เอกสารอ้างอิง

1. Ghali, A and Neville, M. Structural Analysis - A Unifed Classical And Matrix Approach, 2nd ed, Chapman & Hall, 1978

2. Macleod, I.A., "Shear Wall and Frame Interaction", PCA.

3. ทักษิณ เทพชาตรี, โปรแกรมไมโครคอมพิวเตอร์สำหรับวิเคราะห์โครงสร้างข้อแข็ง 2 มิติ, เลขที่ คส 04/2526 ภาควิชาวิศวกรรมโยธา จุฬาลงกรณ์มหาวิทยาลัย

4. Chitty,L., "On the Cantilever Composed of a Number of Parallel Beams Interconnected by Cross-bar", Philosophical Magazine (London), V.38, Series 7,1947, pp. 685-699.

5. --------.,and Wen - Yuh Wan, "Tall Building Structures Under Wind Load" Proceedings, 7th International Conference for Applied Mechanics, V. 1, Paper 22, 1948, pp.254 - 268

6. Beck, Hubert, "Contributed to the Analysis of Coupled Shear Wall", ACI Journal, Vol.59, 1962, pp.1055-1069.

7. Rosman, Riko, "Approximate Analysis of Shear Wall Subjected to Lateral Loads", ACI Journal, Vol.61, June 1964, pp.717 - 732

8. Coull, A. and Choudhury, J.R., "Stresses and Deflections in Couple Shear Walls", ACI Journal, Vol.64, February 1967, pp.65 - 72

9. --------.,and Choudhury, J.R., "Analysis of Coupled Shear Walls", ACI Journal, Vol.64, September 1967, pp. 587 - 593

10. --------.,and Puri, R.D., "Analysis of Pierced Shear Walls", Journal of the Structural Division, ASCE, Vol.94, ST1, January 1968, pp. 71 - 82

11. --------.,and Adams, N.W, "A Simple Method of Analysis of the Load Distribution in Multistorey Shear Wall Struetures", Response of Multistorey Concrete Structures to Lateral forces, Publication SP - 36, ACI, 1973, pp.187 - 216

12. Heidebrecht, A.C. and Stafford S.B., "Approximate Analysis of Tall Wall - Frame Structures", Jnl. Struct. Div, ASCE, 99, No. ST2, February 1973, pp.199 - 221

13. Schwaighofer, J. "Door Openings in Shear Walls", ACI Journal, Vol 64, November 1967, pp.730 - 734

14. --------.,and Microys H.F., "Analysis of Shear Walls Using Standard Computer Programs", ACI Journal, Vol 66, December 1969, pp. 1005 - 1007

15. Smith, B.S., "Modified Beam Method for Analyzing Symmetrical Interconnected Shear Walls", ACI Journal, Vol 67, December 1970, pp. 977 - 980

16. Carolan, B., "Concrete Shear Walls Combine with Rigid Frames in Mulfistorey Buildings Subjected to Lateral Loads", ACI Journal, Vol.58, No.3, 1961, pp.299 - 315

17. Chiyyarath, V. and Girijavallabhan, A.M., "Analysis of Shear Wall with opening", Journal of the Structural Division, ASCE, Vol.95, ST10, 1969, pp.2093 - 2103

18. Macleod, I.A., "New Rectangular Finite Element for Shear Wall Analysis", Journal of the structural Division, ASCE, Vol 95, ST3, March 1969, pp. 339 - 410

19. Sandhu, R.S., "Arbitrary Two Dimehsional Structures Program", The Ohio State University, Columbus.

20. Clough, R.W., King, I.P. and Wilson, E.L., "Structural Analysis of Multistory Buildings", Journal of the Structural Division, ASCE, Vol.90, ST3, 1964, pp. 19 - 34

21. Rubinstein, M.F., Matrix Compute Analysis of Structure, Prentice Hall Inc, Englewood, N.J.,1966

22. Noris, C.H. and Wilbur, J.B., Elementary Structure Analysis, McGraw Hill, 1960

23. Cook, R.D., Concepts and Applications of finite Element Analysis, 2nd Edition, John Willeys & Son, 1974

24. Irons, B.M., "A Frontal Solution Programme for Finite Element Analysis", Int. J. Num. Meth. Engng, Vol 2, No.1 January 1970, pp.5 - 32

25. ภานุวัฒน์ คุรุรัตน์ "โปรแกรมไมโครคอมพิวเตอร์ซึ่งใช้วิธีการฟรอนทัลในการวิเคราะห์โครงสร้างชนิดโครงระนาบ", วิทยานิพนธ์ตามหลักสูตรปริญญามหาบัณฑิต, ภาควิชาวิศวกรรมโยธา, จุฬาลงกรณ์มหาวิทยาลัย

26. เอกเชาว์ จันทรโชติ, "วิธีการอย่างง่ายสำหรับการวิเคราะห์โครงสร้างอาคารหลายชั้น", วิทยานิพนธ์ตามหลักสูตรปริญญามหาบัณฑิต, ภาควิชาวิศวกรรมโยธา, จุฬาลงกรณ์มหาวิทยาลัย

27. Luebbert, W.F., What's Where in the APPLE, A Complete Guide to the Apple Computer, MICRO INK, Chelmsford, Massachusetts.

28. APPLE COMPUTER INC., Apple soft Reference Manual, Cupetino.(1978)

29. -----., The AppleSoft Basic Program Language, Cupertino (1978)

30. ----., The Disk Operation System Manual., Cupertino (1978)

31. A Division of Microsoft, Inc. The Applesoft Compiler (TASC) Manual, Microsoft Consumer Products, 4000108 the Ave.NE Suite 200 Bellevune, WA98004 (1982)

32. Udomlurgchai, S., Development of A General Purpose Finite Element Program on Micro Computer (Apple II), Master's Thesis, Asian Institute of Technology Bangkok, Thailand, 1983

33. Coull, A. and Subedi, N.K., "Coupled Shear Walls with Two and Three Bands of Openings", Build. Sci., Vol. 7, pp. 81 - 86, Pergamon Press, 1972

34. Beer, G. and Haas, W., " A Partitioned Frontal Solver For Finite Element Analysis", Int.J.Num.Meth.Engng, Vol. 18, pp. 1623 - 1654, 1982

35. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley & Sons, 1979

36. Johnson, C.P., " A Frontal-Based Solver with Multi-Level Substructuring" Proceedings, North Carolina State University, May 23-25, 1977, pp. 381-384.

37. Erik Thompson and Yoh Shimazaki, "A Frontal Procedure Using Skyline Storage" Int. J. Num. Meth. Engng, Vol.15, 889-910, 1980.

