THE DEVELOPMENT OF TIMOTHY ESTATES

A SUBDIVISION

A Thesis

Presented for the Degree of

BACHELOR OF LANDSCAPE ARCHITECTURE

Department of Landscape Architecture

University of Georgia

Athens, Georgia

by

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INTRODUCTION

This thesis represents four years and an additional quarter of academic work toward the degree of Bachelor of Landscape Architecture. In studying for this degree the student is exposed to problems dealing with design, construction, planting plans, et cetera, yet seldom has he an opportunity to combine all of the various phases that his field encompasses into one comprehensive project.

The thesis is not only the culmination of the student's undergraduate years, but it gives him an opportunity to combine the varied facets of his curriculum into one specific problem. The solution and presentation of this thesis also gives the student a general idea of the professional practice with which he will be confronted in the future.

HISTORICAL SKETCH

During the past 10 years the City of Athens, Georgia, like many small Southern cities and towns, has experienced sporadic periods of growth because of the influx of industry into the community and the gradual enlargement of the University of Georgia. Because of this growth a need has arisen for more and more housing, but the demand has fluctuated rather sharply. Consequently, the builder is often "caught" with a completed home during one of the periods when demand is at a low ebb. It should also be noted that the majority of the established subdivisions of a higher price range in the Athens area have few, if any, undeveloped lots available.

Considering these factors, Mr. Clarence Berryman has decided to develop a tract of land he owns that fronts on Timothy Road. In so doing, he is aware that he is competing against the aforementioned tracts plus several new developments. To help insure this subdivision's success Mr. Berryman is developing the tract following the Federal Housing Administration program, setting aside a generous area for a park and playground, and is drawing up restrictions that will insure a continuation of an attractive neighborhood appearance and stable property values.

This thesis originated from a desire of the owner to develop a subdivision in such a manner as to provide as many appealing lots as possible in the most economical manner without sacrificing the character of the existing landscape.

STATEMENT OF THE PROBLEM

Mr. Clarence Berryman, a citizen of Clarke County, intends to further subdivide one of his holdings of land into residential lots. The site of approximately 124 acres is located west of Athens. It is bound by Timothy Road on the South, the Middle Oconee River on the East, the property of Professor Rollin Chambliss and Mrs. Fred Robbins on the North, and by Butler's Subdivision on the West. The area is heavily wooded with Shortleaf and Loblolly pines, many of which have been recently planted. The site contains three small streams which head within this property's lines and flow across the property and discharge into the Oconee River. Along these streams are found native Willow, Box Elder, Dogwood, Wild Cherry, Southern Red Oak, Sycamore and Tulip Poplar trees. These same varieties of trees are prevalent along the Middle Oconee river bank.

A survey of its location shows that the property is well situated in regard to access to essential community facilities such as schools, a shopping center and commercial and industrial employment centers. A proposed street which will bridge the Oconee River will be located just south of Butler's Subdivision. This proposed street will give convenient access to Beechwood Shopping Center, the grammar school, the new junior high school, and the high school. With the completion of the proposed street, these facilities will be within less than five minutes driving time from this subdivision. The Atlanta highway, a four-laned thoroughfare, located three-fourths of a mile north of this site, offers quick

and efficient access to downtown Athens and surrounding areas.

The minimum lot size will be approximately twenty thousand square feet, which make a typical lot one hundred feet by two hundred feet with seventy-five foot minimum frontage except those located on the inside of a curve. Such distance may be measured on the set-back line instead of on the street for those lots which are situated on a curve.

The developer is asking for a preliminary study, a preliminary plan, and an engineering plan, all of which will comply with F.H.A. standards. He also states that each dwelling shall cost a minimum of sixteen thousand dollars, have a roof area of two thousand square feet of which four hundred square of roof space may be a car port or porch. It shall also be noted that no car port or garage shall open on any street.

The developer wishes to reserve certain tracts which will be preserved as recreation areas. These will be deeded to a corporation of stockholders which will be composed of the owners of the various lots.

A plan which will give him the maximum number of lots of desirable shape with the most economical layout of streets is required. Additional information required will be to determine as follows:

1. Total number of lots
2. Total acreage in lots
3. Total number of streets
4. Total acreage in streets
5. Total acreage in use
6. Average length of street per lot

In addition to these requirements, the developer desires the following information: lot lines; drainage facilities; utility easements if any; street right-of-way; paving and curb lines; set-back lines; lot and plat numbers; access easements; drainage profiles; street profiles; street names; cross-sections of streets and key maps showing locations of details.

AN ANALYSIS OF THE PROBLEM

Timothy Estates, the name for the proposed development, consists of approximately 124 acres. The site is predominantly forest land of two types, approximately equally divided between areas of established stands of mixed trees and planted pine seedlings. 9 acres along the river is open land, most of which will be devoted to park area.

Timothy Road, the access route to this tract, intersects the Atlanta Highway about 3/4 of a mile to the northeast, thus putting the necessary community facilities within pleasant driving distance. Employment, schools, churches, shopping and recreation facilities can be reached within a two mile radius. The county zoning board classified this area as an "R-20" district--agricultural-residential area.

The site is in many places affected by adverse slope conditions (up to 33%); has several small streams (3) within the property, and is subject to seasonal inundations of the Middle Oconee River which borders the property on one side. These factors must be taken into consideration in developing the street pattern and platting the lots.

The most desirable lots, slope of the land, and the preservation of the existing landscape will dictate the design.

PRESENTATION AND JUSTIFICATION

The statement of the problem outlines the factors which must be considered in resolving the design of Timothy Estates Subdivision.

Using a minimum slope on residential streets of 1% and a maximum slope of 12% as a design standard, there are certain areas on this site that would be difficult to penetrate with a street. To avoid placing streets within these areas and yet allowing as many lots as possible to back on the existing drainage channels and lessen the expense of storm drainage, we developed a functional and pleasing street pattern that would follow the contours of the land.

The street pattern is such that there will be no through streets within the property, but all areas of the site may be reached by automobile from Timothy Road without having to negotiate more than one turn at an intersection after one enters the property.

