

Determining Function of Pompeian Sidewalk Features through GIS Analysis

Claire Weiss¹

¹San Francisco, CA. USA.

Abstract

Pompeian sidewalks exhibit numerous features and attributes, indicating their indispensable utility in the ancient city. One of these characteristics is the presence of small holes chipped through the street-facing edge of curbstones. These holes exist on almost every sidewalk in the city and are consistently oriented toward the street, but their use has yet to be explained satisfactorily. Suggestions of possibilities are several. One such is that the cuts were created at the stone quarry for lifting or hauling. An alternative is that they may have been tethering points, either for the awnings of shops, or for animals being driven through the city. A more robust method of discerning their function must be employed to resolve this quandary. The function and use of the sidewalks in the highly socially-structured built environment of Pompeii ought to have directly affected the use of these holes, how they were allowed to impact the use of the sidewalks, access to doors, partitioning of space, and economic possibilities of the structures to which they were proximal. In this preliminary study, the sidewalks surrounding seven *insulae* of Pompeii (approximately 10% of sidewalks in the city) were examined in detail. The position of sidewalk holes, curbstones, and thresholds was recorded and used to construct a Geographical Information Systems (GIS) database of their attributes and spatial relationships that was then tested for correlations. Through this method, it was found that, though their individual relationships are complex, sidewalk holes are placed preferentially near doorways along cart-accessible streets that were more directly connected to either city gates or the Forum. This suggests that the use of these holes was for the tethering of animals pulling carts, presumably with the intention of visiting or delivering goods to a house or business.

Keywords: Pompeii, sidewalks, pavements, GIS, roads

1 INTRODUCTION

Pompeii is one of the most intensively studied sites of the ancient world. Few areas of Pompeii have been left untouched by research, which ranges in topic to include temples,¹ houses,² public works,³ defensive walls,⁴

gardens,⁵ epigraphy,⁶ streets,⁷ and wall paintings,⁸ as well as the more overarching themes of urbanism,⁹

¹Walter Moeller, "The Building of Eumachia: A Reconsideration," *American Journal of Archaeology* 76 (1972): 323–27; John Dobbins et al., "Excavations in the Sanctuary of Apollo at Pompeii, 1997," *American Journal of Archaeology* 102 (4) (1998): 739–756.

²Penelope Allison, *The Distribution of Pompeian House Contents and Its Significance*, Ph.D. diss., University of Sydney, 1994; Andrew Wallace-Hadrill, *Houses and Society in Pompeii and Herculaneum*. (Princeton: Princeton University Press, 1994); Michael Anderson, "Houses, GIS and the Micro-topology of Pompeian Domestic Space," in *Proceedings of the 14th Annual Theoretical Roman Archaeology Conference, 26–27 March 2004*, ed. J. Bruhn, B. Croxford, and D. Grigoropoulos (Oxford: Oxbow, 2005) 144–156.

³Hans Eschbach, "Die Entdeckung eines Hauses unter den Stabianer Thermen," *Cronache Pompeiane* 1 (1975): 82–117; John Dobbins, "Problems of Chronology, Decoration and Urban Design in the Forum of Pompeii," *American Journal of Archaeology* 98 (4) (1994): 629–694.

⁴Amedeo Maiuri, "Studi e ricerche sulla fortificazione di Pompeii," *Monumenti Antichi* 23 (1929): 113–290; Stefano De

Caro, "Nuove indagini sulle fortificazioni di Pompeii," *AION* VII (1985): 75–114.

⁵Wilhelmina Jashemski, *The Gardens of Pompeii, Herculaneum and the Villas Destroyed by Vesuvius* (New Rochelle: Caratzas Brothers, 1979).

⁶Helen Tanzer, *The Common People of Pompeii. A Study of the Graffiti* (Baltimore: John Hopkins Press, 1939); Henrik Mouritsen, *Elections, Magistrates and Municipal Élite: Studies in Pompeian Epigraphy* (Rome: L'Erma di Bretschneider, 1988).

⁷Sumiyo Tsujimura, "Ruts in Pompeii: The Traffic System in the Roman City," *Opuscula Pompeiana* 1 (1990): 58–86; Eric Poehler, "The Circulation of Traffic in Pompeii's Regio VI," *Journal of Roman Archaeology* 19 (2006): 53–74.

⁸August Mau, *Pompeii, Its Life and Art*, trans. Francis Kelsey (New Rochelle: Caratzas Brothers, 1982); Anne Laidlaw, *The First Style in Pompeii: Painting and Architecture* (Rome: Giorgio Bretschneider, 1985).

⁹Fausto Zevi, "Urbanistica di Pompeii," in *La regione sotterrata dal Vesuvio: studi e prospettive, Atti del convegno internazionale, 11–15 novembre 1979* (1982), 353–365; Herman Geertman, "The Layout of the City and its History: the Dutch Project," in *Unpeeling Pompeii*, ed. Joanne Berry (Rome: Electa, 1998) 17–25.

political life,¹ and the economy.² Despite this volume of research, there is still much to be understood about Pompeii, particularly the final phase for which the city is so famous. Features abound throughout the city that have been overlooked, that are available for research without the need of further excavation, and that would benefit greatly from quantitative analysis, particularly city-wide GIS studies. Among such targets of research are small holes that have been chipped into the curbstones of the sidewalks throughout the ancient city.

