IDARC 2D Version 7.0
Jan. 2010
USER'S GUIDE

INPUT FORMAT

A free format is used to read all input data. Hence, conventional delimiters (commas, blanks) may be used to separate data items. Standard FORTRAN variable format is used to distinguish integers and floating point numbers. Input data must, therefore, conform to the specified variable type.

Notes: 1. Provision is made for a line of text between each set of data items. Refer to the sample data files accompanying this Manual.

2. No blank lines are to be input.

3. A zero input will result in program <u>*default*</u> *values, where applicable.*

<u>SET A: GENERAL INFORMATION</u>

- Title of Probem:

  TITLE

Description: **TITLE**: Alpha-numeric title, up to 80 characters.

- Control Data (See Figure A-1):

  USER_TEXT

  NSO, NFR, NCON, NSTL, NMSR, NPDEL, IFLEX, IFLEXDIST, IPC

Description:	**USER_TEXT**:	Reference information, up to 80 characters of text.
	NSO:	Number of stories.
	NFR:	Number of typical (non-identical) frames
	NCON:	Number of different concrete material properties sets.
	NSTL:	Number of different steel reinforcement properties sets.
	NMSR:	Number of different masonry material properties sets.
	NPDEL:	0 to ignore P-Delta effects, or 1 to include P-Delta effects.
	IFLEX:	0 for Spread Plasticity 1 for Concentrated Plasticity
	IFLEXDIST	0 for linear flexibility distribution 1 for uniform flexibility distribution
	IPC:	0 for Unix operating system, or 1 for DOS/WINDOWS operating system.

Notes: For steel structures no information about material is required.

A structure must be decomposed into a series of parallel frames. Input is required only for non-identical frames, denoted here by the integer variable

NFR. The number of duplicates of each typical frame is specified later in this DATA SET. The entire group of frames can be defined in the IDARC L-I-J nodal locater system. This concept is shown graphically in Figure A-1.

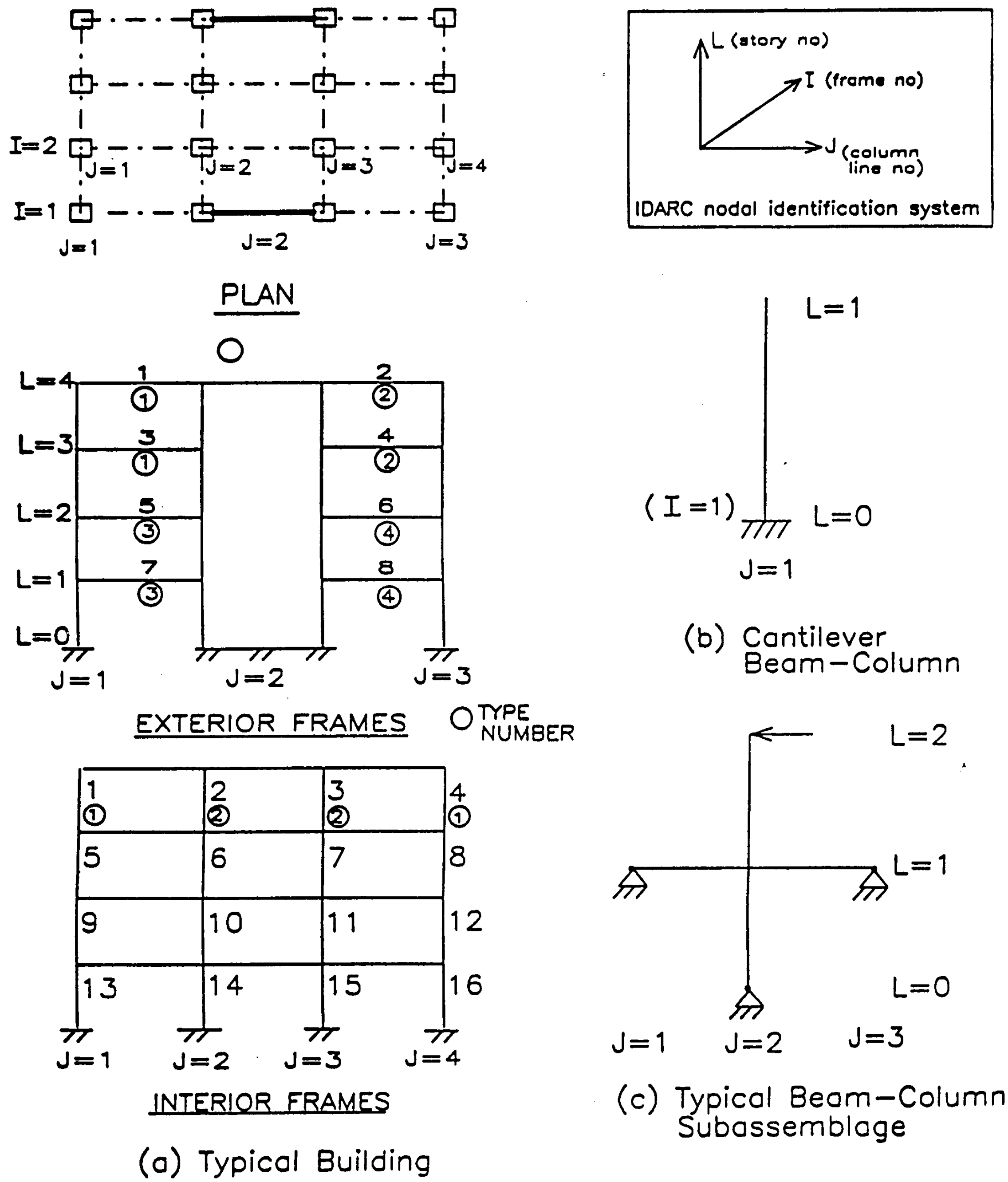


Fig. A-1 Frame Discretization and Nodal Identification

Three examples of different frame definitions are shown. In Figure A-1a, the four-story building made up of a total of four frames is assumed to have two pairs of identical frames, hence, only two of them need be input in IDARC (NFR=2). The cantilever beam/column shown in Figure A-1b is defined as a single-story structure with one column line. Likewise, the subassemblage shown in Figure 1c is defined as a 2-story structure with three column lines. The number of concrete and steel properties refer to the number of stress-strain envelopes to be input in Set B and Set C respectively.

SET A1: ELEMENT TYPES

- Control Data (See Figure A-1):

USER_TEXT
MCOL, MBEM, MWAL, MEDG, MTRN, MSPR, MBRV, MBRF, MBRH, MIW

Description: **USER_TEXT**: Reference information, up to 80 characters of text.
MCOL: No. of column types.
MBEM: No. of beam types.
MWAL: No. of shear wall types.
MEDG: No. of edge column types.
MTRN: No. of transverse beam types.
MSPR: No. of rotational spring types.
MBRV: No. of visco-elastic brace types.
MBRF: No. of friction brace types.
MBRH: No. of hysteretic brace types.
MIW: No. of infill panel types.

Notes: Elements are grouped into identical sets based on cross-section data and initial conditions such as axial loads. For example, in the exterior frame shown in Figure A-1a, there are 8 columns. Typically, the exterior columns at each level will be identical, hence, only 4 column types need to be defined. The interior frame, assuming identical interior and exterior columns in each floor, will require only 8 column types to define all 16 elements, i.e., 2 types per each level as shown in the Figure.

SET A2: ELEMENT DATA

- Control Data:

USER_TEXT
NCOL, NBEM, NWAL, NEDG, NTRN, NSPR, NMR, NBR, NIW

Description: **USER_TEXT**: Reference information, up to 80 characters of text.
NCOL: No. of columns.
NBEM: No. of beams.
NWAL: No. of shear walls.
NEDG: No. of edge columns.

NTRN: No. of transverse beams.
NSPR: No. of rotational springs.
NMR: No. of moment releases.
NBR: No. of braces (VE + friction + hysteretic).
NIW: No. of infill panels.

Notes: NMR is used to specify moment releases (hinge locations) at member ends. Releasing a moment at a member end results in a hinge condition at that end thereby disallowing moments to develop at the section.

SET A3: SYSTEM OF UNITS

- Control Flag:

USER_TEXT
IU

Description:

USER_TEXT: Reference information, up to 80 characters of text.

IU: System of units
1 for inch, kips
2 for mm, kN

DEFAULT SYSTEM OF UNITS*: inch, kip*

A zero input for IU will result in the use of *inch and kip units.*

SET A4: FLOOR ELEVATIONS

- Control Data (See Figure A-2):

USER_TEXT
HIGT(1), HIGT(2), ..., HIGT(NSO)

Description:

USER_TEXT: Reference information, up to 80 characters of text.

HIGT(i): Elevation of story "i" from the base, beginning with the first floor level.

SET A5: DESCRIPTION OF IDENTICAL FRAMES

- Control Data:

USER_TEXT
NDUP(1), NDUP(2), ..., NDUP(NFR)

Description:

USER_TEXT: Reference information, up to 80 characters of text.

NDUP(i): List with the number of duplicate frames of typical (non-identical) frame "i".

Notes: In the sample structure shown in Figure A-1, there are four frames. However, the two interior frames are identical as are the exterior frames. In this case, NFR=2, and NDUP(1) = NDUP(2) = 2. If there is no identical frame, NDUP=1.

SET A6: PLAN CONFIGURATION

- Control Data:

  USER_TEXT
  NVLN(1), NVLN(2), ..., NVLN(NFR)

Description:

	USER_TEXT:	Reference information, up to 80 characters of text.
	NVLN(i):	Number of column lines (or J-locater points) in frame "i".

Notes: *A set of NVLN points for each frame should define completely the column lines necessary to specify every vertical element in that frame. If a beam element is subdivided into two or more segments, then the number of column lines specified must include these internal beam nodes as well.*

SET A7: NODAL WEIGHTS

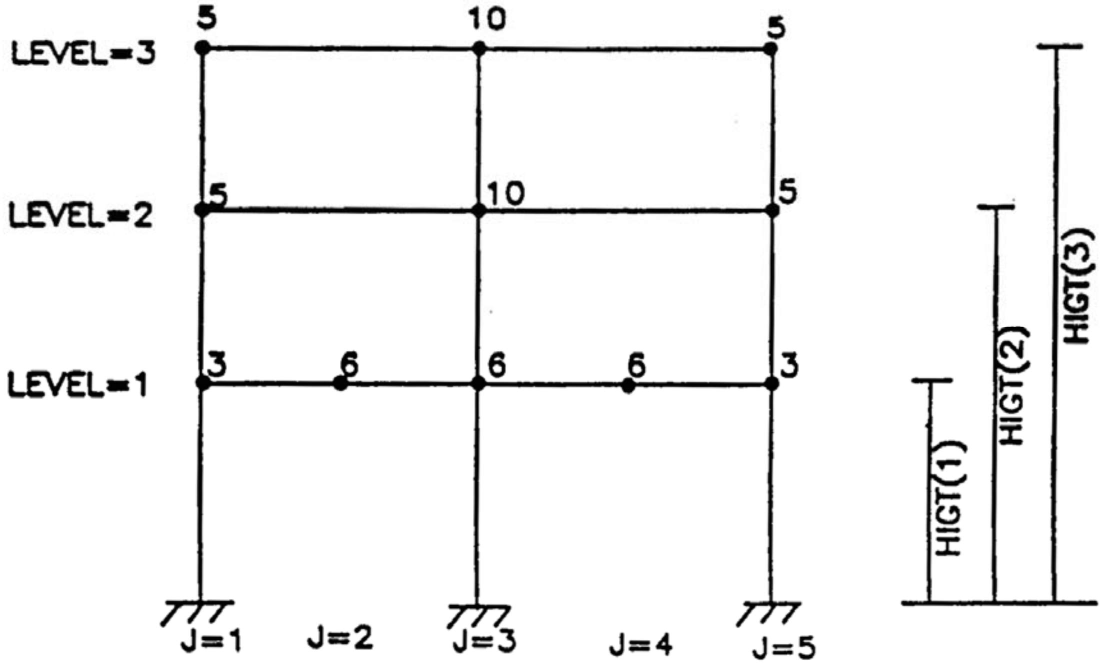
- Control Data (See Figure A-2):

  USER_TEXT
  LEVEL, IFR(1), WVT(1), WVT(2), ..., WVT(NVLN(1))
  IFR(2), WVT(1), WVT(2), ..., WVT(NVLN(2))
  .....repeat for NFR frames
  ....repeat for NSO levels (in ascending or descending order)

Description:

	USER_TEXT:	Reference information, up to 80 characters of text.
	LEVEL:	Story level number.
	IFR(J):	Frame number.
	WVT(K):	Nodal weight.

Notes: 1. Nodal weights in force units (kN) are used internally <u>for the story mass computation</u>, and they are not-cumulative quantities (from tributary area only). Nodal weights are not used to specify gravity or vertical loads.
2. Vertical loads need to be declared in SET M1, if necessary.
3. Nodal weights may be input in ascending or descending story level.
4. In ordinary analyses, reduced weight is used.



FRAME #1
(numbers shown at nodes = nodal weights)

INPUT DATA:

```
1,  1,  3.0, 6.0,  6.0, 6.0, 3.0
2,  1,  5.0, 0.0, 10.0, 0.0, 5.0
3,  1,  5.0, 0.0, 10.0, 0.0, 5.0
```

Fig. A-2 Floor Heights and Nodal Weights

SET B: MATERIAL PROPERTIES SETS

- Envelope Generation Option:

  USER_TEXT
  IUSER

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

IUSER: Code for specification of user properties:
0, produces IDARC generated envelopes for at least one element.
1, requires complete moment-curvature envelope data to be provided by user.

Note: If IUSER = 1 go directly to the SET C.

SET B1: CONCRETE PROPERTIES SETS (SEE FIGURE A-3)

(SKIP THIS INPUT IF IUSER=1 OR NCON=0)

- Reference text:

  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Characteristics of concrete stress-strain curve (one line for each of the NCON concrete types):

  IM, FC, EC, EPS0, FT, EPSU, ZF

Description:

IM: Concrete property type (set) number.
FC: Unconfined compressive strength.
EC: Initial Young's Modulus of concrete.
EPS0: Strain at max. strength of concrete (%).
FT: Stress at tension cracking.
EPSU: Ultimate strain in compression (%).
ZF: Parameter defining slope of falling branch.

DEFAULT VALUES (if a zero was specified as data input):

EC $= 57*\sqrt{FC*1000}$ ksi ; EPS0 = 0.2% ; FT = 0.12*FC ;

EPSU and ZF are derived from Eq. **Error! Reference source not found.** and depends on section data.

