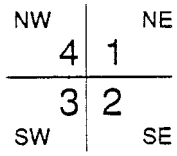
Benchmark Pro Mini Manual

Output Options

(1-) Printer on 3-4
(2-) Printer off 3-4
(4-) Return to Main Program Menu
(5-) Printer on for output only 3-4
(Input will show on screen only)
(6-) Bearing output 3-4
(7-) Azimuth output 3-4
(8-) Angle Right output 3-4
(29-) Azimuth (toggle north/south) 3-6

Quadrant Codes 4-8



Point Storage Routines

(120-) Store field data 2-18
(121-) Store coordinates 2-12
(122-) Open new job 2-9
(123-) List job directory 2-13
(124-) Retrieve old job 2-11
(125-) Delete a job 2-14
(139-) Available space on disk 2-15
(300-) Change drive for job storage 2-10
(301-) Change directory for job storage 2-3
(302-) Rename job 2-25

The commands listed in this section are applicable to all Benchmark programs.

Boundary Traverse

Traverse Selection

(10-) Closed - Enter starting point # then. 7-2
North and East coordinates.

(11-) Open - Same as 10- followed by 7-5
ending North and East coordinates

Angle Selection

(20-) Bearing 7-7
(21-) North Azimuth 7-7
(23-) Deflected angles 7-7
(24-) Angle turned from backsight 7-7

Side Selection

(86-) Automatic/Manual point numbering 7-8
(30-) Side Shot - Multiple 7-9
(31-) Side Shot - Single.....7-12
(330-) Exit multiple side shot routine 7-10
(60-) Radius curve 7-13
(61-) Tangent curve 7-15
(62-) Hold angle constant 7-19
(65-) Hold side constant 7-21
(365-) Direction into chord, chord length, ...7-22
and radius

Length Adjustment

(18-) Auto. /manual slope angle (toggle) 7-26
(50-) Temperature correction 7-28
(51-) Multiple slope angles 7-29
(52-) End multiple slope angles (Average) 7-29
(53-) End of multiple slope angles (Sum) 7-29
(54-) Meters to feet conversion 7-31
(57-) Cancel meters to feet conversion 7-32

End of Entry

(99-) Calculate Closure 7-33

Adjustment Options

Angle or Azimuth Balance

(101-) Automatic 7-34
(102-) Manual 7-35

Closure Trial

(110-) No adjustment 7-36
(111-) Compass Rule balance 7-36
(112-) Crandall's Rule balance 7-36

Special Routines

(113-) Display field data 7-39
(114-) Angular error search 7-40
(115-) Linear error search 7-41

Input Error Correction

(12-) Correct a side 7-44
(13-) Delete side 7-46
(14-) Insert side 7-47

Restart a Previously Input Job

(Assumes field data was stored on disk)
(124-) Retrieve old job 7-41
(99-) Recalculate closure 7-28
(25-) Resume traverse entry 7-48

Coordinate Geometry

Set-Up Commands

(10-) Clear area accumulation…… 6-2
Establish backsight
Establish occupied point
Establish first point for storage
(12-) Enter known coordinates……..6-18
Point number North and East coordinates
(13-) Change next point storage number 6-12
(19-) Display accumulated area.....6-17

Traversing (330-)

(20-) Bearings 6-4
(21-) North Azimuths 6-4
(23-) Deflected Angle 6-4
(24-) Included angles; right positive 6-4
left negative from backsight

Side Shot Options

(30-) Multiple side shot.....6-15
(330-) Exit multiple side shot 6-3
(31-) Single side shot.....6-15
(33-) 90 degree offset.....6-16

Define By Points

(40-) Define bearing 6-13
(41-) Define length 6-13
(42-) Define bearing and length 6-13

Length Adjustments

(18-) Auto./Manual Slope Angle (toggle) 6-6
(50-) Temperature correction 6-8
(51-) Multiple slope angles 6-7
(52-) End multiple slope angles (average) 6-7
(53-) End multiple slope angles (Sum) 6-7
(54-) Convert meters to feet 6-8
(57-) Cancel meters to feet conversion 6-8

