For projects approved prior to August 22, 2006

SAN LUIS OBISPO COUNTY

DEPARTMENT OF PUBLIC WORKS

STANDARD IMPROVEMENT

SPECIFICATIONS

and

DRAWINGS

STANDARD IMPROVEMENT SPECIFICATIONS & DRAWINGS

INDEX TO
STANDARDS AND SPECIFICATIONS
OF
SAN LUIS OBISPO COUNTY
DEPARTMENT OF PUBLIC WORKS

Number		Page
SECTION 11-351.1100	GENERAL REQUIREMENTS	1
.1101	Purpose	1
.1102	Definitions	1
.1103	Control of Materials	2
SECTION 11-351.1200	PREPARATION OF PLANS	3
.1201	General	3
.1202	Design Alternatives	4
.1203	Standard Sheets and Scales	4
.1204	Plan Details	5
SECTION 11-351.1300	INSPECTION	7
.1301	Inspection during Construction	7
.1302	Final Inspection	8
SECTION 11-351.1400	ROADS OR STREETS DEFINED	8
.1401	Classes of Roads or Streets	8
.1402	Geometrics and Profiles	9
.1403	Specifications for Material and Construction	9
.1404	Testing of Base Materials	12
.1405	Signing and Barricades	13
.1406	Right of Way	14

Number		Page
.1407	Planting Cut and Fill Slopes	14
.1408	Soils and Geological Report	14
.1409	Preservation of Trees	14
SECTION 11-351.1500	STORM DRAINAGE	15
.1501	General Statement	15
.1502	Alignment and Capacity	16
.1503	Easements	17
.1504	Basis for Runoff Design	18
.1505	Hydraulic Design Criteria	20
.1506	Drainage Structures	23
.1507	Channels, Outfalls, and Cross Culverts	27
.1508	Structure Backfill	29
.1509	Specifications for Material and Construction	30
.1510	Miscellaneous Items	34
.1520	San Luis Obispo Creek Watershed Drainage Design Manual	34
SECTION 11-351.1600	SEWERAGE	36
.1610	Design Standards	36
.1611	Design Flow	36
.1612	Gradient	36
.1613	Location and Alignment	37
.1614	Depth and Size	39
.1615	Manholes	39

Number		Page
.1616	Flusher Branches	40
.1617	House Service Lines	40
.1618	Sewage Lift Stations, Force Mains and Treatment Plants	40
.1619	Kind of Pipe	41
.1620	Materials	41
.1621	Clay Pipe	42
.1622	Cast Iron Pipe	42
.1623	Asbestos-Cement Pipe	42
.1624	Polyvinyl Chloride (PVC) Pipe	43
.1625	Force Main Pipe	43
.1626	Castings	43
.1630	Installation of Sewers	44
.1631	Lines and Grades	44
.1632	Trench Widths	44
.1633	Excavation for Sewers	44
.1634	Bracing and Shoring	45
.1635	Tunneling	45
.1636	Laying Sewer Pipe	46
.1637	Pipe to be Placed by Boring or Jacking	46
.1638	Trench Backfill	47
.1639	Trench Jetting	48
.1640	Manholes	48

Number			Page
	.1641	House Service Lateral	49
	.1642	Connection to Existing Manholes	50
	.1643	Testing of Sewer Lines	50
	.1644	Cleaning	53
	.1645	Placement of Road Surfaces & Replacement	53
	.1646	Temporary Pavement	55
	.1647	Clean Up	55
SECTION 11-351.1700		WATER SUPPLY	56
	.1710	Water Supply, General	56
	.1711	Quantity of Water	56
	.1712	Regulations Relating to Cross Connections	61
	.1713	Distribution System	62
	.1720	Materials of Construction	63
	.1721	Pipe	63
	.1722	Fittings	64
	.1723	Valves and Valve Boxes	64
	.1724	Fire Hydrants	65
	.1725	Air and Vacuum Release Valves	65
	.1726	Check Valves	65
	.1727	Flushouts (Blowoffs)	66
	.1728	Water Service Connections	66
	.1730	Construction Methods	68

Number			Page
	.1731	Depth	68
	.1732	Excavation	68
	.1733	Laying Pipe	68
	.1734	Installation of Service Lines	70
	.1735	Trench Backfill	70
	.1736	Testing of Water Mains	70
	.1737	Flushing and Disinfecting	71
	.1738	Replacement of Road Surfaces	71
	.1739	Connection to Existing Mains	71
	.1740	Storage Facilities	71
	.1741	Vertical Turbine Pumps	72
	.1742	Temporary Pavement	72
	.1743	Clean Up	72
SECTION 11-351.1800		UTILITIES	72
	.1801	General Statement	72

SECTION 11-352.1

INDEX TO STANDARD DRAWINGS

Drawing No.	Title
A-1	RURAL ROAD SECTIONS
A-2	URBAN ROAD SECTIONS
A-3	DESIGN CRITERIA
A-4	~~STOPPING SIGHT DISTANCE ON SAG VERTICAL CURVES~~
A-5	STOPPING SIGHT DISTANCE ON CREST VERTICAL CURVES
A-6	STOPPING SIGHT DISTANCE ON HORIZONTAL CURVES
A-7	COMFORTABLE SPEED ON HORIZONTAL CURVES
A-7c	TYPICAL GRAVEL ROAD
A-8	TYPICAL CUL-DE-SAC
A-9	TYPICAL KNUCKLE
A-10	MAJOR INTERSECTION
A-11	MINIMUM SIGHT DISTANCE
B-1	DRIVEWAY LOCATION
B-2	DRIVEWAY APPROACH
B-3	P.C.C. DRIVEWAYS, RESIDENTIAL AND COMMERCIAL.
B-4	DRIVEWAYS, (ASPHALT CONCRETE) RESIDENTIAL
B-5	SIDEWALKS
B-6	CUTTING CONCRETE
B-7	WHEELCHAIR RAMP
C-1	CURBS
C-2	CONCRETE CROSS GUTTER
C-3	STORM DRAIN INLET
C-4	DROP INLET AND JUNCTION BOX
C-5	CONCRETE JUNCTION BOX

Drawing No.	Title
C-6	GRATE DETAILS
D-1	BASIN DETAIL
D-2	TABLE OF COEFFICIENT RUNOFF CHART
D-3	NOMOGRAPH
D-4	AVERAGE RAINFALL MAP
D-5	RAINFALL INTENSITY DURATION CURVE (Less than 14 inches per year)
D-6	RAINFALL INTENSITY DURATION CURVE (14 to 18 inches per year)
D-7	RAINFALL INTENSITY DURATION CURVE (18 to 22 inches per year)
D-8	RAINFALL INTENSITY DURATION CURVE (22 to 28 inches per year)
M-1	STANDARD STREET MONUMENT ALTERNATE I
M-2	STANDARD STREET MONUMENT ALTERNATE II
M-3	TREE PLANTING: COMMERCIAL
M-4	METAL BEAM BARRICADE
M-5	TEMPORARY WOOD BEAM BARRICADE
M-6	STANDARD STREET SIGN
P-1	DECORATIVE LIGHT STANDARD
P-4	LOCATION OF UTILITIES
S-1	SEWER MANHOLE COVER
S-2	TYPICAL DROP MANHOLE
S-3	TYPICAL ECCENTRIC CONE PRECAST CONCRETE MANHOLE
S-4	SANITARY SEWERS SEWER CLEANOUT ALTERNATE 1

Drawing No.	Title
S-5	SEWER LATERAL LOCATION
S-6	STEEP SEWER SERVICE LATERALS
W-1	FIRE HYDRANT INSTALLATION
W-2	VALVE ANCHOR
W-3	THRUST BLOCK REQUIREMENTS
W-4	WATER SERVICE CONNECTION
W-5	SERVICE INSTALLATION LOCATION
W-6	BLOW-OFF ASSEMBLY
W-7	1" AIR AND VACUUM RELIEF ASSEMBLY
W-8	BACKFILL REQUIREMENTS FOR WATER AND SEWER LINES

STANDARDS AND SPECIFICATIONS

OF

SAN LUIS OBISPO COUNTY

DEPARTMENT OF PUBLIC WORKS

SECTION 11-351.1100

GENERAL REQUIREMENTS

11-351.1101 PURPOSE:

The purpose of these Standards and Specifications is to provide minimum standards for the design, methods of construction, kinds and uses of materials, and the preparation of plans for construction, repair or alteration of streets, roadways, concrete structures, drainage, sewerage, and water supply facilities within the County of San Luis Obispo, where any portion of such improvement is to be offered to the County of San Luis Obispo for operation and/or maintenance. Any items which are not included in these Standards or Specifications shall be constructed in accordance with the State Specifications as defined below or, if not covered in the State Specifications, as approved by the County of San Luis Obispo Public Works Department.

11-351.1102 DEFINITIONS:

In these Specifications or the State Specifications the intent and meaning of the terms that are used shall be as defined in Section I of the State Specifications except as herein below specifically noted, revised or added.

1. Consultant - Any person or persons, firm, partnership or corporation legally authorized to practice Civil Engineering in the State of California who prepares or submits improvement plans and specifications on behalf of a developer to the County of San Luis Obispo for approval.

2. Contractor - Shall mean any person or persons, firm, partnership, corporation or combination thereof who has/have entered into a contract with any person, corporation, company,

special district, or the County of San Luis Obispo as party or parties of the second part, or his/her legal representatives, for the construction of any improvement or portion of any improvement within the County of San Luis Obispo.

3. County - Shall mean the County of San Luis Obispo.

4. Department - Shall mean the San Luis Obispo County Public Works Department.

5. Engineer - Shall mean the County Director of Public Works of San Luis Obispo County acting either directly or through his authorized representatives.

6. Developer - Shall mean the owner or his representative.

7. Laboratory - Shall mean any testing agency or testing firm which has been licensed by the State of California to act in such capacity and meeting the requirements of the Engineer.

8. State - When State specifications are applicable, the word "State" as used in the State Specifications shall mean San Luis Obispo County.

9. State Specifications - Shall mean the latest edition of Standard Specifications of the State of California, Department of Transportation, Division of California Transportation Authority.

11-351.1103 CONTROL OF MATERIALS:

The Engineer may make such tests of any of the materials used in any work done under these specifications as he considers necessary. Samples of materials for testing shall be furnished the Engineer without charge. In lieu of, or in addition to, tests by the Engineer, he may require properly executed certificates of compliance with these specifications from the manufacturer or fabricator of any materials used in any work done hereunder. Cost of all testing shall be paid for by person, firm or corporation making the improvement.

If pipe manufactured outside of the United States is to be furnished, all the tests required under these specifications

shall be conducted within the continental limits of the United States by an established reputable firm operating in the testing of materials field. The testing firm shall submit a certificate that all the requirements of these specifications have been met.

Requests for substitution of methods or materials differing from those set forth herein will be considered by the Engineer provided the requestor makes any such requests in writing and furnishes complete descriptive information thereon to the ~~Engineer (including any additional information the Engineer~~ may request) as early in this process as possible but, in any event, by not later than the day on which the final improvement plans are submitted for final review by the Engineer. The Engineer will consider requests for emergency substitutions involving materials which suddenly become unavailable, provided requests for such emergency substitutions, including all data to show substitutions comply with specifications, are received at least fifteen calendar days before date of use.

SECTION 11-351.1200
PREPARATION OF PLANS

11-351.1201 GENERAL:

Complete plans and specifications for all proposed streets, drainage facilities, sewerage, water distribution systems, industrial and commercial development and sub-divisions, including any necessary dedications and easements shall be submitted to the Engineer for approval and must receive the required approval prior to the beginning of construction of any such improvements. This shall apply where it is the intent that any portion of such improvement will be turned over to the County or any of the County operated special Districts. Where improvements are required as a condition of County approval of any development, including those where County acceptance of the public ways in said development is not intended, nor imminent, improvement plans acceptable to the Engineer shall be submitted to assure the County that proper construction standards will be used together with Performance Bonds and Labor and Materialman's Bonds as necessary to guarantee compliance. Plans not conforming to the normal standards of quality and neatness may be rejected.

Three sets of plans, specifications and special provisions, together with two copies of all computations, estimates, bid forms, test data, cross sections, and such other items as may be

requested by the Engineer, shall be submitted to the Engineer for approval. One copy of the plans showing desired revisions will be returned to the consultant. At such time as the consultant has made the necessary revisions, the original drawings shall be submitted for approval. No construction will be authorized or plan approved until such time as the Engineer or his designated representative signifies his approval by his signature on the original drawings of the title sheet. There shall be no alterations made to an approved set of plans unless such alterations are submitted to the Engineer for approval. Excepted from approval are any features of the plans that are contrary to, in conflict with or do not conform to any Federal or State law, County Ordinance or Resolution, or generally accepted engineering practice, in keeping with the standards of the profession, even though such errors, omissions or conflicts may have been overlooked in the review of the plans.

Where the improvement plans submitted cover only a portion of the ultimate development, the plans submitted must be accompanied by the approved overall tentative plan, or a study plan if there is no approved overall tentative plan, showing topographic features of the ultimate development at an adequate scale to clearly show the proposed improvements.

A print of the subdivision shall be included with each set of subdivision improvement plans submitted.

11-351.1202 DESIGN ALTERNATIVES:

Design alternatives may be approved by the Director of Public Works where the proposed alternate provides the same level of service, approximately the same estimated maintenance costs, and is not adverse to public health, safety and welfare. This provision is intended to provide for some flexibility in designing streets with bike ways, pedestrian paths and bridle paths; when an area specific plan has been approved showing an alternate to the standard drawings or where appropriate in order to provide compatibility with adjacent areas.

11-351.1203 STANDARD SHEETS AND SCALES:

A. Residential Subdivisions and Commercial or Industrial Streets - These plans shall be prepared on linen, or an approved equal, 23" x 36", Standard Federal Aid Plan - Profile Sheet. Desirable Scales: Horizontal of 1" = 40', with vertical of 1" = 2' or 1" = 4'; or horizontal of 1" = 50' with vertical of 1" = 5'. However, scale may be varied in rough terrain.

B. Storm Drainage - Plans for minor drainage facilities may be shown on street plans, if appropriate. Plans for major drainage facilities shall conform to the sheet size and scale as shown for street plans.

Attention is directed to 11-351.1201 of these Specifications which requires the submittal of computations with improvement plans at the time such plans are submitted for approval.

C. Sanitary Sewerage - Plans for sanitary sewer improvements shall be prepared on standard sheets as defined in paragraph A. Scales are to be as follows except in unusually rough terrain where the scales may be varied.

Standard Sheets (23" x 36") use horizontal scale of 1" = 100' or 1" = 50', and a vertical scale of 1" = 4' or 1" = 5'.

D. Water - Plans for water system layout and improvements shall be submitted on the same plans as the streets. Off street improvements shall be drawn on sheets and to a scale approved by the Engineer.

E. Utilities - Plans for electric, telephone, cable T.V. and gas system improvements shall be submitted on the same plans as the streets.

F. Grading - If any grading is proposed, a grading plan shall be submitted with the other required improvement plans.

11-351.1204 PLAN DETAILS

The following details are to be shown on plans submitted for approval:

A. Title Sheet - On improvement plans exceeding two sheets in the set, a title sheet shall be prepared showing the entire subdivision complete with the following: A key map showing boundaries of the Subdivision, Special Districts, and City Limits; Street Names, section and/or grant lines and corners; and the location of the Subdivision within the County. The title sheet shall also include an index of the sheets; the Consultant's name, and Professional Registration number and signature; the date and scale of the drawing; and the blocks for the necessary approval of the Engineer.

B. Title Blocks - Each sheet of the set of drawings shall have an approved title block showing the sheet title, sheet number,

total number of sheets, date, scale and the Consultant's name, signature and Professional Registration number; and the name and/or number of the Subdivision or Assessment District. The title block shall also include appropriate approval lines for the Director of Public Works.

C. Right of Way - Right of Way lines, the boundaries of lots fronting on the street, drainage easements, utility easements, slope easements, section lines and corners, land grant lines, and temporary construction easements both existing and proposed shall be shown on the plans. All right of way and easement lines shall be properly dimensioned.

D. Topography - All pertinent topographic features which may affect the design, construction, and operation of the improvement shall be shown on the plans, including, but not limited to the following: street lines, curbs, sidewalks, shoulders, location and size of storm and sanitary sewer lines, high water and frequent inundation levels, water and gas lines, existing structures, fences, houses, trees, and other foliage, drainage ditches, utility poles, fire hydrants, and all other features of the area which may affect the design requirements for the area.

E. Profiles - The plans shall clearly show the existing and proposed profiles of all roadways, drainage ditches, storm drains, sanitary sewers, and clearances at structures and power lines, including elevations at 25' minimum intervals for warped surfaces.

F. Stationing and Orientation - The stationing on plan and profile shall read from left to right. Insofar as practical, the plans shall be so arranged that the north arrow is either pointed toward the top or to the right edge of the sheet.

G. Special Notes - Special notes shall be clearly indicated. The following note shall be conspicuously placed on the first sheet of plans:

"All construction work and installations shall conform to the County of San Luis Obispo Standards and Specifications and all work shall be subject to the approval of the County Director of Public Works".

H. Typical Sections - The plans shall include one sheet entitled "Typical Standards", which shall show the following:

(1) Typical street and roads

(2) Detail of all typical concrete structures

(3) Typical Sections of drainage, sewer or water trench construction

(4) Miscellaneous typical details - street signs, monuments, etc.

I. Cross Sections - Cross sectional drawings shall be shown for all culvert and drainage structure locations. Cross sections for the remainder of the street will be required only on request of the Engineer.

J. "As-Built Plans" - During the progress of the work the consultant shall maintain one set of prints of the improvement plans showing all "As-Built" changes. Each "As-Built" change shall be approved by the Engineer before being made. This set shall be available on the job for inspection by the Engineer at any time. Upon completion of the work, the consultant shall obtain the original tracings of the improvement plans from the office of the Engineer and make "As-Built" changes thereon and return the original drawings to the Engineer prior to the County's acceptance of the project.

SECTION 11-351.1300
INSPECTION

11-351.1301 INSPECTION DURING CONSTRUCTION:

Each phase of any and all improvements, constructed to these specifications must first be inspected and approved by the Engineer prior to the contractor's proceeding with subsequent phases. Each phrase shall be inspected as the Engineer considers necessary but in any case shall make an inspection within two working days after receiving a request for inspection from the Contractor.

The Engineer may inspect, as he considers necessary, any improvements required by the Board of Supervisors as a condition of approval of any development even though County acceptance is not intended or imminent. Any improvements constructed without approval as provided above, or constructed contrary to the orders or instructions of the Engineer, will be deemed as not complying

with County Standards and Specifications and will not be accepted for maintenance.

11-351.1302 FINAL INSPECTION:

Upon completion of any improvements which are constructed under and in conformance with these standards and specifications, and prior to requesting final inspection, the area shall be thoroughly cleaned of all rubbish; excess material and equipment; and all portions of the work shall be left in a neat and orderly condition satisfactory to the Engineer.

Within 5 days after receiving the request for final inspection, the Engineer or his authorized agent will inspect the work. The developer or his representative will be notified in writing as to any particular defects or deficiencies to be remedied. The developer or his representative shall proceed to correct any such defects or deficiencies at the earliest possible date. At such time as the work has been completed, a second inspection shall be made by the Engineer within 48 hours after notification that re-inspection is desired to determine if the previously mentioned defects have been repaired, altered and completed in accordance with these Standards and Specifications.

SECTION 11-351.1400
ROADS OR STREETS DEFINED

11-351.1401 CLASSES OF ROADS OR STREETS:

A. Minor Road or Street - A Minor road or street is one which is or will be used primarily or access to abutting property.

B. Collector Road or Street - A Collector road or street is one which is or will be use primarily to enable traffic to move to and from minor roads or streets and arterial roads or streets.

C. Arterial Roads or Streets - An arterial road or street is one which is primarily or the purpose of carrying traffic between State Highways and/or populated centers and/or which is needed to serve large volumes of traffic within an urban area.

D. Rural Road or Street - A rural road or street is one which serves residential suburban, residential rural, rural lands and agricultural land use categories as well as open space and recreational land use categories adjacent to rural uses as those categories are shown by the Land Use Element of the General Plan.

E. Urban Road or Street - An urban road or street is one which serves residential single family, multiple family, commercial, and industrial land use categories as well as open space and recreational categories adjacent to urban uses as those categories are shown by the Land Use Element of the General Plan.

11-351.1402 GEOMETRICS AND PROFILES:

The following standards for the design of geometrics and profiles for proposed improvements shall govern the preparation of plans for such improvements.

A. Minimum Grades

1. Minimum grade along any line on new streets shall be 0.30 percent.
2. Minimum grade of gutter section constructed on existing street shall be 0.30 percent.

B. Minimum Cross Gradient

1. Minimum cross section slope on streets shall be 2.0 percent.
2. When two streets intersect, neither street shall have a grade greater than 3.0 percent for a minimum distance of 40 feet measured from the curb line of the intersected street, except in unusually rough terrain.

C. Bike Lanes - Where bike lanes are required in rural areas, the shoulders will be paved to a minimum width of four feet with 2" A.C., in urban areas the typical section will be widened to eight feet.

D. Cross Gutters - No Cross Gutters will be allowed on Collector Streets or Arterial Routes unless no other provision can be made for adequate drainage.

E. Curve Data - The curve data for all centerline curves shall be computed and shown on the plans. The minimum radius of the property line on the exterior corner of all corner lots shall be 20- feet. The minimum radius of curb returns shall be 30 feet.

11-351.1403 SPECIFICATIONS FOR MATERIAL AND CONSTRUCTION:

A. Contractors License and Supervision

Any Contractor performing work under these standards and specifications is required to possess a valid state license to perform such work. The Contractor or his duly authorized

representative must be available on the job site during the time when any work is in progress. If such is not the case, the work shall be stopped at the direction of the Engineer.

B. Safety

All work shall be performed in accordance with the requirements of the State of California Division of Industrial Safety.

The Contractor shall conform to the permit requirements of the Division of Industrial Safety and shall obtain a trenching permit directly from the Division of Industrial Safety.

The Contractor's attention is directed to the provisions of Section 5705 of the Labor Code concerning trench excavation safety plans.

Excavation for any trench 5 feet or more in depth shall not begin until the Contractor has received approval, from the Engineer, of the Contractor's detailed plan for worker protection from the hazards of caving ground during the excavation of such trench. Such plans shall be submitted at least 5 days before the Contractor intends to begin excavation for the trench and shall show the details of the design of shoring, bracing, sloping or other provisions to be made for worker protection during such excavation. No such plan shall allow for the use of shoring, sloping or a protective system less effective than that required by the Construction Safety Orders of the Division of Industrial Safety and if such plan varies from the shoring system standards established by the Construction Safety Orders, the plan shall be prepared and signed by an engineer who is registered as a Civil or Structural Engineer in the State of California.

C. Materials and Tests

All materials furnished and the methods of performing any proposed work shall conform to and be done in accordance with the applicable portions of these Improvement Standards and Specifications of the County, or if the method and materials are not completely set forth-therein, the provisions of the State Specifications shall apply. Where a California Test Method is specified, it shall mean the one currently in use by the State.

D. Temporary Improvements

The installation of temporary improvements for the winter "shutdown in order to make building sites accessible will be approved on an

individual basis, provided that it is expressly understood that such improvements are of a temporary nature only, and that they will be removed and replaced with permanent type improvements during the construction season immediately following the season in which the temporary installation was made. It shall be further understood that the approval of the installation of temporary improvements in no way obligates the County for any maintenance work.

E. Roadbed

The roadbed shall be prepared and constructed in accordance with the applicable portions of the State Specifications. Unless otherwise modified in the following or approved by the Engineer.

1. Prime Coat and Penetration Treatment - Shall be MC-250 (MC-70 if approved), and shall conform to the requirements of Section 36-1, and Section 93 of the State Specifications.

2. Asphalt Concrete - Shall conform to the requirements for Type B Asphalt Concrete as specified in Section 39 of the State Specifications utilizing the 3/4 inch maximum aggregate, or 1/2 inch maximum aggregate if approved by the Engineer. The completed surface should be sealed with a Fog Seal. The Fog Seal shall comply and be applied in accordance with Section 37-1 of the State Specifications.

3. Asphalt Headers - When the paving of streets is to be only partially completed or at the end of initial construction of the ultimate development, a 2" x 6" redwood header shall be installed to protect all edges of the asphalt concrete pavement. The grading of the redwood timber shall be as specified in Section 57-2.02-of the State Specifications. Other materials may be substituted with approval of Engineer.

4. Survey Monuments - Survey monuments shall be provided at the following locations within an improvement.

   (a) Centerline of streets at intersections with other streets. (See Standard Drawing M-1 or M-2)

   (b) At the beginning and end of curves on the street centerline. (See Standard Drawing M-1 or M-2)

(c) At all subdivision corners of the development and in such other locations so as to enable any lot or portion of the improvement to be retracted or located. A pipe at least 24" long and 1 1/2" minimum diameter shall be used. Section corner monuments shall be of Class "A" concrete, precast or poured in place, with minimum dimensions of 4" x 4" x 24".

The Contractor is responsible for the protection or proper resetting of all existing monuments and other survey markers. Any survey monuments destroyed by the Contractor shall be replaced at the Contractor's expense.

11-351.1404 TESTING OF BASE MATERIALS:

A. Basement Soil

1. Resistance factor "R" (State Stabilometer Method) tests shall be made by the developer as required by the Engineer. The location of the tests within the area shall be selected so that an average "R" value may be determined for the entire development area.

2. Relative compaction tests shall be made by developer as required by Engineer on subgrade material and material placed within the street areas of the development as specified by the Engineer. Said tests will be made prior to placing the next layer of material.

B. Aggregate Bases - Tests for aggregate bases shall be made by the developer as required by the Engineer on a minimum of two representative samples taken at the source from which material will be imported. The sample shall be taken within 15 days prior to placing of either base or subbase. Test results submitted shall indicate clearly the location of the source of material. Base material shall also be subject to testing as it is delivered to the job site in accordance with State Standards.

C. Class III Aggregate Base

The percentage composition by weight of aggregate base shall conform to the following grading when determined by Test Method No. Calif. 202.

Sieve Sizes	Percentage Passing
1 1/2"	100
No. 4	40-60
No. 200	0-15

The aggregate base shall also conform to the following quality requirements:

Test	Test Method No. Calif.	Requirements
Resistance (R-value)*	301	70
Sand Equivalent	217	25
Durability	229	25

*The R-value requirement may be waived provided the aggregate base has a sand equivalent of 30 or more.

The work of furnishing, spreading and compacting the aggregate base shall be done in accordance with these specifications, the special provisions and Section 26 of the State of California Standard Specifications.

11-351.1405 SIGNING, GUARDRAILS AND BARRICADES:

A. Temporary Signing- All signs, signals, flares, barricades, or other warning devices necessary for the protection and convenience of the public during the construction phase and prior to final acceptance by the County shall be furnished, installed, and maintained by the Contractor. Signs and other traffic warning devices must be in accordance with the latest edition of the State of California "Manual of Warning Signs, Lights, and Devices for Use In Performance of Work Upon Highways". If approved by the Engineer, County signs and other equipment for warning traffic may be loaned to the Contractor.

B. Permanent Barricades - Where improvements only cover a portion of the ultimate improvement and where an improved street is proposed to be extended in the future, the improvements shall include a permanent type barricade at the end of surfacing of such a street to serve as a warning to the public. The barricade shall be constructed, erected, painted, and signed. (See Standard Drawing No. M4)

C. Temporary Barricades - Where there is evidence that a street is to be extended within two years the Engineer may permit the use of a temporary barricade (See Standard Drawing No. M5)

D. Sign Maintenance - All existing County signs which will be disturbed by the work shall be removed, stored in upright position, and reset or maintained in place by the Contractor as directed by the Engineer. Any damage to such signs as a result of the work shall be paid for or replaced at the Contractor's expense. Stop signs shall be removed or relocated as directed by the Engineer.

E. Guardrails - Guardrails shall be installed as required by the Engineer. They shall be designed in accordance with State Specifications except on designated scenic highways the rails shall be "KOR-Ten" steel, and the post shall be stained dark brown.

F. Permanent Signing - Permanent signs shall be installed as required by the Engineer.

11-351.1406 RIGHT OF WAY:

Minimum right of way widths shall be as set out in these Standards and Specifications, for the class of street under consideration. In no instance, without specific approval of the Engineer, shall a street have a right of way width which is less than those streets of which they are a continuation. Right of way requirements for widening at intersections shall be as shown in the Standards or as approved by the Engineer.

11-351.1407 PLANTING CUT AND FILL SLOPES:

Cut and fill slopes shall be-planted as required by the Engineer and to the approval of the Engineer. An erosion control plan shall be submitted when improvement plans are required. The erosion control plan shall be approved by the Director of Public Works prior to any grading.

11-351.1408 SOILS AND GEOLOGICAL REPORT:

The Engineer may require a soils and geological report to substantiate road designs and/or lot stability.

11-351.1409 PRESERVATION OF TREES:

Preserve trees as possible, all trees to be removed shall be shown on the grading plan. The Engineer may require additional trees to be removed for reasons of safety or maintenance.

SECTION 11-351.1500
STORM DRAINAGE

11-351.1501 GENERAL STATEMENT:

These specifications are intended to meet the requirements of the National Flood Insurance Program.

While it is intended to permit alternative methods of analysis and solution of drainage problems and to provide for other methods for those situations which do not lend themselves to solution by the following criteria, such alternative methods shall be based upon accepted engineering principles and shall produce results which achieve the product intended by the following specifications.

It is the general purpose of these standards that waters generated by storms, springs, or other sources be contained on the area to be developed or carried through a system of waterways and conduits and disposed of in such a manner that adjacent improvements, existing or projected, will be free from flood hazard. Flood hazard is defined as potential damage by water having sufficient depth or velocity to damage improvements or to deposit or scour soil other than within channels.

Each improvement shall be designed so as to not increase the rate of flow of water onto adjacent properties. An exception to this may be permitted by the Engineer if there are adequate downstream facilities provided to handle the total flow without adverse affect on other properties. In this event, the Developer may be required to participate in the cost of said facilities, and/or obtain easements or other rights as needed.

Unless an individual project required diversion of water to conform to a comprehensive drainage plan, water shall be received and discharged at the locations which existed prior to development and as nearly as possible in the manner which existed prior to development. Should diversion be required, sufficient work shall be done upstream and/or downstream to provide all affected properties at least the same level of flood protection as existed prior to the diversion.

These standards are intended to provide general and some detailed design criteria. Most design details are left to the responsibility of the Consultant and may be handled by following good engineering practice.

The design standards contained herein are minimal and alternates may be approved, provided such alternates are to a higher standard than those set forth. Exceptions to these standards may be allowed by the Engineer when it can be determined that such exceptions are in the best interest of the County.

All drainage facilities other than those within the road right of way shall be maintained by an entity with taxing powers if possible. The Developer shall complete arrangements for such an entity or some other approved method prior to filing of the Final or Parcel Map.

11-351.1502 ALIGNMENT AND CAPACITY:

A. Capacity Special provisions shall be made by the Consultant within the drainage system to insure that the inlet flow line elevations and the capacity of the drainage system is such that it may be extended to serve and to properly handle the entire drainage basin at the time of ultimate development. This is to include the entire upstream portion and the portion of the basin outside the development, regardless of existing conditions.

B. Alignment The diversion of natural drainage will be allowed only within the limits of the proposed improvement. All natural drainage must leave the improved area at its original horizontal and vertical alignment and with approximately the same discharge velocity as existed prior to development unless a special agreement indemnifying and approved by the County has been executed with the adjoining property owners.

The general location for storm drainage lines shall be six feet northerly or westerly of the centerline of a street.

Other general requirements for storm drains are as follows:

1. Storm drainage lines are to be parallel with the centerline of streets unless impracticable. The designer should avoid meandering, offsetting, and unnecessary angular changes (none to exceed 90°).

2. Provide junctions between converging lines in such a manner as will minimize losses and utilize available velocity head, and locate the centerlines of the influent and effluent lines so that they will be approximately in the same plane and be as nearly as possible parallel to the resultant vector of the converging lines.

3. The vertical alignment shall be so designed to eliminate any ponding within the drainage system, other than where sump pumps are provided.

4. Existing open ditches, paved channels, and swale flows shall be maintained as nearly as possible in their existing alignment.

11-351.1503 EASEMENTS:

Drainage facilities must be located in a public street, road or lane, or within a public drainage easement. Necessary dedication for lines to be constructed on private property must be completed before the improvement will be approved for construction.

Where a minor improvement of a drainage facility falls on adjacent property, written permission from the adjacent property owners for such construction and a copy of the approval of the adjacent owners shall be submitted to the Engineer prior to approval of the improvement plans. Agreements between property owners shall hold the County harmless from any damage claim arising from said agreement.

Drainage easements shall be used for drainage purposes exclusively and shall not be combined with easements required for other public utility purposes unless it can be shown to the Engineer that dual use of said easement will not be conflicting.

For natural waterways a drainage easement or right of way when required shall be provided which includes the entire waterway area plus freeboard. Prior to final approval, the easement shall be staked by the subdivider's engineer and reviewed by the Director of Public Work. In the case of a natural waterway having banks with side slopes steeper than two horizontal to one vertical, the right of way may be required to be increased to provide width for not less than 2 to 1 slopes from the existing toe of bank, plus a 10-foot-wide buffer strip. Additional right of way will also be required where unstable ground conditions exist.

A. Easements for Closed Conduits - Easements for closed conduits shall meet the following requirements:

1. Minimum width of ten feet with pipe at quarter point, on north or west. Whenever possible, rights of way for closed conduits shall be along or adjacent to property lines and outside of areas where structures are planned.

2. On pipes of 24" diameter and greater, or trenches exceeding 5 feet in depth, the easement shall have additional width to provide ample working space as required by the Engineer.

3. Provide access and working space rights.

B. Property Rights for Open Channels - Property rights for major and intermediate open conduits shall have sufficient, width to contain the open channel with side slopes, and at least one fifteen foot service road. All channels having a top width in excess of 50 feet shall have a 15 foot service road on each side of the channel.

11-351.1504 BASIS FOR RUNOFF DESIGN: (Rational Method)

A. GENERAL:

The solution of hydraulic design problems commonly encountered for areas not to exceed 200 acres may be made by the rational method using the material listed below: (See Standard Drawings D-1 through D-8)

1. rainfall intensity-duration curve
2. time of concentration chart, and
3. table of runoff coefficients.

For special design problems or drainage areas in excess of 200 acres not susceptible to solution by the abovementioned references, the design engineer shall provide such reference, treatise, model study report, or prototype test as is necessary to confirm his hydraulic design. Improvements in natural water courses will not normally be approved unless the capacity of the improved waterway is at least that of the natural waterway.

a. Major Waterways have a drainage area of over four square miles and shall be designed for an average recurrence interval of 100 years, with freeboard.

b. Secondary Waterways have a drainage area of between one and four square miles and shall be designed for an average recurrence interval of 25 years with freeboard, and shall have sufficient capacity for a 50-year design discharge either by alternate surface routes or be contained within the channel without freeboard.

c. Minor Waterways have a drainage area of less than one square mile and shall be designed for an average recurrence interval of 10 years, with freeboard, and shall have sufficient capacity for a 25-year design discharge by either alternate surface routes or contained within the channel without freeboard.

A given waterway, therefore, may be classed as minor in its upper reaches, then changed to the secondary classification at a point where the drainage area exceeds one square mile and changed again to the major classification at a point where the drainage area exceeds four square miles.

All building pads or first floor elevations shall be at least one foot above the 100-year storm flow elevation.

B. GUTTER FLOW:

Design depth of flow in gutters shall not exceed the top of a 6-inch curb for the 10-year flow. Where the discharge gutter capacity is exceeded, a storm drain or other facilities shall be provided to convey the excess flows.

Drainage shall be designed to accommodate ultimate development of up-stream areas.

C. HYDRAULIC GRADIENTS:

The hydraulic grade line shall be a minimum of 0.50 feet below the elevation of inlet grates and manhole covers of all structures.

D. ULTIMATE DEVELOPMENT:

In computing runoff in a partial development, adequate provisions must be made for the drainage of the overall improvement, including possible commercial areas.

E. FENCING REQUIREMENTS FOR CHANNELS:

1. Constructed channels with side slopes 5 to 1 or flatter need not be fenced.

2. Natural channels need not be fenced, except where special hazards exist.

3. For constructed channels, (not excepted from fencing) a five-foot high chain link fabric with tension wire shall be installed on each side of the right of way. At all road intersections fencing shall prevent public access to channel or culvert, and 14-foot wide chain link drive gates shall be provided at all points of access to maintenance ways, or to channels not requiring maintenance ways.

4. For minor channels with depths less than 3.0 feet and for localized areas steeper than 5 to 1 on other channels, the Director of Public Works may allow the fence requirement to be waived.

5. Fencing shall be constructed per Section 11-351.1510.

11-351.1505 HYDRAULIC DESIGN CRITERIA:

In order to provide a uniform drainage system in the County of San Luis Obispo, the following criteria will be used in all hydraulic computations unless approval otherwise is received in writing from the Engineer.

A. Flow Computations - All flow computations shall be in accordance with the following:

1. Manning's Formula shall be used to compute capacities of all open and closed conduits. (Refer to Bureau of Public Road charts for solutions of Manning's Formula)

2. The "n" values to be used in Manning's Formula shall conform to the following:

a.	Concrete cast-in-place or precast pipe	0.013
b.	Vitrified clay pipe	0.013
c.	Corrugated Metal Pipe (C.M.P.) 100% paved	0.015
d.	Corrugated Metal Pipe (C.M.P.) with paved invert	0.019
e.	Corrugated Metal Pipe (C.M.P.) plain unlined	0.024
f.	Asbestos-cement pipe	0.011
g.	Open channel with gunite lining	0.018
h.	Asphaltic concrete (smooth) road berms	0.015
i.	Sack concrete rip rap	0.030
j.	Grouted rock rip rap	.030
k.	Loose rock rip rap	.035
1.	Open channel with paved bottom	0.025
m.	Earth channel	0.030

B. Closed Conduits - Shall be of either cast-in-place or precast reinforced concrete pipe, clay pipe, corrugated metal pipe, asbestos cement pipe or an approved equal.

1. Minimum pipe diameter allowable on any storm drain shall be 18 inches, except that 15" diameter pipe may be used for culverts of not over 20' in length. A lesser size may be used for down drains on fill slopes if approved by the Engineer.

2. Minimum design velocity in closed conduits shall be 2 f.p.s. when conduit is flowing to capacity and should not exceed 15 f.p.s.

3. Any drainage facility whose capacity is equal to or less than a 30-inch pipe shall normally be carried in a closed conduit in all subdivisions of an average lot size of 20,000 square feet or less.

C. Cover Requirements Cover requirements shall be as shown in The California Department of Transportation Planning Manual Part 7 - Design - Section 7-822 "Physical Standards for Culverts", or as approved by the Engineer.

At locations where the general minimum cover requirements cannot feasibly be obtained, the conduit shall be either encased in concrete or provided with a concrete cover or protected by other methods as approved by the Engineer for each individual circumstance.

D. Open Conduits Open conduits may be natural watercourses, earthen channels, or channels lined with the materials listed below, provided that the selected lining material is approved by the Engineer for the particular channel reach:

1. Low-growing grass, which will form a thick, dense sod. The proposed grass mixture is to be submitted to and approved by the Engineer.

2. Rock slope protection facing class, Method B Placement.

3. Concreted-rock slope protection facing class, Method B Placement.

4. Sacked concrete slope protection.

5. Concrete slope paving.

6. Air-blown mortar.

Minimum velocity for channels flowing full, with freeboard shall be (2) feet per second.

Maximum velocity shall be as follows:

1. Earth channels not to exceed velocity that would cause erosion (maximum 5 feet per second).

2. Lined channels not to exceed 10 feet per second or as approved by the Engineer.

Freeboard of at least one foot or 0.2 of the specific energy (whichever is greater) shall be provided-at design capacity for all channels. Where linings are required, they shall extend to the full height of free-board.

For natural waterways, the design flow may be allowed in the natural overflow area if a drainage easement is provided, which will include the overflow area, and freeboard as specified above exists between the water surface and adjacent ground.

Drainage facilities shall be so constructed and areas adjacent to channels so graded that side drainage will enter in a manner which will prevent erosion within the rights of way. This will often require constructed side inlets and collector ditches to carry side flow to inlets.

E. Design Computations - The design computation for drainage shall include the following information:

1. Drainage area in acres, time of concentration, rainfall intensity and runoff coefficient.

2. Design flow to each structure.

3. Design flow to each pipe.

4. Flow line elevation of each pipe and structure.

5. Top of structure elevation.

6. Water surface elevation at each structure.

7. Hydraulic gradient.

8. Pipe, size, length and gradient.

11-351.1506 DRAINAGE STRUCTURES:

The design and construction of drainage structures and special drainage items shall conform to the designs contained in these Standards and Specifications (unless otherwise noted). Special care must be taken to insure that all drainage structures and pipe are designed at such a capacity that the drainage system may be extended or enlarged to serve the entire drainage basin at ultimate development. The rational formula (Q=CIA), with all numerical quantities, shall be indicated on the improvement plans at each drainage structure.

A. Manholes:

1. Standard precast concrete manholes shall be used wherever feasible. When cases arise where special manholes or junction boxes are required, the design shall be approved by the Engineer.

2. Manholes shall be located at junction points, changes in gradient and changes in conduit size. On curved pipes with radii of 200 feet to 400 feet, manholes shall be placed at the BC or EC of the curve and on 300-foot maximum intervals along the curve. On curves with radii exceeding 400 feet, manholes shall be placed at the BC or EC of the curve and on 400 foot maximum intervals along the curve for pipes 24 inches and less in diameter and 500-foot maximum intervals along the curve for pipes greater than 24 inches in diameter. Curves with radii less than 200 feet will be handled on an individual basis.

3. Spacing of manholes or inlets, of such size as to be enterable for maintenance, shall not exceed 500 feet for drains 24 inches and smaller in diameter and 600 feet for pipes greater than 24 inches in diameter, except under special approved conditions. The spacing of manholes shall be nearly equal wherever possible.

4. All manholes or junction boxes, entry to which does not fall in the gutter line, must have standard 24 inch diameter man-hole covers. Those falling in the gutter line may use the standard grated manhole cover and serve also as an inlet man-hole.

B. Inlets:

1. Gutter inlets shall be in accordance with the types shown on Standard Drawings C-3 and C-4 or other approved special inlets. See State Standard Drawing D-72-9 for extended curb *opening* inlets.
2. Inlets shall be spaced so that gutter flow does not exceed a depth of 6 inches at the face of the curb for a 10-year storm and so that a 100-year storm will not cause any damage and can be contained within the right of way.

3. Grates shall be adequate for State of California H5-20 traffic loading.

C. Junction Boxes:

1. Junction boxes shall be constructed of Class "A" reinforced Portland cement concrete or fabricated from reinforced concrete pipe sections where size limitations permit.

2. Minimum wall thickness for poured-in-place reinforced concrete junction boxes shall be 6 inches.

3. The inside dimension of junction boxes shall be such as to provide a minimum of 3 inches clearance on the outside diameter of the largest outfall pipe.

4. All junction boxes shall have the standard 24 inch manhole cover. (Phoenix P1090, Pinkerton A640, or approved equal)

D. Reinforced Concrete Box Culverts, CMP and Structural Plate Arch Culverts:

1. All materials, designs, and construction shall conform to the requirements of the State Specifications and State Standard Drawings unless otherwise specified by the Engineer.

E. Headwalls, Wingwalls, Endwalls, Trash Racks and Railings:

1. All headwalls, wingwalls, and endwalls shall be of Class "A" reinforced Portland cement concrete.

2. All headwalls, wingwalls and endwalls shall be considered individually and shall be, in general, designed in accordance with State Standards or approved by the Engineer.

3. Trash racks shall be provided where in the opinion of the Engineer they are necessary to prevent clogging of culverts and storm drains.

4. On corrugated metal culvert drains, preformed metal end sections may be utilized with the approval of the Engineer.

5. Steel plate beam guardrail may be required by the Engineer at culverts, headwalls and box culverts and on steep side-slopes. When so required, the railing shall. be installed in accordance with State Standards and Specifications.

F. Drainage Pumps:

1. The use of drainage pumps shall be avoided whenever possible. They shall be used only with the approval of the Engineer.

2. If the use of a drainage pump is approved, the drainage system shall be so designed as to provide for gravity outfall during summer months and periods of low .water stages. If a low stage gravity outfall is impossible or impracticable, a pump of smaller capacity for low stage flow may be used provided approval is granted by the Engineer.

3. Drainage pumps shall be equipped with standby equipment with alternating operation characteristics.

4. When specified by the Engineer, the outfall shall be equipped with floodgates of an approved design.

5. Pumping installations shall be so designed as to accommodate a design storm as specified by the Engineer.

6. Pumping stations shall be designed so that gravity flow does not flow through the pump pit.

7. Each pumping installation shall receive separate approval, including all machinery, electrical system, piping system, housing installation and other miscellaneous design features.

G. SUMPS AND BASINS:

Definitions

1. Infiltration Basin - Any drainage facility which is used as a terminal disposal facility shall be classified as an infiltration basin.

2. Retarding Basin - Any drainage facility which is used to retard the flow and which has a downstream outlet shall be classified as a retarding basin.

Capacity Requirement Computation

1. Infiltration Basin - The basin capacity is to be based on the theoretical runoff from a 50-year storm, 10-hour intensity for 10-hour duration. In addition to the above criteria, the sump shall be designed so the design water surface is one-foot below the lowest inlet gutter elevation. Also the basin will have at least 1 foot of freeboard. The inlet structure is to be designed to convey the 10-year flow without ponding and the 100-year flow without damaging adjacent property.

2. Retarding Basin - Retarding basins require special design considerations. The consultant is to have the design method approved by the Engineer prior to designing the facilities.

3.

Fencing Requirements

1. All water retention facilities within limits of urban areas shall be provided with a six (6) foot chain link fence with a concrete footing and vertical redwood slats. A 14-foot wide chain link drive gate shall be provided for access.

2. In other than urban areas fencing is not mandatory if the maximum water depth obtainable does not exceed two (2) feet and the side slopes are 5 to 1 or flatter.

Right of Way

1. The top of bank shall be located a minimum of five (5) feet inside the right of way line or as dictated by set-back requirements. If a fence is required it shall be located from (4) inches inside the right of way line except where setbacks are required as part of the conditional use permit.

2. Right of way required for drainage basins shall be deeded in fee to the County. Reversionary clauses will not be permitted.

Design

The standard basin design will not apply unless an analysis of soil borings below the invert show that the basin will completely drain within seven days as determined by a test approved by the County Director of Public Works.

Slope stability analysis will also be required for all basins. See Standard Drawing D-1 for other basin details.

Zone Clearance

1. Zone clearance shall be obtained from the Planning Department by the Developer for all drainage basins prior to approval of the plans by the County Director of Public Works. If a conditional use permit is required, a copy is to be submitted to the County Director of Public Works prior to approval of the plans.

11-351.1507 CHANNELS, OUTFALLS, AND CROSS CULVERTS:

All channel realignment, improvement and cross culverts shall be shown on the improvement plans and shall conform to the requirements of these Standards and Specifications. No diversion to roadside ditches will be allowed from natural drainage courses.

A. Open Channels

1. Realigned channels may be required to be lined to an elevation of at least 1.0 foot above the design waterline. The side slopes for realigned channels shall not exceed 1:1 on the lined portion and 2:1 on the unlined portion.

2. For all intermediate or major channels, either realigned or natural, within an improvement, the following information shall be shown on improvement plans in addition to information heretofore required.

   a. Typical sections.

   b. Profile of the existing channel for a minimum of 500 feet each side of the development in order to establish an average profile grade through the development.

B. Outfalls

1. All drainage outfalls shall be shown both in plan and profile on the improvement plans for a distance of 1000 feet or until a definite "daylight" condition is established.

2. When improvements have more than one unit, the drainage out-fall shall be shown as extending to the property boundary, and beyond if required, although it may not be constructed with the current unit development. All temporary outfalls shall be shown both in plan and profile on improvement plans.

C. Cross Culverts

Cross culverts may be of reinforced concrete culvert pipe, corrugated metal pipe, or A.C. pipe meeting the requirements of these Standards and Specifications.

1. Cross culvert design shall be determined on the basis of a ten year storm with no head.

   Also waterways placed in closed conduit systems may be de-signed for full conduit capacity and pressure flow. The hydraulic entrance condition at a closed conduit minor water-way shall be such that the 10 year discharge will have the specified freeboard in the upstream channel or waterway and that the 100 year discharge will be contained within the banks of the upstream waterway or drainage easement. The entrance to the closed conduit minor waterway may be submerged provided that the above criteria are satisfied.

2. Cross culvert profile shall be determined by the average profile of the channel for a minimum distance of 500 feet each side of the installation.

11-351.1508 STRUCTURE BACKFILL:

Backfilling operations shall conform to the following requirements: Material for use as structure backfill shall have a sand equivalent value of not less than 20. The percentage composition by weight as determined by laboratory sieves shall conform to the following grading:

Sieve Size	Percentage passing sieves
2-1/2"	90-100
No. 4	35-100

Structure backfill shall not be placed until the structure footings or other portions of the structure or facility have been inspected by the Engineer and approved for backfilling. No backfill material shall be deposited against the back of concrete abutments, concrete retaining walls, or the outside walls of cast-in-place concrete culverts until the concrete has developed a strength of not less than 2,500 pounds per square inch in compression as determined by test cylinders cured under conditions similar to those prevailing at the site and tested in accordance with Test Method No. California 521, or until approved by the Engineer.

Backfill material shall be placed in horizontal, uniform layers not exceeding 0.67 foot in thickness, before compaction, and shall be brought up uniformly on all sides of the structure or facility. Each layer of backfill shall be compacted to a relative compaction of not less than 90 percent, except that the upper 2 feet shall be compacted to 95 percent. Backfill outside the roadway prism shall have a sand equivalent of not less than 20 and shall be compacted to not less than 85 percent. It shall conform to the above grading limits.

At the option of the contractor, backfill material conforming to the requirements hereinafter specified may be used at the following locations:

1. Footings for slope protection, slope paving and aprons.

2. All headwalls and culvert wingwalls.

3. Retaining walls, except for portions under any roadbed.

4. Drop inlets in median areas or in traffic interchange loops.

The backfill material at the above locations may consist of material from excavation, free from stones, or lumps exceeding 2-1/2 inches in greatest dimension, namely, clay or adobe type material, vegetable matter or other unsatisfactory material, and shall be compacted to a relative compaction of not less than 90 percent. When the material from excavation is unsuitable for use as backfill, it shall be disposed of as directed by the Engineer, and suitable material approved by the Engineer shall be furnished by the Contractor for the backfill.

Compaction of structure backfill by jetting will be permitted, when, as determined by the Engineer, the backfill material is of such character that it will be self-draining when compacted and that foundation material will not soften or be otherwise damaged by the applied water and no damage from hydrostatic pressure will result to the structure. Jetting of the upper 4 feet below subgrade will not be permitted. When jetting is permitted, material for use as structure back-fill shall be placed and compacted in layers not exceeding 4 feet in thickness. The work shall be performed without damage to the structure and embankment, and in such a manner that water will not be impounded. Jetting shall be supplemented by the use of other compaction equipment when necessary to obtain the required compaction.

11-351.1509 SPECIFICATIONS FOR MATERIAL AND CONSTRUCTION:

All drainage items shall be of the material and construction methods as required in accordance with the applicable portions of the State Specifications as herein noted, specified or modified.

A. Reinforced Concrete Pipe - Shall conform to the specification of ASTM Designation C-76-Latest Revision.

1. Excavation for pipe shall conform to Section 11-351.1732 of these specifications except that where tongue and groove pipe is utilized excavation need only be to one inch below the outside diameter of the pipe in uniform material and three inches below the outside of the pipe in rocky material.

2. Laying of reinforced concrete pipe: Section 65-1.07 of the State Specifications.

3. Jointing: Section 65-1.06 of the State Specifications.

4. Trench backfill: Section 11-351.1638 of these Specifications.

B. Non-reinforced Concrete Pipe - Shall conform to the specifications of ASTM Designation C-14. The construction method shall conform to the method specified for reinforced concrete pipe.

C. Asbestos-Cement Pipe - Shall conform to Section 64 of the State Specifications.

D. Corrugated Metal Pipe - Shall conform to the material and construction methods of Section 66, of the State Specifications. Attention is directed to the backfill requirements of Section 11-351.1638 of these Specifications, except that pea gravel or other suitable gravel material may be utilized for bedding and backfill.

E. Clay Pipe - Clay sewer pipe for storm drainage shall be extra strength and conform to the Specifications of ASTM Designation: C-700. The construction method shall conform to the method specified in Section 11-351.1636 of these Standards and Specifications, except that mortar joints shall be utilized.

F. Concrete Structures - Shall be in accordance with these Standards an Specifications and in addition they shall conform to the requirements of Section 51 of the State Specifications. Backfill shall conform to Section 11-351.1508 of these Specifications.

G. Reinforcement - Shall conform to the requirements of Section 52 of the State Specifications.

H. Portland Cement Concrete - Shall be Class "A" or "B" as specified and conform to the requirements of Section 90 of the State Specifications.

I. Gunite Lined Channels - Shall be placed as required by these Standards and Specifications, and shall be mesh reinforced and conform to the materials and methods as follows:

1. Channel Preparation - The channel shall be trimmed to the line and grade and cross section as shown on the plans within the following limitations:

   Allowable deviation from profile 0.05 foot; allowable deviation of slope and line 0.15 foot in any 10-foot length section of channel.
   Care shall be taken to prevent excavating below ditch grade line or beyond the' slope lines. Any deviation in excess of the specified tolerance may not be backfilled with earth, but shall be corrected by the placement of additional gunite materials. The channel shall be clean, damp and free from any rubbish or trash or free flowing or standing water prior to initiating guniting operations.

