

TECHNICAL MEMORANDUM

To: GW Square 103 Team

From: Robert B. Schiesel, P.E.
Dan B. VanPelt, P.E., PTOE

Date: February 22, 2011

Subject: Review of GW Square 103 Access Alternatives

Summary

This memorandum is in response to issues raised during the Zoning Commission's hearing on February 3, 2011 on Z.C. Case No. 06-11A/12A, GW - 2nd Stage PUD & PUD modification & Further Processing of Campus Plan @ Square 103. The purpose of this memorandum is to address concerns regarding the proposed vehicular access scheme of the first phase of development on Square 103.

The applicant, George Washington University (GW) proposed using the existing alley in Square 103, widened to 20 feet, for two-way vehicular access to the site. The proposed scheme is consistent with District Department of Transportation (DDOT) policy and was discussed with DDOT during the preparation of the site plans. DDOT endorsed this access plan in its report to the Commission.

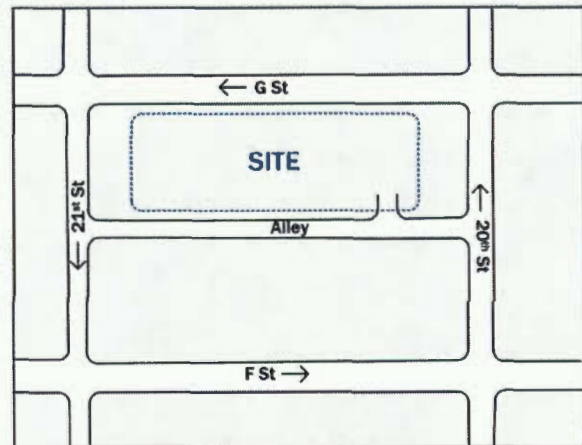
At the close of the hearing and in response to concerns raised by some neighbors, the Commission asked GW to determine whether alternative access schemes would create less impact on pedestrians. The Zoning Commission requested the applicant review two alternatives to the proposed scheme: (1) accessing the proposed parking garage through a curb cut on G Street, and (2) converting the alley to one-way traffic eastbound.

This memo compares the three access schemes by reviewing vehicular and pedestrian volumes, capacity analysis results, and pedestrian/vehicular conflicts. It concludes that the original proposed two-way alley concept is still the preferred concept. Although there are potential pedestrian/vehicular conflicts at the alley intersection with 21st Street, the other alternatives create longer vehicular trips around the Square 103 block that will add more pedestrian/vehicular conflicts at other locations. The results of a conflict analysis show that the G Street alternative generates significantly greater potential for pedestrian/vehicular conflict when compared to the original design. Furthermore, these pedestrian/vehicular conflicts will occur at traffic signals, which are generally considered more severe than those at curb cuts, due to the higher speeds of vehicles passing through signalized intersections. Therefore, this analysis concludes that the preferred two-way alley access, with the ability of drivers to use the alley to access either 20th or 21st Street, has fewer potential conflicts between vehicles and pedestrians over the roadway network.

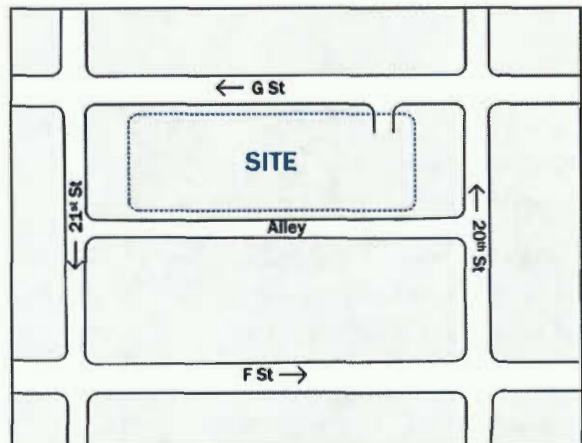
Background

The three alternatives for site access reviewed in this memorandum are:

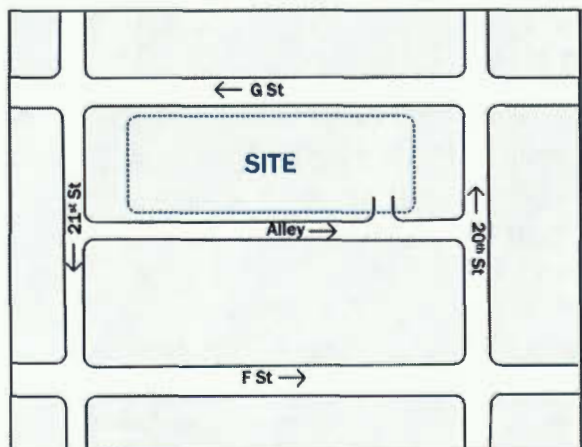
- (1) The original proposal uses the public alley on Square 103. The alley would be widened from 16' to 20' to allow for better flow of two-way traffic. Both the parking garage and the temporary surface parking would be accessed from the alley. This alternative follows DDOT policy on site access.
- (2) A suggested alternative that switches garage access to a curb cut from G Street. The temporary parking spaces would continue to be accessed from the alley.
- (3) A suggested alternative that switches the alley from two-way to one-way traffic eastbound from 21st Street to 20th Street. The alley may not need to be widened in this scenario.



1. Original Proposal: Two-Way Alley Access



2. Suggested alternative: Use G Street to access garage



3. Suggested alternative: Make alley one-way eastbound

Capacity Analysis

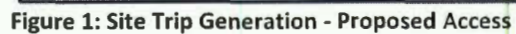
The first component of the analysis is a comparison of the alternatives to the original design to determine impact on the vehicular capacity analyses considered in the original Transportation Impact Study for the Second Stage Application (Exhibit H of the application package dated August 17, 2010).

The Level-of-Service (LOS) results for the original two-way alley configuration are contained on page 21 of the Impact Study. The results show no unacceptable LOS grades for the study intersections. One turning movement, the left turn from the alley onto 21st Street, shows an unacceptable grade of F during the PM peak hour. (Note that this turning movement will operate at an unacceptable grade of E during the PM peak hour under background future conditions even without the proposed project.)

These results were recalculated for the two other alternatives. As part of these calculations, the trips generated by the site were re-distributed for the two new alternatives. Figures 1 through 3 show the resulting site generated trips for each scenario. Tables 1 and 2 compare the LOS and delay calculations.

The results of the capacity analysis comparison show very similar results for the overall LOS grades at the four signalized intersections around the block (F/21st, F/20th, G/21st, G/20th). All four intersections operate at acceptable levels of service both with the original configuration and with the alternatives.

The left turning movement onto 21st Street would continue to operate at a failing level of service under the G Street alternative, though the delay would be reduced. The one-way alley alternative would have no movements with unacceptable levels of delay. Thus, the difference between alternatives to general traffic in the area is minimal. The two new alternatives (access on G Street, and the one-way alley) would decrease the amount of time it would take for users of the proposed garage to turn onto the roadway network when exiting the garage. However, once on the roadway network, drivers would have a longer trip length because of the one-way directionality of the streets surrounding the Square 103 block. While the original two-way alley access scheme it allows drivers to exit directly onto the primary north- and south-bound routes via either 20th Street or 21st Street, the alternatives would require drivers to make additional turns at signalized intersections in order to reach these primary routes.



