CIVIL ENGINEERS
POCKET COMPUTER MONTHLY

SURVEYING - PART I

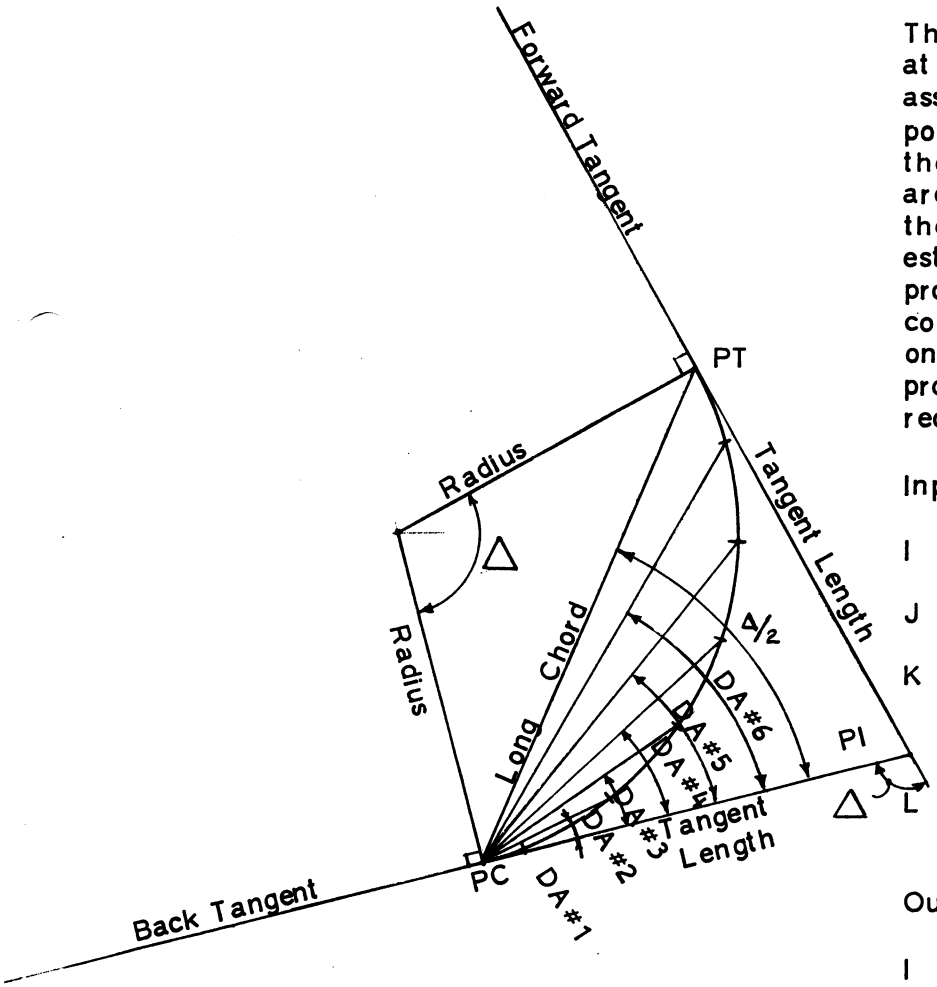
This is the first of a three-part series on the subject of surveying.

This issue includes two programs:

Horizontal Curve

Vertical Curve

HORIZONTAL CURVE



DA=Deflection Angle

PLAN-HORIZONTAL CURVE

The Horizontal Curve program provides information needed to stake out a circular curve. The curve begins at the Point of Curvature (PC) on the back tangent, and continues to the Point of Tangency (PT) on the forward tangent. The two tangents intersect at the Point of Intersection (PI). The deflection angle at the PI is the "delta" angle. A straight line connecting the PC and the PT is called the "long chord". The distance from PC (or PT) to PI is the "tangent".

The transit is set up at the PC and aimed at the PI with the vernier set at zero. We assume that the surveyor will stake out points on the curve at 50 ft. intervals, on the station and the 50 ft. plus. The stakes are set by measurement of a chord from the previous point. The alignment is established from the transit, set at the proper deflection angle. This process continues until the curve ends at the PT on the forward tangent. This program provides all chords and deflection angles required.

