A Report On

ARCHAEOLOGICAL TESTING of the
TWELFTH STREET RIGHT-OF-WAY from
MARKET STREET TO CHESTNUT STREET

Including

ARCHAEOLOGICAL MONITORING of STREET IMPROVEMENT from CHESTNUT STREET TO CARTER STREET

Prepared by

R. Bruce Council, Loretta Lautzenheiser and Nicholas Honerkamp

of the

INSTITUTE OF ARCHAEOLOGY
UNIVERSITY OF TENNESSEE AT CHATTANOOGA
Dr. Nicholas Honerkamp, Director

December 1980

UDAG No. B-80-AA-47-0003 Contract No. 2
# TABLE OF CONTENTS

List of Figures ........................................................................................................ ii

Introduction ........................................................................................................... 1

Historical Background of Project Area ............................................................... 3

The Archaeological Testing and Monitoring Program ......................................... 12
  Overview .............................................................................................................. 12

  Research Goals and Design ............................................................................. 14

  Methodology ..................................................................................................... 15

    Historical Research ....................................................................................... 15

    Archaeological Field Techniques ................................................................. 15

The Market to Broad Street Testing Program .................................................... 17

The Broad to Chestnut Street Testing Program .................................................. 22

  Trench KC: The N&C Depot Testing ............................................................... 23

  Trench TC: The Turntable Testing ................................................................. 28

The Chestnut to Carter Street Monitoring Program ............................................ 39

  Monitoring Program Artifacts ....................................................................... 41

Discussion and Conclusions .............................................................................. 44

Appendix 1 Artifacts Recovered under UDAG Testing and Monitoring ............... 60

Appendix 2 UDAG Testing and Monitoring: Data Inventory .............................. 63

References Cited ................................................................................................. 65
INTRODUCTION

As part of a major redevelopment of a portion of downtown Chattanooga occasioned by the construction of a Tennessee Valley Authority office complex, the City of Chattanooga proposed to extend Twelfth Street from Chestnut of the IVA Office Complex site, crossing existing Chestnut, Broad and Market Streets, and connecting with Newby Street. Of under existing streets or such an improvement would affect or under existing streets or such an improvement would affect

in order to assess the presence or absence of historic or prehistoric cultural remains which might be eligible for inclusion in the National Register of Historic Places and, if eligible, a plan to mitigate the adverse impact on the remains would be formulated and implemented.

A Memorandum of Agreement was executed between the Tennessee State Historic Preservation Officer (SHPO), the
INTRODUCTION

As part of a major redevelopment of a portion of downtown Chattanooga occasioned by the construction of a Tennessee Valley Authority office complex, the City of Chattanooga proposed to extend Twelfth Street from Chestnut Street to Market Street. This extension of Twelfth Street would run roughly east to west across the southern border of the TVA office complex site, crossing existing Chestnut, Broad and Market Streets, and connecting with Newby Street. Concomitant with new street construction would be the improvement of surfaces and buried services and utilities along or under existing streets. Such an improvement would affect Twelfth Street from Chestnut to Carter Streets.

Under provisions of Section 106 of the National Historic Preservation Act of 1966, as amended, the City of Chattanooga and the Tennessee Valley Authority were to contract for the performance of archival research and limited archaeological testing and reconnaissance on their respective properties in order to assess the presence or absence of historic or prehistoric cultural remains which might be eligible for inclusion in the National Register of Historic Places and, if eligible, a plan to mitigate the adverse impact on the remains would be formulated and implemented.

A Memorandum of Agreement was executed between the Tennessee State Historic Preservation Officer (SHPO), the
Advisory Council on Historic Preservation, and the City of Chattanooga. The City of Chattanooga was provided a Scope of Services outlining the archaeological services to be performed by an appropriate contractor.

The following is a report on archaeological testing performed by the Institute of Archaeology, University of Tennessee at Chattanooga, on behalf of the City of Chattanooga, through their agents, the firm of Hensley-Schmidt, Inc., engineering consultants. This report consolidates data gathered under three contracts funded through an Urban Development Action Grant (UDAG) No. B-80-AA-47-0003 (Contract No. 2). These three projects were identified as "Archaeological Testing of the Twelfth Street Extension Right-of-Way, Market to Broad Streets," (May 28, 1980), "Archaeological Monitoring of the Twelfth Street Extension Right-of-Way, Chestnut to Carter Streets," (June 6, 1980), and "Archaeological Testing of the Twelfth Street Extension Right-of-Way, Chestnut to Broad Streets," (June 12, 1980).

The field portion of the archaeological testing and monitoring program was conducted between 2 June and 11 July, 1980, and was directed by R. Bruce Council, Research Instructor, and Loretta Lautzenheiser, Assistant Archaeologist, both of the Institute of Archaeology. Dr. Jeffrey L. Brown served as Principal Investigator of the monitoring phase of the work, and R. Bruce Council was Principal Investigator on the testing portions of the program.
HISTORICAL BACKGROUND OF PROJECT AREA

The area impacted by Phase 1 construction of the Tennessee Valley Authority office complex and the attendant new street construction by the City of Chattanooga under UDAG funds is that area of downtown Chattanooga bound on the north by Eleventh Street, on the east by Market Street, on the west by Chestnut Street, and on the south by and including the extension of Twelfth Street from Chestnut Street east to Newby Street. This area, for purposes of nomination to the National Register of Historic Places, has been designated the Union Railyards Site, and in the Institute of Archaeology, UTC site files, is identified as site 105-SE-74. For purposes of the following historical discussion, it is convenient to refer to the area bounded above as "the site."

The history of the site was from its beginning linked to the industrial history of Chattanooga, -- specifically, to the railroads that have established this city's place in American folklore.

The Western and Atlantic Railroad, chartered and owned by the State of Georgia, opened the first line into the city of Chattanooga in 1850 (Johnston 1931), followed in 1854 by the opening of service of the Nashville and Chattanooga Railroad (Steinberg 1976:5). In 1858-59, the Western and Atlantic, the Nashville and Chattanooga, and the Memphis and Charleston Railroad constructed a common, jointly-owned Union Depot near the present Broad and Chestnut Streets south of Ninth Street.
This new facility was designed strictly for passenger use, relieving the crowding at the combination passenger and freight depot built by the Western and Atlantic Railroad at the corner of Ninth and Market streets late in 1851 (Steinberg 1976:5). The new arched-roof train or car shed was supplemented in 1881 by the construction of a two-story brick passenger building fronting on Ninth Street and connected with the train shed. The area south of the passenger and freight facilities on Ninth Street served as the yards of the N&C and W&A railroads. It is these yards which are the focus of this study.

Chattanooga was occupied by Federal troops late in 1863, and early in 1864 the railyards were taken over by the United States Military Railroad (Prince 1967:12). The tracks of the Nashville and Chattanooga Railroad became the principal line of the U.S.M.R. during the campaigns that led to the capture of Atlanta, and extensive storehouses were built in Chattanooga. Locomotive and car repair shops, and even a rolling mill for rail, were built to maintain the tracks and rolling stock of the military railroad (Abdill 1961:147-151).

Our first usable cartographic representation of the railyards comes from the plan "Chattanooga and Its Approaches...", a military map of the city surveyed during the Union occupation in late 1863 (Dorr 1863). The plan shows the Union Depot Train Shed, the Western and Atlantic Freight Depot, a W&A turntable...
south of the W&A Freight Depot, and, at the southwest corner of the site, the N&C Freight Depot. Tracks of the N&C approach the yards from the southwest and enter the Union Depot running south to north. The tracks of the W&A approach from the south- east, with lines running both to the passenger and freight depots. Across the bottom of the site, a curved track system connects the W&A and N&C lines. This basic wye-form of tracks was maintained throughout the history of the yards.

A photograph of the yards taken in 1863 appears in Johnston’s (1931:134-135) _Western and Atlantic Railroad of the State of Georgia_, showing little standing architecture in the central portion of the yards save for the N&C Freight Depot, a structure with arched facades and a shallow pitched and hipped roof. The impact of the Civil War on Chattanooga and its railroads was to be substantial, given the extensive construction of railroad facilities by the United States Military Railroad. The use of the railways for the transport of soldiers and supplies had reaffirmed the economic importance of rail transport, and the central position of Chattanooga in southern rail systems was to be recognized.

