

IMPROVEMENT STANDARDS

for

FRESNO COUNTY

October, 1966

prepared by:

**Fresno County Public Works &
Development Services Department
2220 Tulare, Sixth Floor
Fresno, California 93721**

adopted by:

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FOR
FRESNO COUNTY

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SECTION I

GENERAL
PROVISIONS

SECTION I

GENERAL PROVISIONS

A. STANDARDS

Required improvement work shall be done in accordance with the applicable sections of these Improvement Standards including the California Standard Specifications, prepared by the Department of Public Works, Division of Highways, January, 1971 (hereinafter called the "Standard Specifications"); Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code; and such other special provisions as the developer's engineer deems necessary for the successful completion of the required work.

In case of conflict between the Standard Specifications and these Standards and the Special Provisions, the Special Provisions shall take precedence over and be used in lieu of such conflicting portions of these Improvement Standards, and the Standard Specifications. To supplement the above specifications, standards and special provisions, the engineer for the developer shall prepare necessary plans and profiles using accepted principles of civil engineering. Wherever applicable the standard plans, which are a part of the improvement standards, shall be used.

B. PLANS AND SEPCIAL PROVISIONS

At least twenty working days before the developer desires the Director of Public Works to present his final map to the Board of Supervisors his engineer shall present completed plans and special provisions to the Director of Public Works for review and approval. The Director will not present any final map to the Board of Supervisors until he has given his approval of the plans and special provisions.

All work covered by the plans shall meet the requirements of these Improvement Standards. No deviation in construction methods or materials whatsoever from these Improvement Standards or the Standard Specifications will be allowed unless it is specifically allowed for in the special provisions for the project. All such deviations in construction methods and materials shall be prefaced with the following words:

"In lieu of the requirements of (give reference to the appropriate section or sections of the Improvement Standards or Standard Specifications) for (give method or material for which the substitution is to be made), the following shall prevail:"

The Special Provisions shall be typed on 8 1/2" x 11" paper and shall be firmly attached to each set of plans.

Construction changes from the approved Improvement Plans shall be permitted only upon approval by the Public Works Director. As built plans shall be furnished to the Department of Public Works upon completion of the work and shall be a requisite to the acceptance of the work.

C. DEFINITIONS

When used for the construction of any improvements required by these Improvement Standards, the definitions and terms listed in Section 1 of the Standard Specifications shall apply, with the following exceptions:

Department of Public Works. The Board of Supervisors of the County of Fresno.

Division of Highways. The Department of Public Works of the County of Fresno.

Engineer. The Director of Public Works, acting either directly or through the properly authorized agents, such agents acting within the scope of the particular duties delegated to them.

Engineer's Estimate. The list of estimated quantities of work to be performed as contained in the "notice to contractors" under "engineer's estimate".

Laboratory. The laboratory of the Construction Division of the Department of Public Works or any other laboratory authorized by the Department of Public Works to test materials and work involved in the contract.

Contractor. The person or persons, firm, partnership, corporation or combination thereof, private or municipal entering into a contract with the County of Fresno as party or parties of the second part, or his or their legal representatives. Contractor shall also mean the developer who has entered into an improvement work agreement with the County of Fresno.

In addition to the definition and terms in Section I of the Standard Specifications, whenever in the specifications or on the plans or the contract documents, the following terms are used or pronouns used in place of them, the intent and meaning shall be as follows:

Standard Plans. The standard plans of the County of Fresno, Department of Public Works.

Design Engineer. The civil engineer retained by the subdivider for the preparation of plans, specifications and the general supervision of the construction of the required improvement works.

Improvement Plans. Plans and profiles prepared by the design

engineer, when they have been approved by the Director of Public Works of the County of Fresno.

Specifications. Directions, provisions and requirements contained herein as supplemented by the Standard Specifications and by such special provisions as may be necessary pertaining to the method and manner of performing the work or to the qualities and quantities of materials involved. The special provisions are specific plans or instructions setting forth conditions or requirements peculiar to the project under consideration and covering work or materials not satisfactorily covered by the Standard Specifications or these improvement standards.

D. DRAINAGE REQUIREMENTS

1. Summary of Alternatives.

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1. Alternative for areas where annexation to the Fresno Metropolitan Flood Control District is not possible.
2. Developer's responsibility.

Case II

1. When determined annexation to Fresno Metropolitan Flood Control District is possible.
2. Developer's responsibility.

Case III

1. Where permanent retention site is not available.
2. Developer's responsibility.

Case IV

1. Where permanent retention site is available.
2. Developer's responsibility.

Case V

1. Where permanent drainage facilities have been formed and assessments levied.

2. Alternative Requirements.

Pursuant to Section 11543.5 of the Business & Professions Code of the State of California, payment of storm drainage fee, except as hereinafter provided, shall be required for the purpose of defraying the estimated cost of constructing drainage facilities for removal of surface and storm waters from local or neighborhood drainage areas.

a. Case I - Where an area lies outside the Fresno Metropolitan Flood Control District and it is determined by the Board of Supervisors that the area could not annex within a reasonable time to said district, the developer will not be required to deposit the standard drainage fee. In lieu thereof, the developer shall provide one of the following:

1. A permanent retention area adequate to contain the total volume of runoff from a 100-year, 48-hour duration storm.
2. Drain storm water into natural drainage channels or irrigation canals or to existing drainage facilities.

b. Case II - Where an area lies outside the Fresno Metropolitan Flood Control District and within the drainage element of the general plan and it is determined by the Board of Supervisors that the area could be annexed within a reasonable time to the Fresno Metropolitan Flood Control District, the developer shall deposit the standard drainage fee. In addition thereto an underground drainage system shall be designed and incorporated on the improvement plans.

The installation of an underground drainage system shall automatically be deferred until such time as the Board of Supervisors determines that there are no other permanent means of removing storm water runoff from the development, in which event said system shall be installed with the funds deposited by the developer. Any remaining funds in excess of the cost of installing the leach lines shall be refunded to the person or persons entitled thereto.

In addition to the above requirements, when critical drainage conditions are anticipated, the developer shall also construct immediate temporary drainage relief for a five year (20%) 24 hour storm.

c. Case III - Where an area lies in a planned local drainage district within the Fresno Metropolitan Flood Control District for which a permanent retention site has not been acquired, the developer shall deposit the standard drainage fee.

When critical drainage conditions are anticipated, the developer shall also construct immediate temporary drainage relief for a five year (20%) 24 hour storm.

d. Case IV - Where an area lies in a planned local drainage district within the Fresno Metropolitan Flood Control District for which a permanent retention site has been acquired, the developer shall deposit the standard drainage fee. In addition thereto, when determined by the Board of Supervisors that the development is within a reasonable distance from the retention site, the developer shall provide temporary facilities to convey storm water from the development to the permanent retention site.

When determined by the Board of Supervisors that the development is not within a reasonable distance from the retention site, the developer shall construct immediate temporary drainage relief, for a five year (20%) 24 hour storm.

e. Case V - Where an area lies within the Fresno Metropolitan Flood Control District and an improvement district for permanent drainage facilities has been formed and assessments levied, the developer will not be required to deposit the standard drainage fee.

S E C T I O N I I

D E S I G N

SECTION II
DESIGN

A. STREETS AND HIGHWAYS

1. Geometric Design

- a. Road Widths - The road widths shall comply with the applicable geometric section listed in Section IV of these Improvement Standards.
- b. Design Speeds - (1) The minimum design speed for all local roads shall be 25 m.p.h. (2) The minimum design speed for local collector roads shall be 30 m.p.h. except that in areas easterly of the Friant-Kern Canal when the subdivision design is such that the abutting lots meet the requirements for a residential district as defined in Section 515 of the State Vehicle Code the design speed may be 25 m.p.h. (3) The design speed for major roads shall be 45 m.p.h. in urban areas as defined by the Fresno County General Plan, 45 m.p.h. in all areas easterly of the Friant-Kern Canal or westerly of Interstate Highway 5, and 65 m.p.h. in all other areas of the County.
- c. Grades - Road grades shall not be less than 0.1 percent nor more than ten percent. Grades may be increased to 15 percent for reaches less than 600 feet and cul-de-sacs and dead end streets. Approval may be granted by the director upon submission of sufficient adequate information to evaluate the need to exceed ten percent maximum grade. In snow removal areas the maximum rate of grade shall be ten percent.
- d. Sight Distance - All roads shall be designed to provide the stopping sight distances and the headlight sight distances shown on Tables G-1, G-2, and G-3, using the appropriate design speed.
- e. Superelevation - All roads shall be designed to provide the superelevation shown on Table G-4. Maximum superelevation for roads above the 3,000 foot elevation easterly of the Friant-Kern Canal shall be 0.08 foot per foot. Superelevations shall have a superelevation transition whose length in feet shall be equal to ten times the percent of superelevation for local roads, 15 times the percent of superelevation for local collector roads and 25 times the percent of superelevation for major roads. The superelevation transition shall be divided two-thirds before and after the horizontal curve and one-third within the horizontal curve. The design shall provide for proper transition vertical curves, and crown runoff.

- f. Horizontal Alignment - All roads shall have radii of curvature as indicated on Table G-4 for the design speed of the road. Lengths of curves shall be equal in length to superelevation lengths or the following minimums: local roads - 50 feet; local collector roads - 100 feet; major roads - 200 feet. For any road, curves with a radius of 600 feet or more minimum curve length shall be 200 feet. Reversing curves shall have tangents long enough to provide for the necessary superelevation transitions as indicated in subsection (e) above. When compounded curves are used, the shorter radius shall be at least two-thirds the longer radius, when the shorter radius is less than 1,000 feet.
- g. Intersections - All road intersections shall be as near to right angles as practicable. Where required by topographic conditions intersection angle may be reduced to not less than 60 degrees. Opposing roads entering upon any given road shall have their centerline directly opposite each other or separated by at least 125 feet. Proper sight distances shall be provided.

2. Pavement Design

All street and road structural sections shall be constructed to the degree warranted by anticipated traffic volumes, existing basement soil, and the type of construction material used. The basement soil shall be tested and the type and thickness of sub-base, rock base and pavement determined by California Test Method #301F "Method of tests for determination of the resistance, R value, of treated and untreated bases, sub-bases and basement soils by the stabilometer" in use by the materials and research department of the California Division of Highways, minimum thickness of any one layer of structural material shall be as shown on Improvement Standard A-11. Required traffic indices shall be determined from Improvement Standard A-10. Allowable gravel equivalents are shown on Improvement Standard A-11.

3. Structure Design

All bridges and culverts shall be of either concrete, steel or aluminum and shall be designed for H20-S16 loadings. Design shall comply with the requirements of the American Association of State Highway Officials (AASHO). For all

lengths less than 80 feet, the full clear width of the roadway including shoulders shall be used. For greater lengths, the clear width shall be traveled way plus four feet with a minimum width of 28 feet.

4. Auxiliary Drainage Facilities

Drainage facilities such as asphalt concrete dikes, paved ditches, down drains, unlined ditches, catch basins, storm drain pipes, and culverts shall be included in the design.

5. Auxiliary Safety Facilities

Safety facilities such as street name signs, warning signs, regulating signs, markers, guard rails, and barricades shall be included in the design. Guard rails may be required when any of the following conditions exist: (a) height of embankment more than 10 feet (b) side slope steeper than 4:1 (c) shoulder width less than 8 feet.

6. Sidewalks

When sidewalks are to be constructed they shall be of a minimum width of 4 feet. Sidewalks in commercial developments shall be constructed in the full width of right of way between the property line and the curb and gutter. Sidewalks in residential developments shall be constructed 6" away from the property line. Adjacent type sidewalks may be constructed in residential areas except at the following locations: (a) major roads or arterial roads (b) on existing streets where non-adjacent sidewalks have been established on either side within the same block (c) on existing streets where trees and utilities have been installed in the location of adjacent sidewalks.

7. Non-access Fence

Where access rights have been waived a non-access fence shall be constructed in accordance with Section IV. Other designs will be allowed if they meet the approval of the Director of Public Works.

8. Redwood Headers

2" x 6" redwood headers shall be installed to protect all edges of asphalt concrete where streets are partially completed. The grading of timber shall conform to the provisions of Section 57-2.02 of the Standard Specifications.

9. Street Lights

When street lighting systems are proposed the lights shall

be installed only within rights of way dedicated to the public and designated to be accepted for maintenance by the County. Easements for electrical supply lines shall be provided. Whenever possible street light standards and other street lighting facilities shall be placed on the alignment of side lot property lines. Lights shall be located not more than 500 feet apart and at all intersections. All street lights shall contain an intensity of at least 7,500 lumens. Up-grading of existing or proposed lights may be required at intersections where necessary to prevent a hazard to traffic or pedestrians. Residential and commercial street lighting poles may be of the ornamental type acceptable to the Director of Public Works when they meet the standards of the serving utility company.

10. Signs

Street name, traffic control, and warning signs will be furnished and installed by the Department of Public Works at the expense of the developer.

11. Street Trees

Trees shall be planted in front of each lot. Corner lots shall have one tree on each frontage. The minimum size shall be of a 5 gallon container and the minimum height shall be 6 feet in place. The type of tree shall be chosen from an approved tree list authorized by the Fresno County Tree Board. Trees planted by the developer shall be maintained and watered for one year after acceptance of the work. All street trees shall be placed in accordance with Fresno County Ordinance No. 483

12A. PRIVATE ROAD DESIGN WHERE LOTS ARE A MINIMUM OF 5 ACRES IN AREA

- a. Roadway compaction shall be 90 percent relative compaction Test Method No. 216-F.
- b. Minimum profile grade shall be 0.2 percent.

Maximum profile grades of roads serving 11 or more lots or parcels shall not exceed 12 percent for developments below 4,000 foot elevation; except in the Sierra-South Regional Plan area below 2,000 foot elevation. The director may approve grades not exceeding 20 percent upon request where unusual physical features of the terrain exist. Approval may be granted upon submission of sufficient adequate information to evaluate the need to exceed the 12 percent maximum grade. Chip seal surfacing may be required when grades exceed 12 percent.

The maximum profile grades of roads serving less than 11 lots or parcels shall not exceed 20 percent.

The above grades shall be limited to ten percent and 12 percent respectively for elevations above 4,000 feet or 2,000 feet in the Sierra-South Regional Plan area.

- c. The minimum construction centerline radii and corresponding superelevation rate shall be as follows:

Centerline Radius, Ft.	Superelevation Rate, Ft./Ft.
75	0.12
100	0.10
125	0.08
150	0.04

Superelevation shall not be required for roads with centerline radii exceeding 150 feet except for roads with design speed of 30 m.p.h. or greater. Right-of-way curve dimensions shall be not less than that required for a 25 m.p.h. design speed.

- d. The minimum values for vertical curves shall be as follows:

Crest Vertical Curves

Sag Vertical Curves

$$L = (2S - \frac{1330}{A})$$

$$L = (2S - \frac{400 + 3.5S}{A})$$

L = Curve length in feet.

A = Algebraic grade difference in percent.

S = Sight distance in feet based on minimum horizontal design speed obtained above.

B. TRAVERSABLE ACCESS EASEMENT ROAD

GENERAL

Where new or the extension of existing traversable access roads are required, the engineer shall submit plans or drawings and drainage calculations to the County for review. The plans or drawings shall show the locations of the new or the extension of the existing and proposed centerline profile, contour lines, natural drainage ways crossing the access road and such necessary drainage facilities to protect the access road and parcels from erosion and off-site sedimentation damages. All culverts in natural drainage ways shall be designed for the peak flow from a ten year storm without static head at the entrance. In addition, the culvert sizing and access easement road profile shall be designed such that the total head generated from a 100 year storm, at the entrance, shall not be above one foot below the edge of the access easement road.

Where the traversable access easement road exists, it shall be the responsibility of the engineer to determine if existing culverts are sufficient, and other existing drainage control facilities are adequate and meet the minimum design criteria to serve the extension of the traversable access easement. Where the existing access easement road does not meet the minimum design criteria, it shall be necessary to correct such deficient facilities. The engineer shall submit plans or drawings and drainage calculations to the County for review.

Where drainage ditches are constructed in erodible soils, the drainage ditch side slopes and bottom shall be lined with six inches of crushed rocks two inches or larger in size. In steeper slope drainage ditches, energy dissipators consisting of larger diameter cobbles, or other approved materials, means and methods of energy dissipation shall be placed at suitable intervals. Such other drainage control facilities shall be provided, where needed, to effectively control erosions within and outside the access easement roads where adverse drainage impacts are anticipated, resulting from, caused by, or due to the access easement road.

All areas made bare by construction, and all roadway cuts and fills shall be seeded and strawed in accordance with the County Improvement Standards.

Upon completion of the access easement road, the engineer shall provide a written report to the Director of the Public Works & Development Services Department that the work has been performed and completed and that the access easement road will provide traversable year round access upon proper maintenance.

Where changes during construction have been made, the engineer's report shall indicate what and where such changes occurred and further indicate the affect of the changes upon erosion and drainage control.

GRADING PERMIT

Prior to the start of work, the Contractor shall acquire a grading permit and pay the required permit fee to the County. The permit shall expire 120 days

from the date of the issuance of the permit unless work has commenced within the 120 day period. Upon request, by the permittee, the permit may be extended without payment of additional fee.

GRAVEL SURFACING

Where the roadway grades are less than seven percent the access easement road shall be surfaced with a minimum compacted thickness of two inches of gravel.

Gravel surface easement roads shall be crowned such that the cross slopes shall be not less than two percent nor more than four percent.

CRUSHED ROCK SURFACING

When the centerline profile of the access road is from seven percent to ten percent, the access road shall be constructed with 3/4 inch size crushed rock in accordance with the following thickness.

- a. Two inches minimum thickness for R-value 60 or more.
- b. Three inches minimum thickness for R-value between 40 and 60.
- c. Four inches minimum thickness for R-value between 20 and 40.

ROAD MIXED ASPHALT SURFACING

When the centerline profile of the access road exceeds ten percent, the access road shall be constructed in accordance with the following thickness.

- a. Two inches minimum thickness for R-value 60 or more.
- b. Three inches minimum thickness for R-value between 40 and 60.
- c. Four inches minimum thickness for R-value between 20 and 40.

Berms needed for drainage control may be constructed with the road mixed materials.

In lieu of road mixed asphalt surfacing, plant mixed asphalt surfacing may be substituted.

Plant mixed asphalt surfacing shall conform to the following requirements:

- a. Asphalt binder to be mixed with aggregate shall be liquid asphalt Grade SC-800.
- b. The combined aggregate to be mixed with the asphalt binder shall meet the grading and quality requirements shown on Improvement Standard No. A-15-A.

Alternate engineered design and material specifications may be approved by the Director of Public Works & Development Services Department.

13. Stabilization of Cut and Fill Slopes

All cut and fill slopes, finished or unfinished, and all areas within the development which have had native vegetation removed shall be stabilized in accordance with Section III-N of these Improvement Standards.

Stabilization will not be required when a qualified Soils Engineer, Engineering Geologist or Civil Engineer submit evidence, satisfactory to the Director of Public Works, that stabilization is not required to protect slopes and graded areas from erosion.

The person who will be responsible for the performance of the work must be a licensed landscape contractor with a C-27 license, unless this provision is waived by the Director of Public Works upon a showing that such person has the equivalent ability and the necessary equipment for the performance of the work in the required manner.

14. Materials Report

1. General

Concurrent with or prior to the presentation to the Director of Public Works of road improvements plans, a materials report shall be presented. The report shall contain, or comment on

- (1) a description of the project, including the proposed improvements and the contiguous roadway system,
- (2) climatic conditions if outside the Fresno-Clovis Metropolitan Area including comments on freeze and thaw conditions if they will be encountered,
- (3) terrain surface and sub-surface drainage
- (4) land use and other surface conditions affecting the road, and
- (5) such other information as the engineer deems appropriate. If the subdivision is in an area where the Director of Planning requires the submission of a geological report, the materials report shall contain necessary cross references to this report relating to significant geological formations, such as faults, old slides, unstable area, recommended degree of slopes, erosion control, etc.

2. Roadway Culvert and Embankment Foundations

Foundation conditions within the subdivision shall be described, including a summary of field investigation and the evaluation of data. Items including, but not limited to, ground water, springs, unstable soils, expansive soils, corrosive and abrasive quality of the soil and its effect on service life of culverts, should be set forth in the report. The materials report shall give specific recommendations for foundation treatment, such as recommended subdrainage, stabilization trenches, sand drains, stripping, compaction of original ground, and such additional information the engineer deems necessary.

3. Cuts and Excavations

The material report shall discuss the specific cut or excavation conditions which will be encountered, including, but not limited to, the type and conditions of material, ground water and springs, existing slopes, dip and strike of bedding planes, faults and estimated rip ability.

The report shall contain specific recommendations on proposed cut slope design, recommending benches as necessary for stability, maintenance, or interception of debris. If appropriate, the report shall recommend specific ground water controls which may include horizontal drains, subdrainage and permeable blankets. If the engineer deems any special excavation procedures are necessary, he shall make appropriate recommendations.

4. Embankments

The materials report shall discuss the material to be used in roadway embankment construction. If the construction of certain embankments is affected by such items as quality of materials to be used, moisture control, erosion control, contouring, temporary drainage and expansive soils, the report shall contain specific recommendations for the control of the problems enumerated, such as moisture control for expansive soils, compaction requirements, berms, and embankment slope design. Data shall be provided on materials obtained from special sites.

5. Structural Design

The report shall include recommended structural sections for all roadways, utilizing basement soil R-Value and

traffic indexes for each structural section submitted. The location of all R-Value samples shall be shown on center line profiles and road cross sections which show the original ground lines and the proposed grading plans.

6. Material Sources

The source of road building materials shall be listed. If from other than commercial manufacturers the report shall contain a description of the sites, the limits of borrow, proposed quality control measures and the results of required testing of the materials to be used.

SECTION II
DESIGN

B. DRAINAGE

1. General - All drainage designs shall be done in accordance with the accepted principles of Civil Engineering, these improvement standards and the latest edition of the Highway Design Manual issued by the California Department of Transportation.
2. Hydrology and System Design - For all areas within the boundaries of the Fresno Metropolitan Flood Control District Master Storm Drainage Plan the procedures and design criteria for all drainage facilities shall be in accordance with the Fresno Metropolitan Flood Control District requirements. For all other unincorporated areas within the County the following criteria shall be used:

- a. All surface facilities shall be designed for the five year storm. All underground storm sewers shall be designed for a ten year storm. All roadway culverts shall be designed for the peak flow from a ten-year storm without static head at the entrance. In addition, the culvert sizing shall be designed such that the total head generated from a 100 year storm, at the entrance, is not more than one foot below the edge of the road pavement.

The headwater surface elevation at the upstream side of the culvert created by the peak flow of a 100-year design storm shall be projected upstream as well as laterally to determine the extent of flooding caused by the culvert. In the event any properties, public and private, will be flooded or flooded to a greater extent than the pre-culvert condition, additional culverts, larger culverts or other facilities or solution must be provided acceptable to the director in order to limit the flooding beyond the development boundaries to the prior existing condition.

Flooding limits determined above shall be delineated on the subdivision map.

- b. Flows shall be determined by using the rational formula $Q=CIA$. The determination of C shall be from Chart H-1. The determination of I shall be based on a time of concentration from Chart H-2, from a 60 minute rainfall intensity from either Charts H-4, H-5, and H-7 and from an intensity duration factor from Chart H-8.
- c. Where a natural drainage way passes through the development or requires realignment the channel shall be designed to protect the streets and structures within and adjacent to the subdivision from a 100-year storm. A minimum of 1.5 feet of freeboard shall be provided to allow for the proper flow of lateral channels and pipes.

SECTION II
C. WATER SYSTEMS

1. Water Requirements for a Community System

- a. Domestic Supply. A community water system shall be designed to meet the following criteria of minimum water requirements for domestic supply:

Number of gallons per day per person in a dwelling	150*
Average number of persons per dwelling	3.5
Number of gallons per day per dwelling (product of the above)	520

*This may be reduced to 100 gal/day in Mountain and Foothill Subdivisions

The flow rate for maximum 2 hour domestic demand shall be in accordance with the "Standards of Minimum Requirements for Safe Practice in Production and Delivery of Water for Domestic Use," adopted by the California Section of the American Water Works Association on October 29, 1948. The maximum flow rate Q in gallons per minute shall be determined from the following equations:

$$Q = 100 + F \sqrt{N} \quad \text{up to 625 customer units}$$

$$Q = 100 + N \quad \text{more than 625 customer units}$$

F is a coefficient, usually taken as 25

Table 1 contains data from these equations for selected numbers of lots.

Table 1

Number of lots	Rate (gpm)	Number of lots	Rate (gpm)
10	180	500	659
25	225	600	712
50	275	700	800
100	350	800	900
200	454	900	1000
300	533	1000	1110
400	600		

- b. Commercial Supply. A community water system shall be designed to meet the following criteria of minimum water requirements for commercial supply:

	Volume	Maximum 2 hour demand
Motel	50 gpd per unit	0.2 gpm per unit
Store	100 - 150 gpd	0.5 gpm
Laundromat	200 gpd per washer	1.5 gpm per washer
Restaurant	5 gallons per meal	0.03 gpm per meal
Wash rack	100 gallons per car	5 gpm per car

c. Residential Irrigation (Lawn, Shrubs, and Trees). The community water system shall be designed to supply water for residential irrigation around the homes in accordance with the following formula:

- (1) Multiply number of lots by area of potentiall irrigable land per lot to determine total irrigable land, in acres
- (2) Assume that 25 per cent of the lot owners will apply one-half inch of water per acre in one 24 hour period, which equals

$$\frac{43,560 \times 0.25 \times 7.48}{24} = \underline{3,400 \text{ gpd per acre irrigated}} = 2.36 \text{ gpm}$$

The flow rate for maximum 2 hour demand for residential irrigation shall be taken as 5 gallons per minute per net acre irrigated.

d. Fire Flow. A community water system shall be capable of supporting a fireflow in accordance with the following formulae. For residential development $Q = (700)(P)^{\frac{1}{2}}$. For areas of commercial development $Q = (1,020)(P)^{\frac{1}{2}}(1 - 0.01P^{\frac{1}{2}})$ in which Q is the rate in gallons per minute and P is the population served in thousands. When using the formula for commercial development, the population served shall be considered at 40 persons per acre. Gravity storage or adequate source capacity shall be provided to maintain this rate of flow for a period of two hours.

e. Storage. Storage capacity shall be provided to protect the users from failure of domestic supply and to assure an adequate quantity of water for fire protection in the event of a power or source failure or major disruption of the distribution system. It shall be determined by the following criteria:

	Domestic use per cent of daily requirement	Fireflow percent of requirements in Section E
(1) Single power source, no standby power and a single source of supply	50	50
(2) Single power source standby power, single source of supply	25	25
(3) Double power source, single source of supply	10	10
(4) Multiple power source, multiple source of supply	0	0

The requirements for domestic use and fireflow shall be additive. The time required for replenishment of storage shall not exceed 48 hours and on subdivisions in the mountain and foothills it shall not exceed 24 hours.

2. Computation of Source Capacity. The engineer for the developer shall file with the Department of Public Works a computation of the water supply requirement for a subdivision.

3. System Design. Each water system shall be designed in accordance with the following criteria.

a. General. All distribution systems shall be designed to permit circulation of water throughout, except where impractical because of a cul-de-sac or like condition or the incomplete development of a grid system. All dead end runs shall be provided with a means for flushing.

b. Water Mains.

(1) Size. The water mains shall be of adequate size and so designed in conjunction with related facilities to maintain a minimum operating pressure of 20 psig for each customer at the time of maximum demand in the system.

All water mains shall have a minimum nominal diameter of six (6) inches, except cul-de-sacs or other streets not required to have a fire hydrant, and serving six (6) lots or less, in which case a minimum size of four (4) inches nominal diameter shall be permitted.

(2) Location. In general, mains shall be placed in the traveled portion of streets parallel to and fifteen (15) feet from the property line, but shall in no case be closer than four (4) feet from the lip of the gutter.

The mains shall be laid in the streets on which the property to be served fronts or on an approved easement, and in subdivisions, on all streets within and to the limits of the subdivision.

c. Gate Valves.

(1) Size. Gate valves shall be of the same size as the pipe line in which they are installed.

(2) Location. In general, on distribution systems, a minimum of three valves shall be placed at a cross and two valves at a tee and shall be placed on the projection of property lines.

(3) Spacing. Valves on distribution systems shall be so located that any single break, accident or repair, will not necessitate shutting from service a length of main greater than 1320 feet except that in mercantile, industrial, or other higher value districts the Director may require a maximum length of 660 feet.

d. Air Release and Vacuum Valves. Air release and vacuum valves of adequate size shall be provided where necessary at all high points on mains. Suitable housing and protection for said valves shall be provided and a shut off valve shall be provided in conjunction with each air release and vacuum valve to permit removal of said valves for maintenance and servicing. Sand blow-offs as required shall be installed.

e. Flexible Couplings. Sufficient flexible couplings shall be provided in all piping adjacent to structures to permit differential settling of the foundations of said piping and structures without damage to the piping.

f. Service Laterals. In general, a separate lateral shall be provided to each lot in the subdivision. Main water pressure, type of development and expected rate of water consumption shall determine the size of the service lateral but in no case shall said lateral be smaller than a nominal diameter of 3/4" for copper services or 1" for galvanized steel services or such other type of material as may be approved by the Director of Public Works. Service laterals shall be placed perpendicular to the main and within the limits of the projection of the property lines of the property to be served wherever feasible.

g. Fire Hydrants. Fire Hydrants shall meet the requirements of the American Waterworks Association. The hydrant spacing shall be uniform, insofar as is practical, with maximum spacing such that the maximum run of hose required between any hydrant and the nearest available point on the extreme lot shall not exceed 800 feet.

Each hydrant shall have a capacity of 500 gallons per minute with a friction loss not to exceed 2½ pounds per square inch through the hydrant and a total loss not to exceed 5 pounds per square inch between the street main and the hydrant outlet.

Each hydrant shall be served by a circulating system so that it may obtain water from two directions in a grid, except that those hydrants which are on cul-de-sacs may have a single supply main not over 500 feet in length.

Fire hydrants shall be placed with the centerline of the hydrant not less than 24 inches behind the face of the curb or edge of pavement nearest to the main. In general hydrants shall be located at street intersections in conformance with standard drawings, with additional hydrants located at sufficient intervals along the streets to comply with the spacing requirements of the standards.

h. Thrust Blocks. All tees, bends, plugs, fire hydrants and other sections of piping and appurtenances that might be capable of being displaced by the action of either working pressures or test pressures within the water system shall be anchored in place by the use of thrust blocks, thrust blocking or harnesses as shown on the Standard Drawings. The bearing areas of thrust blocking on the supporting soil shall not exceed that allowable for the soil involved. The pressure used to determine the required size of thrust blocks bearing area shall be no less than the test pressure required in Section 13-05 herein. Plans for the water system shall indicate the required thrust block bearing areas.

i. Water Tanks. Water tanks shall be designed to have the capacity required by the provisions of this Section. Design shall comply with the requirements of AWWA Standard D100-59, however, wherever the use of these requirements are not feasible the Director may approve other standards.

Wind, seismic and snow loads shall be those specified by Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code in lieu of those specified in Sections 3.2.3, 3.2.4 and 3.2.5 of said AWWA Standard D100-59.

Foundations shall be designed to adequately support the tank against dead, and live loads, including seismic, wind and snow loads.

SECTION II
D. SEWERAGE SYSTEMS

1. General - All calculations requested by the Director of Public Works to verify the design of any portion of the sewerage system shall be submitted for his review. The calculations shall be based on rational methods generally accepted by the engineering profession and shall be neatly and legibly done in such form as to enable them to be readily checked. Literature and technical data concerning any of the materials and equipment proposed to be used may be requested by the Director of Public Works.

When the sewerage collection system is to become a part of an existing sanitation system it shall meet the design requirements of the administrative agency controlling the system. However in no case shall the design standards used be less than those enumerated herein.

Whenever sewerage systems are to be installed in an area which has a master sewerage plan, the facilities shall be designed as much as possible to conform with the various elements of this plan.

2. Standard drawings for sewerage construction purposes as set forth in Section 4 shall be used in conjunction with these standards for all sewerage construction purposes. Construction by methods differing from standard drawings which will give equivalent or better results may be approved by the Director of Public Works.

3. Deviation from the standard drawings may be required by the Director of Public Works for unusual conditions.

4. Main Sewers - Main sewers shall be designed and constructed to transmit the sewage which will result from the ultimate development of the tributary area in the subdivision. Consideration of the type of the development anticipated or existing shall be given in arriving at the design flow but in no case shall any sewer be smaller than the size required by the zoning in the area as determined by Table A with the sewer flowing half full. In no case shall any sewer be less than 6" in actual inside diameter. Sewers larger than 10" in diameter may be designed for full flow without surcharge. In no case shall smaller pipe be used in any location than that upstream of said location. Pipes shall be designed to withstand the vertical loads which will be imposed on them.

TABLE A

Sewer Main Design Coefficients as related to zoning districts as set forth in Part III, Division II, of the Fresno Ordinance Code.

Zone District	Cubic feet per second per acre
R-1	.005
R-2	.011
R-3 & R-3A	.020
R-4	.030
C-P, R-P, C-1 thro C-6	.015
R-A	.001
R-1-A & R-1-AH	.002
R-1-B	.003
R-1-C	.004
T-P	.012

5. Grades - Sewer grades for mains shall be that required to produce a velocity of flow when flowing half full of generally not less than 2 nor more than 10 feet per second determined by using Manning's formula using a coefficient of roughness of 0.013 for clay, concrete, asbestos, cement or cement lined cast iron pipe. For other types of pipe the "N" value shall be assigned by the Director of Public Works.

At each change of alignment sufficient drop shall be allowed through the structure to compensate for the resultant energy loss, but in no case shall the invert drop less than 0.10 feet for deflection angles exceeding 30 degrees. Grades between sewer line appurtenances shall be uniform. No deviations shall be permitted. For pipe sizes, change in manholes or other structures the crown of the smaller sewer shall be no lower than that of the larger sewer.

5. Minimum depth of main sewers within road rights of way shall be 36" from the finish grade to the top of pipe unless special permission is granted by the Director of Public Works for some lesser depth due to topographical or structural limitations. In mountain areas it may be necessary to increase this minimum depth to be sure that the main sewers are below the frost line.

7. Bedding - The bedding of all sewers shall be so designed that the effective working strength of the pipe shall not be exceeded and the pipe will have no misalignment or change in grade after backfilling. Bedding shall be designed to provide a minimum load factor of 1.5 over the pipe strength required by these standards. When calculating anticipated loadings on sewer pipes it shall be assumed that the backfill material gives loading conditions no less severe than that produced by saturated clay having a soil density of 125 pounds per cubic foot, unless soil tests indicate that the backfill will have different density or soil characteristics.
8. Manholes - Manholes shall be spaced no further than 350 feet apart on public main sewers and shall be placed at each change in alignment, grade, or pipe size on such sewers.
9. Clean Outs - Six inch or larger clean outs shall be provided at the dead end of all public sewer lines at no more than 350 feet from the nearest manhole.
10. House Services - House service sewers and private sewers shall comply with the requirements of Chapter 11 of the Uniform Plumbing Code, 1961 edition and these standards.

No house sewer or private sewer shall be less than 4" in diameter. House services shall be of sufficient depth at the property line to serve every portion of the property involved, in no case less than 30" deep at the curb line to the top of the pipe.

No less than one house service shall be constructed to each lot in the subdivision and a property line clean out shall be provided at every house service and shall be considered as a portion of the construction from the main to the property line. Connection of private sewers or house services six inches in diameter or larger to public sewer mains shall be made with standard sewer manholes.

11. Treatment Facilities - All treatment facilities shall be designed to handle the ultimate demands of the subdivision. The design shall be such that additional units can be incorporated to provide for future demand requirements. Design shall provide for the production of effluent which will meet the requirements of local and State agencies. Electrical, Mechanical and Structural design shall comply with the requirements of sub-section E, F, and G of this Section.

SECTION II

E. ELECTRICAL

The design of all necessary electrical installation and related facilities shall be done only by persons properly registered under the Civil and Professional Engineers Act of the State of California, and shall meet the requirements of Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code, Uniform Electrical Code and these standards. Attention is directed to Section III, subsection G of these improvement standards. The design shall be compatible with these construction requirements.

SECTION II
F. MECHANICAL

The design of all mechanical installation and related facilities needed to meet the requirements of these improvement standards shall be done only by persons properly registered under the Civil and Professional Engineers Act of the State of California and shall be in accordance with the accepted principles of mechanical equipment design. All equipment shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation. The equipment shall be adequately stayed, braced and anchored to resist all operational stresses and for necessary wind and seismic loads. Appearance as well as utility shall be given consideration in the design of details. Specifications for each item of equipment shall either be shown on the plans or included in the special provisions. Attention is directed to Section III-D, subsection H, of these improvement standards. The design shall be compatible with these construction requirements.

SECTION II

G. BUILDING AND STRUCTURES

The design of all buildings and structures necessary to meet the requirements of these improvement standards shall be done only by persons properly registered under the Civil and Professional Engineers Act of the State of California and shall be done according to accepted principles of civil and structural engineering. The design shall meet the requirements of Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code.

All requirements of the State of California, Department of Industrial Relations, Division of Industrial Safety shall be met in the design of all buildings and structures.

On minor construction work, the Director may permit the design of the concrete mixture to be designated by either Class A, Class B, etc. as provided in Section 90 of the Standard Specifications in lieu of control by designating compressive strength at a specified age as provided by said Building Code.

In the event that the Standard Specifications are used to control the design of the concrete mixture, said Specifications shall take precedence over said Building Code in case of conflict

REVISED SECTION II-H OF IMPROVEMENT STANDARDS

SECTION II

H. GEOTECHNICAL REPORTS

1. INTRODUCTION

Geotechnical reports are of the following nature:

Geologic

Soils Engineering

Groundwater Supply

Sewage Disposal

For a given project any of the individual evaluations may be required. If the project warrants, all four may be combined into a Project Geotechnical Evaluation.

When the Ordinance Code requires either a Soil Report, (Section 17.32.030), a Geological Survey (Section 17.28.050Y3 and 4), Water Supply Evidence and the water supply is to be provided by wells or springs, (Sections 17.48.310 A and C, 17.28.050X, and 17.72.360), Sewerage Requirement Evidence (Sections 17.72.360 and 17.28.068I) such reports, surveys or evidence shall consist of onsite evaluations and be compiled from the following guidelines:

a. Purpose

The purpose of such surveys, reports or evidence is to provide the County Departments of Health, Planning, Public Works, and Resources and Development sufficient information for interpretation of the onsite conditions of the proposed development and surrounding affected areas to enable them to:

- 1) Determine the nature of the physical improvements which will be required in the development to meet the requirements of the developer and the County Ordinance Code; and

- 2) Evaluate both the capability of the area on which the development will be built to absorb the developments and the impact such development may have on the environment.

b. Professional Qualification

Such surveys, reports and evidence will be prepared by professionals who have been approved by the County Director of Resources and Development. In order to be approved, the professional (in accordance with the appropriate provisions of Chapters 7 and 12.5 of Division 3 of the State Business and Profession's Code) must meet one of the following qualifications:

- 1) be a Certified Engineering Geologist as provided for in Chapter 12.5; or
- 2) be a Registered Geologist as defined in 12.5; or
- 3) be a Registered Civil Engineer as defined in Chapter 7. Each of the above shall accept the responsibility for the Report insofar as Chapters 7 and 12.5 legally allow them to do so.

Insomuch as the surveys, reports and evidence will require extensive soil, hydrology and groundwater expertise, the persons selected to conduct the various portions of the study must have a minimum of three years experience in these fields of study or be in consortium with individuals having this experience.

The contents of the Report(s) shall be the responsibility of the professional or professionals who prepare it. The preparers will use their professional judgment in determining the contents of the report(s). However, the reviewing Departments will expect the Report to be prepared in accordance with and contain appropriate portions of the following sections. It is recommended that the preparer of the Report consult with the reviewing Departments as to the appropriate

content of the Report prior to beginning the work. However, final approval of the report will remain with the Director of Resources and Development and will not be made until the comments of all reviewing Departments are jointly considered.

b. Distribution

Seven copies of the required report or combination of reports shall be presented to the Director of Resources and Development not later than the time Tentative Map is filed. The Director will distribute the Report to other affected Departments. It is recommended that the Report be submitted at an earlier date to provide these Departments sufficient time to complete their review prior to formal submission of the Tentative Map in order to preclude the possibility of the redesign of the lots or the elimination of portions of the proposed subdivisions.

c. General Information

Each report should include definite statements concerning the following matters:

- 1) Location and size of subject area, and its general setting with respect to major geographic and geologic features.
- 2) Who did the related mapping upon which the report is based, and when was the mapping done.
- 3) Any other kinds of onsite investigations made by the professional and, where pertinent, reasons for doing such work.
- 4) Topography and drainage in the subject area.
- 5) Distribution and general nature of exposures of earth materials within the area (soils, bedrock, etc.).

- 6) Nature and source of available subsurface information. Suitable explanations should provide any technical reviewer with the means for assessing the probable reliability of such data. Subsurface relationships can be variously determined or inferred, for example, by projection of surface features from adjacent areas, by the use of test-hole logs, and by interpretation of geophysical data, and it is evident that different sources of such information can differ markedly from one another in degree of detail and reliability according to the method used.

2. MAPPING

a. Geologic Mapping

- 1) Each report must be a product of independent geologic mapping of the subject area at an appropriate scale and in sufficient detail to yield a maximum return of pertinent data. In connection with this objective, it may be necessary for the professional to extend his mapping into adjacent areas.
- 2) All mapping should be done on a base with satisfactory horizontal and vertical control--in general a detailed topographic map. The nature and source of the base map should be specifically indicated. For subdivisions, the base map should be the same as that to be used for the tentative map or grading plan.
- 3) Mapping by the professional should reflect careful attention to the lithology, structural elements, and three-dimensional distribution of the earth materials exposed or inferred within the area. In most hillside areas these materials will include both bedrock and surficial deposits. A clear distinction should be made between observed and inferred features and relationships.
- 4) A detailed large-scale map normally will be required for a report on a tract, as well as for a report on a smaller area in which the geologic relationships are complex.

- 5) Where three-dimensional relationships are significant but cannot be described satisfactorily in words alone, the report should be accompanied by one or more appropriately positioned structure sections.
- 6) The locations of test holes and other specific sources of subsurface information should be indicated in the text of the report or, better, on the map and any sections that are submitted with the report.

b. Hydrologic Mapping

Hydrologic mapping, when required, shall be prepared at the same scale as the geologic map. The map shall clearly delineate those areas in which groundwater exists within ten feet of the ground surface and where bedrock or other impermeable layers exist within five feet of the ground surface. It shall also depict:

- 1) Distribution and occurrence (e.g., steams, ponds, swamps, springs, seeps, subsurface basins).
- 2) Relations to topography. (How do streams, ponds, swamps, springs, seeps, etc., relate to topography?)
- 3) Relations to geologic features (e.g., previous strata, fractures, faults).
- 4) Sources and permanence.
- 5) Variations in amount of water (e.g., intermittent springs and seeps, floods).
- 6) Evidence for earlier occurrence of water at localities now dry (e.g., vegetation, mineral deposits, historic records).

- 7) The effect of water on the properties of the in-place materials.

3. GEOLOGIC REPORT

The report should contain brief but complete descriptions of all natural materials and structural features recognized or inferred within the subject area. Where interpretations are added to the recording of direct observations, the bases for such interpretations should be clearly stated.

The following check list may be useful as a general, though not necessarily complete guide for descriptions:

a. Bedrock--igneous, sedimentary, metamorphic types.

- 1) Identification as to rock type (e.g., granite, silty sandstone, mica schist).
- 2) Relative age and, where possible, correlation with named formations (e.g., Rincon formation, Vaqueros sandstone).
- 3) Distribution.
- 4) Dimension features (e.g., thickness, outcrop breadth, vertical extent).
- 5) Physical characteristics (e.g., color, grain size, nature of stratification, foliation, or schistosity).
- 6) Special physical or chemical features (e.g., calcareous or siliceous cement, concretions, mineral deposits, alteration other than weathering).
- 7) Distribution and extent of weathered zones; significant differences between fresh and weathered rock.

8) Response to natural surface and near-surface processes (e.g., gullying, mass movement).

b. Structural Features--stratification, foliation, schistosity, folds, zones of contortion or crushing, joints, shear zones, faults, etc.

1) Occurrence and distribution.

2) Dimensional characteristics.

3) Orientation, and shifts in orientation.

4) Relative ages (where pertinent).

5) Special effects upon the bedrock. (Describe the conditions of planar surfaces.)

6) Specific features of faults (e.g., zones of gouge and breccia, nature of offsets, timing of movements); are faults active in either the geological sense or the historical sense?

c. Surficial Deposits--unconsolidated deposits, artificial (manmade) fill, topsoil, stream-laid alluvium, beach sands and gravels, residual debris, lake and pond sediments, swamp accumulations, dune sands, marine and nonmarine terrace deposits, talus accumulations, creep and slopewash materials, various kinds of slump and slide debris, etc.

1) Distribution, occurrence, and relative age; relationships with present topography.

2) Identification of materials as to general type.

3) Dimensional characteristics (e.g., thickness, variations in thickness, shape).

4) Surface expressions and correlation with features such as terraces, dunes, undrained depressions, etc.

- 5) Physical or chemical features (e.g., moisture content, mineral deposits, content of expansible clay minerals, alteration, cracks and fissures, fractures).
 - 6) Physical characteristics (e.g., color, grain size, hardness, compactness, coherence, cementation).
 - 7) Distribution and extent of weathered zones; significant differences between fresh and weathered material.
 - 8) Response to natural surface and near-surface processes (e.g., gullyng, subsidence, creep, slope-washing, slumping and sliding).
- d. Features of Special Significance (if not already included in foregoing descriptions).
- 1) Features representing accelerated erosion (e.g., cliff retreat, badlands, advancing gully heads).
 - 2) Features indicating subsidence or settlement (e.g., fissures, scarplets, offset reference features, historic records and measurements).
 - 3) Features indicating creep (e.g., fissures, scarplets, distinctive patterns of cracks and/or vegetation, topographic bulges, displaced or tilted reference features, historic records and measurements).
 - 4) Slump and slide masses in bedrock and/or surficial deposits; distribution, geometric characteristics, correlation with topographic and geologic features, age and rates of movement.
 - 5) Deposits related to recent floods (e.g., talus aprons, debris ridges, canyon-bottom trash).

- 6) Active faults and their recent effects upon topography and drainage.

4. BEARING OF GEOLOGICAL FACTORS UPON THE INTENDED LAND USE

This section shall contain specific recommendations concerning the feasibility of the project as affected by the site's geology, and if necessary an analysis of the property on a lot-by-lot basis. Specific recommendations for the correction of all known and anticipated hazards on the project shall be included. This section involves the evaluation of both (1) the effects of geologic features upon any proposed grading, construction, and land, use; and (2) the effects of these proposed modifications upon future geological processes in the area.

The following check list includes the topics that ordinarily should be considered in submitting discussion, conclusions, and recommendations from a geologic perspective:

a. Compatibility of Natural Features

General compatibility of natural features with proposed land use to determine if it is basically reasonable to develop the subject area.

- 1) Topography.
- 2) Lateral stability of earth materials.
- 3) Problems of flood inundation, erosion, and deposition.
- 4) Problems caused by features or conditions in adjacent properties.
- 5) Other general problems.

b. Proposed Cuts

- 1) Prediction of what materials and structural features will be encountered.

- 2) Prediction of stability based on geologic factors.
- 3) Problems of excavating (e.g., unusually hard or massive rock, excessive flow of ground water).
- 4) Recommendations for reorientation or repositioning of cuts, reduction of cut slopes, development of compound cut slopes, special stripping above daylight lines, buttressing, protection against erosion, handling of seepage water, setbacks for structures above cuts, etc.

c. Proposed Masses of Fill

- 1) General evaluation of planning with respect to canyon-filling and sidehill masses of fill.
- 2) Comment on suitability of existing natural materials for fill.
- 3) Recommendations for positioning of masses, provision for underdrainage, buttressing, special protection against erosion.

d. Special Recommendations

- 1) Areas to be left as natural ground.
- 2) Removal or buttressing of existing slide masses.
- 3) Flood protection.
- 4) Problems of ground water circulation (e.g., flow pattern modification due to pumpage or interruption of recharge).
- 5) Position of structures with respect to active faults.

5. SOIL ENGINEERING AND GRADING

When a soil engineering report is required, it should include a map of all proposed grading sites. The map should also include accurate locations of all subsurface exploratory test wells, pits, or borings.

The Report should describe all proposed grading on the project, giving the location, topographic relief, drainage, rock and soil types present in the areas to be graded, the grading proposed and the effects of such grading on the site and adjoining properties. Cut and fill slope stability analyses should be included to substantiate recommendations concerning the vertical height and angle of all slopes on the project.

The Report should be sufficient to outline existing and anticipated soil problems and recommended solutions to these problems, and should indicate wherever proposed grading or other proposed improvements may adversely affect the existing or future stability of the site.

The Report should include an analysis of the surface and subsurface effect of water from rainfall, irrigation, private and community sewage disposal systems, runoff from proposed grading, or other probable sources from both the subdivision and adjoining properties, wherever such water is likely to reduce the surface or subsurface stability, cause erosion, or sedimentation, reduce infiltration to ground water, increase runoff to streams, or cause degradation of the ground water underlying the subdivision or adjoining properties.

The following list includes the topics that ordinarily should be considered in submitting discussion, conclusions, and recommendations from an engineering perspective, in the soil engineering report.

a) Compatibility of Natural Features

General compatibility of natural features with proposed land use to determine if it is basically reasonable to develop the subject area.

- 1) Topography
- 2) Lateral stability of earth materials
- 3) Problems of flood inundation, erosion, and deposition
- 4) Problems caused by features or conditions in adjacent properties
- 5) Other general problems

b. Proposed Cuts

- 1) Prediction of what materials and structural features will be encountered.
- 2) Prediction of stability based on soils related factors.
- 3) Problems of excavating (e.g., unusually hard or massive rock, excessive flow of groundwater)
- 4) Recommendations for reorientation or repositioning of cuts, reduction of cut slopes, development of compound cut slopes, special stripping above daylight lines, buttressing, protection against erosion, handling of seepage water, setbacks for structures above cuts, etc.

c. Proposed Masses of Fill

- 1) General evaluation of planning with respect to canyon-filling and sidehill masses of fill
- 2) Comment on suitability of existing natural materials for fill
- 3) Recommendations for positioning of fill masses, provision for underdrainage, buttressing, special protection against erosion.

d. Special Recommendations

- 1) Areas to be left as natural ground.
- 2) Removal or buttressing of existing slide masses

- 3) Flood protection
- 4) Problems of groundwater circulation (e.g., flow pattern modification due to pumpage or interruption of recharge)
- 5) Position of structures with respect to active faults.

6. SEISMIC CONSIDERATIONS

Where required, the following published guidelines should be considered when preparing seismic information.

CDMG Note No. 37, "Guidelines to Geologic/Seismic Reports."

CDMG Note No. 43, "Recommended Guidelines for Determining the Maximum Credible and the Maximum Probable Earthquakes."

7. GROUND WATER SUPPLY REPORT

If it is proposed that ground water is to be used to supply water to the subdivision, a complete hydro-geological examination shall be made. Wells should be tested during the time of year when ground water conditions can be expected to be most stressed. If private wells are proposed to be used, the Report shall contain estimated minimum and maximum installation costs, including drilling, of private water wells. These costs shall be for the year the subdivision map is recorded.

a. Hydrogeologic Examination

The Hydrogeological examination shall contain appropriate hydrologic maps, an evaluation of ground water occurrence, depth, movement, recharge, discharge, storage capacity and chemical characteristics. Conclusions shall be submitted as to: (1) The amount of ground water available for the entire development during the most adverse series of dry years; (2) The expected availability of water under full development at future increments of time; (3) The predicted regional ground water decline with time due to pumping for the development; (4) Whether the proposed method of obtaining the water (e.g., the

individual wells or community water supply) is feasible; (5) The anticipated depths and yields of recommended wells; (6) The chemical and bacteriological quality of the water; (7) Type of well to be used; and (8) the adequacy of source data.

b. Geographical Area

The examination shall include the tentative subdivision area and shall be extended peripherally to include an estimate of the effects of development on existing uses of other property beyond the proposed subdivision. Potential adverse interaction effects between these onsite and offsite uses shall be described.

c. Conformance with Standards

All test wells which are utilized to indicate quantities of water available for domestic or other use shall be constructed in accordance with State of California Department of Water Resources Bulletin No. 74-81 entitled "Water Well Standards," State of California dated December 1981, and Title 14 Chapter 14.04 entitled "Well Regulation-General Provisions," plus Chapter 14.08 entitled "Well Construction, Pump Installation and Well Distraction Standards" of the Fresno County Ordinance Code.

d. Individual Domestic Well Test Procedures

If individual domestic wells are to be used (as opposed to community wells) they shall be tested as follows:

- 1) The test will be 72 hours in duration (or longer if the responsible professional deems it appropriate) and will be divided into two phases. During the first eight hours (or longer) a constant discharge test will be performed. This data will be used to establish estimates of aquifer storage coefficient and transmissivity. The remaining 64 hours (or longer) will consist of a constant drawdown test. During this phase the water level in

the well shall be maintained below the lowest water bearing fracture. All water bearing fractures, and volume of flow from each, shall be clearly noted on the well log. If the well is in alluvium, the optimum pumping level shall be determined by the responsible professional. The purpose of the second phase is to aid in evaluating the potential long term yield of the well.