4 SIDEWALKS

Between the well-researched streets and buildings of Pompeii lie the sidewalks, which have enjoyed a comparative anonymity in scholarship.³ They are literally the liminal space between areas of significant study. Pompeian sidewalks were constructed by placing large, upright stones along the edges of the streets with a walking surface, often paved, left between these stones and the frontages of the buildings in the city block (fig. 1). Since it is likely that most people in ancient Pompeii would have walked as their most common form of transportation, the sidewalks are likely to have been used often, setting the stage to pull passersby into shops and bars and coordinating the delivery of goods. Sidewalks would probably have been the locations of abundant activity and exchange in ancient Pompeii.

Some evidence of the level of activity is still discernable through features prevalent on the curbstones. One is the presence of small holes chipped through the upper street-facing edge of the delimiting curbstones (fig. 2). A hole was chipped through the top face—the dorsal side—of the stone, as well as one on the lateral side until the two holes met, leaving a “bridge” of stone (fig. 3). Through these holes could be threaded a rope or lathe for tethering something, a suggestion that is supported by the presence of wearing on the inside of the holes. With only four exceptions that have been identified by the author, all the holes, totalling several hundred, were placed on the street-facing, top edge of the curbstones, suggesting that whatever their purpose, they were created after the curbstones were in place.

Additionally, there are a significant number of holes that have been broken. These breakages seem to have occurred through their use in one of two ways. The first is a sudden application of pressure that appears to have broken the “bridge” and removed some amount of surrounding stone with it. The second is wearing from consistent, regular use that slowly wore down the bridge to a narrow bit of stone that was then more easily broken through (see fig. 3 inset).



Figure 1. Looking south down the Via del Vesuvio, sidewalks flank either side of the street.



Figure 2. An intact sidewalk hole on the upper street-facing edge of the curbstone.

3 PREVIOUS WORK

Discussion of these sidewalk holes appears infrequently in the literature, and there is no standard term for them. There are, however, a few suggestions of their possible use. Spinazzola, excavating on the *Via del'Abbondanza*, noted their presence and suggested that they were used for the fastening of cloth shades that would have hung down from the second story overhangs of shop fronts, creating shade for the pedestrians walking and shopping

¹Paavo Castrén, *Ordo Populusque Pompeianus: Polity and Society in Roman Pompeii* (Rome: Bardi, 1975); James Franklin, *Pompeii Difficile Est: Studies in the Political Life of Imperial Pompeii* (Ann Arbor: The University of Michigan Press, 2001).

²Willem Jongman, *The Economy and Society of Pompeii* (Amsterdam: J. C. Gieben, 1988).

³Catherine Saliou, “Les trottoirs de Pompei: une première approche,” *Bulletin Antieke Beschaving: Annual Papers on Classical Archaeology (BaBesch)* 74 (1999): 161–218.

or for the shops' proprietors.¹ This suggestion may have been influenced by the practice of hanging shades over wall paintings that was common during this era of excavation. Della Corte thought their use had to do with the construction of lean-to shacks by tradesmen, particularly along the sidewalk of the *Via Marina* west of the Forum.² Nappo stated that they were pack animal tethering points, but did not discuss the reason for this attribution.³ Nishida restated two of these options, that the holes were used either for tethering cattle or tying down a corner of a tent, but as with the other authors, offered no evidence or reason for these attributions.⁴

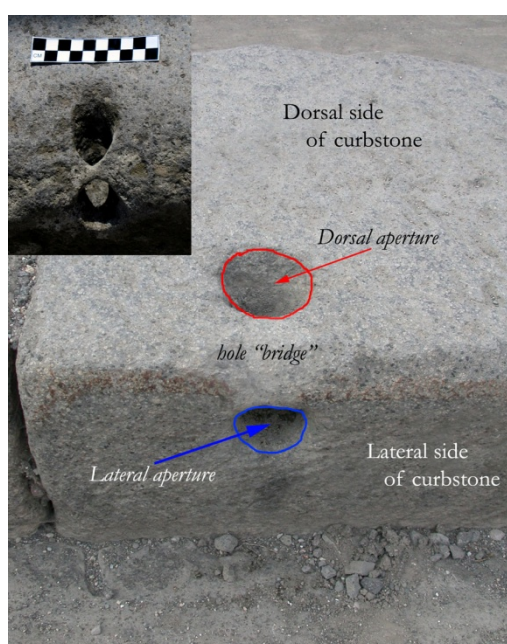


Figure 3. Anatomy of a sidewalk hole. Inset shows a hole with a high degree of wear.

An additional suggestion of the holes' purpose might be that they were the remnants of quarrying activity, either for lifting blocks at a quarry, or for use in transport to the city. If so, the holes may be expected to be randomly distributed throughout the city without any discernable pattern, and would likely be evident on other, similarly sized building stones. Neither is the case. No research was conducted to discover if any of these uses was more or less supported by the placement, location, or attributes of the holes. The present study sought to

¹Vittorio Spinazzola, *Pompeii alla luce degli scavi nuovi di Via dell'Abbondanza (anni 1910–1923)* (Rome: La Libreria dello Stato, 1953) 61.

²Matteo Della Corte, *Casa ed abitanti di Pompeii* (Rome: L'Erma di Bretschneider, 1954) 185–6.

³Salvatore Nappo, *Pompeii: Guide to the Lost City* (London: Weidenfeld and Nicolson, 1998) 41.

