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Eighteenth-Century Wharf Construction in Baltimore, Maryland

Joseph Gary Norman
College of William & Mary - Arts & Sciences

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EIGHTEENTH-CENTURY WHARF CONSTRUCTION IN BALTIMORE, MARYLAND

A Thesis

Presented to
The Faculty of the Department of Anthropology
The College of William and Mary in Virginia

In Partial Fulfillment
Of the Requirements for the Degree of
Master of Arts

by
Joseph Gary Norman
1987
APPROVAL SHEET

This thesis is submitted in partial fulfillment of
the requirements for the degree of

Master of Arts

Joseph Gary Norman

Approved, May 1987

Carol Ballingall

Theodore Reinhart

Anne E. Yentsch
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PREFACE

In November and December of 1984, the Baltimore Center for Urban Archaeology had an opportunity to excavate and expose a portion of Cheapside wharf in the Inner Harbor business district of downtown Baltimore. The excavation took place over 33 days under the direction of the author. This document, however, is not a site report. As a Master's thesis it is, rather, an attempt to make a scholarly contribution to the growing field of "waterfront archaeology." The increasing incidence of archaeological excavations on buried and semi-submerged historic wharves has created a need for archaeologists working on these sites to familiarize themselves with the technology available to the people who created these structures. It is the intent of this work to provide a starting point for archaeologists undertaking this process.

Due to a lack of funding, the copious amounts of data recovered during the 1984 excavation of Cheapside wharf have not, as of this writing, been organized into a report. The information disclosed here is not intended to remedy that situation but, instead, to illustrate various aspects of wharf construction technology and problems relating to it. In no way should this data be considered an expression of the sum total of the information recovered archaeologically. The complete written and photographic record of the excavation is currently housed with the artifacts at the Baltimore Center for Urban Archaeology in Baltimore and is accessible for study.
ACKNOWLEDGEMENTS

I wish to express my appreciation to Carol Ballingall, Anne Yentsch, Ted Reinhart, and Louise Akerson for their evaluations and criticisms of this manuscript. I also wish to acknowledge the contributions of Carmen Weber, who shared with me the burden of directing the Cheapside wharf excavation, and the staff of the Baltimore Center for Urban Archaeology. For their assistance during my documentary research on wharves, I extend my thanks to the staff members of The Henry Francis duPont Winterthur Museum and Library, the Eluetherian Mills—Hagley Library, the Baltimore City Archives, and the Maryland Hall of Records. I wish to thank Joan Geismar and Ken Beem for taking time out of their busy schedules to discuss my findings. Credit must also be given to the Maryland Humanities Council, the Rouse Company, and Maryland Governor William Donald Schaefer without whom investigation of Cheapside wharf would never have taken place. I also want to thank my parents, Joe and Nancy Norman, for their support and faith that I would finish this thesis—some day. Finally, I cannot offer enough gratitude to Stacia Gregory for her candor and comments throughout the preparation of this thesis. Her contribution of computer hardware made the timely completion of this work possible.
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ABSTRACT

The purpose of this study is to investigate the various wharf-building technologies available during the eighteenth and early-nineteenth centuries. Discussion of wharf-building techniques is undertaken in the first chapter and focused in the second chapter on the use of timber cribs in the construction of Baltimore wharves. Evidence for specialization of wharfbuilders in the late-eighteenth century is also presented.

The findings from historical and archaeological research on Cheapside wharf in Baltimore are outlined in Chapter III to illustrate the typical development of wharves in that City during the eighteenth century. The next chapter discusses the maintenance of wharves and docking spaces during the eighteenth century and the technologies applied to this endeavor. The final chapter draws conclusions about the suitability of wooden wharves to the function of these structures and the changing perception of wharf-building technology in preindustrial Baltimore.
EIGHTEENTH-CENTURY WHARF CONSTRUCTION
IN BALTIMORE, MARYLAND
INTRODUCTION

Wharves and the docking space they provided were an integral part of the eighteenth-century business success of Baltimore. Baltimore grew on its shipping capabilities. Exportation of raw materials, such as iron, flour, and timber, together with the importation of foreign goods, brought wealth to scores of merchants and, in turn, economic prosperity to the town.

Wharves were a common sight in eighteenth-century Baltimore and often the first view visitors arriving by water were afforded of the town (Figure 1). Many of these visitors were not impressed by this sight. Ferdinand-Marie Bayard, a French officer who visited Baltimore in 1791, remarked that the "wharves are constructed of trunks of trees . . . [and when] the tide falls it exposes a slime which gives off foul vapors" (Bayard 1950:160).

Another distinguished Frenchman arrived in Baltimore in 1794 and was also distressed by the condition of the town's waterfront. Médéric Moreau de Saint Méry was quick to notice that the wharves in Baltimore were "always made for the convenience of their owners, who always build them out into the harbor." He further described spaces where water filled large indentations in the direction of the town, while nearby wharves stuck out like jetties. This gave "an air
Figure 1. View of Philadelphia from the water in 1778. The wharves of Baltimore would have created a similar scene for visitors in the late-eighteenth century. (Courtesy of the Henry Francis duPont Winterthur Museum).
of disorder to a place to which rigorous alignment would bring added charm" (Moreau de Saint Méry 1947:78).

The wharves described by the Frenchmen are no longer a part of Baltimore's active waterfront. Yet, many still exist beneath tons of concrete, steel, and earth in the heart of the city's downtown business district. The land created by the wharves was gradually incorporated into city blocks, and streets were laid out on many of the filled docking slips. Cheapside wharf did not escape this fate. However, it was distinguished by being uncovered and studied briefly before being destroyed by the construction of an underground parking facility which was part of The Gallery at Harborplace on Pratt Street at Calvert Street (Figures 2 and 3).

During the winter of 1984, the Baltimore Center for Urban Archaeology (BCUA) was funded by the Maryland Humanities Council and the Rouse Company to carry out a 33-day archaeological investigation of a portion of Cheapside Wharf that was unearthed near the corner of Pratt Street and Calvert Street in Baltimore's Inner Harbor business district. This excavation, which was directed, in part, by the author, uncovered a large part of a "crib-type" wharf and provided a large body of structural and artifactual data. During analysis of the findings, many questions arose concerning the technology utilized in constructing the wharf. Research into the topic revealed that very little information had been assembled by archaeologists and historians regarding preindustrial wharfbuilding
Figure 2. Maryland Archaeological Research Units. (Council for Maryland Archaeology).
SITE OF CHEAPSIDE WHARF EXCAVATION

Figure 3. Map of Downtown Baltimore.
technologies other than cursory explanations in archaeological reports.

The reasons for such a lack of documentation are apparently two-fold. Primarily, demand for the information has not been great. Excavations which uncovered wharves have generally been salvage operations, and budgets for such projects do not usually allow extensive supporting research. Only recently has the frequency of archaeological investigations dealing with early wharves increased to a point where focus on this technology can no longer be postponed. Wharf sites were recently investigated in New York City (Geismar 1983, 1985; Huey 1984; Rockman 1982); Salem, Massachusetts (Brady and Wilson 1982, Moran 1980); and New London, Connecticut (Heintzelman-Muego 1983).

A second reason for the lack of previous work in this field can be seen in the scarcity of primary documentation. It seems that wharf-construction techniques were either taken for granted as a folk technology or considered esoteric. In either case few historic accounts of actual construction survive and techniques must be largely inferred from proposals, letters, and condition reports written by the builders and port officials.

In response to an obvious need for a treatise of early wharf construction technologies, this paper will discuss the prevailing techniques of solid-fill wharf building utilized in the United States during the eighteenth and early-nineteenth centuries. The bulk of the discussion will center around wharves constructed in Baltimore.
from the mid-eighteenth century to approximately 1820. Cheapside Wharf will figure prominently in the discussion of wharves because of the body of historical and archaeological data generated by the 1984 archaeological project.

For purposes of organization, this paper is divided into five chapters. Chapter I introduces the types of early timber wharves. Pertinent concepts and terminologies are outlined and references to European wharf technology of the period are presented for comparison. Chapter II treats early wharf construction and wharfbuiliders in Baltimore. This includes a discussion of the variations in structural details and outlines the various steps in the procedure for construction of Baltimore's most common early wharf (crib-type) as inferred from primary and secondary sources. Chapter III deals specifically with the history of the development of Cheapside Wharf as it relates to the techniques and concepts outlined in the two previous chapters. This chapter also presents a synopsis of the archaeological findings of the Cheapside wharf excavation. Chapter IV reveals the onus of wharf maintenance and summarizes the shifting assignment of this burden in Baltimore. There is a general discussion of repairing wharf bulkheads and dredging docking spaces. The final chapter, Chapter V, draws conclusions about the suitability of wooden wharves to the function of these structures and the changing perception of wharf-building technology in preindustrial Baltimore.
CHAPTER I

18TH-CENTURY WHARVES: TYPES & TECHNOLOGIES

The terms and concepts used now and historically to describe wharves and their various parts are loosely applied and vary greatly in different parts of the country. This chapter introduces the bulk of the terminology which will be used throughout the paper and relates the terms to their appropriate structural context.

A wharf is a substantial structure which lies alongside of, or projects into, navigable waters for the purpose of loading and unloading vessels. The term "wharf" was commonly used in the eighteenth and nineteenth centuries with the plural form varying from "wharfs" in England to "wharves" in the United States. Two materials were used historically in the United States for the construction of wharves: timber and stone. Timber, being cheap and readily available in the United States, was more widely used for early wharf construction than stone. However, this was not the case in Europe where wood was scarce and wharves were built predominantly of stone. The greatest advances in the technology of timber wharf construction have been attributed principally to North America (Wilson 1980:6).
There are basically two kinds of wharves: marginal and projecting. A marginal wharf, commonly called a "quay" in Europe, is a wharf constructed along the shore which requires a wall of some sort to retain fill. This retaining wall is usually referred to as a "bulkhead" wall. A projecting wharf, sometimes called a pier, is constructed out from the shore into the water (Greene 1917:1-3). Pier is a term which is used interchangeably today with the term wharf, but it has traditionally referred to a platform or roadbed supported over water by piles set uniformly along its length (Wilson 1980:5). The term "dock" refers to the navigable water adjacent to a wharf and a "slip" is a narrow dock between two projecting wharves.

The most commonly reported projecting wharf in the eighteenth and early nineteenth century in Baltimore was the solid-filled type. This type of wharf consisted of a retaining wall of some kind along the sides and outer end with the enclosed area filled in with earth, stones, mud, or other material. This fill material was often dredged from the slip or docking space alongside the wharf (Greene 1917:4). The design and construction detail of the retaining wall associated with this form of wharf varied considerably but can be categorized into three general groups: "crib" or "cobb" construction, pile walls, and masonry walls. Masonry walls became more common during the nineteenth century and are not addressed in this work. Wharves of solid wood, often referred to as "raft" wharves, have been found archaeologically in the United States and in Europe (Geismar 1983, Baart et al. 1982). These wharves were
positioned in the water in much the same way that crib wharves were.

**CRIB WHARVES**

Cribs are box-shaped frames of timber which are constructed in open-work with numerous compartments formed by means of transverse and longitudinal ties (Figure 4). According to Cunningham (1904:287), cribs range in length from 30 to 50 feet and are never narrower than their total height, with a minimum height, in the shallowest cases, of 20 feet. The main timbers should be 12 inches square throughout, except in the lowest course where they should be 12 by 18 inches. The longitudinal and transverse ties are approximately 10 by 12 inches, and the structure is held firmly together by one-and-one-eighth-inch wrought-iron bolts.

The cribs are framed on a sheltered beach, within easy reach of a depth of 10 to 12 feet of water. After three or four courses of logs have been bolted together, the structure is launched and additional courses are added to it until the height is several feet greater than the depth of the wharf site. At this point, the crib is maneuvered into position and weighted with stone until it sinks. Then it is filled level with the top. Many cribs constructed in this fashion may be situated to form a single wharf. After a period of settlement, all the cribs are leveled with wedges and a roadway of planking is laid at a height of five or six feet above water level (Cunningham 1904: 287).
Figure 4. Wharf cribbing. (From Cunningham 1904:286).
Greene generally concurs with Cunningham on the structure of cribs for wharfing, but he varies on some of the details of the actual construction. Greene (1917: 53-54) observes that the cribs are built with cells eight feet long and five feet wide with several of them being floored over. As the structure is built up, the floored cells are filled with stone and the structure sinks. When the crib is high enough to reach above low water, it is carefully positioned. The sinking of the structure is then completed, and all cells filled. After the crib settles and conforms to the bottom, the portion above the water is completed (Figure 5).

The antiquity of cribbing technology is uncertain. It can be traced in documents to the early-seventeenth century when Scamozzi, the architect of Venice, described several engineering procedures which were used for building in water. He discussed the use of cribbing construction in which horizontal boards were nailed to piles and served to retain soil in tidal situations (Geismar 1983:673). Archaeological evidence has shown that Roman and Medieval ports in both Northern and Eastern Europe made use of this procedure (Baart et al. 1977, Geismar 1983). While the cribbing described by Scamozzi is not of the same construction as that most commonly found in England's American colonies, it is interesting to note that the principle behind this type of landfilling (and eventually wharf construction) was not a "modern" innovation.

One of the earliest accounts which deals specifically with wharfing in the Mid-Atlantic colonies was recorded by William Byrd in 1728 upon a visit to Norfolk, Virginia:
Figure 5. Crib wharf — Philadelphia, circa 1801. (Courtesy of the Henry Francis duPont Winterthur Museum).
The Method of building Wharffs here is after the following Manner: They lay down long Pine Logs, that reach from the Shore to the Edge of the Channel. These are bound fast together by Cross-Pieces notcht into them, according to the Architecture of the Log-Houses in North Carolina. A wharff built thus will stand Several Years in spight of the Worm, which bites here very much, but may be soon repaired in a Place where so many Pines grow in the Neighborhood (Byrd 1929:36)

In another description of the same visit, Byrd (1929:37) commented that "The Wharfs were built with Pine Logs let into each other at the End, by which those underneath are made firm by those which lye over them."

It initially appears that the wharf-construction technique Byrd was describing is that of timber cribbing. His comparison of the wharves to the "architecture of log-houses" supports this idea as cribs constructed of logs in the manner described by Greene (1917) and Cunningham (1904) resemble small log houses. However, Byrd fails to indicate whether the wharves were filled with earth or stone or any other matter. Since cribs were designed specifically to hold fill, Byrd's omission of such an outstanding feature in his description suggests that these wharves may not have been of crib construction. The second description of the same wharves in which logs are "made firm by those which lye over them" implies that these wharves may have been of a variation of "raft" construction. Raft wharves were
composed totally of wood in such a way as to create a solid block.* This method of wharf construction is discussed later in this chapter.

Another description of crib wharf construction is found in the specifications for a wharf proposed in the District of Columbia in 1762:

The said wharf is to be built at the end of Water Street and carried from thence 60 feet wide into the river so as to have 10 foot water at the front in a low tide; the outsides are to be of hewed logges, 12 inches thick laped and the joints broke, braced and girded with hewed logges 10 inches thick and 15 foot long and dovetailed into the outsides. The front to be dovetailed at the outsides and the end of every dovetail to be sawed off. The distance from the front to the first brace not to exceed 10 feet and the distance between every brace the same for the whole length of the wharf. The same to be filled up with stone within two feet of the wharf, one foot of which is to be filled with clay or dirt, the other foot with gravel and to be raised three feet higher than a full tide (Taggart 1907).

Similar wharves were found along the Baltimore waterfront in the eighteenth century. The "hewed logges, 12 inches thick laped and the joints broke" with dovetailed corners and braces was a typical design described in eighteenth century accounts of Baltimore. The major distinction between this proposed wharf and those proposed for Baltimore is that the one in the District of Columbia

*"Raft" construction is a terminology which has been borrowed from Joan Geismar (1986) who encountered this type of wharf on eighteenth-century waterfront sites in New York City.
specifies filling with stones and capping with dirt and gravel while Baltimore wharves generally called for earth fill only.

**COBB WHARVES**

In New England, some crib wharves have historically been referred to as "cobb" wharves. In 1819, William Bentley, pastor of the East Church in Salem, Massachusetts, recorded in his diary that,

> Mr. Pickering Dodge is carrying off his Wharf from the Point opposite to the Derby Wharf at the point most easterly. The work is in the method of the wharf at the Charity House, with stone filled with earth to be solid & not like our other wharves of Cobb & Liable to be hurt by every sea (Bentley 1914:625-6).

Research on the Derby and Central wharves in Salem found references to these structures as "cobb" wharves as early as 1791 (Wilson 1980:23). During the nineteenth century these wharves were converted from cobb to "solid." Since no written explanation survived to distinguish for modern researchers the difference between "cobb" and "solid," the meanings had to be inferred from the wording of nineteenth-century contracts for the conversion of these wharves. This analysis was completed by Merrill Ann Wilson in 1980 with the following conclusions.