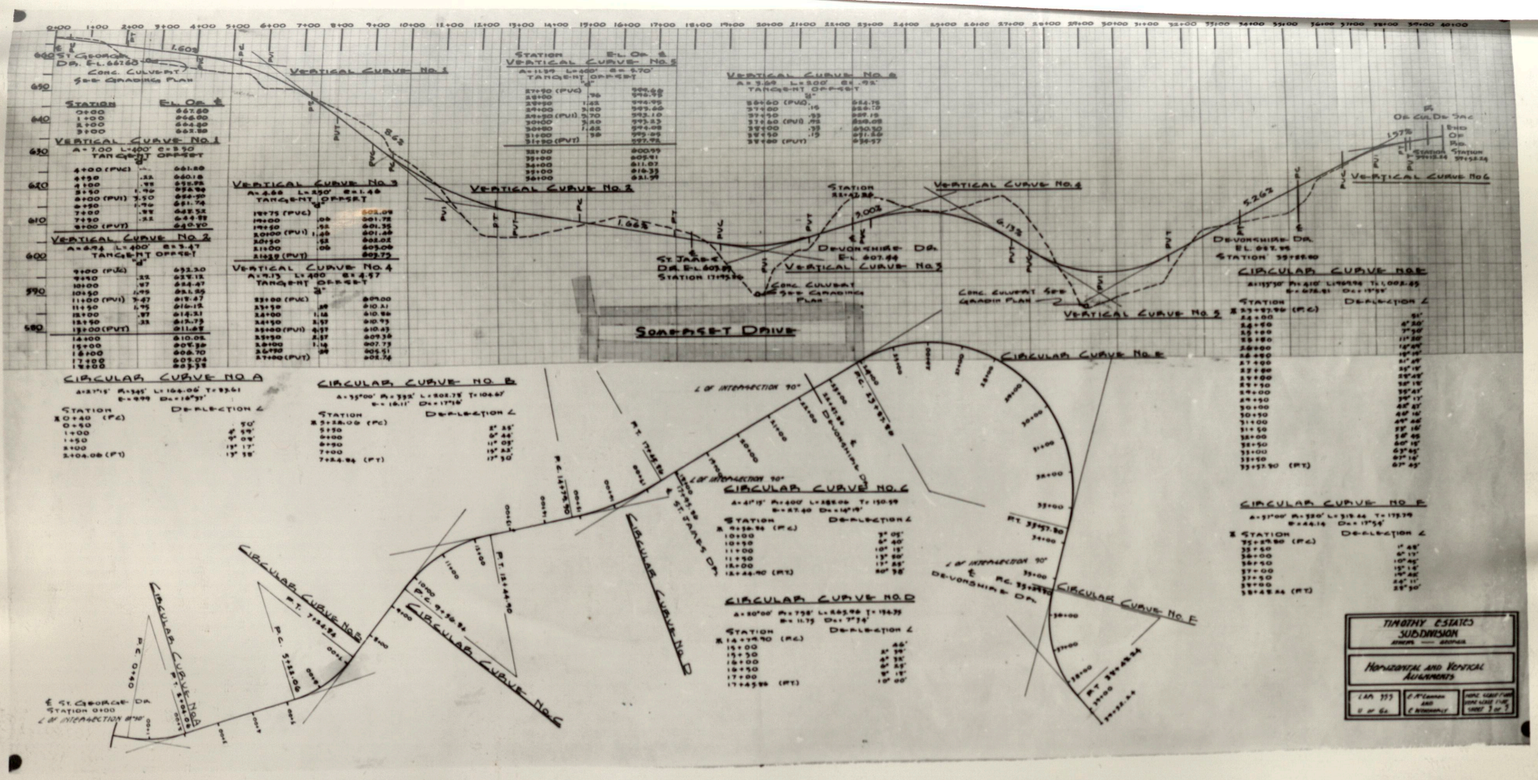
Saint George Drive and Saint James Drive serve as entrance streets and are crossed by Somerset Drive and Devonshire Drive, creating the main traffic arteries of the site. These streets intersect in such a manner as to create an irregular rectangle and provide for flow within the area.

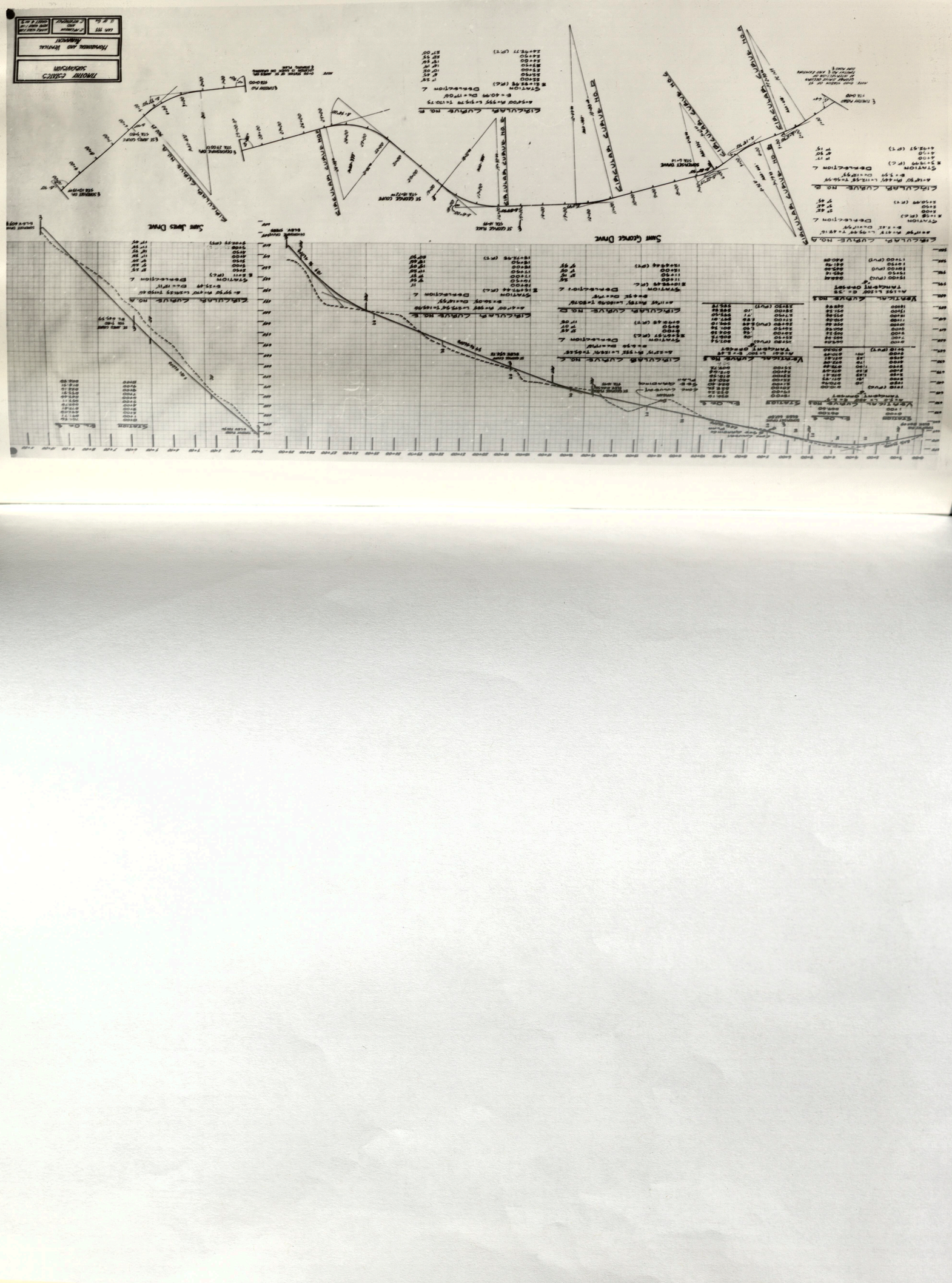
149 usable lots in the 124 acres have been platted and approximately 8½ acres was set aside for recreation. The average lot is 125 feet by 200 feet deep and has a minimum setback of 40 feet from the curb line. There are 11,330 linear feet of road or 6.53 acres. Thus 5.24% of the site is in roads and 6.83% of site is devoted to recreation.