After the Civil War, various rail lines were completed into Chattanooga. The Alabama and Chattanooga Railroad was completed into the city in 1871, followed by the Cincinnati Southern Railroad in 1879, the East Tennessee, Virginia and Georgia Railroad in 1882, and the Chattanooga, Rome and Columbus Railroad in 1888 (Steinberg 1976:15).
A map published by A. B. Paine in 1871, "Map of Chattanooga, Tennessee," shows, in addition to the Union Depot, W&A Freight Depot, W&A turntable and the N&C Freight Depot, a large N&C Engine House situated at the center of the site. The N&C Engine House, an L-shaped structure with wings running north and east, also appears in a perspective view of the city entitled "Bird's Eye View of the City of Chattanooga, Hamilton County, Tennessee, 1871," (illustrated in Hiener Printing Company 1961:82). It is possible that the N&C Engine House shown in the two above-mentioned maps was built by the U.S.M.R. during their occupation of the city. The N&C facilities were returned to the company in September, 1865 (Prince 1967:12), leaving the N&C indebted to the U.S. Government in excess of one million dollars for improvements made to the line during the war. In 1873, the N&C became the Nashville, Chattanooga and St. Louis Railway (Prince 1967:18).

E.F. Wittman's Map of Chattanooga, Tenn. (1885) illustrates the passenger and freight depots along Ninth Street, but fails to indicate any structures in the interior of the railyards. This may have been a omission, for the G. M. Hopkins and Company plan "City of Chattanooga, Tennessee and Vicinity," dated 1889, shows several structures in the central portion of the yard, most notably a turntable at the location of the original W&A turntable (under or near present Broad Street near the middle of the office complex tract), a possible small engine house at the center of the site, and, near the
southern border of the site, a second turntable, presumably operated by the NC&St.L Railway. By 1889, the N&C Freight Depot at the southwest corner of the site is clearly absent.

Increased rail traffic into and through Chattanooga dictated the expansion of passenger facilities beginning in 1888, when the Central Passenger Station near Market and King Streets was constructed. In 1894 the Cincinnati Southern Railroad, the Alabama Great Southern, the East Tennessee, Virginia & Georgia, and the Memphis & Charleston railroads merged into the Southern Railway System, and in 1909 opened Terminal Station at Market Street near Main, (Steinberg 1976).

By 1901, the interior of the railyards was dense with railroad tracks and spurs. A Sandborn-Perris insurance map of that date illustrates a turntable near the southern limit of the site, and north of the turntable, a sand house, coal chute and machine shop (Figure 1). The machine shop, however, appears to have been built after 1904 and prior to 1914: it appears as a pasted-on correction to the 1901 base plan. In 1890, the Western and Atlantic line from Chattanooga to Atlanta had been leased by the Nashville, Chattanooga and St. Louis Railroad, perhaps obviating the need for two turntables on the site. The turntable shown on the 1889 plan, situated near the southern limit of the site, is apparently not the same turntable shown on the 1901 plan. The combination of cartographic, photographic and archaeological evidence seem to confirm this point, the earlier turntable being situated southwest of the later one.

The yards appear essentially unchanged on plans of the
Figure 1. The Sandborn-Perris Insurance Map of 1901. This plan incorporates additions and corrections to 1914. The machine shop north of the turntable was evidently built after 1904 but prior to 1914.
area published by G.M. Hopkins and Company on plats dated 1904 and 1914. In 1914 the turntable at the south end of the site is connected to four main lines, two running north toward Union Depot, one southwest and one southeast. Additionally, there are eleven spurs or dead-end tracks radiating from the turntable's northerly and easterly quadrants, several of these spurs being attended by small maintenance buildings. North of the turntable appear the sand house, coal chute and machine shop.

By 1925, the turntable at the southern limit of the site is no longer in use, for a plat of that date prepared by the Office of Chief Engineer of the NC&St.L Railway shows three trunklines (tracks) terminating at the spot formerly occupied by the turntable.

A major reorganization of the railyards was occasioned by the extension of Broad Street south of Ninth Street in the summer of 1926 (Steinberg 1976:7). "Plat Book of Greater Chattanooga District,...", compiled and published by C. W. Chadwick in 1928, illustrates a small building occupying the spot once held by the NC&St.L Railway turntable. This structure is identified as the Railway Express Agency (REA) building. A larger version of this REA building was constructed on the site after the 1920s and survived until the spring of 1980.

The Nashville, Chattanooga and St. Louis Railway was merged with the Louisville and Nashville Railway in 1957. Use of the old Union Depot waned, and in 1972 the State of Georgia announced their intention to sell their holdings in downtown
Chattanooga. Georgia's title to the property had transferred through the merger of the NC&St.L and the L&N, and the L&N Railroad followed suit in making plans to redevelop the site of the Union Depot. In 1973, the Union Depot was razed (Steinberg 1976:10).

The maintenance yards which attended the train traffic into the Union Depot lapsed into disuse, and soon the L&N Railroad was divesting itself of the railyards property. The Tennessee Valley Authority purchased two tracts of property in the railyards and in the late 1970's announced plans to develop an office complex on the site.

The outline of historical evidence discussed above permitted Institute of Archaeology personnel to project into the path of the Twelfth Street extension right-of-way the approximate locations of railyard structures depicted on the various plans and views noted above. The two principal structures of significance to the industrial history of Chattanooga which could be shown to be impacted by new street construction were the Nashville, Chattanooga and St. Louis Railway turntable near the southern margin of the site, and to the west, the southern end of the Nashville and Chattanooga Railroad Freight Depot. The turntable could be dated to the period c. 1901 to c. 1914, and the freight depot, constructed prior to the Civil War, was evidently demolished by 1889.
Archaeological testing and monitoring was determined to be necessary on tracts affected by TVA's construction of the office complex and by concommitant street development and improvements undertaken by the city. The archaeological program was designed to recover data from the two principal railyard structures noted above, as well as to ascertain the presence of unanticipated cultural remains.

Historical and cartographic data summarized above demonstrated the probable presence of significant archaeological remains in the Market to Broad and Broad to Chestnut Street parcels of the project area. In these areas testing under the direction of the archaeologists was called for. Since street redevelopment in the Chestnut to Carter Street right-of-way would be confined largely to existing streets
THE ARCHAEOLOGICAL TESTING AND MONITORING PROGRAM

Overview

The archaeological testing program described below was conducted on two distinct levels of intensity, as required under recommendations of the SHPO. The operations were tailored to the expected density of historic and industrial remains. Testing, in this paper, refers to sub-surface reconnaissance of limited scope, conducted under the direction and control of the archaeologist, for data recovery. Monitoring, however, is simply inspection of on-going construction activities that involve sub-surface excavation and as such may impact buried cultural resources. It is only in the event of interception of significant features or deposits that data recording takes place; the construction activity does not take place under the direction of an archaeologist.

Historical and cartographic data summarized above demonstrated the probable presence of significant archaeological remains in the Market to Broad and Broad to Chestnut Street parcels of the project area. In these areas testing under the direction of the archaeologists was called for. Since street redevelopment in the Chestnut to Carter Street right-of-way would be confined largely to existing streets
where prior sub-surface disturbance could be anticipated,
it was determined that periodic monitoring of the excava-
tion of pipe trenches would serve as an adequate recon-
aissance of buried resources.

Figure 2 is a plan of both the TVA and UDAG excavations on the Union Railyards site, depicting the outline of the principal structures on the site.

1. To determine the history, function, and characteristics of the various structures within the railyard.

2. To provide evidence of changing railroad practices. In particular, to establish the dates and effects of the shift from wood to coal fuel, and from wrought iron to steel rail hardware.

3. To note in the investigation of structures specific differences between engineering ideals and actual construction practices.

4. To determine how the railyard functioned as both producer and consumer of industrial and domestic waste products.

5. To determine the characteristics and extent of artificial soils (primarily weathered locomotive clinker), and the impact of construction activities on natural soils.
Research Goals and Design

The area affected by UDAG street construction between Market and Chestnut Streets is a portion of the Union Railyards site as it is defined in the nomination form for the National Register of Historic Places. The basic research goals formulated for the testing of the TVA-owned portion of the site were extended to encompass the city-owned portion of the same.

In brief, these research goals were:

1. To determine the history, function, and characteristics of the various structures within the railyard.

2. To provide evidence of changing railroad practices. In particular, to establish the dates and effects of the shift from wood to coal fuel, and from wrought iron to steel rail hardware.

3. To note in the investigation of structures specific differences between engineering ideals and actual construction practices.

