

CHAPTER 2.

CURRENT HCM METHODOLOGY

The Highway Capacity Manual (HCM) by the Transportation Research Board (TRB) is used as the industry standard for analyzing traffic of different transportation modes. The HCM uses the concept of level of service (LOS) as a qualitative measure to describe operational conditions of vehicular and pedestrian traffic, “based on service measures such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience.” The section of the HCM dedicated to the level of service analysis of pedestrian flow on sidewalks, crosswalks, and street corners is mainly derived from John Fruin’s research. In this chapter, the HCM’s current pedestrian and vehicular methodologies will be discussed, compared and contrasted. A discussion of the strengths and weaknesses of the pedestrian level of service methodology in the HCM concludes the chapter.

A. Pedestrian LOS

The HCM’s methods for analyzing pedestrian LOS are based on the measurement of pedestrian flow rate and sidewalk space. The pedestrian flow rate, which incorporates pedestrian speed, density, and volume, is equivalent to vehicular flow. According to the HCM:

“As volume and density increase, pedestrian speed declines. As density increases and pedestrian space decreases, the degree of mobility afforded to the individual

pedestrian declines, as does the average speed of the pedestrian stream.”

The analysis of the sidewalk level of service for the midblock uses the calculation of pedestrians per minute per foot (ped/min/ft) as the basis for LOS classification (see Table 2.1.). According to this measurement, on a walkway with LOS A, pedestrians move freely without altering their speed in response to other pedestrians or to a decrease in the sidewalk width. On the other hand, on a walkway with LOS F, all walking speeds are severely restricted and forward progress is made only by “shuffling.” See Figure 2.1. for the HCM’s description for each pedestrian LOS.

The pedestrian unit flow rate (ped/min/ft) is obtained by taking the pedestrian 15-minute flow rate (ped/15-min) and dividing by the effective walkway width. The HCM suggests collecting pedestrian opposing flow volumes at 15-minute intervals. The sum of the two directional flows is used as the 15-minute flow rate. Effective width of the sidewalk is calculated by taking the total width of the sidewalk and subtracting obstacle widths and a 1 to 1.5 ft buffer width per obstacle. Obstacle widths can be measured from the field. The additional buffer width is based on an estimation provided by the HCM. The HCM cites Pushkarev and Zupan (1975) as their source for the method of buffer width calculation; however, no studies the TD has found, including the cited Pushkarev and Zupan volume, describe any method of buffer width calculation. Using the pedestrian

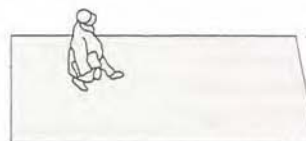
Table 2.1. Average Flow LOS Criteria for Walkways and Sidewalks

LOS	Space (ft ² /p)	Flow Rate (p/min/ft)	Speed (ft/s)	V/C Ratio
A	> 60	≤ 5	> 4.25	≤ 0.21
B	> 40-60	> 5-7	> 4.17-4.25	> 0.21-0.31
C	> 24-40	> 7-10	> 4.00-4.17	> 0.31-0.44
D	> 15-24	> 10-15	> 3.75-4.00	> 0.44-0.65
E	> 8-15	> 15-23	> 2.50-3.75	> 0.65-1.00
F	≤ 8	variable	≤ 2.50	variable

LOS A

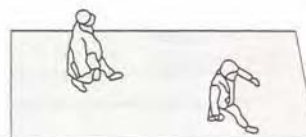
Pedestrian Space > 60 ft²/p, Flow Rate = 5 p/min/ft

At a walkway LOS A, pedestrians move in desired paths without altering their movements in response to other pedestrians. Walking speeds are freely selected, and conflicts between pedestrians are unlikely.

**LOS B**

Pedestrian Space > 40-60 ft²/p, Flow Rate > 5-7 p/min/ft

At LOS B, there is sufficient area for pedestrians to select walking speeds freely to bypass other pedestrians, and to avoid crossing conflicts. At this level, pedestrians begin to be aware of other pedestrians, and to respond to their presence when electing a walking path.

**LOS C**

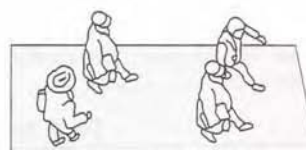
Pedestrian Space > 24-40 ft²/p, Flow Rate > 7-10 p/min/ft

At LOS C, space is sufficient for normal walking speeds, and for bypassing other pedestrians in primarily unidirectional streams. Reverse-direction or crossing movements can cause minor conflicts, and speeds and flow rate are somewhat lower.

