This video has over 40 years of Land surveying experience with it. The information provided within is only an opinion but should give you the general scope of what is covered in the Land Surveying Construction industry.

This instructional video was designed for all construction trades that work with Land Surveyors in the construction field to help aid in the understanding of what Land Surveyors Provide. Instruction of what is provided on the Land Surveyor's Stakes is the main objective and is covered in 8 Basic topics together with some common errors addressed and how to avoid them.

Topics covered

- GRADING
- STORM DRAIN
- SEWER
- WATER
- GAS AND ELECTRIC
- CURB
- FINAL MONUMENTATION / PROPERTY CORNERS
- WALLS AND FENCING
- BUILDING LAYOUT

For further information please contact DVDSURVEYOR.COM

8 BASIC PRINCIPLES

1. GRADING

2. STORM DRAIN

3. SEWER

4. WATER

5. ELECTRIC

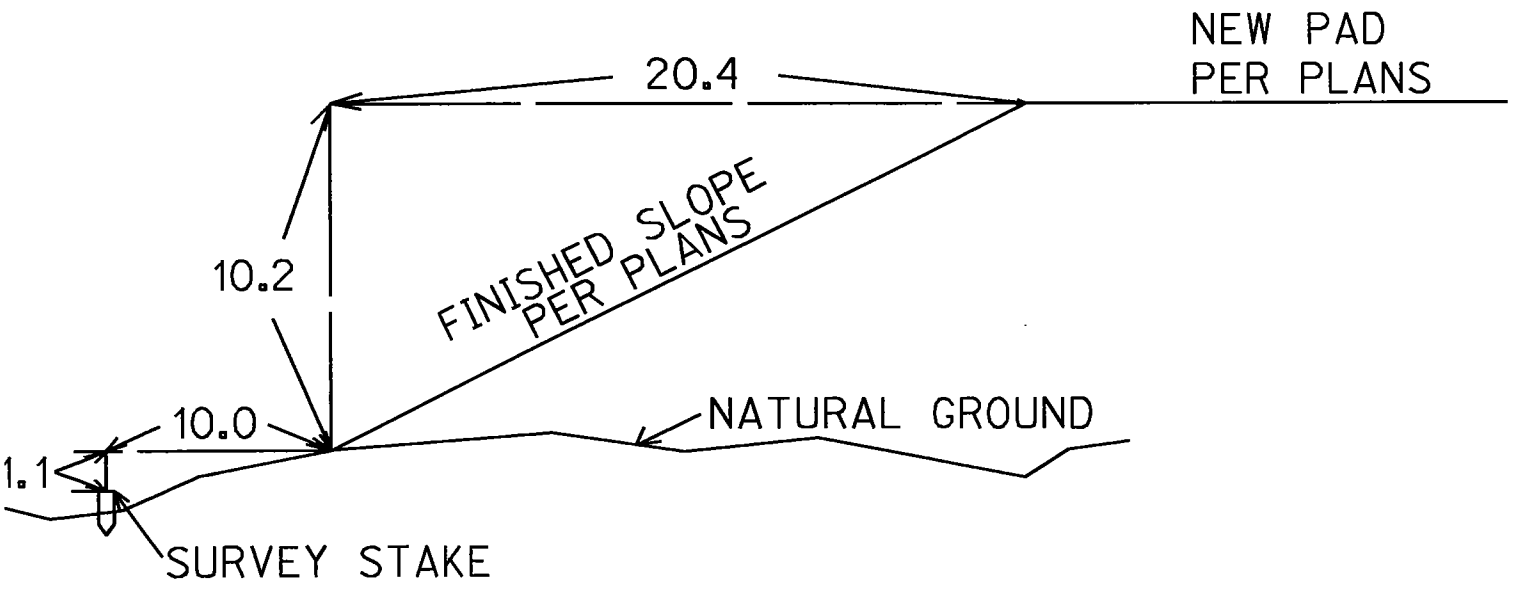
6. CURB

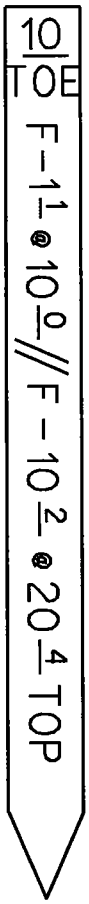
7. WALLS & FENCING

8. FINAL MONUMENTATION

FIGURE 1

GRADING - TOE STAKES



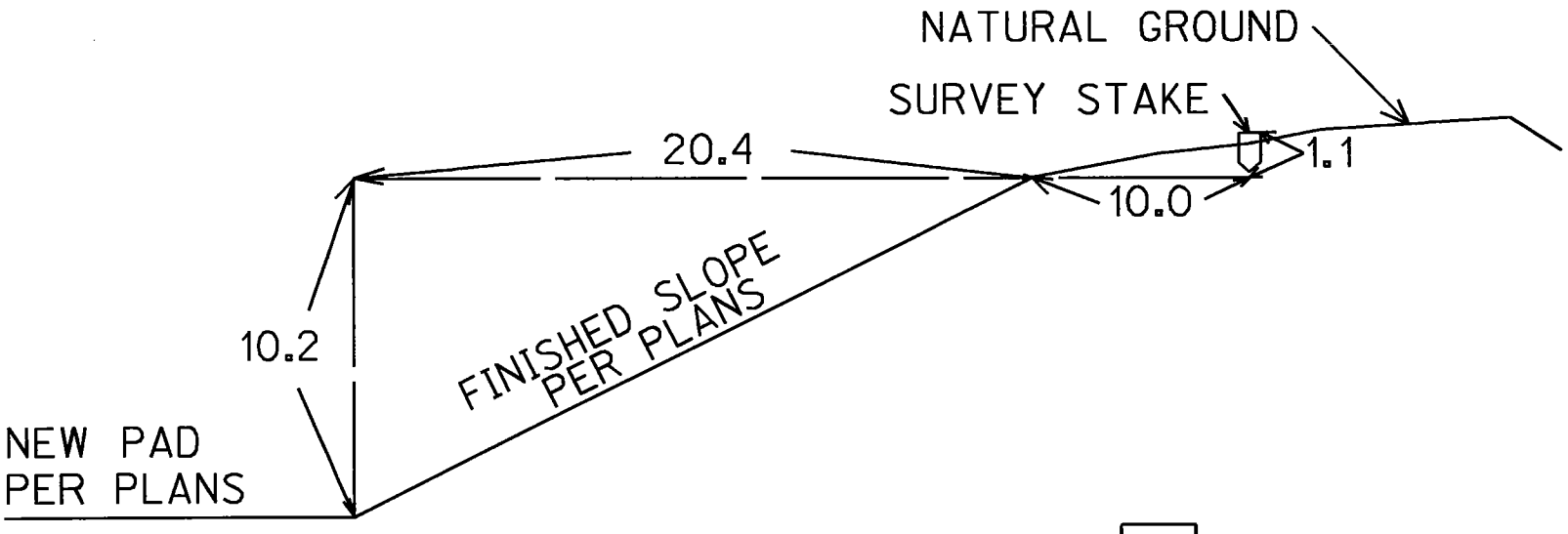


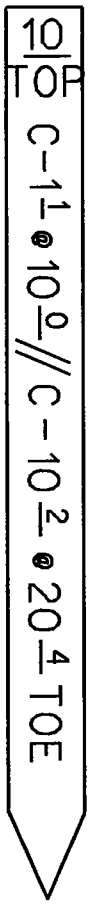
LEGEND:

TOE - TOE OF SLOPE
TOP - TOP OF SLOPE
F - FILL
// - THEN
@ - AT

FIGURE 2

GRADING - TOP STAKES



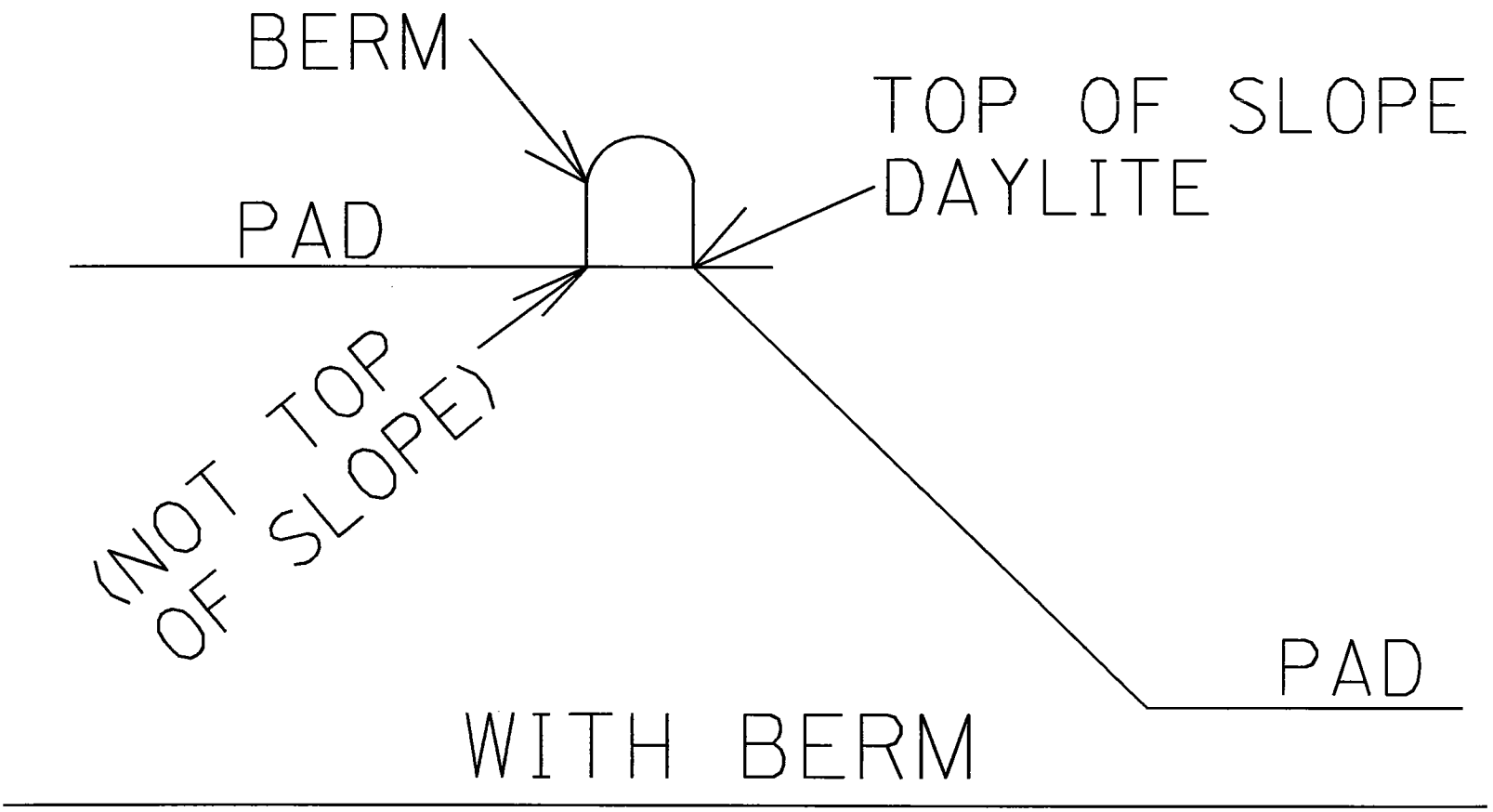


LEGEND:

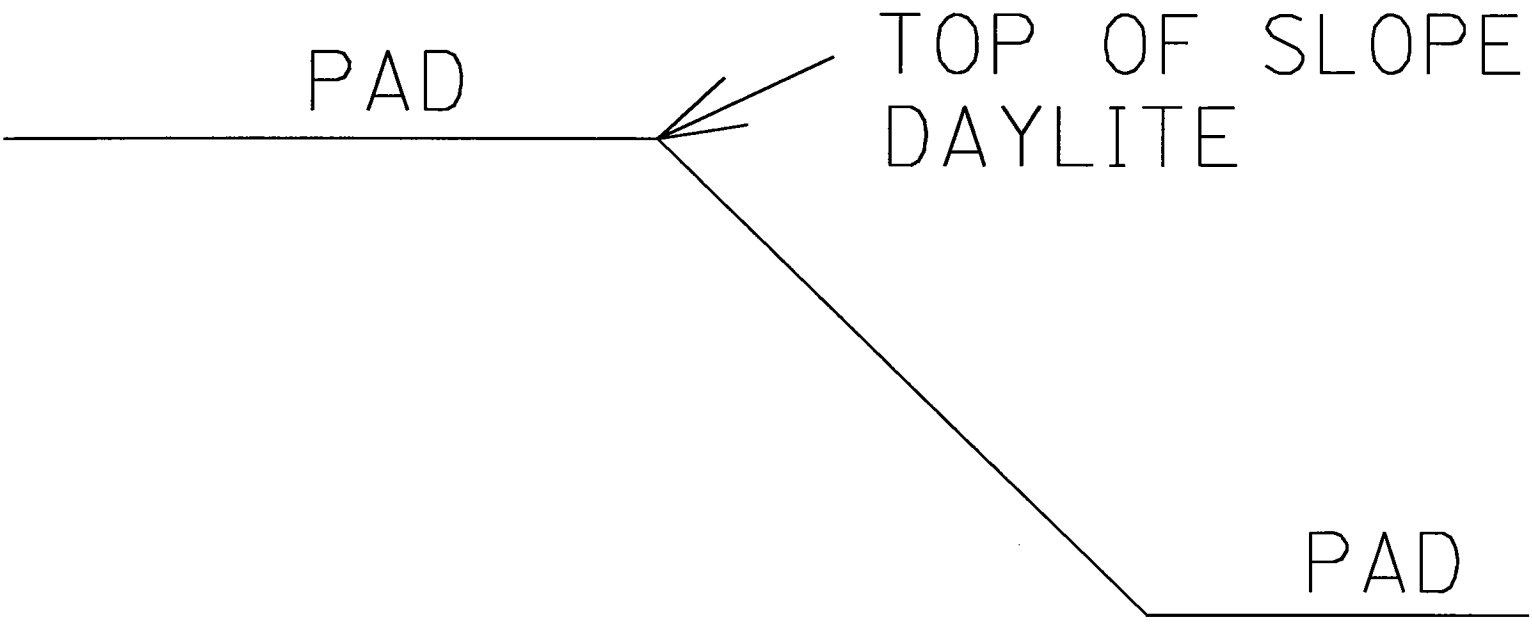
TOE - TOE OF SLOPE
TOP - TOP OF SLOPE
C - CUT
// - THEN
@ - AT