Curve Options

(60-) Direction into radius and length 9-2
(61-) Direction into tangent and length 9-5
(62-) Radius point number and arc 9-7
(63-) Radius length and arc length 9-7
(64-) Chord bearing and length 9-9
(65-) Chord direction, length and radius * 9-11
(66-) Occupy P.I.; direction to P.C.; 9-13
direction to E.C.; radius
(67-) Occupy P.1.; direction to P.C.; 9-15
direction to E.C., tangent
(68-) Inverse to radius point 12-6
(69-) Any two knowns on curve 9-17

Curve Rules

If clockwise around radius point, enter radius point as positive.

If counter-clockwise around radius point, enter radius point as negative.

Curve Solver

(97-) Normal 9-19
(98-) Degree of curve-arc basis 9-19
(99-) Degree of curve-chord basis 9-19
Input any 2 of 5 known items defining curve output will provide complete curve data

Triangle Solver

(245-) *Input any 3 of 6 items defining triangle ....* **15-14**
Output will provide all data

Point Override

To store over existing point
Enter point number preceded by -
Note: Storing over occupied point not allowed

To jump to unused point number
Enter the desired point number

To let program select next empty location
Press "return" with no input

Point Utility Routines ……**14-1 to 14-7**

Utility	Sngl. Pt. Range		Job
Clear	**(200-)**	**(201-)**	**(202-)**
Print	**(210-)**	**(211-)**	**(212-)**
Move	**(220-)**	**(221-)**	**------**
Used Pts.	----------	**(213-)**	**--------**
Open Pts.	----------	**(214-)**	**--------**
Most N,S,E,W	----------	**(222-)**	**------**

inverse

(68-) Curve inverse 6-20
(81-) Consecutive 6-19
(82-) Radial 6-21

Miscellaneous Commands

(26-) Set Stadia Method for slope reduction 6-8
(27-) Set VA Method for slope reduction 6-8

(35-) Angle entry format - toggle normal/alt.....6-9
(37-) Line feed - toggle single/double 6-9
(76-) Activate auto. numbering for 12- routine 7-17
(86-) Point numbering option - 6-10
toggle automatic/manual
(88-) Rounds Area in Acres 3-10
(89-) Rounds Area in Square Feet 3-10
(90-) Select distance rounding 3-11
(94-) Select coordinate rounding 3-11
(95-) Select bearing rounding 3-11
(96-) Select elevation rounding 3-11

(223-) Enter and print comment 15-9

Radial Stakeout

(156-) 15-9

- Enter the setup point number
- Enter the backsight point number

(<return> with no entry if azimuth output)

- Enter the first and last point numbers

in the range to be searched

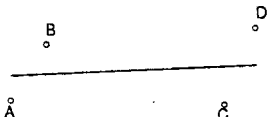
- Input maximum distance from the setup point

Output is the direction, distance to, and coordinates of each point found within the stakeout.
Once the setup and backsight are established, the direction, distance, and coordinates of individual points may be found by

- entering **159-**
- input the point number

Linear Regression

(138-) Find best fit line through group of points. 15-13



Enter 138-; then enter all points along the line. Return with no entry to exit routine and display results.

(227-) Three Point Problem (Resection) 15-15

1. Enter point A
2. Enter point B
3. Enter point C
4. Enter angle A
5. Enter angle B

(228-) Circular Curve through Three Points. , …. 15-16

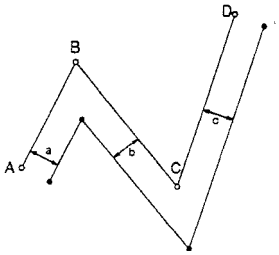
1. Enter first point
2. Enter second point
3. Enter third point

Street Design

(140-) Parallel lines…….. 10-3

1. Occupy point A; then enter 140-
2. Offset "a"; (+) right, (-) left
3. Point B
4. Offset "b"; (+) right, (-) left
5. Point C