**LOS D**

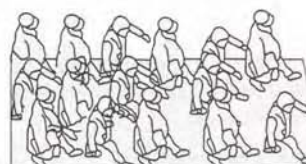
Pedestrian Space > 15-24 ft²/p, Flow Rate > 10-15 p/min/ft

At LOS D, freedom to select individual walking speed and to bypass other pedestrians is restricted. Crossing or reverse-flow movements face a high probability of conflict, requiring frequent changes in speed and position. The LOS provides reasonably fluid flow, but friction and interaction between pedestrians is likely.

**LOS E**

Pedestrian Space > 8-15 ft²/p, Flow Rate > 15-23 p/min/ft

At LOS E, virtually all pedestrians restrict their normal walking speed, frequently adjusting their gait. At the lower range, forward movement is possible only by shuffling. Space is not sufficient for passing slower pedestrians. Cross- or reverse-flow movements are possible only with extreme difficulties. Design volumes approach the limit of walkway capacity, with stoppages and interruptions to flow.

**LOS F**

Pedestrian Space = 8 ft²/p, Flow Rate varies p/min/ft

At LOS F, all walking speeds are severely restricted, and forward progress is made only by shuffling. There is frequent unavoidable contact with other pedestrians. Cross- and reverse-flow movements are virtually impossible. Flow is sporadic and unstable. Space is more characteristic of queued pedestrians than of moving pedestrian streams.

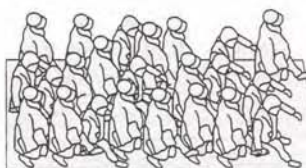


Figure 2.1. Pedestrian LOS according to HCM

unit flow rate in the “Average Flow LOS Criteria for Walkways and Sidewalks” (see Table 2.1), pedestrian LOS can be calculated. In addition to LOS grades A to F, space (ft²/p), speed (ft/s), and the volume-to-capacity (v/c) ratio can also be derived from the table. Capacity is “the maximum number of persons that can be accommodated along a given point of a sidewalk or transit corridor, or that can be accommodated within a crosswalk, intersection, corner reservoir, transit vehicle or turnstile” (CEQR). The volume-to-capacity ratio is “the ratio of flow rate to capacity for a transportation facility” (HCM).

Pedestrians often travel together as a group, voluntarily or involuntarily, due to signal control, geometrics, or other factors. This phenomenon is called platooning and it occurs, for example, when a large number of bus or subway riders exit onto the sidewalk. To account for the impact of platooning on pedestrian travel behavior, the HCM introduces the “Platoon-Adjusted LOS Criteria for Walkways and Sidewalks,” a table which can be used to obtain the platoon LOS. Using research done by Pushkarev and Zupan in *Urban Space for Pedestrians*, impeded flow in the HCM platoon LOS starts at 530 ft²/p, 0.5 ped/min/ft (LOS A); while “jammed flow” begins at 11 ft²/p, 18ped/min/ft (LOS F) (see Table 2.2.). The HCM states that the LOS which occurs in platoons is generally one level poorer than that determined by average flow criteria.

Table 2.2. Platoon-Adjusted LOS Criteria for Walkways and Sidewalks

LOS	Space (ft ² /p)	Flow Rate (p/min/ft)
A	> 530	≤ 0.5
B	> 90-530	> 0.5-3
C	> 40-90	> 3-6
D	> 23-40	> 6-11
E	> 11-23	> 11-18
F	≤ 11	> 18

B. Vehicular LOS

Similarly to the pedestrian HCM LOS analysis, vehicular LOS analysis is based on a scale from A through F, with A representing the best and F representing the worst traveling conditions. There are three street categories in the vehicular LOS analysis: urban streets, freeways, and highways. Within the urban street analysis, there are sub-analyses for arterial, signalized and unsignalized intersections. The main criterion for evaluating the LOS of arterial streets is travel speed (Table 2.3). The criterion for determining LOS at signalized and unsignalized intersections is control delay per vehicle, in seconds per vehicle (Tables 2.4. and 2.5). Delay is the “additional travel time experienced by a driver, passenger or pedestrian” (HCM). Control delay is defined by “initial deceleration delay, queue move-up, stopped delay, and final acceleration delay” (HCM). Signals are often put in place to handle high traffic flow at intersections. Combining higher volumes with drivers’ perceptions and reaction times to traffic signals, signalized intersections often have higher delays than unsignalized intersections. A roundabout is defined by the Federal Highway Administration as “a one-way, circular intersection without traffic signal equipment in which traffic flows around a center island”. Roundabout analysis in the HCM is based on gap acceptance - or “the process by which a minor-street vehicle accepts an available gap to maneuver” (HCM) – and it is evaluated in terms of capacity and v/c ratio. For vehicular traffic, capacity is defined as “the maximum numbers of vehicles that can pass a point on a street or highway during a specified time period, usually expressed as vehicles per hour” (CEQR). No formal LOS has been established for roundabouts by the HCM.