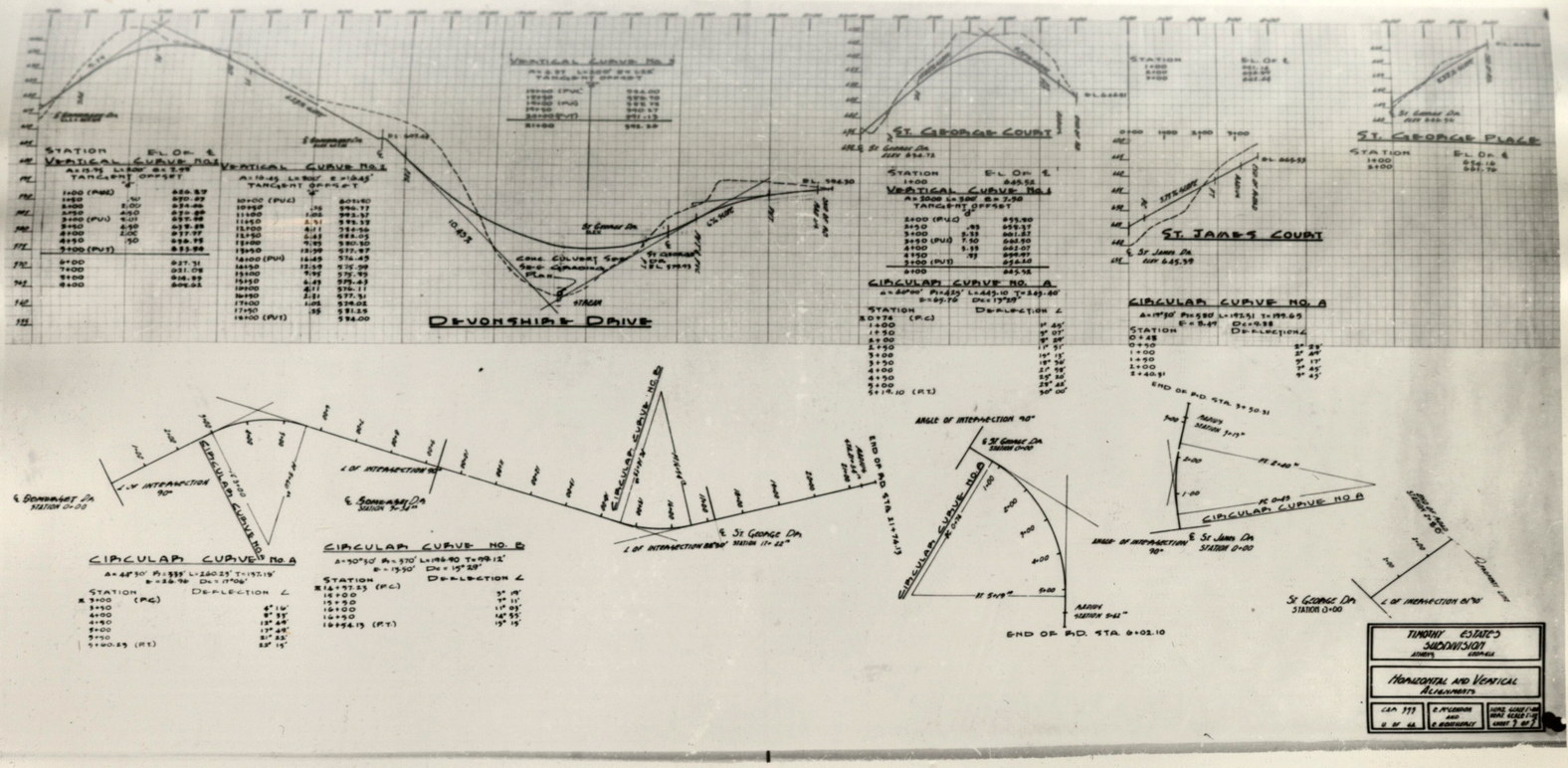
The solution meets these requirements and can be resolved in an economical manner. In addition, the individual lots provide pleasant homesites without making disturbing intrusions in the landscape.

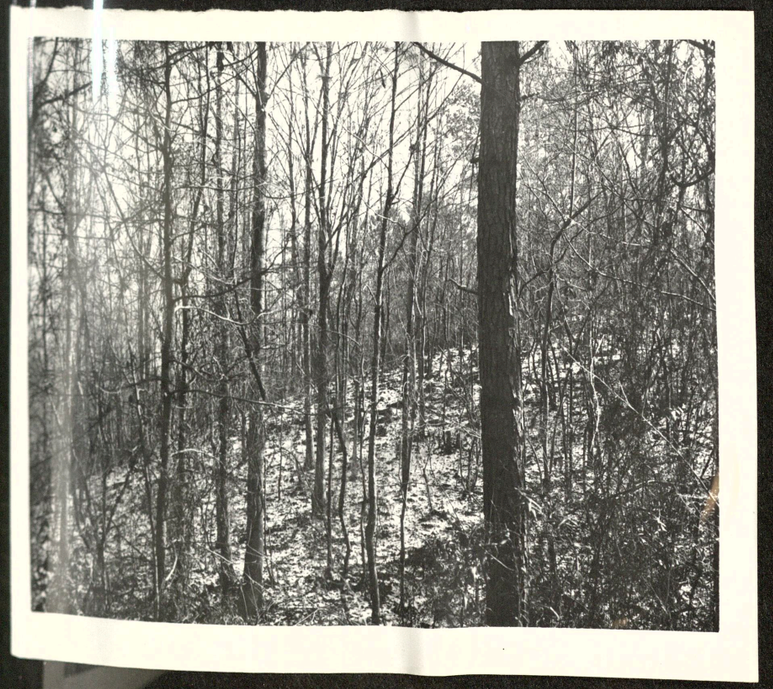

TIMOTHY ESTATES
SUBDIVISION
ATHENS —— GEORGIA
MASTER PLAN
NORTH
CONTOUR 5' INTERVAL

TIMOTHY ESTATES SUBDIVISION
GRADING AND DRAINAGE
WILLIAMS
DEYNMAN
HIGH
TIMOTHY ROAD
DETAIL OF CATHANCE
SCALE 1"=20'
TYPICAL STREET CROSS SECTION
SCALE IN"=1'0"
NORTH


