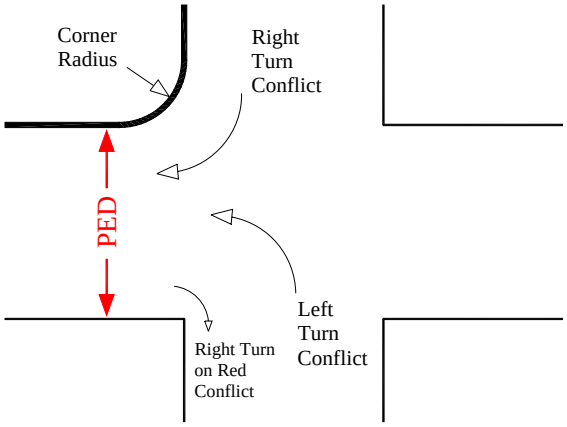


Table 2A **Left Turn Conflicts (Left Turns into Pedestrian Crossing Path)**	**Points**
A1. Lefts on GREEN BALL Only (permissive phase - left turns unprotected) • From SINGLE lane, no pedestrian phase on conflicting crossing • From SINGLE lane, with pedestrian phase on conflicting crossing • From 2 or more lanes, no pedestrian phase on conflicting crossing • From 2 or more lanes, with pedestrian phase on conflicting crossing	 **-5** **0** **-10** **-5**
A2. Lefts on GREEN ARROW & GREEN BALL (protected/permissive phase) • From SINGLE lane, no pedestrian phase on conflicting crossing • From SINGLE lane, with pedestrian phase on conflicting crossing	 **-5** **0**
A3. Lefts on GREEN ARROW Only (protected only phase) • From SINGLE lane, no pedestrian phase on conflicting crossing • From SINGLE lane, with pedestrian phase on conflicting crossing • From 2 or more lanes, no pedestrian phase on conflicting crossing • From 2 or more lanes, with pedestrian phase on conflicting crossing	 **5** **15** **0** **15**
A4. No Left Turn Conflict (e.g., "T" intersections, one-way streets, exclusive pedestrian phase)	**15**

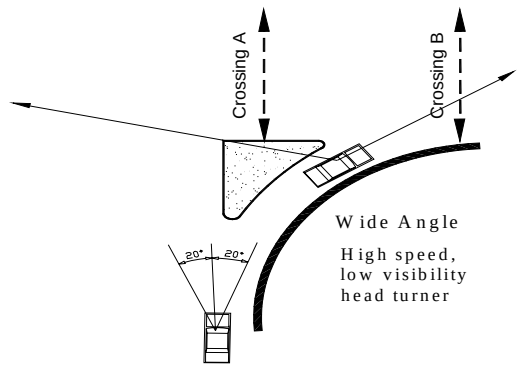
Table 2B **Right Turn Conflicts (Right Turns into Pedestrian Crossing Path)**	**Points**
B1. Rights on GREEN BALL Only (permissive phase)	
• From SHARED Thru-Right lane, no pedestrian phase on conflicting crossing	**0**
• From SHARED Thru-Right lane, with pedestrian phase at crossing	**0**
• From SINGLE Right lane, no pedestrian phase on conflicting crossing	**0**
• From SINGLE Right lane, with pedestrian phase on conflicting crossing	**0**
• From 2 or more Right lanes, no pedestrian phase on conflicting crossing	**-10**
• From 2 or more Right lanes, with pedestrian phase on conflicting crossing	**-7**
B2. Rights on GREEN ARROW & GREEN BALL (overlap phase)	
• From RIGHT turn lane(s), no pedestrian phase on conflicting crossing	**-10**
• From RIGHT turn lane(s), with pedestrian phase (no conflict for duration of the Green Arrow)	**0**
B3. Rights on GREEN ARROW Only (protected phase)	
• From SINGLE Right lane, no pedestrian phase	**-10**
• From SINGLE Right lane, with pedestrian phase – turning traffic held for pedestrian movement, which eliminates turning/crossing conflict	**10**
• From 2 or more Right lanes, no pedestrian phase	**-15**
• From 2 or more Right lanes, with pedestrian phase – turning traffic held for pedestrian movement, which eliminates turning/crossing conflict	**10**
B4. No Right Turn Conflict (e.g., "T" intersections, one-way streets, exclusive pedestrian phase)	**15**