The two-lane highway LOS analysis is separated into Class I and Class II categories. The HCM explains that, on Class I highways, “efficient mobility is paramount, and LOS is defined in terms of both percent time-spent-following and average travel speed.” (see Table 2.6.). On Class II highways, however, “mobility is less critical and LOS is defined only in terms of per time-spent-following, without consideration of average travel speed” (see Table 2.7.). According to

Table 2.3. Urban Street LOS by Class

Urban Street Class	I	II	III	IV
Range of free-flow speeds (FFS)	50-45 mi/h	45-35 mi/h	35-30 mi/h	35-25 mi/h
Typical FFS	50 mi/h	40 mi/h	35 mi/h	30 mi/h
LOS	Average Travel Speed (mi/h)			
A	> 42	> 35	> 30	> 25
B	> 34-42	> 28-35	> 24-30	> 19-25
C	> 27-34	> 22-28	> 18-24	> 13-19
D	> 21-27	> 17-22	> 14-18	> 9-13
E	> 16-21	> 13-17	> 10-14	> 7-9
F	≤ 16	≤ 13	≤ 10	≤ 7

Table 2.4. LOS Criteria for Signalized Intersections

LOS	Control Delay per Vehicle (s/veh)
A	≤ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 80

Table 2.6. LOS Criteria for Two-Lane Highways in Class I

LOS	Percent Time-Spent-Following	Average Travel Speed (mi/h)
A	≤ 35	> 55
B	> 35-50	> 50-55
C	> 50-65	> 45-50
D	> 65-80	> 40-45
E	> 80	≤ 40

the HCM, drivers usually have a higher tolerance for delay on Class II highways because Class II highways tend to serve shorter trips.

The HCM's Multilane Highway analysis focuses on uninterrupted highway flow segments. The characteristics of a multilane highway include a 12-foot minimum lane width, a 12-foot minimum total

Table 2.5. LOS Criteria for Two-Way (TWSC) and All-Way Stop-Controlled (AWSC) Intersections

LOS	Control Delay per Vehicle (s/veh)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Table 2.7. LOS Criteria for Two-Lane Highways in Class II

LOS	Percent Time-Spent-Following
A	≤ 40
B	> 40-55
C	>55-70
D	> 70-85
E	> 85

lateral clearance, facilities for passenger cars only, the absence of direct access points, a divided highway, and free-flow speeds higher than 60 mi/hr. The LOS criteria for multilane highways are based on “typical speed-flow” and “density-flow relationships” (see Table 2.8.). Since LOS F indicates that the flow rate exceeds capacity, it is not listed in the table.

Table 2.8. LOS Criteria for Multilane Highways

Free Flow Speed	Criteria	A	B	C	D	E
60 mi/h	Maximum density (pc/mi/l)	11	18	26	35	40
	Average speed (mi/h)	60.0	60.0	59.4	56.7	55.0
	Maximum v/c	0.30	0.49	0.70	0.90	1.00
	Maximum service flow rate (pc/h/ln)	660	1,080	1,550	1,980	2,200
55 mi/h	Maximum density (pc/mi/l)	11	18	26	35	41
	Average speed (mi/h)	55.0	55.0	54.9	52.9	51.2
	Maximum v/c	0.29	0.47	0.68	0.88	1.00
	Maximum service flow rate (pc/h/ln)	600	990	1,430	1,850	2,100
50 mi/h	Maximum density (pc/mi/l)	11	18	26	35	43
	Average speed (mi/h)	50.0	50.0	50.0	48.9	47.5
	Maximum v/c	0.28	0.45	0.65	0.86	1.00
	Maximum service flow rate (pc/h/ln)	550	900	1,330	1,710	2,000
45 mi/h	Maximum density (pc/mi/l)	11.0	18.0	26.0	35.0	45.0
	Average speed (mi/h)	45	45	45	44.4	42.2
	Maximum v/c	0.26	0.43	0.62	0.82	1.00
	Maximum service flow rate (pc/h/ln)	490	810	1,170	1,550	1,900

The HCM LOS analysis methodology for freeway facilities is separated into three categories: basic freeway segments, ramp segments, and weaving segments. The HCM assumes that the performance of each of the freeway components does not affect the performance of the others. The freeway segment methodology treats each segment in terms of an individual scenario, with no impact on adjacent segments. Therefore, there is no one general LOS designation for freeway facilities; instead there are basic freeway, ramp, and weaving LOS ratings. Basic freeway LOS analysis is defined by density (vehicle per mile per lane), speed, and the volume to capacity ratio for passenger cars (see Table 2.9.). In the weaving analysis, LOS is defined by the weaving segment density (vehicle per mile per lane) (Table 2.10.). In the ramp segments analysis, the HCM focuses on the merging and diverging areas of ramps to freeways. LOS is denoted from A to E only, as LOS F represents a demand over capacity conditions (see Table 2.11.).