Somerset Drive
Vertical Curve No. 1
Vertical Curve No. 2
Vertical Curve No. 3
Vertical Curve No. 4
Vertical Curve No. 5
Vertical Curve No. 6
Circular Curve No. A
Circular Curve No. B
Circular Curve No. C
Circular Curve No. D
Circular Curve No. E
Circular Curve No. F
Circular Curve No. G
Circular Curve No. H
St. George Dr.
Devonshire Dr.
St. James Dr.
Timothy Estates Subdivision
Horizontal and Vertical Alignments




DEVONSHIRE DRIVE
ST. GEORGES COURT
ST. JAMES COURT
ST. GEORGES PLACE
VERTICAL CURVE NO. 1
VERTICAL CURVE NO. 2
CIRCULAR CURVE NO. A
CIRCULAR CURVE NO. B
CIRCULAR CURVE NO. C
CIRCULAR CURVE NO. D
TIMOTHY ESTATES SUBDIVISION
HORIZONTAL AND VERTICAL ALIGNMENTS



DESIGN STANDARDS

A. STREETS

1. The arrangement, character, extent, width, grade, and location of all streets shall conform to the Master Plan and shall be considered in their relation to existing and planned streets, to topographical conditions, to public convenience and safety, and in their appropriate relation to the proposed uses of the land to be served by such streets.

2. Where such data is not shown in the Master Plan, the arrangement of streets in a subdivision shall either:

   a. Provide for the continuation or appropriate projection of existing principal streets in the surrounding areas; or

   b. Conform to a plan for a neighborhood approved or adopted by the Federal Housing Administration to meet a particular situation where topographical or other conditions make continuance or conformation to existing streets impractical.

3. Minor streets shall be laid in such a manner as to discourage through traffic.

4. Street jogs with centerline offsets of less than one hundred and twenty-five (125) feet shall be avoided.

5. Street rights-of-way and street widths shall be as shown in the Master Plan and where not shown therein shall be fifty (50) feet for the right-of-way and twenty-six (26) feet for

the street. The street measurement shall be taken from inside of curb to inside of curb on the opposite of the street.

6. Half streets shall be prohibited, except where essential to the reasonable development of the subdivision, and where it is determined to be practical to require the dedication of the other half when the adjoining property is subdivided, or when an adjoining property requires an access easement.
7. Dead-end streets may be platted in an instance referred to in design standard number six provided the Federal Housing Authority deems such street desirable.
8. Dead-end street designed to be so permanently shall not exceed six hundred (600) feet in length, shall be closed at dead-end by a turn-around having an outside radius of forty (40) feet and a right-of-way radius of fifty (50) feet.
9. No street names shall be used which will duplicate or be confused with the names of existing streets. Street names shall be subject to the approval of the County Commissioners.
10. No street shall have a maximum slope of more than twelve (12) percent, or minimum slope of less than one (1) percent.
11. Grading for street side slopes shall not exceed 2:1 slope in area of cut and shall not exceed 3: in areas of fill, thus saving as many of the existing trees as possible.
12. The vertical curves shall be such that all are negotiable at a speed of thirty-five (35) miles per hour safely.
13. The horizontal curves shall be such that all are negotiable at a speed of thirty-five (35) miles per hour safely.

B. EASEMENTS

1. Utility easements shall be avoided unless in unusual cases where no other satisfactory arrangements can be provided for the installation of utilities.
2. Where a subdivision is traversed by a water course, drainage way, natural channel, or stream there shall be provided an easement confronting substantially to the limits of such water course plus additional width as necessary to accommodate future construction. Ten (10) feet on each side of center line of drainage channel is the standard adopted for this site.
3. All adjoining properties that hold access easements shall be connected to the traffic pattern by a dead-end street that will dead-end on property line. Width of the street and its right-of-way requirements shall be the same as the requirements for all other streets of this tract (see A-5).

C. BLOCKS

1. The lengths, widths, and shapes of blocks shall be determined with regard to:
   a. Provision of adequate building sites suitable to the special needs of the type of use contemplated.
   b. Clarke County zoning requirements as to lot sizes and dimensions.
   c. Needs for convenient access, circulation, control, and safety of street traffic.
2. When feasible, all trees of major growth in the subdivision shall be preserved.

D. LOTS

1. The lot size, width, depth, shape, and orientation, and the minimum building setback lines shall be appropriate for the location of the subdivision and for the type of development and use contemplated.

2. Lot dimensions shall conform or exceed the requirements of the zoning ordinance of the Clarke County Zoning Ordinances. This area is classified as an "R-20" district and has these zoning ordinances:

	With Sewage
a. Minimum frontage	100 feet
b. Minimum depth	no requirement
c. Minimum area	20,000
d. Building setback	30 feet

3. The deed restrictions are as follows:

a. Minimum frontage	100 feet
b. Minimum depth	200 feet
c. Minimum area	20,000
d. Building setback	40 feet

4. Corner lots shall have dimensions of at least one hundred and twenty-five (125) feet and two hundred (200) feet depth thus providing for appropriate building set-back from and orientation to both streets.

5. Each lot shall front upon a public street.

6. Double frontage and reverse frontage are prohibited.

7. Side lot lines shall be substantially at right angles or radical to street lines.

E. GENERAL SUITABILITY

1. Final approval of this subdivision as to whether it would be in the best interest of the public welfare shall rest with the Federal Housing Administration and the Clarke County Commissioners.
2. Land subject to flooding or deemed topographically unsuitable shall not be platted for residential occupancy, nor for such other purposes where it may endanger health, life, or property or aggravate erosion or flood hazard.