4. To determine how the railyard functioned as both producer and consumer of industrial and domestic waste products.

5. To determine the characteristics and extent of artificial soils (primarily weathered locomotive clinker), and the impact of construction activities on natural soils.
Items 4 and 5 were not specifically addressed in the testing or monitoring phases due to the reduced scale of the UDAG work in comparison to the TVA-funded research. Soil samples taken from Trench CC, TC and KC profiles will be filed with site documentation.

Methodology

Historical Research

Historical research relating to the research goals consisted of two main types: examination of primary documentation, and review of secondary documentation and topical literature. Primary documentation, consisting of maps, plans, court records, etc., was examined in order to reveal site-specific information concerning the history of the Union Railyards. Secondary documentation (e.g. local histories) and topical literature was examined to formulate generalizations about period architecture, railroading practices, etc., as well as to determine the role of the railyards in the perspective of Chattanooga and the region.

Archaeological Field Techniques

On the Market to Chestnut Street tracts, testing involved the machine excavation of search trenches laid out in such a manner as to intercept the anticipated features. This subsurface reconnaissance yielded information concerning the location and distribution of cultural features in horizontal plan as well as vertically, the stratigraphic record providing
evidence of successive site utilizations. Hand clearing was limited to cleaning profiles and exposed features. Where required, plan views of features were drawn to record structural and other details. Profile drawings documented site stratigraphy and the relationship of vertically contiguous layers. These profiles were keyed with soil samples from each stratum. Features were photographed for documentation purposes, and narrative style field notes were made describing the operations and encountered features. Limited artifact collections were made, in most cases only to characterize the types of debris present in the trenches; contextual control was limited by the basic excavation technique, (i.e. backhoe excavation).

Monitoring techniques employed on the Chestnut to Carter Street tract were more eclectic. Institute personnel were present while storm sewer trenches were being cut in order to assess the impact on buried cultural resources. Recording was done on a minimal level and only where archaeological features of interest were intercepted by the trenching. Narrative style field notes were maintained by the monitors. In the event substantial features were encountered, more detailed data recording would have been required.
The Market to Broad Street Testing Program

Testing of the Market to Broad Street portion of the Twelfth Street extension was conducted from June 3 through June 6, 1980. Testing consisted of an east-west backhoe trench, designated Trench CC, 185 feet long, designed to intercept the north-south railbeds of the Western and Atlantic Railroad. These beds had been exposed in the TVA Office Complex testing to the north of this tract, and could be projected through the street right-of-way on the basis of historic maps.

The trench, which was located along a line two feet south of the staked center line of the Twelfth Street connector, was graduated in depth from 8.5 feet Below Surface (B.S.) at the west end to four feet B.S. at the east end. The trench originated at a point 19 feet east of Broad Street, and continued eastward for nine feet, before encountering a concrete junction box. This box, which was not shown on current utility maps, was unidentified as to origin and was left undisturbed. The trench resumed at the 30 foot mark. Four features were identified in the trench, and a total of 77 feet of profile, including these features, was recorded.

Feature 1, a wooden drain, was discovered in the 0 to 9 foot interval, and ran roughly southwest to northeast at a depth of 7.45 feet B.S. at the western end, rising to 7.35 feet B.S. at the exposed eastern end (Fig. 3). The west end
Figure 3. Trench CC, North Profile; UDAG Testing, Market to Broad Street

Key to Soil Strata

1. gravel
2. cinder fill
3. rust layer
4. clay w/ bits of cinder
5. compacted slag and cinder
6. brown clay w/ bits of wood and coal
7. orange clay fill
8. cinder
9. mixed clay fill
10. brown stained clay
11. sterile clay
12. cinder and ash
13. cinder ballast railbed
14. coal mixed w/ gray-orange clay
15. brown clay w/ bits of charcoal
16. rock ballast, Feature 2
17. wood
18. coal
19. brown clay w/ bits of coal
20. loosely packed cinder
21. ash
22. dense packed cinder & clay w/ slag
23. clay fill, rock ballast
24. mixed clay and rubble
TRENCH CC-NORTH PROFILE
UDAG TESTING, MARKET TO BROAD STREET

PLAN VIEW OF WOODEN DRAIN

UNEXCAVATED
of the drain continued under the south face of the profile, and the east end continued under the north face at the junction box. The drain was exposed for six feet of its length. Over this six foot section, the drain sloped one degree east to west. The drain was constructed with wooden plank sides one foot deep, an interior width of 0.36 foot, and a wooden plank cover 1.28 feet wide. No bottom plank was noted. This lack of a bottom indicates that the drain was used to convey water away from the site, collecting water by seepage, and dispersing it at a lower distant point. Alternatively, this feature may have functioned as a runoff collection ditch near the railbeds.

This drain was set into what appeared to be sterile soil, and had a layer of brown clay 0.3 foot thick (Fig. 3, level 10) on its surface. A thin layer of cinder (Fig. 3, level 8) and clay fill (Fig. 3, level 9), 0.1 and 0.3 foot thick, respectively, surmounted this. There was no evidence of a railbed in this nine foot section, although level 5, a hard packed slag and cinder level, may have been a ballasted surface. The absence of charcoal in levels 8, 9 and 10 indicated that there was no provenience identifiable with the wood-burning era of locomotives, a period that extended into the last quarter of the nineteenth century.

Feature 2 was a probable rock-ballasted railbed extending from the 33 foot to 49 foot interval along the trench, and is a probable continuation of a railbed profiled in Trenches AA and BB of the adjacent TVA Office Complex testing.
Feature 3, in the interval from 60 feet to 80 feet, is a railbed with wooden ties in situ, ballasted with low grade coal. This bed represents a type not seen in any other area tested in the yard, and is distinctive due to the coal ballast and the presence of a wooden stringer timber placed at a 90 degree angle to the cross ties (Fig. 3). This railbed was situated at 3.9 feet B.S.

Feature 4 is a 0.9 foot square wooden plank water pipe at the 141 foot mark of the trench, situated at 4.1 feet B.S. This feature was profiled in the north face of the trench, but also appeared in the south face. Insufficient length of the feature was exposed to determine the direction of flow.

Testing in the Market to Broad Street portion of the site revealed stratigraphy similar to that in the trenches situated to the north on TVA property. The wooden drain exposed in trench section 0 to 9 feet was unique to the UDAG trench, however, due to its unusual construction. Early railbeds from the wood-burning era of the locomotive which were anticipated in the eastern end of Trench CC were absent in recognizable form, perhaps due to the disturbance caused by the installation of the drain.

Documentation of this trench included profile sections around the principal features, black-and-white photographs, profile-keyed soil samples, and narrative-style field notes.
The Broad Street to Chestnut Street Testing Program

Archaeological reconnaissance at the level of testing was determined to be required on the right-of-way of the Twelfth Street extension between Broad and Chestnut Streets. As noted earlier, historical research indicated the presence in this area of two main features pertinent to the industrial activity of the railyards. The first, on the east side of the Broad to Chestnut Street tract, was the turn-of-the-century turntable which operated during the first quarter of the present century. The second feature anticipated by documentary research was the Nashville and Chattanooga Railroad freight depot. Constructed prior to the Civil War and in use through the 1870's, the depot was projected to appear within the street right-of-way on the west half of the tract.

Backhoe search trenching was required in these two areas in order to locate the anticipated structures, and to assess their information potential. Trench TC was laid out to intercept the turntable, Trench KC, to intercept the N&C Depot.
Trench KC: The N&C Depot Testing

Search Trench KC was excavated along the centerline of the proposed Twelfth Street extension right-of-way, and was 90 feet in length. This trench was originally to be excavated along the southern limit of the right-of-way, but the presence of existing railroad tracks along that front did not permit excavation. Fortuitously, the new trench location resulted in the exposure of the southeast corner and south wall line of the N&C Depot. After some delay occasioned by the presence in the trench of an unknown chemical residue, recording of the trench proceeded.

In Trench KC, backhoe exploration revealed, among other features, structural brick footings interpreted as being foundations of the N&C Freight Depot (Figure 4). The footings can be described as being constructed of hand-made common red brick, bonded with lime-and-sand mortar, and laid in a shallow footing trench. Four courses of brick were present in the footings of the depot as exposed in Trench KC, although in adjacent excavations on TVA property at least five courses have survived.

The first course of the footings consisted of a three-brick wide base course, laid in stretcher bond, surmounted by the second course of two-and-a-half brick width, laid in stretcher bond, although occasionally employing headers. The third and fourth (and subsequent courses) were of finished wall width, being two-brick width (1.3 feet) and also laid in stretcher or common bond.
In summary, the structural evidence of the N&O Depot in Trench KC consisted of brick footings represented by a 12.8-foot length of the south depot wall footing at the southeast corner near the 1871 plan.