Cobb construction consisted of timber cribbing, frames of logs notched together, loaded with heavy ballast for anchorage. Cobwork required a "ballast floor" near the top of the cribbing to hold a surfacing of earth and gravel. In contrast, solid wharves
consisted of freestanding, load-bearing retaining walls or bulkheads, usually filled behind with dredged materials. Three types of bulkheads were used in solid wharf construction. These included 1) large horizontal timbers, squared and notched together and usually positioned in the form of cribwork; 2) vertically driven timber piles with horizontal planking spiked inside the piles; and 3) load-bearing stone walls, usually granite and laid up without mortar. "Solid," therefore, referred to the nature of the fill employed in the wharf. Although it had the advantage of being constructed quickly and easily, a cobb wharf with its timber platform under the earth and gravel surfacing was unquestionably subject to decay and collapse and would not have provided a consistently safe or sound working platform (Wilson 1980:25).

This distinction between cobb and solid wharves is supported by Bentley's observation that a solid wharf is more sturdy and not "liable to be hurt by every sea." Presumably the greater mass of a wharf filled with stone and/or mud would be more resistant to the horizontal forces of waves and strong tides, than a similar structure which is but anchored with stones and capped with a few feet of earth and gravel.

The origin of the term "cobb" or "cob" as it applied to wharves has not been determined. Many of the scholars who have researched aspects of wharf construction technology suggest that the term derived from the use of cobblestones or "cobbs" which were utilized in the sinking of the cribs (Geismar 1986; Wilson 1980:4; Heintzelman-Muego 1983:18). Nevertheless, this hypothesis has not
been verified by the historical record. An eighteenth-century dictionary gave a definition for "cob" as "a word often used in the composition of low terms" (Johnson 1765). This term may have been in use in those areas where "cob wharves" have been recorded and originally intended to indicate that the structure was of "low" quality as opposed to wharves with stone bulkheads or solid-filled wharves.

Specifications for what seems to be a variation of a cobb wharf in Virginia in 1773 were found at the Library of Congress among the papers of a merchant, Neil Jamieson. It is not known exactly where the wharf was constructed, either in Norfolk or Portsmouth, Virginia. The contractor was Col. George Veale, who, by his own admission, had long been acquainted with wharf work. According to the specifications, the wharf was to consist of two parallel lines of cribs, 16 feet wide and 160 feet long, running to a large 54- by 40 foot crib at the end. Each 160 foot length of cribbing was to be divided by ties into ten compartment or cribs, each 16 feet square. There was to be an empty space 22 feet in width between the two lines of cribbing (Wilson 1980:21).

The specifications for the wharf required that all the cribbing be "bottomed with Logs," each 12 inches thick, and "the bottom to be made up all of Loggs to keep from Sinking in the mud." The bulkheads of the "outer penn" or crib were to be constructed "9 logs high," each log 18 inches thick "Sided two sides" and "Clossley Trayed." (Presumably "Sided two sides" meant that the logs were planed down or flattened on opposite sides and "Clossley Trayed" referred to the positioning of these logs on top of each other in such a
way as to leave as small a space as possible between them). The two 160 foot lengths of cribbing were constructed eight logs high with 15 inch timbers "Sided 2 sides" at a level slightly lower than that of the end crib. Cross-timbers or ties were to be placed every 16 feet, "10 Tyes on each tear [sic] above the bottom." The large crib at the end of the wharf was to be "filled mostly with stone not above 3 foot thick of Wood in it," while the "Two wharfs 160 by 16 foot [were] . . . filled up with wood and mud" (Wilson 1980:21).

The practice of using cord wood, short lengths of wood usually used for fuel, as fill material was apparently not uncommon in areas where wood was more abundant than stone. Wilson (1980:21) allowed that this practice was "peculiar" to Virginia and the Southern colonies and constituted the major difference in crib construction between the North and South. Nevertheless, evidence for filling wharves with cord wood has been found for Baltimore. Citing records which have long since disappeared, Thomas Griffith (1824:37) recorded that, in 1759, John Smith and William Buchanan built "two wharves of pine cord wood, about one thousand feet long each, to the channel of the river." Because of its short length (2-4 feet), the cord wood was unlikely to have served in the construction of bulkhead walls. It was, instead, probably a major constituent of the fill for the wharves. Archaeological evidence for the use of cord wood as wharf fill in Baltimore also exists. While monitoring deep trenching for the construction of a slurry wall in downtown Baltimore in December 1984, the author observed heavy
concentrations of cord wood in the fill of Hollingsworth's wharf, adjacent to Calvert Street and Cheapside dock.

The design of Neil Jamieson's wharf was similar to the early wharves of the Boston Harbor as described by Frank Hodgdon in 1923. These wharves were constructed of "stone-filled timber cribs enclosing areas which were filled with earth" (Hodgdon 1923:440). However, the plan for Jamieson's wharf specified that the space between the two parallel lines of cribbing be enclosed by an end crib and remain empty. Functionally, this would not make sense. Unless the entire structure were planked over, or similarly surfaced, activities on the wharf would be carried out around a vast, open pit. Perhaps this area was intended to be filled by another contractor, or when it was specified to remain empty, this meant empty of cribwork. The 22- by 160-foot void may have been left empty in anticipation of the construction of shallow-cellared warehouses in the middle of the wharf. Whatever the intended purpose of the "empty" area between the cribs of this wharf, it is unlikely that it remained empty for very long.

Timber cribwork was an extremely versatile medium for early wharfbuilders. Cribs of varying size could be arranged in any number of layouts to create wharves to fit any need or size restriction. They were utilized in the construction of "block-and-bridge" type wharves which consisted of crib blocks resting on the river bottom with bridges extending between blocks. These wharves allowed the freer movement of water within an area thereby reducing the stagnation problems which so often occurred within the
docking slips. According to Greene (1917:112) this type of structure was only economical for small wharves (piers) in shallow water and on hard bottom. However, it had the advantages inherent in any timber crib structure of being inexpensive and easy to build. This type of wharf has been investigated archaeologically at Site One of the Washington Street Urban Renewal Project in New York City (Geismar 1986).

PILE WHARVES AND PILE DRIVING

Piles and piling are terms used to describe any columnar members which are driven vertically, or near vertically, into the ground to form a foundation for construction purposes or to act as a barrier against horizontal forces. Piles include basically two types: sheeting piles, which are used to enclose or confine an area, and bearing piles, which act either in isolation or in groups as supports for construction.

Sheeting piles are usually much wider than they are thick, and are set with their edges in close contact to form a continuous wall or partition. To achieve this, sheeting piles are driven in bays of moderate length, between guide piles, to which horizontal walings or cross-timbers are affixed. Bearing piles are more equilateral in cross section, and are driven separately, or in clusters. Sheet ing piles are made with a sharp edge at their lower end; bearing piles have either pointed or butt ends (Cunningham 1908:61).
Bearing Piles

The driving of bearing piles is undertaken for the consolidation of soil which is not sufficiently compact to support heavy construction. This process is applied because piles driven close together tend to prevent compression of the ground which might cause foundations to sink into mud or loose soil. The driving of bearing piles is also resorted to when a solid stratum lies at a depth too great to uncover, or when it is covered by layers of soft earth (mud) difficult to remove (Cresy 1872:1070). The origin of this type of piling technology is not known, but the driving of piles to create coffer dams and foundations for marine structures was recorded as early as the first century B.C. by Marcos Vitruvius Pollio, a Roman architect and engineer. In his Ten Books on Architecture (Morgan 1914), Vitruvius discusses methods for using piling, platforms, and wooden cofferdams to create and prepare land for further construction (Geismar 1983:672).

Piles for foundations were usually of oak, elm, fir, or beech timber; very straight; and barked and dressed with care. In some cases, piles were shod with an iron shoe weighing as much as thirty pounds. The lower end of these piles were sharpened by cutting each side to a length of about eighteen inches, in such a manner as to bear on the iron shoe, which was spiked or nailed to the end of the pile. The head of the pile was cut at a right angle to the length and rounded whenever a removable hoop of iron was fitted to prevent splitting during driving. In cases where the piles were temporary, it was only necessary to sharpen the end and char it in a fire to harden
it. Piles driven for foundations were then cut off just above the bed of the river, and the intervals between them filled with stone rubble or gravel in such a manner as to prevent them from bending under the weight of their superstructure (Cresy 1872:1071).

**Sheeting Piles**

Sheet piling is used in the construction of cofferdams and the facing of wharves. These piles are generally from four to six inches in thickness and about 12 inches wide. The length of these piles depends upon the nature of the soil they are to penetrate and the depth to which the neighboring piles have been driven. Although sheeting piles are not generally driven to the depths that are required by bearing piles, they often necessitate an iron tip or shoe to aid in their placement. The pointing of sheeting piles is accomplished by cutting only one side of the plank (Cresy 1872:1071).

The thick planks which form sheeting piles are "shot" or "jointed" on the edges in order to form a close joint which will preclude the passage of water through them. In many cases, the sides of the planks are grooved and tongued so that they form a very tight joint which prevents the passage of air or water. Cresey (1872:1071) observes that the driving of these "grooved" piles is often somewhat difficult, requiring not only a small pile-engine but use of a hand tool known as a "beetle" (discussed later).

The earliest usage of sheeting piles has not been documented, but they were certainly in common usage in Europe and
America during the eighteenth century. One of the most frequent uses for sheeting piles was in the construction of cofferdams which were used to hold back the water from a given area while construction or pile driving took place on the bed of a river or other body of water.

Piles used for sheeting purposes were not always planks. In 1778, John Smeaton, a British engineer, described the "piers" at Bridleton quay in a report offering recommendations for slowing the ravages of marine borers on the wooden structures.

It is observable that the outside of the pier is formed by a strong row of squared piles of oak, in general about a foot square, and near the pier heads the spaces between them is not much more than the breadth of the piles. Inside of those they are planked with three inch plank, in the general old ship plank, but of late years there being a scarcity of this, fir plank has been in some places tried, which is found still more subject to the worm than oak; this planking is to keep in the ballast, wherewith . . . the piers are filled (Smeaton 1812:189).

In this quote, Smeaton described an alternate usage of sheet piling which was commonly employed in some form in the construction of wharves in North America during the eighteenth century. Sheeting piles were not used to contain earth fill in these cases, but, rather, to act as stays against lateral pressures from the wharf fill which would otherwise distort the walls of the wharf and cause them to bulge outward. Such piles also anchored crib wharves against the motions of waves and tides during construction and reinforced the bulkhead
walls of these same wharves against the outward pressure of their fill (Figure 6).

Wharves constructed with walls of piles were recorded for New York City in 1840 by Freeman Hunt. He noted that the wharves were erected entirely of earth and timber, in a rude and simple manner. A row of wooden piles was driven close to each other into the bed of the river to form the face-work of the wharf, which projected from the shore to a depth of water sufficient to float the largest class of vessels. The piles, composing the face-work, were driven perpendicularly into the ground and were secured in place by horizontal wale-pieces or stretchers, which were bolted onto the front of the wharf running its entire length. Diagonal braces were bolted onto the inside of the piles. Beams of wood were bolted onto the face-work, extending behind it to be firmly embedded in the wharf fill or, in the case of a marginal wharf, the shore. These beams functioned both as struts and ties, serving to counteract the tendency of lateral pressure, whether acting internally or externally, from deranging the line of the wharf (Hunt 1840:313).

According to the Hunt's accounts, the void between the perpendicular piles which formed the face-work and the sloping bank rising from the margin of the water was "generally filled up with earth obtained in the operation of levelling sites and excavating foundations for the dwellings and warehouses in the city." This filling of earth was carried to the height of about five feet above high water, at which level the heads of the piles, forming the face-work, were cut off. The whole roadway or surface of the wharf was then
Figure 6. View of a pile-wall wharf in front of Nieuwe Stadhersberg, a public house on River Y in Amsterdam, circa 1750-1760. (Courtesy of the Henry Francis duPont Winterthur Museum).
planked over. The planking used in forming the roadway of the wharf was, in some cases, left exposed; but, in general, where there was a great thoroughfare, the surface of the wharves was pitched with round water-worn stones (Hunt 1840:313).

During the nineteenth century, wharves with piled walls became more common in New York than in earlier centuries, as they did in other places in the United States. To date, no such wharves have been reported in the archaeological literature (Geismar 1986). Cast-iron sheeting piles were developed as early as the 1820's and were used in England in 1825 in the construction of the Liverpool Dock (Kirby and Laurson 1932:257). Presumably the advances made in pile-driving technology during the early nineteenth century made the use of this construction technique more practical and affordable.

Pile Driving

No one has determined when the first primitive "pile engine," or apparatus for forcing pointed sticks into the soil, was used. It is likely that something of this sort has been in use for thousands of years. Some types of pile engines used in Europe several centuries past, employed a weight which was secured to the end of a long pole hinged midway and free to move about on a horizontal axis. The weight was raised by pulling vertically downward on the unweighted end of the pole. A weight which could be dropped vertically came into favor as soon as a means for tripping it was devised. Some seventeenth- and eighteenth-century illustrations show at least a score of men lifting the weight by pulling
small ropes attached to a main rope; others show horses performing this task (Figure 7) (Kirby and Laurson 1932:257).

Cresey (1872:1071) discussed a hand-tool called a "three-hand beetle" which was used to drive piles whose length did not require an engine. The "beetle" was described as a large maul made of a block of hard wood hooped with iron. It had two long handles radiating from its center and spaced at such a distance that it could be easily worked by two men. A third man assisted in lifting it by means of a short handle opposite the two long handles. Such a maul was likely to have been used in antiquity for the driving of piles.

The structural details of pile-driving machinery have varied greatly though the principle has remained unchanged. The process of driving a pile essentially relies upon the fall of a heavy weight, called a "ram" or "monkey," in a series of blows onto the head of the pile. For this job, a piling machine is constructed with two long vertical runners or guides. The ram slides up and down the face of these runners and is kept in position by a lug or projection which fits into the groove between the guides (Cunningham 1904:56).

The simplest kind of pile driver is the "ringing machine," with which the work is done entirely by hand. The monkey usually does not weigh more than a third of a ton, and is lifted by a rope which passes over a pulley at the head of the frame. This rope is attached to several shorter lengths, which afford a hold to a corresponding number of men, in the proportion of about 40 pounds weight per man. The lift does not exceed four feet. At a given signal,
Figure 7. Early pile-driving engine. Pile driving often required a score of men. (Kirby and Laurson 1932).
the men allow the monkey to fall and strike the pile whereupon, taking advantage of the rebound, the monkey is raised once more. Driving is usually carried out in this manner in spells of three or four minutes' duration, with intervals of rest. In this way men are said to be able to deliver from 4,000 to 5,000 blows per day (Cunningham 1904:57).

More complex machines were in use by the eighteenth century. In 1738, Mr. Charles Labelye of Switzerland contracted with the commissioners of London to construct a newly designed Westminster Bridge. The engine for driving the piles was contrived by Mr. James Vauloué, a watchmaker. This engine had a monkey, or ram, which weighed 1700 pounds and a mean stroke height of 20 feet perpendicular. With two horses, it gave 48 strokes per hour, and with three horses, 70 strokes per hour. When it had worked long enough for the pivots to be rubbed smooth and the rope to be worn, three horses going at a common pace gave five strokes in two minutes with the ram being raised from eight to ten feet (Cresy 1872:422-3).

This machine was probably a type of "crab engine." This name applied to those pile-driving machines which were constructed so that the rope, instead of being held directly by hand, passed around the drum or "crab" of a windlass which was turned by men or horses. This type of machine provided the ram with a greater falling distance than if raised solely by hand (Cunningham 1904:57) (Figure 8).
Figure 8. German "crab engine" for pile driving. (Kirby and Laurson 1932).
Pile driving became more practical in the nineteenth century with the introduction of steam power for raising the rams. The first use of any force in addition to gravity for driving piles appears to have been in 1846, when the piles in the foundation of Stephenson's High Level Bridge at Newcastle, England, were driven by means of Nasmyth's steam hammer. British engineers seem to have led the world in pile-driving technology during the eighteenth century. The jet method for sinking piles which utilized a jet stream of water to excavate a hole for the pile was first suggested by James Brunlees and then used by him for sinking iron piles on railroad construction in 1850 on the west coast of England.

Screw piles were the invention of another Englishman, Alexander Mitchel. His first use of these piles was in the construction of a lighthouse on the Malpin Sands, in the Thames estuary, in 1838. A decade passed before this technology appeared in the United States in constructing a foundation for a lighthouse on the Brandywine Shoal, near the mouth of the Delaware Bay (Kirby and Laurson 1932:258).

Piles-driving machines used in wharf construction in the United States were usually placed on scows so they could be easily maneuvered into place (Figure 9). These floating pile engines served a double purpose in that they could be used to carry piles and other timber to required locations (Greene 1917:29).
Figure 9. Floating pile-driving engine. Late in the eighteenth century, horses supplanted men for heavy lifting on this floating pile-driving engine (Kirby and Laurson 1932).
GRILLAGE OR RAFT WHARVES

Early in the seventeenth century, the Venetian architect Scamozzi described several engineering procedures which were used for constructions in water. In his discussion of bridge-building, Scamozzi described a wooden grillage system of oak upon which a foundation could be partially built and then sunk directly onto a leveled section of river bottom (Geismar 1983). The use of this practice for landfilling and wharf construction was found in Northern Europe between the tenth and fifteenth century (Baart et al. 1977:15).