2. Placing of Material - Channel lining shall consist of a mixture of Portland Cement and sand, mixed dry, passed through a flexible hose, hydrated at the nozzle and deposited upon a dampened subgrade by air pressure. The final ditch lining shall not be less than 3 inches in thickness and shall conform to the dimensions shown on the plans. The pneumatic pressure at the gage shall-remain uniform at the following pressures:

   a. For hose length up to 100 feet - 45 psi.
   b. Where the length of hose exceeds 100 feet the pressure shall be increased 5 psi for each additional 50 feet of hose.

3. Weep Holes - Shall be provided at intervals of 10 feet midway between contraction joints. The holes shall be backed by a minimum of 1 cubic foot of concrete aggregate tied in a burlap bag to insure proper operation of the weep hole. The aggregate shall extend at least 0.5 foot above the weep hole.

   All weep holes shall be 2 inches in diameter and be placed at an elevation of 1 foot above the flow line of the channel.

4. Curing - Shall be accomplished by the pigmented curing compound method as specified in Section 40-1.11C of the State Specifications, except that the manual operation of an unshielded spray nozzle will be permitted. Surface shall be kept moist or wet until the curing compound is applied. Curing compound shall not be applied to surfaces of construction joints.

5. Materials for Gunite Lining:
   a. Portland cement shall conform to the requirement of Section 90-1.02A of the State Specifications.

b. Sand shall be washed sand and shall be hard, dense durable, clean and sharp and graded evenly from fine to coarse within the following limits:

Sieve Size	Percentage Passing by Weight
3/8"	100
No. 4	97-100
No. 8	70-85
No. 16	60-73
No. 30	36-47
No. 50	10-20
No. 100	0-5

Sand shall be free from organic matter and shall contain not more than 5 percent by weight of deleterious substances, and shall have a fineness modulus of between 2.70 and 3.30.

c. The materials above shall be mixed in the proportions of 1 part Portland cement to 4-1/2 parts of sand, by volume.

J. Concrete Lined Channels - Concrete lined channels shall be constructed of the materials and in accordance with Section 72-4 of the State Specifications.

1. Weep Holes - shall be provided at intervals of 10 feet mid-way between contraction joints. The holes shall be backed by a minimum of 1 cubic foot of concrete aggregate tied in a burlap bag to insure proper operation of the weep hole. The aggregate shall extend at least 0.5 foot above the weep hole.

2. All weep holes shall be 2 inches in diameter and be placed at an elevation of 1 foot above the flow line of the channel.

K. Grouted Rock Rip Rap Channels - Shall conform to the materials and methods called for in State Specifications 72-5.01.

Weep Holes - Weep hole pipe consisting of two and one-half (2-1/2) inch diameter galvanized iron pipe shall be placed through the grouted rock rip rap along both sides of the channel approximately one (1) foot above the channel invert. Spacing of weep holes shall be such as to provide complete

drainage of the *foundation* and filter material and shall not exceed ten (10) feet.

11-351.1510 MISCELLANEOUS ITEMS

Fencing

1. Chain link fence for drainage channel enclosure shall be Type CL-6 as specified in Section 80-101 of the State Specifications, with or without extension arms and barbed wire as specified.

2. Chain link fence shall be of the materials and construction as specified in Section 80-4 of the State Specifications.

3. Drive gates and walk gates will be provided, complete with master keyed locks and keys, at such locations as specified by the Engineer for the purpose of maintenance vehicles and personnel.

4. Attention is called to Section 11-351.1503 of these Specifications for easement requirements of open channels. The fence shall be located 6 inches within the required easement lines and shall provide sufficient room for maintenance vehicles as set out, or as specified by the Engineer.

11-351.1520 The San Luis Obispo Creek Watershed Drainage Design Manual

The City and County of San Luis Obispo have developed the San Luis Obispo Creek Watershed Drainage Design Manual to provide criteria and planning procedures for floodplains, waterways, channels, and closed conduits in the San Luis Obispo Creek watershed. This watershed comprises Zone 9 of the San Luis Obispo County Flood Control and Water Conservation District.

It is recommended that private property owners submitting applications for grading and building permits within the San Luis Obispo Creek watershed follow these guidelines and procedures if they wish to streamline their environmental permitting processes. The design criteria will be used by the County in drainage facility design review and the checking of design and construction of private projects. It is required that these guidelines and procedures be followed on projects which, upon completion, will be managed and maintained by the County.

Drainage facility review as used here includes the review of all drainage and hydraulic structures, and all supporting engineering calculations. Drainage facilities include but are not limited to: hydraulic structures, open channels, closed conduits, pipes and culverts, storm-water management structures, bank stabilization and bank repair structures, and grade control and aquatic enhancement structures that may be placed in stream channels.

Guidelines for stream corridor planting and management, bank repair and stabilization structures and devices, and general erosion control and storm-water management requirements are also provided in this Manual.

It is critically important that any proposed channel modification and/or drainage improvement project preserve, protect, and enhance the waterways within the San Luis Obispo Creek watershed, including stream-side or riparian vegetation and aquatic habitat and fisheries. Although specific design criteria and design procedures are presented, the design engineer is invited to be as creative as possible in ways that provide functional, safe and aesthetically pleasing channels or waterways, which are also compatible with the environment.

Early consultation with the County Public Works and Planning Departments, and collaboration with stream geomorphologists and biologists prior to completing engineering designs that potentially impact creek resources in this watershed is strongly encouraged.

Alternate methods of analysis and design are subject to the approval of the County Public Works Director.

A copy of the Design Manual is available for review at the San Luis Obispo County Public Works Office and at http://suntzu.larc.calpoly.edu/slo_creek/Drainage_Design_Manual_2-03.pdf

SECTION 11-351.1600
SEWERAGE

11-351.1610 DESIGN STANDARDS:

Sanitary sewer lines and appurtenances within County jurisdiction shall be constructed in accordance with the details shown on plans and specifications approved by the Engineer, and where such sewer system is to be operated and/or maintained by any Special District, the plans and specifications and construction must also be approved by that Special District.

11-351.1611 DESIGN FLOW:

An average flow of 100 gallons per person per day shall be used for design purposes, with the peak flow double the average flow. Pipes shall be sized to handle peak flows with pipe flowing half full.

11-351.1612 GRADIENT:

Sanitary sewer grades should be designed to provide a minimum velocity of two feet per second when flowing full. The following table indicates the slopes which will provide that velocity, and these shall be used as the minimum standard for design. Recognizing that occasionally it is difficult to maintain these grades, we have also listed the minimum acceptable slope. These shall be used only when topographic features preclude standard slopes.

	Slope in Feet/Foot	
Diameter	Recommended	Minimum Acceptable
6"	.0050	.0035
8"	.0035	.0025
10"	.0025	.0015
12"	.0020	.0012
15"	.0015	.0008
18"	.0012	.0006
House Service Line	.02	.01

Sewers larger than 18" diameter shall be designed to the approval of the Engineer.

Wherever a change in the size of the pipe, or an angle of 20 degrees or greater in alignment occurs, the flowline of the pipe flowing into the manhole shall be a minimum of 0.17 foot above the flowline of the pipe flowing from the manhole, or an amount necessary to match the inside crowns of the pipe, whichever is greater.

Unless special provisions for erosion protection have been provided, and approved by the Director of Public Works, design velocities for sanitary sewers shall not exceed ten (10) feet per-second. The maximum design discharge shall not exceed the flow at critical slope and velocity. Sanitary sewers should not be designed for flow conditions at critical slope and velocity.

11-351.1613 LOCATION AND ALIGNMENT:

1. LOCATION

All sanitary sewers designed for the collection and transportation of domestic sewage and/or industrial wastes shall be constructed and installed within rights of way dedicated for public streets or roads, unless such construction or installation is determined to be impractical by the Engineer.

The location of the sanitary sewers installed in any street or road not having frontage roads shall normally be six feet southerly or easterly of the centerline of the street.

2. ALIGNMENT

Sewerage systems shall be designed so as to have a minimum of curvature both horizontal and vertical.

Whenever possible, sewer lines shall be laid out in a straight line between structures. Curved sewer lines will be allowed under the following conditions:

a. All curve data shall be shown on the plans.

b. Minimum radius of curvature and joint deflections shall be as recommended by the pipe manufacturer and approved by the Engineer.

C. All deflections shall be at the pipe joints or by specialty mitered pipe sections.

The location of the sanitary sewers installed in any street having frontage roads shall be in the frontage road eight feet from the top of the curb face. Whenever it is essential that curved alignment be used, a radius of not less than 200 feet shall be required, but shall be greater whenever possible. No sanitary sewer, including house service lines, shall be located within 50 feet of a water well.

Sewer lines shall be installed in accordance with Standard Drawing P-4 where possible. See Standard Drawing W-7 for special construction requirements when sewer lines are to be placed in close proximity with water lines.

The location and installation requirements for any sanitary sewer to be installed in an existing street or road shall be obtained from the Engineer prior to submission of the plans.

Location of sewer lines in easements shall be kept to a minimum. Whenever possible, sewers shall be placed in the public roadway. Where sewer lines are located within easements, the easements shall conform to the following:

a. Be granted on the final map, or

b. Be granted to the entity accepting and maintaining the sewers, or

c. Be dedicated to and accepted by San Luis Obispo County.

d. The minimum width of any easement for sanitary sewer purposes shall be ten (10) feet wide; in special cases of terrain, depth of sewer line, etc. the required easement width shall be increased. All easements shall include right of ingress and egress over adjoining property for maintenance, replacement and operation.

3. SPECIAL CONSTRUCTION IN AREAS OF CONFLICT BETWEEN WATER AND SEWER LINES

In the interest of public health and to minimize the possibility of contamination of the public water supply, the following special construction requirements shall be met at any time that the separation between water and sewer lines is less than that described. These requirements apply to construction of a water main, sewer main, sewer lateral, or any other type construction causing the separation to be less than that indicated. All special construction required herein is to be discussed thoroughly with the Engineer prior to starting any work and is subject to the Engineer's approval.

If a sewer main or sewer house lateral crosses above a water main and is within a critical zone (defined as being 10-foot horizontal distance on either side of the water main), the sewer line is to be

constructed of or replaced by Class 100 cast iron pipe with approved mechanical joints. The length to be replaced shall be as necessary to provide cast iron pipe for the sewer main or sewer lateral which is within the critical zone.

If a sewer main crosses below a water main and is within a critical zone (defined as being a 4-foot horizontal distance on either side of the water main and a 3-foot vertical distance below the water main), the sewer main is to be constructed of or replaced by Class 100 cast iron pipe with approved mechanical joints.. The length to be replaced shall be as necessary to provide cast iron pipe for the sewer main which is within the critical zone. This paragraph does not apply to sewer house laterals.

If plastic sewer lines are being used on the project, plastic pipe may be used in. lieu of the cast iron pipe provided that a full length (approximately 20 feet) of plastic pipe is centered on water main at the crossing location. The intent is to locate the sewer line joints at the maximum distance from the water line.

11-351.1614 DEPTH AND SIZE:

1. DEPTH

The normal design depth of a sanitary sewer system shall be such as to obtain a cover of 36 inches for the house service lateral at the property line. Under certain topographic conditions lesser depths may be allowed by Engineer.

2. SIZE

The normal minimum sewer main size shall be eight (8) inches inside diameter. Six (6) inch diameter lines may be used on certain short lines where no possibility of line extensions exists, subject to the Engineer's approval.

11-351.1615 MANHOLES:

Normal maximum spacing for manholes shall be 400.feet. Where the locations of two manholes are determined by intersecting lines, the distances between intervening manholes shall be approximately equal. A sewer on a curved alignment with a radius of less than 400 feet shall have manholes spaced at a maximum of 300 feet, or adjusted to fit the individual case.

The maximum spacing of manholes on trunk sewer lines shall be as follows:

12" to 24" diameter	500 feet
27" to 36" diameter	600 feet

The spacing of manholes on trunk sewer lines larger than 36 inches in diameter shall be determined for each individual case.

DROP MANHOLES

Whenever the vertical distance between the inverts of sewer lines coming into a manhole exceeds thirty (30) inches, a standard drop manhole shall be constructed.

11-351.1616 FLUSHER BRANCHES:

A flusher branch may be used in lieu of a manhole for any stub line with a length of 200 feet or less. Any line more than 200 feet in length shall have a manhole at the end. Lateral sewers installed to a subdivision line for future extension shall have a flusher branch at the end, if there are any house service lines attached to it, and if it is not over 200 feet in length. Lines longer than 200 feet shall terminate in a manhole with a stub for future extension.

11-351.1617 HOUSE SERVICE LINES:

In all new subdivision work, the house service lines from the sewer to the property line shall be installed at the time the sewer is constructed. Each house service line shall be referenced to the plan stationing. Minimum size of-any sanitary lateral or side sewer to serve individual residences, commercial structures, etc., shall be nominal four (4) inches inside diameter. Actual size of laterals larger than four (4) inches shall be determined by fixture unit requirements as per the current edition of the Uniform Plumbing Code.

11-351.1618 SEWAGE LIFT STATIONS, FORCE MAINS AND TREATMENT PLANTS:

All special structures such as treatment plants shall meet all requirements of the State Regional Water Quality Control Board, State and County Health Department and the Engineer. Special structures, such as pump stations, pressure lines and sags, etc., shall require special considerations and approval by the Engineer.

Whenever the design of a sanitary sewerage system includes the necessity of a sewage lift station and a-force main, the following

data shall be submitted for tentative approval before plans are submitted:

A. Sewage Lift Station:

Minimum distance from a lift station to any residence shall be 50 feet except with advance approval of the Engineer for the specific case.

No lift station shall be constructed with bypasses which will bypass any effluent into any stream or water course.
The design computations for the pumps or ejectors, the type to be used, and a plot plan showing the dimensions of the site and its location with respect to homes or other structures.

An alarm system, which meets the approval of the Engineer, shall be provided on all sewage lift stations.

B. Force Mains:

The size and type of pipe to be used and a tentative alignment shall be submitted.

11-351.1619 KIND OF PIPE:

All sanitary sewer lines shall be clay pipe, cast iron pipe, or approved by the Engineer.

Where sewer grades are designed with a flow line of 2% or more, Asbestos-Cement Non-Pressure Sewer Pipe (ASTM-Designation-C428-Latest Revision) may be used.

11-351.1620 MATERIALS: General

All material that is to become a permanent part of any sanitary sewer or appurtenant structure shall conform to the requirements for the particular material as set forth in these specifications. The Contractor shall supply any and all certificates of compliance, certified test results or shall perform tests as required to assure the Engineer that the material being incorporated into the work has met the requirements as specified. Approval of the Engineer shall be required for use of material not listed in these standards.

Pipe and Pipe Joining Material

A. Pipe & Conduits

All pipe or conduits shall be of the size, material and strength as shown on the plans. All pipe and fittings shall be marked or stamped with the trade brand name of the manufacturer, and strength or class of pipe. All pipe shall be designed to withstand all internal or external loads applied. Supporting strength of conduits as installed to safely carry imposed gravity loads and superimposed loads including a suitable factor of safety) shall be determined by use of the Marston formula.

11-351.1621 CLAY PIPE:

Clay Pipe (CP) and fittings shall be new, first quality pipe and shall comply with the specifications for Extra Strength Unglazed Clay Pipe ASTM Designation C700-Latest Revision. Joints for bell and spigot CP shall conform to ASTM, Designation.C425. Installation of CP shall comply with ASTM. Designation C-12. The only allowable variations from the above recommended practices will be as definitely specified in other sections of these standards or by written approval of the Engineer.

11-351.1622 CAST IRON PIPE:

a. All cast iron pipe and fittings for main sewers shall be at least Class 2 water main pipe and conform to AWWA Standards. Joints shall be approved type mechanical joints. No lead joints will be allowed without the approval of the Engineer.

b. Cast iron pipe and fittings for laterals within the public right of way shall be new first quality and conform to ASTM Designation A 74, Cast Iron Soil Pipe and Fittings.

11-351.1623 ASBESTOS-CEMENT PIPE:

Generally Asbestos Cement Pipe will not be allowed for construction of gravity sewer lines. Asbestos Cement Pipe may be used for gravity sewers only after the Engineer has given written approval. Asbestos Cement Pipe and fittings shall conform to ASTM C 644 and ASTM C 428 NonPressure. Asbestos cement pressure pipe shall conform to ASTM Designation C 296. Rubber rings used for joining asbestos-cement pipe couplings shall be as recommended by the manufacturer and conform to ASTM Designation D 1869.

Pipe Lengths

1. Lateral sewers - Maximum length, for lateral sewers within public right-of-way shall not be greater than six and one-half (6-1/2) feet or as approved by the Engineer.

2. Maximum length of asbestos-cement pipe which is rigidly connected to a structure shall not be over six and one-half (6-1/2) feet or a half-length.

11-351.1624 POLYVINYL CHLORIDE (PVC) PIPE:

P.V.C. pipe may only be used for gravity sewers under the following conditions:

1. The Consultant makes a written request to the Engineer to allow P.V.C. pipe, together with any design data the Engineer might require.

2. The Engineer gives written approval to the Consultant.

3. The Engineer will require that the P.V.C. pipe meet at least ASTM Standard D 3034/SDR 35.

4. Deflection tests shall be required as prescribed by the Engineer.

11-351.1625 FORCE MAIN PIPE:

Pipe used in the construction of force mains shall be either cast iron or asbestos cement. However, the Engineer may approve P.V.C. for installation under low head conditions where the surge forces are minimal.

11-351.1626 CASTINGS:

All castings for manhole rings and covers, flushing branch frames. and covers, or other purposes, shall be cast iron meeting the requirements of Specifications ASTM Designation A48, Class 25. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the castings, without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned.

11-351.1630 INSTALLATION OF SEWERS:

11-351.1631 LINES AND GRADES:

All lines and grades will be given by the Consultant and the Engineer shall be informed twenty-four hours in advance of the times and places at which work is to be done in order that lines and grades may be inspected and necessary measurements made with a minimum of inconvenience and delay. All stakes and marks once given shall be fully protected and preserved. Flow line elevations shall be established at all changes in grade and at 50 foot intervals.

11-351.1632 TRENCH WIDTHS:

The maximum width of trench measured at the top of pipe shall be governed in all cases by the size of the pipe to be installed therein.

The following table showing relationship between pipe size and width of trench shall be strictly adhered to and any deviation there from must first be approved in writing by the Engineer.

Nominal Size of Pipe	Width of Trench
Four (4) inch	Twenty (20) inches
Six (6) inch	Twenty-four (24) inches
Eight (8) inch	Twenty-four (24) inches
Ten (10) inch	Twenty-seven (27) inches
Twelve (12) inch	Twenty-nine (29) inches
Fifteen (15) inch	Thirty-three (33) inches
Eighteen (18) inch	Thirty-eight (38) inches
Twenty-one (21) inch	Forty-two (42) inches
Twenty-four (24) inch	Forty-six (46) inches

For pipe larger than 24 inches in diameter, the trench width shall not exceed the outside diameter of the pipe plus 16 inches. The sides of the trench shall be as nearly vertical as possible in the material through which it is passing. If the width of the trench at the ground surface becomes excessive, the Engineer may require solid sheeting and bracing.

11-351.1633 EXCAVATION FOR SEWERS:

Unless otherwise specified, the excavation for sewer pipe shall be an open trench, excavated to three inches below the outside diameter of the bell. This undercutting shall be refilled with suitable bedding material as specified in the section on pipe bedding, thoroughly compacted into place. Where the trench is in

granular or sandy material, the pipe may be bedded in the native material in lieu of importing bedding material providing it complies with the specification for bedding material. The Engineer shall determine the suitability of the native material. When the trench is in an existing paved area, the pavement shall be sawed or scored and broken ahead of the trenching operations. The proper tools and equipment shall be used in marking and breaking so that the pavement will be cut accurately on neat and parallel lines at the width required for the trench, except that when in the opinion of the Engineer the remaining paving has been damaged. An additional 12 inches shall be cut from each side to the approval of the Engineer. When the existing pavement is concrete, it shall be sawed to a neat line six inches wider on each side than the trench width. Whenever the bottom of the trench is soft, yielding, or unsuitable as a foundation for the pipe, sufficient crushed rock or coarse, clean gravel shall be rammed into the soft material until, in the opinion of the Engineer, a suitable condition is achieved. If such treatment does not provide a proper foundation, the unsuitable material shall be removed to a depth determined by the Engineer, that when replaced with bedding material, it will provide a stable foundation.

When water is encountered, the trench shall be kept de-watered until the laying and jointing of the pipe, and placing of the bedding material has been completed, inspected, and approved. The Contractor shall place not less than **six** inches of 2-1/2" maximum size rock below the required bedding material, or otherwise de-water the trench in a manner which has received prior approval of the Engineer. Ground water pumped from the trench shall be disposed of in such a manner as will not cause or be a menace to the public. The manner employed to dispose of water pumped from an excavation shall be subject to the approval of the Engineer.

11-351.1634 BRACING AND SHORING:

As required by the "Trench Construction Safety Orders" of the California State Industrial Accident Commission, sufficient bracing and shoring shall be installed in trenches to insure the safety of workmen, and to protect and facilitate the work. Where practicable all such bracing and shoring shall be removed from the trench as the backfilling proceeds.

11-351.1635 TUNNELING:

Tunneling shall not be permitted unless approved by the Engineer.

11-351.1636 LAYING SEWER PIPE:

The pipe shall be laid in conformity to the prescribed line and grade, and each pipe length checked to the grade lines. Three consecutive points shown on the same rate of slope shall be used in common, in order to detect any variation from a straight grade. In case any such discrepancy exists, the work shall be stopped and the discrepancy immediately reported to the Engineer. In addition, a string line shall be used in the bottom of the trench to insure proper alignment and grade.

Pipe shall be laid continuously upgrade with the bell of the pipe for-ward. Each length of pipe shall be laid on a firm bed and shall have a true bearing for the entire length. No wedging or blocking up of the pipe will be permitted.

Both bell and spigot shall be clean before the joint is made, and care shall be taken that nothing but the joint-making material enters the joints.

When for any reason, pipe laying is discontinued for an hour or more, the open end of each line shall be closed with a close-fitting stopper.

The Contractor's attention is called to the required use of short lengths of sewer pipe to provide curves, flexibility, and prevent cracking or shearing failures. The use of short lengths of pipe is particularly required but not necessarily limited to these locations: (1) inlets and outlets to all manholes; and (2) vertical and horizontal curvilinear sewers.

11-351.1637 PIPE TO BE PLACED BY BORING OR JACKING:

The work contemplated under this heading consists of placing cast iron pipe or other pipe of approved material, usually in a conductor pipe, under a paved roadway, street, or railroad to a true line and grade as shown on the plans, by means of boring or jacking operations. The equipment and method of operation shall be approved by the Engineer before proceeding with the work.

The excavation for the boring operation shall be kept to a minimum, but shall be of sufficient dimensions to satisfactorily complete the work. If so required, bracing and shoring shall be provided to adequately protect the workmen and the roadway or railroad.

The conductor pipe shall be placed closely behind and in conjunction with the boring operation. The bored hole shall be not more than

two inches in diameter larger than the conductor pipe. Guide rails shall be accurately set to line and grade so as to achieve close adherence to the line and grade shown on the plans.

The pipe to be placed inside the conductor pipe shall have non-rigid joints and shall be installed by the use of suitable centering devices. A one sack cement grout shall then be pumped into the conductor pipe to completely fill the annular space around the pipe for its full length.

11-351.1638 TRENCH BACKFILL:

A. Bedding material, approved by the Engineer and meeting the minimum standards listed below, shall be deposited and compacted to 90% relative compaction in the trench uniformly on both sides of the pipe for the full width of the trench and to a depth of 6 inches over the top of the pipe.

Sand Equivalent	20
Sieve Size	Percentage-Passing Sieve
1"	100
No. 4	80-100
No. 200	0-15

The sand equivalent of 20 shall also be required outside of the roadway prism.

B. The balance of the backfill shall contain no rock, stones or boulders in excess of 4 inches in its greatest dimension, and shall be free from all deleterious matter. It shall be compacted to a relative compaction of 85% to within 5 feet of the finish grade and not less than 90% for the remainder of the trench, except that the top 1.0' shall be brought to 95% compaction. Ponding or puddling will be permitted only at the express permission of the Engineer. The backfill under and around any and all pipes shall be thoroughly consolidated before any additional material is placed.

C. Compaction methods must be carried out so no damage or displacement of the pipe results.

D. Any trenches improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted, with the surface

restored to the required grade and compacted and smoothed off.

E. All waste material-shall be disposed of outside of the County right of way or as approved by the Engineer.

11-351.1639 TRENCH JETTING:

If this method of placing trench backfill is permitted by the Engineer, backfill material shall be water soaked with suitable pipe jets approved by the Engineer, but in no case shall the pipe jet be less than one and one-half inches in diameter.

The pipe jet shall be sent to the bottom of the backfill layer and raised slowly in order to thoroughly saturate the material and cause it to slump to its maximum compaction.

Proceeding upgrade, jet points shall be staggered from side to side of the ditch at intervals not to exceed six feet or as necessary to insure that the backfill takes all possible subsidence. All "bridges" in the backfill material shall be completely broken down during the jetting process. No jetting operations will be allowed that will, in the opinion of the Engineer, jeopardize in any manner the stability of the sewer line in the trench.

Jetting operations done any time except during regular working hours shall have prior approval of the Engineer.

11-351.1640 MANHOLES:

Manholes shall be watertight structures constructed by placing precast concrete sections on a poured concrete base. Poured-in place manholes shall not be used unless specifically called for in the Special Provisions.

A. Temporary covers of 3/8" steel plate of sufficient size to adequately cover the opening shall be placed on the cone until the pavement is completed. Suitable locating ribs shall be welded to the underside of the cover to hold it in place during the grading and paving operations.

B. When adjusting an existing manhole to grade and the total depth of the throat from the top of the frame to the bottom of the throat exceeds 24 inches, the upper portion of the manhole shall be removed to the first

full-size manhole section. The upper portion shall then be reconstructed as outlined above.

C. Manholes shall be tested for water tight integrity either jointly with testing of sewer line or as separate units, in accordance with Section 11-351.1643 B, Testing Sewer Lines. The allowable leakage for one manhole shall not exceed one (1) gallon during a 2-hour test period.

11-351.1641 HOUSE SERVICE LATERAL:

House service laterals shall be constructed as shown on the Standard Drawings.

If it becomes necessary to locate a house service lateral less than 100 feet from a well, it shall be constructed of cast iron pipe.

Whenever house service laterals are to be installed as part of the contract for the construction of the lateral sewer, the use of wye or tee saddles will not be permitted.

That portion of any house service lateral to be placed under an existing curb and gutter and/or sidewalk shall be done by tunneling. Cutting of the existing curb and gutter and/or sidewalk will not be permitted.

All house service laterals shall be considered as part of the lateral sewers for the purpose of the hydrostatic test as set forth in Paragraph 11-351.1643.

The location of house service laterals shall be permanently indicated by embedding the letter "S" in the curb directly above the line. In new subdivisions when the house service laterals are installed before the curb is constructed, it shall be the sewer contractor's responsibility to place the "S" in the curb after it is poured. When house service laterals are constructed in existing easements or streets where curbing does not exist, a 2" x 2" x 36" construction grade .redwood stake shall be driven in the ground to within 2" of the surface directly above the service line at the property line and an "S" stamped in the top. Every house service lateral shall be so marked before final acceptance will-be given of any job.

11-351.1642 CONNECTION TO EXISTING MANHOLES:

Connections to existing manholes shall be made by carefully breaking an opening in the wall of the manhole, inserting the end of the pipe through the opening flush with the inside wall, and packing the opening around the pipe with a stiff mix of cement mortar, thoroughly compacted to form a watertight connection. The mortar shall be trowelled smooth and flush with the interior surface of the manhole. Channelizing of the flow through the manhole shall conform to the details shown on the Standard Drawings for new manholes.

The Contractor shall notify the Engineer 24 hours in advance before any connection is made to existing structures. He shall schedule his work so that interruption of flow is held to a minimum.

11-351.1643 TESTING OF SEWER LINES:

Prior to final approval, all sewer lines shall be tested for leakage by standard hydrostatic or low pressure air test.

A. AIR TEST PROCEDURE

Each section of sanitary sewer between two successive manholes shall be tested by plugging all pipe outlets with suitable test plugs. Air shall be slowly added until the internal pressure is raised to 4.0 pounds per square inch gauge (psig). The compressor used to add air to the pipe shall have a blow-off valve set at 5 psig to assure that at no time the internal pressure in the pipe exceeds 5 psig. The internal pressure of 4 psig shall be maintained for at least two minutes to allow the air temperature to stabilize after which the air supply shall be disconnected and the pressure allowed to decrease to 3.5 psig. The time in minutes that is required for the internal air pressure to drop from 3.5 psig to 2.5 psig shall be measured and the results compared with the values tabulated below.

Pipe Diameter Inches	Test Time in Minutes	Minimum Distance Between Manholes Feet
8	4	340
10	5	260
12	6	230
15	7	170
18	9	150
21	10	120

24	11	110
27	13	100
30	14	90
33	16	80
36	17	70
39	18	60
42	19	50

The above tabulated values shall be used for the respective diameter pipes except where the distance between successive man-holes is less than the above tabulated values; or the pipe diameter is less than 8 inches, in which case the following formula will be used to determine the test time:

$$T = .000183\ d^2 \cdot L$$

T = test time in minutes
d = inside diameter of pipe in inches
L = distance between successive manholes in feet

If the pressure drop from 3.5 psig to 2.5 psig occurs in less time than the above tabulated or calculated values, the pipe shall be repaired and, if necessary, replaced and relaid at the Contractor's expense until the joints and pipe shall hold satisfactorily under this test. The Contractor shall furnish all labor, air test equipment, and all other materials for making the required air test at his own expense. After the sewer lines have been properly backfilled to a depth where additional backfilling will not disturb the position of the pipe, all or any sections that the Engineer may select may be tested. In no case shall the required minimum backfill be less than four feet above the top of the pipe before subjecting the line to the test. The Contractor shall supply all equipment, labor, material and perform all tests as required prior to final approval.

B. HYDROSTATIC TEST PROCEDURE:

A section of sewer line shall be prepared for testing by plugging the upper side of the downstream manhole and all openings in the upstream manhole except the downstream opening. Where grades are slight, two or more sections between manholes may be tested at once. Where grades are steep, and excessive test heads would result by testing from one manhole to another, test tees the full size of the main shall be installed at intermediate points so the maximum head on any section under test will not exceed 12 feet.

The section of sewer line prepared as above shall be tested by filling with water to an elevation five feet above the top of pipe at the upstream end of the test section, or five feet above the existing ground water elevation, whichever is greater. The water should be introduced into the test section four hours in advance of the official test period to allow the pipe and joint material to become saturated. The pipe shall then be refilled to the original water level.

At the beginning of the test, the elevation of the water in the upper manhole shall be carefully measured from a point on the manhole rim. After a period of four hours, or less, with the approval of the Engineer, the water elevation shall be measured from the same point on the manhole rim and the loss of water during the test period calculated. If this calculation is difficult, enough water shall be measured into the upper manhole to restore the water to the level existing at the beginning of the test, and the amount added taken as the total leakage.

Should an initial test show excess leakage in a section of line, it is permissible to draw the water off and test the manholes that contained water. This test shall be made by plugging all the openings in the manholes and filling with water to the same elevation as existed during the test. The leakage from the manhole may be deducted from the total leakage of the test section in arriving at the test leakage. After the testing is complete, the manhole shall be waterproofed by grouting. Other approved water-proofing methods may be used if satisfactory to the Engineer.

The allowable-leakage in the test section shall not exceed 500 gallons per mile, per 24 hours, per inch diameter of pipe tested at the five-foot test head.

If it is necessary or desirable to increase the test head above five feet, the allowable leakage will be increased at the rate of 80 gallons for each foot of increase in head.

Test sections showing leakage in excess of that allowed shall be repaired or reconstructed as necessary to reduce the leakage to that specified above, and the line retested, after a minimum period of 24 hours during which no additional water shall be introduced into the line.

C. FORCE MAINS

Each section of pipe to be tested shall be slowly filled with water and all air expelled from the pipe. After the pipe has been filled, it shall be allowed to set for a period of not less than 24 hours.

The pipe shall then be refilled to the original water level and subjected to a pressure of not less than 100 pounds per square inch or the service pressure plus 50 pounds, whichever is greater, for a period of two hours. All exposed joints, ~~bends, angles, and fittings shall be closely examined during~~ the test. Any part of the line which proves to be defective shall be replaced and the line retested.

The maximum allowable leakage shall not exceed 100 gallons per 24 hours per mile of pipe per inch of nominal diameter.

11-351.1644 CLEANING:

Prior to the acceptance of any sewer line by the County the Contractor shall clean all lines with a Wayne-type sewer cleaning ball under hydrostatic pressure. Any stoppage, dirt or foreign matter shall be removed from the lines. All cleaning and testing of sewer lines shall take place after all construction work is completed, up to but not including the final paving. The system will be inspected after final paving is completed and any damage to the system during final paving and cleanup will be corrected before approval.

11-351.1645 PLACEMENT OF ROAD SURFACES AND REPLACEMENT:

Paving replacement shall not proceed until the full requirements of Paragraphs 11-351.1630 through 11-351.1644 have been met to the satisfaction of the Engineer, but in no less than ten days after backfill has been completed.

A. The replacement of roadway structural section over all cuts in existing bituminous pavement shall be made in the following manner:

Minor and Collector Roads: Six (6) inches of aggregate base and two (2) inches of Type B asphalt concrete.

Arterial Roads: Twelve (12) inches of aggregate-base and three (3) inches of Type B asphalt concrete.

Alternate structural sections may be proposed for approval by the Director of Public Works providing the design is performed by a licensed Civil Engineer and is done in accordance with good engineering practice.

Until the permanent pavement is placed, the material at the surface of the trench shall be maintained at all times at a grade level with the street, suitable for the safe passage of traffic. When ready for repairing, the upper portion of the trench shall be excavated to a depth sufficient for installation of the required structural section. Aggregate base shall be placed, compacted and graded. Edges of the existing asphalt concrete shall be trimmed to provide a neat and straight vertical joint. The joint face shall then be cleaned and tacked with asphaltic emulsion: Type B asphalt concrete shall be placed in accordance with Section 39 of the Standard Specifications.

B. Where Portland cement pavement is removed, the compacted backfill shall be made to within twelve (12) inches of the original surface, and six (6) inches of aggregate base added having a relative compaction of 90 percent. The pavement shall be six (6) inches of Class "B" concrete (containing four sacks of cement per cubic yard). The finished surface of the concrete shall be given a finish treatment with a wood float and then broomed to cause a slight groove in the-surface at right angles to the direction of traffic. The pavement shall not be opened to traffic until seven days after the concrete was placed.

C. Where the sewer trench follows the edge of pavement or is placed in an existing shoulder, the top six (6) inches of the backfill shall consist of thoroughly compacted aggregate base.

Shoulders having a greater depth of base material than six inches shall be replaced with a thickness at least equal to that removed, and the approval of the Engineer as to the exact type of replacement in such cases is required.

The finished replacement shall be rolled and finished to make the best possible connection to the existing pavement or shoulder and then liquid asphalt SC-250 shall be applied at the rate of one-half gallon per square yard.

D. Any exceptions to the above will be indicated on the plans, except that replacements of heavier pavements shall be of a

thickness at least equal to that removed, with the approval of the Engineer.

E. The replacement of all pavement and shoulder surfaces as designated above shall be in conformance with SECTION 11-351.1400, STREETS, of these "Improvement Standards and Specifications" as to materials and methods of construction.

11-351.1646 TEMPORARY PAVEMENT:

In any case where a trench is cut across a main thoroughfare, or if noted on the drawings, a temporary asphalt plant-mix-cutback surface shall be placed immediately after backfill has been completed, and removed just prior to placing the permanent surfacing material.

11-351.1647 CLEAN UP:

During the progress of the work, the Contractor shall keep the entire job site in a clean and orderly condition. Excess or unsuitable backfill material, broken pipe, or other waste material shall be removed from the job site. Spillage resulting from hauling operations along or across existing streets or roads shall be re-moved immediately by the Contractor. All gutters and roadside ditches shall be kept clean and free from obstructions. Any deviation from this practice shall have prior approval from the Engineer.

Before final acceptance of the work, the Contractor shall carefully clean up the work and premises, remove all temporary structures built by or for him, remove all surplus construction materials and rubbish of all kinds from the grounds which he has occupied and leave them in a neat condition.

SECTION 11-351.1700
WATER SUPPLY

11-351.1710 WATER SUPPLY: GENERAL

A. Water mains connecting existing publicly regulated water distribution systems shall be installed to serve each lot in subdivisions containing lots of one acre or less. Any agency serving water for human consumption or for domestic uses shall hold a permit as provided by the Health and Safety Code of the State of California and shall comply with all applicable laws and regulations of the State of California and the County Department of Public Health. Installation of water mains and all appurtenances thereto will be installed to grades, location, design and sizes approved by the Engineer for the public or private water and fire agencies, the governing bodies thereof and the Engineer as hereinbefore defined.

B. When connection to an existing publicly regulated water system is not available, the subdivider shall provide water service by the establishment of a public water agency, or of a private water company which is subject to the regulations of the State Public Utilities Commission except as provided elsewhere for subdivisions containing lots of one acre or more.

11-351.1711 QUANTITY OF WATER:

The quantity of water delivered to the distribution system from all sources must be sufficient to supply adequately, dependably and safely the total requirements of all customers (including fire hydrants) under maximum consumption. The distribution system must be capable of adequately delivering this water supply to all the customers. Storage facilities must be provided to care for the minimum sanitary and fire fighting requirements during breakdowns and repair of wells and pumps. Storage may also be required to store water during off peak demand periods for use during peak demand periods. Formulas are presented below as a guide in determining the adequacy of proposed water systems in meeting the above requirements.

A. Formulas

1. Average Demand: To meet customer demand for water in residential and commercial areas, water supply sources must be capable of producing a minimum of 400 gallons per day per lot served.

Industrial and agricultural area requirements are determined for the industries and agriculture involved and added to the residential and commercial demands. Average demand rate shall be increased to equal peak demand rate times the specified period over which peak demand is used. Average Demand (Gal. per day = + 400L + DI. Where L equals number of residential and commercial lots served by the system (excluding industrial areas).

Where I = Industrial or agricultural areas in acres served by the system.

D = Demand in gallons per day per acre for the industrial or agricultural areas served by the system.

2. Peak Hourly Demand: To meet customer and fire protection demand the combination of well pump capacity, well capacity, firm surface water supply and system storage capacity together with an adequate distribution system must be capable of delivering 5 gallons per minute per customer for metered systems (9 gallons per minute for flat rate systems) plus fire flow requirements dependent on the type of development in the area. The customer requirement to be modified by a factor of (f) varying from 2.00 to 0.33, dependent on the number of services in the system. The system must be capable of delivering this flow for from 2 to 4 hours depending on the number of services in the system. Pipeline size can also be computed from the formula below by using factors for the portion of the system served by the pipeline whose size is to be determined.

In doing this, the required fire flow must always be capable of being taken from any one hydrant in the system. Under certain conditions the engineer of the Fire District having jurisdiction may require a larger minimum size of pipeline in certain locations.

Peak hourly demand (gallons per minute) = Ncf + F + X + Y. Systems must be able to serve this rate for a minimum of 2 hours when N is less than 100; for 3 hours when N is from 100 to 250; and for 4 hours when N is greater than 250.

a. Where N = Number of residential and commercial services in system.

b. c = 5 gallons per minute for metered service and 9 gallons per minute for flat rate service.

c. f = 2.00 for systems with 5 services or less
1.33 for systems with 25 services
1.00 for systems with 40 services
0.75 for systems with 80 services
0.50 for systems with 200 services
0.33 for systems with 500 services

Intermediate values may be interpolated from a table.

d. F = Fire Requirements

Residential Areas - Flow from any one hydrant with residual gauge pressure not less than 15 pounds per square inch shall be as stated below.

F = 250 gallons per minute for building density of 1 or less per acre.

330 gallons per minute for building density of 2 per acre.

420 gallons per minute for building density of 3 per acre.

500 gallons per minute for building density of 4 or more per acre.

Intermediate values may be interpolated from the above.

No separate fire flow requirement shall be imposed in subdivisions having lots averaging more than one acre in size.

Commercial Areas - The minimum flow from any one hydrant with residual gauge pressure of not less than 15 pounds per square inch shall be 1,000 gallons per minute.

Industrial Areas - Flow and pressure as required by Fire Department or District for industry involved. In determining peak flow required by the system, use highest value of F required in system. IN determining pipe size, try the fire flow F, from each hydrant in

the system, one at a time, together with peak domestic flow.

Use value of F for type of district each hydrant is in.

e. X = Peak agricultural demand on system in gallons per minute.

f. Y = Peak industrial demand on system in gallons per minute.

3. Storage: To meet minimum sanitary demands and the necessary quantity of water for fire protection during periods of pump breakdown, there must be the following minimum quantities of water stored per acre served. However, in no case shall the storage for any new subdivision be less than 30,000 gallons. The storage requirement may be increased due to the inability of the source to produce water at the peak demand rate.

LOT SIZE IN ACRES	REQUIRED STORAGE CAPACITY IN GALLONS PER ACRE SERVED
Less than ½	1,000
1	800
2	650
3	500
4	350
5	200

The above requirements are not applicable in subdivision with lots of one acre or larger where the water supply may be from wells or some other source on individual lots.

4. Required Residential Supply: In addition to meeting the above requirements the system must also meet the following requirements in approving all water systems for adequate source and storage capacities:

a. The peak hourly residential flow or the sum of the minimum fire flow plus one-half (1/2) of the peak hourly residential flow, whichever is greater, shall be maintained for the period of time of 2 hours when N is less than 100; for 3 hours when N is from 100 to 250 and for 4 hours when N is greater than 250. With the most critical well or pump inoperative, a minimum of 2/3 of the above flow shall be maintained for the time specified.

This requirement may be met by drawing from both well pumping and storage.

b. The minimum residential flow shall be equal to one-half (1/2) of the peak hourly residential flow and shall be maintained for a period of three days. This requirement may be met from a combined source of the wells and storage.

c. The average daily residential flow for the maximum month shall be equal to one-third (1/3) of the peak hourly residential flow and shall be maintained continuously from the well pumping only.

d. If the original source of the water is not from a well then requirements will be developed by the Director of Public Works on an individual project basis. It is the intent that the supply of water and fire protection provided be equivalent to that noted above when the original source is from a well; this may require a larger storage facility.

5. Number of Customers:

a. Residential Areas:

Each single family home or lot will be counted as one (1) customer. Each dwelling unit of an apartment, duplex or triplex building will be counted as one-half (1/2) customer.

b. Commercial and Industrial Areas:

Each acre (including storage and parking area) will be counted as a minimum five.(5) customers.

c. Parks and Landscaped Areas:

Each acre of land will be counted as two (2) customers, except where specific design indicates otherwise.

d. Mobile Home Subdivision:

Each trailer or trailer space will be counted as three-quarters (3/4) customer.

11-351.1712 REGULATIONS RELATING TO CROSS CONNECTIONS:

Reference is also made to Title 17, Chapter V, Sections 7583-7622 inclusive of the California Administrative Code, regulating the construction of cross connections between drinking water systems and other sources of water. All construction shall be in strict compliance with said regulations.

In the interest of public health and to minimize the possibility of contamination of the public water supply, the following special construction requirements shall be met at any time that the separation between water and sewer lines is less than that described. These requirements apply-to construction of a water main, sewer main, sewer lateral, or any other type construction causing the separation to be less than that indicated: All special construction required herein is to be discussed thoroughly with the Engineer prior to starting any work and is subject to the Engineer's approval.

If a sewer main or sewer house lateral crosses above a water main and is within a critical zone (defined as being 10-foot horizontal distance on either side of the water main), the sewer line is to be constructed of or replaced by Class 100 cast iron pipe with approved mechanical joints. The length to be replaced shall be as necessary to provide cast iron pipe for the sewer main or sewer lateral which is within the critical zone.

If a sewer main crosses below a water main and is within a critical zone (defined as being a 4-foot horizontal distance on either side of the water main and a 3-foot vertical distance below the water main), the sewer main is to be constructed of or replaced by Class 100 cast iron pipe with approved mechanical joints. The length to be replaced shall be as necessary to provide cast iron pipe for the sewer main which is within the critical zone. This paragraph does not apply to sewer house laterals.

If plastic sewer lines are being-used on the project, plastic pipe may be used in lieu of the cast iron pipe provided that a full length (approximately 20 feet) of plastic pipe is centered on water main at the crossing location. The *intent* is to locate the sewer line joints at the maximum distance from the water line.

11-351.1713 DISTRIBUTION SYSTEM:

The distribution system, wherever possible, shall be in grid form so that pressures throughout the system tend to become equalized under varying rates and locations of drafts.

A. Layout of Mains - In general, the minimum size pipe shall be not less than six inches inside diameter. The installation of four inch mains should be limited to cul-de-sacs or courts serving less than seven (7) service connections, or as indicated under dual mains, below.

All dead end mains shall be provided with a standard blow-off or other acceptable means of flushing. Dual mains (one pipeline on each side of the street) shall be installed in streets which carry heavy concentrations of traffic, or the rights of way of which are 84 feet or more in width (if required by the Engineer). In those streets classified for dual mains, the minimum size shall be six inches on each side in residential areas, except that one of them may be four inches in diameter where the distance between intersecting lines is not greater than 600 feet. In commercial districts the sizes shall be not less than one eight-inch and one six-inch. The distribution system shall be grid-ironed with eight-inch or larger cross-connecting mains at intervals of approximately 1,300 feet, with intermediate six-inch lines as required., Larger mains shall be provided to serve multiple housing, commercial or industrial areas as determined by an engineering evaluation of the anticipated demand.

B. The distribution system shall be equipped with a sufficient number of valves so that no single shut down will result in shutting down a transmission main, or necessitate the removal from service of a length of pipe greater than 500 feet in high value districts or greater than 800 feet in other sections, and in no case should be so located that any section of main can be shut down without going to more than three locations to close valves. The location of valves should be uniform with respect to street lines insofar as practical.

C. Fire hydrants shall be placed at street intersections whenever possible, and should be located to minimize the hazard of damage by traffic. They shall have a maximum normal-spacing of 500 feet in residential areas and 300 feet in commercial areas, measured along the street frontage or as otherwise specified by the local fire protection agency. For subdivisions having lots greater than one acre, fire hydrants shall be placed' at intervals not to exceed 1,000 feet.

The minimum size main serving a fire hydrant shall be not less than six inches in diameter. The pipeline connecting the hydrant and the main shall be six-inch, with a gate valve installed near the main as shown on the Standard Drawings.

D. Service lines from the water main to the property line shall normally be installed at the time the main is constructed to avoid frequent cutting of the street. Single and double service lines shall be 3/4 inch and one (1) inch, respectively, in inside diameter.

E. Concrete anchors or thrust blocks shall be provided at all bends of 5 degrees or more at the end of plugged mains, behind tees and fire hydrants, and behind crosses which are valved in such a manner that they can be used as tees.

F. Water distribution systems shall be designed to maintain normal operating pressures of not less than 25 psig at the service connection, except that during periods of hourly maximum demand as defined in Section 11-351.1711 the pressure may be not less than 20 psig and that during periods of hourly minimum demand the pressure may not be more than 150 psig. (Computations shall be submitted to demonstrate that these maximum and minimum pressures will be met.) Variations in pressures under normal operations shall not exceed 5.0% when measured approximately three inches from the ends of the pipe. Water mains minimum nominal diameter shall be four inches.

11-351.1720 MATERIALS OF CONSTRUCTION

11-351.1721 PIPE:

Pipe used in the construction of water distribution systems shall be either asbestos-cement, cast iron, or cement mortar lined and coated welded steel pipe and shall meet the standards of the A.W.W.A. where applicable. The use of steel pipe shall be limited to those areas where an engineering evaluation indicates that galvanic (or soil) corrosion is not a problem, or provision is made for suitable cathodic protection. The Engineer may specify which types shall be used in any instance.

The supplier shall furnish a certificate, stating that all pipe, valves, fittings, protective coatings and all other materials comply with the specifications in this manual.

A. Asbestos-cement pipe shall be not less than Class 150, and shall conform to and meet the requirements of A.W.W.A. Specification C400.

B. Cast iron-pipe shall be not less than Class 150, caulked, bell and spigot, mechanical joint pipe, or of a bell and spigot type which employs a single gasket to effect the push-on joint seal, and shall conform to and meet the requirements of A.W.W.A. Specification C106 or C108. Mechanical joints and the push-on joints shall fulfill the requirements of A.W.W.A. Specifications C111. All cast iron pipe shall have a cement mortar lining conforming in all respects with A.W.W.A. Specification C105. Packing material for caulked bell and spigot joints shall be approved by the Engineer prior to any use of the pipe.

C. Steel pipe shall conform to and meet the requirements of A.W.W.A. Specifications C201 or C202, with cement mortar lining and coating in accordance with A.W.W.A. Specifications C205. The method used for coupling the ends of the pipe, whether mechanically couple welded, bell-and-spigot ends with rubber gasket or any other type, shall be approved by the Engineer prior to any use of the pipe.

11-351.1722 FITTINGS:

Bends, elbows, tees, crosses, and special fittings shall meet the following requirements:

A. Fittings for asbestos-cement pipe shall be cast iron, and shall conform to and meet requirements of A.W.W.A. Specification C110. The fittings shall have rubber gasket push-on joints conforming to A.W.W.A. Specification C111.

B. Fittings for cast iron pipe shall be cast iron, and shall conform to and meet the requirements of A.W.W.A. Specification C110.

C. Fittings for steel pipe shall be factory fabricated from steel pipe and shall conform to designs as specified in A.W.W.A. Specification C208. The fittings shall be mortar lined in accordance with A.W.W.A. Specification C104. Cast iron fittings meeting the requirements of Paragraph B (above) may be used in lieu of the fabricated steel fittings.

11-351.1723 VALVES AND VALVE BOXES:

Valves shall open in counter-clockwise direction and shall meet the requirements of A.W.W.A. Specifications C500 for gate valves and A.W.W.A. Specifications C504 for butterfly valves. Valve boxes

shall be as shown on Standard Drawing No. W-1. The cover shall be marked "WATER", and shall have a loose fit in the box.

The butterfly valve standard is not intended to cover valves for installation where service conditions exceed the shutoff pressures and line velocities-stated in Table L of A.W.W.A. C504.

11-351.1724 FIRE HYDRANTS:

Fire hydrants shall be wet or dry barrel type, 30-inch bury, and meeting the requirements of A.W.W.A. Specifications C502 and C503 and shall also meet the requirements set forth by the Fire District in which the improvement is located or by the Engineer in the absence of a Fire District. In single family residential areas, fire hydrants shall have not less than two (2) two and one-half inch (2-1/2") outlets with National Standard fire thread. In business, industrial, institutional, school and multiple family dwelling areas, fire hydrants shall have two, two and one half (2½") inch outlets with National Standard fire thread and one four inch (4") suction outlet with California Standard fire thread.

11-351.1725 AIR AND VACUUM RELEASE VALVES:

Air and vacuum release valves shall be installed in the water system at all points where it is indicated that air pockets may form. The design shall be such as-to insure the release of air automatically from the water main. These valves may also insure the entrance of air into the water main when the pressure inside the line is below atmospheric pressure. All valves shall be designed for a minimum of 150 PSI operating pressure. The inlet to each valve shall be provided with a gate valve or corporation stop to provide a positive closure between the main pipeline and the air and vacuum release valve, and the air and vacuum release vent outlet shall be installed above ground in such manner as to preclude back-flow.

11-351.1726 CHECK VALVES:

All check valves shall seat readily and completely to assure water tightness. The face of the closure element and valve seat shall be bronze, composition, or other non-corrodible material which will seat tightly under all prevailing conditions of field use.

Slow-closing check valves shall be used where excessive pressures or water hammer may occur, and the static operating pressure is within 20% of the pressure class or rating of the

pipe. All check valves, 4-inch and larger in size, for use of distribution mains, shall be designed for a minimum of 175 PSI working pressure.

11-351.1727 FLUSHOUTS (BLOWOFFS):

All flushouts (blowoffs) shall be a minimum outlet size of 2" and shall be designed for a minimum operating pressure of 150 PSI. Flushout or fire hydrant shall be installed at the terminus of all dead-end water mains or non-circulating flow water mains.

11-351.1728 WATER SERVICE CONNECTIONS:

A. Materials - The following materials are acceptable for 3/4" and 1" service connections:

1. Copper tubing, ASTM B-88-58, Type R.

2. Polyvinyl Chloride, Schedule 40, ASTM D-1785-68.

3. Polyethylene tubing, ASTM D-2239-67 P.E. 3306 - Type II - Grade 3 (Flarable).

4. Galvanized Iron Pipe - in accordance with the applicable sections of steel pipe specification A.W.W.A. C202.

B. The following materials are acceptable for 1-1/2 inch *and* larger service connections:

1. All of the materials listed above for 3/4" and 1" services.

2. Copper Pipe shall be seamless copper conforming to "ASTM B-42-58".

3. Brass Pipe - All brass pipe for use in water service connections shall be seamless red brass conforming to "ASTM B-43-58".

4. Asbestos-Cement Pipe - All asbestos-cement water pipe for use in water service connections shall comply with Section 11-351.1721.

C. Sizes - Single service connection shall be not less than 3/4 inside diameter; and for double service shall be 1-inch minimum

inside diameter. (Note that Polyethylene tubing is normally. specified in outside diameter.)

D. On asbestos-cement pipe mains, service connections shall be made on extra-heavy couplings, or a tapping saddle shall otherwise be required.

E. Corporation Stops - All corporation stops, if used, shall be bronze, round, with inlet for either corporation stop (C.S.) thread for asbestos-cement or cast-iron pipe, or iron pipe standard (I.P.S.) thread for steel pipe, and outlet for the type of service pipe used.

F. Meter Stops

All 3/4 inch and 1 inch (curb) meter stops shall be bronze, with inlet for the type of service pipe used, and outlet for the type of service pipe or meter coupling used.

For 1-1/2 inch and 2 inch service, bronze curb stop valve, straight ground key curb stop, or bronze gate valve (Minimum of 200 PSI rated working pressure) may be used. Inlet and outlet shall be appropriate for the type of service pipe or meter flange used. All valves shall be factory hydro-tested to 300 PSI or air-tested to 100 PSI under water.