TABLE 2C **Pedestrian Phase Signal Display**	
C1. No Pedestrian Phase	**-5**
C2. UPRAISED HAND, WALKING PERSON display	**0**
C3. UPRAISED HAND, WALKING PERSON display – with LEADING pedestrian phase (pedestrians start crossing seconds before vehicles on the adjacent street)	**4**
C4. COUNTDOWN display (crossing time is shown) With pedestrian crossing time based on following walk speeds:	
> 3.5 ft/sec	**5**
≤ 3.5 ft/sec	**8**
C5. LEADING COUNTDOWN display (pedestrians start crossing seconds	

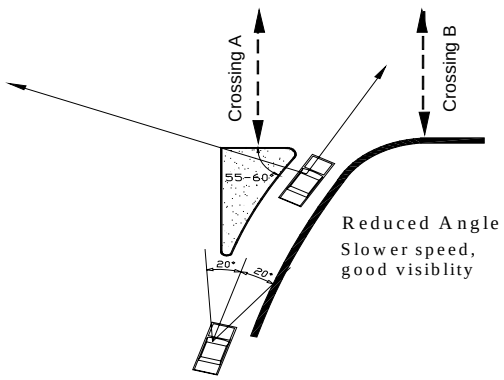
before vehicles on the adjacent street) With pedestrian crossing time based on following walk speeds: > 3.5 ft/sec ≤ 3.5 ft/sec	 **8** **12**

TABLE 3. PEDESTRIAN LOS: Corner Radius

Standard Radius	**Points**
A. Radius ≤ to 20’	**10**
B. Radius > 20’ and ≤ 30’	**5**
C. Radius > 30’ and ≤ 40’	**0**
D. Radius > 40’ and ≤ 60’ (or Equivalent Compound Curve)	**-10**
E. Radius > 60’ (or Equivalent Compound Curve)	**-15**



(A) Standard channel island



(B) Modified slip lane design

CHANNEL ISLAND (in lieu of standard radius)	
F. Painted Channel Island (no curb)	
- Right turns are uncontrolled (free flow)	**-20**
- Right turns made on Yield or Signal Control	**-10**
G. Curbed Channel Island (Figure A)	
- Right turns are uncontrolled (free flow)	**-20**
- Right turns on Yield, Green Ball or Green Arrow/Green Ball	
(& Pedestrian crossing at location B)	**-10**
(& Pedestrian crossing at location A)	**0**
- Right turns on Green Arrow Only	
(& Pedestrian crossing at location B)	**0**
(& Pedestrian crossing at location A)	**5**
H. Curbed Low Speed Design Slip Lane (Figure B)	
- Right turns on Yield, Green Ball or Green Arrow/Green Ball	
(& Pedestrian crossing at location B)	**0**
(& Pedestrian crossing at location A)	**5**
- Right turns on Green Arrow Only	
(& Pedestrian crossing at location B)	**5**
(& Pedestrian crossing at location A)	**10**

I. No Corner Radius (e.g., "T" intersection)	**10**

TABLE 4. PEDESTRIAN LOS: Right Turns On Red

	Points
Allowed	**0**
Prohibited (or no conflict because right turns are not permitted/possible)	**5**

Table 5. PEDESTRIAN LOS: Crosswalk Treatment

No designated crosswalk	**-5**
Painted crosswalk	
- Transverse markings (Type A)	**0**
- LADDER type markings (Type B)	**5**
Textured/Colored Pavement	**5**

Crosswalk Types

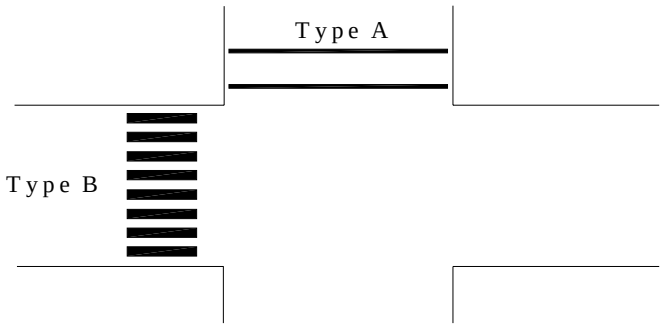


Table 6. PEDESTRIAN LOS: Adjustment for One-Way Street Crossings

Applies only to the departure leg of a one way street with 4 or more lanes that intersects a two-way street. (Figure 3, page 6)	
Conflicting left turns made on:	
• Green Ball Only (with or without pedestrian phase)	**-10**
• Green Arrow/Green Ball (with or without pedestrian phase)	**-10**
• Green Arrow Only (without pedestrian phase)	**-5**
• Green Arrow Only (with pedestrian phase)	**-2**
• Condition does not apply	**0**