SET B2: REINFORCEMENT PROPERTIES SETS (SEE FIGURE A-4)

(SKIP THIS INPUT IF IUSER=1 OR NSTL=0)

- Reference Text:

  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Characteristics of steel stress-strain curve (one line for each of the NSTL steel types):

IM, FS, FSU, ES, ESH, EPSH

Description:	**IM**:	Steel type (set) number.
	FS:	Yield strength.
	FSU:	Ultimate strength.
	ES:	Modulus of elasticity.
	ESH:	Modulus of strain hardening.
	EPSH:	Strain at start of hardening (%).

DEFAULT VALUES (if a zero was specifed as data input):
FSU = 1.4 * FS ; ES = 29,000 ksi ; ESH = (ES / 60) ksi ; EPSH = 3.0%

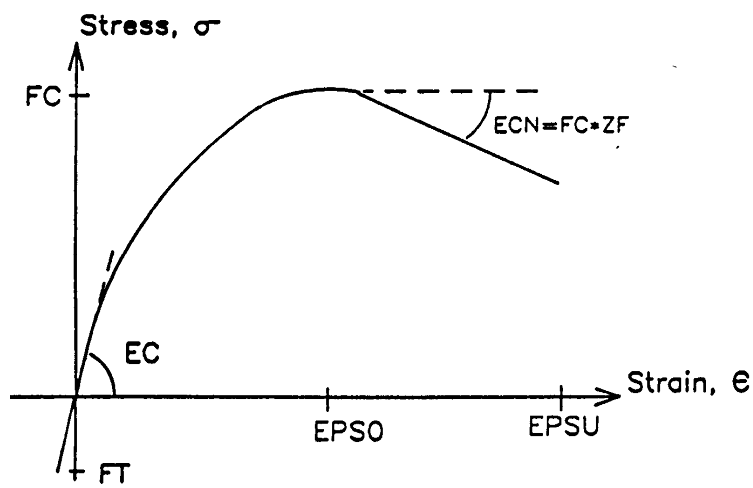


Fig. A-3 Stress Curve for Unconfined Concrete

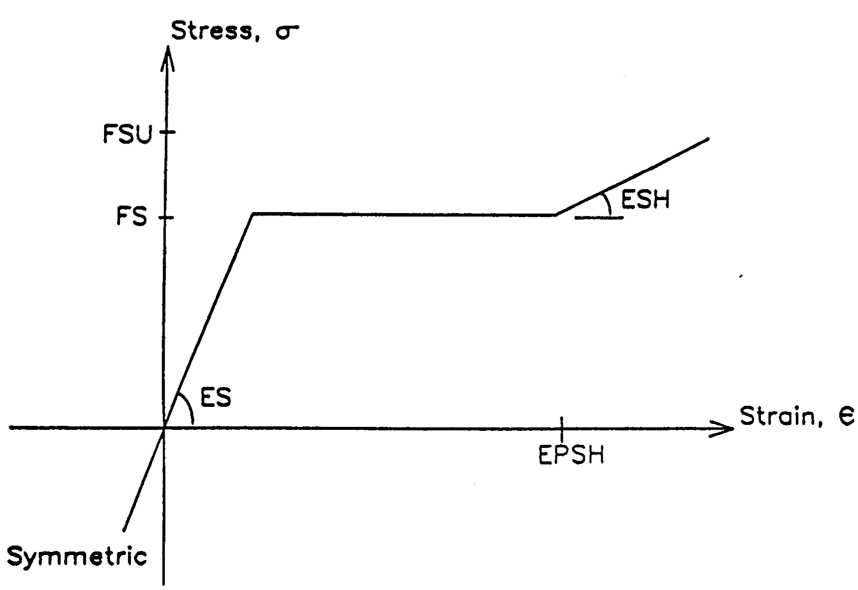


Fig. A-4 Stress Curve for Reinforcing Bars

<u>SET B3:</u> MASONRY INFILL PROPERTIES SETS

(SKIP THIS SECTION IF IUSER=1 OR NMSR=0)

- Reference text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Characteristics of masonry (one line for each of the NMSR masonry types):

  IM, FM, FMCR, EPSM, VM, SIGMM, CFM

  Description:

IM:	Masonry type number.
FM:	Prism strength of masonry.
FMCR:	Cracking modulus of masonry
EPSM:	Strain corresponding to prism strength (%).
VM:	Basic shear strength of masonry bed joints.
SIGMM:	Maximum allowable shear strength
CFM:	Coefficient of friction of frame-infill interface.

  DEFAULT VALUES (if a zero was specified as data input):

  EPSM = 0.2% ; FMCR = 0.05*FM; VM = 0.04 ksi; SIGMM = 0.05*FM; CFM=0.3

SET C: HYSTERETIC MODELING RULES (SETS)

(SEE FIGURE A-5)

- Control Data:

  USER_TEXT

  NHYS

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

NHYS: Number of types (sets)of hysteretic rules.

- Hysteretic Model Parameters (one line for each NHYS hysteresis rule types):

  For Multi-linear Hysteretic Model

  IR,1, HC, HBD, HBE, HS, IBILINEAR

  Description:

  IR: Hysteretic Rule Number

  HC: Stiffness Degrading Parameter, α (Default: 200 – No Degradation)

  HBD: Ductility-based Strength Decay Parameter, β_1 (Default: 0.01 – No Degradation)

  HBE: Hysteretic Energy-based Strength Decay Parameter, β_2 (Default: 0.01 – No Degradation)

  HS: Slip Parameter, γ (Default: 1.0 – No Slip)

  IBILINEAR: 0 for Trilinear Model
  1 for Bilinear Model
  2 for Vertex Oriented Model
  3 Nonlinear Elastic-Cyclic Model

*Note: If IBILINEAR = 3 all h*ysteretic model parameters are set with default values automatically even though another values are input.

For Smooth Hysteretic Model

IR, 2, HC, HBD, HBE, NTRANS, ETA, HSR, HSS, HSM, NGAP, PHIGAP, STIFFGAP

Description:

IR: Hysteretic Rule Number

HC: Stiffness Degrading Parameter, α (HC >= 2) (Default: 200 – No Degradation)

HBD: Ductility-based Strength Decay Parameter, β_1 (Default: 0.01 – No Degradation)

HBE: Hysteretic Energy-based Strength Decay Parameter, β_2 (Default: 0.01 – No Degradation)

NTRANS: Smoothness Parameter for elastic-yield transition, N (Default: 10 – Bilinear)

ETA: Parameter for Shape of Unloading, η (Default: 0.5 – Linear)

HSR: Slip Length Parameter, R_s

HSS: Slip Sharpness Parameter, σ

(Default: 100 – No Slip)

HSM: Parameter for Mean Moment Level of Slip, λ

NGAP: Exponent of Gap Closing Spring, N_{gap}

PHIGAP: Gap Closing Curvature Parameter, ϕ_{gap}

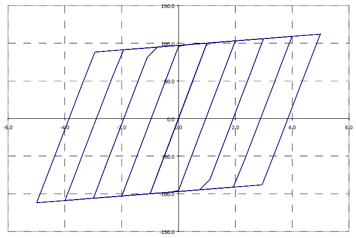
(Default: 1000 – No Gap)

STIFFGAP: Gap Closing Stiffness Coefficient, κ

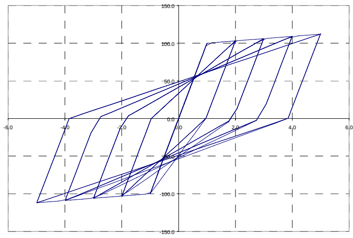
Notes: Hysteretic behavior is specified at both ends of each member. Access to experimental results of the cyclic force-deformation characteristics of components typical to the structure being analyzed provides the best means of specifying the above degrading parameters. Table A-1 and Figure A-5 provide a number of qualitative insights into modeling of the hysteretic parameters. The loops shown in Figure A-5 are only meant to show the relative effects of changing the parameters. The general meaning of the parameters can be characterized as follows: An increase in HC retards the amount of stiffness degradation; an increase in HBD,HBE accelerates the strength deterioration; and an increase in HS reduces the amount of slip. (Also refer to Section 3.3 of this report)

Table A-1. Typical Range of Values for Hysteretic Parameters

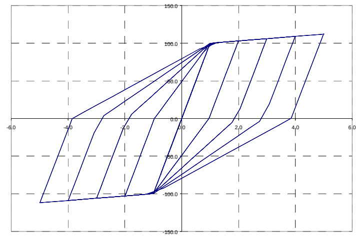
Parameter	Meaning	Value	Effect
HC	Stiffness degrading parameter	4.0 10.0 15.0 200.0	Severe degrading Moderate degrading Mild degrading No degrading (Default)
HBD	Strength degrading parameter (ductility-based)	0.60 0.30 0.15 0.01	Severe degrading Moderate degrading Mild degrading No degrading (Default)
HBE	Strength degrading parameter (energy-controlled)	0.60 0.15 0.08 0.01	Severe deteriorating Moderate deteriorating Mild deteriorating No deteriorating (Default)
HS	Slip or Crack-closing parameter	0.05 0.25 0.40 1.00	Severe pinched loops Moderate pinching Mild pinching No pinching (Default)



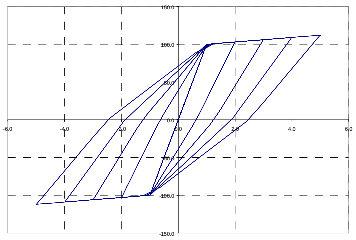
Bilinear



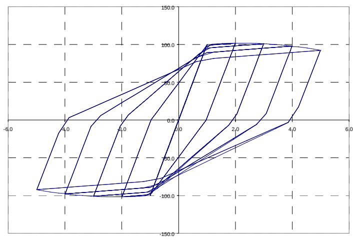
Vertex Oriented



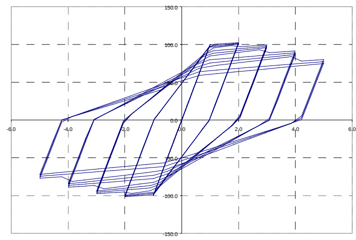
No Degradation



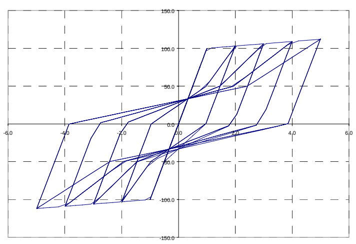
Stiffness Degradation (α=2)



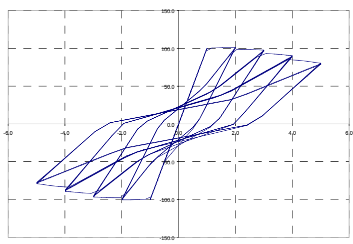
Ductility-Based Strength Degradation (β_1=0.5, μ_{ult}=10)



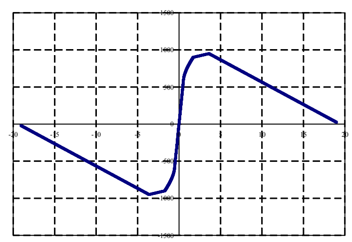
Energy Based Strength Degradation (β_2=0.2, μ_{ult}=10)



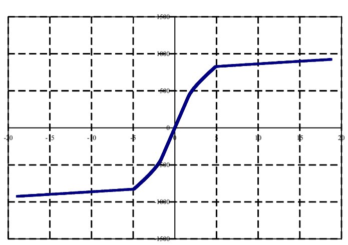
Slip (γ= 0.5)



Combined Degradation (α=5, β_1=0.5, β_2=0.2, γ=0.5, μ_{ult}=10)

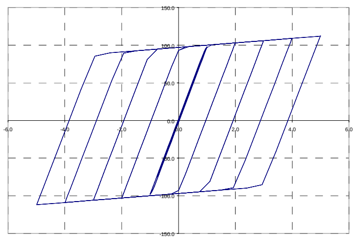


Nonlinear Elastic-Cyclic Model with "negative stiffness"

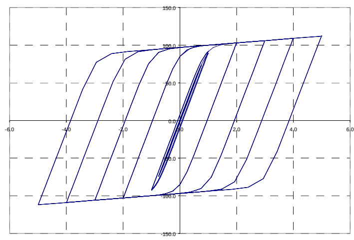


Nonlinear Elastic-Cyclic Model without "negative stiffness"

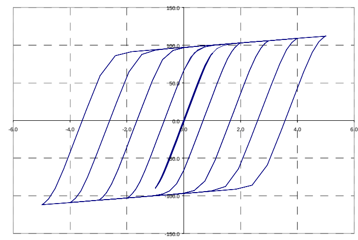
Fig. A-5 (a) Qualitative View of Effects of Degrading Parameters on Hysteretic Behavior – Multilinear Model



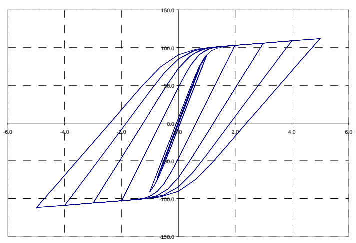
Bilinear (N =20)



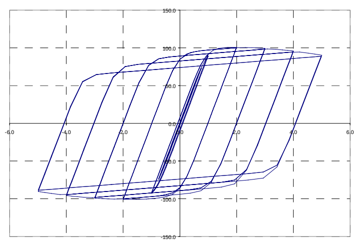
Smooth (N =5)



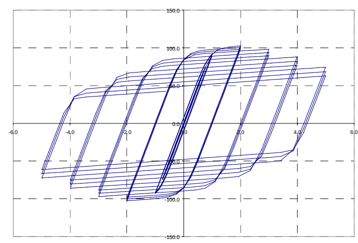
Nonlinear Unloading
(η =0.1)



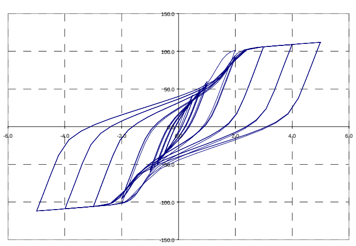
Stiffness Degradation
(α =2)



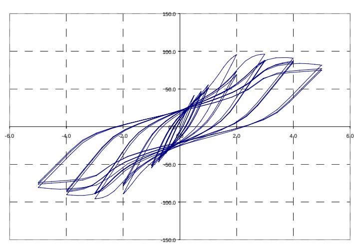
Ductility-Based Strength Degradation
(β_1 =0.5, μ_{ult} =10)



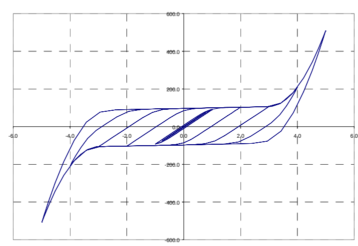
Energy Based Strength Degradation
(β_2 =0.2, μ_{ult} =10)



Slip
(σ =0.2, λ =0.3, R_s =0.25)



Combined Degradation
(α =5, β_1 =0.5, β_2 =0.2,
σ =0.2, λ =0.3, R_s =0.25,
μ_{ult} =10)



Gap Closing
(N_{gap} =2, ϕ_{gap} =3, κ =2)

Fig. A-5 (b) Qualitative View of Effects of Degrading Parameters on Hysteretic Behavior – Smooth Model

SET D: COLUMN PROPERTIES

(SKIP THIS INPUT IF THE STRUCTURE HAS NO COLUMNS)

- Control Data:

  USER_TEXT
  IUCOL

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

IUCOL: Type of column input:
0;Section dimensions and reinf. to be specified,
1;Moment (Shear)-curvature (Strain) envelope to be specified

IF IUCOL = 1, GO TO SET D3

- Reference Text:

  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- For each column type (MCOL), input the following:

  ICTYPE
  Data from **SET D1(a) (ICTYPE**=1), **SET D1(b) (ICTYPE=**2**)** or **SET D2 (ICTYPE**=3**)**

Description: **ICTYPE**: Type of column:
1; rectangular regular
2; rectangular deep beam-column
[User Input Properties(SET D3) is more preferable]
3; circular

READ DATA FROM SET D1(a), D1(b) OR D2 (See below)
GO TO SET E WHEN FINISHED READING ALL COLUMN TYPES.