G. Bronze Gate Valves

All 1-1/2 inch through 3 inch gate valves shall be all bronze and comply with A.W.W.A. C500.

H. Standard Service Clamps

All service clamps and straps shall be in accordance with A.W.W.A. Standards and the pipe manufacturer's recommendations.

I. Repair Service Clamp

Where no service clamp is required, and the corporation stop does not seal properly, a repair service clamp shall be used.

11-351.1730 CONSTRUCTION METHODS

11-351.1731 DEPTH:

Water mains shall be installed at a depth which will provide a minimum cover of 36 inches over the top of the pipe measured from the finished grade.

11-351.1732 EXCAVATION:

The minimum trench width shall be the nominal diameter of the pipe plus twelve (12) inches, but in any case shall be ample to permit the proper installation of the pipe and appurtenances. All of the requirements as set forth in "Excavation for Sewers" and "Bracing and Shoring," shall apply to excavation for water mains. Upon approval by the Engineer, tunneling for short distances under other utilities, sidewalks, etc., will be permitted.

Excavated material shall be piled in such a manner that it will not endanger the work and will offer minimum obstruction to traffic. Open trenches and waste piles shall be adequately barricaded and lighted.

All safety orders, rules, or recommendations of the Occupational Safety and Health Administration (OSHA) and the Division of Industrial Safety of the Department of Industrial Relations of the State of California applicable to this work shall be obeyed and enforced.

11-351.1733 LAYING PIPE:

Each section of pipe and each fitting shall be thoroughly cleaned before it is installed. All pipe, fittings, valves, etc., shall be carefully lowered into the trench by suitable tools or equipment, in such manner as to prevent damage to the pipe, lining, coating, fitting, or other appurtenances. Under no circumstances shall pipe or accessories be dropped into the trench.

The pipe shall be laid true to line, with no visible change in alignment at any joint, unless curved alignment is shown on the plans.

When curved alignment is shown on the plans the maximum deflection at any joint shall not exceed the manufacturer's recommendation for the type of pipe and joint being used.

Thrust blocks of Class "B" concrete shall be cast in place at all bends of 5 degrees or more at the end of plugged mains, behind each

tee or each cross which is valved in such a manner that it can act as a tee, and at the back of fire hydrants. The thrust block shall extend from the fitting to undisturbed soil, shall be kept clear of the joints, and shall be of such bearing area as to assure adequate resistance to the force to be encountered. In lieu of the above, movement may be prevented by the use of pipe collars and rods.

Whenever pipe laying is discontinued for short periods, or when work is stopped at the end of the day, the open ends of all mains shall be closed with water-tight plugs or bulkheads. The plug or bulkhead shall not be removed unless or until the trench is dry.

Gate valves shall be set plumb, supported on a concrete base or a 2 inch by 8 inch by 12 inch redwood block, and properly fitted to the adjacent sections of main. A valve box shall be installed over each valve.

Fire hydrants shall stand plumb, with the steamer nozzle, if any, facing the street and in accordance with Standard Drawing W-1.

A. Asbestos-Cement Pipe - Asbestos-cement pipe joints shall be made only with the couplings and rubber rings furnished with the pipe, and aligned in the trench in accordance with the manufacturer's instruction manual. After assembly, the ends of the pipe within the coupling shall be separated a minimum of 1/4 inch to allow for expansion and contraction. The final location of the rubber rings within each coupling shall be checked with a gauge.

Where necessary for inserting valves or fittings, the pipe shall be neatly and squarely cut to length. Joints between asbestos-cement pipe and cast-iron fittings shall be made either by means of an adapter, or as outlined for joints in cast iron pipe (follows).

B. Cast Iron Pipe - Before lowering into the trench, each section of cast iron pipe shall be rung with a light hammer and examined for defects. Any defective, damaged, or unsound pipe shall be rejected. Each section of cast iron pipe shall be lowered into the trench by means of approved slings, and the pipeline assembled piece by piece. Where necessary to properly locate valves and fittings, the pipe shall be neatly and squarely cut to length. After the pipe or fitting has been lowered into the trench, all foreign matter shall be completely brushed from the bell and spigot end before assembly.

11-351.1734 INSTALLATION OF SERVICE LINES:

The water main shall be tapped at the service locations shown on the approved plans, and a service line extended to the property line. One house service line may be constructed to serve two single family dwelling lots, in which case, the service line shall be located at the common lot line. Each service line shall be equipped with a corporation stop at the main and curb stop at the property line. The service line may be either laid in open cut or placed by boring or jacking. If installed by the open cut method, the trench shall be completely backfilled with sand.

The water service line shall be considered as a part of the main for the purpose of the hydrostatic test as specified below.

11-351.1735 TRENCH BACKFILL:

All the requirements for backfilling of sewer-line trenches set forth in Section 11-351.1638 shall apply to backfill of water main trenches.

11-351.1736 TESTING OF WATER MAINS:

Backfill and compaction shall be completed prior to the final 2-hour test. Each section of the pipe to be tested shall be slowly filled with water, and all air shall be expelled from the pipe. The release of the air can be accomplished by opening hydrants and service line cocks at the high points of the system and the blowoffs at all dead ends. The valve controlling the admission of water into the section of pipe to be tested should be opened wide before shutting the hydrants or blowoffs. After the system has been filled with water and all air expelled, all the valves controlling the section to be tested shall be closed, and the line be allowed to set for a period of not less than 24 hours.

The pipe shall then be refilled, if necessary, and subjected to a pressure of not less than 200 PSI or 50 PSI over the pipe class being installed, whichever is greater, for a period of two hours.

Any cracked or defective pipe, fittings, valves or hydrants discovered during the test shall be removed and replaced with sound material, and the test repeated until the system is proved satisfactory.

The allowable leakage in the test section shall not exceed 100 gallons per mile per 24 hours per inch diameter of pipe tested. The test water shall be left in the mains until back-filling operations are completed.

11-351.1737 FLUSHING AND DISINFECTING:

After the pressure test, the system should be thoroughly flushed out and disinfected in accordance with A.W.W.A. Standard C601 latest revision and/or the requirements of the County Health Department.

11-351.1738 REPLACEMENT OF ROAD SURFACES:

Paving replacement shall not proceed until the full requirements of Sections 11-351.1731 through 11-351.1737 have been met to the satisfaction of the Engineer, but in no case less than ten days after backfilling has been completed.

All of the requirements of Section 11-351.1645 shall apply to the replacement of road surfaces over water main trenches.

11-351.1739 CONNECTION TO EXISTING MAINS:

The engineer of the Water Service Agency shall be given not less than 24 hours notice before any connection is to be made to any existing main, and all necessary Encroachment Permits, Rights of Entry, etc., shall first be obtained. In general, shutdowns in residential areas shall be made at times when there will be the least interference with the preparation of meals. Connections shall be made only after complete and satisfactory preparation for such work has been made, in order that the shut-down may be as short as possible.

11-351.1740 STORAGE FACILITIES:

A. Design

All steel tanks, standpipes, reservoirs and elevated tanks for water storage shall comply with "A.W.W.A. D100" and also meet all foundation and seismic requirements of the Building Code. Where limited service life is satisfactory for a particular situation the Engineer may approve steel tanks meeting the standards of the American Petroleum Institute (A.P.I.).

B. Repairing and Painting

All inspection, repairing, painting and repainting of steel tanks, standpipes, reservoirs, and elevated tanks for water storage shall comply with "A.W.W.A. D102".

11-351.1741 VERTICAL TURBINE PUMPS:

All vertical turbine pumps shall comply with "A.W.W.A. E101".

11-351.1742 TEMPORARY PAVEMENT:

In any case where a trench is cut across a main thoroughfare, or if noted on the drawings, a temporary asphalt plant-mix-cutback surface shall be placed immediately after backfill has been completed, and removed just prior to placing the permanent surfacing material.

11-351.1743 CLEAN UP:

During the progress of the work, the Contractor shall keep the entire job site in a clean and orderly condition. Excess or unsuitable backfill material, broken pipe, or other waste material shall be removed from the job site. Spillage resulting from hauling operations along or across existing streets or roads shall be removed immediately by the Contractor. All gutters and roadside ditches shall be kept clean and free from obstructions. Any deviation from this practice shall have prior approval from the Engineer.

Before final acceptance of the work, the Contractor shall carefully clean up the work and premises, remove all temporary structures built by or for him, remove all surplus construction materials and rubbish of all kinds from the grounds which he has occupied and leave them in a neat condition.

SECTION 11-351.1800
UTILITIES

11-351.1801 GENERAL STATEMENT:

In accordance with Section 21.28.040 of the San Luis Obispo County Code, subdivision improvement plans shall include electrical, telephone, and gas and Cable T.V. (where applicable).

The utility plans shall show the following information as a minimum:

A. Show all utilities in detail on the typical street sections. Include trench-dimensions, depth, number of lines, and description of lines (line material, size, etc.).

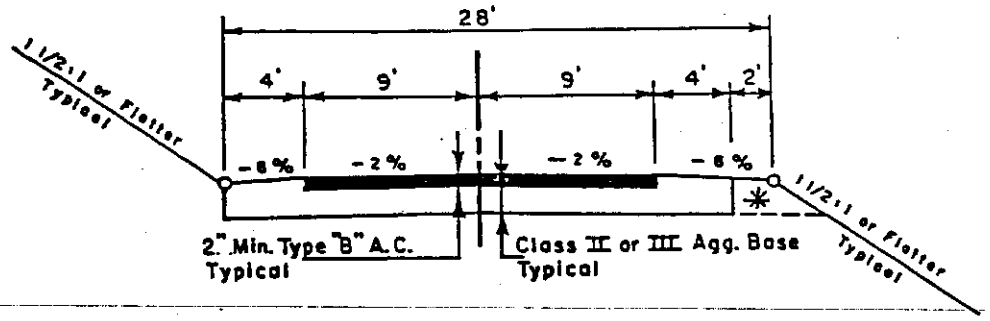
B. Show complete utility layout. Include line location, road crossings, junction boxes, manholes, service connections or stub-outs, etc.

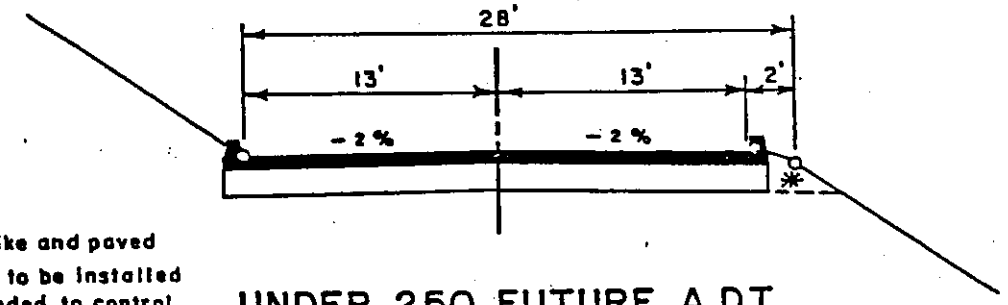
C. The typical section should be in accordance with County Standard Drawing P-4.

The intent of these requirements is that sufficient utility detail be shown to permit the Engineer to locate all utilities when maintenance to the roads and other utilities in the public right-of-way or easements becomes necessary.

V:\ADM_SERV\STORED\standardimprovementspecsWOdrawings.doc.lnd.tt

Revisions				Approvals	
Description	By	Approved	Date	County Engineer	
				Recommended by Deputy Co. Eng.	Clinton Milne 6/7/84

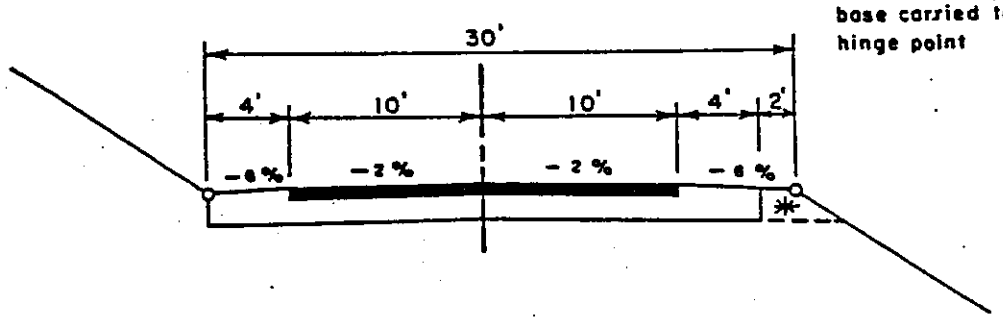


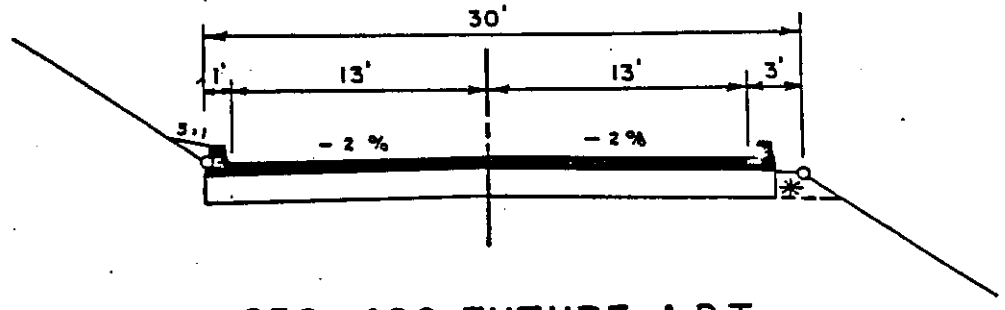


Asphalt dike and paved shoulders to be installed where needed to control drainage or erosion

UNDER 250 FUTURE A.D.T.

✳ NOTE: As an alternate the choker can be eliminated and the agg. base carried to the hinge point

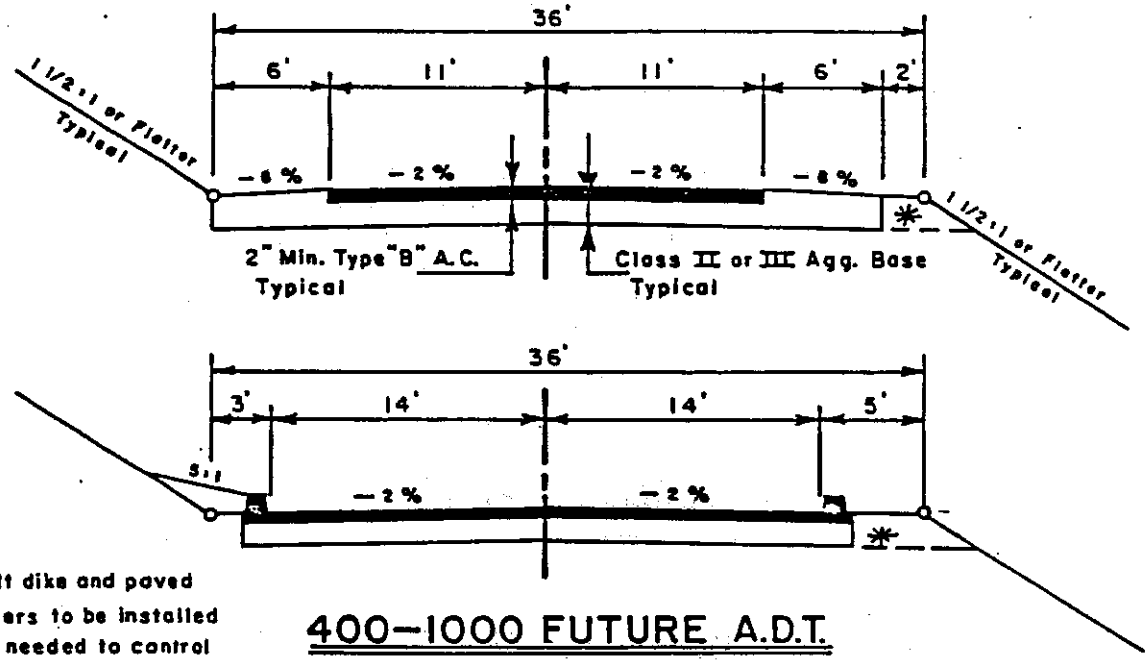




250-400 FUTURE A.D.T.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
	TYPICAL SECTIONS RURAL	Drawing No **A-1 (a)**
Drawn: Date:		

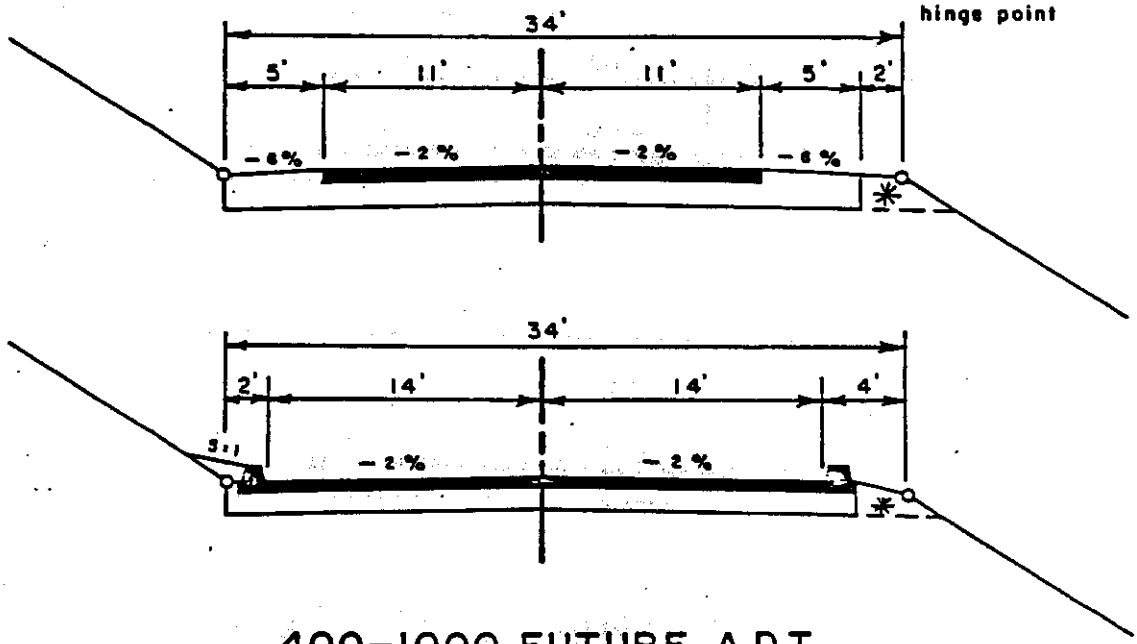
Revisions				Approvals	
Description	By	Approved	Date	County Engineer	
				Recommended by Deputy Co. Eng.	Clinton Milne 6/7/84



Asphalt dike and paved shoulders to be installed where needed to control drainage or erosion

400–1000 FUTURE A.D.T.
FLAT & ROLLING

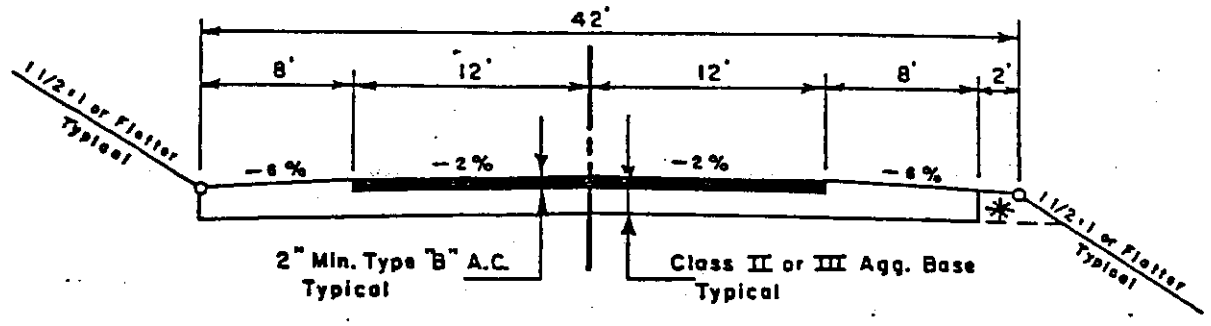
* NOTE: As an alternate the choker can be eliminated and the agg. base carried to the hinge point

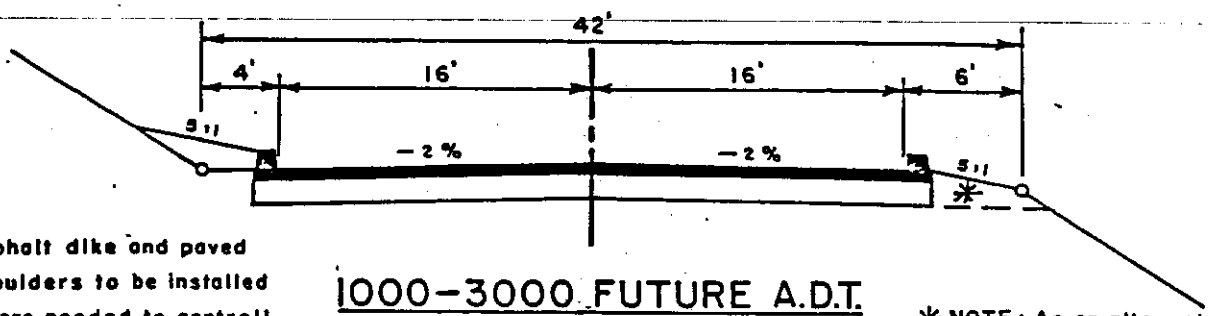


400–1000 FUTURE A.D.T.
MOUNTAINOUS

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
Drawn: Date:	**TYPICAL SECTIONS RURAL**	Drawing No **A-1 (b)**

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		6-8-84
				Recommended by Deputy Co. Eng.		6/7/84

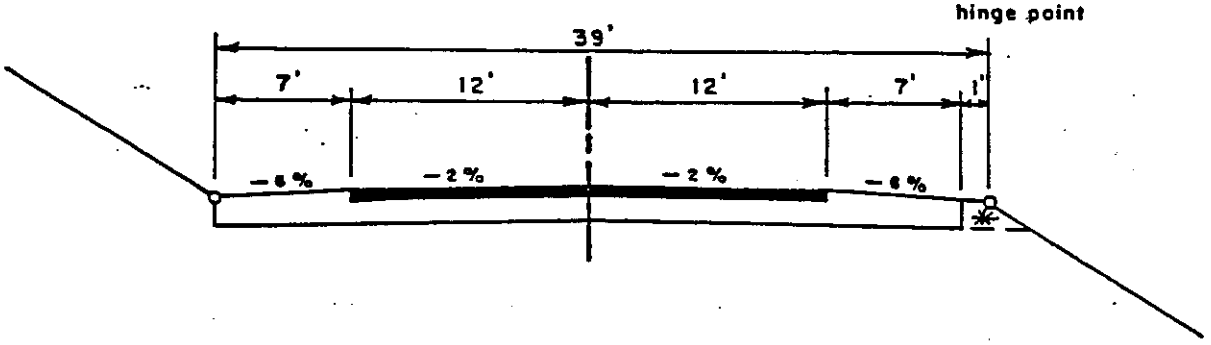


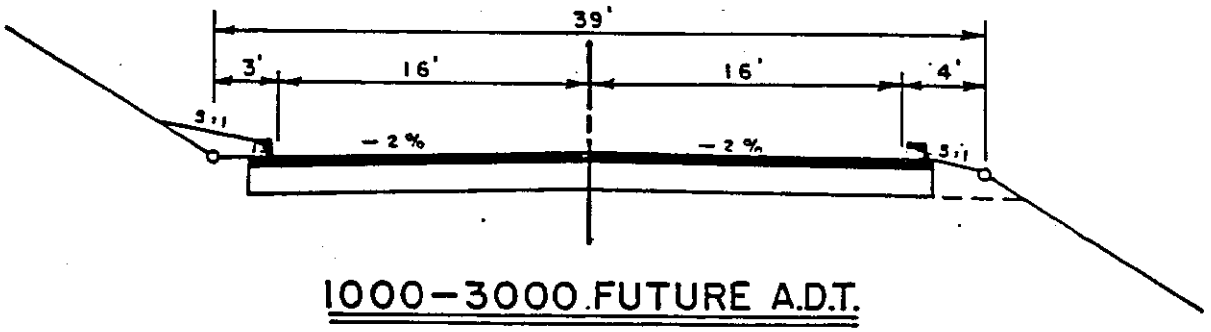


Asphalt dike and paved shoulders to be installed where needed to controll drainage or erosion

1000-3000 FUTURE A.D.T.
FLAT & ROLLING

*NOTE: As an alternate the choker can be eliminated and the agg. base carried to the hinge point

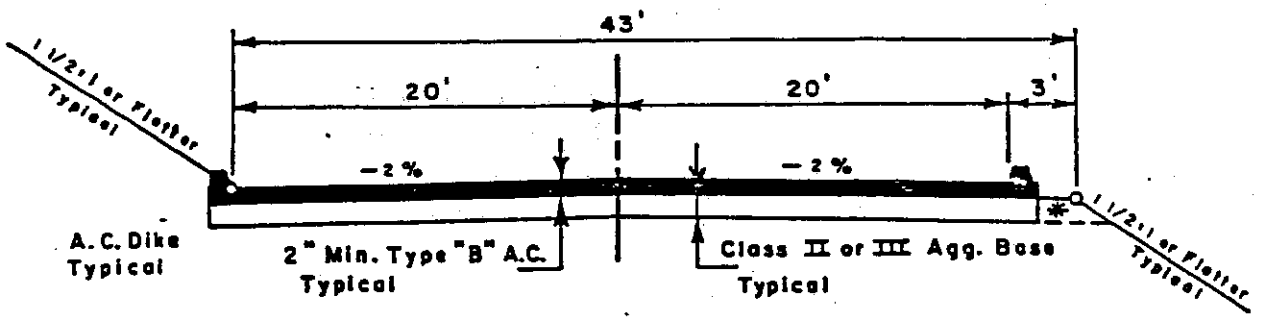




1000-3000 FUTURE A.D.T.
MOUNTAINOUS

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
	TYPICAL SECTIONS RURAL	Drawing No **A-1 (c)**
Drawn: Date:		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		
				Recommended by Deputy Co. Eng.	Victor Mikre	6/7/84



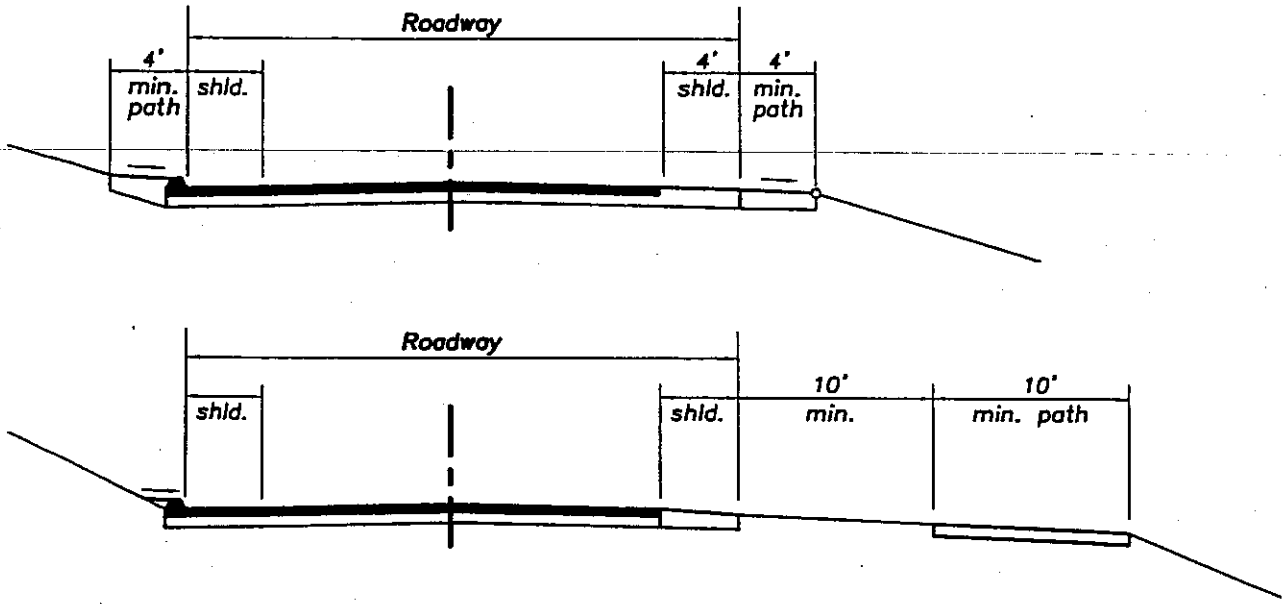
3000-6000 FUTURE A.D.T.

* NOTE: As an alternate the choker can be eliminated and the agg. base carried to the hinge point

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
	TYPICAL SECTIONS RURAL	Drawing No. A-1(d)
Drawn: Date:		

Revisions			
Description	By	Approved	Date

Approvals		
	By	Date
County Engineer		
Recommended by Deputy Co. Eng.	[illegible]	5/3/96
	[illegible]	5/3/96



Any rural road may be required to include either an adjacent or a seperated equestrian/pedestrian path, if deemed necessary due to heavy existing or potential equestrian use.

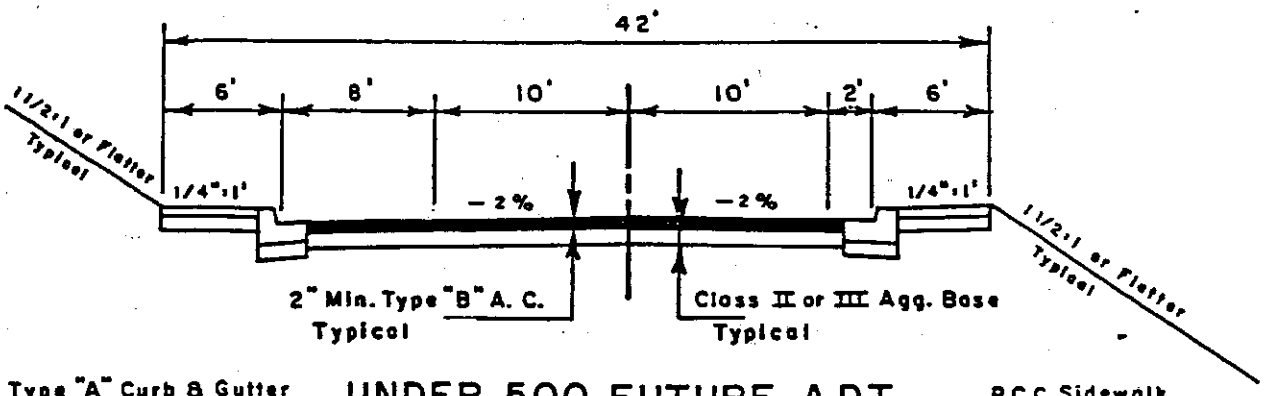
Every A-1 (rural) Section will include one of the following Equestrian/Pedestrian facility when the rural road is shown as an equestrian route on the latest adopted County Trails Plan.

(1) A minimum four-foot clear width adjacent to the roadway on both sides. The area will be surfaced with Class 1 aggregate base or other material creating a low erosion potential.

(2) A minimum ten-foot wide clear graded area on one side of the roadway located a minumum distance of ten feet from the edge of the roadway. When either the grade or the side slope would cause erosion problems, the area will be surfaced with Class 1 aggregate base or other material with low erodability.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	TYPICAL EQUESTRIAN/PEDESTRIAN PATH	Drawing No. A-1(x)
Drawn: 5-91 By: PGH		

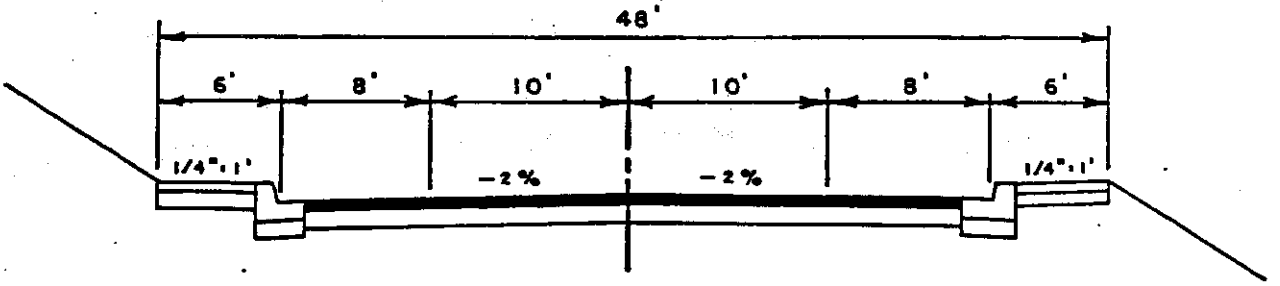
Revisions				Approvals		
Description	By	Approved	Date	County Engineer		6-2-88
				Recommended by Deputy Co. Eng.	Clinton Milner	6/7/88



Type "A" Curb & Gutter Typical

UNDER 500 FUTURE A.D.T.
MOUNTAINOUS

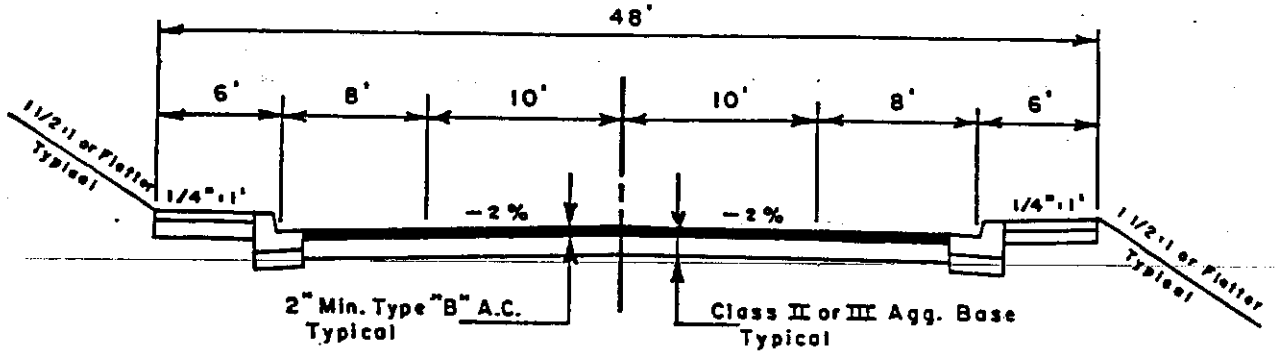
P.C.C. Sidewalk 6' Residential Typical



UNDER 500 FUTURE A.D.T.
FLAT & ROLLING

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
Drawn: Date:	**TYPICAL SECTIONS URBAN**	Drawing No **A-2(a)**

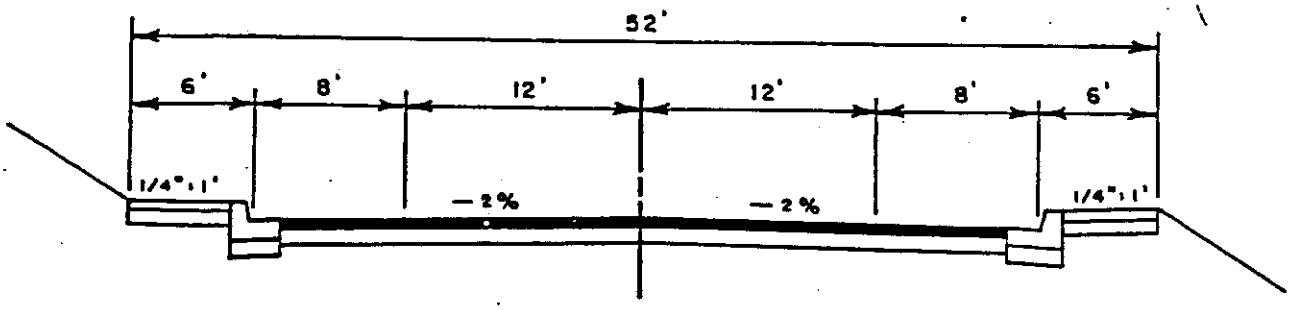
Revisions				Approvals		
Description	By	Approved	Date	County Engineer		
				Recommended by Deputy Co. Eng.		



Type "A" Curb & Gutter Typical

500–1500 FUTURE A.D.T. ROLLING AND MOUNTAINOUS

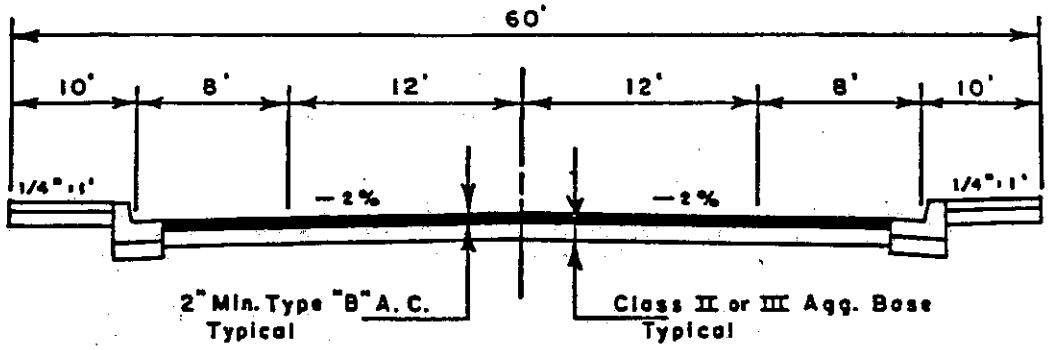
P.C.C. Sidewalk 6' Residential Typical



500–1500 FUTURE A.D.T.-FLAT & 1500–5000 FUTURE A.D.T.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
Drawn: Date:	TYPICAL SECTIONS URBAN	Drawing No. A-2(b)

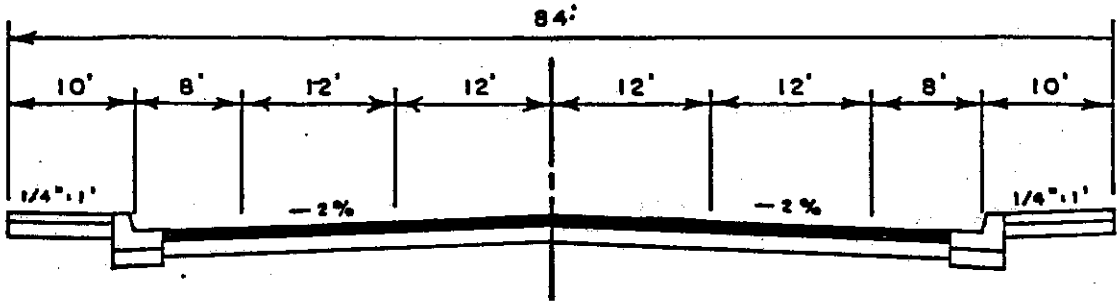
Revisions				Approvals	
Description	By	Approved	Date	County Engineer	
				Recommended by Deputy Co. Eng.	



Type "A" Curb & Gutter
Typical

INDUSTRIAL AND COMMERCIAL

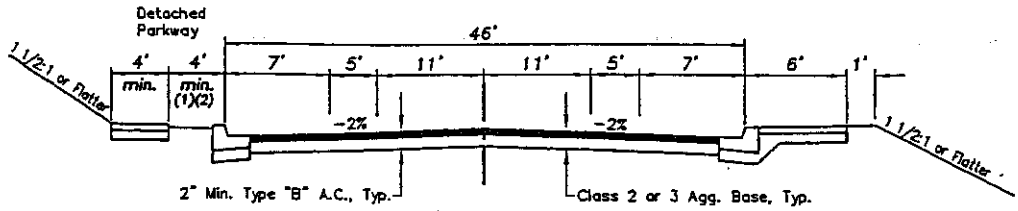
P.C.C. Sidewalk
6' Industrial
10' Commercial
Typical



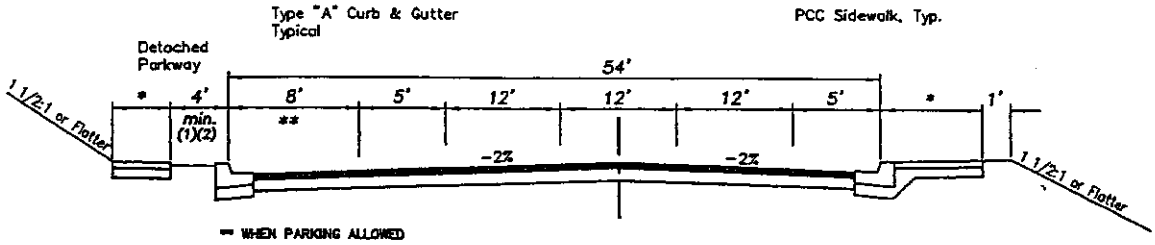
INDUSTRIAL AND COMMERCIAL

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
Drawn: Date:	TYPICAL SECTIONS URBAN	Drawing No A-2(c)

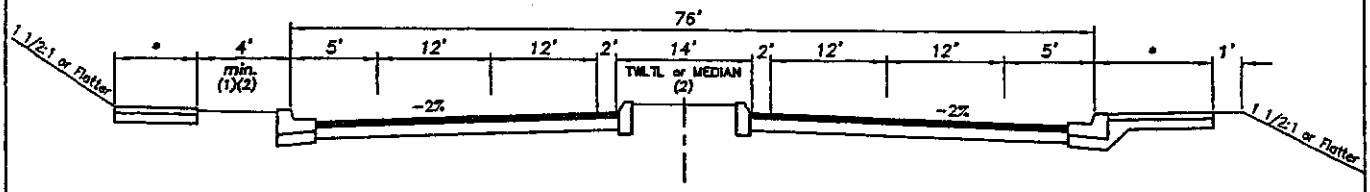
Revisions				Approvals		
Description	By	Approved	Date		By	Date
				Deputy Director of Public Works	GR	7/7/04



RESIDENTIAL w/BIKELANES



FUTURE A.D.T.>5000



FUTURE A.D.T.>16000

* SIDEWALK WIDTH PER TABLE SHOWN BELOW

SIDEWALK WIDTH

LAND USE CATEGORY	INTEGRAL (FT)	DETACHED (FT)
CR	10	6
CS	6	4
OP	8	4
IND	6	4

NOTES
(1) PARKWAY MINIMUM WIDTH = 4 FT. SIDEWALK MAY MEANDER CREATING A LARGER PARKWAY.
(2) LANDSCAPE AND MAINTENANCE OF MEDIANS AND PARKWAYS SHALL BE ADDRESSED IN APPROVED PROJECT PLANS. LOCAL FUNDING SOURCE MUST BE IDENTIFIED.

Specification Ref.	COUNTY OF SAN LUIS OBISPO PUBLIC WORKS DEPARTMENT TYPICAL SECTIONS URBAN	Scale: NONE
		Drawing No.
Drawn: 4/04 By: DR		A-2(d)

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	6-8-87
				Recommended by Deputy Co. Eng.	Clinton Milne	6/7/87

CRITERIA	ADT Under 250 (c)	ADT 250-400	ADT 400-1000	ADT 1000-3000	ADT 3000-10000 (d)
Design Speed					
Flat	40	50	50	55	55
Rolling	30	40	40	40	45
Mountainous	20	20	30	30	35
Curve Radius (min.) (a)					
Flat	510	830	830	1050	1050
Rolling	275	510	510	510	670
Mountainous	110	115	250	275	350
Grade (Max) (e)					
Flat	7	6	6	6	6
Rolling	9	8	8	8	8
Mountains	12	12	10	10	10
Right of Way (b)	50	50	50	60	60

a Superelevation required (see Drawing A-7)

b Right of Way shall be the minimum shown plus any additional right of way that is necessary to contain slopes and drainage.

c ADT is based upon a 20-year projection.

d ADT's in excess of 10000 will require a design to the requirements of the Engineer.

e For ADT below 250 grades of relatively short lengths may be increased 150%.

f The structural section will be based on a traffic index determined by the Engineer.

Flat roadways are those sections of roadway in which there are little or no topographic restraints on vertical and horizontal sight distance and which could be constructed with minor cuts and fills.

Rolling roadways are those sections of roadway in which there are topographic restrainst to vertical and horizontal sight distance which require some moderate cuts and fill.

Mountainous roadways are those sections of roadway which require maximum or near maximum grades and minimum curve radii in order that the cut and fill be reduced to a practical and visually acceptable height.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale
	DESIGN CRITERIA RURAL ROADS	Drawing No A-3 (a)
Drawn: Date: 6-87		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		6-8-84
				Recommended by Deputy Co. Eng.		6/7/84

CRITERIA	ADT (d) Under 500	ADT 500-1500	ADT (e) 1500-5000
Design Speed			
Flat	25	35	45
Rolling	25	35	40
Mountainous	20	30	35
Curve Radius (min.)			
Flat	250	600	1100
Rolling	250	600	800 (a)
Mountainous	125	400	600 (b)
Grade (Max)			
Flat	7	6	4
Rolling	12	9	6
Mountainous	15	13	8
Right of Way (c)	50	60	60

a 500 with superelevation (see Drawing A-7)

b 400 with superelevation (see Drawing A-7)

c Right of Way shall be the minimum shown plus any additional right of way that is necessary to contain slopes, drainage, Bike Lanes, and Turn Lanes

d ADT is based upon a 20 year projection

e ADT's in excess of 5000 will require a design to the requirements of the Engineer

f The structural section will be based on a traffic index determined by the Engineer.

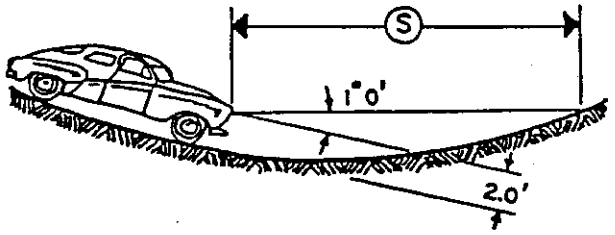
Flat roadways are those sections of roadway in which there are little or no topographic restraints on vertical and horizontal sight distance and which could be constructed with minor cuts and fills.

Rolling roadways are those sections of roadway in which there are topographic restrainst to vertical and horizontal sight distance which require some moderate cuts and fill.

Mountainous roadways are those sections of roadway which require maximum or near maximum grades and minimum curve radii in order that the cut and fill be reduced to a practical and visually acceptable height.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale
	DESIGN CRITERIA URBAN ROADS	Drawing No A-3(b)
Drawn. Date 6-84		

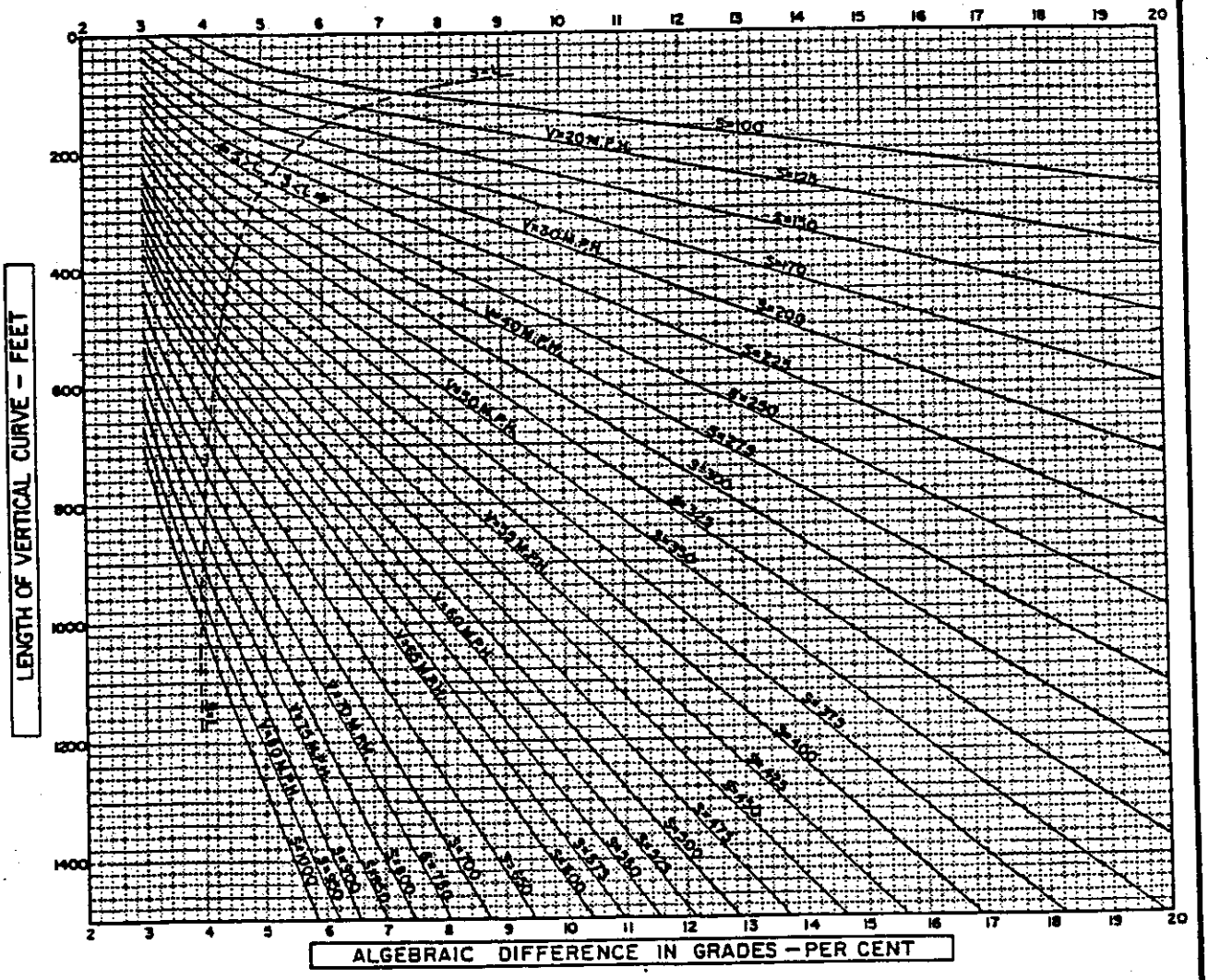
Revisions						
Description	By	Approved	Date	County Engineer		6-8-84
				Recommended by Deputy Co. Eng.		6/7/84



L = Curve length – Ft
A = Algebraic grade difference – %
S = Sight distance – Ft.
V = Design speed – M.P.H. for "S"

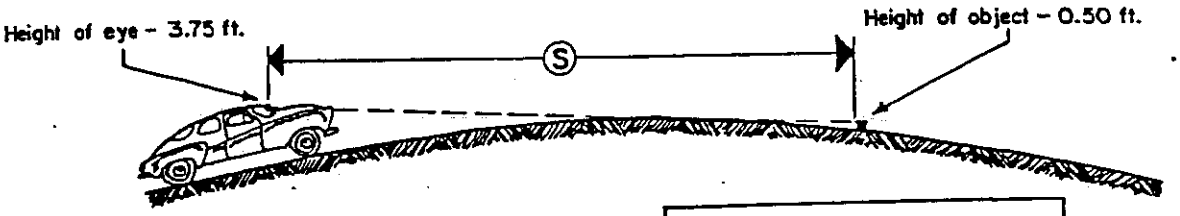
WHEN S > L	WHEN S < L
$L = 2S - \frac{400 + 3.5S}{A}$	$L = \frac{AS^2}{400 + 3.5S}$

DESIGN SPEED M.P.H.	SIGHT DISTANCE FEET
25	160
30	200
40	275
50	350
55	425
60	525
65	600
70	750



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	STOPPING SIGHT DISTANCE ON SAG VERTICAL CURVES	Drawing No. A-4
Drawn: F.A. Date: APR. 1977		

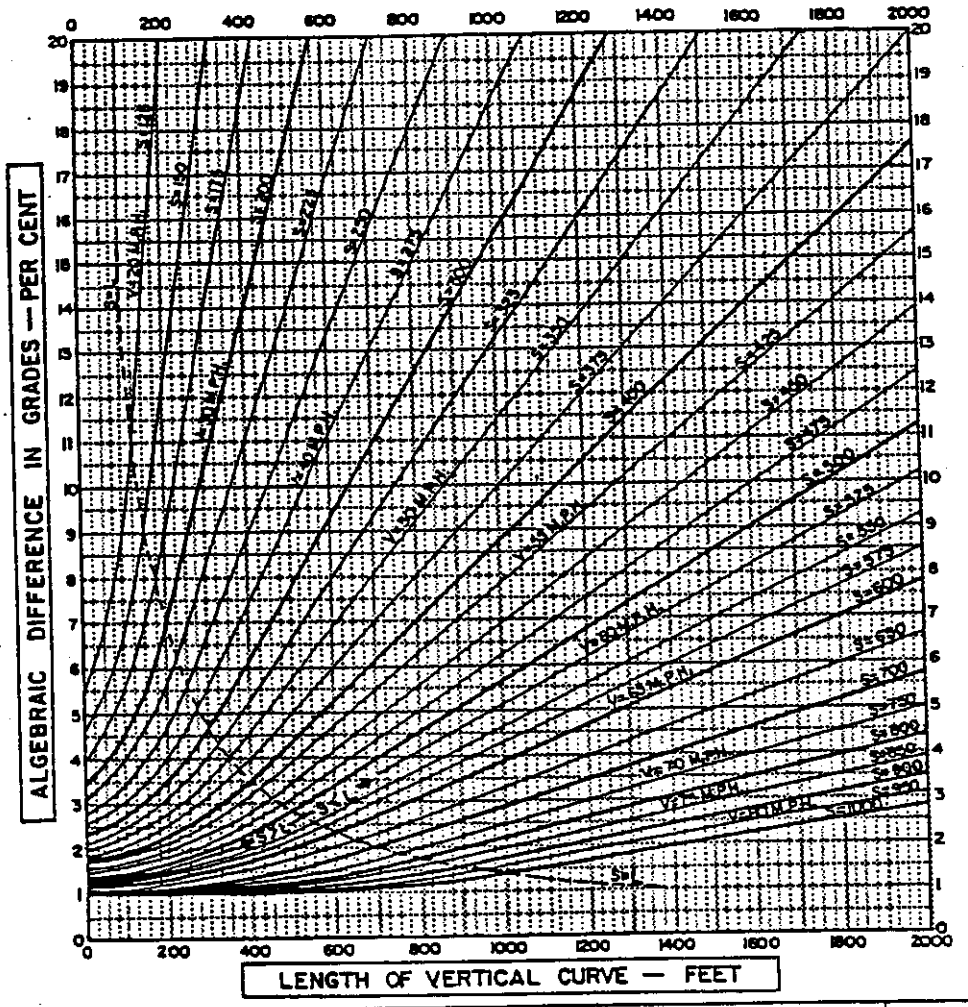
Revisions				Approvals		
Description	By	Approved	Date	County Engineer		
				Recommended by Deputy Co. Eng.		6/7/84



L=Curve length – Ft.
A=Algebraic grade difference – %
S=Sight distance – Ft.
V=Design speed – M.P.H. for "S"

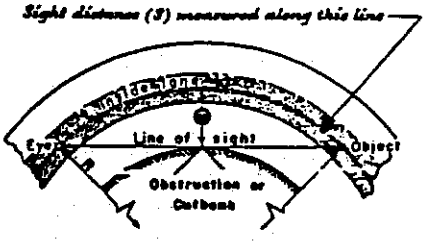
WHEN S>L	WHEN S<L
$L = 2S - \frac{1398}{A}$	$L = \frac{AS^2}{1398}$

DESIGN SPEED M.P.H.	SIGHT DISTANCE FEET
25	160
30	200
40	275
50	350
55	425
60	525
65	600
70	750



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	STOPPING SIGHT DISTANCE ON CREST VERTICAL CURVES	Drawing No. A-5
Drawn: F.A. Date: APR. 1977		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		6-8-84
				Recommended by Deputy Co. Eng.	Clinton Milne	6/7/84



Height of eye- 3.75 feet . . .Height of object- 0.50 feet

Line of sight is 2.0 feet above ℄ inside lane of point of obstruction

S= SIGHT DISTANCE IN FEET
R= RADIUS OF ℄ INSIDE LANE IN FEET
m= DISTANCE FROM ℄ INSIDE LANE IN FEET
V= DESIGN SPEED FOR S IN M.P.H.