FIGURE 3

GRADING - BERM & D/L



WITH BERM



WITHOUT BERM

FIGURE 4

GRADING-SAWTOOTH

LEGEND:
TOE - TOE OF SLOPE
TOP - TOP OF SLOPE
D\L - DAYLIGHT
P\L - PROPERTY LINE

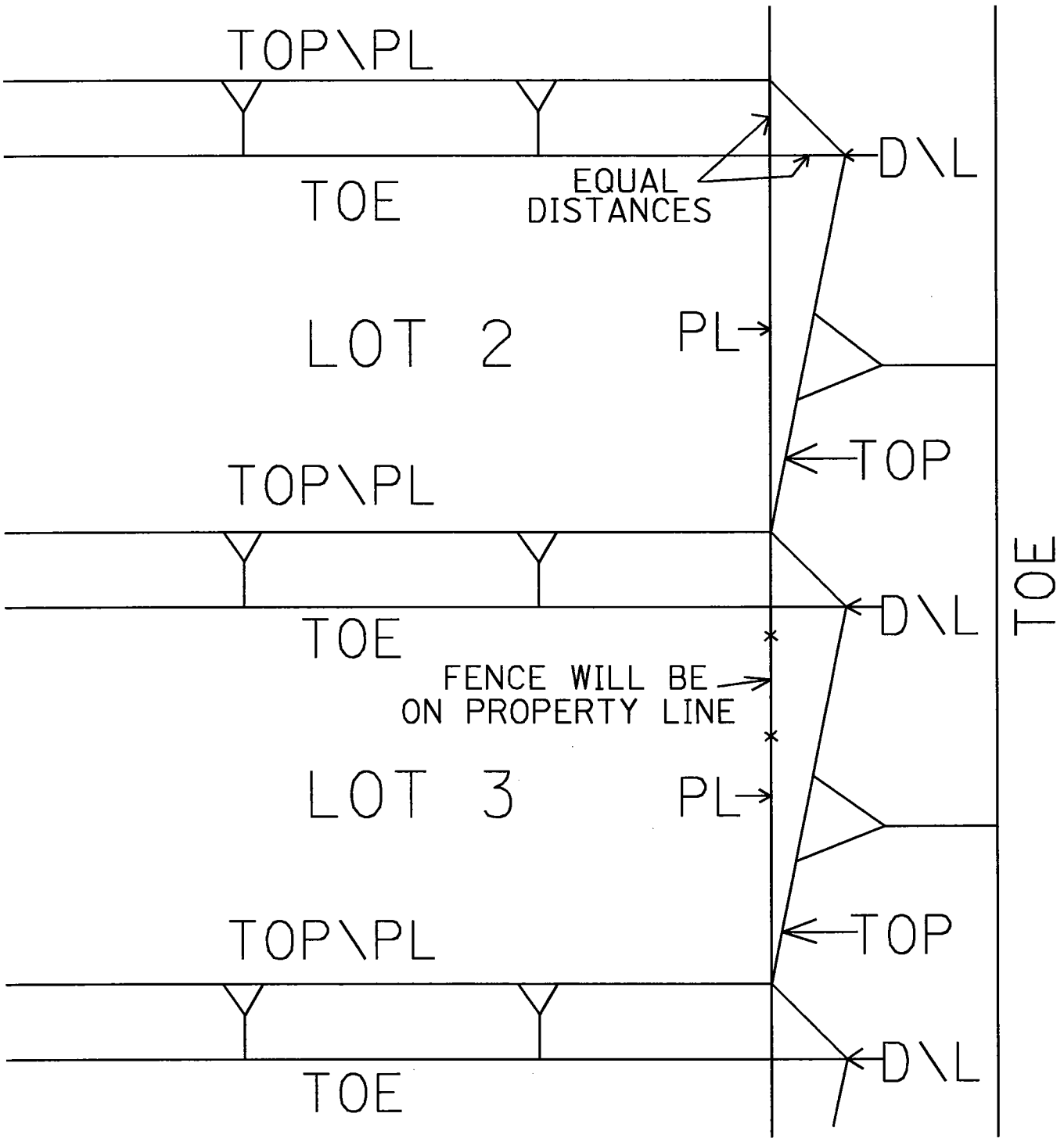
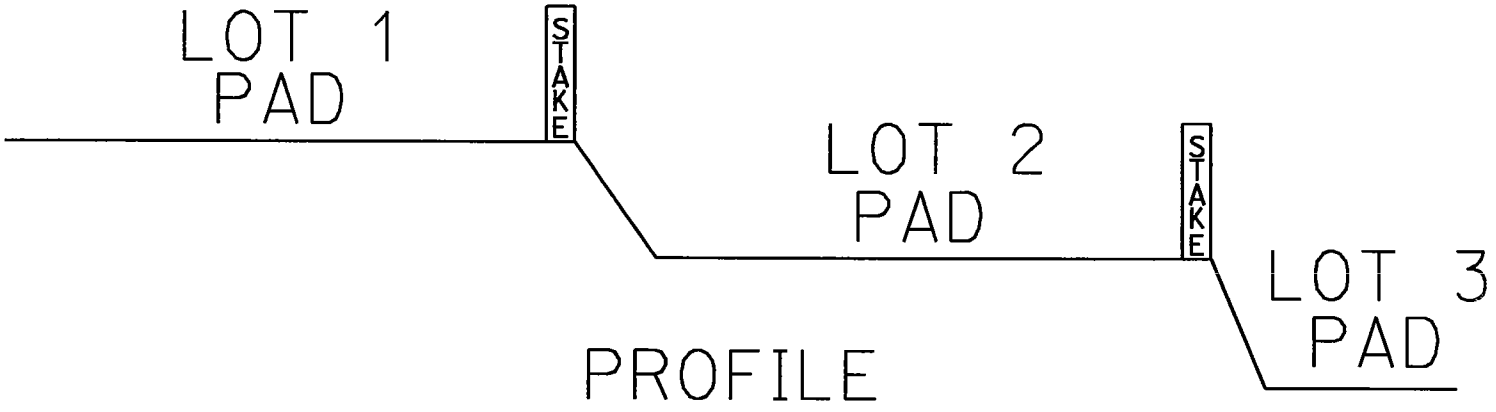
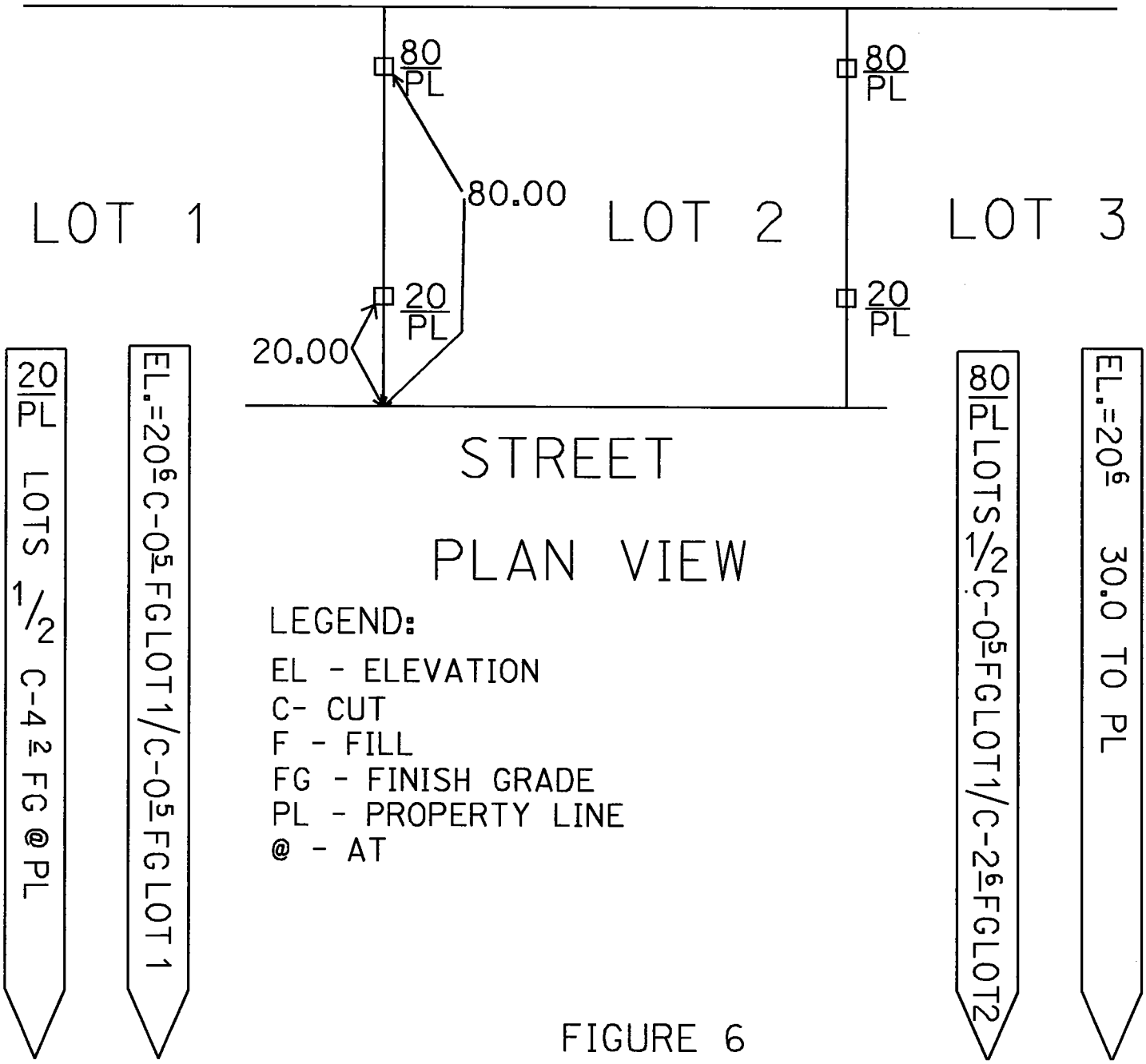


FIGURE 5

GRADING 20'S & 80'S



PROFILE



PLAN VIEW

LEGEND:

EL - ELEVATION
C- CUT
F - FILL
FG - FINISH GRADE
PL - PROPERTY LINE
@ - AT

FIGURE 6

Grading Overview

1. Perimeter grading is the first step in grade staking and involves catching the fill and cut slopes around the perimeter of the job. Perimeter stakes help delineate the job for clearing.

2. Daylight stakes are used to establish the limits of cut and fill. This is the defining line of where the grader will cut the hills and fill the canyons.

3. Remedial grading is performed to ensure that slopes are placed on suitable soil foundations to prevent future slope failures.

4. Rough grade stakes are used to assist in moving the dirt to its final location. The stakes can be referenced to property lines and centerline of streets.

5. Finish grade stakes are the fine tune stakes to get the dirt in its final position and within tolerance as required by local agencies. The distances are given to property line on streets or common lot lines.

6. Transitions and super elevations must be clearly defined on all grading and improvement plans as this is one of the biggest oversights on grading plans.

7. Grade check is the final process to validate the position of slopes, pad grades, and street positions.

STATIONING AND INTERVALS

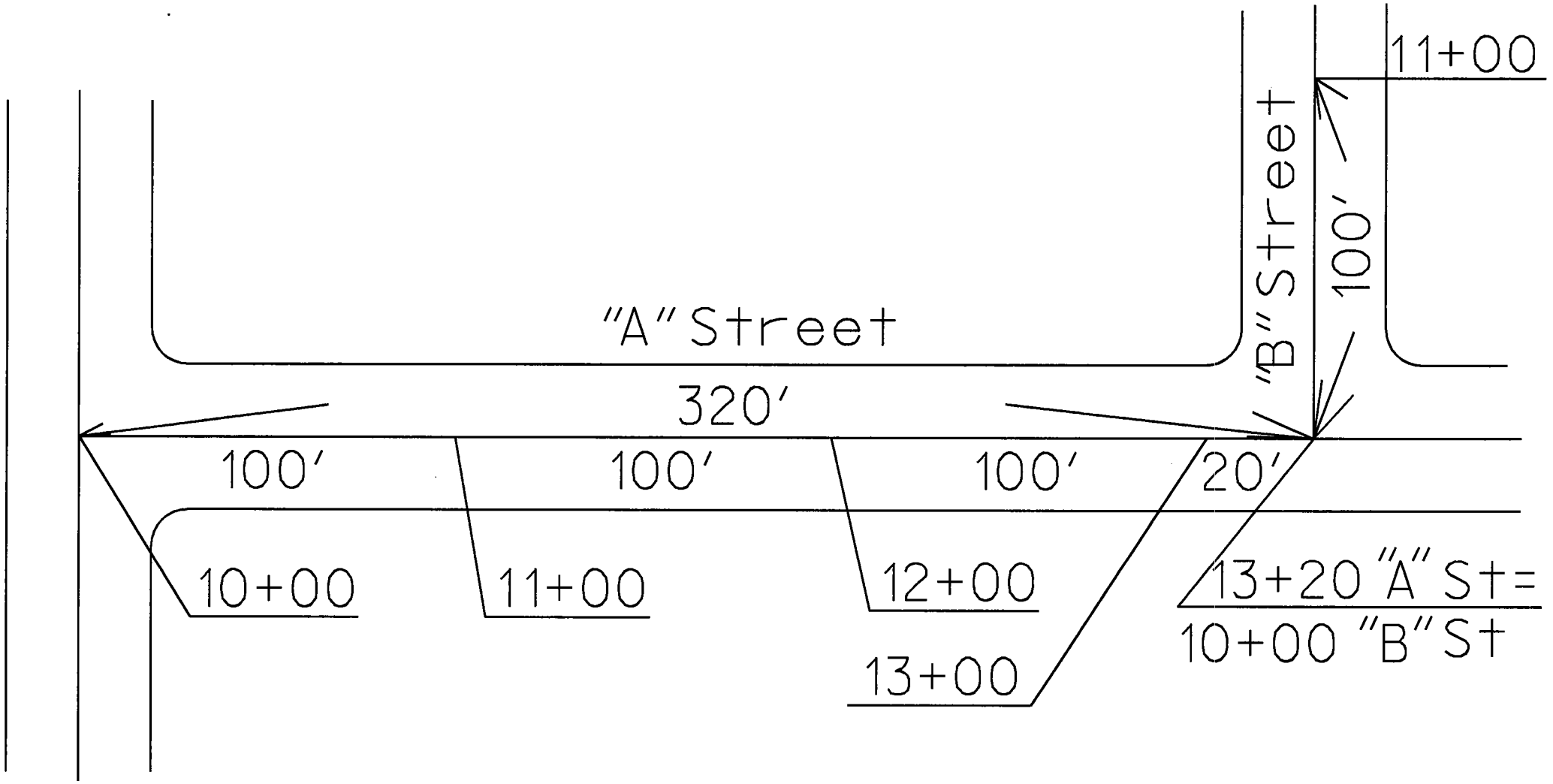
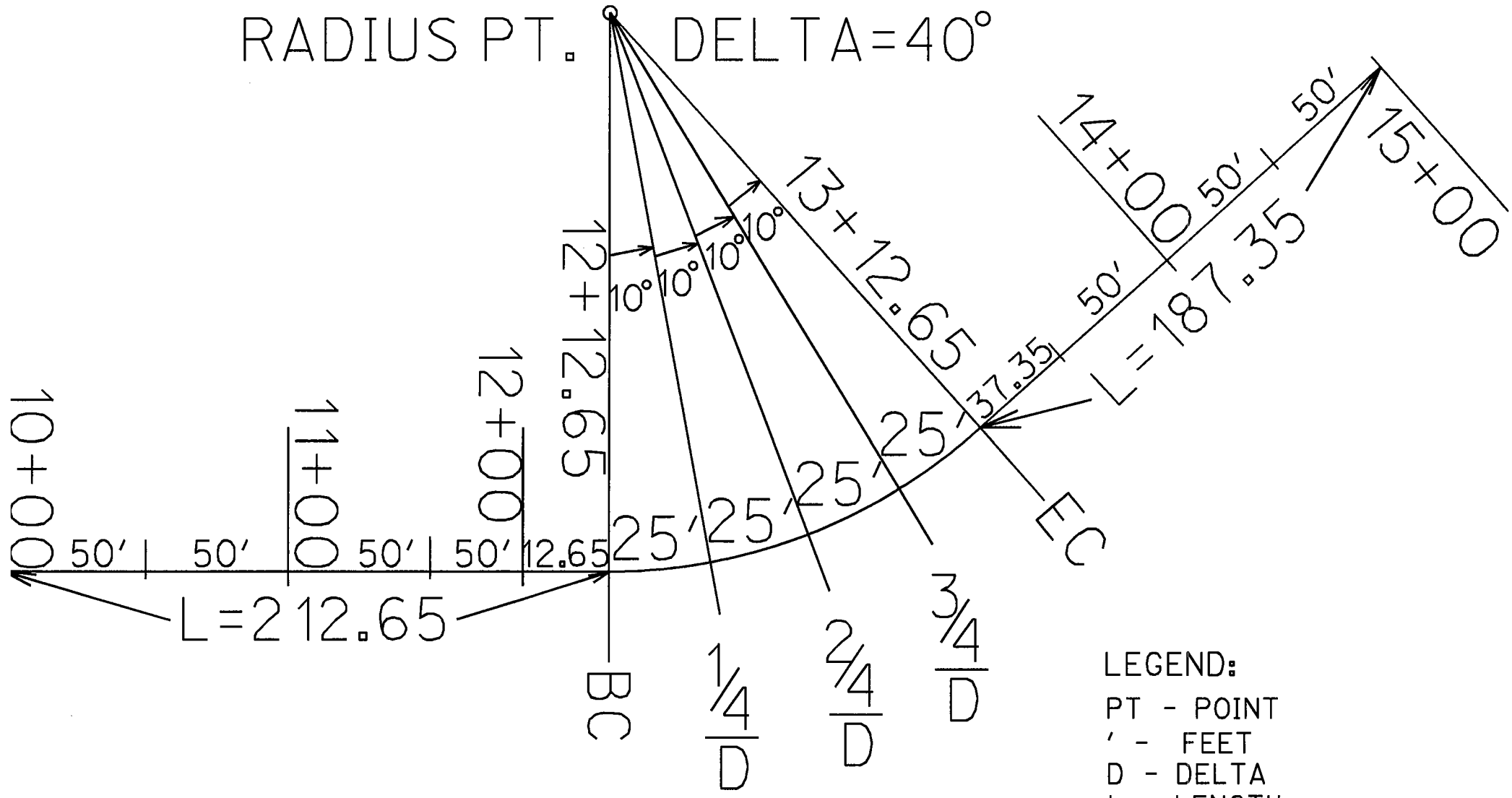