38. เริงเดชา รัชตโพธิ์, "โปรแกรมไมโครคอมพิวเตอร์สำหรับระบบไฟไนต์เอเลเมนต์ โดยใช้วิธีโครงสร้างย่อย", รายงานวิจัย, 2526

ภาคผนวก ก

รายละเอียดการใช้โปรแกรมและตัวอย่างการวิเคราะห์

ก-1 ความนำ

โปรแกรมที่ใช้วิเคราะห์ผนังต้านแรงเฉือนแบบมีช่องเปิดในงานวิจัยนี้ เขียนขึ้นเพื่อใช้กับเครื่องไมโครคอมพิวเตอร์ Apple II ซึ่งมีไมโครโปรเซสเซอร์ 6502 มีหน่วยความจำ 48 เคไบท์ (48 K Byte) โดยเขียนเป็นภาษาแอปเปิ้ลซอฟท์เบสิก และเปลี่ยนเป็นภาษาเครื่อง (Machine Language) ด้วยโปรแกรมแอปเปิ้ลซอฟท์คอมไพลเลอร์[31] ทั้งนี้เพื่อให้โปรแกรมทำงานเร็วขึ้น โดยจะเปลี่ยนเป็นภาษาเครื่องเฉพาะบางโปรแกรมย่อยเท่านั้น (โปรแกรมย่อยที่เปลี่ยนเป็นภาษาเครื่องมีโปรแกรมย่อย EXECUTE DATA, FRONTST และ BACKSUB ซึ่งรายละเอียดในโปรแกรมย่อยเหล่านี้อยู่ในภาคผนวก ข)

ดังนั้นถ้าจะนำโปรแกรมไปใช้กับเครื่องไมโครคอมพิวเตอร์ชนิดอื่นจะต้องเปลี่ยนแปลงคำสั่งบางคำสั่งให้สอดคล้องกับเครื่องไมโครคอมพิวเตอร์นั้น

สำหรับโปรแกรมในงานวิจัยนี้ นอกจากจะใช้วิเคราะห์ผนังต้านแรงเฉือนแบบมีช่องเปิดในรูปแบบต่าง ๆ กันแล้ว ยังสามารถใช้วิเคราะห์โครงข้อแข็งในระนาบ โครงข้อแข็งกับผนังต้านแรงเฉือนในระนาบได้อีกด้วย ดังตัวอย่างซึ่งจะแสดงต่อไป และยังสามารถใช้ได้ทั้งในกรณีที่มีเครื่องอ่านแผ่นจานแม่เหล็กเพียงตัวเดียวหรือ 2 ตัวก็ได้

ในกรณีที่มีเครื่องอ่านแผ่นจานแม่เหล็กเพียงตัวเดียว ผู้ใช้จะต้องป้อนข้อมูลเกี่ยวกับเครื่องอ่านแผ่นจานแม่เหล็กดังนี้

```
PROGRAM      SLOT : 6
             DRIVE : 1
DATA         SLOT : 6
             DRIVE : 1
```

จากนั้นเวลาโปรแกรมทำงานให้สอดแผ่นจานแม่เหล็กที่เป็นแผ่นโปรแกรมและแผ่นข้อมูลเข้าออกสลับกันไป ตามคำสั่งที่ปรากฏบนจอภาพ

ส่วนในกรณีที่มีเครื่องอ่านแผ่นจานแม่เหล็ก 2 เครื่อง จะต้องป้อนข้อมูลดังนี้

PROGRAM SLOT : 6

DRIVE : 1

DATA SLOT : 6

DRIVE : 2

และเวลาโปรแกรมทำงาน ให้สอดแผ่นโปรแกรมไว้ในเครื่องอ่านตัวที่ 1 และแผ่นข้อมูลไว้ในเครื่องอ่านตัวที่ 2

การทำงานของโปรแกรมจะแยกเป็นโปรแกรมย่อยดังต่อไปนี้

1. INPUT DATA
2. EXECUTE DATA
3. DISPLAY DATA
4. CHANGE DATA
5. PLOT DATA

ก-2 การป้อนข้อมูล

โปรแกรมย่อย INPUT DATA เป็นโปรแกรมสำหรับป้อนข้อมูลต่าง ๆ ในการวิเคราะห์ โดยมีลำดับการป้อนข้อมูลดังนี้

1. ป้อนข้อมูลรายละเอียดของโครงสร้าง ได้แก่

   1.1 จำนวนขั้ว (NP)

   1.2 จำนวนชิ้นส่วนย่อย (NUEL)

   1.3 จำนวนชิ้นส่วนย่อยที่มีแรงภายนอกกระทำ (LM)

   1.4 จำนวนขั้วที่มีแรงภายนอกกระทำ (LJ)

   1.5 จำนวนชุดคุณสมบัติของชิ้นส่วนย่อย (Material Sets, MS)

   1.6 จำนวนขั้วที่ต้องกำหนดสภาพเงื่อนไข (BJ)

   1.7 ค่า Poisson's Ratio (PT)

1.7 เมื่อผ่านขั้นตอนการป้อนข้อมูลข้างต้นแล้วจะต้องตอบคำถามการยอมรับข้อมูลชุดนี้ด้วยคำตอบ 'Y'es หรือ "N'o

2. ป้อนข้อมูลเกี่ยวกับพิกัดของขั้วแต่ละขั้ว

2.1 พิกัดทางแกน X X(J)

2.2 พิกัดทางแกน Y Y(J)

2.3 ตอบคำถามการยอมรับข้อมูลชุดนี้ด้วยคำตอบ 'Y'es หรือ 'N'o

3. ป้อนข้อมูลเกี่ยวกับคุณสมบัติของชิ้นส่วนย่อย

3.1 คำโมดูลัส E(J)

3.2 พื้นที่หน้าตัดของชิ้นส่วนย่อย AREA(J)

3.3 โมเมนต์อินเนอเชีย IZ(J)

3.4 ความกว้างของส่วนปลายที่มีความแข็งอนันต์ด้านซ้าย JR(J)

3.5 ความกว้างของส่วนปลายที่มีความแข็งอนันต์ด้านขวา KR(J)

3.6 คิดผลของการเคลื่อนที่เนื่องจากหน่วยแรงเฉือนหรือไม่

3.7 ตอบคำถามการยอมรับข้อมูลชุดนี้ด้วยคำตอบ 'Y'es หรือ 'N'o

4. ป้อนข้อมูลเกี่ยวกับหมายเลขขั้วและชุดของคุณสมบัติของชิ้นส่วนย่อย

4.1 หมายเลขขั้วที่ปลายซ้ายของชิ้นส่วนย่อย J(J)