   Repeat steps 4-5 for all points
6. Enter 141- to print the last point,



Elevation Option

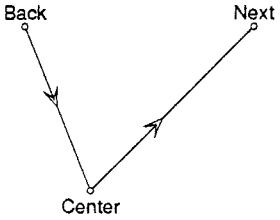
(26-) Select Stadia Reduction 6-8
(27-) Select EDM/Taping Reduction 6-8
(39-) Assign elevation to existing point 8-19
(44-) Three-wire leveling (on/off toggle) 3-7
(46-) Trigonometric leveling (on/off toggle) 3-7
(48-) Level at Station (on/off toggle) 3-7
(260-) Select difference of elevation mode 3-5
(261-) Select direct elevation entry mode 3-5
(320-) Set new benchmark elevation 8-8
(321-) Adjust elevations by a factor 8-9
(322-) Elevation traverse from backsight 8-10
(323-) Elevation traverse from foresight 8-12
(324-) Set measure-up 8-15
(325-) Set measure-down 8-16
(326-) Mean reciprocal observations 8-17
(327-) Update foresight elevation only 8-18

Compute Angle

(157-) Compute angle from stored points 15-11

1. Occupy back point
2. Enter 157-
3. Center point number
4. Next point number

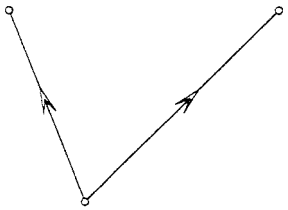
   Angle will be displayed.
5. Repeat step 4 as needed



(158-) Compute angle given direction……15-12

1. Enter 158-
2. Back direction
3. Foreword direction

   Angle will be displayed.
4. Repeat step 3 as needed.



Offsets from center line

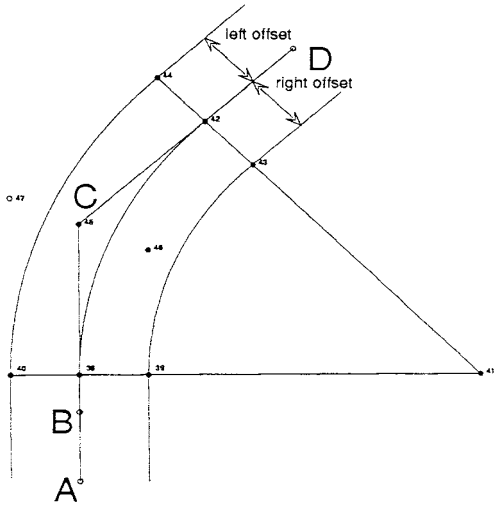
(180-) Begin offset from center line ……10-4
(185-) Describe radius curve……..10-4
(186-) Describe tangent curve……..10-4

1. Occupy A
2. 180-
3. Right offset length
4. Left offset length
5. Point B

Repeat step 5 to continue straight road

To add curve:

1. 185- (radius) or 186- (tangent)
2. Point B
3. Point C
4. Point D
5. Length

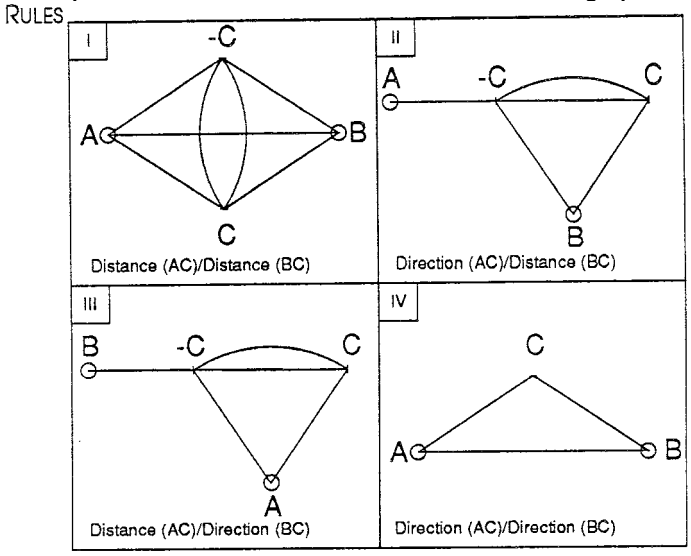


Intersections

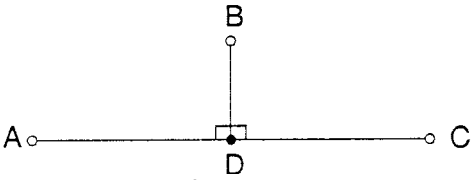
(91-) End on Point B 6-23
(92-) End on Point A 6-23
(93-) End on Point C 6-23

1. Direction to intersection
2. Length to intersection
3. Other known point number
4. Direction to intersection
5. Length to intersection
6. New point number; (+) right point, (-) left point

(Enter <return> for unknown direction or length)

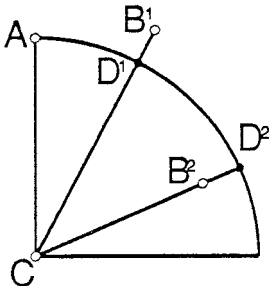


(70-) Offset intersection from line 6-27



1. Occupy point A
2. Select point for storage
3. Enter 70-
3. Enter point B
4. Enter point C

(71-) Offset intersection from arc 6-29



1. Occupy point A (either end of curve)
2. Select point for storage
3. Enter 71-
4, Enter point B
5. Enter point C

Transformation and Rotation

(151-) Coordinate by angle rotation 13-4
Point number of base point
New coordinates of base point
Point number of second point
New coordinates of second point

(152-) Compute rotation and scale factors……..13-3
same as 151- except that no point coordinates are changed.

(153-) Rotate all points to chosen bearing …….13-5
Point number of base point
New coordinates of base point
Chosen bearing
Average feet above sea level (<return> if not applicable)

Lot editing functions

(130-) list lot group file 11-3
(134-)Print lot data 11-9
(135-)Generate Script File 20-23
(142-) Save lot group file 11-11
(144-) Load lot group file 11-12

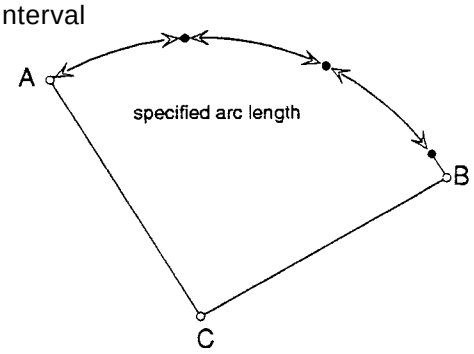
Benchmark/AutoCAD Interface

(127-) Create AutoCAD DXF file 20-2
(128-) ASCII Import of Point Data 19.2
(129-) ASCII Export of Benchmark Point File……..19-3

Divide an Arc

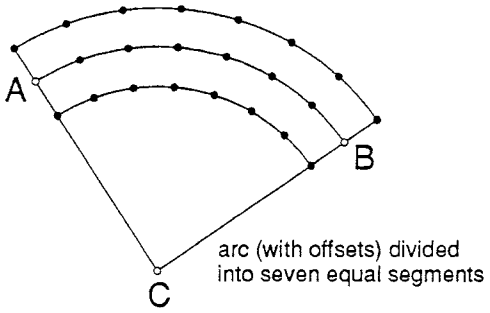
***(72-)* Divide arc by interval 15-2**

1. Occupy start of curve, Point A
2. Enter 72-
3. Point B
4. Point C
5. Left and right offsets
6. Interval



(74-) Divide arc by division 15-3

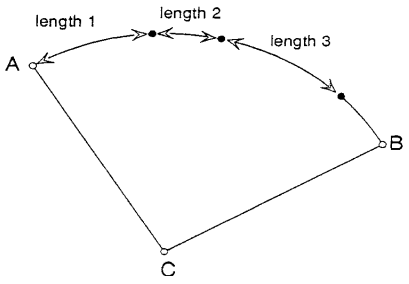
1. Follow steps 1-5 of 72- procedure above.
2. At interval prompt (I) enter 74-
3. Enter division