An example of this method of construction was archaeologically investigated on the 175 Water Street Block site in New York City (Geismar 1983). The wharf on this site was found to have been constructed of several layers of logs laid alternately at right angles and intermittently weighted with stone rubble fill. Although the actual number of log courses was undetermined, at least ten of these alternating layers of logs were exposed in this excavation. The designation of "wharf/grillage" was given to this solid, raft-like log construction which was determined to have been a wharf from historic documentation. Documents in New York City described the sinking of timber "blocks" in the building of wharves. Similar structures on other archaeological sites have been correlated with documented wharves. "Grillage" was added to the wharf designation because it is the architectural term for this type of cross-layered, load-bearing construction used on unfirm ground whether intended to be a wharf or not (Geismar 1983:686).
The construction of this type of wharf consisted of building several "rafts" of logs and stacking them on top of each other so that the logs in each raft lay perpendicularly to the logs of the raft below it. This "block" of rafts was presumably floated into position and sunk with stone rubble. If more height was needed, additional rafts could be sunk on top the the block already in place. A late-seventeenth-century definition of a wharf as "rafts of many pines or firs" (Murray 1888) hinted at this mode of construction.

SUMMARY

The technology available for the construction of timber wharves in the eighteenth century was somewhat limited. Retaining walls and sunken rafts of timber and stone were considered "state of the art." Nevertheless, the variations on these themes was virtually endless. Retaining walls could be constructed of logs laid horizontally and braced to hold fill; or they could be constructed of rows of piles driven close together into the bottom of the harbor. Rafts of timber could be constructed in various sizes to accommodate any number of uses.

This chapter provides an introduction into wharf-building technologies as they were applied through the early-nineteenth century. The following chapter continues the discussion of these technologies with an emphasis on wood-crib wharves in Baltimore, Maryland.
CHAPTER II
BALTIMORE WHARVES AND WHARFBUILDERS

Written accounts of the techniques and materials used in the building of wharves in the eighteenth and nineteenth centuries are generally found in the form of contractual agreements, proposals, and specifications for construction or repairs. While few documents of this nature have survived which pertain to early wharf-building in Baltimore, enough information can be gleaned from those that still exist to permit an inferential reconstruction of the most probable state of this technology in the city during the late-eighteenth and early-nineteenth centuries.

In March of 1791, Joseph Smith of Baltimore presented to the Board of Port Wardens a condition report for the wharves in the Baltimore harbor (Baltimore City Archives 1791). Of the 26 wharves mentioned in this report, most of which were badly in need of repair, structural detail occurs for only 15. In each of these 15 cases, the evidence suggested they were constructed from earth-filled timber cribs; several of the wharves needed to be raised "one log higher," and at least one of the docks had silted in to "within two or three logs of the top." In his evaluation of the Light Street wharf, Smith noted that the "inclosures, or pens" were "quite filled" causing the fill to wash over into the dock.
The reference to "inclosures," "pens," and horizontal logs in the discussion of these wharves indicates that the wharves were constructed of filled timber cribs. Other surviving eighteenth-century records dealing with Baltimore wharves substantiate this. In 1785 three wharf owners complained to the Board of Port Wardens that Mr. Levering and Company were "putting in their filling of their wharf into the Bason at the head of the dock before their logs are laid . . ." and "will not fix the frame of their wharf which they have begun where it should be . . . " (Baltimore City Archives 1785a). Michael Foy, the builder of this same wharf, wrote to the Port Wardens that he had been made to move the wharf twice after he had it ready to fix in place. The first move was a distance of 12 feet and the second move was only accomplished "with a high tide and a strong purchase from Mr. Morrison's wharf" (Baltimore City Archives 1785b).

Clearly, Mr. Levering's wharf was constructed of timber cribs or "frames" which, with some difficulty, were floated on a high tide into their proper position before filling (although it seems that Mr. Levering was intent upon filling his wharf before he finished positioning it). This construction technique was apparently common in Baltimore. In 1783 George Prestman and his partners confessed to the Board of Port Wardens that they had proceeded with their wharf and "sunk" it before receiving written orders (Baltimore City Archives 1783).
While the use of filled timber cribbing for wharf construction was common in Baltimore during the eighteenth and early-nineteenth centuries, the similarity between these wharves was probably limited to the broadest structural traits. Most of the wharf bulkheads were comprised of horizontal timbers, one-foot or more in diameter, laid one on top of the other; however, the arrangement of internal braces and ties seemingly varied from builder to builder. In 1811 William Fisher prepared a proposal to put two new rows of logs on the Powder House wharf. After examining the wharf, Fisher increased the price of his bid when he found that there were "a number of Small Tyes Dovetailed from one Tye to another" which he did not calculate in his earlier estimate (Baltimore City Archives 1811b). Apparently, the original builder(s) of this wharf utilized a system of ties which was different from what Fisher had expected.

By the early-nineteenth century Baltimore developers had become cognizant of the variations in construction details of their wharf cribs and were taking measures to insure that minimum standards were met. In 1812, when Henry Stouffer advertised for proposals to construct a portion of the Pratt Street wharf, he was careful to indicate the arrangement and spacing of anchor piles and ties he would require, for each section of the crib structure. He also specified how the logs in the crib were to be hewn and finished (Baltimore City Archives 1812).

Baltimore's earliest wharves were probably constructed by the same carpenters who were building houses and bridges. Greene
(1917:52) pointed out that crib wharves, like those built in eighteenth- and early-nineteenth-century Baltimore, were relatively inexpensive and could be built using only hand tools. (This may be reflected by the hammer which was archaeologically recovered from the eighteenth-century fill of Cheapside wharf). However, specialization within the profession had begun before the turn of the century. The 1797 Accounts of the Port Wardens listed Archibald Shaw as being paid £35.1.8 on his account for repairing the public wharf at Fell's Point, while a Mr. Hassafras was paid £52.0.7 for "wharfing Conway Street" (Baltimore City Archives 1797a). Shaw had been listed the year before in the Baltimore City Directory as a wharfbuilder and Hassafras was listed as a carpenter (Thompson and Walker 1796). Three years later, no wharfbuilders were specifically listed in the directory but Hassafras (Hassarraty) was still advertised as a carpenter (Mullin 1799).

In 1800 the city directory for Baltimore listed no less than four "wharfbuilders": Benjamin Davis, Richard Hoggins, Archibald Shaw, and George Hassafras (Hassafraus) (Warner and Hanna 1800). The shift from "carpenter" to "wharfbuilder" reflected by Mr. Hassafras from 1796 to 1800 and the increase during that same period in the number of wharfbuilders hint of a trend towards specialization. Given the growing tendency of developers to require more stringent adherence to structural details by wharfbuilders, such specialization would not be unexpected.
CRIB-WHARF CONSTRUCTION

In spite of growing specialization within the ranks of wharf-builders, the techniques used in building the wharves remained unchanged. The construction of a crib wharf in its simplest form consisted of six steps: measuring the bottom, constructing the crib(s), positioning the wharf, sinking the cribbing, filling, and topping. These steps were reflected by surviving Baltimore records of the late-eighteenth and early-nineteenth centuries.

Measuring the Bottom

The first step in constructing a crib wharf, or any wharf, was to measure the contour of the surface upon which the structure would rest. In Baltimore this surface was the floor of the harbor or basin. Measuring gave the builder information on the type of bottom he would be dealing with and the height to which he would need to construct the wharf to bring it above high tides. Because of miscalculations at this planning stage, Archibald Shaw had problems erecting a public wharf at the south end of Market Street in 1804. The commissioners appointed to oversee the construction of this wharf reported to the Mayor and City Council that Mr. Shaw's "mode of measure was improper" and that the logging was "now under
water at the south end* (Maryland Historical Society 1804). Since
the wharf was not completed at this stage in that it lacked a capping
of several courses of logs, the submersion of the south end did not
pose a serious problem. However, Shaw's lapse in professional
performance coupled with the suspicion he had not constructed the
wharf of "materials agreeable to contract" prompted the
commissioners to withhold a portion of his remuneration until the
"contract and work should be judged off by some judicious and
disinterested persons" (Maryland Historical Society 1804).

Construc\ng the Crib(s)

Once a wharf builder had measured the bottom, he began
construction of the "logging" or cribbing which formed the wharf.
The cribs were usually built of pine logs, 11 to 12 inches in diameter,
which, if at all, were only roughly hewn below the water line. The
cribbing was begun on land in a spot very close to its final position.
After several courses of logs were laid, the structure was launched
into the water and floated into place (Cunningham 1904:287). Once
roughly positioned, the structure was anchored in some way to keep
it from drifting on the tides. Driving temporary anchor-piles into the
river bed probably accomplished this task.

*It is very difficult to determine from the context of the
document whether the "mode of measure" mentioned referred to the
measurement of the Basin floor or the measurement of the running
length of the wharf, which was a common method of determining
cost. In either case, the submersion of the wharf at one end
indicated a miscalculation on the part of the builder most likely
during this phase of the construction.
Once afloat, the wharf cribbing was continued by builders who presumably stood on the raft-like floors of the cribs as they raised the cribbing by a sufficient number of log courses to reach the height of common tides. As the structure rose in height, the cribs were filled with wood, stone, or earth so the builder could continue to reach and work on the top course of logs. Wood may have been preferred for this purpose for a number of reasons. Unlike stone or earth, wood did not put a great deal of weight on the cribbing and cause it to sink too quickly. Though the logs in the cribs may have been laid very close together, they probably did not create a waterproof chamber. Therefore, when wood was used as fill it acted to raise within the cribs a self-bouying platform on which the wharf builders could stand. Cord wood may have been used as fill in Jamieson's wharf in Virginia and Smith and Buchanan's wharves in Baltimore (Chapter I) as earth fill below the waterline would have created a quagmire from which it would have been impossible to work. The large quantities of wood which were noticed in the lower levels of fill when portions of Hollingsworth's wharf in Baltimore were excavated with heavy equipment during December 1984 and January 1985 suggest such a use of wood.

There is insufficient data from the few wharf excavations conducted in the United States to determine if a standard crib size existed. Archaeology has indicated, however, that the configuration of the internal bracing of the cribbing was highly variable. The size of the cribs often depended upon the size of the wharf or, possibly, the builder's personal preference. At best, the internal bracing and
anchoring of logs sufficed to hold the logs in place for only a few years. In 1791, many of the crib wharves in Baltimore were reported to have been in very bad shape with logs bulging from the sides or completely missing (Baltimore City Archives 1791). Many of these wharves were less than ten years old.

The variation of the internal bracing of the crib wharves was reflected in William Fisher's proposal to make repairs on Gunpowder wharf in Baltimore. Fisher increased his bid after examining the structure and finding that there were several small ties dovetailed to each other which he did not calculate in his earlier estimate (Baltimore City Archives 1811b). From this one may surmise that the original engineer of this wharf had utilized bracing ties in a manner which Fisher had not expected and probably would not have used himself.

Variation was further shown in other proposals to build or repair wharves. In 1811, Joseph Jeffers prepared a proposal for the Commissioners of Baltimore in which he would repair Bowley's wharf and put in "two tier of ties each 12 feet apart" (Baltimore City Archives 1811a). The following year proposals for a wharf south of Pratt Street specified that the structure be built with "two tyes at Each pile [20 feet apart] with a short [word illegible] tye in the back of Each pile, & the other cor[ces] of loging to have one tye at every [every] intermediat Spac[e] of the others" (Baltimore City Archives 1812). In spite of the fact that developers were requiring builders to adhere to specific guidelines or specifications for wharf construction
in the early-nineteenth century, there seemed to be no standard form for the internal bracing or tying of the cribs.

Apparently by 1817, a standard had still not been established for Baltimore. In that year Jehu Brown signed a standing contract with the Baltimore Port Wardens to construct a number of wharves. Among the prices agreed upon in the contract was the sum of thirty-seven-and-a-half cents for "putting in each tie" (Baltimore City Archives 1817). The Port Wardens did not presume to instruct Mr. Brown in the placement or number of ties necessary for the construction of the individual wharves. Instead, they stipulated that, under the superintendence of the Wardens, the wharves were to be constructed "with all due expedition, in a permanent durable stile, and in a good and sufficient workmanlike manner." Payment on a "per tie" basis permitted Brown to use his judgement for securing the structural stability of the wharf. At the same time, this procedure eliminated any reason for scrimping and so insured the placement of a sufficient number of ties.

Occasionally, specifications for early wharves contained references to the types of joinery to be used when assembling and bracing the cribbing. One of the earliest such references for the Baltimore area was for a crib wharf proposed for Washington, D.C. in 1762. According to the proposal, the outer logs of the wharf were to be "12 inches thick laped [sic] and the joints broke" while the braces and ties were to be "10 inches thick and 15 foot long and dovetailed into the outsides. The front to be dovetailed at the outsides and the end of every dovetail to be sawed off" (Taggart 1907). Another
reference was made regarding the joinery used in wharves nearly
half a century later when William Fisher found a number of small
ties dovetailed to each other in a wharf in Baltimore (Baltimore City
Archives 1811b).

The dovetail joint is a variation of a mortise and tenon joint
(Appendix A). The mortise and tenon joint appears to have been
widely used in one form or another in the construction of timber
wharves from the medieval period onward (Tatton-Brown 1974,
Milne and Milne 1978, Heintzelman-Muego 1983). A mortise is a
cavity cut into one of the wharf timbers so as to receive the
projecting end of another timber. The projecting end of a timber
which has been shaped to fit into a mortise is called a tenon. To
prevent separation of the mortise and tenon, the joint is
strengthened by pinning it with an iron spike or a wooden pin called
a trunnel or trenail. These joints can also be strengthened by
shaping the mortise and tenon in such a way as to resist the
separating force. One of the more common types of shaped mortise
and tenon joint is the dovetail. A dovetail consists of a fan-shaped
tenon which forms a tightly interlocking joint when fitted into a
corresponding mortise (Davies 1976:215).

Lap joints, or some variation of them, seem to have been
widely used in wharf construction (e.g., Geismar 1985, Moran 1980).
This type of joint was made by overlapping timbers at portions
which have been prepared to fit together (Appendix A). For
additional strength many of these joints were notched and/or
pinned. This type of joinery was referred to in the 1762 proposal for
Positioning and Sinking

The positioning and sinking of crib wharves began with anchoring the raft-like base and first few courses of the cribbing in place with piles. Next, additional courses of cribbing were constructed. As the courses of logs increased in number, the height and weight of the structure also increased and caused the rafted bottom of the cribbing to settle into the harbor floor. This operation was necessarily a slow one so that by the time the cribbing had been built up to final grade, settlement of the foundation raft was essentially complete (Bray 1938:3).

This procedure was alluded to in a letter to the Baltimore Port Wardens in 1785. Hans Morrison, John Mickle, and John McDonough entered a complaint with the wardens that Mr. Levering and Company would not "fix the frame of their wharf," which they had begun in its proper location. Instead, they kept "sinking it down with timbers which if they once press into the mud" would not permit proper positioning of the structure (Baltimore City Archives 1785b). Their reference to "sinking it down with timbers" clearly suggested that the three gentlemen who wrote this letter were describing the process discussed in the previous paragraph. They were concerned that this wharf, which was apparently situated adjacent to their own wharf properties and occupying docking space that they had once had to their advantage, was not anchored, or
"fixed," in its proper place with anchor piles. If construction continued, they feared the cribbing would settle into the bottom and then be impossible to move. While this complaint seemed quite valid, a bit more insight was provided the Port Wardens by the builder of the wharf.

At about the same time that the above complaint was registered, Michael Foy, who had been contracted by Mr. Levering and Mr. Barge to build their wharf, filed a letter of his own with the Port Wardens. In an attempt to answer the charges and explain his plight, Foy related the following events. When the wharf was ready to be fixed in its place, Mr. Morrison came to Mr. Foy and, "seeming very angry," told him that the wharf was "going too far down." So, with Morrison's assistance, Foy measured the proper distances from the adjacent wharf. He then drove stakes from which to range the distances for his wharf, which he did "to the greatest exactness." Foy proceeded with the wharf construction until Levering and Barge sent orders for him to move the wharf a distance of nearly 12 feet. This was accomplished with "great difficulty" and, as the wharf was "in great forwardness," one corner unavoidably "Shov'd down towards Forest Street about 3-1/2 or 4 feet." Foy then continued building the wharf until a Mr. Hart and others "came a surveying of the wharf" and informed him that the southernmost corner was 14 inches in Lee Street dock. So, with the assistance of "a high tide and a strong purchase from Mr. Morrison's wharf," Foy managed to get his wharf moved back out of the dock. However, the 3-1/2 feet of the wharf which "Shov'd down towards Forest Street" could not be moved back
into line as the wharf had settled too far into the harbor bottom. The only way to correct this was to cut the wharf, and it was Foy's great desire to avoid having to do this (Baltimore City Archives 1785a).