4.2 หมายเลขขั้วที่ปลายขวาของชิ้นส่วนย่อย K(J)

4.3 ชุดของคุณสมบัติของชิ้นส่วนย่อย M5(J)

4.4 ตอบคำถามการยอมรับข้อมูลชุดนี้ด้วย คำตอบ 'Y'es หรือ 'N'o

5. ป้อนข้อมูลเกี่ยวกับแรงภายนอกที่กระทำบนชิ้นส่วนย่อย

5.1 หมายเลขของชิ้นส่วนย่อย K1(J)

5.2 คำน้ำหนักบรรทุกคงที่ในพิกัดของชิ้นส่วนย่อย โดยมีทิศทางตามแกน y ML(J)

(พิกัดของชิ้นส่วนย่อย x,y ดูรูปที่ 2.5.1 ประกอบ)

5.3 จำนวนแรงที่กระทำเป็นจุด K2(J)

5.4 ค่าของแรงที่กระทำเป็นจุด T1(K,J)

5.5 ระยะทางจากปลายซ้ายของชิ้นส่วนย่อยถึงจุดที่แรงกระทำ T2(K,J)

5.6 ถ้าไม่มีน้ำหนักบรรทุกคงที่หรือไม่มีแรงที่กระทำเป็นจุด ในหัวข้อ 5.2 และ 5.3 กรณีใดกรณีหนึ่งก็ให้ป้อนข้อมูลด้วยค่าศูนย์

5.7 ตอบคำถามการยอมรับข้อมูลชุดนี้ด้วยคำตอบ 'Y'es หรือ 'N'o

6. ป้อนข้อมูลเกี่ยวกับแรงภายนอกที่กระทำที่ขั้วในพิกัดของโครงสร้าง

6.1 หมายเลขขั้วที่แรงกระทำ K3(J)

6.2 แรงในทิศทาง X P(1,J)

6.3 แรงในทิศทาง Y P(2,J)

6.4 โมเมนต์รอบแกน Z P(3,J)

6.5 ตอบคำถามการยอมรับข้อมูลชุดนี้ด้วยคำตอบ 'Y'es หรือ 'N'o

7. ป้อนข้อมูลเกี่ยวกับสภาพเงื่อนไขที่ขั้ว ถ้าระดับขั้นความเสรีในทิศทางใดเป็นอิสระ (Free) ให้ป้อนข้อมูลเป็น 0 ถ้าระดับขั้นความเสรีในทิศทางใดถูกบังคับไม่ให้เคลื่อนที่ (FIXED) ให้ป้อนข้อมูลเป็น 1 และถ้าระดับขั้นความเสรีในทิศทางใดถูกกำหนดด้วยค่าที่ทราบแน่นอนให้ป้อนข้อมูลด้วย 2

7.1 หมายเลขขั้วที่กำหนดสภาพเงื่อนไข K4(J)

7.2 สภาพเงื่อนไขในทิศทาง X Q(1,J)

7.3 สภาพเงื่อนไขในทิศทาง Y Q(2,J)

7.4 สภาพเงื่อนไขในทิศทาง Z Q(3,J)

7.5 ถ้าสภาพเงื่อนไขในทิศทาง X, Y, Z ในหัวข้อ 7.2, 7.3 และ 7.4 เป็น 2 ก็ต้องป้อนค่าการเคลื่อนที่ที่ทราบค่าแน่นอน QN(1,J), QN(2,J) และ QN(3,J)

7.6 ตอบคำถามการยอมรับข้อมูลชุดนี้ด้วยคำตอบ 'Y'es หรือ 'N'o

8. เมื่อป้อนข้อมูลดังกล่าวข้างต้นครบถ้วนแล้ว โปรแกรมย่อย INPUT DATA จะบันทึกข้อมูลทั้งหมดลงในแผ่นจานแม่เหล็ก ทั้งนี้หมายความว่า ผู้ใช้โปรแกรมจะต้องมีแผ่นจานแม่เหล็กที่ผ่านการฟอร์แมทเรียบร้อยแล้ว เพื่อใช้สำหรับเก็บข้อมูล โดยการเก็บข้อมูลจะเก็บในลักษณะแฟ้มข้อมูล ซึ่งผู้ใช้เป็นผู้ระบุชื่อแฟ้มและสามารถเรียกข้อมูลดังกล่าวมาใช้ในการวิเคราะห์หรือทำการแก้ไขใหม่ได้

ก-3 การวิเคราะห์ข้อมูล การแสดงข้อมูล การแก้ไขข้อมูลและการวาดรูปโครงสร้าง

1. การวิเคราะห์ข้อมูลสามารถทำได้โดยเลือกการทำงานของโปรแกรมย่อย EXECUTE DATA ผลลัพธ์ที่ได้จากการวิเคราะห์จะแสดงผลทั้งบนจอภาพและเครื่องพิมพ์

2. การแสดงข้อมูลสามารถทำได้โดยเลือกการทำงานของโปรแกรมย่อย DISPLAY DATA ข้อมูลของโครงสร้างจะแสดงผลทั้งบนจอภาพและเครื่องพิมพ์

3. การแก้ไขข้อมูลสามารถทำได้โดยเลือกการทำงานของโปรแกรมย่อย CHANGE DATA โดยมีรายละเอียดการทำงานดังนี้