FIGURE 7

HORIZONTAL CURVE LAYOUT

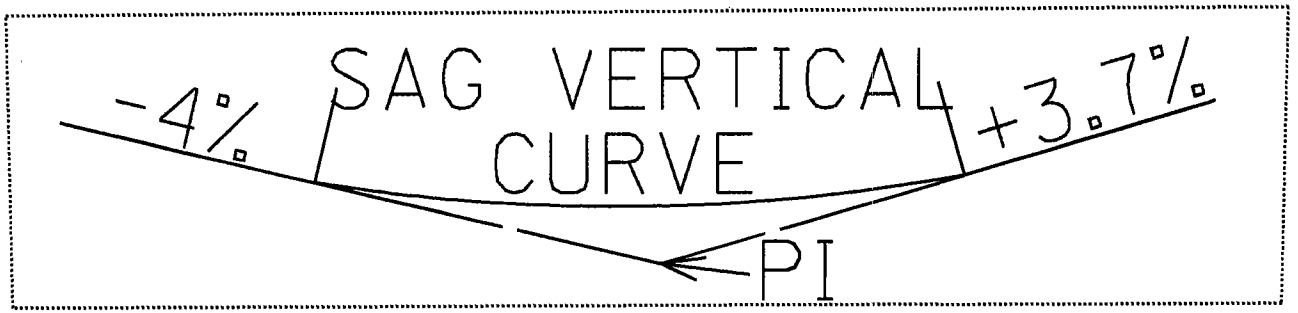


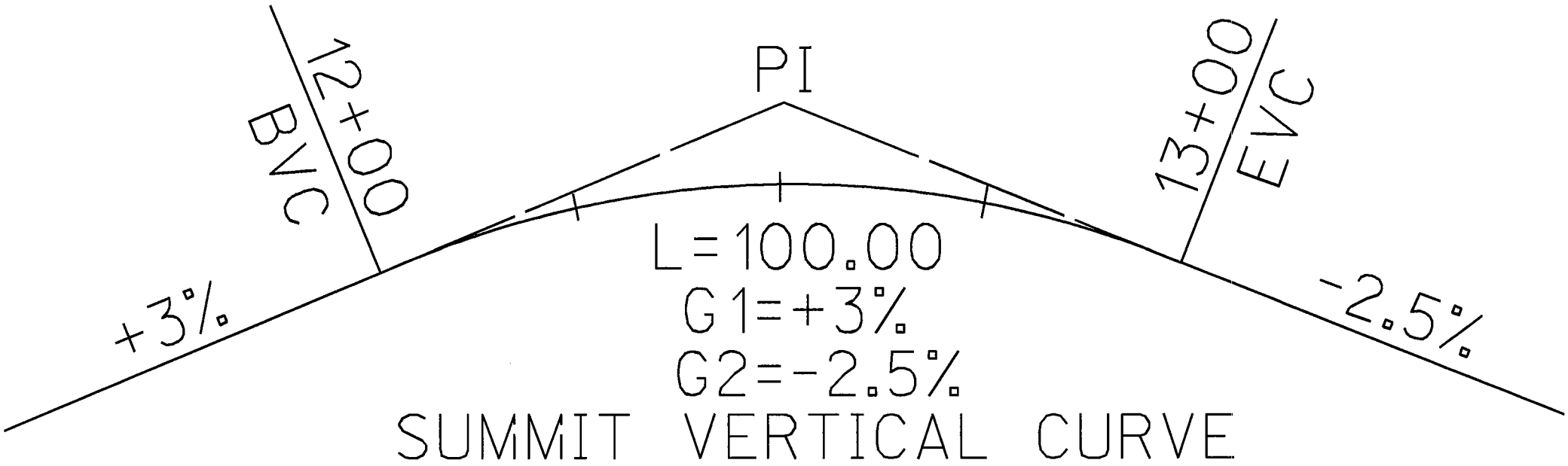
LEGEND:

PT - POINT
' - FEET
D - DELTA
L - LENGTH
BC - BEGIN OF CURVE
EC - END OF CURVE
O - DEGREES

FIGURE 8

VERTICAL CURVE LAYOUT





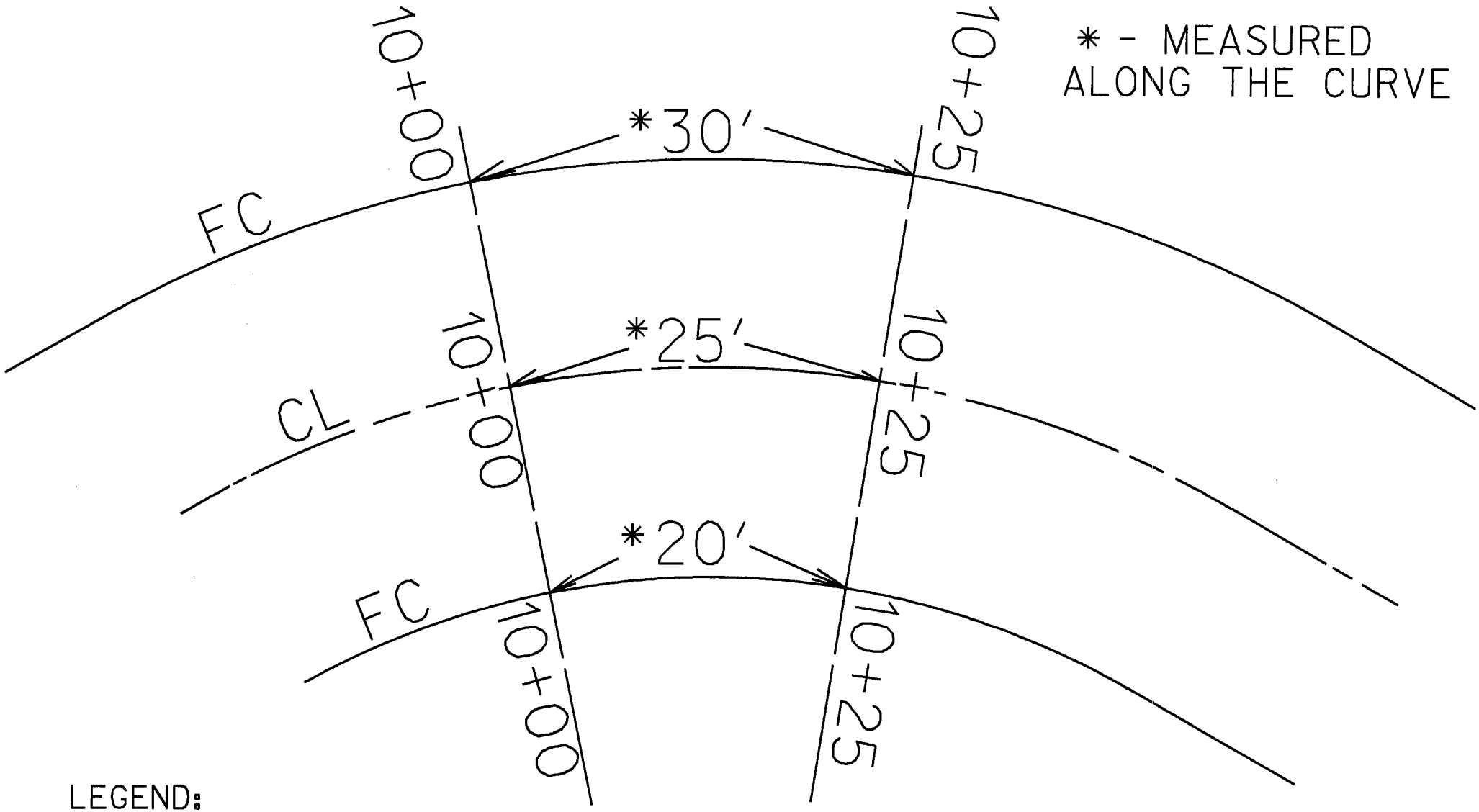
SUMMIT VERTICAL CURVE

LEGEND:

% - PERCENT
BVC - BEGIN VERTICAL CURVE
EVC - END VERTICAL CURVE
L - LENGTH
G1 - GRADE INTO VERTICAL CURVE
G2 - GRADE OUT OF VERTICAL CURVE
PI - POINT OF INTERSECTION

FIGURE 9

STATIONS ON HORIZONTAL CURVE



* - MEASURED ALONG THE CURVE

LEGEND:

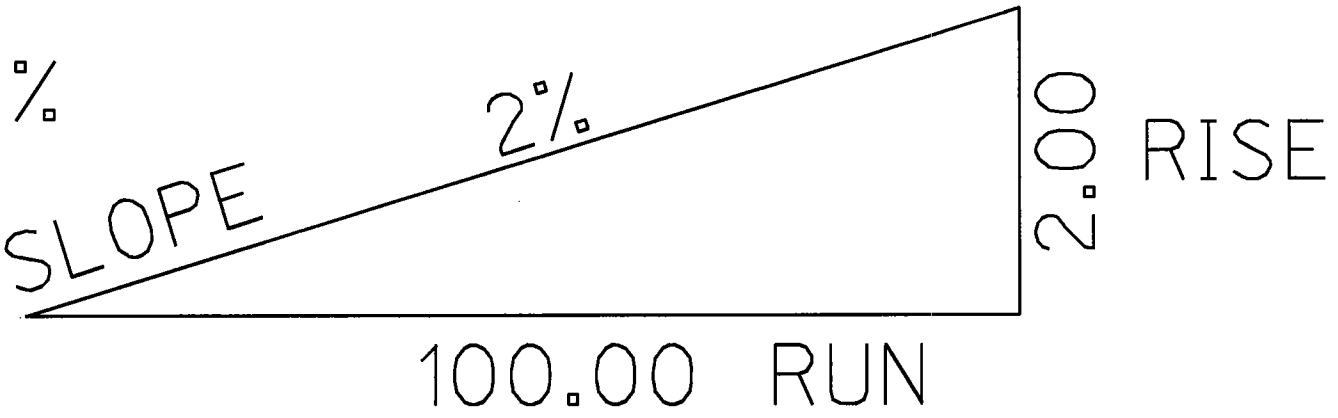
FC - FACE OF CURB
CL - CENTERLINE

FIGURE 10

UNDERSTANDING PERCENTAGES

$$\text{PERCENTAGE} = \frac{\text{RISE}}{\text{RUN}}$$

$$\frac{2.00}{100.00} = .02 \text{ OR } 2\%$$



$$\frac{0.20}{10.00} = .02 \text{ OR } 2\%$$

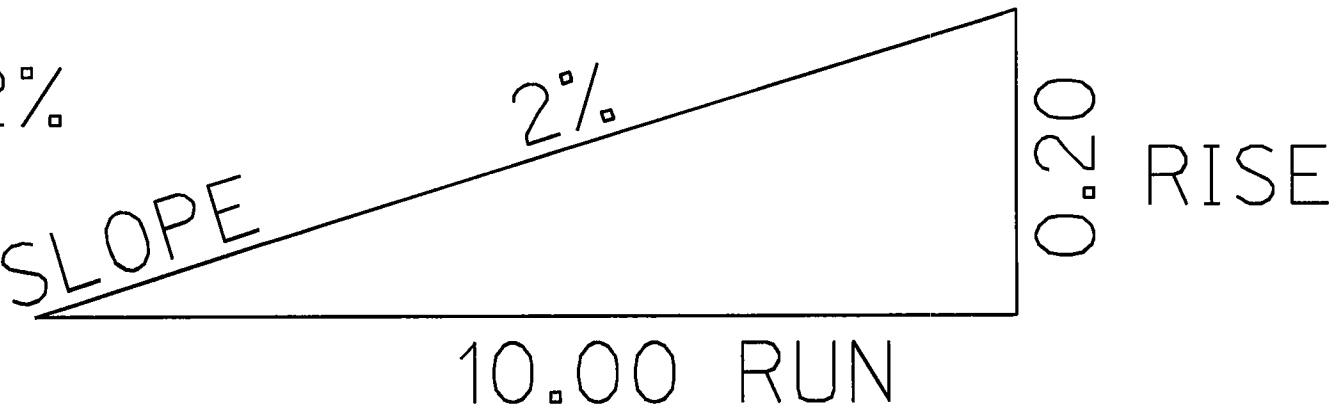


FIGURE 11

SURVEY REQUEST FORM

PROJECT _____

PRIORITY	TYPE OF STAKING	LOCATION	DATE

REQUESTED BY _____ DATE _____

COMMENTS _____

FIGURE 12

PROJECT MARKOUT

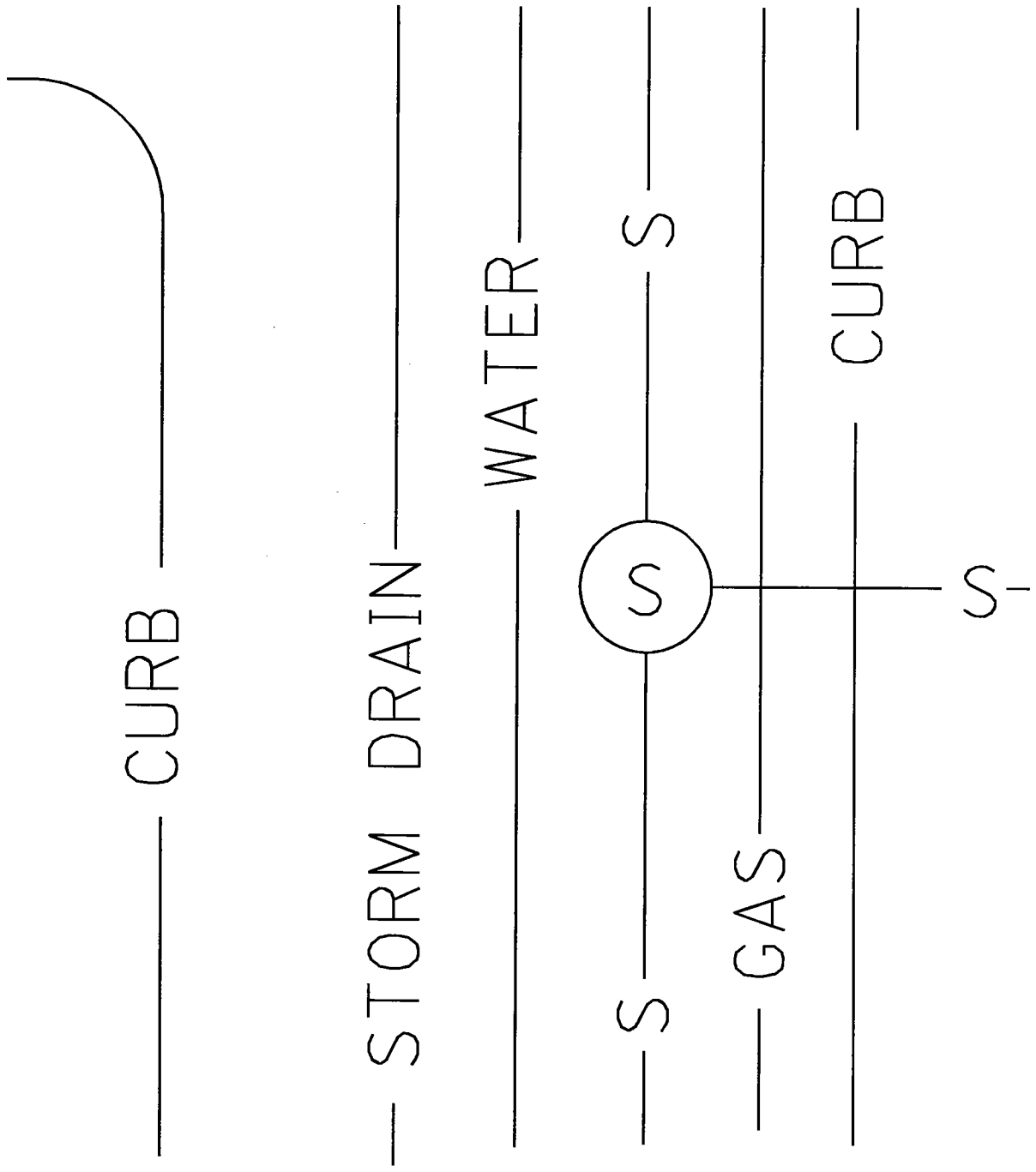
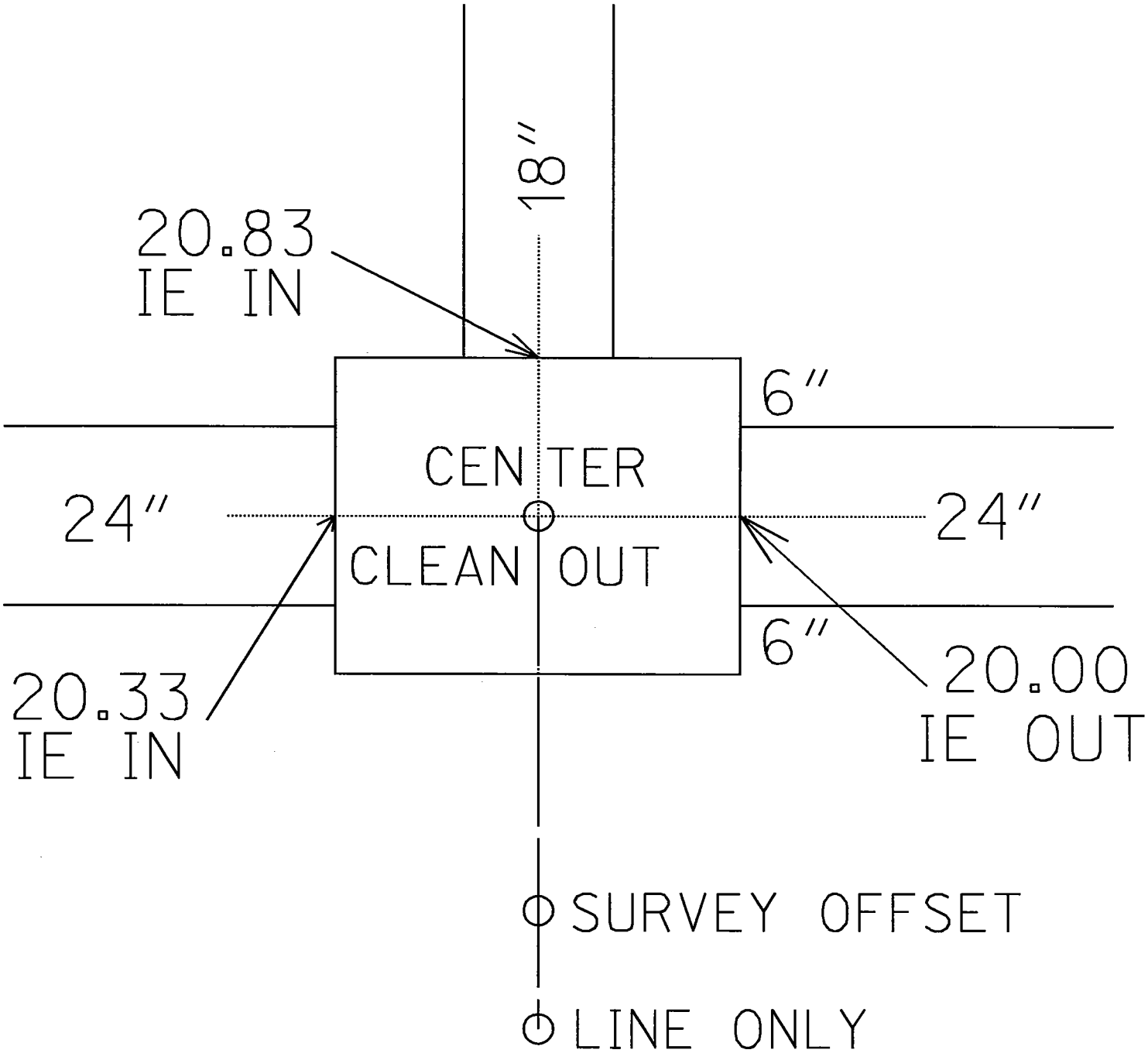