C. Pedestrian LOS and Vehicular LOS Comparison

The HCM's pedestrian LOS analysis criteria are based on space, average speed, flow rate, and the ratio of volume to capacity. There are some similarities in the pedestrian analysis to the determination of vehicular LOS. For example, pedestrian space (ft²/ped) is equivalent to vehicular density on multi-lane highway and freeway facilities, including basic freeway, ramp, and weaving segments. Pedestrian average speed (ft/min) is equivalent to vehicular average travel speed (mi/hr) for urban streets, Class I two-lane and multilane highways, and basic freeways. The pedestrian flow rate (ped/min/ft) is equivalent to vehicular flow rate (passenger car/hr/lane) on multilane highways and basic freeways. In addition, the pedestrian's volume to capacity ratio is the equivalent of the volume to capacity ratio on multilane highways and basic freeway segments.

In contrast to pedestrian LOS calculations, vehicular LOS analysis includes a "control delay per vehicle" component in the analysis of signalized and unsignalized intersections. Control delay is the travel

Table 2.9. LOS Criteria for Basic Freeway Sections

Level of Service	Maximum Density (pc/mi/ln)	Maximum Speed (mph)	Max Service Flow Rate (PCPHPL)	Maximum v/c ratio
Free-flow Speed = 70 mph				
A	10.0	70.0	700	0.318/0.304
B	16.0	70.0	1,120	0.509/0.487
C	24.0	68.5	1,644	0.747/0.715
D	32.0	63.0	2,015	0.916/0.876
E	36.7/39.7	60.0/58.0	2,200/2,300	1.000
F	var	var	var	Var
Free-flow Speed = 65 mph				
A	10.0	65.0	650	0.295/0.283
B	16.0	65.0	1,040	0.473/0.452
C	24.0	64.5	1,548	0.704/0.673
D	32.0	61.0	1,952	0.887/0.849
E	39.3/43.4	56.0/53.0	2,200/2,300	1.000
F	var	var	var	var
Free-flow Speed = 60 mph				
A	10.0	60.0	600	0.272/0.261
B	16.0	60.0	960	0.436/0.417
C	24.0	60.0	1,440	0.655/0.626
D	32.0	57.0	1,824	0.829/0.793
E	41.5/46.0	53.0/50.0	2,200/2,300	1.000
F	var	var	var	var
Free-flow Speed = 55 mph				
A	10.0	55.0	550	0.250/0.239
B	16.0	55.0	880	0.400/0.383
C	24.0	55.0	1,320	0.600/0.574
D	32.0	54.8	1,760	0.800/0.765
E	44.0/47.9	50.0/48.0	2,200/2,300	1.000
F	var	var	var	var

Table 2.10. LOS Criteria for Weaving Segments

LOS	Density (pc/mi/ln)	
	Freeway Weaving Segment	Multilane and Collector-Distributor Weaving Segments
A	≤ 10.0	≤ 12.0
B	> 10.0-20.0	>12.0-24.0
C	> 20.0-28.0	>24.0-32.0
D	> 29.0-35.0	>32.0-36.0
E	> 35.0-43.0	>36.0-40.0
F	> 43.0	> 40.0

Table 2.11. LOS Criteria for Merge and Diverge Areas

LOS	Density (pc/mi/ln)
A	≤ 10
B	> 10-20
C	> 20-28
D	> 28-35
E	> 35
F	Demand exceeds capacity

time vehicles waste due to signal timing, queuing and stop and start time; it is the travel time that one would incur on stop controlled street facilities in excess of the time it would take to traverse the same distance with no control devices. In addition, the pedestrian LOS analysis lacks percent time-spent-following criteria, a measurement found in analyses of Class I and Class 2 two-lane highways. Percent time-spent-following is defined by the HCM as "...the average percentage of travel time that vehicles must travel in platoons behind slower vehicles due to the inability to pass."

D. Pedestrian HCM LOS Strengths and Weaknesses

The HCM pedestrian LOS methodology's foremost advantage is its simplicity. It is relatively easy to collect data and calculate the pedestrian LOS for a location. For the midblock pedestrian LOS, the only data necessary is a pedestrian count, the effective width of the sidewalk, and an indication whether or not platooning was occurring.

Second, the pedestrian LOS methodology attempts to create a universal standard in pedestrian analysis regardless of the size of the city, the type of pedestrians, or various environmental factors. This allows planners to easily compare the LOS derived across locations and time.

Third, although the standard LOS calculation is fixed, the HCM's pedestrian LOS methodology allows for local flexibility based on actual conditions. For example, the HCM encourages planners to consider their own LOS methodologies in areas with significant elderly populations or with a dominant trip purpose.