⁴Yasutami Nishida, "Measuring Structures in Pompeii," *Opuscula Pompeiana* 1 (1990): 96.

address this, determining the use of the holes based on their placement and spatial properties within Pompeii.

4 STUDY SAMPLE

In order to make a preliminary determination of the use of the holes, an area of Pompeii was identified as a representative sample. This sample was made up of a portion of *Regio VI* and a portion of *Regio VII*, adjacent at its southern extent to the Forum (fig. 4). This area included approximately 10% of all accessible, fully excavated sidewalks in the city as well as a variety of street types and sizes, including large, two-lane, bidirectional streets, and narrow, single-lane, unidirectional streets.⁵ The sample area also contained a wide range of property types within its city blocks, including large domestic structures, commercial properties, production areas, and a temple. The Eschebach 1970 *Stadtplan von Pompeji im Massstab 1:1000* provided the final phase building attributions.⁶ Eschebach assigned one of nine categories of use to each property.⁷ Seven of these categories were represented by buildings in the sample area, including shops, hospitality buildings, workshops, public buildings, private buildings, seats of guilds, and a temple. Shops were referred to here as "commercial", hospitality as "service", and workshops as "production."



Figure 4. Sample area in which the current study was conducted (after van der Poel).

5 RECORDING METHOD

There is no plan known to the author that represents the sidewalks of Pompeii accurately, nor one that includes any more detail than a boundary line delineating the edge of a city block. Thus, in order to measure with any fidelity the location and spatial relationships of

⁵Eric Poehler (p. 355n7) 68.

⁶Hans Eschebach, *Stadtplan von Pompeji im Massstab 1:1000* (Mainz: Verlag P. von Zabern, 1970).

⁷The Eschebach attributions are not without their difficulty and debate around the correct assignation of property use and function continues. However, for the purposes of this study, the attributions of Eschbach have been applied uncritically.

attributes that appear on the sidewalks, a method of measurement had to be developed that recorded the curbstones at a sufficient level of detail. To accomplish this, a 50-meter tape measure was stretched from one end of a sidewalk down its length. This tape measure was used as a baseline from which all measurements were taken (fig. 5). In order to be able to situate measurements into a city plan of the buildings (discussed below), the x and y coordinates of the edge of the corner building on the *insula* were measured from the baseline. This allowed the baseline to be anchored into a plan of Pompeii. Having established the placement of the baseline, measurements to the middle point between each curbstone were taken, giving an x and y value for each side of a stone (see fig. 5). This allowed for the recording of both straight and curved sidewalks with the same degree of accuracy. If a sidewalk had a length in excess of 50 meters, the tape measure was moved along the next length, with an overlap of at least one curbstone to ensure adequate coordination of two transect segments when they were combined in AutoCAD. For more significant changes in sidewalk trajectory, the baseline was stretched to the point of the change, affixed at this point, and stretched straight along the new trajectory. Measurements were taken to ensure a clear understanding of the change in angle of the line. Each curbstone along the edge of a sidewalk was then assigned a unique character string extrapolated from the *Regio* and *insula* numbers, as well as the orientation of the sidewalk. Each stone was numbered sequentially, from north to south or west to east as dictated by the street's orientation. As an example, by this method, the third stone to the east beginning from the northwest corner of *Regio* VI *insula* 14 would be given the number VI.14.N.03. The length, type of stone, and any further attributes were recorded for each stone. The termination of the baseline was measured in the same manner as the beginning, relating it to the corner of the building at the corner of the *insula*.

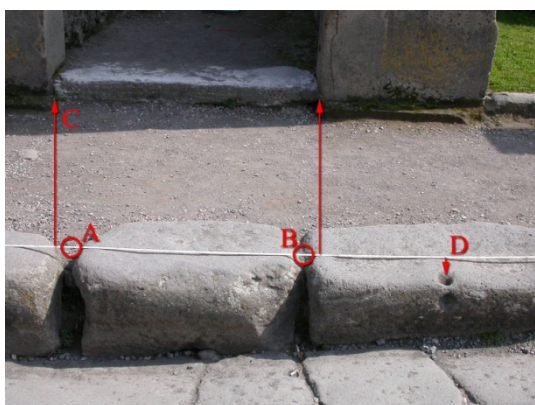


Figure 5. Recording method. A and B denote the measurements taken between each curbstone, C the measurement of a doorway, and D the measurement of a sidewalk hole.

Doorways were also measured relative to the baseline by taking an x and y value at either side (see fig. 5).

Additionally, the door type,¹ whether a threshold stone was present, and if so, its stone type, was recorded. If a blocked doorway could be identified, attributes were recorded as for an open doorway. Finally, each hole feature was measured and recorded relative to the baseline (see fig. 5). Each hole was assigned a unique number based on the particular sidewalk stone into which the hole was chipped. Thus, a hole chipped into the 40th stone of the northern sidewalk of *Regio* VII *insula* 2 was numbered VII.2.N.40.1. If there were additional holes that had been placed on the same curbstone, they were numbered sequentially from north to south or west to east—VII.2.N.40.2 and VII.2.N.40.3. The attributes of the holes were recorded, including whether they were intact, broken, or unfinished and the diameters of both the dorsal and lateral apertures were measured. Each of these same measurements was taken for any holes that were broken. Additional attributes, patterns of wear, or distinctions were noted. Due to the degree of wear suffered by the curbstones, mars and chips occasionally seemed to be remnants of sidewalk holes, broken beyond the point of reliable identification. Each of these potential features was measured in the same way as more certain examples. However, each hole, whether more or less certain, was assigned a “likelihood value.” Intact holes received a value of five, holes that had been broken but were unquestionably the same type of hole received a value of four, slightly questionable holes received a value of three, continuing down to zero, which included mars in curbstones that had correct placement and angle, but did not seem to the author to be sidewalk hole features. To offset the subjectivity of identifying the less-certain features, only those holes with likelihood values of five, four, and three were used for analysis, as identification of these as holes was much more certain.