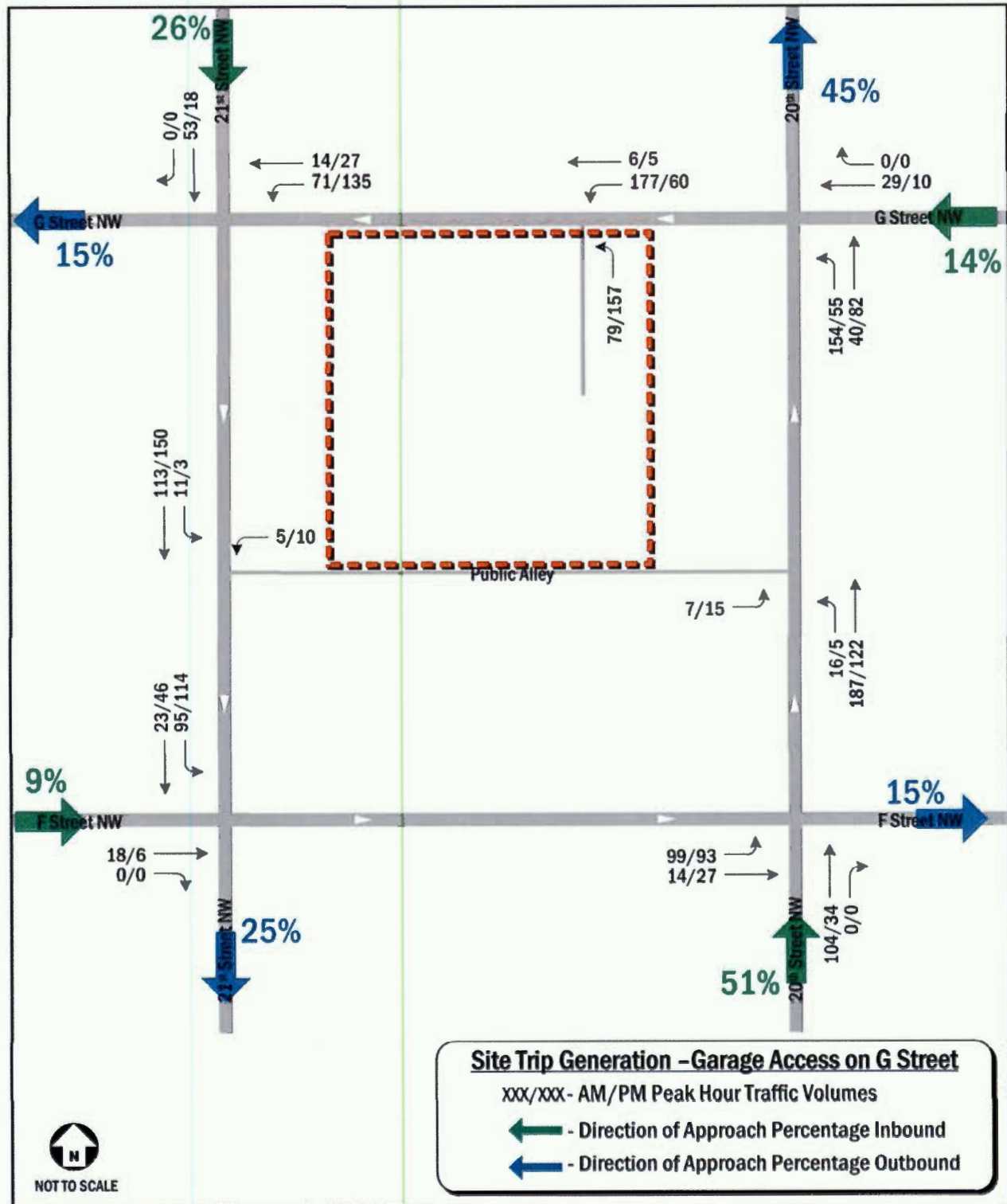


Figure 2: Site Trip Generation - G Street Access

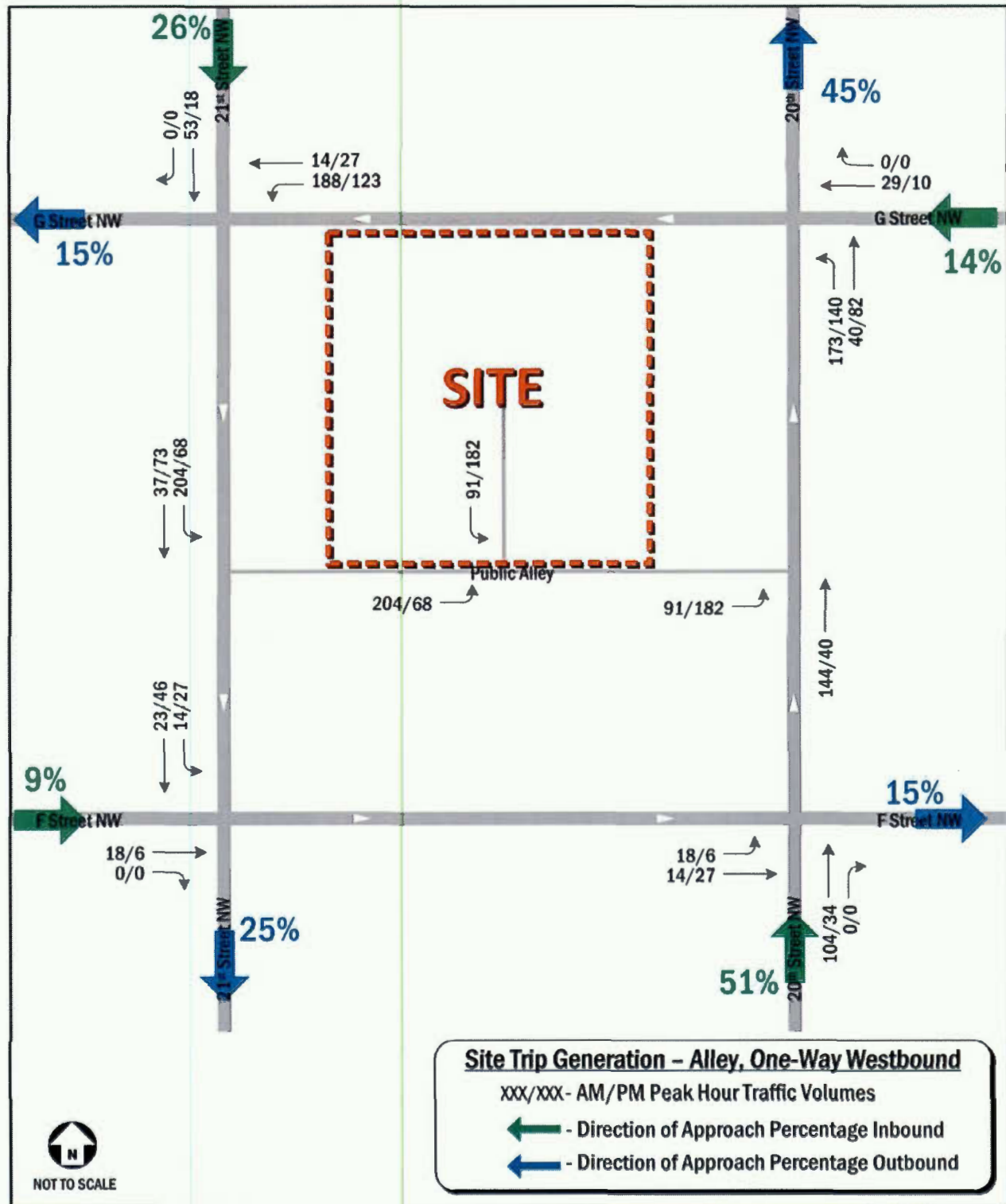


Figure 3: Site Trip Generation - One-Way Alley

Table 1: Capacity Analysis Comparison – AM Peak Hour

Intersection (Approach)	Capacity Analysis Results									
	AM Peak Hour									
	Existing		Background		Total Future - Proposed		Total Future - G St Access		Total Future - One-way Alley	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21st Street & G Street	10.1	B	10.2	B	10.4	B	10.8	B	9.9	A
Westbound	3.9	A	3.9	A	3.5	A	6.5	A	6.0	A
Southbound	12	B	12	B	12.9	B	12.9	B	12.9	B
21st Street & Alley	--	--	--	--	--	--	--	--	--	--
Westbound Left	11.7	B	11.7	B	14.9	B	13.0	B	--	--
Southbound Left	0.2	A	0.2	A	2.2	A	0.3	A	2.2	A
21st Street & F Street	7.8	A	7.8	A	8.3	A	7.5	A	9.4	A