SET D1: ICTYPE=1; *Rectangular Regular Column Data Set* (SEE FIGURE A-6)

- General data:

  KC, IMC, IMS, AN, AMLC, RAMC1, RAMC2

- Bottom section:

  KHYSC, D, B, DC, AT, HBD, HBS, CEF

- Top section:

If KHYSC for bottom section is input with negative sign, section is symmetric, hence, do not input top section data, otherwise repeat as above, starting with KHYSC.

Description:

KC: Column type set number.
IMC: Concrete type number.
IMS: Steel type number.
AN: Axial load.
AMLC: Center-to-center column height.
RAMC1: Rigid zone length at bottom.
RAMC2: Rigid zone length at top.

KHYSC:	Hysteretic rule number (may be negative)*.
D:	Depth of column.
B:	Width of column.
DC:	Distance from centroid of reinforcement to face of column.
AT:	Area of reinforcement on one face.
HBD:	Hoop bar diameter.
HBS:	Hoop bar spacing.
CEFF:	Effectiveness of column confinement.

*Notes: * An input value of KHYSC with negative sign for the bottom section will result in symmetric values being assigned to the top section.*

***If the section has a not-symmetric reinforcement, the SET D3 has to be used.*

**** AN is used for evaluating the moment-capacity envelope only. Vertical loads need to be declared in SET M1, if necessary.*

EXAMPLE
1
1, 1, 1, 270.0, 3810.0, 762.0, 762.0
-1, 1270.0, 254.0, 20.0, 645.16, 5.0, 150.0, 0.5

Return to input of ICTYPE for next column type. When done go to SET E.

SET D1(b): ICTYPE=2; *Rectangular Deep Beam-Column Data Set*

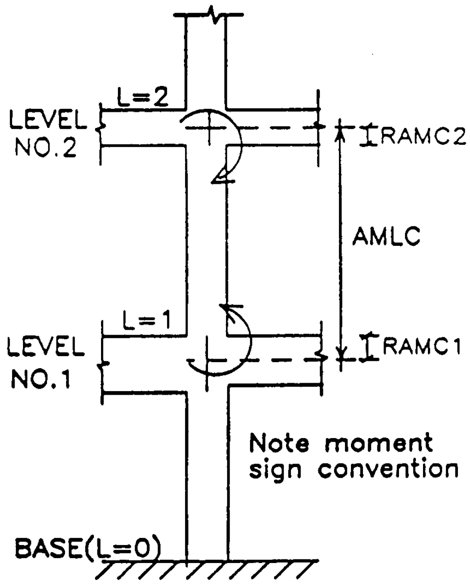
● Add shear hysteretic rule number in **SET D1(a)**

KHYSC

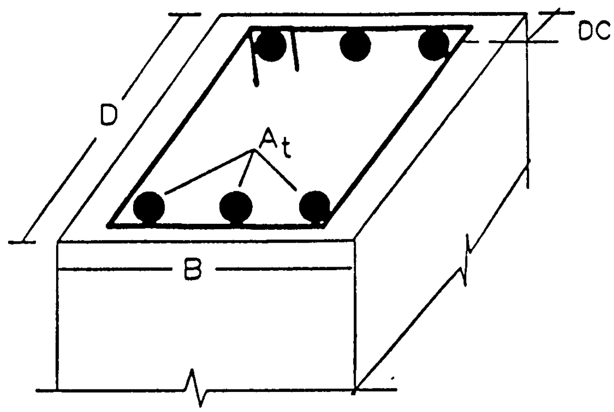
Description: **KHYSC**: Hysteretic rule number (positive)

EXAMPLE
2
1, 1, 1, 270.0, 3810.0, 762.0, 762.0
-1, 1270.0, 254.0, 20.0, 645.16, 5.0, 150.0, 0.5
2

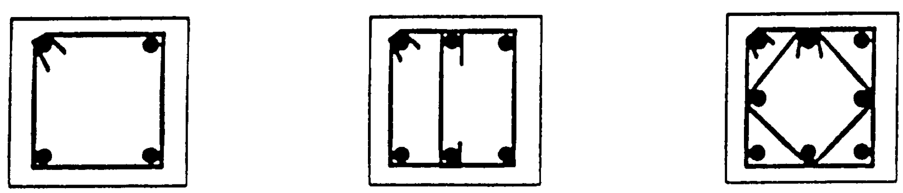
Return to input of ICTYPE for next column type. When done go to SET E.



Typical Column Line



Typical Column Cross-Section



Minimal Confinement
CEFF = 0.5

Nominal Confinement
CEFF = 0.66

Well Confined
CEFF = 1.0

Effectiveness of Confinement for Some Typical Hoop Arrangements

Fig. A-6 Rectangular Columns Input Details

SET D2: ICTYPE = 3; *Circular Column Input Data Set* (SEE FIGURE A-7)

- General Data:
  KC, IMC, IMS, KHYSC, AMLC, RAMC1, RAMC2
- Column Section:
  AN, DO, CVR, DST, NBAR, BDIA, HBD, HBS

Description: **KC**: Column type set number.

IMC:	Concrete type number.
IMS:	Steel type number.
KHYSC:	Hysteretic Rule number.
AMLC:	Center-to-center column height.
RAMC1:	Rigid arm bottom.
RAMC2:	Rigid arm top.
AN:	Axial load on the column.
DO:	Outer diameter of column.
CVR:	Cover to center of hoop bar.
DST:	Distance between centers of long. bars.
NBAR:	Number of longitudinal bars.
BDIA:	Diameter of longitudinal bar.
HBD:	Diameter of hoop bar.
HBS:	Spacing of hoop bars.

EXAMPLE
3
1, 1, 1, 1, 360.0, 0.0, 0.0
1000.0, 60.0, 2.5, 54.5, 25, 1.69, 0.625, 3.5

Return to input of ICTYPE for next column type. When done go to SET E.

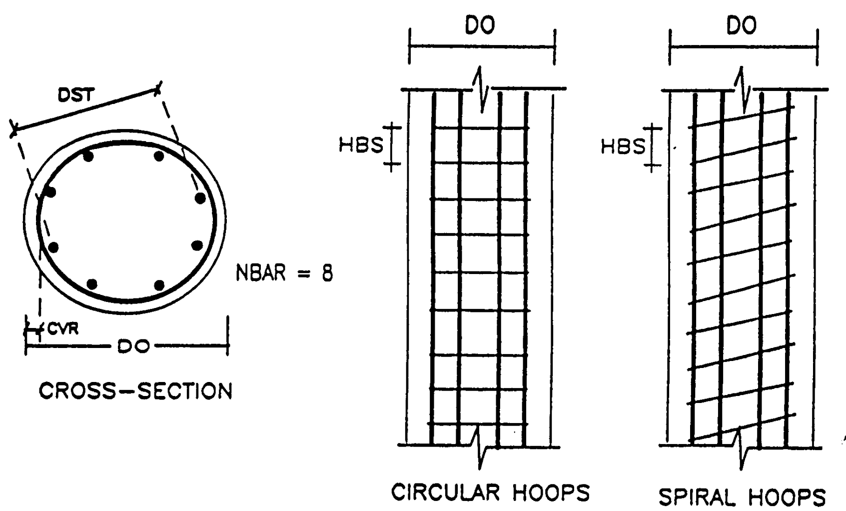


Fig. A-7 Circular column Input Details

<u>SET D3:</u> USER INPUT PROPERTIES (Rectangular or Circular)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- For each column type (MCOL), input the following:

  ICTYPE

  Data from **SET D3(a)**(**ICTYPE**=1), or **SET D3(b)**(**ICTYPE**=2)

  Description: **ICTYPE**: Type of column:
  1; regular column
  2; deep beam-column
  3; rocking column

READ DATA FROM SET D3(a), SET D3(b), OR SET D3(c) (See below)
GO TO SET E WHEN FINISHED READING ALL COLUMN TYPES.

<u>SET D3(a):</u> **ICTYPE**=1; *Regular Column Input Data Set* (SEE FIGURE A-8)

For each section type provide the following data:

- General Data:

  KC, AN, ANY, ANB, AMLC, RAMC1, RAMC2

- Bottom section:

  KHYSC, EI, EA, PCP, PYP, UYP, UUP, EI3P,
  PCN, PYN, UYN, UUN, EI3N

- Top section:

If KHYSC for bottom section is input with negative sign, section is symmetric, hence, do not input top section data, otherwise repeat as above, starting with KHYSC.

Description:

KC:	Column type number.
AN	Axial Force
ANY	Axial Yield Force
ANB	Axial Balance Force (Cut-off on PM diagram)
AMLC:	Column Length.
RAMC1:	Rigid Arm (Bottom).
RAMC2:	Rigid Arm (Top).
KHYSC:	Hysteretic rule number (may be negative)*.
EI:	Initial Flexural Rigidity (EI).
EA:	Axial Stiffness.
PCP:	Cracking Moment (positive). (When using bilinear model, use 99% of PYP)
PYP:	Yield Moment (positive).
UYP:	Yield Curvature (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
UUP:	Ultimate Curvature (positive).
EI3P:	Post Yield Flexural Stiffness (positive) as % of elastic.

PCN:	Cracking Moment (negative).
PYN:	Yield Moment (negative).
UYN:	Yield Curvature (negative).
UUN:	Ultimate Curvature (negative).
EI3N:	Post yield Flexural Stiffness (negative) as % of elastic.

Notes: * *AN is the axial force due to the static vertical loads.*
** *An input value of KHYSC with negative sign for the bottom section will result in symmetric values being assigned to the top section.*
*** *All the negative quantities (PCN, PYN, UYN, UUN, EI3N) have to be put as positive ones.*

EXAMPLE
1
1, 270.0, 2000.0, 3500.0, 3810.0, 762.0, 762.0
-1, .1981E+14, .8003E+04, .3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683
.3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683

Repeat for each column type, starting with ICTYPE (DET D3). When done go to SET E

SET D3(b): **ICTYPE**=2; *Deep Beam-Column Data Set* (SEE FIGURE A-8)

● Add shear properties in **SET D3(a)**
● For shear properties

KHYSC, GA, PCP, PYP, UYP, UUP, EI3P,
PCN, PYN, UYN, UUN, EI3N

Description:		
	KHYSC:	Hysteretic rule number. (positive)
	GA:	Shear Stiffness (Shear modulus*Shear Area).
	PCP:	Cracking Shear (positive). (When using bilinear model, use 99% of PYP)
	PYP:	Yield Shear (positive).
	UYP:	Yield Strain (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
	UUP:	Ultimate Strain (positive).
	EI3N:	Post yield Shear Stiffness (positive) as % of elastic.
	PCN:	Cracking Shear (negative).
	PYN:	Yield Shear (negative).
	UYN:	Yield Strain (negative).
	UUN:	Ultimate Strain (negative).

EI3N: Post yield Shear Stiffness (negative) as % of elastic.

Notes: All the negative quantities (PCN, PYN, UYN, UUN, EI3N) have to be put as positive ones.

EXAMPLE

```
2
1, 270.0, 2000.0, 3500.0, 3810.0, 762.0, 762.0
  -1,  .1981E+14, .8003E+04, .3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683
                             .3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683
   2,   5.543E+06, 3000.0, 5000.0, 0.0058, 0.1, 0.5
                   3000.0, 5000.0, 0.0058, 0.1, 0.5
```

For considering a shear stiffness without shear hysteretic behavior (Constant shear stiffness), the shear cracking force (PCP) should be higher than the expected maximum shear force corresponding the flexural failure which is related to ultimate moments and element length

Repeat for each column type, starting with ICTYPE (SET D3). When done go to SET E.