It should be emphasized that the magnitude of instantaneous well flow from this test will be only one criterion for judging long term yield. Its validity will be determined by comparison with other factors such as recovery time, available recharge, available subsurface through-flow, and aquifer storage capacity in the vicinity of the well.

- 2) Records on the well performance shall include: (1) time-drawdown; (2) flow rate; (3) total pumpage; (4) water quality at the beginning of the test; and (5) water quality at the end of the test. (1) and (2) shall be used for semilog plots of yield vs. time. These plots will be included in the Report. All samples shall be tested for conductivity and such chemical and other components as required by the health officer.

Recommended time intervals for time-drawdown plots.

<u>Time since pumping</u>	<u>Time intervals</u>
0 - 5 minutes	0.5 minutes
5 - 60 minutes	5 minutes
60 - 100 minutes	20 minutes
100 min. - 5 hours	30 minutes
5 hours - end of test	Discretion of responsible professional

- 3) Immediately following pump shut-off a recovery test shall be conducted, until well has recovered 90 percent of drawdown. Information shall be of sufficient detail to verify or improve

data gathered during the original time-drawdown and constant drawdown phase of the test.

- 4) The Hydrogeologic Report shall specify proposed locations for wells to provide adequate amounts of water to meet standards imposed for fire protection.
- 5) Present an accurate well test site location map, time drawdown and recovery curves along with specific capacities, total depths, well driller's yield estimates, depth of casing, and copies of actual well driller's logs.
- 6) All information derived from the drilling and testing must be in the report, including all dry holes and wells dry after testing.
- 7) The following minimum number of wells shall be developed and tested: Where the subdivision is less than 100 acres - 3; where the subdivision is from 100 to 1,000 acres - 3 plus one additional for each 100 acres or portion thereof in excess of 100 acres; where the subdivision is more than 1,000 acres - 12 plus three additional for each 500 acres or portion thereof in excess of 1,000 acres.
- 8) Well locations shall be as specified by the Director of Resources and Development in consultation with the geologist. Generally, test locations will be selected to test the varying types of surface land and rock types evident in the subdivision. The Director may require additional wells at this selection stage if he deems it necessary in order to properly evaluate the subdivision.
- 9) Additional wells, after the first selection, may be permitted by the Director to further test conditions in portions of the subdivision.
- 10) Wells producing 2 g.p.m. or less after a two hour air test will be considered dry for purposes of establishing suitability.

e. Community Well Testing Procedures

If a community type well is anticipated, the recommended aquifer test procedure will consist of 4 parts. It should be recognized that the procedures are guidelines and will be flexible to fit the performance of the well. The objective of this process is to obtain as accurate information as possible about the transmissivity and storage coefficient of the aquifer in the vicinity. The descriptions are as follows:

- 1) Development of well to degree necessary to perform aquifer test (responsibility of driller).
- 2) Step Drawdown Test

After the well has been developed, it may be necessary to perform a step drawdown test to determine the optimum flow for the aquifer test. If during development the professional responsible for aquifer testing feels he can give an adequate estimate of maximum well capability, the test may not be required.

Depending on well performance the step test will consist of 3 or 4 stages. Due to well sounding requirements, it will be necessary to attach a sounding tube to the pump column. The tube will allow readings to be taken unaffected by disturbances caused by pumpage.

Three types of data shall be gathered during step test: (1) time of soundings; (2) water level; (3) discharge (GPM). During each step the well will be pumped at a constant rate of flow until drawdown becomes stabilized or a straight-line relation of the time-drawdown curve plotted on a semilog scale is established. Then the rate is increased and the above described procedures is repeated until the well has been pumped at 3 or 4 rates.

3) Aquifer test

- a) The water level in the well should be observed for 24 hours prior to the test to determine the initial depth to ground water. If the ground water prior to the test is not stable, observations should be used to adjust the actual test drawdown data to an approximate equilibrium condition for analysis. Pumping of any wells in the vicinity of the test well, which may influence the test results, should be regulated to discharge at a constant, uninterrupted rate prior to and during the complete tests or until pump shut off.
- b) Any test wells drilled during the exploration of the site shall be preserved in such a manner that they may be used for observation wells to supplement the well testing procedures.
- c) The measurements to be made, recorded and made part of the Report, for both the well being tested and observation wells, shall include the following: static water levels prior to pumping, the rate of discharge from the pumped well, pumping levels or dynamic water levels, time of starting the pump, time of any change in discharge rate, time of stopping the pump, and such other measurements responsible professional deems appropriate.
- d) The duration of the test shall be determined by the responsible professional in consultation with the Resources and Development Department. Decisions about test duration shall be made on the basis of well performance.
- e) The test pump should be either a centrifugal, or more preferable, a turbine or submersible pump. It should be capable of lowering the water level to the bottom of the well being tested. The pump should preferably be powered with an electric motor, or with an engine capable of operating continuously for the duration of the test. The pump discharge

line should be equipped with a valve and flow meter so that the rate of discharge can be accurately controlled. At the beginning of the test, the valve should be partially closed so that back pressure on the pump can be varied as the test progresses to keep the rate of flow constant.

- f) During the aquifer parameter test, it is imperative that the water flow rate (Q) be constant.
- g) Lowering of the water level in the well will usually cause the pumping rate to decrease unless the valve in the discharge line is opened to compensate for the additional head or lift created on the pump. If the pump is powered with a gas or diesel engine, changes in temperature and humidity of the air may affect the operation of the engine and thus cause variations in the pumping rate. Variations in line voltage may similarly affect the speed of electric motors and thus the pumping rate. Any appreciable variation in pumping rate should be recorded and the cause of the variation noted.
- h) The flow from the test well must be conveyed away from the test site so that recharge of the aquifer from water being pumped does not occur within the zone of influence of the test well, or any observation wells.
- i) Time Interval Recommendations for measurements listed in (c) above.

Recommended time intervals for measurements in the pumped well:

<u>Time since pumping</u>	<u>Time intervals</u>
0 - 5 minutes	0.5 minutes
5 - 60 minutes	5 minutes
60 - 100 minutes	20 minutes
100 min. - 5 hours	30 minutes

5 hours - end of test

Discretion of responsible
professional

Recommended time intervals for measurements in observation wells:

<u>Time since pumping started</u>	<u>Time intervals</u>
0 - 2 minutes	Approx. 10 seconds
2 - 5 minutes	30 seconds
5 - 15 minutes	1 minute
15 - 100 minutes	10 minutes
100 min. - 5 hours.	30 minutes
5 hours - end of test	Discretion of professional

Recommendations are given only to emphasize the detail required for test purposes. It is recognized that final format for time intervals will be a function of the well performance.

- 4) Recovery test and report (report all wells drilled, including "dry" wells).
 - a) A recovery test shall be made at the conclusion of the pumping test to provide a check of the pumping test results and to verify recharge and aquifer boundary conditions assume in analysis of the pumping test. When the pump is turned off, the recovery of the ground water levels should be observed in the same manner as when the pump was turned on, and continued until recovery of 90 percent of drawdown.
 - b) The records to be included in the report and that are required for analysis and the tolerance in measurement generally considered acceptable are as follows:
 - 1 Control-well discharge (± 10 percent).

- 2 Depth to water in wells below measure point (± 0.01 ft)
- 3 Distance from control well to each observation well (± 0.5 percent).
- 4 Synchronous time (± 1 percent of time since control affected).
- 5 Description of measuring points.
- 6 Elevation of measuring points on observation wells (± 0.01 ft, relative to pumping well).
- 7 Vertical distance between measuring point and land surface (± 0.1 ft).
- 8 Total depths of all wells (± 1 percent).
- 9 Depth and length of screened intervals of all wells (± 1 percent).
- 10 Diameter, casing type, screen type, and method of construction of all wells (nominal).
- 11 Location of all wells in plan, relative to land-survey net or by other acceptable method (accuracy dependent on individual need).

5) Additional Community Well Requirements

- a) Only wells with a yield of 10 gallons per minute or more will be considered sufficient for a community well. A well should not be aquifer tested unless there is reasonable assurance that this flow requirement can be attained for long term use.

- b) All season vehicular access to any community well must be designed, verified and included as a part of any community well testing project.

8. SEWAGE DISPOSAL REPORT

a. Individual Onsite System

If individual on-site sewage disposal systems are to be utilized:

- 1) The Sewage Disposal Report shall make specific recommendations upon the type and size of systems that should be utilized, based upon the geological and soil information including, but not limited to, the following:
 - a) texture of the material into which the effluent is disposed by the leach field
 - b) thickness of this material
 - c) depth to ground water in the area
 - d) hydraulic properties of the area
 - e) bedrock configuration
 - f) direction of surface runoff
 - g) direction of subsurface flow
 - h) proximity of other individual sewage disposal systems
 - i) slope of the land
 - j) proximity to road cuts and other possible areas of short circuit
 - k) nearness to water bodies
 - l) geologic environment as related to neighboring properties
 - m) interrelation of the disposal system in the hydrologic inventory
- 2) An analysis shall be made of the short term and long term effect of sewage or waste effluent on stability of the soil and underlying formation and on possible contamination of the ground water.

- 3) Systems recommended shall reflect all system design requirements of the Central Valley Regional Water Control Board, and the International Association of Plumbing and Mechanical Officials.
- 4) If individual sewage disposal is proposed, each proposed parcel shall be shown to be able to have sufficient area for leaching that has an average percolation rate of less than 200 min/inch. No single percolation rate in leaching area may exceed 240 min/inch.
- 5) There shall be an onsite inspection on the property and a subsequent conference with the applicant (or his representative) and his consultant prior to initiation of field work to prepare the sewage disposal report.
- 6) If test or other well locations conflict with the proposed private sewage disposal system the Report shall make appropriate recommendations for correction.
- 7) The Sewage Disposal Report shall contain estimated minimum and maximum installation costs of any recommended private sewage systems. These costs shall be for the year the subdivision map is recorded.

b. Public System

If a public sewage disposal system is to be used, the Report shall make a recommendation upon the disposal of the effluent from the treatment facility based upon the geological and soil analysis findings of the Report and any recommendations shall be in accordance with the regulations enforced by the Central Valley Regional Water Quality Control Board.

S E C T I O N I I I

C O N S T R U C T I O N

SECTION III

CONSTRUCTION

A. CONTROL OF THE WORK

All work accomplished and all materials furnished under these improvement standards shall be subject to the inspection and approval of the Director of Public Works. Such inspection and approval of work and materials shall not relieve the developer of any of his obligations to complete the work as specified. Work and materials not meeting these requirements shall be made good and unsuitable work and material may be rejected.

The Director of Public Works at all times shall have access to the work, and shall be furnished every reasonable facility for ascertaining that the methods, materials and workmanship are in accordance with the requirements and intent of these improvement standards. The developer or his authorized agent shall be in charge of all phases of the work while it is in progress.

Approval of all work shall be necessary at the completion of each of the following stages of work and such approval must be obtained before subsequent stages of work may be commenced. The Director of Public Works shall be notified at least one working day in advance before any of the following stages of work are commenced. Only that work that is done in the presence of the Director of Public Works or lacking such presence at his option, done with his knowledge will be approved. In addition to the following the Director of Public Works may require additional notification on these other stages of work.

- a. Compaction and preparation of embankments, excavations and sub-grades.
- b. Construction of forms for all concrete work, including curbs and gutters.
- c. Excavation for storm drains and culverts.
- d. Placing of concrete in structures.
- e. Placing of storm drains and culvert pipes.
- f. Backfilling for structures in pipes.
- g. Placing and compacting of base material. If more than one course or type of base or sub-base is to be used, approval shall be necessary for each course and/or type.
- h. Construction of roadside ditches and other drainage ways.

- i. Placement of pavement or surfacing.
- j. Final clean up.

Whenever the developer works on holidays, at night or varies the period in which work is normally carried on each day he shall give due notice to the Director of Public Works so that proper inspection may be provided.

When ordered in writing by the Director of Public Works the developer shall furnish all tools and labor necessary to make an examination of any work completed or in process of construction under these improvement standards. If the work so examined is found to be in any way defective or not in accordance with the requirements of these improvement standards the developer shall bear all the expense of such examination. But if the work so examined is found to be in accordance with the contract specifications the cost of such examination shall be the responsibility of the County.

The source of the materials used under these improvement standards shall be approved by the Director of Public Works before delivery is started. The developer shall give the Director of Public Works sufficient advance notice of sources of material so that he can determine by necessary inspection and testing that they comply with the requirements of these standards. If the source is not already approved by the Director of Public Works this notice shall be not less than 10 working days. Only material conforming to these standards and approved by the Director of Public Works shall be used in the work. After trial, if it is found that sources of supply which have been previously approved do not furnish a uniform product or if the product from any source proves unacceptable at any time the developer shall furnish approved material from another approved source. No material which after approval has in any way become unfit for use shall be used in the work.

All tests of materials and work required to determine the compliance with required specifications shall be in accordance with the methods and procedures in use by the Division of Highways and defined in Section 6-3.01 of the "Standard Specification" or as they may be amended by these improvement standards or by the Special Provisions. The developer shall furnish to the Director of Public Works, without charge, samples of all materials entering into the work. The Director of Public Works may require.

certificates of compliance from the supplier of manufactured products such as reinforcing and structural steel, culvert pipe, paint, cement, and asphalt products. The developer shall defray all costs of all tests the Director of Public Works deems necessary for materials which are used on the project and shall arrange to have the tests made by an approved and recognized laboratory or organization. Samples of material from which tests are to be made shall be taken under the supervision of the Director of Public Works, or an approved and recognized testing laboratory.

After approved products have been delivered and placed upon the project quality control shall be the responsibility of the Director of Public Works provided, however, any retesting that is required due to the failure of original quality control tests shall be at the expense of the developer, who shall arrange to have the tests made by an approved and recognized laboratory or organization.

The developer shall provide for construction engineering, other than quality control, and surveying to enable the work covered by the plans and specifications to be carried out to its successful conclusion. The Director of Public Works shall make such field checks of slope stakes and other construction markers as he deems necessary to ascertain their compliance with the plans and specifications. At his direction the developer shall correct such stakes and markers that are incorrectly set.

Failure of the developer to comply with any of the provisions of the specifications and the special provisions shall be deemed sufficient cause for the rejection by the County of all or any portion of the work. The Director of Public Works may cause rejected or unauthorized work to be remedied, removed, or replaced, all at the expense of the developer.

SECTION III
CONSTRUCTION

B. STREETS, HIGHWAYS, AND DRAINAGE STRUCTURES

1. General - The construction of all streets, highways, drainage structures and their auxiliary facilities shall comply with the requirements of the following sections of the Standard Specifications, Division of Highways, Department of Public Works, State of California, dated January 1971, hereinafter called the Standard Specifications, except as such sections shall be amended by these improvement standards and/or the special provisions.

1. Definition and Terms
5. Control of Work
6. Control of Materials
10. Dust Control
15. Existing Highway Facilities
16. Clearing and Grubbing
17. Watering
18. Dust Palliative
19. Earth Work
20. Erosion Control and Highway Planting
22. Finishing Roadway
24. Lime Treatment
25. Aggregate Subbases
26. Aggregate Bases
27. Cement Treated Bases
36. Penetration Treatment
37. Bituminous Seals
38. Road-Mixed Asphalt Surfacing
39. Asphalt Concrete
51. Concrete Structures
52. Reinforcement
53. Air-blown Mortar
60. Rubble Masonry
63. Case-in-Place Concrete Pipe
65. Reinforced Concrete Pipe
66. Corrigated Metal Pipe
67. Structural Steel Plate Pipe
68. Sub-surface Drains
69. Over-side Drains
70. Miscellaneous Facilities
72. Slope Protection
73. Concrete Curb and Sidewalks
80. Fences
82. Markers
83. Railings and Barriers
84. Raised Bars.

- 90. Portland Cement Concrete
- 92. Asphalt
- 93. Liquid Asphalts
- 94. Asphalt Emulsions

All references to measurement and payment in the above sections of the Standard Specifications are the responsibility of the Developer unless the construction is being done under the provisions of either Division Seven or Twelve of the Streets and Highway Code of the State of California in which case measurement and payment shall be as specified in the special provisions.

The following sub-sections of the Standard Specifications are hereby made a part of these improvement standards except as they may hereinafter be amended by these improvement standards and/or the special provisions.

- 2-1.12 Material Guarantee, with the deletion of the next to last sentence of said sub-section
- 4-1.01 Intent of Plans and Specifications
- 4-1.02 Final Cleanup
- 4-1.04 Detours
- 4-1.05 Use of Materials found on the Work
- 7-1.01 Laws to be Observed, excepting sub-sub-sections 7-1.01A through 7-1.01H: In lieu of these excepted sub-sections, the Developer shall comply with all applicable local, State and Federal laws, and shall hold the County of Fresno harmless from any breach of said laws.
- 7-1.02 Weight Limitations
- 7-1.04 Permits and Licenses
- 7-1.05 Patents
- 7-1.06 Safety Provisions
- 7-1.07 Sanitary Provisions
- 7-1.08 Public Convenience
- 7-1.09 Public Safety
- 7-1.10 Use of Explosives
- 7-1.11 Preservation of Property
- 7-1.12 Responsibility for Damage
- 7-1.13 Disposal of Material Outside the Highway Right of Way
- 7-1.14 Cooperation
- 7-1.16 Contractors Responsibility for the Work and Materials
- 8-1.10 Utility and Non Highway Facilities

All reference to measurement and payment in the above sub-sections shall be the responsibility of the Developer unless the work is being done under the provisions of either Division Seven or Twelve of the Streets and Highway Code of the State of California in which case the measurement and payment shall be as specified in the special provisions.

2. Dust Control - The contractor shall comply with the requirements of Section 10 of the Standard Specifications. It shall be the joint responsibility of the contractor and the developer to provide for the payment of such dust control as may be ordered by the Director.

3. Earthwork - The earthwork involved shall conform to the requirements of Section 19 except the provisions of Section 19-5.02 will not be required; however, on any portion of the road bed on which pavement, surfacing, base, or subbase or layer of any other material which may be specified is to be placed, a subgrade complying with the appropriate provision of Section 21 of the Standard Specifications shall be prepared. When aggregate base or sub-base is to be placed over existing surfacing the existing surfacing shall first be scarified and broken into 4 inch maximum pieces so that a Class "A" subgrade conforming to provisions of 21 of the Standard Specifications may be prepared. All surplus or unsuitable excavated material shall become the property of the contractor and shall become disposed of in accordance with Section 7-1.13 of the Standard Specifications. Surplus material may be used to regrade lots within the subdivision with the permission of the developer and the Engineer provided that such regrading is done in the manner which will not prohibit the proper draining of the lots within the subdivision.

4. Aggregate Sub-Base - Aggregate Sub-Base shall conform to the requirements of Section 25 of the Standard Specifications and these specifications unless specified in the special provisions or shown on the plans. Aggregate sub-base shall be Class 4 and shall conform with all the requirements of Section 25 except for grading and quality which shall be as specified below:

GRADING

<u>Sieve Sizes</u>	<u>Percentage Passing Sieves</u>	<u>Test Method</u>
3 inches	95-100	No. Calif.
No. 4	60-100	200
No. 200	5-40	

QUALITY

<u>Test</u>	<u>Requirements</u>	<u>Test Method</u>
Resistance (R-value)	55 minimum	No. Calif. 301
Sand Equivalent	15 minimum	No. Calif. 217

"R" Value test taken subsequent to the placement of the Class 4 Aggregate Sub-base upon the road bed will be waived provided the Aggregate Sub-base conforms to the specified grading and has a Sand Equivalent value of 25 or more.

5. Aggregate Base - Aggregate base shall conform with the requirements of Section 26 of the Standard Specifications and these specifications: Aggregate Base shall be Class 2, 3/4" maximum or as specified on the plans or the special provisions. In lieu of the requirements of Section 26-1.04B of said Section 26 Class 2 Aggregate Base may be spread in a manner which shall conform with Section 25-1.04 of the Standard Specifications.

6. Asphalt Concrete - Asphalt concrete shall comply with the provisions of Section 39 of the Standard Specifications and these specifications; Asphalt Concrete shall be Type B, surface course 1/2" maximum coarse. The penetration range of the paving asphalt will be determined by the Engineer. All asphalt pavement shall have a Fog Seal complying with the requirements of Section 37 of the Standard Specifications. The mixture of emulsion shall contain not more than 50% of added water. The exact quantity will be determined by the Engineer. The rate of application of the combined mixture of Fog Seal Coat shall be 0.10 gallon per square yard, or such lesser rate of application that may be required by the Engineer. Prime coat and paint binder meeting the requirements of Section 39-4.02 of the Standard Specifications shall be applied to all areas to be surfaced. Liquid asphalt for prime coat shall be grade SC-250 or such other grade as directed by the Engineer. In lieu of the rate of 50 tons per hour specified in Section 39-5.03A the rate of 100 tons per hour shall be used.

7. Sub-Grades - Sub-grade shall comply with the requirements of Section 21 of the Standard Specifications and these specifications. In lieu of the requirements of compaction of Section 21-1.02 of the Standard Specifications, when the following two conditions occur the relative compaction as specified below shall apply.

(a) When the profile grade of the road or street is greater than 10%, compaction need only be 92% unless the plans specify 95%.

(b) When the material from which the sub-grade is being made has a sand equivalent, measured by Test Method No. Calif. 217-F, of less than 6 the compaction requirements may be reduced 1% for each point under six.

In addition to all the requirements of Sub-Section 21 of the Standard Specifications the following shall apply. Any visible displacement vertically or horizontally of sub-grade under the action of construction equipment shall be considered as evidence that the sub-grade does not meet the requirement herein specified, and no subsequent layers of materials shall be placed upon the sub-grade until such time as the cause of the displacement is discovered and repaired in a manner that will meet the requirements of these specifications. If the cause of such displacement is not due to the operation of the contractor but rather is an unforeseen condition not contemplated during the design of the improvements, the responsibility for its correction falls to the developer and is covered by the 10% contingency amount included in the subdivision improvement bond.

8. Slope Protection. Slope Protection shall meet the requirements of Section 75 of the Standard Specifications and these specifications. In lieu of the grading for Cobble Grouted Rock Slope Protection as shown in Section 72-5.02 of the Standard Specifications, the percentage larger than 25 lbs. shall be 30% and the percentage larger than 15 lbs. shall be 95-100 and the minimum penetration of grout shall be 3 inches.

9. Curbs, Gutters, Sidewalks, Driveway and Alley Approaches, and Valley Depressions. Portland Cement concrete curbs, gutters, sidewalks, driveway and alley approaches, and valley depressions shall comply with the requirements of Section 73 of the Standard Specifications and as hereinafter specified.

Concrete shall be Class A (6 sack) with a maximum slump of four (4) inches. Either the 1½" or 1" maximum aggregate may be used.

Subgrade shall be prepared in accordance with Section 73 and shall obtain 85% compaction as determined by California Test Method #216-F

Expansion joints, 3/8" wide shall be constructed at maximum intervals of 56 feet and as required by the provisions of Section 73-1.07. Construction joints shall conform to the details shown in Section IV of these improvement standards. Weakened plan joints shall be installed at 14 foot maximum intervals and shall be constructed to a minimum depth of 1" by scoring with a tool which will leave the corners rounded and assure a free movement of the concrete at the joint. Construction joint and weakened plan joints shall be constructed at right angles to the line of the curb and the gutter.

Where the plans provide for the reconstruction of a portion of an existing sidewalk or driveway, the existing section shall be cut to a minimum depth of 1-1/2" with an abrasive type saw at the first scoring line at or beyond the planned point, and the entire section to be reconstructed shall be removed. Curb cuts for driveway and alley approaches shall be made at any location beyond the influence of the approach and an expansion joint shall be constructed where the approach meets the original curb alignment.

All concrete work shall be finished with a steel trowel and given a brush finish except gutters, valley depressions, and driveway and alley approaches which shall be given a float finish.

10. Drainage and Irrigation Pipes. Drainage and irrigation pipes shall comply with the requirements of Section 65, 66, 67, and 68 of the Standard Specifications depending on the type of pipe used. Irrigation pipelines shall be given leakage tests to comply with Section IIID-5 of these improvement standards with the test head being 2 feet greater than the operating head of the pipeline. Non-reinforced concrete pipe used for irrigation and drainage shall meet the requirements of A.S.T.M. Specifications C118-65T (mortar joint) or A.S.T.M. Specifications C505-65T (rubber gasket)

11. Street Lights. Electroliers must be installed in accordance with the serving utility company. All electrical equipment and installations shall conform to the applicable standards of the following: (a) electrical safety orders of the Division of Industrial Safety, Department of Industrial Relations, State of California (b) rules for overhead electric line construction. General Order No. 95 of the California Public Utilities Commission. (c) Standard Specifications of the serving utility company. (d) Section IIIG of these standards.

SECTION III
CONSTRUCTION

C. WATER SYSTEMS

1. Materials

a. General. All materials shall be new, shall conform to these specifications, and shall bear the manufacturer's stamp or marking. Any newly developed materials not generally accepted by the water works industry shall have the approval of the Director and the Health Officer prior to use.

b. Pipes and Piping.

(1) Cast Iron Pipe and Fittings. All cast iron pipes shall be cement lined and conform to A.W.W.A. Standard Specification C 102-53, C 106-62 and C 108-62. Cement lining shall conform to A.W.W.A. Standard Specifications C 104-64. Fitting shall conform to A.W.W.A. Standard C 100-64.

The minimum pressure class allowable shall be Class 150. Where necessary, pipe of a higher pressure rating shall be used to give the proper factor of safety. Cast iron fittings shall be of the proper class for the intended use and in no case shall they be of a lower pressure rating than the pipe to which attached.

Cast iron pipe and fittings shall be joined by any of the methods generally accepted in water works practice, including bell and spigot joints, flanged joints, mechanical joints and sleeve type coupling joints. Any newly developed joints not generally accepted in the water works industry must have the approval of the Director.

Where caulked bell and spigot joints are used they shall be made up of the following materials:

Caulking or packing material shall consist of (a) molded or tubular rubber rings, or (b) asbestos rope, or (c) material approved by the Director.

Lead shall be hot poured into the joint and shall contain not less than 99.73 per cent pure lead. The producer's name or the mark of Lead Industries shall be clearly cast or stamped upon each piece of lead.

(2) Asbestos-Cement Pipe and Fittings. Asbestos-cement pipe shall conform to A.W.W.A. Standard Specifications C 400-64T.

The minimum pressure class allowable shall be Class 150. Where necessary, pipe of a higher pressure rating shall be used to give the proper factor of safety.

Fittings for asbestos-cement pipe shall be of cast iron and shall be of the proper pressure rating for the intended use and in no case shall they be of a lower pressure rating than the pipe to which attached.

Asbestos-cement pipe and cast iron fittings shall be joined by any of the methods generally accepted in water works practice, including continuous bell ring joints and lead caulking.

Where lead caulked joints are used between asbestos-cement pipe and cast iron fittings the joint shall be a hot lead joint and the materials for same shall be as follows:

Caulking or packing material shall consist of (a) molded or tubular rubber rings, or (b) asbestos rope, or (c) material approved by the Director.

Lead shall be hot poured into the joint and shall contain not less than 99.73 percent pure lead. The producer's name or the mark of Lead Industries shall be clearly cast or stamped upon each piece of lead.

(3) Non Prestressed Reinforced Concrete Pipe - Steel Cylinder Type. Non-prestressed reinforced concrete pipe-steel cylinder type shall conform to A.W.W.A. Standard Specifications C 300-64.

The minimum pressure class allowable shall be Class 150. Where necessary, pipe of a higher pressure rating shall be used to give the proper factor of safety.

Fittings for non-prestressed reinforced concrete pipe-steel cylinder type, shall conform to the dimensions of A.W.W.A. Standards C 208-59. Fittings shall be of the proper pressure rating and in no case shall they be of a lower pressure rating than the pipe to which attached.

Pipe and fittings shall be joined by any of the methods generally accepted in water works practice. Any newly developed joints not generally accepted in the water works industry must have the approval of the Director.

(4) Prestressed Reinforced Concrete Pipe-Steel Cylinder Type. Prestressed reinforced concrete pipe-steel cylinder type shall conform to A.W.W.A. Standard Specifications C 301-64.

The minimum pressure class allowable shall be Class 150. Where necessary, pipe of a higher pressure rating shall be

used to give the proper factor of safety.

Fittings for prestressed reinforced concrete pipe-steel cylinder type, shall conform to the dimensions of A.W.W.A. Standards C 208-59. Fittings shall be of the proper pressure rating and in no case shall they be of a lower pressure rating than the pipe to which attached.

Pipe and fittings shall be joined by any of the methods generally accepted in water works practice. Any newly developed joints not generally accepted in the water works industry must have the approval of the Director.

(5) Steel Pipe. Steel pipe of sizes up to but not including 30 inches (O.D.) shall conform to A.W.W.A. Standards C 202-64T. Steel pipe of sizes greater than 30 inches (O.D.) shall conform to A.W.W.A. Standards C201-60T.

Wall thickness of steel pipe shall be such that design working pressures can be adequately met.

Steel pipe protective coatings shall be approved by the Director, but in no case shall such protective coatings be less than A.W.W.A. Standards C 203-62. Where galvanizing is specified it shall conform to the requirements of A.S.T.M. Designation A 120-63T. Where cement mortar lining is specified it shall conform to A.W.W.A. Standards C104-64 or C205-62, whichever is applicable.

Fabricated steel fittings shall conform to A.W.W.A. Standards C208-59 and shall be of the proper pressure rating for the use intended and in no case shall they be of a lower pressure rating than the pipe to which attached.

All other steel fittings shall be approved by the Director and shall be of the proper pressure rating for the use intended and in no case shall they be of a lower pressure rating than the pipe to which attached.

Pipe and fittings shall be joined by any of the methods generally accepted in water works practice. Any newly developed joints not generally accepted in the water works industry must have the approval of the Director.

(6) Copper Pipe. Copper pipe for service laterals shall conform to A.S.T.M. Designation B88-61 for "Type K Copper Water Tube".

(7) Ductile Iron Pipe. Ductile iron pipe shall comply with the requirements of A.W.W.A. Standards C151-65.

(8) Other Types of Pipe and Fittings. Pipe and fittings of any material other than those herein set forth shall have the specific approval of the Director.

c. Valves.

(1) Gate Valves. All gate valves larger than four (4) inches shall conform to A.W.W.A. Standards C500-61 when standard operating conditions are encountered. Where other than standard operating conditions are encountered, such as excessive water-hammer, operating in throttled position or high operating pressures, gate valves of design approved by the Director shall be used.

Gate valves four (4) inches and smaller shall be rated at 200 p.s.i. working pressure for non-shock, cold water service. All working parts of this class valve shall be bronze or bronze mounted and shall be standardized and interchangeable.

Gate valve ends shall be of any of the types commonly used in the water works industry, including screwed ends, hub ends, mechanical joint ends, flanged ends, spigot ends, universal ends, any ends other than those commonly used in the industry must have the approval of the Director.

(2) Plug Valves. The term "plug valve" shall, in these Standards, refer to regular duty plug valves, corporation stops and curb stops.

Regular Duty Plug Valves shall be designed for regular duty service and in sizes below twelve (12) inches, shall have a pressure rating not less than 175 p.s.i. water, oil or gas working pressure. Valves larger than twelve (12) inches shall have a pressure rating adequate for the service intended and said pressure rating shall have the approval of the Director.

Corporation stops shall have all bronze bodies, keys, stems, stem washers and stem nuts. Corporation stops shall have the proper type threads for the type of pipe or pipe clamp to which attached.

Curb stops shall have all bronze bodies, keys, tailpieces, base caps, combined cap and tees, stem washers and stem nuts. Curb stops shall have the proper coupling threads for the type of fittings to which attached.

(3) Check Valves. Check valves for regular duty water works service shall employ non-corrosive materials in the construction of hinge pins, hinges, gate faces and seat faces.

Check valves up to twelve (12) inches in size for regular duty shall have a pressure rating of not less than 200 p.s.i.

non-shock, cold water, oil or gas rating. Larger valves and valves for use in other than regular duty shall be of a pressure rating approved by the Director.

End connections on check valves may be any ends commonly used in water works practice, including hub ends, flange ends and universal ends. Types of ends other than those commonly used in the water works industry shall have the approval of the Director.

(4) Air and Vacuum and Air Release Valves. Air and vacuum and air release valves shall have the internal working parts made of corrosion resistant materials.

Air and vacuum and air release valves for regular service shall have a pressure rating of not less than 150 p.s.i., water, oil and gas, non-shock. Where other than regular service operation is required the valves shall have a pressure rating approved by the Director.

(5) Miscellaneous Types of Valves. Any type of valve not specifically covered in these specifications shall be considered in this category of "Miscellaneous Types of Valves".

Such valve types include: pressure relief valves, pressure regulating valves, altitude valves and globe valves, among other valve types.

Valves in this classification shall have the approval of the Director.

d. Fire Hydrants.

Fire hydrants shall meet the requirements of A.W.W.A. Standards C503-59 or C502-54. In areas above the 2000 foot elevation, fire hydrants shall meet the requirements of A.W.W.A. Standard C502-54. The number and size of outlets and type of thread shall be shown on the plans. Provisions shall be incorporated in the construction of the hydrant to automatically shut off the flow of water in the event the hydrant is broken off.

e. Valve and Meter Boxes. Valve and meter boxes shall be constructed of materials capable of withstanding the loads imposed upon them.

Adequate access to all boxes shall be provided by means of readily removable covers.

Sizes of boxes shall be determined by sizes of valve or meter served.

2. Installation - Installation of water distribution systems shall comply with the requirements of Section III E, Pipeline Installation and Section III F, Pipeline Earthwork.

3. Leakage Tests - New or repaired water distribution mains shall be tested to a minimum hydrostatic pressure of 50 pounds per square inch greater than the design pressure for the system. The duration of test shall be one hour. All water mains with cement joints shall not be tested until 36 hours after the joint was made. All asbestos-cement pipe shall be filled with water for at least 24 hours before testing. Before applying the hydrostatic pressure, all entrapped air shall be thoroughly bled off. For all type of water mains, there shall be no visible leakage at any point or section of pipe and the allowable leakage for the total lengths of all water main under tests shall not exceed the amount specified in A.W.W.A. Standard C600-64 or C603-64T. Where applicable, pipe other than cast iron or asbestos cement shall meet the requirements of the following formula $L=ND(P)^{\frac{1}{2}}/3700$, where L is the allowable leakage in gallons per hour, D is the nominal diameter of the pipe, P is the test pressure during the leakage test and N is the number joints in the length of pipe line being contested.

Measurement of allowable leakage need not be made until after the pipe has been filled with water for a period of 24 hours. All tests shall be made only in the presence of an authorized representative of the Director and no joint, valve, or fitting shall be completely covered until it is inspected, tested, and approved.

When it is necessary to cover the ditch immediately after the water main is laid, the authorized representative of the Director may permit the backfilling to be completed prior to testing and disinfecting. If the pipe then tested exceeds the allowable leakage, the pipe must be uncovered, repaired, and tested until it meets the allowable requirements.

4. Disinfection - All new or repaired water mains, before being placed in service, shall be completely disinfected in accordance with Procedures for Disinfecting Water Mains, A.W.W.A. C601-54. Every new water main and every repaired section of an existing water main must be given an application of chlorine between 50 and 100 parts per million of available chlorine. The new or repaired pipe shall be thoroughly flushed before and after chlorination. If the first application of chlorine is not sufficient, the procedure shall be repeated until the water will meet the bacteriological drinking water standards as set forth in the United States Public Health Service Drinking Water Standards. Any other disinfecting procedure, if approved by the Health Officer, may be used.

All open ends of all water mains being installed shall be properly covered at the end of each day's work to prevent the entry of foreign matter, animals, debris, or children.

5. Fire Flow Tests - Tests shall be made by flowing fire hydrants of all new water distribution systems constructed in accordance with the Improvement Standards and approved by the Director. The Engineer for the developer or his representative shall be present when the tests are made.

6. Water Tanks - The construction of water tanks shall comply with the applicable sections for the type of tank to be furnished as specified in A.W.W.A. Standard D100-59 and as shown on the plans and specified in the special provisions.

7. Well Construction and Abandonment - Wells for community domestic water supplies shall be constructed in accordance with State of California Department of Water Resources Bulletin No. 74, Water Well Standards, State of California dated February 1968 and State of California Department of Water Resources Bulletin No. 74-6, Water Well Standards, Fresno County dated September 1968.

8. Pumps - Pumps installed in community water systems shall comply with the standards set forth in A.W.W.A. E101-61.

SECTION III

CONSTRUCTION

D. SEWER SYSTEMS

1. Materials for Piping and Appurtenances

a. Pipes and Piping.

(1) Vitrified Clay Pipe and Fittings. Vitrified clay pipe and fittings shall conform to A.S.T.M. Specifications C200-59T for extra strength clay pipe with the exception that glazing of interior of pipe and fittings is optional with designer or owner.

Vitrified clay pipe and fittings joints may be any of the following:

Hot pour joints. Only the hot pour compounds approved by the Clay Pipe Institute shall be used and a certificate of approval for any hot pour compound from the said Clay Pipe Institute must be provided to the Director prior to use of any such compounds.

Hot pour joints shall utilize dry jute for caulking material and a proper pipe primer of the type recommended by the manufacturer of the hot pour compound employed shall be used.

Joints using materials having resilient properties, also known as mechanical compression joints. Jointing material in this category shall conform to A.S.T.M. Specifications C425-60T with the exception that Section 7, Part (e), covering infiltration and exfiltration shall not be a requirement of these Sewer Standards.

Joints not acceptable. It should be noted that under these Sewer Standards it is not permissible to use Portland Cement Mortar Joints with vitrified clay pipe and fittings. The only exception to this requirement is where some unusual or exceptional problem of joining vitrified clay pipe or fittings arises, and in such cases, the specific approval of the Director must be obtained for such use. Where such mortar joints are permitted the mortar shall consist of one part Portland cement to two parts clean sharp sand with sufficient water added to thoroughly dampen the mixture.

(2) Asbestos Cement Pipe and Fittings. Asbestos cement non-pressure sewer pipe and couplings shall conform to A.S.T.M. Standards C428-63T. The minimum class of non-pressure asbestos cement pipe allowable on sewer lines other than house service sewers is Class 1500 as specified by said A.S.T.M. Standards C428-63T.

The class of non pressure asbestos cement pipe for house service shall meet the requirements of Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code. Any pipe fittings for use for asbestos cement non pressure sewer pipe shall be of the same class and materials as the pipe or as approved by the Director.

Asbestos cement pressure sewer pipe and couplings shall conform to A.S.T.M. Standards C296-63T.

Fittings for use with asbestos cement pressure sewer pipe shall be of cast iron of the pressure rating corresponding to the pressure ratings of the pressure sewer pipe. Any exceptions to the use of cast iron fittings shall be specifically approved by the Director.

Where lead caulked joints are used between asbestos-cement pipe and fittings of material other than asbestos cement, the joint shall be a hot lead joint and the materials for same shall be as follows:

Calking yarn may be either oiled or dry jute, molded or tubular rubber, asbestos rope or treated paper rope, all of a type approved by the Director.

Lead shall contain not less than 99.73 per cent pure lead and the producer's name or the mark of Lead Industries shall be clearly cast or stamped upon each piece of lead.

(3) Cast Iron Pipe and Fittings. Cast iron pipe and fittings for non-pressure house service sewer lines shall conform to Federal Specifications WW-P-401, Amendment 3, entitled "Pipe and Pipe Fittings; Soil, Cast Iron". The minimum weight of such pipe shall conform to Class B - Service-weight, as described in said Federal Specifications.

Cast iron pipe and fittings for non-pressure sewer lines, other than house service lines, and cast iron pipe for pressure sewer lines shall be cement lined and conform to A.W.W.A. Standard Specifications C102-53, C106-62 and C108-62. Pressure rating of this type of pipe shall be adequate for the intended use. Cast iron fittings shall be of the proper class for the intended use and in no case shall they be of a lower pressure rating than the pipe to which attached.

Cast iron pipe and fittings shall be joined by any of the methods generally accepted in sewerage practice, including bell and spigot joints, flanged joints, mechanical joints and sleeve type coupling joints. Any newly developed joints not generally accepted in sewerage practice must have the approval of the Director prior to use.

Where caulked bell and spigot joints are used they shall be made up of the following materials:

Caulking yarn may be either oiled or dry jute, molded or tubular rubber or asbestos rope, all of a type approved by the Director.

Lead shall be hot poured into the joint and shall contain not less than 99.73 per cent pure lead and the producer's name or the mark of Lead Industries shall be clearly cast or stamped upon each piece of lead.

(4) Concrete Sewer Pipe.

Non-reinforced concrete sewer pipe shall conform to ASTM specifications C14-65.

Non-pressure type reinforced concrete sewer pipe. Non-pressure reinforced concrete sewer pipe shall conform to ASTM Specifications C76-65T.

Joints for non-pressure type reinforced concrete sewer pipe shall conform to ASTM Specifications C443-65T pertaining to flexible, watertight, rubber-type gasket joints.

Fittings for non-pressure type reinforced concrete sewer pipe shall be of a strength equal to the pipe to which it is attached and shall be joined to such pipe with joints conforming to A.S.T.M. Specification C 443-65T.

Pressure type, reinforced, non-prestressed steel cylinder concrete pipe. Pressure type, reinforced, non-prestressed steel cylinder concrete pipe shall conform to A.W.W.A. Standard Specifications C300-64.

The pressure rating of the pipe shall be adequate for the intended use.

Fittings for this type of pipe shall conform to the dimensions of A.W.W.A. Standards C 208-59. Fittings shall be of the proper pressure rating and in no case shall they be of a lower pressure rating than the pipe to which attached.

Pipe and fittings shall be joined by any of the methods generally accepted in sewerage works practice. Any newly developed joints not generally accepted in sewerage works practice must have the approval of the Director prior to use.

Pressure type, reinforced, prestressed, steel cylinder concrete pipe. Pressure type, reinforced, prestressed steel cylinder concrete pipe shall conform to A.W.W.A. Standard Specifications C 301-64.

The pressure rating of the pipe shall be adequate for the intended use.

Fittings for this type of pipe shall conform to the dimensions of A.W.W.A. Standards C 208-59. Fittings shall be of the proper pressure rating and in no case shall they be of a lower pressure rating than the pipe to which attached.

Pipe and fitting shall be joined by any of the methods generally accepted in sewerage works practice. Any newly developed joints not generally accepted in sewerage works practice must have the approval of the Director prior to use.

(5) Steel Pipe. Steel pipe of sizes up to but not including 30 inches (O.D.) shall conform to A.W.W.A. Standards C 202-64T.

Steel pipe of sizes greater than 30 inches (O.D.) shall conform to A.W.W.A. Standards C 201-60T.

All steel pipe carrying domestic sewage or industrial wastes shall be cement mortar lined. Such cement mortar lining shall conform to A.W.W.A. Standards C 104-64 or C 205-62T, whichever is applicable. Steel pipe carrying other than domestic sewage or industrial wastes shall have protective coatings approved by the Director, but in no case shall such protective coatings be less than A.W.W.A. Standards C 203-62.

Where galvanizing is specified it shall conform to the requirements of A.S.T.M. Designation A 120-63T.

Wall thickness of steel pipe shall be such that design working pressures can be adequately met, but in no case shall wall thickness be less than 12 gauge. (Manufacturer's Standard Gauge for Sheet Steel).

Fabricated steel fittings shall conform to A.W.W.A. Standards C 208-59 and shall be of the proper pressure rating for the use intended and in no case shall they be of a lower pressure rating than the pipe to which attached.

All other steel fittings shall be approved by the Director prior to use and shall be of the proper pressure rating for the use intended and in no case shall they be of a lower pressure rating than the pipe to which attached.

(6) Other Types of Pipe and Fittings. Pipe and fittings of any material other than those herein set forth shall have the specific approval of the Director prior to their use.

b. Appurtenances

(1) Iron Castings shall be of uniform quality, free from blow holes, porosity, cracks or other injurious defects. They shall be smooth and well cleaned.

Material used in the manufacture of the castings shall conform to A.S.T.M. Specifications A 48-56, Class 30 Iron or of United States Government Specification 00 11-652 for gray iron castings.

All castings are to be manufactured true to pattern and with satisfactory fit of component parts. Round frames and covers shall have machined bearing surfaces and shall be so constructed and fitted that they will not rattle or rock under traffic. Covers shall not be perforated.

(2) Manholes. Design and construction of precast reinforced concrete manhole sections shall comply with A.S.T.M. Specifications C478-64T for the shaft diameter and type of top specified .

2. Sewer Line Installation. Sewer line installation shall comply with the requirements of Section III E, Pipe Line Installation and Section III F Pipe Line Earthwork.
3. Manhole Construction. Manholes shall be constructed as shown on the appropriate Standard Drawings. Invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer pipe invert. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels as shown on the Standard Drawings.

Joints in manholes shall be made watertight by mortaring.

4. Cleanout Construction.

(1) House Services and Private Sewers. Clean outs shall be plugged wyes.

5. Hydrostatic Test

a. Where Test Required. All sewer construction shall be subject to a hydrostatic test at the option of the Director. He may waive such test in the event of high ground water table or other field condition that he may determine makes the test unnecessary or impractical to conduct.

If the Director elects to waive the test, he shall satisfy himself that the line is capable of passing the test and may require whatever measures he deems necessary to prove or insure the watertightness of the line.

b. Method of Making Test. After backfill is completed to finish grade, sections of sewer line complete with appurtenances and of lengths selected by the Director shall in turn be isolated from the remainder of the system by means of sewer plugs. Water shall then be added to the section under test in sufficient quantity to produce a head of not less than 2 feet above the top of the sewer, any appurtenant house services or the ground water table, whichever is the greater. When the section under test has been completely filled and all air exhausted, timed measurement of the leakage shall be commenced and shall be continued for any period deemed necessary to establish the rate of leakage. Leakage shall be the total amount of water added to maintain the water at the same level as at the start of the test. Even though the leakage may prove to be less than the allowable amount, the Contractor shall stop any individual leaks that may be observed.

Should the leakage exceed 750 gallons per inch pipe diameter per mile of pipe per 24 hour day the Contractor shall overhaul, or relay the pipe if necessary, until it passes the test. The length of line used to calculate the allowable leakage shall include the length of all portions of the system coming under the test including the main sewer, and any house service or private sewers appurtenant thereto. Pressure lines shall be tested in the manner specified in Section IIIC-3 with a test pressure 20% above the design pressure.

c. Cleanup. After satisfactory completion of the hydrostatic test the sewer lines shall be cleaned of all mud, sand, gravel or any other obstruction to flow and left clear and unobstructed at time of final inspection.

SECTION III

CONSTRUCTION

E.

WATER AND SEWER PIPELINE INSTALLATION

1. General. All piping shall be supported and braced against movement as shown on the plans or as specified herein. When temporary supports are used they shall be sufficiently rigid to prevent any shifting or distortion of the pipe.

Where piping is installed on curves the maximum deflection of each joint shall be within the maximum deflection recommended by the pipe manufacturers. Sewer pipe deflection angles shall not exceed 5 degrees.

Sufficient flexible couplings of Director approved design shall be provided in all piping adjacent to structures to permit differential settling of the foundation of said piping and structures without damage to the piping, or as may be required for ease of installation or removal of the pipe.

All dirt and scale shall be removed from the pipe prior to installing.

When sewer or water house or building connections pass under a curb the curb shall be permanently marked with a capitol S or capitol W at least 2" high. When connections are installed before curbs and curbs are to be installed under the same subdivision agreement, the sewer or water line contractor shall reference the connection locations and mark the curbs after the curb installation.

2. Trenching. All trenching work shall conform to the requirements of the section on "Pipeline Earthwork" as found in these Standards.

Minimum Depth of Cover Within the Rights of Way. Cover from finish grade at valve locations shall be as follows:

4-6" pipe - 36" - 38"	12" pipe - 44" - 50"
8" pipe - 36" - 42"	14" pipe - 47" - 53"
10" pipe - 40" - 46"	14"+pipe - As required by Engineer

In no case shall cover of pipes be less than 36" unless otherwise permitted by the Director.

3. Laying and Handling Pipe. Proper implements, tools and facilities satisfactory to the Director shall be provided and used by the Contractor for the safe, convenient and workmanlike prosecution of the work.

All pipe, fittings and valves shall be carefully lowered into the trench in such a manner as to prevent damage to pipe or pipe coating. Under no circumstances shall pipe or accessories be dropped or dumped into the trench. Before laying the pipe shall be inspected for defects and cast iron pipe shall be rung with a light hammer to detect cracks. Any defective, damaged or unsound pipe shall be rejected and sound material furnished. Cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and skillful manner without damage to the pipe.

All pipe shall be laid and maintained in the required alignment with fittings and valves at the required locations and with joints centered and spigots home, and with all valve stems plumb. When the pipe is bedded in a trench it shall be brought into true alignment and shall be secured there with proper backfill material, carefully tamped under and on each side of it as specified herein. Care shall be taken to prevent dirt from entering the joint space.

Pipe laying for sewers shall commence at the lowest point and, where bell and spigot pipe is used, the spigot ends shall point in the direction of flow.

Preparatory to making pipe joints all surfaces of the portions of the pipe to be jointed or of the factory made jointing material shall be clean and dry. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined and adjusted in such a workmanlike manner as to obtain the degree of watertightness required. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to offset conditions that might tend to move the pipe off line and grade

All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless other protection of the pipeline is directed. Under no circumstances, however, shall water be permitted to rise in unbackfilled trenches after pipe has been placed.

Each length of pipe shall be freed of any visible evidence of contamination, dirt and foreign material before it is lowered into its position in the trench, and it shall be kept clean during and after laying. At time when pipe laying is not in progress, the open ends of any pipe which has been laid shall be plugged. Trench water shall not be permitted to enter the pipe.

All installation shall be in full conformance with the manufacturer's recommendation.

a. Cast iron bell and spigot pipe. The spigot end of the pipe or special fitting shall be inserted into the bell the full depth of the bell and the spigot end adjusted in the bell so as to give a uniform space for the joint.

The caulking or packing material shall be placed around the spigot of the pipe and shall be of proper dimensions to center the spigot in the bell. When the spigot is shoved home, the caulking or packing material shall be driven tightly against the inside base or hub of the bell with suitable caulking tools. Caulking or packing materials shall be handled with care in order to prevent contamination and shall be dry when put into place in the joint. The material shall be free of oil, tar or greasy substances.

For lead joints, a space not less than $2\frac{1}{4}$ inches in depth shall be left in the bell in pipe having a nominal diameter of 20 inches or less; $2\frac{1}{2}$ inches in 24, 30, and 36 inch pipe; and 3 inches in pipe larger than 36 inches.

The melting pot shall be kept near the joint to be poured and only one pouring shall be made for each joint. The joint shall be perfectly clean and dry when the lead is applied. Dross shall not be allowed to accumulate in the melting pot. The joints shall be thoroughly caulked by competent workmen, by means of proper and satisfactory tools, in such a manner as to secure a tight joint without overstraining the iron in the bells. In all cases, the caulking shall be done towards the gate and other points where the lead is likely to be porous, so as to compact it there. Care shall be taken in making joints to provide suitable escape for the air in the joint when it is being poured.

b. Flanged Pipe. Flanged joint pipe shall be installed as indicated on the plans. All flanges shall be clean, faced and provided with 1/16" thick gaskets for regular duty service. Special gaskets for other than regular duty service shall have the Director's approval prior to use. Flanges shall be bolted up evenly and tightly.

c. Threaded Connections. All screwed connections shall be made metal to metal tight, hemp or similar material will not be permitted in either rough or finished work. Joints shall be made with threads fully coated with an approved joint compound and screwed together tightly with proper wrenches. Pipes shall be reamed and all burrs removed from the end of the pipe. Caulking of the threads will not be permitted.

d. Steel Pipe. After joining steel pipe the joints shall be given a protective coating of materials equal to that of the joined pipe sections.

e. Service Laterals. Service laterals shall be installed in a trench of such depth and direction that the service pipe (tubing) will be at least 24" below finished street grade, shall be laid in a plane perpendicular to the longitudinal axis of the main, shall be as far away from sewer laterals as possible and shall not interfere with other utility installations.

The tubing shall be bent in such a manner as to prevent kinking of the tubing.

For 1" services, the corporation stops shall be tapped into that side of the main to which the service is to be installed at a point approximately 45 degrees down from the top of the main with the shut-off valve of the corporation stop facing up or to the side.

Service laterals may be attached to mains by the use of saddles where recommended by the pipe manufacturer and shall conform to the manufacturer's recommendations.

The house end of the service lateral shall terminate with a curb stop corresponding to the size of the service, with the outlet in a horizontal position facing the lot to be served. A service box of proper size shall be levelled and longitudinally centered over the end of the service. The service box shall be

Set square with the curb or property line in solid ground, with the top of the box at the elevation of the top of the curb. A concrete meter box, if required by the administrating agency, shall be installed in the manner required by said agency.

f. Vitrified Clay Pipe.

Hot poured joints. The primer shall be applied to both the spigot end of the pipe and the inside of the bell in full conformance with the manufacturer's recommendations.

The pipe shall be prepared for pouring by installing the caulking material into the annular space to a sufficient depth to insure closing the open spaces between ends of the pipe. The depth of the calking material should not exceed one-half inch in a 4 inch pipe and one inch in a 36 inch pipe, intermediate sized being caulked with proportionate amounts. The outside of the bell shall be closed off with a runner off center at the top in such a way that a pouring gate is left through which the compound may be introduced into the bell.

The kettle, in which the compound is heated, shall be thoroughly cleaned of foreign substances before placing the joint compound therein.