Eastbound	11.9	B	12.0	B	12.2	B	12.2	B	12.2	B
Southbound	4.7	A	4.8	A	5.5	A	4.7	A	7.4	A
20th Street & F Street	11.9	B	12.0	B	12.7	B	13.6	B	12.7	B
Eastbound	25.6	C	25.6	C	27.1	C	29.8	C	27.1	C
Northbound	10.1	B	10.2	B	10.7	B	10.7	B	10.7	B
20th Street & Alley	--	--	--	--	--	--	--	--	--	--
Eastbound Left	9.6	A	9.7	A	10.7	B	9.8	A	10.4	B
Northbound Left	0.1	A	0.1	A	2.8	A	0.1	A	--	--
20th Street & G Street	7.7	A	7.8	A	8.3	A	8.6	A	8.3	A
Westbound	28.2	C	28.3	C	28.6	C	28.6	C	28.6	C
Northbound	5.4	A	5.5	A	5.7	A	6.3	A	5.9	A
Alley & Garage Driveway	--	--	--	--	--	--	--	--	--	--
Eastbound Left	--	--	--	--	7.6	A	--	--	--	--
Southbound	--	--	--	--	10.2	B	--	--	--	--
G St & Garage Driveway	--	--	--	--	--	--	--	--	--	--
Westbound Left	--	--	--	--	--	--	4.8	A	--	--
Northbound Left	--	--	--	--	--	--	14.5	B	--	--