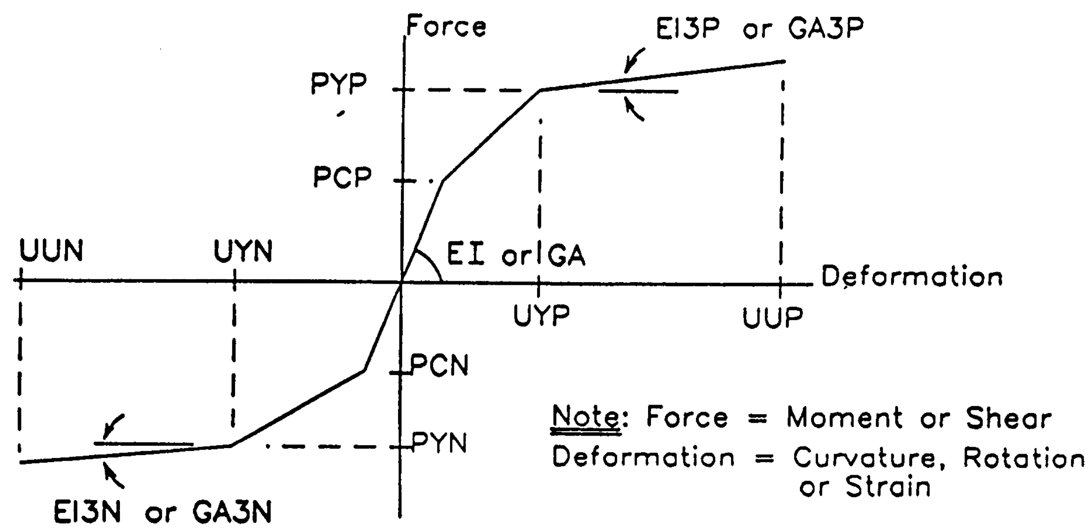


Fig. A-8 Notation for User Input Trilinear Envelopes

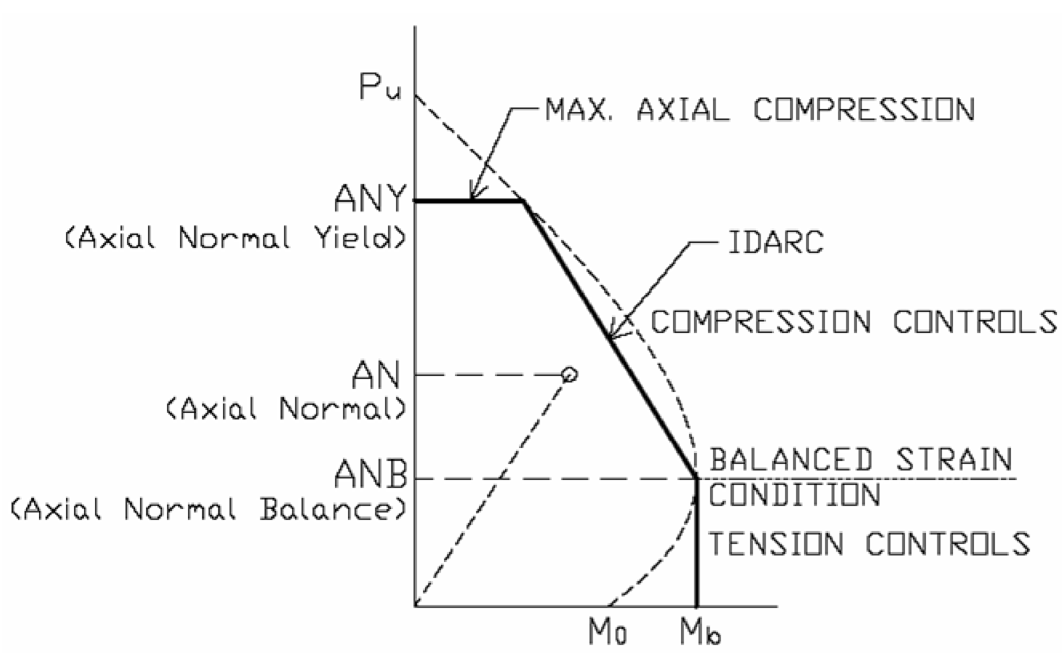


Fig. A-9 P-M interaction diagram

<u>SET D3(c):</u> **ICTYPE**=3; *Rocking Column Input Data Set* (SEE FIGURE A-10)
For each section type provide the following data:

- General Data:

KC, AN, ANY, ANB, AMLC, RAMC1, RAMC2, NEV

Description:	**KC**:	Column type number.
	AN	Axial Force
	ANY	Axial Yield Force
	ANB	Axial Balance Force (Cut-off on PM diagram)
	AMLC:	Column Length.
	RAMC1:	Rigid Arm (Bottom).
	RAMC2:	Rigid Arm (Top).
	NEV:	Type of input data for overturning point. 0; Maximum latral displacement capacity input corresponding to overturning point, 1; Overturning curvature input.

IF NEV = 1, GO TO SET D3(c-2)

<u>SET D3(c-1):</u> **NEV**=0; Latral Displacement Input correponding overturning point

- Bottom section:

KHYSC, EI, EA, PCP, PYP, UYP, UNSP, ULP, EI3P,
PCN, PYN, UYN, UNSN, ULN, EI3N

- Top section:

If KHYSC for bottom section is input with negative sign, section is symmetric, hence, do not input top section data, otherwise repeat as above, starting with KHYSC.

Description:	**KHYSC**:	Hysteretic rule number (may be negative)*.
	EI:	Initial Flexural Rigidity (EI).
	EA:	Axial Stiffness.
	PCP:	Cracking Moment (positive). (When using bilinear model, use 99% of PYP)
	PYP:	Yield Moment (positive).
	UYP:	Yield Curvature (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
	UNSP:	Rocking Curvature (positive).
	ULP:	Maximum Latral Displacement Capacity at overturing point (positive).
	EI3P:	Post Yield Flexural Stiffness (positive) as % of elastic.
	PCN:	Cracking Moment (negative).
	PYN:	Yield Moment (negative).
	UYN:	Yield Curvature (negative).
	UNSN:	Rocking Curvature (negative).
	ULN:	Maximum Latral Displacement Capacity at overturing point (negative).

EI3N: Post yield Flexural Stiffness (negative) as % of elastic.

<u>SET D3(c-2):</u> **NEV**=1; Overturning Curvature Input.

- Bottom section:
  Replace ULP and ULN with UUP and UUN, respectively, from SET D3(c-1)

- Top section:

If KHYSC for bottom section is input with negative sign, section is symmetric, hence, do not input top section data, otherwise repeat as above, starting with KHYSC.

Description:	**UUP**:	Overturning Curvature (positive).
	UUN:	Overturning Curvature (negative).

Notes: * *AN is the axial force due to the static vertical loads.*
** *An input value of KHYSC with negative sign for the bottom section will result in symmetric values being assigned to the top section.*
*** *All the negative quantities (PCN, PYN, UYN, UNSN, ULN, UUN, EI3N) have to be put as positive ones.*

Repeat for each column type, starting with ICTYPE (SET D3). When done go to SET E.

```
EXAMPLE
3
1, 28.4,  200.0,  80.0,  1143.0,  76.2,  76.2,  0
  -1,  129700000.0,  73400.0,  482.045,  1253.3,  0.000024,  0.000049,  60.96, 1.5
                                          482.045,  1253.3,  0.000024,  0.000049,  60.96, 1.5
```

```
EXAMPLE
3
1, 300.0, 1500.0, 600.0, 4100.0, 100.0, 100.0, 1
  -1,  2.0E+10,  1.0E+06,  800000.0,  1100000.0,   0.0002,   0.00025,  0.0019,  1.0
                            800000.0,  1100000.0,   0.0002,   0.00025,  0.0019,  1.0
```

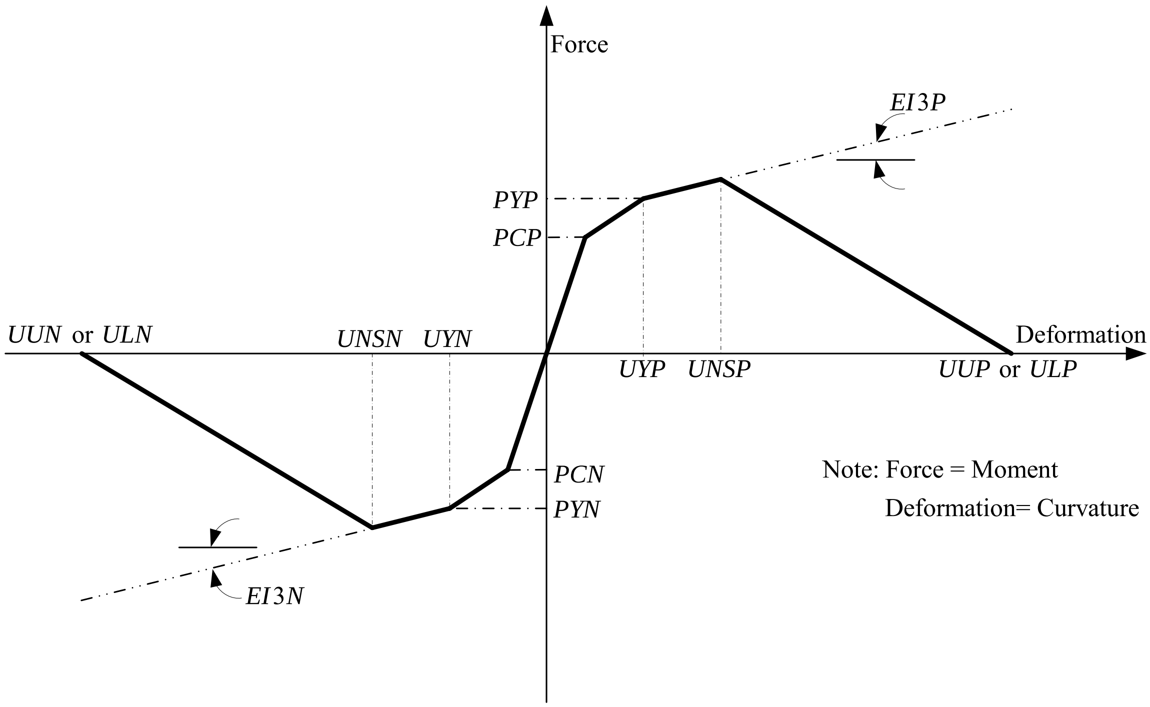


Fig. A-10 Notation for User Input Trilinear Envelopes for rocking column

SET E: BEAM PROPERTIES SETS

(SKIP THIS INPUT IF THE STRUCTURE HAS NO BEAMS)

- Control Data:

  USER_TEXT
  IUBEM

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

IUBEM: Type of beam input:

0; Section dimensions, and reinforcement details (internal computation of moment-curvature envelope),

1; User specified moment (Shear)-curvature (Strain) envelope.

IF IUBEM = 1, GO TO SET E2

- Reference Text:

  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- For each beam type (MBEM), input the following:

  IBTYPE
  Data from **SET E1** (**IBTYPE** =1), or **SET E2** (**IBTYPE** =2)

Description: **IBTYPE** : Type of column:

1; regular beam

2; deep beam

[User Input Properties(SET E2) is more preferable]

READ DATA FROM SET E1(a), OR SET E1(b)(See below)
GO TO SET F WHEN FINISHED READING ALL BEAM TYPES.

SET E1(a): **IBTYPE**=1; *Regular Beam Data Set* (SEE FIGURE A-11)

- Reference Text:

  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

For each section type provide the following data:

- General data:

  KB, IMC, IMS, AMLB, RAMB1, RAMB2

- Left section:

  KHYSB, D, B, BSL TSL, BC, AT1, AT2, HBD, HBS

- Right section:

If KHYSB for left section is input with negative sign, section is symmetric, hence, do not input right section data, otherwise input right section data starting with KHYSB as in the left section.

Description:	**KB**:	Beam type set number.
	IMC:	Concrete type number.
	IMS:	Steel type number.
	AMLB:	Member length.
	RAMB1:	Rigid zone length (left).
	RAMB2:	Rigid zone length (right).
	KHYSB:	Hysteretic rule number (may be negative)*.
	D:	Overall depth**.
	B:	Lower width**.
	BSL:	Effective slab width**.
	TSL:	Slab thickness**.
	BC:	Cover to centroid of steel.
	AT1:	Area of bottom bars.
	AT2:	Area of top bars.
	HBD:	Diameter of stirrup bars.
	HBS:	Spacing of stirrups.

*Notes: * An input value of KHYSB with negative sign for the left section will result in symmetric values being assigned to the right section.*

*** For a rectangular beam or flat slab D is the overall depth, B=BSL&TSL=0*

Repeat for each beam type starting with IBTYPE. When done, go to SET F

EXAMPLE
1
1, 1, 1, 2159.0, 1079.0, 0.0
-1, 1524.0, 254.0, 254.0, 0.0, 20.0, 774.192, 774.192, 5.0, 150.0

<u>SET E1(b):</u> **IBTYPE** =2; *Deep Beam Data Set*

- Add hysteretic rule number in **SET E1(a)**
  KHYSB
  Description: **KHYSB**: Hysteretic rule number (positive)

EXAMPLE
2
1, 1, 1, 2159.0, 1079.0, 0.0
-1, 1524.0, 254.0, 254.0, 0.0, 20.0, 774.192, 774.192, 5.0, 150.0
2

Repeat for each beam type starting with IBTYPE**.** When done, go to SET F

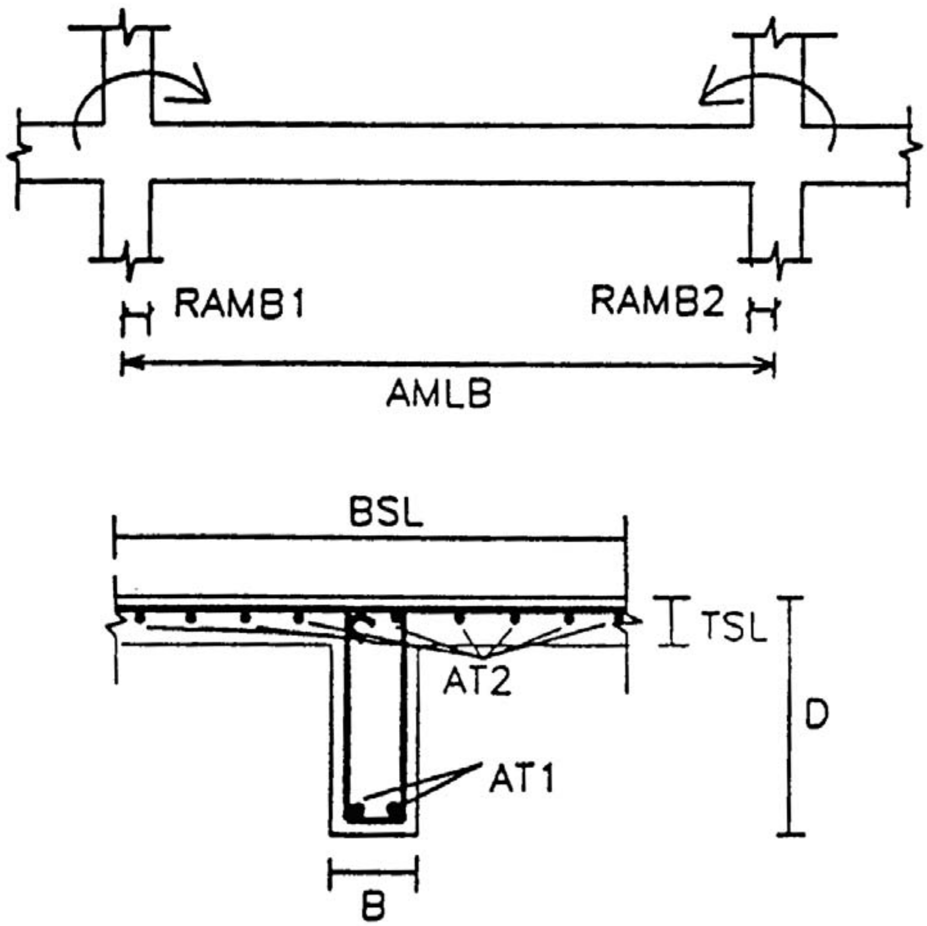


Fig. A-11 Input Details for Beam-Slab Sections

SET E2: USER INPUT PROPERTIES SETS

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- For each beam type (MBEM), input the following:

  IBTYPE

  Data from **SET E2(a)** (**IBTYPE** =1), or **SET E2(b)** (**IBTYPE** =2),

  Description: **IBTYPE** : Type of column:
  1. regular beam,
  2. deep beam,

READ DATA FROM SET E2(a), OR SET E2(b) (See below)
GO TO SET F WHEN FINISHED READING ALL BEAM TYPES.