(77-) Divide arc by segments 15-5

1. Follow steps of 72- procedure above.
2. At the interval prompt (I) enter 77-
3. Enter length.

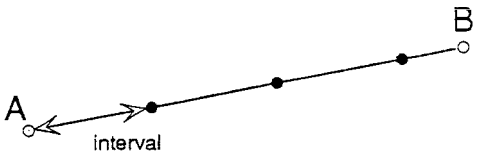
Length prompt will repeat until another command is entered.



Divide a Line

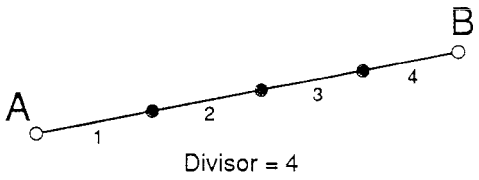
(73-) Divide line by interval 15-6

1. Occupy start of line, Point A
2. Enter 73-
3. Endpoint of line, Point B
4. Left and right offset
5. Interval



(75-) Divide line by division 15-7

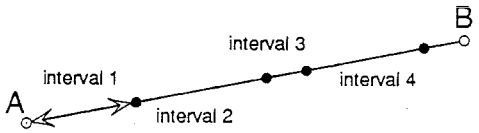
1. Follow steps 1-4 of the 73- routine above.
2. At the interval prompt (I) enter 75-
3. Enter the desired division



(79-) Divide line by segment 15-8

1. Follow steps 1-4 of the 73- routine above
2. At the interval prompt (I) enter 79-
3. Enter desired length

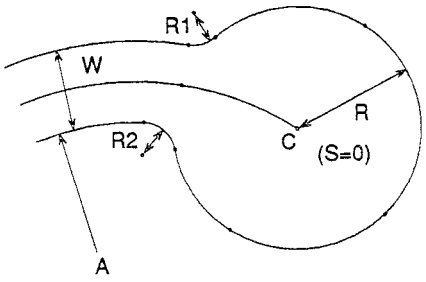
Length prompt will repeat until another command is entered.