Input Parameters:

I = Delta Angle, Enter in degrees and decimals, (e.g. 22.31444°) Δ
J = Degree of Curvature, Enter in degrees and decimals
K = Radius, ft.
(Note: Either the Degree of Curvature, or the Radius may be entered, not both.)
L = Station of PC in this form: Station 12 + 65.47 is entered as 1265.47

Output Parameters:

I = Delta Angle, DMS
J = Degree of Curvature, DMS
K = Radius, Ft.
F and G = Station of PC in the form 12 + 65.47
Q and R = Station of PT in the form: 14 + 21.26

Output Parameters (continued)

A = Arc Length, ft.
B = Tangent Length, ft.
C = Length of Long Chord, ft.
D = Chord Length, 50 ft. Arc, ft.
T = Chord Length, 100 ft. Arc, ft.

Staking Information:

N = Chord Length, first chord, ft.
M = First Deflection Angle, DMS
U and V = Station along Curve
O = Deflection Angle, DMS
X = Chord Length, final chord

PROGRAM LISTING - HORIZONTAL CURVE/PC-2

```
  5:"A"WAIT 90:
    PRINT "HORIZON
    TAL CURVE"
  7:LPRINT "*HORIZ
    ONTAL CURVE*":
    LF 2
 10:INPUT "DELTA="
    ;I
 20:INPUT "DEG.CUR
    VE=";J
 30:INPUT "RADIUS,
    FT=";K
 35:INPUT "STATION
     OF PC=";L
100:IF J=0LET J=10
    0/K*180/Π:J=
    INT (J*10000+.
    5)/10000:GOTO
    120
110:K=100/J*180/Π:
    K=INT (K*100+.
    5)/100
120:B=K*TAN (I/2):
    B=INT (B*100+.
    5)/100
130:C=2*K*SIN (I/2
    ):D=2*K*SIN (J
    /4)
133:C=INT (C*100+.
    5)/100:D=INT (
    D*100+.5)/100
135:T=2*K*SIN (J/2
    ):T=INT (T*100
    +.5)/100
140:A=K*I*Π/180:A=
    INT (A*100+.5)
    /100
160:F=INT (L/100)
170:G=L-F*100:G=
    INT (G*100+.5)
    /100
180:IF G<50LET H=5
    0-G:GOTO 200
190:H=100-G
200:M=(H/K*180/Π)/
    2:M=INT (10000
    *M+.5)/10000
210:N=2*K*SIN M:N=
    INT (N*100+.5)
    /100
220:P=L+A
230:Q=INT (P/100)
240:R=P-Q*100:R=
    INT (R*100+.5)
    /100
980:LPRINT "DELTA
    ANGLE      =";
    I1=I:GOSUB 150
    0
990:LPRINT "DEGREE
    /CURVE     =";
    I1=J:GOSUB 150
    0
1000:LPRINT "ARC
     LENGTH=";A
1010:LPRINT "TANG
     ENT LENGTH
      =";B
1020:LPRINT "CHOR
     D LENGTH
      =";C
1030:LPRINT "CHD.
     LGTH, 50FT.AR
     C=";D
1040:LPRINT "CHD.
     LGTH, 100FT.A
     RC=";T
1080:LF 2:LPRINT
     "STATION/P.C
          =";F;"
     +";G
1090:LPRINT "STAT
     ION/P.T.
      =";Q;"+";R
1100:LPRINT "RADI
     US=";K:LF 2
1105:LPRINT "STAK
     ING INFO:":
     LF 1
1110:W=L+H:U=INT
     (W/100):V=W-
     U*100:V=INT
     (100*V+.5)/1
     00
1113:LPRINT "STAT
     ION=";U;"+";
     V
1120:LPRINT "DEFL
     .ANGLE=";I1=
     M:GOSUB 1500
1130:LPRINT "CHOR
     D LGTH=";N:
     LF 1
1220:O=M
1240:O=O+J/4
1245:W=W+50:U=INT
     (W/100):V=W-
     U*100:V=INT
     (100*V+.5)/1
     00
1246:LPRINT "STAT
     ION=";U;"+";
     V
1255:LPRINT "DEFL
     .ANGLE=";I1=
     O:GOSUB 1500
1260:LPRINT "CHOR
     D LGTH=";D
1270:IF (I/2-O)<=
     J/4THEN 1290
1280:LF 1:GOTO 12
     40
1290:LF 1:LPRINT
     "AT P.T."
1295:X=2*K*SIN ((
     I-2*O)/2):X=
     INT (X*100+.
     5)/100
1300:LPRINT "STAT
     ION=";Q;"+";
     R
1410:LPRINT "DEFL
     .ANGLE";I1=I
     /2:GOSUB 150
     0
1420:LPRINT "CHOR
     D LGTH=";X:
     LF 3:END
1500:A1=(I1-INT I
     1)*60:B1=INT
     ((A1-INT A1)
     *60+.5)
1510:LPRINT INT (
     I1);"DEG";
     INT A1;"MIN"
     ;B1;"SEC":
     RETURN
```