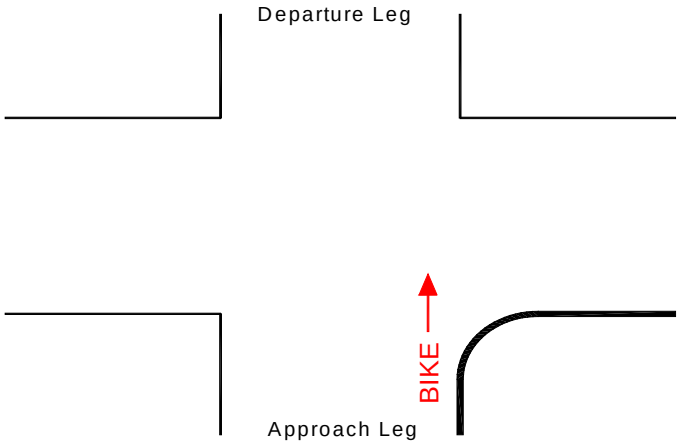
TABLE 7. Point Totals and Corresponding PEDESTRIAN Level of Service

Points	**LOS**

93+	A
74 - 92	B
55 - 73	C
37 - 54	D
19 - 36	E
0 - 18	F

BICYCLE LEVEL OF SERVICE CALCULATION

TABLE 8. BICYCLE LOS*:* Bicycle Travel Way & Speed of Adjacent Traffic



Bike Travels in: (Approach/Departure Legs)	Speed Limit	Points
• **Shared Auto Lane to Shared Auto Lane** (lanes ≤ 12' wide)	≥ 40 mph	5
	30 to 35 mph	30
	‹ 30 mph	50
• **Shared Auto Lane to Wide Curb Lane** (13' to 14' wide)	≥ 40 mph	20
	30 to 35 mph	40
	‹ 30 mph	55
• **Shared Auto Lane to Bike Lane**	≥ 40 mph	35
	30 to 35 mph	50
	‹ 30 mph	60
• **Shared Wide Curb Lane To Shared Auto Lane**	≥ 40 mph	15
	30 to 35 mph	35
	‹ 30 mph	50
• **Shared Wide Curb Lane to Wide Curb Lane** (13' to 14' wide)	≥ 40 mph	30
	30 to 35 mph	50

	‹ 30 mph	60
• **Shared Wide Curb Lane to Bike Lane**	≥ 40 mph	45
	30 to 35 mph	60
	‹ 30 mph	70

TABLE 8 (continued)

Bike Travels in: (Approach/Departure Legs)	Speed Limit	Points
• **Bike Lane to Shared Auto Lane** (lanes ≤ 12' wide)	≥ 40 mph	30
	30 to 35 mph	45
	‹ 30 mph	55
• **Bike Lane to Wide Curb Lane** (13' to 14' wide)	≥ 40 mph	40
	30 to 35 mph	55
	‹ 30 mph	65
• **Bike Lane to Bike Lane**	≥ 40 mph	60
	30 to 35 mph	70
	‹ 30 mph	80

TABLE 9. BICYCLE LOS: Signal Features – Left Turn Phasing & Stop Bar Location

Vehicular Left Turn Phase – turns opposing cyclists (Figure 4, page 7)	**Points**
Made on Green Ball Only	**0**
Made on Green Ball/Green Arrow	**5**
Made on Green Arrow Only	**15**
No Left Turn Conflict (e.g., "T" intersection, one-way streets)	**15**
Stop Bar Location	
Shared stop bar - automobiles & bikes stop at common point	**0**
Advanced stop bar – bikes stop closer to intersection than automobiles	**10**