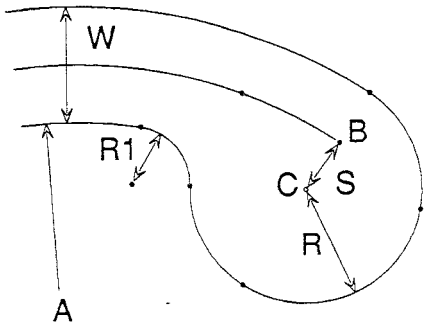


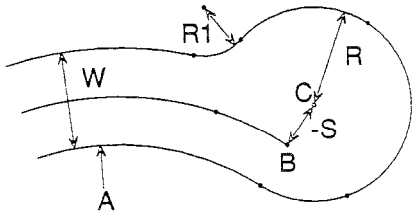
Cul-de-sac Design

See Chapter 10

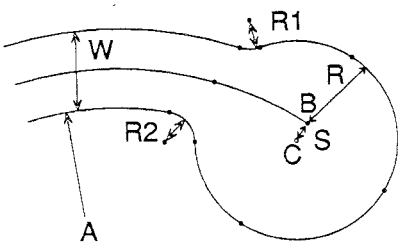
163- Center point known

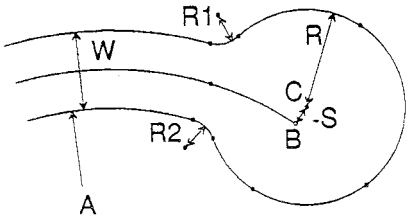




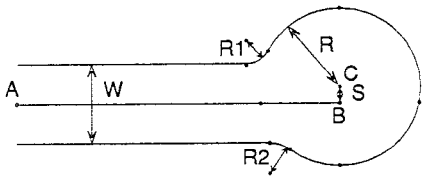


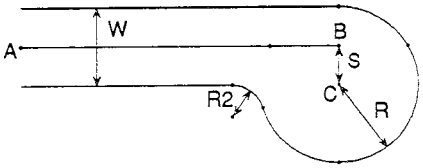
164- Offset point known



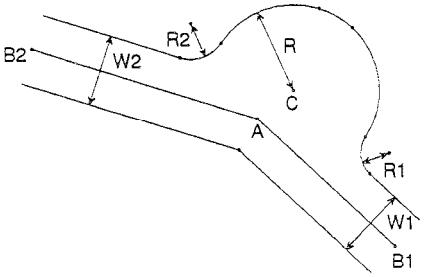


166- Offset point known

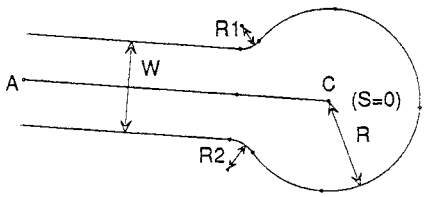


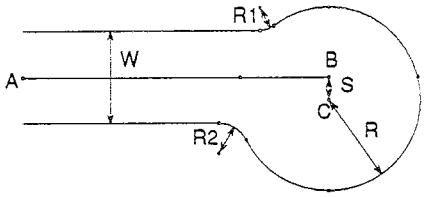


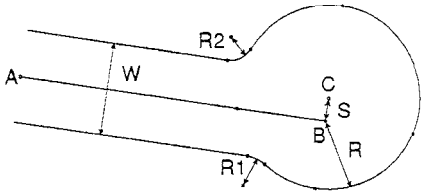
167- Bend with cul-de-sac



165- Center point known







Notes on cul-de-sac input variables

First entry is first point for storage

W, **W1,** and **W2** refer to the full street width entering the cul-de-sac

R1 and **R2** refer to the small radii where the street enters the cul-de-sac

R is the large radius inside the cul-de-sac

S is the offset distance to or from the center point of the cul-de-sac

C is the center point within the cul-de-sac **B**

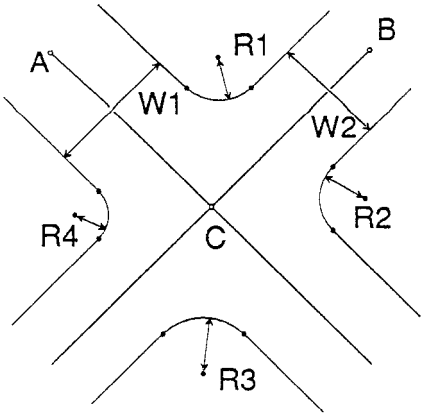
is the offset point within the cul-de-sac

A is a point on the centerline of the street, or a radius point used to define the location of the centerline of the street