As stated on Page 1, this Horizontal Curve Program requires entry of angles Delta and Degree of Curvature in degrees and decimals. If you would prefer to enter these angles in degrees, minutes, seconds (DEGMNSC) format, the following modifications to the program would be required:

In PC-2:

Line 10 becomes:

```
10 INPUT "DELTA=";I:O=I:GOSUB
   1600:I=O
```

Line 20 becomes:

```
20 INPUT "DEG. CURVE=";J:O=J:
   GOSUB 1600:J=O
```

Add subroutine 1600 as follows:

```
1600  A=INT(O/10000)
1610  W=INT((O-10000*A)/100)
1620  S=O-10000*A-100*W
1630  O=A+(W+S/60)/60:RETURN
```

In PC-1:

Line 10 becomes:

```
10 INPUT "DELTA=";I:O=I:GOSUB
   600:I=O:INPUT "DEG. CURVE=";J:
   O=J:GOSUB 600:J=O
```

Add subroutine 600 as follows:

```
600   A=INT(O/10000):W=INT((O-
      10000*A)/100):S=O-A*1E4-100*W:
      O=A+(W+S/60)/60
601   RETURN
```

The following example illustrates the use of this entry format:

Delta Angle = 22.314444 is actually 22°18' 52" and would be entered as 221852. Another illustration: 153°7'6" would be entered as 1530706.

PROGRAM LISTING - HORIZONTAL CURVE/PC-1

```
  5:"A"CLEAR :
    PRINT "***HO
    RIZONTAL***"
    :PRINT "
     CURVE":
    PRINT " ":
    PRINT " "
 10:INPUT "DELTA
    =";I:INPUT "
    DEG.CURVE=";
    J
 30:INPUT "RADIU
    S;FT=";K:
    INPUT "STATI
    ON/PC=";L
100:IF J=0LET J=
    100/K*180/π:
    J=INT (J*100
    00+.5)/10000
    :GOTO 120
110:K=100/J*180/
    π:K=INT (K*1
    00+.5)/100:B
    =INT (K*TAN
    (I/2)*100+.5
    )/100
130:C=2*K*SIN (I
    /2):D=2*K*
    SIN (J/4):C=
    INT (C*100+.
    5)/100:D=INT
    (D*100+.5)/1
    00
135:T=2*K*SIN (J
    /2):T=INT (T
    *100+.5)/100
    :A=K*I*π/180
    :A=INT (A*10
    0+.5)/100
160:F=INT (L/100
    ):G=L-F*100:
    G=INT (G*100
    +.5)/100
180:IF G<50LET H
    =50-G:GOTO 2
    00
190:H=100-G
200:M=(H/K*180/π
    )/2:M=INT (1
    0000*M+.5)/1
    0000
210:N=2*K*SIN M:
    N=INT (N*100
    +.5)/100:P=L
    +A:Q=INT (P/
    100)
240:R=P-Q*100:R=
    INT (R*100+.
    5)/100:PRINT
    "DELTA ANGLE
        =":E=I:
    GOSUB 900
260:PRINT "DEGRE
    E/CURVE   ="
    :E=J:GOSUB 9
    00:PRINT "AR
    C LENGTH
     =";A
310:PRINT "TAN.L
    GTH=";B:
    PRINT "CHD.L
    GTH=";C
330:PRINT "CHD.L
    .;50FT.ARC="
    ;D:PRINT "CH
    D.L.100FT.AR
    C=";T
379:PRINT " "
380:PRINT "STATI
    ON/PC     ="
    ;F;"+";G
390:PRINT "STATI
    ON/PT     ="
    ;Q;"+";R:
    PRINT "RADIU
    S=";K
391:PRINT " "
405:PRINT "STAKI
    NG INFO:":
    PRINT " ";W=
    L+H:U=INT (W
    /100):V=W-U*
    100:V=INT (1
    00*V+.5)/100
413:PRINT "STATI
    ON=";U;"+";V
    :PRINT "DEFL
    .ANGLE=";E=M
    :GOSUB 900
430:PRINT "CHORD
     LGTH=";N:
    PRINT " ";O=
    M
450:O=O+J/4
460:W=W+50:U=INT
    (W/100):V=W-
    U*100:V=INT
    (100*V+.5)/1
    00
470:PRINT "STATI
    ON=";U;"+";V
    :PRINT "DEFL
    .ANGLE=";E=O
    :GOSUB 900:
    PRINT "CHD L
    .=";D
480:IF (I/2-O)<=
    J/4THEN 520
510:PRINT " ":
    GOTO 450
520:PRINT " ":
    PRINT "AT P.
    T."
530:X=2*K*SIN ((
    I-2*O)/2):X=
    INT (X*100+.
    5)/100
540:PRINT "STATI
    ON        ="
    ;Q;"+";R:
    PRINT "DEFL.
    ANGLE=";E=I/
    2:GOSUB 900
560:PRINT "CHORD
     LGTH=";X:
    PRINT " ":
    PRINT " ":
    PRINT " ":
    END
900:Y=(E-INT E)*
    60:Z=INT ((Y
    -INT Y)*60+.
    5)
905:E=INT (E):Y=
    INT (Y):
    PRINT E;"DEG
    ";Y;"MIN";Z;
    "SEC":RETURN
```