Mechanical Compression Joints shall be assembled in full accordance with the manufacturer's written recommendations.

g. Asbestos-Cement Pipe. Asbestos cement pipe shall be joined in full conformance with the manufacturer's written recommendation unless shown otherwise on the plans or specified. Connections to manholes or other structures shall be made by the use of short pipe lengths, 3' - 3" maximum length. When rubber ring is used to make the seal, and flexibility is provided by a grooved design profile similar to that of the couplings used to join pipe between fittings, up to a full 13' length may be used.

h. Other types of Pipe. Other types of pipe shall be joined in full conformance with the manufacturer's recommendations.

4. Thrust Backing and Harness. All tees, bends, plugs, fire hydrants and appurtenances as may be specified on the plans, shall be provided with thrust backing and/or harness in accordance with Standard Drawings.

Thrust backing shall be of Class "B" concrete conforming with requirements of Section 90, of the Standard Specification, State of California, 1964, cast in place between solid ground and the fittings to be anchored. The backing shall be so placed that the pipe and fitting joint will be accessible for repair.

5. Valves. A valve box or masonry pit shall be provided for every valve. A valve box sufficient in strength to withstand the vertical and horizontal loads, shall be provided for every valve which has no gearing or operating mechanism or in which the gearing or operating mechanism is fully protected with a cast iron grease case. The valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the surface of the finished pavement of such other level as may be directed.

A masonry valve pit shall be provided for every valve which has exposed gearing or operating mechanisms. The valve nut shall be readily accessible for operation through the opening in the manhole, which shall be set flush with the surface of the finished pavement or such other level as may be specified. Pits shall be so constructed as to permit minor valve repairs and afford protection to the valves and pipe from impact where they pass through the pit walls.

6. Fire Hydrants. All fire hydrants shall stand plumb and shall have their outlets parallel with or at right angles to the curb, with the steamer outlet facing the curb, except that hydrants having two hose outlets 90 degrees apart shall be set with each outlet facing the curb at an angle of 45 degrees. Hydrants shall be set to the established grade, with outlets at least 12 inches above the ground, or as otherwise shown on the plans.

7. The minimum distance between pressure water mains and parallel sanitary sewers shall be 5' wherever practical.

8. Testing. All pipe lines shall be tested according to either sections IIIC-3 or IIID-5 prior to the placing of permanent paving on streets.

9. Location of Pipe Line. Generally, water mains shall be installed on the southerly and westerly sides of the streets centerline 6 feet from the face of curb, or 6 feet from edge of pavement if there is no curb and the sanitary sewers on the centerline or if this is impractical on the northerly or easterly side of the centerline. Sanitary sewers shall parallel as nearly as possible the streets centerline, however, horizontal curves shall not have radii less than 100'

SECTION III
CONSTRUCTION

F. PIPELINE EARTHWORK

1. Trenching. Trenching for all pipes shall be in open cut to the lines and grades shown on the plans except that sections not to exceed eight (8) feet in length may be in tunnel where necessary in the opinion of the Director, to protect existing trees or structures. Where tunnels are required, the roof shall be sloped 45 degrees downward from each end. The trench shall be dug to the proper alignment and of adequate width to permit tamping the backfill around the bottom half of the pipe. Any paving which is to be removed shall be scored at or adjacent to the edges of the trench to such a depth and in such a manner before trenching operations are begun as to avoid damage to paving outside the trench area during trenching operations.

2. Timbering. The sides of all excavations shall be supported in the manner set forth in the "Construction Safety Orders", (effective September 28, 1957) issued by the Division of Industrial Safety, Department of Industrial Relations, State of California. Sheet piling and other timbering shall be withdrawn in such a manner as to prevent caving of the walls of excavations or damage to piping or other structures. Whenever timber or other sheeting is driven to a depth below the elevation of the top of the pipe, that portion of the sheeting below the elevation of the top of the pipe shall not be disturbed or removed.

3. Water Control. The Contractor shall remove all water which may accumulate in the excavation during the progress of the work so that all work can be done in the dry. Trenches shall be kept free from water while the pipe or other structures are installed, while concrete is setting and until backfill has progressed to a sufficient height to anchor the work against possible flotation of leakage.

4. Bedding and Backfill. Bedding for all piping installations shall be sufficient for the loads to which the pipe may be subjected as determined by the Director, but no less than the minimum herein set forth.

All trenches shall be subexcavated to allow the placing of at least 2" of number 4 rock or its approved equivalent under all asbestos cement, clay, or concrete pipe joints where the joints bell or coupling extend beyond the exterior diameter of the pipe. Where the trench is in hardpan, rock, or any similar unyielding

bed, at least 3" of number 4 rock or its approved equivalent shall be placed for the full width of the trench under the entire length of pipe with such additional excavation as is necessary to provide for a minimum of 3" under all bells or coupling. The pipe shall be bedded in or back filled with a suitable bedding material up to a depth of 12" over the pipe.

Table No. III-1, No. 4 Rock, herein, presents a satisfactory grading for material for use as bedding and backfill material up to 12 inches over the top of the pipe. With the permission of the Director materials with a different grading which will essentially bed and protect the pipe in the same manner as #4 rock may be used. The Director may require certification by the material supplier that the material supplied for use as pipe bedding and backfill meets the specifications for No. 4 rock or any other grading that the Director may approve.

If the foundation soil is soft, wet, spongy, or unstable, the trench shall be excavated to stable soil or 12 inches below the bells, whichever is the least and the excavation backfilled with No. 4 rock.

Backfill material around the pipe and to 12 inches over the pipe shall be placed by hand in such a manner as to not injure or disturb the pipe.

If the pipe is installed in an area where the backfilling requirements are controlled by an agency other than the Fresno County Department of Public Works, then the requirements of said agency shall govern from a point 12 inches above the pipe to finished grade with the exception that no particle exceeding 6 inches in greatest dimension shall be permitted in the backfill and only hand operated pneumatic or mechanical tampers will be permitted unless special permission is obtained from the Engineer.

In areas where the backfill from 12 inches over the top of the pipe to finished grade is under the control of the Fresno County Department of Public Works, then the backfill materials and compaction methods shall comply with the requirements of the standard plan in these improvement standards and/or the special provisions.

TABLE NO. III-1

NO. 4 ROCK

<u>Sieve Size</u>	<u>Percent Passing</u>	
	<u>Min.</u>	<u>Max.</u>
3/4 inch	100	100
3/8 inch	60	100
No. 4	0	15
No. 8	0	5

SECTION III
CONSTRUCTION

G. ELECTRICAL SERVICE

1. General

a. Overall Features of Design - Electrical systems, where shown on the plans, shall be considered generally diagrammatic, and locations of outlets and equipment shall be considered approximate unless dimensioned. The exact locations, and the routing of conduits shall be governed by structural conditions. All equipment shall be located and installed so that it will be readily accessible for maintenance and/or operation.

The contractor shall be responsible for the installation of any wiring recommended by the manufacturer as being necessary for the satisfactory operation of equipment in addition to that specifically shown on the plans.

b. Qualification Clause. Unless specifically excepted by the Department of Public Works, the installer of each piece of electrical equipment shall be licensed by the State of California as specified in the State Contractor's Licensing Provisions, Chapter 9 of Division 3 of the Business and Professional Code, State of California. Upon request, the Contractor shall furnish a list of representative installations to the Department of Public Works.

2. Protection of Equipment. The Contractor shall be responsible for damage to any of his work prior to final acceptance. He shall adequately protect all conduit openings, equipment, appliances, fixtures, and materials, to prevent obstructions, breakage, misuse, or disfigurement during construction, insofar as possible. Any damage occasioned shall be repaired before acceptance of the work.

3. Identification. All switches, automatic cutouts, and other control devices shall be so located or marked as to clearly indicate the equipment controlled by them, and switches (excepting magnetic switches) shall indicate whether they are open or closed.

Where identification of control devices is deemed to be required by the Director, such identification shall be provided by engraved, white center, laminated plastic nameplates.

4. Grounding. Grounding connections shall be made to all steel conduits, control panels, motor frames, lighting transformer cases and secondary neutral, and all other equipment enclosures as required.

5. Tests. Electrical insulation tests shall be made on all circuits after all wiring is installed and after fixtures and equipment are connected. The tests of all circuits shall be made between conductor and ground and values shall exceed those given in the National Electric Code. All tests shall be conducted in the presence of the Director.

6. Materials, Equipment and Workmanship.

a. Intent. It is the intent of these Standards to secure high quality in all materials and equipment and excellent workmanship, to facilitate operation of the plant. All equipment and materials shall be the product of reputable, recognized suppliers, having adequate experience in the manufacture of these particular items. Manufacturers of electrical materials and equipment shall have had similar equipment in similar operations for at least five years and shall, if requested by the Director submit a list of representative installations.

Electrical material and the methods of construction and installation thereof shall comply with Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code, Uniform Electric Code, Rules and Standards of the American Institute of Electrical Engineers and Standards of the National Electrical Manufacturer's Association.

b. Approval. Before beginning the work, the Contractor shall submit for approval by the Director.

1. A listing of all electrical supplies not covered specifically by these Standards, or not specified individually on the plans, that specified type and manufacturer of each item to be used;
2. Detailed drawings of all switchboards and control panels, showing general location, position, type and manufacturer of all switches and controls to be used;

3. Data for all electric motors, including manufacturer's name and type, horsepower, speed, frame size, number of phases, voltage frequency, temperature rise, bearings, enclosure and insulation.

All equipment and materials shall be new and shall be listed by the Underwriter's Laboratories, unless exception to such listing is specifically approved by the Director.

c. Conduits.

1. Conduit within Buildings. All conduits shall be rigid steel, galvanized or sherardized, inside and out, of the I.P.S. noted or required by Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code and the Electrical Safety Orders, but in no case smaller than shown on the plans.

Where conduit is exposed, it shall be run parallel to building lines, and may where necessary to clear other mechanical work, be run through sleeves placed in beams. Exposed conduit shall be supported at intervals of not more than 10 feet by galvanized hangers or supports.

2. Flexible Conduit. Flexible conduit shall be fabricated from continuous lengths of spirally wound, galvanized steel strip, with successive convolutions securely interlocked. Flexible conduit shall be used only at each motor, and as specifically shown on the plans. In exterior or wet locations, neoprene jacketed flexible conduit shall be used.

3. Conduit Boxes and fittings. such as bushings, locknuts couplings, and unions shall be galvanized or sherardized. Fixture outlet boxes shall be not smaller than 3 inch round size. Switch and receptacle boxes shall be not smaller than 4 inch square size, where recessed.

d. Cable and Wire.

1. General. All building wire shall be run in conduit, except as noted on the plans

2. Building Service Wire. All service control panels shall be installed in location and size as shown on plans. The panels and sub-panels will be equipped with a main disconnecting means with permanent identification of all circuits. All control wiring shall be color coded and conform to the standards of the requirement of Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code.

Each conductor, and its branches shall be distinctly colored throughout its entire length, so it may be easily identified and distinguished from any other separate conductor.

e. Motors. Where 3 phase current is available, all motors rated at one horsepower and above shall be 3 phase motors operating at the available voltage and frequency. Motors rated at less than 1 horsepower may be single phase.

Construction and performance of all motors shall conform to the National Electrical Manufacturer's Association. Frame construction of electric motors for average use shall conform to the following National Electrical Manufacturer's Standards as a minimum of construction:

<u>Use</u>	<u>Classification</u>	<u>N.E.M.A. Standard</u>
Average indoor use	Drip-proof	MG 1-1.20 (1959)
Average outdoor use	Splash-proof with Class B insulation	MG 1-1.20 (1959)

For conditions other than average use the Director may permit or require exception to these standards. "Average use" shall be as determined by the Director.

All motors shall be of sufficient horsepower so that the requirements of the driven machine will not exceed the rated horsepower of the motor. In selecting motors for centrifugal pumps, the maximum power requirement of the pump over the entire range from free discharge to shut-off head shall be the determining factor. In no case shall the rated service factor of the motor be considered a justifiable cause for selecting a motor whose nameplate horsepower rating is less than that required by the driven unit. Full information shall be submitted to the Director to verify compliance with these specifications.

f. Motor Controls.

1. Voltage Rating of each control device shall be as required by the load it is to control but each device shall be capable of operating satisfactorily at 10 percent above or below its rating.

2. Push Button Stations. Push button stations for the control of motors shall be heavy duty type. Push button stations mounted outdoors shall be weatherproof enclosing cases. Push buttons mounted at the motor or for remote operation shall have a lockout bar on the stop button.

3. Hand-off automatic Switches shall be heavy duty rotary selector type. Where mounted outside, they shall be in weatherproof cases. Hand-off-automatic switches shall be provided for all equipment that is capable of starting automatically. Said switches shall be located within sight of and not more than fifty feet away from the motor they control.

4. Disconnecting Means. For motors over 1/8 horsepower the disconnecting means may be a circuit breaker. Circuit breakers on 3 phase motors shall be so equipped that an overload on any pole opens all poles.

5. Motor Overload Protection shall be provided for all 3 phases of 3 phase motors. Overload protection shall be adequate for the motors served.

SECTION III

CONSTRUCTION

H. MECHANICAL EQUIPMENT

1. General.

a. Overall Features of Design. All equipment shall be of rugged construction, of ample strength for all stresses which may occur during fabrication, transportation, erection and during continuous or intermittent operation and shall be adequately stayed, braced and anchored and shall be installed in a neat and workman-like manner. Appearance as well as utility shall be given consideration in the design of details. Specifications for each item of equipment shall be included with the plans.

b. Qualification Clause. Unless specifically excepted by the Department of Public Works, the installer of each piece of mechanical equipment shall be licensed by the State of California as specified in the State Contractor's Licensing Provisions, Chapter 9 of Division 3 of the Business and Professional Code, State of California. Upon request, the Contractor shall furnish a list of representative installations to the Department of Public Works.

c. Accessories. The Contractor shall furnish and install all necessary guides, inserts, anchor and assembly bolts, and all other appurtenances required for the installation of the devices included in the equipment items.

Anchor and assembly bolts shall be of ample size and strength for the purpose intended and cadmium plated or galvanized bolts shall be used in moist or damp locations and wherever they are embedded in concrete. All bolts shall be hex head machine bolts, with cold pressed hexagon nuts.

Expansion bolts of approved type may be used, where shown on the drawings or approved by the Director.

d. Manufacturer's Drawings. The arrangement of mechanical equipment and appurtenant piping shown on the drawings shall be considered as indicative and may be varied as necessary to fit the approved certified manufacturer's installation drawings. Manufacturer's installation drawings approved by the Director shall be used to supplement the plans. Manufacturer's drawings shall not require any great deviation from the plans as to location, size, type and design of equipment.

Three sets each of certified equipment drawings with installation details thereon shall be submitted to and approved by the Director for each piece of mechanical equipment before its shipment to the site of the work.

e. Responsibility for Care of Equipment. The Contractor shall be responsible for the equipment included in the construction until it has been finally inspected, tested and accepted in accordance with the requirements of these standards.

f. Tests, Adjustments and Operation. Following completion of the installation, all mechanical equipment shall be adjusted by competent personnel, and an operational test shall be conducted in the presence of the Director to verify that the system is capable of operating in the intended manner.

SECTION III

CONSTRUCTION

I. BUILDINGS AND STRUCTURES

1. General. All buildings and structures required to be constructed for water supply and distribution systems and for sewage collection and treatment facilities shall comply with the requirements of Chapters 2 through 4 of Division IV, Part VII of the Fresno County Ordinance Code and the plans and special provisions.

SECTION III

CONSTRUCTION

J. MISCELLANEOUS METAL WORK

1. General. Unless noted otherwise on the plans with the detail specifications for each specific item of equipment or material, the following specifications for metal work shall apply.

All miscellaneous metal work shall be of ample strength and design to adequately resist the loads that may be imposed upon it as calculated by recognized engineering methods.

2. Materials.

a. General. Unless designated otherwise on the plans, the following shall apply:

Structural Steel shall conform to steel for Bridges and Buildings of the A.S.T.M. Designation A7-58T.

Zinc Coatings (hot-dip galvanized). All galvanizing for steel shall be done by the hot-dip process conforming to the A.S.T.M. Designation A 123-59. Zinc coating (hot-dip) on iron and steel hardware shall conform to A.S.T.M. Designation A153-60.

Welding. All welding shall be shielded arc method and shall be done in accordance with the latest requirements of the American Welding Society. Proposed welding operators may be examined at the site of the work and upon satisfactory completion of test welds, designated by the Director may be permitted to perform welding operations on the project. All welding operators shall be subject to examination, for re-qualification, at any time during the progress of the work.

b. Floor Grating and Checkered Deck Plates, including angle iron floor framing and anchorages, shall be hot dipped galvanized after fabrication. The top surface of all bars and panels of grating and deck plates shall be flush.

Aluminum grating and frames may be substituted for galvanized steel grating. All gratings and checked deck plates shall be of sufficient strength to sustain any load that may reasonably be expected to be applied and shall be approved by the Director.

Where required for the passage of pipes, valve stems or other devices, openings shall be left in the gratings and deck plates. The ends of all grating bars cut for openings and those supported in a recessed angle frame, shall be provided with binding strips of the same depth and thickness as the main bars, welded thereto at every main bar, and neatly finished at the intersections with the bars.

All grating panels and deck plates, as furnished on the site of the work, shall be absolutely flat and true to provide for even, uniform non-rattling bearing in the grating frame. Curb angles and other supports shall be furnished and installed in accordance with the plans. The manufacturer's detailed layout and samples of gratings shall be submitted for the Director's approval.

Checkered deck plates shall be provided with steel angle iron edging set in the concrete by means of steel dowels on not more than 24" centers. Angle iron edging shall be set so that floor plates will be flush with the finished floor slab. The plates shall be of the thickness indicated on the drawings, but shall be not less than 1/4" thick. They shall be cut into convenient size sections for easy removal. The maximum size section shall not weigh more than 160 pounds. Each removable section shall be provided with a U-bolt lifting handle or any other lifting device that shall not project beyond the surface of the plate when not in use. Where required for the passage of pipes, valve stems or other devices, the plates shall be cut to conform to the general shape of the pipe or other projection through the plates. The plates shall be cut in such a manner that they can be removed from around the projection easily and without binding.

c. Hand Rails shall be provided where required by the State of California General Industry Safety Orders. Hand rail construction shall comply with the appropriate Standard Drawings.

3. Installation and Finish. All work of this section shall be securely anchored in place. Placing of the various items shall be coordinated with work specified under other headings so as to produce workmanlike finish and avoid tearing out and replacement. Provision shall be made for expansion and contraction of metal by use of clip fastenings.

4. Shop Drawings. For all work of this section of the Standards not covered by Standard Drawings, shop drawings shall be provided for approval by the Director before fabrication of the materials is commenced.

5. Galvanizing. Exposed iron and steel work except as herein otherwise specified shall have a hot dipped galvanized coating after fabrication except that pipe railings, manhole and cleanout frames and covers, and metal stair treads and stairs shall not be galvanized

6. Painting For painting requirements refer to section on "Painting", Section K herein.

SECTION III

CONSTRUCTION

K. PAINTING

1. General. Unless specified otherwise on the plans, the following items shall be painted as hereinafter specified:

- (a) Above ground piping.
- (b) Exterior surfaces of buildings constructed with wood siding.
- (c) Structural steel.
- (d) Miscellaneous metal work (not galvanized).
- (e) Mechanical equipment.
- (f) Electrical control panels, exposed conduit and control boxes.
- (g) Electric motors.

2. Intent. The intent of these standards is to assure satisfactory protection from the elements and neat appearance on all equipment, buildings and appurtenances associated with the plant. Painting shall be done at such time as the contractor and the Director may agree upon in order that dust free and neat work shall be obtained. All painting shall be done in strict accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the Director.

3. Materials. All coatings shall be of first quality material and have demonstrated suitability for the service intended.

Unless the type of paint is specified on the plans the Contractor shall apply for and receive the approval of the Director as to materials proposed prior to any application of paint. Complete data on any type of paint proposed, including past performance under similar conditions, composition or type, and directions for use and application shall accompany the proposal.

All paints shall be delivered to the job in unopened containers, bearing the name of the manufacturer and clearly marked for product contained within.

4. Preparation and Application. Except as otherwise specified, all surfaces shall be clear, dry, smooth and free from rust, grit, grease, oil and frost.

All surfaces to be painted on the job shall be approved by the Director prior to application of any coatings. In general, painted surfaces shall be free from drops, runs, sags and brush marks and no paint shall be applied when the temperature is below 50°F. All preceding coats shall be complete and thoroughly dry before applying the succeeding coat. In general, each coat shall vary slightly in color to distinguish it from the preceding coat.

All paint shall be kept at a consistency and applied in accordance with the printed directions of the manufacturer.

SECTION III
CONSTRUCTION

L. FENCING

1. General. Fencing of adequate construction shall be required to protect from damage by exterior forces all equipment, machinery and appurtenances susceptible to said damage and shall be capable of excluding unauthorized personnel from hazardous areas. Proposed fencing, including details of construction, shall be shown on the plans and approved by the Director. Unless specified on the plans or in the Special Provisions fencing shall comply with the requirements of Section 80-4 of the Standard Specifications.

SECTION III
CONSTRUCTION
M. CLEANUP

1. General. Surplus materials, tools and temporary structures shall be removed by the Contractor, and all dirt, broken pavement, rubbish, and excess earth from excavations shall be hauled to a dump provided by the Contractor and the construction site shall be left clean, to the satisfaction of the Director.

SECTION III

CONSTRUCTION

N. STABILIZATION OF CUT AND FILL SLOPES BY SEEDING & MULCHING

1. Time of Application

Stabilization shall be performed between September 15 and November 1, or later if permitted by the Director of Public Works.

2. Slope Preparation

- a. Cut and/or fill slopes in erodible material shall be no steeper than one and one-half horizontal to one vertical. Two to one slopes or flatter are recommended.
- b. Run-off shall be prevented from flowing over the face of slopes of cuts and fills by constructing drainage diversions such as paved ditches, dikes, down drains or similar facilities.
- c. Cut slopes more than 40' in vertical height and fill slopes more than 30' in vertical height shall be protected from run-off originating on the slope itself with 10' wide benches, interceptor ditches or other mechanical measures.
- d. All runoff water from diversions, such as those listed in b, and c above, shall be conveyed and disposed of in such a manner that no erosion will result.
- e. Small gullies and irregular areas greater than three inches in size shall be filled and compacted in advance of seeding.
- f. An adequate seedbed shall be prepared by scarifying, disking, harrowing, or otherwise working up the soil to a depth of 2 to 3 inches.

Preparation of the seedbed as stated above shall not be required if, during construction, the top two to three inches of fill slopes are left uncompacted and loose material on cut slopes is three inches or less in depth.

3. Approved Seeds and Planting Rates

a. Elevations to 4,000 feet.

- (1) Blando Brome at 12 pounds per acre, and Lana Vetch at 30 pounds per acre, or
- (2) Cucamonga Brome at 24 pounds per acre, and Lana Vetch at 30 pounds per acre, or
- (3) Blando Brome at 18 pounds per acre, or
- (4) Cucamonga Brome at 36 pounds per acre, or
- (5) Lana Vetch at 45 pounds per acre.

NOTE: Lana Vetch Seed shall be inoculated with nitrogen fixing bacteria.

- b. Elevation at 4,000 to 7,000 feet, mixture composed of: Greenar Intermediate Wheatgrass at 8 pounds per acre, and Topar or Luna Pubescent Wheatgrass at 8 pounds per acre, and Akaroa Orchardgrass at 5 pounds per acre, and either Sherman Big Bluegrass at 4 pounds per acre, or Alta Fescue at 8 pounds per acre.
- c. All seeds must conform to the minimum standards of the California Seed Law as it applies to germination, inert matter, variety, purity and weed contents.
- d. Other seeds and quantities may be approved by the Director of Public Works.

4. Approved Fertilizer and Rates

Commercial fertilizer shall be applied at a rate that will provide not less than 80 pounds per acre of available nitrogen (N) and 80 pounds per acre of available phosphoric acid (P₂O₅)

5. Approved Mulch and Rates of Application

- a. Straw mulch, free of noxious weeds, at 2 tons per acre, or
- b. Wood fiber mulch at 1,500 pounds per acre, or
- c. Wood fiber mulch at 800 to 1000 pounds per acre, with adhesive mulch stabilizer at manufacturer's recommended rate.

6. Application Methods

a. Manually or mechanically.

- (1) Fertilizer and seed shall be uniformly distributed over the area. Fertilizer may be applied just prior to, or at the time of seeding.
- (2) Seed and fertilizer shall be covered to a depth of one-half inch by raking or harrowing.
- (3) Straw shall be spread uniformly over the area immediately after seeding and fertilizing. The straw shall be anchored to keep it from blowing or washing away. Anchoring methods include tucking the mulch into the soil with a straight-blade disk, sheep-foot compactor, mulching colter, fiber netting or such other methods approved by the Director of Public Works.

b. Hydraulic

Seed, fertilizer, and mulch may be applied as a slurry in an all-in-one operation, or seeds may be applied first, followed by wood fiber mulch and fertilizer application, in each case using approved hydro-seeding equipment.

7. Temporary Stabilization

Up to elevation 7000 feet where temporary short term stabilization is desirable (1 year or less) Wimmera 62 Rye Grass applied at the rate of 27 pounds per acre may be used in lieu of the grasses specified in Section III N-3a. All other requirements of this Section, III N, will be required. This substitution may not be used as final stabilization.

When final stabilization is performed, seeds and planting rate, as specified in Section 3a, may be seeded into the rye grass and fertilized, and further mulching may be waived by the Director of Public Works.

8. All seeded areas shall be inspected for failures during the summer following the seeding. Where determined by the Director of Public Works that reseeding, fertilizing, and mulching is necessary this shall be done during the following seeding and mulching period, (September 15 to November 1).

9. For any slopes which are required to be stabilized, which are constructed subsequent to November 1 of any calendar year and prior to March 15 of the subsequent calendar year or if it is not possible or reasonable to stabilize temporary construction slopes as specified herein, sediment retention basins, designed and constructed to the satisfaction of the Director of Public Works shall be provided.

S E C T I O N I V

P L A N S a n d C H A R T S

SECTION IV

MINIMUM REQUIREMENTS FOR STREETS IN FRESNO COUNTY

A-1
Local Road

Local roads are streets providing direct access to single residential units, whose principal use is providing access to abutting property.

CASE A-1, A-1E(50) or A-1E(40) standard shall be used for all Local Roads unless one of the following cases apply.

CASE A-1a This standard may be used if any of the following conditions are present:

- a. The subdivision is east of the Friant-Kern Canal
or
- b. The subdivision is west of Interstate Highway 5 and above elevation 900 feet in Township 20, elevation 800 feet in Township 14, 15, and 21, and elevation 600 feet in Township 12, 13, 16, 17, 18 and 19 or
- c. The subdivision has no parcel fronting the street with a width of less than 165 feet.

CASE A-1b This standard may be used when the street is either below the 3,000 foot elevation or is specifically excluded from the County's snow removal area by the Board of Supervisors and any of the following conditions are present:

1. No parcels fronting the street are smaller than 2 acres.
2. The subdivision is located either:
 - a. East of the Friant-Kern Canal.
 - b. West of Interstate Highway 5 and above elevation 900 feet in Township 20, elevation 800 feet in Townships 14, 15, and 21 and elevation 600 feet in Townships 12, 13, 16, 17, 18, and 19.

and all parcels meet the requirements of R-A zoning in area and frontage.

This area may be reduced to 25,000 square feet and the frontage to 110 feet when the Board of Supervisors determines that there is sufficient usable "Common Area" held in joint ownership by all owners of the subdivision to make the average area per lot in the subdivision equivalent to 36,000 square feet.

3. The subdivision meets location requirements under 2 above, all parcels meet the requirements of R-1-A zoning in area and frontage, and further, two off-street parking spaces for each residential unit, connecting to the improved street shall be constructed at the same time and under the same control by the County as the street.
4. The subdivision meets the location requirements of 2 above and the street is a cul-de-sac not over 200 feet long and serves not more than 6 single residential units.

CASE A-1c This standard may be used when either Conditions 1, 2, or 3 listed under CASE A-1b exist.

A-2
Local Collector Road

These are local streets that do not meet the criteria for Local Roads, which have the dual purpose of serving abutting property and carrying traffic from Local Roads to Major Collector and Arterial Streets.

CASE A-2 or A-2E standard shall be used for all Local Collector Roads unless one of the following cases apply.

CASE A-2a This standard may be used if any of the following conditions are present:

- a. The subdivision is east of the Friant-Kern Canal.
- b. The subdivision is west of Interstate Highway 5 and above elevation 900 feet in Township 20, elevation 800 feet in Townships 14, 15 and 21, and elevation 600 feet in Townships 12, 13, 16, 17, 18 and 19.
- c. The subdivision has no parcel fronting the street with a width of less than 165 feet.

CASE A-2b This standard may be used when any of the following conditions are present:

1. No parcels fronting the street are smaller than 2 acres.

2. The subdivision is located either:
 - a. East of the Friant-Kern Canal or
 - b. West of Interstate Highway 5 and above elevation 900 feet in Township 20, elevation 800 feet in Townships 14, 15 and 21 and elevation 600 feet in Townships 12, 13, 16, 17, 18 and 19.

and all parcels meet the requirements of R-A zoning in area and frontage.

This area may be reduced to 25,000 square feet and the frontage to 110 feet when the Board of Supervisors determines that there is sufficient usable "Common Area" held in joint ownership by all owners of the subdivision to make the average area per lot in the subdivision equivalent to 36,000 square feet.

3. The subdivision meets location requirements under 2 above, all parcels meet the requirements of R-1-A zoning in area and frontage; and further, two off-street parking spaces for each residential unit connecting to the improved street shall be constructed at the same time and under the same control by the County as the street is.

CASE A-2c This standard may be used when either conditions 1, 2, or 3 listed under CASE A-1b exist.

A-3
Collector Road

A street or road which serves the internal traffic movement within an area and connects with the Arterial System.

CASE A-3 This standard shall be used (a) Within the Fresno-Clovis Metropolitan Area as approved by the Board of Supervisors (b) Within 2000 feet of the city limits of any other incorporated city in the County (c) Within 2000 feet of the boundaries of other urban areas covered by a general plan adopted by the Board of Supervisors (d) When the minimum size of abutting lots is less than 36,000 square feet.

CASE A-3a This standard may be used in all areas where CASE A-3 is not required.

A-4
Arterial Road

A street or highway for through traffic on a continuous route joining collectors, major traffic generators, other arterials and freeways.

CASE A-4 This standard shall be used (a) Within the Fresno-Clovis Metropolitan Area as approved by the Board of Supervisors (b) Within 2000 feet of the city limits of any other incorporated city in the County (c) Within 2000 feet of the boundaries of other urban areas covered by a general plan adopted by the Board of Supervisors (d) When the minimum size of abutting lots is less than 36,000 square feet.

CASE A-4a This standard may be used in all areas where CASE A-4 is not required.

A-5
Industrial Local Road

A street which provides access to abutting industrial zoned parcels.

CASE A-5 shall be used in all cases.

A-6
Collector Road (Industrial)

Same requirements as A-3 (Major Collector Road).

CASE A-6 This standard shall be used in all areas where abutting property is zoned industrial.

A-7
Frontage Road

A street which serves property abutting an Arterial, Major Collector, Expressway or Freeway.

CASE A-7 shall be used in all cases.

A-8
Frontage Road (Industrial)

A street which serves industrially zoned property abutting an Arterial, Major Collector, Expressway or Freeway.

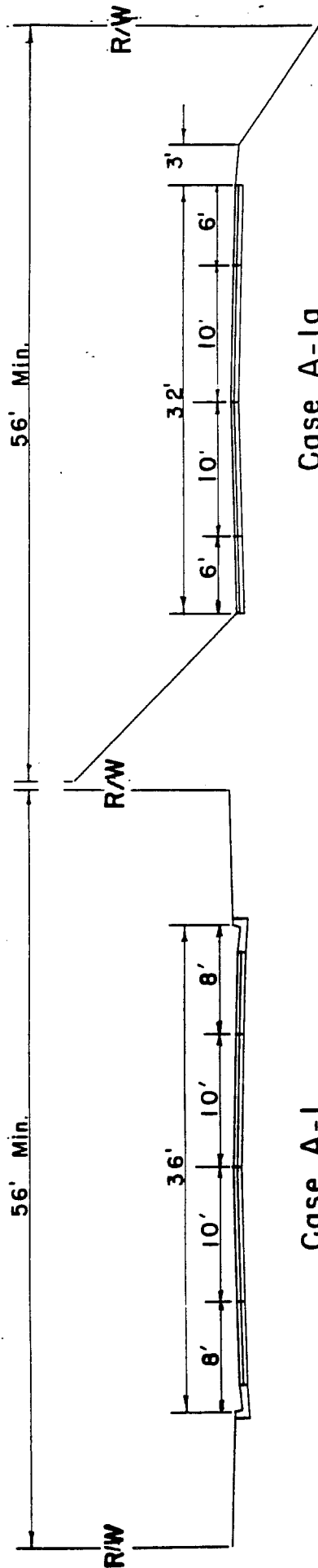
CASE A-8 shall be used in all cases.

Private Local Residential Street

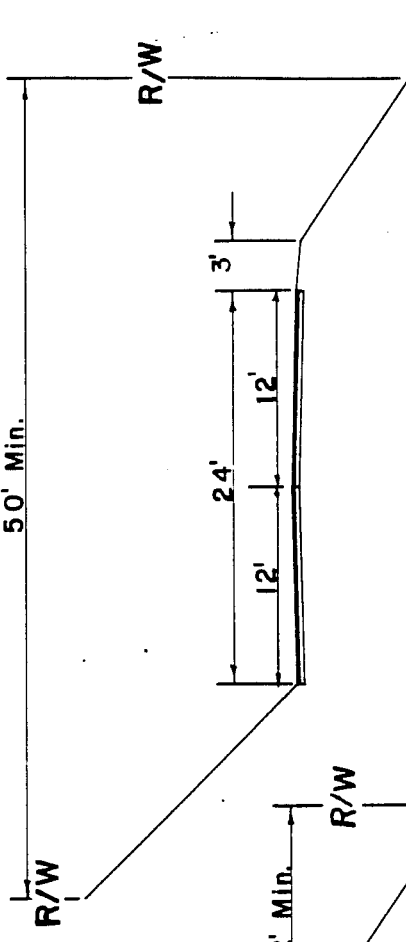
Private Local Residential Streets provide access to Local Roads, common parking areas or a maximum of six housing units.

These standards may be used if the following conditions are present:

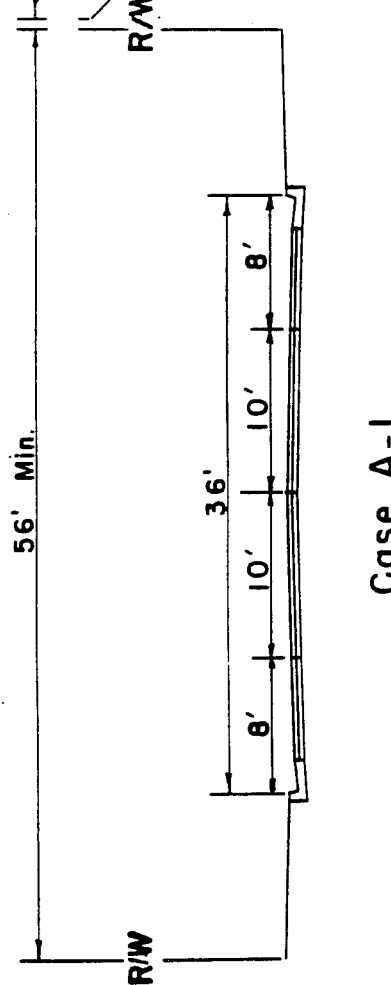
1. The subdivision is an urban development, and
2. The subdivision is located either:
 - a. West of the Friant-Kern Canal or
 - b. East of Interstate Highway 5.



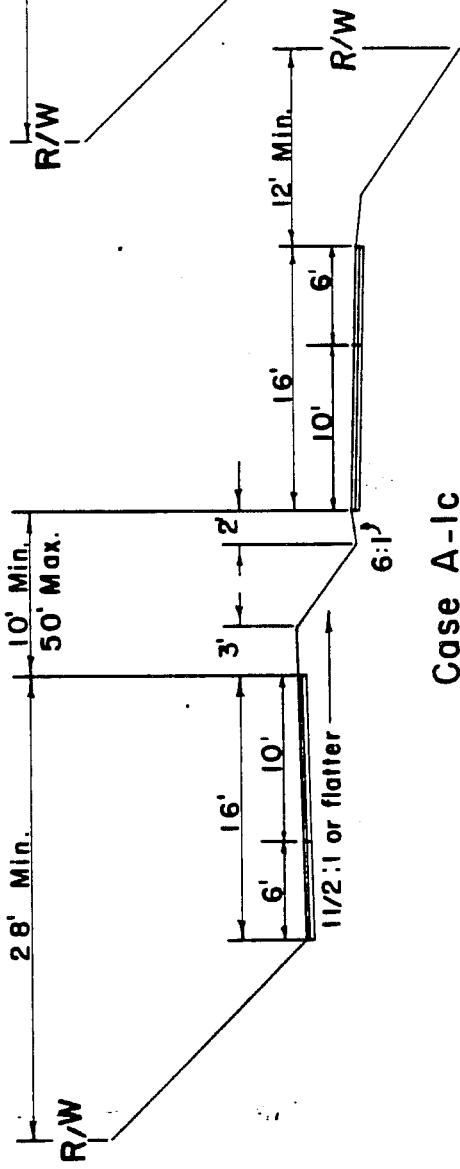
Case A-1a



Case A-1b



Case A-1



Case A-1c

Case A-2c

COUNTY OF FRESNO - CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS
 IMPROVEMENT STANDARD
 A-1

REVISED DATE

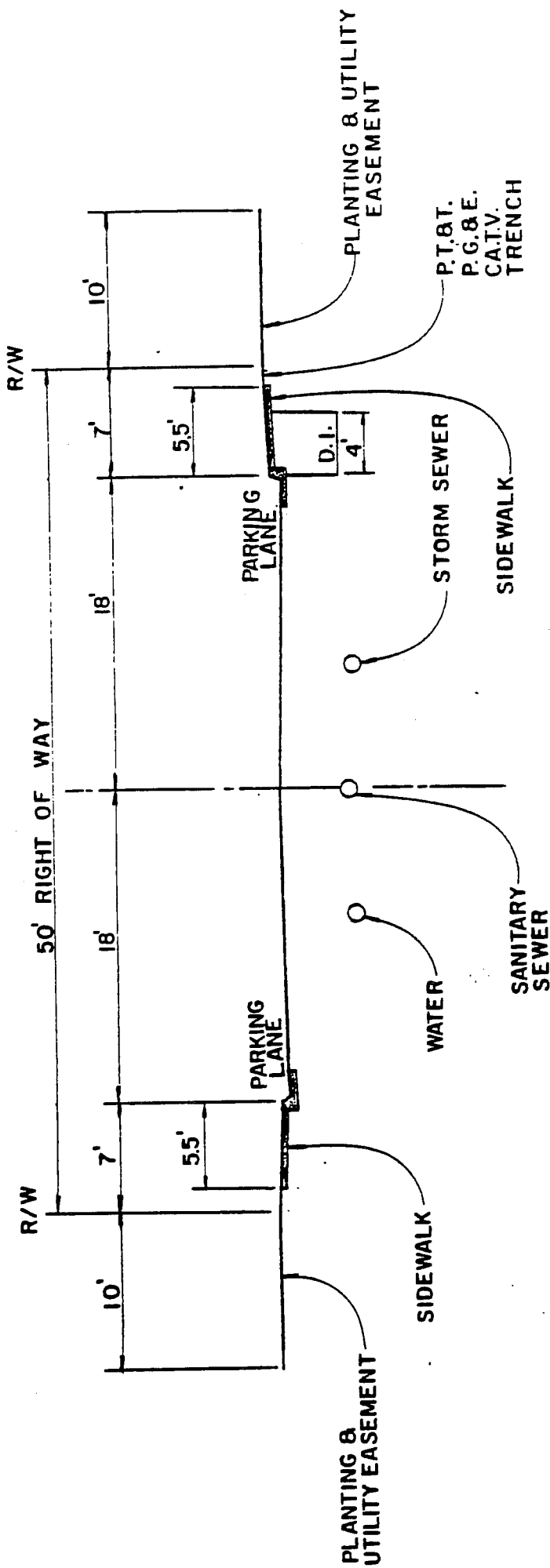
Date: 10-66

LOCAL ROAD
GEOMETRIC SECTION

50' RIGHT-OF-WAY
LOCAL RESIDENTIAL STREET

SPECIFICATIONS

1. Sidewalks on both sides, one side or delete sidewalk.
2. Subject to monolithic sidewalk and driveway approach detail (A-19).
3. Greater right-of-way may be approved. In such cases, 4-foot sidewalk to be installed 6 inches from property line (exception may be approved for a meandering sidewalk).
4. 1,500-foot maximum length of continuous street.
5. In other than single-family areas, this street section can only be used on cul-de-sacs and on one-block streets not exceeding 800 feet in length.
6. Subject to pipeline installation requirements formula (A-21).
7. F.I.D. facilities shall be located in a separate easement out of the street area.
8. Street furniture to be located in accordance with street furniture location diagram (A-20).
9. Can be used in conventional development, planned unit developments or other residential developments.
10. 34-foot curb to curb is acceptable in this right-of-way if used on a loop street or a loop street with cul-de-sacs if the maximum number of residential units served by the loop street does not exceed 75 and no through traffic will be carried by the street.



**50' RIGHT OF WAY
LOCAL RESIDENTIAL STREET
GEOMETRIC SECTION**

COUNTY OF FRESNO — CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

IMPROVEMENT STANDARD
A-1
CASE A-IE (50)

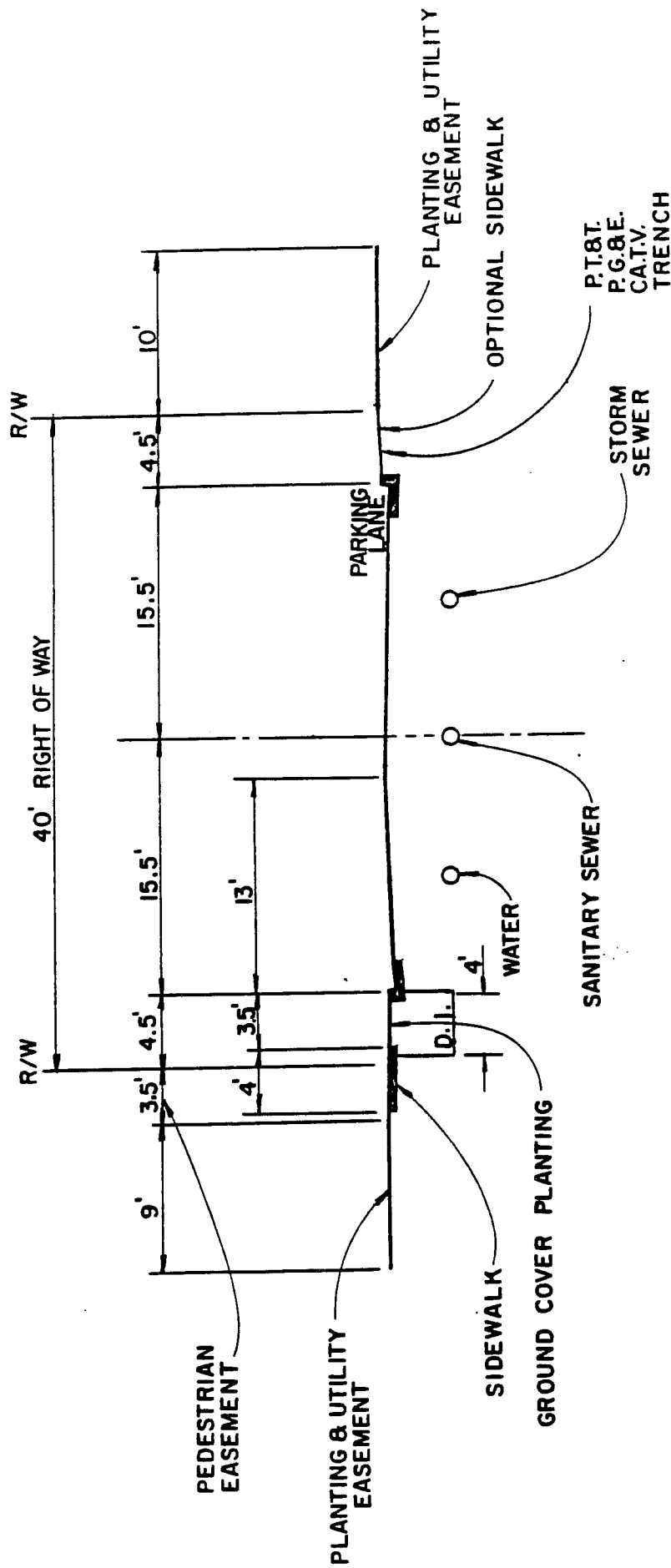
REVISED DATE

DATE: 10-83

40' RIGHT-OF-WAY
LOCAL RESIDENTIAL STREET

SPECIFICATIONS

1. Sidewalks allowed on both sides, but mandatory on side with no parking.
2. Where optional sidewalks (monolithic) are installed, a 2.5-foot pedestrian easement is required to be dedicated in addition to the right-of-way to accommodate sidewalk at the driveway approaches (see detail standard). 4-foot separated or curvilinear sidewalk is acceptable if additional right-of-way is dedicated and park strip is adequate width for planting.
3. Subject to sidewalk and driveway approach detail (A-19).
4. Serve 75 dwelling units maximum. May not be used where through traffic is collected from other streets.
5. In other than single-family areas, this street section can only be used on cul-de-sacs or one-block streets not exceeding 450 feet in length.
6. May not provide pedestrian or vehicular access to a school, park, community center or other heavy traffic generator.
7. F.I.D. facilities shall be located in a separate easement out of the street area.
8. Street furniture to be located in accordance with street furniture location diagram (A-20).
9. Additional FMFCD facilities may be required to accommodate narrowed street.
10. Subject to pipeline installation requirements formula (A-21).
11. Can be used in conventional development, planned unit developments or other residential developments.



**40' RIGHT OF WAY
LOCAL RESIDENTIAL STREET
GEOMETRIC SECTION**

COUNTY OF FRESNO — CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

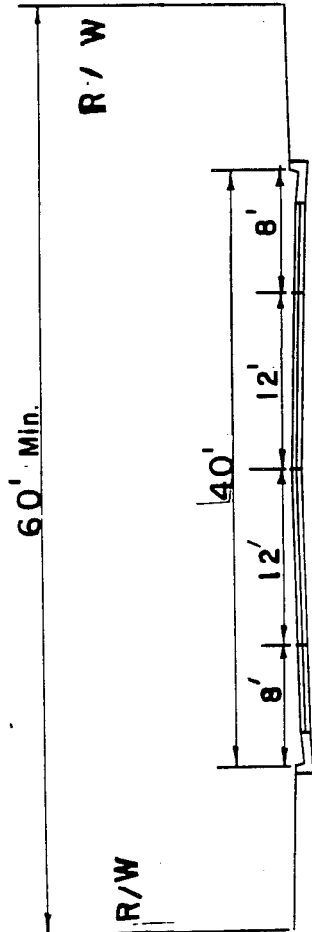
IMPROVEMENT STANDARD
A-1
CASE A-IE(40)

REVISED DATE

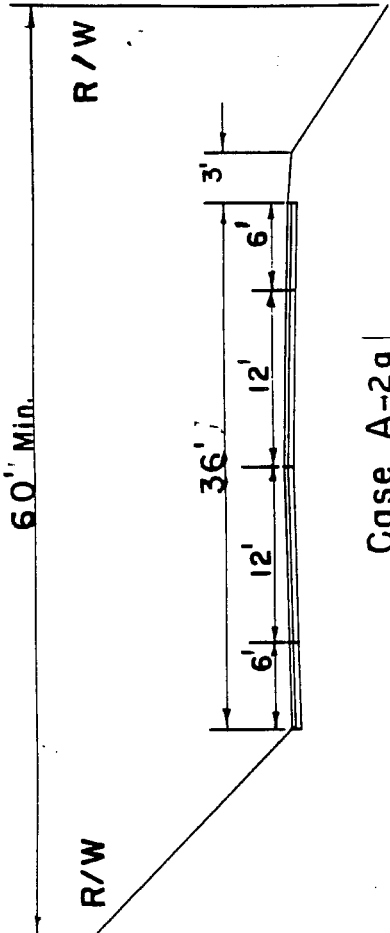
DATE: 10-83

SPECIFICATIONS

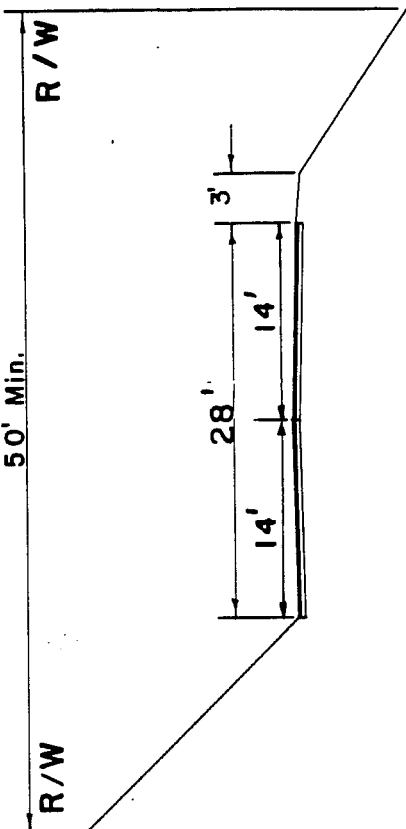
1. Sidewalk both sides.
2. Subject to monolithic sidewalk and driveway approach detail (A-19).
3. Greater right-of-way may be approved. In such cases, 4-foot sidewalk to be installed 6 inches from property line (exception may be approved for a meandering sidewalk).
4. No restrictions on number of units served.
5. 1,200-foot maximum block length.
6. Use at all contact points with major streets, except where standard cul-de-sacs contact major streets, a 50-foot right-of-way standard is acceptable. Minimum 150-foot throat distance from curb line on major street. May be minimum standard when needed for traffic safety. Generally required for multiple-family development.
7. Subject to pipeline installation requirements formula (A-21).
8. F.I.D. facilities shall be located in a separate easement out of the street area.
9. Street furniture to be located in accordance with street furniture location diagram (A-20).
10. Can be used in conventional development, planned unit developments or other residential developments.