SET E2(a):: **IBTYPE** = 1; *Beam Input Data Set* (SEE FIGURE A-8)
For each section type provide the following data:

- General Data:

  KB, AMLB, RAMB1, RAMB2

- Left section:

  KHYSB, EI, PCP, PYP, UYP, UUP, EI3P,
  PCN, PYN, UYN, UUN, EI3N

- Right section

  If KHYSB for left section is input with negative sign, section is symmetric, hence, do not input right section data, otherwise repeat as above, starting with KHYSB as in the left section.

Description:

KB:	Beam type set number.
AMLB:	Beam Length.
RAMB1:	Rigid Arm (Left).
RAMB2:	Rigid Arm (Right).
KHYSB:	Hysteretic rule number (may be negative)*.
EI:	Initial Flexural Rigidity.
PCP:	Cracking Moment (positive). (When using bilinear model, use 99% of PYP)
PYP:	Yield Moment (positive).
UYP:	Yield Curvature (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
UUP:	Ultimate Curvature (positive).
EI3P:	Post Yield Flexural Stiffness (positive) as % of elastic..
PCN:	Cracking Moment (negative).
PYN:	Yield Moment (negative).
UYN:	Yield Curvature (negative).
UUN:	Ultimate Curvature (negative).

	EI3N:	Post yield Flexural Stiffness (negative) as % of elastic..

*Note: * An input value of KHYSB with negative sign for the left section will result in symmetric values being assigned to the right section.*

Repeat for each beam type, starting with IBTYPE(SET E2). When done go to SET F .

EXAMPLE
1
1, 3810.0, 762.0, 762.0
-1, .1981E+14, .3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683
.3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683

SET E2(b): **ICTYPE**=2; *Deep Beam Data Set* (SEE FIGURE A-8)

- Add shear properties in **SET E2(a)**
- For shear properties

KHYSB, GA, PCP, PYP, UYP, UUP, EI3P,
PCN, PYN, UYN, UUN, EI3N

Description:	**KHYSB**:	Hysteretic rule number. (positive)
	GA:	Shear Stiffness (Shear modulus*Shear Area).
	PCP:	Cracking Shear (positive). (When using bilinear model, use 99% of PYP)
	PYP:	Yield Shear (positive).
	UYP:	Yield Strain (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
	UUP:	Ultimate Strain (positive).
	EI3P:	Post Yield Shear Stiffness (positive) as % of elastic.
	PCN:	Cracking Shear (negative).
	PYN:	Yield Shear (negative).
	UYN:	Yield Strain (negative).
	UUN:	Ultimate Strain (negative).
	EI3N:	Post yield Shear Stiffness (negative) as % of elastic.

Notes: All the negative quantities (PCN, PYN, UYN, UUN, EI3N) have to be put as positive ones.

```
EXAMPLE
2
1, 3810.0, 762.0, 762.0
  -1,  .1981E+14, .3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683
                  .3112E+07, .5658E+07, .8516E-06, .2725E-03, 0.3683
   2,  5.543E+06, 3000.0, 5000.0, 0.0058, 0.1, 0.5
                  3000.0, 5000.0, 0.0058, 0.1, 0.5
```

For considering a shear stiffness without shear hysteretic behavior (Constant shear stiffness), the shear cracking force (PCP) should be higher than the expected maximum shear force corresponding the flexural failure which is related to ultimate moments and element length

Repeat for each beam type, starting with IBTYPE (SET E2). When done go to SET F.

SET F: SHEAR WALL PROPERTIES SETS (SEE FIGURES A-12 AND A-13)

(SKIP THIS INPUT IF THE STRUCTURE HAS NO SHEAR WALLS)

- Control Data:
  USER_TEXT
  IUWAL

Description:

	USER_TEXT:	Reference information, up to 80 characters of text.
	IUWAL:	Type of wall input: 0; Section dimensions and reinforcement. details (internal computation of moment-curvature and shear strain envelopes), 1;User specified moment-curvature and shear strain envelopes.

IF IUWAL = 1, GO TO SET F2

SET F1: WALLS SECTION DIMENSIONS SETS

- Reference Text:
  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

For each section type provide the following data:

- General Data:
  KW, IMC, KHYSW(1), KHYSW(2), KHYSW(3), AN, AMLW, NSECT
- For each of the NSECT sections, input the following:
  KS, IMS, DWAL, BWAL, PT, PW

Description:

	KW:	Shear wall type set number.
	IMC:	Concrete type number.
	KHYSW(1):	Hysteretic Rule Number (bottom).
	KHYSW(2):	Hysteretic Rule Number (top).
	KHYSW(3):	Hysteretic Rule Number (shear).
	AN:	Axial load.
	AMLW:	Height of shear wall.
	NSECT:	Number of Sections.
	KS:	Section number.
	IMS:	Steel type number.
	DWAL:	Depth of section.
	BWAL:	Width of section.
	PT:	Vertical reinforcement ratio (%).
	PW:	Horizontal reinf ratio (%).

Repeat for each wall type starting with General Data; When done go to SET G

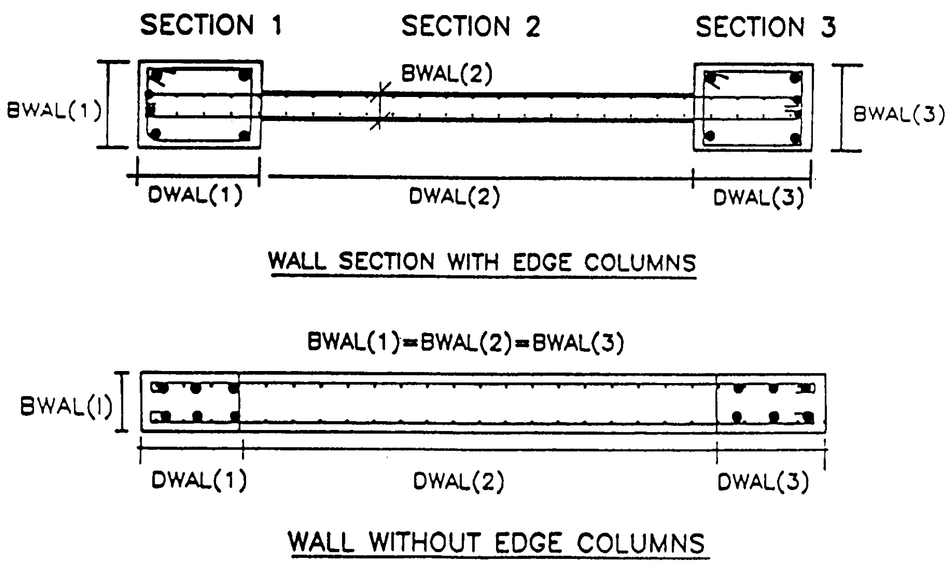


Fig. A-12 Typical Input Details for Shear Wall Sections

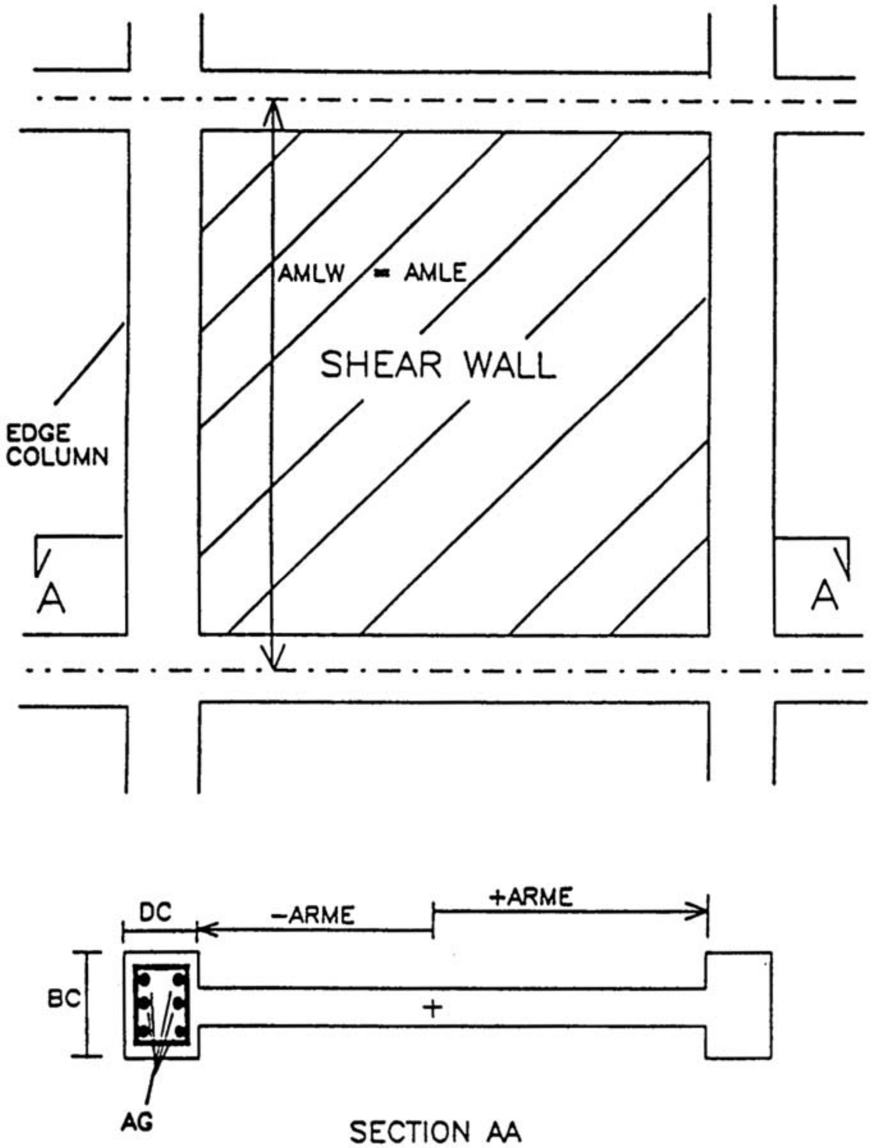


Fig. A-13 Shear Wall and Edge Column Details

<u>SET F2:</u> USER INPUT PROPERTIES SETS (SEE FIGURE A-8)

- Reference Text:

  USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

For each section type provide the following data:

- General Data:

  KW, AMLW, EAW
- Flexure BOT:

  KHYSW, EI, PCP, PYP, UYP, UUP, EI3P, PCN, PYN, UYN, UUN, EI3N
- Flexure TOP:

  If KHYSW for bottom section is input with negative sign, section is symmetric, hence, do not input top section data, otherwise repeat as above, starting with KHYSW.
- Shear:

  KHYSW, GA, PCP, PYP, UYP, UUP, GA3P, PCN, PYN, UYN, UUN, GA3N

Description:

KW: Wall type set number.
AMLW: Wall length.
EAW: Axial Stiffness (EA/L).

Data for Flexural Properties:

KHYSW: Hysteretic rule number (may be negative)*.
EI: Initial flexural stiffness (EI).
PCP: Cracking Moment (positive). (When using bilinear model, use 99% of PYP)
PYP: Yield Moment (positive).
UYP: Yield Curvature (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
UUP: Ultimate Curvature (positive).
EI3P: Post Yield Flexural Stiffness (positive) as % of elastic..
PCN: Cracking Moment (negative).
PYN: Yield Moment (negative).
UYN: Yield Curvature (negative).
UUN: Ultimate Curvature (negative).
EI3N: Post yield Flexural Stiffness (negative) as % of elastic..

Data for shear properties:

KHYSW: Hysteretic Rule Number.
GA: Initial Shear Stiffness (shear modulus*area).
PCP: Cracking Shear (positive). (When using bilinear model, use 99% of PYP)
PYP: Yield Shear (positive).

UYP:	Yield Shear strain (positive). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
UUP:	Ultimate Shear strain (positive).
GA3P:	Post Yield Shear Stiffness (positive).
PCN:	Cracking Shear (negative).
PYN:	Yield Shear (negative).
UYN:	Yield Shear strain (negative).
UUN:	Ultimate Shear strain (negative).
GA3N:	Post Yield Shear Stiffness (negative).

*Note: * An input value of KHYSW with negative sign for the bottom section will result in symmetric values being assigned to the top section.*

Return to start of General Data (SET F2). Repeat for each wall type

SET G: <u>EDGE COLUMN PROPERTIES SETS</u> (SEE FIGURE A-13)

(SKIP THIS INPUT IF THE STRUCTURE HAS NO EDGE COLUMNS)
Do not duplicate edge column data if already input in SHEAR WALL data.

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Edge Column Data (Provide one line for each MEDG edge column type):

  KE, IMC, IMS, AN, DC, BC, AG, AMLE, ARME

  Description:

KE:	Edge column type set number.
IMC:	Concrete type number.
IMS:	Steel type number.
AN:	Axial load.
DC:	Depth of edge column.
BC:	Width of edge column.
AG:	Gross area of main bars.
AMLE:	Member length.
ARME:	Arm length.

Repeat for each of MEDG elements starting with edge column type number.

SET H: TRANSVERSE BEAM PROPERTIES SETS (SEE FIGURE A-14)

(THIS INPUT NOT REQUIRED IF STRUCTURE HAS NO TRANSVERSE BEAMS OR IS MADE OF IDENTICAL BEAMS ONLY)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Transverse Beam Data (Provide one line for each MTRN transverse beam type):

  KT, AKV, ARV, ALV

  Description:

	KT:	Transverse beam type set number
	AKV:	Vertical Stiffness
	ARV:	Torsional Stiffness
	ALV:	Element length

Repeat for each of MTRN elements

Notes: 1. Transverse elements are assumed to remain elastic. The degree of fixity at the ends will depend on the state of the joint and the state of the members that frame into the joint before and during the application of load. If the entire region is expected to stay elastic, then the vertical stiffness should be computed as : $AKV = 12EI / L^3$. In the extreme case that one of ends do not transmit stiffness due to yielding of adjoining members or deterioration of the joint, then $AKV = 3EI / L^3$. An intermediate value is a good average approximation.