All of these measurements—a total of 25,634 unique values—were entered as multilayer files into AutoCAD 2006 to allow for centimetric accuracy in their plotting, as well as the manipulation of these measurements into their correct orientation without compromising that accuracy (fig. 6). Multiple transects that recorded a single sidewalk were combined to one continuous transect with all associated measurements.

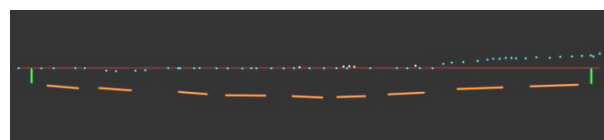


Figure 6. Sample transect in AutoCAD. Longest central line is the baseline, short horizontal lines are doorways, vertical lines are wall anchors, and dots are curbstone measurements.

¹Door type included folding shop door, *fauces* doorway, side door to a house, etc., including blocked doorways that were open in a previous phase, but were not in use in the final phase of the city.

These complete point-value representations of the sidewalks and their features were introduced into the preexisting SAP plan of the city of Pompeii (fig. 7).

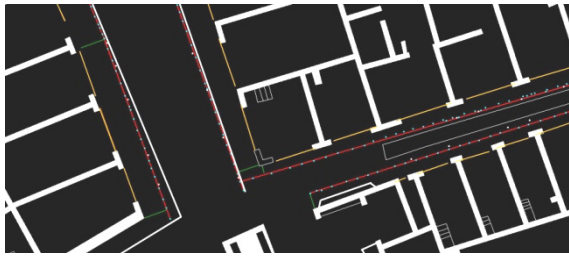


Figure 7. Several transects inserted into a plan of Pompeii.

6 SAP PLAN DXF

The *Soprintendenza Archaeologica di Pompei* plan, or SAP plan, consists of the RICA Maps¹ digitized into a DXF, and was used here to form the base to which the sidewalk transects were added. Note should be made that the creation of the RICA Maps was carried out by tracing the architecture from aerial photographs that had been “rubber sheeted” to match survey points located in the city. Error in excess of several meters is not uncommon. As a result, the SAP plan served only as a guide to join transects together and to provide a more easily understood visualization of the research area. Analyses utilized measurements taken by the author were consistent within each transect, and did not rely on the correctness of the SAP plan.

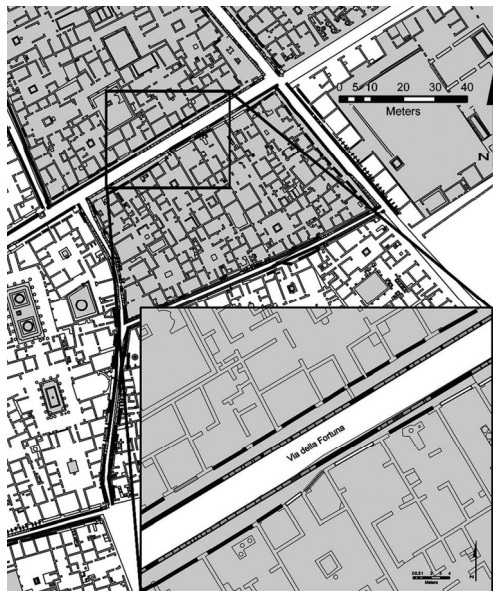


Figure 8. A portion of the GIS sample area. Inset shows detail of curbstome stone type display.

¹Halsted van der Poel, *Corpus Topographicum Pompeianum. Pars III. The RICA Maps of Pompeii* (Rome: The University of Texas at Austin, 1984).

7 GIS

The combined DXF of the SAP plan and sidewalk measurements was imported into ESRI’s ArcGIS 9. Layers were made for the sidewalk curbstones, hole features, doorways, and roads with corresponding attribute databases for each. Each component was traced within its respective layer, assigned unique identifying names as discussed above, and linked to the attribute database. This allowed, among other things, for the visualization of the composition of the sidewalks by stone type (fig. 8). Additionally, queries of these data were built in order to address specific questions.

8 RESULTS

On the 33 sidewalks sampled, 2178 sidewalk curbstones were recorded. Of these, 1028 were made of lava, 640 of sarno stone, 507 of tuff, and one each of marble, limestone, and cruma (Table 1). 268 sidewalk hole features were found and recorded, including 107 intact holes (likelihood = 5), 93 broken holes that had clearly been holes of the same nature (likelihood = 4), 29 broken holes of a less convincing form (likelihood = 3), 19 broken holes that were much less convincing (likelihood = 2), four broken holes that only suggested the form of a sidewalk hole (likelihood = 1), and eight that were certainly not holes, but gave the impression of being broken holes (likelihood = 0). Eight unfinished holes were also identified and recorded (Table 2).