Figure 4. N&O Depot brick footings. Facing east; one foot scale.
The exposed footings constituted a coherent structural unit taken to be the southeast corner of the depot. The east wall regressed into the north profile of the trench, and the south footing stopped abruptly 12.8 feet from the corner. The northeast corner of the N&C Depot was archaeologically exposed in the adjacent excavations on TVA property. At a distance of six feet from the northeast corner of the depot the south footings terminated, indicating that only the east wall footings of the Depot were continuous, and that the north and south wall footings were discontinuous (not perimeter footings). Measurement revealed the length (north to south) of the Depot footings to be 169.7 feet, far shorter than the 240 foot length suggested by the scale of the 1871 plan of the area.

It should be noted here that while no datable artifacts were recovered in definitive structural contexts, the footings exposed in Trench KC could be linked by their structural identity to those footings in the Trench K complex in the TVA portion of the railyards site. In that area, artifacts in association with the depot footings were sufficient to date the structure to the 1860's and 1870's, thus linking the archaeological structure with its cartographic representation and name on the 1871 plan.

In summary, the structural evidence of the N&C Depot in Trench KC consisted of brick footings represented by a 12.8 foot length of the south depot wall footing at the southeast corner of the structure. The location of this footing permitted
a determination of the final length of the N&C Depot, and indicated the use of continuous footings only along the east side of the structure.

Artifacts recovered from Trench KC were not in usable dating contexts. These items, listed in Appendix 1, were collected to represent the types of materials present in the test trench. Several of the salt-glazed, Albany-slipped stoneware sherds (accession numbers 1692, 1693) were found atop the ruined brick wall of the depot, and several more (accession number 1682) were in the adjacent rail bed. These sherds were similar in type to those found in the TVA Office Complex area to the north, which have been identified as a type popular from the 1850s to the early 1900s. (Watkins 1968:11).

The stratigraphy of the south face profile of Trench KC revealed stratigraphy similar to that of Trench KF in the TVA test area. The majority of this profile contained a cinder level, c.2.5 feet thick laying directly on sterile clay. Measuring from the east end of the trench, a layer of cinder and clay between these two levels was in an interval extending from 40 feet to 70 feet with a possible builder's trench from 63 feet to 66 feet. The eastern end of the profile shows a railbed adjacent to the depot, a ditch, clay fill and debris from the destruction of the depot. A pipe trench at 13 feet to 16.5 feet c. 1.5 feet B.S. cuts across the depot footings. The absence of buried humus horizons in the depot area was noted
in testing for both the City of Chattanooga and TVA. Whether this lack is the result of grading prior to deposition of cinder fill or the scouring action of frequent floods in the area could not be determined. (TVA 1959)

Trench KC and the N&C Depot footings were documented photographically and a plan view drawing of the footings prepared. A profile drawing of the south face of the trench was made and profile-keyed soil samples taken of strata. Artifacts recovered from Trench KC are listed in Appendix 1.

Upon completion of the excavation and documentation of Trench KC a field determination was made that no further testing for the remains of the N&C Depot would be required in the Twelfth Street right-of-way. On July 9, 1980 the area surrounding Trench KC was released for street construction.
Trench TC: The Turntable Testing

Backhoe search trench TC was excavated along the southern edge of the Twelfth Street extension right-of-way on 24 June 1980. The final length of Trench TC was 120 feet, and it intercepted not only the walls of the anticipated turntable, but a variety of structural features. Machine excavation revealed the basic outline of the turntable but also demonstrated the presence of the concrete foundation walls of a modern structure, these walls having been poured inside the limits of the earlier turntable. In order to clarify the relationship of features and to expose the hub of the turntable, additional backhoe clearing was required.

The principal feature exposed in Trench TC was an example of an early 20th century turntable, a rotating platform on which locomotives and tenders were directionally shifted from one rail line to another. While nothing remained of the turntable platform itself, the housing, consisting of a circular perimeter wall, floor and hub, was substantially intact, albeit somewhat obscured by the foundation walls of a later, superimposed structure (Figure 5).

The turntable housing was of heavy, unreinforced concrete construction, featuring a perimeter retaining wall 71.0 feet in diameter (outside measure), 2.08 feet thick, and about 2.3 feet high. The perimeter wall footing rested on a coarsely poured concrete pad projecting two feet beyond the outer
The trench measured more than three feet in depth, but the bottom was not reached during testing.

The wall was evidently occupied by a series of anchor pieces of unknown thickness and varying length (2.5 feet). The general form of these pieces can be seen in Figure 4. Iron anchor rods projected vertically from the interior side of the top of the perimeter wall, the lining was from 2.5 feet to 3.2 feet. There anchor pieces were evidently intended to anchor additional wooden coping pieces.

Around the outer perimeter of the drum, concrete blocks of the turntable housing were used, based on angular notations (2.17 feet long, .66 feet wide, and .41 feet high) at the junction of the turntable and the block wall. The turntable proved in many cases to contain a concrete shelf that base directly from this base to the edge of the hub.

The turntable hub, located at the center of the structure, is a center hub that was reconstructed using an array of concrete 12.0 feet in diameter and varied in depth (Figure 4). The hub rose 1.7 feet above the laying depths.

INSTITUTE OF ARCHAEOLOGY
UNIVERSITY OF TENNESSEE AT CHATTANOOGA

TRENCH TC - TURNTABLE
UNION RAILYARDS SITE 105 - S.E. 74
UDAG TESTING 1980

Figure 5. Trench TC - Turntable; Plan of Features.
finished wall. The pad was at least three feet in depth, but the bottom was not exposed during testing.

The outer edge of the top of the perimeter wall was slightly recessed, and was evidently occupied by timber coping pieces of unknown thickness and varying lengths (6.2 to 9.5 feet). The general form of these pieces can be seen in Figure 6. Iron anchor rods projected vertically from the interior side of the top of the perimeter wall, the spacing varying from 2.5 feet to 3.3 feet. These anchor rods were evidently intended to anchor additional wooden coping pieces.

Around the outer perimeter of the dished concrete floor of the turntable housing were level-based rectangular recesses 3.17 feet long, .84 feet wide, and .41 feet deep at the junction of the perimeter wall and floor. These rectangular slots proved in many cases to contain deteriorated wood remains, and evidently originally contained short sections of railroad ties (Figure 7).

From the junction of the perimeter wall and the floor to a point 4.1 feet from the outer edge of the turntable hub the concrete floor sloped down (in three stages) 2.65 feet, then rose slightly from this point to the edge of the hub. The turntable hub, resting at the center of the structure, sat atop a slightly crowned single-pour slab of concrete 12.0 feet in diameter and of undetermined depth (Figure 8). The hub rose .7 feet above the circular pad, and was reinforced
Figure 6. Plan and sectional profile of turntable. A - hub; B - hub pad; C - slab floor; D - tie slots; E - retaining wall and timber coping; F - retaining wall slab.
Figure 7. Turntable retaining wall and tie slots. Facing south; one foot scale.
Figure 8. Turntable hub and REA building foundations
Facing north.
around its circumference by an iron band .5 feet wide. Four wrought iron anchor rods, spaced equidistant around the perimeter of the hub, projected vertically from its upper face.

Radiating from the edge of the central circular hub pad were concrete pour seam lines, periodically intercepted by pour seams on tangents to the circle. The floor of the turntable housing, between the outer tie slots and the central 12 foot diameter hub pad, was evidently poured in three tiers, involving 80 slab pours. The pour pattern, as reconstructed from the field data, can be seen in Figure 6.

Exposure of the turntable floor was quite limited, but one example of a floor drain opening in the floor was noted. Our limited information on drain features does not permit us to detail the manner in which rainwater was drained from the interior of the turntable housing.

The observed characteristics of turntable construction have been graphically summarized in Figure 6, which is reconstructive and based on an assumption that our limited sample of structural features of the turntable was nonetheless characteristic of the whole.

Rectangular slots around the perimeter of the housing floor evidently held short sections of railroad ties upon which was mounted a rail. Truck wheels or rollers attached to the ends of the turntable platform tracked along this rail. At the hub, wrought iron tie bars anchored the central pivot, with
shell and bearings, to the concrete pad beneath. Turntable technology will be discussed in the concluding section of this report.