Finally, the pedestrian LOS methodology is not static—it evolves as researchers discover new relationships between factors or as they discover new ways to collect and model data. In fact, the TRB made significant changes to the pedestrian LOS chapters as recently as 2000.

However, the pedestrian LOS methodology does have shortcomings. Pedestrian flow rate is used to assign LOS in the HCM. For example, from the sum of two directional counts, a count of 800 pedestrians on a 12-foot effective sidewalk width yields a flow rate of 4.44 ped/ft/min. Looking up the flow rate on the "Average Flow LOS Criteria for Walkways and Sidewalks" tables (Tables 2.1. and 2.2.), an LOS of A and C for normal and platoon conditions are identified respectively. From the tables, one can also get the values of speed, space, and the V/C ratio based on the flow rates from previous research. Using the HCM methodology, the flow rate calculation does not account for possible bi-directional or multi-directional effects. Flow rate is calculated using the sum of the two directional counts. Therefore, friction introduced by the opposing pedestrian flow is not accounted for.

The HCM methodology also generalizes the makeup of the study population without much consideration for individual pedestrian characteristics. For example, pedestrians' gender, age, and trip purpose could have significant impact on their speed and comfort level on different sidewalk segments. Different times of a day, surrounding land uses, and weather could also affect the sidewalk LOS.

The sidewalk effective width is calculated in the HCM's methodology by taking the total width and subtracting sidewalk obstacle widths and a "shy distance", which is the buffer distance that pedestrians typically walk from obstacles. The shy distance is estimated in the HCM to be 1 to 1.5 feet. No detailed studies the TD has come across, including the Pushkarev and Zupan (1975) book which the HCM cited as the source of the shy distance measurement, have described how to calculate a shy distance. It would seem that the shy distance of pedestrians on an individual sidewalk could be affected by the number of pedestrians on the sidewalk, the time of day, and by the surrounding land use. It is important to find out what the real effective width is for each sidewalk if flow rate is to be used as the determining factor for LOS; this would involve developing a repeatable methodology for calculating a sidewalk's shy distance.

The HCM's pedestrian LOS methodology appears to be too insensitive to changes in pedestrian volume and sidewalk width. For example, a case study was done by the Department of City Planning, Transportation Division to examine whether the reduction of sidewalk space by sidewalk café's would induce a significant impact on the pedestrian LOS. A series of tests were done using the HCM's LOS methodology.

The tests revealed that the number of pedestrians that would need to be added to a sidewalk to degrade the sidewalk's LOS was insensitive (see Table 2.12.). For example, on a sidewalk with twelve-foot effective width, with 1,300 pedestrians in a fifteen-minute period, the LOS was C; it would take an additional 600 pedestrians for the LOS to change to D. This translates into an hourly volume of 7,600 pedestrians

Table 2.12. Sidewalk Width, Pedestrian Volume and Level of Service

The following chart shows the pedestrian level of service for sidewalks with varying clear paths.

- The top portion of the chart shows café width alternatives for various sidewalk widths. (Café widths that would be unavailable under current zoning restrictions are italicized.)

- The bottom portion of the chart shows the clear path for adjacent sidewalks along the top. On the vertical axis, possible pedestrian volumes are shown. The center of the chart shows the pedestrian Level of Service (LOS), based on those two inputs.

Café Widths		Sidewalk Width (ft)							
8' Sidewalk Café	12		15		18		20		
7' Sidewalk Café		12		15		18			
6' Sidewalk Café			12		15		18		
5' Sidewalk Café				12		15			
4' Sidewalk Café					12		15		
		Clear Path*							
15 Min Peak Flow Rate (ped/15 min)	4	5	6	7	8	9	10	11	12
200	A	A	A	A	A	A	A	A	A
300	B	A	A	A	A	A	A	A	A
400	B	B	A	A	A	A	A	A	A
500	C	B	B	A	A	A	A	A	A
600	C	C	B	B	B	A	A	A	A
700	D	C	C	B	B	B	A	A	A
800	D	D	C	C	B	B	B	A	A
900	D	D	C	C	C	B	B	B	B
1000	E	D	D	C	C	C	B	B	B
1100	E	D	D	D	C	C	C	B	B
1200	E	E	D	D	C	C	C	C	B
1300	E	E	D	D	D	C	C	C	C
1400	F	E	E	D	D	D	C	C	C
1500	F	E	E	D	D	D	C	C	C
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1700	F	E	E	E	D	D	D	D	C
1800	F	F	E	E	D	D	D	D	C
1900	F	F	E	E	E	D	D	D	D
2000	F	F	E	E	E	D	D	D	D
2100	F	F	F	E	E	E	D	D	D

* For the purposes of this chart, Clear Path is defined as the perpendicular distance from the edge of the sidewalk café to the curb. LOS is typically calculated using the effective sidewalk width, which deducts sidewalk width for street furniture and other obstructions. However, the LOS figures shown on this chart are calculated with the clear path and are intended for illustrative purposes.