WORKED OUT EXAMPLES-HORIZONTAL CURVE/PC-2

EXAMPLE #1

In the first example, the curve has a delta angle of 22° 18' 52" which is entered as 22.31444°. The curve radius is to be 400 ft. which is entered. However the degree of curvature is calculated in the program; enter zero.

Press SHIFT A to begin. The program will print out all information needed for drafting and staking.

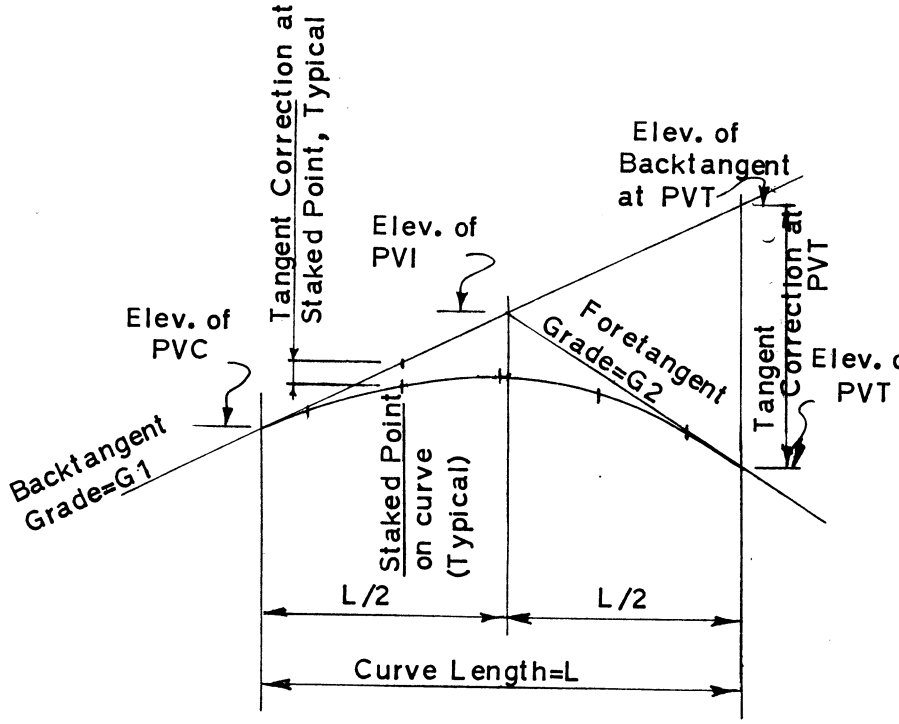
```
*HORIZONTAL CURVE*


DELTA ANGLE       =
 22DEG 18MIN 52SEC
DEGREE/CURVE      =
 14DEG 19MIN 26SEC
ARC LENGTH= 155.79
TANGENT LENGTH    =
 78.89
CHORD LENGTH      =
 154.8
CHD.LGTH, 50FT.ARC=
 49.97
CHD.LGTH, 100FT.ARC
= 99.74


STATION/P.C.      =
 12+ 65.47
STATION/P.T.      =
 14+ 21.26
RADIUS= 400


STAKING INFO:

STATION= 13+ 0
DEFL.ANGLE=
 2DEG 28MIN 23SEC
CHORD LGTH= 34.52

STATION= 13+ 50
DEFL.ANGLE=
 6DEG 3MIN 14SEC
CHORD LGTH= 49.97

STATION= 14+ 0
DEFL.ANGLE=
 9DEG 38MIN 6SEC
CHORD LGTH= 49.97

AT P.T.
STATION= 14+ 21.26
DEFL.ANGLE
 11DEG 9MIN 26SEC
CHORD LGTH= 21.25
```