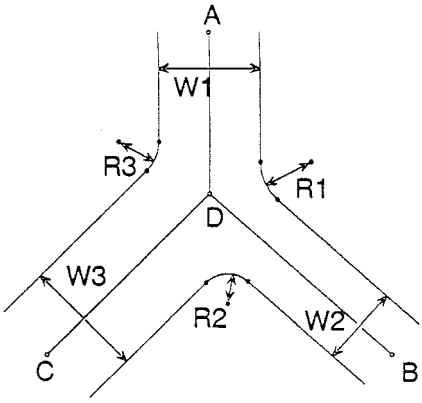
Street Intersections

Chapter 10 – Starts at Page 18

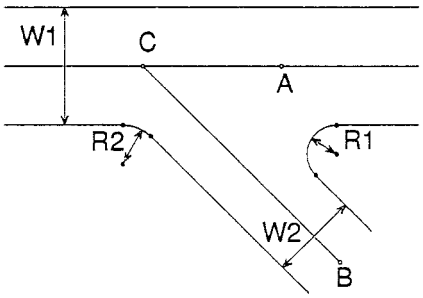
170- Four Way



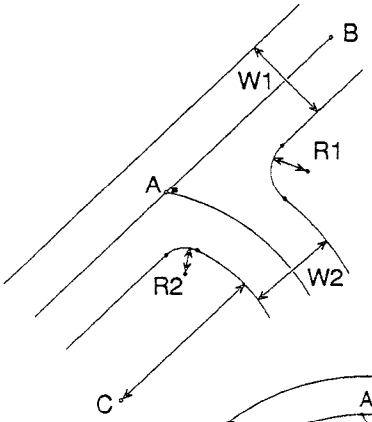
171- Three Way



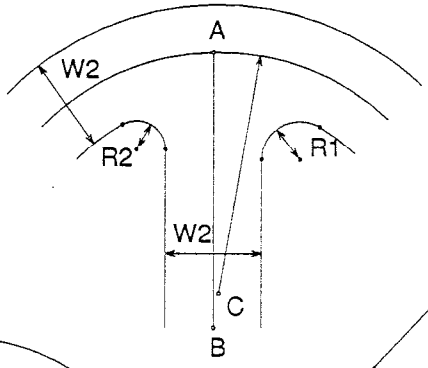
172- Two Way



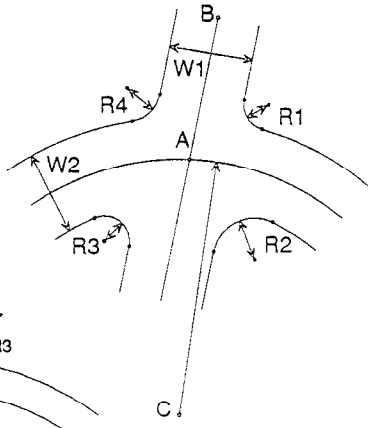
173- Curved Into Straight

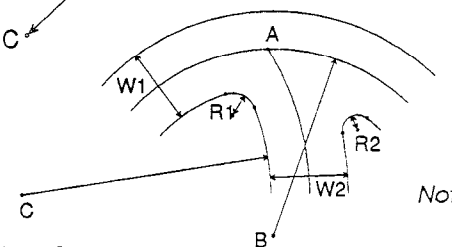


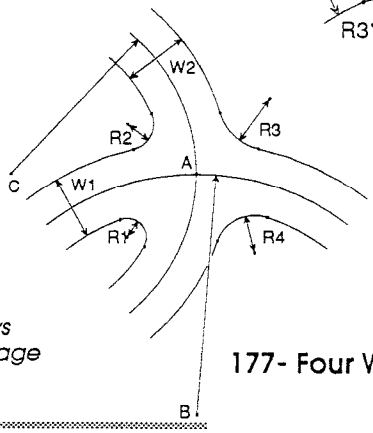
174- Two Way Straight Into Curve



175- Four Way Straight Into Curve





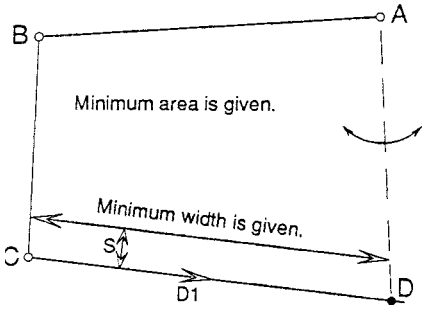


Note: First entry is always first point for storage

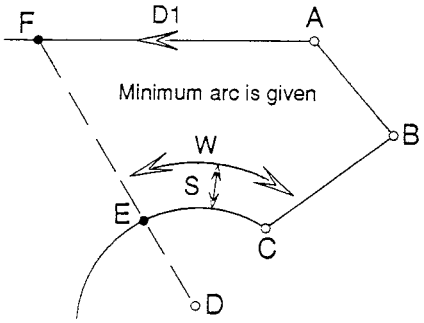
176- Two Way Curve/Curve Entry

177- Four Way Curve

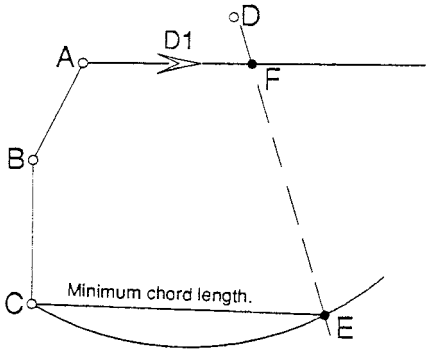
191- Bearing Swing



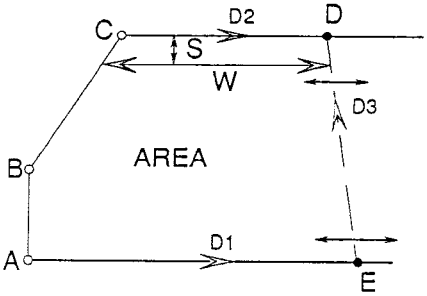
192- Radial/Minimum Arc



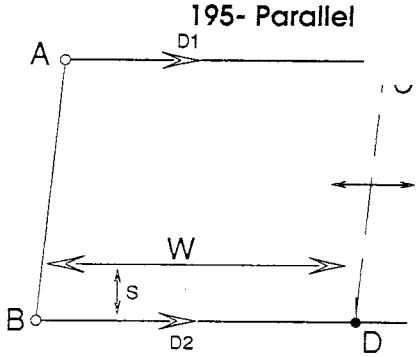
193- Radial/Minimum Chord



194- Sliding Bearing



195- Parallel



Lot Design

Chapter 12 - Pages 1-15

Utility I – Chapter 16

Curve Staking

1. (10-) to select output of deflection angle and chord
2. Enter radius -or-
   - (12-) for degree of curve - Arc basis
   - (13-) for degree of curve - Chord basis
3. Inside offset length
4. Outside offset length
5. P.C. point number
6. Length of curve -or- distance along tangent
7. Increment for stationing

Complete staking information will be displayed.

Elevation Reduction

(20-) Begin stadia note reduction
(21-) Reduce slope angle and distance
(22-) Create a turning point
(23-) Reduce level notes
(26-) Set stadia method for slope reduction
(27-) Set VA method for slope reduction

Triangle Solver

(245-) Given any 3 of 6 knowns display all triangle data

Vertical Curve Solver

(40-) Displays vertical curve data