FIGURE 13

STORM DRAIN CLEAN-OUT



LEGEND:
IE - INVERT ELEVATION (OR FLOWLINE)
IN - FLOWLINE INTO STRUCTURE
OUT - FLOWLINE LEAVING STRUCTURE (ALWAYS LOWEST POINT)

FIGURE 14

STORM DRAIN STAKING

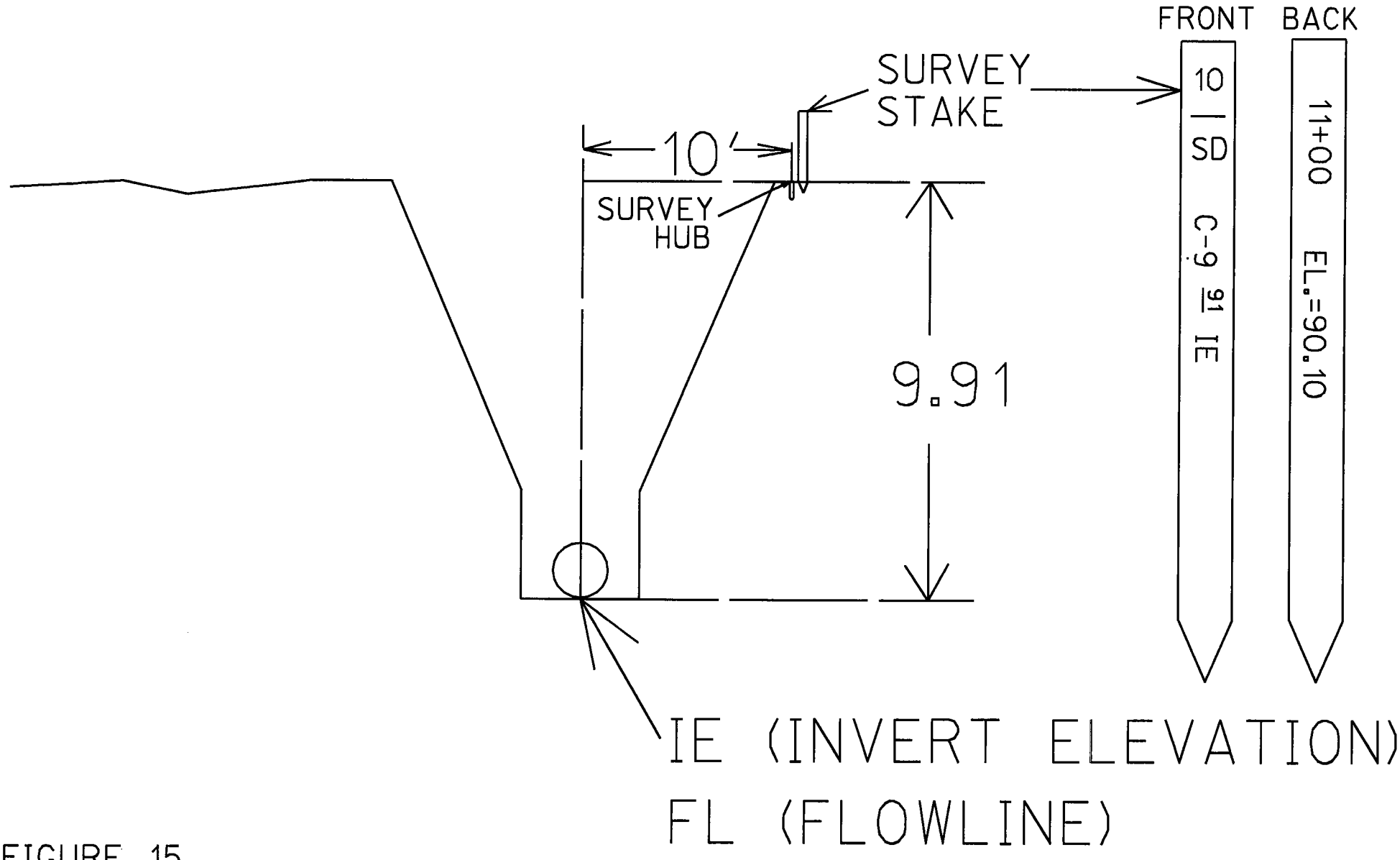


FIGURE 15

STORM DRAIN INLET STAKING

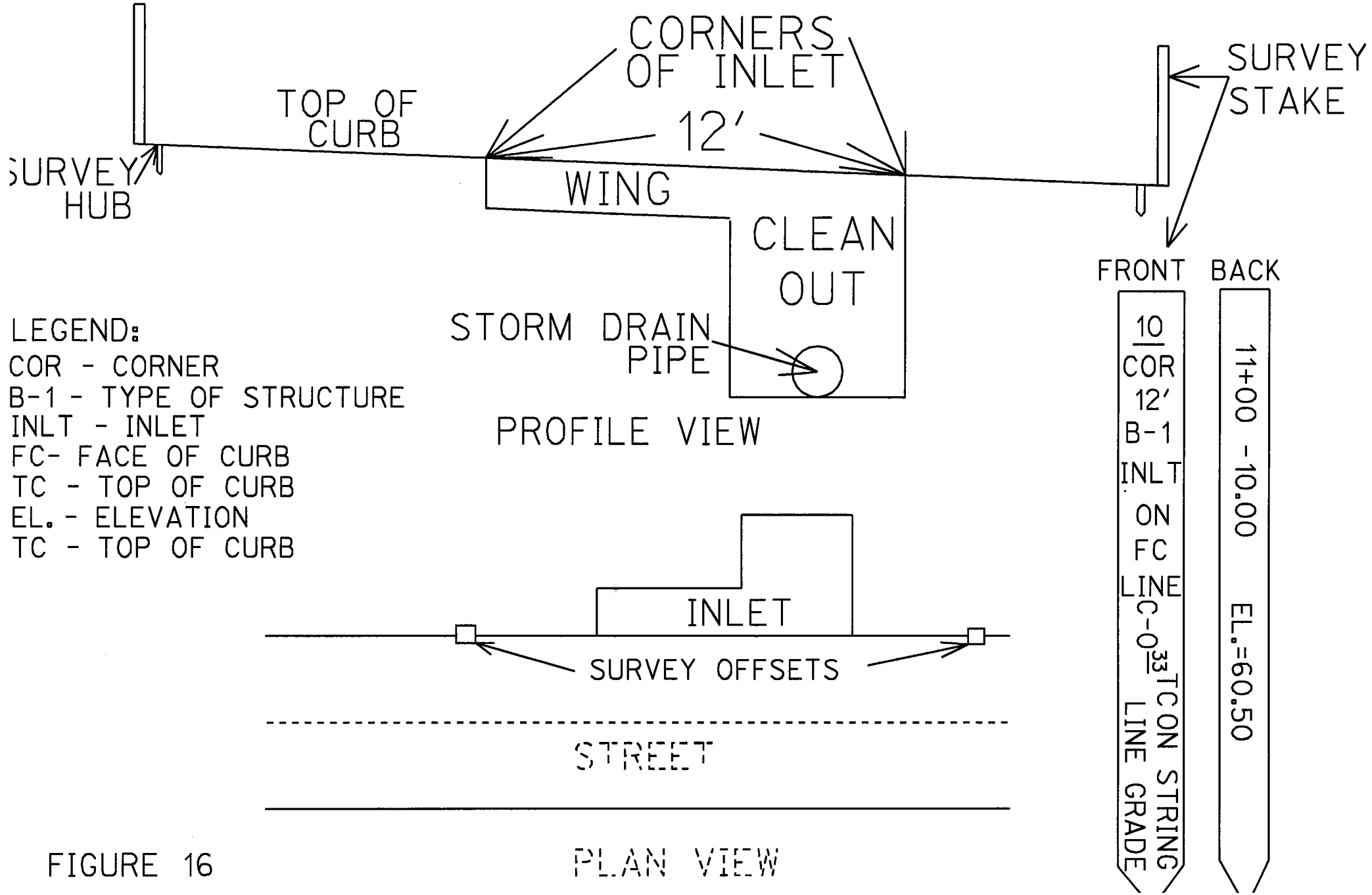
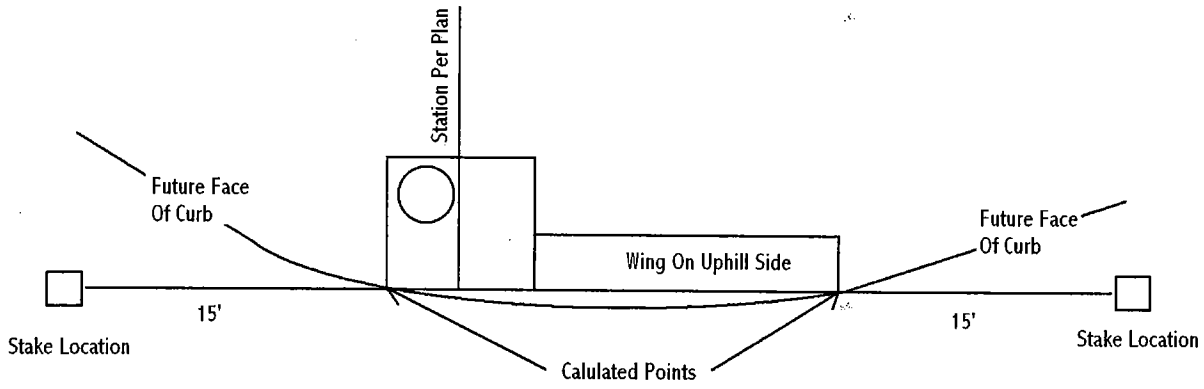


FIGURE 16

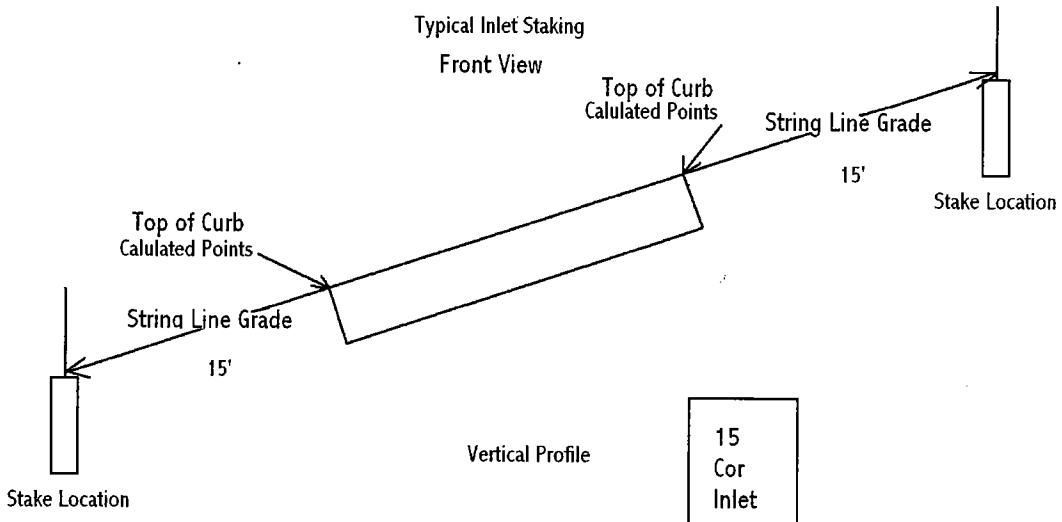
Typical Inlet Staking

Top View



Typical Inlet Staking

Front View



Vertical Profile

15 Cor Inlet on FC Prod on String Line Grade

Storm Drain Overview

1. Storm Drain is usually the deepest and first utility to go in. It is essential that the job drains properly during the construction phase to avoid penalty from runoff.

2. Storm drain is staked to flowline or invert elevation and to the centerline of the pipe. As with all underground staking, if there is 11 feet of cut, then a 15 foot offset should be used when staking.

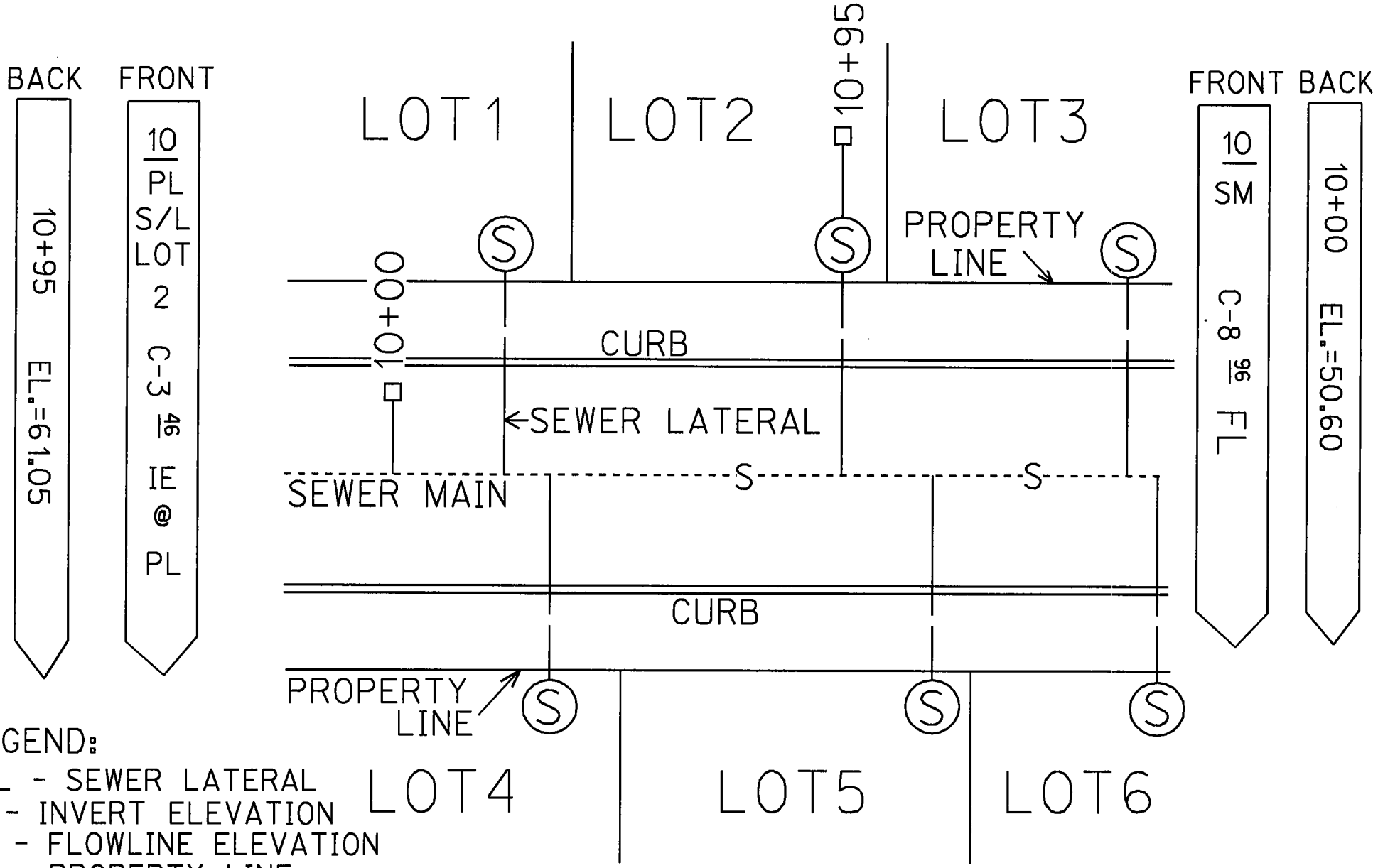
3. Storm drain connections must be field verified to allow proper drainage. This must be done before digging to avoid further delay and added construction costs.

4. All improvements are staked at 50 foot intervals in tangent and 25 foot in curve. This includes both horizontal and vertical curves.

5. All storm drain boxes should be on face of curb line produced and on string line grade with a distance to the edge of box on both stakes. These stakes should be facing each other.

6. All storm drain, concentric or not, should be tied to centerline of street with station and offsets too cleanouts, inlet structures, headwalls, or any other structure.