EXAMPLE #2

In the second example the delta angle is 53.21472; the degree of curvature is entered as 15°; the radius is entered as zero.

```
*HORIZONTAL CURVE*


DELTA ANGLE       =
 53DEG 12MIN 53SEC
DEGREE/CURVE      =
 15DEG 0MIN 0SEC
ARC LENGTH= 354.76
TANGENT LENGTH    =
 191.34
CHORD LENGTH      =
 342.15
CHD.LGTH, 50FT.ARC=
 49.96
CHD.LGTH, 100FT.ARC
= 99.71


STATION/P.C.      =
 6+ 25.38
STATION/P.T.      =
 9+ 80.14
RADIUS= 381.97


STAKING INFO:

STATION= 6+ 50
DEFL.ANGLE=
 1DEG 50MIN 47SEC
CHORD LGTH= 24.62

STATION= 7+ 0
DEFL.ANGLE=
 5DEG 35MIN 47SEC
CHORD LGTH= 49.96

STATION= 7+ 50
DEFL.ANGLE=
 9DEG 20MIN 47SEC
CHORD LGTH= 49.96

STATION= 8+ 0
DEFL.ANGLE=
 13DEG 5MIN 47SEC
CHORD LGTH= 49.96

STATION= 8+ 50
DEFL.ANGLE=
 16DEG 50MIN 47SEC
CHORD LGTH= 49.96

STATION= 9+ 0
DEFL.ANGLE=
 20DEG 35MIN 47SEC
CHORD LGTH= 49.96

STATION= 9+ 50
DEFL.ANGLE=
 24DEG 20MIN 47SEC
CHORD LGTH= 49.96

AT P.T.
STATION= 9+ 80.14
DEFL.ANGLE
 26DEG 36MIN 27SEC
CHORD LGTH= 30.14
```

VERTICAL CURVE



PROFILE-VERTICAL CURVE

This program provides information needed to stake out a parabolic vertical curve. The vertical curve is a true parabola with a vertical axis. The two grade lines are called the back tangent and the forward tangent; they intersect at the PVI. The beginning of the curve is the PVC; the end is the PVT. The curve starts at a gradient equal to the rate of grade of the back tangent at the PVC. It changes in accordance with the second order curve so that it has the gradient of the forward tangent where it intersects the PVT. It is assumed that staking will occur at 50 ft. intervals, on station and at the 50 ft. plus. The program finds the station and elevation of the highest point, summit, or the lowest point in the sag.

Input Parameters:

L = Curve Length, ft.
S = Station of PVI (Station 9 + 12.56 is entered as 912.56)
E = Elevation at PVI
G1 = Grade on Backtangent, with due regard to sign (uphill is plus, downhill minus).
G2 = Grade on Foretangent

Output Parameters:

L, E, G1, G2 = As above
F & G = Station of PVI in the form 9 + 12.56
D = Elevation of PVC
Q & R = Station of PVC
W = Elevation of PVT
A & B = Station of PVT

Data for Staking along Curve:

U & V = Station
X = Elevation

PROGRAM LISTING - VERTICAL CURVE/ PC-2

```
  5:"A"WAIT 90:
    PRINT "VERTICA
    L CURVE"
  7:LPRINT "**VERT
    ICAL CURVE**":
    LF 2
 10:INPUT "CURVE L
    ENGTH   =";L
 20:INPUT "STATION
    , PVI    =";S
 30:INPUT "ELEVATI
    ON, PVI  =";E
 50:INPUT "GRADE, B
    ACK-TANGENT=";
    G1
 60:INPUT "GRADE, F
    ORE-TANGENT=";
    G2
110:H=L/2*(G1-G2)/
    100
120:C=H/L/L
160:F=INT (S/100):
    G=S-F*100:G=
    INT (G*100+.5)
    /100
200:P=S-L/2
230:Q=INT (P/100):
    R=P-Q*100:R=
    INT (R*100+.5)
    /100
```