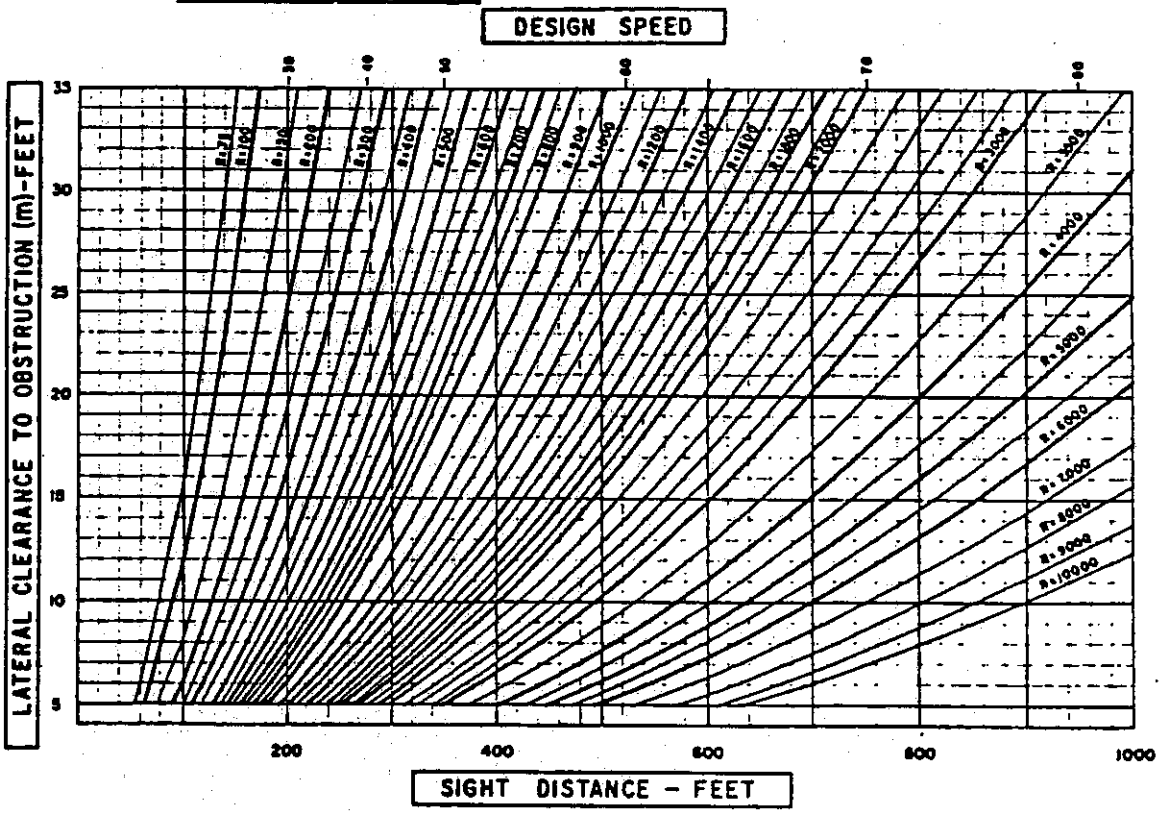
Angle is expressed in degrees.

$$m = R\left[\text{vers}\left(\frac{28.65S}{R}\right)\right]$$

$$S = \frac{R}{28.65}\left[\cos^{-1}\left(\frac{R-m}{R}\right)\right]$$

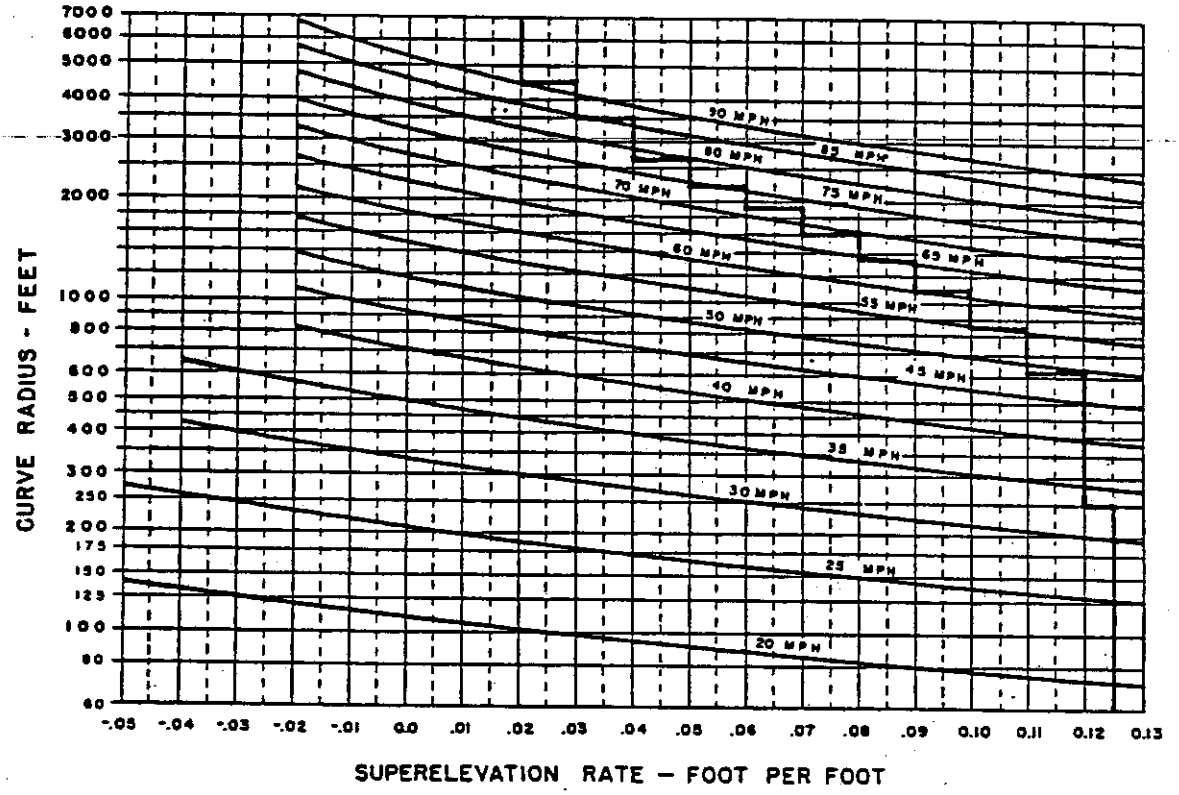
Formula applies only when S is equal to or less than length of curve.

DESIGN SPEED M.P.H.	SIGHT DISTANCE FEET
25	160
30	200
40	275
50	350
55	425
60	525
65	600
70	750



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	STOPPING SIGHT DISTANCE ON HORIZONTAL CURVES	Drawing No. A-6
Drawn: F.A. Date: MAR. 1977		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	6-8-84
				Recommended by Deputy Co. Eng.	Victor Wilson	6/7/84



Note

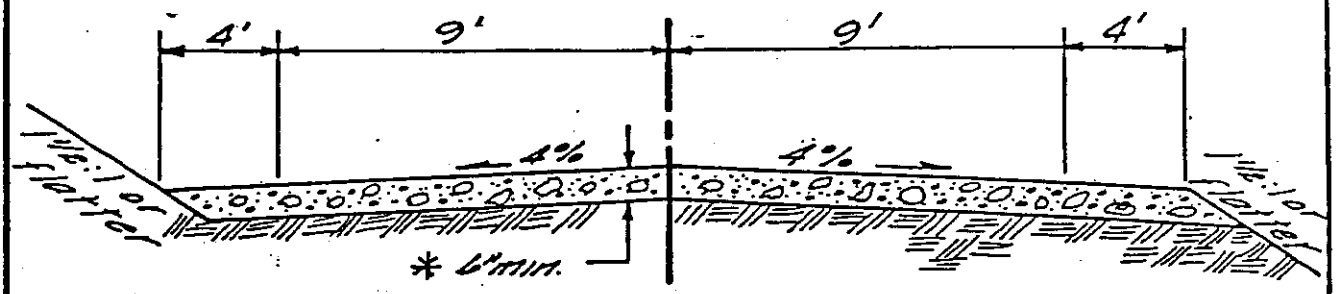
Broken Line indicates standard superelevation rate. Higher value of steep is the proper superelevation for indicated curve radius.

MINIMUM LENGTH FOR SUPERELEVATION RUNOFF FOR 2-LANE PAVEMENTS

Superelevation Rate	L-Length of runoff in feet for design speed, MPH, of:				
	20	30	40	50	60
Foot per foot					
.02	50	100	125	150	175
.04	50	100	125	150	175
.06	50	110	125	150	175
.08	50	145	170	190	215
.10	50	180	210	240	270
.12	50	215	250	290	325

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	COMFORTABLE SPEED ON HORIZONTAL CURVES	Drawing No. A-7
Drawn: F.A. Date: MAR. 1977		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		6-8-84
				Recommended by Deputy Co. Eng.	Clinton Milne	6/7/84



* 4" min. if subgrade R Value ≥ 40 as shown by representative soil tests

TYPICAL SECTION

DESIGN CRITERIA:

Minimum Grade - 0.5%
Maximum Grade - 12%
Side Slopes - 1½:1 or flatter
Minimum Cross Grade - 4%

DRAINAGE:

V ditches to be added outside the shoulder as necessary to controll drainage and stabilized to prevent erosion of ditch and/or adjacent gravelled road.

AGGREGATE SPECIFICATIONS

Grading:	Seive	Percent Passing
(Or as approved by the County Engineering Dept.)	1"	100
	3/4"	70-98
	1/2"	—
	No.4	36-60
	No.8	25-47
	No.30	12-31
	No.200	5-15

Quality:	Calif. Test Method	Requirement
Compaction	216	95 %
Durability	229	35 min.
Liquid Limit	204	** (35 max.)
Plasticity	204	** (2-9)
Dust Ratio*	202	** (2/3 max)
S.E.	217	** (>30 <75)

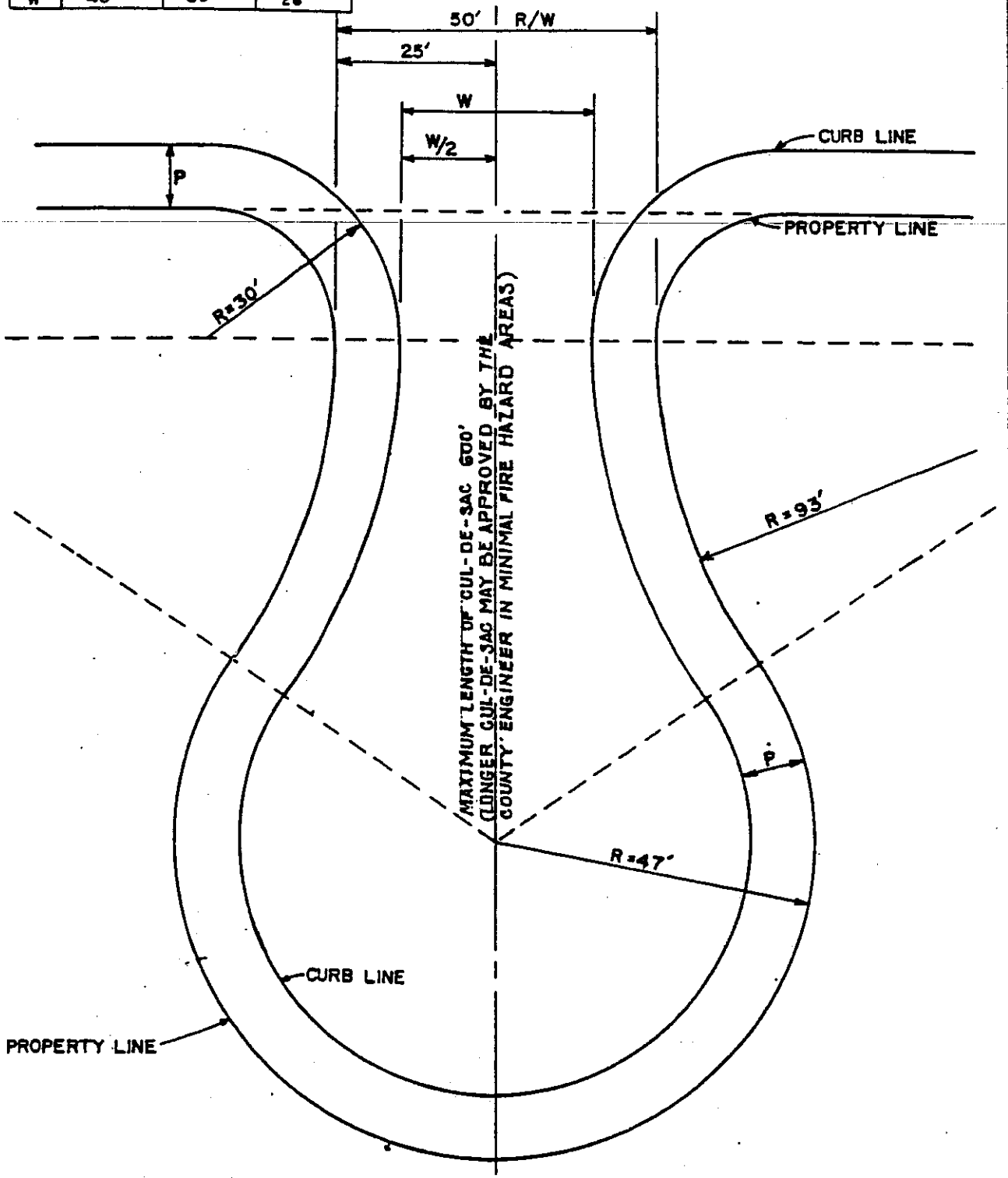
* % passing No.200 / % passing No.30

** For documentation only (recommended limits)

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	TYPICAL GRAVEL ROAD (Not County Maintained)	Drawing No. A-7(C)
Drawn: JH	Date: 12-83	

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Wilber	8/28/75

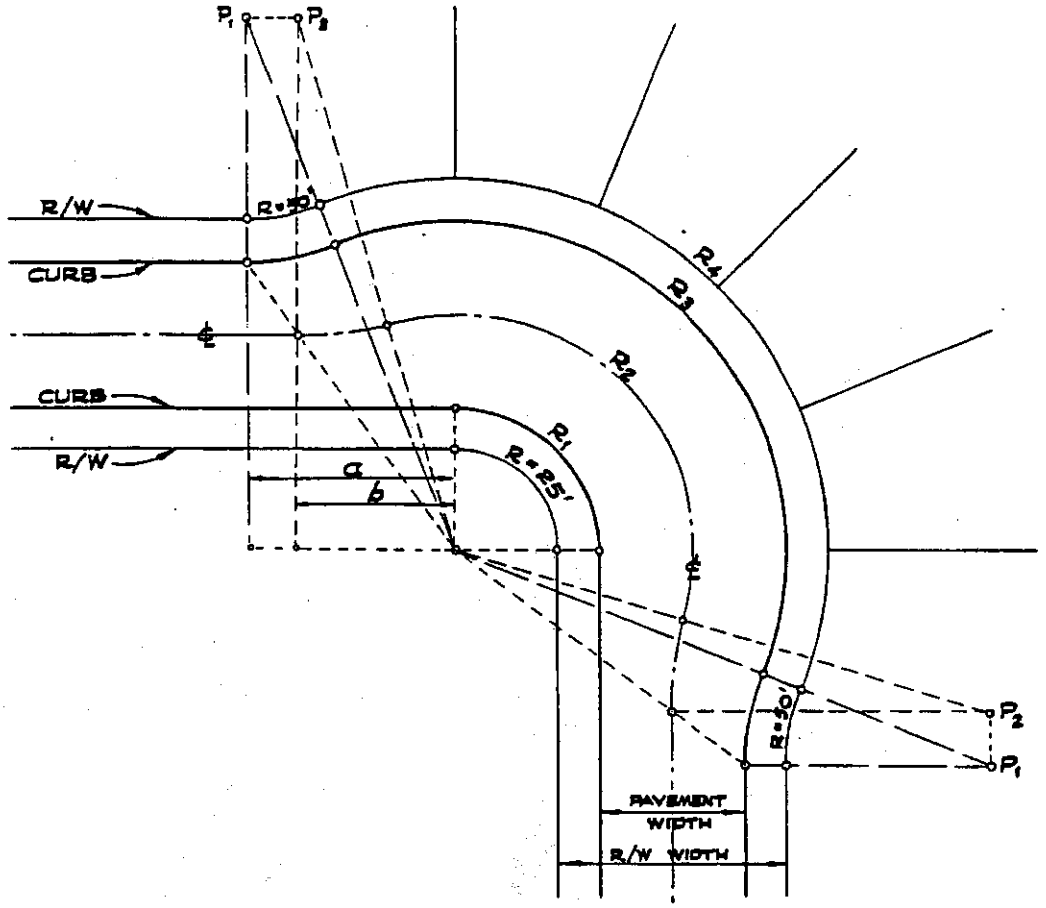
	URBAN	SUBURBAN	RURAL
P	7'	10'	12'
W	40'	30'	26'



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: 1"=20'
	TYPICAL CUL-DE-SAC	Drawing No. A-8
Drawn: MJG Date: 1-67		

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works		5-62
				Engineering & Road Div'n.	J.R.M.	
						5 1962

P_1 = CENTER FOR CURB & R/W ARCS
P_2 = CENTER FOR ℄ ARC

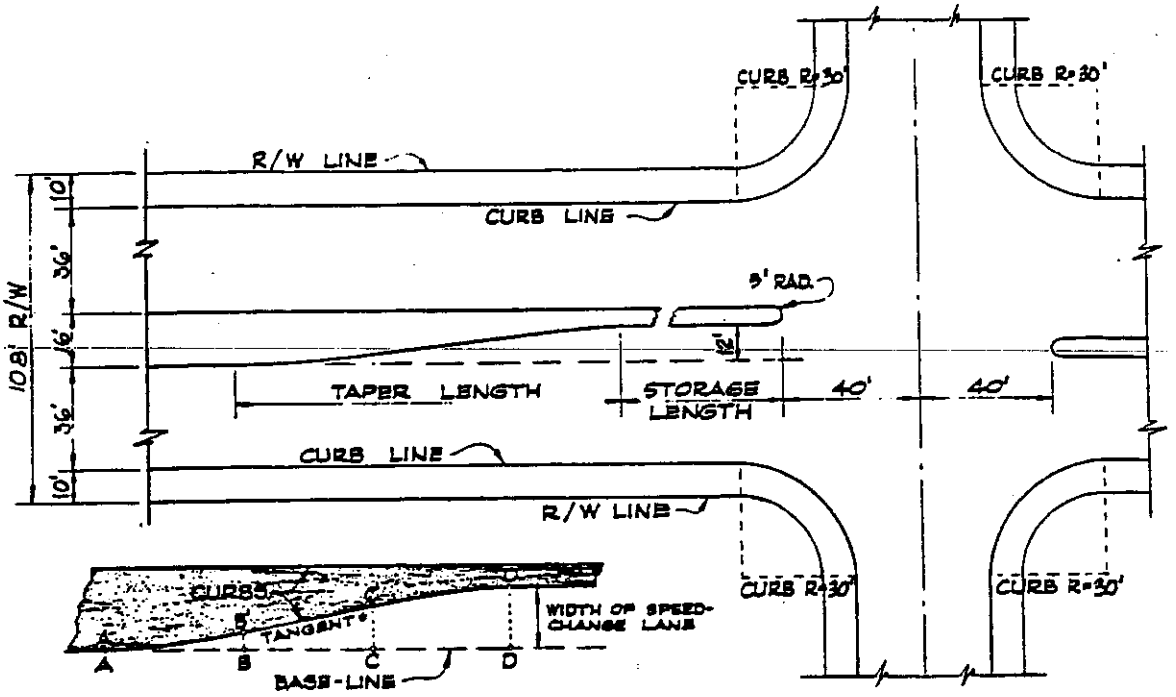


R/W WIDTH	PAVEMENT WIDTH	R_1 (CURB)	R_2 (℄)	R_3 (CURB)	R_4 (R/W)
50'	36'	32'	55'	78'	85'
60'	40'	35'	60'	85'	95'
64'	44'	35'	62'	89'	99'

R/W WIDTH	a	b	P_1 to P_2
50'	50.97'	35.73'	15.24'
60'	52.91'	37.10'	15.81'
64'	53.68'	37.64'	16.05'

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	TYPICAL KNUCKLE	Drawing No. A-9
DRWN.: MAR 1962 BY: S.G.		

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	R. L. [illegible]	5-62
				Engineering & Road Div'n.	[illegible]	4-10-62
					J.R.M.	



AD = TAPER LENGTH

AB = BC = CD = ⅓ AD

AB' & C'D' ARE PARABOLIC CURVES.

TABLE BELOW GIVES OFFSETS FROM A BASE-LINE PARALLEL TO THE EDGE OF PAVEMENT AT INTERVALS MEASURED FROM POINT "A".

NOTES:

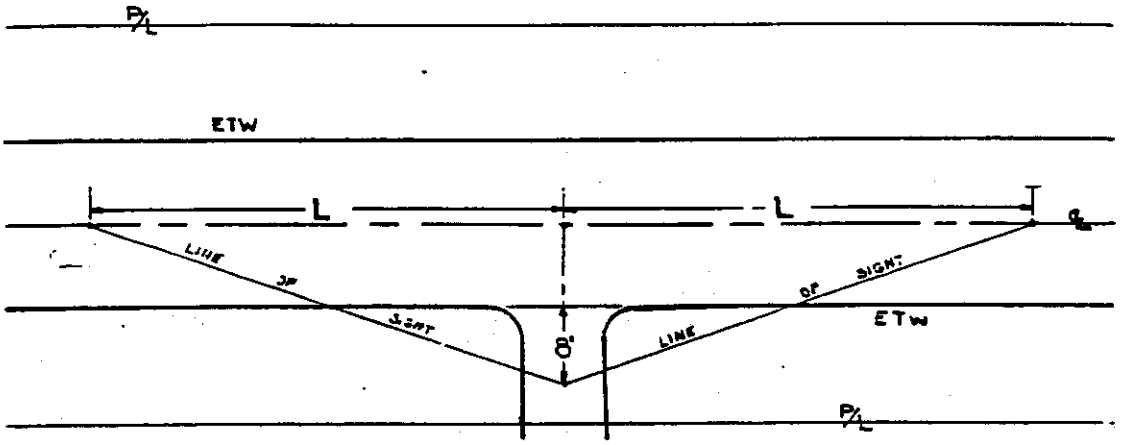
1. SPEED-CHANGE LANES REQ'D. FOR LEFT TURN MOVEMENTS WHEN DESIGN HOURLY VOLUME IS 25 VEHICLES OR MORE.
2. STORAGE LENGTH SHALL BE PROVIDED ON THE BASIS OF 25 FEET PER VEHICLE. MINIMUM STORAGE = 50'.

OFFSET DISTANCE, FT.		DESIGN SPEED - M.P.H.					
		25	30	35	40	50	60
		LENGTH OF TAPER FEET					
		90	120	150	180	240	270
	DD' = 12'	DISTANCE FROM POINT "A"					
	0	-	-	-	-	-	-
	0.19	7.5	10	12.5	15	20	22.5
	0.75	15	20	25	30	40	45
	1.69	22.5	30	37.5	45	60	67.5
BB' —	3.00	30.	40	50	60	80	90
	6.00	45	60	75	90	120	135
CC' —	9.00	60	80	100	120	160	180
	10.31	67.5	90	112.5	135	180	202.5
	11.25	75	100	125	150	200	225
	11.81	82.5	110	137.5	165	220	247.5
DD' —	12.0	90	120	150	180	240	270

* WHERE EDGE OF PAVEMENT IS A CURVE, NEITHER BASE LINE NOR TAPER BETWEEN B' AND C' WILL BE A TANGENT. USE PROPORTIONAL OFFSETS FROM B' TO C'.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	MAJOR INTERSECTION	Drawing No. A-10
DRWN.: MAR 1962 BY: G.G.		

Description	By	Approved	Date			
				County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co Engineer	Clinton Milne	8/29/75

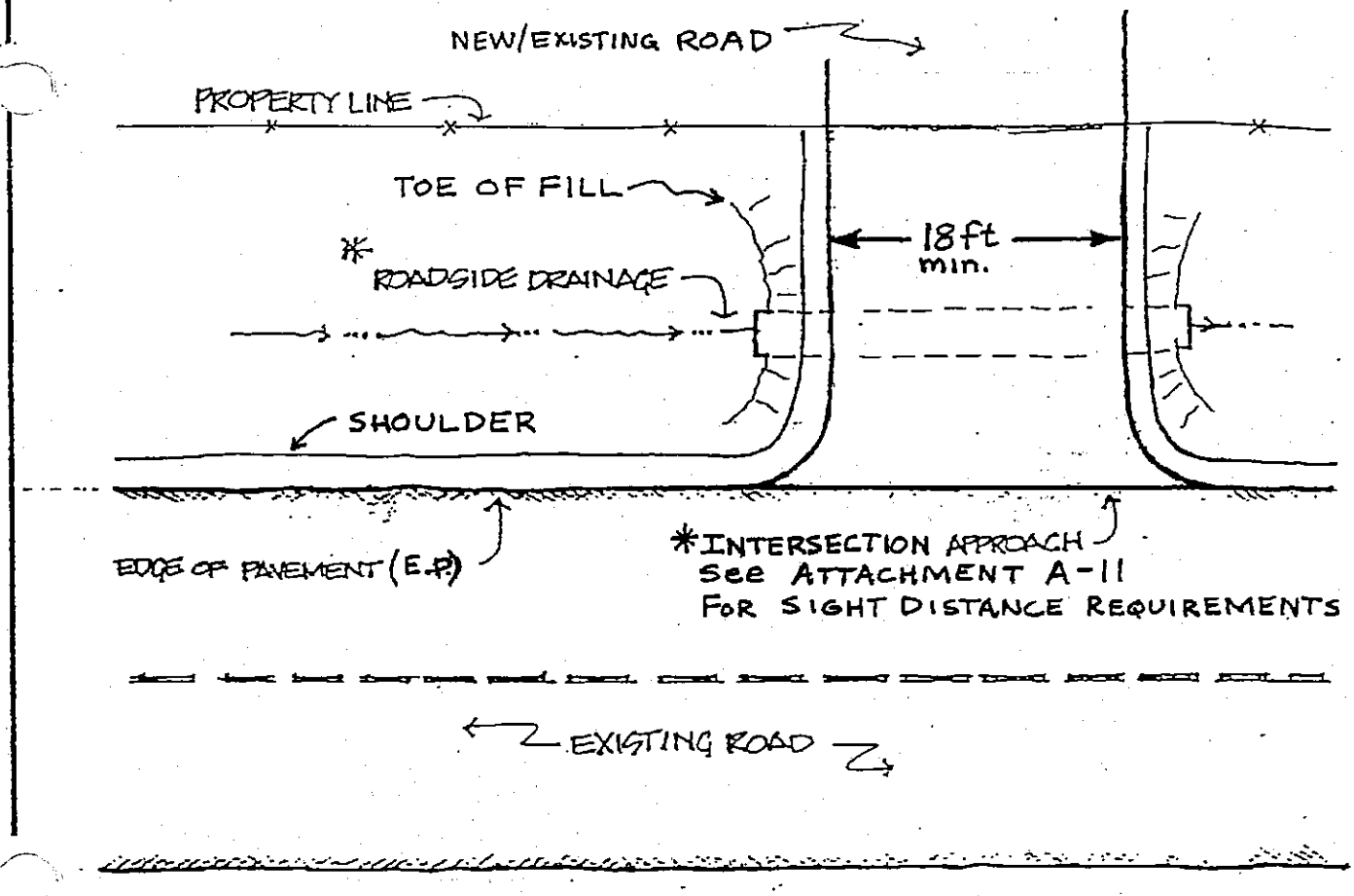


LINE OF SIGHT IS FROM A POINT 3' HIGH ON DRIVEWAY ℄ TO A POINT 3' HIGH ON ROADWAY ℄.

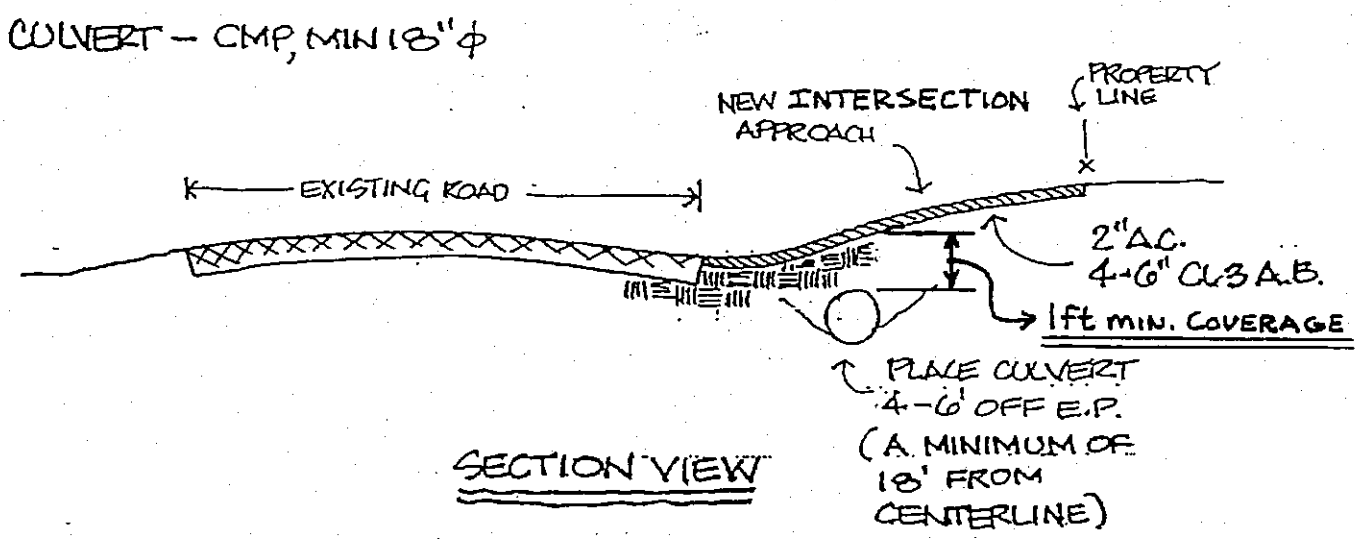
M.P.H.	L.
30	200'
40	275'
50	350'
60	450'
65	500'

NOTE: USE STATE STANDARDS FOR INTERSECTING ROADS.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	MINIMUM SIGHT DISTANCE DRIVEWAYS	Drawing No. A-11
Drawn: SHY Date: 8-16-74		



PLAN VIEW



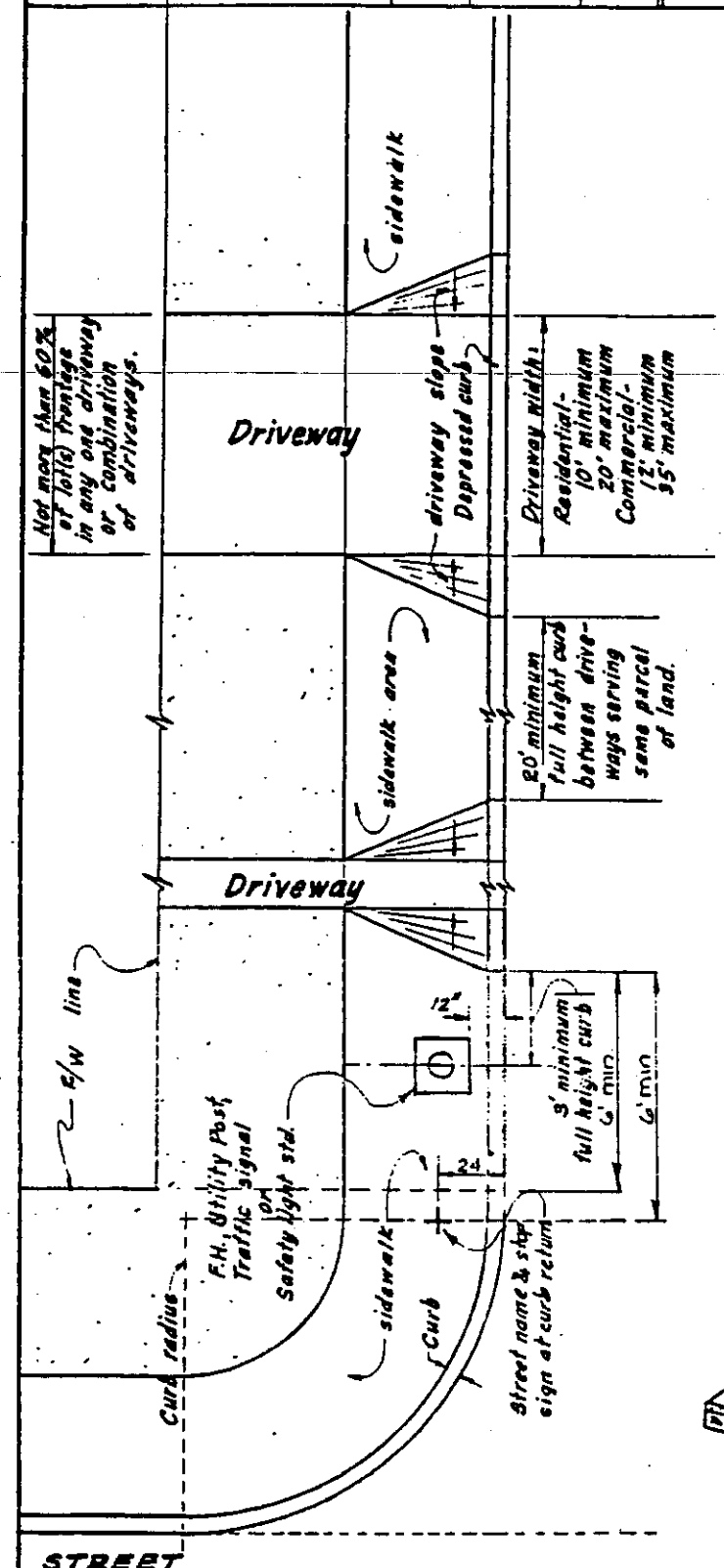
SECTION VIEW

SAN LUIS OBISPO COUNTY ENGINEERING DEPARTMENT
ENCROACHMENT PERMIT STANDARD DRAWING

A-13

ROAD INTERSECTION WITH CULVERT

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	Richard [illegible]	5-62
Add Isometric & Note To Describe	S.B.	RS	12-3-62	Engineering & Road Div'n.	J.R.M.	
Changed some spec.'s & added notes	M.M.				[illegible]	5 1962



Driveways shall be constructed in accordance with Standard Specifications and Drawings of the County of San Luis Obispo.

A Residential Driveway is one that serves a dwelling or dwellings used by two (2) families or less. All other driveways are commercial.

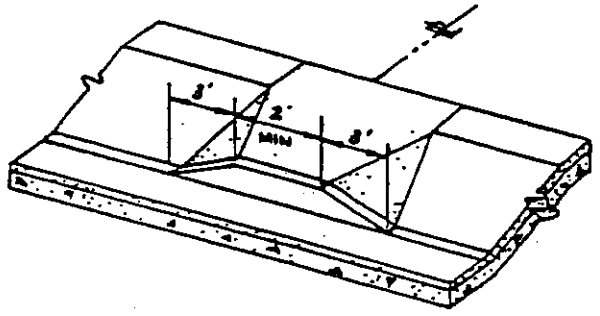
Driveway width shall be the net width of opening, exclusive of side slopes.

The maximum width of Residential Driveways shall be 20 feet.

The maximum width of Commercial Driveways shall be 35 feet.
Where the curb is not existing in old subdivisions, the curb location and grade must be designed by the Engineering Department

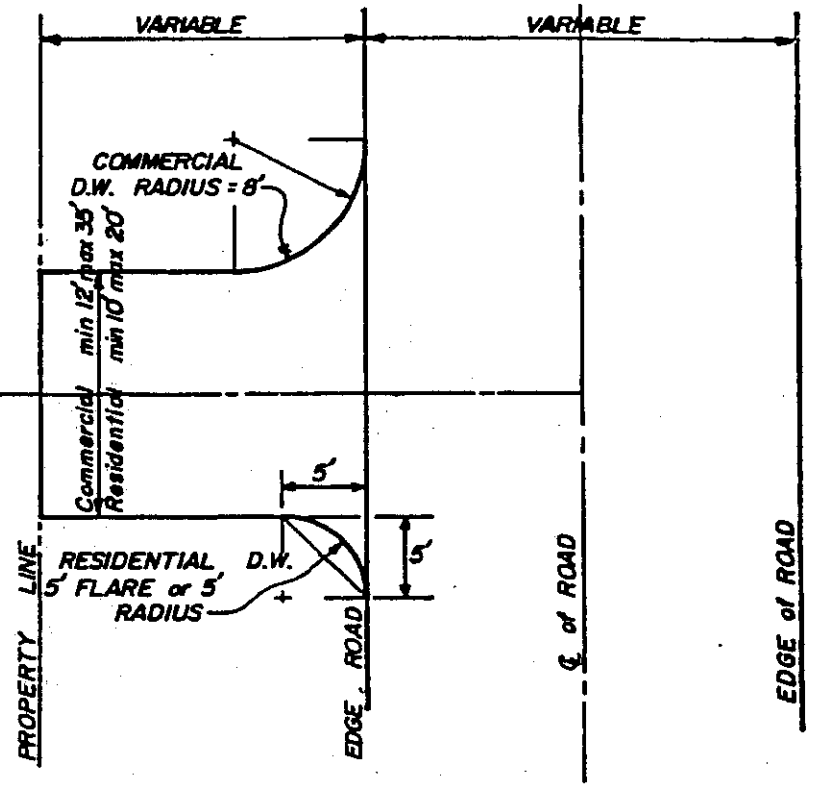
As a condition of issuance of any driveway permit, all abandoned driveway area on the same frontage shall be removed and the curbing and sidewalk properly restored.

In all cases driveways on abutting parcels shall be separated by a min. of 2' of full height curb or berm between them as shown below. This requirement may be waived in commercial areas.



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	DRIVEWAY LOCATION	Drawing No. B-1
DRWN: DEC. 1961 BY: S.G.		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	J.C. Patton	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/28/75

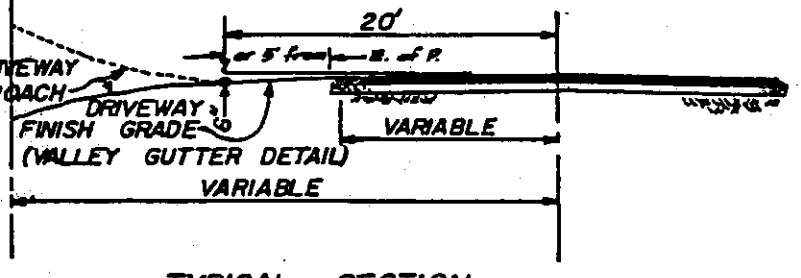


NOTE: For connection to an existing county road, thickness and type of base, drainage control, and surfacing will be specified in the encroachment permit

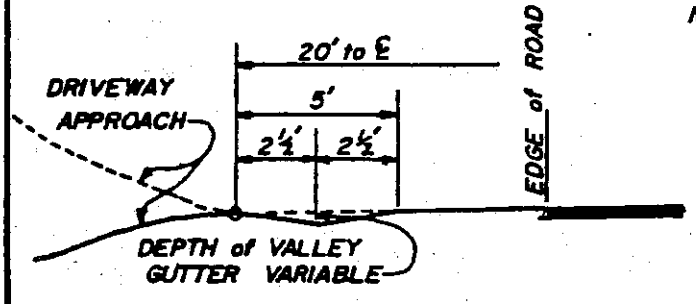
DRIVEWAY APRON — NO SCALE

NOTE: Driveways shall be 6" below Edge of Pavement of road at 20' from ℄ of road or 5' from Edge of Pavement, which ever is greater.

17% maximum difference in grade at hinge point

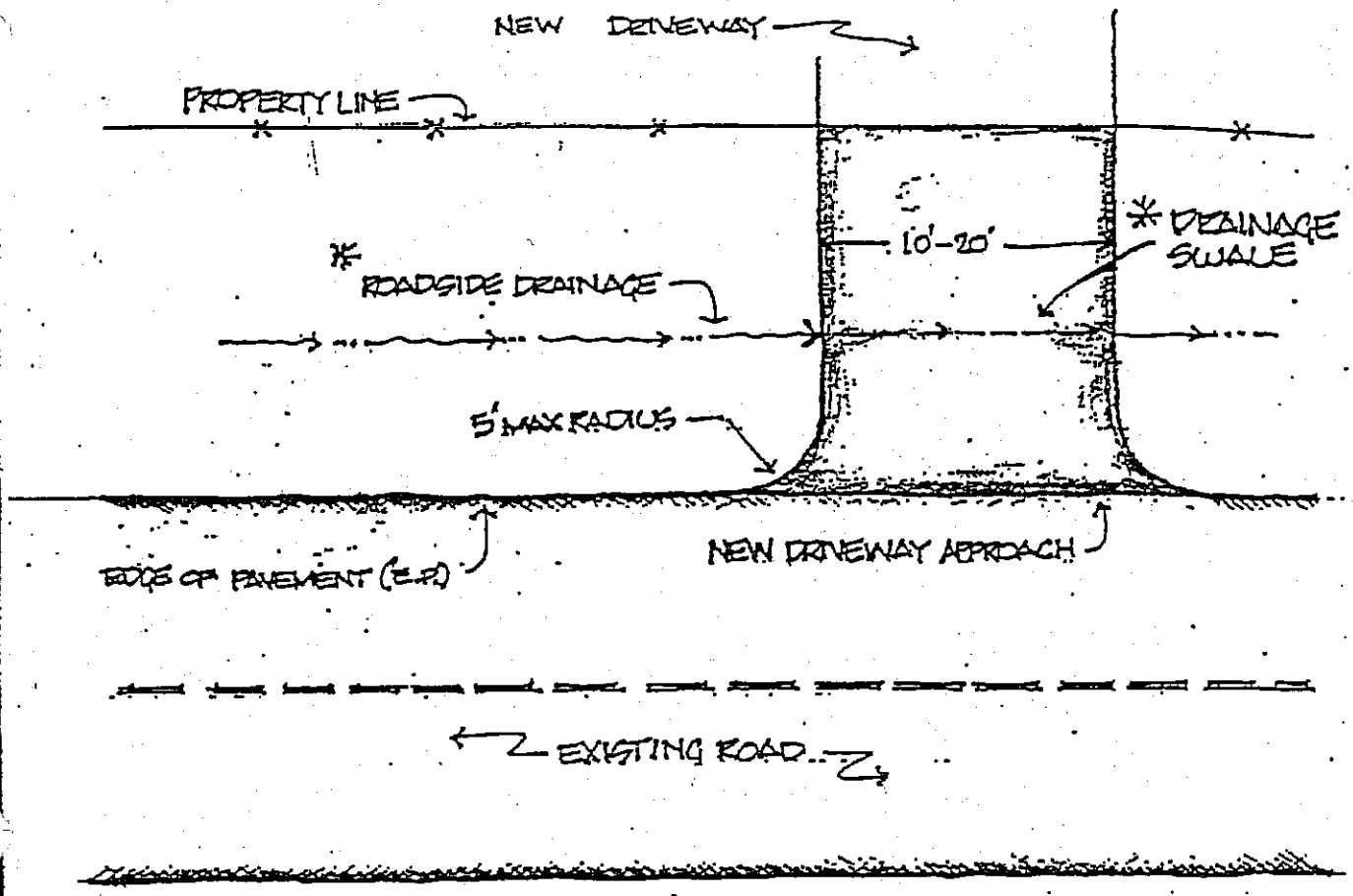


TYPICAL SECTION
NO SCALE

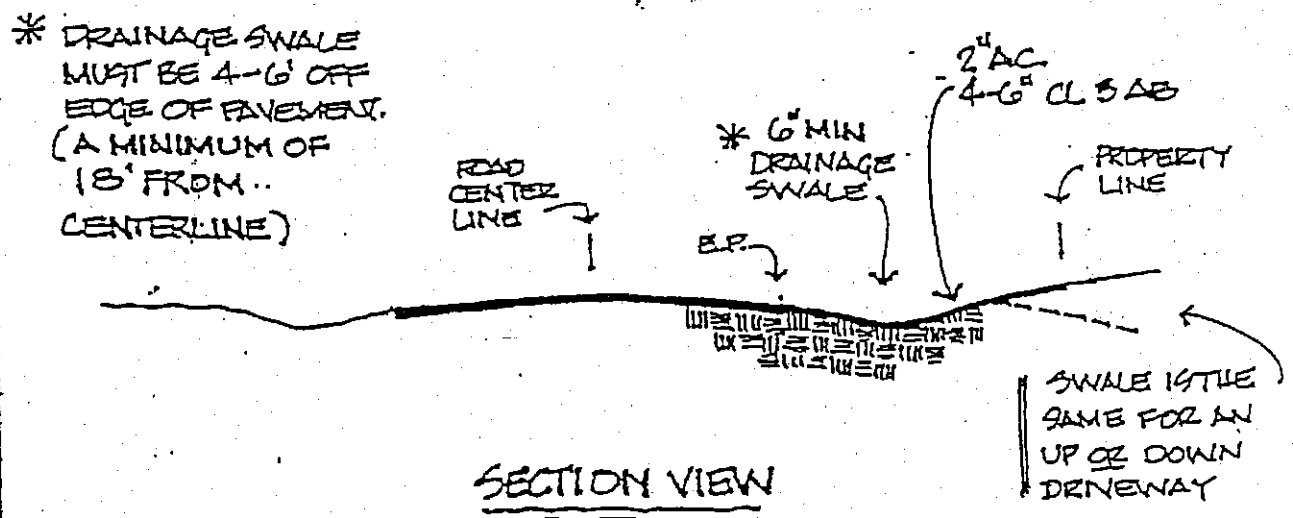


VALLEY GUTTER DETAIL
NO SCALE

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: AS SHOWN
	DRIVEWAY APPROACH	Drawing No.
Drawn: G.B.H. Date: 10-25-72	(ROADWAYS WITHOUT BERMS OR CURBS)	B-2



PLAN VIEW

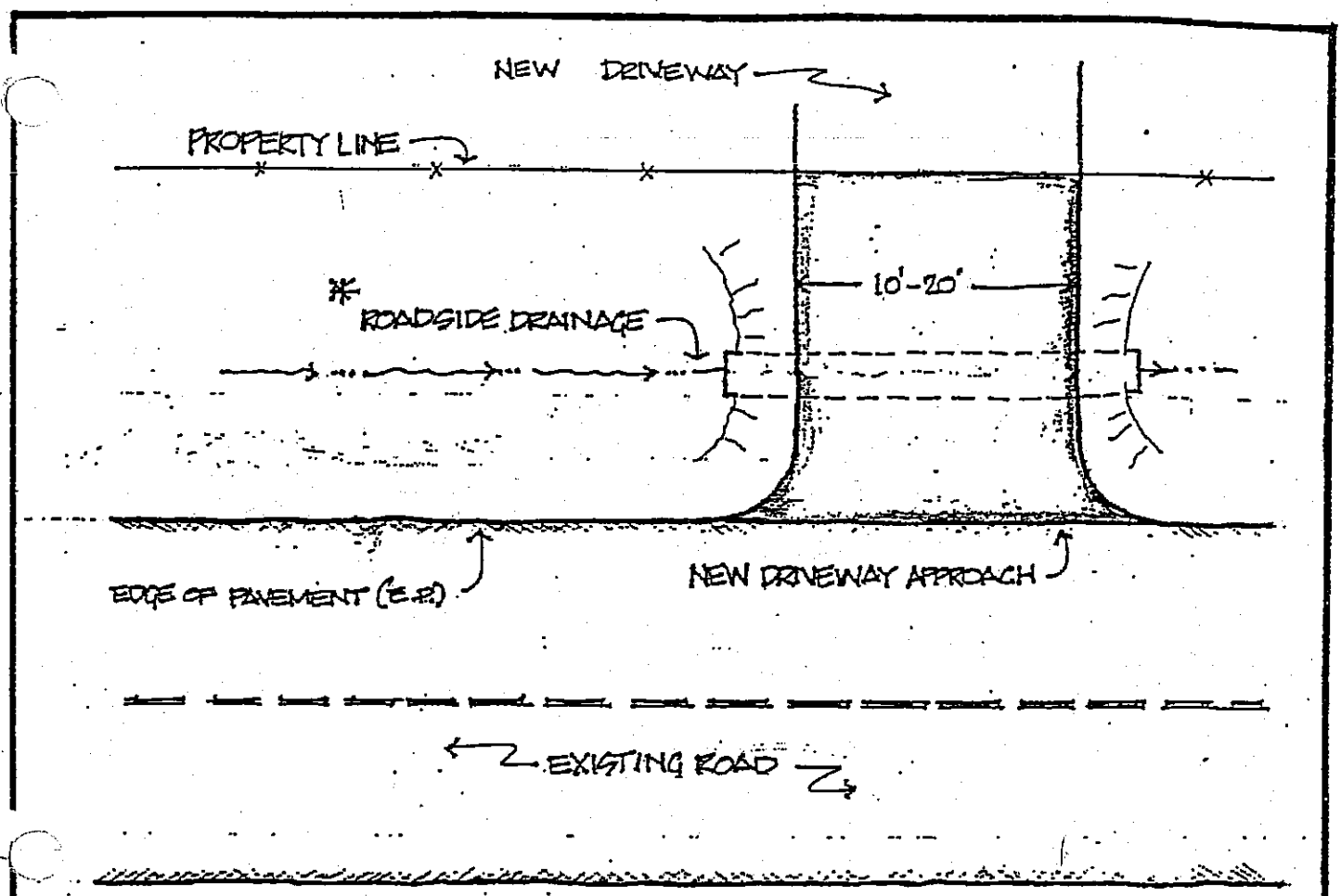


SECTION VIEW

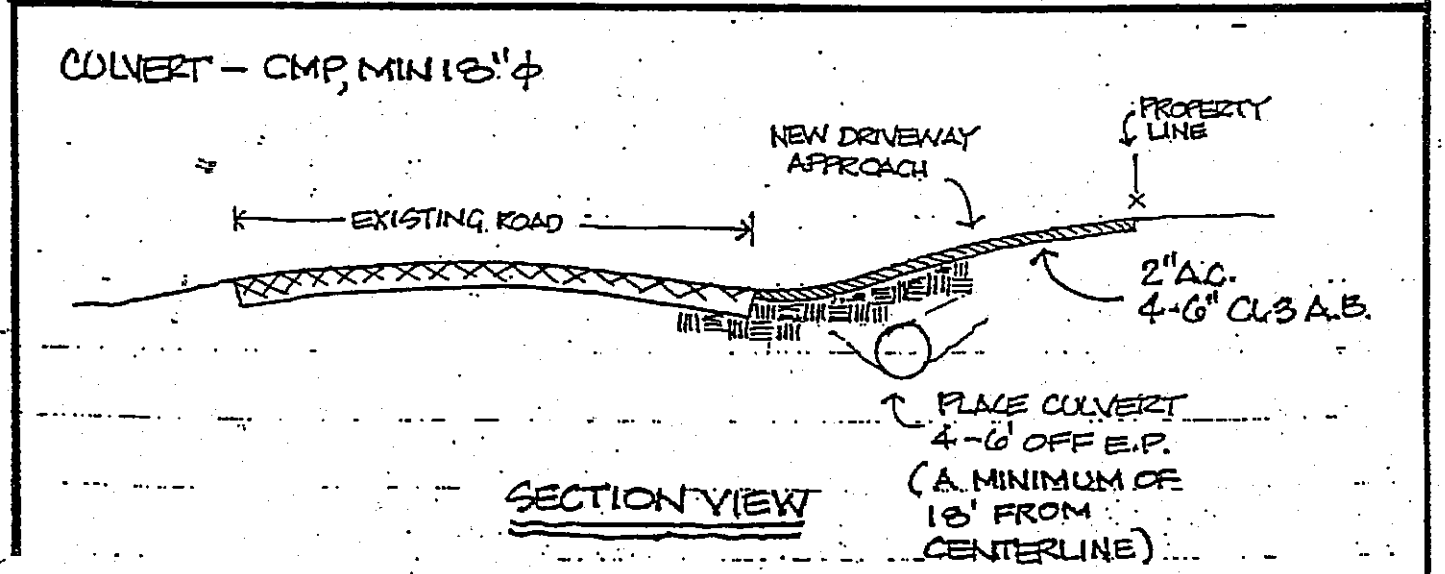
SAN LUIS OBISPO COUNTY ENGINEERING DEPARTMENT
ENCROACHMENT PERMIT STANDARD DRAWING