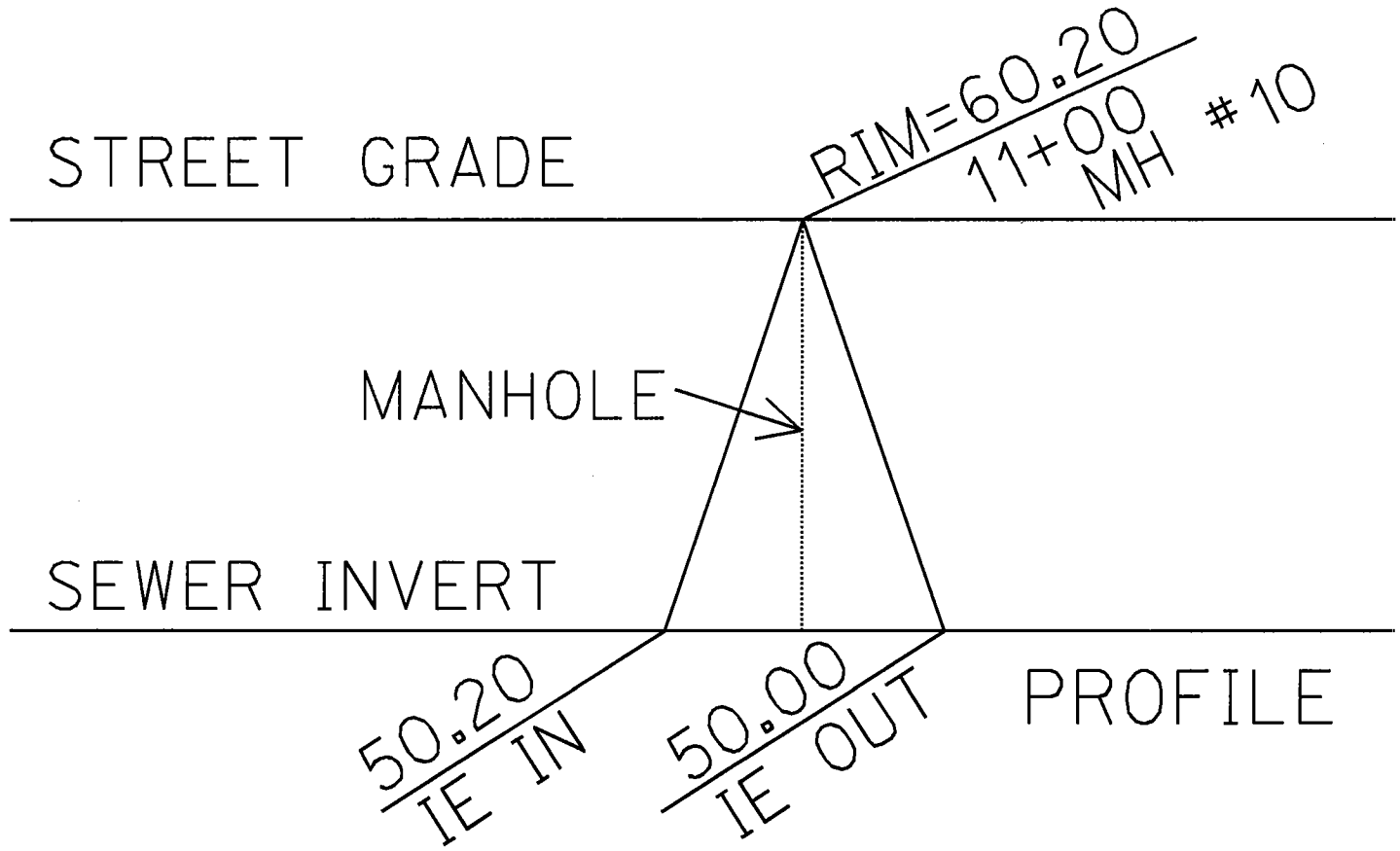
SEWER STAKING

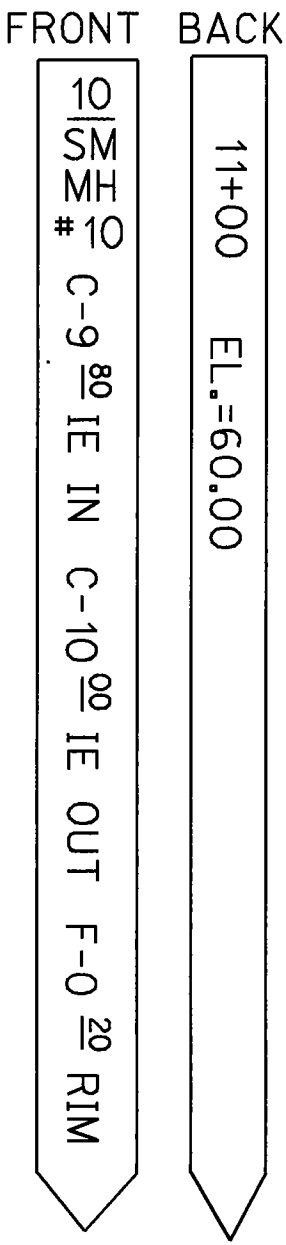


LEGEND:
S/L - SEWER LATERAL
IE - INVERT ELEVATION
FL - FLOWLINE ELEVATION
PL - PROPERTY LINE
EL. - ELEVATION
@ - AT

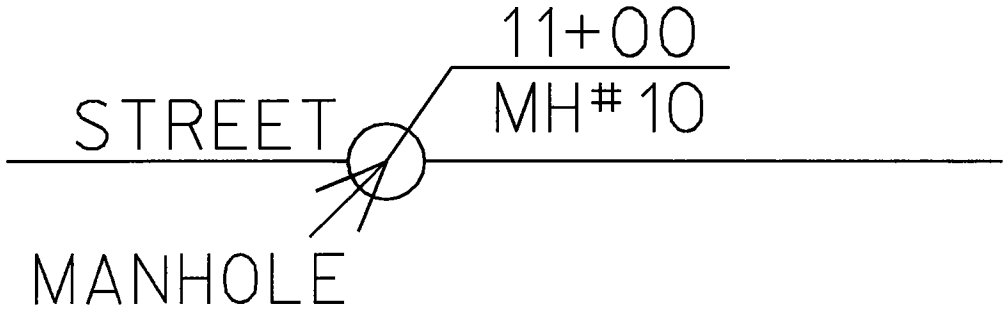
FIGURE 17

SEWER MANHOLE STAKING





LEGEND:
SM - SEWER MAIN
IE - INVERT ELEVATION
FL - FLOWLINE ELEVATION
MH - MANHOLE
EL. - ELEVATION



PLAN VIEW

FIGURE 18

SEWER IN CUL-DE-SAC

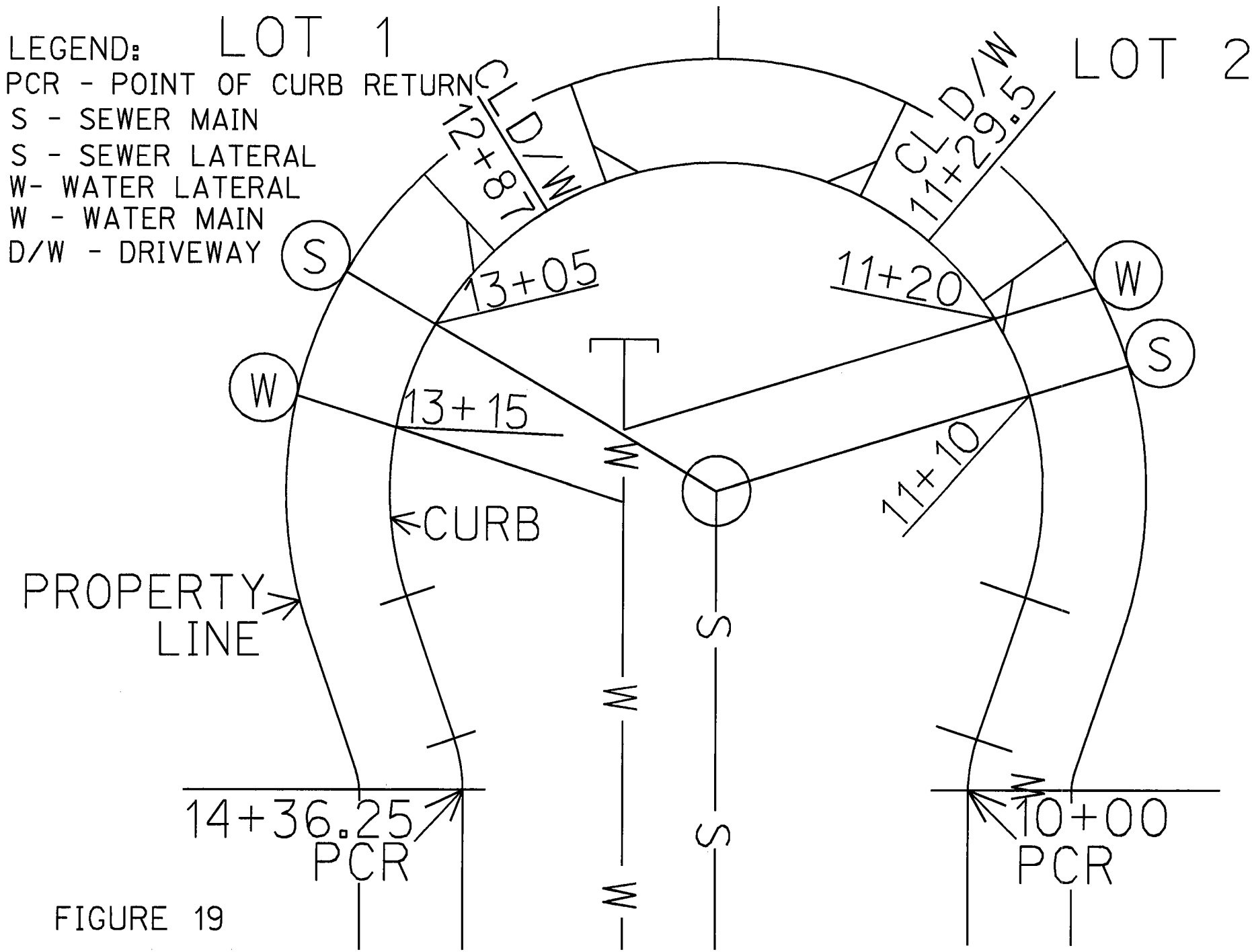


FIGURE 19

Sewer Overview

1. Sewer systems are generally staked concentric to centerline and are referenced by station.

2. Sewer systems not following centerline alignment must be detailed to allow proper location. They are graded to flow line or invert elevation and offset to the centerline of the pipe.

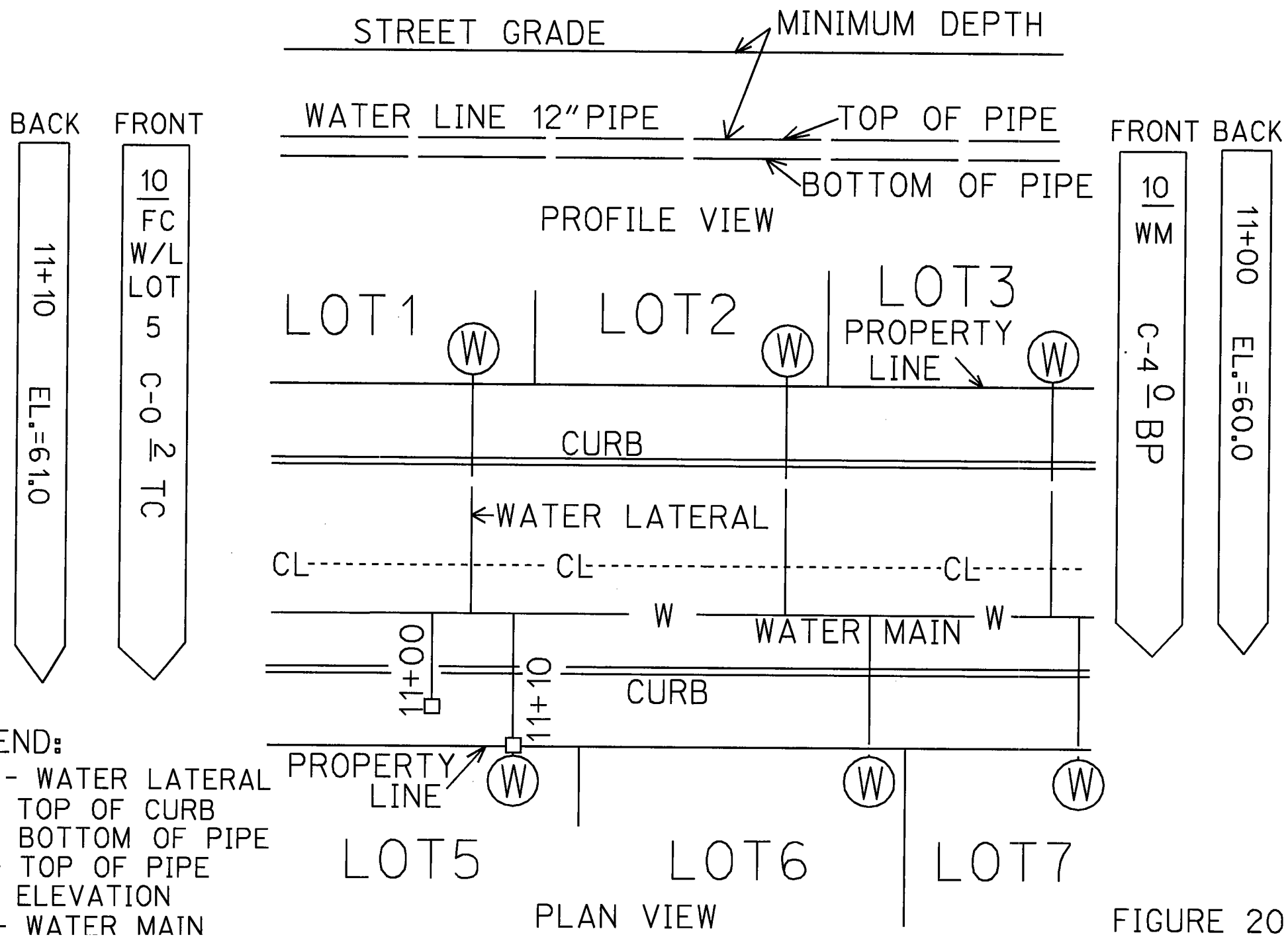
3. Sewer laterals should follow centerline stationing and are generally stubbed to property line. It is essential to stub the sewer lateral far enough to avoid digging up concrete to find them. An example of such is sidewalks, as shown on the video.

4. Sewer laterals in cul-de-sac locations should be given extra references to help aid in proper location using a station from a known point of curb return.

5. Sewer lateral tables need to be referenced accordingly with station and grades to invert elevation at property line.

6. The most important thing is to verify all sewer connections before you dig.

WATER STAKING



LEGEND:
W/L - WATER LATERAL
TC - TOP OF CURB
BP - BOTTOM OF PIPE
TP - TOP OF PIPE
EL. - ELEVATION
WM - WATER MAIN

FIGURE 20

SEWER/WATER LATERALS

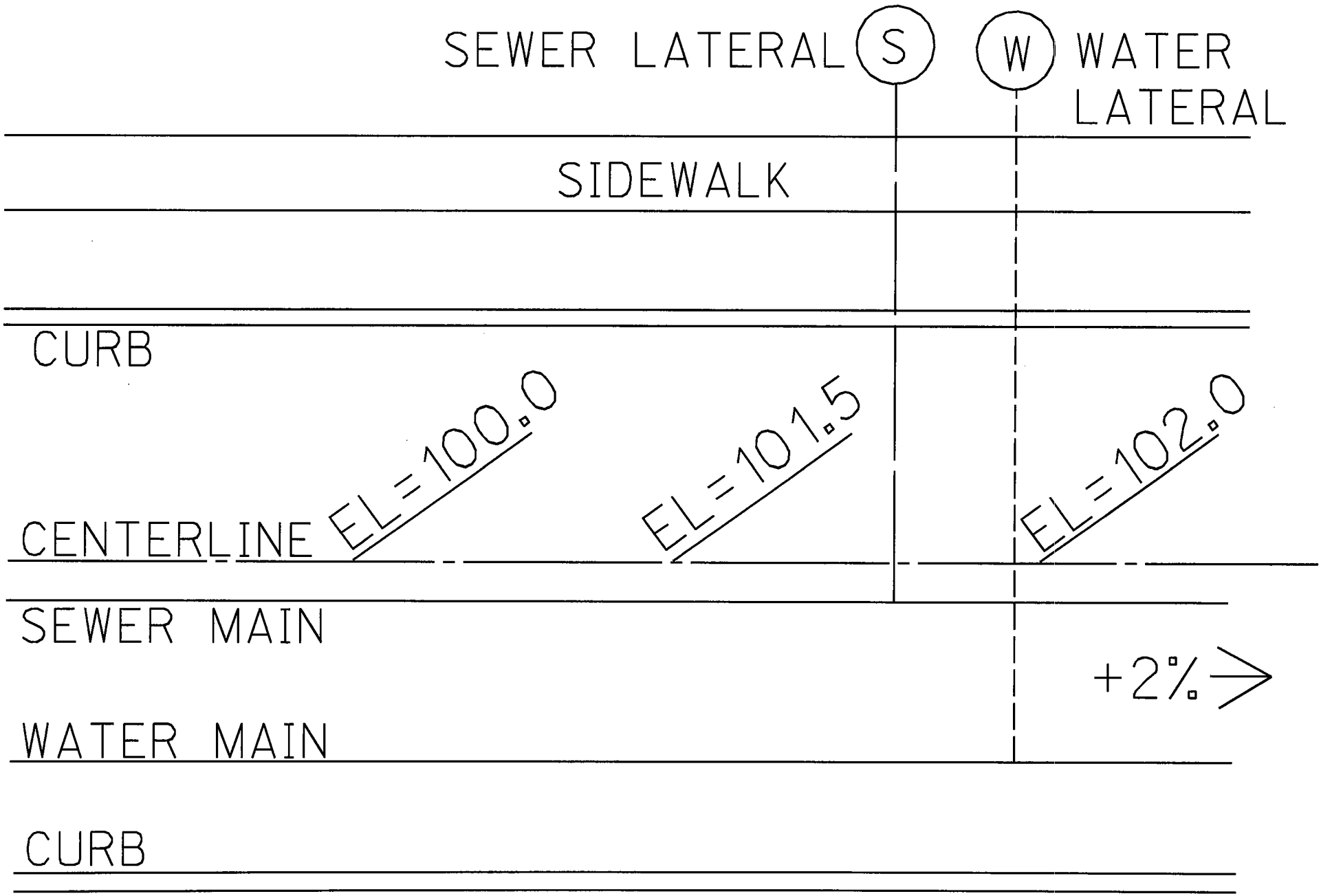


FIGURE 21

Water Overview

1. Water systems are generally staked concentric to centerline and are referenced by station.

2. Water systems not following centerline alignment must be detailed to allow proper location.

3. Water laterals should follow centerline stationing and are generally stubbed to the engineer's detail. It is essential to stub the water lateral far enough to avoid digging up concrete to find them. Fire hydrants, blow offs, and air release valves should also be stationed according to centerline.