Case A-2



Case A-2a



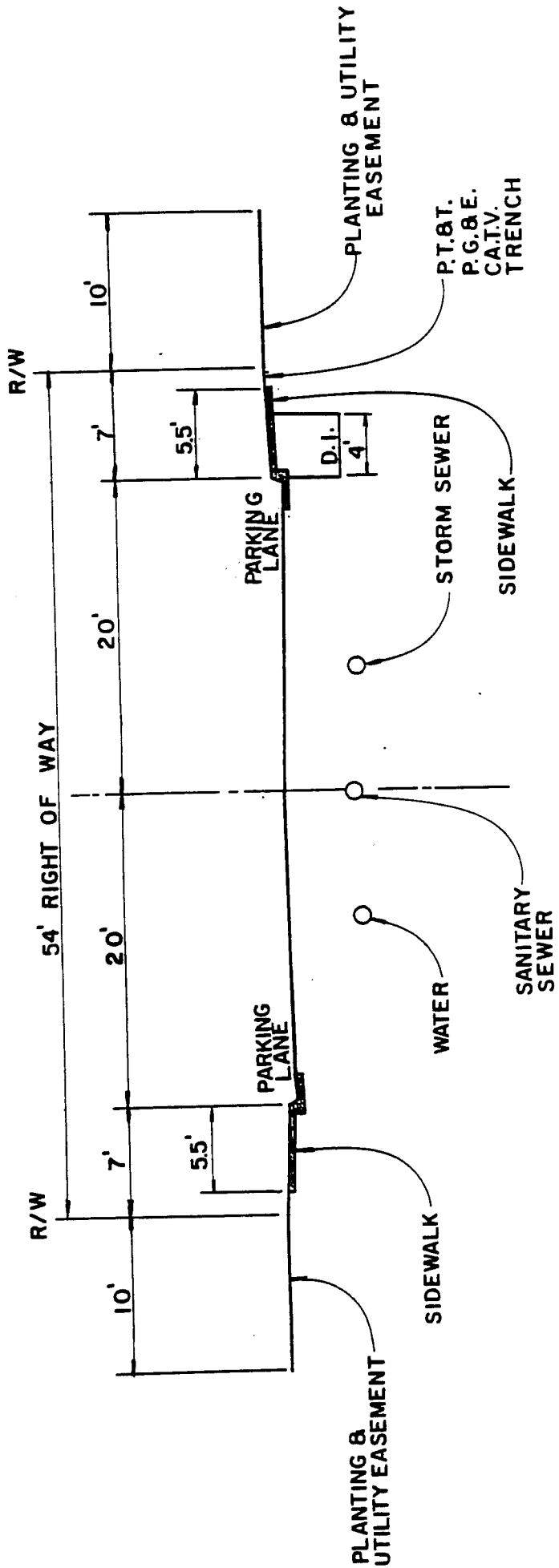
Case A-2b

Case A-2c

(See Case A-1c)

LOCAL COLLECTOR ROAD
GEOMETRIC SECTION

COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
REVISED	IMPROVEMENT STANDARD A-2
DATE	
Date: 10-66	

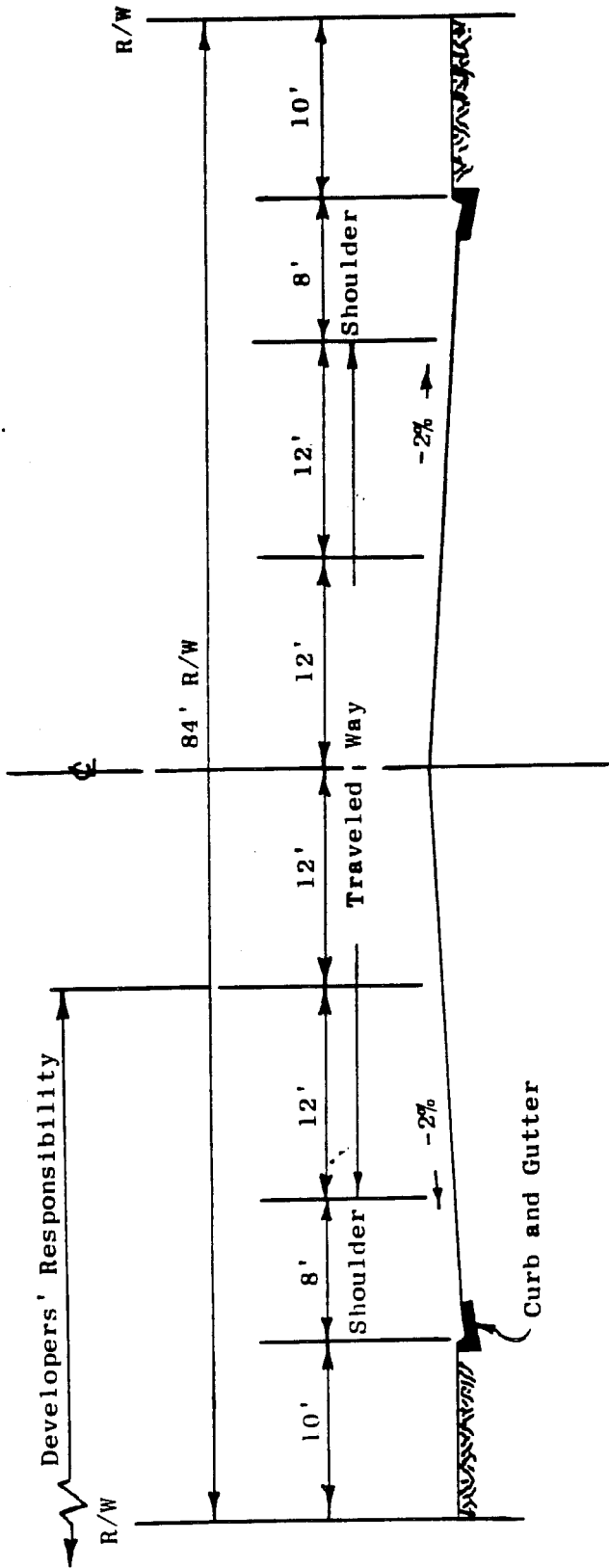


54' RIGHT OF WAY
LOCAL COLLECTOR RESIDENTIAL STREET
GEOMETRIC SECTION

COUNTY OF FRESNO — CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS
 IMPROVEMENT STANDARD
 A-2
 CASE A-2E

REVISED DATE

DATE: 10-83



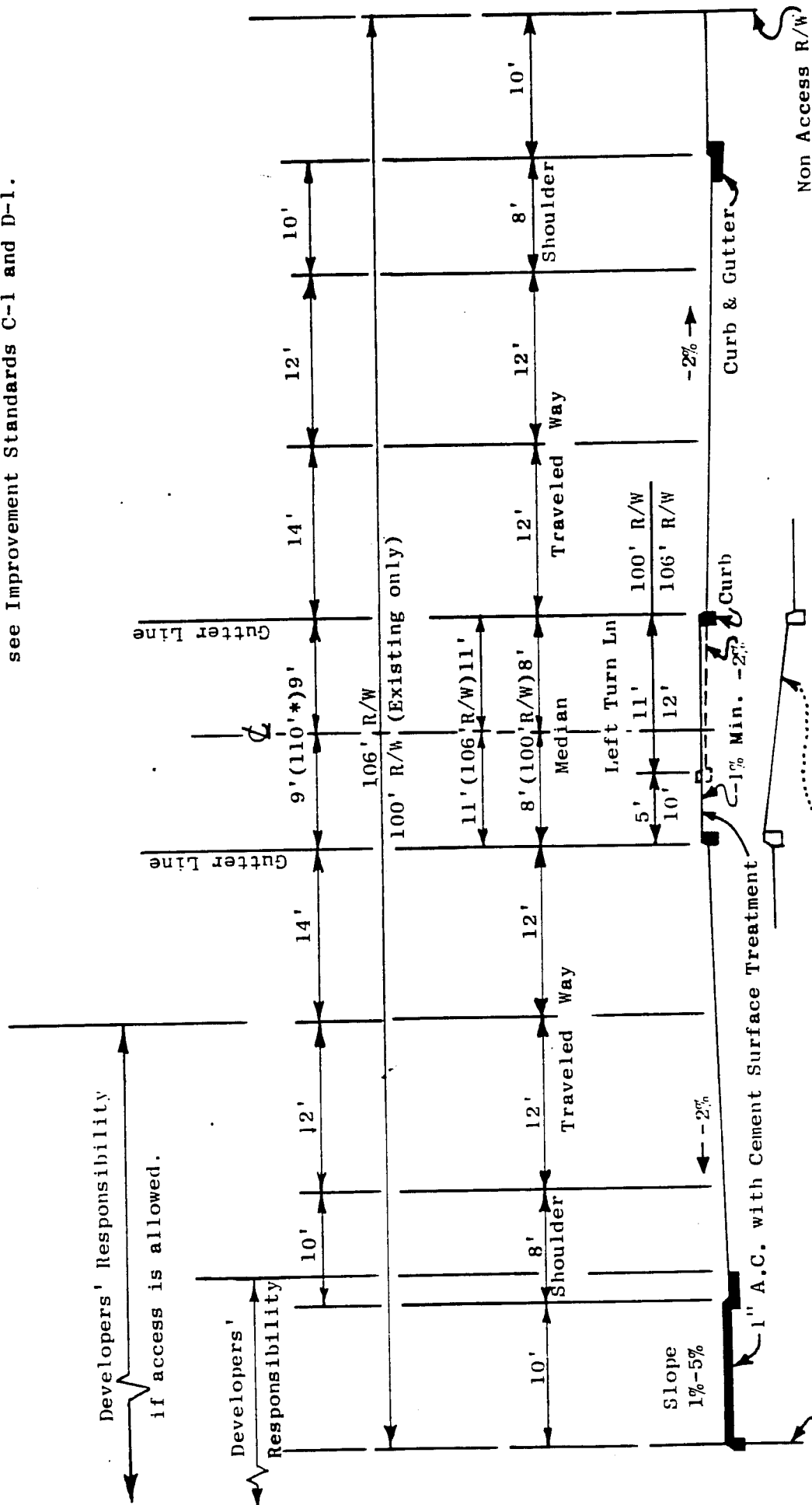
COLLECTOR ROAD
GEOMETRIC SECTION

NOTE: Use 8' curb pattern for existing 80' rights of way
 Case A-3: As shown
 Case A-3a: As shown, but without curb, gutter and sidewalk (8' paved shoulder)

COUNTY OF FRESNO - CALIFORNIA	
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REVISED	A-3
DATE	
IMPROVEMENT STANDARD	
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* FAS Routes within Urban Boundaries

NOTE:
For Sidewalk and Curb and Gutter details,
see Improvement Standards C-1 and D-1.



1" A.C. with Cement Surface Treatment
Frontage Road R/W
Curb
C-1% Min. -2%
Curb
Non Access R/W
-2%
-2%
4:1 Max. except at Median openings and left turn lane.
2% at Median openings.

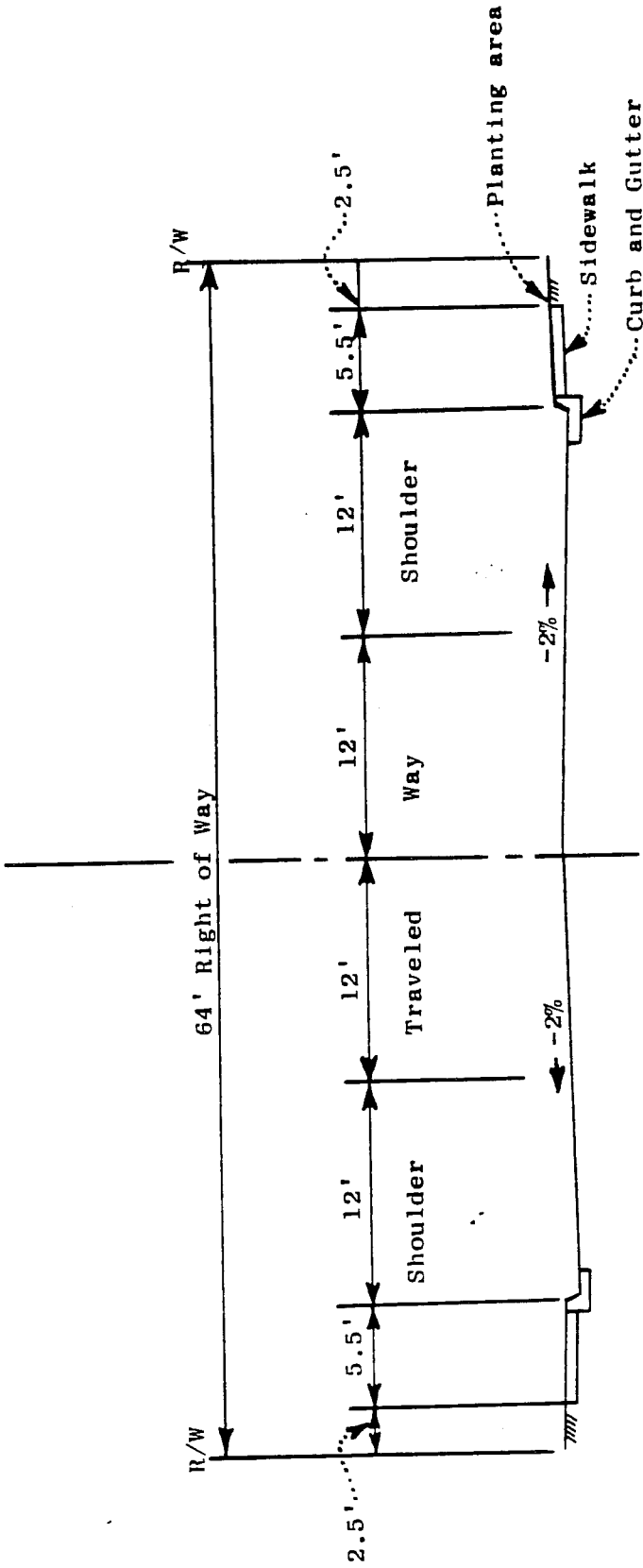
ARTERIAL ROAD
GEOMETRIC SECTION

Case A-4: As shown
Case A-4a As shown but without curb, gutter, sidewalk or median paving (8' paved shoulder)

COUNTY OF FRESNO - CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

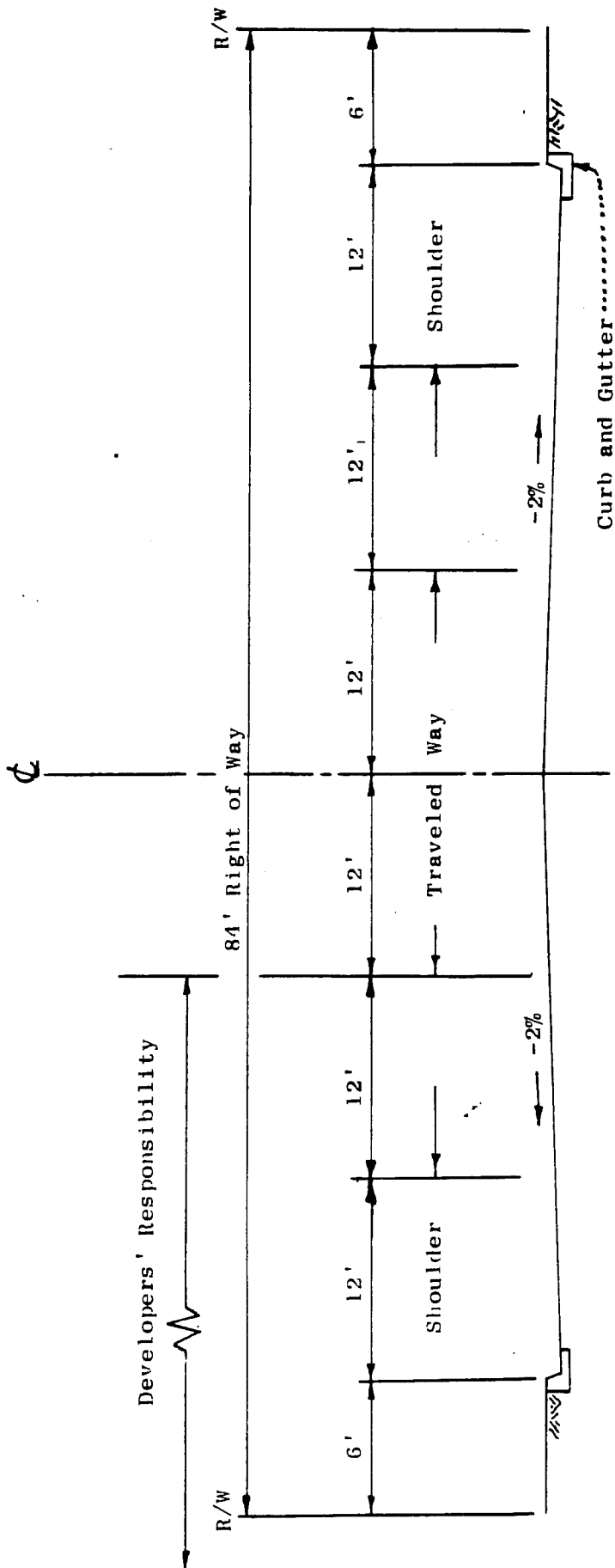
REVISED DATE

IMPROVEMENT STANDARD
A-4
Date: 10-66



LOCAL ROAD (INDUSTRIAL)
GEOMETRIC SECTION

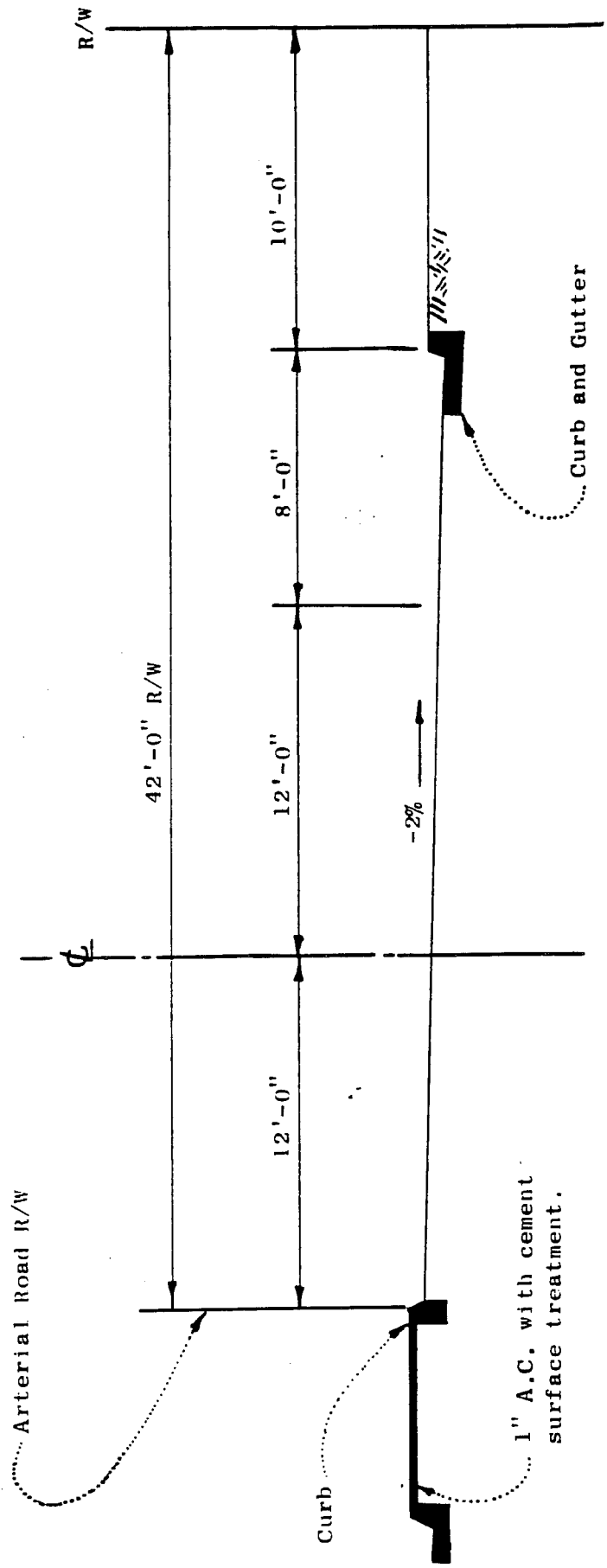
COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
REVISED	A-5
DATE	
IMPROVEMENT STANDARD	
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COLLECTOR ROAD (INDUSTRIAL)
 GEOMETRIC SECTION

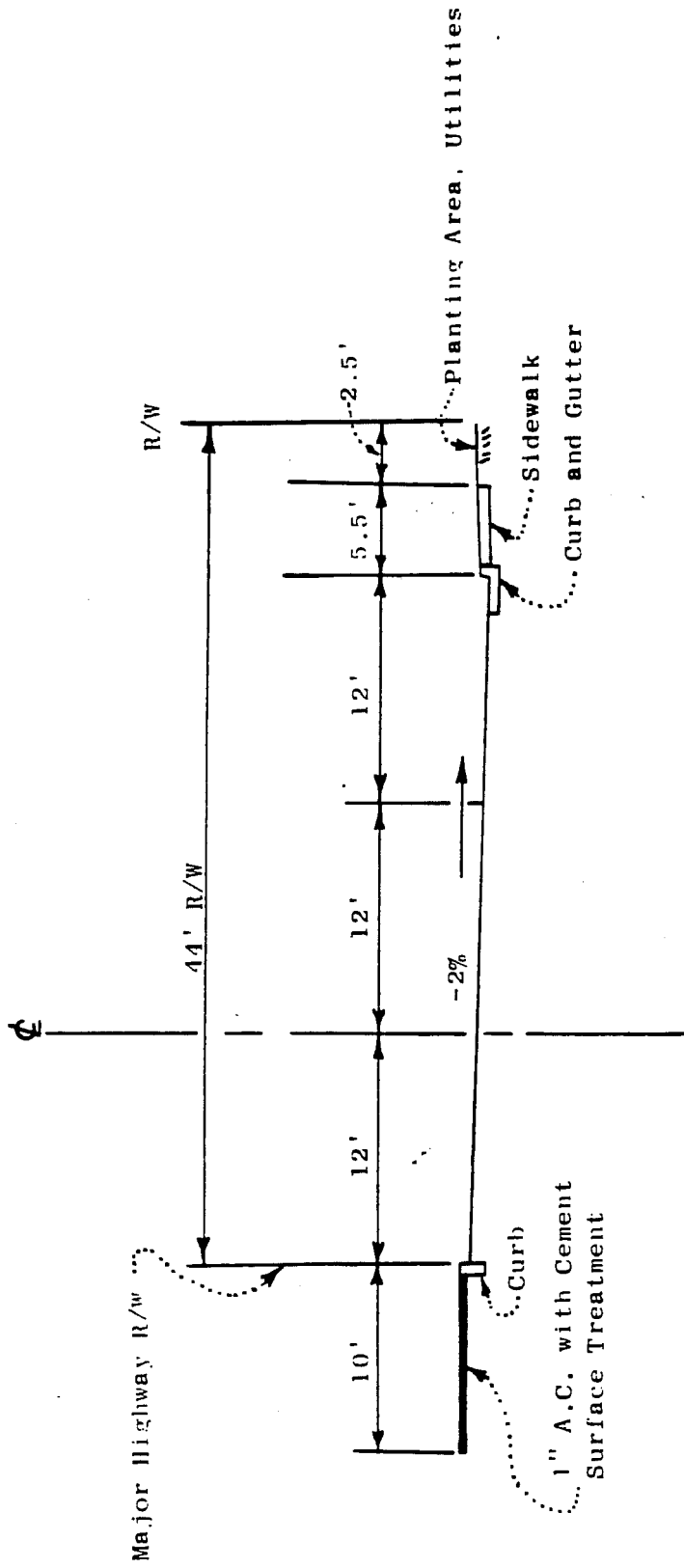
COUNTY OF FRESNO - CALIFORNIA	
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REVISED	IMPROVEMENT STANDARD
DATE	A-6

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FRONTAGE ROAD
GEOMETRIC SECTION

COUNTY OF FRESNO - CALIFORNIA	
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Date: 10-56	



FRONTAGE ROAD (INDUSTRIAL)
GEOMETRIC SECTION

COUNTY OF FRESNO - CALIFORNIA	
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A-8	

Date: 10-66

CASE A-1, A-2, A-3, A-4, A-5, A-6, A-7, A-8

- a - Asphalt Concrete Surfacing Type B.
 - b - Class 2 Aggregate Base or Equivalent.
 - c - Aggregate Subbase if required by design.
- Class and total thickness to be based on design requirements.
- d - Standard integral curb and gutter.
 - e - Sidewalks as required by zoning.

CASE A-1a, A-2a, A-3a, A-4a, A-1b, A-2b, A-1c, A-2c

- a, b, c, - Same as Case A-1
- d - 3' minimum
- e - Asphalt concrete dike:

1. Shall be used in all cuts (See note)
2. Where fill slope is steeper than 4:1

f - The outside 4' on Cases A-1a and A-2a and the outside 6' on Cases A-3a and A-4a may be considered as shoulders

g - Where cuts exceed 5' provide 5' to R/W (g=5')

h - Where cuts exceed 20' construct ditch and provide 10' to R/W (g=10')

i - Where fills exceed 20' provide 10' to R/W (h=10')

j - Backfill with same material as dike, tamp in place, and grade to drain.

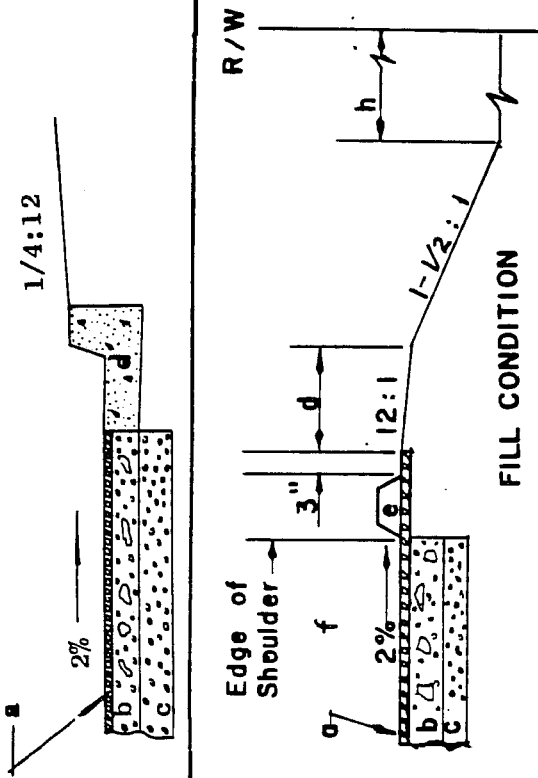
NOTE: Roadside ditch alternate. Pave when grade is steeper than 1%.

GENERAL NOTES:

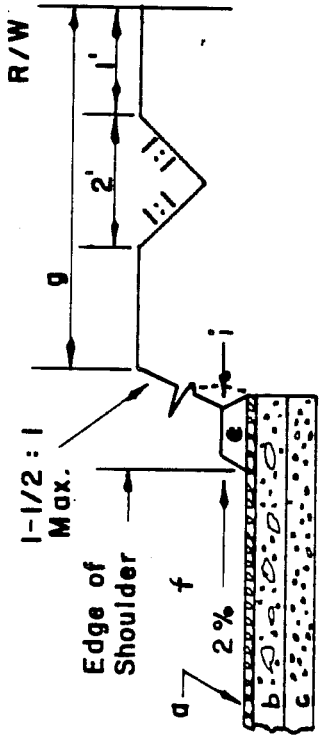
- (a) Pavement Slope Variation where necessary for drainage shall not be less than 1% nor more than 4% except at locations of superelevation.

COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
REVISED	
DATE	
IMPROVEMENT STANDARD	
A-9	

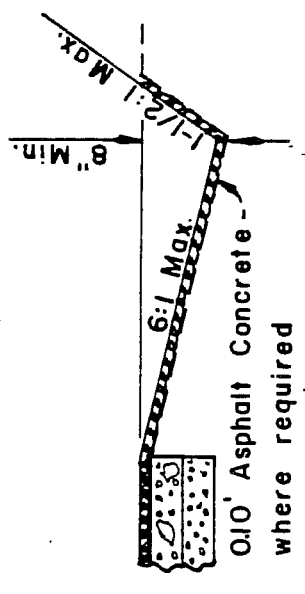
Date: 10-66



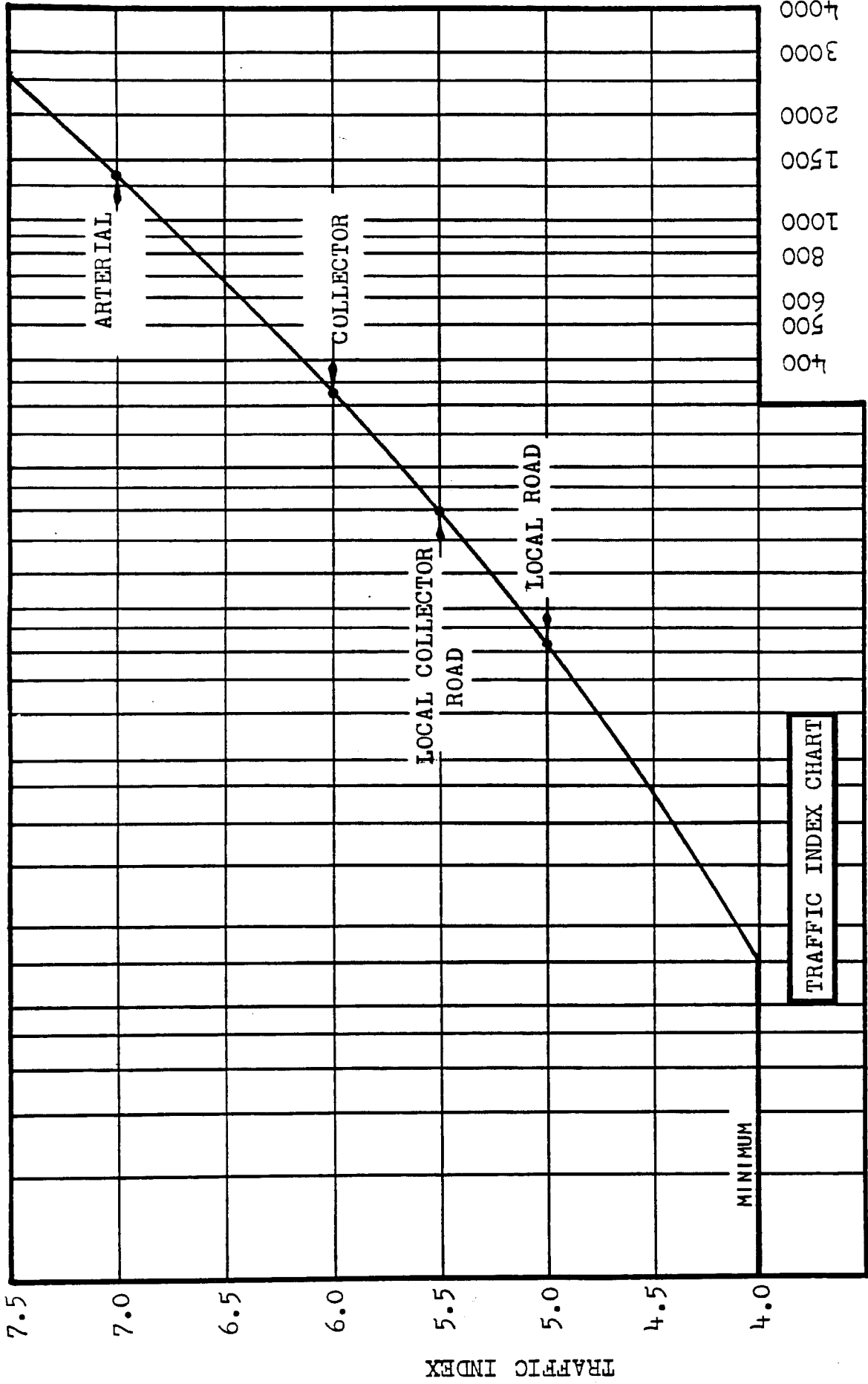
FILL CONDITION



CUT CONDITION



ROADSIDE DITCH ALTERNATE



TRAFFIC INDEX CHART

NUMBER OF RESIDENTIAL UNITS (H) SERVED

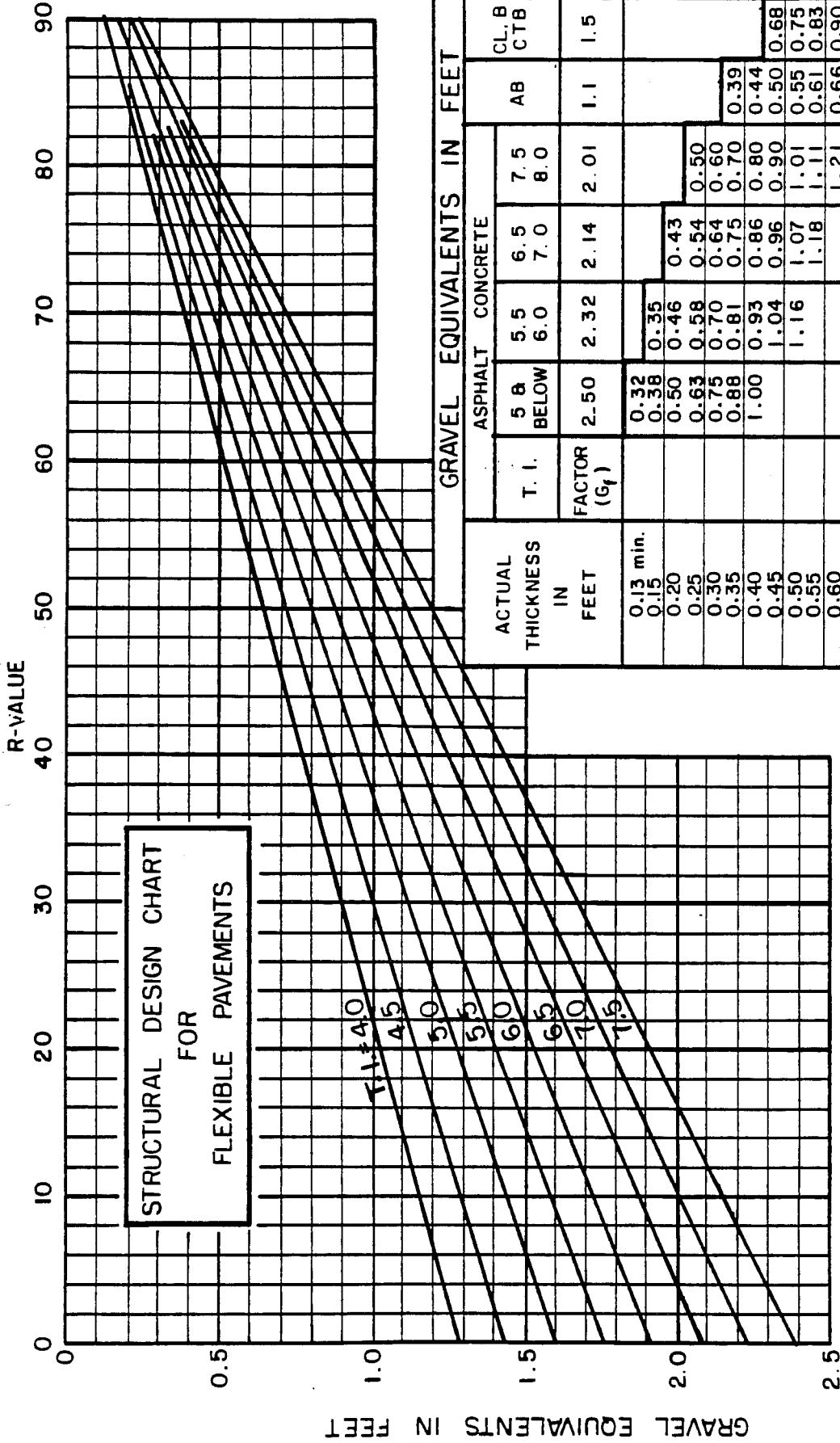
T.I. = $3.16(H)^{0.11}$: Where the number of units to be served or traffic counts can not be determined, use the Traffic Indices shown. Areas considered as shoulders may have T.I.'s equal to 0.6 of the travel lanes. 4.0 is minimum T.I. for design of travelway & shoulders.

COUNTY OF FRESNO - CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS

REVISIONS
 DATE

IMPROVEMENT STANDARD
 A-10

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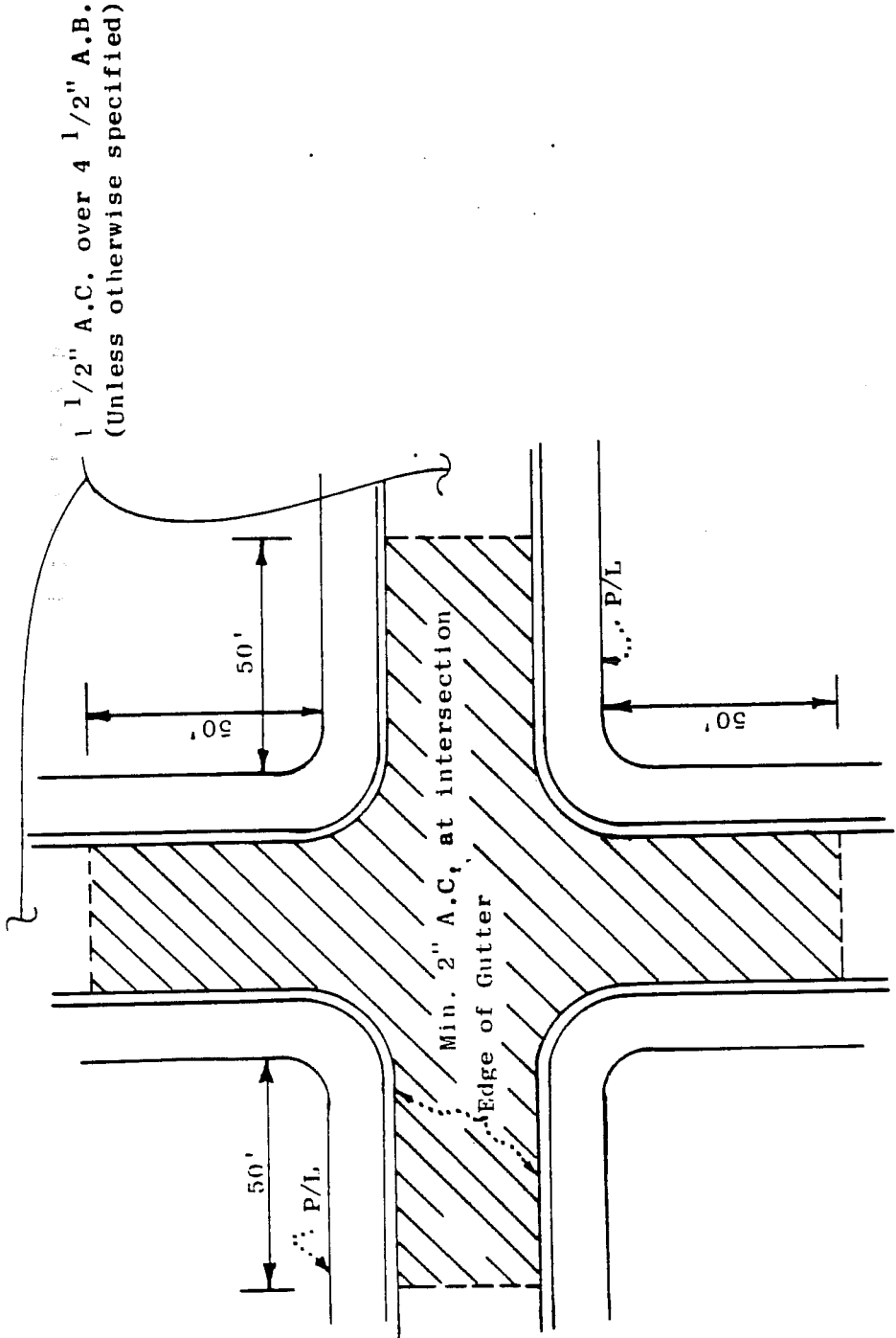


GRAVEL EQUIVALENTS IN FEET

ACTUAL THICKNESS IN FEET	T. I. FACTOR (G_f)	ASPHALT CONCRETE						AB	CL. B		CL. C		CL. D	
		5 & BELOW	5.5	6.0	6.5	7.0	7.5		CTB	CTB	BTB	LTB	CTB	CTB
0.13 min.		2.50	2.32	2.14	2.01			1.1	1.5	1.2	1.0			
0.15		0.32	0.35											
0.20		0.38	0.46	0.43										
0.25		0.50	0.58	0.54	0.50									
0.30		0.63	0.70	0.64	0.60									
0.35		0.75	0.81	0.75	0.70			0.39				0.42	0.35	
0.40		0.88	0.93	0.86	0.80			0.44				0.48	0.40	
0.45		1.00	1.04	0.96	0.90			0.50	0.68	0.54	0.45	0.50	0.45	
0.50			1.16	1.07	1.01			0.55	0.75	0.60	0.50	0.60	0.55	
0.55				1.18	1.11			0.61	0.83	0.66	0.55	0.72	0.60	
0.60					1.21			0.66	0.90	0.72	0.60	0.78	0.65	
0.65					1.31			0.77	0.98	0.78	0.65	0.84	0.70	
0.70								0.83	1.05	0.84	0.70	0.84	0.70	
0.75								0.88	1.13	0.90	0.75	0.84	0.75	
0.80								0.88	1.20	0.96	0.80	0.84	0.80	

GENERAL NOTES:

- (a) All pavements shall be designed according to Test Method No. Calif. 301-G and Part VII, Planning Manual of Instructions, State of California with the exception that T.I.s will be determined from Standard A-10 where applicable.
- (b) Solid line indicates minimum thickness allowed.



4 1/2" A.B. over 4 1/2" A.B.
(Unless otherwise specified)

INTERSECTION PAVEMENT DETAIL

Scale: 1" = 40'

NOTE: Applicable with A-1, A-2, A-5, and A-7 Standards.

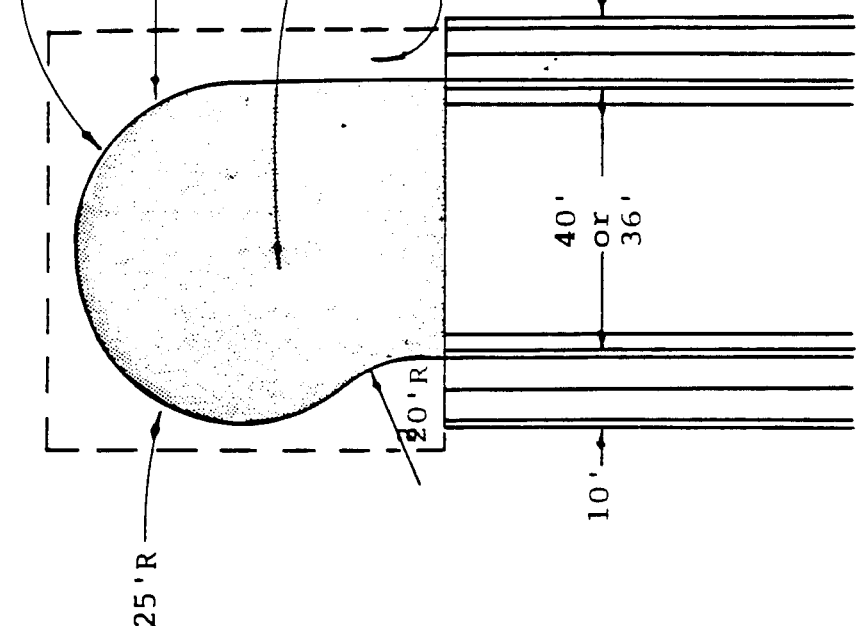
COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
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DATE	
A-12	
Date: 10-66	

Install 6" AC dike when Necessary for drainage control

70' radius on Industrial road

2" asphalt concrete over Class "A" subgrade

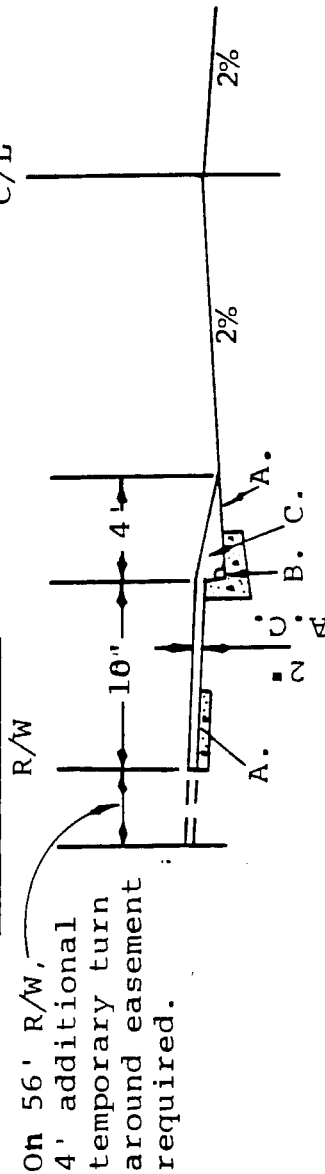
Easement area adequate in size to contain all cut and fill



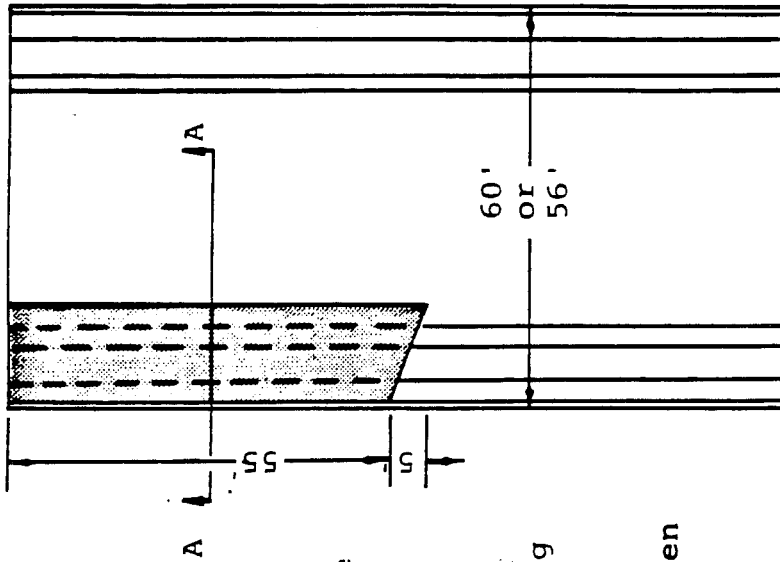
NOTES

- A. Place heavy duty roofing paper to protect all permanent surfaces.
- B. Install 3" iron pipe when necessary for drainage control.
- C. Fill with asphalt concrete.

TEMPORARY TURNAROUND OFF DEVELOPMENT



On 56' R/W, 4' additional temporary turn around easement required.



TEMPORARY TURNAROUND WITHIN DEVELOPMENT

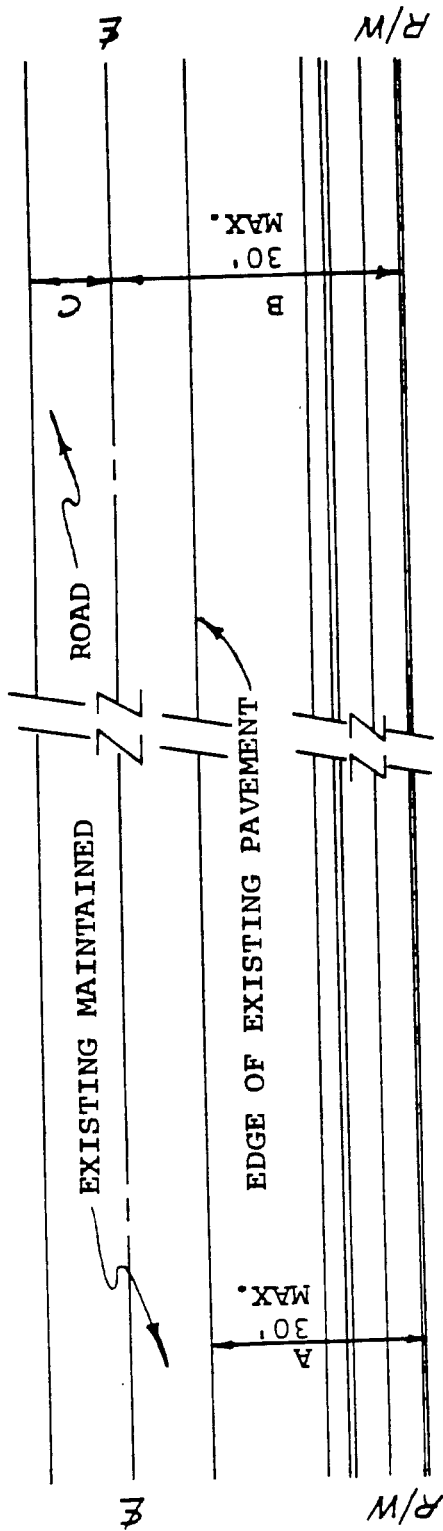
COUNTY OF FRESNO - CALIFORNIA
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A-13

Date: 10-66

SECTION A-A



CASE I

When the existing grade is within 0.2 foot of the design grade and the road is structurally adequate the developer shall install all improvements for the width A.

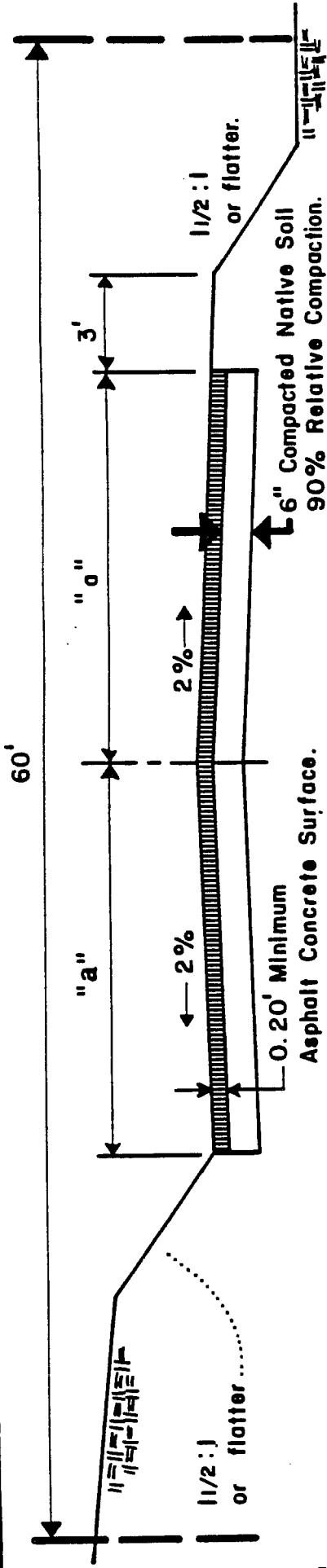
CASE II

When the existing grade is more than 0.2 foot above or below the design grade or the road is structurally inadequate the developer shall install all improvements for the width B plus C.

The County shall pay for the base and surfacing for width C.

IMPROVEMENTS REQUIRED ON EXISTING COUNTY MAINTAINED ROADS

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- a = 9' Ultimate lots to be served, less than 11.
- a = 10' Ultimate lots to be served, 11 to 60.
- a = 12' Ultimate lots to be served, 60 or more.

Structural section shall be determined from the A-10 and A-11 Improvement Standards. When aggregate base is determined necessary it may be Class 3 meeting the requirements indicated on Improvement Standard A-15-A. From the total Gravel Equivalent structural section determined above the Gravel Equivalent of 0.13' for asphalt concrete may be deducted for the required structural section. This structural section shall be not less than that shown on the above drawing. The 0.13' asphalt concrete pavement will be added as a second stage of construction in the future by the maintaining agency when traffic and road conditions warrant.

Alternate engineered design and material specifications may be approved by the Director of Public Works & Development Services.

The County will review the plans for private roads built to this standard and will inspect their construction.

Materials Specifications (See A-15-A).

Private roads shall meet all of the County of Fresno improvement standards except as modified by this A-15 Standard.

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PRIVATE ROAD

Class 3 Aggregate Base

<u>Test</u>	<u>Requirements</u>	<u>Test Method</u>
Resistance (R-Value)	70 Min.	No. Calif. 301
Sand Equivalent Grading	20 Min.	No. Calif. 217 No. Calif. 202

<u>Sieve Sizes</u>	<u>Percent Passing</u>
3/4"	100
No. 4	50-100
No. 200	5-15

Gravel Equivalent Factor - 1.0

Road Mixed Asphalt Surfacing

<u>Test</u>	<u>Requirements</u>	<u>Test Method</u>
Stabilometer Value	25 Min.	No. Calif. 304
Moisture Vapor Susceptibility CKE	20 Min.	No. Calif. 307 No. Calif. 303
Aggregate	- Same requirement as for Class 3 Aggregate Base	

Liquid Asphalt Grade - SC-800 or as specified by the Director.
Gravel Equivalent Factor RMAAS - 1.2

Plant Mixed Asphalt Surfacing

Aggregate Grading Requirements
1/2" Maximum Medium

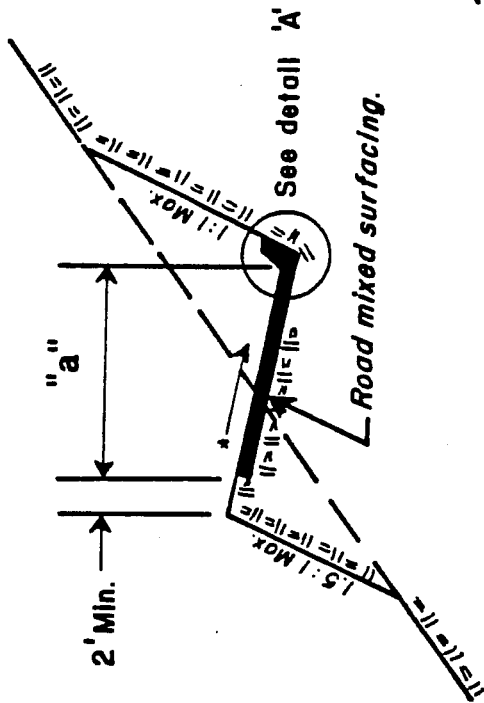
<u>Sieve Sizes</u>	<u>Percent Passing</u>
3/4"	100
1/2"	89-100
3/8"	75-100
No. 4	51-74
No. 8	35-57
No. 30	14-35
No. 200	0-11

<u>Test</u>	<u>Requirements</u>	<u>Test Method</u>
Moisture Vapor Susceptibility	25 Min.	No. Calif. 307
Stabilometer Value	30 Min.	No. Calif. 304

Gravel Equivalent Factor - See Improvement Standards A-10 and A-11.

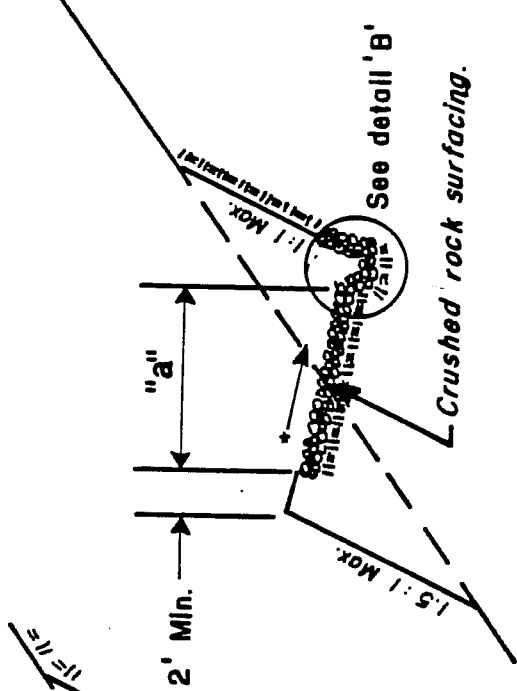
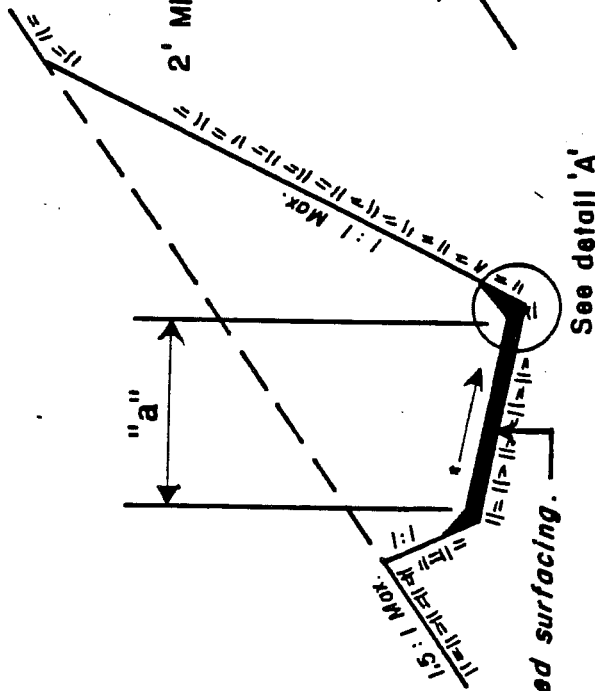
Asphalt binder to be mixed with aggregate shall be liquid asphalt Grade SC-800.