Lava	1028
Sarno	640
Tuff	507
Cruma	1
Marble	1
Limestone	1
Total	2178

Table 1. Curbstone types in Pompeii.

Intact (likelihood=5)	107
Broken (total)	153
Broken (likelihood=4)	93
Broken (likelihood=3)	29
Broken (likelihood=2)	19
Broken (likelihood=1)	4
Broken (likelihood=0)	8
Unfinished	8
Total	268

Table 2. Sidewalk hole features in Pompeii.

As noted above, all analyses of sidewalk hole features included only holes with a likelihood of 5, 4, and 3 (229 holes), and the least likely and unfinished holes were discarded (fig. 9). Additionally, 308 doorways were

recorded, including 288 open, functioning doorways and 20 doorways that had been blocked at some point prior to the destruction of the city. These doorways corresponded to 148 “commercial” properties, 42 “production”, 39 “service”, 66 “private”, seven “guild”, and four “public” properties, as well as two temples—the *Tempio della Fortuna Augusta* and a possible *Sacraria Compitales*¹ (Table 3).

Commercial	148
Service	39
Production	42
Private	66
Public	4
Guild	7
Temple	2
Total	308

Table 3. Property types at Pompeii.

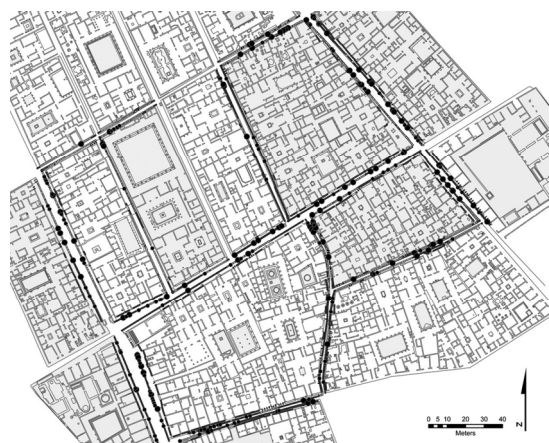


Figure 9. All sidewalk holes of likelihood values 5, 4, and 3 shown.

It was considered that a typology might be of use in identifying different functions based on the relative size of the holes, if any groups of distinct sizes existed. To determine whether there were indeed groupings, the measurements of the diameters of both the dorsal and lateral apertures were used to build histograms of size frequencies. In each case, it was found that there were normal distributions around a median value of approximately 6.5cm. Because multiple peaks did not appear and instead, a single value seemed to be the “ideal” around which the diameters of most holes clustered, there was no more than one category and therefore a typology was not necessary. If there had been several peaks, this may have suggested multiple “ideal” diameters, which may have been used in different ways or in different locations and therefore a typology would have been beneficial.

Given that the holes were present on sidewalks, which necessarily were situated in relation to streets, it may be asked if there was a type of street to which the holes

¹Liselotte Eschebach, *Gebäudeverzeichnis und Stadtplan der antiken Stadt Pompeji* (Vienna: Böhlau, 1993) 185.

were more strongly associated?² This question was addressed in two ways. First, the number of holes present along the length of a street was divided by the length of the street in meters. To provide a more easily compared number, this value was then divided by 0.04 to provide a “hole index” number for each street, such that a street with 0.4 holes per meter had an index value of 10. These indices were then mapped onto a plan of the sample area (fig. 10).

The street with the greatest number of holes was the *Via del Foro* (hole index = 10), a street directly connected to the Forum and therefore one that must have been a highly active street. The next greatest number of holes were located on streets that were connected to city gates, such as the *Via del Vesuvio* (hole index = 7), connected with the Forum, such as the *Via di Mercurio* (index = 6.5) and the *Vico degli Augustali* (index = 7), or served as the most direct routes to the Forum from one of the city gates, such as the *Via della Fortuna* (index = 6). Secondary streets, those that connected the city gates and the Forum but provided a more circuitous route, had the next greatest number of holes, such as the *Vicolo Storto* (index = 5) and the *Vico del Panettiere* (index = 4). Finally, the tertiary streets that did not have a direct connection to the gates or the Forum had the lowest number of holes, including the *Vico di Mercurio* and *Vico dei Vettii* (index = 2.75), as well as the *Vico del Fauno* (index = 1). The *Vico del Labirinto* had the lowest index (index = 0), and will be discussed further below.



Figure 10. Relative density of sidewalk holes on streets. (Streets enlarged for illustration).

It seems likely that streets with a higher degree of connectivity to gates or the Forum were likely to have

²It should be noted that the associations between features are not to be assumed to have the statistical robustness of a chi-squared test of correlation. Though statistical significance is a future goal of this work, at present, the number of data points is such that the application of statistics would be fruitless.

had a greater volume of cart traffic because they were more directly connected with centers of public activity and were more easily accessible. It was often the case that the more connected streets were those with two lanes and bidirectional traffic. This suggests that streets with a greater volume of cart traffic had need of a greater number of holes.