Two centuries later Foy's dilemma seems nearly comical. However, the sequence of events illustrates very well the method of sinking used for this wharf. When the wharf was "ready to fix in its place," Foy was able to do this "to the greatest exactness." At this stage the wharf was probably a raft with a few courses of logging. By the time Levering and Barge ordered the wharf to be moved 12 feet, Foy had great difficulty in repositioning it. Construction of the wharf had undoubtedly progressed considerably and the weight of the added log courses had probably caused the structure to sink nearly to the bottom of the harbor, if it was not already resting on it. During this move, one corner of the wharf was displaced. The final move of 14 inches, occurring when the wharf must have been nearly completed, could only be accomplished at high tide and required a strong hold on Mr. Morrison's wharf. By this time the wharf had settled so far into the mud on the floor of the basin that Foy was unable to realign the corner that had been displaced in the previous move.

The method employed by Michael Foy for constructing and sinking his wharf, as can be inferred from the above account, may have been common in Baltimore in the late-eighteenth century. That the references to fixing and sinking the wharf in the letters are general and unprefaced with explanation tends to support this assumption. Had Foy been employing techniques not generally used
in the area, more details of the procedures might have been offered to the Port Wardens so they could more readily see where the procedures were failing.

**Filling**

When a crib wharf had been constructed to the height of common tides, it was considered ready to receive filling. By having the wharf filled at this point in its construction, the wharf builder could be sure that settling would have all but ceased before he added the topping logs which would be visible above the waterline. These points were illustrated by the example of Archibald Shaw who contracted with the City of Baltimore in about 1803 to build a public wharf in the Eighth Ward. According to a letter written the following year to the Mayor and City Council of Baltimore, "Shaw proceeded with his work and loged [sic] it up so far as to be in a situation to receive filling and rendered his account for the same . . ." (Maryland Historical Society 1804). The letter also stated that the south end of the wharf was under water. This indicated that the top of the logging must have been very close to the waterline and that filling needed to take place before the top logs were added. The fact that Shaw rendered his account at this time may indicate that this was a "natural" stopping point for the wharf builder.

In Baltimore the filling of wharf cribs was not ordinarily bid as part of constructing the wharf. In 1812, Henry Stouffer advertised for proposals to build a wharf south of Pratt Street. In what appeared to have been an afterthought, Stouffer advertised on
the back of the page for "filling in the above described wharf with mud or durt to the same hight" as well as for the filling up of various old docks (Baltimore City Archives 1812). Apparently, the timberwork and the filling or earthwork were seen as separate jobs.

Since wharfbuilders were basically skilled carpenters, they were not expected to haul dirt to fill the wharf cribs. Their time was too expensive to expend on tasks which unskilled laborers could accomplish more economically. This job distinction was made clear by Joseph Jeffers in his 1811 proposal to repair Bowley's wharf. Jeffers proposed to pay for "taking off the old logs & getting out the iron bolts, and leveling the foundation ready to lay on the new logs." The city commissioners were responsible for providing laborers "for digging out the trenches for laying ties and back logs & fill them up when the ties are put in" (Baltimore City Archives 1811a). Eighteen years later Mr. D. Hanesworth proposed to "execute all the wood work" for another wharf very near Bowley's wharf (Baltimore City Archives 1829). It seemed that these wharfbuilders were acutely aware of what was their job and what was not.

Since construction of the wharf and the subsequent filling of it were considered separate jobs, one might expect that the specifications for the fill would not be included with the specifications for the timber portion. Nevertheless, some surviving documents do indicate the nature of the material required for the filling of individual wharves. The 1773 specifications for Jamieson's wharf in Virginia called for the large crib at the outer end of the structure to be filled "mostly with stone not above three foot thick of
Wood in it" and the other cribs of the wharf to be filled with wood and mud (Wilson 1980:21). Additionally, a District of Columbia wharf of 1762 was specified to be filled with stone to within two feet of the top and the remainder to be one foot of clay or dirt and one foot of gravel (Figure 10).

It is noteworthy that in the two known examples which specified type of fill both listed stone as the primary material. It is likely that stone was harder to obtain or more expensive than wood or earth. Also, if stone was to be required in the filling of the wharf, it may have been necessary to advertise this fact from the start in order to prevent partial submersion of the timbers with other materials. Of equal likelihood is that the wharf builder was bidding a wharf as a general contractor and subcontracting the carpentry and earthmoving jobs to other persons. Although no definite evidence for this has been found in the cases discussed, it would account for the joint specification of timberwork and fillwork.

Stone, mud, and gravel seemed to have been standard filling for wharves. The late-eighteenth century Derby wharf in Salem, Massachusetts was repaired in 1824, and the contract included the shovelling up of the "gravel mud and stones" for the removal of "all the old timber belonging to the said cob" (Wilson 1980:23). In 1814 an ordinance was passed in Baltimore that empowered the Port Wardens to contract with property owners in the low-lying Cove area of the city to "fill up their respective lots with the mud of the basin" (Baltimore City Archives 1814a). Ten years earlier the City of Baltimore filled the cribs of a wharf
Figure 10. Detail of the 1717 Burgis View of New York City showing a crib quay with what appears to be cobble fill or paving. (Geismar 1985).
constructed by Archibald Shaw by procuring "Ballast and other filling for the said wharf which . . . filled it to the waters [sic] edge at Common Tides." At the same time the city purchased "8 yellow pine logs to assist in topping of the loging [sic]" of the same wharf (Maryland Historical Society 1804).

**Topping the Wharf**

The topping of the wharf cribbing was one of the most important aspects of the wharf in that it was the part that was visible above the waterline. The logs comprising this portion of the wharf were often more carefully finished than the lower logs. Henry Stouffer made the distinction between the topping and the lower wharf clear in the specifications for his wharf in Baltimore in 1812. Stouffer carefully stipulated that the wharf was to be constructed with logs hewn on the upper and lower surfaces underwater (so as to hold the mud filling better) and logs hewn on the upper, lower, and front surfaces above the water (Baltimore City Archives 1812). This hewing of the logs on the front surface was necessary only to create a more finished, flat surface above the water line to present to the public.

Attempts to add eye-appeal of the topping of a wharf were ironically ill-fated since these uppermost logs were most susceptible to rapid decay. In the 1791 condition report of the wharves of Baltimore, all but a few of these wharves needed some repair to the topmost logs. In most cases the logs were no longer adequately retaining their filling, but in more severe cases the logs were "out of
place" or were in need of being "raised one log higher" (Baltimore City Archives 1791). As most of the city's wharves were in this stage of disrepair, it is not unlikely that dilapidation was normal for Baltimore's wharves. Insufficient height of logging caused earth to wash over the top logs and fill the docking slips to the point of being almost unusable without constant dredging. In at least one case in Baltimore the absence or poor condition of the topmost logs of a wharf ended in a fatality. Early one evening in February of 1803, after a "great fog in the atmosphere" had covered the city, a porter employed by Peters and Johnson's brewery was found in the basin with his horse and dray. It was supposed that he lost his way, drove over the end of Bowly's wharf, and was drowned (Griffith 1824:177). Had sufficient logging been in place, this accident might have been averted.

**SUMMARY:**

Much information has been gleaned from late-eighteenth and early-nineteenth-century documents concerning the wharves of that period in Baltimore. This data indicates that the majority of those wharves were composed of timber cribs filled with earth and mud. Documentary evidence also suggested that Baltimore wharfbuilders were originally carpenters but that by 1800, specialized wharfbuilders increased in numbers. Documentation also allows us to reconstruct the sequence of stages in crib-wharf construction. The several stages of building a crib wharf are all jobs which would have been appropriate to a carpenter with the possible exception of hauling dirt for the filling. There is evidence that this
task was probably subcontracted to other individuals. A clearer view of the process of building a crib wharf is presented in Chapter III by following the structural development of Cheapside wharf in Baltimore.
CHAPTER III

CHEAPSIDE WHarf: HISTORY AND ARCHAEOLOGY

Tracing the evolution of a single wharf in Baltimore helps to reveal the purpose and thinking of the developers of waterfront property in the city. Results from archaeological research on the wharf supports inferences made in Chapter II about the methods of wharf construction used in Baltimore during the late-eighteenth century. However, before a description of the development of this wharf is begun, a brief synopsis of the development of Baltimore will provide a useful framework within which to place our wharf.

HISTORY

Baltimore

The early history of Baltimore is unremarkable and relatively uneventful. Five ships ventured up the Patapsco River in 1723 to take on cargo bound for England. Only one of these ships was said to have braved the shoals of the Northwest Branch to land at the small settlement on Cole's Harbor at the head of the tributary. It was here that a survey of 1726 recorded but three dwellings, a mill, tobacco-houses, and orchards on land which was about half cleared and of "middling quality" (Scharf 1874:18).
"Cole's Harbor," later resurveyed as "Todd's Range," was the site selected in 1729 to become Baltimore Town.

Business was slow for the first 18 years of Baltimore's existence with one ship per year taking on freight for England. In addition, it was not unusual for a vessel to be delayed in departure for two or three months while a cargo was assembled. However, seven ships cleared the Basin at Baltimore Town in 1747 and more than twice that number were reported the following year (Scharf 1874:37).

Beginning with the exportation of wheat in the late 1740s, Baltimore's contact with profitable and growing markets transformed the village and its relationship with its hinterland (Browne 1980:4). By about 1750, a road had been constructed between Baltimore and Frederick, providing an artery through the heart of the wheat country on which to move the grain to port. Wagonloads of wheat, flour, and bread rolled into Baltimore causing the town's export trade to rise sharply. Four markets received exports from Baltimore Town: the West Indies, southern Europe, the Atlantic seaboard and, of course, the British Isles (Steffen 1984:7). By the mid-eighteenth century, European demand had so stimulated the plantation and slave-labor system of the West Indies islands to specialize in high-priced, easily marketed crops as sugar, cocoa, tobacco, coffee, and rice that the islanders were forced to look elsewhere for supplies of food and other commodities not abundant in the islands (Browne 1980:4). Because the nearest British colonies to the sugar islands were in
North America, and because Baltimore was closer than its major competitors (i.e. Philadelphia and New York), the town captured a large portion of the market. Baltimore received sugar, rum, molasses, cotton, cocoa, and coffee from the Caribbean in exchange for its three main staples: wheat, iron, and lumber (Steffen 1984:7).

After 1750, warfare and poor harvests created a large demand for grain in the cities and towns around the Mediterranean, and, not unexpectedly, Baltimore's flour merchants were more than willing to accommodate. The balance of this trade swung heavily in Baltimore's favor as the town imported little more than salt and wine from southern Europe. At this same time, New England farmers were having trouble producing adequate amounts from their rocky soil and short growing season to sustain their ever-increasing number of townspeople. They also turned to Baltimore for help. Baltimore imported oil, fish, molasses, and rum from Massachusetts and pork and naval supplies from other important coastal markets in Virginia and the Carolinas. Shrewd merchants were able to accumulate enough profits in their dealings with the West Indies, southern Europe, and the Atlantic seaboard to finance their imports of cotton cloth and East Indian silk from the British Isles (Steffen 1984:8).

The production and shipping of grain and iron created a complex series of exchanges that led to the development of a mercantile class (Brooks and Rockel 1979:32). The merchants in Baltimore demanded the docking and storage space for overseas shipments that only wharves could provide. During the Revolutionary War, Baltimore served as the central shipping depot
for the French forces in America and emerged from the war as the third largest city in the new nation. A marked increase in the development of waterfront properties following the war signalled Baltimore's acceptance of its new role as a major urban port.

With the increase in wharf construction came the legal and technical concerns of "made land." The Assembly of Maryland answered the question of ownership in 1745 when it enacted that "all improvements, of what kind soever, either wharf, houses, or other buildings, that have or shall be made out of the water, or where it usually flows, shall be forever deemed the right, title, and inheritance of such improvers . . . forever" (Scharf 1874:35). This provision was probably enacted as an incentive to wharf construction, but the Assembly did not choose to address matters concerning the maintenance of public roads on or the dredging of docks adjacent to the wharves.

By 1783 the post-war explosion of wharf construction and landfilling in the town impelled the Maryland Assembly to appoint a Board of Port Wardens for Baltimore. The Assembly appointed nine men to this board and authorized them to make a survey and chart of the basin, harbor, and Patapsco River. They were to ascertain the depth and course of the channel, provide for its clearing, dredging, and other maintenance. To defray expenses incurred by the Port Wardens, a tariff of one penny per ton was imposed on vessels entering or clearing the port. This sum was raised to two cents, and sanctioned by Congress, after the adoption of the Constitution in 1787. The Port Wardens were additionally authorized to make rules
regarding wharves and wharfage, and oversee the proper maintenance of the wharves and docks (Scharf 1874:207). In an effort to preserve the shrinking harbor basin, they established a "line of limitation" beyond which no wharves could be extended into the harbor.

In 1797, a few months after Baltimore was incorporated as a city, the city council passed an ordinance "to preserve the navigation of the harbor of Baltimore" in which they provided for the exercise of the powers previously vested in the Port Wardens. A new chart was authorized and the "line of limitation" was upheld. A Harbor Master was appointed to maintain an ease of navigation in the harbor by overseeing the mooring and stationing of vessels, and to collect wharfages and fines. Owners of private wharves were ordered to keep them in good repair, to facilitate navigation in harbor waters (Baltimore 1798:95-102).

Cheapside Wharf

It was during the post-war expansion of Baltimore's waterfront that Cheapside wharf was built from an earlier quay called "Harrison's Dock." Thomas Harrison, the owner of this dock, was a gentleman merchant and land speculator who had arrived in Baltimore from England 40 years earlier, in 1742, and had built a house and begun to purchase waterfront property. Within three years he had been named one of the town commissioners (Scharf 1874:34).
In 1754, Harrison leased, from Charles Carroll of Annapolis, Lot 49, the first one-acre parcel in Baltimore Town taken up 15 years earlier by Carroll. Carroll had leased a corner of this lot soon after it was taken up so a tenant's house could be built to satisfy the housing requirement imposed by the legislature. A sketch of Baltimore Town, drawn in 1752, suggested that the remainder of the lot was probably left undeveloped. This sketch also showed that one small wharf existed in this neighborhood, located at the end of Calvert Street, adjacent to the southwest corner of Lot 49. In other words, Harrison leased the lot from Carroll in 1754, the waterfront was undeveloped and a narrow lane called Water Street crossed its lower end and ran parallel with the shoreline. Sometime between 1754 and 1773, Harrison extended the lot into the basin 80 feet on the west side and 35 feet on the east side to form a quay from which he could load and unload cargos of seagoing vessels. Water Street, the narrow lane which crossed the lot and had been established very early in the development of the town, was widened and straightened during this episode of wharfing.

In 1773, after leasing the lot for about 19 years, Harrison bought the lot from Carroll for the sum of £200 sterling. In the next six-and-a-half years, he sub-divided the lot and leased portions of it to shopkeepers, mariners, joiners, plasterers, and merchants with the stipulation that each lessor had to build a "good and sufficient 2-storey brick house" on the front of his parcel of ground within two years or pay a substantial rent penalty. The last section of Lot 49 was leased in August of 1779.
For almost two years no further land transaction were recorded for Lot 49. However, by the end of May 1781, additional wharfing had been added to the west side of the lot, adjacent to the county wharf. At that time, Harrison leased Thomas Hollingsworth, merchant, a 32 by 30-foot lot that bordered on the south side of Harrison's quay and on the west side of a "canal." Harrison required Hollingsworth to construct a house within three years and charged him with the responsibility for keeping the dock cleared out to the middle to a depth of at least three feet at low water opposite Hollingsworth's lot. Harrison retained a personal right-of-way to his wharf at the head of the dock (Baltimore County 1781). This lot was later extended several hundred feet into the basin and became known as "Hollingsworth's wharf" (Figure 11).

The history of Hollingsworth's wharf has not been fully researched; however early-nineteenth-century maps indicate that a parcel of it was a portion of Harrison's quay. Early maps also show that a portion of the east bulkhead of this wharf near the head of the dock was out of line with the rest of the wharf (Figure 12). If this was a part of Harrison's original quay, the logs which comprised the east bulkhead, having been laid earlier than the rest of the wharf and possibly by a different wharf builder, may have become untied and pushed outward into the dock by the force of the earth behind them.