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* Tilt roadway toward uphill side at 4%.

Road mixed surfacing.

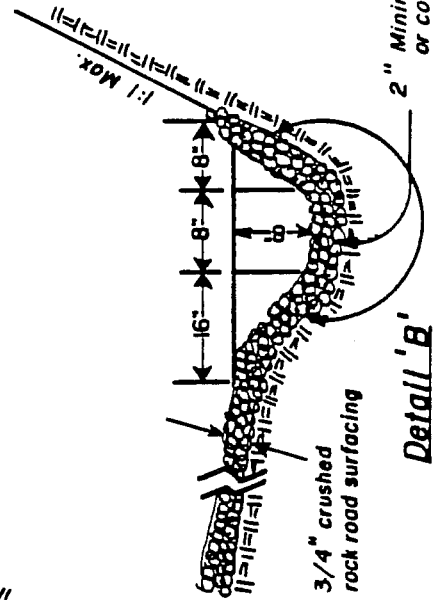
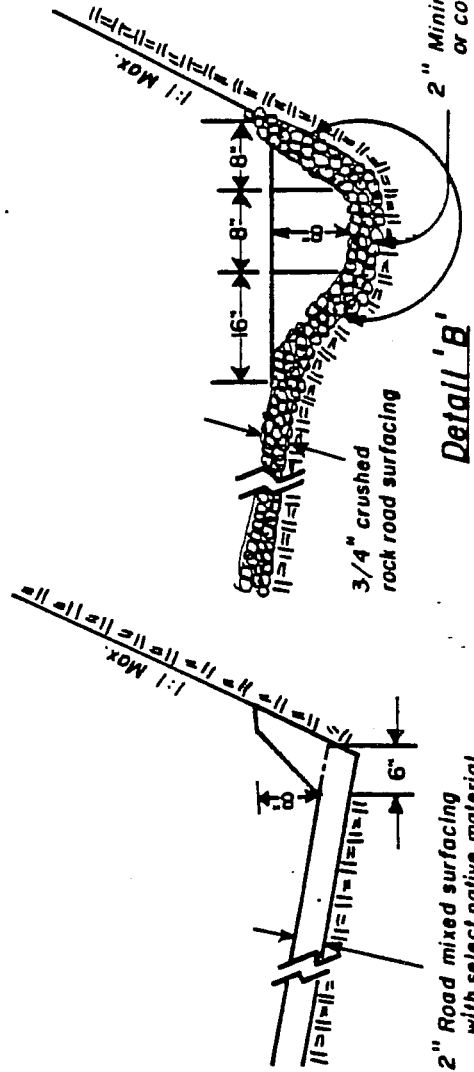


10% OR STEEPER GRADES

- a = 18' Ultimate lots to be served, less than 11.
- a = 20' Ultimate lots to be served, 11 to 60.
- a = 24' Ultimate lots to be served, 60 or more.

GRADES BETWEEN 7 & 10 %

1. Bituminous binder to be mixed with select native material shall be liquid asphalt of grades SC - 800.
2. The road mixed material produced shall contain approximately 7% by weight of liquid asphalt.
3. The liquid asphalt and native material shall be thoroughly mixed to produce a uniform mixture.
4. The mixed material shall be spread on the roadbed to a uniform thickness and compacted. The compacted thickness shall be not less than 2 inches.



Detail 'A'

Traversable Access Easement Road

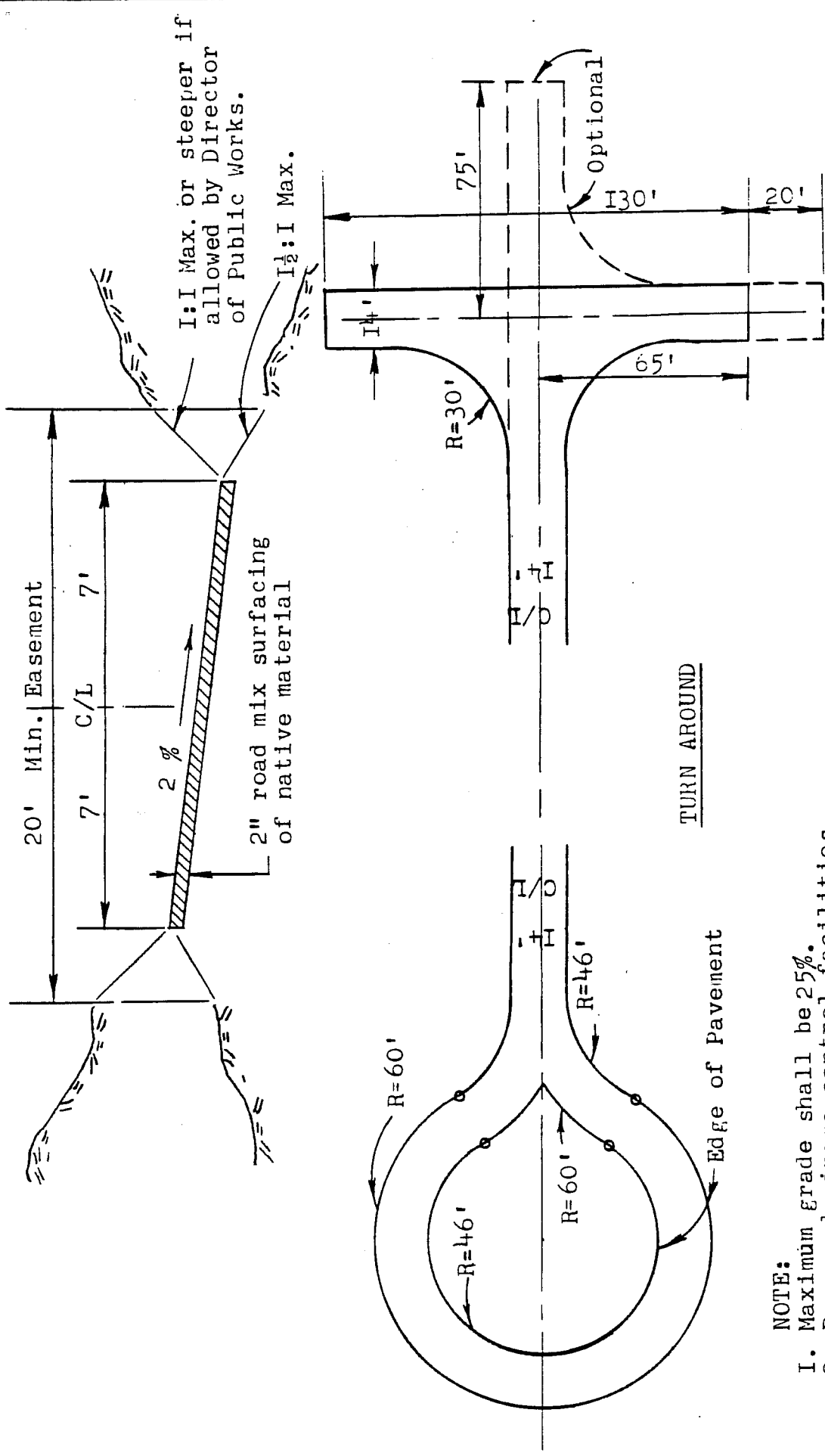
COUNTY OF FRESNO - CALIFORNIA
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DATE

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A-15-B

Date: 1-89



NOTE:

1. Maximum grade shall be 25%.
2. Proper drainage control facilities shall be installed.
3. Horizontal and vertical alignment shall meet the criteria for a design speed of 15 MPH.
4. At all entrance to fire roads, signs shall be installed stating "Emergency Use Only".

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A-16	
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FIRE ROAD

GRAVEL SURFACING REQUIREMENTS

Gravel surfacing shall meet the following requirements.

<u>Sieve Sizes</u>	<u>Percent Passing</u>
2"	100
1-1/2"	90-100
3/4"	25-50
No. 4	0-5

As an alternative decomposed granite may be substituted for gravel meeting the following definitions and requirements.

<u>Definition</u>	<u>Sizes</u>	<u>Percent Passing</u>
Silt & Sand	No. 4	100
	No. 200	70-50
	5 4	20-0
Silty Sand	No. 4	100
	No. 200	50-30
	5 4	20-0
Sandy Silt	No. 4	100
	No. 200	90-50
	5 4	20-0

Gravel and decomposed granite shall have a minimum Sand Equivalent value of 20 determined in accordance with California Test 217.

CRUSHED ROCK SURFACING REQUIREMENTS

Crushed rock surfacing shall be 3/4 inches meeting the following requirements.

Percentage of crushed aggregate shall be not less than 90 percent in accordance with California Test 205.

The combined aggregate shall conform to the following sieve analysis.

<u>Sieve Sizes</u>	<u>Percent Passing</u>
3/4"	10-25
No. 4	25-50
No. 8	0-15

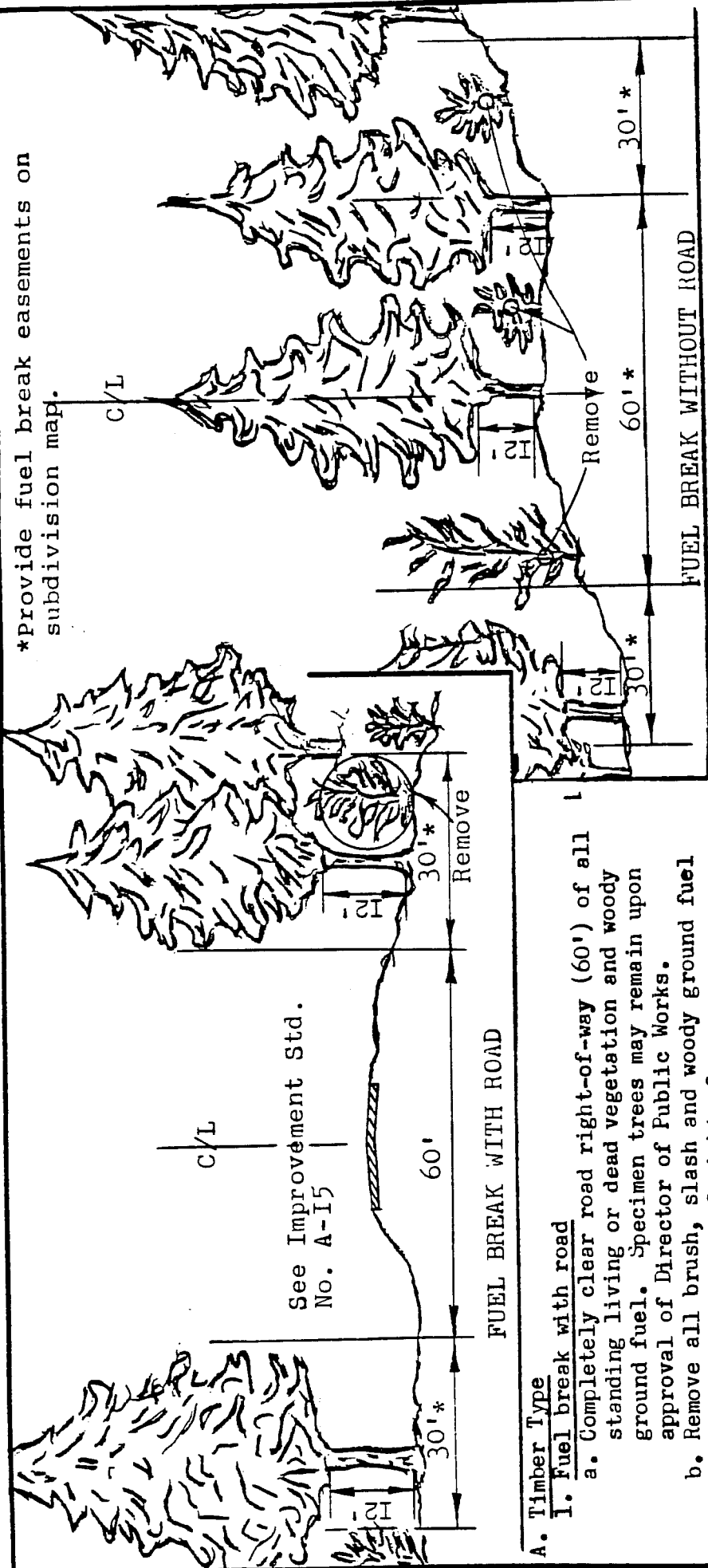
The Sand Equivalent value shall be a minimum of 22 in accordance with California Test 217.

35' PRIVATE
LOCAL RESIDENTIAL STREET

SPECIFICATIONS

1. No on-street parking allowed.
2. No sidewalks required for up to 40 dwelling units served. Sidewalk on one side for 41-150 dwelling units served. Sidewalks on both sides for 150+ dwelling units served.
3. If sidewalk installed, planting and utility easement to be 10 feet behind walk.
4. Where sidewalks are installed, a 2.5-foot pedestrian easement is required in addition to an easement to accommodate sidewalk at the driveway approaches (see detail standard).
5. Subject to monolithic sidewalk and driveway approach detail (A-19).
6. No direct frontage or driveway access from individual units. Private driveway access only to common parking areas with undesignated stalls.
7. Internal solid waste pickup only (no on-street collection).
8. F.I.D. facilities shall be located in a separate easement out of the street area.
9. Additional FMFCD facilities may be required to accommodate narrowed street.
10. Subject to pipeline installation requirements formula (A-21).
11. Conditional use permit required.

*Provide fuel break easements on subdivision map.



A. Timber Type

1. Fuel break with road

- a. Completely clear road right-of-way (60') of all standing living or dead vegetation and woody ground fuel. Specimen trees may remain upon approval of Director of Public Works.
- b. Remove all brush, slash and woody ground fuel 30' on each side of right-of-way.
- c. Fall and remove all standing dead trees (snags) 30' on each side of the right-of-way.
- d. Prune living and dead limbs from live standing coniferous trees within the fuel break to a height of 12' or one-half their height, whichever is the least.
- e. Cut and remove all standing live trees under 10' in height within the fuel break.
- f. Pine needles, grass, forbs, squaw carpet or bear clover need not be cleared from the fuel break.

2. Perimeter fuel break without road included -

Treatment standards for full 120' of width will be the same as "b" through "f" above.

B. Brush Type or Brush, Grass and Hardwood Tree Mixture Type

1. Fuel break with road
 - a. Completely remove all brush from 60' road right-of-way Plus 30' on each side.
 - b. Remove defective or dead oak trees.
 - c. Remove thickets of oak trees where trees are under 6" in diameter.

FUEL BREAK WITHOUT ROAD

d. Chemicals may be used for clearing in steep areas.

2. Perimeter fuel break without road - Treatment standards same as above for full 120'

C. Grass Type

Develop a fireline 10' wide cleared to mineral soil within a 30' easement. Streets or green open space such as parks, golf courses, meadows and similar type uses may meet this requirement. Chemicals may be used for clearing in steep areas.

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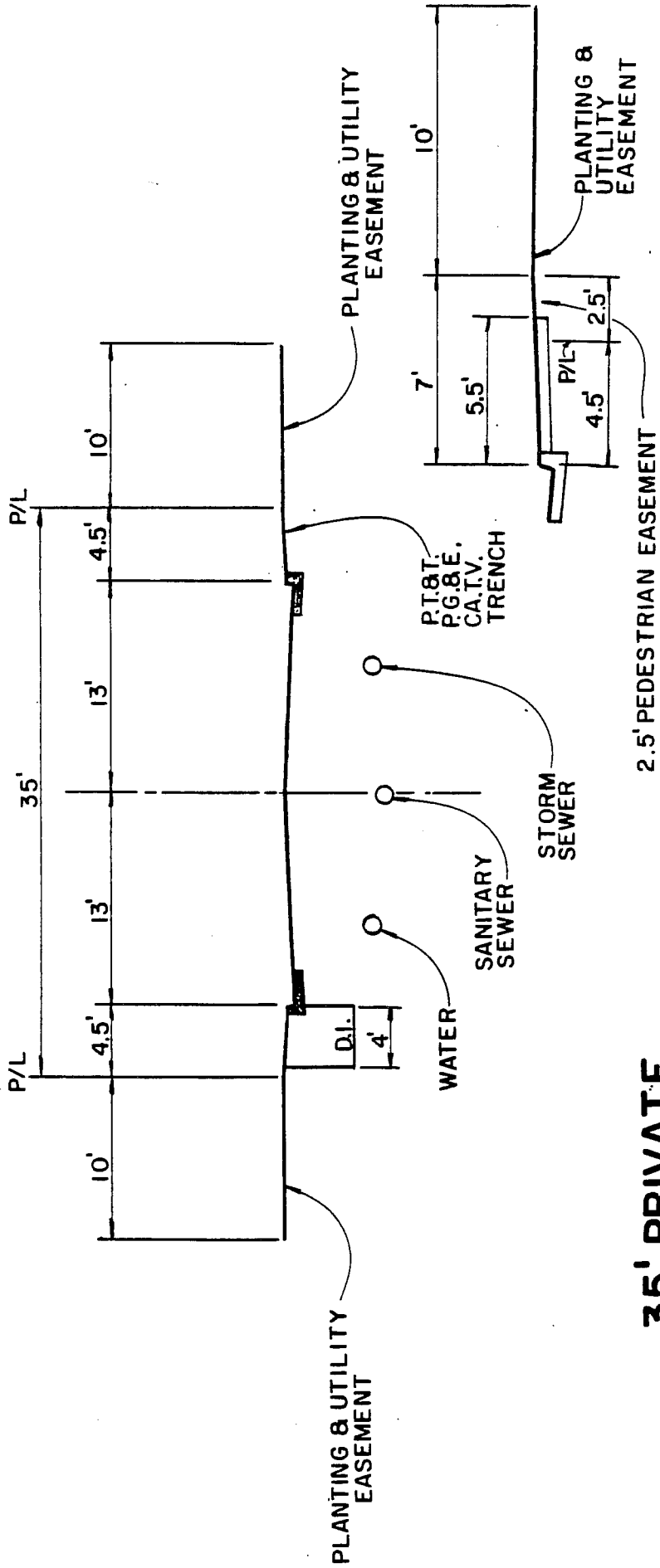
IMPROVEMENT STANDARD

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30' PRIVATE
LOCAL RESIDENTIAL STREET

SPECIFICATIONS

1. No sidewalk allowed.
2. No curbs; gutter only.
3. No on-street parking allowed.
4. 24-foot driveway approach width maximum.
5. Use on dead-end street only. Cul-de-sac not needed. (Solid waste pickup only at nearest cross street).
6. Serve 6 housing units maximum (6 units include the two corner lots).
7. Subject to pipeline installation requirements formula except for sewer line placement (A-21).
8. Conditional use permit required.



35' PRIVATE LOCAL RESIDENTIAL STREET GEOMETRIC SECTION

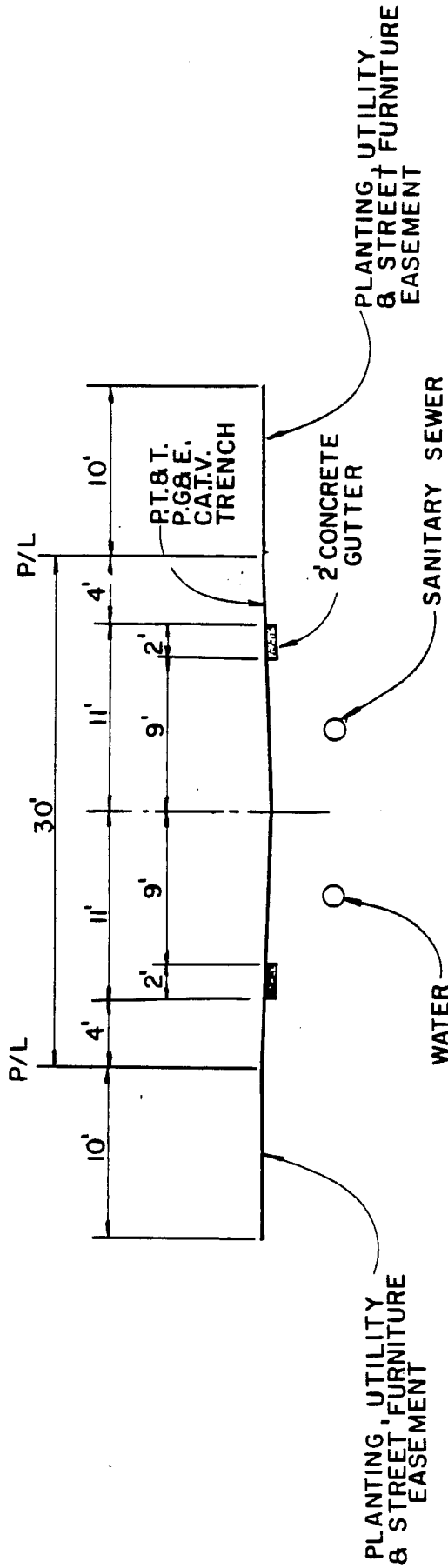
SIDEWALK DETAIL

COUNTY OF FRESNO --- CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

REVISED
DATE

IMPROVEMENT STANDARD
A-18

DATE: 10-83



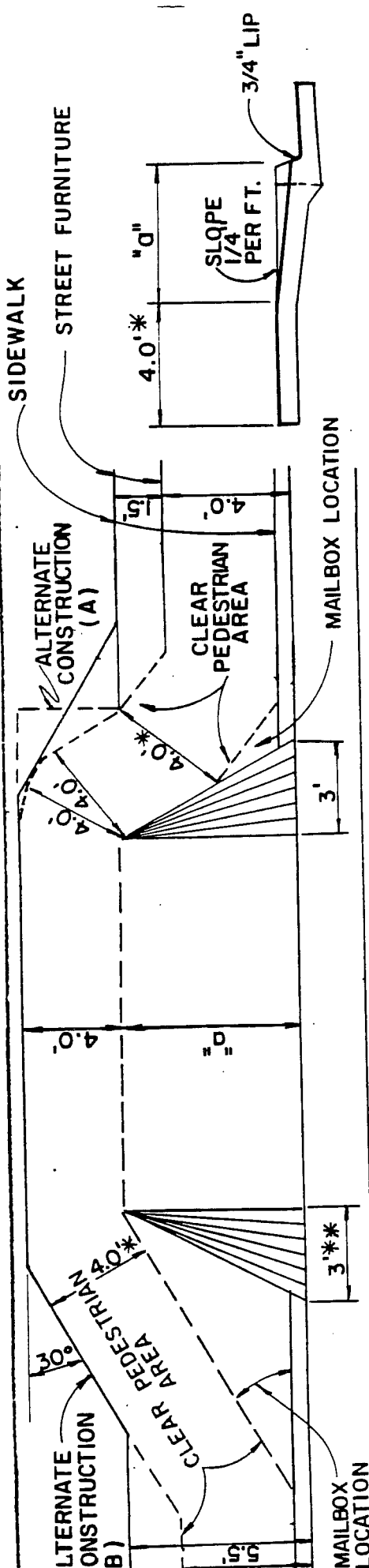
**30' PRIVATE
LOCAL RESIDENTIAL STREET
GEOMETRIC SECTION**

COUNTY OF FRESNO --- CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

REVISED
DATE

IMPROVEMENT STANDARD
A-18
CASE A-18a

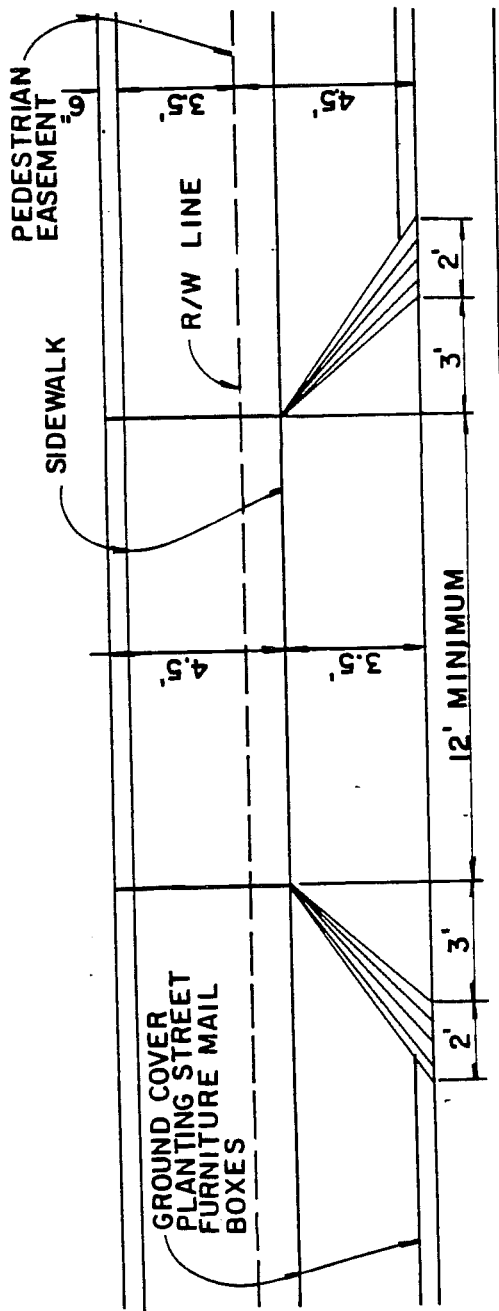
DATE: 10-83



* * COMMERCIAL FLARE (5') ON SIDE OF STREET WITH NO ON STREET PARKING

* 4.0' MINIMUM DISTANCE FOR HANDICAP REQUIREMENTS. CROSS SLOPE NOT TO EXCEED 2%. SIDEWALK CAN BE CONSTRUCTED IN ACCORDANCE WITH ALTERNATES (A) OR (B) OR AS PROVIDED BY THE COUNTY

MONOLITHIC SIDEWALK



"d" = 4.75' MULTIFAMILY WITH UP TO 10 PARKING SPACES

"d" = 5.75' FOR MULTIFAMILY WITH MORE THAN 10 PARKING SPACES

"d" = 3.75' FOR 1 OR 2 DWELLING UNITS.

40' RIGHT OF WAY
SIDE WITH PARKING PROHIBITION

COUNTY OF FRESNO — CALIFORNIA
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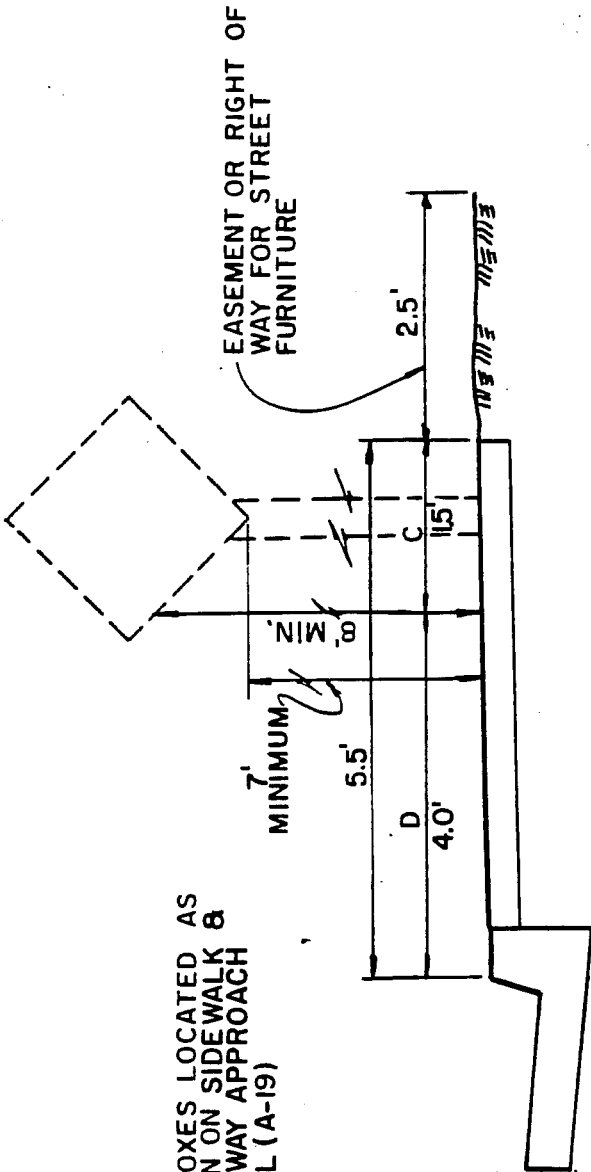
IMPROVEMENT STANDARD
A-19

**SIDEWALK & DRIVEWAY APPROACH DETAIL
LOCAL RESIDENTIAL STREETS**

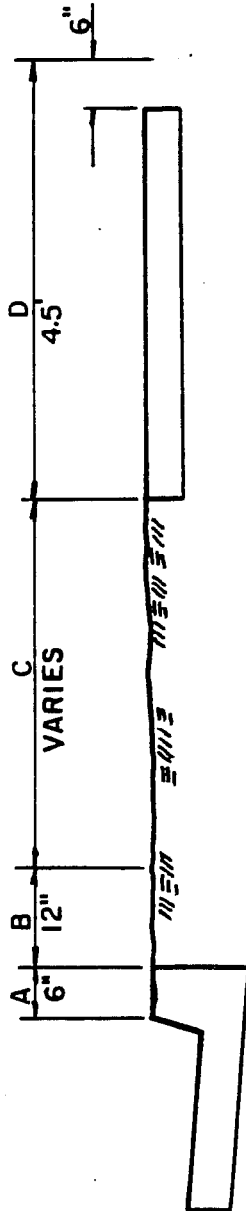
(A-2E, A-1E, A-1B)

DATE: 10-83

MAILBOXES LOCATED AS SHOWN ON SIDEWALK & DRIVEWAY APPROACH DETAIL (A-19)



MONOLITHIC SIDEWALK



SEPARATED SIDEWALK

- A - NO STREET FURNITURE
- B - NO STREET FURNITURE ALLOWED EXCEPT MAILBOXES WHEN REQUIRED BY U.S. POST OFFICE
- C - STREET FURNITURE TO BE LOCATED IN THIS AREA (MAILBOXES ALLOWED IN THIS AREA ON SEPARATED SIDEWALK)
- D - CLEAR PEDESTRIAN AREA. NO STREET FURNITURE CAN ENCROACH UNLESS VERTICAL CLEARANCE EXCEEDS 8' ABOVE SIDEWALK

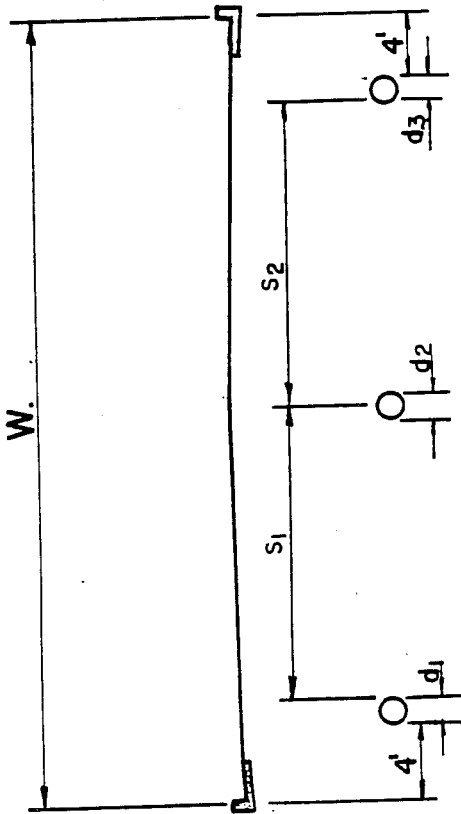
COUNTY OF FRESNO — CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

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STREET FURNITURE LOCATION DIAGRAM

IMPROVEMENT STANDARD
A - 20

THE MINIMUM ALLOWABLE CURB TO CURB WIDTH MUST BE CALCULATED USING THE FORMULA BELOW. TO DETERMINE THE REQUIRED STANDARD STREET WIDTH CALCULATE IN THE FORMULA AND ROUND UP TO THE NEAREST WIDTH SHOWN ON THE ARRAY OF LOCAL RESIDENTIAL STREET SECTIONS.



1. SEWER TO BE WITHIN 2' OF CENTER OF WIDTH(W)
2. WATER AND SEWER TO BE SEPARATED BY MINIMUM 10' CLEAR HORIZONTAL DISTANCE
3. MINIMUM "S" IS 2' OR AS APPROVED BY THE DIRECTOR OF PUBLIC WORKS.
4. IF THE DEPTH TO FLOWLINE OF A PIPE EXCEEDS 5', THE MINIMUM "S" OF 2' TO ADJACENT PIPES WILL INCREASE BY 6" FOR EACH 1' OF DEPTH GREATER THAN 5'.
5. IF THE ELEVATION OF THE TOP OF A WATER OR SEWER LINE IS WITHIN 6" IN ELEVATION OF THE TOP OF ANOTHER PIPE, (NOT WATER OR SEWER) THE SEPARATION ("S") SHALL BE AT LEAST 5'.

IN CURVILINEAR STREETS, ALL FACILITIES, EXCEPT WATER, MAY CROSS SEWER PROVIDED VERTICAL SEPARATION OF 3' IS MAINTAINED. ALSO, DEVIATION FROM ABOVE AS APPROVED BY THE DIRECTOR OF PUBLIC WORKS IS ALLOWABLE.

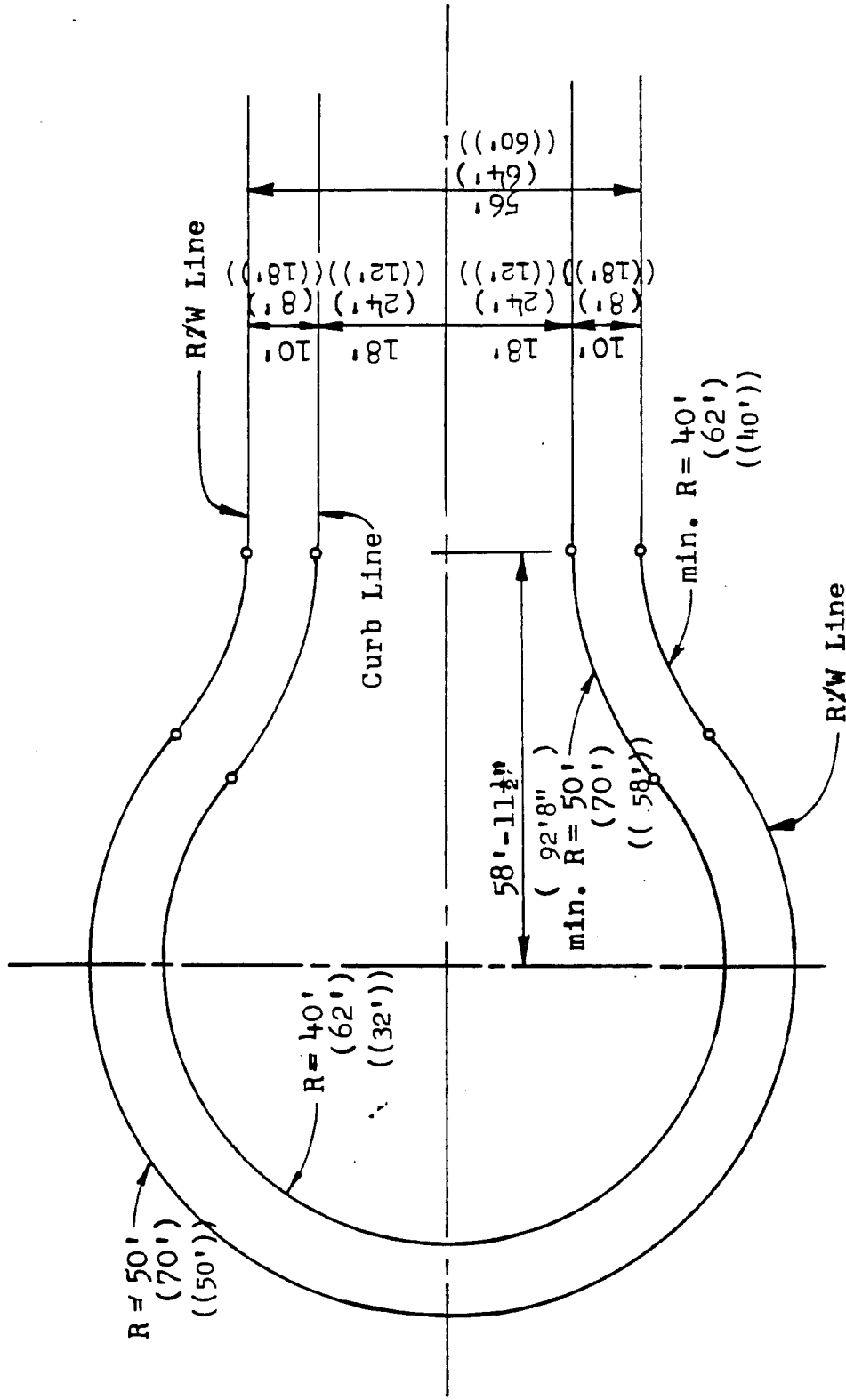
$$W \geq (8) + (S_1 + S_2 + \dots + S_n) + (d_1 + d_2 + \dots + d_n) + (2)(L) \quad (IN FEET) \quad 6.$$

d_n = O.D. OF PROPOSED PIPE
 S_n = CLEAR HORIZONTAL DISTANCE BETWEEN PROPOSED PIPES
 L = NUMBER OF PIPES EXCEEDING 10" NOMINAL I.D.

COUNTY OF FRESNO --- CALIFORNIA	
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DATE	

PIPELINE INSTALLATION FORMULA

NOTE: () indicates dimensions for Industrial Roads
 (()) indicates dimensions for Rural Residential Roads



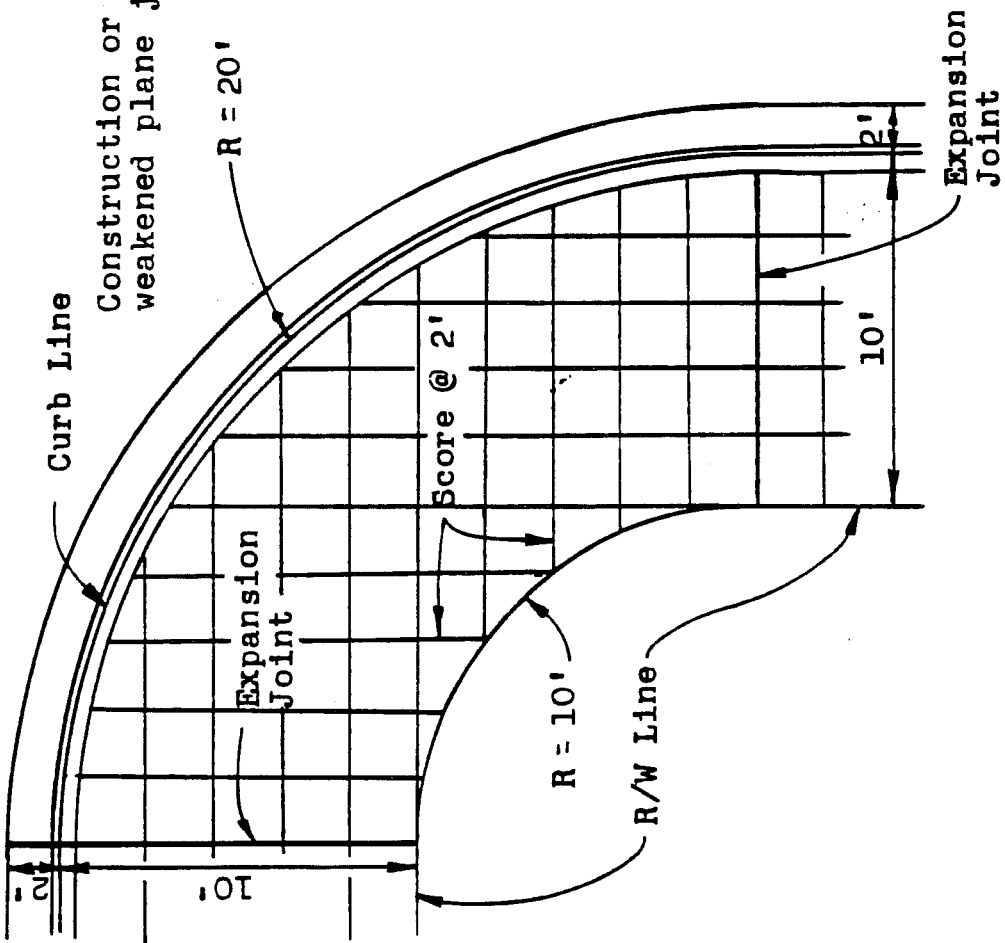
CUL - DE - SAG TURN-AROUND

COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
REVISED	B-2
DATE	
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((Proposed September 13, 1977))	

IMPROVEMENT STANDARD

B-2

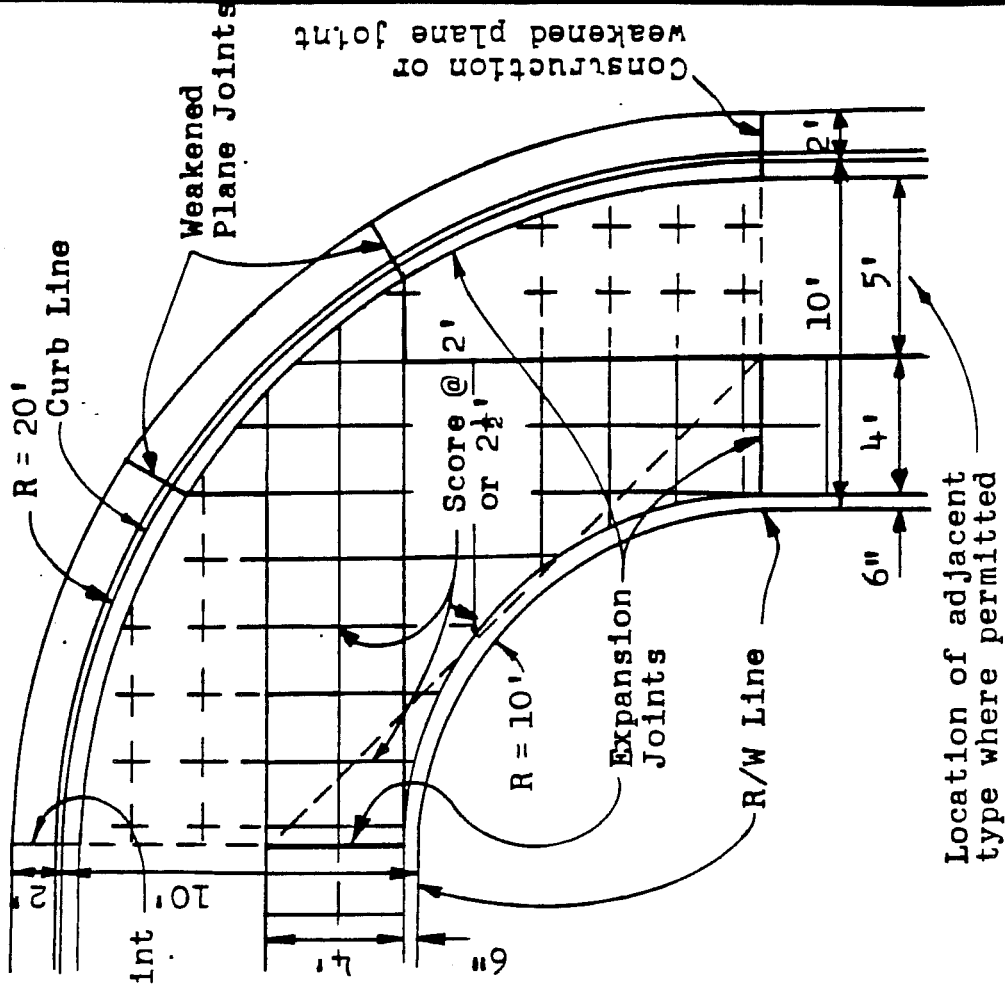
Date: 10-66
 ((Proposed September 13, 1977))



COMMERCIAL

NOTE:
 For construction joint detail
 see Standard C-2.

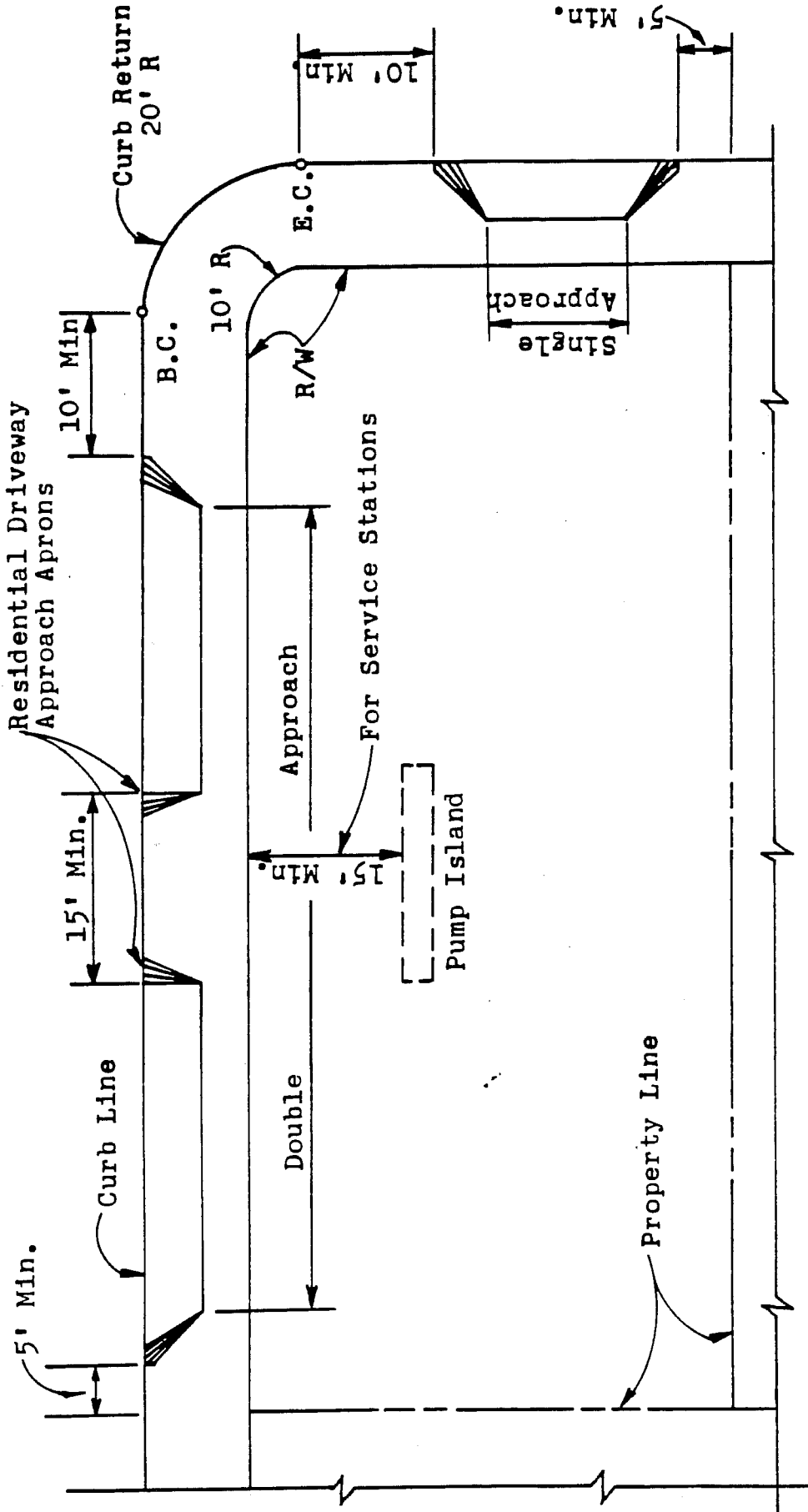
CURB RETURNS



RESIDENTIAL

COUNTY OF FRESNO-CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
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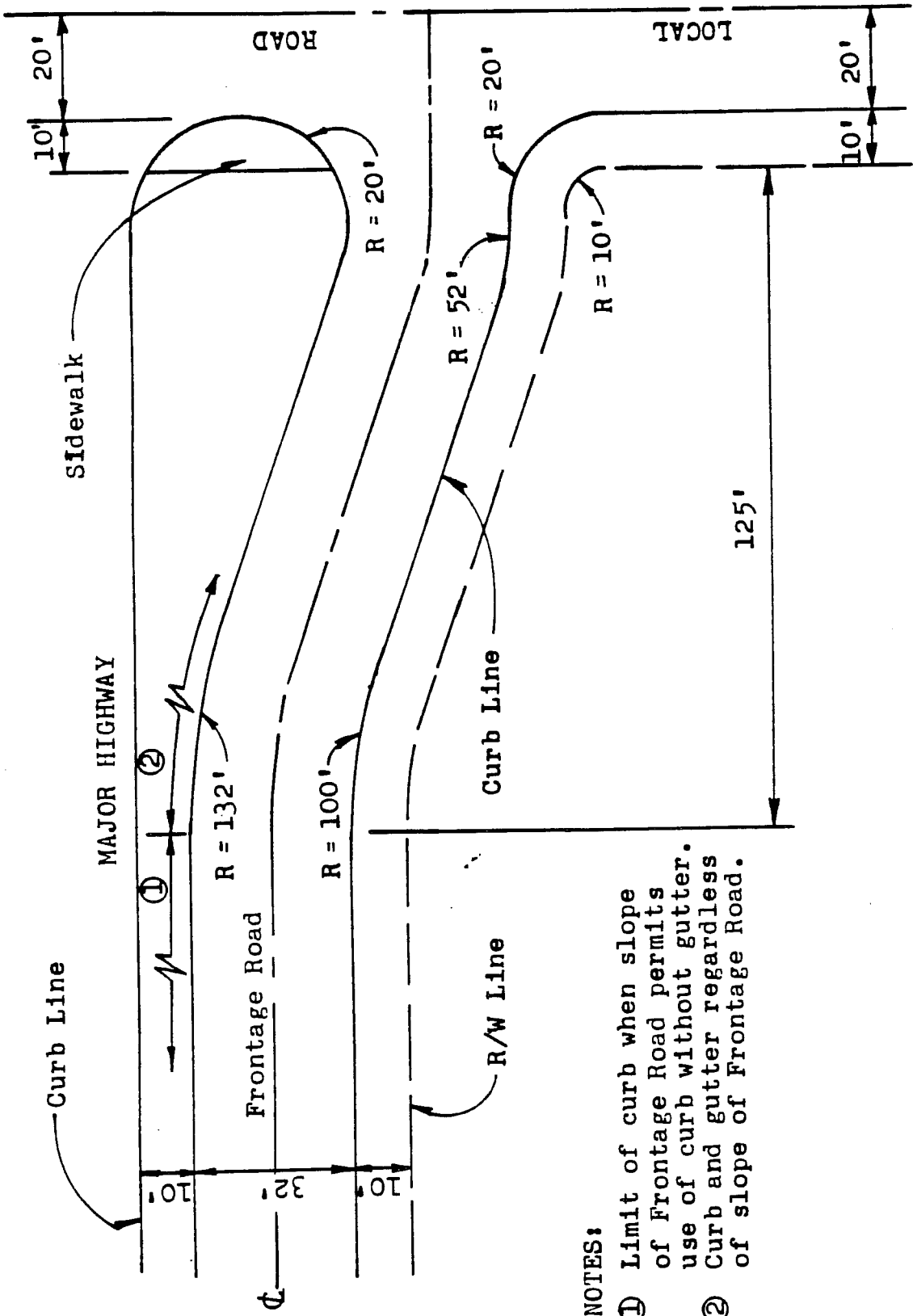
Location of adjacent
 type where permitted



Notes:
 Not more than 60% of frontage to be in driveway opening, measured at Property Line.
 For Commercial Driveway Approach Detail, see Improvement Standard D-3.
 For Residential Driveway Approach Detail, see Improvement Standard D-2 and D-2A.
 For Curb Return Details, see Improvement Standard B-1.

COMMERCIAL DRIVEWAY APPROACH

COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
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Date: 10-66	



NOTES:

- ① Limit of curb when slope of Frontage Road permits use of curb without gutter.
- ② Curb and gutter regardless of slope of Frontage Road.