B-2-2

STANDARD B-2 DWG 2/7/02



PLAN VIEW



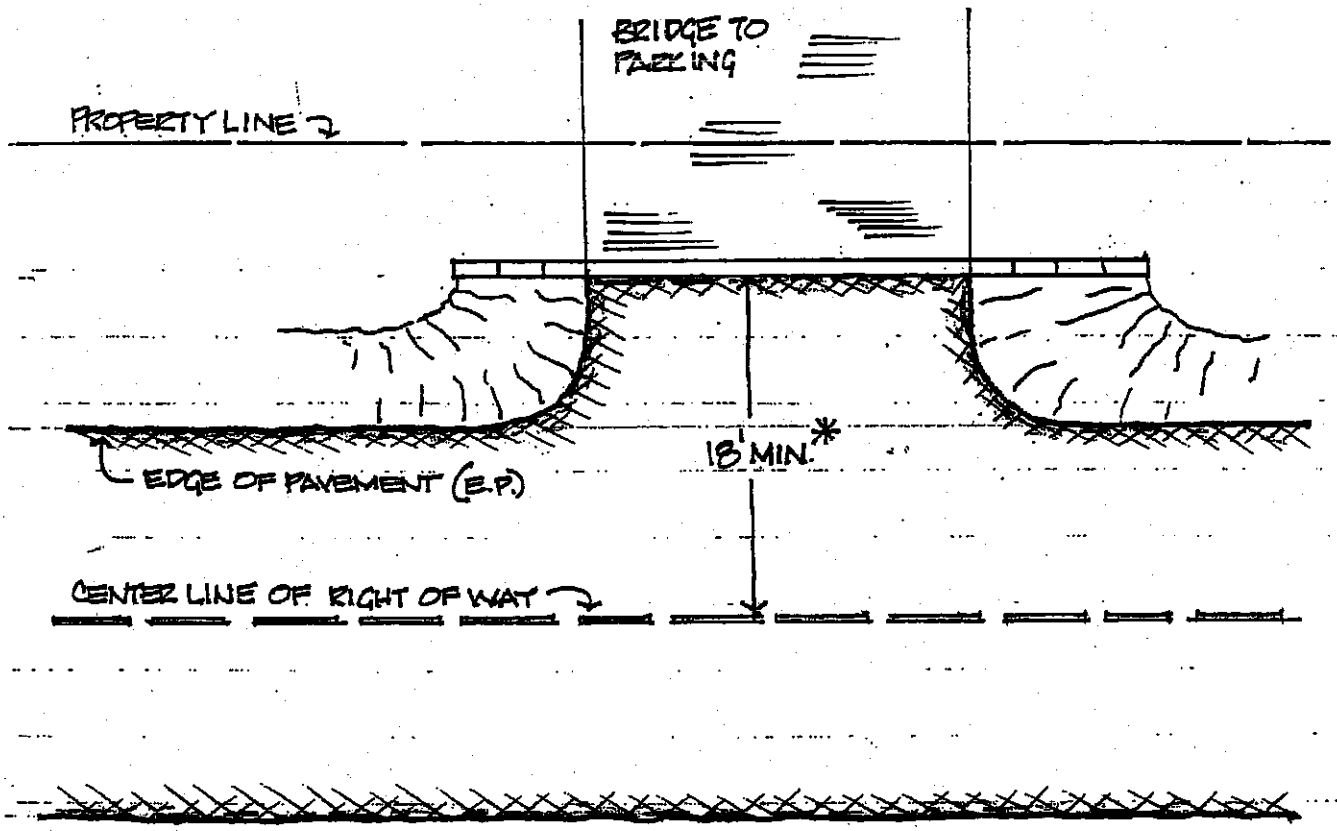
SECTION VIEW

SAN LUIS OBISPO COUNTY ENGINEERING DEPARTMENT
ENCROACHMENT PERMIT STANDARD DRAWING

B-2-3

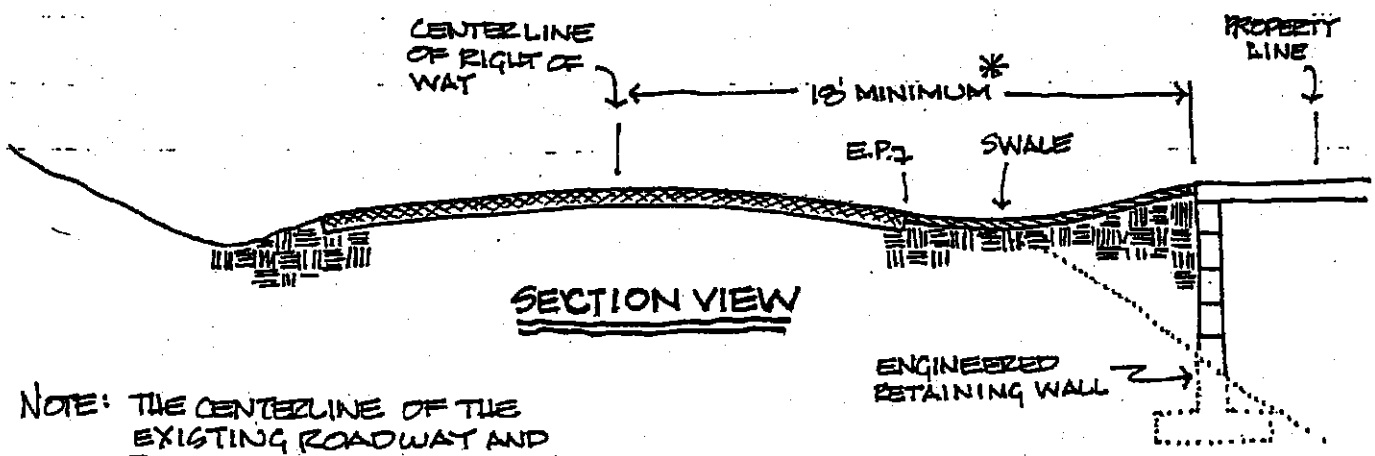
DWA WITH CULVERT

FOR XEROX ONLY - DO NOT ISSUE



PLAN VIEW

* NO RETAINING WALLS OR OTHER CONSTRUCTION IN THIS 18' AREA



SECTION VIEW

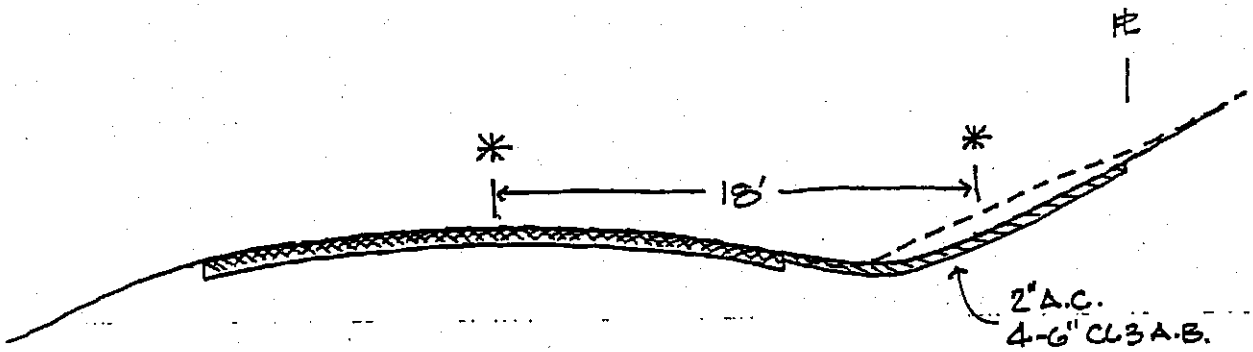
NOTE: THE CENTERLINE OF THE EXISTING ROADWAY AND THE TOP OF THE RETAINING WALL MUST BE THE SAME ELEVATION

SAN LUIS OBISPO COUNTY ENGINEERING DEPARTMENT
ENCROACHMENT PERMIT STANDARD DRAWING

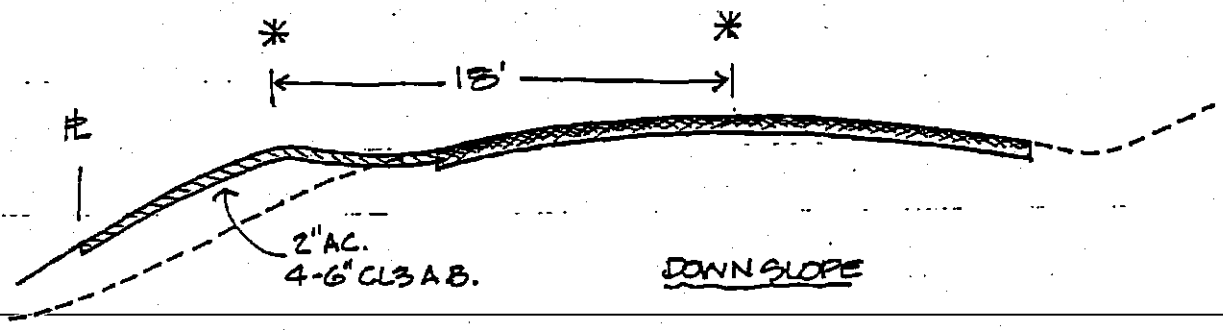
B-2-4

HILLSIDE LOT DWA W/STRUCTURE

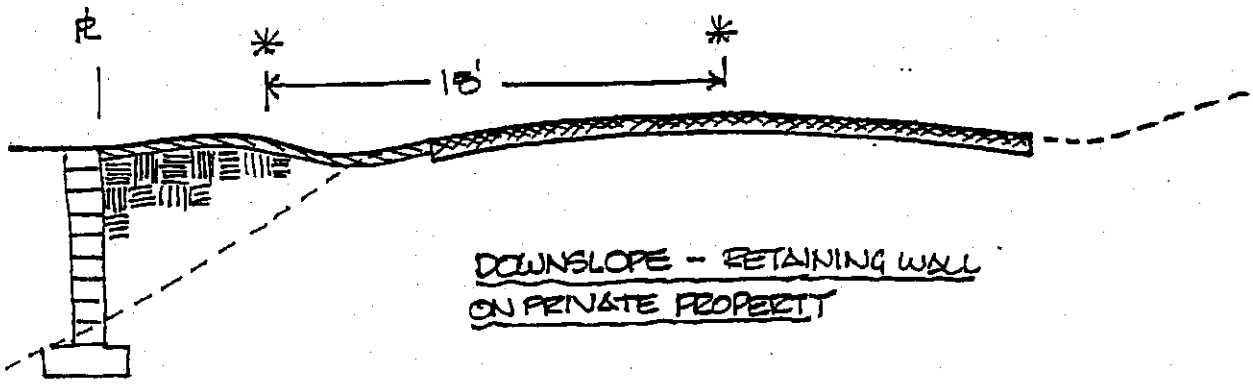
* MUST BE THE SAME ELEVATION



UP-SLOPE



DOWN SLOPE



DOWNSLOPE - RETAINING WALL
ON PRIVATE PROPERTY

SAN LUIS OBISPO COUNTY ENGINEERING DEPARTMENT
ENCROACHMENT PERMIT STANDARD DRAWING

B-2-5

HILLSIDE LOT · NO STRUCTURE

Revisions			
Description	By	Approved	Date

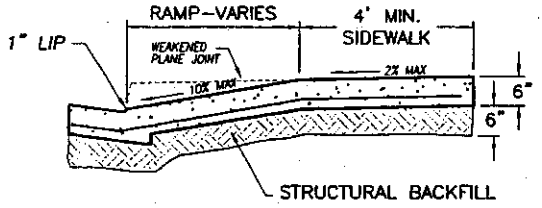
Approvals		
	By	Date
County Engineer	TPN	9-13-99
Recommended by Deputy Co. Eng.	[illegible]	9-15-99

RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL DRIVEWAYS

1. All residential, commercial, and industrial driveways not qualifying as High Volume driveways shall be designed as shown in B-3 SHT. 2 of 2.
2. x = 3 feet except for curb heights over 8 inches where 1:4 slopes shall be used on curb slope.
3. w = Driveway width. Residential: 10 feet min. and 20 feet max. Commercial and Industrial: 12 feet min. and 35 feet max.
4. The sidewalk cross slope shall not exceed ¼" per foot (2%). However if local conditions create an unreasonable hardship, as determined by the ADA coordinator, the cross slope shall be increased to a maximum of ½" per foot (4%) for distances not to exceed 20 feet.
5. Sidewalk and ramp thickness at driveway shall be 6".
6. Structural backfill shall be 6"(Section 19-306 of the State Standard Specifications)
7. The slope of the ramp is a straight grade from the top of the back of ramp to the top of the lip at the gutter.
8. The grade differential between the slope of the driveway and the cross slope of the roadway shall not exceed 15%.
9. Minimum sidewalk width for clear passage shall be 48". Where physical barriers (i.e. utility poles), natural barriers, or other existing conditions create an unreasonable hardship, as determined by the ADA Coordinator, the clear width may be reduced to 36".
10. Expansion joints and dowels shall be installed where indicated in B-3 SHT 2 of 2. Refer to B-5 for details on expansion joints and dowels.
11. Curing shall be by the Pigmented Curing Compound Method according to the provisions of section 90-7 of the State Standard Specification. Curing compound shall be the white pigment type.
12. Retaining curbs and acquisition of construction easement may be necessary.
13. The County Engineer may grant exceptions to these standards on an individual basis. The ADA Coordinator shall review all exceptions for recommendation to the County Engineer.

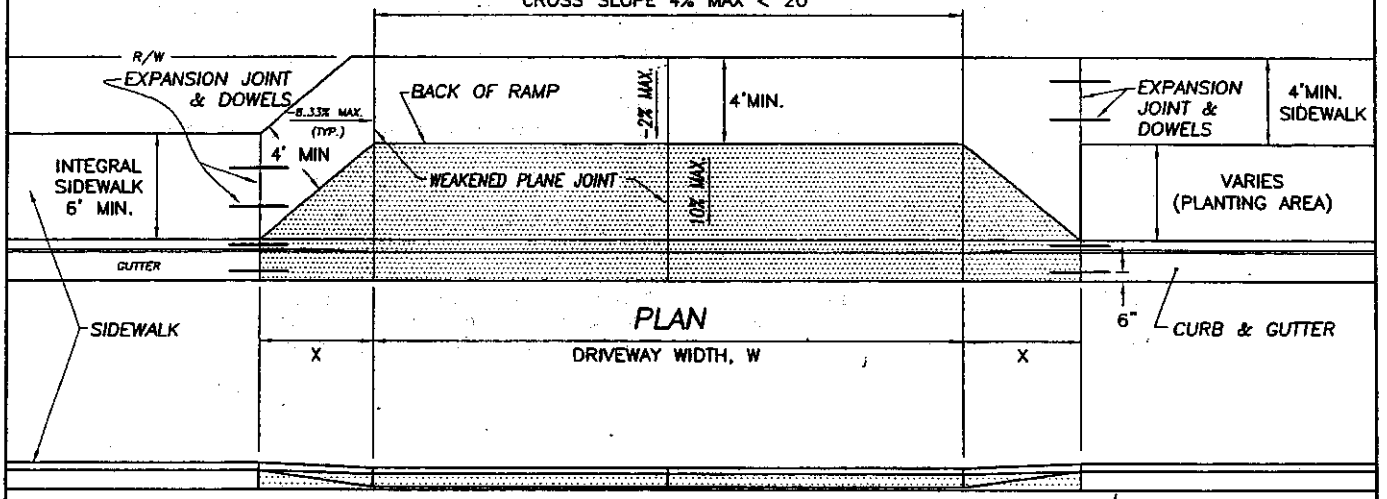
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL DRIVEWAYS	Drawing No. B-3 SHT. 1 OF 2
Drawn: 8/99 By: dr		

Revisions				Approvals		
Description	By	Approved	Date		By	Date
Integral sidewalk changed from 4' to 6'	AT	[illegible]	11/10/99	County Engineer	TPN	11/12/99
				Recommended by Deputy Co. Eng.	GS	11/12/99



SECTION

CROSS SLOPE 2% MAX > 20'
CROSS SLOPE 4% MAX < 20'

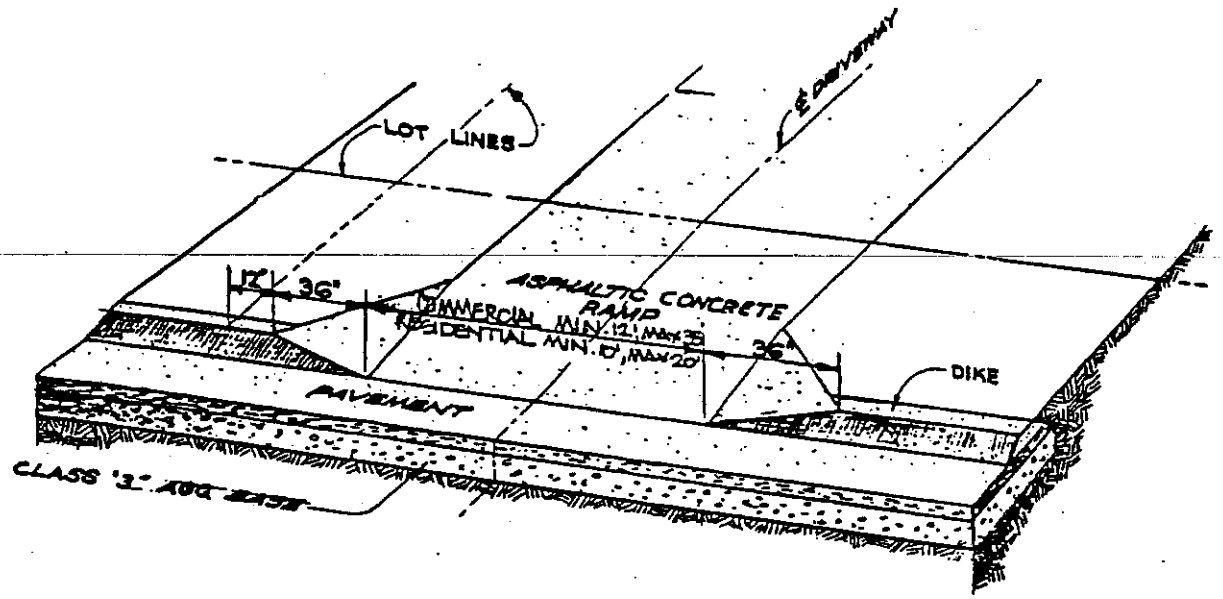


ELEVATION

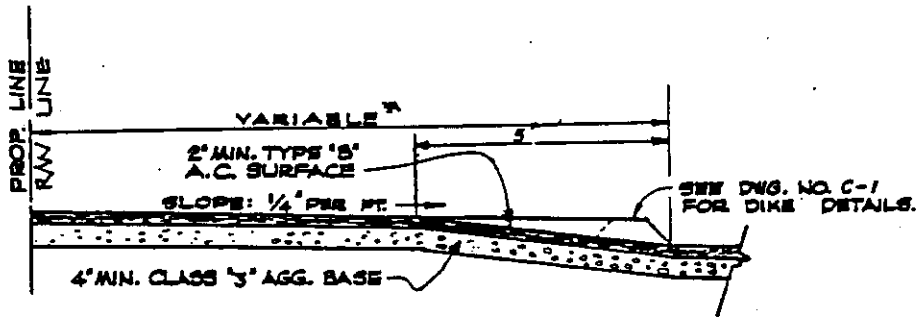
GUTTER GRADE

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	RESIDENTIAL , COMMERCIAL AND INDUSTRIAL DRIVEWAYS	Drawing No. B-3
Drawn: 8/99 By: DR		SHT. 2 OF 2

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	Richard Sullivan	5-62
				Engineering & Road Div'n.	J.R.M.	
					Bill Ray Tribble	5 1962



PERSPECTIVE VIEW
NO SCALE

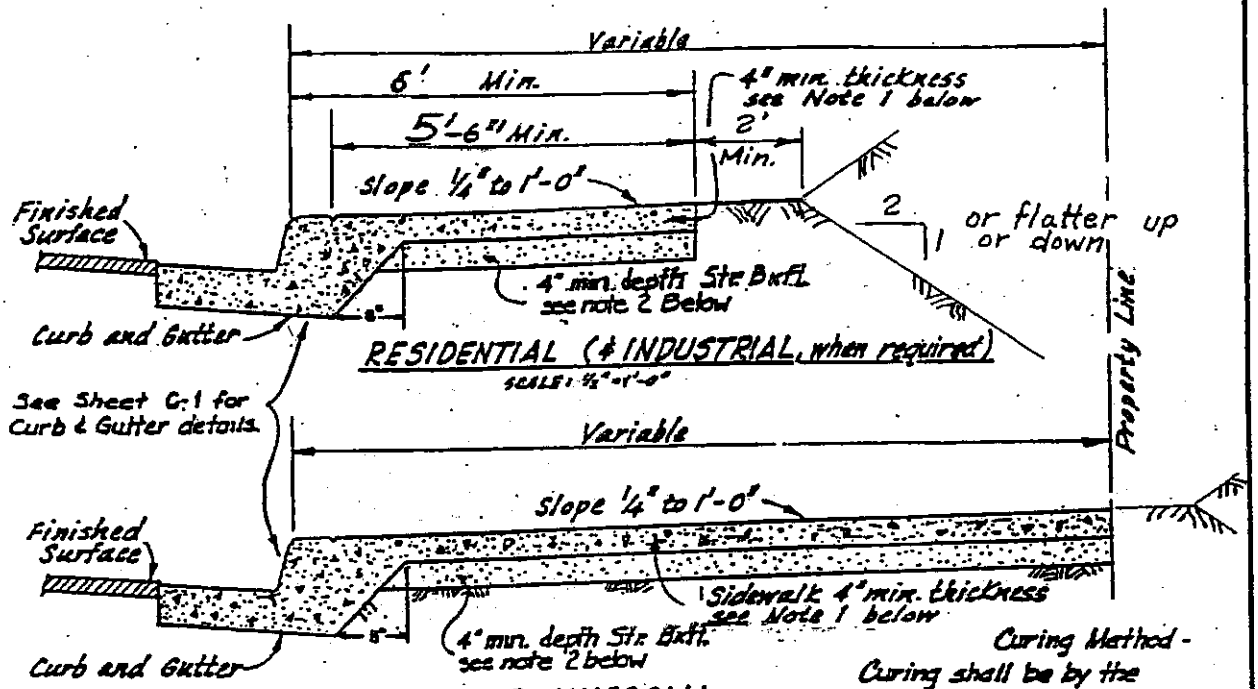


℄ SECTION
SCALE: 3/8" = 1'-0"

* PAVING MAY BE REQUIRED BEYOND THE R/W LINE IF NECESSARY TO CONTROL SILTING OF THE GUTTER.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NOTED ABOVE
	DRIVEWAYS (ASPHALT CONC.)	Drawing No. B-4
DRAWN JAN. 1962 BY: S.G.		

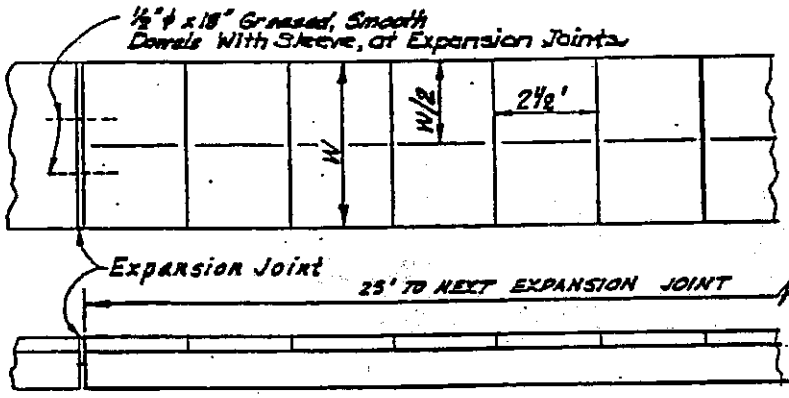
Revisions				Approvals		
Description	By	Approved	Date	Road Commissioner Surveyor	Richard S. Hugh	5-6-2
Add "With Sleeve" Note	S.B.	Done	9/17/62	Design Division	J.R.M.	
Dimension Table change	S.B.		1/22/64		Allan Ray Tuckett	5 1967
Delete "Asphaltic" ~~mastic~~ Add 25' dim.	Trans.					



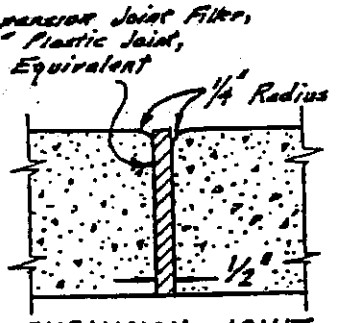
RESIDENTIAL (& INDUSTRIAL, when required)
SCALE: 1/2" = 1'-0"

COMMERCIAL
SCALE: 1/2" = 1'-0"

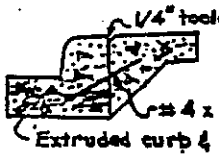
Curing Method -
Curing shall be by the Pigmented Curing Compound Method according to the provisions of Section 90-T of the State Standard Specifications. Curing Compound shall be the white pigment type.



SIDEWALK MARKING
NO SCALE



EXPANSION JOINT
SCALE: 3" = 1'-0"



OPTIONAL CURB-GUTTER & SIDEWALK JOINT

note: when extruded curb-gutter is used, extruding machine must be capable of placing a dense grade of concrete. Sidewalk portion must be placed not more than one hour after the curb-gutter has been placed, unless optional joint is used.

(5) Use Class "B" P.C.C.

Notes:

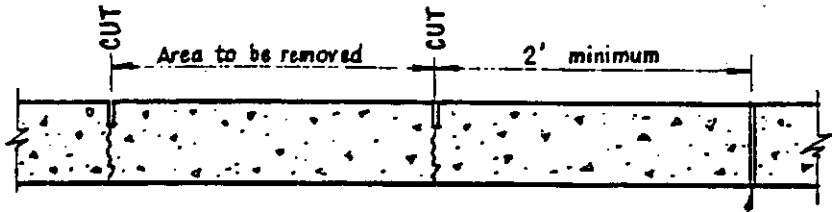
(1) Sidewalk thickness to be not less than 4" and to be 6" at Driveway Approaches.

(2) Structure Backfill shall conform to the provisions of Section 19-3.06 of the State Standard Specifications

(4) Expansion joints shall be placed at 25' intervals and at ends of all curb returns, each side of driveway depressions and each end of the gutter transitions adjacent to storm drain inlets. The intervals between expansion joints shall vary to allow matching of joints in adj. existing improvements

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: as noted above
	SIDEWALKS	Drawing No. B-5

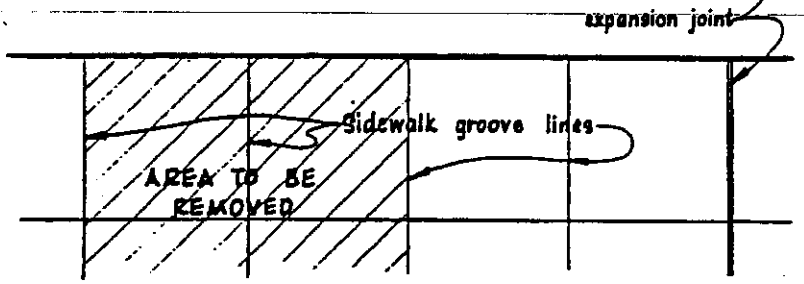
Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	Richard Sadlgh	5-62
				Engineering & Road Div'n.	J.R.M.	
					Delbert Kuhl	5 1967



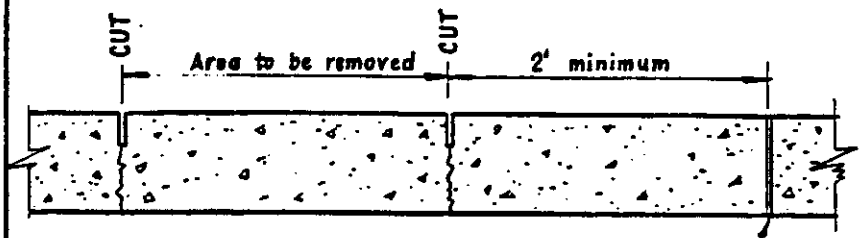
SIDEWALK SECTION

NOTES

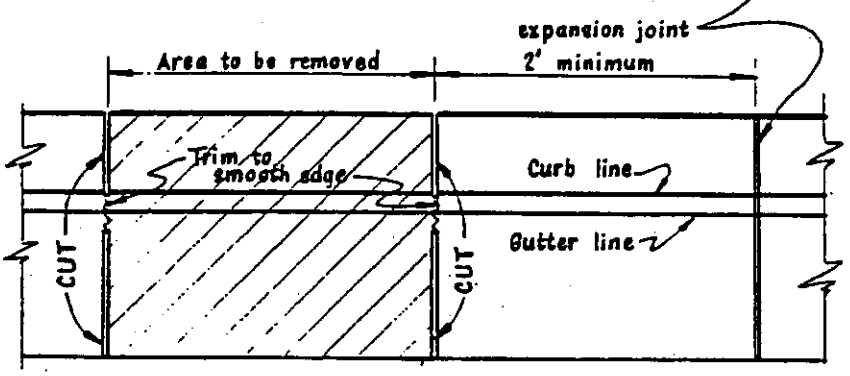
Complete section of curb shall be removed.



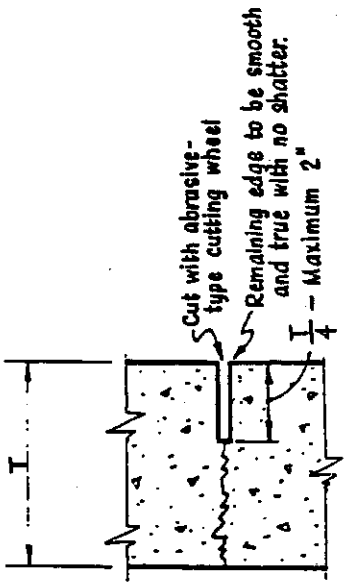
SIDEWALK PLAN



PAVEMENT SECTION



CURB PLAN



SECTION
Showing Cut

56

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	CUTTING CONCRETE	Drawing No. B-6
DRWN. DEC. 1961 BY: S.G.		

Revisions				Approvals		
Description	By	Approved	Date		By	Date
				County Engineer	TPN	9-15-99
				Recommended by Deputy Co. Eng.	G. Prudom	9-15-99

CURB RAMPS

1. New sidewalks or paths shall have a curb ramp or a sloped area wherever they intersect streets, roads, or highways.
2. All curb ramps for new construction shall conform to the latest revision of Caltrans' Standard Plan A88. (English version attached)
3. All notes on Standard Plan A88 not revised below are applicable.

* Note 6: Flush transitions from ramps to walks, gutters, or streets are strongly recommended. However, a 1/2 inch lip beveled at a 45-degree angle is permitted, but requires review by the ADA Coordinator.

* Note 8: Grooving along the top and sides of the ramp should be placed on the level surface of the sidewalk.

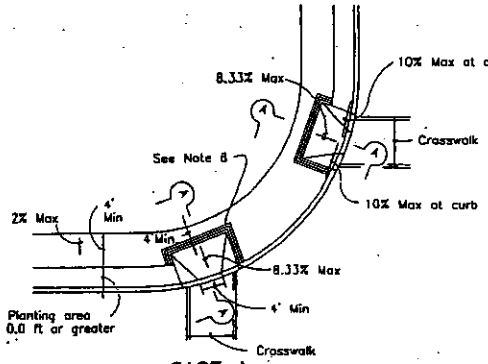
* Note 9: Curb ramp slopes should be constructed between 6.67% and 8.33% to avoid installing truncated domes. Curb ramp slopes less than 6.67% require review by the ADA Coordinator.

* Note 10: All ramp surfaces shall have a medium-broom finish.

4. Curing shall be by the Pigmented Curing Compound Method according to the provisions of section 90-7 of the State Standard Specification. Curing compound shall be the white pigment type.
5. The County Engineer may grant exceptions to these standards on an individual basis. The ADA Coordinator shall review all exceptions for recommendation to the County Engineer.

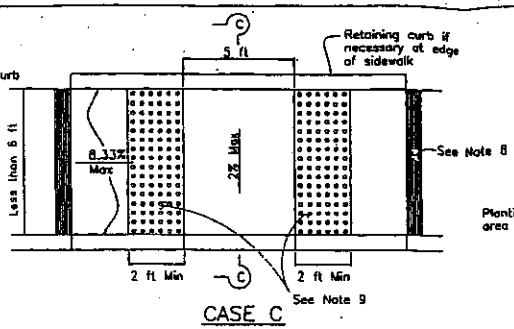
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	CURB RAMPS	Drawing No.
Drawn: 8/99 By: dr		B-7

Revisions					Approvals		
Description	By	Approved	Date			By	Date
					County Engineer		
					Recommended by County Co. Eng.		



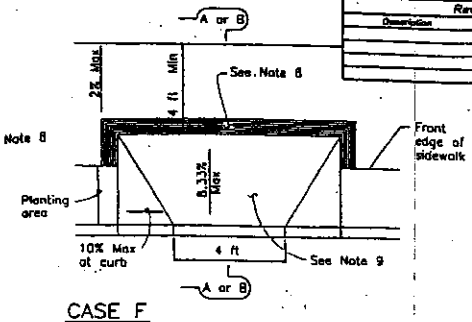
CASE A

See Note 9



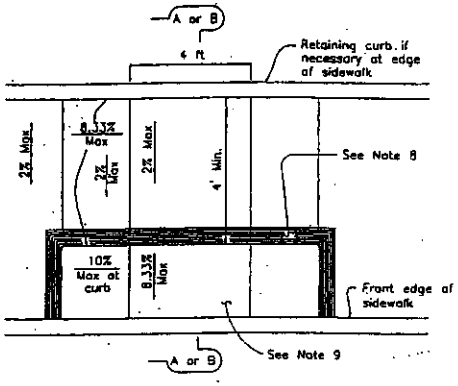
CASE C

Use when sidewalk is less than 6 ft wide

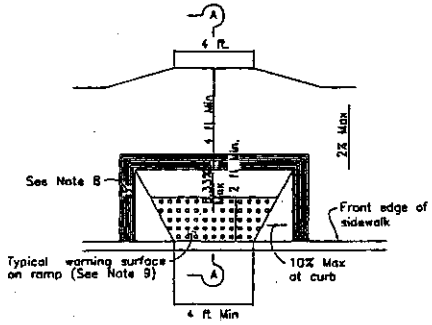


CASE F

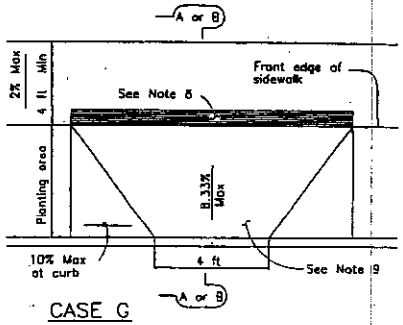
See Note 4



CASE B

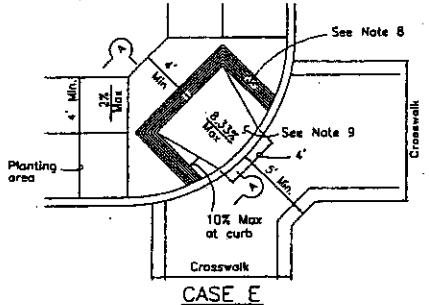


CASE D

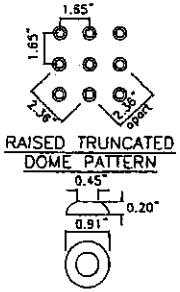


CASE G

See Note 4



CASE E

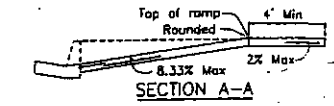


RAISED TRUNCATED DOME PATTERN

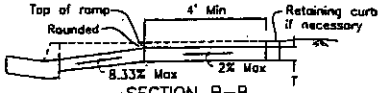
RAISED TRUNCATED DOME

DETECTABLE WARNING SURFACE

See Note 9

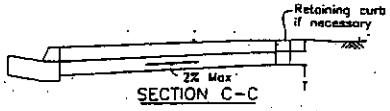


SECTION A–A

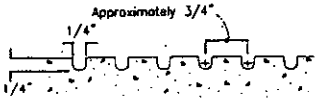


SECTION B–B

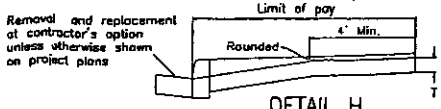
Depress entire sidewalk as required



SECTION C–C



GROOVING DETAIL



DETAIL H

Existing curb and sidewalk

NOTES

1. If distance from curb to back of sidewalk is too short to accommodate ramp and 4 ft. platform as in Case A, the sidewalk may be depressed longitudinally as in Case B or C or may be widened as in Case D.
2. If sidewalk is less than 6' wide, the full width of the sidewalk shall be depressed as shown in Case C.
3. When ramp is located in center of curb return, crosswalk configuration must be similar to that shown for Case E to accommodate wheelchairs.
4. For Cases F and G, the longitudinal portion of the sidewalk may need to be depressed as shown in Case B.
5. If located on a curve the sides of the ramp need not be parallel, but the minimum width of the ramp shall be 4 ft.
6. Transitions from ramps to walks, gutters, or streets shall be flush and free of abrupt changes.
7. Sidewalk and ramp thickness, "T", shall be 3 1/2" minimum.
8. The ramp shall have a 12" wide border with 1/4" grooves approximately 3/4" on center. See grooving detail.
9. Curb ramps that have a ramp slope flatter than 6.67% shall have a detectable warning surface that extends the full width of the ramp and 2 ft. minimum length, similar to that shown on Case D. Detectable warning surfaces, at the option of the Contractor, shall be constructed by cast-in-place or stamped method, or consist of a prefabricated surface. The prefabricated surface shall conform to the requirements in the special provisions.
10. When detectable warning surface is not required on a curb ramp, the concrete finish of the ramp and its flared sides shall have a transverse broomed surface texture rougher than the surrounding sidewalk.
11. Ramp side slope varies uniformly from a maximum of 10% at curb to conform with longitudinal sidewalk slope adjacent to top of the ramp, except in Case C.
12. Utility pull boxes, manholes, vaults and all other utility facilities within the boundaries of the curb ramp will be relocated or adjusted to grade by the owner prior to, or in conjunction with, curb ramp construction.
13. Maximum slopes of adjoining gutters, the road surface immediately adjacent to the curb ramp and continuous passage to the curb ramp shall not exceed 5 percent within 4 ft. of the top or bottom of the curb ramp.
14. Design details approved by the Division of the State Architect on March 18, 1996.

COUNTY OF SAN LUIS OBISPO
ENGINEERING DEPARTMENT

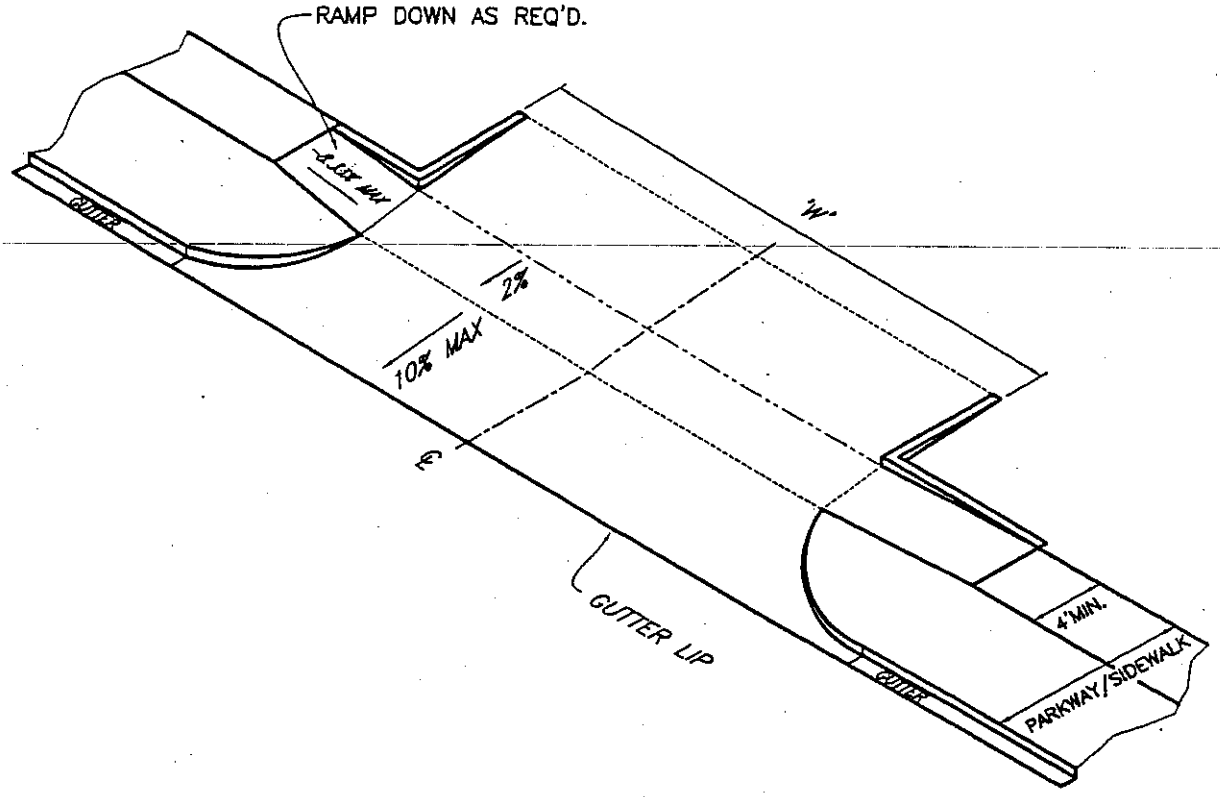
CURB RAMP DETAILS

NO SCALE

STD. PLAN A88

A88

Revisions				Approvals		
Description	By	Approved	Date		By	Date
				County Engineer	TPN	9-15-99
				Recommended by Deputy Co. Eng.	[illegible]	9-15-99



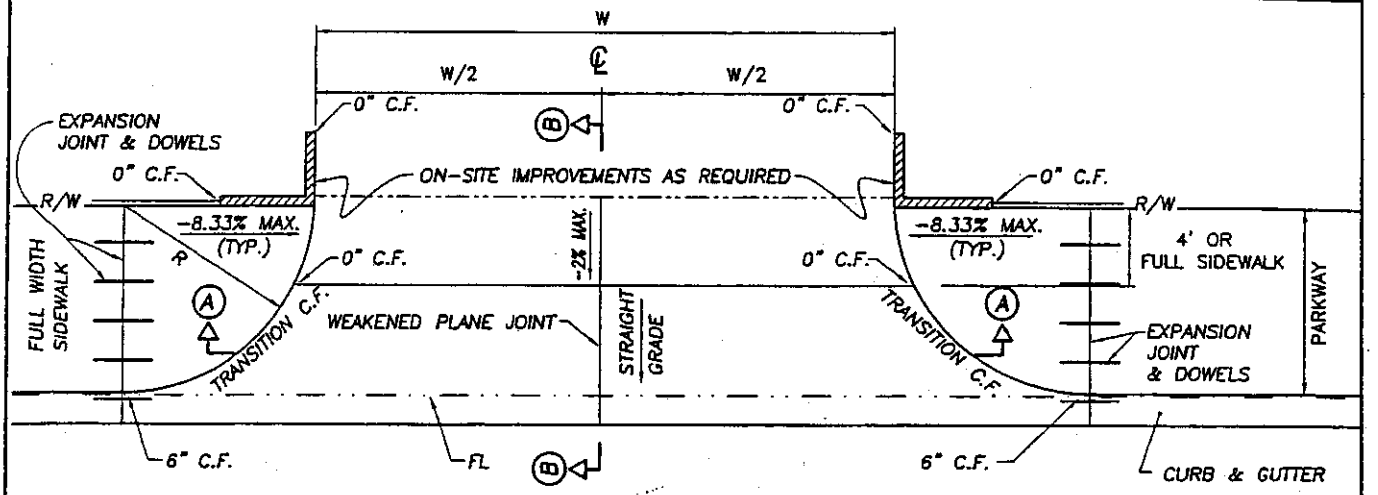
SPECIFICATION FOR LOCATION OF DRIVEWAYS:

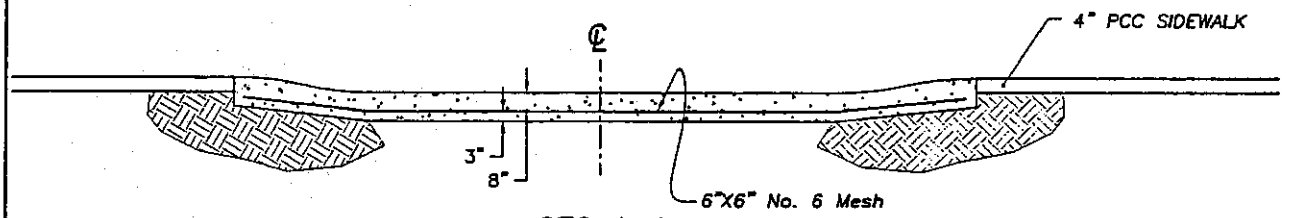
1. THE HIGH VOLUME DRIVEWAY STANDARD SHALL BE USED AT ENTRANCES TO COMMERCIAL, RESIDENTIAL, OR INDUSTRIAL DRIVEWAYS THAT EXCEED 200 VEHICLES PER PM PEAK HOUR AND EXIT ONTO AN ARTERIAL ROAD. THE COUNTY ENGINEERING DEPT. RESERVES THE RIGHT TO REQUIRE THE USE OF A HIGH VOLUME DRIVEWAY IN OTHER LOCATIONS BASED ON EXTENUATING CONDITIONS. (e.g. a high percentage of trucks.)
2. 'W'=27' MINIMUM TO 45' MAXIMUM WIDTH
3. THE SAME PARCEL SHALL HAVE 24 FT. MINIMUM OF FULL HEIGHT CURB BETWEEN DRIVEWAYS.
4. ALL PLANNED DRIVEWAY OPENINGS SHALL BE SUBMITTED TO THE COUNTY ENGINEERING DEPARTMENT FOR REVIEW AND APPROVAL. THE NUMBER OF DRIVEWAY OPENINGS SHALL BE NO MORE THAN ARE NEEDED TO ADEQUATELY SERVE THE PARCEL.
5. THE COUNTY ENGINEER MAY GRANT EXCEPTIONS TO THESE STANDARDS ON AN INDIVIDUAL BASIS. THE A.D.A. COORDINATOR SHALL REVIEW ALL EXCEPTIONS FOR RECOMMENDATION TO THE COUNTY ENGINEER.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	HIGH VOLUME DRIVEWAY	Drawing No. B-8
Drawn: 8/99 By: DR		SHT. 1 OF 3

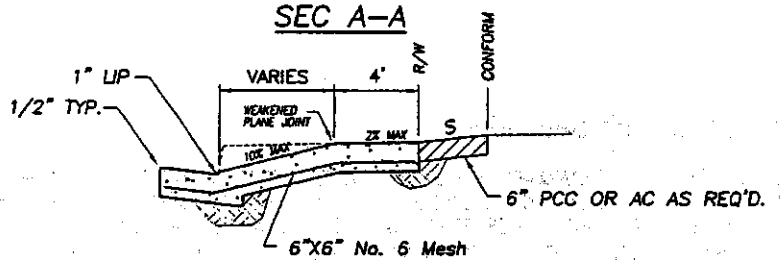
Revisions			
Description	By	Approved	Date

Approvals		
	By	Date
County Engineer	TPN	9-15-99
Recommended by Deputy Co. Eng.	[illegible]	9-15-99





SEC A–A



SEC B–B

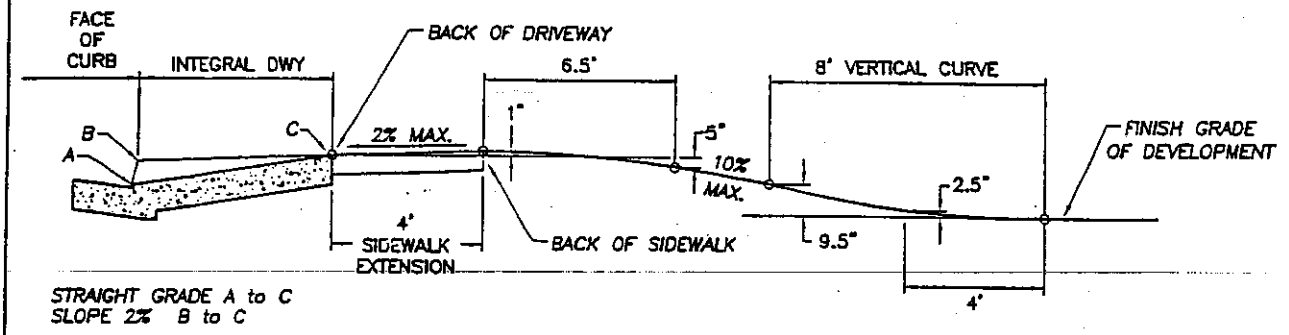
GENERAL NOTES:

1. DIMENSIONS 'W' & 'R' AND PARKWAY WIDTH SHALL BE SHOWN ON PLANS.
2. 'R' EQUALS PARKWAY WIDTH BUT SHALL NOT BE LESS THAN 10 FEET.
3. SLOPE 'S', ON-SITE SHALL VARY DEPENDING ON EXISTING CONDITIONS, SEE DWG. 3.
4. A COURSE BROOM FINISH TRANSVERSE TO THE LINE OF TRAFFIC SHALL BE USED ON THE APPROACH OTHER THAN THE CURB & GUTTER AREA. THE CURB & GUTTER AREA SHALL HAVE A LIGHT BROOM FINISH PARALLEL TO THE LINE OF TRAFFIC.
5. A CHANNELIZED CONCRETE PEDESTRIAN PATH WITH A MEDIUM BROOM FINISH SHALL BE PROVIDED ACROSS THE DRIVEWAY. THE PEDESTRIAN PATH CROSS SLOPE SHALL NOT EXCEED 1/4" PER FOOT (2%).
6. EXPANSION JOINTS AND DOWELS SHALL BE INSTALLED WHERE INDICATED IN B-3 SHT 2 OF 2. REFER TO B-5 FOR DETAILS ON EXPANSION JOINTS AND DOWELS.
7. CURING SHALL BE BY THE PIGMENTED CURING COMPOUND METHOD ACCORDING TO THE PROVISIONS OF SECTION 90-7 OF THE STATE STANDARD SPECIFICATION. CURING COMPOUND SHALL BE THE WHITE PIGMENT TYPE.

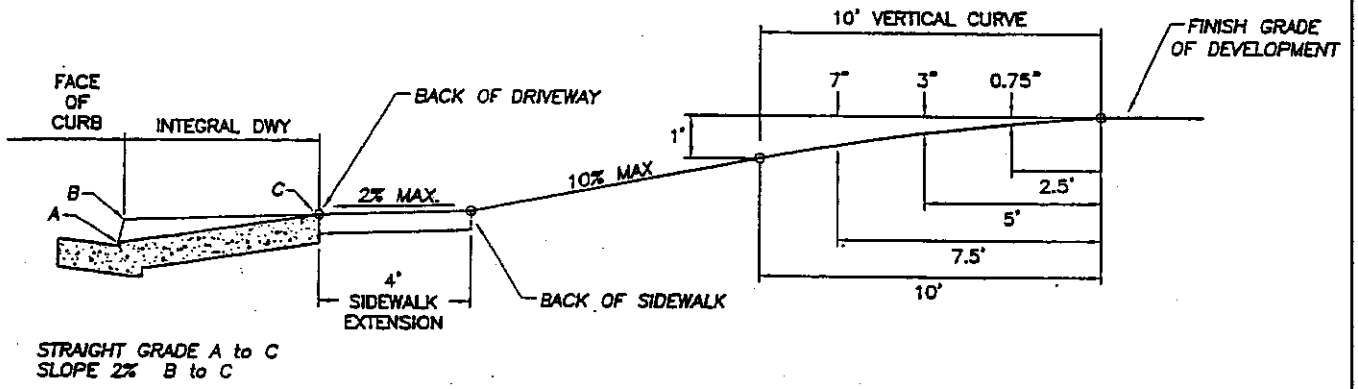
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	HIGH VOLUME DRIVEWAY	Drawing No. B-8
Drawn: 8/99 By: DR		SHT. 2 OF 3

Revisions			
Description	By	Approved	Date

Approvals		
	By	Date
County Engineer	TPN	9-15-99
Recommended by Deputy Co. Eng.	[illegible]	9-15-99



DOWNWARD DRIVEWAY



UPWARD DRIVEWAY

GENERAL NOTES:

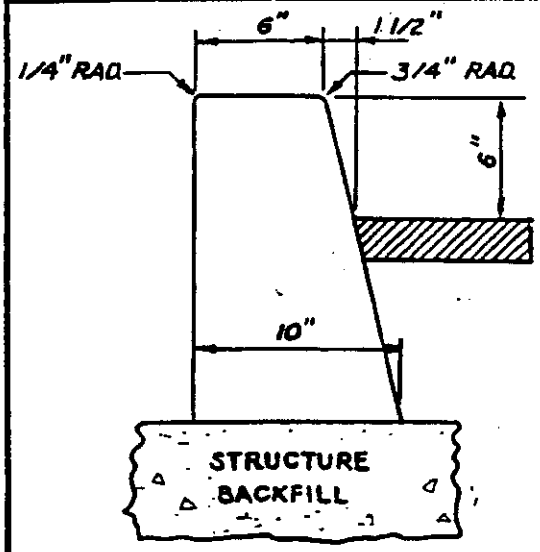
A. TEN PERCENT (10%) MAXIMUM GRADE FOR COMMERCIAL AND INDUSTRIAL USES. GRADE MAY BE INCREASED TO 15% WITH SPECIAL CONSTRUCTION TECHNIQUES IF APPROVED BY THE COUNTY ENGINEER.