The features of the interior of the turntable housing were obscured by the presence of the basement walls of a building designated, on early 20th century maps, as an office of the Railway Express Agency. Figure 8 demonstrates the juxtaposition of the REA building and the hub of the earlier turntable. The concrete floor of the turntable was a convenient foundation on which to pour the concrete walls of the REA structure. The building, built about 1927 and demolished sometime after 1969, was approximately 38 feet by 50 feet in size (See Figure 5). At least one window or similar aperture of deliberate construction was noted in these concrete walls, which may indicate the presence of a basement in the REA structure; (the aperture is visible in Figure 8). Whether or not the space below ground level of the structure was utilized, the use of the turntable floor as the foundation for the small REA building presents an interesting juxtaposition of early and late railyard facilities.

West of the turntable a number of features were encountered. Two limestone piers, composed of squared, stacked slabs, were noted (see Figure 9). These piers, resting on a surface of crudely poured unreinforced concrete, may have served as supports for a water tank or similar pier-supported feature. The piers rested on an extension of the pad poured under the perimeter retaining wall of the turntable, suggesting possible contemporaneity or subsequence to that feature.
Figure 9. Limestone block piers. Turntable retaining wall is at left. Facing south.
Numerous cast-iron and glazed ceramic pipes graced the west end of Trench TC, the above-mentioned stone piers having been somewhat disturbed by their laying. In the extreme west end of Trench TC a relatively modern concrete wall was exposed, evidently laid prior to the construction of a concrete loading ramp built after 1969. Too little of this hidden concrete wall was exposed to comment upon it further.

East of the turntable two features of interest were noted. A stone-lined drain capped with slabs of cedar logs was present, partially obscured by a later, modern concrete wall footing clearly attributable to the Railway Express Agency building. This second REA building was built after the late 1920s, demolished early in 1980, and was built as a larger version of the small building situated within the limits of the turn-of-the-century turntable.

Stratigraphically, the cedar-capped drain was much earlier than the later REA building foundations, but the date of construction of this drain has not been determined. The drain was linear in aspect, running north-south, and composed of squared but uncoursed blocks of limestone enclosing an open conduit 2.7 feet wide and of undetermined depth. The conduit was covered with lengths of cedar tree trunks four feet long, c. 0.8 feet in diameter, and split or sawn in half longitudinally. The drain was laid in a trench about five feet in width and excavated into the sterile silty clay layer underlying the entire railyards site. When constructed, the top of the drain would have been barely a foot below existing surface grade.
Stylistically, the drain exposed in Trench TC was identical to one exposed in Trenches TA and TB in an adjacent archaeological test clearing an easement through the Twelfth Street right-of-way for a TVA service and pedestrian tunnel. This drain in the easement was structurally associated with a building dated to the early 1870s. The cedar-capped drain in the tunnel easement evidently drained the southern end of a railyard building annexed to the Nashville and Chattanooga Railroad Engine House, and our example in Trench TC may have served a similar purpose with respect to the engine house proper, the south wall of which was situated c. 70 feet to the north of the drain in question.

The primary documentation of the turntable and related features of Trench TC consisted of a plan table/alidade plan view of the trench, a profile drawing of the south face of the backhoe trench (with profile-keyed soil samples), black and white and color photographic documentation, as well as narrative description in field notes. No significant artifacts were recovered from Trench TC, the essential information being structural in nature.
Periodic monitoring of the Chestnut to Carter Street sewer installation commenced on June 16, 1980 and was completed on June 27. As the Scope of Services for the contract stipulated that only monitoring of trench cuts would be needed, no detailed profiles were drawn, and archaeological data recording was limited to verbal description of the cuts and sketch maps of the common stratigraphy.

The route of this sewer installation proved to have been continually popular for utility construction in the past. The presence of a one-foot diameter ceramic pipe (c. 4 feet B.S.) and a metal pipe (c. 1.5 feet B.S.) approximately 100 feet east of Carter Street, a level of brick fill with a metal cable (c. 0.5 foot B.S.) 130 feet east of Carter, a water pipe (c. 2.5 feet B.S.) at the intersection of Twelfth and Fort streets, and an in-use water pipe at the intersection of Twelfth and Chestnut streets demonstrates the extent of previous disturbance in this area.

Because of these frequent disturbances for utility construction, very few coherent cultural features were defined. Two features, however, deserve brief mention: a deposit of broken glass and a set of buried rail tracks.

The east-west trench that cut across Chestnut Street to the north side of the intersection with Twelfth Street disclosed a set of buried rails. The stratigraphy of this
trench revealed a ceramic pipe (c. 3 feet B.S.) in a clay matrix which contained fine gravel, surmounted by a gravel bed containing wooden ties. This in turn was surmounted by a concrete roadbed (c. 0.8 foot B.S.). The rails were embedded in this upper concrete level. A layer of asphalt approximately two inches thick covered the concrete and rails and comprised the modern street surface level.

In 1890 the Chattanooga Electric Street Railroad began operation of a streetcar line down Chestnut Street. This St. Elmo line operated until November 1932, when the company, now Tennessee Electric Power Company or TEPCO, discontinued service (Steinberg 1975:24). Unfortunately, no artifacts were recovered from this feature in contexts which would reflect whether this was a section of the streetcar line or a railroad spur.

The stratigraphy in this cut typified the stratigraphy throughout the street redevelopment area, disclosing successive generations of road beds of clay, brick or gravel, macadam, asphalt, and in some cases concrete.

The other significant feature noted was a glass deposit revealed during construction of a catch basin at the northwest corner of Twelfth and Fort Streets.
Monitoring Program Artifacts

The entire collection of artifacts from the Chestnut to Carter Street monitoring project comes from a single trash deposit at the northwest corner of the intersection of Twelfth and Fort Streets. Specimens from this deposit are shown in Figure 10. All the datable specimens were manufactured after the late 1880's, and were probably deposited around the turn of the century.

No systematic sampling of the deposit was made, but rather an informal sample of the debris was collected. The deposit consisted totally of glass, and appeared to be largely brown beer-bottle glass, with some lesser quantities of clear glass beer bottles, green glass wine bottles and miscellaneous forms.

The only intact glass vessel recovered from the deposit was a Carter's ink bottle (Figure 10, left). Blown in a two-piece, post-bottom mold, the base of the ink bottle bears the embossed marks "CARTER'S" and "78". The Carter Ink Company has been producing its own bottles since 1858, although the date of manufacture of this example is not known (Munsey 1970:120).

Two substantial portions of beer bottles were also recovered, one in aqua or pale blue-green glass, the other in clear glass. Both were blown in two-piece, cup-bottom molds. Both bottles bear the same embossing on their sides: "CHATTANOOGA
Figure 10. Monitoring program artifacts. Left - Carter's ink bottle; left center - aqua beer bottle base, marked; center - clear beer bottle, without neck, marked; right center - beer (?) bottle neck, brown glass; right - green glass wine bottle base, with kick-up.
BOTTLING CO. CHATTANOOGA Tenn.," and on the opposite side, "THIS BOTTLE IS NEVER SOLD." A clear manufacturer's mark is present around the lower edge of the clear bottle: "N.B.BG.CO.," and is attributable to the North Baltimore Bottle Glass Company of Baltimore, Ohio, which operated between 1885 and 1930 (Toulouse 1971: 378-380).

The clear beer bottle example is equipped with a patented closure device known as the Hutchinson stopper, (Fig. 10, center). This device was patented in April of 1879 and consisted of a rubber gasket seal held in place in the neck of the bottle by a looped wire spring. Use of the Hutchinson stoppers continued into the 1920's, but enjoyed its greatest popularity in the last decade of the nineteenth century (Toulouse 1971: 105-106).

Bottles of the type just discussed were mass produced for a national market, the two examples noted above having been "customized" by the use of special molds engraved with the company name of the purchaser in this case, the Chattanooga Bottling Company. On an 1889 plan of the city published by G.M. Hopkins, the bottling firm was situated on the east side of the block bound on the north by Twelfth Street and on the east by Fort Street, barely half a block from the deposit where the archaeological examples were found.
DISCUSSION AND CONCLUSIONS

The research goals generated for the study of the Union Railyards, broadly speaking, concerned four areas of inquiry: site-specific data and history of the yards, the history of railroad technology, the effect of industrial activity on the natural landscape, and the formulation of models for the comparison of the real versus the ideal. This hierarchy of topics ranges from site-specific observations to broad generalizations, and is reflected in the types of data employed at each level of inquiry. Concomitantly, with each step up from raw data to interpretation and theory, the difficulty of generating conclusions increases.