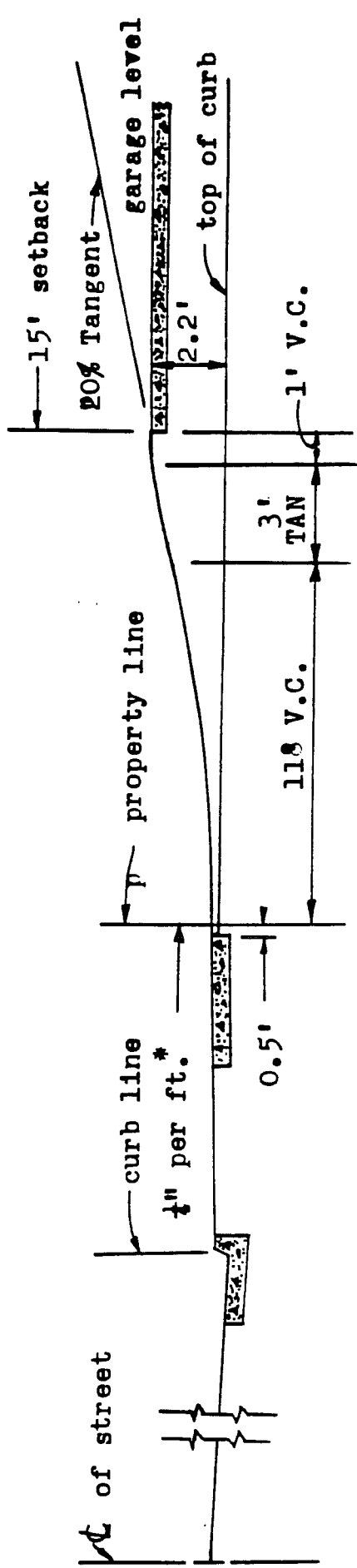
FRONTAGE ROAD ACCESS
BULB CONNECTION LAYOUT

COUNTY OF FRESNO - CALIFORNIA
DEPARTMENT OF PUBLIC WORKS

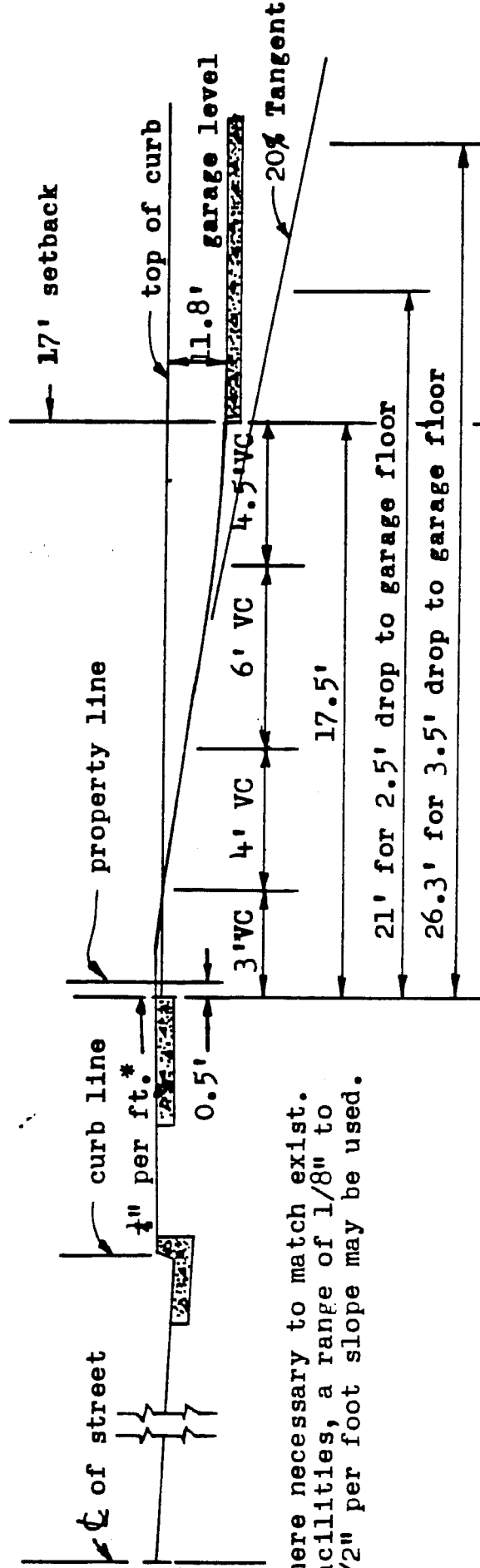
REVISED	DATE

IMPROVEMENT STANDARD
B-4

Date: 10-66



ELEVATED GARAGE DRIVEWAY



0 + 00

0 + 17.5

DEPRESSED GARAGE DRIVEWAY

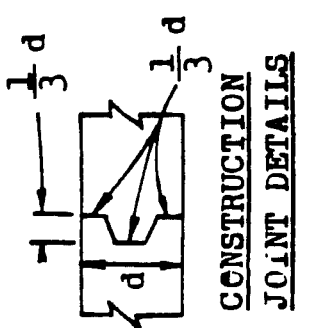
*Where necessary to match exist. facilities, a range of 1/8" to 1/2" per foot slope may be used.

COUNTY OF FRESNO - CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS

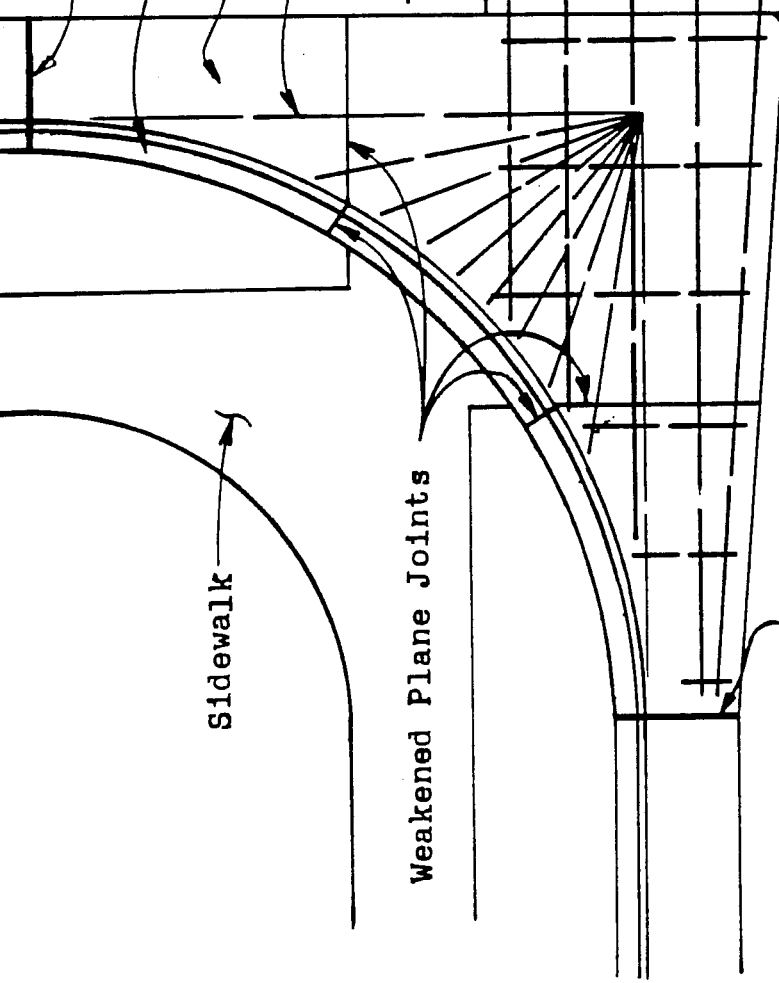
REVISED	
DATE	

IMPROVEMENT STANDARD
 B-5
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MINIMUM SETBACK FOR
 DEPRESSED AND ELEVATED GARAGES

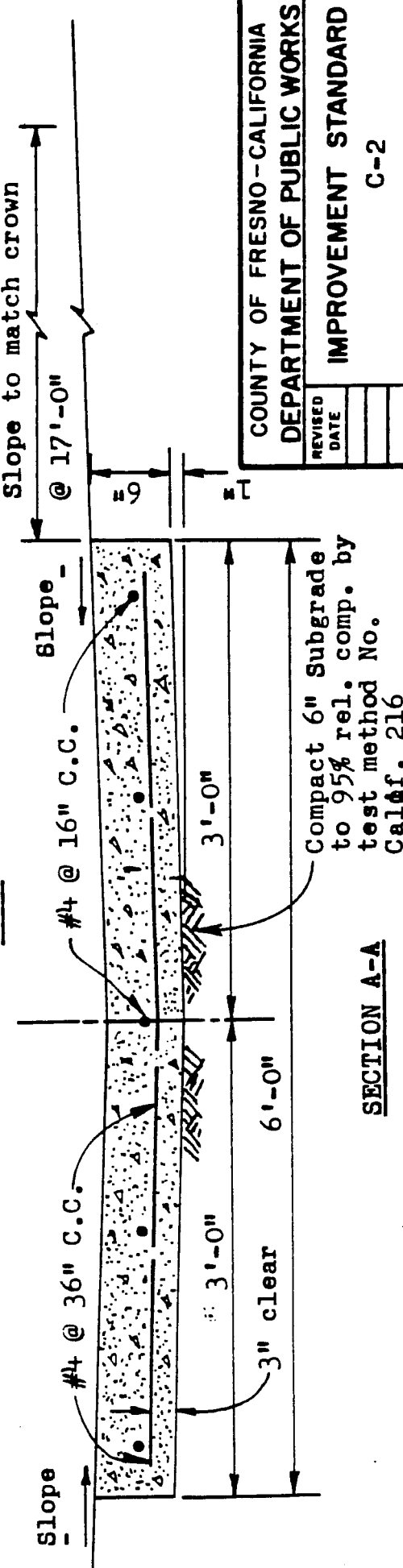


Construction Joint or Weakened Plane Joint
Curb
Gutter
Gutter lines to extend to point of intersection



Construction Joint or Weakened Plane Joint
Construction Joint
Construction Joint =
#4 bars to extend 12" beyond construction joint

PLAN

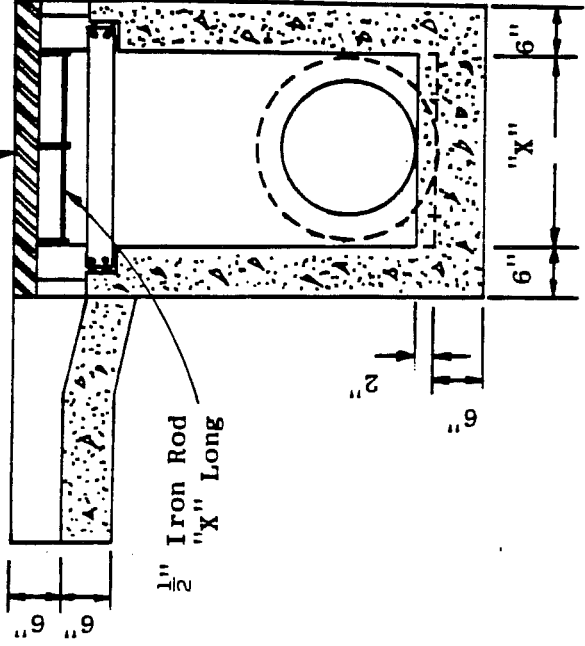


SECTION A-A
VALLEY DEPRESSION

COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
REVISED DATE	
IMPROVEMENT STANDARD C-2	
Date: 10-66	

Frame & Grate for Curb & Gutter Inlet
Std. Drwg. No. C-4

L 3"x2"x $\frac{1}{2}$ "x (X"+12") Long

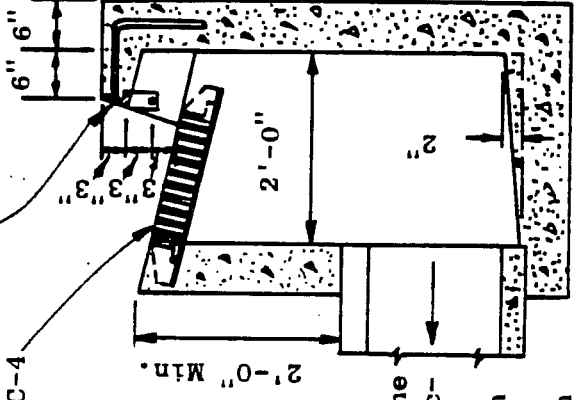


$\frac{1}{2}$ " Iron Rod "X" Long

Gutter Flow Line

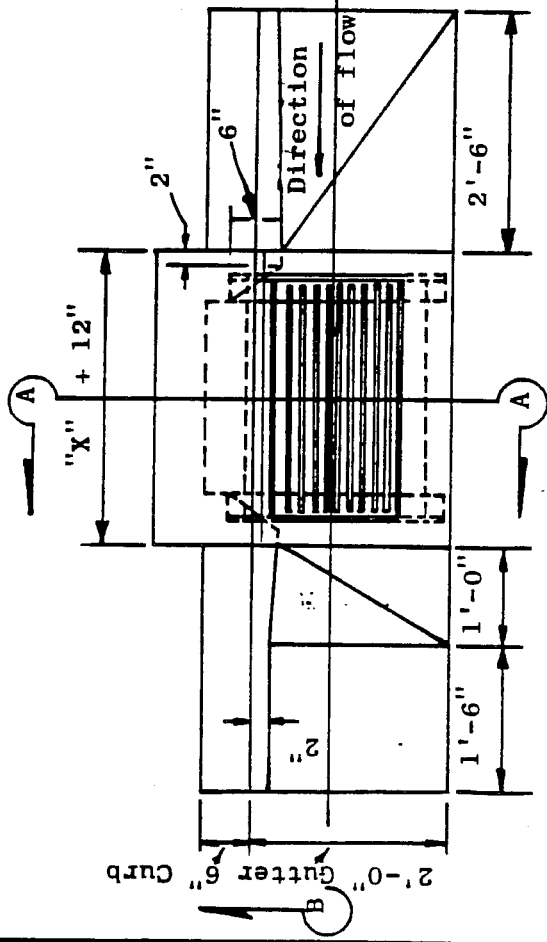
Direction of Flow
For flow in the opposite direction reverse the depression pattern. For flow from both directions depress both sides equally.

See Detail "A"
Std. Drwg. No. C-4



- NOTES**
- Structure shall be Class "A" concrete. Exposed surfaces shall be finished as per curb specifications.
 - When employed as outlet, construct open bottom, place frame & grate 6" below top of curb grade and eliminate $\frac{1}{2}$ " ϕ iron rod & hangers.
 - Curb & gutter shall be constructed or reconstructed for a distance of 8'-0".

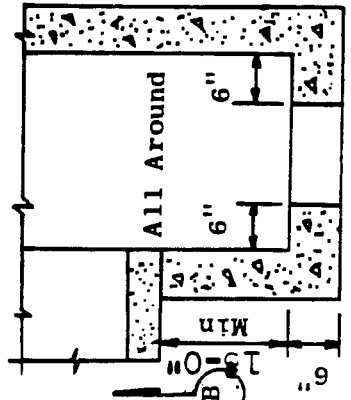
SECTION B-B



PLAN

Scale: $\frac{1}{2}$ " = 1'-0"

SECTION A-A



Open Bottom as Req'd.

OPEN BOTTOM DETAIL
(See Note 3)

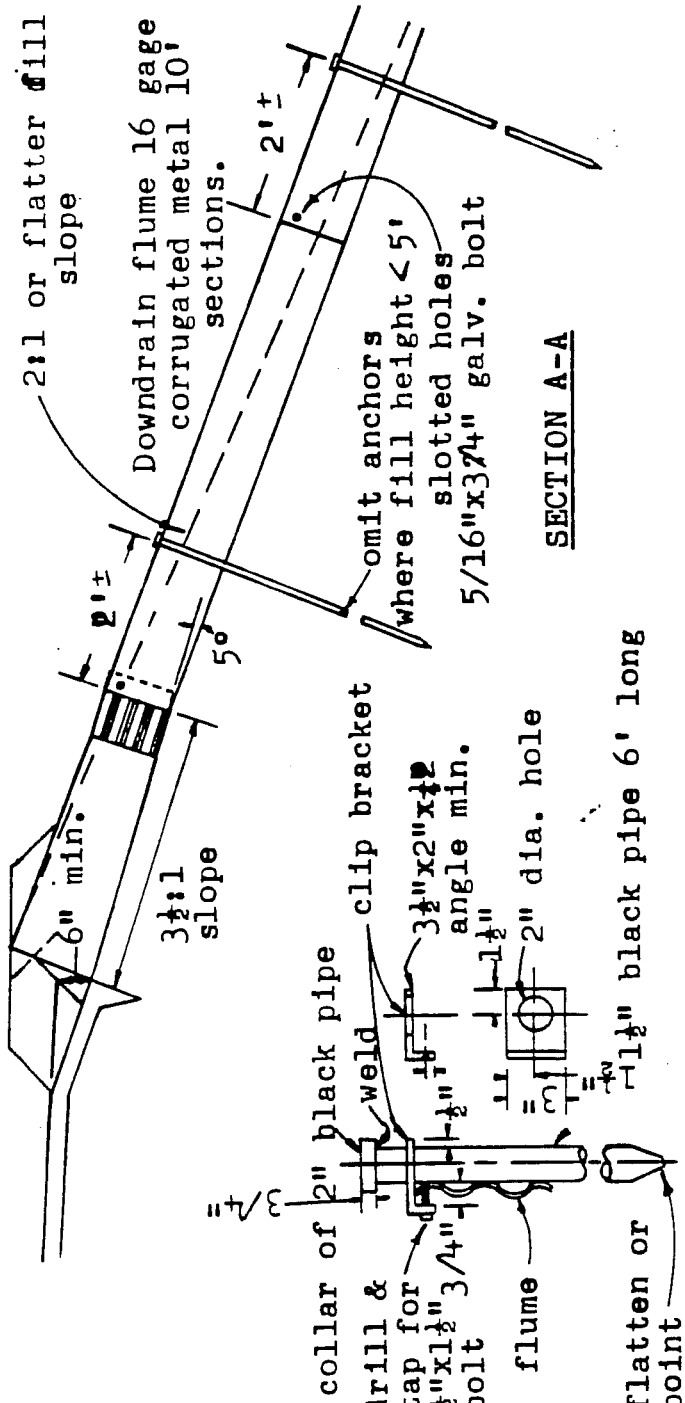
INLET & OUTLET TYPES

Type "A" - 36" inlet, "X" = 3'-0"
Type "B" - 36" inlet with open bottom, "X" = 3'-0"

Type "E" - 36" Outlet, "X" = 3'-0"

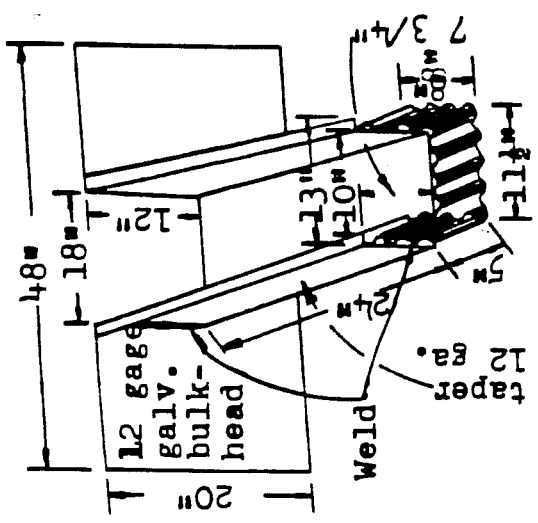
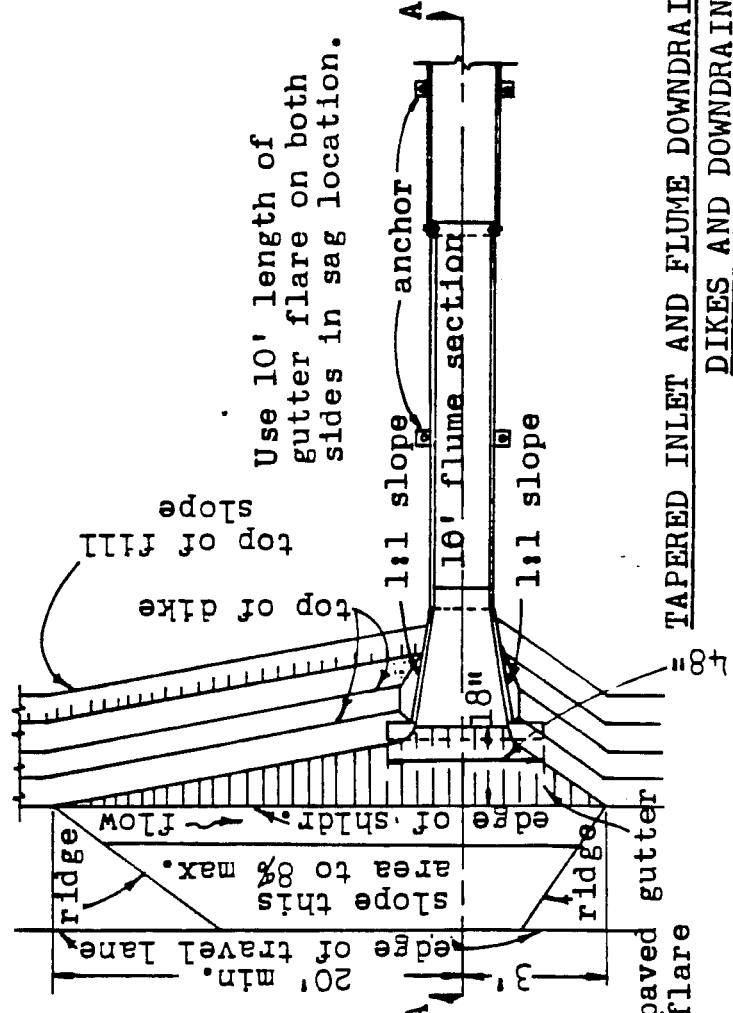
COUNTY OF FRESNO - CALIFORNIA	
DEPARTMENT OF PUBLIC WORKS	
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DATE	
IMPROVEMENT STANDARD	
C-3	

Date: 10-66

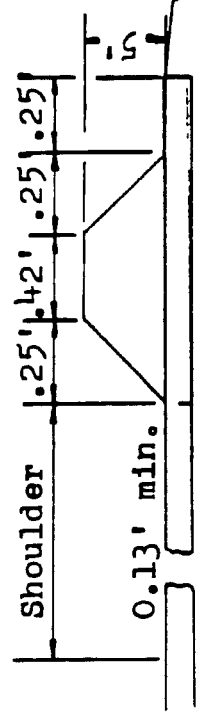


SECTION A-A

ANCHOR DETAIL



TAPERED INLET

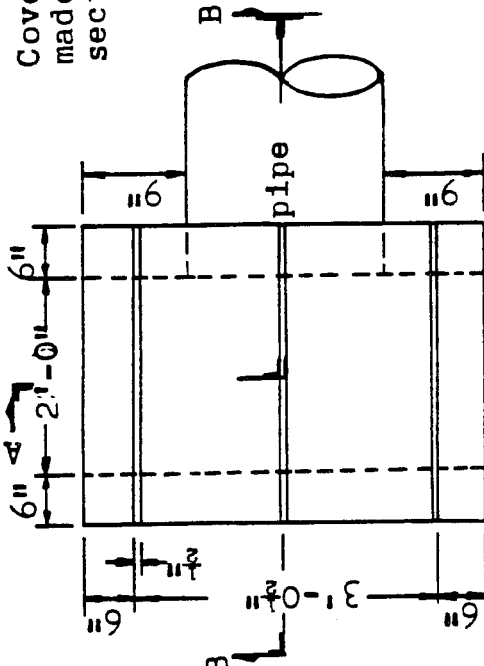


A.C. DIKE

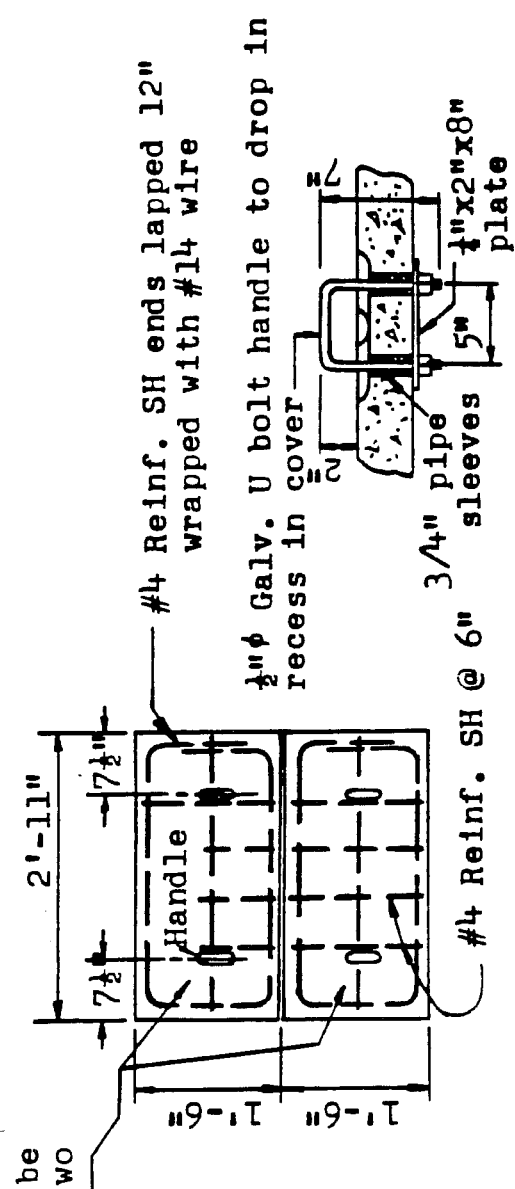
1 1/2:1 to 4:1 fill slopes and low side of curves

REVISED DATE		C-6
COUNTY OF FRESNO - CALIFORNIA		
DEPARTMENT OF PUBLIC WORKS		
IMPROVEMENT STANDARD		
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TAPERED INLET AND FLUME DOWNDRAIN DIKES AND DOWNDRAIN

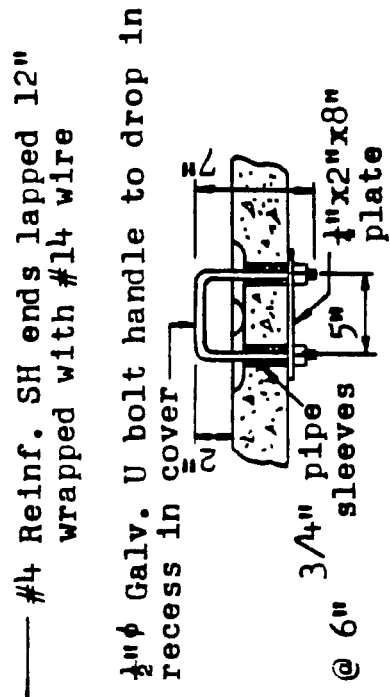


PLAN

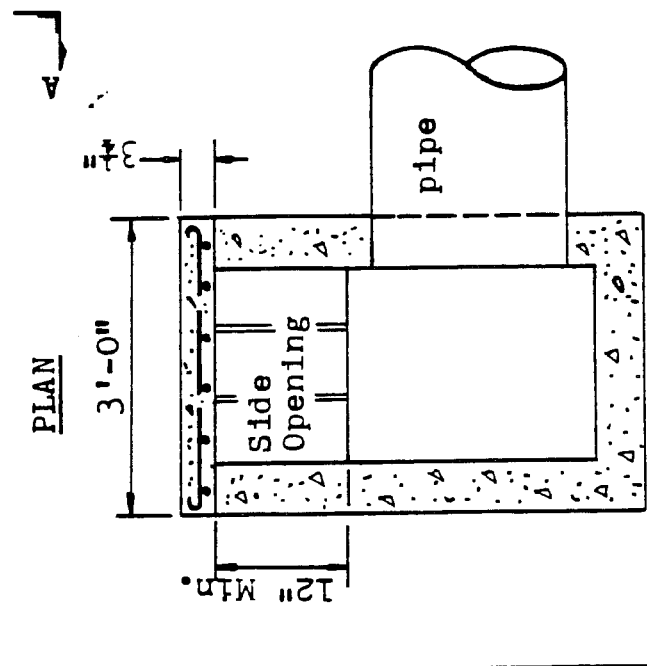


COVER PLAN

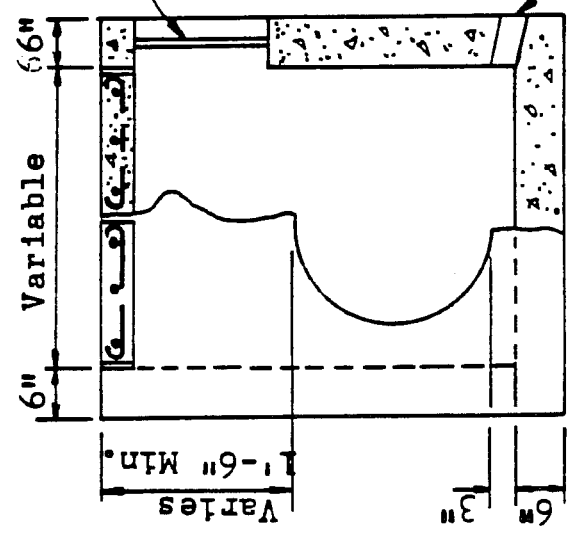
Cover to be made in two sections



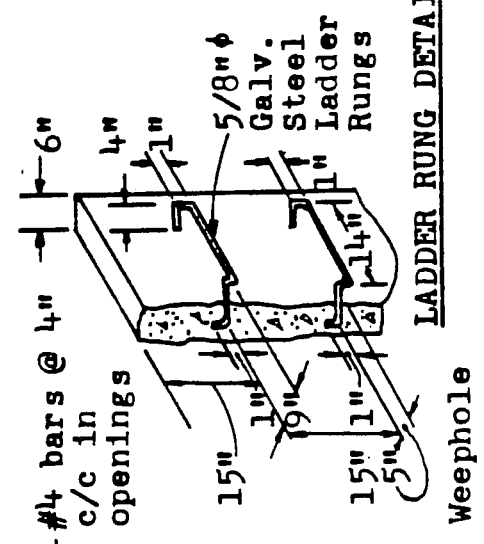
HANDLE DETAILS



SECTION B-B



ELEVATION & SECTION A-A



LADDER RUNG DETAILS

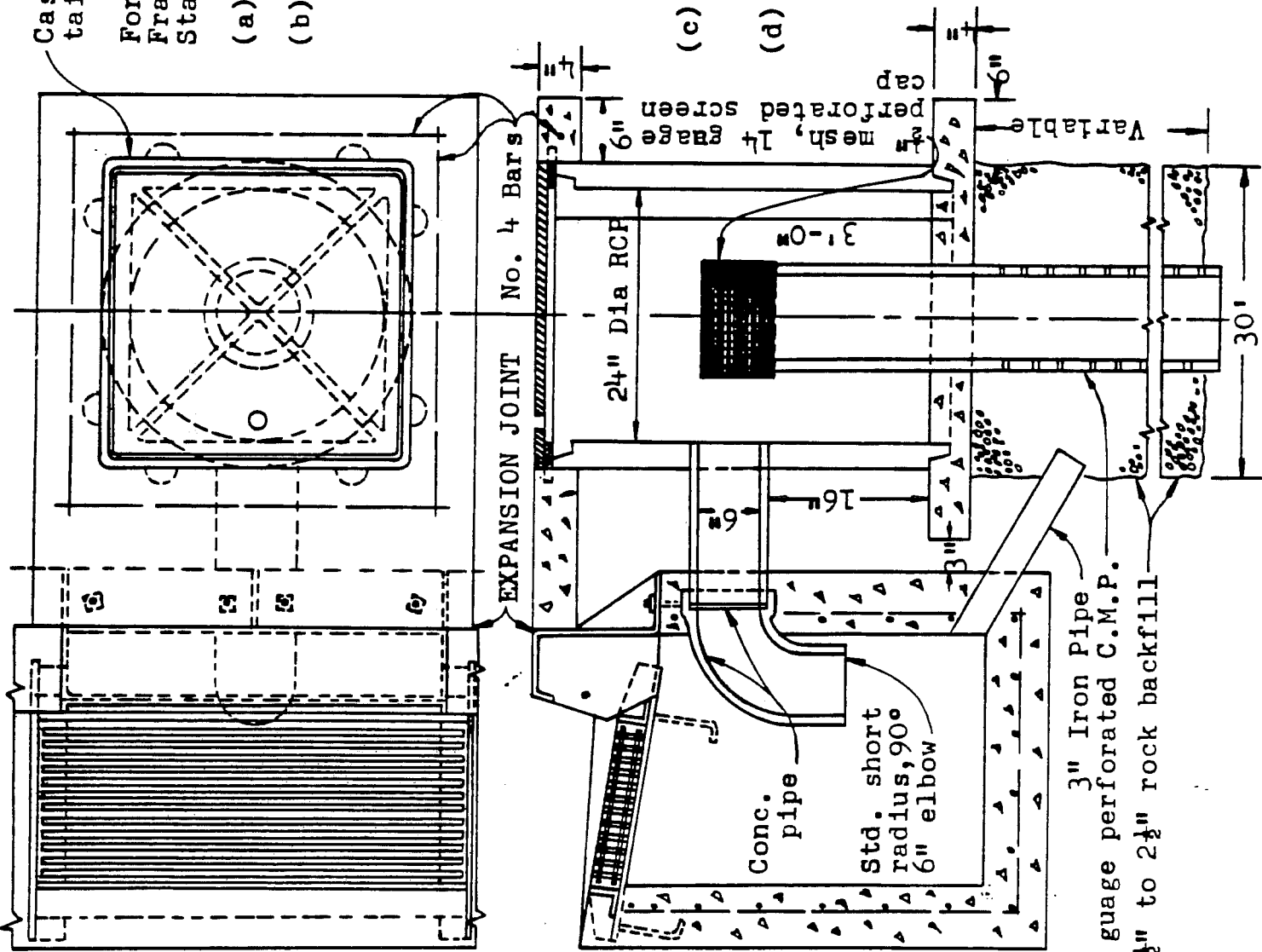
CATCH BASIN WITH CONCRETE COVER

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Cast iron frame and cover, for details see Improvement Standard C-9

For details of Drop Inlet, Grate, Frame and Hood see Improvement Standard C-3, & C-4

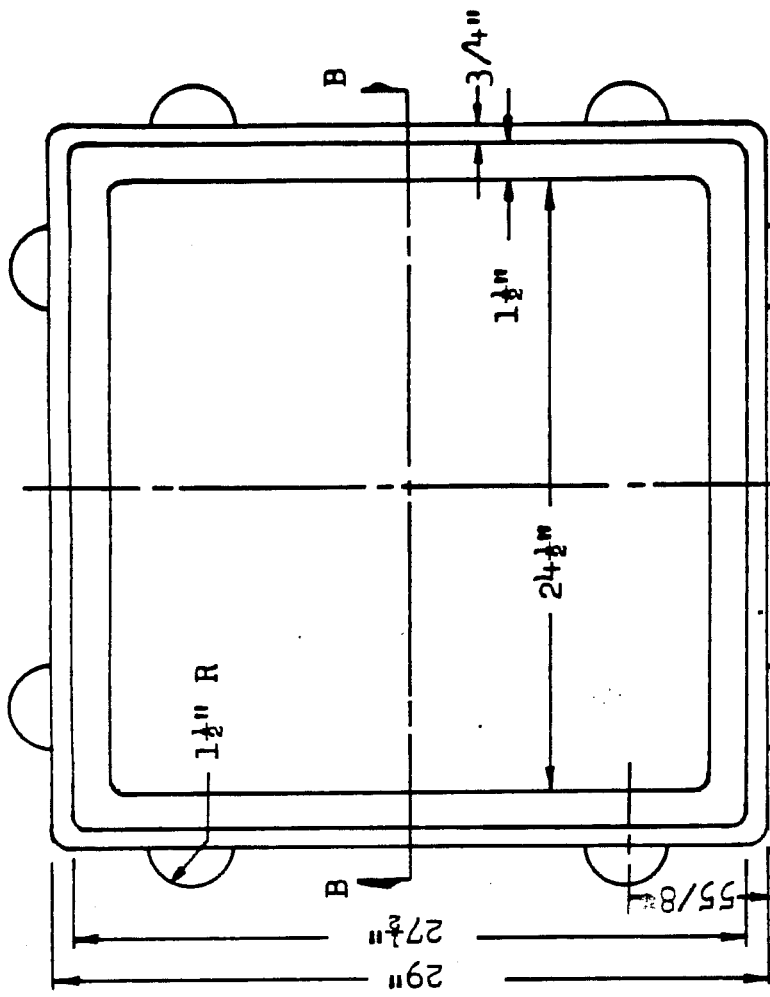
- (a) Filter Material-Crushed or natural stone.
- (b) Filter Pipe-8" I.D. 16 gage galvanized CMP or 8" I.D. 12 gage steel water well casing or an approved equal perforated by cutting, punching or drilling. Perforations shall be evenly distributed around the circumference and along the length of pipe providing 10 square inch minimum effective percolation area per L.F. of pipe without permitting filter material to pass into the pipe.
- (c) The lower end of drainwell shall be at least 10' above local ground water table.
- (d) Percolation-Design acceptance rate for each drainwell shall be 0.05 CFS.



3" Iron Pipe
 8"-16 gage perforated C.M.P.
 1 1/2" to 2 1/2" rock backfill

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CAST IRON FRAME

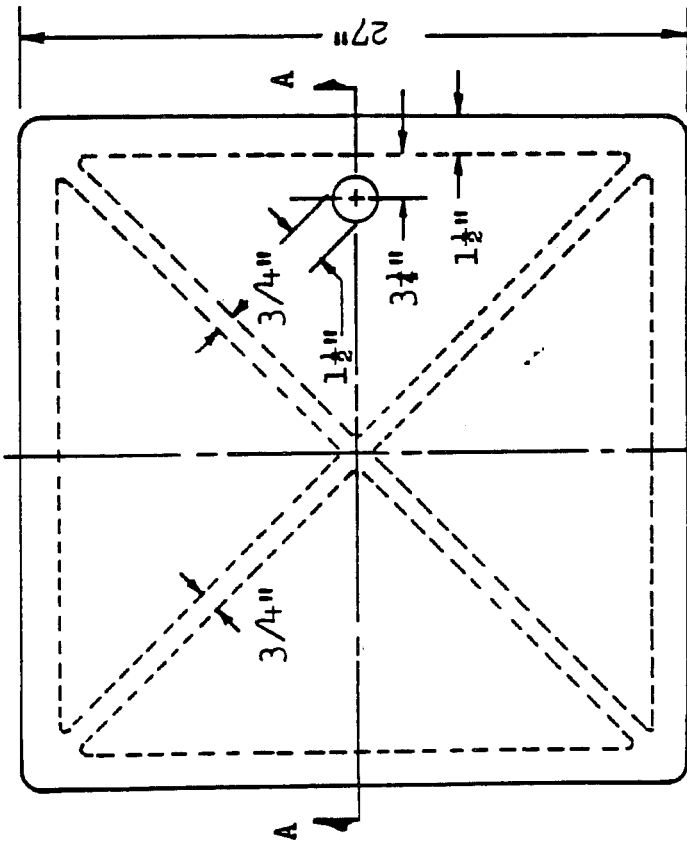
27 1/2"

29"

3/4"

7/8"

SECTION B-B



CAST IRON COVER

27"

5/8"

1"

7/8"

Hook Hole

SECTION A-A

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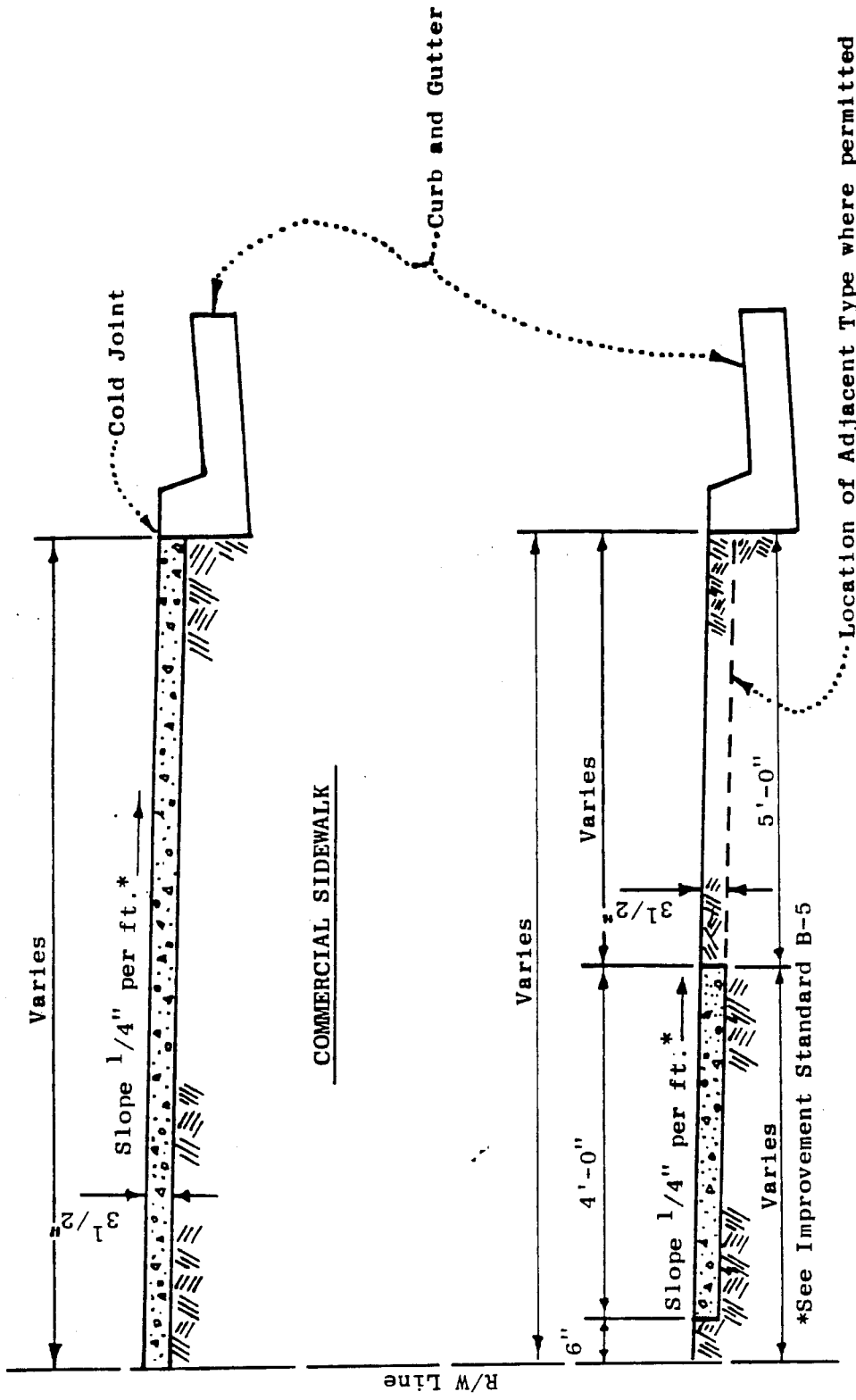
REVISED
DATE

IMPROVEMENT STANDARD

C-9

DRAINWELL COVER

Date: 10-66

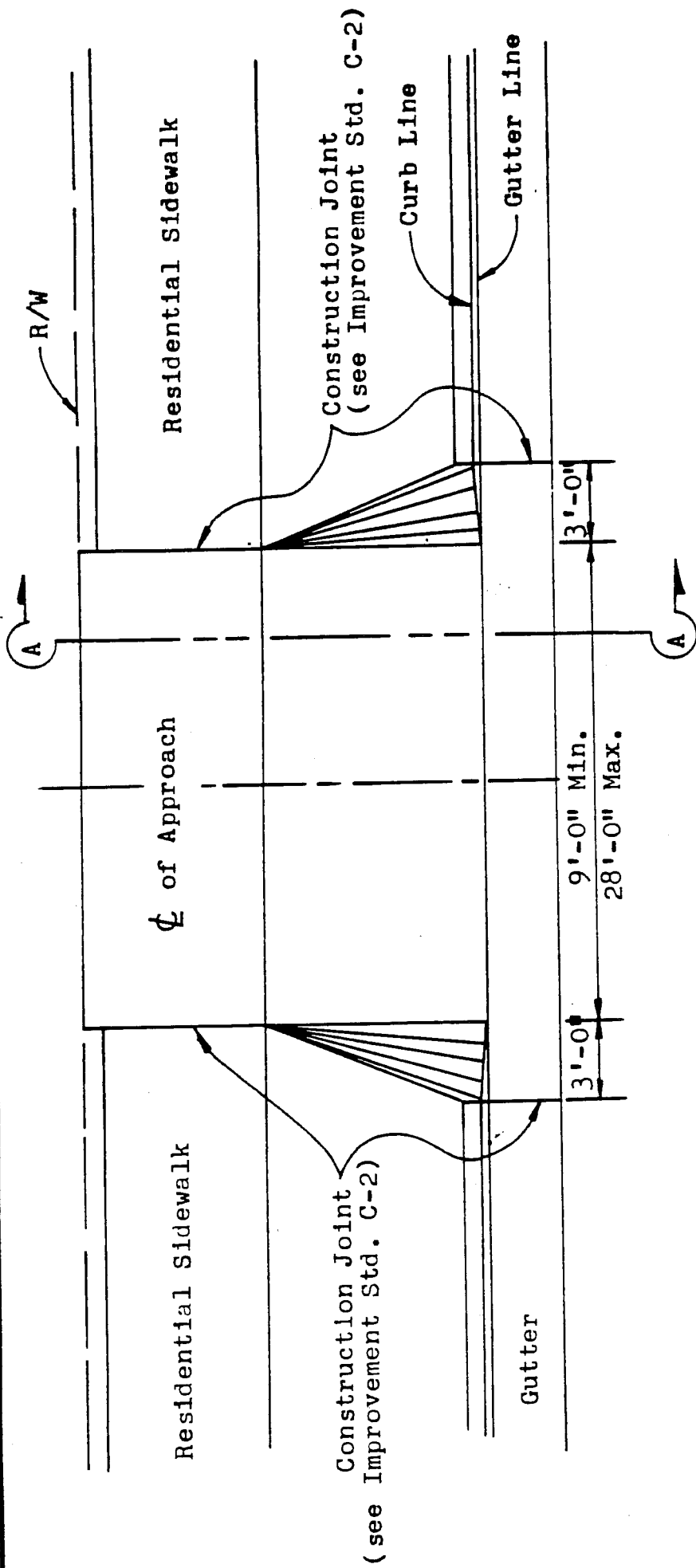


NOTE: For Curb and Gutter Details, see Improvement Standard No. C-1

COUNTY OF FRESNO - CALIFORNIA	
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DATE	

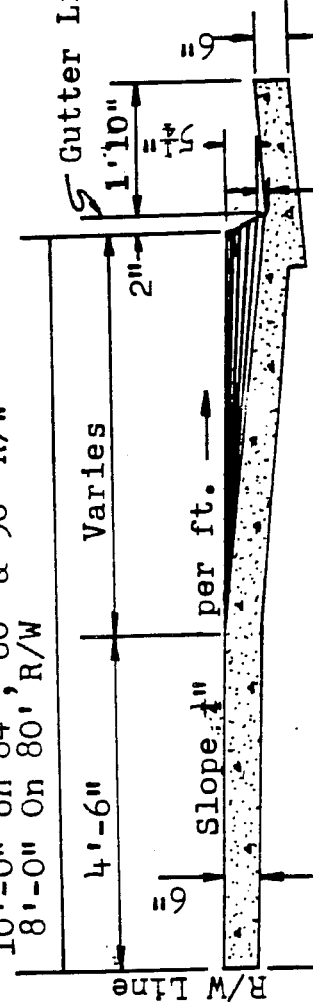
SIDEWALKS

Date: 10-66



PLAN

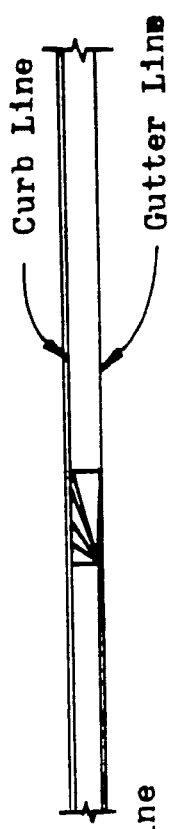
See Improvement Std. B-6
 10'-0" on 84', 60' & 56' R/W
 8'-0" on 80' R/W



SECTION A-A

NOTE:

To be constructed where concrete drainage facilities are required.
RESIDENTIAL DRIVEWAY APPROACH



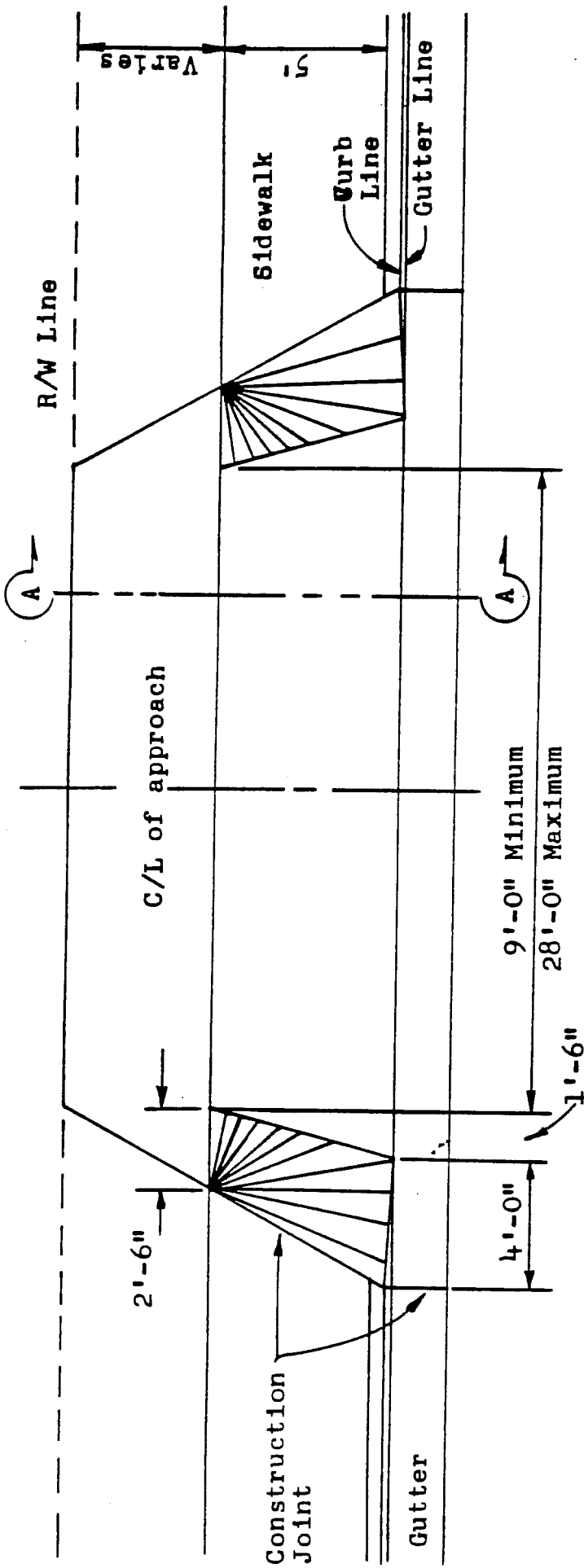
ELEVATION

COUNTY OF FRESNO - CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS

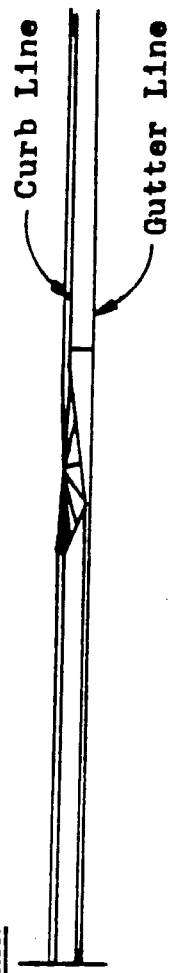
REVISED DATE

IMPROVEMENT STANDARD
 D-2

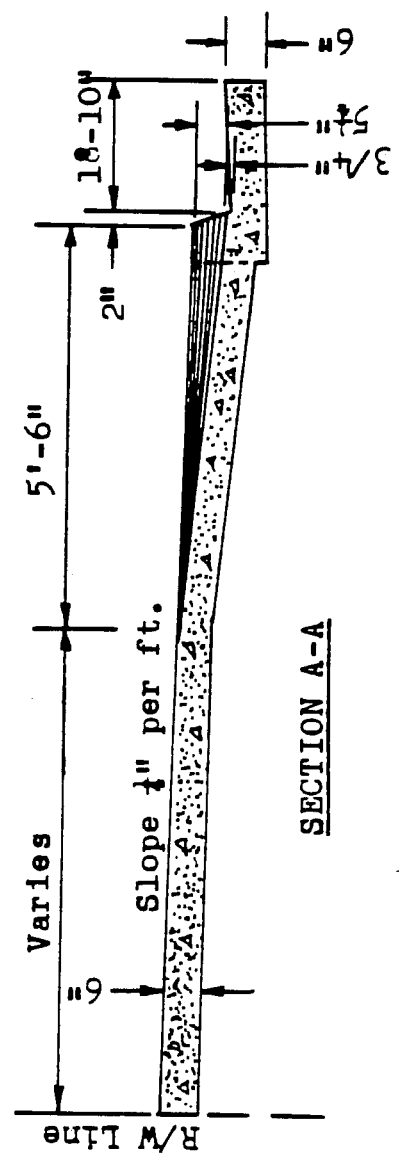
Date: 10-66



PLAN

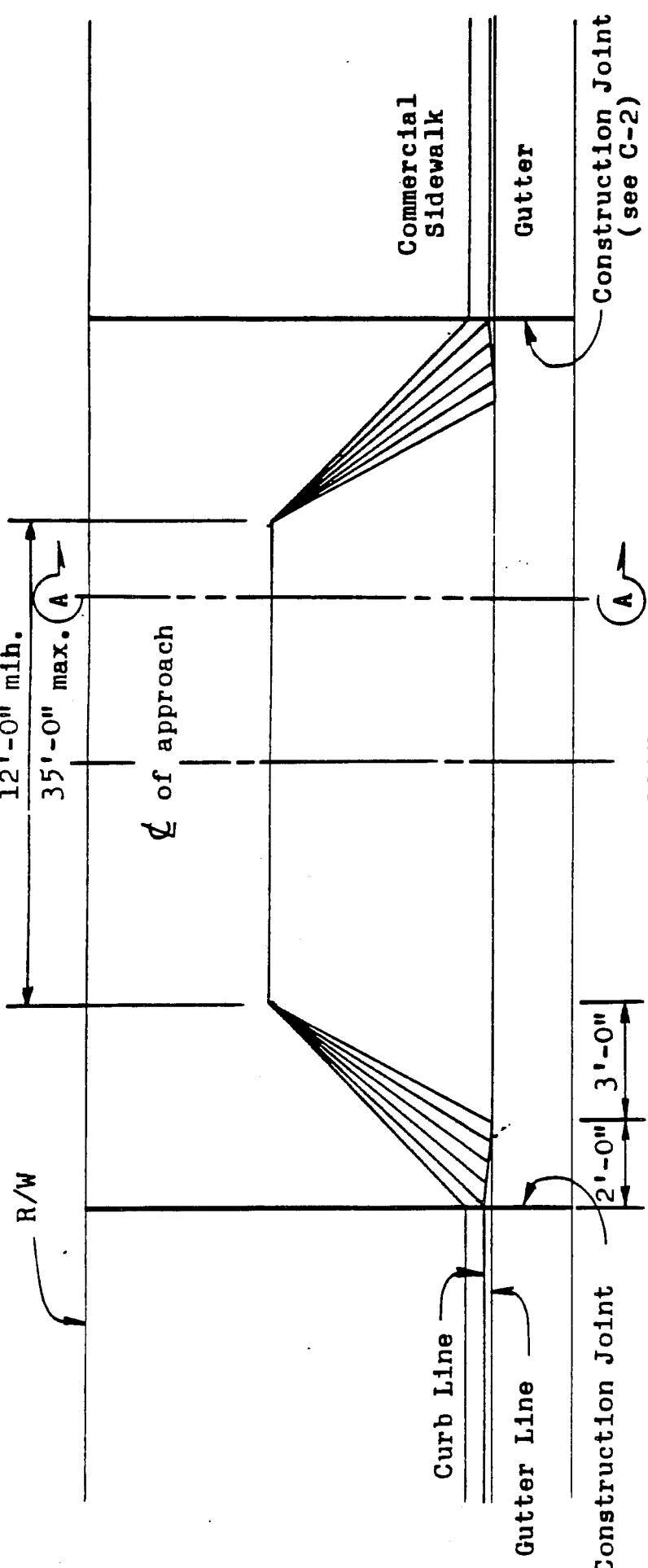


ELEVATION

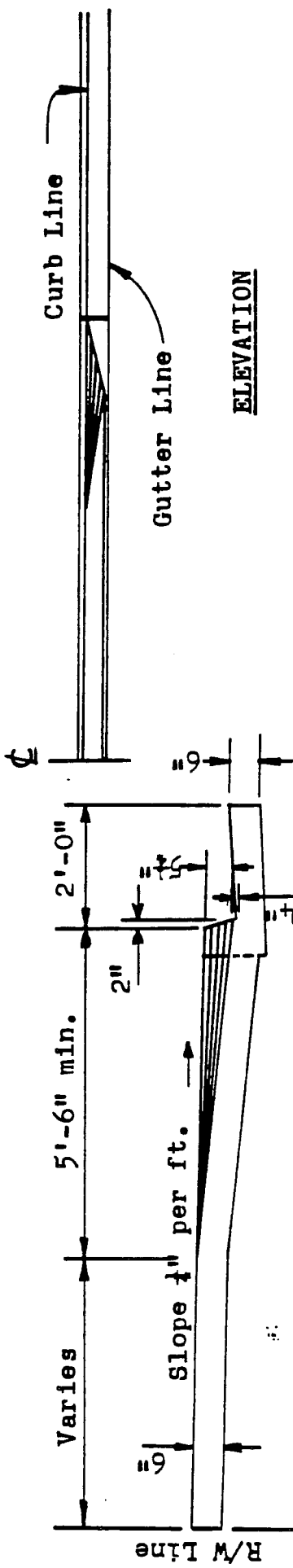


RESIDENTIAL DRIVEWAY APPROACH
(adjacent sidewalks)

COUNTY OF FRESNO - CALIFORNIA	
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IMPROVEMENT STANDARD	
D-2A	
Date: 10-66	



PLAN



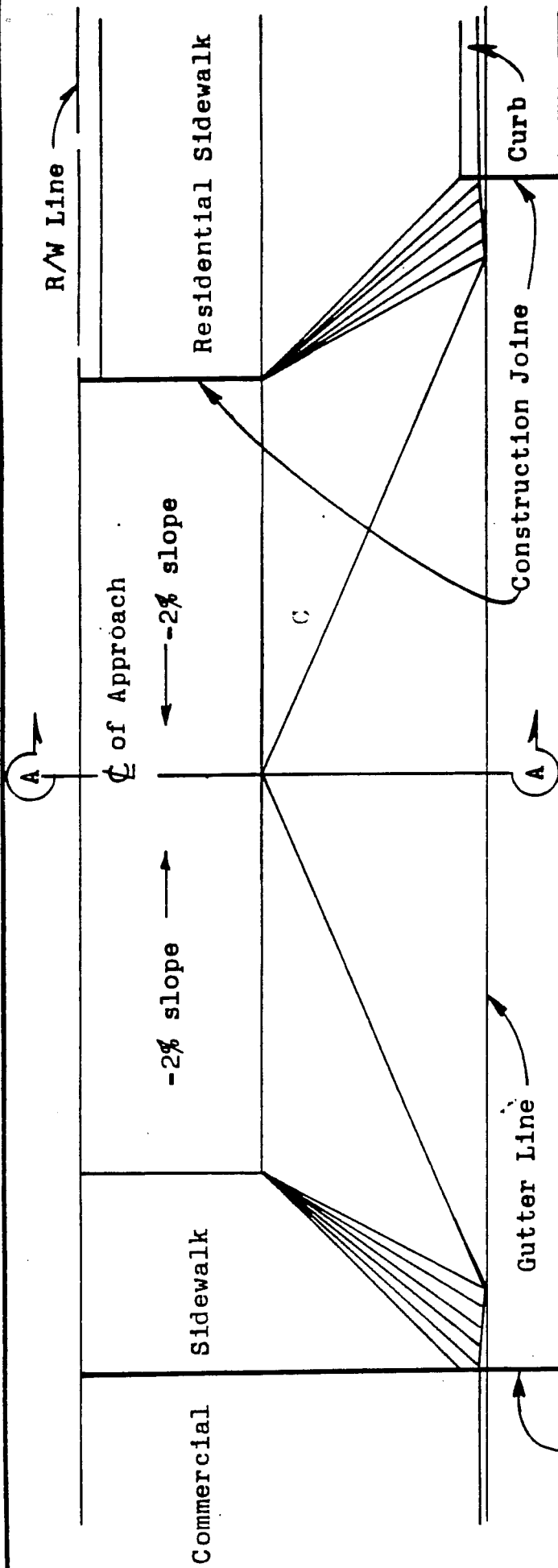
ELEVATION

SECTION A-A

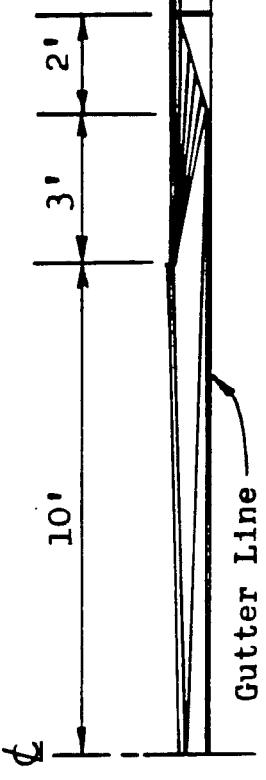
NOTE: Where curb is replaced with driveway approach, see Improvement Standard D-2 for details.