B. MAXIMUM RISE AND DESCENT, AND THE RUN, SHALL BE MEASURED FOR THE WORST CONDITION BETWEEN THE BACK OF SIDEWALK EXTENSION AND THE FINISHED GRADE OF THE DEVELOPMENT.

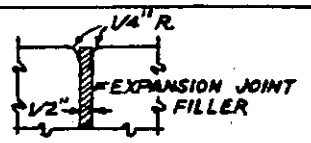
C. SIDEWALK EXTENSION CROSS-SLOPE MAY NOT EXCEED 2% AND MUST SLOPE TOWARDS THE STREET.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	HIGH VOLUME DRIVEWAY	Drawing No. B-8
Drawn: 8/99 By: DR		SHT. 3 OF 3

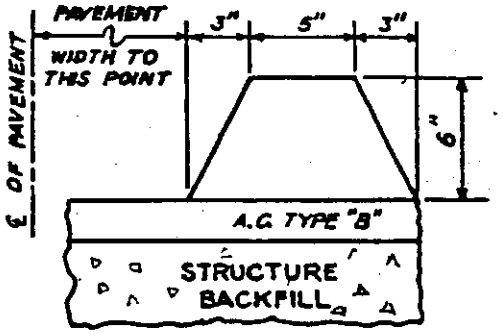
Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75



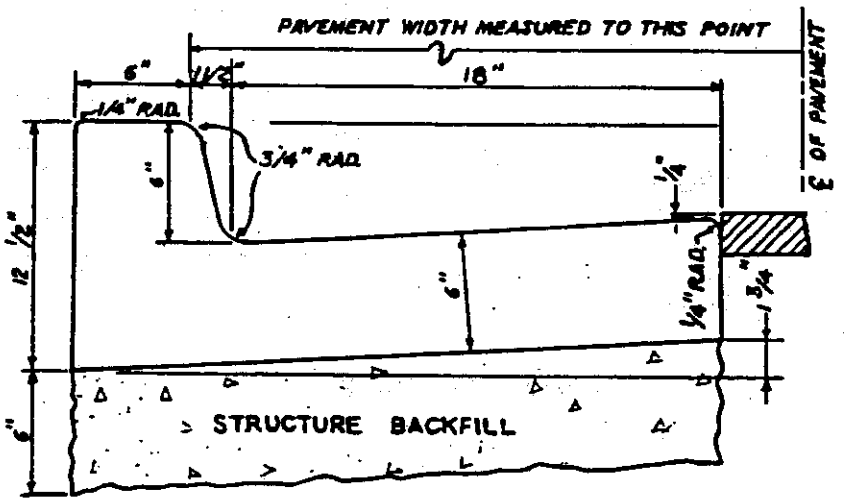
TYPE C



EXPANSION JOINT



AC DIKE



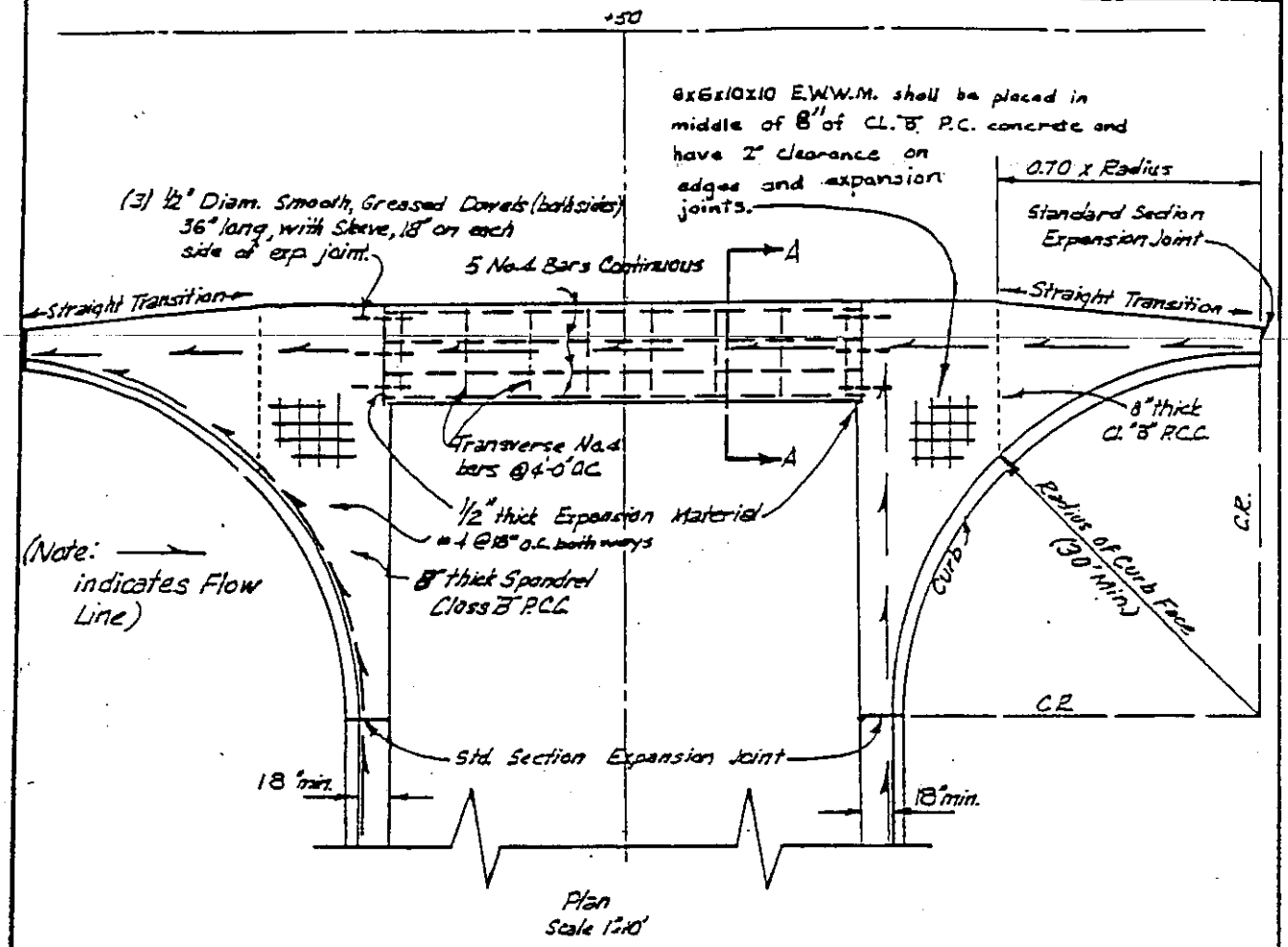
TYPE A

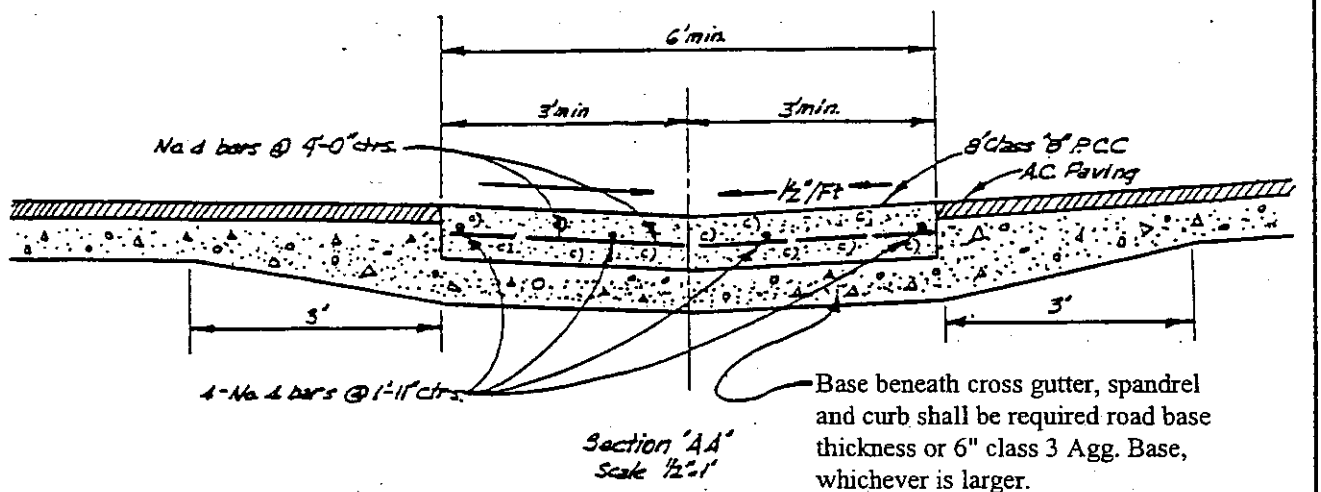
NOTE: (1.) TYPE A AND C CURB TO BE CLASS 'B' P.C.C.
(2.) A.C. DIKE TO BE TYPE 'B'.
(3.) STR. BKFL. Sect. 19-3.06 State Std. Specs.

Curing Method –
Curing shall be by the Pigmented Curing Compound Method according to the provisions of Section 90-7 of the State Standard Specifications. Curing Compound shall be the white pigment type.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: 1" = 8"
	CURBS	Drawing No. C-1
Drawn: R.P.L. Date: 6-24-70		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/28/75





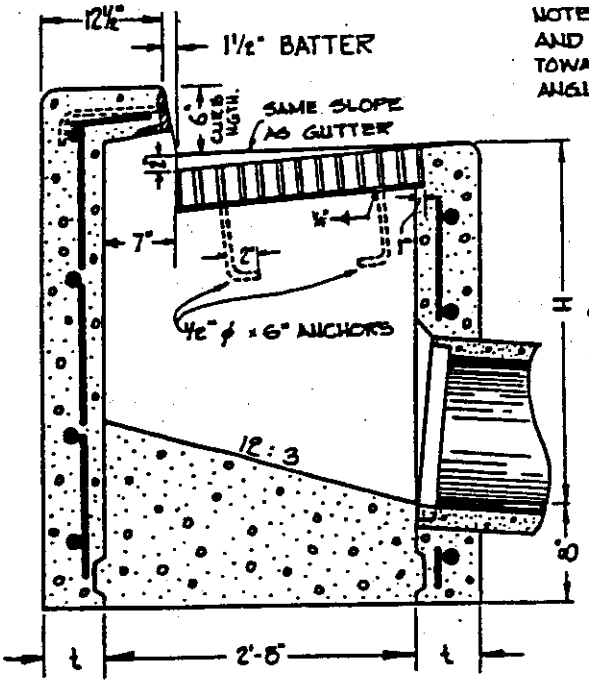
Curb returns, spandrels and cross gutters shall be Cl. "B" P.C.C.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: As Noted
		Drawing No.
Drawn. Date:	CONCRETE CROSS GUTTER	C-2

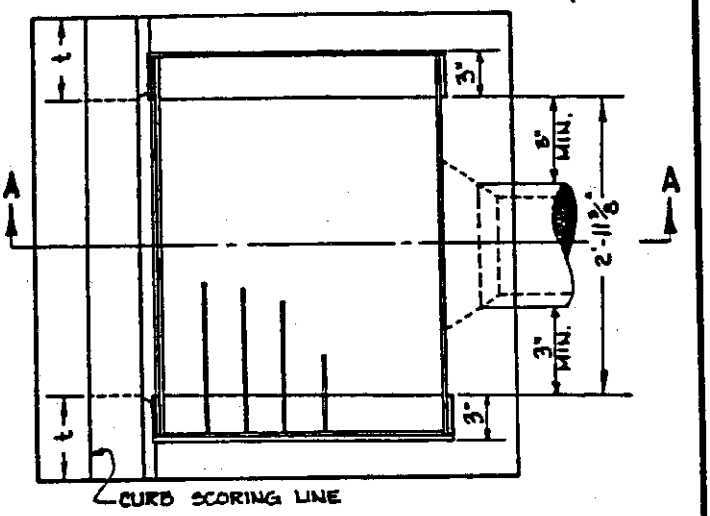
Revisions

Description	By	Approved	Date			
				County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75

NOTE: REINFORCING STEEL SHALL BE NO. 4 BARS AT 18" O.C. PLACED 1½" CLEAR TO INSIDE OF BOX UNLESS OTHERWISE NOTED. BASIN FLOORS SHALL HAVE WOOD FLOAT FINISH AND A MINIMUM SLOPE OF 12:3 FROM ALL DIRECTIONS TOWARDS OUTLET PIPE. USE CLASS "A" P.C.C. FACE ANGLE TO EXTEND FULL WIDTH OF BOX.



SECTION A-A

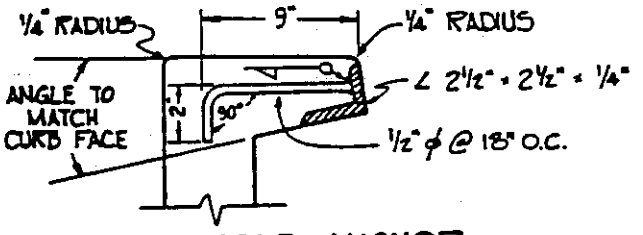


PLAN

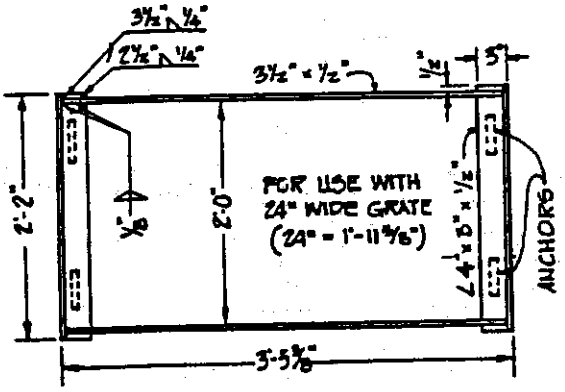
SEE SHEET C-6 FOR GRATE DETAIL

H	t
8'-0" OR LESS	6"
8'-1" TO 20'-0"	8"

HEIGHT TABLE

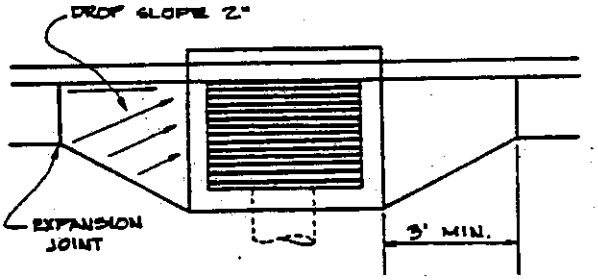


FACE ANGLE ANCHOR



TYPICAL FRAME

NOTE: FRAME SHALL BE DIPPED OR PAINTED IN COMMERCIAL QUALITY ASPHALTUM PAINT.

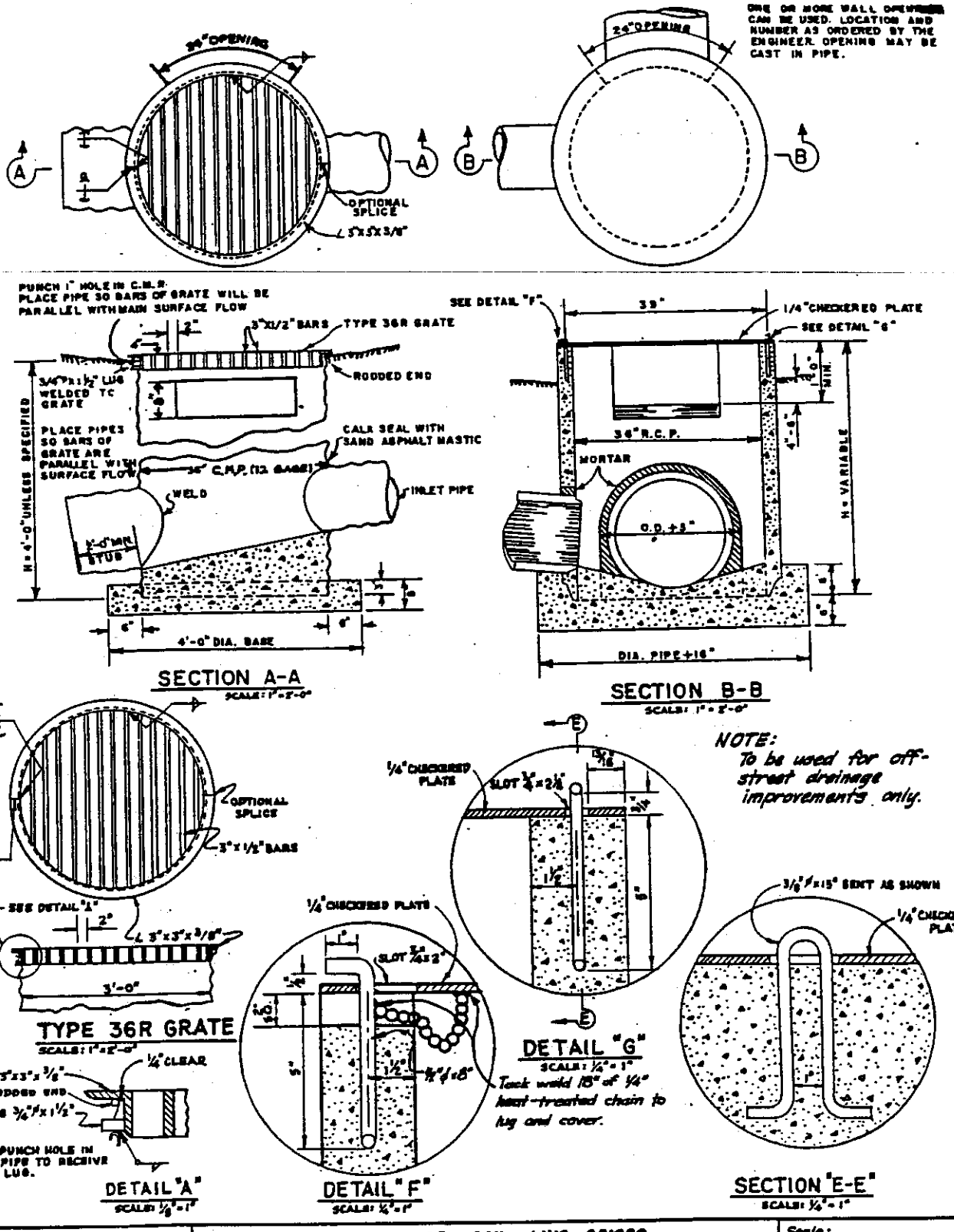


WING TRANSITION PLAN

NOTE: PIPES THAT ARE UNABLE TO ATTAIN 3" MIN. CLEARENCE FROM INSIDE BOX WALLS WILL REQUIRE A DESIGN APPROVED BY THE COUNTY ENGR.

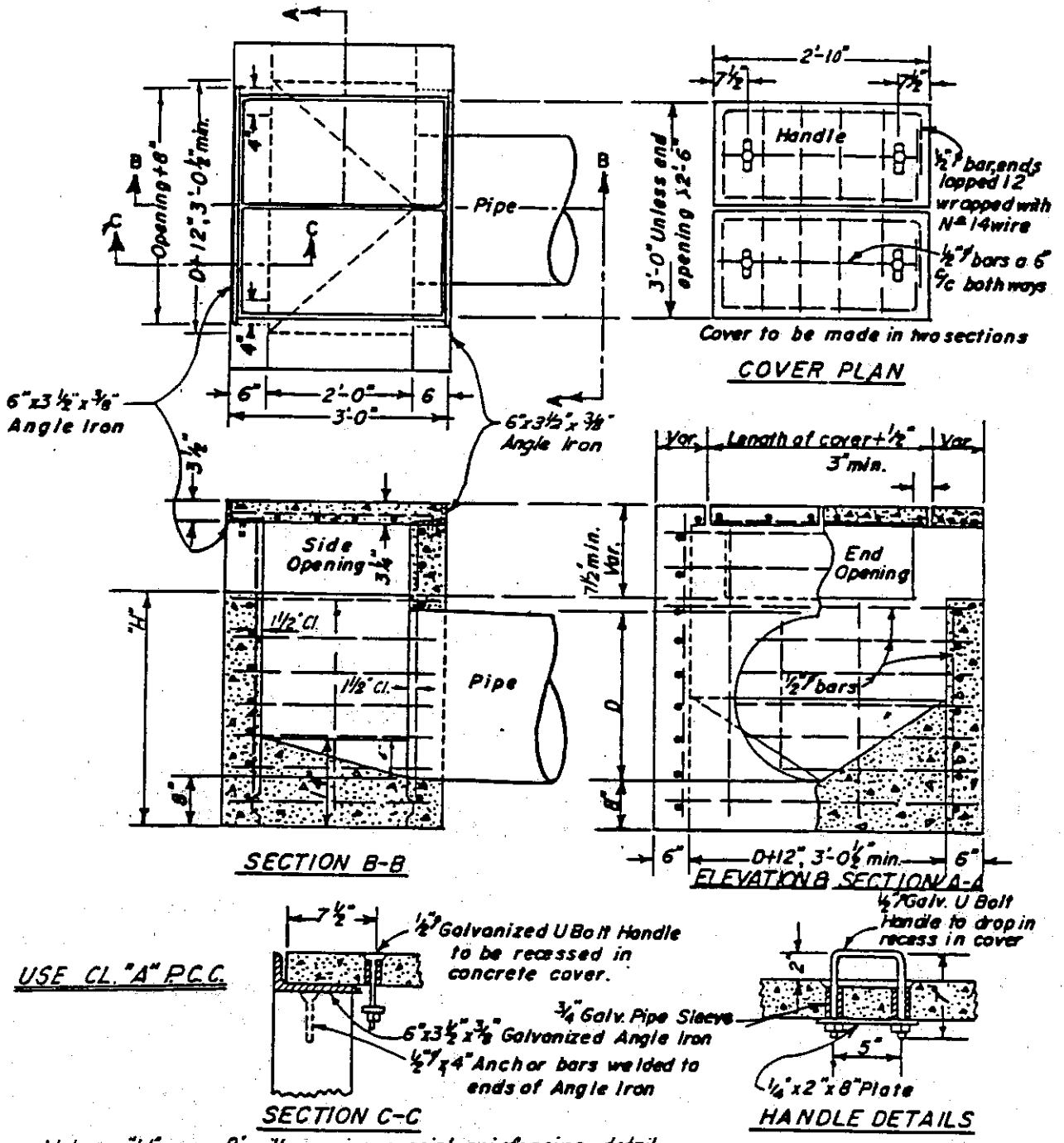
SPECIFICATION REF.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	SCALE: NONE
	STORM DRAIN INLET	DRAWING NO. C-3
DRWN: FEB. 1974	BY: C. HOWE	

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	Richard Gallagher	5-6-62
				Engineering & Road Div'n.	J.R.M.	
					Neil Guy Kimball	5 1962



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: As Noted
	DROP INLET & JUNCTION BOX	Drawing No. C-4
DRAWN: DEC. 1961 BY: S.G.		

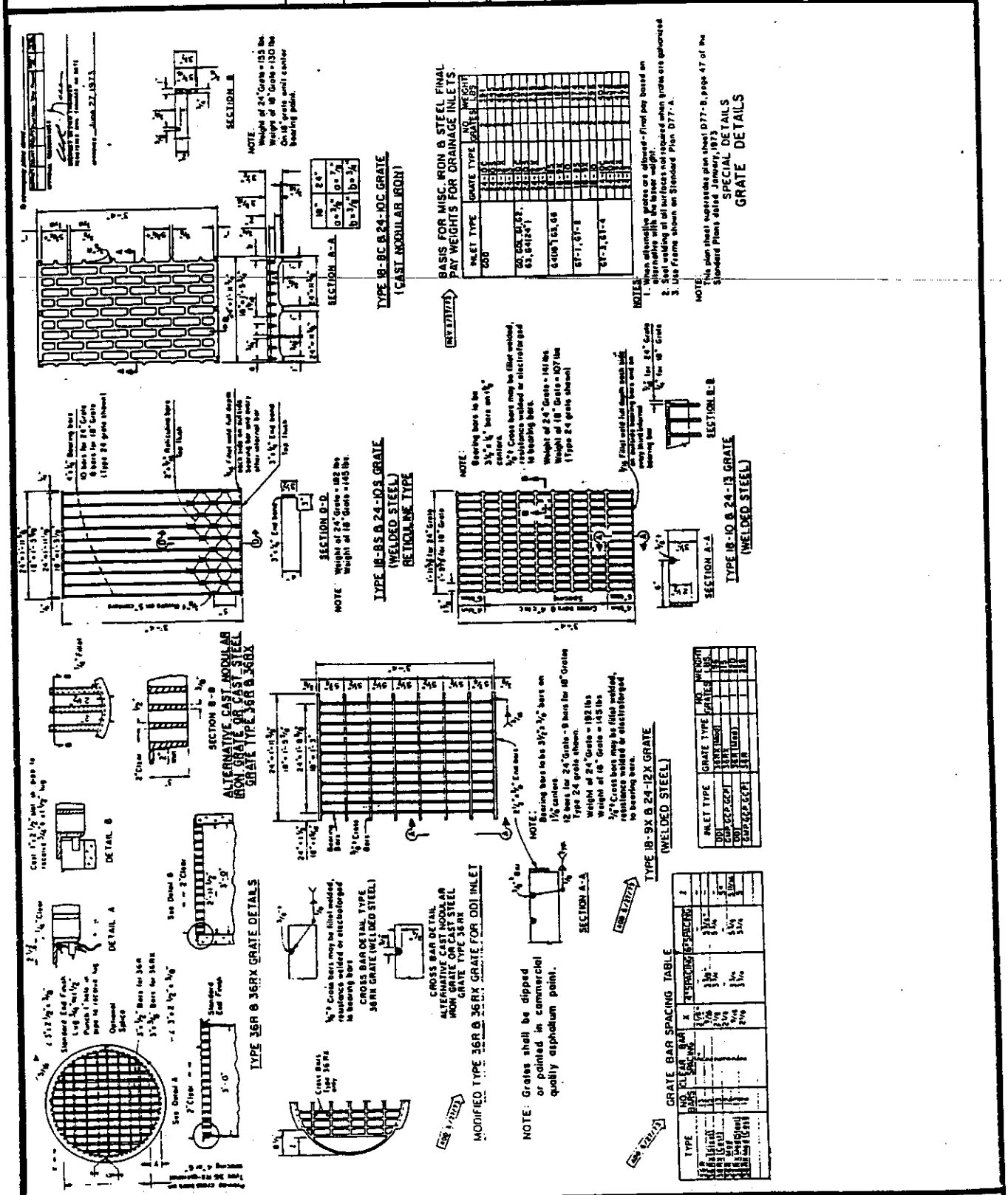
Revisions				Approvals		
Description	By	Approved	Date	Road Commissioner-Surveyor	[illegible]	5-62
"H" over 8' Note, "Rein. steel" Note				Design Division	J.R.M.	
"Angle Iron", "1½" Cl", "7½" min" dimen.	J.t.n.m.				[illegible]	5-1-62



Note: "H" over 8' will require special reinforcing detail.
Box to be used for drainage improvements within right-of-way or for off-street drainage improvements.
Reinforcing steel shall be No. 4 bars at 12" ctrs placed 1½" clr to inside of box unless otherwise noted.

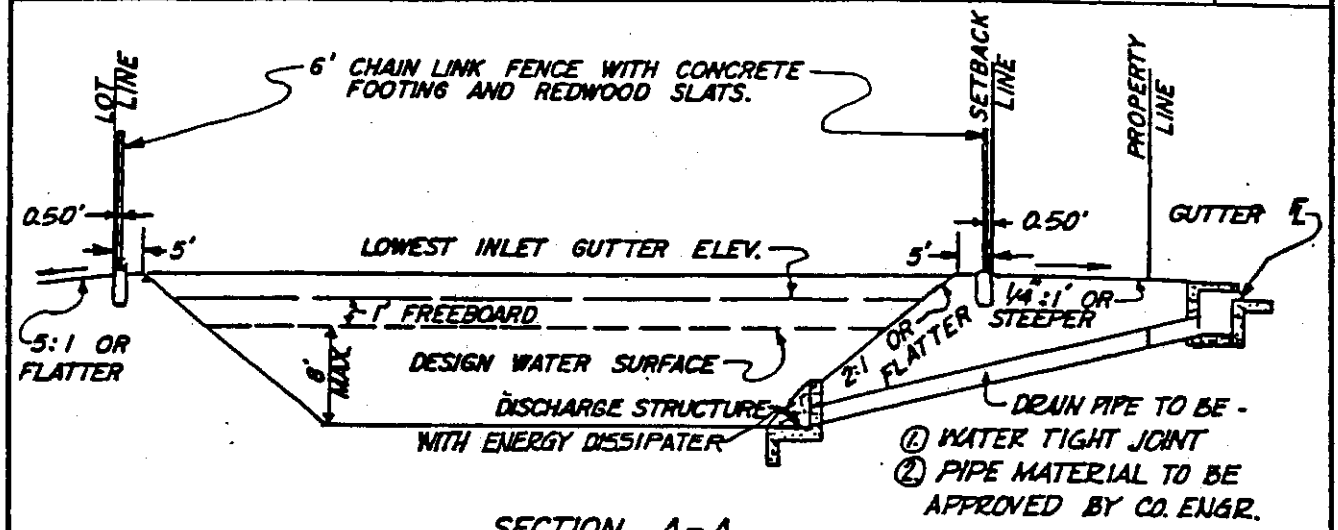
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: None
	CONCRETE JUNCTION BOX	Drawing No. C-5
DWN: APR. 1962 BY: G.G.		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		2-3-76
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75

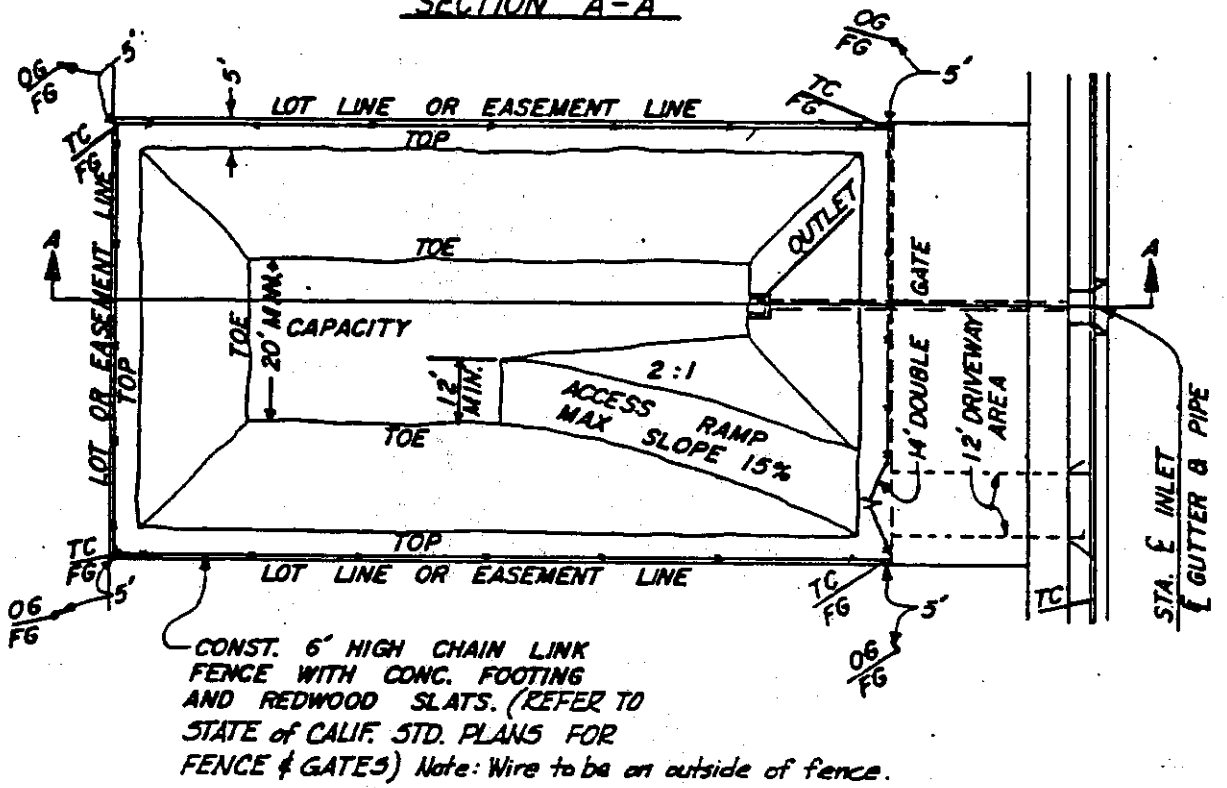


SPECIFICATION REF.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	SCALE: NONE
		DRAWING NO.:
DRAWN: APR. 74 BY: C. HOWE	GRATE DETAILS	C-6

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/28/75



SECTION A-A



LEGEND: TC - TOP OF CURB
FG - FINISH GRADE
OG - ORIGINAL GRADE

NOTE: VARIATIONS TO THE DIMENSIONS AND DESIGN MUST BE APPROVED BY THE COUNTY ENGINEER.

ADDITIONAL REQUIREMENTS MAY BE IMPOSED AS PART OF THE CONDITIONAL USE PERMIT.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	BASIN DETAIL	Drawing No. D-1
Drawn: G.B.H. Date: NOV. 72		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by Deputy Co. Eng.	[illegible]	8/28/75

TABLE OF COEFFICIENT RUNOFF CHART

	TYPE OF DEVELOPMENT	TYPE OF SOIL**	COEFFICIENT OF RUNOFF FOR* SLOPE <2%	2% to 10%	>10%
URBAN	20,000 sq. ft.	C	.35	.40	.45
		S	.25	.35	.40
	10,000 sq. ft.	C	.40	.45	.55
	"	S	.30	.40	.45
	6,000 sq. ft.	C	.45	.55	.65
	"	S	.35	.40	.50
	APARTMENTS	C	.50	.60	.70
	"	S	.40	.50	.60
	INDUSTRIAL	C	.55	.65	.75
	"	S	.45	.55	.65
	COMMERCIAL	C	.75	.80	.85
	"	S	.70	.75	.80
RURAL	DENSE VEGETATION	C	.15	.25	.35
	"	S	.10	.15	.20
	MODERATE VEGETATION	C	.20	.30	.40
	"	S	.15	.20	.25
	SPARSE VEGETATION	C	.25	.35	.45
	"	S	.20	.25	.30
	IMPERVIOUS; PAVED, ETC.		.85	.90	.95

* Note: These values are intended to be a minimum; higher values may be required by the County Engineer.

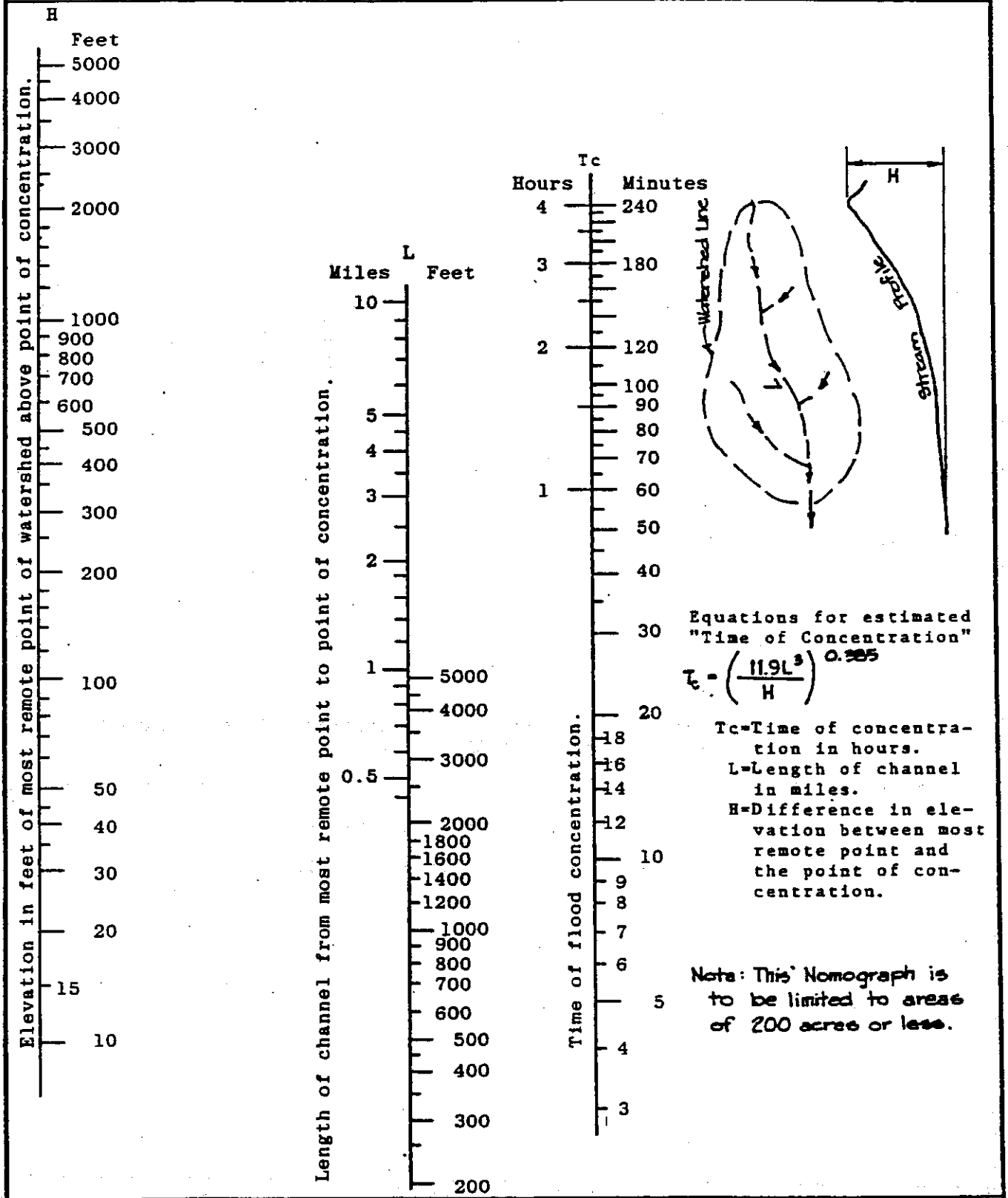
** Note: Soil Type

C = Clay, Adobe, Rock or Impervious Material

S = Sand, Gravel, Loam or Pervious Material

Specification Ref	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	TABLE OF COEFFICIENT RUNOFF CHART	Drawing No. D-2
Drawn: lr Date: 5-3-73		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by Deputy Co. Eng.	Clinton Milne	8/28/75



Equations for estimated "Time of Concentration"

$$T_c = \left(\frac{11.9L^3}{H}\right)^{0.385}$$

Tc=Time of concentration in hours.
L=Length of channel in miles.
H=Difference in elevation between most remote point and the point of concentration.

Note: This Nomograph is to be limited to areas of 200 acres or less.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	NOMOGRAPH FOR DETERMING THE "TIME OF CONCENTRATION" OF SMALL DRAINAGE BASINS	Drawing No. D-3
Drawn: Jr Date: 5-4-75		

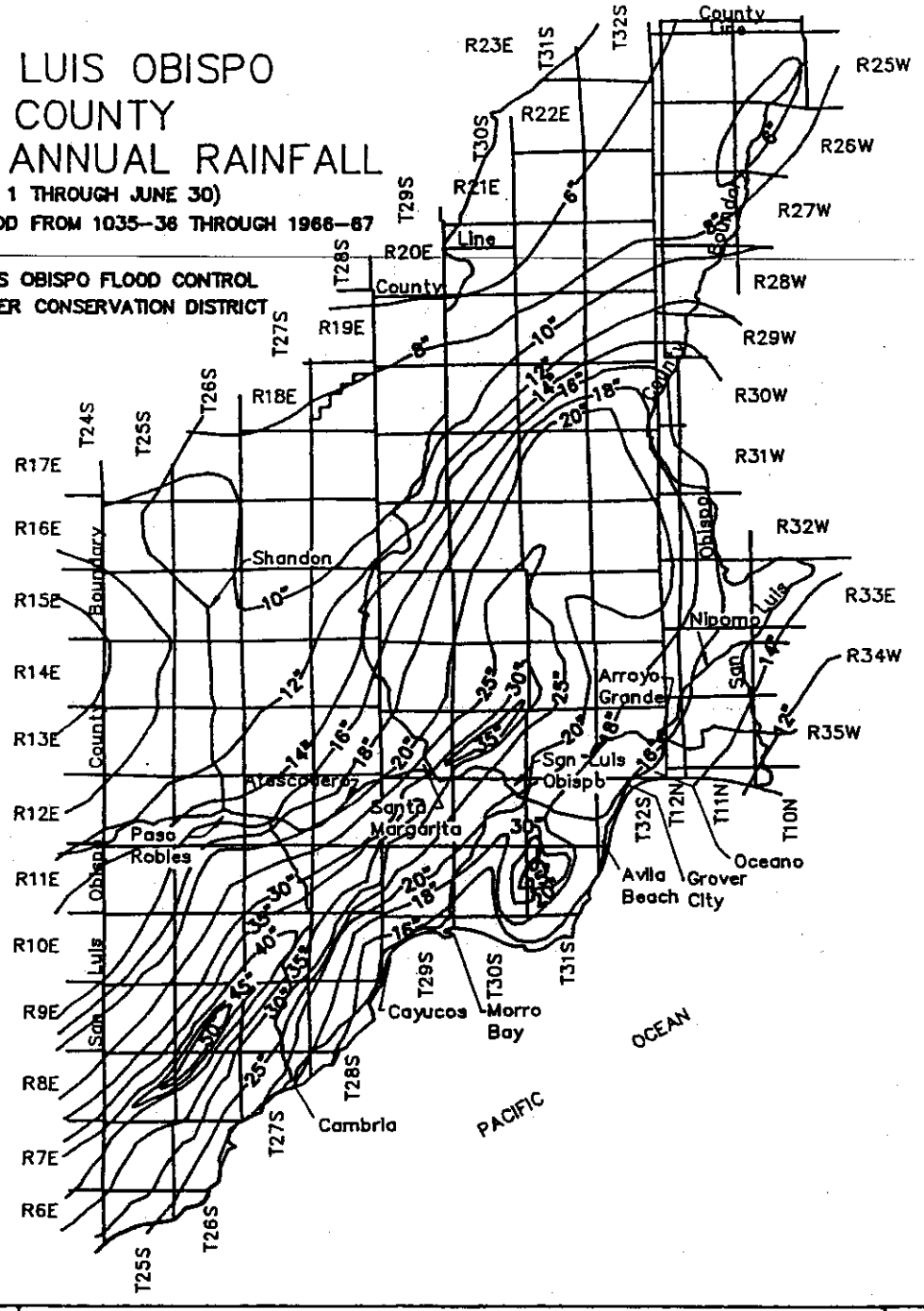
Revisions				Approvals		
Description	By	Approved	Date	County Engineer		
				Recommended by Deputy Co. Eng	[illegible]	5/3/96
					T. Nanson	5/3/96

SAN LUIS OBISPO COUNTY AVERAGE ANNUAL RAINFALL

(JULY 1 THROUGH JUNE 30)

FOR 32 YEAR PERIOD FROM 1035–36 THROUGH 1966–67

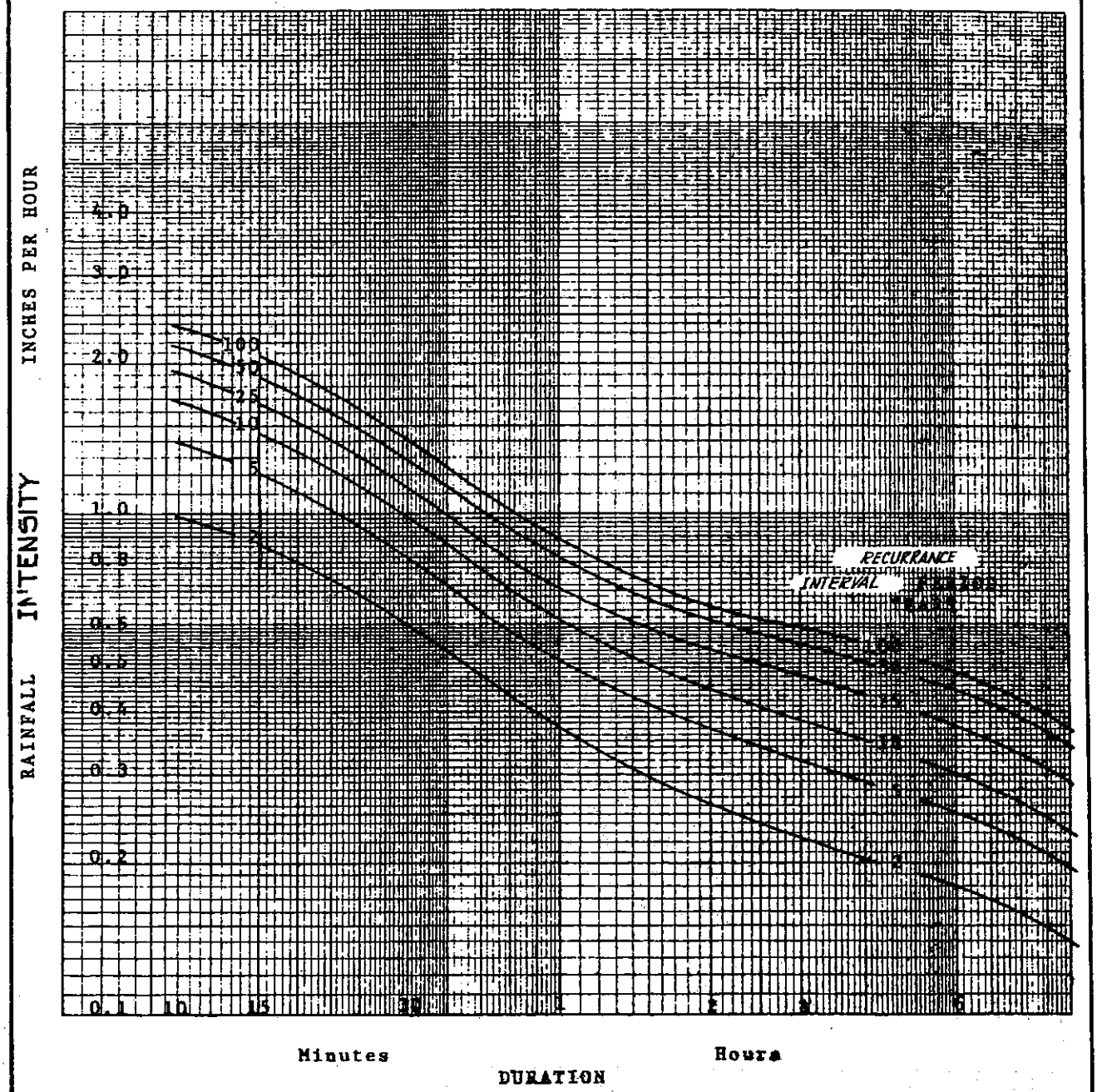
SAN LUIS OBISPO FLOOD CONTROL AND WATER CONSERVATION DISTRICT



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
FEBRUARY 1, 1991	AVERAGE RAINFALL MAP	Drawing No. D–4
DRAWN BY: PGH		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by Deputy Co. Eng.	Victor Milan	8/28/75

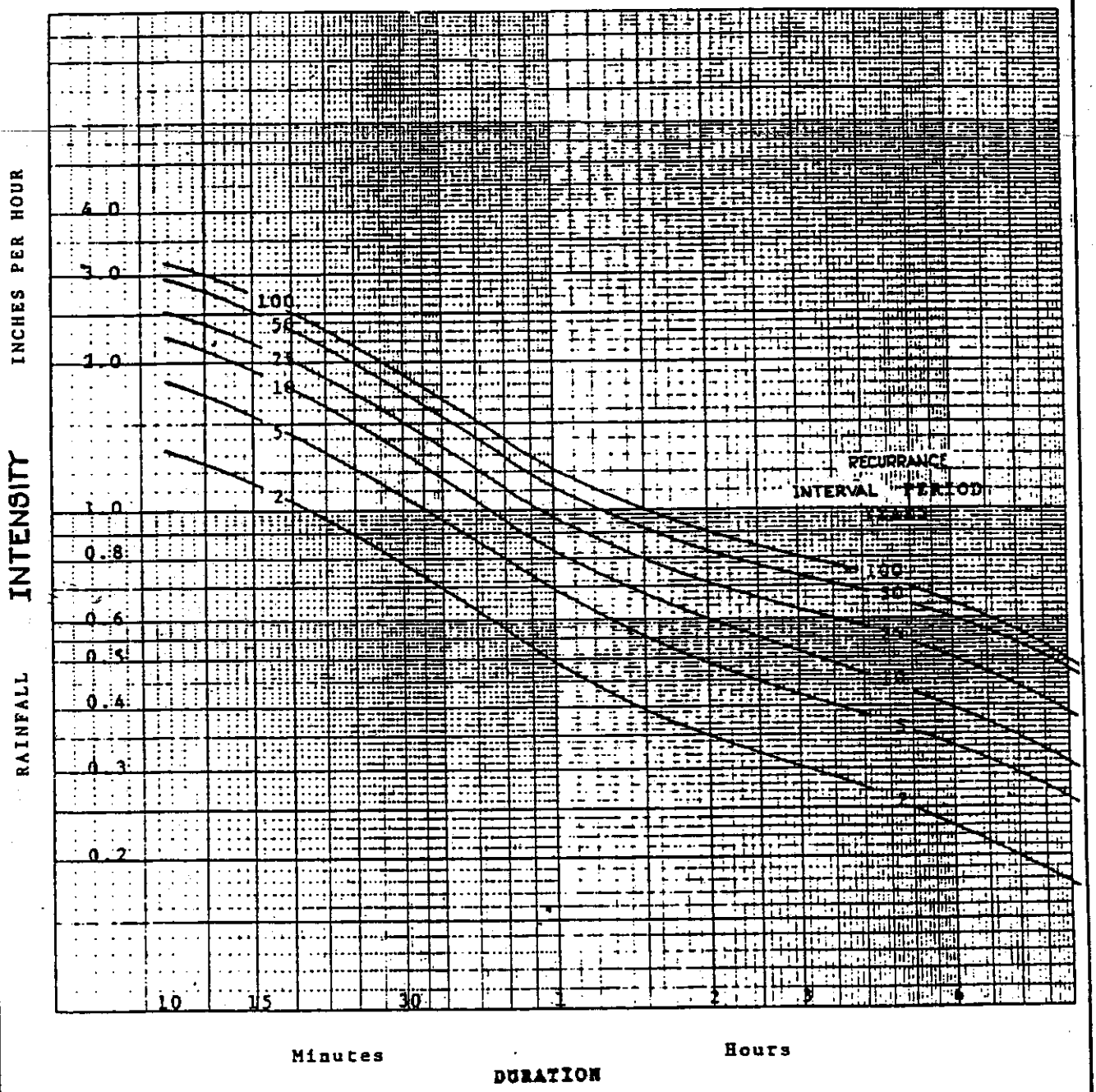
AREAS OF AVERAGE ANNUAL RAINFALL
OF LESS THAN 14 INCHES



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	RAINFALL INTENSITY DURATION CURVE	Drawing No. D-5
Drawn: [illegible] Date: [illegible]		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	8-25-75
				Recommended by Deputy Co. Eng.	Clinton Milne	8/28/75

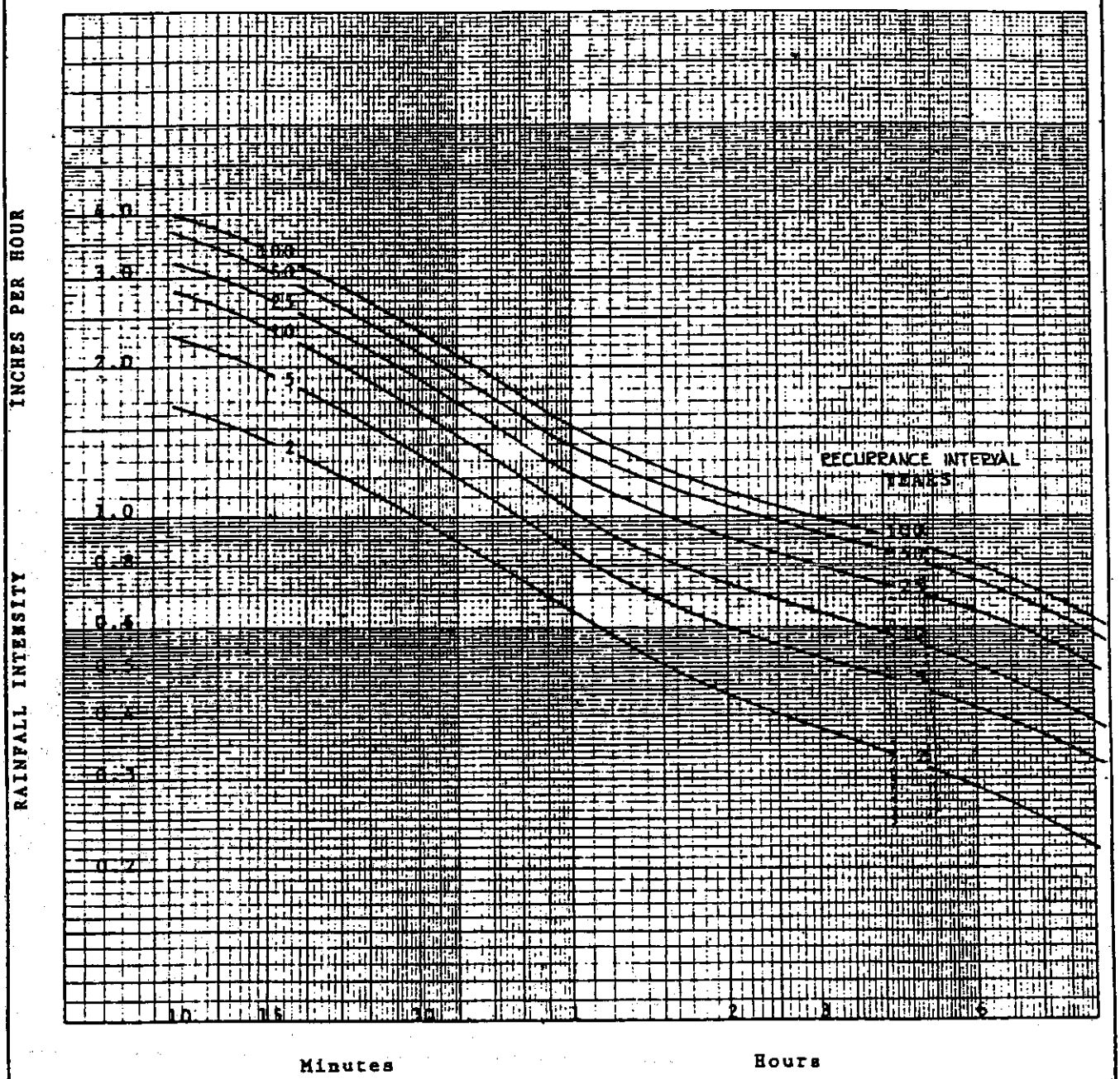
AREAS OF AVERAGE ANNUAL RAINFALL
OF 14 TO 18 INCHES