Later that year (1781), Harrison sold an additional portion of his quay to another merchant, Christopher Hughes. This lot was 30-feet square and bordered on a 20-foot wide street (later known
Figure 11. 1786 Plat of Baltimore waterfront (Maryland Hall or Records). Hollingsworth's wharf was later extended further into the basin and the docking slip adjacent to it on the west was filled to extend County wharf. Hutchings' wharf, originally located between Cheapside and Bowly & Ridgely's wharf, was absorbed into these two wharves as their construction caused it to become "landlocked."
as "Dock Row") which Harrison had laid out running north-south across the quay. In September 1782, Harrison leased another quay lot to yet another merchant, William Stayton. This lot was situated south of the one let the previous year to Christopher Hughes. From the description in the deed, this lot extended a short distance beyond the edge of the quay into the dock. The most noticeable difference between the lease of this lot and any of the other lots Harrison had let up to this time were stipulations imposed. Not only was Stayton required to build the requisite two-story brick house on the lot, but Harrison insisted that Stayton at his own cost and charge at all times hereafter clean out and keep the river or dock open opposite the southwest corner of the aforementioned lot on the west side thereof (allowing twenty feet for the street [Dock Row] running through the same opposite the said wharf which is always to be kept open and used in common as a public street for passing and repassing and all kinds of communication as a highway) for the remaining space of ten feet opposite the said dock and parallel with the said lot on the southwest corner thereof to the middle or center of the dock and 3 feet deep at low tide... [There was a penalty of £5 per month for noncompliance] (Baltimore County 1782:302).

While these demands were not unusual for Harrison or other property owners in Baltimore, the care that went into the wording of the rights and expectations of each of the parties involved revealed Harrison's intention to develop his quay out into the basin. Between Mr. Harrison and Mr. Stayton it was expressly agreed that the sd Thomas Harrison... shall not at any time hereafter erect any other building on the said wharf
The dock in front of Lot 49 was by no means Thomas Harrison's only real estate interest. He was especially busy at this time selling lots in the filled marsh land he had acquired east of town. A notice of October 8, 1782 in the Maryland Journal and Baltimore Advertiser listed some of his properties:

Balto. In a week, or ten days, will be offered on lease, a number of Lots, between Gay Street, or the Upper Bridge and Baltimore Street, or the Middle Bridge, about 30 of which are on Navigable water for Scows, on Jone's Falls. For further particulars, inquire of Thomas Harrison. October 5, 1782, Baltimore (Maryland Journal 1782a).

One week later the same newspaper carried a one line obituary: "Last Night died, near this town, in an advanced age, Thomas Harrison, Esq." (Maryland Journal 1782b). Harrison's last will and testament left a large and complex estate in the hands of three executors: William West, Daniel Bowly, and Richard Ridgely. Within a month, these gentlemen were advertising for sale the same lots on the Jones Falls (Maryland Journal 1782c), and by December
they were auctioning both of Harrison's plantations outside of town (Maryland Journal 1782d). In the first week of January 1783, Harrison's executors offered for sale at auction "a number of Valuable Lots of Ground fronting on South and Water Streets, and on the Canal and County Wharf . . . " (Maryland Journal 1783).

Apparently "the Canal" referred to the docking space in front of Harrison's quay. The deed of the first lot sold on the wharf gives a similar reference describing the property as "beginning at 210 feet from the south side of water street bounding on a canal . . . " (Baltimore County 1783a). Richard Lemmon, George Prestman, and George Evans, three Baltimore merchants, bought the end lot of a wharf extension which had been added to the southern end of William Stayton's lot on Harrison's quay. These gentlemen were required to "at their own proper cost and charge, clean our and keep the river or dock open opposite the said lott (be it extended hereafter more or less into the water) on the west side thereof, to the middle or center of the dock, three feet deep . . . " Likewise they were required to leave open a 20-foot wide alley or street bounding on the canal. This street [Dock Row] had been laid out by Harrison and was first mentioned in conjunction with the lot leased to William Stayton the previous year. However, in return for accepting the burden of these stipulations, Lemmon, Prestman, and Evans were granted the privilege of extending the lot south into the water for their own use and benefit (Baltimore County 1783a).

The lot which was sold to Lemmon, Prestman, and Evans on January 4th of 1783 was situated on a wharf which had been
extended 190 feet from William Stayton's lot into the Basin. The extension was begun by Thomas Harrison by late September 1782 when he leased a waterfront lot to William Stayton (Baltimore County 1782). The careful wording of the lease to Stayton preserved Harrison's rights to extend the lot into the water and the absence of a reference, in the lease, to water on the south side of the lot indicated that Harrison had already begun wharfing out. Whether the wharf was finished by the time Harrison died in October 1782 is not known, but it is not likely since no lots on it were advertised for sale. It is also unlikely that Harrison's executors commissioned the extension of the wharf since they demonstrated no interest in retaining the right of future extensions when they sold the end lot to Lemmon, Prestman, and Evans in 1783.

Richard Lemmon, George Prestman, and George Evans, all craftsmen turned merchant, paid dearly for the wharfing rights on the end of Harrison's wharf extension, agreeing to pay more than three times the going rate per square foot. They then made plans to extend their lot 200 feet further into the Basin and to sell the lots to compensate their expenses. All of the materials were gathered for the wharf extension and construction was ready to commence when, on the last day of May in that year (1783), the Maryland Legislature appointed a board of Port Wardens and charged them with the review and approval of any and all wharf construction in the Baltimore harbor. Lemmon, Prestman, and Evans filed the proper petitions with the Wardens and waited several weeks for approval. After delaying for several weeks, and with only verbal permission,
the three merchants proceeded with the construction of their crib wharf and, by mid-August, sunk it in place.

Sinking the wharf without written permission generated criticism and the owners postponed filling it until they could obtain this permission. In an effort to allay charges of contempt and avoid possible reprisals from the wardens, Lemmon, Prestman, and Evans addressed the following apology to the "Honourable Board":

It is supposed by some that we have exceeded our Orders if we have it is done through Ignorance not design, and are sorry to be supposed transgressors. It is our desire to comply with every reasonable direction from your board. We hope your honourable Board will take our case into consideration and permit us to finish our wharf as it now stands, & your petitioners will ever acknowledge the favour (Baltimore City Archives 1783).

The Port Wardens must have accepted the apology of the "supposed transgressors" because the wharf was completed and plans were immediately undertaken to extend it another 170 feet. Filling of the 200-foot extension may have even been ongoing while the 170-foot extension was under construction, or the installation of the top logs and final filling of the 200-foot wharf extension may have been delayed since the first lots were not sold on this portion of the wharf until April of the following year. The sale of these lots was possibly delayed because this portion of the wharf was used as a staging area for the construction of the subsequent extension of 170 feet. West, Bowly, and Ridgely, Harrison's executors of the original extension (north end) of the wharf, also sold no lots on the wharf until after all extensions were completed. It was likely that they struck a deal
with Lemmon, Prestman, and Evans to retain this portion of the
wharf open for the storage of materials and/or the actual joining of
cribwork until the work was done.

The winter of 1783-1784 was unusually severe. The
Chesapeake Bay was closed by ice almost to its mouth. The Baltimore
harbor, which was closed on the second of January was not clear to
admit vessels until March 25, and only then with great labor
expended in cutting passages (Griffith 1824). The cold weather and
the ice in the harbor undoubtedly slowed wharf construction
permitting only the assembly of those portions which could be joined
on land. If the builder was using the 200-foot extension of the
previous year to stage this construction, he must have launched the
new extension as soon as weather permitted, possibly in early March.
By April 12, 1784, when the first of the lots on the 200-foot
extension was sold to Amos Underhill of New York, George Evans had
already erected a warehouse on the center lot of this extension
(Baltimore County 1784a). However, if the wharfbuilder was using
the presumably vacant lots owned by Thomas Harrison's estate on
the north end of the wharf as a staging area, which the presence of
Evan's warehouse by April suggests, then construction of the 170-
foot wharf extension could have been postponed until warmer
weather later in the spring. In either case, the wharf had evidently
been launched into the water by mid-April when Bowly, Ridgely, and
West, in a single day, sold all the lots on the wharf belonging to the
estate of Thomas Harrison.
The 170-foot extension of the wharf in 1784, like the previous extensions, was of crib construction. It was constructed during the spring and summer of the year; topping and filling was completed by the end of September. In early October Lemmon, Prestman, and Evans divided the unsold lots on the wharf between themselves and the formation and initial distribution of land on this wharf was complete.

This new wharf suffered an identity crisis for a few years. It was traditional to refer to a wharf by the name of the owner, as in Smith's wharf, Buchanan's wharf, and even County wharf. However, since Thomas Harrison had begun the wharf, West, Bowly, and Ridgely had sold portions of it, and Lemmon, Prestman, and Evans had extended it twice, the assignment of a name to the wharf could not follow the usual course. Some continued to refer to it as "Harrison's Dock" as was evinced by Christopher Hughes advertisement for a lost cow in April of 1784:

One Guinea Reward. A large Red Cow, big with calf and in good order strayed away from the subscriber about 4 days ago. Whoever returns her to me, living opposite to Harrison's Dock, near the County Wharf, or gives me info where she may be found, shall receive the above reward (Maryland Journal 1784b).

However, not everyone followed Hughes' example. The best evidence for early identification of the wharf came from one of the wharf's developers. By early spring of 1784, Richard Lemmon had situated a store on the 200-foot extension of the wharf, just north of George
Evan's warehouse. On the second of April in that year, he placed the following advertisement in the newspaper:

Just imported, in the "Lively Lass" from Barbados, And now selling for ready money only by Mark Allen, at Mr Richard Lemmon's new store, fronting the Dock, near the County Wharf, Some good old Spirits, in Barrels and West India Cotton. A small box of fashionable Buckles and Buttons etc to be disposed of (Maryland Journal 1784a).

Mr. Lemmon referred to his store not by the name of the wharf, but by the name of the dock associated with it, which had come to be called simply "the Dock." References to properties on this wharf were probably made in this fashion for at least a few years before a name was settled upon. In February, 1788, West, Bowly, and Ridgely sold to William Stayton the lot he had formerly leased of Thomas Harrison. In the record of this transaction the lot was described as being "on the east side of a Dock or canal left by Thomas Harrison" and binding on Dock Row "now called Cheapside" (Baltimore County 1788). The 20-foot-wide lane which was required to be left open along the entire length of the wharf had come to be known by the name "Dock Row," being the row or lane along "the Dock," and by early 1788 had acquired the appellation of "Cheapside."

This name was easily traced to London where Cheapside was a district and a street running from Saint Paul's churchyard to the Bank of England. It was an important and famous market center of medieval London (Seltzer 1952:379). From the thirteenth century onwards shops were the dominant feature of London's Cheapside and other nearby streets and a good deal of trading, especially in
foodstuffs, took place in the street (Keene 1985:12). The mercantile activity along the new wharf in Baltimore was reminiscent of its namesake. Before the close of the eighteenth century, Baltimore's Cheapside was the location of numerous shops for merchants such as a saddler, a currier, a windsor chair maker, tobacco manufacturers, ship chandlers, paint sellers, an innkeeper, and at least three grocers (Thompson and Walker 1796).

Business was good on the wharf despite the rapid decline of the structure itself. By 1791, a commissioner appointed by the Port Wardens recorded that

The wharf called cheapside is very much filled upon the outside and wants to be raised at least one log higher opposite to the store occupied by Aquella Johns and from thence to the head and at the head or north end it is filled up on the outside of the dock to the third log and the logs on the west side of cheapside Dock are very much out of repair the logs being out of place and some of them appear to be Removed (Baltimore City Archives 1791).

Cheapside was not immune to the almost immediate onset of decay which plagued wooden wharves. The need for additional top logs and the displacement of logs from the cribbing of Hollingsworth's wharf "on the west side of cheapside Dock" permitted soil to wash into the dock and caused it to become "very much filled." This problem was not uncommon, especially among Baltimore's older docks. The Calvert Street dock, immediately to the west of Cheapside dock, suffered greatly from silt washing in from County wharf, which had been constructed before 1752. In July of 1797, in their first
year, the Mayor and City Council of Baltimore approved an ordinance "to fill up Calvert street dock, not more than seventy-five feet nor less than sixty feet from its northern extremity. . . to remove the nuisance caused thereby." In order to accomplish this filling, the City Commissioners were authorized to receive loans from property owners adjacent to the dock which the city would pay back in two years (Baltimore City Archives 1797b).

Early-nineteenth-century maps indicate that this filling was performed and the unhealthy "nuisance" which had accumulated in the dock in the form of garbage, sewage, and stagnant water was buried. Nevertheless, siltation remained a problem at the County Wharf, which, in its filled configuration, was located at the mouth of the Cheapside docking slip (Figure 12). In 1811 a group of concerned citizens "respectfully informed" the city's Commissioner of Health that "the dock, commonly called County Wharf, is in such a state of nuisance as may, if not shortly removed, endanger the Health of the City" and requested that it be removed as soon as possible (Baltimore City Archives 1811c).

If conditions were improved, it was temporary for the state of "nuisance" reappeared three years later. In 1814 the Board of Health for the City of Baltimore judged that the Calvert Street dock "at the head thereof, is in a state of nuisance & ought to be removed." To this end they requested that the Board of Port Wardens "have the same deepened and cleaned as soon as convenience will permit, that is to say as much as may be found necessary to remove the nuisance therein of that part claimed by the city" (Baltimore City Archives
Figure 12. 1818 Plan of the opening and extension of Pratt Street in Baltimore. (Baltimore Department of Records and Survey). Note the bulge in the wall of old Hollingsworth's wharf (between Calvert Street and Cheapside Dock). Harrison's quay was originally situated at the head of Cheapside Dock. The first extension of Cheapside took it through Lot 13; the second extension through Lot 23, and the third extension, to the end. Lot "No. 2" at the corner of Water Street and Franklin Lane shows a vestige of Hutchings' wharf.
A third appeal was made to the city in 1818 to once again remove "the present situation of Calvert Street dock" which threatened to endanger the health of citizens in the neighborhood (Baltimore City Archives 1818a).

On January 29, 1818, the Maryland Legislature passed a bill authorizing laying out and extending Pratt Street across the mouths of the docks associated with Cheapside, Calvert Street, Hollingsworth's and Ellicott's wharves in order to complete the last span of a major crosstown thoroughfare. The filling of these docks and the extension of Pratt Street had been proposed at least once before, in 1811 (Maryland 1818).

With the passage of this bill in January of 1818, the City of Baltimore began to survey the impact area and to assess the damages of the neighboring property owners. By mid-December bids were being accepted for filling the docks with earth; the proposed prices ranged from 30 to 55 cents per cubic yard, depending on how far the dirt had to be hauled in carts (Baltimore City Archives 1818b, 1818c, 1818d).

A little over a month later Cheapside Dock had been filled and the owners and residents of houses in the vicinity of the dock complained to the Mayor and City Council that "the Cellars which were heretofore dry and of great use, and advantage, have since the filling up of the said dock, become partially filled with water, and of course rendered useless, also to endanger our health." To afford some relief from this unforeseen predicament, these owners and
residents petitioned that "one general sewer" be made "in the place now to be occupied as a street, heretofore the dock" (Baltimore City Archives 1819a).

Three years passed before Cheapside Street was given further attention by the city, possibly to allow sufficient time for the fill to settle in the old dock area. In February of 1822 a resolution was passed to grade Cheapside street suitable for paving and the following month a resolution was passed to carry out the paving (Baltimore City Archives 1822a, 1822b). Two years later the state legislature provided means to widen Cheapside Street by incorporating the private land which had been Dock Row on Cheapside Wharf (Maryland 1828:33). Apparently the grading and paving resolutions of 1822 were never carried out or were inadequate. On March 19, 1824, an ordinance was approved which authorized the grading and paving of all of Cheapside Street, including the portion which had just been added by the state legislature (Baltimore City Archives 1824).

The evolution of Cheapside wharf and dock from open water to warehouses and paved street took slightly more than 40 years. While documents provided a sketchy view of the development of Cheapside wharf and the subsequent filling of its dock, more detailed information was obtained through the archaeological excavation of a portion of the wharf and dock.
ARCHAEOLOGY

In July of 1983, the Rouse Company and the City of Baltimore announced plans to construct a 22-story hotel/office/retail/parking complex on Baltimore's "Magic Corner" at the Inner Harbor. The 120 million dollar structure was to fill the parking-lot block bounded by South Calvert, Pratt, Lombard, and South streets (Figure 3). Research was carried out by the Baltimore Center for Urban Archaeology (BCUA) to determine the significance of the archaeological remains which would be destroyed during construction. This research revealed the potential presence of undisturbed remains of a large section of Baltimore's eighteenth century waterfront beneath the parking lot. Historic maps indicated that no fewer than six of Baltimore's old wharves would be impacted by the Rouse construction: County wharf, Hollingsworth's wharf, Cheapside wharf, Hutchings' wharf, Harrison's dock, and Bowly's wharf.

The need for archaeological investigation of an early wharf and waterfront community was obvious. The Rouse Company and the BCUA agreed that an attempt should be made to recover some of the endangered archaeological data and James Rouse pledged cooperation and generous financial support. Matching funds were provided by a grant from the Maryland Humanities Council to subsidize a large-scale public education and awareness program in archaeology at the site. Arrangements were made with the general contractor to give the BCUA access to a 100-foot by 200-foot portion of the job site on which they would be permitted to conduct an
archaeological investigation. Excavation was permitted for 33 days and took place from November 14 through December 16, 1984.