2. If duplicate frames are present, extreme care should be taken in specifying transverse beam properties. The program multiplies the input values by the number of duplicate frames to which they are attached. For example, for the frames shown in Figure A-1, NDUP(1) = NDUP(2) = 2. The program will factor the input stiffness values by (NDUP(1)+NDUP(2))=4.0. Input stiffnesses should, therefore, be modified to account for this effect. If the modeling of transverse elements is not crucial to the analysis, the use of duplicate frames should be avoided.

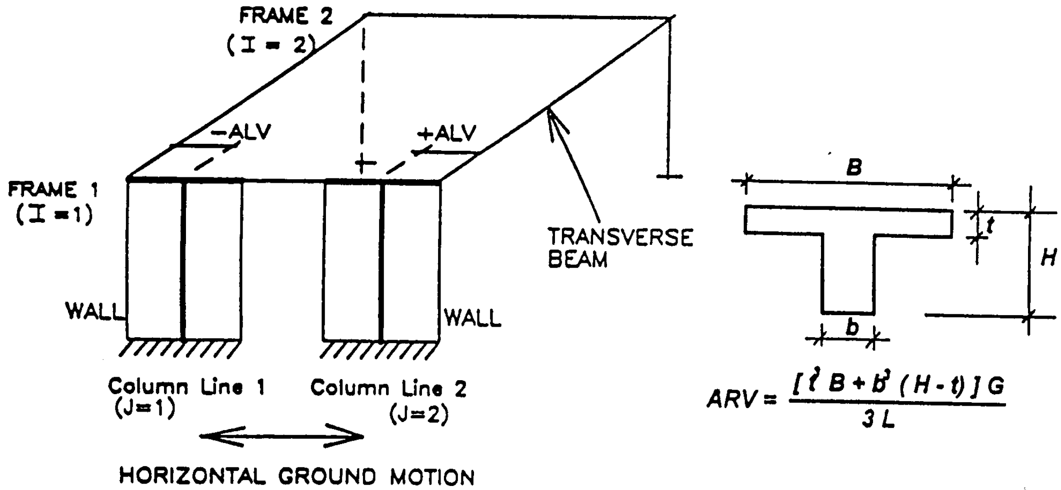


Fig. A-14 Transverse Beam Input

SET I: ROTATIONAL SPRINGS PROPERTIES SETS (SEE FIGURE A-8)

(THIS INPUT NOT REQUIRED IF ROTATIONAL SPRINGS ARE NOT SPECIFIED)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- General Data (Provide one line of data for each MSPR spring type):

  KS, KHYSR, EI, PCP, PYP, UYP, UUP, EI3P, PCN, PYN, UYN, UUN, EI3N

  Description:

KS:	Rotational spring set number.
KHYSR:	Hysteretic Rule Number.
EI:	Initial Rotational Stiffness.
PCP:	Cracking moment (positive). (When using bilinear model, use 99% of PYP)
PYP:	Yield moment (positive).
UYP:	Yield rotation (positive, radians). (When using bilinear model, use 102% of PCP/EI ensuring post crack slope < post yield slope)
UUP:	Ultimate rotation (positive, radians).
EI3P:	Post-yield stiffness ratio (positive) as % of elastic..
PCN:	Cracking moment (negative).
PYN:	Yield moment (negative).
UYN:	Yield rotation (negative).
UUN:	Ultimate rotation capacity (negative).
EI3N:	Post yield stiffness ratio (negative) as % of elastic.

Repeat for each spring type

Notes: Spring properties, unlike other element types, are specified in terms of moment and rotation (in radians). The envelope follows the same nonsymmetric trilinear pattern as shown in Figure A-8.

SET J: BRACES PROPERTIES SETS

SET J1: VISCO-ELASTIC BRACE PROPERTIES SETS
(SKIP THIS IF NO VISCO-ELASTIC BRACES ARE SPECIFIED)

- Control Information:
  USER_TEXT
  ITMODEL, ITDVCON

Description:

	USER_TEXT:	Reference information, up to 80 characters of text.
	ITMODEL:	Model for viscous dampers: 0 for Maxwell model, 1 for Kelvin model.
	ITDVCON:	Type of connection: 0 for diagonal braces, 1 for chevron braces.

SET J1-1: VISCO-ELASTIC BRACE PROPERTIES

- General Data (Provide one set of data for each MBRV visco-elastic brace type):
  ITDV, CDV, KDV,ALPHADV
- Chevron Braces Data (Provide only if ITDVCON=1):
  KDVCH, ANGDV

Description:

	ITDV:	Visco-elastic brace type set number.
	CDV:	Damping constant C of this type of visco-elastic brace.
	KDV:	Axial stiffness of this type of visco-elastic brace (EA/L).
	ALPHADV	Polynomial power α of velocity for non-linear dampers
	KDVCH:	Axial stiffness of one leg of the Chevron bracing (EA/L).
	ANGDV:	Angle of inclination of the brace with respect to a horizontal line.

Notes: *DEFAULT VALUES (if a zero was specified as data input):*
ALPHADV=1.0 (i. e. linear damper)

Repeat set J1-1 for each visco-elastic brace type

SET J2: FRICTION DAMPER BRACE PROPERTIES SETS
(SKIP THIS IF NO FRICTION DAMPER BRACES ARE SPECIFIED)

- Reference Text:
  USER_TEXT
  ITDFCON

Description: **USER_TEXT**: Reference information, up to 80 characters of text.
ITDFCON: Type of connection:
0 for diagonal braces,
1 for chevron braces.

<u>SET J2-1:</u> FRICTION DAMPER BRACE PROPERTIES

- General Data (Provide one line of data for each MBRF friction brace type):
  ITDF, KDF, FYDF
- Chevron Brace Data (Provide only if ITDFCON=1):
  KDFCH, ANGDF

Description:
ITDF: Friction (damper) brace type set number.
KDF: Axial stiffness (EA/L).
FYDF: Friction force of this type of friction dampers.
KDFCH: Axial stiffness of one leg of the Chevron brace (EA/L).
ANGDF: Angle of inclination of the brace with respect to a horizontal line.

Repeat set J2-1for each friction damper brace type

<u>SET J3:</u> HYSTERETIC DAMPER BRACE PROPERTIES SETS

(SKIP THIS IF NO HYSTERETIC DAMPER BRACES ARE SPECIFIED)

- Reference Text:
  USER_TEXT, ITDHCON

Description: **USER_TEXT**: Reference information, up to 80 characters of text.
ITDHCON: Type of connection:
0 for diagonal braces,
1 for chevron braces.

<u>SET J3-1:</u> HYSTERETIC DAMPER BRACE PROPERTIES

- General Data (Provide one line of data for each MBRH hysteretic brace type):
  ITDH, 1, KDH, FYDH, RPSTDH
- Chevron Brace Data (Provide only if ITDHCON=1):
  KDHCH, ANGDH

Description:
ITDH: Hysteretic damper brace type set number.
KDH: Axial stiffness (EA/L).
FYDH: Yield force of this type of hysteretic dampers.
RPSTDH: Post yield stiffness ratio.
KDHCH: Axial stiffness of one leg of the Chevron bracing (EA/L).
ANGDH: Angle of inclination of the brace with respect to a horizontal line.

Repeat set J3-1 for each hysteretic damper type

<u>SET K:</u> <u>INFILL PANEL PROPERTIES SETS</u>

(SKIP THIS IF NO INFILL PANEL ELEMENTS ARE SPECIFIED)

- Reference Text

  USER_TEXT

Description: **USER_ TEXT**: Reference information, up to 80 characters of text.

<u>SET K1:</u> CONTROL DATA

- Control Information

  USER_TEXT
  IPT, ICTYPE

Description:

USER_ TEXT: Reference information, up to 80 characters of text.

IPT: Masonry infill panel type set

ICCTYPE: Type of infill panel input:

0, Masonry panel dimensions to be specified for automatic generation of panel strength envelope parameters.

1. User specified panel strength envelope parameters

<u>SET K2-1:</u> INPUT FOR GENERATION OF STRENGTH ENVELOPE PARAMETERS

(SKIP TO K2-2 IF ICTYPE = 1)

- Infill panel dimensions (provide two lines of data for each IPT infill panel type set):

IMT,TMP,VLMP,VHMP

Description:

IMT: Masonry property type number

TMP: Thickness of masonry infill panel

VLMP: Length of infill panel

VHMP: Height of infill panel

QMPC,QMPB, QMPJ

Description:

QMPC: Plastic moment capacity of column

QMPB: Plastic moment capacity of beam

QMPJ: Plastic moment capacity of joint

<u>SET K2-2:</u> USER INPUT FOR STRENGTH ENVELOPE PARAMETERS

(SKIP THIS INPUT IF ICTYPE = 0)

- User specified infill panel strength envelope properties (provide one line of data for each IPT infill panel type set):

EAIW, VYIW

Description:

EAIW: Initial elastic stiffness of the panel type

VYIW: Lateral yield force of the panel type

SET K3: INFILL PANEL HYSTERETIC PROPERTIES

- Hysteretic model parameters for infill panel (provide three lines of data for each IPT infill panel type set):

  AIW, BTA, GMA, ETA, ALPHIW
  IS, AS, ZS, ZBS
  SK, SP1, SP2, MU

Description:

AIW:	Parameter A in Wen's model.
BTA:	Parameter beta in Wen's model.
GMA:	Parameter gamma in Wen's model.
ETA:	Parameter eta in Wen's model.
ALPHIW:	Post yielding stiffness ratio.
IS:	Flag to indicate no slip (=0), or slip (=1) in the hysteretic response.
AS:	Control parameter for slip length.
ZS:	Parameter that controls the sharpness of the slip.
ZBS:	Offset value for slip response.
SK:	Control parameter to vary the rate of stiffness decay.
SP1:	Parameter to control the rate of strength deterioration.
SP2:	Parameter to control the rate of strength deterioration.
MU:	Ductility capacity of the infill panel.

Notes: 1 DEFAULT VALUES (if a zero was specified as data input):
AIW=1.0, BTA=0.1, GMA=0.9, ETA=2.0, ALPHIW=0.01
IS=1, AS=0.3, ZS=0.1, ZBS=0.0
SK=0.1, SP1=0.8, SP2=1.0, MU=5.0
2 See Section 3.3 for details on the role of hysteretic model parameters,

Repeat Sets K1, K2 and K3 for each IPT infill panel type set.

Note: "*Infill*" model does not work in static analysis (including quasi-static, pushover), only work with the dynamic analysis. The capacity curve of structures with the *infill* model can be obtained by performing the dynamic analysis with incremental specific excitation levels (ex: 0.1g, 0.2g, 0.3g, ….), recording a maximum base shear versus a maximum overall displacement at each excitation level. Each pair of the maximum values at may not be recorded at the same time step.

SET L: ELEMENT CONNECTIVIES

Notes: *Element connectivity is established through the 3 positional locaters described in Figure A-1: a story level, a frame number and a column line. The L position locater (or story level) varies from 0 to the number of stories; the I position locater (or frame number) varies from 1 to the number of frames; and the J locater varies from 1 to the number of NVL positions (column lines) for each frame. NVLN can be different for each frame, being a 'local' information. The hypothetical structure shown below is used to demonstrate the input format. Only a representative data set is shown.*

Element Type	Number	Type	IC	JC	LBC	LTC
COLUMNS	1	1	1	1	3	4
	2	2	1	2	3	4
	10	8	1	4	0	2
	Number	Type	LB	IB	JLB	JRB
BEAMS	1	1	4	1	1	2
	2	2	4	1	2	3
	6	3	3	1	3	4
	Number	Type	IW	JW	LBW	LTW
WALLS	1	1	1	3	3	4
	2	2	1	3	2	3

SET L1: COLUMNS CONNECTIVITY (SEE FIGURE A-15)

(SKIP THIS INPUT IF THE STRUCTURE HAS NO COLUMNS)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Column Connectivities (Provide one line of data for each NCOL column):

  M, ITC, IC, JC, LBC, LTC

  Description:
  M: Column number.
  ITC: Column type number.
  IC: Frame number.
  JC: Column Line number.
  LBC: Story level at bottom of column.
  LTC: Story level at top of column.

Notes: *Input is required for each of the NCOL columns.*

SET L2: BEAMS CONNECTIVITY (SEE FIGURE A-15)

(SKIP THIS INPUT IF STRUCTURE HAS NO BEAMS)

- Reference Text:

USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Beam Connectivities (Provide one line of data for each NBEM beam):

M, ITB, LB, IB, JLB, JRB

Description:

M:	Beam number.
ITB:	Beam type number.
LB:	Story level.
IB:	Frame number.
JLB:	Column Line number of left section.
JRB:	Column Line number of right section.

Note: Input is required for each of the NBEM beams.

<u>SET L3:</u> SHEAR WALLS CONNECTIVITY (SEE FIGURE A-15)
(SKIP THIS INPUT IF STRUCTURE HAS NO SHEAR WALLS)

- Reference Text:

USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Wall Connectivities (Provide one line of data for each NWAL wall):

M, ITW, IW, JW, LBW, LTW

Description:

M:	Wall number.
ITW:	Wall type number.
IW:	Frame number.
JW:	Column line number.
LBW:	Story level at bottom.
LTW:	Story level at top.

Note: Input is required for each of the NWAL shear walls.