3.1 ใส่ชื่อแฟ้มข้อมูลที่ต้องการแก้ไข

3.2 ข้อมูลต่าง ๆ จะปรากฏบนจอภาพ

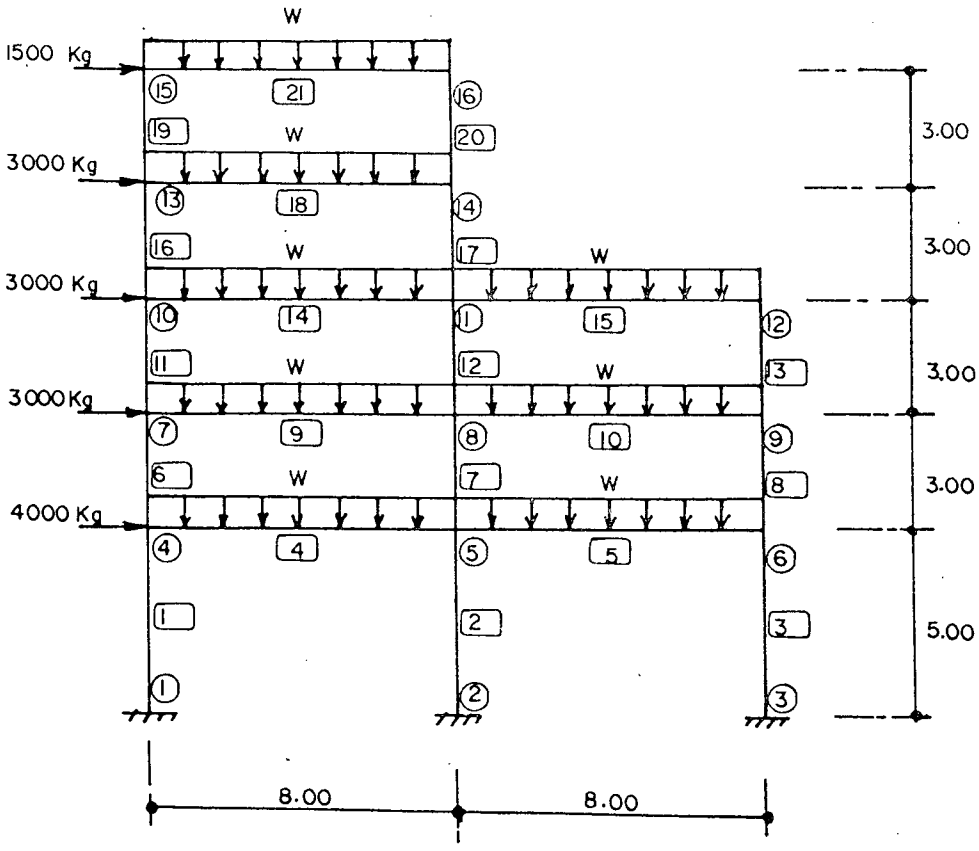
3.3 แก้ไขข้อมูลให้เป็นไปตามที่ต้องการ

3.4 เก็บข้อมูลที่แก้ไขแล้วลงในแผ่นจานแม่เหล็ก โดยจะใช้ชื่อแฟ้มใหม่หรือเก่าก็ได้ ถ้าใช้ชื่อแฟ้มเก่า ข้อมูลเก่าจะถูกลบออกและถูกแทนที่ด้วยข้อมูลใหม่

4. การวาดรูปของโครงสร้าง สามารถทำได้โดยเลือกการทำงานของโปรแกรมย่อย PLOT DATA รูปของโครงสร้างนี้มีประโยชน์เพื่อตรวจสอบ พิกัดของขั้วของโครงสร้าง โดยจะแสดงผลทั้งทางจอภาพและเครื่องพิมพ์

ก-4 ตัวอย่างข้อมูลของโครงและผลการวิเคราะห์

1. ตัวอย่างที่ 1 เป็นโครงสร้างประเภทโครงข้อแข็งในระนาบ ดังแสดงในรูปที่ ก-1



$E = 2.0X10^{9}$ kg/m^2

$A_c = 0.125$ ม^2

$I_c = 2.6X10^{-3}$ ม^4

$A_b = 0.15$ ม^2

$I_b = 4.5X10^{-3}$ ม^4

W = 1000 kg/m

รูปที่ ก - 1

ตัวอย่างที่ 1 นี้มีข้อมูลที่ต้องป้อนและผลการวิเคราะห์ดังนี้

DATA FILE NAME : EX.1
TITLE : FRAME

NO. OF NODES = 16
NO. OF MEMBERS = 21
NO. OF LOADED MEMBERS = 8
NO. OF LOADED JOINTS = 5
NO. OF MATERIAL SETS = 2
NO. OF BOUNDARY JOINTS = 3
POISSON'S RATIO = .15

********** NODAL POINT COORDINATES **********

NODE	X - COOR.	Y - COOR.
1	0.0000	0.0000
2	8.0000	0.0000
3	16.0000	0.0000
4	0.0000	5.0000
5	8.0000	5.0000
6	16.0000	5.0000
7	0.0000	8.0000
8	8.0000	8.0000
9	16.0000	8.0000
10	0.0000	11.0000
11	8.0000	11.0000
12	16.0000	11.0000
13	0.0000	14.0000
14	8.0000	14.0000
15	0.0000	17.0000
16	8.0000	17.0000

********** MATERIAL SETS **********

MAT. NO.	YOUNG'S MODULUS	X-SECTION AREA	MOMENT INERTIA	RIGID ZONE OF NODE I	RIGID ZONE OF NODE J	SHEARING DEF-TION
1	2.0000E+09	0.1250	0.0026	0.0000	0.0000	NEGLECT
2	2.0000E+09	0.1500	0.0045	0.0000	0.0000	NEGLECT

********** NODE NO. AND PROPERTY OF ELEMENTS **********

ELEM. NO.	NODE I	NODE J	MAT. SET
1	1	4	1
2	2	5	1
3	3	6	1
4	4	5	2
5	5	6	2
6	4	7	1
7	5	8	1
8	6	9	1
9	7	8	2
10	8	9	2
11	7	10	1
12	8	11	1
13	9	12	1
14	10	11	2
15	11	12	2
16	10	13	1
17	11	14	1
18	13	14	2
19	13	15	1
20	14	16	1
21	15	16	2

********** MEMBER LOADS IN LOCAL COORDINATE **********

CARD NO.	ELEMENT NO.	UNIF. LOAD	NO. TRANV.	TRANV. LOAD	DIST. -LEFT
1	4	-1000.0000	0		
2	5	-1000.0000	0		
3	9	-1000.0000	0		
4	10	-1000.0000	0		
5	14	-1000.0000	0		
6	15	-1000.0000	0		
7	18	-1000.0000	0		
8	21	-1000.0000	0		

********** JOINT LOADS IN GLOBAL COORDINATE **********

CARD NO.	NODE NO.	FORCE IN-X	FORCE IN-Y	MOMENT AB.-Z
1	4	4000.0000	0.0000	0.0000
2	7	3000.0000	0.0000	0.0000
3	10	3000.0000	0.0000	0.0000
4	13	3000.0000	0.0000	0.0000
5	15	1500.0000	0.0000	0.0000