REQUIRED IMPROVEMENTS

A. STREET AND ROAD IMPROVEMENTS

1. Street improvements shall be provided for this subdivision as follows:

   a. Grading shall be done by developer.

   b. Concrete curbs (see Specifications) shall be furnished and set by developer. Any curb damaged after pouring but before pavement is completed shall be replaced by developer.

   c. Pavement shall be furnished and paid for by the developer. For thickness, type, application, et cetera, see Specifications.

   d. Driveways shall be sixteen (16) feet wide at edge of curb and narrow to eight (8) feet at property line. Driveways within right-of-way area shall be a minimum of six (6) inches thick, and have a twenty-eight day compressive strength of 3000 PSI.

2. Street markers similar to the county's standard concrete posts painted and lettered, shall be furnished and set at all street intersections by the developer.

3. Two (2) copies of the complete plans and profiles for the street improvements shall be submitted for approval of the Road Engineer prior to approval of the final plat by the County Commissioners.

B. SANITARY FACILITIES

1. Sanitary sewers shall be laid in all streets, service connections installed to property lines, and connections made to trunk line sewers. Data and improvements shall be provided in subdivision as prescribed in the following:

a. Two (2) copies of the sewer plan, designed by a registered civil engineer or person of equal professional status, showing the proposed sewer in plan and profile shall be submitted and approved by the Director of the Sewer Department prior to beginning installation of the sewer system. The plans shall be prepared from an actual engineering survey and shall include the following information and data:

1. Station and deflection angle of each manhole.
2. Property or lot lines and present owners if sewer is on private property.
3. Lot, block, and house number.
4. Invert elevation at each manhole.
5. Grade of sewer between manholes expressed in percent.
6. Bench mark elevation and description at least each one thousand (1,000) linear feet along sewer line.

b. Prior to the beginning of construction the engineer shall set construction stakes as follows and shall furnish the construction foreman with a cut sheet showing the to flow line of the pipe:

1. An offset tack line with hubs not over fifty (50) feet apart. Under wet conditions the hubs shall set not over twenty-five (25) feet apart.

2. Each hub shall have a guard stake showing the station on one side the cut to flow line of pipe on the other.

3. Cuts shall be calculated and marked to the nearest one hundredth of a foot.

4. Stakes shall be set at each point where a wye is required.

c. A qualified sewer contractor shall be employed by the developer to install the sewer system. The installment shall be done under the direction of the Sewer Department, according to their sewage specifications and shall conform exactly to the approved plan with no exceptions unless approved by the Department Sewage Director. The contract must be carried out under bond-bid stipulations; that is the contractor is responsible for all work and materials until acceptance is given by Sewage Department.

d. All manhole castings shall be adjusted to the finish grade of paving and all manholes shall be left free of dirt, asphalt, and other debris.

e. Upon completion of project the developer shall supply the Sewer Department with three (3) copies of the plan and profile drawing showing sewer as built with exact location of each service connection (stub-out) indicated.

C. STORM DRAINAGE

1. Adequate storm drainage pipes and catch basins or sulverts shall be installed by developer according to F.H.A. Regulation.

D. WATER MAINS

1. Water mains shall be designed by Clarke County Water System standards andwill be laid under contract.

E. MONUMENTS

1. Iron pins of no less than twenty-four (24) inches lone nor less than one-half ($\frac{1}{2}$) inch in diameter shall be set at every lot corner.

VARIANCES

A. HARDSHIP

Where the Planning Commission finds that extraordinary hardships may result from strict compliance with these regulations, it may vary the regulations so that substantial justice may be done and the public interest secured; provided that such variation will not have the effect of nullifying the intent and purpose of the General Community Plan or these regulations.

B. LARGE SCALE DEVELOPMENT

The standards and requirements of these regulations may be modified by the Planning Commission in the case of a plan and program for a new town, a complete community, or a neighborhood unit, which in the judgment of the Planning Commission provide adequate public spaces and improvements for the circulation, recreation, light, air, and service needs of the tract when fully developed and populated, and which also provide such covenants or other legal provisions as will assure conformity to and achievement of the plan.

C. CONDITIONS

In granting variances and modifications, the Planning Commission may require such conditions as will, in its judgment, secure substantially the objectives of the standards or requirements so varied or modified.

DEFINITIONS

A. AREA

1. Building Area. The total ground area of each building and accessory building but not including uncovered entrance platforms, terraces, and steps.

2. Floor Area. The total area of all stories or floors finished as living accommodations. This area includes bays and dormers but does not include space in garages or car ports or in attics. Measurements are taken to the outside of exterior walls.

B. BUILDING LINE

A line established by law or agreement usually parallel to property line, beyond which a structure may not extend. This generally does not apply to uncovered entrance platforms, terraces and steps.

C. DRIVEWAY

A private way for the use of vehicles and pedestrians.

D. DETACHED DWELLING

A dwelling which is completely surrounded by permanent open spaces.

E. DWELLING UNIT

See Living Unit.

F. FLOOR AREA

See Area.

G. GRADE

1. Finish. The top surface elevation of lawns, walks, drives, or other improved surfaces after completion of construction or grading operations.

2. Natural. The elevation of the original or undisturbed natural surface of the ground.

3. Subgrade. The elevation established to receive top surfacing or finishing materials.

H. LOT

A parcel of land that is described by reference to a recorded plat or by metes and bounds.

1. Corner Lot. A lot abutting upon two or more streets at their intersection.

2. Interior Lot. A lot bounded by a street on one side only.

3. Double-fronted Lot. An interior lot bounded by a street on front and back.

I. LOT COVERAGE

That percentage of the plot area covered by the building area.

J. LOT LINE

A line bounding the lot as described in the title to the property.

K. PLAT

A map, plan or chart of a city, town, section or subdivision, indicating the location and boundaries of individual properties.

L. PLOT

A parcel of land consisting of one or more lots or portions thereof, which is described by reference to a recorded plat or by metes and bounds.

M. PROPERTY LINE

A recorded boundary of a plot.

N. STORY

That portion of a building between a floor and the next floor above.

1. First Story. (First Floor). The lowermost story that has at least half its total floor area designed for and finished as living accommodations. For the purposes of determining this area, the area of halls, closets, and stairs is included. The area of storage, utility or heating rooms or spaces is not included. The location of the first story as defined herein is based upon the use of the space rather than on the location of entrance doors or the finished grade.

2. Half Story. A story finished as living accommodations located wholly or partly within the roof frame and having a floor area at least half as large as the story below. Space with less than 5 feet clear headroom shall not be considered as floor area.

3. Top Story. The story between the uppermost floor and the ceiling or roof above.

O. STREETS AND ALLEYS

The term "street" means a way for vehicular traffic, whether designated as a street, highway, thoroughfare, parkway, throughway, road, avenue, boulevard, lane, place, or however otherwise designated.