The area chosen for archaeological investigation was positioned so it would expose a portion of Cheapside wharf and the docking slip adjacent to it. This location was selected to permit recovery of information pertinent to the dock, the wharf bulkhead and structural timbers, and the structures on the wharf. Removal of the macadam parking lot and the subsequent layers of overburden was implemented with a backhoe. The depth of this mechanical excavation ranged from six feet over the western side of the project area to two feet over the eastern portion of the site. Several distinct features emerged in this initial excavation. The timber wharf was still intact, running north-south, with the slip or canal to the west filled with heavy clay. To the east of the exposed wharf bulkhead was a 20-foot wide area, abutted on the west side by a series of stone foundations. This area was assumed to be old Dock Row and the foundations were regarded initially as the remains of warehouses, although their age was not known.

The presence of concrete footings beneath these foundations and the use of portland-type cement in the mortar indicated that these structures were built after circa 1860. Artifacts in a heavily burned layer on top of the brick flooring for the structure associated with these foundations suggested that these buildings may have been among those consumed in the Baltimore fire of 1904. The brick floors and the foundations of the late-nineteenth-century warehouses were removed with a backhoe and earlier stone
foundations were found beneath them. At the same time, archaeologists exposed structural timbers associated with the wharf buried in the fill directly beneath the early foundations. The site revealed five major area or features which were studied by the archaeologists: 1) the timber wharf, 2) the wharf-related structural timbers beneath the road and foundations, 3) the early foundations and the spaces they enclosed, 4) the eighteenth-century roadway called Dock Row, and 5) the filled slip or canal. The information recovered from each of these areas concurred extensively with and supplemented the documentary record. The findings which related to the wharf structure and the adjacent docking area are discussed here.

Timber Wharf

The portion of Cheapside wharf which was unearthed by archaeologists late in 1984 was of crib construction, which corresponded to information in the eighteenth and early-nineteenth-century documents that referred to wharves in Baltimore. The end of a large crib was discovered in a location which corresponds to the projected location for the end of the 1783 extension of 200 feet constructed under the ownership of Lemmon, Prestman, and Evans. The disposition of the warehouse remains later found on the wharf confirmed this assumption as warehouse sizes matched lot dimensions recorded in deeds and tax records. The portions of the logging exposed by this excavation were the "topping" of the wharf (Appendix B). Approximately 105 feet were exposed along the west
bulkhead of the wharf which had four topping logs for the first 50 feet of its extent as measured northward from the end of the crib. Beyond this the logs were badly decayed; there was evidence for at least five topping logs in the northern half of the exposed west bulkhead (although the decay made it difficult to discern whether these logs were as carefully finished as their southern counterparts). The topping logs, for the most part, were hewn flat on four sides (Figure 13) and, like all of the other horizontal members of the wharf, were identified as a variety of short-leaf, southern yellow pine (possibly *Pinus echinata*) (Lamb 1985, Sliker 1985). The anchor-piles (Figure 14) which braced the exterior of the wharf topping were identified as species of the white oak group (*Quercus* sp.) (Lamb 1985, Quirk 1985).

The topping logs, which varied in length from 13 feet to 50 feet, were spliced together with half lap joints which were secured with a wrought-iron pin through them (Figure 15; Appendix B). The corners of the topping were joined with interlocking lap joints and also secured with a wrought-iron pin which was driven into a hole drilled vertically through the joint (Figure 16; Appendix B). The topping logs which comprised the south end and east side of the crib extension were not square-hewn like their counterparts on the west side of the wharf, perhaps because these logs would not be seen after the completion of the construction. This assumption permits a couple of inferences regarding the intentions of the eighteenth-century owners of this wharf and the neighboring wharf. Because the logs on the end of the 200-foot wharf extension of 1783 were not squared or
Figure 13. Detail of west bulkhead — Cheapside wharf  (Note square-hewn topping logs).  (Courtesy of the Baltimore Center for Urban Archaeology).
Figure 14. Southward view of west bulkhead of Cheapside wharf. Oak anchor piles assist in supporting the weight of the topping. (Courtesy of the Baltimore Center for Urban Archaeology).
Figure 15. Detail of the west bulkhead of Cheapside wharf showing lap joint. (Courtesy of the Baltimore Center for Urban Archaeology).
Figure 16. Detail of the southeast corner of the second crib extension of Cheapside wharf. (Courtesy of the Baltimore Center for Urban Archaeology).
otherwise finished as the logs facing the dock were, it was likely that Lemmon, Prestman, and Evans had made the decision to extend the wharf further before this section was completed, and saved on labor costs by not spending the time to finish the logs. If this were not the case, the logs on the end of this section of cribbing should have been finished for the same aesthetic reasons as the logs facing the slip. Similarly, the logs on the east side of the wharf extension were not squared indicating that they were not to be exposed to view. This was probably due to concurrent wharfing which was taking place east of Cheapside.

James Hutchings, a merchant from Queen Anne's county, Maryland, had purchased the water lot on the southwest corner of lot 52, which adjoined the east side of "Harrison's Dock" (Baltimore County 1777). By 1780 he had constructed a wharf, 45 feet in width, which extended south into the basin and could be approach by vessels from three sides. According to the 1780 Presbury map of Baltimore Town, on which the town's wharves were inked, Hutchings' wharf was approximately 100 feet in length (Reps 1972:288). In 1782, when Thomas Harrison presumably commissioned the extension of the first portion, against the west side of Hutchings' wharf, of what was to become Cheapside wharf, water access to Hutchings' wharf was reduced to approaches from the south end and the east side. In 1783, while Lemmon, Prestman, and Evans were extending Harrison's wharf an additional 200 feet (and more) into the harbor, Daniel Bowly and Richard Ridgely were likewise constructing a wharf out from their property into the harbor which
adjoined the east side of Hutchings' wharf. This reduced the docking space of Hutchings' wharf to approximately 45 feet located at the end of a narrow slip. It appeared that Hutchings then extended his wharf south into the basin by simply filling the slip created by the construction of Cheapside wharf and Bowly and Ridgely's wharf. Essentially Hutchings was able to extend his wharf the same distance as his neighbors for little more than the cost of the dirt.

The absence of evidence for cribbing beyond the east bulkhead of Cheapside wharf supports the above supposition. Likewise, some of the presumed eighteenth-century warehouse foundations on Cheapside wharf extended slightly past the east bulkhead of the wharf and onto what contemporaneous deeds called "Hutchings' Lott" (e.g., Baltimore County 1783b, 1784b). This indicated that Hutchings was filling his wharf very soon after the completion of the Cheapside work, before warehouse construction had begun on Cheapside and even before some of the lots were sold. The fact that the logs on the east side of Cheapside wharf were not squared like the logs on the west side reflected an acknowledgement of Hutchings' intent on the part of Lemmon, Prestman, and Evans.

The round logs on the east side and south end of the 200-foot 1783 extension of Cheapside wharf were the same type and shape as those used below the squared topping logs in the west bulkhead of the wharf (Figure 17). These logs were flattened only on the surfaces which would serve as top and bottom in order to create a closer joint to slow the escape of the wharf fill. The logs in this portion of the wharf were joined with the same type of half lap joints
Figure 17. Rounded logs in the end of the 200-foot extension of Cheapside wharf. The lack of squaring indicates these logs were not intended to be seen after construction. (Courtesy of the Baltimore Center for Urban Archaeology).
that were utilized in the upper portion. The overall depth (or height) of the wharf crib was not ascertained. However, monitoring of a deep test which was excavated with a backhoe at the outset of the excavation exposed wharf timbers at depths up to 15 feet from the top of the timberwork. Borings which were performed in the vicinity by geotechnical engineers revealed that the original harbor fill bottomed at approximately 10 to 12 feet below mean sea level (Balter 1984). If the wharf had been sunk to the base of the silt and mud which had accumulated on the bottom of the harbor, and the wharf rose several feet above the level of the water, crib depths of 15 feet and more would be reasonable.

The topping logs in the west bulkhead of the wharf crib studied did not rest directly on top of the lower logs for their entire length. Instead, the lower logs appeared to splay westward into the slip to such a degree that at the end of 75 feet north of the southwest corner of the crib a lateral displacement of approximately two-and-a-half feet was evident. The piles which were driven to support the topping logs were driven in this space so the topping logs were actually held in place by piles in the fill of the lower section of the crib (Figure 18).

There are a number of possible explanations for the fact that the lower logs in the west bulkhead were not aligned. The first, and least likely, of these explanations is that all the topping logs were replaced at some time because of deterioration. During this replacement, the old topping logs would have been removed down to the water line and built up. At that time the builders may have
Figure 18. Northward view of the west bulkhead of Cheapside wharf. Note the dislocation of the lower logs out into the slip. (Courtesy of the Baltimore Center for Urban Archaeology).
positioned piles on the inside of the crib wall against which to build the new topping for the crib. This is unlikely since the southwest corner of the crib showed no signs of having been altered from its original joining with the logs of the south end of the crib which were buried under fill and warehouses, and thus could not be replaced.

Nevertheless, repair work was undoubtedly carried out on Cheapside wharf. In 1791 the wharf was reported to need repair. The dock was "very much filled," and a recommendation was made that the wharf "be raised one log higher" (Baltimore City Archives 1791). Probably in response to this recommendation, work was undertaken to add an additional log to the height of the wharf. Evidence for this repair was apparent; the topmost log of the portion which was uncovered in 1984 did not form a part of the interlocking corner joint at the southwest corner of the crib. This indicated that this log was not part of the original wharf crib. Additionally, a wrought-iron docking ring which survived intact and remnants of several others were all positioned in the second log from the top of the wharf. As the pins securing these rings were two to three feet in length, it was likely that they were originally driven into the top log of the wharf.

A second explanation for the misalignment of the topping and lower logs in the west bulkhead of Cheapside wharf might be that the lower logs yielded to the lateral pressure of the wharf fill and bulged out into the dock. However, the staggered nature of the lap joints in the crib walls and the probable tying together of log courses with iron pins driven through the logs makes it unlikely that
such a bulge could occur without the failure of a substantial number of joints and pins. Even if enough of the joinery had given way to permit such a bulge in the bulkhead of the wharf, the involvement of only the lower logs of the wharf crib suggested that the topping logs were placed later and not tied to the lower logs. In light of this and an understanding of how wharves in Baltimore were constructed in the late-eighteenth century, a third possibility offered the most plausible explanation of the misalignment.

The third and most probable explanation traced the alignment failure of topping and lower logs to the construction phase of the wharf. It appeared that the crib in question (the total length of which is unknown) drifted slightly out of alignment during the sinking or "fixing" stage of construction of the wharf. (This may have been caused by improper filling of the crib as described below). Since this portion of the wharf was at or slightly below the waterline, the wharfbuilder was able to correct the alignment of the wharf in the topping logs without undertaking the impossible task of moving the sunken crib. The visible portion of the wharf appeared to be accurately aligned even though the underwater portion was slightly off. The piles which were placed to support the topping of the west bulkhead were driven into the fill of the lower cribbing. This suggested that the discrepancy in the alignment of the upper and lower cribwork was probably the result of the correction of a miscalculation on the part of the wharfbuilder.

The earth which was used to fill the cribs of Cheapside wharf represented a wide assortment of locally occurring sand, silt,
and clay, much of which was probably hauled in from nearby excavations or dredged out of the adjacent slip. A portion of this fill which was exposed in profile revealed that relatively small quantities of diverse soils were being deposited from the landward side. The several layers of soil which were obvious in the profile probably represented individual cartloads, or "tips," which, judging from their moderately large size, were likely to have been hauled in with horses.

The deposition of fill from the landward side of the crib was not a wise engineering practice. Greene (1917) warned against this procedure as it was likely to create a "mud wave" which could be detrimental to the structure of the wharf. This would occur whenever there was mud, as was common on the bottom of the harbor, which could move as a fluid behind a retaining structure such as crib walls. The filling of the structure would produce a wave or elevation of the surface of the mud. According to Greene,

Mud acts like any other fluid against a retaining structure except that it exerts a pressure greater than water. It has not angle of repose and therefore will exert a much greater pressure than earth or any similar non-fluid filling. If a filling is deposited on mud from the shore outwards toward a retaining wall it will push the mud wave ahead of it and increase the elevation of the mud pressing against the wall and may thus increase the pressure so much above that of the filling for which the wall is designed as to destroy the structure. This has happened in practice so frequently that the matter demands the greatest emphasis (Greene 1917:48).
The remedy, Greene went on to point out, was simply to deposit the filling from the wall toward the shore. In this way the mud would be driven away from the wall and the increasing pressure caused by the increasing height of the mud wave would be resisted by the increasing width of the bank of filling. Nevertheless, the added inconvenience and extra expense inherent in this precaution undoubtedly caused it to be neglected frequently.

The disalignment of the upper and lower log courses in the archaeologically investigated portion of Cheapside wharf may have been a result of mud-wave pressure. The lower cribbing of this portion appeared to have been made as a unit of at least 100 feet in length. If the filling of this crib proceeded from the shore, as was evidenced by archaeological analysis, then the mud wave created by this filling may have exerted enough lateral pressure to have forced the west wall of the crib outward into the slip.

An apparent attempt to avoid a similar occurrence was undertaken with the subsequent crib addition on the southern end of the wharf. This extension was anchored to the preceding crib with a single, diagonal corner tie (Figure 17; Appendix B). This tie was a yellow pine log, eight inches in diameter, which was mortised into the top log of the south end of the preceding crib and presumably extended to the west bulkhead wall.* This would have served well to resist the lateral force of an advancing mud wall and, in order to

* It was impossible to determine the full extent of this tie as a large portion of it was removed during construction in the late-nineteenth century.
make sure the tie held, the builder drove two trunnels (wooden pins) into the mortise to wedge the tenon into place (Figure 19). An additional precaution against the force of a mud wave was taken with the placement of an anchor pile at the vulnerable north end of this crib (Figure 20).

While most of the soil used to fill the wharf crib was probably local in origin, some was not. A pocket of white "pasty" material was found adhering to the inside of the top log in the east wall of the wharf. This material was analyzed by Dr. Ken Beem, a paleogeologist at Montgomery College, and determined to be a "broken-down limestone" which is not indigenous to this part of the world. According to Dr. Beem, this type of substance was probably "reef rock" and would have originated in shallow water in some tropical climate. This suggests that at least a portion of the fill in the wharf may have come from cast-off ballast of ships importing goods from the West Indies (Beem 1987).

The internal bracing timbers which were employed within the cribbing of Cheapside wharf to impart strength and rigidity to the structure were not well studied. The combined lack of time and equipment in concert with the physical constraint imposed by the water table prohibited a thorough investigation of the configuration of these features. However, enough of the internal bracing timbers were exposed and mapped to establish that the bracing was provided to the cribbing on a random and/or "as needed" basis. No distinct or regular tie-back pattern was found within the topping logs and the depth of the lower logs precluded sufficient study to ascertain
Figure 19. Detail of trunneled mortise and tenon joint — Cheapside wharf. (Courtesy of the Baltimore Center for Urban Archaeology).
Figure 20. Anchor pile placed at the northwest corner of the final extension of Cheapside wharf to prevent displacement of cribbing by "mud wave." (Courtesy of the Baltimore Center for Urban Archaeology).
whether or not a pattern existed within the lower cribwork. Nineteenth and twentieth-century trenching and construction in the area destroyed many of uppermost of the internal logs making interpretation of the crib even more difficult. Nevertheless, two types of bracing were demonstrated by the internal timberwork which was exposed: cross ties and diagonal corner-ties.

Cross ties were utilized by the wharf builder to anchor the outer walls of the cribwork in such a way as to permit the walls to withstand the lateral force of the fill within the crib(s) (Appendix B). During the construction of Cheapside wharf, the builder extended these ties, which were tree trunks eight to ten inches in diameter, across the entire 50-foot section of the crib in single spans. The ends of the ties were shaped into rectangular tenons which were fitted into mortises prepared to receive them. They were then fastened in place with a wooden trunnel or wrought-iron pin. This type of mortise and tenon joint was often planned to occur in conjunction with a lap joint of the crib wall in order to permit both joints to be fixed with a single pin (Figure 13).

By tying the opposite walls of the crib together with cross ties, the wharf builder was permitting the lateral pressure of the fill behind each of the walls to be transferred through the cross tie to resist the same pressure in the other wall. The weight of the earth behind the west wall acted to hold up the weight of the earth behind the east wall, and conversely. Cross ties also added rigidity to the wharf structure and facilitated the sinking of the cribbing as a unit.
Seven cross ties associated with Cheapside wharf were uncovered during the 1984 excavation. Six of these ties were located within the 1783 200-foot extension. They occurred at various depths in the uppermost courses of the lower crib (the portion beneath the topping logs). Spacing between the cross ties appeared to be random with the distance ranging from three to 20 feet. Two of the ties appeared to have spanned the crib at a slight angle rather than running directly across. The seventh cross tie investigated in the 1984 excavation was within the crib directly south of the 1783 extension just discussed. It differed from the other cross ties in that it spanned the wharf at a higher elevation and tied together topping logs. Neither end of this tie was exposed during excavation and the type of joinery used to attach it to the crib walls was not ascertained.