VERTICAL CURVE/PC-2 (continued)

```
240: IF R<50LET J=5
     0-R:GOTO 270
250: J=100-R
270: T=S+L/2
280: A=INT (T/100):
     B=T-A*100:B=
     INT (B*100+.5)
     /100
290: W=E+G2*L/2/100
295: D=E-G1*L/2/100
300: LPRINT "CURVE
     LENGTH,FT= ";L
310: LPRINT "STATIO
     N,PVI     =";
     LPRINT F;"+";G
320: LPRINT "ELEV.,
     PVI       = ";E
330: LPRINT "GRADE,
     BACK-TANG=";
     LPRINT G1;"%"
340: LPRINT "GRADE,
     FORE-TANG=";
     LPRINT G2;"%":
     LF 2
350: LPRINT "DATA F
     OR STAKING:";
     LF 1
370: LPRINT "STATIO
     N,PVC";:LPRINT
     Q;"+";R
380: LPRINT "ELEV="
     :LPRINT D:LF 1
500: O=J:GOTO 520
510: O=O+50
520: X=D+O*G1/100-C
     *O^2:X=INT (10
     0*X+.5)/100
530: U=INT ((P+O)/1
     00):V=P+O-U*10
     0:V=INT (V*100
     +.5)/100
540: LPRINT "STATIO
     N";:LPRINT U;"+
     ";V:LPRINT "EL
     EV=";:LPRINT X:
     LF 1
550: IF T-O-P<=50
     THEN 570
560: GOTO 510
570: LPRINT "STATIO
     N,PVT";:LPRINT
     A;"+";B
580: LPRINT "ELEV="
     :LPRINT W:LF 1
600: N=G1*L/(G1-G2)
     :M=P+N
610: A=INT (M/100):
     B=M-A*100:B=
     INT (B*100+.5)
     /100
615: IF SGN G1=SGN
     G2THEN END
620: LPRINT "HIGH/L
     OW POINT,AT"
630: LPRINT "STATIO
     N";:LPRINT A;"+
     ";B:LPRINT "EL
     EV="
640: LPRINT INT (10
     0*(D+N*G1/100-
     C*N^2)+.5)/100
650: LF 3:END
```

PROGRAM LISTING VERTICAL CURVE/PC-1

```
  5:"A"CLEAR :
    PRINT "*VERT
    ICAL CURVE*"
  7:PRINT " ":
    PRINT " "
 10:INPUT "CURVE
     LENGTH,FT="
    ;L
 20:INPUT "STATI
    ON,PVI=";S
 30:INPUT "ELEVA
    TION,PVI=";E
 50:INPUT "GRADE
    ,BACK-TANGEN
    T=";I
 60:INPUT "GRADE
    ,FORE-TANGEN
    T=";K
110:H=L/2*(I-K)/
    100
120:C=H/L/L
160:F=INT (S/100
    ):G=S-F*100:
    G=INT (G*100
    +.5)/100
200:P=S-L/2
230:Q=INT (P/100
    ):R=P-Q*100:
    R=INT (R*100
    +.5)/100
240:IF R<50LET J
    =50-R:GOTO 2
    70
250:J=100-R
270:T=S+L/2
280:A=INT (T/100
    ):B=T-A*100:
    B=INT (B*100
    +.5)/100
290:W=E+K*L/2/10
    0
295:D=E-I*L/2/10
    0
300:PRINT "CURVE
     LENGTH,FT="
    ;L
310:PRINT "STATI
    ON,PVI    ="
    :PRINT F;"+"
    ;G
320:PRINT "ELEV.
    ,PVI=";E
330:PRINT "GRADE
    ,BACK-TANG="
    :PRINT I;"%"
340:PRINT "GRADE
    ,FORE-TANG="
    :PRINT K;"%"
    :PRINT " ":
    PRINT " "
350:PRINT "DATA
    FOR STAKING"
    :PRINT " "
370:PRINT "STATI
    ON,PVC":
    PRINT Q;"+";
    R
380:PRINT "ELEV=
    ":PRINT D:
    PRINT " "
500:O=J:GOTO 520
510:O=O+50
520:X=D+O*I/100-
    C*O^2:X=INT
    (100*X+.5)/1
    00
530:U=INT ((P+O)
    /100):V=P+O-
    U*100:V=INT
    (V*100+.5)/1
    00
540:PRINT "STATI
    ON":PRINT U;
    "+";V:PRINT
    "ELEV=":
    PRINT X:
    PRINT " "
550:IF T-O-P<=50
    THEN 570
560:GOTO 510
570:PRINT "STATI
    ON,PVT":
    PRINT A;"+";
    B
580:PRINT "ELEV=
    ":PRINT W:
    PRINT " "
600:N=I*L/(I-K):
    M=P+N
610:A=INT (M/100
    ):B=M-A*100:
    B=INT (B*100
    +.5)/100
615:Y=SGN I:Z=
    SGN K:IF Y=Z
    THEN 650
620:PRINT "HIGH/
    LOW PT,AT"
630:PRINT "STATI
    ON":PRINT A;
    "+";B:PRINT
    "ELEV="
640:PRINT INT (1
    00*(D+N*I/10
    0-C*N^2)+.5)
    /100
650:PRINT " ":
    PRINT " ":
    PRINT " ":
    END
```

