

A.1: TRD: DESIGN REINFORCED CONCRETE BEAM WITH TENSION REINFORCEMENT ONLY

PROGRAM LISTING:

KEYSTROKES

```
HOME ' CONC ' CRDIR ENTER  
VAR CONC ' TRD ' CRDIR ENTER  
TRD  
* ' 12 * M / (B * D ^ 2) ' EVAL * ENTER  
' K ' STO  
* ' (1 - sqrt(1 - 2 * K / (.9 * .85 * FC))) * .85 * FC / FY ' EVAL * ENTER  
' R ' STO  
* IF FC 4 < THEN .85 ELSE IF FC 8 >  
THEN .65 ELSE ' .85 - (FC - 4) / 20 ' EVAL  
END END * ENTER  
' B1 ' STO  
* ' .75 * .85 * 87 * B1 * FC / (FY * (87 + FY)) ' EVAL * ENTER  
' RMAX ' STO  
* ' .2 / FY ' EVAL * ENTER  
' RMIN ' STO  
* ' R * B * D ' EVAL * ENTER  
' AS ' STO  
* ' .85 * 2 * B * D * sqrt(1000 * FC) / 1000 ' EVAL * ENTER  
' PHVC ' STO
```

COMMENTARY

Create parent directory, CONC.

Create subdirectory, TRD.

Open current directory, TRD.

Define the parameter, K.
Store K.

Define the reinforcement ratio, R. (ie. ρ of reference 1).
Store R.

Define the factor, B1 (i.e. β_1 of reference 2).
Store B1.

Define the maximum reinforcement ratio, RMAX (i.e. ρ_{max} of reference 3).
Store RMAX.

Define the minimum reinforcement ratio, RMIN (i.e. ρ_{min} of reference 4).
Store RMIN.

Define reinforcement area, AS.
Store AS.

Define concrete design shear strength, PHVC (i.e. ϕV_c of reference 5).
Store PHVC.

• '12•50•B/(1000•FY)' EVAL • ENTER

'AVS' STO

{[M • 'M' STO •]}[FY • 'FY' STO
•][FC • 'FC' STO •][B • 'B' STO •][D•D'
STO •] K R B1 RMAX RMIN AS PHVC
AVS} TMENU • ENTER
'DAT' STO

Define minimum shear reinforcement AVS
(ie. A_v/s of reference 6).

Store AVS.

Set up an input menu for data entry

Store the data menu

EXAMPLE

HOME VAR CONC TRD
DAT

53.5 M
60 FY
3 FC
12 B
14.4 D

K
NEXT
R
B1
RMAX
RMIN
AS
PHVC

NEXT
AVS

Recall program TRD
Prepare data entry.

Required factored moment, kip ft.
Reinforcement yield strength, ksi
Concrete compressive strength, ksi.
Beam width, in.
Effective depth of reinforcement, in.
Key output functions.
= 0.258 ksi

Reinforcement ratio, $\rho = 0.0051$
Compression zone factor $\beta_1 = 0.85$
Maximum reinforcement ratio, $\rho_{max} = 0.016$
Minimum reinforcement ratio $\rho_{min} = 0.0033$
Reinforcement area $A_s = 0.878 \text{ in}^2$
Concrete design shear strength, $\phi V_c = 16.09$
kip

Minimum required shear reinforcement A_v/s
= $0.12 \text{ in}^2/\text{ft}$.