Table 2: Capacity Analysis Comparison – PM Peak Hour

Intersection (Approach)	Capacity Analysis Results									
	AM Peak Hour									
	Existing		Background		Total Future - Proposed		Total Future - G St Access		Total Future - One-way Alley	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
21st Street & G Street	21.3	C	22.4	C	24.3	C	27.2	C	26.1	C
Westbound	21.8	C	22.2	C	24.2	C	31.2	C	28.6	C
Southbound	21	C	22.4	C	24.4	C	24.4	C	24.4	C
21st Street & Alley	--	--	--	--	--	--	--	--	--	--
Westbound Left	33.9	D	35.7	E	112.2	F	66.5	F	--	--
Southbound Left	0.1	A	0.1	A	0.8	A	0.1	A	1.6	A
21st Street & F Street	17.2	B	18.2	B	24.6	C	21.1	C	22.0	C
Eastbound	13.4	B	13.4	B	13.5	B	13.5	B	13.5	B
Southbound	18.2	B	19.4	B	27.2	C	22.7	C	24.0	C
20th Street & F Street	21.1	C	21.3	C	22.0	C	21.9	C	21.9	C
Eastbound	12.3	B	12.4	B	13.2	B	15.8	B	13.2	B
Northbound	23.5	C	23.8	C	24.7	C	24.6	C	24.6	C
20th Street & Alley	--	--	--	--	--	--	--	--	--	--
Eastbound Left	16.8	C	17	C	30.2	D	20.9	C	40.3	E
Northbound Left	0.1	A	0.1	A	1.1	A	0.1	A	--	--
20th Street & G Street	13.2	B	13.3	B	14.5	B	15.2	B	15.0	B
Westbound	19.8	B	20	B	20.1	C	20.1	C	20.1	C
Northbound	6.6	A	6.7	A	9.8	A	11.2	B	11.2	B
Alley & Garage Driveway	--	--	--	--	--	--	--	--	--	--
Eastbound Left	--	--	--	--	7.3	A	--	--	--	--
Southbound	--	--	--	--	9.7	A	--	--	--	--
G St & Garage Driveway	--	--	--	--	--	--	--	--	--	--
Westbound Left	--	--	--	--	--	--	1.2	A	--	--
Northbound Left	--	--	--	--	--	--	18.0	C	--	--

Pedestrian Counts

The next component of the analysis is a comparison of the alternatives to the original design to determine potential impacts to pedestrians in sidewalks surrounding Square 103.

First, the public alley is an existing condition that is used by vehicles and will continue to be used by vehicles independent of the proposed project. Second, the G Street alternative would not replace the alley intersections at the sidewalks; rather, it would add an additional location where vehicles would cross the pedestrian right-of-way. Third, regardless of garage location, the same number of vehicles would cross pedestrians walking on sidewalks surrounding Square 103. Importantly, the original two-way alley scheme would split garage traffic between 20th and 21st Streets, while the alternatives would focus all exiting traffic on either G Street or 20th Street.

In order to compare the relative impact of these crossings, pedestrian counts of 21st, 20th and G Streets were performed on Monday, February 7, 2011 between 6 am and 7pm. The counts were performed only on the sidewalk adjacent to the project. Table 3 shows a summary of the count data.

Table 3: Summary of Pedestrian Count Data

Time Period	Number of Pedestrians per Location		
	21st Street	20th Street	G Street
AM Peak Hour	191	131	84
PM Peak Hour	453	416	130
Hourly Average	347	287	116

The counts show that, among the three streets that border the site, G Street has the least amount of pedestrian activity. Thus, at first glance, the above data appears to suggest that the G Street alternative would result in the fewest number of conflicts at the point where drivers exiting the garage enter the street network, they would encounter the least amount of pedestrians under the alternative that uses G Street. As discussed below, however, the additional movements required for vehicles once on the street network will actually result in greater pedestrian/vehicular conflicts.