WORKED OUT EXAMPLES - VERTICAL CURVE/PC-2

EXAMPLE #1

A vertical curve with a length of 450 ft. has a PVI Station at 9 + 12.56. The elevation where the fore and back tangents intersect is 56.21. The back tangent grade is +5% (uphill) and the foretangent is -3% (downhill).

The output documents the input, provides elevations at PVC and PVT, and at all stations and half-stations along the curve. Finally the highpoint or crest is defined at Station 9 + 68.81, Elev. 51.99.

```
**VERTICAL CURVE**


CURVE LENGTH, FT=
450
STATION, PVI     =
 9+ 12.56
ELEV., PVI       =
56.21
GRADE, BACK-TANG=
 5%
GRADE, FORE-TANG=
-3%


DATA FOR STAKING:

STATION, PVC
 6+ 87.56
ELEV=
              44.96

STATION
 7+ 0
ELEV=
              45.57

STATION
 7+ 50
ELEV=
              47.74

STATION
 8+ 0
ELEV=
              49.46

STATION
 8+ 50
ELEV=
              50.74

STATION
 9+ 0
ELEV=
              51.57

STATION
 9+ 50
ELEV=
              51.96

STATION
 10+ 0
ELEV=
               51.9

STATION
 10+ 50
ELEV=
              51.41

STATION
 11+ 0
ELEV=
              50.46

STATION, PVT
 11+ 37.56
ELEV=
              49.46

HIGH/LOW POINT, AT
STATION
 9+ 68.81
ELEV=
              51.99
```

EXAMPLE #2

This vertical curve occurs on two down hill gradients, -7.5% and -2.5%. Therefore no low point exists; the program recognizes this fact and ignores the "High/Low Point".

```
**VERTICAL CURVE**


CURVE LENGTH, FT=
350
STATION, PVI     =
 5+ 14.75
ELEV., PVI       =
97.25
GRADE, BACK-TANG=
-7.5%
GRADE, FORE-TANG=
-2.5%


DATA FOR STAKING:

STATION, PVC
 3+ 39.75
ELEV=
             110.375

STATION
 3+ 50
ELEV=
              109.61

STATION
 4+ 0
ELEV=
              106.12

STATION
 4+ 50
ELEV=
              102.97

STATION
 5+ 0
ELEV=
              100.19

STATION
 5+ 50
ELEV=
               97.76

STATION
 6+ 0
ELEV=
               95.69

STATION
 6+ 50
ELEV=
                93.98

STATION, PVT
 6+ 89.75
ELEV=
              92.875
```

ERRATA

In some copies of our "Premier" December, 1982 issue our listing of the Statistics—Confidence Program PC-2 on Page 9 contained an error in Line 44Ø. This line should read as follows:

```
44Ø  G=(79*Z^9+ 776*Z^7 +1482*Z^5-
     1920*Z^3-945*Z)/9216Ø/A^4
```

In our September 1983 Issue, the Errata for "Wood Members in Axial Stress" applied to our program "Wood Members in Combined Axial and Bending" which initially appeared in the April issue (pg. 6-7). On Page 7 of the Sept. issue, we provided all necessary changes in lines 22Ø, 23Ø and 24Ø and an additional line 115; however, we failed to point out that these changes also apply to our PC-1 listing for the same program as it appeared in the July 1983 issue (Pg. 4-5). In addition, we should point out once more that the PC-1 version of this CA&B program does not accomodate eccentricity; delete the words "AND ECCENTRICITY" from the title on Page 4 of the July Issue.