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	RAINFALL INTENSITY DURATION CURVE	Drawing No. D-6
Drawn: Date:		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		
				Recommended by Deputy Co. Eng.	Clinton Milne	8/28/75

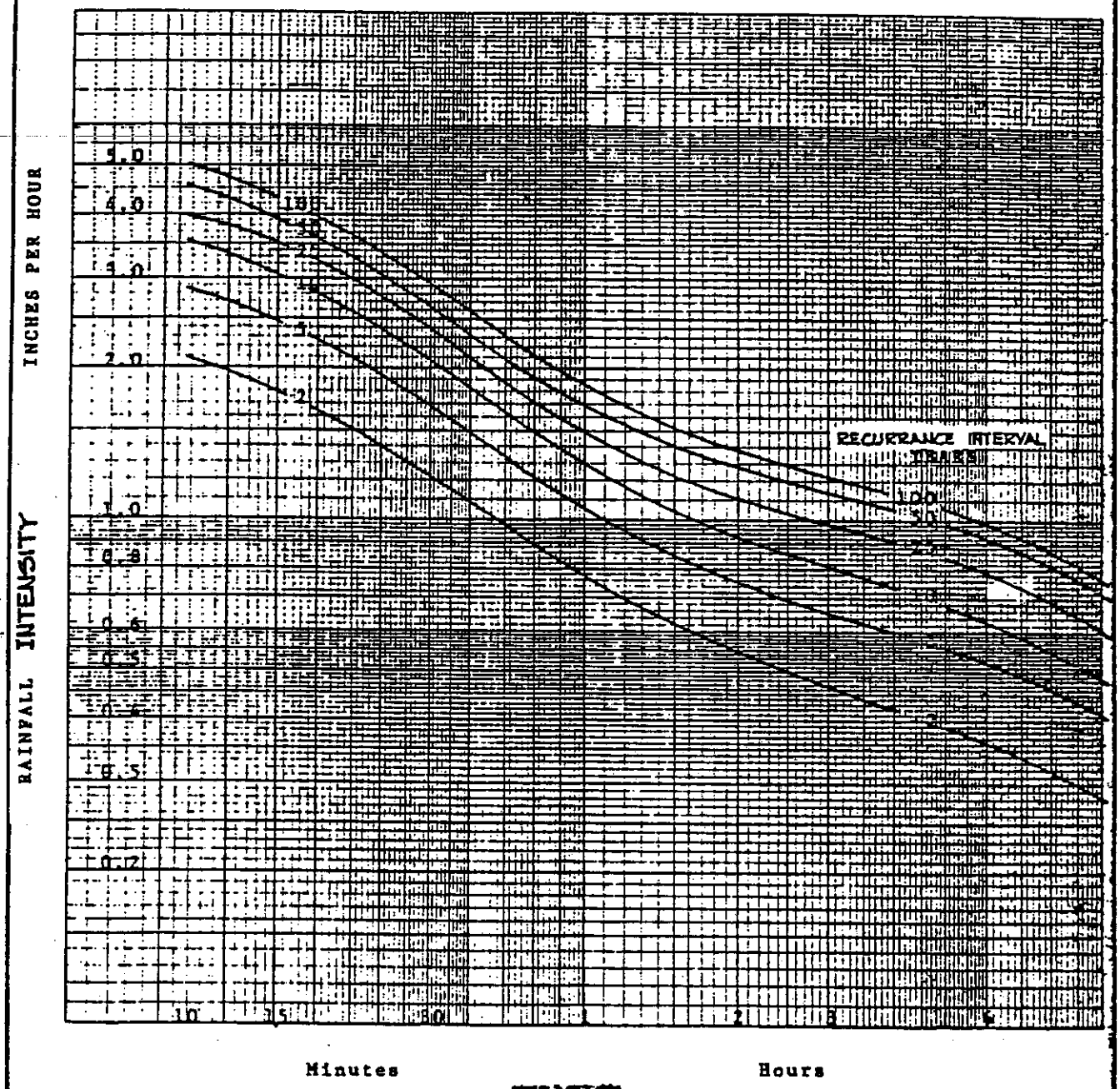
AREAS OF AVERAGE ANNUAL RAINFALL
OF 18 TO 22 INCHES



Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	RAINFALL INTENSITY DURATION CURVE	Drawing No. D-7
Drawn: Date:		

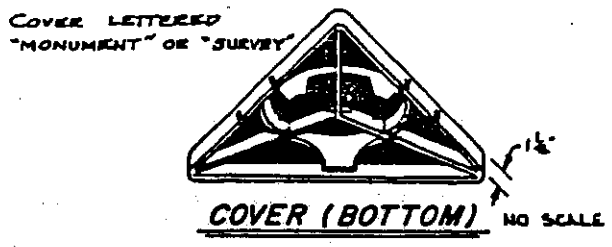
Revisions				Approvals		
Description	By	Approved	Date	County Engineer		2-3-75
				Recommended by Deputy Co. Eng.	Clinton Milne	8/28/75

AREAS OF AVERAGE ANNUAL RAINFALL
OF 22 TO 28 INCHES

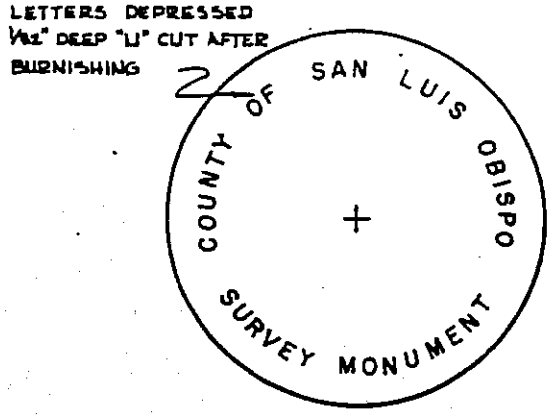


Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale:
	RAINFALL INTENSITY DURATION CURVE	Drawing No. D-8
Drawn: Date:		

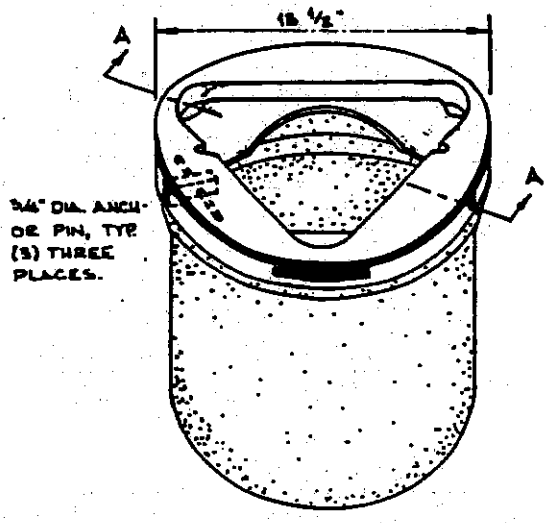
Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	Richard Gallagher	12-12-6
Changed 6" of concrete to 2" Gal pipe.	O.B.H.		12-12-2	Engineering — Road Div'n.	[illegible]	12-12-62



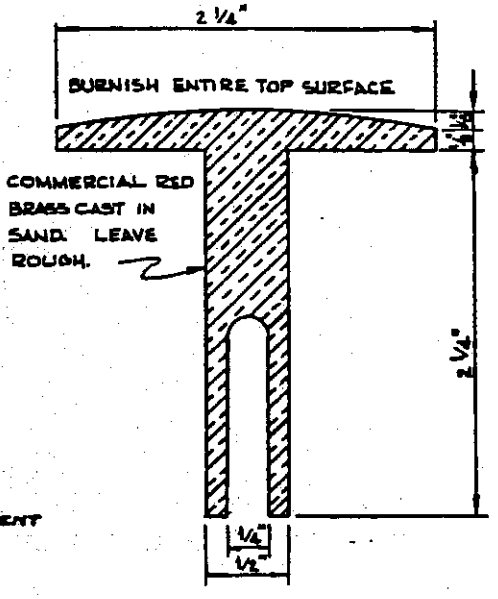
COVER (BOTTOM) NO SCALE



CAP PLAN

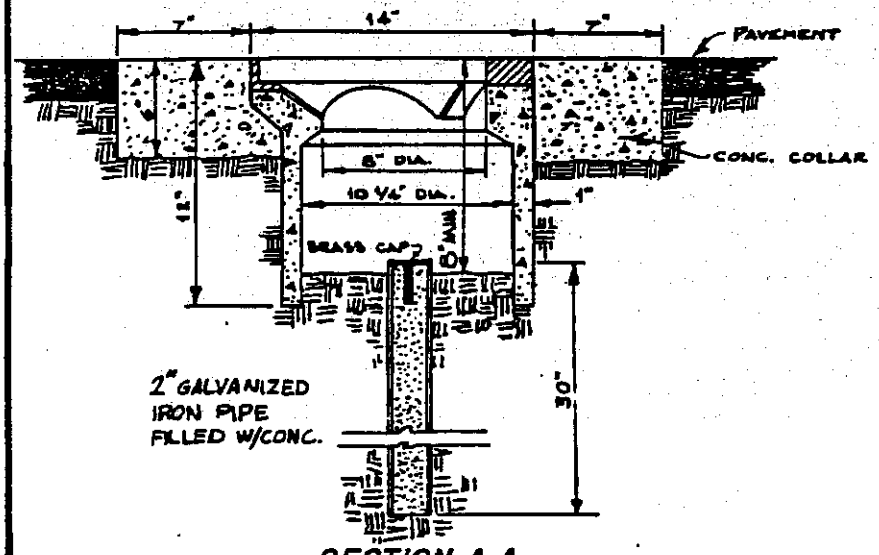


ISOMETRIC NO SCALE



CAP SECTION
SCALE: 1" = 1'

RISER RING NO SCALE



SECTION A-A NO SCALE

NOTE:

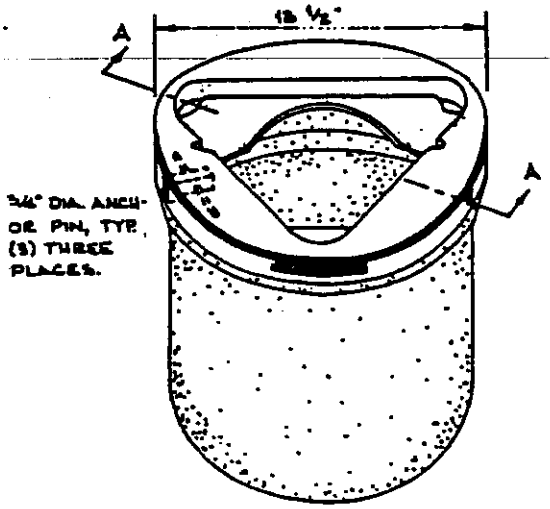
1. ENGINEER OR SURVEYOR SETTING THE MONUMENT SHALL INDICATE EXACT POINT BY MARKING A CROSS ON THE CAP. HE SHALL ALSO STAMP HIS LICENSE TYPE & NUMBER.
2. MONUMENT WELL TO BE BROOKS PRODUCTS NO. 4TT OR EQUAL.
3. BRASS CAP AVAILABLE AT THE ENGINEERING DEPARTMENT.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: AS SHOWN
	STANDARD STREET MONUMENT (ALTERNATE I)	Drawing No. M-1
DRWN: NOV. 1962 BY: S.B.		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		
				Deputy County Engineer		

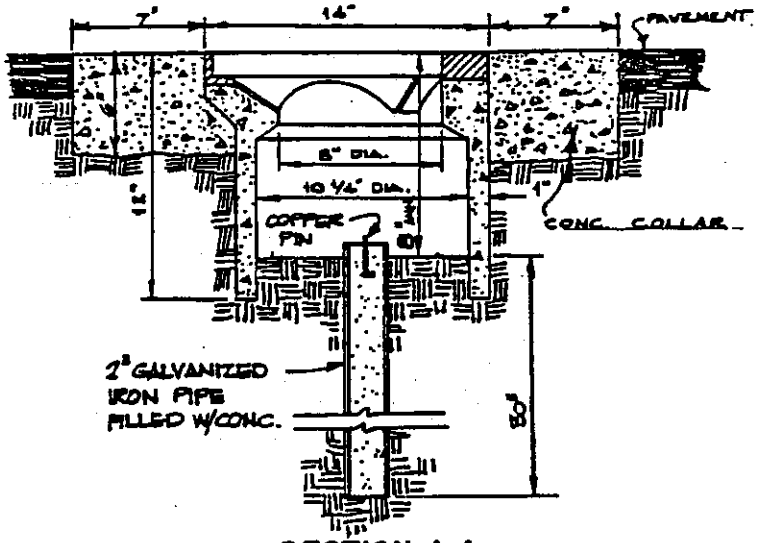
COVER LETTERED "MONUMENT" OR "SURVEY"

COVER (BOTTOM) NO SCALE



ISOMETRIC NO SCALE

RISER RING NO SCALE



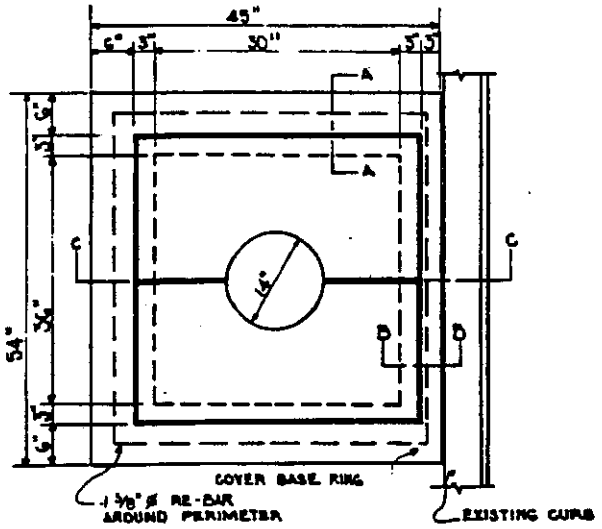
SECTION A-A NO SCALE

NOTES:

1. MONUMENT WELL TO BE BROOKS PRODUCTS NO. 4TT OR EQUAL.
2. MONUMENT WELL AND IRON PIPE TO BE SET BY CONTRACTOR. CONCRETE IN PIPE AND COPPER PIN TO BE SET BY ENGINEER OR SURVEYOR.
3. EXACT POINT TO BE SET WITH A COPPER PIN, OR EQUAL, AND A STANDARD SURVEYOR'S TAG.

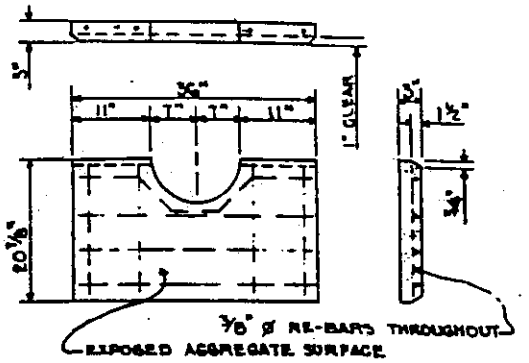
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: AS SHOWN
	STANDARD STREET MONUMENT (ALTERNATE II)	Drawing No. M-2
DRWN: NOV. 1962 BY: S.B.		

Revisions						
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75



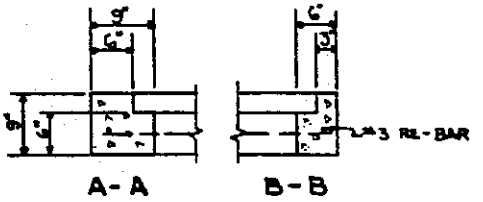
NOTE: COVER BASE RING SHALL BE FLUSH WITH EXISTING CURB.

PLAN – BASE RING & PLANTER

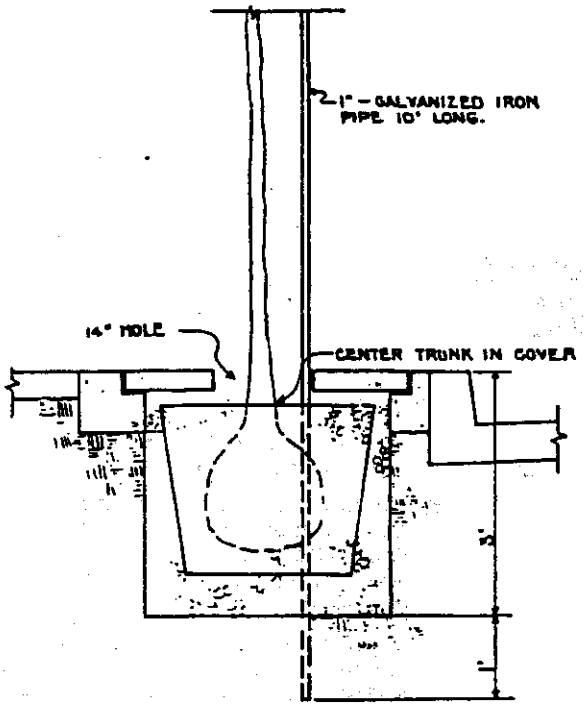


NOTE: ½" CHAMFER ON ALL BOTTOM CORNERS THAT BEAR ON THE BASE.

PLAN – HALF COVER



SECTIONS



SECTION C-C

NOTES:

ROOT AND SOIL BALL 2'-0" DEEP TO BE 2" TO 3" BELOW COVER BOTTOM.

FINISH ELEVATION OF FILL TO BE 2" BELOW BASE OF COVER SLAB.

FILL HOLE TO ABOUT 5" ABOVE LINE WHERE BOTTOM OF ROOT-BALL WILL REST WITH EXISTING EXCAVATED MATERIAL.

WATER TO SETTLE FILL.

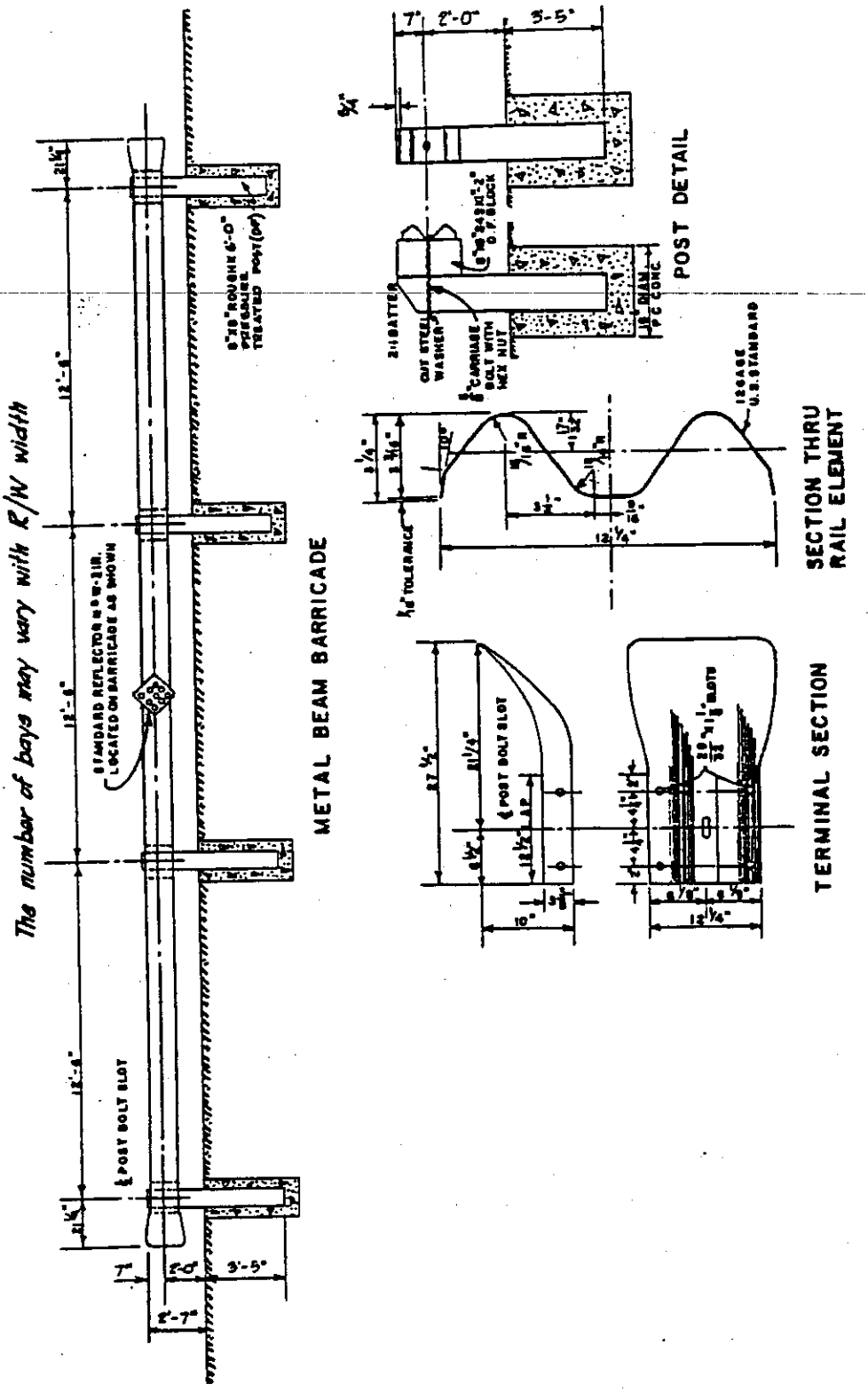
PLACE TREE AND FILL AROUND ROOTBALL TO WITHIN 18" OF TOP OF ROOT-BALL WITH EXISTING SOIL.

IN THE TOP 18" OF EXISTING FILL, PLACE 2 CUPS OF "BONEMEAL" AND 1 CUP OF "BLOODMEAL."

TREES ARE TO BE SELECTED FROM A LIST OF THOSE APPROVED BY THE COUNTY PLANNING DEPARTMENT.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: 1" = 2'-0"
	TREE PLANTING COMMERCIAL	Drawing No. M-3
Drawn: SHY Date: 11-25-74		

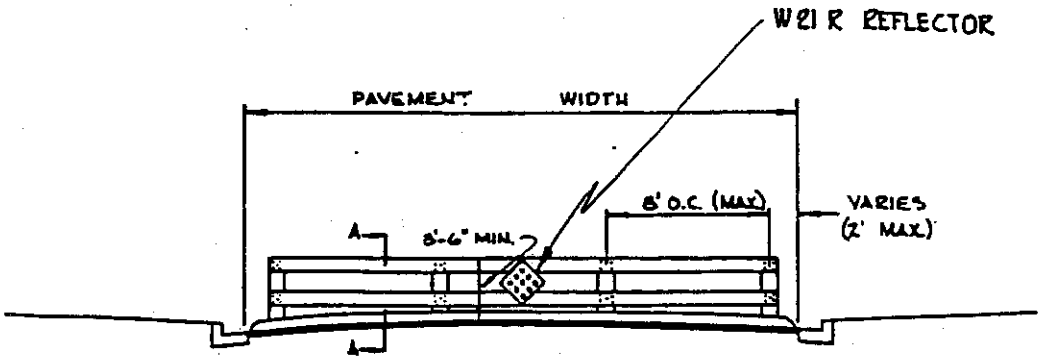
Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works		5-62
				Engineering & Road Div'n.	J.R.M.	
						1967



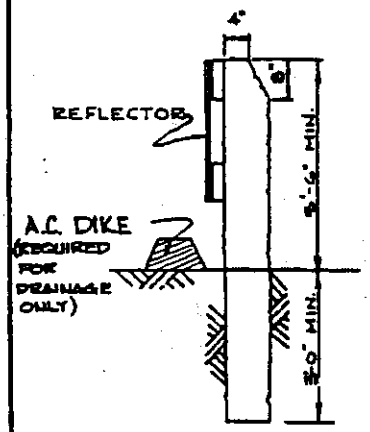
NOTE: Posts and metal beam railing shall be painted in accordance with State Specifications.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
		Drawing No.
DWN.: APR. 1962 BY: S.G.	METAL BEAM BARRICADE USED AS PERMANENT STREET END	M-4

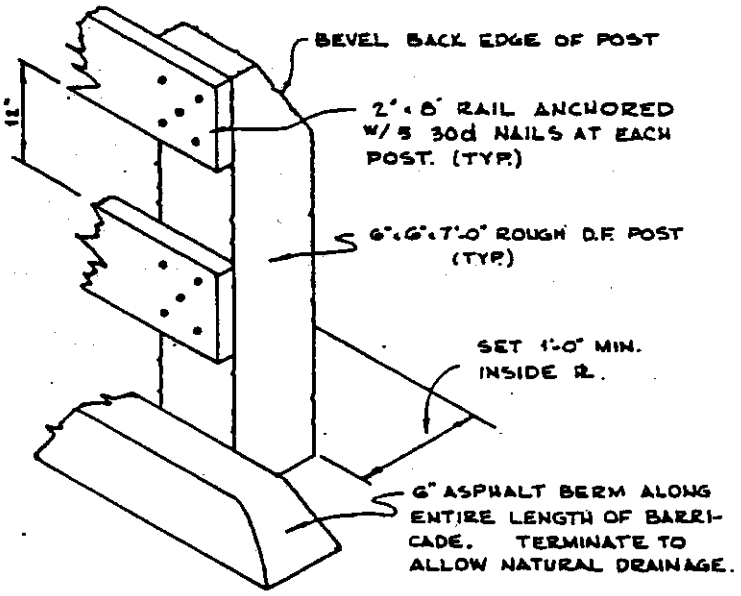
Revisions				Approved		
Description	By	Approved	Date	Director of Public Works	R. Gallagher	10-10-63
				Engineering & Road Div'n.	[illegible]	10-10-63



WOOD BEAM BARRICADE



SECTION A-A



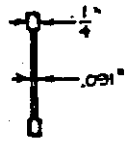
POST DETAIL

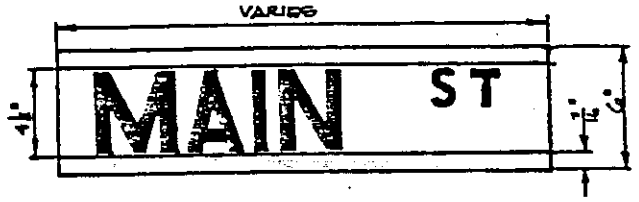
NOTES:

1. RAILS TO BE 2"x8" CLEAR D.F. S4S AND POSTS TO BE 6"x6"x7'-0" ROUGH D.F.
2. BUTT ALL RAIL JOINTS ON CENTER OF POST.
3. ALL EXPOSED WOOD SHALL BE PAINTED WHITE, 2 COATS.
4. STANDARD W 21 R REFLECTOR TO BE LOCATED ON BARRICADE AS SHOWN.
5. BERM IN FRONT OF BARRICADE SHALL TERMINATE TO LEAVE A MAXIMUM OF 2' BETWEEN END AND CURB.

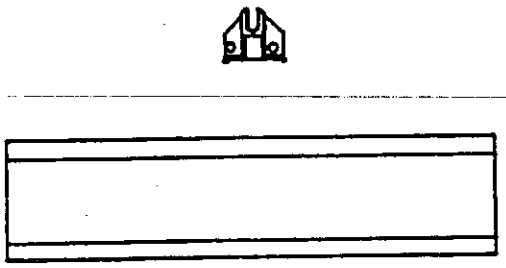
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	TEMPORARY WOOD BEAM BARRICADE	Drawing No. M-5
DATE: APRIL, 63 / DRAWN: S.B.		

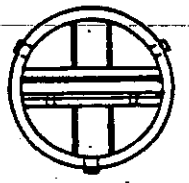
Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	2-10-72
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75



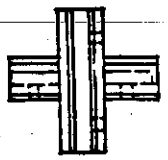


SIGN DETAIL



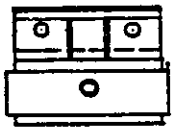


PLAN



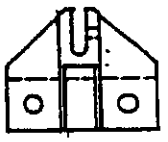
PLAN

ASSEMBLY DETAIL



FRONT

POST-TO-SIGN

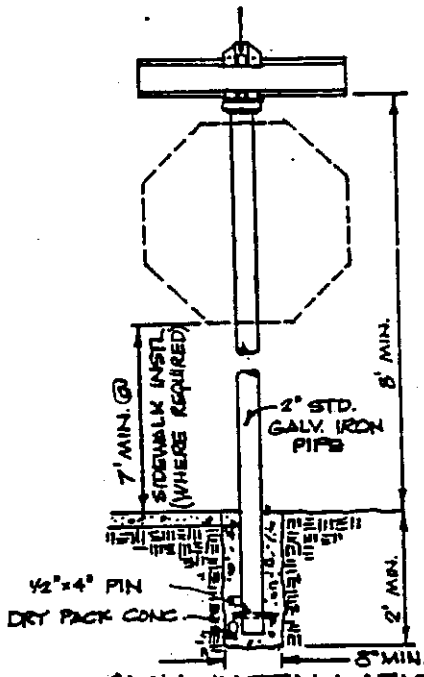


FRONT

SIGN-TO-SIGN

NOTES:

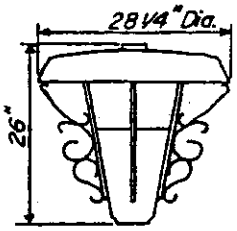
1. SIGN BLADES TO BE EXTRUDED ALUMINUM, 6063-T6 ALLOY, DE-GREASED AND ETCHED WITH GREEN SCOTCHLITE APPLIED TO BOTH SURFACES.
2. POST-TO-SIGN BRACKET TO BE DIE-CAST #360 ALLOY, W/ TWO ANGLED GUSSETS EACH SIDE FOR STRENGTH. TO FIT 2 3/8" O.D. GALV. PIPE (2" I.D.). SIGN-TO-SIGN BRACKET TO BE SIMILAR CONST. W/ 90° AND 45° SEPARATION.
3. CAPITAL LETTERS TO BE DIE-CUT SILVER SCOTCHLITE, SERIES B.
4. SCREWS FOR SECURING BRACKETS TO BE ZINC PLATED HEX SOCKET HEAD SCREWS 1/4" x 1/2".



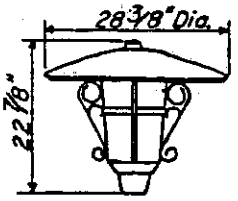
SIGN INSTALLATION

Specification Ref	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	STANDARD STREET SIGN	Drawing No. M-6
Drawn: GRR Date: 2-7-72		

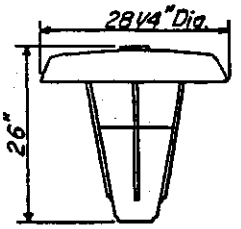
Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	7-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Miller	8/28/75



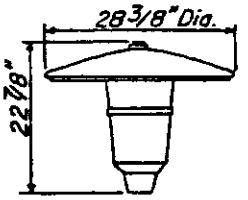
W.E. Corp. Promenade
COLONIAL



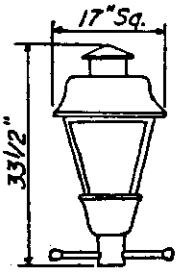
Mc-Ed. Co. Styleking
ORNAMENTAL



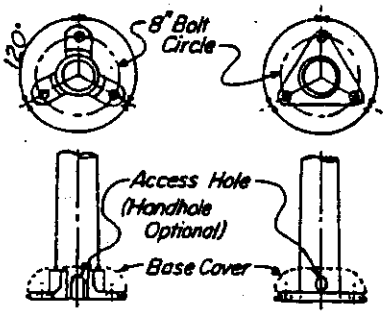
W.E. Corp. Promenade



Mc-Ed. Co. Styleking
CONVENTIONAL

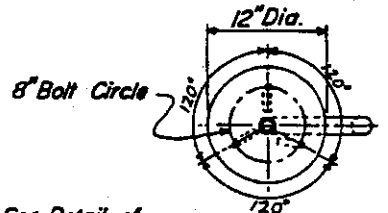


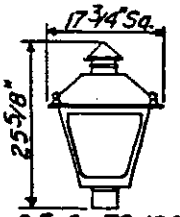
Mc-Ed. Co. Traditionaire



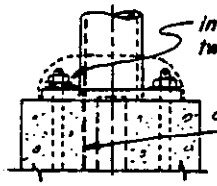
TYPICAL ALUMINUM POST BASE

TYPICAL STEEL POST BASE

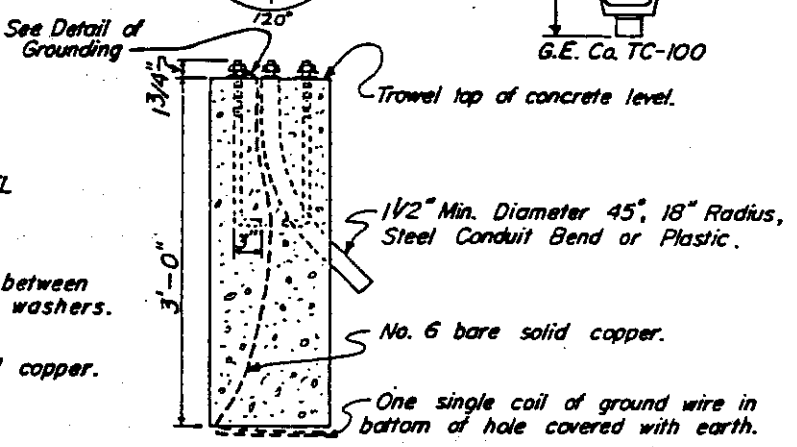




G.E. Co. TC-100



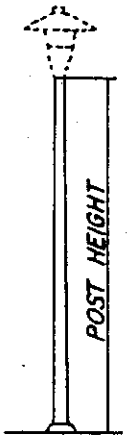
DETAIL OF GROUNDING FOR STEEL AND ALUMINUM POSTS



FOUNDATION FOR STEEL AND ALUMINUM POSTS

ANCHOR BASE DATA FOR STEEL AND ALUMINUM POSTS

POSTS			ANCHOR BOLTS	
MATERIAL	NOMINAL SHAFT SIZE	BOLT CIRCLE	QUAN.	SIZE
STEEL or ALUMINUM	3"x5"x12'-0" 3"x5"x14'-0" 3"x5"x16'-0"	8"	3	3/4"-10NCx17'-3"

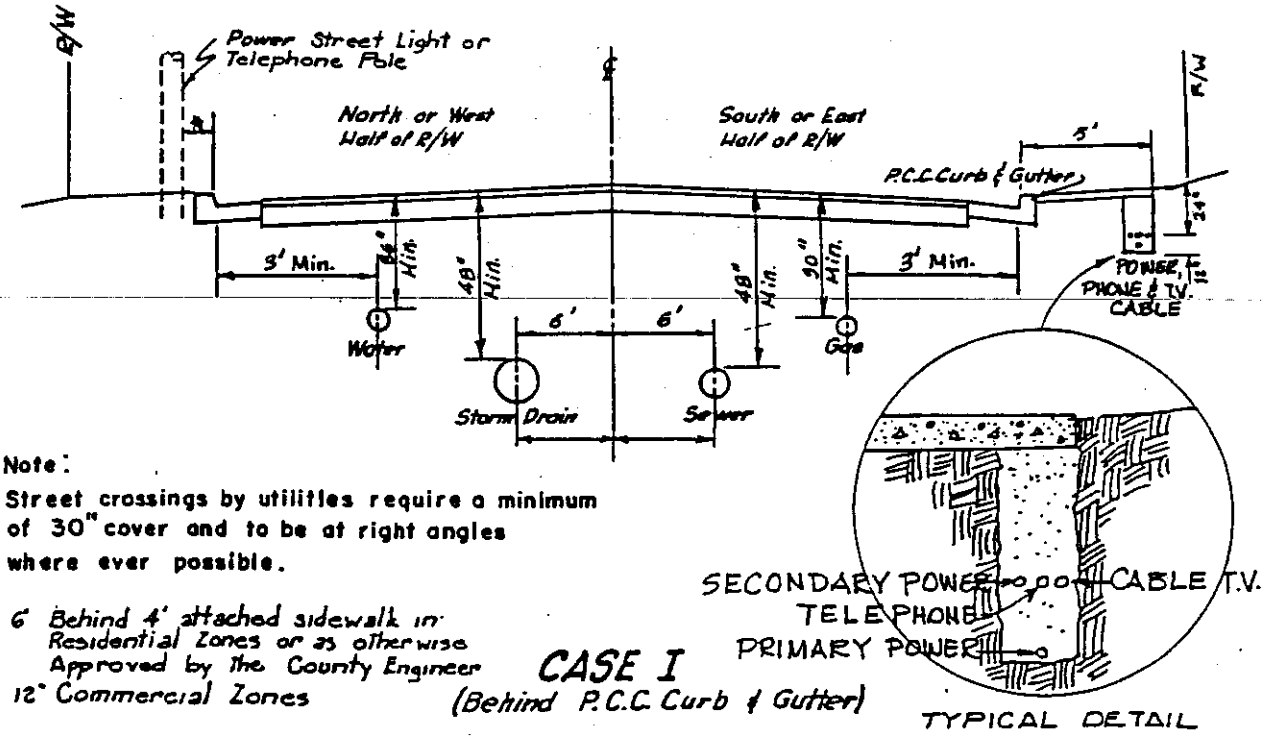


STEEL AND ALUMINUM POSTS

NOTE: FOR SPECIAL USE ONLY. MUST HAVE PERMISSION OF COUNTY ENGINEERS OFFICE.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale. NO SCALE
	DECORATIVE LIGHT STANDARD	Drawing No. P-1
Drawn G.B.H. Date DEC.72		

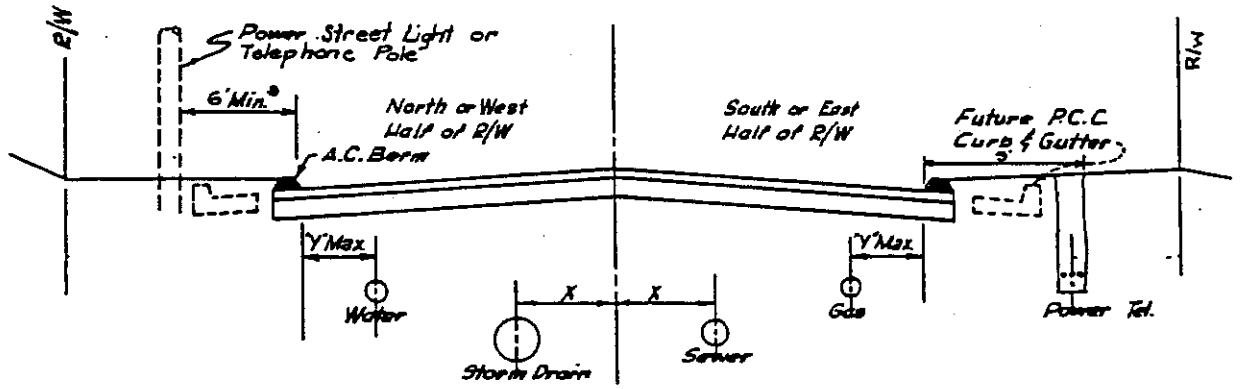
Revisions				Approvals		
Description	By	Approval	Date	County Engineer	J.C. [illegible]	2-7-72
				Design Division		



Note:
Street crossings by utilities require a minimum of 30" cover and to be at right angles where ever possible.

* 6' Behind 4' attached sidewalk in Residential Zones or as otherwise Approved by the County Engineer
12' Commercial Zones

CASE I
(Behind P.C.C. Curb & Gutter)



Street Width	"X"	"Y" Max.
With A.C. Berms		
26' & 28'	4'	3'
30' & 34'	4'	4'
Greater than 34'	6'	5'

* RESIDENTIAL ZONES

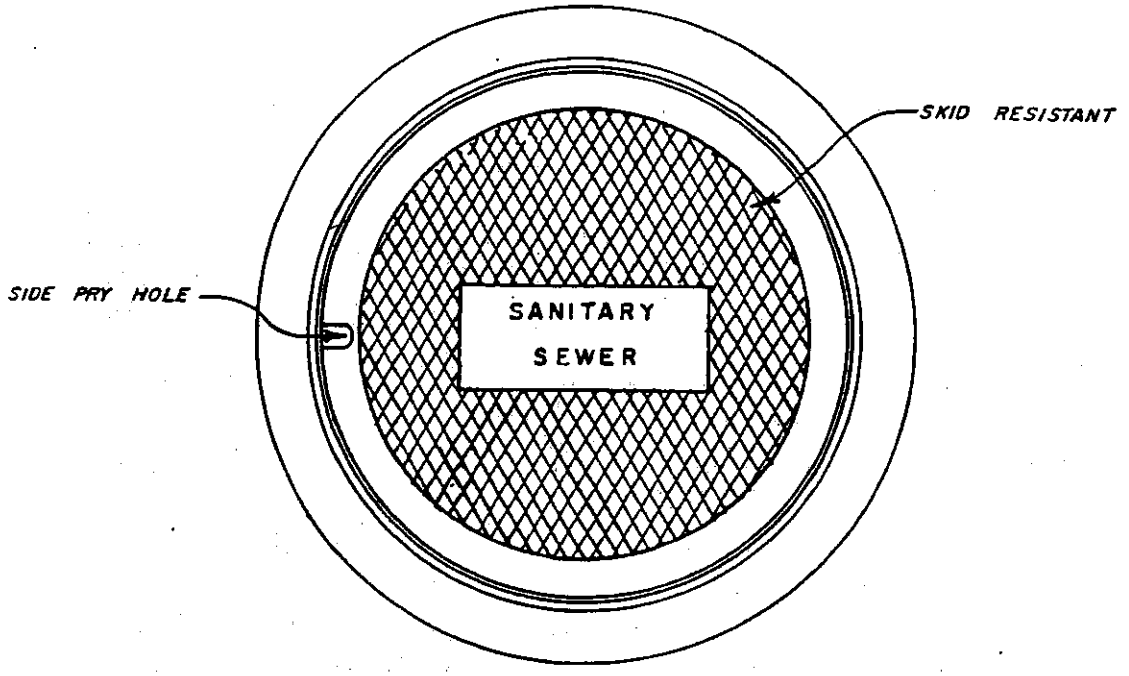
CASE II
(Behind A.C. Berm)

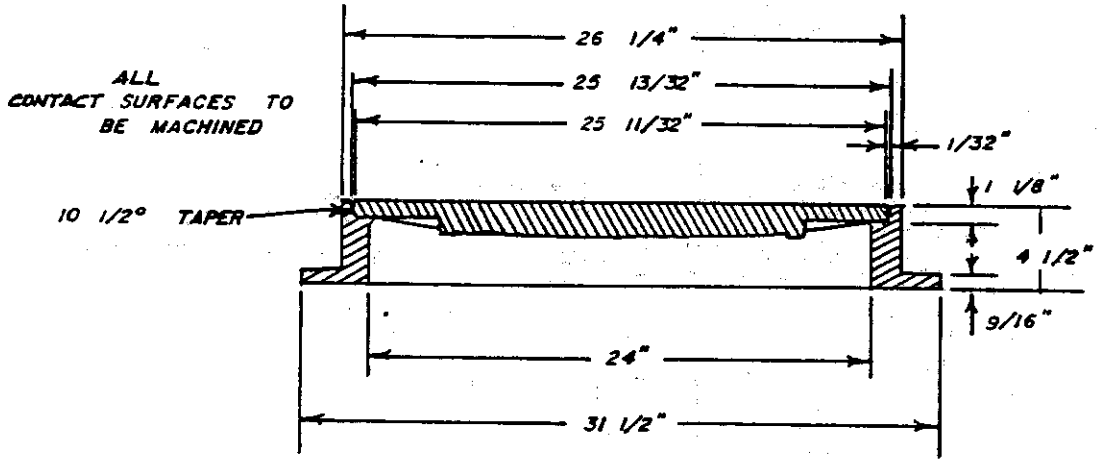
Note: Minimum Cover - Both Cases.

Sewer Mains	48" Min.
Water	36"
Telephone & Power	24"
Gas	30"
Storm Drain	48" Min.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale No scale
	LOCATION of UTILITIES For New Subdivisions (Desirable In Exist. R.O.W's)	Drawing No. P-4
Drawn Jon Lynn DATE		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/28/75



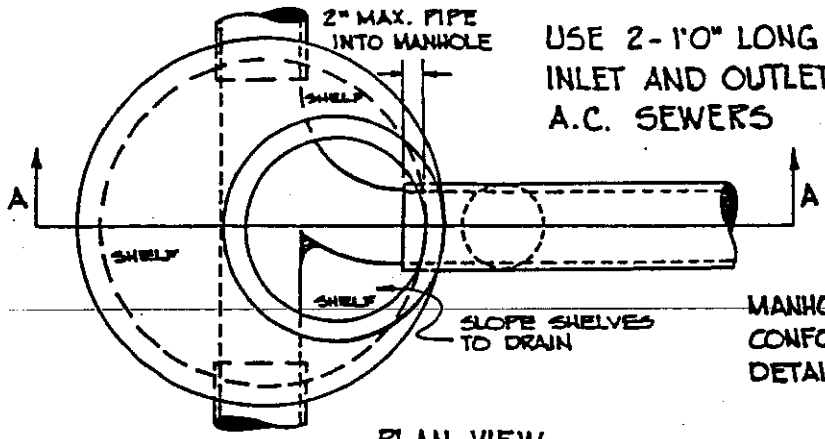


PINKERTON A-640. (WITHOUT A PICK HOLE)
OR APPROVED EQUAL

NOTE: Capacity shall be adequate for State HS-20 traffic loading

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	SEWER MAN-HOLE COVER	Drawing No. S-1
Drawn: YWL / Date: May, 1973		

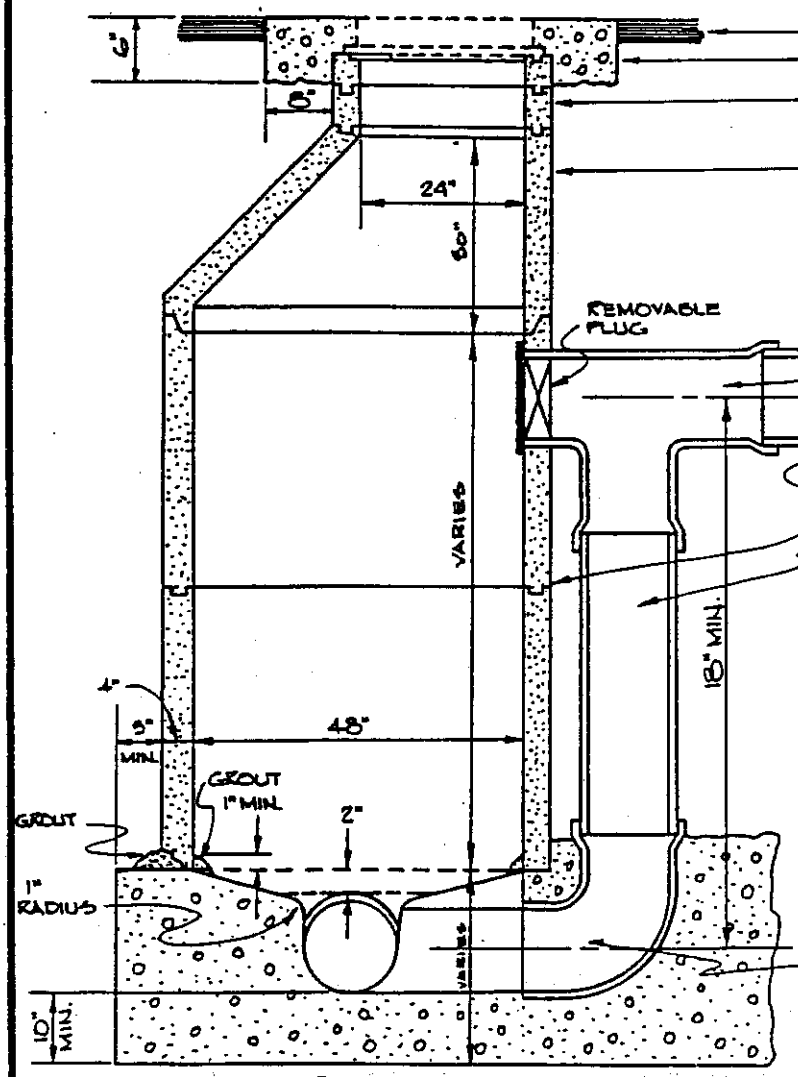
Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75



USE 2-1'0" LONG PIPE JOINTS AT EACH INLET AND OUTLET FOR V.C.P. OR A.C. SEWERS

MANHOLE FRAME AND COVER TO CONFORM WITH STANDARD DETAIL NO. S-1

PLAN VIEW



PAVEMENT

CONCRETE COLLAR

3" OR 6" RISER RING (9" MAXIMUM)

PRECAST CONCRETE (TYPICAL) MANHOLE WALLS SHALL BE A PRECAST TYPE CONFORMING TO ASTM STANDARD C478-61T FOR CLASS 2 REINFORCED CONCRETE PIPE.

TEE

MANHOLES SHALL BE WATERTIGHT

JOINTS TO BE SET IN A WATERTIGHT SEALANT APPROVED BY THE COUNTY ENGINEER.

LATERAL CONNECTION OVER 5' TO BE P.V.C. FOR DROP TEE, PIPE & 90° BEND.

LEAVE OUT PIPE IN CHANNEL OR PIPE SHALL BE PRECUT BEFORE PLACING BASE.

MANHOLE BASE SHALL BE A MINIMUM OF 10" WITH CLASS "A" CONCRETE. FRESH CONCRETE SHALL NOT FALL OVER 6' UNLESS AN "ELEPHANTS TRUNK" OR AN "ADJUSTABLE PIPE" IS USED. CONCRETE WORK IN CHANNEL SHALL BE A STEEL TROWEL FINISH AND SHELF AREAS SHALL BE A BROOM FINISH. BASE SHALL BE MONOLITHICLY PLACED.

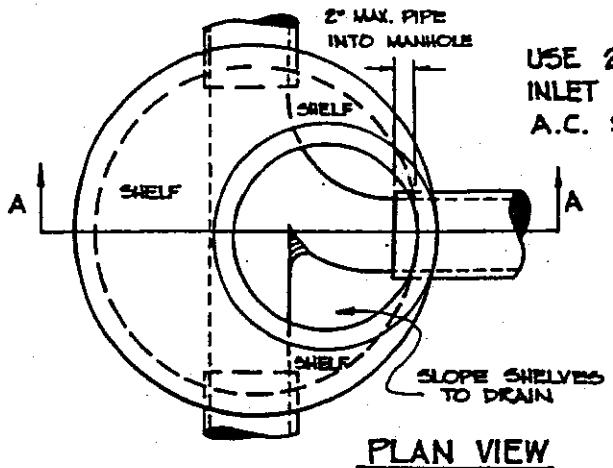
90° BEND

BROKEN OR CHIPPED RINGS AND CONES SHALL NOT BE USED EXCEPT BY APPROVAL OF THE ENGINEER.

SECTION A-A

SPECIFICATION REF.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	SCALE: NONE
	TYPICAL DROP MANHOLE	DRAWING NO. S-2

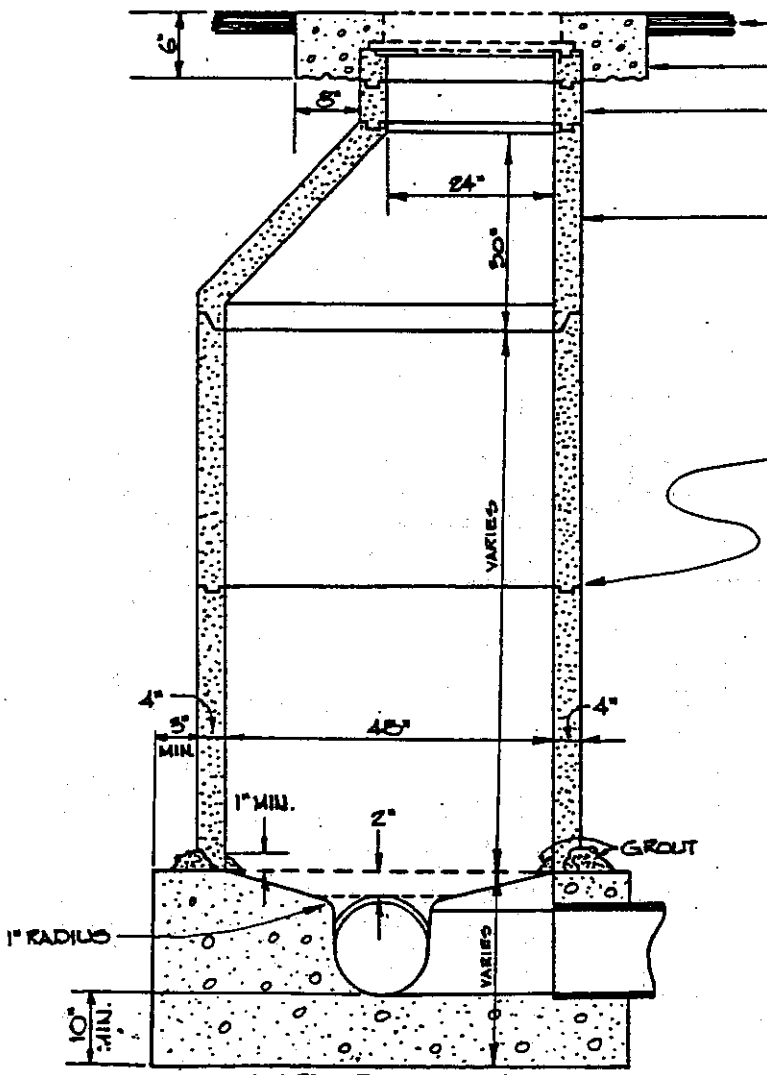
Revisions				Approvals		
Description	By	Approved	Date	County Engineer	[illegible]	9-3-75
				Recommended by		
				Deputy Co. Engineer	Clinton Milne	8/29/75



USE 2-1'0" LONG PIPE JOINTS AT EACH INLET AND OUTLET FOR V.C.P. OR A.C. SEWERS.