4. Water laterals in cul-de-sac locations should be given extra references to help aid in proper location.

5. Water laterals are referenced to top of curb and face of curb.

6. The most important thing is to verify all water connections before you dig.

7. Water main is referenced to top of pipe or bottom of pipe and should be determined before it is staked.

8. Water mains using shop drawings need special consideration since everything is manufactured before it is installed. Verification of connections is very critical.

CONSTRUCTION LEVEL

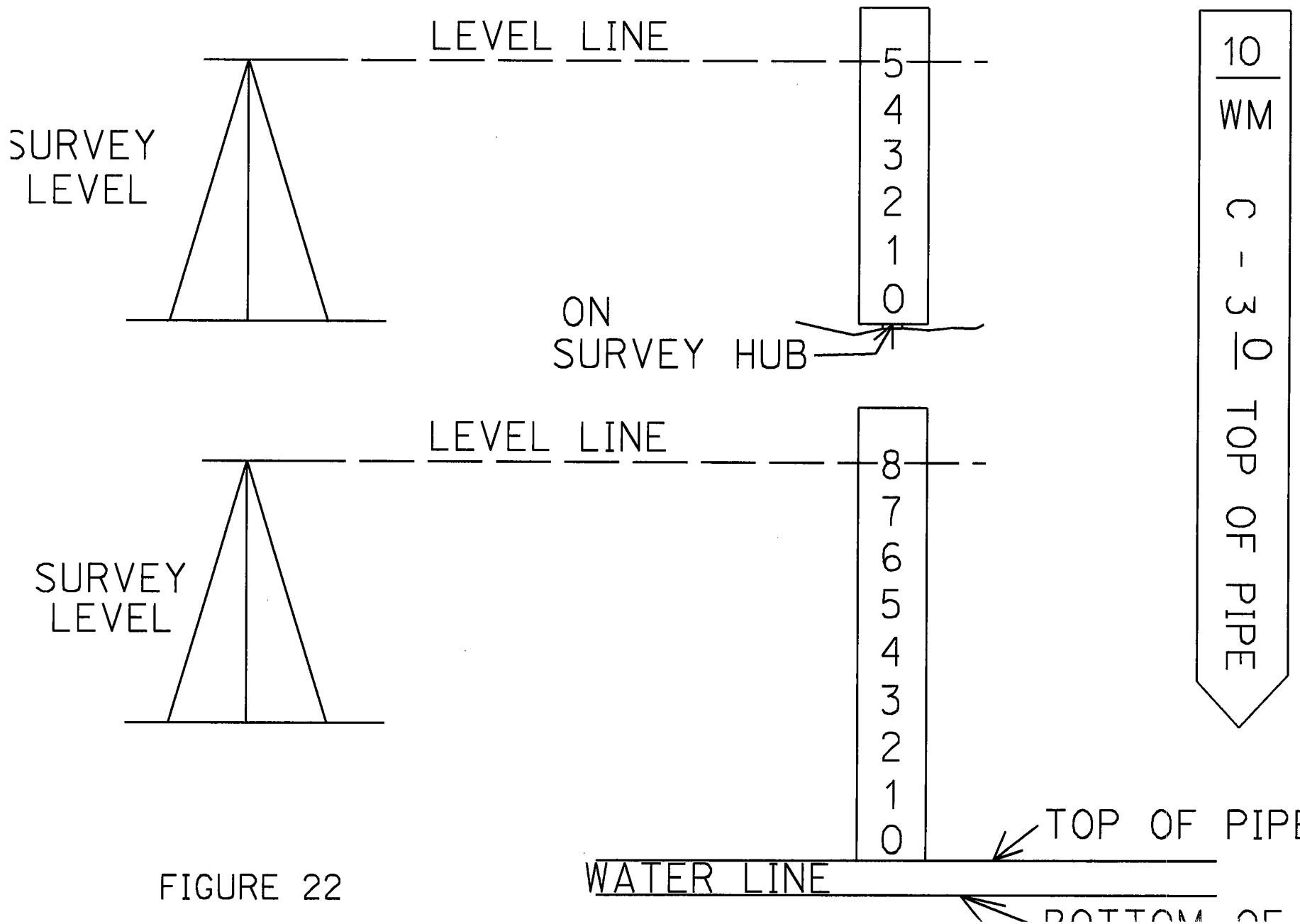
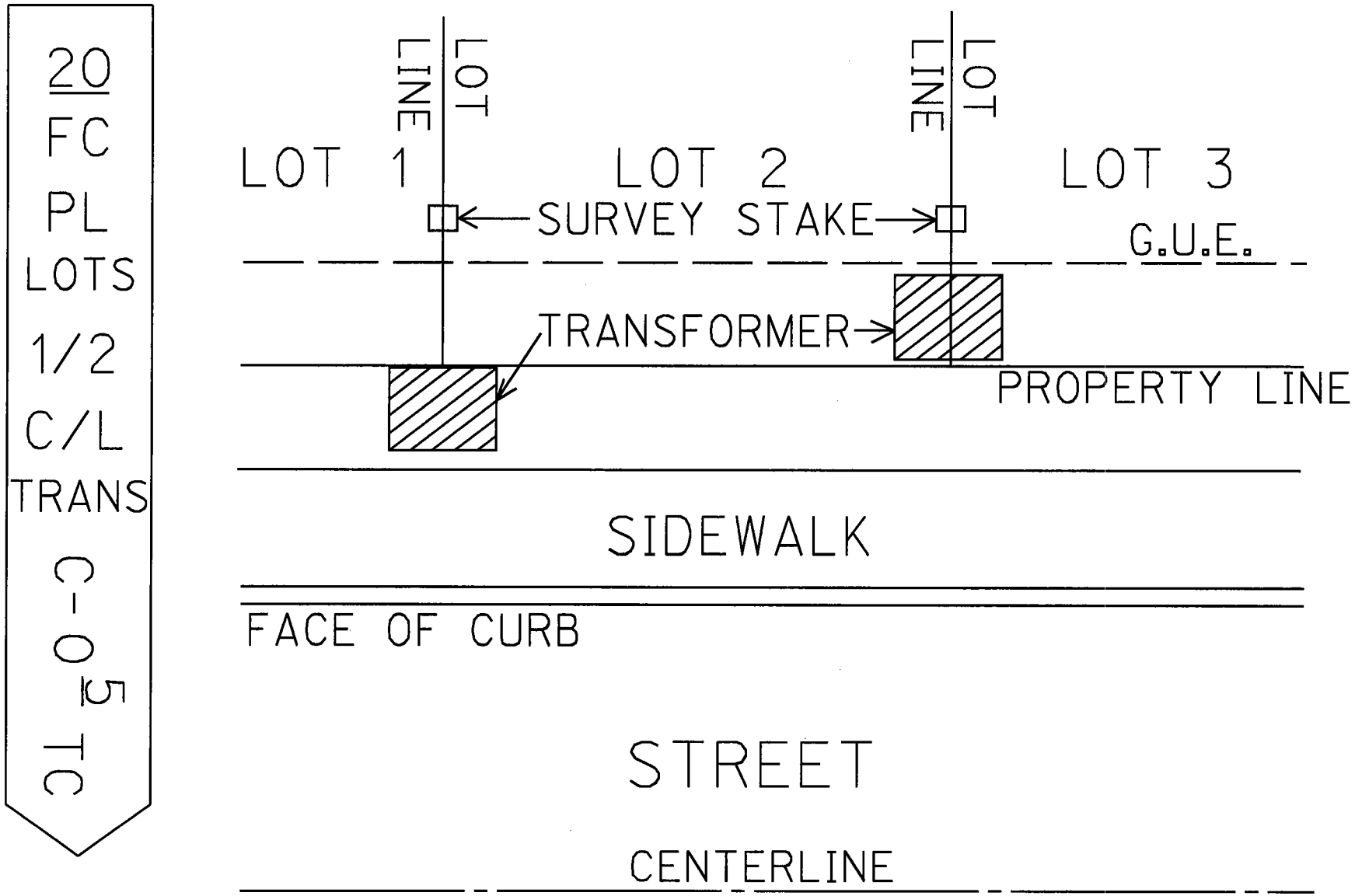


FIGURE 22

GAS AND ELECTRIC STAKING



LEGEND:
G.U.E. - GENERAL UTILITY EASEMENT
TC - TOP OF CURB
TRANS - TRANSFORMER
C/L - CENTERLINE
FC - FACE OF CURB

FIGURE 23

Gas and Electric

1. Stakes are referenced to top of curb and generally 15 or 20 feet to face of curb.

2. Stakes are referenced to face of curb for gas, electric, telephone, and cable television. The depth of the trench and relationship to face of curb is the responsibility of the contractor.

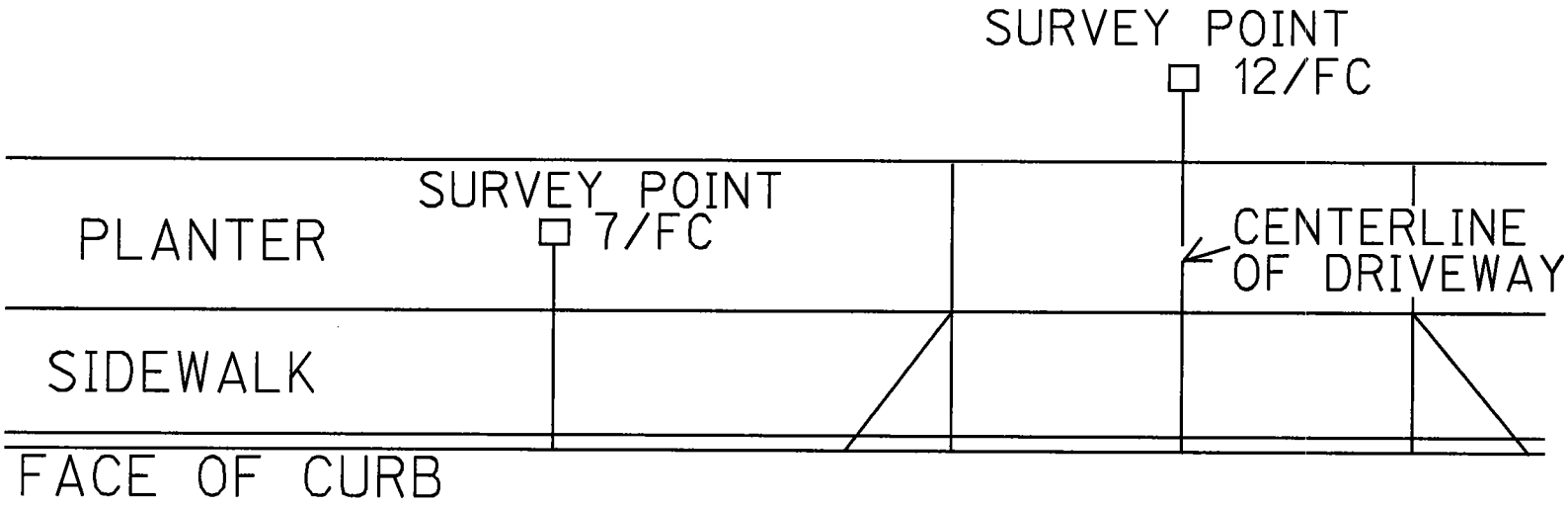
3. All transformers, hand holes, and streetlights are referenced to centerline and will be staked accordingly.

4. All transformers or vaults should have the outside edges staked with an offset to face of curb. Line only stakes should be place behind the offset for all large objects and objects in curve.

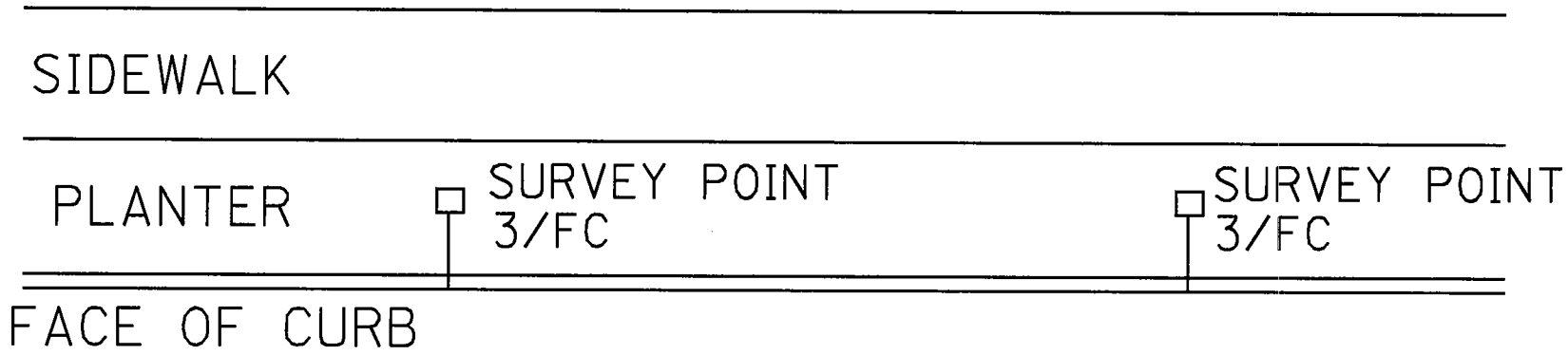
5. Cul-de-sacs need special attention to stationing, as this is a place of many conflicts and errors. Stationing is critical and should be referenced to a point of curvature return.

6. Street light locations should be cross-referenced with the improvement plan and electric plans, as this is a common place for conflicts.