Additionally, streets with a greater width had a higher number of holes placed along their sidewalks, with a few exceptions. The *Via del Foro*, the widest street in the sample, had the greatest number of holes along its length (index = 10). The *Vico di Mercurio*, the narrowest street, had the least number of holes (index = 0). However, there were exceptions to this trend, as illustrated by the *Vico degli Augustali*, one of the narrower streets in the sample, but one with a high “hole index” value (index = 7), and the *Vico del Labirinto* (index = 0), which had a median width, but a low index. Though the width of a street influenced the volume of traffic that could pass along it, other factors, such as its connectivity to the Forum or whether it was blocked to cart traffic, may have had a greater impact on hole placement. Subsequently, as the volume of traffic and the connectivity of a street decreased, so too did the number of holes located along it. Holes therefore seem to correspond to areas with a greater volume of cart traffic.

Was there then a relationship between the placement of sidewalk hole features and doorways? A test of proximity was conducted in the GIS to determine whether there was an association. This test found that all holes were within six meters of a doorway, with the vast majority—85%—within three meters of a doorway. This finding is perhaps unsurprising since it is common in Pompeii for many doorways to be within six meters of another doorway (fig. 11). However, the strong association between doorways and sidewalk hole features was most apparent on streets that had a lower incidence of doorways.

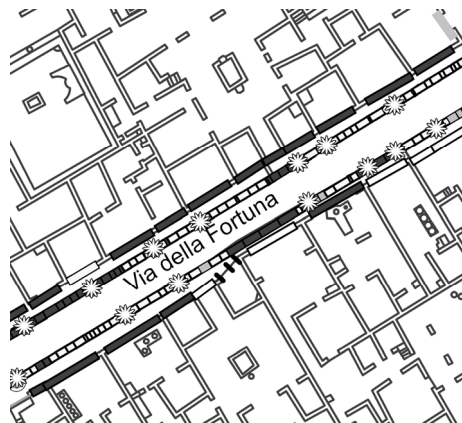


Figure 11. Sidewalk holes—shown in red—proximal to doorways. Doorways are notably close together.

The *Vico dei Vettii*, for instance, lacks doorways along the majority of its length and has correspondingly few holes. The areas in which holes do appear are those areas with nearby doorways (fig. 12). There are exceptionally few holes that are not associated with doorways, suggesting that the function of the holes was tied closely to their presence. Given this association, was there then a particular type of property into which a doorway opened that had a greater incidence of sidewalk holes?

If sidewalk holes clustered around a specific type of property preferentially, this could help to elucidate what their function may have been. A test of proximity was conducted based on the various property categories. The distance was limited to a 2.95-meter maximum distance from a doorway, as this was the distance at which all holes could be related to a single doorway with no duplication or overlap. The resulting correspondence of holes to property types is summarized in Table 4.

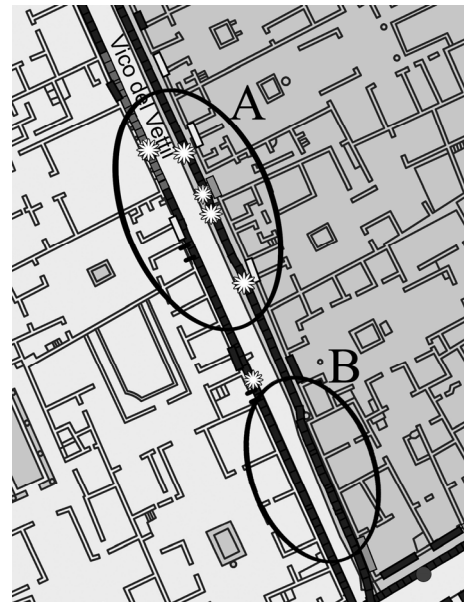


Figure 12. The *Vico dei Vettii* showing the prevalence for doorway/sidewalk hole association. Area A has both doorways and holes. Area B has no doorways and no holes.

Prop. Type	# Holes	% Holes	# Doors	% Doors	% diff.
Comm.	116	51%	148	48%	+3%
Private	43	19%	66	21%	-2%
Prod.	31	14%	42	14%	0%
Service	33	14%	39	13%	+1%
Public	5	2%	4	1%	+1%
Guild	1	<1%	7	2%	-2%
Temple	0	0%	2	1%	-1%
Total	229	100%	308	100%	

Table 4. Number and percentage of sidewalk holes and doorway compared.

Should there have been a perfectly random scatter of holes, percentages would be expected to be even with

the percentages of doorways of each property type. However, this was not the case. For example, of the 208 doorways in the sample area, 148 were doorways to commercial properties, or 48%. Of the 229 holes in the sample area, 116 were found proximal to commercial areas, or 51%. The difference between the two percentages—3% in the case of holes associated with commercial properties—shows there was a preference for the placement of holes in association with that particular property type, if only a slight one. Similarly, service and public properties had a slightly greater number of holes associated with them. Private, guild and temple properties had a mild negative association. This demonstrates that the holes appeared nearly everywhere, with only temples having no visible association in this sample area, and therefore the holes were likely to have had wide, fairly ubiquitous use across the city with slight deviations in preference for certain types of properties.

The locations where sidewalk holes did not appear were also telling. There were several locations that lacked holes on their sidewalks entirely. As noted above, the two temples in the sample area did not have holes associated with them. In fact, the *Tempio della Fortuna Augusta* lacked holes both in association with its threshold, as well as along the entire northern side of the building that flanked the *Via della Fortuna Augusta* (fig. 13). Though there was a significant stretch of sidewalk with available curbstones, no holes were present. Whether this lack was due to a negative association with religious buildings, legal stipulations, because the temple was built on private land,¹ or some other reason, is unknown.

