

A.2: TRA: ANALYSIS OF REINFORCED CONCRETE BEAM WITH TENSION REINFORCEMENT ONLY

PROGRAM LISTING:

KEYSTROKES

HOME VAR CONC

' TRA ' CRDIR ENTER

TRA

* ' AS/(B*D) ' EVAL * ENTER
' R ' STO

* .9*AS*FY*D*(1-.59*R*FY/ FC)/12 ' EVAL * ENTER
' M ' 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

* ' .85*2*B*D*√(1000*FC)/1000 ' EVAL * ENTER
' PHVC ' STO

* ' 12*50*B/(1000*FY) ' EVAL * ENTER

' AVS ' STO

COMMENTARY

Open parent directory, CONC.

Create subdirectory, TRA.

Open current directory, TRA.

Define the reinforcement ratio, R.
Store R.

Define the design moment strength, M. (i.e. ϕM_n of reference 1).
Store M.

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

Define minimum shear reinforcement, AVS (i.e. A_v/s of reference 6).
Store AVS

```

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

```

Set up an input menu for data entry.

Store the data menu.

EXAMPLE

HOME VAR CONC TRA
DAT

```

.878  AS
12    B
14.4  D
60    FY
3     FC

```

```

R
M
B1
RMAX

```

```

RMIN
PHVC

```

AVS

Recall program TRA.
Prepare for data entry.

Reinforcement area, in².
Beam width, in.
Effective depth of reinforcement, in.
Reinforcement yield strength, ksi.
Concrete compressive strength, ksi.
Key output functions.
Reinforcement ratio, $\rho = 0.0051$.
Design moment strength $\phi M_n = 53.5$ kip ft.
Compression zone factor, $\beta_1 = 0.85$
Maximum reinforcement ratio, $\rho_{max} = 0.016$

Minimum reinforcement ratio, $\rho_{min} = 0.0033$
Concrete design shear strength, $\phi V_c = 16.09$ kip.
Minimum required shear reinforcement, $A_v/s = 0.12$ in²/ft.

The actual reinforcement ratio lies between the maximum and minimum allowable values and is satisfactory.