Diagonal corner ties were discovered bracing the two exposed corners of the wharf crib. These ties spanned the corners of the crib and stabilized adjacent perpendicular walls of the crib (Appendix B). The south wall of the crib was tied into both the east and west walls (Figure 21). This practice not only added to the strength of the crib but helped provide rigidity to resist "wracking" or deformation of the structure during the "fixing" and "sinking" stages of the wharf's construction. The lower courses of the crib logging would have had more need for corner ties than topping logs as the lower section was potentially required to withstand more uneven lateral pressures during the floating, positioning, and filling of the crib. When the interior of the southwest corner of the crib investigated at Cheapside wharf was archaeologically excavated to a
Figure 21. Two diagonal corner ties mortised into the south wall of a crib — Cheapside wharf. (Courtesy of the Baltimore Center for Urban Archaeology).
depth below the topping logs, diagonal ties were found at every course of the lower logs comprising a small, triangular "crib-within-a-crib." The logs utilized as ties were 7 to 8 inches in diameter and were not hewn as bulkhead logs were. Only four courses of these ties were exposed so the depth to which this method of tying was carried out was not documented.

Fewer diagonal corner ties were used in the uppermost, or topping, logs of the wharf crib and the span of these ties was greater than lower ones. One pair of diagonal corner ties was exposed in the southern end of the wharf crib which tied the first and second log courses of the south wall to the west and east walls respectively. Because the topping logs were constructed in place on the wharf and did not have to be floated and sunk, they did not require the corner stabilization that lower courses did.

**Cheapside Dock or Slip**

The area between Cheapside wharf and Hollingsworth's wharf became known as Cheapside dock, slip, or canal by the late 1780s. It served to provide docking space to boats for 36 years before it was filled in order to allow Pratt Street to be extended across its southern end. The principle materials used for filling the slip in 1819 were heavy, gray clayey sands which were probably carted in from nearby quarries or similar excavations.

Archaeological excavation in the slip showed that by the time it was filled, the docking space accommodated less than two feet
of water at an average tide. Several layers of mud, silt, and debris, trapped by the misalignment of the lower cribbing, had also accumulated adjacent to the bulkhead of the wharf (Figure 22). This accumulation of material against the outside of the bulkhead was documented as early as 1791 when Cheapside wharf was reported as "very much filled upon the outside" and a portion was "filled up on the outside of the dock to the third log" (Baltimore City Archives 1791).

The dark gray and black mud which was present on the bottom of the slip when it was filled in 1819 was impregnated with what appears to be tar. Tar may have washed off of the wharves or the bottoms of sea vessels, on which it was used as waterproofing, and accumulated in the mud. The presence of tar oil in the water and mud probably contributed to the preservation of many organic artifacts which were recovered from the debris adjacent to the bulkhead of the wharf. Among the organics recovered were wooden trunnels, tree limbs, pine needles, a darning egg, bone, seeds, leather shoes and scraps, and a complete barrel.

Excavators recovered an assortment of garbage-type debris along the wall of the wharf which suggested that the dock was being used as a midden for disposal of unwanted items. In a 43-foot by two-foot trench along the slip side of the wharf, archaeologists found remains of at least 142 ceramic vessels and 35 glass vessels (most of which were wine and case bottles). If concentrations of this nature were consistent across the slip, a ratio of slightly more than two vessels per square foot, the floor of the dock must have been literally
Figure 22. Profile sketch of deposition in the dock against the west bulkhead of Cheapside wharf. (Recorded by Robert Dunn, Baltimore Center for Urban Archaeology).
paved with discarded, broken china and glass. However, there is an alternative explanation. The concentration of rubbish near the bulkhead could have been higher than elsewhere in the slip because this would have been the area most likely to receive broken items swept from the wharf into the dock. The presence of sawn animal bones, egg shells, and fruit pits suggested the dock was also being utilized for disposal of other types of garbage.

Many artifacts which were probably not intended to be discarded were recovered from the mud of the slip. Twenty coins of English, Irish, Spanish, and American colonial and national origin were found near the outside of the wharf where they may have been dropped by workers loading and unloading cargo scows. Other such valuable objects recovered included a glass signet pendant, a carpenter's dividers, pewter spoons, and an unidentified object which resembles a watch.

Analysis of mud deposited against the bulkhead of the wharf revealed the presence of many microorganisms which are no longer found in this region. Several varieties of *Foraminiferida*, a microscopic marine organism, were found which apparently thrived in the water near the dock. These tiny animals lived in shallow, brackish water and fed chiefly on marine diatoms, which were also recovered from the mud in the slip. The presence of these organisms indicated that the water surrounding the dock was likely to have been shallow and supporting the growth of submarine grasses. A previously unknown species of *Foraminiferida* was found in Cheapside slip and appeared to be related to a species found recently
in polluted water sources around Baltimore (Beem 1985, 1987). The presence of this organism may have been an indication of similar polluted conditions in the dock waters, which would support the assumption that the dock was being used for garbage disposal.

Whether material was inadvertently dropped into the slip or deliberately thrown in, the water must have taken on the aroma of a sewer from the presence of garbage in various stages of decomposition. The smell of the tar and the stagnation created by oil rising to the surface could only have added to its unwholesomeness. If the other docks adjacent to Cheapside were in similar condition it is not surprising that townspeople often decried them as "nuisances" and "menaces to the public health." At least three requests for the filling of dock at County wharf (next to Cheapside) were made by Baltimore residents in 1811, 1814, and 1818. Not unexpectedly each of these requests was made during the month of June. It was probably at about that time of year that the weather had been warm long enough to advance the decomposition of garbage in the dock to noticeable levels.

Filling of Cheapside dock occurred rather quickly in late 1818 or early 1819 and a layer of pitch was laid down in an attempt to make the surface of the former slip serviceable as a road. Over the next 150 years, at least six episodes of paving with cobblestones, Belgian blocks, and macadam elevated the surface of Cheapside street more than four feet. The various layers of pavement added through the nineteenth and twentieth centuries were clearly visible in archaeological profiles (Figure 23).
Figure 23. Profile drawing of a section of Cheapside Dock showing accumulation of road surfaces. (Drafted by Donald Linebaugh).
Artifactual Data

More than 20,000 artifacts dating from the eighteenth through twentieth centuries were recovered by archaeologists during the Cheapside wharf excavation. The majority of the eighteenth-century material was recovered from the mud of the docking slip. This artifact collection, together with the written and photographic record of the excavation, is housed at the Baltimore Center for Urban Archaeology and is accessible for study.
CHAPTER IV

WHARF AND DOCK MAINTENANCE

The greatest drawback to the construction of wharves from timber rather than stone was that timber was highly susceptible to rapid decay due to infestation by marine fauna as well as its natural propensity to rot when exposed to repeated periods of wet and dry. "Insectile ravages," according to Cunningham (1908:65) presented the most pressing danger to which timber wharves were exposed. "Worms," as they were generically called, were marine animals which weakened and destroyed wharf timber by repeatedly boring into the wood. In 1778, John Smeaton (1812:188) described these creatures:

This worm appears as a small white soft substance, much like a small maggot, so small as not to be seen distinctly without a magnifying glass, and even then a distinction of parts is not easily made out; it does not attempt to make its way through the wood longitudinally, or along with the grain, as is the case with the common ships' worm, but directly, or rather a little obliquely inward; the holes made by each worm are small proportioned to the size of the worm, but they are so many in number as to be but barely clear of each other, . . . the outward crust [of the timber] becomes macerated and rotten, and gradually washes away by the beating of the sea.
The animal Smeaton described was probably the *Limnoria terebrans*, a small crustacean resembling a grain or rice, which seldom reached a length of more than 1/6-inch. It was considered especially troublesome because it seemed to be indifferent to foul water. No harbors could be considered immune to its presence (Cunningham 1908:66). The marine borer, *Teredo navalis*, on the other hand, showed a decided preference for clear, salty water and deliberately avoided water which was muddied, sewage polluted, or even fresh. The teredo was, and is, one of the most persistent assailants of marine timber structures.

The degradations of this creature seem to follow along these lines: Its eggs, which drift freely in the water, adhere to any exposed woodwork they happen to wash against and remain there until ripe for hatching. On leaving its egg, the young *teredo* attacks the wood in its immediate vicinity by boring or tunneling into it, generally in the direction of the grain. Its operations tend to be confined chiefly within the tidal range, but it also attacks timber at any moderate depth. The work of these creatures can progress with extreme rapidity. Newly-driven timber piles in England showed signs of teredo within six months; and the same piles six months later were reported to be seriously injured (Cunningham 1908:65-6).

If Baltimore suffered from infestation of these or other hurtful marine fauna, the surviving documents and the archaeological evidence do not reflect it. Instead it seems that Baltimore's wharves were more subject to the malignancy of "wet
rot." Wet rot is a form of decomposition in wood which arises from and is promoted by frequent alternations of moisture and dryness, and these conditions could scarcely be avoided in wharf situations. The process of wet rot is such that every time a log becomes wet and dries again, a fresh portion of the fiber is converted into soluble matter which is eventually extracted and lost. In addition, the continual evaporation of moisture from the pores of the wood results in putrefaction, the progress of which, once begun, is usually rapid (Cunningham 1908:67). However, if wood can be kept constantly wet and deprived of air by being submerged in water or wet earth it will not rot (Greene 1917:4). Many techniques for preserving wood that is not submerged in water or wet earth from damage inflicted by moisture and drying are based on the principle of preventing moisture from penetrating the wood to any depth.

George Semple, an Irish architect/engineer outlined, in his Treatise on Building in Water, several practices which were in use for preserving wood which was to be used in marine constructions in the late-eighteenth century:

... The Venetians make use of one, which seems to be very rational, viz. to burn and scorch their Timber in a flaming Fire, continually turning it round with an Engine, till it has got a hard black crusty Coal upon it. ... Others inform us, that the Dutch preserve their Gates, Portcullis's, Draw-bridges, Sluices, Etc. by coating them over with a Mixture of Pitch and Tar, whereon they strew small Pieces of Cockle and other Shells, beaten almost to Powder and mixed with Sea-sand, which incrusts and arms it wonderfully against all assaults of Wind or Weather; but for my own Part, I conclude, that the Venetian Method is preferable, because I believe, it is the
that is the principal Cause of their decaying so soon. Besides, that Sap probably breeds and nourishes the Worms . . . (Semple 1776: 83-4).

Semple recorded the method he thought best for preserving wood which would "make red Fir Timber near as durable as Oak." To achieve this, it was necessary to situate the timber on the ground, . . . with Stones or Bricks under it to about a Foot high, and burn Wood (which is the best firing for that Purpose) under it, till you thoroughly heat and even scorch it all over, then, whilst the Wood is hot, rub it over plentifully with Linseed-oil and Tar in equal Parts, and well boiled together, and let it be kept boiling whilst you are using it; and this will immediately strike and sink (if the Wood be tolerably seasoned) one Inch or more into the Wood, close all the Pores, and make it become exceeding hard and durable, either under or over Water; and if there should be any sappy Parts in it, they will receive such benefit by the Fire and Heat of this natural penetrating Liquid, that they will also thereby become exceeding durable (Semple 1776:85).

Tar and pitch were used extensively for retarding the decomposition of wood in the eighteenth and nineteenth centuries. Tar was the resin of pine tree roots which was extracted through a process of slow heating. Pitch, which was solid when cooled, was produced by the prolonged boiling of tar. Both tar and pitch were used to seal the seams on the sides and decks of ships after they were caulked to preserve the caulking (Cresy 1872:728-9). Likewise, tar or pitch was used on the topping logs of Cheapside wharf in Baltimore in an apparent attempt to deter, or delay, decomposition of those timbers. Whether the use of tar and pitch as a wood
preservative was common in Baltimore can only be the subject of
speculation. An account of the expenses incurred in the construction
of a wharf in the Eighth ward of Baltimore in 1811 listed a balance
due of $3.50 to "Chs & P Wirgman" for one barrel of tar (Baltimore
City Archives 1811d).

A single barrel of tar seems hardly enough to have treated
an entire wharf; however, if it were used sparingly might suffice to
cover the crucial joints and areas especially susceptible to rot. That
portion of wooden wharves which is subject to rot, decays most
rapidly at points where moisture enters the wood and does not dry
out, such as butt joints and where one timber bears on another. A
brush coating of a good preservative, like tar, on all joints, butts,
tenons, and any area where one timber rests on or against another is
a relatively cheap way of increasing the life of the timber and
making deterioration of the structure more uniform (Greene
1917:11). Based on the archaeological evidence from Cheapside
wharf and the 1811 account which survives, it is not unlikely that
tar and pitch were regularly used in the construction of wharves in
Baltimore.

The apparent absence of marine borers in the Baltimore
docks is probably due in part to the quality of the water which
surrounded the wharves. The mud excavated from the bottom of
Cheapside dock in 1984 was heavily impregnated with tar and coal
oil. This suggested to the archaeologists that the water around the
docks was probably heavily laden with tar and pitch washing from
the docks and ships in their close proximity. These chemicals and
the inevitable presence of sewage in the water probably discouraged
the flourishing of most marine pests, especially the troublesome
teredo which did not generally inhabit this type of water.

Siltation constantly plagued the wharves in Baltimore. Sediments brought into the basin by the Jones Falls and earth fill spilling over the tops of and through the cracks in the timber wharves created a need for constant attention to clearing the docks and the harbor channel. The earliest surviving report of wharf conditions in late-eighteenth-century Baltimore clearly indicated that many of the docks were in very bad condition and the outsides of the wharves were filled up or banked considerably with mud (Baltimore City Archives 1791). A committee appointed to examine the state of the wharves in Fell's Point in 1819 reported that the flow of silt and runoff into the Cove [a portion of the Baltimore harbor] was so injurious that "many wharfs which seven years past had from twelve to fourteen feet of water are now dry" (Baltimore City Archives 1819b).

In 1802 three Baltimore wharf owners wrote to the Mayor and City Council to express their discontent with the city's failure to dredge the silt away from the ends of their wharves.

We the subscribers being the whole Proprietors of all the Wharfe Property fronting on the Bason from Gay Street Dock to the Market Space Dock, respectfully beg some Publick attention to the suffering state of our Property. We have at very heavy individual expence [sic], extended long wharves into the Bason, yet in front of our Wharves, we have not eighteen inches depth of water at almost any usual tide & at many times entirely dry; if we have extended to the limits in the Bason
formerly prescribed to us, we fondly expect the Publick with their Machines would have given us some depth of Water on the Bason in the front of our Property, but for Years since our Extension We have been entirely neglected, not a Vessel has ever been seen at the end of any of our Wharves, nor is it possible for them, from the want of Water, thus situated our Property remains dead & unproductive (Baltimore City Archives 1802a).

Since these wharves were extensions of public streets, the city shared the burden of maintenance of the docks at the end of the wharves. The three wharf owners additionally petitioned that if the city could not "immediately start taking up the mud & deepening" the Basin at the end of their wharves, that they be permitted to extend their wharves still further into the harbor.

The "machines" which the wharf owners referred to in the above document were the city's dredging scows or "mud machines." It is not possible to determine the origin of dredging technology; primitive dredging was carried on from flatboats, using scoops worked by hand. The Dutch, however, were pioneers in this work, as were the Italians and, later, the French. Balthasar de Monconys, the celebrated seventeenth-century traveler, recorded, in his *Journal des Voyages*, a short circumstantial account of a dredge which he saw operating near Emmerich on the lower Rhine in 1663:

We saw there a floating contrivance for dredging the channel of the river, on which is an iron chain, provided with iron-tipped buckets like spades; this chain passes between two boats at the bottom of the river, and by means of two wheels the chain is made to turn below the water, on a plane surface furnished with iron rollers, on which it slides and comes up easily, and when it is at the top the buckets turn over, in order to redescend,
emptying out the sand and placing it in a boat which receives it (Kirby and Laurson 1932:249-250).

A similar dredging device was reported to have been in use as much as a century earlier. This would seem to indicate that the Dutch had developed a type which could be run by the force of the current, or, where this was lacking, by the feet of men who trod along inside a large revolving cylinder (Figure 24). Even as late as 1737 dredges are reported to have been operated by a treadmill using human power (Kirby and Laurson 1932:250).