CURB STAKING LAYOUT



MONOLITHIC CURB STAKING



NON-CONTIGUOUS CURB STAKING

FIGURE 24

CURB STAKING LAYOUT

FOR CURB RETURN

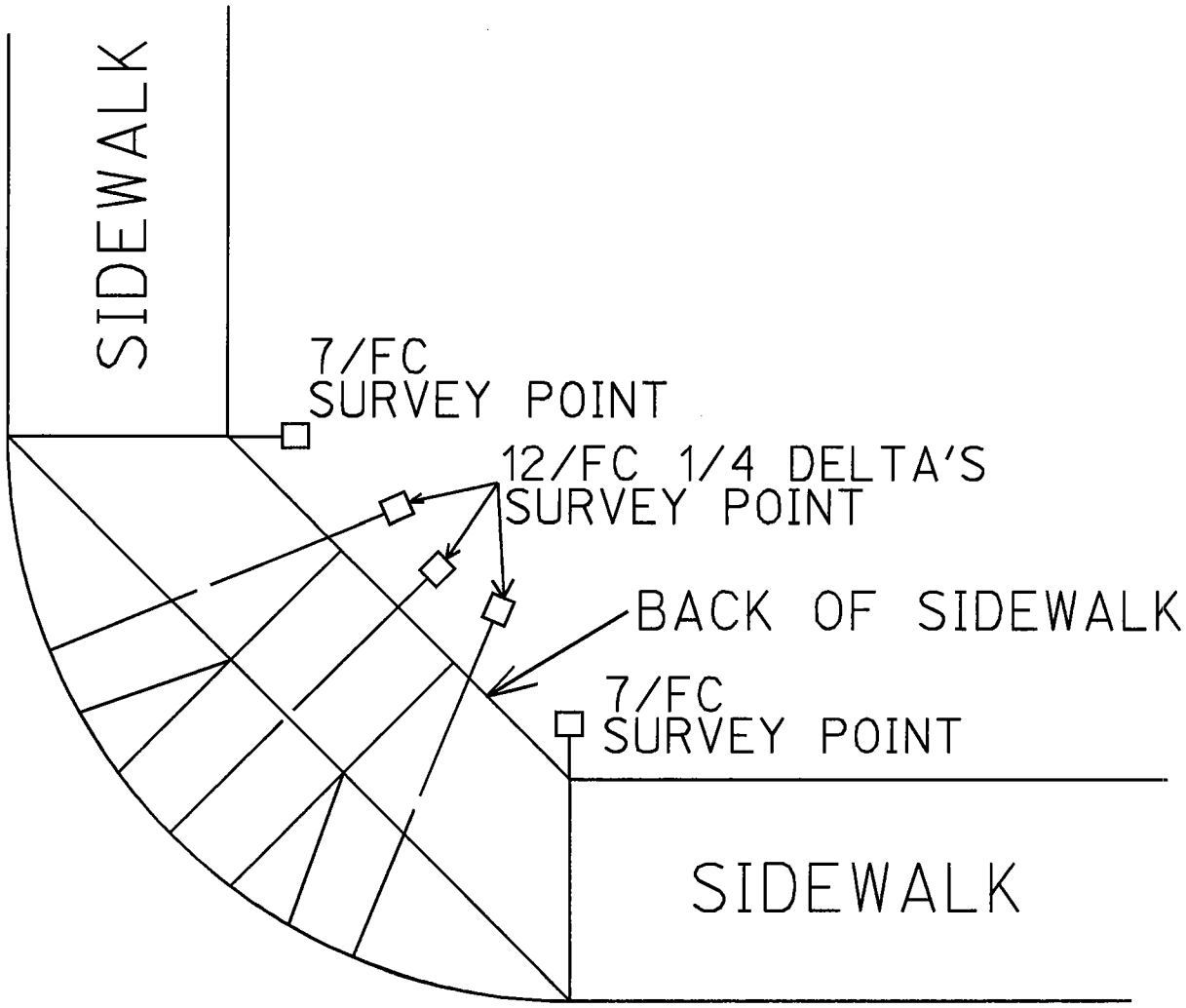


FIGURE 25

CURB STAKING LAYOUT
TEE INTERESECTION

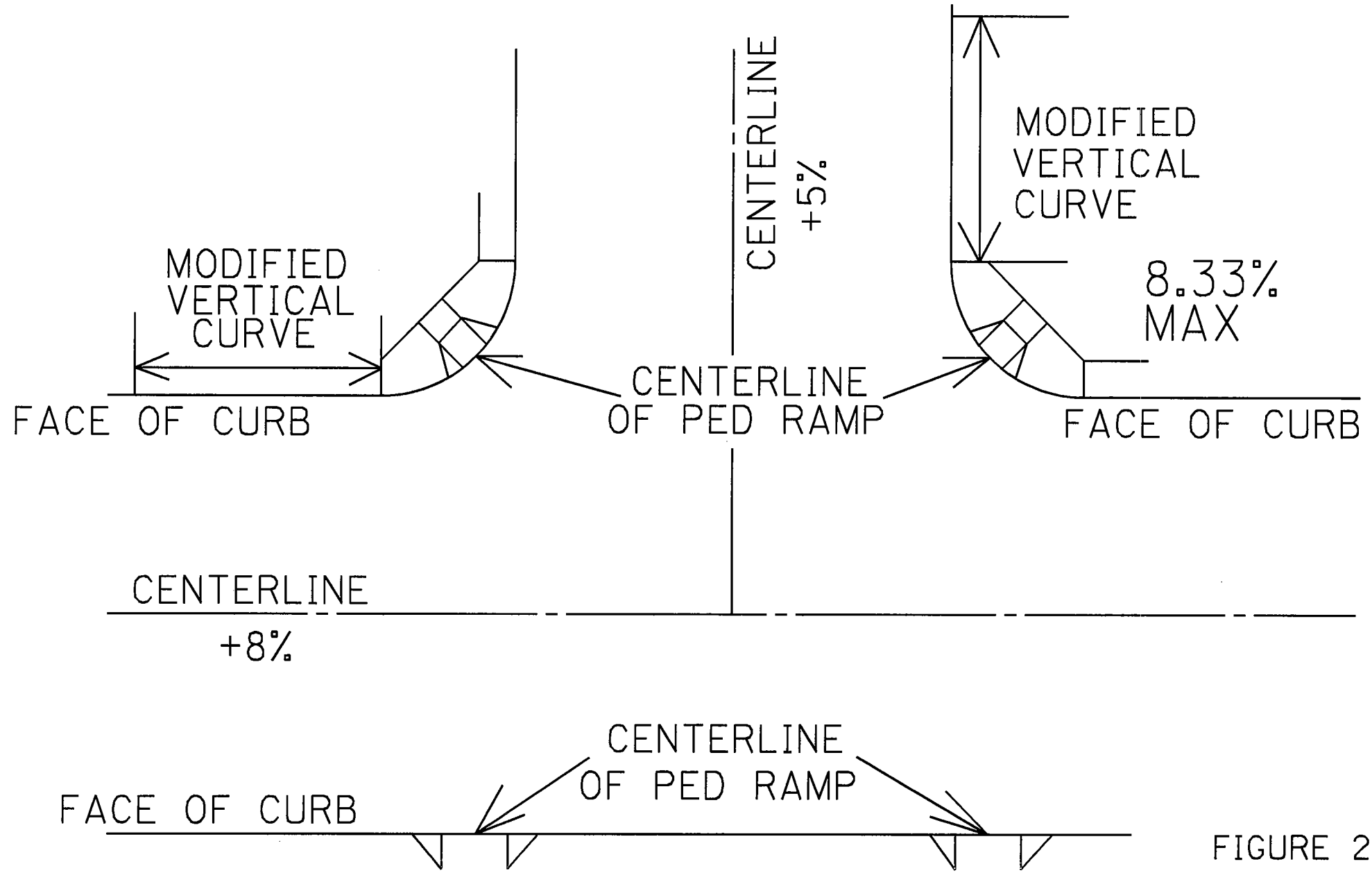


FIGURE 26

Curb

1. Stakes are referenced to top of curb and generally 3 or 7 feet to face of curb. Generally curb returns are staked on 12 offsets due to monolithic pours.

2. Driveways are staked at 7 or 12 foot offsets and should be determined before staking. All driveways and handicap ramps are staked at centerline. The contractor is responsible to comply with local agency standards.

3. All driveways in cul-de-sacs should be given special consideration to avoid confusion.

4. All cul-de-sac curb grades should be detailed and easy to follow using an assumed stationing.

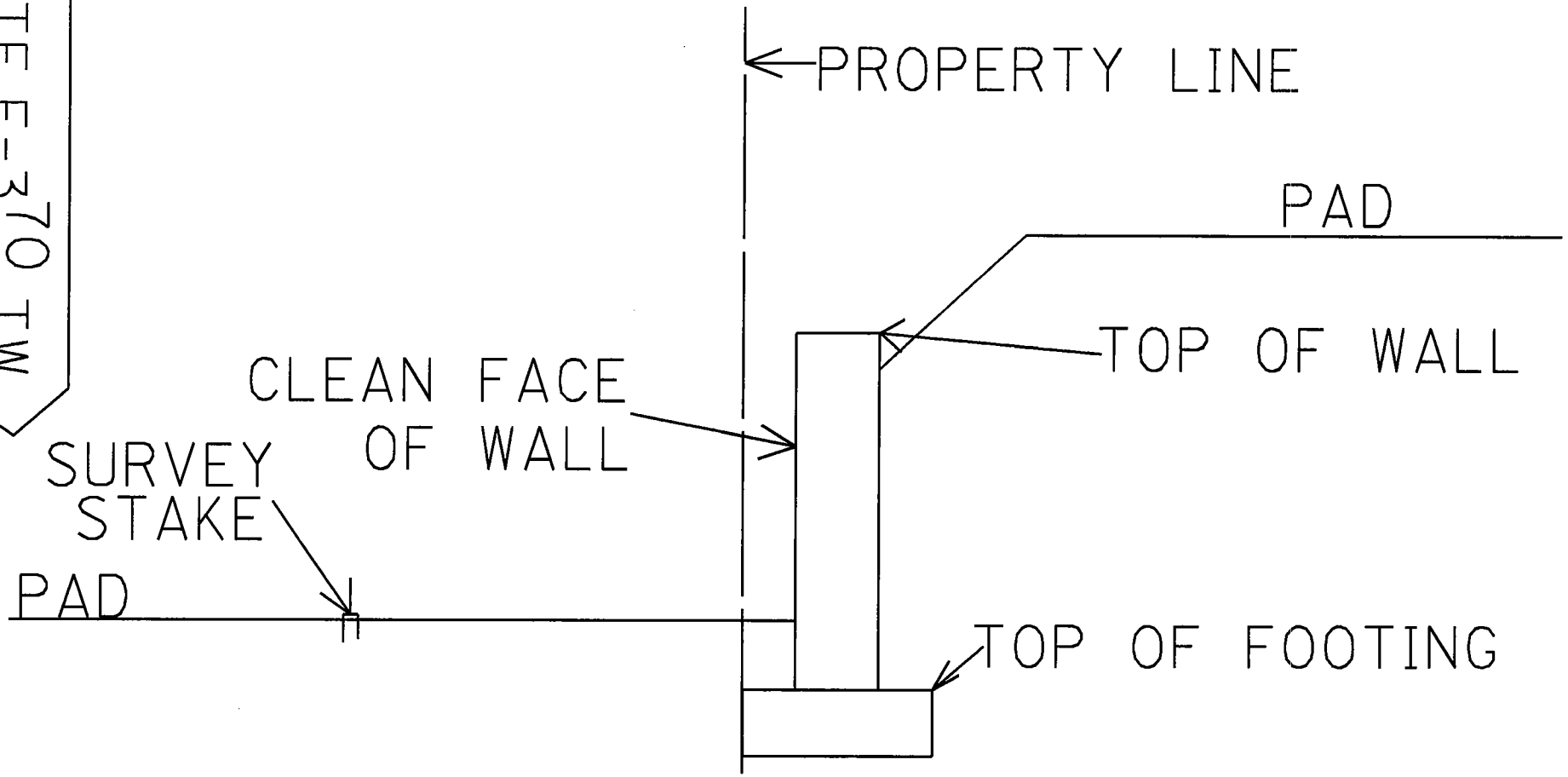
5. Cul-de-sacs are the biggest cause of trouble and conflicts. It cannot be stressed enough to pay special attention when staking and referencing in this area.

6. Transitions and super elevations must be clearly defined on all grading and improvement plans, as this is one of the biggest oversights.

WALL STAKING LAYOUT

10 FW C-1 20 TF F-3 70 TW

LEGEND:
TF - TOP OF FOOTING
TW - TOP OF WALL



PROFILE VIEW FOR SIDEYARD RETAINING WALL
FIGURE 27

FENCING LAYOUT

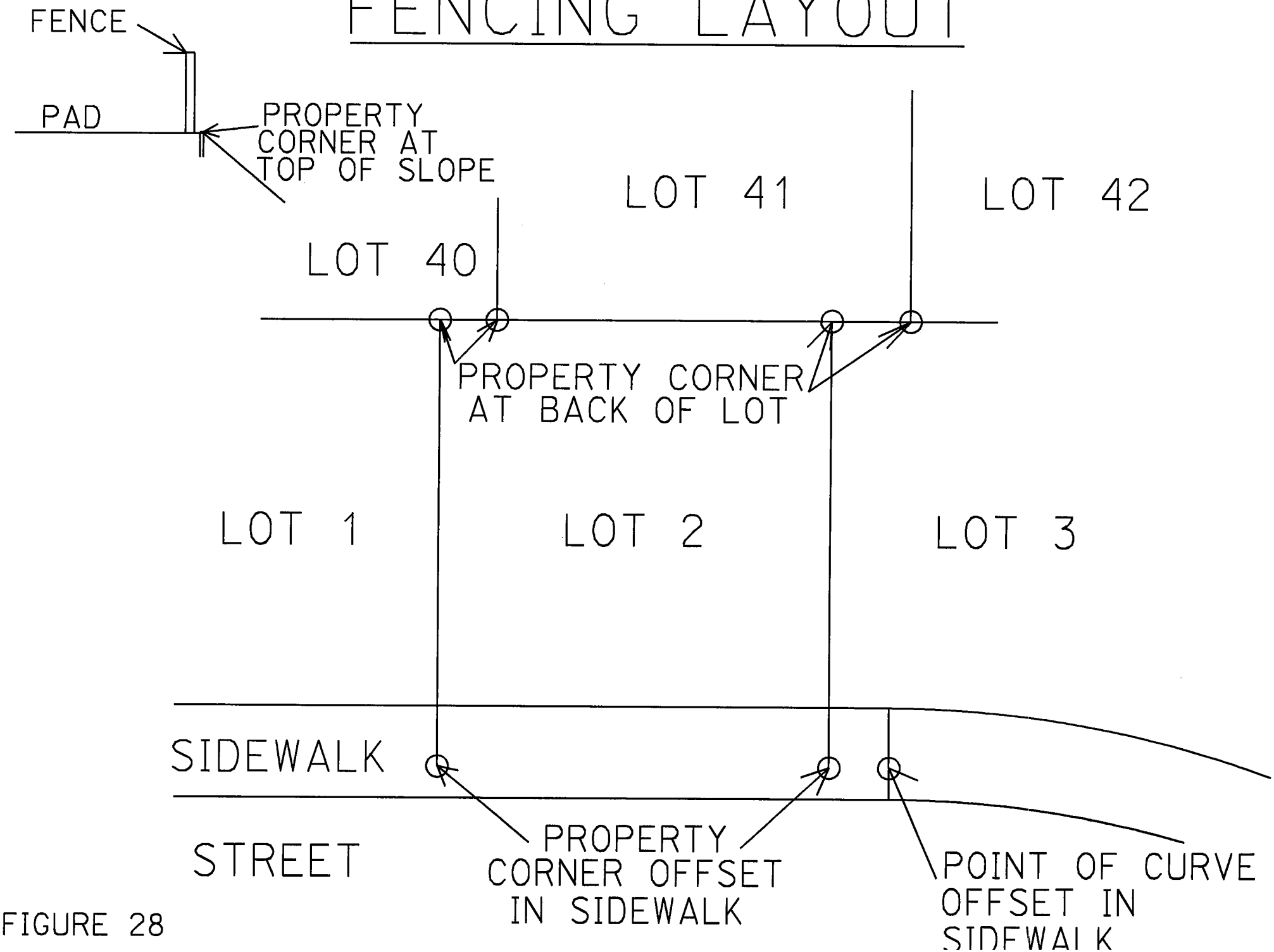


FIGURE 28

Walls and Fencing Overview

1. All walls should be referenced to property line and exposed face of wall, non-retaining side.

2. Grades are referenced to top of wall and top of footing.

3. Ties to the wall should be referenced to property line or centerline to the exposed face of wall.

4. Wall dimensions should clearly be stated in a typical drawing.

5. The footing of a wall should be a consideration to avoid encroachment when staking or positioning a wall.

6. Walls with stationing should be clearly defined, and reference top of wall and footing steps accordingly.

FINAL MONUMENTATION

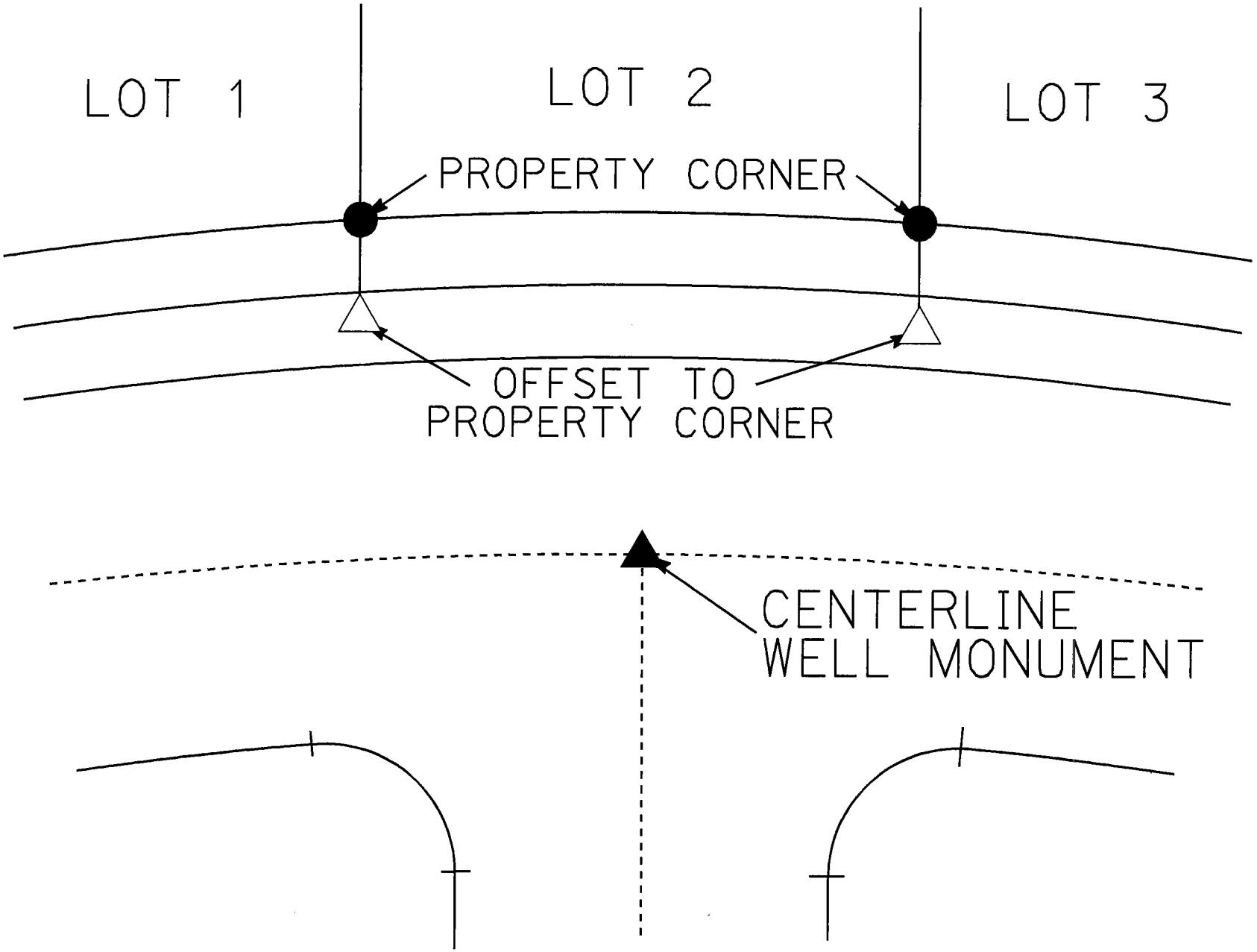


FIGURE 29

Final Monumentation Overview

1. Final monuments are generally placed in the back of the lots with iron pipes and the front of the lots with brass tags. Final monumentation should be requested by the contractor as soon as the sidewalks and fine grading are done. Final monumentation should be in before fences are installed.