<u>SET L4:</u> EDGE COLUMNS CONNECTIVITY
(SKIP THIS INPUT IF STRUCTURE HAS NO EDGE COLUMNS)

- Reference Text:

USER_TEXT

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

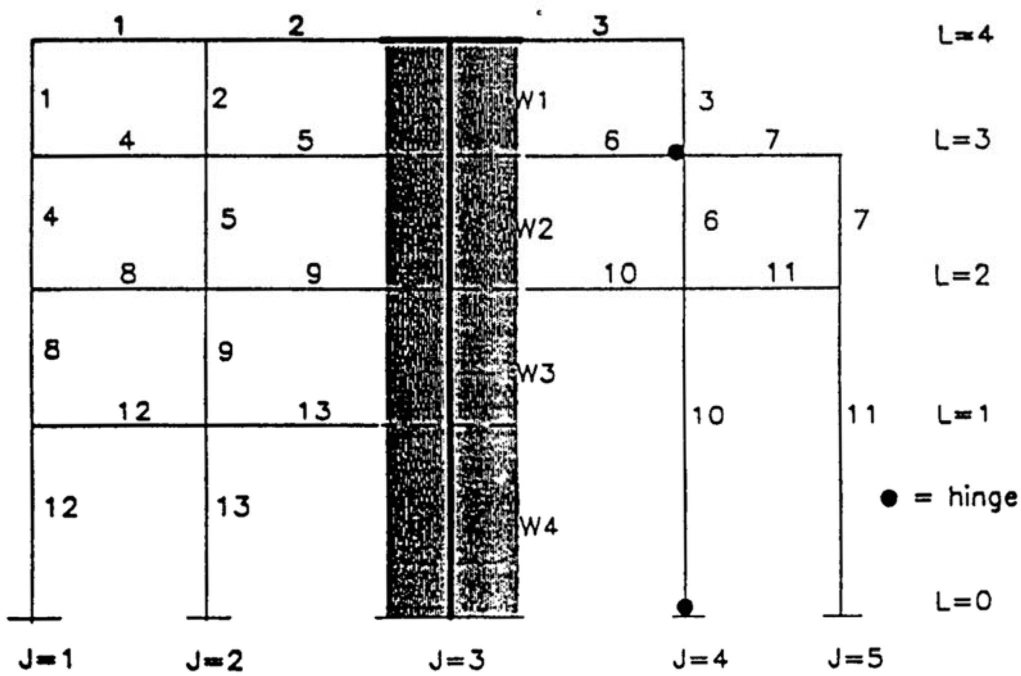
Edge Column Connectivities (Provide one line of data for each NEDG edge column):

M, ITE, IE, JE, LBE, LTE

Description:

M:	Edge column number.
ITE:	Edge column type number.
IE:	Frame number.
JE:	Column line number.

LBE: Story level at bottom of column.
LTE: Story level at top of column.



Element Type	Number	Type	IC	JC	LBC	LTC
COLUMNS	1 2 10	1 2 8	1 1 1	1 2 4	3 3 0	4 4 2
	Number	Type	LB	IB	JLB	JRB
BEAMS	1 2 6	1 2 3	4 4 3	1 1 1	1 2 3	2 3 4
	Number	Type	IW	JW	LBW	LTW
WALLS	1 2	1 2	1 1	3 3	3 2	4 3

Fig. A-15. Element Connectivity for Sample Structure

<u>SET L5:</u> TRANSVERSE BEAMS CONNECTIVITY
(SKIP THIS INPUT IF STRUCTURE HAS NO TRANSVERSE BEAMS)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Transverse Beam Connectivities (Provide one line of data for each NTRN transverse beam):

  M, ITT, LT, IWT, JWT, IFT, JFT

  Description:
  M: Transverse beam number.
  ITT: Transverse beam type number.
  LT: Story level.
  IWT: Frame number of origin of transverse beam*.
  JWT: Column line of origin of transverse beam*.
  IFT: Frame number of connecting wall or column.
  JFT: Column line of connecting wall or column.

*Note: *For beam-to-wall connections, IWT and JWT refer to the I,J locations of the wall.*

<u>SET L6:</u> SPRINGS LOCATIONS (SEE FIGURE A-16)
(SKIP THIS INPUT IF ROTATIONAL SPRINGS ARE NOT SPECIFIED)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Spring Location (Provide one line of data for each NSPR springs):

  M, ITRSP, ISP, JSP, LSP, KSPL

  Description:
  M: Spring number.
  ITRSP: Rotational Spring Type Number.
  ISP: Frame number.
  JSP: Column line number.
  LSP: Story level.
  KSPL: Relative spring location as follows:
  1, for spring on beam, left of joint, or
  2, for spring on column, top of joint, or
  3, for spring on beam, right of joint, or
  4, for spring on column, bottom of joint.

Note: The number of springs at a joint is limited to one less than the total number of members framing into the joint.

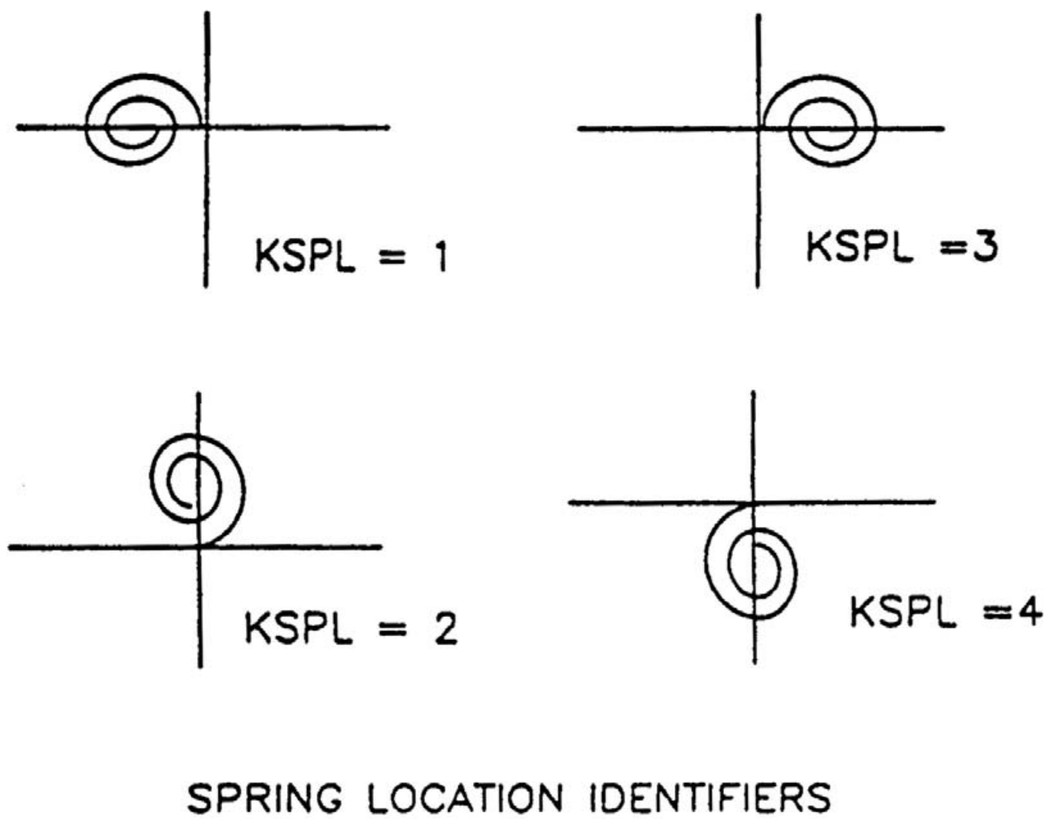


Fig. A-16 Specification of Discrete Inelastic Springs

SET L7: MOMENT RELEASES (SEE FIGURE A-17)
(SKIP THIS INPUT IF MOMENT RELEASES ARE NOT REQUIRED, NMR = 0)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Moment Release Locations (Provide one line of data for each NMR moment releases):

  IDM, IHTY, INUM, IREG

  Description:
  IDM: ID number.
  IHTY: Element type using following code:
  1 for COLUMN, or
  2 for BEAM, or
  3 for WALL.
  INUM: Column, Beam or Wall number.
  IREG: Location of hinge or moment release:
  1 for BOTTOM or LEFT,
  2 for TOP or RIGHT.

Sample Input (with reference to Fig A-13)

IDM	IHTY	INUM	IREG
1	1 (col)	10 (col #)	1 (bot)
2	2 (beam)	6 (beam#)	2 (right)

Fig. A-17 Specification of Moment Release

SET L8: BRACES CONNECTIVITIES
(SKIP THIS IF NO BRACES ARE SPECIFIED)

- Reference Text:

  USER_TEXT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

- Brace Connectivities (Provide one line of data for each NBR braces):

  M, IF, ITBR, ITD, LT, LB, JT, JB, AMLBR

Description:

M:	Brace number.
IF:	Frame number.
ITBR:	Brace type: 1, Visco-elastic brace, or 2, Friction damper brace, or 3, Hysteretic damper brace.
ITD:	Property type number of specified brace.
LT:	Story level at top side of the brace.
LB:	Story level at bottom side of the brace.
JT:	Column line number at top side of the brace.
JB:	Column line number at bottom side of the brace.
AMLBR:	Brace length (joint to joint).

<u>SET L9:</u> INFILL PANELS CONNECTIVITIES

(SKIP THIS IF NO INFILL PANELS ARE SPECIFIED)

- Reference Text:

  USER_TEXT

Description:

USER_TEXT:	Reference information, up to 80 characters of text.

- Infill panels connectivities (Provide one line of data for each of NIW panels):

  M, IF, ITIW, LT, LB, JL, JR, JBMT

Description:

M:	Infill panel number.
IF:	Frame number.
ITIW:	Property type number of specified infill panel.
LT:	Story level at top of infill panel.
LB:	Story level at bottom of infill panel.
JL:	Column line number at left side of the infill panel.
JR:	Column line number at right side of the infill panel.
JBMT:	Beam type number on top of infill panel

SET M: ANALYSIS OPTIONS

- General Data:

  USER_TEXT
  IOPT

Description:

USER_TEXT: Reference information, up to 80 characters of text.

IOPT: Option for continuing analysis:
0 , STOP (Data check mode).
1 , for Inelastic incremental static analysis (with static loads.if specified)
2 , for Monotonic "pushover" analysis including static loads (if specified).
3 , for Inelastic dynamic analysis including static loads (if specified).
4 , for Quasi-static cyclic analysis including static loads (if specified).

Notes: *It is generally advisable to use the "data check" mode for the first trial run of a new data set. The program performs only minimal checking of input data. Structural elevation plots generated by IDARC help identify errors in connectivity specification. Since IDARC prints all input data almost immediately after they are read, the task of detecting the source of input errors is generally expedited. It is also important to verify all printed output, especially section properties such as flexural stiffness and yield moment.*
OPTION 1 permits an independent nonlinear static analysis. Static loads are input in data set M1. OPTIONS 2 - 4 may be combined with long-term static loads which is input in data set M1.

SET M1: LONG-TERM LOADING (STATIC LOADS)

- Control Information:

  USER_TEXT
  NLU, NLJ, NLM, NLC

Description:

USER_TEXT: Reference information, up to 80 characters of text.
NLU: No. of uniformly loaded beams.
NLJ: No. of laterally loaded joint.
NLM: No. of specified nodal moments.
NLC: No. of concentrated vertical loads.

Note: *This input is required for all analysis options.*

- Long Term Loading Analysis (Provide only when static loads are present):

  JSTP, IOCRL

Description:

JSTP: No. of incremental steps in which to apply the static loads (default = 1 step).

IOCRL: Steps between printing output (If IOCRL=0, only final results will be printed; if IOCRL=2, printout will result every 2 steps, and so on).

Notes: Dead and live loads that exist prior to the application of seismic or quasi-static cyclic loads can be input in this section. Such loads are typically specified through uniformly loaded beam members. An option is also available for lateral load analysis and the specification of nodal loads at joints. When used in conjunction with Options 2-4, the resulting forces are carried forward to the monotonic, dynamic and quasi-static analysis.

These loads are used for calculation of initial bending stresses, and do not affect the axial loads. The stresses are calculated through a global analysis of the structure (uniform loads on beams is automatically considered in columns).

- Uniformly Loaded Beam Data (Skip this input section if NLU=0):

    USER_TEXT

Provide NLU lines of data as following:

IL, IBN, FU

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
IL:	Load number.
IBN:	Beam number.
FU:	Magnitude of load (Force/length).

- Laterally Loaded Joints (Skip this input section if NLJ=0):

    USER_TEXT

Provide NLJ lines of data as following:

IL, LF, IF, FL

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
IL:	Load number (number of loaded beams).
LF:	Story level number.
IF:	Frame number.
FL:	Magnitude of load.

- Nodal Moment Data (Skip this input section if NLM=0):

    USER_TEXT

Provide NLM lines of data as following (See Figure A-9 for beam moment sign convention):

IL, IBM, FM1, FM2

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
IL:	Load number. (number of loaded nodes)
IBM:	Beam number.
FM1:	Nodal moment (left).
FM2:	Nodal moment (right).

- Data on Concentrated Vertical Loads (Skip this input section if NLC=0):

  USER_TEXT

Provide NLC lines of data as following:

  IL, IFV, LV, JV, FV

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
IL:	Load number. (number of loaded columns)
IFV:	Frame number.
LV:	Story level number.
JV:	Column line number.
FV:	Magnitude of external nodal force.

IF IOPT = 2, CONTINUE TO SET M2.
IF IOPT = 3, CONTINUE TO SET M3.
IF IOPT = 4, CONTINUE TO SET M4.

SET M2: MONOTONIC PUSH-OVER ANALYSIS (FOR IOPT = 2 ONLY)

- General Data:

  USER_TEXT
  JOPT

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
JOPT:	Push over option: 1, force control 2, displacement control

For JOPT = 2 GO TO SET M2.2

SET M2.1: Force Controlled Input

(PROVIDE ONLY IF JOPT=1)

- Control Data:

  USER_TEXT
  ITYP

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
ITYP:	Option for lateral load distribution: 1 for linear (inverted triangle), or 2 for uniform, or 3 for modal adaptive pushover distribution, or 4 for user input, or 5 for distribution proportional to a power of the story elevation.

For ITYP = 4 GO TO Set M2.2

- Stop Criteria:

PMAX, MSTEPS, DRFLIM

Description: **PMAX**: Target ultimate base shear coefficient.
MSTEPS: Number of steps to reach PMAX.
DRFLIM: Upper limit for displacement of structure top-story (percentage of building height).

- Number of Modes for Modal Adaptive Option (Provide only if ITYP=3):

NMOD, POWER1, POWER2

Description: **NMOD**: Number of modes used during the modal adaptive pushover analysis.
POWER1: Power for Norm in Modal Adaptive Pushover Analysis. See Eq. A-1.
POWER2: 1 or 2: from story height for story force increments. Note: the numbers 1 and 2 are the power of story height
3: from modal responses (more than one mode) for story force increments. Note: the number 3 is not a power, it's just a option.
4: from fundamental mode only for story force increments. Note: the number 4 is not a power, it's just a option.

$$Norm_{\mathbf{POWER1}}(Value) = \sqrt[\mathbf{POWER1}]{\sum_{\mathbf{n=1}}^{\mathbf{NMOD}} (Value_n)^{\mathbf{POWER1}}} \quad \text{(A-1)}$$

- Power for lateral distribution (Provide only if ITYP=5):

EXPK

Description: **EXPK**: Power for story elevation.

Note: *The lateral forces at story "i" are proportional to the story weight (W_i), and the story elevation (h_i) to the power EXPK, according to:*

Error! Objects cannot be created from editing field codes.

