APPENDIX C

Existing Condition and Demand Variable References

Table C-1. Variables used in pedestrian suitability analysis tools.

Variable	Pedestrian Level of Service (LOS) (Segment)	Pedestrian Level of Service (LOS) (Uncontrolled Crossing)	Pedestrian Level of Service (LOS) (Signalized Intersection)	FHWA Crosswalk Guidelines	Pedestrian Intersection Safety Index (ISI)	Pedestrian Crash Modification Factors	Notes
Traffic speed in the parallel direction of travel or roadway being crossed	X	X	X	X	X		
Traffic volume and composition (proportion heavy vehicles) in the parallel direction of travel or roadway being crossed	X	X		X	X		
Right-turn-on-red restricted/allowed			X			X	
Signal timing (e.g., leading pedestrian interval, pedestrian clearance time, pedestrian and bicycle delay)						X	
Presence/type of traffic control (e.g., traffic signal, stop sign)					X		
Presence of crosswalk warning signs or beacons (e.g., in-street crossing signs, rectangular rapid flashing beacons, pedestrian hybrid beacon)		X				X	
Number of general-purpose (through) lanes in the parallel direction of travel or being crossed	X		X	X	X		
Number of designated right-turn lanes in the parallel direction of travel or roadway being crossed							See Schneider et al. (2010)
Total crossing distance		X					
Curb radius (for right-turn vehicles)							See AASHTO Pedestrian Guide (2004) and FHWA PedSAFE (2013)
Presence of median or crossing island				X		X	
Presence and utilization of on-street parking	X						

Table C-1. (Continued).

Variable	Pedestrian Level of Service (LOS) (Segment)	Pedestrian Level of Service (LOS) (Uncontrolled Crossing)	Pedestrian Level of Service (LOS) (Signalized Intersection)	FHWA Crosswalk Guidelines	Pedestrian Intersection Safety Index (ISI)	Pedestrian Crash Modification Factors	Notes
Presence and width of bicycle lanes	X						
Presence and width of the paved outside shoulder	X						
Frequency of driveway crossings							See Schneider (2011)
Presence and width of buffer between sidewalk and motorized traffic	X						
Presence and width of sidewalk	X						
Presence of traffic calming measures							See Zein, et al. (1997), AASHTO Pedestrian Design Guide (2004), and FHWA PEDSAFE (2013)
Sidewalk condition							See AASHTO Pedestrian Design Guide (2004) and FHWA PEDSAFE (2013)
Source	Multimodal Level of Service for Urban Streets (Dowling et al., 2008, p. 88)	Multimodal Level of Service for Urban Streets (Dowling et al., 2008, p. 88-91)	Multimodal Level of Service for Urban Streets (Dowling et al., 2008, p. 88)	Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations, Final Report and Recommended Guidelines (Zegeer et al., 2005, p. 54)	Pedestrian and Bicyclist Intersection Safety Indices, Final Report (Carter et al., 2006, p. 38)	Crash Modification Factor Clearinghouse (FHWA, 2014, http://www.cmfclearinghouse.org/)	

Table C-2. Variables used in bicycle suitability analysis tools.

Variable	Bicycle Level of Service (LOS) (Segment)	Bicycle Level of Traffic Stress (LTS)	Bicycle Compatibility Index (BCI)	Bicycle Level of Service (LOS) (Signalized Intersection)	Bicycle Level of Traffic Stress (LTS)	Bicycle Intersection Safety Index (ISI)	Bicycle Crash Modification Factors	Notes
Traffic speed in the parallel direction of travel or roadway being crossed	X	X	X		X			
Traffic volume and composition (proportion heavy vehicles) in the parallel direction of travel or roadway being crossed	X		X			X		
Right-turning traffic volume			X					
Right-turn-on-red restricted/allowed								See *NACTO Urban Bikeway Design Guide* (2012)
Presence/type of traffic control (e.g., traffic signal, stop sign)						X		
Presence of crosswalk warning signs or beacons (e.g., in-street crossing signs, rectangular rapid flashing beacons, pedestrian hybrid beacon)						X		
Number of general-purpose (through) lanes in the parallel direction of travel or being crossed	X	X			X	X	X	
Number of designated right-turn lanes in the parallel direction of travel						X	X	
Total crossing distance				X				
Curb radius (for right-turn vehicles)					X			
Presence of median or crossing island					X		X	
Presence and utilization of on-street parking	X		X					
Presence and width of bicycle lanes	X	X	X				X	
Presence and width of the paved outside shoulder	X	X						
Degree of separation/buffer width between bicycle and motorized traffic							X	Also see Dill and McNeil (2012) and Lusk et al. (2013)
Frequency of driveway crossings	X						X	
Presence of traffic calming measures								See Zein, et al. (1997), AASHTO Pedestrian Design Guide (2004), and FHWA BIKESAFE (2014)
Width of the outside through lane	X		X					
Pavement condition	X							
Source	Multimodal Level of Service for Urban Streets (Dowling et al., 2008, p. 83)	Low-Stress Bicycling and Network Connectivity (Mekuria et al., 2012, Tables 2 to 6)	Bicycle Compatibility Index, Implementation Manual (FHWA, 1999, Table 1)	Multimodal Level of Service for Urban Streets (Dowling et al., 2008, p. 83-84)	Low-Stress Bicycling and Network Connectivity (Mekuria et al., 2012, Tables 5 to 8)	Pedestrian and Bicyclist Intersection Safety Indices, Final Report (FHWA, 2006, p. 34)	Crash Modification Factor Clearinghouse (FHWA, 2014, http://www.cmfclearinghouse.org/)	

Table C-3. Variables used in pedestrian demand model studies.