At the first level of inquiry is data of the simplest sort, nominal data. The presence in the project area of glass beer bottles manufactured in Baltimore for a Chattanooga firm is a document indicating commercial connections between two distant cities, as well as the presence of a local commercial network. Rail connections between cities in the nineteenth and early twentieth centuries allowed transport of products and material on an industrial scale, and in no small way contributed to the economic prosperity of the region and the nation as a whole. The glass bottle fragments discussed under the Chestnut to Carter Street monitoring section of this report are meager but material reminders that the industrial fabric of Chattanooga is part of a larger economic network.
At a higher level of inquiry, our study of the Union Railyards was addressed to changes in railroad practices and technology. In the UDAG testing program the exposure of the turn-of-the-century turntable provided an opportunity to compare available technology with existing technology, the turntable serving as a dated example of a class of railroad structure. Similarly, the construction of the N&C Freight Depot is a valid but limited example of early railroad architecture. Finally, the network of drains beneath the site, while occasioned by site-specific conditions, reflect period practice and response to practical engineering problems. Our examination of turntable technology not only provided an example of period railroad practice, but also served at the highest level of inquiry to point out the difficulty of model formation. We will return to this matter shortly.

At the third level of inquiry, the effect of industrial activity on the natural landscape is a topic of much interest and concern to modern society as a whole. Perhaps uniquely, archeaology can add time depth to the study of industrial wastes and their effect on the environment. Along these lines, the physical alteration of both the natural and the cultural landscape by earth works such as railroad tracks is a topic worthy of attention (Brown 1980).

Various railroad authors cite the critical importance of drainage of tracks and structures (Kirkman 1904: 120, 153, 356;
Webb 1908: 112-113; Paine 1885: 25-38). In our UDAG testing program we encountered two types of drains, one, in Trench CC, formed of wooden planks, the other, in Trench TC, composed of a stone lining and capped with cedar logs. Both evidently served as drains, that is, collected and conveyed water from one point to another.

The railyards site has been described in informal communications as having a "perched water table," that is, groundwater accumulating upon a layer of more or less impermeable clay or silty loam. In this circumstance, water does not collect in any natural channel and flow, but rather collects in a sheet on top of the subsoil.

The function of the drains exposed was evidently to create a channel or course where none existed, providing an egress for water accumulating in the yards. Impermeable ceramic or metal pipe can convey water, but not collect it; plank and stone drains of seamed construction doubtless would allow seepage. In both cases, the drains encountered were excavated into the clay subsoil, and would have served as open ditches, except for the need of lining and capping to prevent their clogging by the accumulation of cinder and clinker waste or by the erosion of the ditch walls.

Graphic evidence of the continual aggradation of the site ground surfaces as a function of the generation and disposal of industrial wastes has been presented in Figure 3. Whether the sump-action drains uncovered at the site were a response to
already existing natural drainage conditions, to the creation of a reservoir of perched ground water brought about by the alteration of surface contours and sub-surface soils, or to a combination of these factors is as yet unknown, but is certainly deserving of future study. The significance of this line of inquiry is best stated by the following quote from Brown's "Earthworks and Industrial Archaeology" (1980:1):

Earthworks produce both intended and unintended consequences for social and natural systems. The ecological consequences of earthworks are thus important subjects of inquiry. The industrial archaeologist should provide the same sorts of insights into manmade landforms that the geomorphologist provides for natural landforms—should analyze the human forces that shape the modern landscape and the consequences of these activities for animate communities.

Although these questions cannot be directly addressed by the present authors due to the limited scope of this study, the results reported here should prove useful to future researchers concerned with the ecological effects that industrial processes have on natural and man-made environments.

Our research into turntable technology was primarily aimed at providing interpretive background for the physical remains. The topic of available versus existing technology, however, has lead to the consideration of broader issues, as the following discussion indicates.

Turntables are simply devices by which locomotives and tenders can be directionally shifted from one track to another, accomplished by rotating the locomotives on a platform mounted...
in a circular housing from which radiate multiple tracks. Turntables were employed at terminal points along rail lines, and commonly were in association with roundhouses. A roundhouse is a type of engine house or locomotive maintenance facility, constructed in semicircular form around a turntable which could "dial" a locomotive and tender into one of many stalls furnished by tracks radiating from the turntable. In the case of our archaeological example, the turntable was situated at the crux of a wye-form track system, enabling locomotives to be shifted either onto dead-end spurs around the turntable or onto one of several tracks running north, southeast or southwest.

The construction of a turn-of-the-century turntable is described in "The Elements of Railroad Engineering" by the Colliery Engineer Company (1897), quoted below. The illustration accompanying the text is shown in Figure 11.

"A turntable, as shown in Fig. 638, is a platform usually from 50 to 70 feet long, and from 8 to 10 feet wide, upon which a locomotive and tender may be run and then turned horizontally through any portion of a circle, and thus be transferred from one track to another forming any angle with it. The table is supported by a pivot under its center, and by wheels or rollers under its ends. Beneath the platform is excavated a circular pit 4 or 5 feet deep, having its circumference lined with brick or stone masonry 2 feet in depth, and capped with either cut stone or wood.... The masonry lining is usually built with a step (see elevation B), which supports the rail upon which the end rollers travel. At the center of the pit is a substantial foundation of masonry, upon which the pivot rests.... One man can readily turn one of these tables, loaded, without the assistance of machinery. The consist of two heavy cast-iron girders, perforated by circular holes to reduce weight and cost...."(1285-1287).
Figure 11. Plan and Section of a Cast-Iron Turntable. From "The Elements of Railroad Engineering," Volume II, (1897), The Colliery Engineer Company, pp 1286.
In operation, the locomotive and its tender were driven onto the table or platform and shifted until the center of balance was achieved. The weight of the locomotive and tender was intended to rest almost totally upon the central pivot, thus concentrating the frictional resistance to motion at the pivot (the center of motion) and not on the rollers at the ends of the table. By concentrating the weight and thus the friction at the pivot and by applying force at the end of the platform, substantial loads could be rotated by hand, that is, by yardmen pushing on lever bars attached to the table ends.

To effect the concentration of weight on the pivot it was necessary that the platform be rigid as well as strong, in order that the ends of the table not sag and so place weight on the end rollers. Examples of mid-nineteenth century turntable platforms were constructed of heavy timber frameworks tensioned by wrought-iron tie rods. The rigidity and strength of wrought or cast-iron plate construction was a dramatic improvement over timber construction. As Paine, writing in 1885, noted, "Probably no one would now build a wooden turntable, although it is but a few years since they were common enough. Wrought-iron tables, of sufficient strength, are doubtless the best of any, if kept well painted; if they are to be neglected, cast-iron ones are better," (Paine 1885:84). An example of a wrought-iron turntable is shown in Figure 12.

A second important aspect of turntable technology was the central pivot and bearings upon which enormous loads were put.
Figure 12. Details of Wrought-Iron Turntable and Pivot. From "Building and Repairing Railways," (1904), Marshall M. Kirkman, pp 272.
In 1904 Kirkman (1904:271) noted:

"With the increased weight and length of engines, the styles of turntables in use a few years ago are not able to do the work required of them at present. Attention is now being given to improving the bearings at the center to secure a distribution of the weight of engine and turntable, so that the table can be quickly and easily turned. Turntables are now made from thirty to seventy feet in length, and of both wrought and cast iron."

An illustration of the type of bearings then in use appears in Figure 13. Steel roller bearings of truncated cone form rolled in a track around the top of a steel pedestal, of which, in Figure 13, we see only the outer casing.

The third crucial aspect of turntable construction concerns the foundations for the central pivot. Webb, writing early in this century, noted "The table must be supported on a pivot which must have an adequate foundation which must be able to support a load of perhaps 200 tons," (Webb 1908:199). Of course, the foundations for the pivot not only had to support the weight of the locomotive and tender, but the often substantial weight of the platform and bearings. Linked with the structural strength and rigidity of the turntable platform and bearings was the necessary stability of the foundations upon which these elaborate constructions were poised. The answer to this last problem would involve the use of the material discussed in this following passage, published in the last quarter of the nineteenth century:
"The great value of concrete is its durability, yet it is not availed of largely in large structures because of the cheapness, convenience and speed with which it can be applied. It is, however, most applicable to any building which can not fail in any part of it, if of suitable strength." (P. 53)

Three interrelated comments occur in our examination of the development of railways.

1. The first is the progressive increase in the weight and length of locomotives, and the increased speed with which they could be operated, and the increased loads hauled by rails during the late-nineteenth and early-twentieth centuries.

2. The second is the development of a new type of railway locomotive, the 4-4-0 type, which was able to run at a higher speed without tending to derail.