2. Survey monuments are generally placed in the street at intersections and beginning and end of curves and should be put in after the final lift of asphalt.

3. Final monuments should be fixed in a permanent manner and display the license number of the licensed land surveyor.

BUILDING LAYOUT

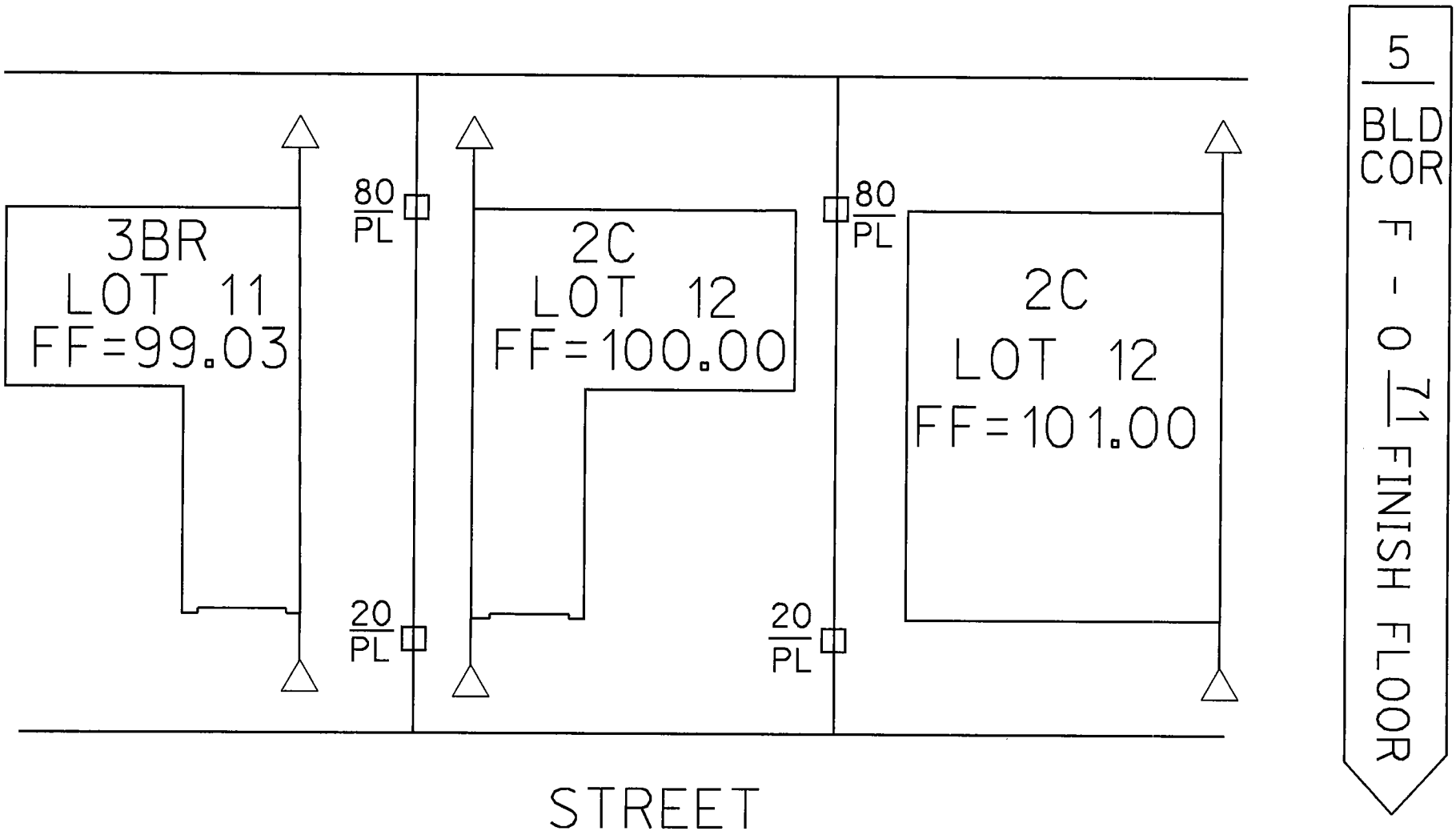


FIGURE 30

BUILDING LAYOUT
WITH ENVELOPE LINES

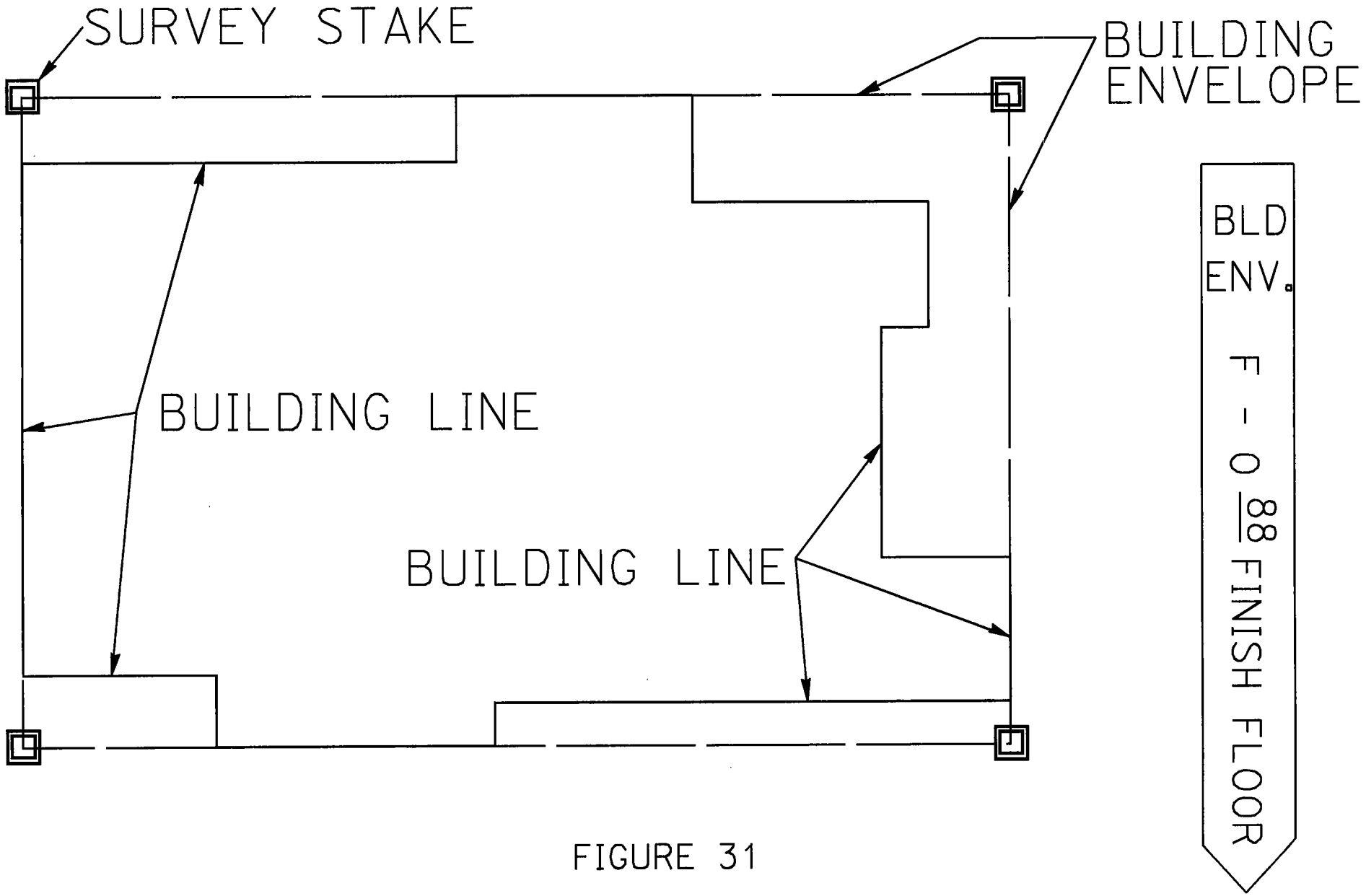


FIGURE 31

BUILDING LAYOUT WITH GRID LINES

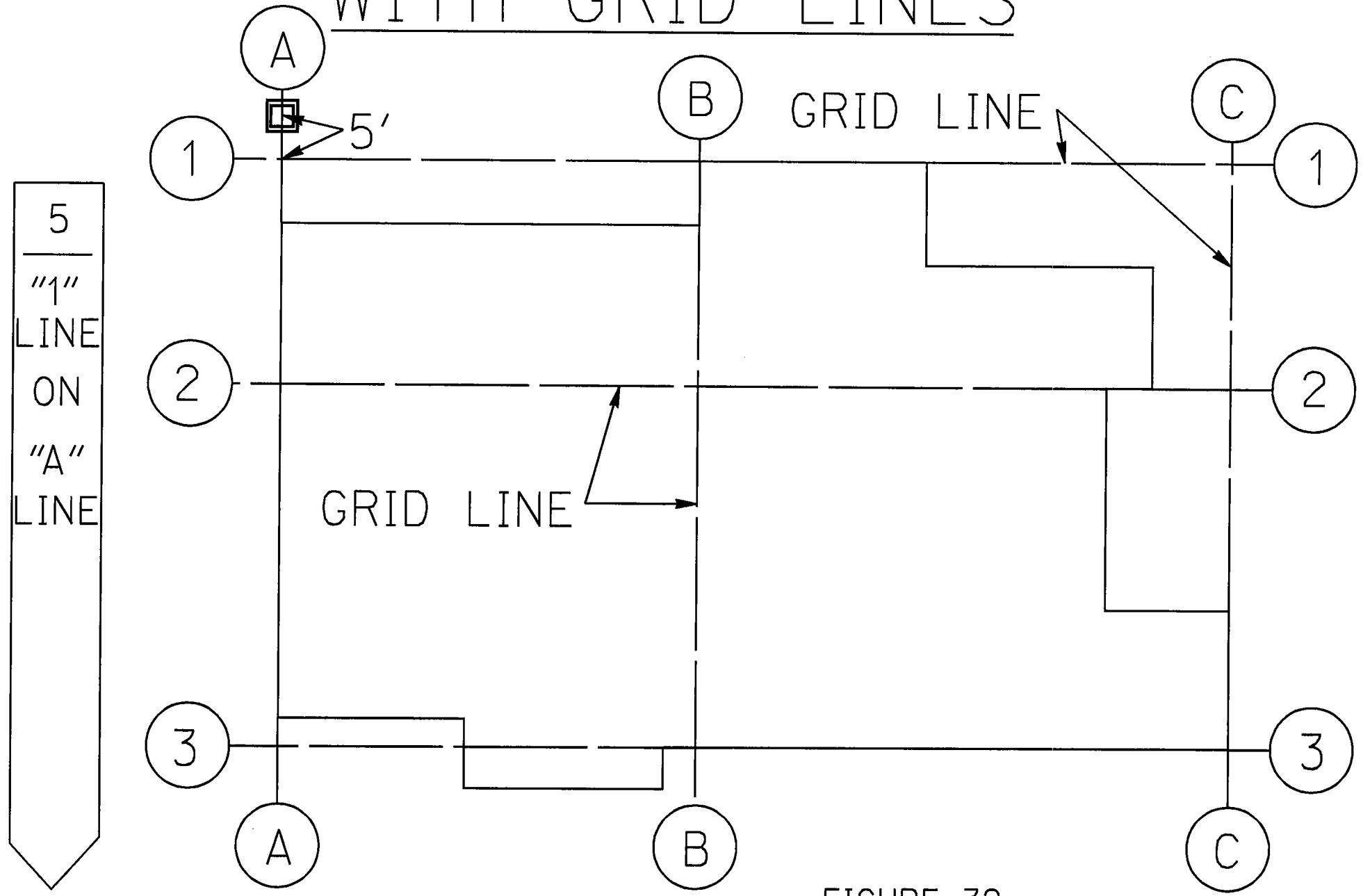


FIGURE 32

Building Layout Overview

1. All buildings should be checked for distances to property lines before digging the foundation.

2. All buildings should show a minimum setback dimension to the nearest tenth of a foot along the property lines.

3. Building form check should be done on all residential and commercial buildings as a safety check. Failure to perform form checks is asking for trouble. Remember the golden rule of " measure twice pour once."

4. Buildings are generally staked on the long side with an offset to each building corner. With bigger commercial buildings it is common to have envelope stakes or grid lines. This should be discussed before stakeout to allow proper time and procedure for layout.

Survey Stakes

4 Foot lath = Orange Painted Lath

Color Designation

1. Rough Grading = Red
2. Daylight Stakes = Red or Blue and White
3. Finish Grade Stakes = Pink or Red
4. Storm Drain = White
5. Sewer = Yellow
6. Reclaimed Water = Green and Blue or Green and White
7. Water Main = Blue
8. Gas & Electric = White or Pink
9. Walls = Green
10. Bldg Corners on Non Residential = Blue or Green

2 Foot Lath = Orange Painted Lath

1. Curb Stakes No Flagging
2. Final Lot Corners No Flagging
3. Bldg Corners for Residential Housing No Flagging

General Notes for Points Set

1. Storm Drain Inlets are generally Hub and Tack
2. Building Layout Stakes are generally Hub and Tack
3. Construction Staking is generally Ginny or Spike

General Notes for Grading

1. // In a Slope Stake means Then
   As in Then Fill or Cut
2. / In a Slope Stake means And or Also

Top Construction Staking Questions Answered

1. Top of Slope Stakes are 10 Offset to Top With Line Stake

2. Toe of Slope Stakes are 20 Offset to Toe With Line Stake

(Toe Stakes Should Have Extra Room for the Removal at the Toe)

3. Lot Lines in Grading With a Distance to the Front Property Line usually 20 & 80 to the Front PL (**Property Line**). (The 20 should have a grade to the front PL and both pad grades, the 80 to PL should have both pad grades with a Distance to the back Property Corner).

4. When staking underground, remember an 11 foot cut should have a 15 foot offset and a 16 foot cut a 20 foot offset, etc.

5. Storm drain and Sewer is generally the deepest utility and should be examined to see which is done first. A 15 foot offset upstream is generally the offset to the depth unless **Rule 4** applies.
Sewer Laterals are generally 10 to PL with a cut to IE (Invert Elevation) at the property line.

6. Water Main is generally staked to short side on a 10 foot offset. Grades are generally to Top of Pipe or Bottom of Pipe. **Water Services** are 10 to Face of curb with a cut or fill to Top of Curb. All highpoints of streets should have **Air Release Valves** and all Low Points should have **Blowoff** valves.

7. Gas & Electric is generally 15 foot to face of curb with a grade to top of curb.

8. Curb stakes are normally 3 or 7 foot offsets. Curb returns need to be 12 foot offsets when **Monolithic Pours** are required.

9. Final Monumentation (Property Corners) should be installed before fencing takes place.

10. Wall stakes are generally 10 foot offsets to face of wall. Face of wall should be exposed face and should be talked about for confirmation. **Note:** most errors occur in walls when the wall is built exactly on Property Line without compensation for the footing overhang.

General Survey Construction Staking Markings

PL = PROPERTY LINE
TOP = TOP OF SLOPE
TOE = TOE OF SLOPE
FG = FINISH GRADE
FS = FINISH SURFACE
SG = SUB GRADE
D/L = DAYLIGHT
FL = FLOW LINE
IE = INVERT ELEVATION
RIM = TOP OF RIM FINISH GRADE
TG = TOP OF GRATE FINISH GRADE
TP = TOP OF PIPE
BP = BOTTOM OF PIPE
TC = TOP OF CURB
FC = FACE OF CURB
R/W = RIGHT OF WAY
S/M = SEWER MAIN
WM = WATER MAIN
R/WM = RECLAIMED WATER MAIN
GE = GAS AND ELECTRIC
FW = FACE OF WALL
TW = TOP OF WALL
TF = TOP OF FOOTING
BF = BOTTOM OF FOOTING
C/L = CENTERLINE
L/O = LINE ONLY
BLDG = BLDG

COR = CORNER
L&D = LEAD AND DISC
SD = STORM DRAIN
FH = FIRE HYDRANT
ST. LITE = STREET LIGHT
TRANS = TRANSFORMER
TB = TOP OF BERM
CO = CLEAN OUT
AV = AIR VAC
BO = BLOWOFF VALVE
GB = GRADE BREAK
BC = BEGIN CURVE
PC = POINT OF CURVE
EC = END OF CURVE
PT = POINT OF TANGENCY
PRC = POINT OF REVERSE CURVE
PCR = POINT OF CURVE RETURN
PCC = POINT OF COMPOUND CURVE
BVC= BEGIN VERTICAL CURVE
EVC = END VERTICAL CURVE
PRVC = POINT OF REVERSE VERTICAL CURVE
CVC = CIRCULAR VERTICAL CURVE
STA. EQ = STATION EQUATION 1+00 = 9+00
D/4 = DELTA OVER 4 OR ¼ DELTA (THIS IS THE CURVE BROKEN INTO 4 EQUAL PARTS)
< = ANGLE POINT
@ = AT (USUALLY EXPRESSED FOR A DISTANCE) @ 25.00 FEET
EL = ELEVATION