NYC Department of City Planning, Transportation Division, 25 June 2002

on a 12-foot wide sidewalk in order to have a LOS D. During odata collection, the highest pedestrian traffic during the AM peak was on the north sidewalk (12.4 feet wide) of Wall Street between William and Hanover, the volume was just over 3,000 pedestrians per hour. During the midday peak, on the east sidewalk (11.5 feet wide) of Broadway between Wall and Pine Street, there were 4,200 pedestrians hourly. Therefore, it seems almost impossible for a sidewalk to get an LOS D.

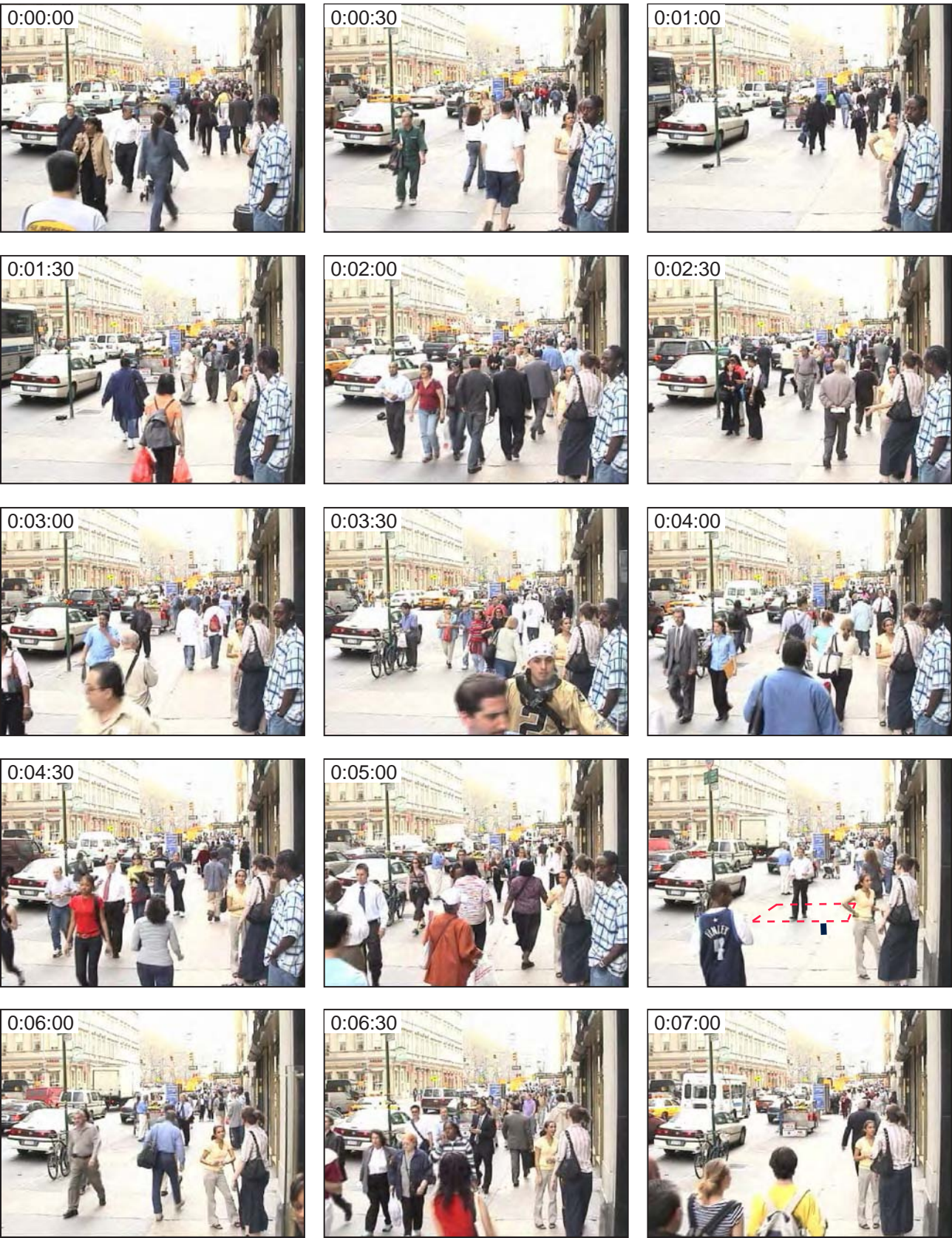
In order to help conceptualize the HCM's measurement of LOS, two series of thirty still images from a 15-minute video of a sidewalk's pedestrian traffic were captured in Lower Manhattan. These images were part of the data collection effort for this project (see Chapters 4 and 5 for further explanation of the methodology and the data analysis). One frame was exported from the 15-minute video clip every thirty seconds. In Figure 2.2, these frames are shown in sequence by time from left to right and top to bottom.