Variable	Maryland Meso-Scale Model of Pedestrian Demand	Charlotte, NC, Signalized Intersection Pedestrian Volume Model	Alameda County, CA, Intersection Pedestrian Volume Model	San Francisco Intersection Pedestrian Volume Model (1)	Santa Monica, CA, Pedestrian Volume Model	San Diego, CA, Pedestrian Volume Model	Montreal, QC, Signalized Intersection Pedestrian Volume Model	San Francisco Intersection Pedestrian Volume Model (2)	Portland, OR, Pedestrian Index of the Environment	WalkScore®	Notes
Population or housing unit density	X	X	X	X		X	X	X	X		
Employment density	X	X	X	X	X	X		X	X		
Commercial retail property density/proximity/accessibility	X		X		X	X	X	X		X	
Transit station or stop density/proximity/accessibility		X	X	X	X	X	X	X	X		
Density/proximity/accessibility of attractors (grocery stores, restaurants, coffee shops, banks, parks, schools)							X		X	X	
Land use mix		X		X							
Proximity to college/university campus								X			
Bicycle facility density/proximity/accessibility (e.g., multi-use trail, bicycle lane, cycle track, bicycle boulevard)				X		X					
Number of boardings at transit stops						X					
Proportion of residents living in poverty or without access to an automobile	X					X					
Roadway slope				X				X			
Distance from downtown/central business district							X				
Source	A Meso-Scale Model of Pedestrian Demand (Clifton et. al, 2008)	Assessment of Models to Measure Pedestrian Activity at Signalized Intersections (Pulugurtha and Repaka, 2008)	Pilot Model for Estimating Pedestrian Intersection Crossing Volumes (Schneider et al., 2009a)	Pedestrian Volume Modeling: A Case Study of San Francisco (Liu and Griswold, 2009)	GIS Based Bicycle and Pedestrian Demand Forecasting Techniques (Haynes and Andrzejewski, 2010)	Seamless Travel: Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type (Jones et al., 2010)	Modeling of Pedestrian Activity at Signalized Intersections: Land Use, Urban Form, Weather, and Spatiotemporal Patterns (Miranda-Moreno and Fernandes, 2011)	Development and Application of the San Francisco Pedestrian Intersection Volume Model (Schneider et al., 2012)	The Pedestrian Index of the Environment (PIE): Representing the Walking Environment in Planning Applications (Singleton et al., 2014)	www.walkscore.com (Note: The details of the WalkScore calculation methodology are not available publicly. The methodology has been changed in the past and could be changed again. Public users can also update data.)	

Table C-4. Variables used in bicycle demand model studies.

Variable	Cambridge, MA, Space Syntax Bicycle Volume Model	Santa Monica, CA, Bicycle Volume Model	San Diego, CA, Bicycle Volume Model	Alameda County, CA, Bicycle Volume Models	Montreal, QC, Signalized Intersection Bicycle Volume Model	Portland, OR, Bicycle Route Choice Model	San Francisco Bicycle Route Choice Model	Bike Score™	Notes
Population or housing unit density	X								
Employment density	X		X		X				
Commercial retail property density/proximity/accessibility				X				X	
Transit station or stop density/proximity/accessibility		X			X				
Density/proximity/accessibility of attractors (grocery stores, restaurants, coffee shops, banks, parks, schools)								X	
Land use mix		X			X				
Proximity to college/university campus				X					
Bicycle facility density/proximity/accessibility (e.g., multi-use trail, bicycle lane, cycle track, bicycle boulevard)		X	X	X	X	X	X	X	Also significant in Dill and Voros (2007) Portland survey.
Proportion of residents living in poverty or without access to an automobile					X				Also significant in Dill and Carr (2003) bicycle commuting study and Dill and Voros (2007) Portland survey.
Density/proximity/accessibility of number of bike share docking stations									Strauss and Miranda-Moreno (2013) recommend for future research
Roadway slope				X		X	X	X	
Roadway density/connectivity	X			X	X				
Distance from downtown/central business district									Significant in Dill and Voros (2007) Portland survey.
Source	The Applicability of Space Syntax to Bicycle Facility Planning (McCahill and Garrick, 2008)	GIS Based Bicycle and Pedestrian Demand Forecasting Techniques (Haynes and Andrzejewski, 2010)	Seamless Travel: Measuring Bicycle and Pedestrian Activity in San Diego County and its Relationship to Land Use, Transportation, Safety, and Facility Type (Jones et al., 2010)	Pilot Models for Estimating Bicycle Intersection Volumes (Griswold, Medury, and Schneider, 2011)	Spatial Modeling of Bicycle Activity at Signalized Intersections (Strauss and Miranda-Moreno, 2013)	Understanding and Measuring Bicycling Behavior: A Focus on Travel Time and Route Choice (Dill and Gliebe, 2008)	A GPS-based bicycle route choice model for San Francisco, California (Hood, Sall, and Charlton, 2011)	http://www.walkscore.com/bike-score-methodology.shtml (Note: The methodology could be changed in the future. Public users can also update data.)	