1. Arterial Streets and Highways. Those which are used primarily for fast or heavy traffic.

2. Collector Streets. Those which carry traffic from minor streets to the major system of arterial streets and highways,

including the principal entrance streets of a residential development and streets for circulation within such a development.

3. Minor Streets. Those which are used primarily for access to the abutting properties.

4. Alleys. Minor ways which are used primarily for vehicular service access to the back or the side of properties otherwise abutting on a street.

P. SUBDIVISION

The term "subdivision" means the division of a parcel of land into two (2) or more lots or parcels for the purpose of transfer of ownership or building development, or, if a new street is involved, any division of a parcel of land; provided that a division of land for agricultural purposes into lots or parcels of five (5) acres or more and not involving a new street shall not be deemed a subdivision. The term includes resubdivision and, when appropriate to the context, shall relate to the process of subdividing or to the land subdivided.

Q. WAY

A street, alley or other thoroughfare or easement permanently established for passage of persons or vehicles.

R. YARD

The open, unoccupied space on the plot between the property line and the front, rear or side wall of the building.

1. Front Yard. The yard across the full width of the plot facing the street extending from the front line of the building to the front property line. Either yard facing a street may be selected

as the front yard of a corner lot.

2. Rear Yard. The yard across the full width of the plot opposite the front yard, extending from rear line of building to rear property line. The rear yard of a corner lot is the yard opposite the selected front yard.

3. Side Yard. The yard between the side line of building and the adjacent side property line, extending from the front yard to the rear yard.

SPECIFICATIONS

A. GRADING

1. Description

This item shall consist of necessary clearing and grubbing, removal of existing structures, excavating, filling, spreading and compacting the areas to be filled in accordance with these specifications and in conformity with the lines, grades, slopes and typical cross-sections shown on the accepted plans.

2. Material

Material for the fill shall consist of material obtained from the excavation of banks, borrow pits or other approved sources. The material used shall be free from vegetable matter and other deleterious substances and shall not contain large rocks or lumps.

3. Construction Methods

a. Grading Tolerance. Areas to be graded by cutting or filling shall be rough graded to within 0.2 of a foot of the accepted elevation after necessary allowance has been made for the thickness of topsoil, paved areas and other installations.

b. Stripping and Storing Topsoil. Where suitable topsoil exists on areas to be disturbed by grading or building operations, the topsoil shall be stripped in the amount needed to complete finish grading operations, and shall be piled in convenient locations for storage during construction.

c. Clearing and Grubbing. All timber, logs, trees, brush, vegetable matter and other rubbish shall be removed, piled and burned or otherwise disposed of so as to leave the areas that have been disturbed with a neat and finished appearance.

d. Removal of Debris. All tree stumps, masonry and other obstructions shall be removed to a depth as follows:

For paved areas: 2' below subgrade

For lawn areas: 2' below finished grade

Solid rock, shale or other similar material shall be removed to a depth as follows:

For paved areas: 15'' below subgrade

For lawn areas: 2' below finished grade, except when it is impractical to remove rock outcropping.

e. Preparing Areas to be Filled. In order to insure proper bond and prevent slipping between the original ground and the fill the surface of the original ground shall be scarified to a reasonable depth. Where fills are made on hillsides or slopes, the slope of the original ground upon which the fill is to be placed shall be plowed or scarified deeply. Where the nature of the ground justifies taking greater precautions for binding the fill to the original ground, steps shall be cut into the original ground before filling is begun.

f. Placing, Spreading and Compacting Fill Material. The selected fill material shall be placed in layers which when compacted shall not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly blade mixed during spreading to

insure uniformity of material in each layer.

The moisture content of the fill material shall be such that the fill can be compacted to maximum practical density. If the moisture content of the fill material is below the needed amount necessary to creat the necessary density the proper amount of water shall be added. Similarly if the moisture content of the fill material is above the needed amount necessary to create the desired density the fill material shall be aerated by blading or other satisfactory method until the moisture content of the fill material is satisfactory.

After each layer has been placed, mixed and evenly spread it shall be thoroughly compacted to maximum practical density. Compaction shall be by means of tamping or sheeps foot rollers, multiple-wheel pneumatic-tired rollers or other types of rollers or equivalent which will be able to compact the fill to the desired density. Rolling shall be accomplished while the fill material is at the desired moisture content. Rolling shall be accomplished while the fill material is at the desired moisture content. Rolling of each layer shall be continuous over its entire area and sufficient trips shall be made by the rolling equipment to insure that the desired maximum practical density has been obtained.

g. Completion of Grading. Excavating of cut areas shall continue until these areas conform with the lines, grades, slopes and typical cross-sections shown on the accepted plans. Placing, spreading, filling and compacting areas to be filled

shall also be continued alternately until these areas conform with the lines, grades, slopes and typical cross-sections shown on the accepted plans.

4. Seasonal Limits

a. No fill material shall be placed, spread or rolled while the ground or fill is frozen or thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until the moisture content and density of the fill are as previously specified.

B. CURBS AND GUTTERS

1. Description

a. This item shall consist of Portland cement concrete curbs and gutters constructed on a prepared subgrade in accordance with these specifications and the cross-sections shown on the accepted drawings.

2. Materials

a. Aggregates.

1. Coarse aggregate shall consist of crushed stone or gravel. It shall be clean, hard, tough, durable pieces free from injurious amounts of soft friable, thin, elongated or laminated pieces, soluble salts, organic or other deleterious matter.

2. Fine aggregate shall consist of either a natural sand or a stone sand, composed of sound particles of approved stone. All sand shall be free of clay or other adherent coatings and injurious amount of deleterious matter.

b. Cement. Standard Portland cement and high early strength Portland cement shall meet the requirements of current Federal Specifications SS-C-192 or equal.

c. Water. Water shall be free from oil, acids, alkali and vegetable matter and shall be reasonably clean. Sea water shall not be used.

d. Gradation. The aggregates when tested by means of laboratory sieves shall meet the following requirements:

	Per Cent by Weight Passing Square Mesh Sieve	
Sieve Designation	Coarse Aggregate	Fine Aggregate
1½ inch	100	--
1 inch	95-100	--
½ inch	35-70	--
3/8 inch	--	100
No. 4	0-10	95-100
No. 16	--	45-80
No. 50	--	10-30
No. 100	--	2-10

e. Proportions. Concrete shall contain 6 bags of cement per cubic yard and shall be proportioned as follows:

Per Bag of Cement		
Quantity of Water	Fine Aggregate	Coarse Aggregate
6 gals.	188 lbs.	345 lbs.