The Dutch engineers who did a great deal of reclamation work in the eastern counties of England in the seventeenth century doubtlessly introduced dredging machines into that country. A Dutch engineer, Cornelius Meyer, invented what might be considered the first "power dredge" in 1680 or 1685. It was used on the Holland dikes and canals and was powered by horses (Kirby and Laurson 1932:250) (Figure 25). Apparently the Dutch maintained their superior reputation in dredging in next century also. In 1793 the Board of Port Wardens for Baltimore received a report from C. Mayer [certainly not the one above] in response to a request for information about a Dutch dredging machine:

The person, who some years ago, contracted with the Regencies of Totterdam & Dortrecht to clean the Docks & Canals of those cities, by a Machine of his invention, resides in the Province of Zealand. The machine is worked by two men & one horse, & raises daily 240 scow loads of Mud, each load of 2 lasts or 4 tons (Baltimore City Archives 1793).
Figure 24. Scoop dredge making use of human power. (Jensen 1969:168).
Figure 25. Dutch "power dredge" operated by horses. (Jensen 1969:168).
This report possibly reflected the Port Wardens cognizance of the growing necessity for a more rapid means for clearing siltation in the harbor and docks. Only two years previously they had received a report (Baltimore City Archives 1791) in which was outlined the "filled" condition of many of the town's docks and the machines employed at that time could not keep up. Thomas Griffith (1824:100) recounted the 1783 extension of Ellicott's wharf in Baltimore and reported that for the filling of that wharf they had used a drag pulled by a team of horses to draw the oozy sediments from the bottom of the river. They also performed the same operation with iron scoops which were operated by hand or windlass. These methods were vastly slower than the rate attributed to the Dutch machine.

By 1802 the City of Baltimore had acquired a horse-powered mud machine that apparently had a single large scoop of 25 cubic feet (Baltimore City Archives 1802b) which was principally employed in the task of deepening the channel of the harbor (Baltimore City Archives 1802c). This machine was probably of Dutch design and purchased as a result of the inquiry begun nine years previously by the Board of Port Wardens. By 1814, this mud machine was evidently no longer serviceable. Peter Zacharie, in a moderately long proposal to the City of Baltimore, dated 1814, informed the Port Wardens that "if the corporation had put an ingenious man to superintend that dutch machine, she would be yet working with as much advantage as any one they ever had and they ever will build" (Baltimore City Archives 1814c).
At about this same time, the Board of Health of the City of Philadelphia contracted with Oliver Evans, an engineer, to design and construct a machine for dredging the docks of that city. On a return trip from Washington, D.C. in late February of 1805, Evans stopped long enough in Baltimore to observe the operation of the corporation's horse-operated machine which was then at work in the basin. Upon his return to Philadelphia, Evans, being very distracted and discouraged over several unrelated patent renewal disputes, commented that the machine which Baltimore was operating was "at least equal to the purpose to any which he could devise." In response to Evan's flippancy, the Philadelphia Board of Health decided to write to Baltimore to ascertain from the engineer in charge there if he could construct a machine for them within six weeks for the sum of 3000 dollars. By mid-March, however, Philadelphia resumed their contract with Evan's and by that summer operated America's first steam-powered bucket-chain dredging machine (Bathe and Bathe 1935:108).

In 1811 Baltimore purchased, from Benjamin Colver, a second mud machine (Baltimore City Archives 1811e). Colver's sale's pitch to the city was as revealing of the city's old machine as it was of his new one:

Having understood that the City will require another Mud Machine, I take the liberty of offering my Horse Machine to you for sale. It is faithfully built of the best materials and was Entirely new the last Spring. It is smaller than the one belonging to the Corporation and Yet will do equally as much work in proportion, & as it will go up any of the private Docks, which the Corporation one Cannot do, it is so Much the more useful in that respect,
when they require cleaning which several of them now want to be done. This Machine cost me above two thousand five Hundred Dollars and is not the worse for Wear. I will dispose of it with the Horses & three Scows for two thousand with the priviledge [sic] of private work, and I apprehend, the Corporation may very probably repay themselves for it in One Season (Baltimore City Archives 1811f).

Apparently the mud machine in use prior to 1811 was too massive to work in the relatively narrow docks between the private wharves (Cheapside dock was only 50 feet in width). The wharf slips of the city were undoubtedly suffering greatly from siltation by this time, especially the older ones, and the city had to rely on private contractors to deepen the docks, usually at great expense. Late in 1817 the Maryland Legislature appointed a Board of Commissioners who were to be responsible for having McClure's dock deepened. To accomplish this task the Board hired Christian Slemmer who began work early in March of the following year. Slemmer's rates were not exorbitant: $25 per day for work at raising large stones with a "stone raising machine," and $1.33-1/3 per cubic yard for mud, clay, and gravel taken up with a mud machine. Nevertheless, the project required 44 days of the stone raising machine while the mud machine removed in excess of 2900 cubic yards of mud fill for a total bill of more than 5000 dollars (Baltimore City Archives 1819c).

With the purchase of a second mud machine in the spring of 1811, the City of Baltimore resolved to establish a hierarchy governing the direction and superintendence of the machines (Baltimore City Archives 1811g) and a Mr. Cruse was employed as superintendent of the city's dredging equipment. Three years later
Mr. Cruse assisted one of the port wardens in testing a mud machine which had been copied by the warden, "with very little alteration," from a design patented by Peter Zacharie. After a few trials, performed by Mr. Cruse, the scow and mud machine, which had been constructed at public expense, were destroyed "for want of a proper and ingenious man to take the charge of it" (Baltimore City Archives 1814c).

Dock maintenance was an expensive undertaking. This fact was reflected in the care that was so often taken in assigning this responsibility to the owners of property which fronted docking space. When Thomas Harrison began assigning lots fronting on what was to become Cheapside dock, he was very specific in assigning also the responsibility of dock maintenance. He required that William Stayton, at his own expense, forever after keep the dock opposite his lot cleaned out and open, out to the middle of the dock, to a depth of at least three feet at low tide (Baltimore County 1782). When Harrison's executors sold the end lot of the wharf to Lemmon, Prestman, and Evans, they assigned this same maintenance burden to the new owners and required that it apply to any extensions they made of the property into the water (Baltimore County 1783a). As lots were sold on the two extensions of Cheapside wharf, Lemmon, Prestman, and Evans reduced their maintenance responsibility by assigning it with the lots to the new owners. Each owner of a lot fronting on the dock was responsible for keeping the dock open and of a certain depth in front of his property.
In spite of the vulnerability of timber wharves to the ravages of marine animals and wet rot, these structures continued to dominate Baltimore's waterfront into the twentieth century. One of the largest problems inherent in timber-crib wharves was the filling of docking space caused by fill seeping over or from between the logs. This one problem stimulated many advances in dredging technology during the early-nineteenth century as American port cities strove to keep their docks and harbors open for trade. While Baltimore does not seem to have had any major problems with "insectile ravages," evidence for destructive marine animals should not be overlooked in the early wharves of other cities. It is likely that the tar and pitch which was used to protect the wharves in Baltimore from wet rot also served to deter the settlement of harmful marine borers.

Regardless of the measures that were taken to protect wharves in Baltimore, the condition of any one of these wharves within a few years of completion was dilapidation. Wharves were apparently viewed by their owners and tenants as structures intended to serve a specific function. As long as that function could be carried out, wharf owners tended to ignore aesthetics flaws. This way of thinking is elaborated upon in Chapter V.
CHAPTER V
CONCLUSIONS

When Ferdinand-Marie Bayard sailed into the Baltimore Harbor in 1791, he was struck not only by the sight of the crudely constructed log wharves, but also by the "foul vapors" given off from "slime" which covered the logs exposed at low tide (Bayard 1950:160). In that same year a report was prepared outlining the condition of the wharves in Baltimore. Twenty-six wharves were discussed in that report; all were constructed of wood and most of them were badly in need of some repair (Baltimore City Archives 1791). Wharves in Baltimore had presumably been built of wood since the beginning of the town's waterfront development in the 1740s.

In 1838 David Stevenson affirmed that wharves in American ports had not progressed beyond the use of wood for construction. He contended that an European who is accustomed to the solid stone docks of London, Liverpool, and Havre might be astonished to find, upon his arrival in an American port, his vessel moored by bow and stern to a wooden quay. After leaving the vessel, he will be greeted with anything but pleasant sensations when ushered forth upon a hastily constructed wooden jetty which is
as often as not covered with a deep layer of mud. This state of things struck foreigners in a very forcible manner:

The high, and in some cases superfluous, finish, which the Americans bestow on many of their vessels employed in trading with this country [England], lead those who do not know the contrary to expect a corresponding degree of comfort, and an equal display of workmanship, in the works of art connected with their ports; and it strikes one at first sight as a strange inconsistency, that all the works connected with the formation of the harbors in America should be of so rude and temporary a description, that, but for the sheltered situations in which they are placed, and other circumstances of a no less favorable nature, the structures would be unfit the serve the ends for which they were intended (Stevenson 1838:20).

What struck Stevenson as a "strange inconsistency" raised an interesting question regarding wharves in the United States and, more specifically, Baltimore. Browne (1980) outlined how Baltimore's greatest periods of growth occurred during times of war, and it stood to reason that during periods of rapid economic growth which were based on shipping capabilities of Baltimore's merchant fleet, wharves and docking space would be needed fairly quickly. Wooden wharves were the fastest and easiest to construct. As wood was readily available in Baltimore, timber wharves were undoubtedly the cheapest to build. Wooden wharf construction persisted well into the nineteenth century in spite of the obvious disadvantages of the form. Such wharves rotted quickly, often in less than a decade, and required extensive maintenance and repair. Why did Baltimore's developers continue to construct impermanent
wooden wharves, which would decay in a few years, when large maintenance and repair expenses could be avoided by using stone? Stone construction was initially more expensive and required more time for completion, but the continual replacement of bulkhead logs and dredging of docks necessitated by siltation from wooden wharves would ultimately have exceeded the expense of a more permanent stone wharf.

Baltimore developers were very shrewd and the unprecedented profits garnered from risky wartime trading in the mid- and late-eighteenth century had apparently made them greedy as well. By constructing an inexpensive, wooden wharf a developer maximized his profits in the sale of lots on the wharf. He could then recoup the expenses of the construction and retain a portion of the property for himself at essentially no cost. The problem of eventual upkeep and repair was averted by transferring that responsibility for each lot to the owner of the lot at the time of purchase.

This fragmentation of responsibility potentially served two ends. First it relieved the wharf developer of sole financial responsibility for wharf maintenance and divided that responsibility among several individuals. In this way repairs could be effected without a large monetary outlay from one person. Secondly, it created a source for possible confusion from which the tenants of a wharf could base a petition to the state or local government for funds to execute repairs on the wharf or dock. In 1802 several owners of wharf property petitioned the City of Baltimore to provide free dredging in front of their lots (Baltimore City Archives 1802a). They
argued that this was necessary because their property lay in the center of the business district of the town and without dredging the docks might soon create a health hazard. Apparently these men were attempting to take advantage of confusion over who was responsible for this maintenance. Whether or not their request was granted is not known.

While the owners of wharf property were faced with problems of maintenance and repair, wharfbuilders dealt with a completely different set of problems. If a code of standards for timber crib wharf construction was generally acknowledged by wharfbuilders in the eighteenth or early-nineteenth century, it was apparently never written down. Instead, early wharfbuilders shared a knowledge of wharf requirements and adhered to a practical set of rules in constructing their wharves. These rules dealt with the most general concepts of the wharf, e.g., cribs, bracing, anchor piles, etc., but left the specifics up to the builder. The placement or number of braces or ties might have depended on the preference of the builder or the needs of a particular wharf. Likewise, the type of joinery used in the construction seemed to be a matter of preference. While some joints were indisputably superior to others for given purposes, there existed a wide degree of variation in the execution of these joints.

An additional aspect of the rules honored by wharfbuilders acknowledged a "sequence of events" which was to be followed during the construction of a wharf. In 1785 Levering & Company were reprimanded for breaking these rules. They were guilty of attempting to fill their wharf cribbing before it was fixed in place
While wharfbuilders appeared to have acknowledged rules for wharf construction, uniformity in the application of these rules did not apply below a certain level. It was not unusual to find differing arrangements of ties and piles, various kinds of joinery, woods, fills, and so forth utilized to build two very similar-looking wharves.

In order to understand this divergence of construction techniques it is useful to refer to Ralph Linton's (1936:397-400) classification of cultural elements by item, trait, trait complex, and activity. Cultural "activity" is defined by combining multiple "trait complexes." Trait complexes are made up of "traits" which are broken down into "items." The relevant cultural activity in this study is eighteenth-century maritime trade in Baltimore. This activity was defined by the incorporation of several trait complexes—the ship complex, the warehouse complex, and the wharf complex, to mention but a few. A wharf was composed of a number of traits such as cribs, fill, ties, topping logs, and so forth. Each trait embodied a number of items which have little individual significance but all contribute in some way to the successful functioning of the trait. For example, cribs are given structural stability with cross-ties. Items like the arrangement of these cross-ties and the wood they are made from may vary yet permit the cross-tie trait to perform its function of giving the wharf stability.
This classification is an extreme oversimplification. The number of subdivisions could be expanded almost indefinitely, but it is questionable whether such an increase would make for greater accuracy (Linton 1936:398). A number of items, in combination, constitute a trait; a number of traits, a trait complex; a number of trait complexes, an activity. However, the smallest combination of elements to which functional studies would pertain is probably the trait complex. "It is possible to analyze such a unit into its component traits and items and to study these individually, but the average member of any society regards the trait complex as a whole, and it operates as a whole" (Linton 1936:403).

Since the average member of a society regards the trait complex as a whole, it would not be unexpected for a merchant of eighteenth-century Baltimore to have viewed his wharf as a single, functioning unit without regard to the numerous traits which comprise it. The particulars of the construction of the wharf were of little or no interest to him. In this event, individual wharfbuilders were free to construct the wharf traits according to their own expertise. This could, in part, account for the many different techniques applied to crib-wharf construction in Baltimore during the eighteenth century.

There is evidence that merchants and other wharf developers were becoming involved with the particulars of wharf construction in the late-eighteenth and early-nineteenth century. Specifications for the construction of wharves from that period demonstrate an increasing concern with crib size, placement of piles
and ties, and types of fill. Probably due to experience with the rapid decay of timber wharves, wharf developers attempted to get more use of their investments by designing them to last longer. When this occurred, the wharf, which had before been a trait complex, became the activity. The object was to build a wharf. The cribs, ties, fill, and piles became trait complexes and were subject to the scrutiny of the developers. The design freedom of the individual wharfbuilders waned as fewer traits were left to his ingenuity. When steam-powered pile drivers came into general use in the second quarter of the nineteenth century, the concept of wharfbuilding underwent drastic changes, and crib wharves were largely replaced by wharves with piled walls.

It may not be possible to understand completely the rules which governed the construction of wharves in Baltimore in the eighteenth and early-nineteenth centuries. However, the intent of this paper is to provide enough information regarding the relevant technology of the period to allow the reader to begin such an understanding. Likewise, the discussion of wharves in Baltimore, and specifically Cheapside wharf, is intended to give a contextual example for many of the concepts discussed. Archaeologists who are excavating wharf sites may benefit from the discussion and examples contained in this work, but should be careful to not base their expectations on a single example. Wharves in the eighteenth and early-nineteenth centuries were highly variable. Each one was constructed to suit a particular site and circumstance. While the concepts and rules followed for the construction of wharves were
transferred from wharf to wharf, the application of these concepts differed from one to the next based on the structural needs of the wharf and the ingenuity of the builder.
APPENDIX A

TYPES OF JOINERY USED IN WHARF CONSTRUCTION

(from Geismar 1985)
APPENDIX A.

1. SADDLE NOTCH
2. CROSS LAP VIA SQUARED-OFF NOTCH
3. CROSS LAP WITH TREENAIL
4. WEDGE
5 HALF LAP
6 HALF LAP WITH METAL BOLT FASTENING
7 SCARF JOINT WITH HALF LAP DOVETAIL CLEAT
8 MITRE JOINT
9 SHOULDERED HOUSING
10 HOUSING AT CHECK AND SHOULDER OF HALF LAP
11 DOVETAIL JOINT
APPENDIX B

HISTORICAL AMERICAN BUILDINGS SURVEY DRAWINGS

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CHEAPSIDE WHARF
ISOMETRIC DETAIL #1

SOUTHWEST CORNER OF WHARF AND EXTENSION OF UNKNOWN DATE. APPROXIMATELY 400 FEET SOUTH OF WATER STREET, CONSTRUCTION IS OF SHORT LEAF LUMBER, NUTTED AND TENON JOINT SECURED WITH A WROUGHT IRON PIN.

ISOMETRIC DETAIL #2

SOUTHWEST CORNER OF WHARF AND EXTENSION LOCATED APPROXIMATELY 400 FEET SOUTH OF WATER STREET. CONSTRUCTION IS OF SHORT LEAF LUMBER WITH ORM BRACES OR UPHOLSTERED, NUTTED AND TENON JOINT SECURED WITH A WROUGHT IRON PIN.
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VITA

Joseph Gary Norman

Born in Richmond, Virginia, May 28, 1959. Graduated from Lee-Davis High School in Mechanicsville, Virginia, June 1977; B.A., with honors, in anthropology from the University of Virginia, 1981. Entered College of William and Mary as a graduate assistant in the Department of Anthropology, September 1983.

In November and December of 1984, co-directed the Cheapside Wharf excavation in Baltimore, Maryland.