3. The third is the development of new types of railway foundations and superstructures, which were necessary to support the increasing loads hauled by rails during the late-nineteenth century.

**Figure 13.** Detail of Turntable Roller Bearings. From "Building and Repairing Railways," (1904), Marshall M. Kirkman, pp 273.
"The great value of concrete in foundations is slowly coming to be appreciated, yet is not availed of largely in railway works, except those of the most imposing character; while the cheapness, convenience and superiority in all respects to any other sort of base, should recommend it for universal use. It enables the engineer to build his superstructure on a monolith as long, as wide and as deep as he may think best to construct, which can not fail in parts, but must go all together, if of suitable proportions," (Paine 1885:11).

The use of concrete answered in part the need for steady, substantial foundations, under the pivot in particular, but under the entire turntable housing as well.

Three interrelated themes, then, recur in our examination of turntable technology around the turn of the century: the construction technique and material of the platform, the nature of the bearings at the central pivot, and the construction of the foundations for the turntable housing, in particular, for the central pivot.

Our survey of the literature on railroad practice shows that the technological improvements discussed above were dictated by the increasing weight and length of locomotives during the nineteenth and twentieth centuries. In 1882 a 4-4-0 type Baldwin passenger locomotive measured roughly 32 feet in overall length and about 65,000 pounds in weight, without tender (Benjamin 1882:341). The same type of locomotive made by Baldwin in 1917 measured c. 36 feet overall, and grossed 118,000 pounds (Raymond 1917:160). These figures, in turn, are indicators of the increasing loads hauled by rails during the late-nineteenth and early twentieth centuries.
In an 1898 report of the Properties Control Commission of the Western and Atlantic Railroad comes a description of the improvements on the W&A holdings in downtown Chattanooga. Among the structures described is the following: "1 Seller's turn-table, iron, in good order, circular masonry in good order, center foundation in bad order, sinking" (Properties Control Commission 1898:13). This terse description of a turntable "in bad order, sinking," apparently refers to the W&A turntable situated under, or adjacent to, present-day Broad Street. The Nashville, Chattanooga and St. Louis Railway turntable exposed archaeologically in the Twelfth Street right-of-way may or may not have had a similar problem. While the central pivot and the pour around it reveal no evidence of subsidence, it is possible that the entire structure was sinking into the poorly drained soils beneath the site. More likely, however, the turntable was abandoned when the yards were reorganized due to the extension of Broad Street.

We have suggested, in our discussion on turntable technology, that because of increasing locomotive weights and lengths technological improvements in turntable construction were necessary during the late nineteenth and early twentieth centuries. The construction of turntable platforms progressed from wood, to wrought and cast iron, and ultimately to structural steel. Improvements in the bearings at the pivot, and the use, starting in the late nineteenth century, of concrete for
foundations, also contributed to the ability of turntables to carry and turn increasing loads.

The technological and economic issues affecting the documented increase in weights and lengths of locomotives is obviously linked to larger railroad perspectives beyond the scope of this report. The turntable exposed in Trench TC enables us to document the physical reality of a point in a technological continuum, to compare the real versus the ideal (after Brown 1980:6) in terms of construction, and to document changing railroad practices in an historical as well as archaeological manner.

It is interesting to note Kirkman's (1904:271) use of an illustration of a turntable that employs rubble stone pivot and retaining wall foundations (Fig. 14). We have already quoted above Paine's 1885 admonition about the desirability of monolithic concrete in railroad structure foundations, and have documented in the UDAG testing the presence of a concrete turntable built after 1889 and before 1901. In this light, Kirkman's 1904 example of turntable construction might seem surprising and perhaps anachronistic. An alternative suggestion would be to propose that the archaeologically exposed example is innovative. Our few examples of period observations about turntable technology do not suffice as a valid sample from which to make conclusions about the degree or extent to which the real approaches the ideal. The position of our exposed turntable
Figure 14. Plan and Section of a Sellers Turntable. From "Building and Repairing Railways," (1904), Marshall M. Kirkman, pp 271.
in the technological continuum is unfixed, between the traditional and the innovative.

The nature of the process of formulation of the concept of the "ideal" is itself subject to critical evaluation, and in part hinges on the manner by which the ideal model would be translated, in the most favorable of circumstances, into behavior, that is, the real. In structural terms, the reality of the ideal turntable would have to be adapted to specific site conditions, with the depth of concrete foundations, for example, dependent upon the drainage of the soils and other soil attributes, the load to be carried, etc. It seems obvious that there could be no one "ideal" model, expressed in immutable dimensions and form and construction, for no single turntable design could perform in a variety of sites and functions. Rather, the ideal would be an expression of characteristics rather than a recipe or blueprint. How then is it possible to measure the adherence of a specific example to the generalized model?

The results of this admittedly limited study suggest that hypotheses dealing with "real" versus "ideal" distinctions at industrial sites—particularly railroad sites—are not amenable to testing until considerably more basic information on industrial site structure and function is known. Despite the relatively recent time frame investigated in the present study, few primary documents for the period were found that could be used for interpretive purposes, and, as indicated
above, a dearth of secondary sources pertaining to railroad technology has hampered our ability to address the research goals that were defined for this project.

There is unfortunately much irony in the fact that a site that is scarcely 100 years old in Chattanooga, Tennessee is as poorly documented and understood as a 16th century Hispanic occupation in St. Augustine, Florida (Deagan 1978). Clearly it is the task of archaeologists working with both types of sites to establish the archaeological data base necessary for the formulation of higher level hypotheses such as the real/ideal comparisons mentioned above.

Brown (1980:1) has suggested that the proper structure of inquiry at industrial sites proceeds from a history of technology, which represents the "starting point for interpretation." The difficulty that the present authors encountered in the interpretation of site structure and function at the railyards serves to underscore the correctness of Brown's observation. At the same time, the paucity of documentary information on railroad technology points out the need for more basic, comparative archaeological data concerning the physical remains of our industrial and technological past. It is to this end that the present study has been devoted, and, within the context of the project limitations, it is felt that this study has provided baseline data for the anthropological investigation of important and little-known aspects of Chattanooga's industrial past.
APPENDIX 1

Artifacts Recovered under UDAG #B-80-AA-47-003 (Contract 2)
Archaeological Testing and Monitoring.

**Chestnut St. to Carter St. Monitoring**

<table>
<thead>
<tr>
<th>Accession Number</th>
<th>Provenience</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#3178</td>
<td>Pipe Trench</td>
<td>Beer (?) bottle neck and crown; brown glass</td>
</tr>
<tr>
<td>#3179</td>
<td>Pipe Trench</td>
<td>Wine (?) bottle base, pontil kick-up; green glass</td>
</tr>
<tr>
<td>#3180</td>
<td>Pipe Trench</td>
<td>Bottle glass fragments; clear glass</td>
</tr>
<tr>
<td>#3181</td>
<td>Pipe Trench</td>
<td>Beer bottle base; 2-piece molded, aqua glass; marked &quot;THIS BOTTLE IS NEVER SOLD&quot; and &quot;BEER BOTTLING CO, CHATTANOOGA TENN&quot;</td>
</tr>
<tr>
<td>#3182</td>
<td>Pipe Trench</td>
<td>Bottle glass fragments; clear and aqua</td>
</tr>
<tr>
<td>#3183</td>
<td>Pipe Trench</td>
<td>Snail shell from bottle (3181) interior</td>
</tr>
<tr>
<td>#3184</td>
<td>Pipe Trench</td>
<td>Ink bottle; 2-piece molded; brown glass; marked on base &quot;CARTER'S&quot; and &quot;78&quot;</td>
</tr>
<tr>
<td>#3185</td>
<td>Pipe Trench</td>
<td>Beer bottle body; clear glass; 2-piece molded; marked &quot;CHATTANOOGA BOTTLING CO, CHATTANOOGA, TENN&quot; and &quot;THIS BOTTLE IS NEVER SOLD&quot; and &quot;N. B. BG. CO.&quot;; furnished with Hutchinson stopper</td>
</tr>
</tbody>
</table>