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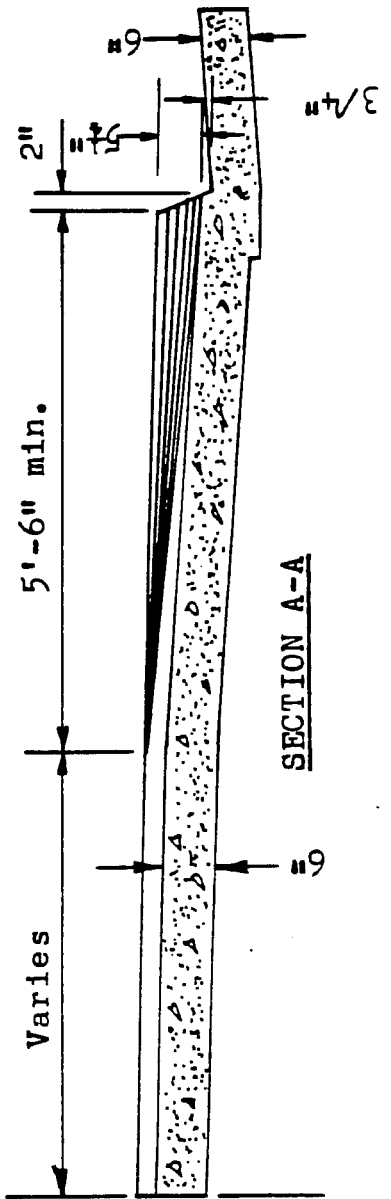
IMPROVEMENT STANDARD
D-3



PLAN



ELEVATION



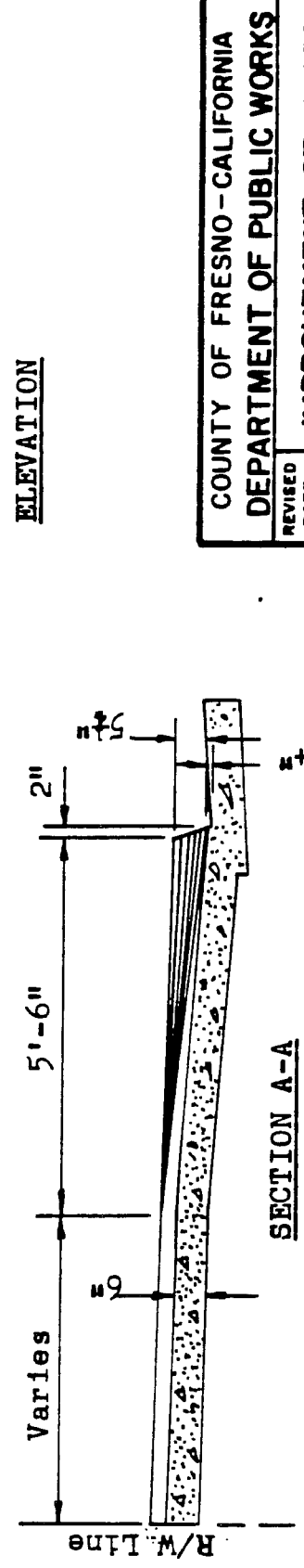
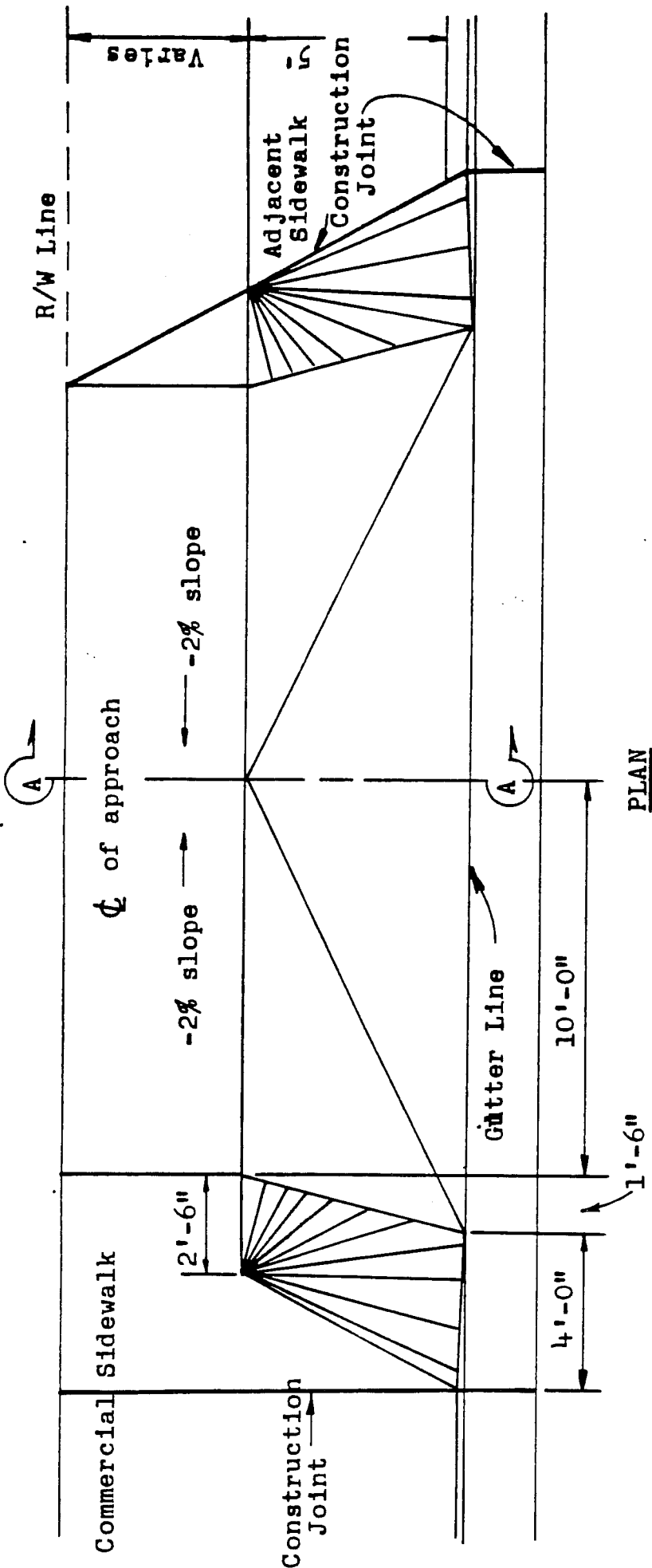
COUNTY OF FRESNO - CALIFORNIA
 DEPARTMENT OF PUBLIC WORKS
 IMPROVEMENT STANDARD

REVISED DATE

D-4

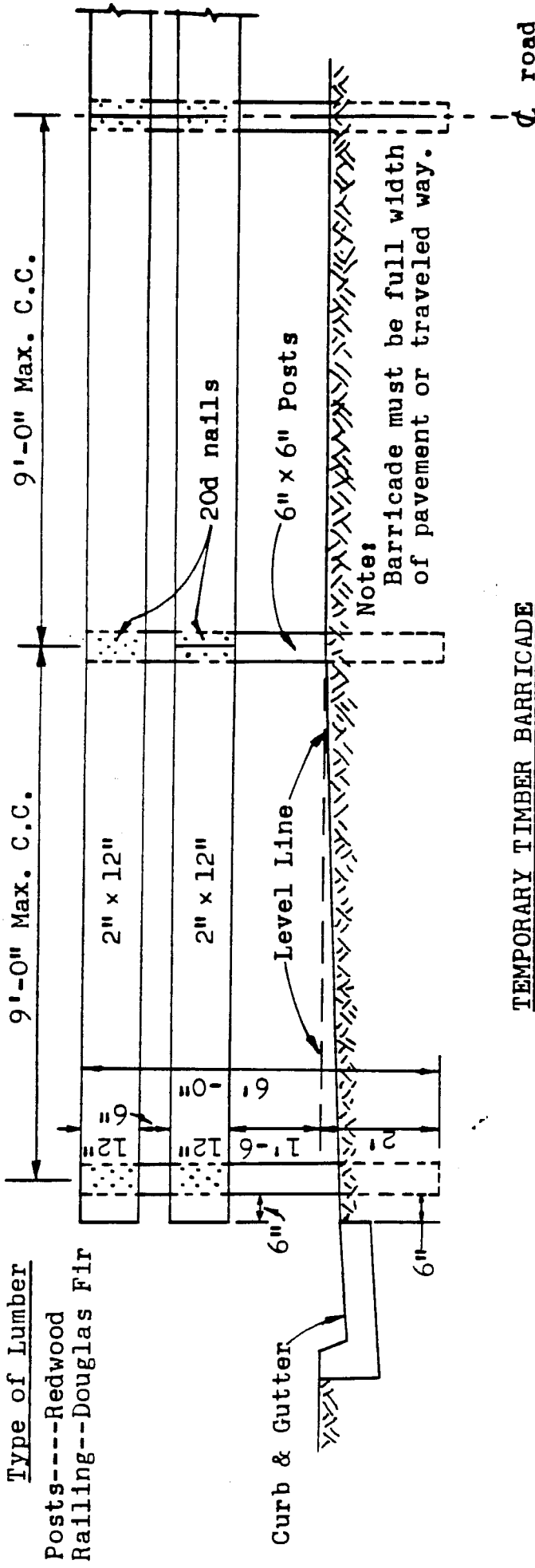
Date: 10-66

ALLEY APPROACH

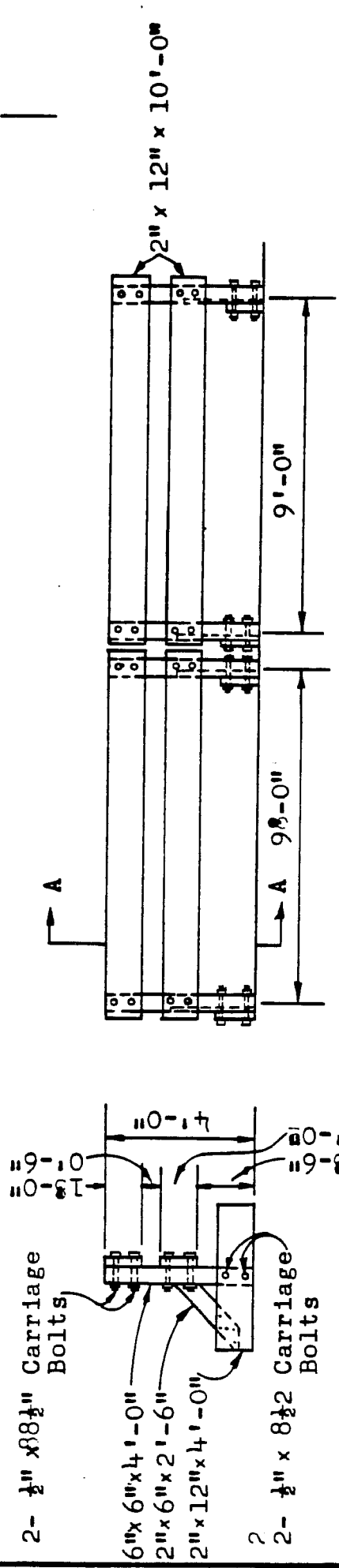


ALLEY APPROACH
(adjacent sidewalks)

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D-4A	
Date: 10-66	



TEMPORARY TIMBER BARRICADE



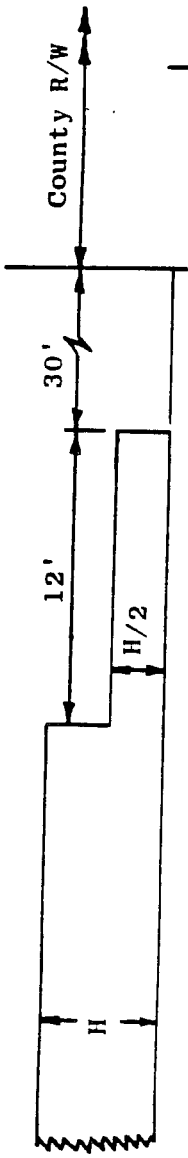
PORTABLE TIMBER BARRICADE

Note:

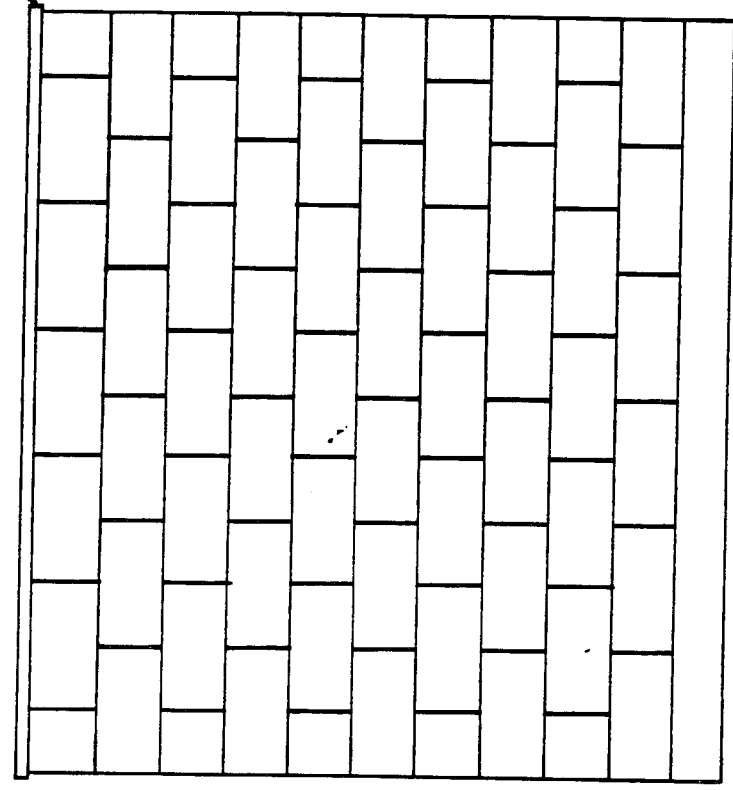
Appropriate signs to be designated by the Dept. of Public Works.
 All signs to be in accordance with the State of California
 Division of Highways Standards.
 2 coats of white paint shall be applied to the surface of all
 lumber.

BARRICADES

COUNTY OF FRESNO - CALIFORNIA	
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D-5	
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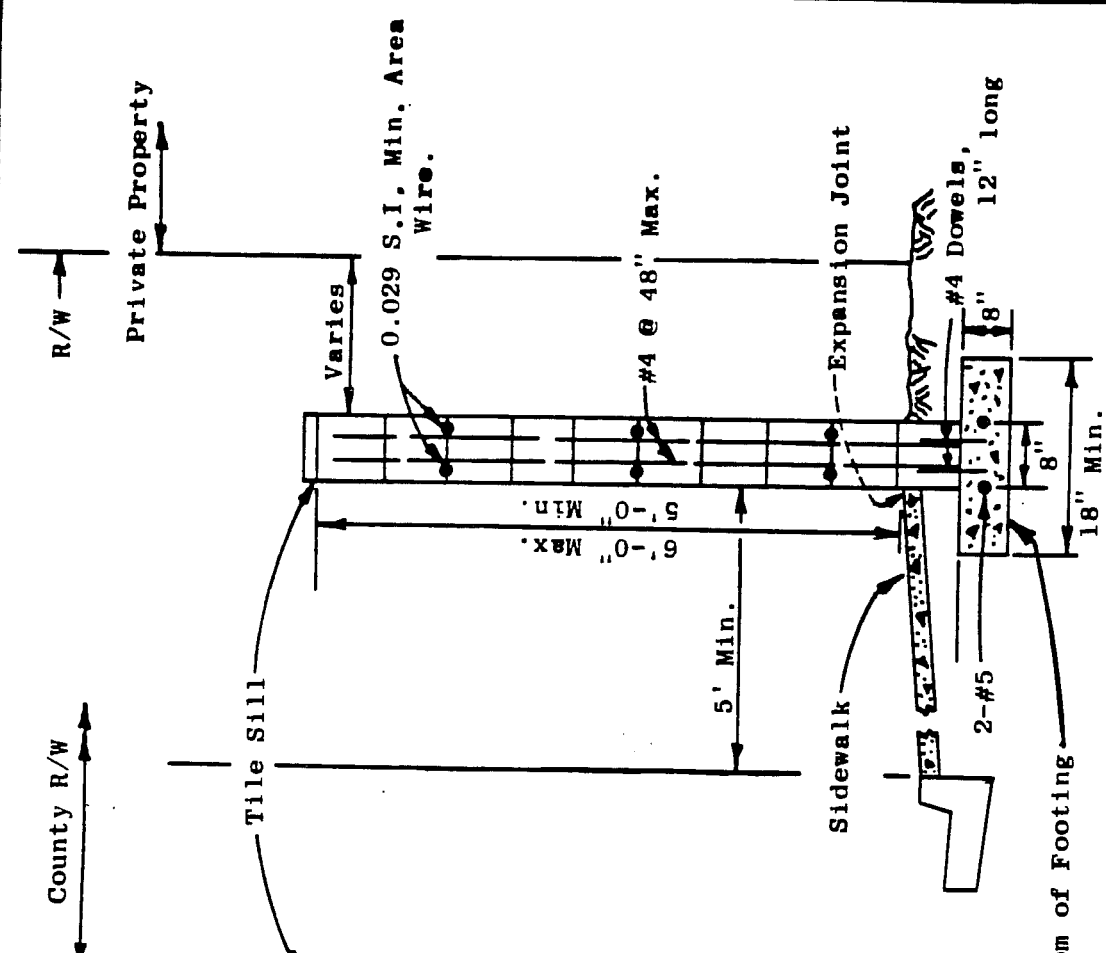


HEIGHT LIMITATIONS @ INTERSECTIONS



ELEVATION

CONCRETE BLOCK FENCE



SECTION

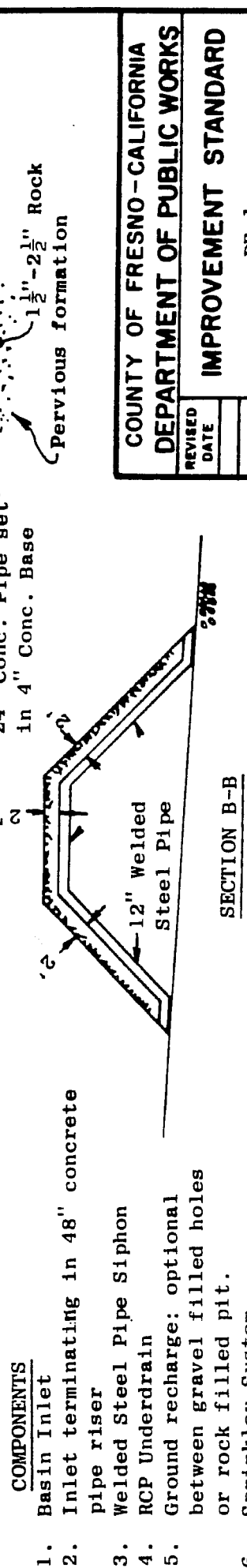
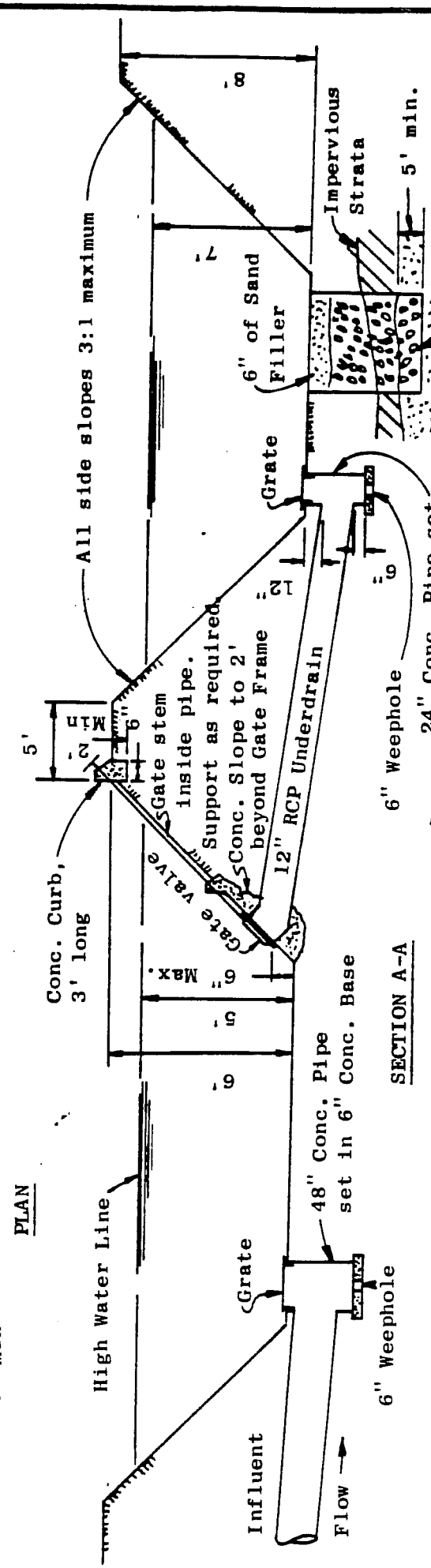
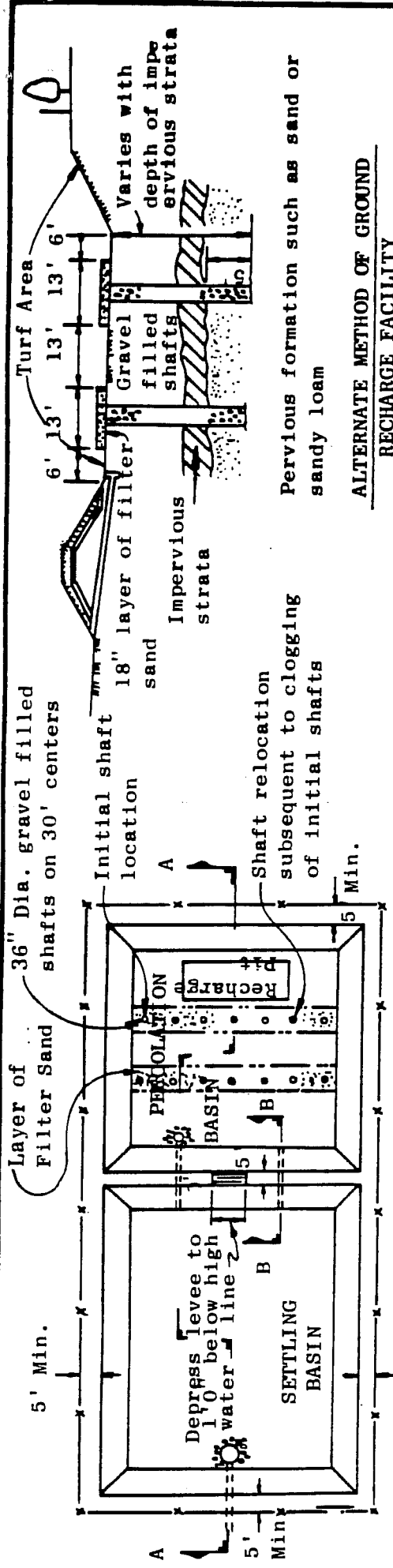
COUNTY OF FRESNO - CALIFORNIA
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IMPROVEMENT STANDARD

D-6

1. Grout to be placed at location of vertical bar reinforcement.
2. 6'-chain link fence may be used at canal banks as an alternate.
3. Other approved masonry materials may be used in place of concrete block.
4. Other designs may be used subject to approval by Dept. of Public Works.



COMPONENTS

1. Basin Inlet
2. Inlet terminating in 48" concrete pipe riser
3. Welded Steel Pipe Siphon
4. RCP Underdrain
5. Ground recharge: optional between gravel filled holes or rock filled pit.
6. Sprinkley System
7. Perimeter Fence (6' Chain Link) and screen planting
8. 12 foot Gate on street side

Pervious formation such as sand or sandy loam

ALTERNATE METHOD OF GROUND RECHARGE FACILITY

GENERAL LAYOUT OF PERCOLATION FACILITIES

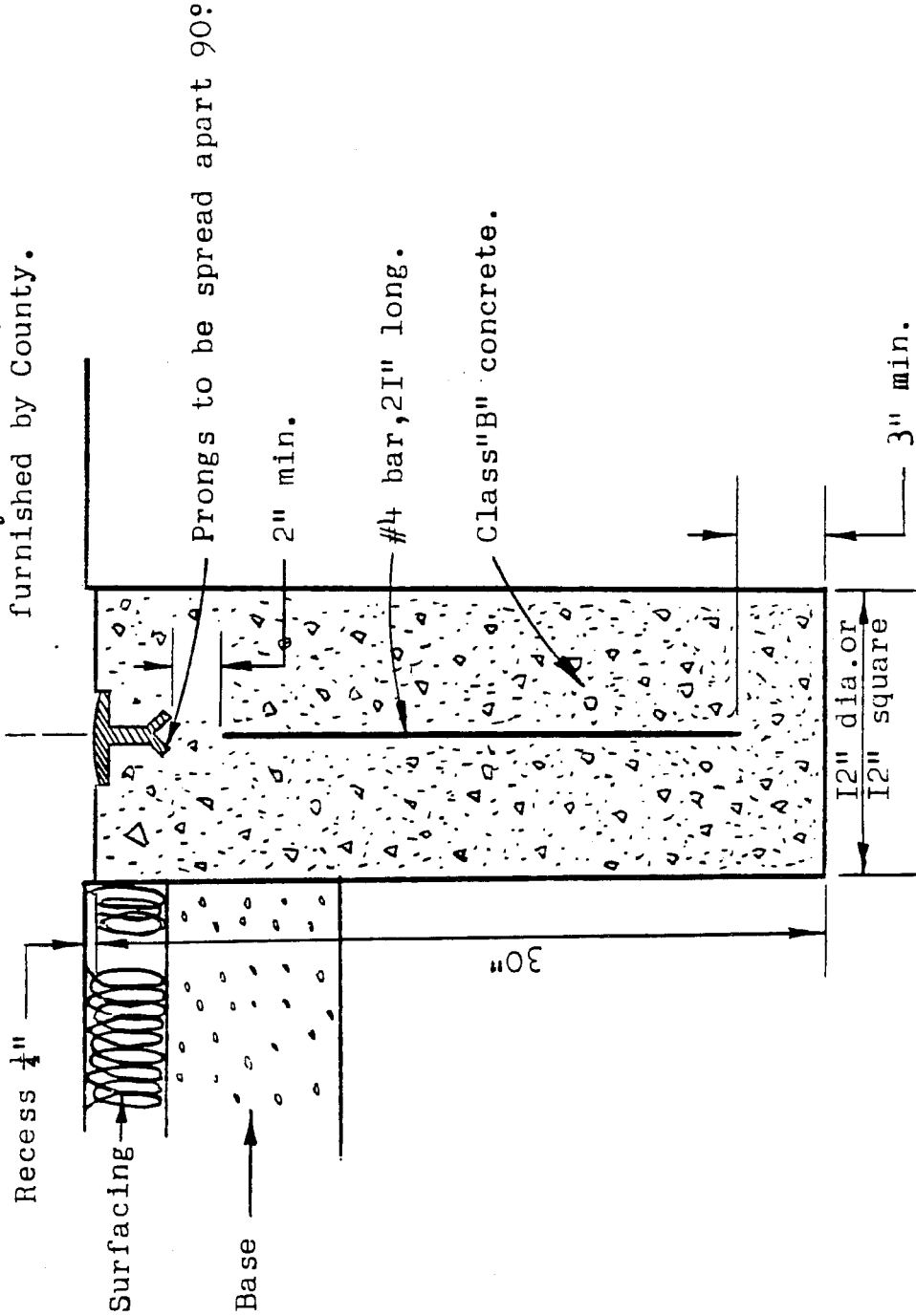
COUNTY OF FRESNO - CALIFORNIA
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 IMPROVEMENT STANDARD

REVISED	
DATE	

DR-1

Date: 10-66

Survey monuments to be furnished by County.



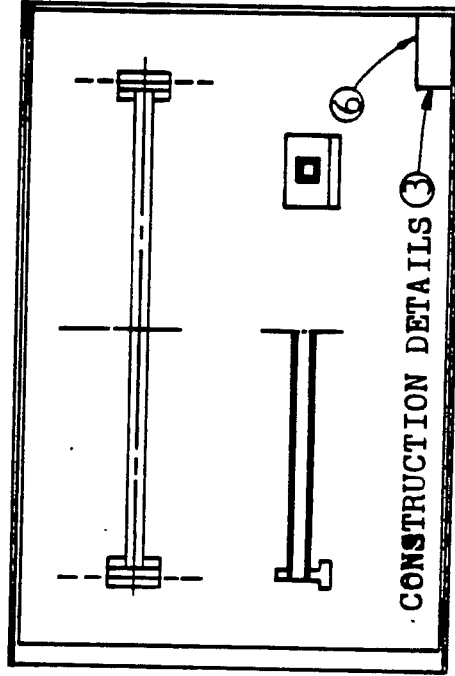
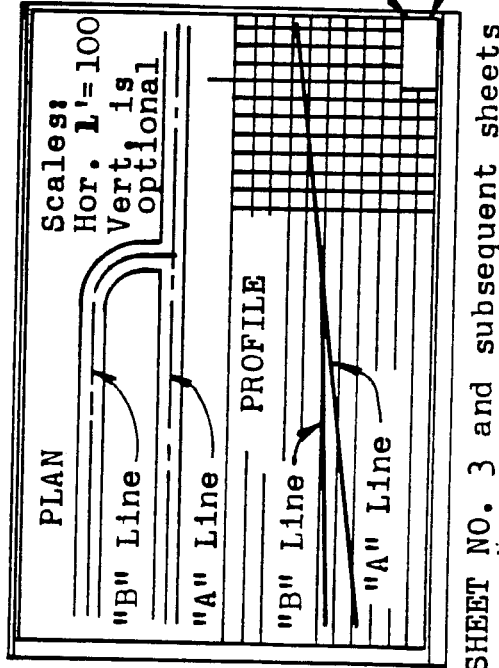
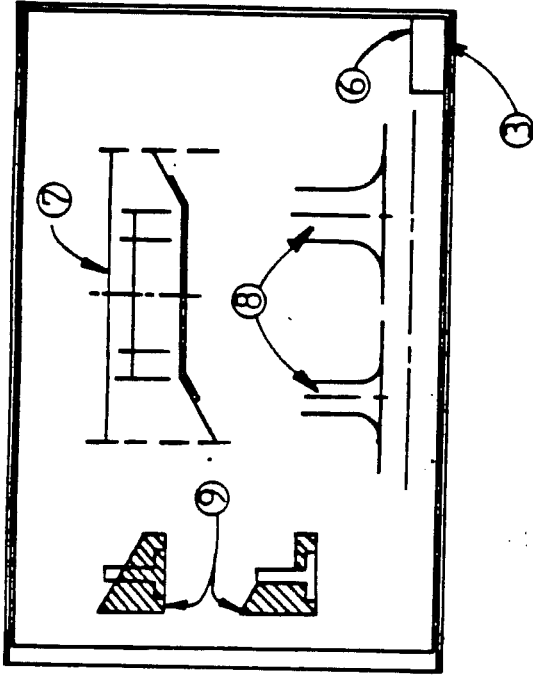
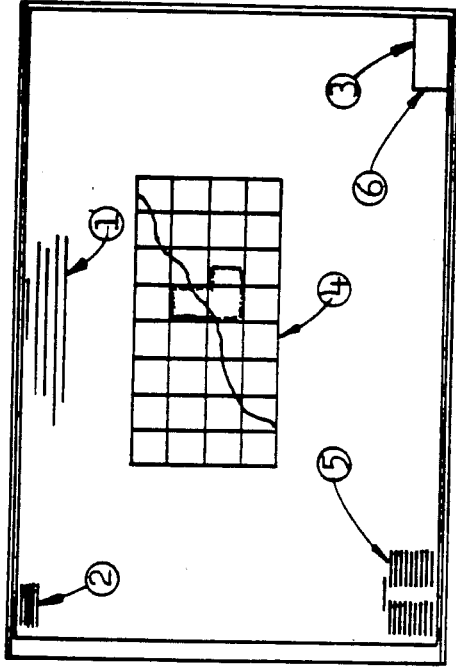
NOTE:

All street centerline survey monuments shall be stamped with the registered Civil Engineer or Licensed Land Surveyor's number including the appropriate prefix.

SURVEY MONUMENT ASSEMBLY
No Scale

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App. Rev.	Date: 10-66

NOTE: See Improvement Standard E-3 for details of Approval and Title Block Outside dimensions of Sheets 24"x36"



SHEET NO. 3 and subsequent sheets as necessary.

Remaining sheets following plan and profile.

- ① Project Title
- ② Index of Sheets
- ③ Approval Blocks
- ④ Vicinity Map
- ⑤ Conventional Symbols
- ⑥ Title Block
- ⑦ Typical Cross section(s)
- ⑧ Road Approaches
- ⑨ Earthwork Details

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IMPROVEMENT STANDARD
 E-2

Date: 10-66

TYPICAL IMPROVEMENT PLANS LAYOUT

SUBDIVISION IMPROVEMENT PLANS COUNTY OF FRESNO		SCALE
(NAME OF ENGINEERING FIRM)		DRAWN BY
(TRACT IDENTIFICATION)		REVISED
(TITLE OF SHEET)		
DESIGN ENGINEER _____		
DATE _____	C. E. LICENSE NO. _____	
Date Revised		
Approval		
APPROVED _____ C. E. NO. _____		
DIRECTOR OF PUBLIC WORKS		
Approved Rev		
Date		
		SHEET
		2 OF
		10 SHEETS

Note: Place on
title page only

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E-3	
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TYPICAL TITLE AND APPROVAL
BLOCK FOR SUBDIVISION
IMPROVEMENT PLANS

4'-0" Octagonal Conc. Collar

Plan view showing quarter bend to be used when making turn. All straight pipe to be laid through manholes with top half removed and rough broken edges mortared up smooth.

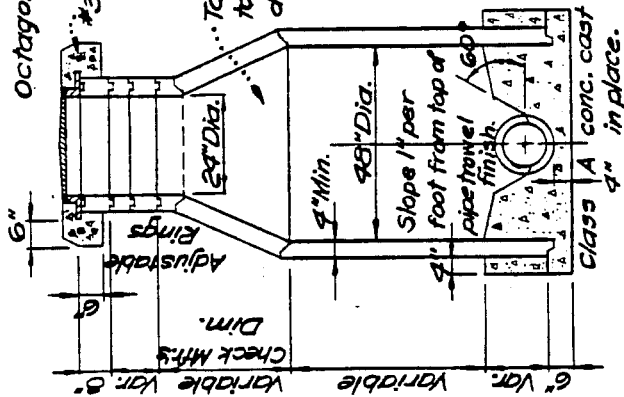
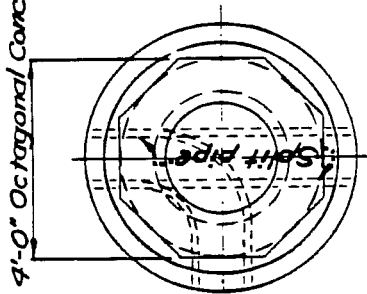
Quarter turns to be constructed to form a smooth flow line of same shape and pattern as bottom wall of pipe.

Octagonal collar around C.I. frame cast in place.

*3 bars lap 20", Total 2

Taper section to be according to approved manufacturers dimensions.

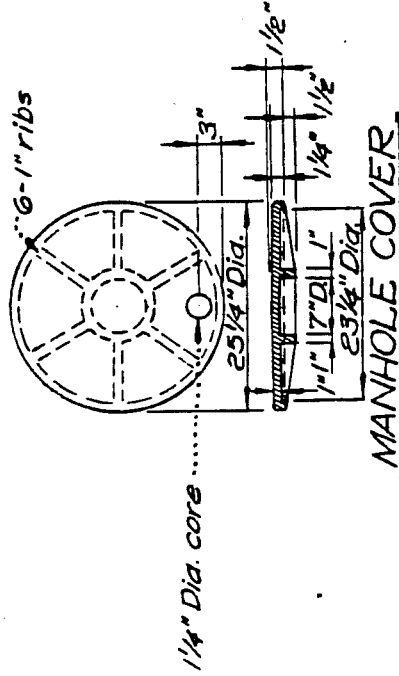
Enlarged base optional to top of pipe. Surface to top of pipe. Surface of base and concrete flow line to equal smoothness of pipe.



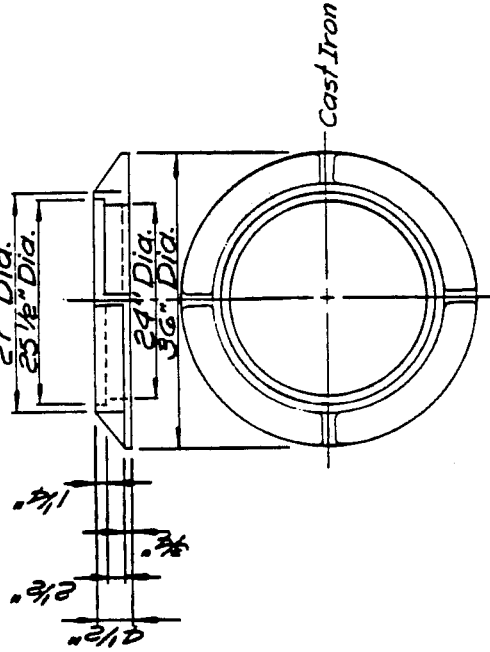
See plan for flow line elevation and size of pipe.

MANHOLE DETAILS

Scale: 1/4" = 1'-0"



MANHOLE COVER



MANHOLE FRAME

Scale: 1/2" = 1'-0"

NOTE:

Sections to meet ASTM Specification C478-64T for concrete pipe manholes for respective diameters

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IMPROVEMENT STANDARD

S-1

Date: 10-66

4'-0" Octagonal conc. collar

NOTE:

All straight pipe to be laid through manholes with top half removed and rough broken edges mortared up smooth.

All exposed reinforcing steel to be coated with 2" of concrete.

6" Octagonal collar around C.I. frame cast in place

#3 bars lap 20", Total 2

Adjustment rings

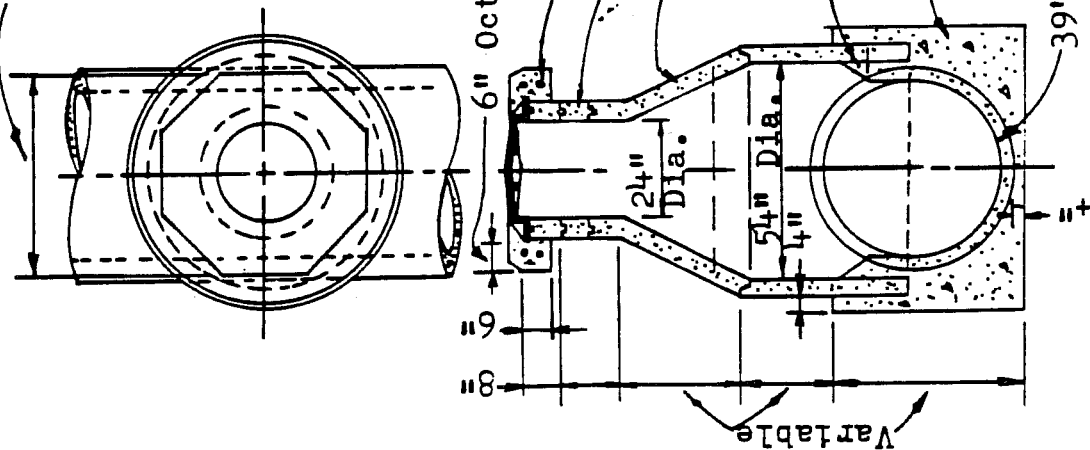
Standard precast cone

NOTE:

Sections to meet ASTM Specification C478-64T for conc. pipe manholes for respective diameters.

Base to be poured in place with Class "A" concrete. Base may be made round or square.

39" to 42" Dia.



MANHOLE DETAILS

scale: 1" = 1'-0"

NOTE: For manhole cover & manhole frame see S-1

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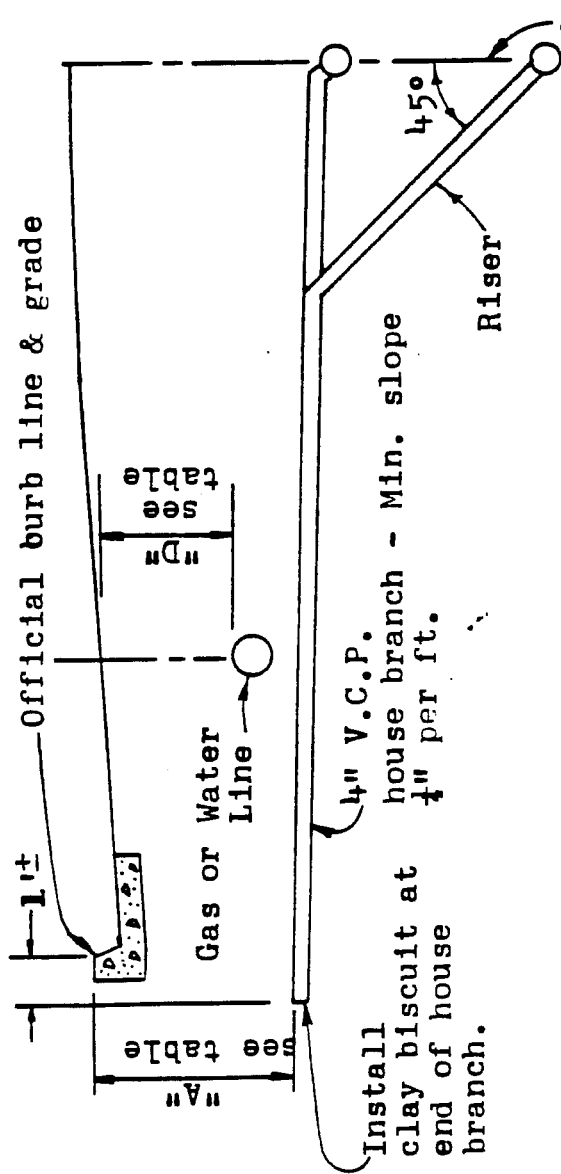
REVISED
DATE

IMPROVEMENT STANDARD

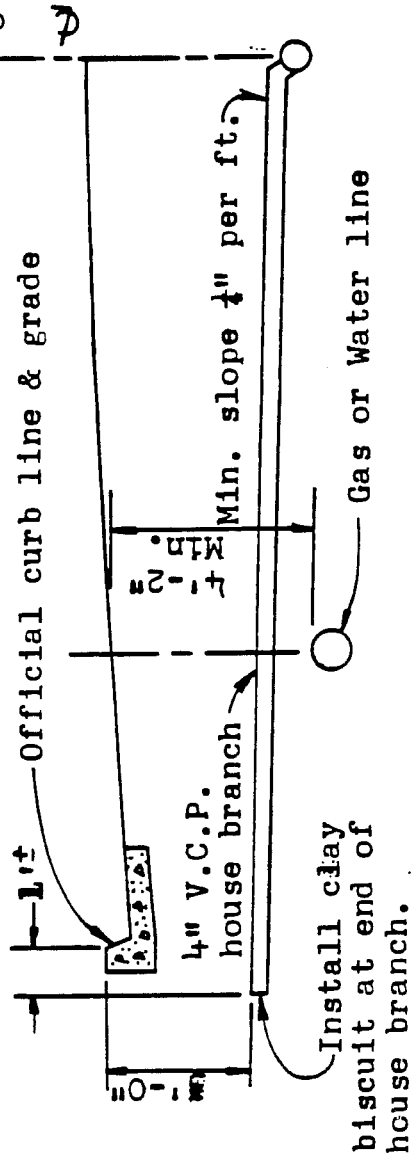
S-2

Date: 10-66

MIN. DEPTH OF HOUSE BRANCH IF SEWER INSTALLATION PRECEDES INSTALLATIONS OF WATER AND GAS



MIN. DEPTH OF WATER OR GAS MAIN IF INSTALLATION OF WATER OR GAS MAIN PRECEDES INSTALLATION OF SEWERS



	A	D
6" Water or gas main	3.6'	2.5'
8" " " "	3.9'	2.6'
10" " " "	4.3'	2.9'
12" " " "	4.6'	3.1'

"A" & "B" dimensions are set to allow ϕ .6' clearance between sewer and water lines.

Extend house branches 1'± beyond sidewalk if to be under combination curb and walk.

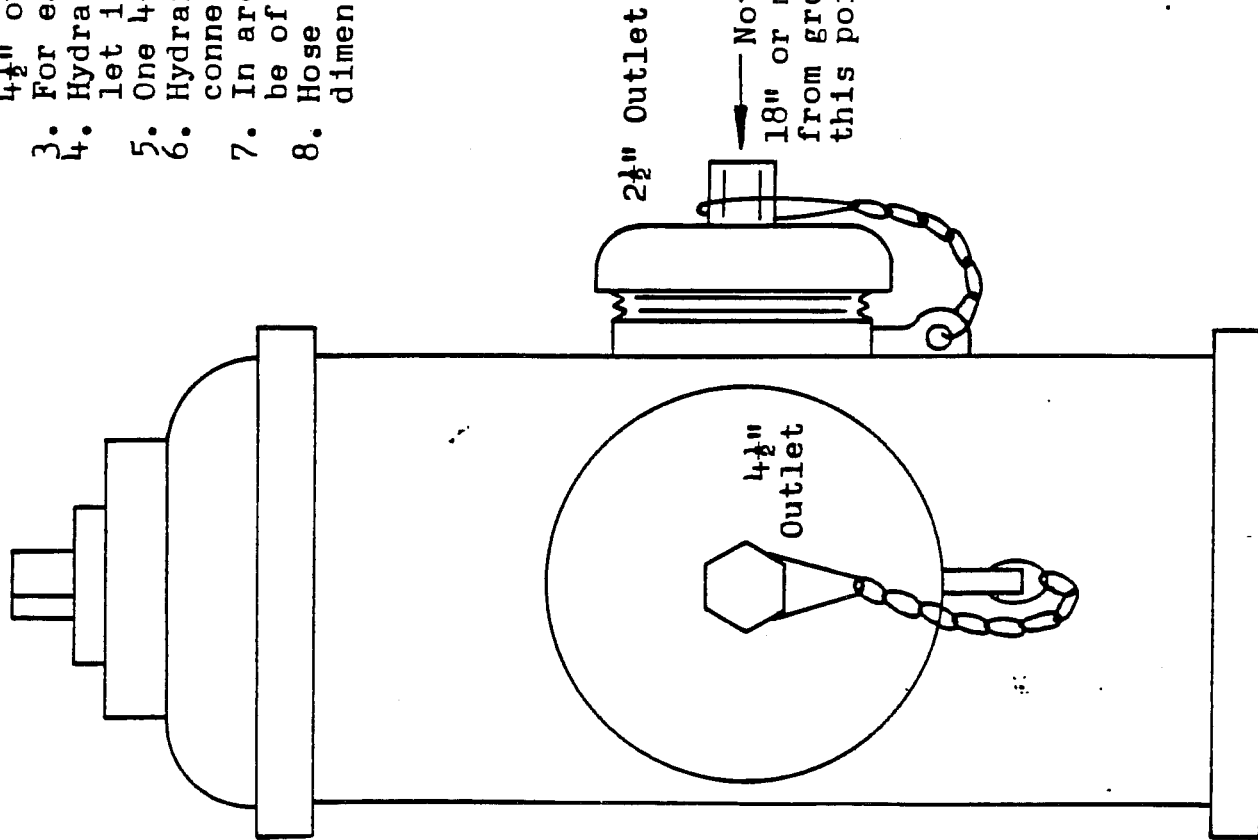
Extend house branches in streets 1'± inside curb.