********** BOUNDARY CONDITION AT JOINTS **********

CARD NO.	B.C.JOINT	X-DISPL.	Y-DISPL.	ROTATION
1	1	1	1	1
2	2	1	1	1
3	3	1	1	1

<0> = FREE : <1> = FIXED : <2> = KNOWN

********** MEMBER FORCES IN LOCAL COORDINATE **********

FILE NAME : EX.I
TITLE : FRAME

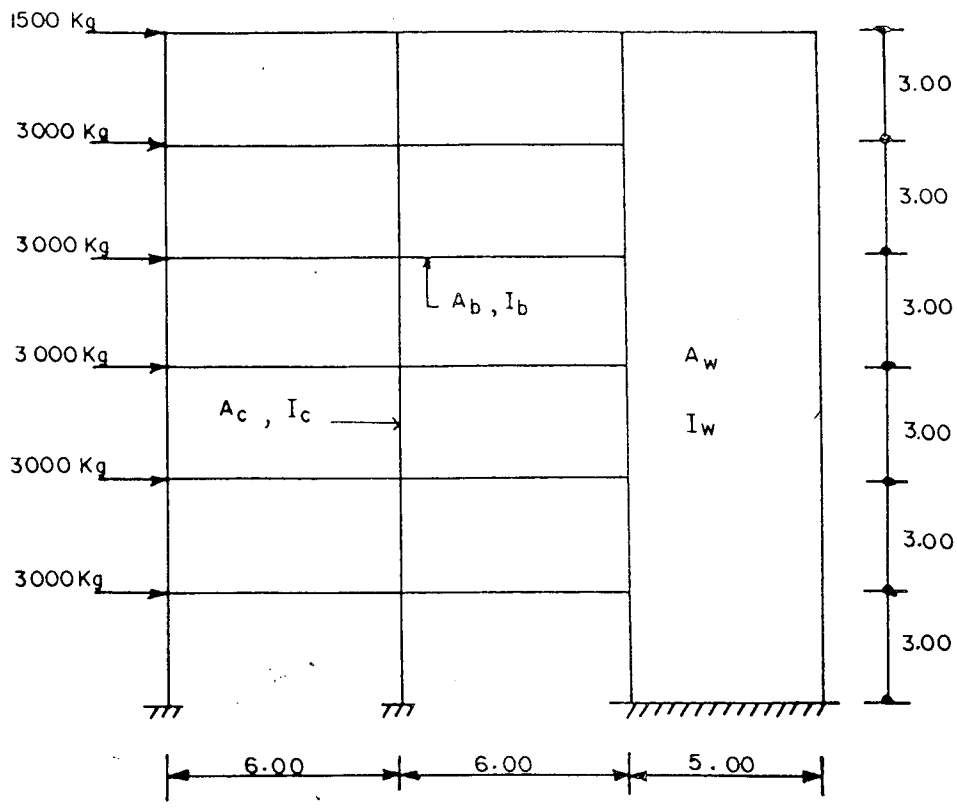
MEMBER NO.	NODE	AXIAL FORCE	SHEAR FORCE	MOMENT
1	1	12303.9618	4145.6843	12739.5762
	4	-12303.9618	-4145.6843	7988.8455
2	2	34534.0680	5407.5209	14836.7141
	5	-34534.0680	-5407.5209	12200.8904
3	3	17161.9702	4946.7956	14059.6509
	6	-17161.9702	-4946.7956	10674.3273
4	4	533.9266	1097.4345	-7420.8085
	5	-533.9266	6902.5654	-15799.7152
5	5	828.2285	1484.2388	-4324.3328
	6	-828.2285	6515.7611	-15801.7565
6	4	11206.5273	679.6103	-568.0370
	7	-11206.5273	-679.6103	2606.8682
7	5	26147.2639	5701.8226	7923.1576
	8	-26147.2639	-5701.8226	9182.3103
8	6	10646.2090	4118.5676	5127.4292
	9	-10646.2090	-4118.5676	7228.2736
9	7	2346.7716	2214.4560	-2331.0237
	8	-2346.7716	5785.5439	-11953.3276
10	8	-362.5280	2262.7895	-1483.2751
	9	362.5280	5737.2104	-12414.4085
11	7	8992.0713	26.3812	-275.8444
	10	-8992.0713	-26.3812	354.9882
12	8	18098.9307	2992.5231	4254.2924
	11	-18098.9307	-2992.5231	4723.2770
13	9	4908.9987	4481.0954	5186.1347
	12	-4908.9987	-4481.0954	8257.1514
14	10	3810.2670	2505.1917	-1115.5583
	11	-3810.2670	5494.8082	-10842.9079
15	11	4481.0947	3091.0014	985.1628
	12	-4481.0947	4908.9986	-8257.1516
16	10	6486.8797	836.6480	760.5699
	13	-6486.8797	-836.6480	1749.3741
17	11	9513.1202	3663.3520	5134.4675
	14	-9513.1202	-3663.3520	5855.5885
18	13	566.7176	2929.0296	666.6615
	14	-566.7176	5070.9703	-9234.4246
19	13	3557.8498	-1596.6348	-2416.0360
	15	-3557.8498	1596.6348	-2373.8686
20	14	4442.1494	3096.6350	3378.8360
	16	-4442.1494	-3096.6350	5911.0692
21	15	3096.6348	3557.8499	2373.8684
	16	-3096.6348	4442.1501	-5911.0692

********** NODAL DISPLACEMENTS IN GLOBAL COORDINATE **********

NODE	DX	DY	RZ
1	4.1456E-32	-1.2303E-31	-1.2739E-31
2	5.4075E-32	-3.4534E-31	-1.4836E-31
3	4.9467E-32	-1.7161E-31	-1.4059E-31
4	1.4014E-02	-2.4607E-04	-2.2840E-03
5	1.4000E-02	-6.9068E-04	-1.2672E-03
6	1.3978E-02	-3.4323E-04	-1.6275E-03
7	1.9786E-02	-3.8055E-04	-1.3681E-03
8	1.9724E-02	-1.0044E-03	-9.0400E-04
9	1.9734E-02	-4.7099E-04	-1.0215E-03
10	2.3629E-02	-4.8846E-04	-1.1861E-03
11	2.3528E-02	-1.2216E-03	-7.6872E-04
12	2.3408E-02	-5.2990E-04	-1.3567E-04
13	2.7122E-02	-5.6630E-04	-9.0096E-04
14	2.7107E-02	-1.3357E-03	-5.6070E-04
15	2.9116E-02	-6.0899E-04	-8.8880E-04
16	2.9033E-02	-1.3890E-03	1.6974E-04