Bicycle Crossing Conflicts

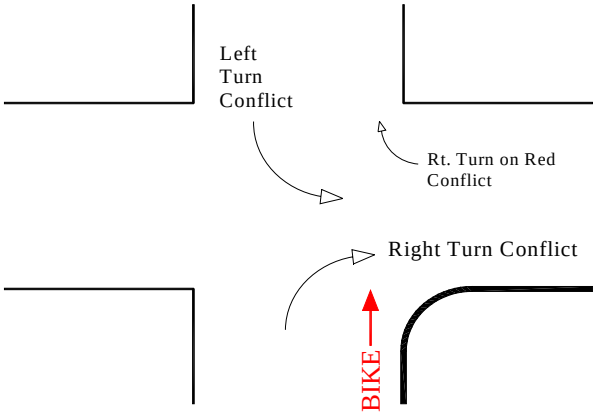


TABLE 10. BICYCLE LOS: Right Turn Traffic Conflict

	Points
No Right Turn Conflict (e.g., "T" intersection, one-way street)	**15**
No Separate Right Turn Lane (Bike in Shared Lane)	**0**
Separate Right Turn Lane (Figure 5, page 8)	
Bike lane LEFT of right turn lane (cyclist travels straight ahead and motorist merges right) – see Figure 5A	**10**
Curb lane drops as right turn lane, with bike lane left of turn lane (cyclist merges left, motorist merges right) – see Figure 5B	**5**
No bike lane (cyclist travels straight ahead and motorist merges right) – see Figure 5C	**0**
Curb lane drops as right turn lane, no bike lane at intersection (cyclist merges left, motorist merges right) – see Figure 5D	**0**
Bike lane RIGHT of right turn lane – see Figure 5E	**-20**

TABLE 11. BICYCLE LOS: Right Turns On Red

Allowed	**0**
Prohibited (or no conflict because right turns are not permitted/possible)	**5**

TABLE 12. BICYCLE LOS: Intersection Crossing Distance

	≤ 3 motor vehicle travel lanes	**0**
	4 to 5 motor vehicle travel lanes	**-5**
	≥ 6 travel motor vehicle lanes	**-10**

TABLE 13. Point Totals and Corresponding BICYCLE Level of Service

Points	LOS
93+	A
74 - 92	B
55 - 73	C
37 - 54	D
19 - 36	E
0 - 18	F

Intersection Example # 1

Application of the pedestrian and bicycle level of service methodologies for an example intersection is presented in Figures 6 and 7. The intersection evaluated is that of a one-way street (4th Street) and a two-way street (McDowell Street) in downtown Charlotte. The sample worksheets in figures 6 and 7 provide information on features relevant to the intersection.