Pedestrian/Vehicular Conflicts

Although the pedestrian counts presented in the prior section show a potential difference for conflicts between the alternatives, it only takes into account conflicts at the point where traffic enters the roadway from the garage. Due to the one-way counterclockwise circulation pattern of the streets surrounding Square 103, drivers exiting the garage will have to circulate some or all of the block in order to proceed in their desired direction. The act of circling the block increases the amount of pedestrian/vehicular conflicts, as drivers will pass through more crosswalks at intersections.

Given that the alternatives (1) require all drivers to enter the road network at a single access point and (2) require exiting traffic turn at one or more signalized intersection to reach their primary north-south route, this section reviews the potential pedestrian/vehicle conflicts around the entire Square 103 block for these alternatives and compares them to the originally proposed two-way alley scheme, which permits drivers to choose between two access points at either end of the alley and does not require additional turns to reach their primary north-south route. The potential conflicts reviewed fall into two categories:

- Left turning vehicles at traffic signals crossing crosswalks during a “green ball” traffic light, when the pedestrian has the “walk” sign.
- Left turning vehicles into and out of the alley or garage access curb cut crossing sidewalks adjacent to Square 103 where the pedestrians have the right of way.

The conflicts at the permissive left turn at the traffic signal are generally considered more severe than those at curb cuts, due to the higher speeds of vehicles passing through signalized intersections and the fact that pedestrians have a walk signal indicating it is safe to traverse the crosswalk while, at the same time, vehicles have a green signal permitting a left turn across that crosswalk.

The site trip generation graphics in Figures 1 through 3 illustrate how the three alternatives will create significantly different patterns of turning vehicles on the Square 103 block. Figure 4 depicts the locations of the potential conflicts, and sums the amount of site generated vehicles per alternative that conflict with the pedestrians in their respective sidewalk/crosswalk. Figure 4 indicates that the G Street alternative creates nearly five times as many conflicts at surrounding street intersections, and nearly twice as many overall pedestrian-vehicular conflicts compared to the original two-way alley access scheme. Figure 4 also indicates that the one-way alley alternative creates nearly four times as many conflicts at surrounding street intersections, and approximately 80% more overall pedestrian-vehicular conflicts compared to the original two-way alley access scheme.

The results of the conflict analysis show that while the G Street alternative may have fewer conflicts at the garage curb cut versus the original two-way alley access scheme, it generates significantly greater potential for pedestrian/vehicular conflict when compared to the original design¹. Furthermore, many of these additional potential conflicts occur at street intersections in the surrounding block, which are generally considered more severe than those at curb cuts, due to the higher speed of vehicles passing through signalized intersections. Similarly, the one-way alley alternative generates significantly greater potential for pedestrian/vehicular conflict, particularly at surrounding street intersections. The originally proposed two-way alley access has significantly fewer pedestrian-vehicular conflicts.

¹ It should be noted that changing G Street to a two-way street on the Square 103 block would not be a viable alternative. G and F Streets form a one-way pair. Changing to two-way operation for just a block is impractical, due to geometrical and operational concerns, and such a change would really require converting both corridors to two-way between 17th and Virginia Avenue. This would have significant impacts for several blocks in each direction. Most likely, some streets would require widening or removal of on-street parking to enable such a change.