MANHOLE FRAME AND COVER TO CONFORM WITH STANDARD DETAIL NO. S-1.

PLAN VIEW



PAVEMENT

CONCRETE COLLAR

3" OR 6" RISER RING (9" MAXIMUM)

PRECAST CONCRETE (TYPICAL)

MANHOLE WALLS SHALL BE A PRECAST TYPE CONFORMING TO ASTM STANDARD C478-61T FOR CLASS 2 REINFORCED CONCRETE PIPE.

MANHOLES SHALL BE WATER TIGHT.

JOINTS TO BE SET IN A WATER TIGHT SEALANT APPROVED BY THE COUNTY ENGINEER.

LEAVE OUT PIPE IN CHANNEL OR PIPE SHALL BE PRE CUT BEFORE PLACING BASE

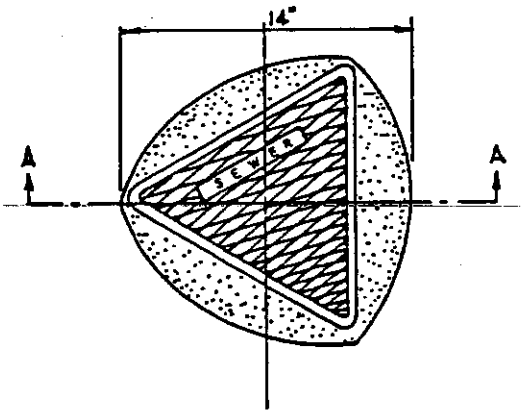
MANHOLE BASE SHALL BE A MINIMUM OF 10" WITH CLASS "A" CONCRETE. FRESH CONCRETE SHALL NOT FALL OVER 6' UNLESS AN "ELEPHANTS TRUNK" OR AN "ADJUSTABLE PIPE" IS USED. CONCRETE WORK IN CHANNEL SHALL BE A STEEL TROWEL FINISH AND SHELF AREAS SHALL BE A BROOM FINISH. BASE SHALL BE MONOLITHICLY PLACED.

BROKEN OR CHIPPED RINGS AND CONES SHALL NOT BE USED EXCEPT BY APPROVAL OF THE ENGINEER.

SECTION A-A

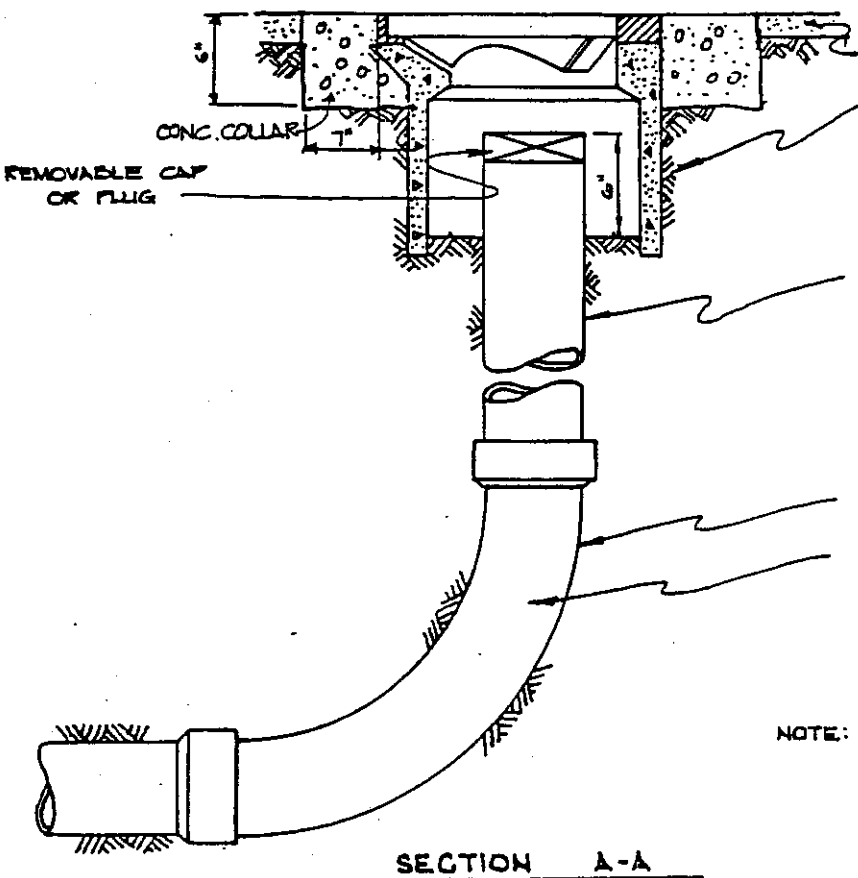
SPECIFICATION REF.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	SCALE: NONE
	TYPICAL ECCENTRIC - CONE PRECAST CONCRETE MANHOLE	DRAWING NO. S-3
DRWN. FEB. '74 BY: C. HOWE		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		3-3-75
				Recommended by Deputy Co. Eng.	Clinton Miller	3/28/75



NOTE: NO LATERALS ARE TO BE CONNECTED TO CLEANOUTS

PLAN

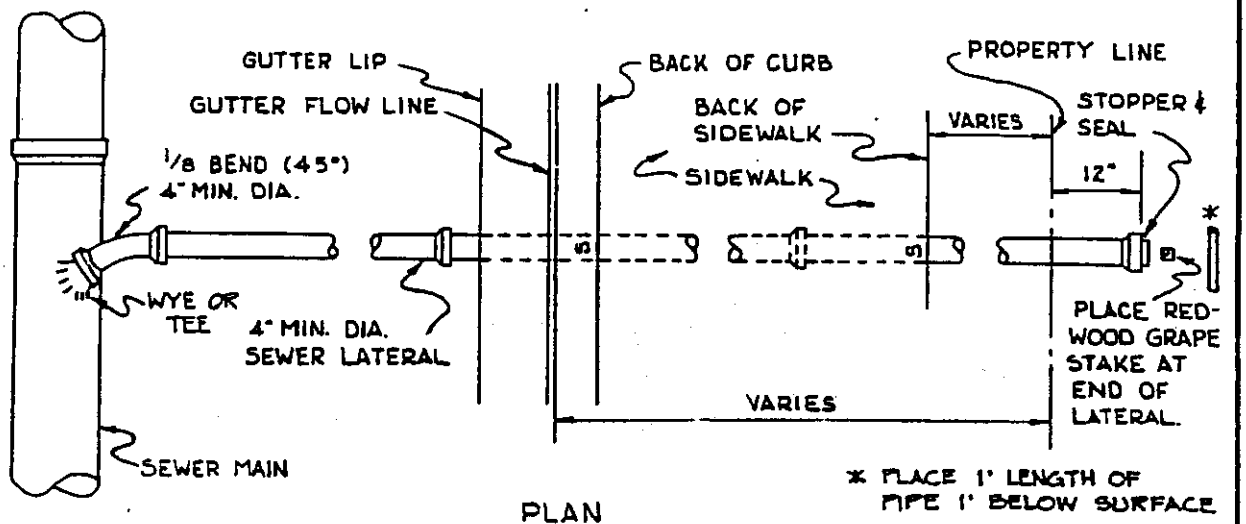


NOTE: WELL TO BE NO. 4TT VALVE BOX WITH CAST IRON FACE AND COVER (BROOKS PRODUCTS INC. OR APPROVED EQUAL.) CAPACITY SHALL BE ADEQUATE FOR STATE HS-20 TRAFFIC LOADING

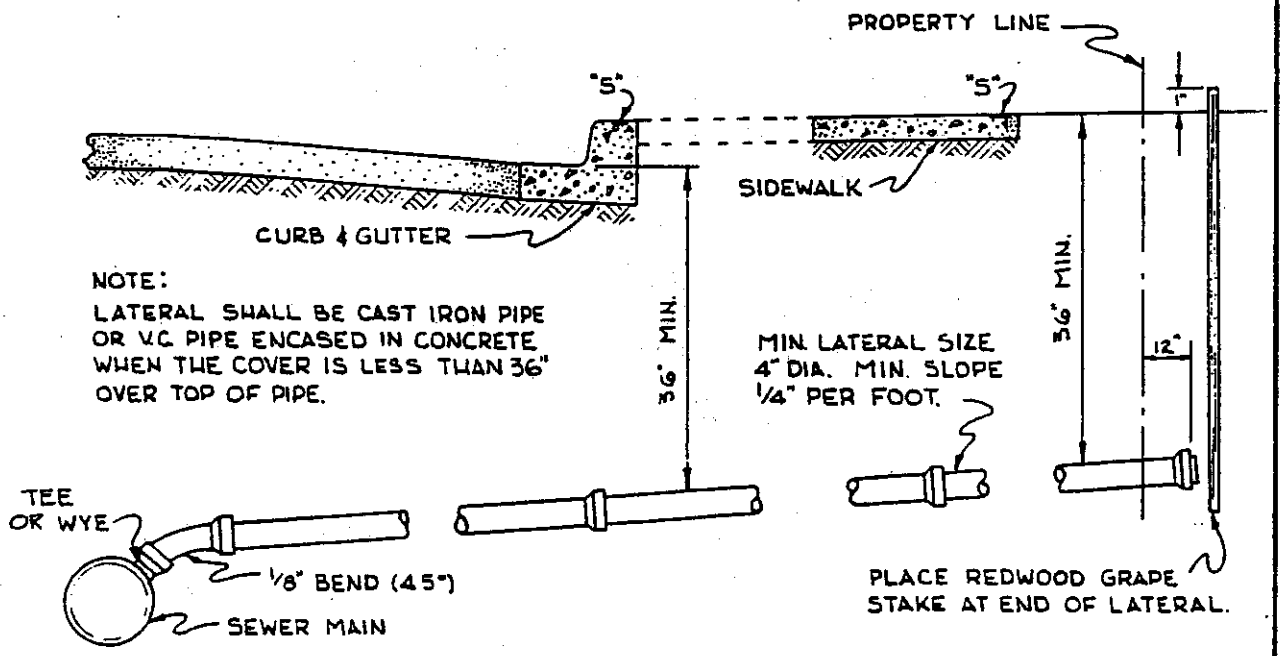
SECTION A-A

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	SEWER CLEANOUT ALTERNATE I	Drawing No. S-4
DRWN: BY:		

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	R. Gallagher	10-4-62
				Engineering — Road Div'n	[illegible]	10-3-62
						10-4-62



PLAN



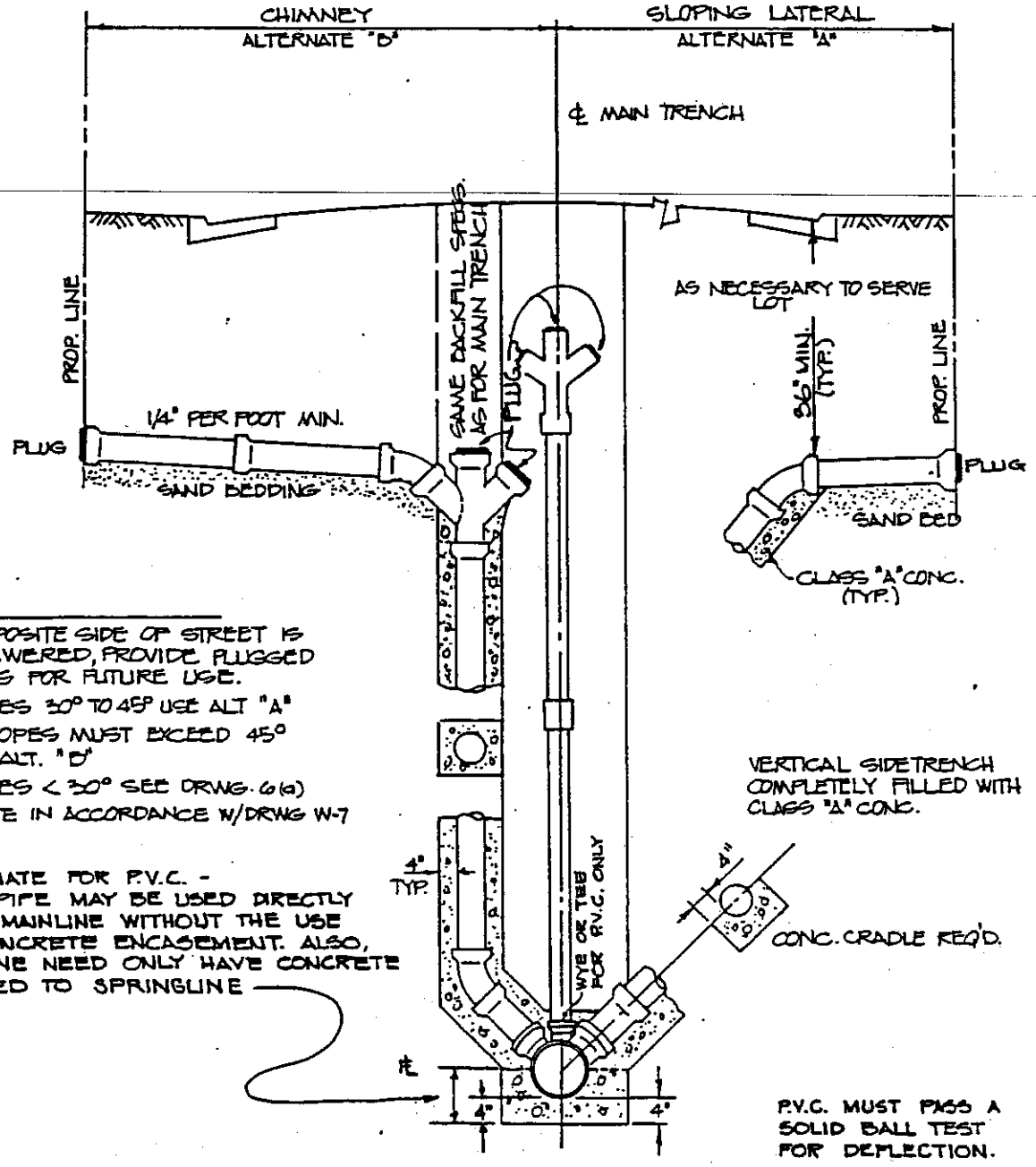
SECTION

NOTES:

1. "S" SHALL BE MARKED ON CURB OVER LATERAL WHEN CURB AND GUTTER ONLY IS TO BE CONSTRUCTED, OR EXISTS.
2. "S" SHALL BE MARKED ON BACK OF SIDEWALK OVER LATERAL WHEN BOTH CURB AND GUTTER AND SIDEWALK IS TO BE CONSTRUCTED, OR EXISTS.
3. THE "S" SHALL BE STAMPED INTO NEW CONCRETE AND SHALL BE CHISELED INTO EXISTING CONCRETE.
4. THE "S" SHALL BE NOT LESS THAN 3" HIGH, 2" WIDE, AND 3/16" DEEP.
5. LOCATE PER W-4

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	SEWER LATERAL LOCATION	Drawing No. S-5
DRWN: SEPT. 1962 BY: S.B.		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		9-3-75
				Recommended by Deputy Co. Eng.	Clinton Miller	8/22/75



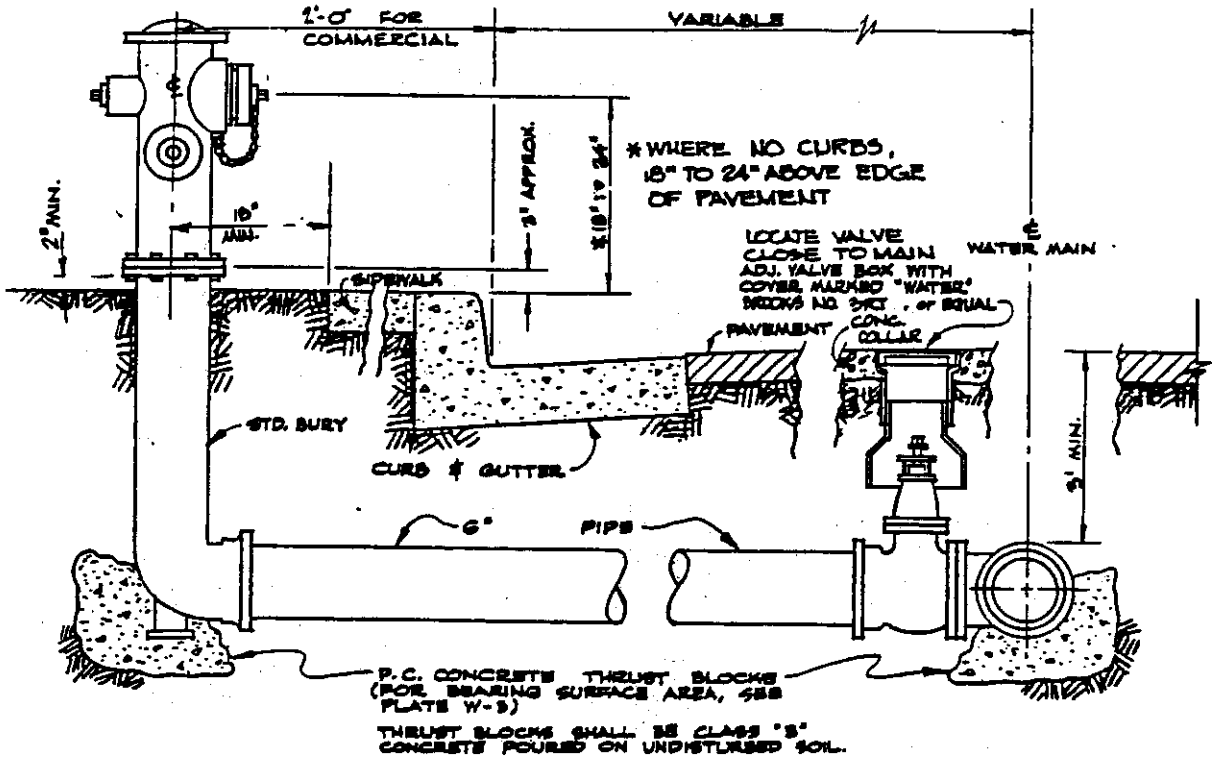
NOTES

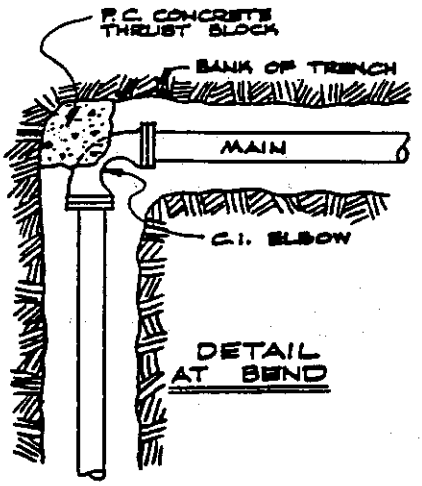
1. IF OPPOSITE SIDE OF STREET IS UNSEWERED, PROVIDE PLUGGED INLETS FOR FUTURE USE.
2. SLOPES 30° TO 45° USE ALT "A"
   IF SLOPES MUST EXCEED 45° USE ALT. "B"
   SLOPES < 30° SEE DRWG. 6(a)
3. LOCATE IN ACCORDANCE W/DRWG W-7

ALTERNATE FOR P.V.C. - P.V.C. PIPE MAY BE USED DIRECTLY OVER MAINLINE WITHOUT THE USE OF CONCRETE ENCASEMENT. ALSO, MAINLINE NEED ONLY HAVE CONCRETE PLACED TO SPRINGLINE

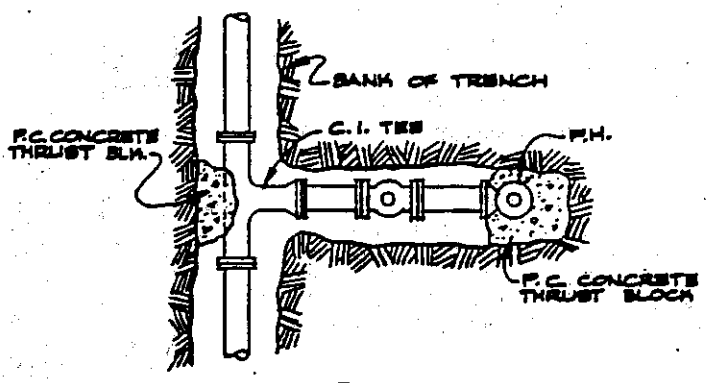
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	STEEP SEWER SERVICE LATERALS	Drawing No. S-6
Drawn: GRR Date: 5-4-75		

Revisions				Approvals		
Description	By	Approved	Date	Road Commissioner - Surveyor	Richard Gillespie	5-9-62
COMMERCIAL 1'-0" DIM.	G.B.		1/22/62	Design Division	JRM	
"Painted ---- yellow."	trm				Albany Tibbetts	5-9-62





DETAIL AT BEND



DETAIL AT FIRE HYDRANT

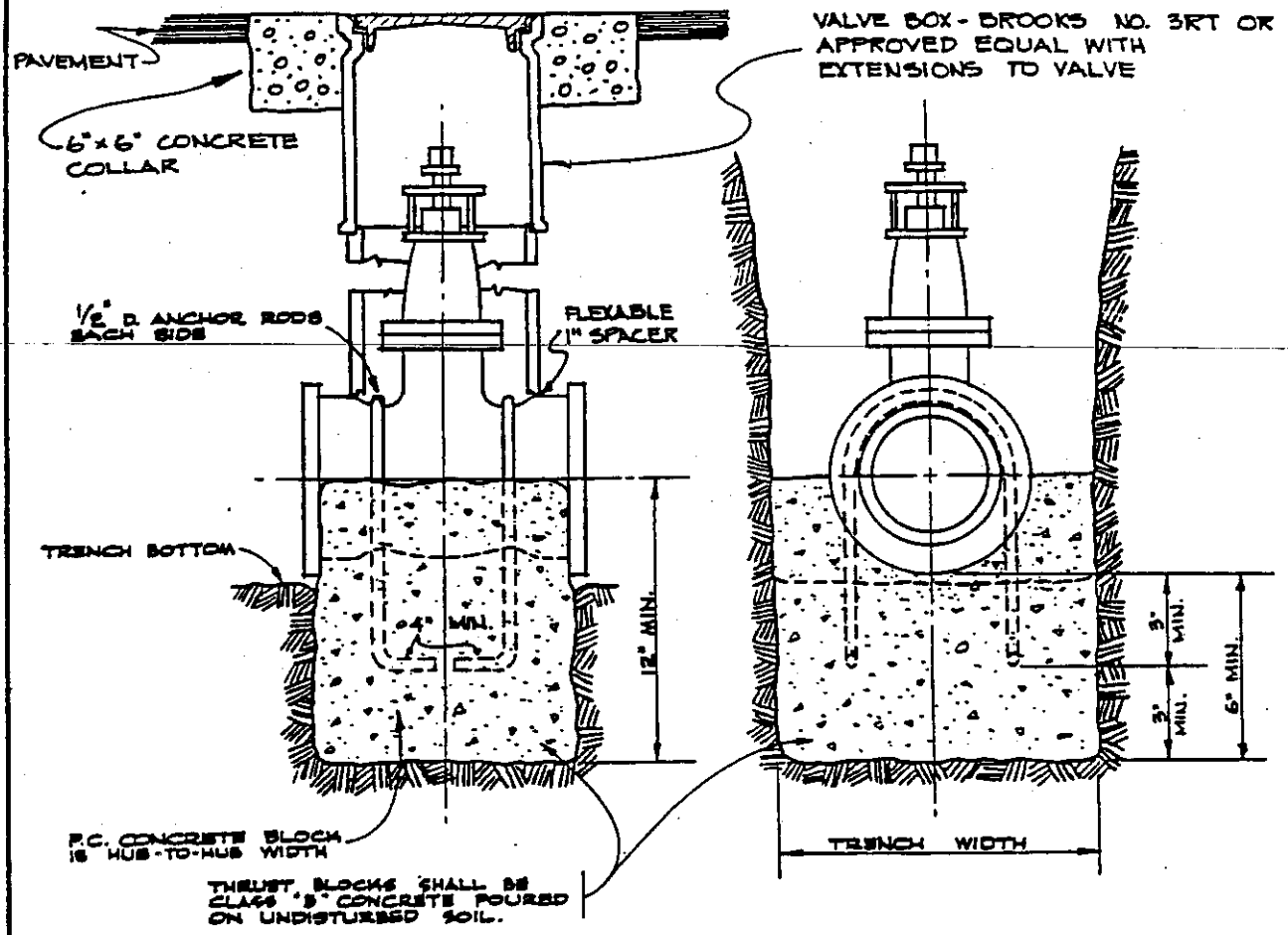
NOTES:

FIRE HYDRANT SHALL BE THE WET OR DRY TYPE FOR MINIMUM 30 INCH BURY, AND MEETING THE REQUIREMENTS OF A.W.W.A. SPECIFICATIONS C 502 AND C503, AND SHALL ALSO MEET THE REQUIREMENTS SET FORTH BY THE FIRE DISTRICT IN WHICH THE IMPROVEMENT IS LOCATED.

A LESSER STANDARD FOR RURAL SUBDIVISIONS MAY BE APPROVED BY THE COUNTY ENGINEER.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	FIRE HYDRANT INSTALLATION	Drawing No. W - 1
DRAWN MAY, 1962 BY: S.G.		

Revisions				Approvals		
Description	By	Approved	Date	Director of Public Works	Richard Gallagher	5-9-62
Added valve box	G.B.H.		11-72	Engineering & Road Div'n.	JRM	
					Bill Ray Nickel	5-9-62



NOTE: NOT APPLICABLE TO 4" OR 6" VALVES.

ALL MATERIALS AND INSTALLATION SHALL CONFORM WITH THE APPLICABLE SECTIONS OF THE SAN LUIS OBISPO COUNTY STANDARDS.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	VALVE ANCHOR	Drawing No. W-2
PREW.: MAY, 1962 BY: G.G.		

Revisions				Approvals		
Description	By	Approved	Date	Road Commissioner-Surveyor	[illegible]	9-3-75
"1" "2" (Title Block Heading	trm			Design Division	JRM	
					[illegible]	5-9-62

TABLE 1

THRUST AT FITTINGS
AT 100 P.S.I. WATER PRESSURE

Pipe Size & Class	Tees	90° deg. Bend	45° deg. Bend	22½° deg Bend
4"-100	1,720	2,440	1,320	660
150	1,850	2,610	1,420	720
200	1,850	2,610	1,420	720
6"-100	3,580	5,030	2,720	1,380
150	3,800	5,370	2,910	1,470
200	3,800	5,370	2,910	1,470
8"-100	6,140	8,680	4,700	2,380
150	6,580	9,300	5,040	2,550
200	6,580	9,300	5,040	2,550
10"-100	9,380	13,270	7,190	3,640
150	10,750	15,200	8,240	4,170
200	10,750	15,200	8,240	4,170
12"-100	13,330	18,860	10,240	5,170
150	15,310	21,640	11,720	5,940
200	15,310	21,640	11,720	5,940
14"-100	17,930	25,360	13,740	6,960
150	20,770	29,360	15,910	8,060
200	20,770	29,360	15,910	8,060
16"-100	23,210	32,820	17,880	9,000
150	26,880	38,010	20,590	10,430
200	26,880	38,010	20,590	10,430

TABLE 2*

SOIL	Safe Bearing Load in lb./sq. ft.
Soft clay	500
Sand	1000
Sand and gravel	1500
Sand and gravel cemented with clay	2000
Shale	5000

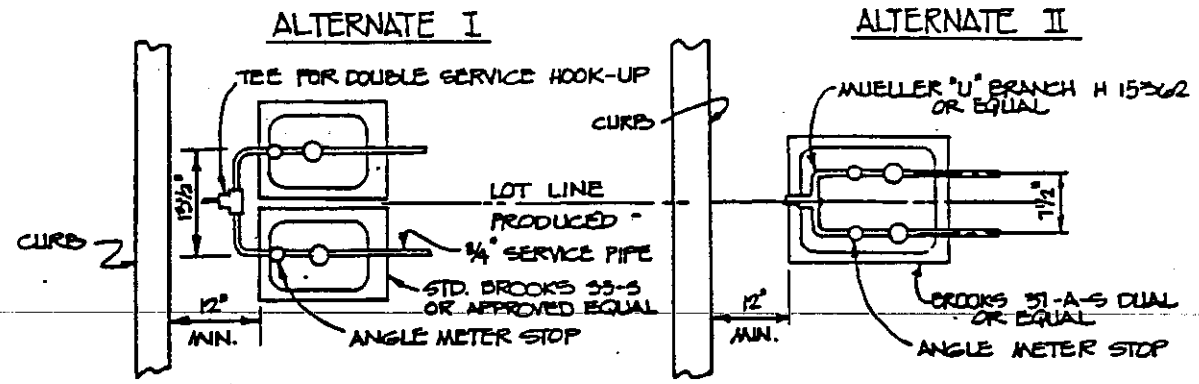
Example: Determine thrust block area for 90° bend for 8" class 150 pipe in sand.

Pressure = 150 plus 50 (test pressure) = 200 PSI from Table 1 9,300 lb. for 100 PSI 18,600 lb. for 200 PSI. Bearing Capacity of sand, Table 2, is 1,000 lb./sq. ft. 18,600/1000=18.6 sq.ft.

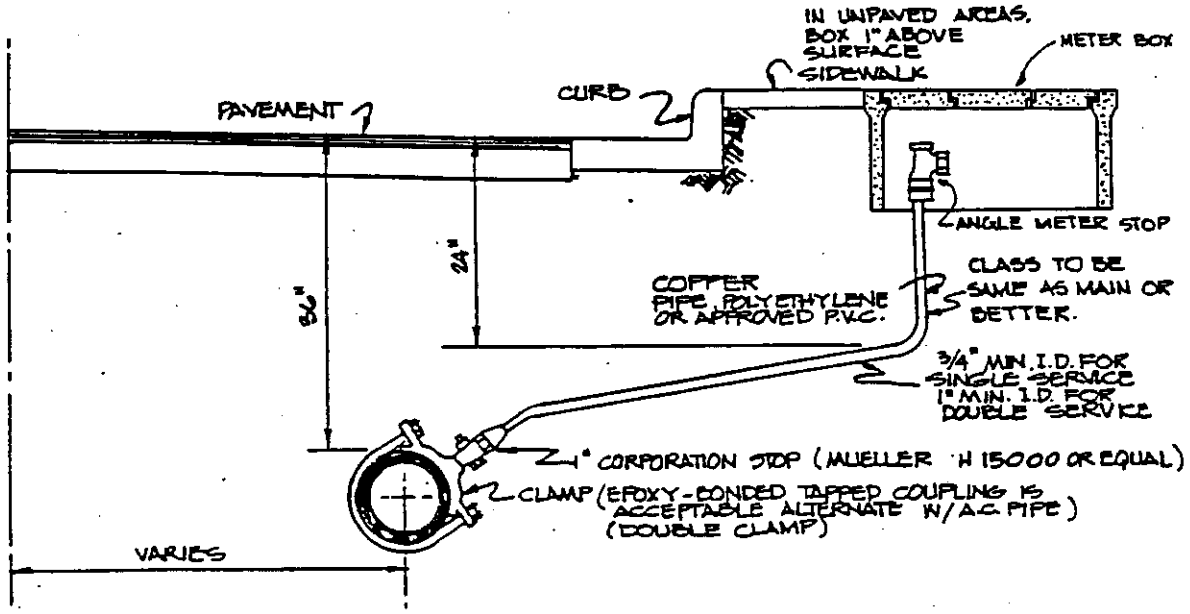
* TABLE 2 SHALL BE SUPERSEDED WHEN THE ACTUAL BEARING CAPACITY OF THE SOIL IS KNOWN FROM SOILS ANALYSIS.

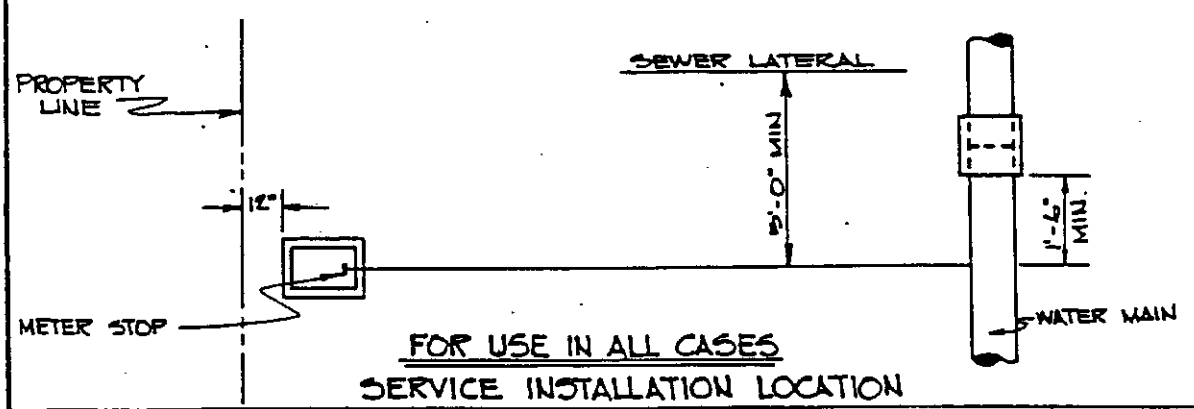
Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	THRUST BLOCK REQUIREMENTS	Drawing No. W-3

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		9-3-75
				Recommended by Dep. Co. Eng.	Clinton Milne	8/29/75



NOTE: ALL MATERIALS AND INSTALLATION SHALL CONFORM WITH APPLICABLE SECTIONS OF THE SAN LUIS OBISPO COUNTY STANDARD.



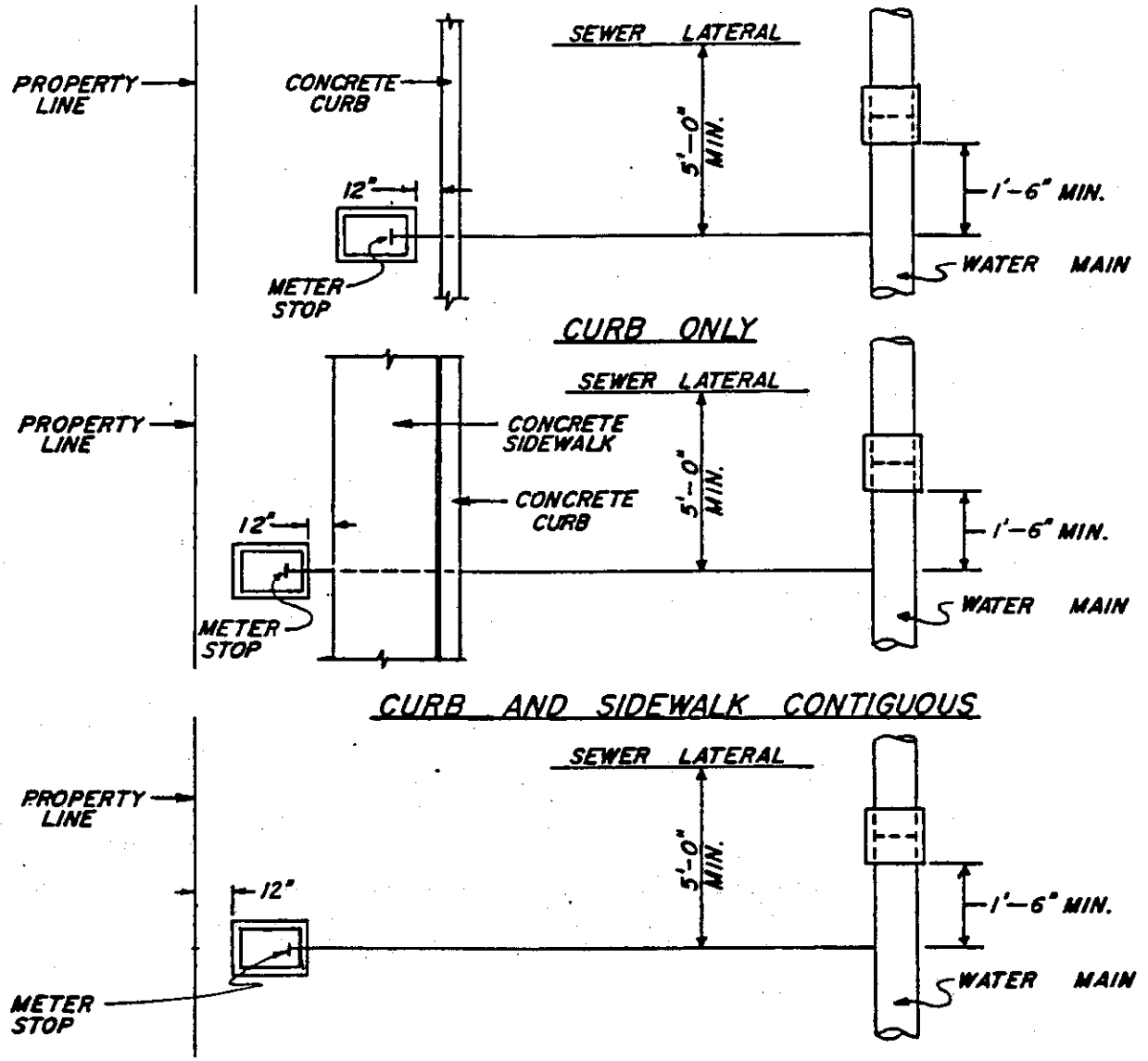


FOR USE IN ALL CASES

SERVICE INSTALLATION LOCATION

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NONE
	WATER SERVICE CONNECTION	Drawing No. W—4
Drawn: GRR Date: 5-75		

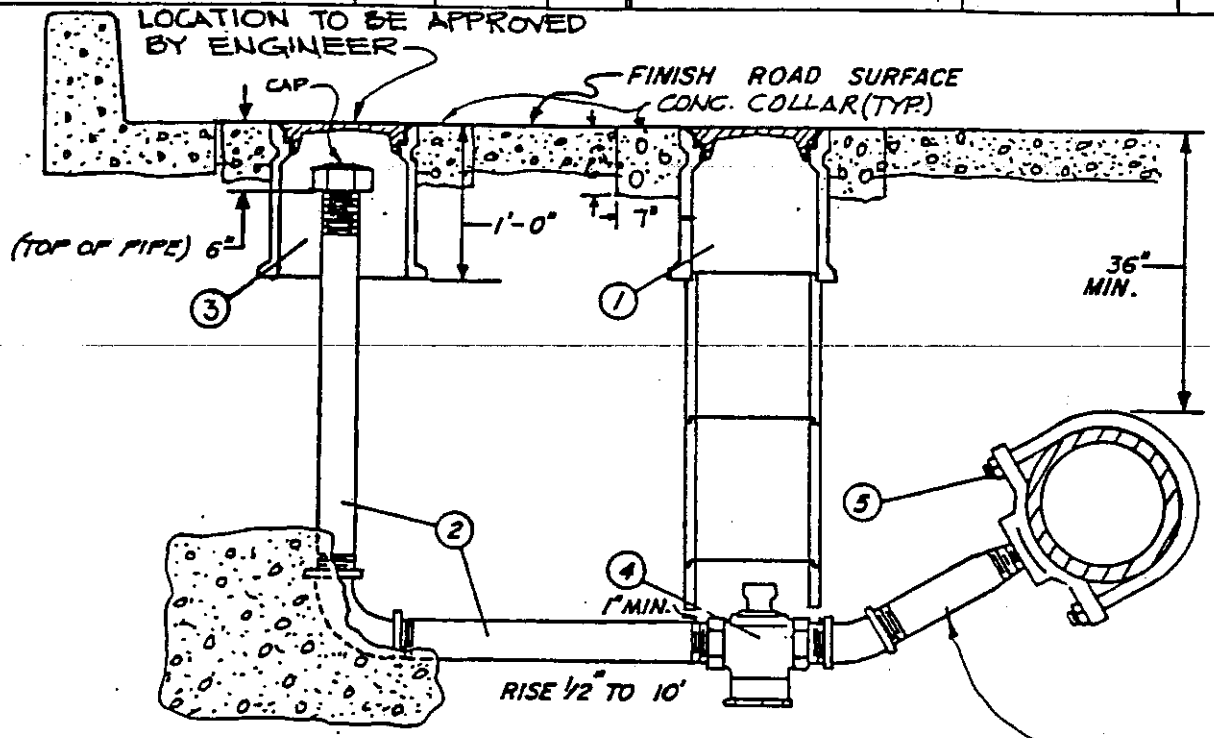
Revisions				Approvals		
Description	By	Approved	Date	County Engineer		9-3-75
				Recommended by Deputy Co. Eng.		8/28/75



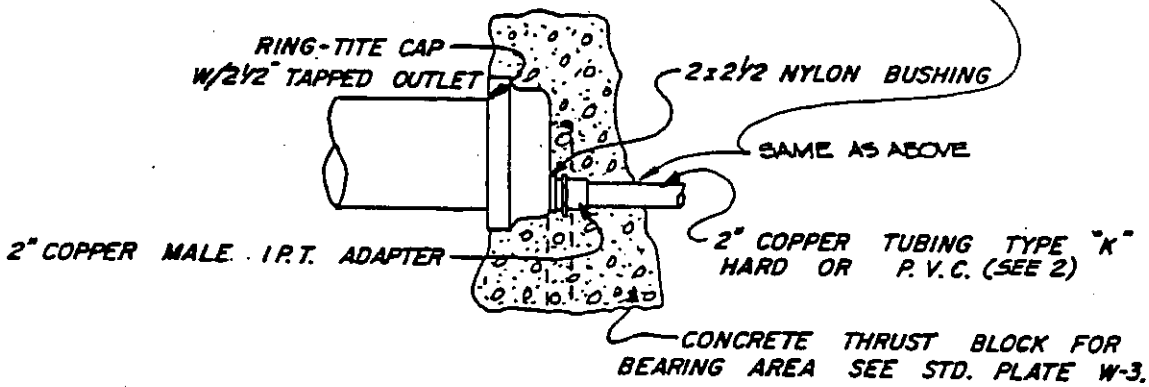
NOTE: ALL BOXES ARE STANDARD METER BOXES.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	SERVICE INSTALLATION LOCATION	Drawing No. W-5
Drawn: G.B.H. Date: NOV. 72		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		9-3-75
				Recommended by Deputy Co. Eng.		8/28/75



ON-RUN CONNECTION OR DEAD END

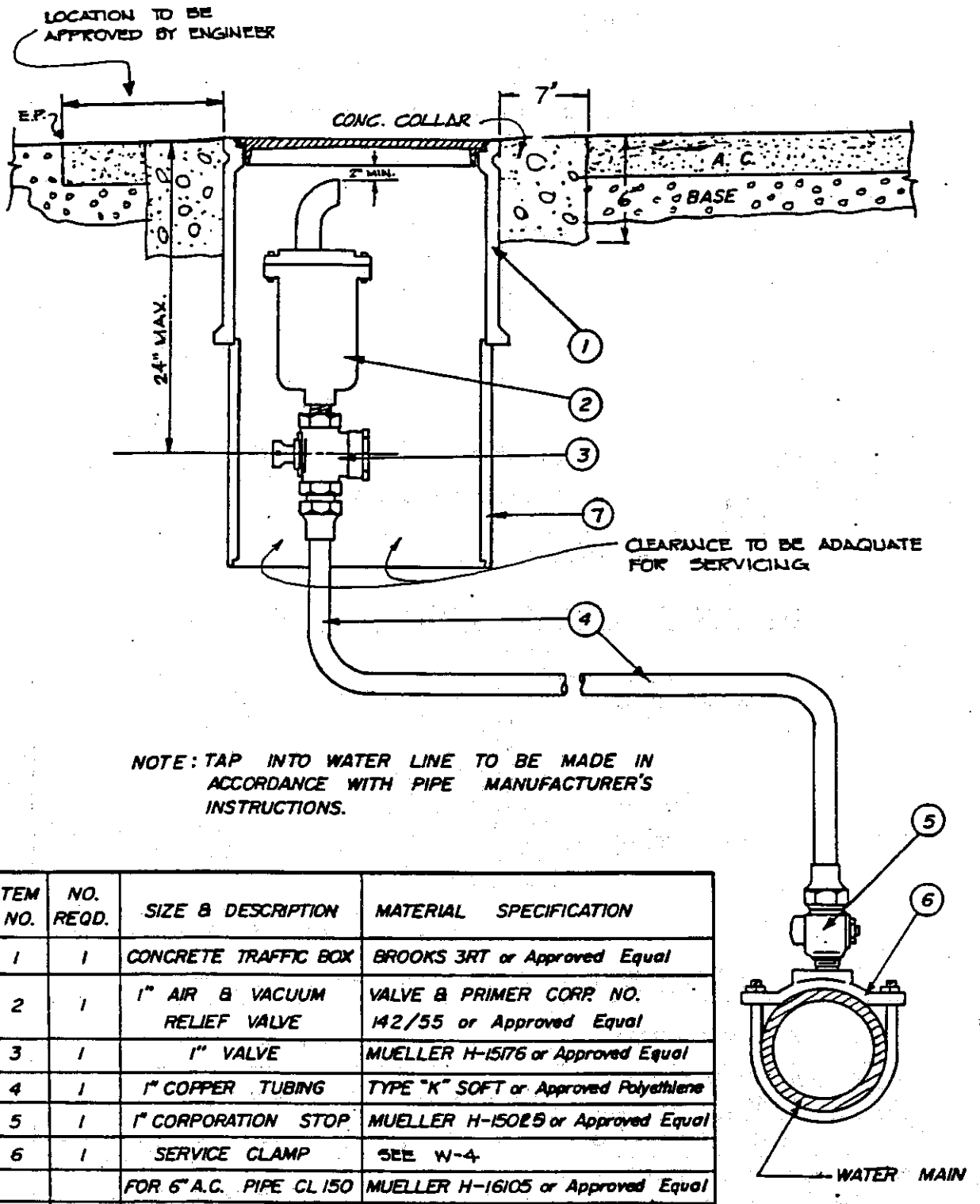


DEAD-END CONNECTION (ALTERNATE)

ITEM NO.	NO. REQD.	SIZE AND DESCRIPTION	MATERIAL SPECIFICATION
1	1	VALVE BOX, EXTENSION, CAST IRON FACE AND LID	BROOKS 3RT OR APPROVED EQUAL
2		2" COPPER TUBING TYPE "K" HARD	OR 2" P.V.C. & POLYETHYLENE (SEE W-4)
3	1	VALVE BOX WITH CAST IRON FACE AND LID	BROOKS 3RT OR APPROVED EQUAL
4	1	2" VALVE - SCREWED ENDS	MUELLER H-10291 OR APPROVED EQUAL
5	1	SERVICE CLAMP (DOUBLE STRAP OR EQUAL)	MUELLER BRONZE DOUBLE STRAP OR APP. EQUAL

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	BLOW-OFF ASSEMBLY	Drawing No. W-6
Drawn. G.B.H. Date: NOV. 72		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		9-3-75
				Recommended by Deputy Co. Eng.	Clinton Milne	8/29/75

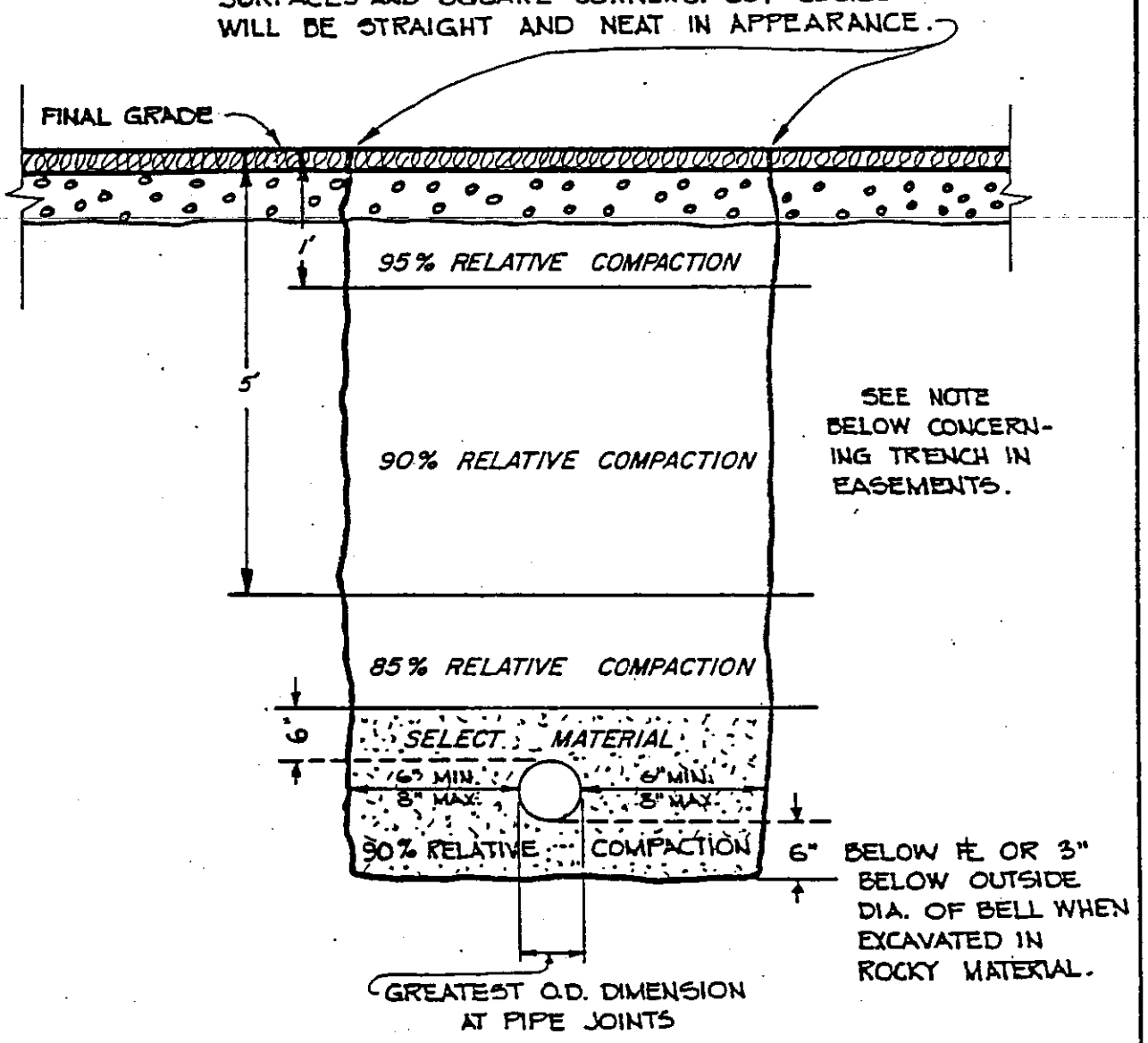


NOTE: TAP INTO WATER LINE TO BE MADE IN ACCORDANCE WITH PIPE MANUFACTURER'S INSTRUCTIONS.

ITEM NO.	NO. REQD.	SIZE & DESCRIPTION	MATERIAL SPECIFICATION
1	1	CONCRETE TRAFFIC BOX	BROOKS 3RT or Approved Equal
2	1	1" AIR & VACUUM RELIEF VALVE	VALVE & PRIMER CORP. NO. 142/55 or Approved Equal
3	1	1" VALVE	MUELLER H-15176 or Approved Equal
4	1	1" COPPER TUBING	TYPE "K" SOFT or Approved Polyethlene
5	1	1" CORPORATION STOP	MUELLER H-15025 or Approved Equal
6	1	SERVICE CLAMP	SEE W-4
		FOR 6" A.C. PIPE CL 150	MUELLER H-16105 or Approved Equal
		FOR 8" A.C. PIPE CL 150	MUELLER H-16109 or Approved Equal
7	1	EXTENSION	BROOKS EXTENSION or Approved Equal

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale: NO SCALE
	1" AIR AND VACUUM RELIEF ASSEMBLY	Drawing No. W-7
Drawn: G.B.H. Date: Oct. 72		

Revisions				Approvals		
Description	By	Approved	Date	County Engineer		9-3-75
				Recommended by Deputy Co. Eng.		8/28/75



SEE STANDARD SPECIFICATIONS COVERING BACKFILL AND TRENCHING OF WATER AND SEWER LINES FOR FURTHER DETAILS AND REQUIREMENTS.

NOTE: A MINIMUM OF 85% RELATIVE COMPACTION PERMITTED IN NON-ROADWAY TRENCH WHEN NO STRUCTURES TO BE BUILT OVER TRENCH. IF STRUCTURES ARE TO BE BUILT OVER TRENCH, USE RELATIVE COMPACTIONS SHOWN ON TRENCH SECTION ABOVE.

Specification Ref.	COUNTY OF SAN LUIS OBISPO ENGINEERING DEPARTMENT	Scale NO SCALE
	BACKFILL REQUIREMENTS FOR WATER OR SEWER LINES	Drawing No. W-8
Drawn G.B.H. Date OCT. 72		