**Broad St. to Chestnut St. Testing**

<table>
<thead>
<tr>
<th>Accession Number</th>
<th>Provenience</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1627</td>
<td>Trench TC</td>
<td>Unidentified metal object</td>
</tr>
<tr>
<td>Accession Number</td>
<td>Provenience</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>------------</td>
<td>-------------</td>
</tr>
<tr>
<td>#1628</td>
<td>Trench TC</td>
<td>Bolt (?) fragment</td>
</tr>
<tr>
<td>#1682</td>
<td>Trench KC</td>
<td>6 stoneware sherds; gray bodied, salt-glazed, interior Albany slip</td>
</tr>
<tr>
<td>#1683</td>
<td>Trench KC</td>
<td>Bottle neck fragment; clear glass; flat-rimmed</td>
</tr>
<tr>
<td>#1684</td>
<td>Trench KC</td>
<td>Bottle fragment; brown glass</td>
</tr>
<tr>
<td>#1685</td>
<td>Trench KC</td>
<td>5 fragments, clear window pane glass</td>
</tr>
<tr>
<td>#1686</td>
<td>Trench KC</td>
<td>3 bone fragments; cow or pig humerus, phalange, small rib</td>
</tr>
<tr>
<td>#1687</td>
<td>Trench KC</td>
<td>Bottle fragment; brown glass</td>
</tr>
<tr>
<td>#1688</td>
<td>Trench KC</td>
<td>Stoneware sherd, bottleneck fragment; gray body, brown glaze</td>
</tr>
<tr>
<td>#1689</td>
<td>Trench KC</td>
<td>Unidentified metal object</td>
</tr>
<tr>
<td>#1690</td>
<td>Trench KC</td>
<td>Bottle base; aqua glass; 2-piece molded</td>
</tr>
<tr>
<td>#1691</td>
<td>Trench KC</td>
<td>Stoneware sherd; buff paste, brown glazed</td>
</tr>
<tr>
<td>#1692</td>
<td>Trench KC</td>
<td>Stoneware sherd; jar neck; gray paste, salt-glazed, Albany slip interior</td>
</tr>
<tr>
<td>#1693</td>
<td>Trench KC</td>
<td>Bone fragment; cow or pig femur</td>
</tr>
<tr>
<td>#1694</td>
<td>Trench KC</td>
<td>Undecorated whiteware plate base fragment</td>
</tr>
<tr>
<td>#1695</td>
<td>Trench KC</td>
<td>Machine cut square nail</td>
</tr>
<tr>
<td>#1696</td>
<td>Trench KC</td>
<td>Unidentified metal object</td>
</tr>
<tr>
<td>#1697</td>
<td>Trench KC</td>
<td>Unidentified metal object</td>
</tr>
<tr>
<td>#1698</td>
<td>Trench KC</td>
<td>Cut nail fragment</td>
</tr>
<tr>
<td>Accession Number</td>
<td>Provenience</td>
<td>Description</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>#1893</td>
<td>Trench KC</td>
<td>Railroad spike</td>
</tr>
<tr>
<td>#1894</td>
<td>Trench KC</td>
<td>Bone fragment; cow or pig femur</td>
</tr>
</tbody>
</table>

**Market St. to Broad St. Testing**

No material recovered

**1. Field Notes:**
Union Railyards 1980, Field Notes, pp 27.

**2. Field Drawings:**
Trench CC (M-B) North Face Profile, 6 sheets.

**3. Photographs:**
Union Railyards 1980, B/W Roll #8, frames 9-20.

**Broad St. to Chestnut St. Testing**

**1. Field Notes:**
Union Railyards 1980, Field Notes, Sharon Belcher, pp 2, 5-11, 18-22.
Union Railyards 1980, Field Notes, R. Bruce Council, pp 46-47, 49-51, 54-58, 60.

**2. Field Drawings:**
Trench TC (B-C) South Face Profile, 3 sheets.
Trench KC (B-C) South Face Profile, 6 sheets.
Trench TC (B-C) Plan View Detail, Turntable Housing, 1 sheet.
Trench KC (B-C) Plan View, N&C Depot Footings.
Trench TC (B-C) Plan View, Trench TC and Turntable, 1 sheet.

**3. Photographs:**
Union Railyards 1980 Color Roll #5, frame 21 (Trench KC); Color Roll #6, frames 1-13 (Trench KC), frames 18-19 (Trench TC); Color Roll #7, frames 1-8 (Trench TC), frames 14-18 (Trench KC), frames 19-21 (Trench TC); Color Roll #8, frames 1-12 (Trench TC); Color Roll #9, frames 15-16 (Trench TC); Color Roll #11, frames 2-5 (Trench TC).
**APPENDIX 2**

**UDAG Testing and Monitoring: Data Inventory**

### Market St. to Broad St. Testing

1. **Field Notes:**
   - Union Railyards 1980, Field notes, R. Bruce Council, pp 27.

2. **Field Drawings:**
   - Trench CC (M-B) North Face Profile, 6 sheets.

3. **Photographs:**
   - Union Railyards 1980, B/W Roll #8, frames 9-20.

### Broad St. to Chestnut St. Testing

1. **Field Notes:**
   - Union Railyards 1980, Field Notes, Sheron Belcher, pp 2, 6-11, 18-22.
   - Union Railyards 1980, Field Notes, R. Bruce Council, pp 46-47, 49-51, 54-58, 60.

2. **Field Drawings:**
   - Trench TC (B-C) South Face Profile, 8 sheets.
   - Trench KC (B-C) South Face Profile, 6 sheets.
   - Trench TC (B-C) Plan View Detail, Turntable Housing, 1 sheet.
   - Trench KC (B-C) Plan View, N&C Depot Footings.
   - Trench TC (B-C) Plan View, Trench TC and Turntable, 1 sheet.

3. **Photographs:**
   - Union Railyards 1980 Color Roll #5, frame 21 (Trench KC); Color Roll #6, frames 1-13 (Trench KC), frames 18-19 (Trench TC); Color Roll #7, frames 1-8 (Trench TC), frames 14-18 (Trench KC), frames 19-21 (Trench TC); Color Roll #8, frames 1-12 (Trench TC); Color Roll #9, frames 15-18 (Trench TC); Color Roll #11, frames 2-5 (Trench TC).
Union Railyards 1980 B/W Roll #12, frames 1-7, 9-12 (Trench TC); B/W Roll #13, frames 12-15 (Trench TC).

**Chestnut St. to Carter St. Monitoring**

1. Field Notes: UDAG 1980 Field Notes, Steve Richeson and Steve Hearn, pp 1-5.

2. Field Drawings: None


**Laboratory Documentation**

3. Photographs: Union Railyards 1980 B/W Roll #20, frames 1-12; B/W Roll #21, frames 1-21.
REFERENCES CITED

Abdill, George B.

Benjamin, Park, editor
1882 Appleton's Cyclopaedia of Applied Mechanics:
A Dictionary of Mechanical Engineering and
the Mechanical Arts ... Volume III. New York:
D. Appleton and Company.

Brown, Jeffrey L.
1980 "Earthworks in Industrial Archeology,"

Colliery Engineer Company
1897 The Elements of Railroad Engineering. Volume II.
Scranton: The Colliery Engineer Company

Deagan, Kathleen
1978 "The Material Assemblage of Sixteenth Century
Dorr, F. W.

1863 "Chattanooga and Its Approaches, showing the Union and Rebel Works before and during the Battles of 23d, 24th and 25th November 1863," Surveyed under the direction of Brig. Gen. W.F. Smith. Copy on file, Tennessee Valley Authority Mapping Services Division.

Hiener Printing Company


Hopkins, G. M., and Company


Johnston, James Houstoun

Kirkman, Marshall M.


Munsey, Cecil


Office of Chief Engineer

1025 "Passenger and Freight Terminals, Chattanooga, Tenn., showing proposed extension of Broad St.," Office of Chief Engineer, N.C.&St. L. Railway, W. & A. Railroad. Copy of plat, on file, Institute of Archaeology, University of Tennessee at Chattanooga, Chattanooga, Tennessee.

Paine, A.B.

Paine, Charles

Prince, Richard E.
1967  The Nashville, Chattanooga and St. Louis Railway: History and Steam Locomotives. Green River, Wyoming: Published by the Author.

Properties Control Commission

Raymond, William G.

Sandborn-Perris Map Company, Ltd.
Steinberg, David H.

1975  And to Think It Only Cost a Nickel: The Development of Public Transportation in the Chattanooga Area. Chattanooga: Published by the Author.

1976  Pardon Me ... Is That the Chattanooga Choo-Choo. Chattanooga: Published by the Author.

Tennessee Valley Authority


Toulouse, Julian Harrison


Watkins, Lura

Webb, Walter Loring


Wittman, E. F.

1885  "Map of Chattanooga, Tenn.," compiled by E. F. Wittman, Chattanooga. On file, Hamilton County Public Library, Chattanooga, Tennessee.
Figure 2. Plan of Excavations
Union Railyards, 1980