The exponential distribution will take into account the effects of higher modes in the response. If EXPK<0 a default value is calculated as a function of the fundamental period (T):

Error! Objects cannot be created from editing field codes.

Continue to SET N

SET M2.2: Displacement Controlled Input (or User Defined Force Control)

(PROVIDE ONLY IF JOPT=2 OR JOPT=1 AND ITYP=4)

- Displacement Control Data (or User Defined Force Control Data):

USER_TEXT
NLDED
NSTLD(1), NSTLD(2), ..., NSTLD(NLDED)

PX(1), PX(2), ..., PX(NLDED)
MSTEPS, DRFLIM

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
NLDED:	number of loaded stories (levels).
NSTLD(i):	list of loaded stories.
PX(i):	list of maximum forces/displacements applied at loaded stories (levels).
MSTEPS:	number of steps to reach each ultimate story force/displacement.
DRFLIM:	upper limit for displacement of structure top story (percentage of building height).

Continue to SET N

SET M3: DYNAMIC ANALYSIS CONTROL PARAMETERS (FOR IOPT = 3 ONLY)

- Control Data:

USER_TEXT
GMAXH, GMAXV, DTCAL, TDUR, DAMP, ITDMP

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
GMAXH:	Peak horizontal acceleration (g's).
GMAXV:	Peak vertical acceleration (g's).
DTCAL:	Time step for response analysis (secs).
TDUR:	Total duration of analysis (secs).
DAMP:	Damping coefficient (% of critical).
ITDMP:	Type of structural damping: 1 for Mass proportional (default), 2 for Stiffness proportional, or 3 for Rayleigh proportional damping.

Notes: 1. The input accelerogram is scaled uniformly to achieve the specified peak acceleration. DTCAL should not exceed the time interval of the input wave, DTINP. The nonlinear analysis of the structure is often very sensitive to the choice for DTCAL, a value of 0.005 is suggested for typical buildings, however, a smaller value may be necessary if drastic changes in the stiffness of the elements are expected, or if the structure consists of only a few elements. Larger values can be used for smoother transitions in the stiffness of the elements. Often an inadequate choice of this parameter will yield large unbalanced forces, that may cause numerical instabilities, and stop the execution of the program, or report extremely large values in the damage indices (DI>>3) of some or all elements.

2. The ratio (DTINP/DTCAL) must yield an integer number.

3. *TDUR may be less than the total duration of the earthquake. If TDUR is greater than the total time duration of the input wave, a free vibration analysis of the system will result for the remaining time.*

- Input Wave:

  USER_TEXT
  IGMOT, IWV, NDATA, DTINP

Description:	**USER_TEXT**:	Reference information, up to 80 characters of text.
	IGMOT:	0 for General types from wave input data files 1 Whitenose generation from program
	IWV:	0 for Horizontal component of acceleration included, or 1 for Vertical component of acceleration included additionally.
	NDATA:	Number of points in earthquake wave files.
	DTINP:	Time interval of input wave.

IF IGMOT = 1, CONTINUE TO SET N.

- Wave Title:

  NAMEW

Description:	**NAMEW**:	Alpha-numeric title for input wave upto 80 characters.

- Filename - Horizontal Component:

  WHFILE

Description:	**WHFILE**:	Name of file (with extension) from which to read horizontal component of earthquake record. Note: Filename should not exceed 12 characters. WINPH(I),I=1,NDATA Horizontal component of earthquake wave (NDATA points). NOTE: This data is read from the file WHFILE specified in the previous data item.

- Filename - Vertical Component (Skip this input if IWV=0):

  WVFILE

Description:	**WVFILE**:	Name of file (with extension) from which to read vertical component of earthquake record. Note: Filename should not exceed 12 characters. WINPV(I),I=1,NDATA Vertical component of earthquake wave (NDATA points).

NOTE: This data is read from the file WVFILE specified in the previous data item.

Notes: *Accelerogram data may be input in any system of units. The accelerogram is scaled uniformly to achieve the specified peak values of GMAXH and GMAXV. Since data is read in free format, as many lines as necessary to read the entire wave must be input. The data points of the input wave may, therefore, be entered sequentially until the last (or NDATA) point.*

Continue to SET N

SET M4: QUASI-STATIC CYCLIC ANALYSIS (FOR IOPT=4 ONLY)

- Quasi-Static Data:

USER_TEXT
ICNTRL
NLDED
NSTLD(1), NSTLD(2), ..., NSTLD(NLDED)
NPTS
F(1,1), F(2,1), ..., F(NPTS,1)
F(1,2), F(2,2), ..., F(NPTS,2)
...
F(1,NLDED), F(2,NLDED), ..., F(NPTS,NLDED)
DTCAL

Description:

USER_TEXT: Reference information, up to 80 characters of text.

ICNTRL: Cyclic Analysis option:
0, Force controlled input, or
1, displacement controlled input.

NLDED: Number of story levels at which the force or displacement is applied.

NSTLD(j): List of story levels at which the force or displacement is applied.

NPTS: Number of points to be read in force or displacement history.

F(i,j): Quasi-Static force step "i", at story NSTLD(j).

DTCAL: Analysis step (fraction of input steps).
The analysis is performed between (1/DTCAL) interpolated points on the input history.

SET N: OUTPUT CONTROL

SET N1: DEFORMATION, STRESS AND DAMAGE SNAPSHOTS

SET N1.1: Pushover Snapshot Control Data

(Provide only if Pushover analysis was selected in set M: IOPT=2)

- Control Data:

  USER_TEXT
  NPRNT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

  NPRNT: Additional number of snapshots of the structural response during pushover (≤ 10).

Notes: 1. Output in this set is written in file "DEFORMED.OUT". The story displacements, and the element stress ratios are provided at each snapshot.

2. By default the program will always identify the structural response at the first crack, first yield, or first collapse of a column, beam and wall.

- Ratios for wich Additional Snapshots are Required (Provide only if NPRNT>0):

  ITPRNT, UPRNT(1), UPRNT(2), ..., UPRNT(NPRNT)

  Description: **ITPRNT**: Type of data provided to print snapshots:
  1 if Base shear/Total weight is specified, or
  2 if Top displacement/Total height is specified.

  UPRNT(i): List of base shear/total weight ratios (if ITPRNT=1), or top displacement/total building height (if ITPRNT=2), for wich printing of additional snapshots is required.

Continue to set N1.3

SET N1.2: Dynamic and Quasistatic Analysis Snapshot Control Data

(Provide only if Dynamic or Quasistatic analysis was selected in set M: IOPT=3 or IOPT=4)

- Control Data:

  USER_TEXT
  NPRNT

  Description: **USER_TEXT**: Reference information, up to 80 characters of text.

  NPRNT: Flag to indicate if additional snapshots during dynamic analysis are required:
  0 for no user defined additional snapshots,
  1 for user defined additional snapshots.

Notes: 1. Output in this set is written in file "DEFORMED.OUT". The story displacements, and the element stress ratios are provided at each snapshot.

2. By default the program will always identify the structural response at the first crack, first yield, or first collapse of a column, beam and wall.

- User Defined Snapshots (Provide only if NPRNT=1)

  DTPRNT, DFPRNT, BSPRNT

  Description:

  DTPRNT: Time increment for printing additional snapshots (Use DTPRNT $\leq$ 0 to deactivate this option)

  DFPRNT: Threshold story drift ratio at which snapshots are desired (Use DFPRNT $\leq$ 0 to deactivate this option)

  BSPRNT: Threshold base shear coefficient at which snapshots are desired (Use BSPRNT $\leq$ 0 to deactivate this option)

Notes: 1. Output in this set is written in file "DEFORMED.OUT". The story displacements, and the element stress ratios are provided at each snapshot.

2. By default the program will always identify the structural response at the first crack, first yield, or first collapse of a column, beam and wall.

SET N1.3: General Snapshot Control Flags (Provide Always)

- Control Flags for Default Snapshots:

  ICDPRNT(1), ICDPRNT(2), ICDPRNT(3), ICDPRNT(4), ICDPRNT(5)

  Description:

  ICDPRNT(1): Flag to activate (=1), or deactivate (=0), printing of the displacement profile during default snapshots.

  ICDPRNT(2): Flag to activate (=1), or deactivate (=0), printing of the element stress ratios during default snapshots.

  ICDPRNT(3): Flag to activate (=1), or deactivate (=0), printing of the element collapsed state during default snapshots.

  ICDPRNT(4): Flag to activate (=1), or deactivate (=0), printing of the structural damage indices during default snapshots.

  ICDPRNT(5): Flag to activate (=1), or deactivate (=0), printing of the structural dynamic characteristics during default snapshots.

Notes: 1. By default the program will identify the first crack, yield, and collapse of a column, beam and wall. At these stages during the pushover analysis, the user may indicate the program to report the displaced profile, the stress ratios, collapse state, damage indices, and periods.

2. Output for the default snapshots is written in the file "DEFORMED.OUT".

- Control Flags for User Defined Snapshots (Provide only if NPRNT>0):

  ICPRNT(1), ICPRNT(2), ICPRNT(3), ICPRNT(4), ICPRNT(5)

  Description:

  ICPRNT(1): Flag to activate (=1), or deactivate (=0), printing of the displacement profile during user defined snapshots.

ICPRNT(2):	Flag to activate (=1), or deactivate (=0), printing of the element stress ratios during user defined snapshots.
ICPRNT(3):	Flag to activate (=1), or deactivate (=0), printing of the element collapsed state during user defined snapshots.
ICPRNT(4):	Flag to activate (=1), or deactivate (=0), printing of the structural damage indices during user defined snapshots.
ICPRNT(5):	Flag to activate (=1), or deactivate (=0), printing of the structural dynamic characteristics during user defined snapshots.

SET N2: STORY OUTPUT CONTROL

- Output Control Data:

USER_TEXT
NSOUT, DTOUT, ISO(1), ISO(2), ..., ISO(NSOUT)
FNAMES(1)
FNAMES(2)
...
FNAMES(NSOUT)

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
NSOUT:	No. of output histories.
DTOUT:	Output time/step interval[1].
ISO(i):	List of output story numbers.
FNAMES(i):	Filename to store time history output for story number ISO(i).

Notes: 1 If the pushover or quasi-static cyclic analysis option is used, DTOUT refers to the number of steps between output printing; for example, DTOUT=2 will print results every 2 steps.

SET N3: ELEMENT HYSTERESIS OUTPUT

- Control Data for Element Output:

USER_TEXT
KCOUT, KBOUT, KWOUT, KSOUT, KBROUT, KIWOUT

Description:

USER_TEXT:	Reference information, up to 80 characters of text.
KCOUT:	Number of columns for which hysteresis output is required (≤ 10).
KBOUT:	Number of beams for which hysteresis output is required (≤ 10).
KWOUT:	Number of walls for which hysteresis output is required (≤ 10).

KSOUT: Number of springs for which hysteresis output is required (≤ 10).

KBROUT: Number of braces for which hystereis output is required (≤ 10).

KIWOUT: Number of infill panels for which hysteresis output is required (≤ 10).

<u>SET N3.1:</u> Column Output

- Column Ouput Specification (Skip this input if KCOUT=0):

  USER_TEXT

  ICLIST(1), ICLIST(2), ..., ICLIST(KCOUT)

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

ICLIST(i): List of column numbers for which moment-curvature hysteresis is required.

<u>SET N3.2:</u> Beam Output

- Beam Output Specification (Skip this input if KBOUT=0):

  USER_TEXT

  IBLIST(1), IBLIST(2), ..., IBLIST(KBOUT)

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

IBLIST(i): List of beam numbers for which moment-curvature hysteresis is required.

<u>SET N3.3:</u> Shear Wall Output

- Shear Wall Output Specification (Skip this input if KWOUT=0):

  USER_TEXT

  IWLIST(1), IWLIST(2), ..., IWLIST(KWOUT)

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

IWLIST(i): List of shear wall numbers for which moment-curvature and shear-strain hysteresis is required.

<u>SET N3.4:</u> Spring Output

- Discrete Spring Output Specification (Skip this input if KSOUT=0):

  USER_TEXT

  ISLIST(1), ISLIST(2), ..., ISLIST(KSOUT)

Description: **USER_TEXT**: Reference information, up to 80 characters of text.

ISLIST(i): List of spring numbers for which moment-rotation hysteresis is required.

<u>SET N3.5:</u> Brace Output

- Brace Output Specifications (Skip this input if KBROUT=0):

USER_TEXT
IBRLIST(1), IBRLIST(2), ..., IBRLIST(KBROUT)

Description: **USER_TEXT**: Reference information, up to 80 characters of text.
IBRLIST(i): List of brace numbers for which force-displacement hysteresis is required.

SET N3.6: Infill Panel Output

- Infill Panel Output Specifications (Skip this input if KIWOUT=0):

USER_TEXT
IIWLIST(1), IIWLIST(2), ..., IIWLIST(KIWOUT)

Description: **USER_TEXT**: Reference information, up to 80 characters of text.
IIWLIST(i): List of infill panel numbers for which force-displacement hysteresis is required.

Notes: All the output generated in this section refers to moment-curvature hysteresis for beams, columns and shear-walls; in addition shear vs. shear strain history is generated for walls; whereas moment-rotation hysteresis is produced for the discrete spring elements. Output filenames are generated as follows:
IF KCOUT = 2, AND ICLIST(1) = 3 AND ICLIST(2) = 12, THEN THE FOLLOWING FILES WILL BE CREATED:
COL_003.PRN and COL_012.PRN
(where 3 and 12 refer to the element numbers for which output is requested)

END OF DATA INPUT

SPECIAL SPRING BASE ISOLATOR

The element can be used as diagonal brace, or as base isolator, if columns are infinitely flexible. To develop such element is required to follow the steps below. The development provided below is as an example for a "twisted hysteretic model" defined by a lower and upper bound curves.

SET J: BRACES PROPERTIES SETS

SET J3: HYSTERETIC DAMPER BRACE PROPERTIES SETS

(Provide ITDHCON=0 only)

SET J3-1: HYSTERETIC DAMPER BRACE PROPERTIES

- General Data (Provide one line of data for each MBRH hysteretic brace type):

ITDH, 2, KDH, FYDH, RPSTDH, POWER, ETA

Description: **ITDH**: Hysteretic damper brace type set number.
KDH: Axial stiffness (k_0).
FYDH: Yield force of this type of hysteretic dampers (V_y).
RPSTDH: Post yield stiffness ratio (α).
POWER: Power of stiffness transition (n).
ETA: Ratio of forces in upper to lower bound curves (η).

Note: The program calculates the angle of inclination of the brace internally based on the length of columns and beams. For a base isolator provide "very small length" columns.