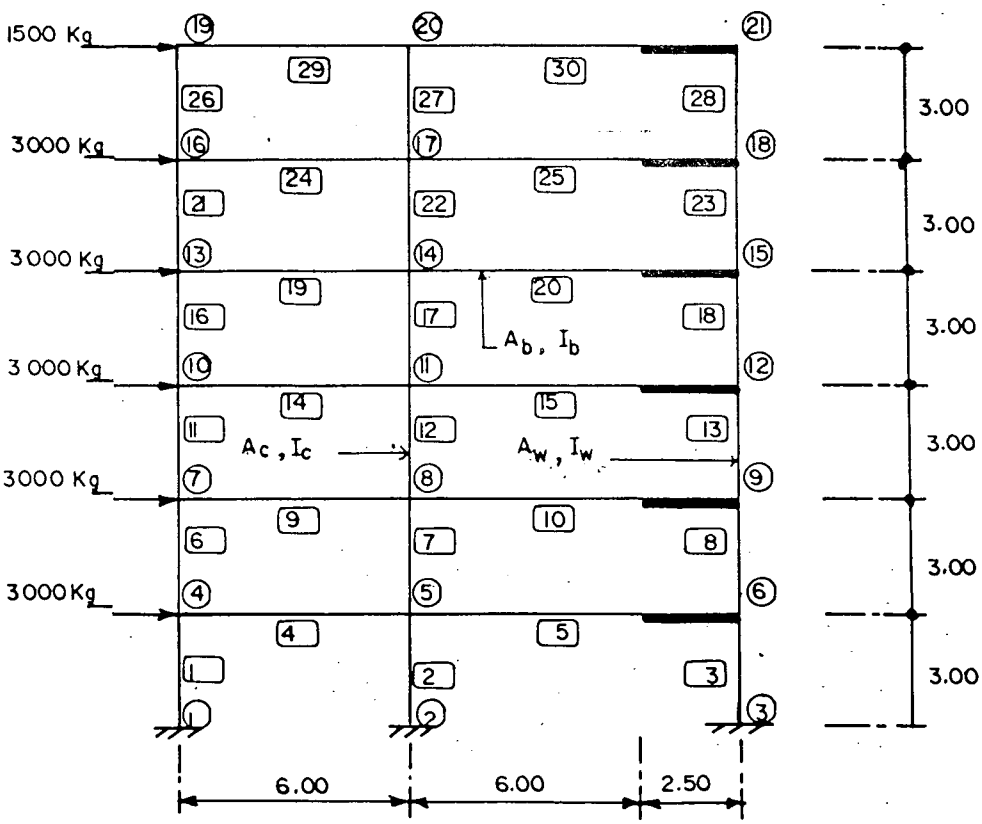
จากข้อมูลข้างต้นจะพบว่า ข้อมูลเกี่ยวกับคุณสมบัติของชิ้นส่วนย่อยในเรื่องของความกว้างที่ส่วนปลายมีความแข็งอนันต์จะเป็นศูนย์ทั้งทางด้านซ้ายและขวา เนื่องจากไม่คิดความกว้างของเสาและคาน สำหรับผลของการเคลื่อนที่เนื่องจากหน่วยแรงเฉือนก็ไม่คิดเช่นกัน

2. ตัวอย่างที่ 2 เป็นโครงสร้างประเภทโครงข้อแข็งกับผนังด้านแรงเฉือนในระนาบดังแสดงในรูปที่ ก-2



$E = 2.0X10^{9}$ kg/m^2
$A_c = 0.09$ ม^2
$I_c = 6.75X10^{-4}$ ม^4
$A_b = 0.15$ ม^2
$I_b = 3.12X10^{-3}$ ม^4
$A_w = 1.5$ ม^2
$I_w = 3.125$ ม^4

รูปที่ ก-2



รูปที่ ก-3

สำหรับโครงสร้างในรูปที่ ก-2 ต้องจำลองผนังต้านแรงเฉือนเสียก่อนโดยคิดเป็นเสากว้างและคานที่เชื่อมต่อกับเสามีความแข็งอนันต์ที่ส่วนปลาย ดังแสดงในรูปที่ ก-3

ตัวอย่างที่ 2 นี้มีข้อมูลที่ต้องป้อนและผลการวิเคราะห์ดังนี้

DATA FILE NAME : EX.2
TITLE : FRAME - SHEAR WALL

NO. OF NODES = 21
NO. OF MEMBERS = 30
NO. OF LOADED MEMBERS = 0
NO. OF LOADED JOINTS = 6
NO. OF MATERIAL SETS = 4
NO. OF BOUNDARY JOINTS = 3
POISSON'S RATIO = .15

********** NODAL POINT COORDINATES **********

NODE	X - COOR.	Y - COOR.
1	0.0000	0.0000
2	6.0000	0.0000
3	14.5000	0.0000
4	0.0000	3.0000
5	6.0000	3.0000
6	14.5000	3.0000
7	0.0000	6.0000
8	6.0000	6.0000
9	14.5000	6.0000
10	0.0000	9.0000
11	6.0000	9.0000
12	14.5000	9.0000
13	0.0000	12.0000
14	6.0000	12.0000
15	14.5000	12.0000
16	0.0000	15.0000
17	6.0000	15.0000
18	14.5000	15.0000
19	0.0000	18.0000
20	6.0000	18.0000
21	14.5000	18.0000

********** MATERIAL SETS **********

MAT. NO.	YOUNG'S MODULUS	X-SECTION AREA	MOMENT INERTIA	RIGID ZONE OF NODE I	RIGID ZONE OF NODE J	SHEARING DEF-TION
1	2.0000E+09	0.0900	0.0006	0.0000	0.0000	NEGLECT
2	2.0000E+09	0.1500	0.0031	0.0000	0.0000	NEGLECT
3	2.0000E+09	0.1500	0.0031	0.0000	2.5000	NEGLECT
4	2.0000E+09	1.5000	3.1250	0.0000	0.0000	INCLUDE

********** NODE NO. AND PROPERTY OF ELEMENTS **********

ELEM. NO.	NODE I	NODE J	MAT. SET
1	1	4	1
2	2	5	1
3	3	6	4
4	4	5	2
5	5	6	3
6	4	7	1
7	5	8	1
8	6	9	4
9	7	8	2
10	8	9	3
11	7	10	1
12	8	11	1
13	9	12	4
14	10	11	2
15	11	12	3
16	10	13	1
17	11	14	1
18	12	15	4
19	13	14	2
20	14	15	3
21	13	16	1
22	14	17	1
23	15	18	4
24	16	17	2
25	17	18	3
26	16	19	1
27	17	20	1
28	18	21	4
29	19	20	2
30	20	21	3