A second area of interest is the *Vico del Labirinto*. This street was unique in the sample area for two reasons. First, the street lacked sidewalk holes entirely. Second, it was deliberately blocked to cart traffic. At its southern end where it intersected the *Via della Fortuna Augusta*, a large upright stone was erected that would have prevented carts from entering at this end (fig. 14). At its intersection with the *Vico di Mercurio* to the north, the construction of a water fountain overtook the majority of the street, again restricting access to cart traffic (fig. 15). This suggests that because the street lacked cart traffic, there was no need for the placement of sidewalk holes.

Additionally, the *Vico del Fauno* had only four sidewalk holes along its length. At the time of the destruction of the city, this street seems to have been undergoing repavement, with only the southern half completed.²

Cart traffic would not have been able to use this street because half of it was a dirt track with wide steps in elevation between the northern portion and the newly paved southern portion. The four holes that did appear along the sidewalks of this street were likely associated with a previous phase, since they were on curbstones that predated the repavement of the street and would therefore have found their use prior to the street becoming inaccessible to cart traffic. In both of these cases, there was a strong dissociation between holes and streets that were inaccessible to cart traffic. This points to a clear link between the use of the holes and wheeled traffic.



Figure 13. The north side of the *Tempio della Fortuna Augusta* showing a length of sidewalk devoid of sidewalk holes.



Figure 14. South end of the *Vico del Labirinto* blocked to cart traffic by an upright stone.

¹Paul Zanker, *Pompeii: Public and Private Life*, trans. Deborah Lucas Schneider (London: Harvard University Press, 1998) 82.

²Eric Poehler, "A Diachronic Perspective on Directionality: Detour and the Pattern of Pompeian Traffic," paper presented

9 CONCLUSIONS

at the 104th Annual Meeting of the Archaeological Institute of America, New Orleans, Louisiana, January 3–6, 2003.

Sidewalk hole features showed a strong association with larger, more well-connected streets, particularly those connected to city gates and the Forum. Through GIS analysis, their placement was found to be very strongly associated with doorways, and had a slightly stronger association with commercial, service, and public properties—an analysis that will only become more refined with the inclusion of a larger area of the city.

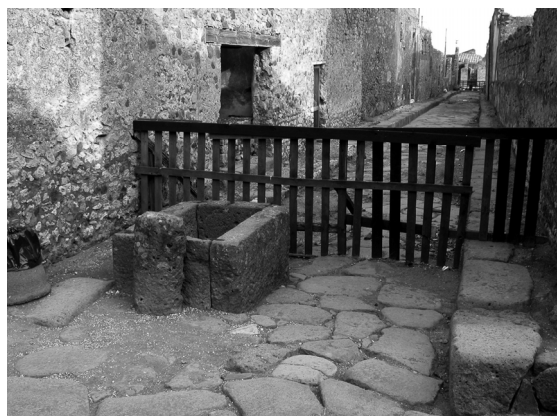


Figure 15. North end of the Vico del Labirinto blocked to cart traffic by the construction of a water fountain.

Perhaps the most telling result was the lack of holes on sidewalks along streets that were not open to wheeled traffic. Sidewalk holes were therefore most strongly linked to streets that had a high volume of cart traffic and most likely served as places where animals pulling carts could be tethered. Perhaps their placement was dictated by the need for some way to “park” a cart while goods were delivered or picked up at the properties to which they were proximal.

Since most types of properties were likely to require regular deliveries of goods or supplies, their common appearance near all types of properties, except temples, makes sense for their likely use. The streets closest to the Forum showed an increase in the number of holes on their sidewalks, suggesting that although this area of central commerce was inaccessible to cart traffic itself, it may have had a greater need for places nearby to tether an animal pulling a cart in order to deliver goods to the *Macellum* and shops within. The eastern side of the *Via del Foro*, which had the greatest number of sidewalk holes for its length, suggests a “parking lot,”

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allowing numerous cart-pulling animals to be tethered here while their drivers made deliveries in the Forum (fig. 16).

Spinazzola’s suggestion of the holes being used to secure awnings, while impossible to refute entirely, seems unlikely for two reasons. First, the eastern side of the *Via del Foro*, where these holes were especially prevalent, possessed a portico that would have shaded this side of the street already (see fig. 16). Second, while too few second stories survive to say definitively, there is scant evidence of beams or joists that would have functioned to hold such awnings. Regardless, though this may have been one additional use of the holes, it seems unlikely for this function to have been the holes’ primary purpose. Further analysis modeling light patterns and the orientation of the streets may help to elucidate whether the holes were placed in preference to sunnier sides of streets.



Figure 16. East side of the *Via del Foro* showing the sidewalk with the greatest number of sidewalk holes, as well as a brick columned portico.

The widespread occurrence of these holes across Pompeii suggests a ubiquity of use throughout the city, if not a single purpose. Though they could easily have served several functions at once, the current data support the assertion that they were used as tethering points for animals pulling carts. Further expansion of this study will help to increase understanding of their function on a citywide scale. Additionally, a more critical look at property type attribution will improve the fidelity of trends. On a grander scale, holes of this nature appear in other ancient cities throughout the Italian peninsula. The author has noticed them in Ostia, Paestum, and Herculaneum, but no further comparison or analysis has yet been applied to these features. The inclusion of other cities into the study, as well as the complete survey of Pompeii, will serve to give an even wider look at the possible function of these holes.