The first location, chosen to illustrate a LOS A and platoon LOS C, is this project's control location, the west sidewalk of Broadway between Duane Street and Reade Street (see Figure 2.2.). The control location is where the TD goes back repeatedly to collect data to study for daily, monthly, or seasonal variation. The fifteen-minute video for this location was filmed on April 19, 2004, at 3:15 pm. A total of 562 pedestrians were counted on the sidewalk during this fifteen-minute period. The total sidewalk width is 16.2 ft and the effective width is 14.2 ft, based on the HCM's effective width calculation methodology. According to the HCM, this section has an LOS A for overall conditions, and an LOS C for platoon conditions. A square with an approximate area of 60 ft² was drawn in frame 0:05:30. Using this square space, it is possible to compare a real life street condition in a 60 ft² space to the HCM's illustration in Figure 2.1., and consider what LOS ratings means in terms of space. 60 ft²/pedestrian is the minimum space that has to be available for each pedestrian for a sidewalk to achieve LOS A. However, based on the observation of the image sequence, pedestrians seem to have less than 60 ft² of available space on average. Using the

platoon condition LOS C (24-40 ft²/pedestrian) to describe the location maybe closer to reality.

The second location is the south sidewalk of John Street between Cliff Street and Pearl Street (see Figure 2.3.). The video at this location was filmed on April 20, 2004, at 1:20 pm. A total of 471 pedestrians were counted on the sidewalk during the fifteen minute filming time. The total sidewalk width is 12 ft, and the HCM-calculated effective width is 5 ft. According to the HCM, this section has LOS B for overall conditions and LOS D for platoon conditions. Frame 0:08:00 shows the 60 ft² area. As in the previous location, the images show a sidewalk that, on average, seems more congested than a sidewalk should if it corresponded to the HCM's criteria and diagrams of LOS B. The platoon condition of LOS D (15-24 ft²/pedestrian) may be better in describing this sidewalk's crowdedness.

Figure 2.2. Pedestrian LOS at Control Location on a Weekday, 3:15 p.m.