********** JOINT LOADS IN GLOBAL COORDINATE **********

CARD NO.	NODE NO.	FORCE IN-X	FORCE IN-Y	MOMENT AB.-Z
1	4	3000.0000	0.0000	0.0000
2	7	3000.0000	0.0000	0.0000
3	10	3000.0000	0.0000	0.0000
4	13	3000.0000	0.0000	0.0000
5	16	3000.0000	0.0000	0.0000
6	19	3000.0000	0.0000	0.0000

********** BOUNDARY CONDITION AT JOINTS **********

CARD NO.	B.C.JOINT	X-DISPL.	Y-DISPL.	ROTATION
1	1	1	1	1
2	2	1	1	1
3	3	1	1	1

(0) = FREE : (1) = FIXED : (2) = KNOWN

********** MEMBER FORCES IN LOCAL COORDINATE **********

FILE NAME : EX.2
TITLE : FRAME - SHEAR WALL

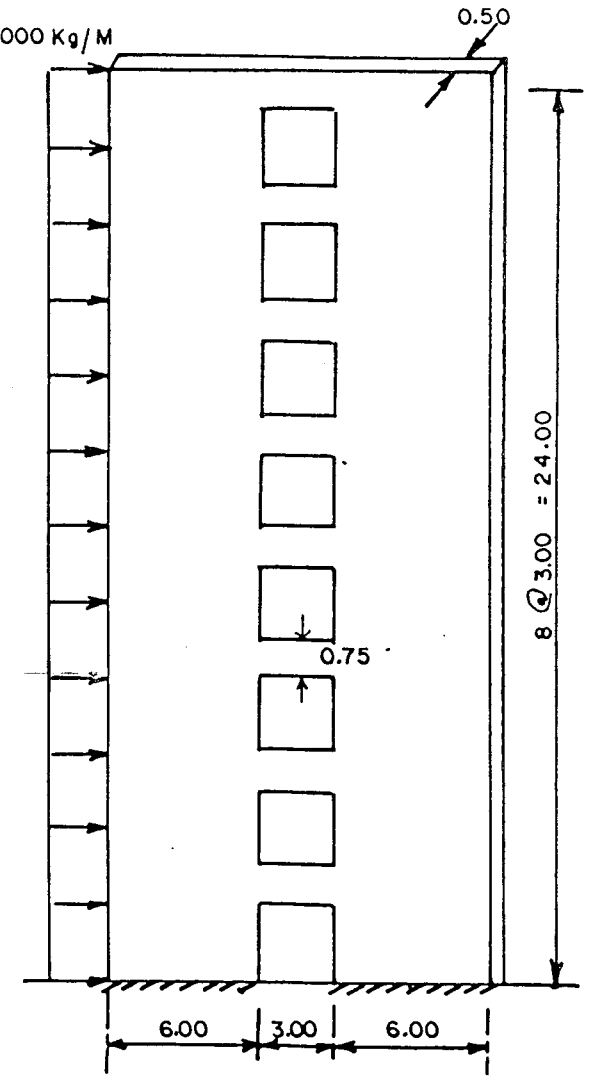
MEMBER NO.	NODE	AXIAL FORCE	SHEAR FORCE	MOMENT
1	1	-499.3970	126.0315	217.5719
	4	499.3970	-126.0315	160.5226
2	2	-950.9917	142.5593	216.3736
	5	950.9917	-142.5593	211.3043
3	3	1450.3887	17731.4089	173241.3680
	6	-1450.3887	-17731.4089	-120047.1410
4	4	2954.3547	-74.5098	-283.6916
	5	-2954.3547	74.5098	-163.3674
5	5	3005.0031	-134.2840	-335.3972
	6	-3005.0031	134.2840	-806.0172
6	4	-424.8872	80.3863	123.1690
	7	424.8872	-80.3863	117.9898
7	5	-891.2175	193.2077	287.4603
	8	891.2175	-193.2077	292.1628
8	6	1316.1047	14726.4058	120853.1570
	9	-1316.1047	-14726.4058	-76673.9398
9	7	3039.3818	-77.7603	-304.8800
	8	-3039.3818	77.7603	-161.6817
10	8	3105.5589	-213.7601	-519.0011
	9	-3105.5589	213.7601	-1297.9603
11	7	-347.1269	119.7680	186.8902
	10	347.1269	-119.7680	172.4139
12	8	-755.2176	259.3849	388.5201
	11	755.2176	-259.3849	389.6346
13	9	1102.3445	11620.8473	77971.9000
	12	-1102.3445	-11620.8473	-43109.3580
14	10	3014.1576	-95.5868	-376.4046
	11	-3014.1576	95.5868	-197.1164
15	11	3050.4907	-263.2125	-635.7978
	12	-3050.4907	263.2125	-1601.5084
16	10	-251.5400	133.9257	203.9907
	13	251.5400	-133.9257	197.7866
17	11	-587.5920	295.7179	443.2796
	14	587.5920	-295.7179	443.8742
18	12	839.1320	8570.3562	44710.8672
	15	-839.1320	-8570.3562	-18999.7982
19	13	3006.7920	-104.0239	-409.5850
	14	-3006.7920	104.0239	-214.5589
20	14	3020.0845	-288.0331	-693.6438
	15	-3020.0845	288.0331	-1754.6380

21	13	-147.5160	140.7178	211.7984
	16	147.5160	-140.7178	210.3551
22	14	-403.5828	309.0103	464.3284
	17	403.5828	-309.0103	462.7026
23	15	551.0989	5550.2727	20754.4382
	18	-551.0989	-5550.2727	-4103.6201
24	16	3009.0855	-109.0580	-424.4758
	17	-3009.0855	109.0580	-229.8722
25	17	3039.4606	-298.7812	-721.5552
	18	-3039.4606	298.7812	-1818.0853
26	16	-38.4580	149.8033	214.1206
	19	38.4580	-149.8033	235.2893
27	17	-213.8596	339.3854	488.7248
	20	213.8596	-339.3854	529.4315
28	18	252.3176	2510.8113	5921.7072
	21	-252.3176	-2510.8113	1610.7272
29	19	2850.1967	-38.4580	-235.2893
	20	-2850.1967	38.4580	4.5410
30	20	2510.8111	-252.3176	-533.9726
	21	-2510.8111	252.3176	-1610.7276