(Approximate 1:2:4 mix)

Note: Weight of aggregates based on specific gravity of 2.65

3. Construction Methods

a. Preparation of Subgrade. All boulders, organic material, soft clay, spongy material, and any other objectionable material shall be removed and replaced with approved material.

The subgrade shall be properly shaped, rolled and uniformly compacted to conform with the accepted cross-sections and grades.

b. Forms for Concrete. The forms for the concrete shall be of wood or metal, straight, free from warps or kinks and of sufficient strength. They shall be staked securely enough to resist the pressure of the concrete without spring. When ready for the concrete to be deposited they shall not vary from the approved line and grade and shall be kept so until the concrete has set. Where a face form for a curb is used it shall be so designed as to permit it to be securely fastened to the other forms.

c. Placing and Finishing Concrete. Just prior to placing the concrete the subgrade shall be moistened. The concrete mixed to the proper consistency shall be placed in the forms and thoroughly tamped in place so that all honeycombs will be eliminated and sufficient mortar will be brought to the surface. After this the surface shall be brought to a smooth even finish by means of a wooden float. All faces adjacent to the forms shall be spaded so that after the forms are stripped the surface of the faces will be smooth, even and free of honeycomb. All edges shall be tool rounded.

d. Expansion and Contraction Joints for Concrete. Half-inch ($\frac{1}{2}$") expansion joints shall be placed at intervals not exceeding sixty (60) feet. At intervals not greater than ten (10) feet or less than five (5) feet the concrete shall be scored for a depth equal to one-third the total depth of the concrete.

e. Curing Concrete. When completed the concrete shall be kept moist for a period of not less than three (3) days and longer if necessary and shall be protected from the elements in a satisfactory manner.

f. Backfilling. Backfill shall be of suitable selected material and shall be placed and tamped in layers of not over 6 inches in depth until firm and solid. Backfilling shall follow immediately after the concrete forms have been removed.

4. Seasonal Limits

No concrete shall be poured on a frozen or thawing subgrade, or during unfavorable weather conditions, or when the temperature is 38°F. and falling.

C. COMPACTED SUBGRADE

1. Description

The Subgrade is designated as that part of the roadbed forming the foundation, upon which the base course or pavement is to be placed. Subgrade area shall include one foot in width beyond the edges of the base course or pavement, which forms are to be used during such construction.

2. Construction Methods.

a. Preparation. All organic or yielding material, soft clay, spongy soil, and other portions of the subgrade which will not compact readily when rolled or tamped, shall be removed. All rock or boulders found in the roadbed shall be removed or broken off to a depth of not less than six (6) inches below the finished surface of the subgrade. All holes or depressions made

by the removal of such unsatisfactory material, shall be filled with approved material. The approved roadbed material, to a depth of six (6) inches, shall then be scarified, disced, harrowed and bladed to a uniform pulverized condition.

b. Compaction. The pulverized roadbed material shall be brought to proper moisture content, and compacted with a sheeps-foot roller having at least 200 P. S. I. weight on the face of the tamping feet. Rolling shall continue over the entire subgrade until maximum practical density has been obtained throughout the entire six (6) inches of prepared depth. Satisfactory density generally is indicated when the feet of the roller ride on the surface of the subgrade without making appreciable indentations. Finishing and shaping of the subgrade to crown, grade, and typical cross-section shall be accomplished by blading and rolling with a suitable smooth three-wheel power roller weighing at least eight (8) tons. Care shall be taken to obtain compaction in utility trenches and other places inaccessible to the roller, by means of mechanical or approved hand tampers.

c. Protection and Maintenance. At all times the subgrade surface shall be kept in such condition that it will drain readily. Shaping and rolling shall be performed as required to maintain a uniformly compacted surface, until a base course or pavement has been constructed on the subgrade.

3. Seasonal Limits

a. Subgrade compaction shall not be started or continued while the roadbed material is frozen, or its moisture content

is such that maximum practical density cannot be obtained.

4. BASE COURSE

1. Description.

This item shall consist of a base course composed of selected topsoil constructed on a prepared subgrade in accordance with these specifications and in conformity with the lines, grades and typical cross-sections as shown on the accepted drawings.

2. Materials. All materials shall be secured from approved sources.

Topsoil shall consist of natural soil suitable for the proposed purpose generally pebbly in character, occurring in a surface layer usually limited to a depth of 6 to 18 inches on elevated areas and shall meet the following requirements:

	Minimum	Maximum
Passing 2-1/2" Screen (Square Openings) % by weight	100	..
Material Passing No. 10 Sieve: Silt, % by weight . . .	...	50
Clay, % by weight . . .	5	30
Material Passing No. 40 Sieve: Liquid Limit.	...	25
Plasticity Index. . . .	...	10

3. Construction Methods

a. Preparation of Subgrade. All boulders, organic material, soft clay, spongy material and any other objectionable material shall be removed and replaced with approved material. The subgrade shall be properly shaped, rolled and uniformly compacted to conform with the accepted cross-section and grades.

b. Placing, Mixing and Rolling Base Material.

All base course material shall be deposited and spread by means of spreader boxes, or approved mechanical equipment, or from moving vehicles equipped to distribute the material in a uniform layer. Each layer shall be not more than three (3) inches in thickness after compaction. Each layer shall be constructed as follows:

After the base course material has been spread it shall be thoroughly blade mixed to the full depth of the layer by alternately blading the entire layer to the center and back to the edges of the road. The material shall be watered during the mixing when needed. When uniform the mixture shall again be spread smoothly to the cross-section as shown on the accepted drawing. Immediately following final spreading and smoothing all material placed shall be compacted to the full width by rolling with a smooth wheel power roller weighing eight (8) to ten (10) tons. Rolling shall progress gradually from the sides to the center, parallel with the center line of the road and lapping uniformly each preceding track by one-half the width of such track and shall continue until all the surface has been rolled and satisfactory compaction obtained. Any irregularities or depressions that develop under such rolling shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform. Blading and rolling shall be performed alternately as required to maintain a uniformly compacted base

until a surface or treatment has been applied to the base. Along curbs, header and walls and at all places not accessible to the roller, the base course material shall be tamped thoroughly with mechanical tampers or with approved hand tampers.

c. Seasonal Limits. No base material shall be deposited or shaped when the subgrade is frozen or thawing or during unfavorable weather conditions.

E. PAVING

1. Description

Bituminous Penetrated Macadam Base (Paving Asphalt) shall be composed of aggregates and bituminous material combined as specified below, constructed on a prepared subgrade, in accordance with these specifications and conforming with the lines, grades and typical cross-sections shown on the accepted drawings.