1. Rate of change into P.I.
2. Rate of change out of P.I.
3. P.I. point number (station)
4. P.I. elevation
5. Length of vertical curve

Earthwork by Average End Area

Computes volume

1. Elevation
2. Distance
3. (52-) when profile is complete
4. Repeat 1-3 for next profile
5. Distance between profiles

Volume is displayed.

6. Repeat from step 1

Merge Utility

Merge Two Job Files

(110-) Makes temporary copy ……..20-3 of job 1 to merge
(111-) Merges current job with ……20-3 job stored with 110-

1. Use 124- to get first job
2. Use point routine utilities to arrange points in memory.
3. 110- to create temporary copy of job
4. Repeat steps 1-2 for second job
5. 111- combines the two jobs
6. Use final output routines to store combined point file

Utility II – Chapter 17

Circular Curve

(225-) Two chords and included angle

1. First chord length
2. Second chord length
3. Angle between chords

(228-) Through three points

1. First North coordinate
2. First East coordinate
3. Repeat steps 1-2 for next two points

Three Point Problems

(226-) Three angles, two lengths given

1. Enter each angle
2. Enter each length

(227-) Three points, two angles

1. North and East of each point
2. Enter each angle

Road Profile

(229-) Vertical Curve

1. Rate of change into P.I.
2. Rate of change out of P.I.
3. PVI point number
4. PVI elevation
5. Length of vertical curve

(230-) Tangent Grade

1. Known station
2. Known elevation
3. Grade % (+ or -)

Curve Staking

(235-) Offsets from tangent
(234-) Angles from PC; Chords stake to stake
(233-) Angle and chord from stake to stake

Azimuth of Polaris

(232-) See manual for procedure

Solar Observation

(237-) See manual for procedure

Spiral Curve Stakeout

(240-) See manual for procedure