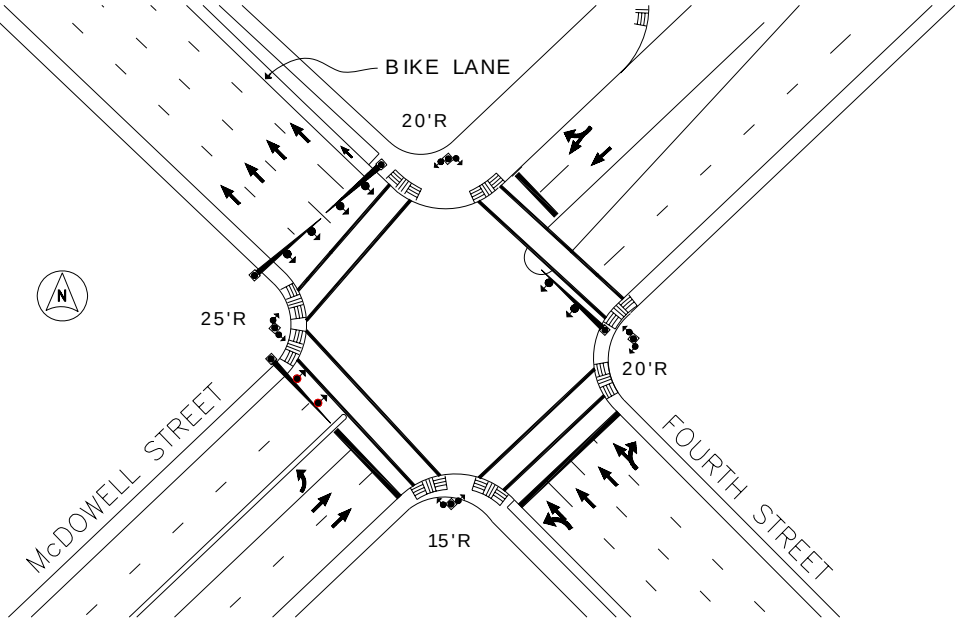


Figure 6. Example Intersection #1: Pedestrian LOS Calculation

Location: 4th Street & McDowell Street

	Crossing of Northbound Approach (McDowell St.)	Crossing of Southbound Approach (McDowell St.)	Crossing of Eastbound Approach (4th St.)	Crossing of Westbound Approach (4th St.)
Pedestrian Crossing Distance	5 Lanes (2' median)	4 Lanes (10' median refuge)	4 Lanes	4 Lanes
Score	**50**	**68**	**65**	**65**
Signal Features				
Left Turn Conflict (left turns into pedestrian path)	Lefts on Green Ball Only, from a single lane – with pedestrian phase	No Left Turn Conflict - (4th St. one-way)	Lefts on Green Arrow/Green Ball - with pedestrian phasing	No Left Turn Conflict - (4th St. one-way)
Score	**0**	**15**	**0**	**15**
Right Turn Conflict (right turns into pedestrian path)	No Right Turn Conflict (4th St. one-way)	Right Turns on Green Ball, from a shared thru-right lane - with pedestrian phase	Right Turns on Green Ball, from a shared thru-right lane - with pedestrian phase	No Right Turn Conflict (4th St. one-way)
Score	**15**	**0**	**0**	**15**
Pedestrian Signal Display	Countdown Display (4 ft/sec)	Countdown Display (4 ft/sec)	Countdown Display (4 ft/sec)	Countdown Display (4 ft/sec)
Score	**5**	**5**	**5**	**5**

Corner Radius	25'	20’	20'	15'
Score	**5**	**10**	**10**	**10**
Right Turns on Red	No Conflict (4^{th} St. one-way)	Prohibited	No Conflict (4^{th} St. one-way)	Allowed
Score	**5**	**5**	**5**	**0**
Crosswalks	Textured/Colored	Textured/Colored	Textured/Colored	Textured/Colored
Score	**5**	**5**	**5**	**5**
Adjustment for One-Way Street Crossings	Two-Way Street (Not Applicable)	Two-Way Street (Not Applicable)	Departure Leg 4 Lanes Wide, with left and right turn conflicts	Multilane One-Way street, no left and right turn conflicts (Not Applicable)
Score	**--**	**--**	**-10**	**--**
Approach Total	**85**	**108**	**80**	**115**
Approach LOS	**B**	**A**	**B**	**A**
Intersection AVG.	**97**			
INTERSECTION LOS	**A**			

Figure 7. Example Intersection #1: Bicycle LOS Calculation

Location: 4^{th} Street & McDowell Street

	Northbound Approach (McDowell St.)	Southbound Approach (McDowell St.)	Eastbound Approach (4^{th} St.)	Westbound Approach (4^{th} St.)
Bike Travel Way & Speed of Adjacent Traffic	Shared 12’ Lane with Motor Vehicles 35 mph	Shared 12’ Lane with Motor Vehicles 35 mph	Does not Apply	Shared 12’ Lane Transitions to 4’ Bike Lane 35 mph
Score	**30**	**30**		**50**
Signal Features				
Opposing Vehicular Left Turn Phase	No Left Turn Conflict	Green Arrow & Green Ball		No Left Turn Conflict
Score	**15**	**5**		**15**
Stop Bar Location	Vehicles & Bikes Stop at Same Point	Vehicles & Bikes Stop at Same Point		Vehicles & Bikes Stop at Same Point
Score	**0**	**0**		**0**
Right Turning Traffic Conflict Shared Traffic Lane/Separate Right Turn Traffic Lane	No Right Turn Conflict	Shared Thru-Right lane - no bike lane		Shared Thru-Right Lane - no bike lane on approach

Score	**15**	**0**		**0**
Right Turns On Red	Allowed	No Conflict		Prohibited
Score	**0**	**5**		**5**
Intersection Crossing Distance	4 Travel Lanes	4 Travel Lanes		5 Travel Lanes
Score	**-5**	**-5**		**-5**
Approach Total	**55**	**35**		**65**
Approach LOS	**C-**	**E+**		**C**
Intersection AVG.	**52**			
Intersection LOS	**D+**			

Intersection Example # 2

A second application of the pedestrian level of service methodology is presented in Figure 8. This example illustrates how the methodology should be applied for slip lane or channel island designs. The sample worksheet in figure 8 provides information on features relevant to the intersection.