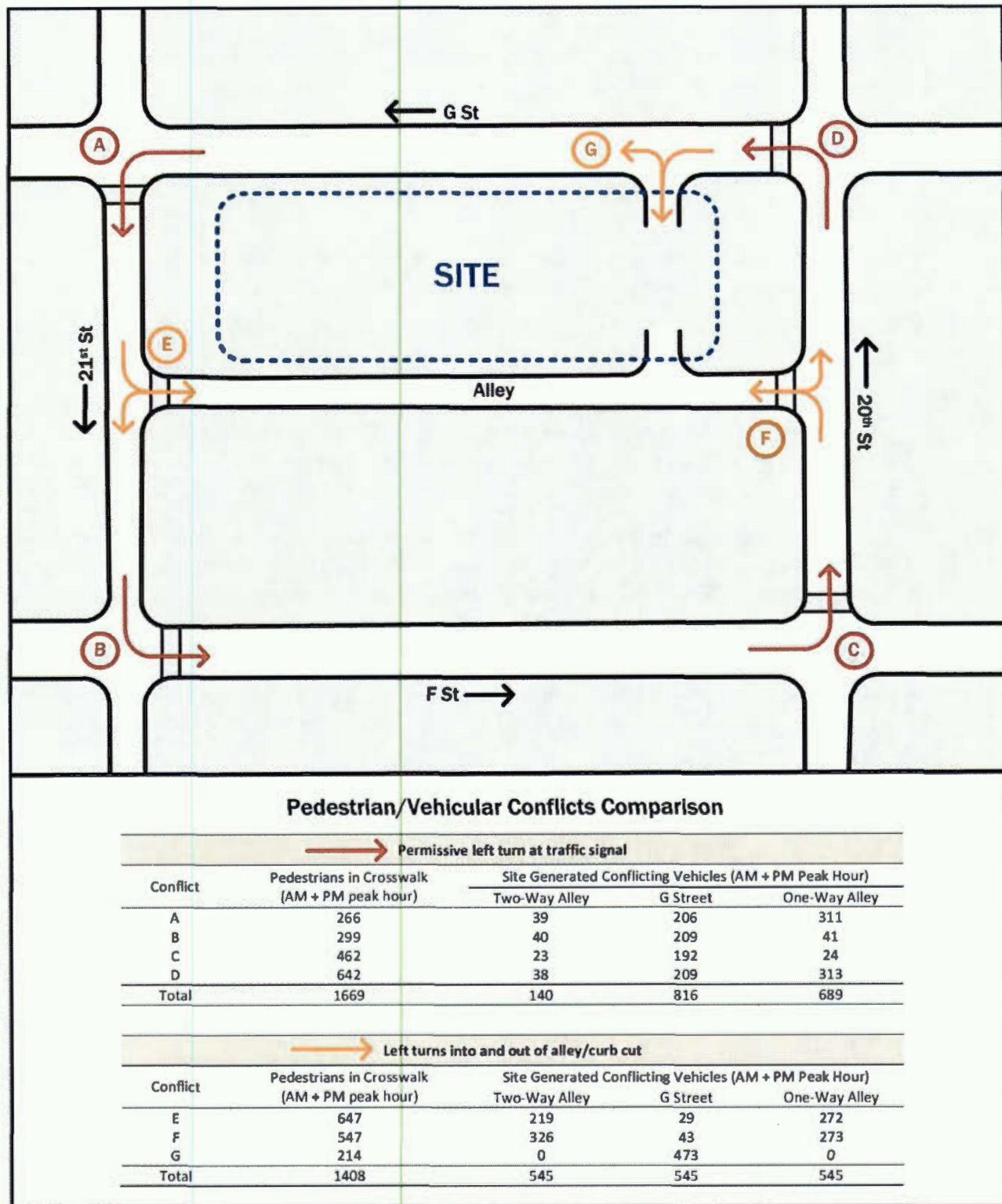


Figure 4: Pedestrian/Vehicular Conflicts Comparison

Conclusions

Based on the technical review of capacity and pedestrian/vehicular conflicts, the original two-way alley access is still recommended over the two suggested alternatives. This conclusion is based on the following:

- The capacity analyses suggest that the alternatives would both decrease the delay experienced by garage users compared to the two-way alley scheme because they would decrease the amount of time it would take for users of the garage to turn onto the roadway network. (This is only for vehicles exiting the garage and had no correlation with delay due to pedestrian traffic).
- Similarly, pedestrian counts also suggest a potential benefit to the G Street alternative, since there are fewer pedestrians per day walking along G Street compared to 21st and 20th Streets.
- However, the one-way directionality of the streets surrounding the Square 103 block significantly impacts these initial observations:
 - The one-way street pattern requires drivers exiting under either alternative to exit from a single point and requires many drivers to make additional turns at the surrounding signalized intersections to reach the primary north-south route. By comparison, the original two-way alley design allows drivers to shorten their trip length because they can chose to exit via either 20th Street or 21st Street.
 - The vehicular circulation pattern resulting from the one-way street grid requires significantly higher amount of left turning conflicts at traffic signals for the alternative options. Furthermore, pedestrian/vehicle conflicts at traffic signals are generally considered more severe than those at curb cuts, due to the higher speeds of vehicles passing through signalized intersections and the fact that pedestrians are in the crosswalk at the same time that vehicles are permitted to turn across the crosswalk.
- Therefore, the original two-way alley configuration continues to be preferred, because it more efficiently directs vehicular traffic to its primary route and results in significantly fewer potential pedestrian-vehicular conflicts in the overall transportation network.