Extend house branches in alley to property line.

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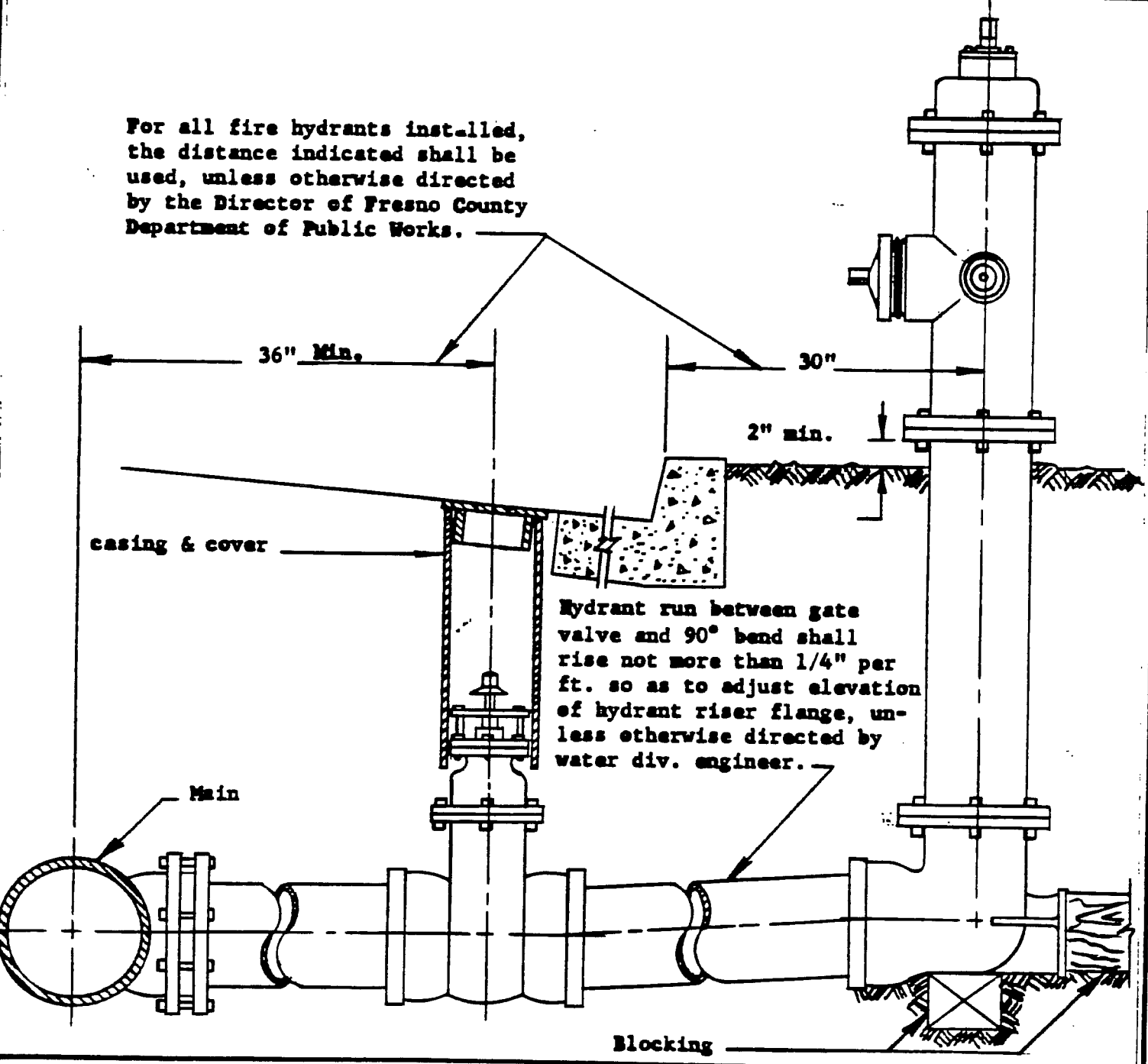
CONSTRUCTION DETAILS
FOR TYPICAL HOUSE BRANCH

1. Each hydrant must be gated between hydrants and street main.
2. Each Hydrant shall be placed in such a manner that the $4\frac{1}{2}$ " outlets face the street.
3. For easy access to fire engines $2\frac{1}{4}$ " from curb $6\frac{1}{2}$ " street.
4. Hydrants shall have at least one $4\frac{1}{2}$ " and one $2\frac{1}{4}$ " outlet in residential areas.
5. One $4\frac{1}{2}$ " and two $2\frac{1}{4}$ " outlets if in shopping area.
6. Hydrants shall be of steamer type with a barrel and connection to main of not less than 6" in diameter.
7. In area of prolonged freezing temperatures barrel must be of dry type.
8. Hose threads on outlets should be National Standard dimensions.



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DATE	

For all fire hydrants installed, the distance indicated shall be used, unless otherwise directed by the Director of Fresno County Department of Public Works.



casing & cover

36" Min.

30"

2" min.

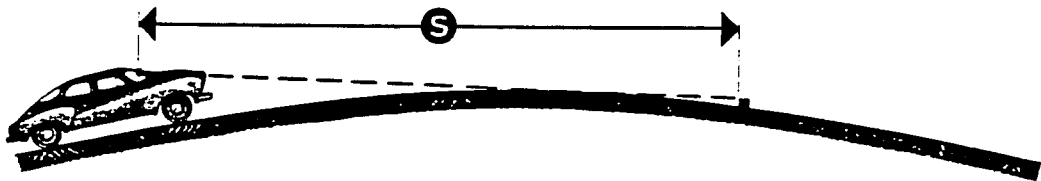
Main

Hydrant run between gate valve and 90° bend shall rise not more than 1/4" per ft. so as to adjust elevation of hydrant riser flange, unless otherwise directed by water div. engineer.

Blocking

STOPPING SIGHT DISTANCE ON CREST VERTICAL CURVES

*Height of eye 3.75 feet
Height of object 0.50 feet*



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

WHEN S > L

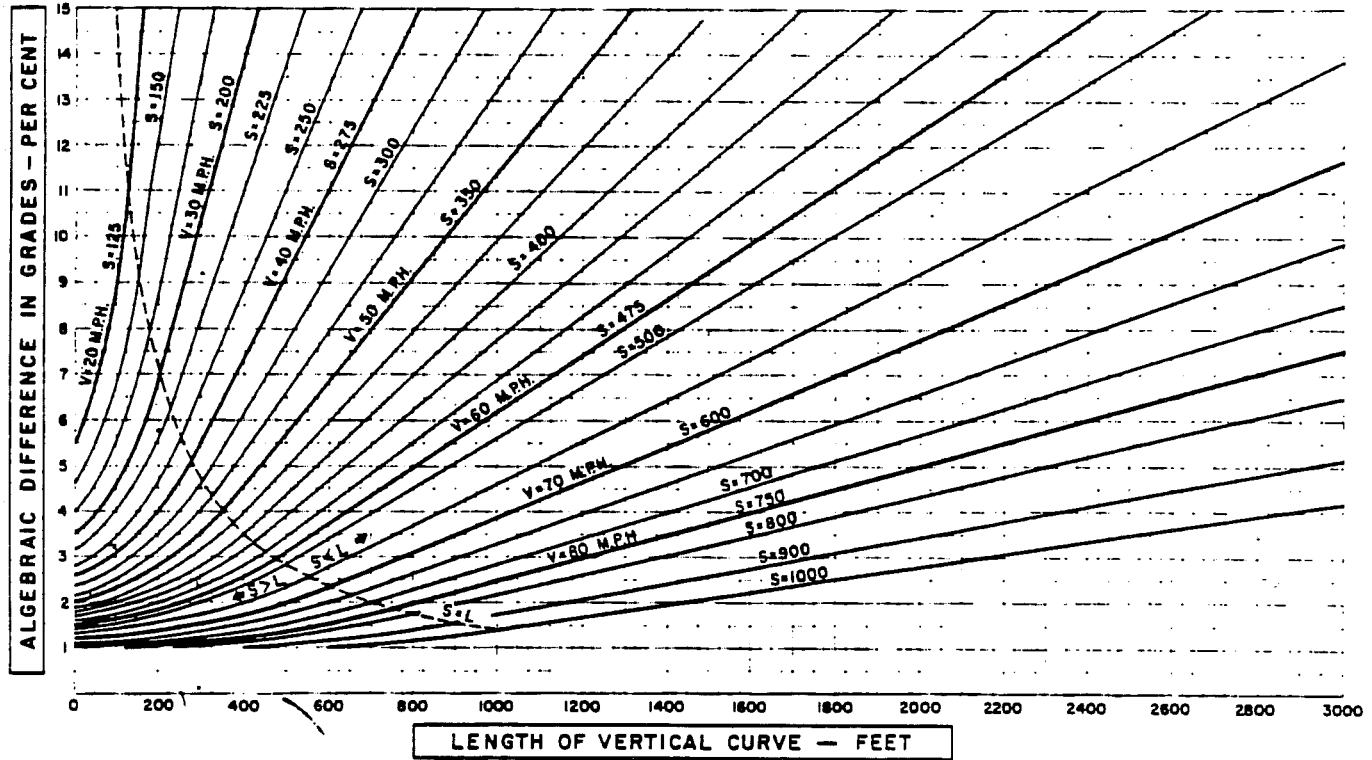
$$L = 2S - \frac{1398}{A}$$

WHEN S < L

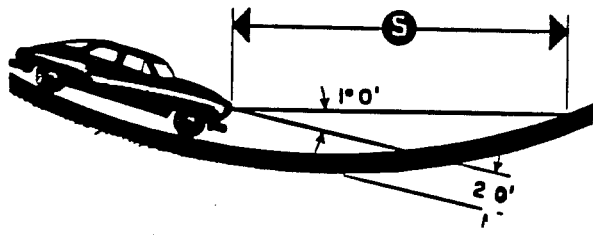
$$L = \frac{AS^2}{1398}$$

DESIGN SPEED M.P.H.	SIGHT DISTANCE FEET
30	200
40	275
50	350
60	475
65	550
70	600
75	675
80	750

20 163



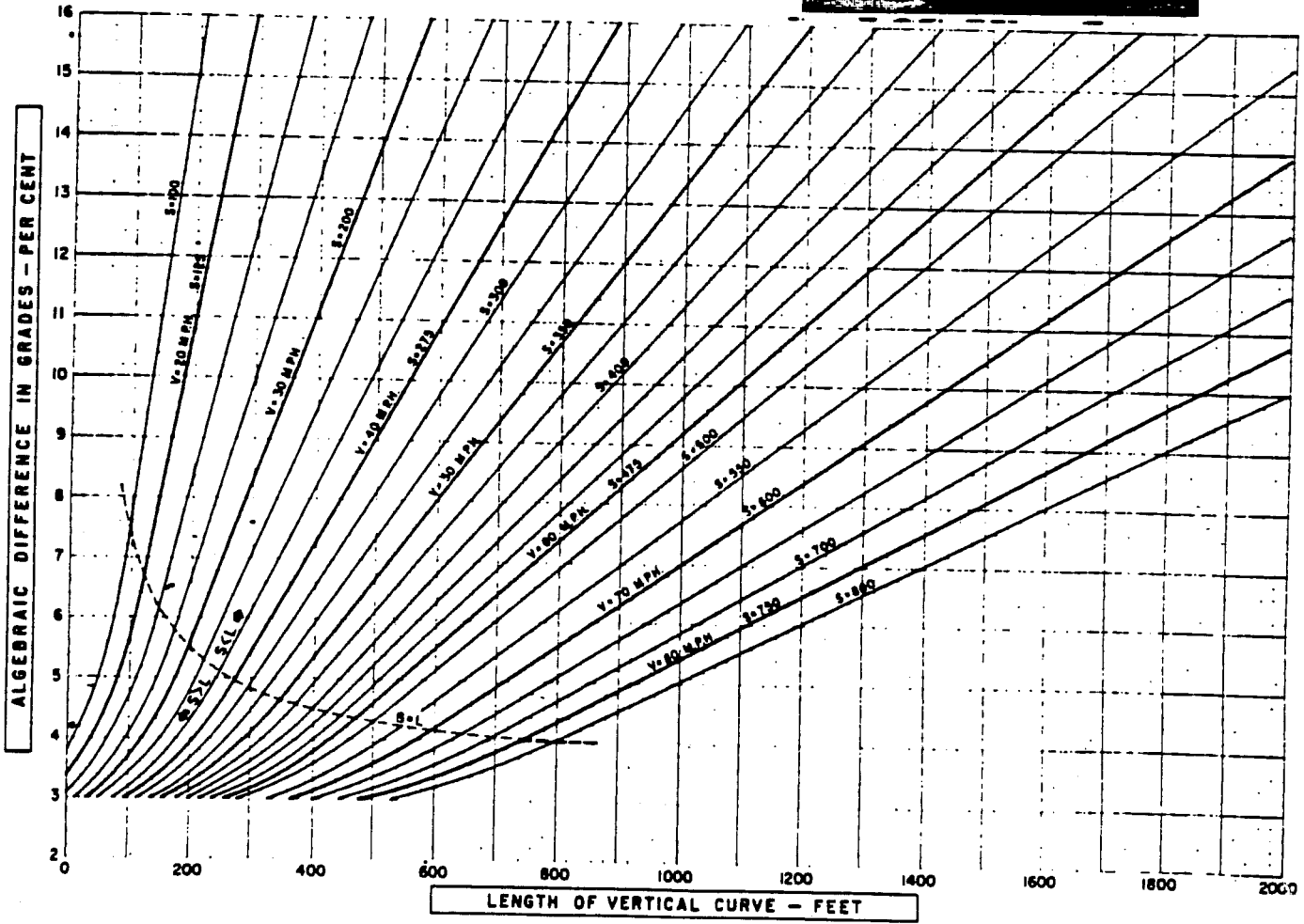
HEADLIGHT SIGHT DISTANCE ON SAG VERTICAL CURVES



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

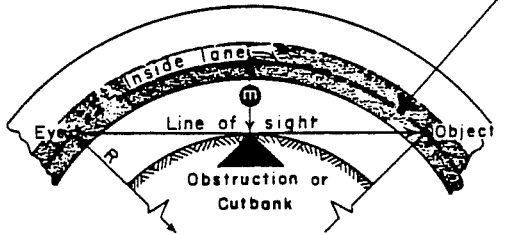
WHEN $S > L$	WHEN $S < L$
$L = 2S - \frac{400 + 3.5S}{A}$	$L = \frac{AS^2}{400 + 3.5S}$

DESIGN SPEED M.P.H.	SIGHT DISTANCE FEET
30	200
40	275
50	350
60	475
65	550
70	600
75	675
80	750



STOPPING SIGHT DISTANCE ON HORIZONTAL CURVES

Sight distance (S) measured along this line



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

Line of sight is 2.0 feet above ϵ inside lane at point of obstruction

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

Angle is expressed in degrees.

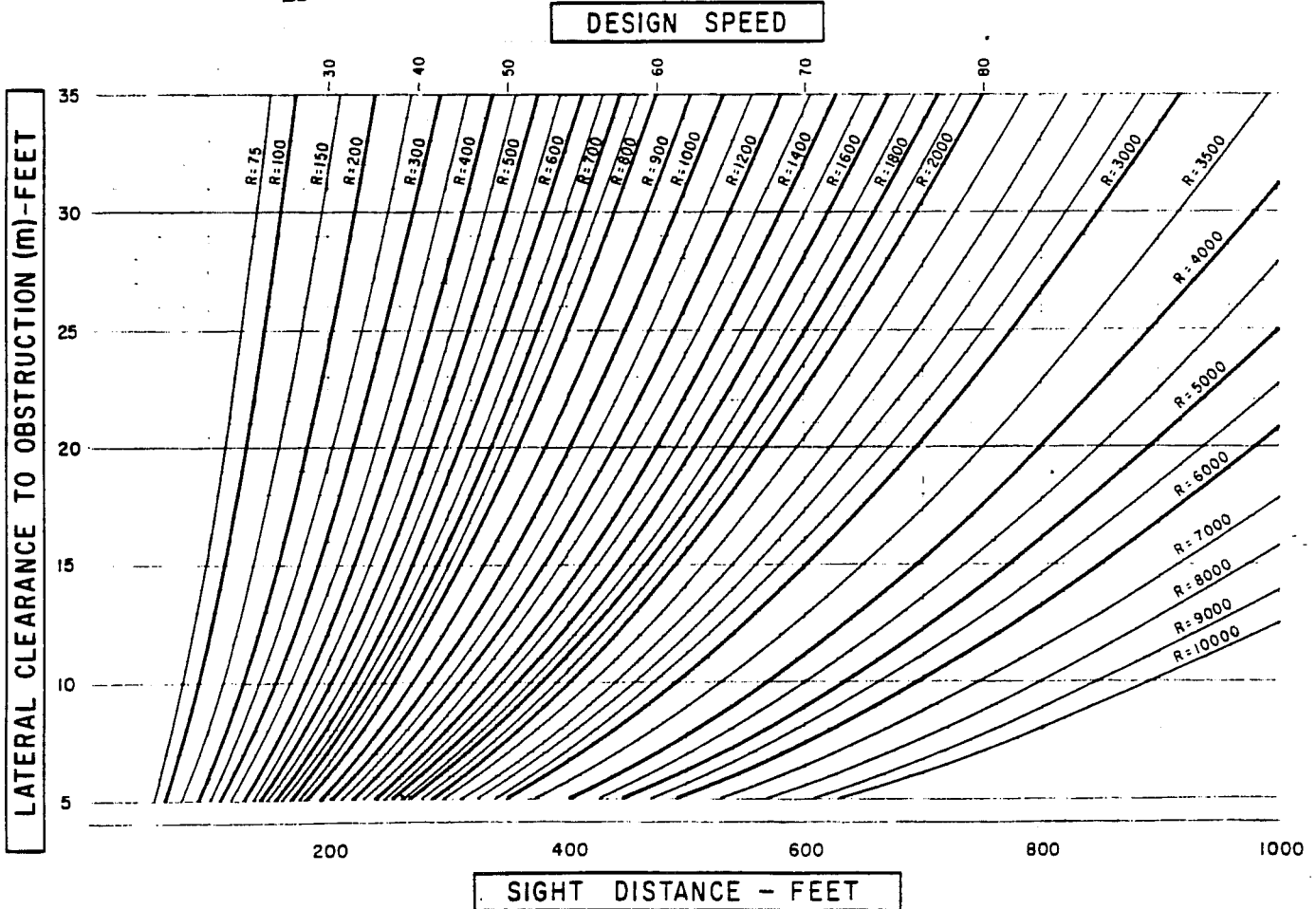
$$m = R \left[\text{vers} \left(\frac{28.65S}{R} \right) \right]$$

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

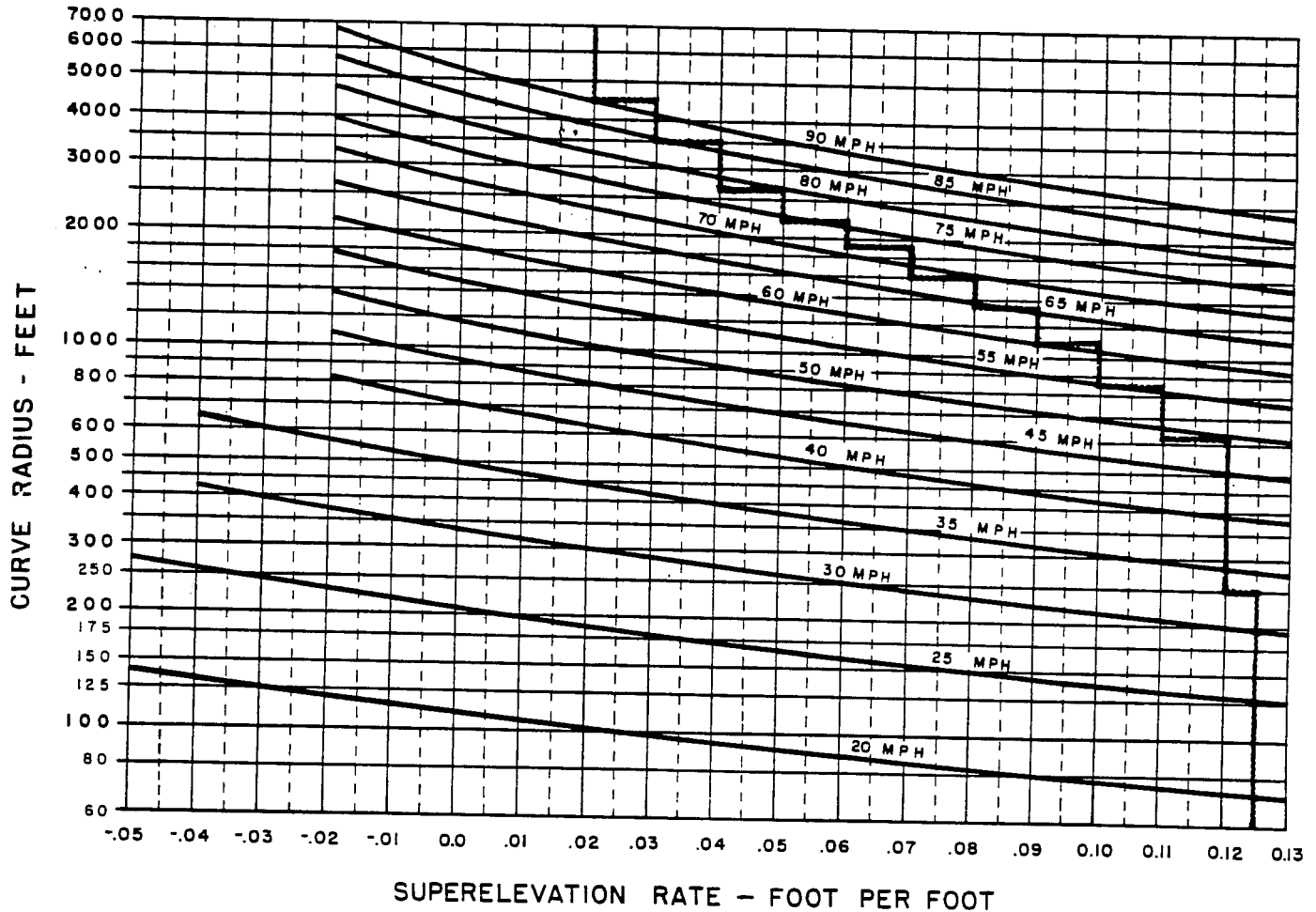
Formula applies only when S is equal to or less than length of curve.

DESIGN SPEED	SIGHT DISTANCE
M.P.H.	M.P.H. feet
30	200
40	275
50	350
60	475
65	550
70	600
75	675
80	750

20 163



SAFE SPEED ON HORIZONTAL CURVES



SPEED	FRICTION FACTOR
20	0.24
30	0.18
40	0.15
50	0.14
60	0.13
70	0.12
80	0.11
90	0.10 (Extrapolated)

Note

Broken Line indicates superelevation rate. Higher value at steps is the proper superelevation for indicated curve radius.

S = SUPERELEVATION
 F = FRICTION FACTOR
 V = SPEED IN MILES PER HOUR
 R = RADIUS IN FEET

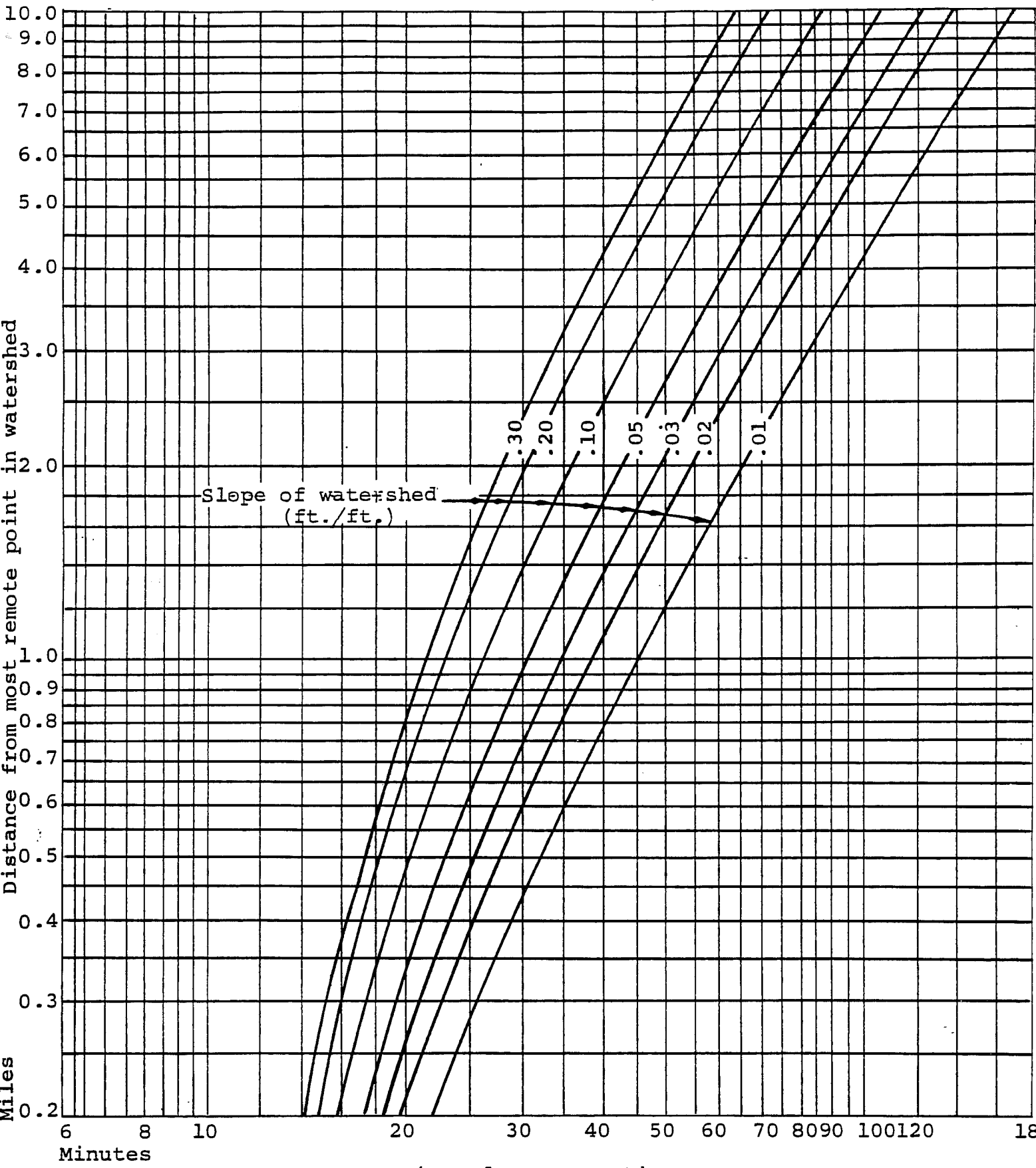
$$S + F = \frac{0.067V^2}{R}$$

Chart for obtaining "C" in rational drainage formula $Q=CiA$, for Rural Areas.
 C normally falls between .30 & .55, .55 to .75 is high, above .75 is extreme and below .30 is low. Add partial factors for relief, soil, cover and storage to obtain total C factor;

Example: Flat terrain .08 to .12
 Clay soil .11 to .15
 No cover .15 to .19
 Normal storage $\frac{.06 \text{ to } .11}{.40 \text{ to } .57}$
 C=

DESIGNATION OF WATERSHED CHARACTERISTICS		DESCRIPTION AND RANGE OF RUNOFF PRODUCING CHARACTERISTICS			
Relief	.30 to .38 Steep rugged terrain-average slopes above 40%.	.22 to .30 Hilly to mountainous terrain-average slopes between 15 and 40%.	.12 to .22 Rolling to hilly terrain-average slopes from 6 to 15%.	.08 to .12 Flat to mildly rolling terrain-average slopes less than 6%.	
Soil	.15 to .19 No effective soil cover-either rock or thin soil mantle of poor to negligible infiltration capacity.	.11 to .15 Slow to take up water-clay or other soil with fair to poor infiltration capacity.	.06 to .11 Normal-permeable soils of good depth with good to fair infiltration capacity.	.04 to .06 Soils of good to excellent infiltration capacity-sands, loamy sands, and other loose open soils.	
Vegetal Cover	.15 to .19 No effective plant cover-bare to very sparse cover.	.11 to .15 Fair to sparse cover-clean cultivated crops or poor natural, vegetation-less than 20% of drainage area under good cover.	.06 to .11 Good to fair cover-not more than 50% of area in clean cultivated crops or poor natural vegetation-between 20 & 65% in good grass-land, woodland or equivalent cover.	.04 to .06 Good to excellent cover-65 to 85% of area in good grassland, woodland or equivalent cover.	
Surface Storage	.15 to .19 Negligible-surface depression few and shallow-drainage ways steep and narrow-no ponds or marshes.	.11 to .15 Low- only fair amount of surface depression storage well defined system of small drainage ways-no ponds or marshes.	.06 to .11 Normal-fair to considerable surface depression storage-having a drainage system similar to that of prairie lands-small amount of lakes, ponds, and	.04 to .06 High-large amount of surface depression storage drainage system not sharply defined-large flood plain storage or a large number of lakes, ponds,	

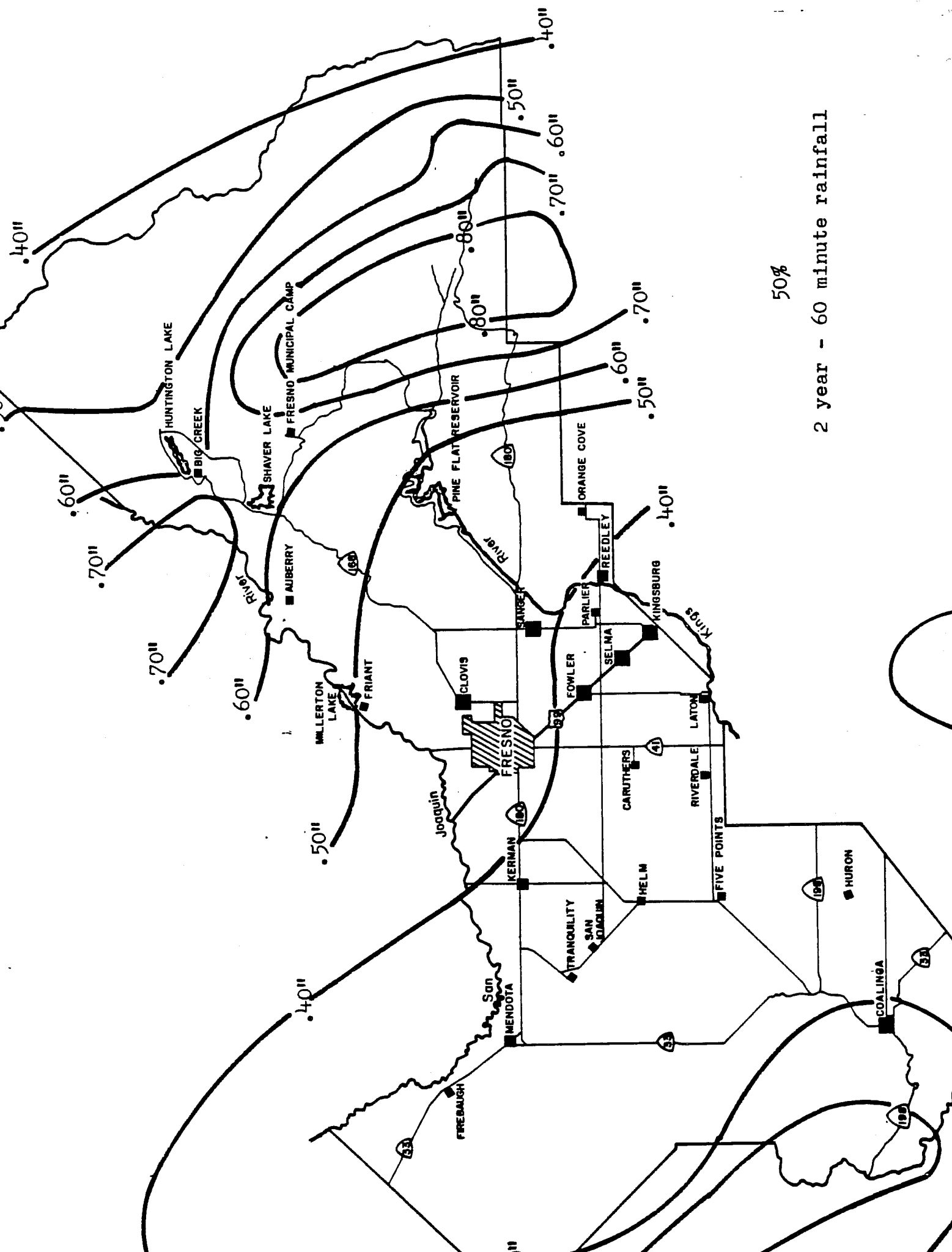
Time of Concentration



Time of Concentration

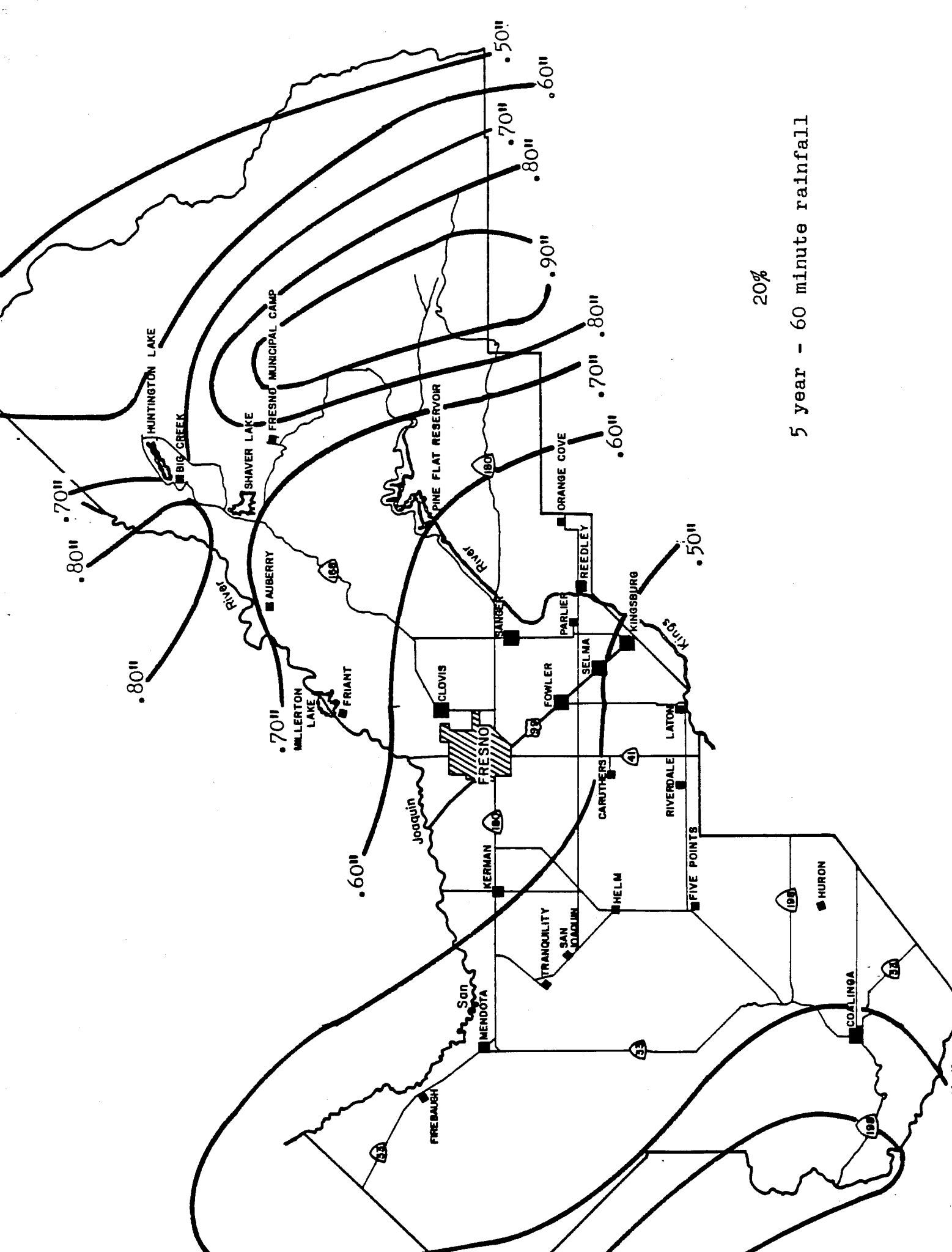
Note: Derived for rural areas where vegetal cover is light. Increase time of concentration for heavy vegetal cover or decrease for more barren areas. Revision not to exceed 15 minutes.

Slope is measured by dividing the difference in elevation between the most remote point in the watershed and the culvert site by the distance between them. Slope is measured in feet per feet.



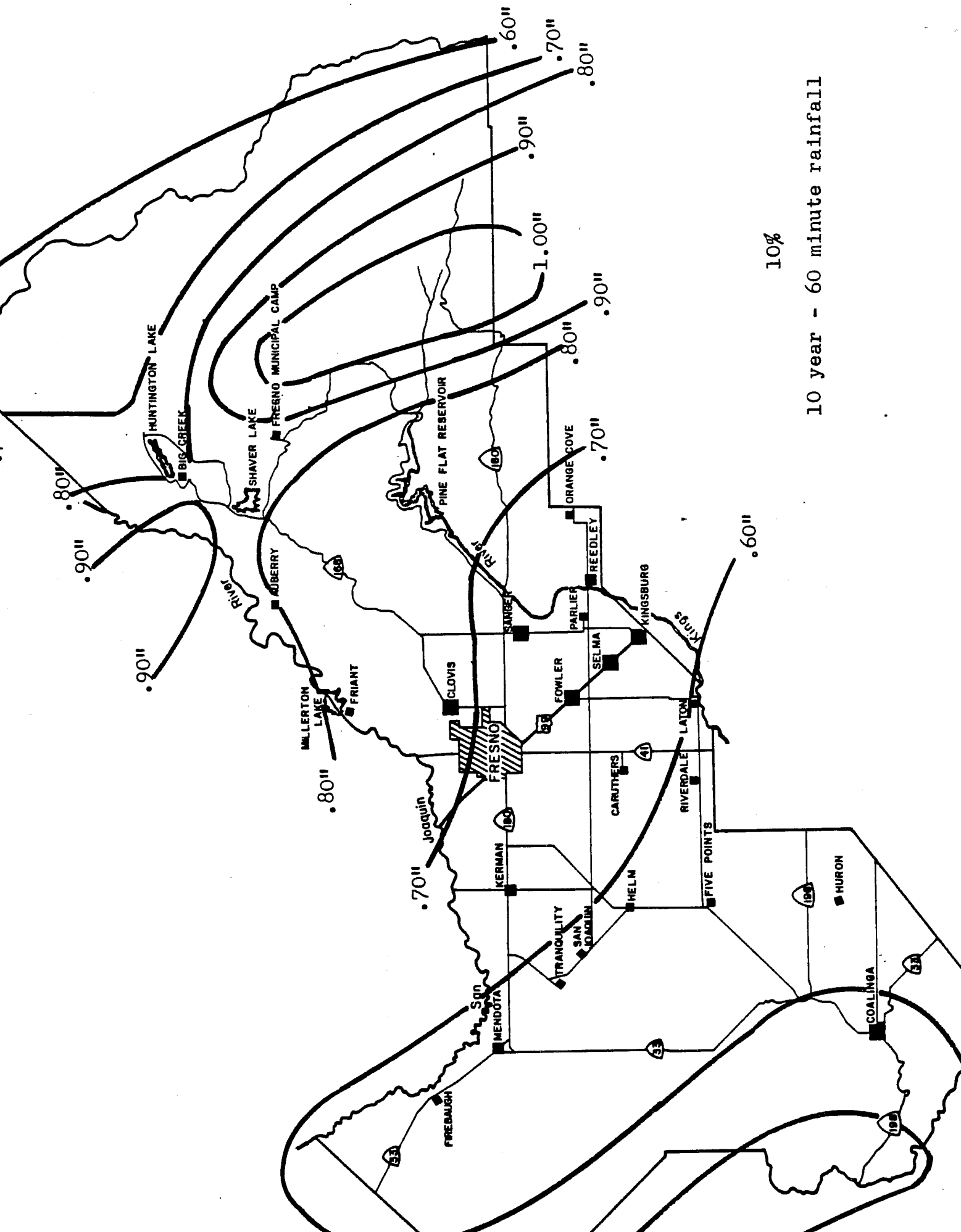
50%

2 year - 60 minute rainfall



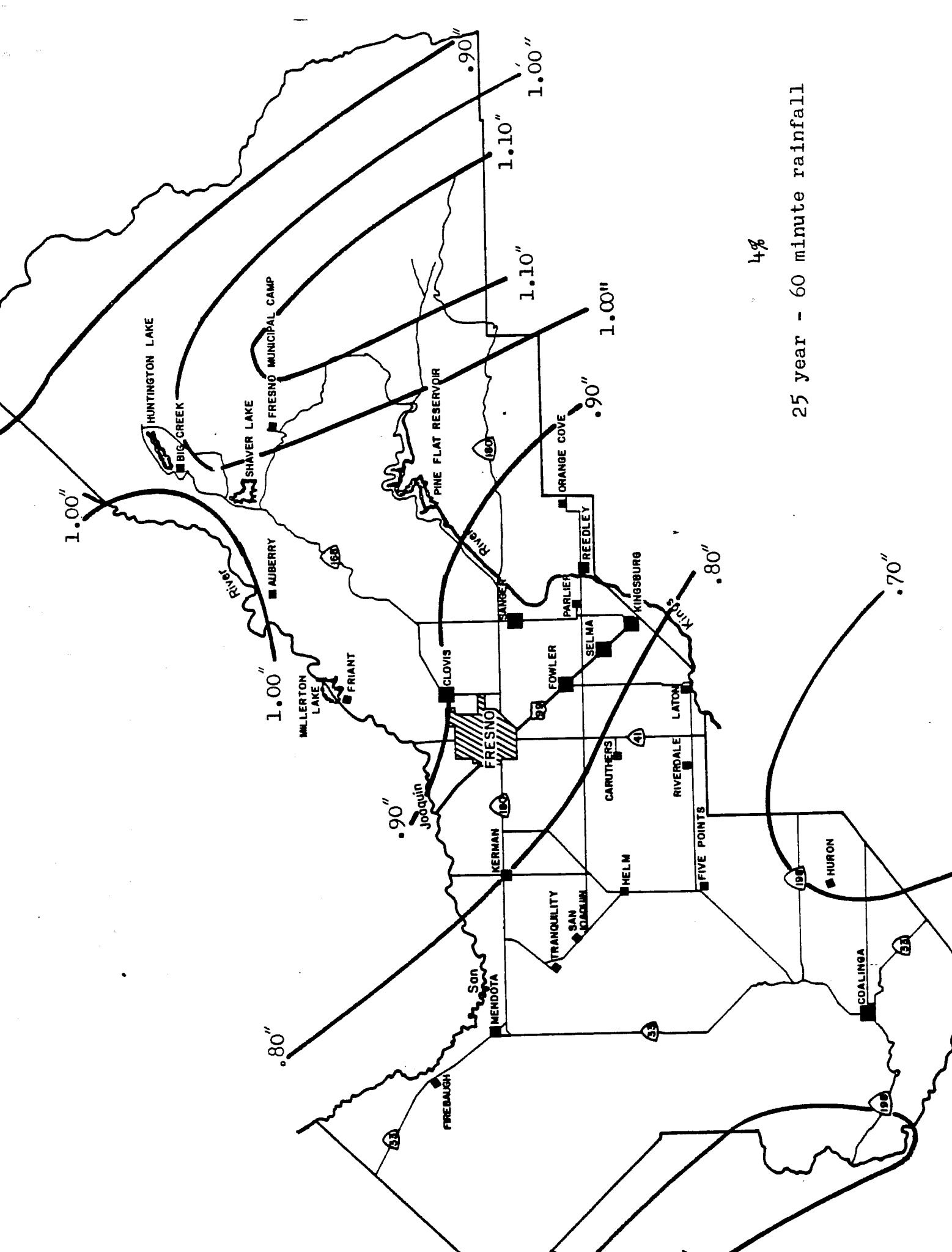
20%

5 year - 60 minute rainfall



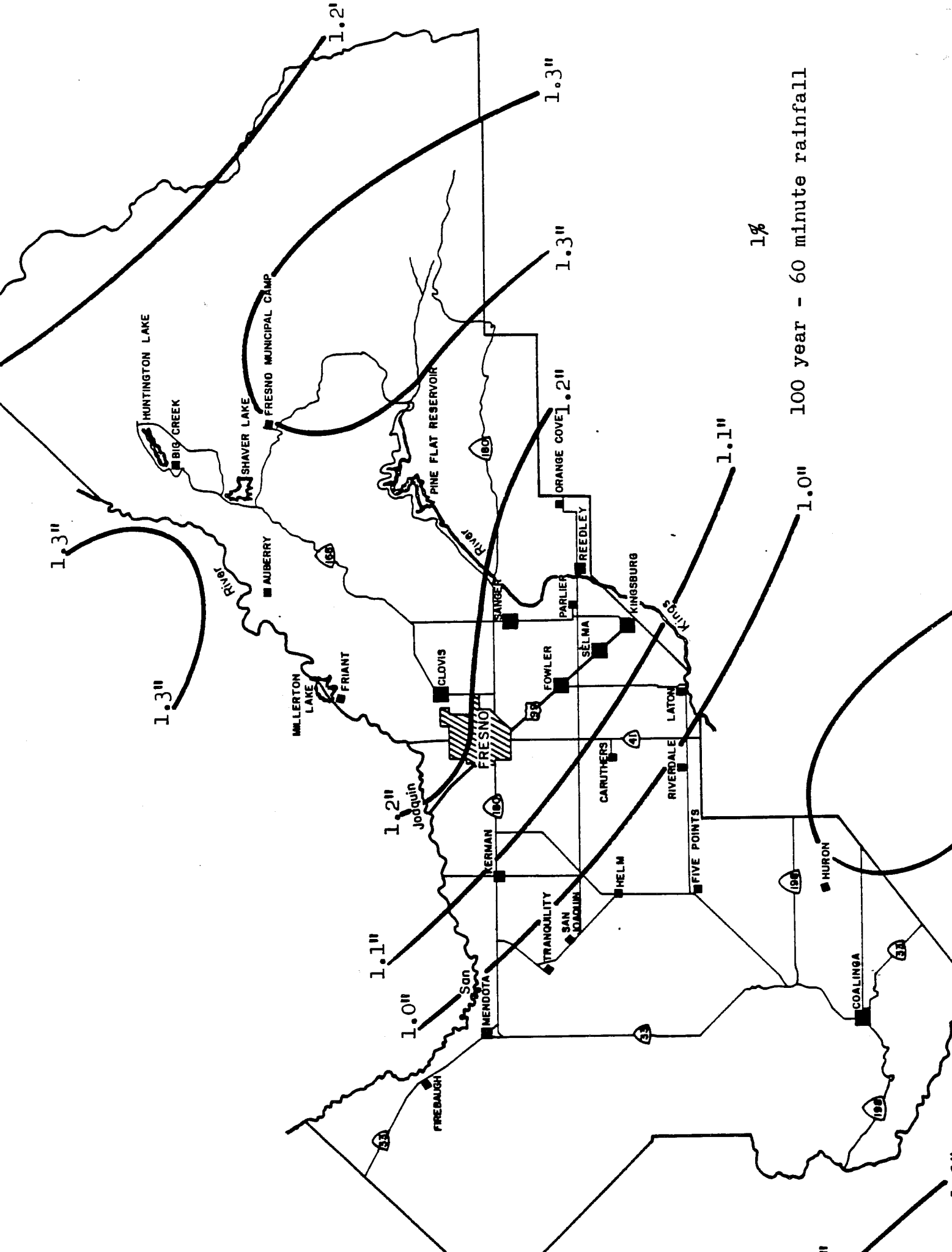
10%

10 year - 60 minute rainfall



4%

25 year - 60 minute rainfall



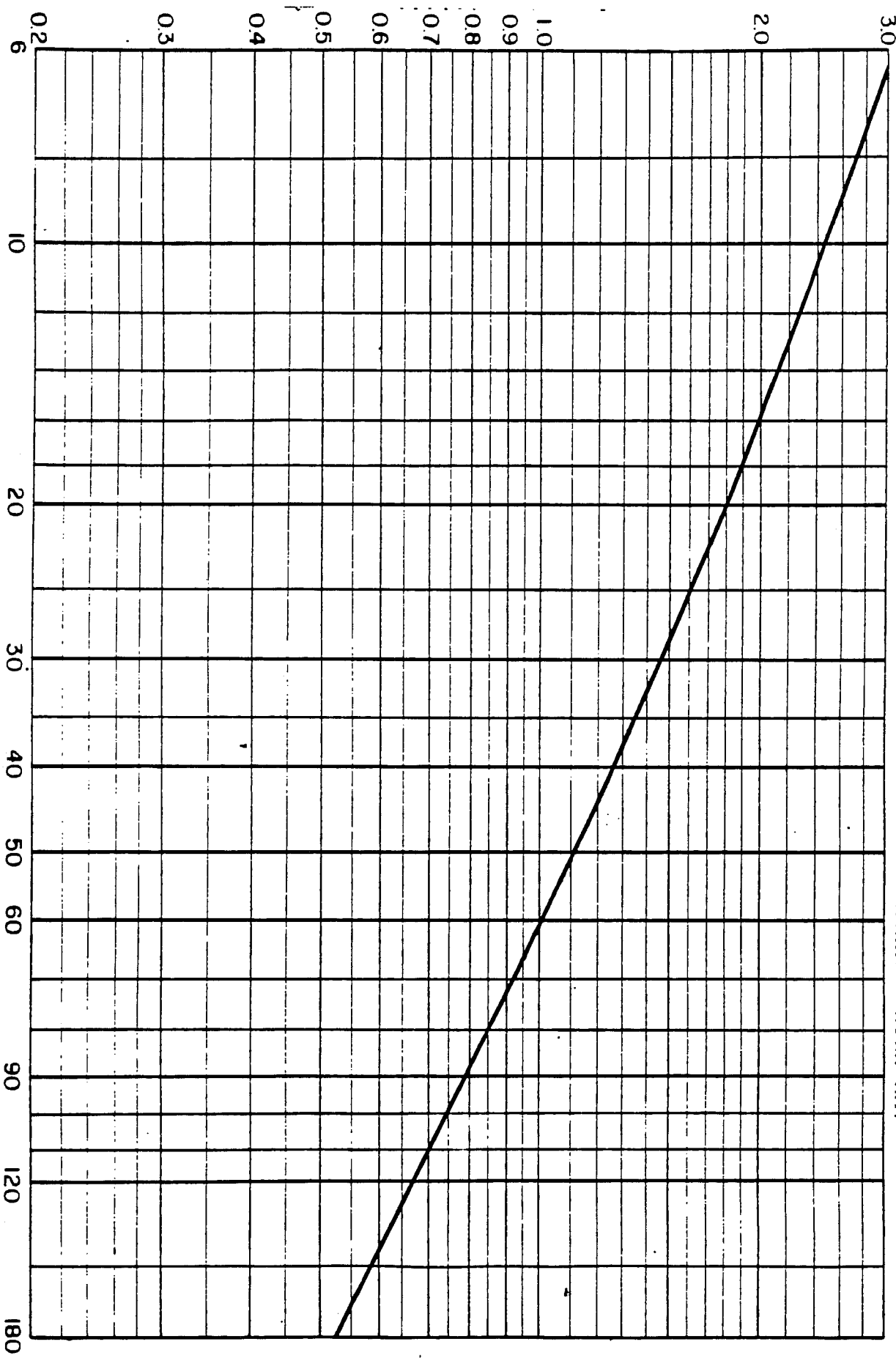
1%

100 year - 60 minute rainfall

INTENSITY DURATION FACTOR

Intensity Factor "F"

For Permanent Retention Facilities use an Intensity factor of 1.0
For 1/2 hr to 10 min retention in 100 ft of storage = 0.28 (CA)



H-8

10-66

Minutes

Duration