WARNING - PROGRAM RERUNS

In any program which is restarted without clearing variables (i.e., setting parameter values to zero), all parameters will of course contain the value which existed when the program reached the END of its most recent run. Ideally all INPUT variables should be set to zero and then re-entered for all runs; however, this may be tedious. As an example, consider the GCP program. In our "Instructions" provided as a loose sheet with our February Issue we pointed out how to avoid re-entry of all INPUT values. To quote: "If during a RERUN, "ENTER" is pressed without a number having been entered, the computer will assume that the parameter values remain the same and will cease asking for them."

However, you should be aware of the possibility that the value which was initially input, may have been altered during the program run. The danger associated with the use of this shortcut procedure is that an input parameter could carry a different value than the value entered initially.

PROGRAMMERS GUIDE/PC-2

Radio Shack is marketing a book entitled "Getting Started on the PC-2" by Pennington, Camp and Burris, published in May 1963 ($12.95). We recently bought a copy. As you may know, early purchasers of the PC-2 were promised a "TRS-8Ø PC-2 Programming Guide" which was to be "available in the summer of 1982". We are quite sure no such title was ever published. We believe the Pennington, et al book is intended by Radio Shack to fill this void.

The style is breezy but the book seems authoritative and comprehensive; it is indexed and has a detailed Table of Contents.

We recommend it.

Please let us know of any other books, articles, etc. which you have found helpful.

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THE SHARP 1500A

Sharp is advertising the PC 1500A, a new model of the PC-1500. The keyboard has been rearranged and, we think, improved; for example, the SPACE bar and ENTER bar are no longer side-by-side. Most importantly, the 1500A comes with 8K of RAM.

THE 16K EXPANSION MODULE

Sharp has also announced the availability of a 16K expansion module (CE 161). Sharp is also advertising plug-in modules for Spreadsheet, Finance, Math, Electrical Engineer, Circuit Analysis, Buiness Graphics, General Graphics, Statistical Distribution, and Graphics Development.

After installing the 16K Module, type NEW 256, then ENTER. If you follow the instructions packed with the module, you should have over 18600 bytes of available RAM in your PC-2.

We think the PC-2/PC-1500 is an out-standing tool for engineers, particularly those who are skilled in writing application programs in BASIC or machine language. We believe its limitations, such as the small display, are more than offset by its capabilities, if these capabilities are fully exploited. With 18.6 to 24K RAM now available, this superior computer becomes even better.

RS 232 INTERFACE

Sharp sells an RS 232 interface (CE 158). It allows communication links to a wide variety of peripherals such as modems, bar-code reader, data bases, as well as other micro, mini or mainframe computers.

You may call Sharp at 1-800-447-4700 for more information. Or write Sharp Electronics Corp., 10 Sharp Plaza, Paramus, N.J. 07652.

PROGRAMS AVAILABLE

Michael J. Sampl, a consulting engineer, offers civil engineering programs for sale. These programs pertain to civil engineering, structural engineering, and energy analysis. His programs are available on cassette tape or disk for the Texas Instruments 99/4A computer, and the Commodore 64. To obtain a free catalog, write: Canned Engineering, 1047 Driftwood Trails, Florissant, MO 63031. Mr. Sample hopes to prove that you do not have to spend a fortune on hardware and software to obtain vast computing power.

Mr. Sampl kindly has given us a program titled Continuous Beam Analysis, which analyzes a continuous beam with up to 18 spans and 19 supports. Gives final bending moments and reactions at the supports. Any combination of span lengths may be inserted. Any combination of loads may be applied to each span including uniformly distributed and point loads. Uses moment distribution method of analysis.

If you would like Mr. Sampl's TI listing of this program, please send a self-addressed stamped envelope to CECOM, P.O. Box 6, Hart, MI 49420. You may purchase a disk (TI or Commodore 64) directly from Canned Engineering.