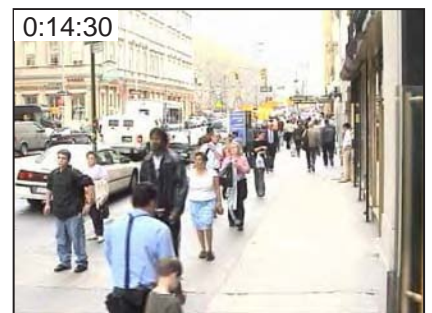
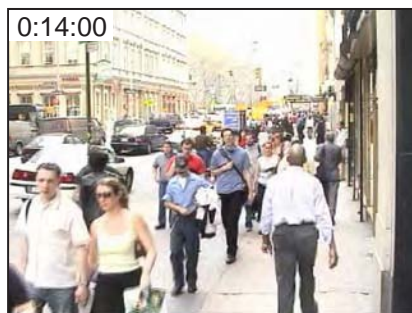
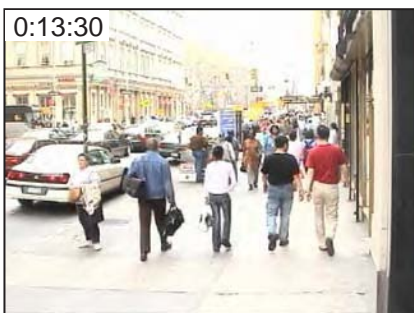
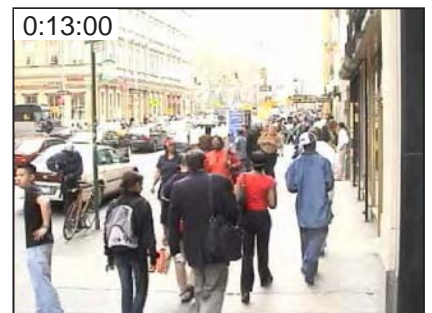
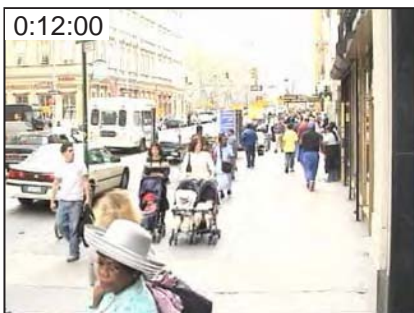
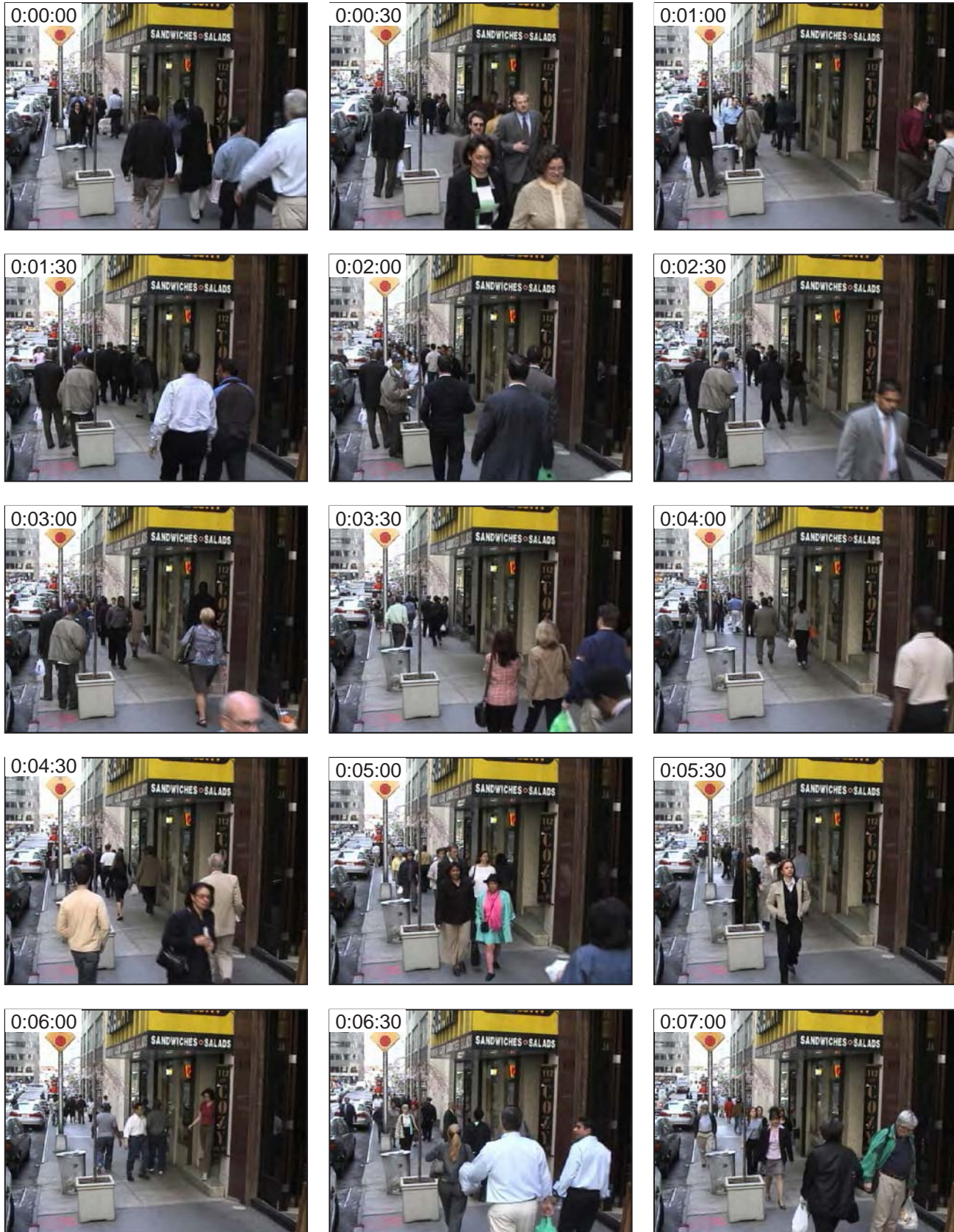
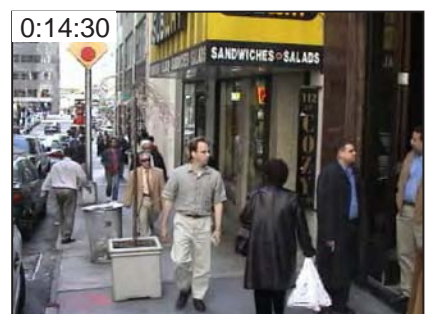
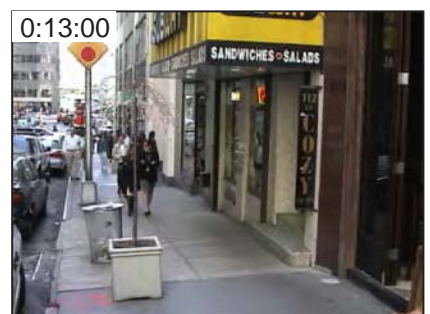


Figure 2.3. Pedestrian LOS at John St. between Cliff St. and Pearl St. on a Weekday, 1:20 p.m.





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