BIBLIOGRAPHY

- Allison, Penelope. *The Distribution of Pompeian House Contents and Its Significance*. Ph.D. diss., University of Sydney, 1994.
- Anderson, Michael. "Houses, GIS and the Micro-topology of Pompeian Domestic Space," in *Proceedings of the 14th Annual Theoretical Roman Archaeology Conference, 26–27 March 2004*, edited by J. Bruhn, B. Croxford, and D. Grigoropoulos, 144–156. Oxford: Oxbow, 2005.
- Castrén, Paavo. *Ordo Populusque Pompeianus: Polity and Society in Roman Pompeii*. Rome: Bardi, 1975.
- De Caro, Stefano. "Nuove indagini sulle fortificazioni di Pompei." *AION* VII (1985): 75–114.
- Della Corte, Matteo. *Case ed Abitanti di Pompeii*. Rome: L'Erma di Bretschneider, 1954.
- Dobbins, John, Larry F. Ball, James G. Cooper, Stephen L. Gavel, and Sophie Hay. "Excavations in the Sanctuary of Apollo at Pompeii, 1997." *American Journal of Archaeology* 102 (4) (1998): 739–756.
- Dobbins, John. "Problems of Chronology, Decoration and Urban Design in the Forum of Pompeii." *American Journal of Archaeology* 98 (4) (1994): 629–694.
- Eschbach, Hans. *Stadtplan von Pompeji im Massstab 1:1000*. Mainz: Verlag P. von Zabern, 1970.
- Eschbach, Hans. "Die Entdeckung eines Hauses unter den Stabianer Thermen." *Cronache Pompeiane* 1 (1975): 82–117.
- Eschbach, Liselotte. *Gebäudeverzeichnis und Stadtplan der antiken Stadt Pompeji*. Vienna: Böhlau, 1993.
- Franklin, James. *Pompeii Difficile Est: Studies in the Political Life of Imperial Pompeii*. Ann Arbor: The University of Michigan Press, 2001.
- Geertman, Herman. "The Layout of the City and its History: The Dutch Project," in *Unpeeling Pompeii*, edited by Joanne Berry, 17–25. Rome: Electa, 1998.
- Jashemski, Wilhelmina. *The Gardens of Pompeii, Herculaneum and the Villas Destroyed by Vesuvius*. New Rochelle: Caratzas Brothers, 1979.
- Jongman, Willem. *The Economy and Society of Pompeii*. Amsterdam: J. C. Gieben, 1988.
- Laidlaw, Anne. *The First Style in Pompeii: Painting and Architecture*. Rome: Giorgio Bretschneider, 1985.
- Maiuri, Amedeo. "Studi e ricerche sulla fortificazione di Pompei." *Monumenti Antichi* 23 (1929): 113–290.
- Mau, August. *Pompeii, Its Life and Art*, trans. Francis Kelsey. New Rochelle: Caratzas Brothers, 1982.
- Moeller, Walter. "The Building of Eumachia: A Reconsideration." *American Journal of Archaeology* 76 (1972): 323–27.
- Mouritsen, Henrik. *Elections, Magistrates and Municipal Élite: Studies in Pompeian Epigraphy*. Rome: L'Erma di Bretschneider, 1988.
- Nappo, Salvatore. *Pompeii: Guide to the Lost City*. London: Weidenfeld and Nicolson, 1998.
- Nishida, Yasutami. "Measuring Structures in Pompeii." *Opuscula Pompeiana* 1 (1990): 91–103.
- Poehler, Eric. "A Diachronic Perspective on Directionality: Detour and the Pattern of Pompeian Traffic," paper presented at the 104th Annual Meeting of the Archaeological Institute of America, New Orleans, Louisiana, January 3–6, 2003.
- Poehler, Eric. "The Circulation of Traffic in Pompeii's Regio VI." *Journal of Roman Archaeology* 19 (2006): 53–74.
- Saliou, Catherine. "Les trottoirs de Pompei: une première approche." *Bulletin Antieke Beschaving: Annual Papers on Classical Archaeology (BaBesch)* 74 (1999): 161–218.
- Spinazzola, Vittorio. *Pompeii alla luce degli scavi nuovi di Via dell'Abbondanza (anni 1910–1923)*. Rome: La Libreria dello Stato, 1953.
- Tanzer, Helen. *The Common People of Pompeii. A Study of the Graffiti*. Baltimore: John Hopkins Press, 1939.
- Tsujimura, Sumiyo. "Ruts in Pompeii: The Traffic System in the Roman City," *Opuscula Pompeiana* 1 (1990): 58–86.
- van der Poel, Halsted. *Corpus Topographicum Pompeianum. Pars III. The RICA Maps of Pompeii*. Rome: The University of Texas at Austin, 1984.
- Wallace-Hadrill, Andrew. *Houses and Society in Pompeii and Herculaneum*. Princeton: Princeton University Press, 1994.
- Zevi, Fausto. "Urbanistica di Pompei," in *La regione sotterrata dal Vesuvio: studi e prospettive, Atti del convegno internazionale, 11–15 novembre 1979* (1982): 353–365.
- Zanker, Paul. *Pompeii: Public and Private Life*, trans. Deborah Lucas Schneider. London: Harvard University Press, 1998.