2. Materials

a. Aggregate. Aggregates shall consist of clean durable crushed stone obtained by breaking and crushing solid or shattered rock and shall be free from an excess of flat, elongated, soft or disintegrated pieces, dirt or other objectionable matter.

b. Bituminous Material. Bituminous material shall conform with current Federal Specifications for one of the following grades:

	Asphalt Grades	Penetration at 77° F.
PAVING ASPHALT	AP - 3 or	85 - 100
	AP - 2	100 - 120

c. Gradation. The aggregate when tested by means of laboratory sieves shall meet the following requirements:

	Per Cent by Weight Passing Square Mesh Sieve	
Sieve Size	Coarse Aggregate	Fine Aggregate
2½ inch	100	-
2 inch	95 - 100	-
1¼ inch	0 - 50	-
1 inch	-	100
3/4 inch	0 - 15	70 - 100
1/2 inch	0 - 5	20 - 60
1/4 inch	-	-

d. Proportions. The penetration macadam shall be proportioned per square yard as follows:

For 4" Thickness

APPLICATION	GALS. OF BITUMEN	LBS. OF STONE
Base Course	1.5	400 to 500
Add - For each additional ½ inch of thickness Base Course	0.2	50 - 60

The weight of stone aggregate is based on a specific gravity of 2.56

3. Construction Methods.

a. Subgrade. All boulders, organic material, soft clay, spongy material and any other objectionable material shall be removed and replaced with approved material. The subgrade shall be properly shaped, rolled and uniformly compacted to conform with the accepted cross-sections and grades.

b. Spreading Coarse Aggregate. All base course material shall be deposited and spread by means of spreader boxes, or approved mechanical equipment, or from moving vehicles equipped to distribute the material in uniform layers. Each layer after compaction shall not be more than four inches (4") in thickness.

c. Compacting. Immediately following the spreading of the coarse aggregate all material placed shall be compacted for the full width by rolling with a smooth wheel power roller weighing ten tons. Rolling shall progress gradually from the sides to the center, parallel with the center line of the road and lapping uniformly each preceding tract by one-half the width of such tract. The rolling shall continue until all the surface has been rolled and thoroughly keyed, the

interstices of the stone reduced to a minimum, and until the base ceases to creep or wave ahead of the roller. Along curbs, headers and walls and at all places not accessible to the roller, the base course material shall be tamped thoroughly with mechanical tampers or with approved hand tampers.

d. Applying Bitumen. The base course material shall be perfectly dry before any bituminous material is applied. The bituminous material shall be applied uniformly at the rates specified in paragraph 2d. (Proportions) above, by means of a power distributor of approved type under a pressure of not less than thirty (30) to forty (40) pounds per square inch. Bituminous material shall be applied at a temperature of not less than 300° F.

e. Spreading Fine Aggregate. Immediately after the bituminous material has been applied to the coarse aggregate, and while it is yet warm, there shall be spread over its surface a sufficient quantity of the fine aggregate to keep the bituminous material from sticking to the wheels of the roller. Brooms shall be used to distribute the fine aggregate evenly over the surface.

f. Final Compaction. Rolling by means of a ten ton three wheel tandem roller shall start immediately after the spreading of the fine aggregate. Rolling shall be done as outlined in paragraph 3c. (Compacting) above. Rolling shall continue until the fine aggregate is thoroughly imbedded into the bitumen, the base course is firmly bound together

the surface is hard and smooth and shows no perceptible movement under the rolling.

4. Seasonal Limits

a. Paving asphalt specification in paragraph 2b. above (AP-3) provides for a material suitable for use in construction of bituminous macadam for usual summer conditions. Paving asphalt specification in paragraph 2b above also shows (AP - 2) provision for a material suitable for use in construction of bituminous macadam for cool weather construction.

b. No bituminous material shall be applied when the temperature of the air is 50° F. or less and falling or during unfavorable weather conditions.

F. DRIVEWAYS

1. Description.

This item shall consist of a Portland cement concrete driveway and driveway apron constructed on a prepared subgrade in accordance with these specifications and as shown on the accepted drawings.

2. Materials. All materials shall be secured from approved sources.

a. Aggregate shall be graded as follows:

	Per Cent by Weight Passing Square Mesh Sieve	
Sieve Designation	Coarse Aggregate	Fine Aggregate
2½ inch	100	-
2 inch	95 - 100	-
1 inch	35 - 70	-
1/2 inch	10 - 30	-
3/8 inch	-	100
No. 4	0 - 5	95 - 100
No. 16	-	45 - 80
No. 50	-	10 - 30
No. 100	-	2 - 10

b. Water shall be free from oil, acids, alkali and vegetable matter and shall be reasonably clean. Sea water shall not be used.

c. Concrete shall contain five and one quarter (5¼) bags of cement per cubic yard and shall be proportioned as follows:

Quantities Per Bag of Cement (Approximate 1:2½:5 Mix)		
Water	Fine Aggregate	Coarse Aggregate
7 gals.	230 lbs.	386 lbs.

Note: Weight of aggregate based on a specific gravity of 2.65

3. Construction Methods.

a. Preparation of Subgrade. All boulders, organic material, soft clay, spongy material, and any other objectionable material shall be removed and replaced with approved material. The subgrade shall be properly shaped, rolled and uniformly compacted to conform with the accepted cross-sections and grades.

b. Forms for Concrete. The forms for the concrete shall be of wood or metal, straight, free from warps or kinks and of sufficient strength. They shall be staked securely enough to resist the pressure of the concrete without spring. When ready for the concrete to be deposited they shall not vary from the approved line and grade and shall be kept so until the concrete has set.

c. Placing and Finishing Concrete. Just prior to placing the concrete the subgrade shall be moistened. The concrete mixed to the proper consistency shall be placed in the for

and thoroughly tamped in place so that all honeycombs will be eliminated and sufficient mortar will be brought to the surface. After this the surface shall be brought to a smooth even finish by means of a wooden float. All faces adjacent to the forms shall be spaded so that after the forms are stripped the surface of the faces will be smooth, even and free of honeycombs. All edges shall be tool rounded.

d. Expansion Joints. Half (½) inch transverse expansion joints shall be placed where the driveway apron and driveway joins the sidewalk and the gutter or pavement.

e. Curing Concrete. When completed the concrete shall be kept moist for a period of not less than three (3) days and longer if necessary and shall be protected from the elements in a satisfactory manner.

f. Backfilling. Backfill shall be of suitable selected material and shall be placed and tamped until firm and solid. Backfilling shall follow immediately after the concrete forms have been removed.

g. Seasonal Limits. No concrete shall be poured on a frozen or thawing subgrade, or during unfavorable weather conditions, or when the temperature is 38° F. and falling.

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