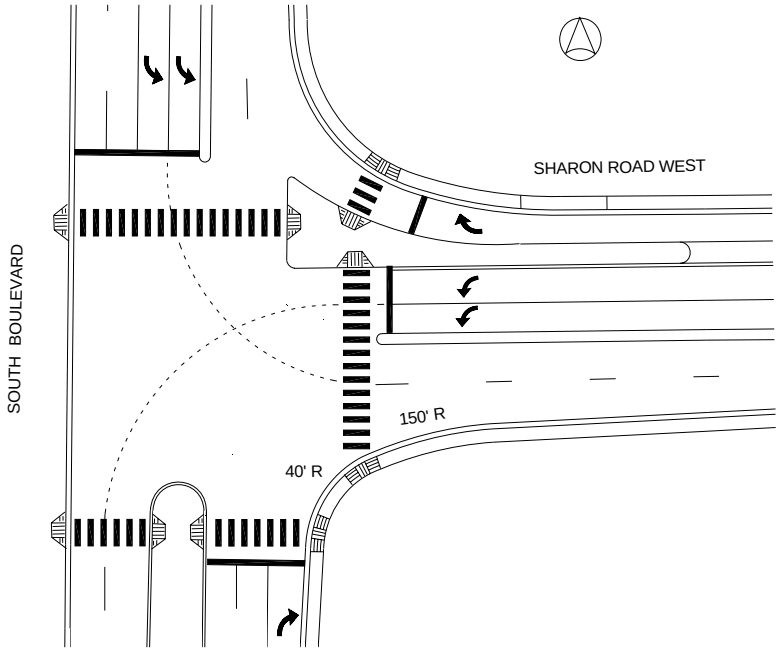


Figure 8. Example Intersection #2: Pedestrian LOS Calculation

Location: South Boulevard & Sharon Road West

	Crossing of Northbound Approach (South Blvd..)	Crossing of Southbound Approach (South Blvd.)		Crossing of Westbound Approach (Sharon Rd. West)
Pedestrian Crossing Distance	5 Lanes (12' median refuge)	7 Lanes 6+1 slip lane – under yield control (no median refuge)		5 Lanes 4+1 slip lane – under yield control (no median refuge)
Score	**55**	**27**		**53**
Signal Features				
Left Turn Conflict (left turns into pedestrian path)	Lefts on Green Arrow Only, from 2 lanes – with pedestrian phase	No Left Turn Conflict		Lefts on Green Arrow Only, from 2 lanes – with pedestrian phase
Score	**15**	**15**		**15**
Right Turn Conflict (right turns into pedestrian path)	No Right Turn Conflict	Cross to Corner Channel Island		Right Turns on Green Arrow/Green Ball, from single right turn lane
Score	**15**	**7**		**0**
Pedestrian Signal Display	Countdown Display	Countdown Display		Countdown Display (4 ft/sec)

	(4 ft/sec)	(4 ft/sec)		
Score	**5**	**5**		**5**
Corner Radius	None (T intersection)	Corner Slip Island (crossing point A)		Compound Curve (55' equivalent)
Score	**10**	**5**		**-10**
Right Turns on Red	Allowed	No Conflict		Slip Lane, right turns yield controlled
Score	**0**	**5**		**0**
Crosswalks	Ladder Style	Ladder Style		Ladder Style
Score	**5**	**5**		**5**
Adjustment for One-Way Street Crossings	Not Applicable	Not Applicable		Not Applicable
Score	**--**	**--**		**--**
Approach Total	**105**	**69**		**68**
Approach LOS	**A**	**C**		**C**
Intersection AVG.	**81**			
INTERSECTION LOS	**B**			