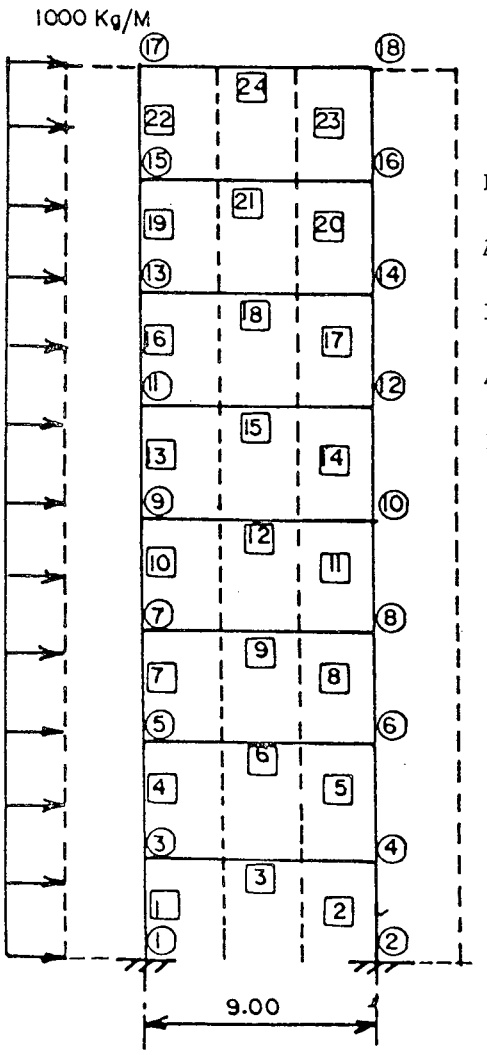
********** NODAL DISPLACEMENTS IN GLOBAL COORDINATE **********

NODE	DX	DY	RZ
	--	--	--
1	1.2603E-33	4.9939E-33	-2.1757E-33
2	1.4255E-33	9.5099E-33	-2.1637E-33
3	1.7731E-31	-1.4503E-32	-1.7324E-30
4	3.0513E-04	8.3232E-06	-6.3388E-05
5	2.4604E-04	1.5849E-05	-5.6324E-06
6	1.6090E-04	-1.4503E-06	-7.0389E-05
7	6.3790E-04	1.5404E-05	-6.9142E-05
8	5.7712E-04	3.0703E-05	-4.0755E-07
9	4.8912E-04	-2.7664E-06	-1.1779E-04
10	1.0690E-03	2.1190E-05	-8.5227E-05
11	1.0087E-03	4.3290E-05	8.3085E-07
12	9.2236E-04	-3.8688E-06	-1.4685E-04
13	1.5583E-03	2.5382E-05	-9.2120E-05
14	1.4981E-03	5.3083E-05	1.4916E-06
15	1.4126E-03	-4.7079E-06	-1.6214E-04
16	2.0716E-03	2.7841E-05	-9.3724E-05
17	2.0114E-03	5.9810E-05	-3.1483E-07
18	1.9253E-03	-5.2590E-06	-1.6811E-04
19	2.5671E-03	2.8482E-05	-7.0203E-05
20	2.5101E-03	6.3374E-05	4.4914E-05
21	2.4390E-03	-5.5113E-06	-1.6914E-04

3. ตัวอย่างที่ 3 เป็นโครงสร้างประเภทผนังต้านแรงเฉือนดังแสดงในรูปที่ ก-4



รูปที่ ก-4



รูปที่ ก-5

$E = 2.0 \times 10^9 \ kg/m^2$

$A_w = 3 \ ม^2$

$I_w = 9 \ ม^4$

$A_b = 0.375 \ ม^2$

$I_b = 0.0176 \ ม^4$

เช่นเดียวกันกับในตัวอย่างที่ 2 ต้องจำลองโครงสร้างผนังต้านแรงเฉือนเป็นโครงข้อแข็งเสียก่อน จะได้โครงสร้างดังแสดงในรูปที่ ก-5

สำหรับตัวอย่างที่ 3 นี้ มีข้อมูลที่ต้องป้อนและผลการวิเคราะห์ดังนี้

DATA FILE NAME : EX.3
TITLE : SHEAR WALL

NO. OF NODES = 18
NO. OF MEMBERS = 24
NO. OF LOADED MEMBERS = 8
NO. OF LOADED JOINTS = 0
NO. OF MATERIAL SETS = 2
NO. OF BOUNDARY JOINTS = 2
POISSON'S RATIO = .15

********** NODAL POINT COORDINATES **********

NODE	X - COOR.	Y - COOR.
1	0.0000	0.0000
2	9.0000	0.0000
3	0.0000	3.0000
4	9.0000	3.0000
5	0.0000	6.0000
6	9.0000	6.0000
7	0.0000	9.0000
8	9.0000	9.0000
9	0.0000	12.0000
10	9.0000	12.0000
11	0.0000	15.0000
12	9.0000	15.0000
13	0.0000	18.0000
14	9.0000	18.0000
15	0.0000	21.0000
16	9.0000	21.0000
17	0.0000	24.0000
18	9.0000	24.0000

********** MATERIAL SETS **********

MAT. NO.	YOUNG'S MODULUS	X-SECTION AREA	MOMENT INERTIA	RIGID ZONE OF NODE I	RIGID ZONE OF NODE J	SHEARING DEF-TION
1	2.0000E+09	3.0000	9.0000	0.0000	0.0000	INCLUDE
2	2.0000E+09	0.3750	0.0176	3.0000	3.0000	NEGLECT

********** NODE NO. AND PROPERTY OF ELEMENTS **********

ELEM. NO.	NODE I	NODE J	MAT. SET
1	1	3	1
2	2	4	1
3	3	4	2
4	3	5	1
5	4	6	1
6	5	6	2
7	5	7	1
8	6	8	1
9	7	8	2
10	7	9	1
11	8	10	1
12	9	10	2
13	9	11	1
14	10	12	1
15	11	12	2
16	11	13	1
17	12	14	1
18	13	14	2
19	13	15	1
20	14	16	1
21	15	16	2
22	15	17	1
23	16	18	1
24	17	18	2

********** MEMBER LOADS IN LOCAL COORDINATE **********

CARD NO.	ELEMENT NO.	UNIF. LOAD	NO. TRANV.	TRANV. LOAD	DIST. -LEFT
1	1	-1000.0000	0		
2	4	-1000.0000	0		
3	7	-1000.0000	0		
4	10	-1000.0000	0		
5	13	-1000.0000	0		
6	16	-1000.0000	0		
7	19	-1000.0000	0		
8	22	-1000.0000	0		

********** BOUNDARY CONDITION AT JOINTS **********

CARD NO.	B.C.JOINT	X-DISPL.	Y-DISPL.	ROTATION
1	1	1	1	1
2	2	1	1	1

(0) = FREE : (1) = FIXED : (2) = KNOWN

********** MEMBER FORCES IN LOCAL COORDINATE **********

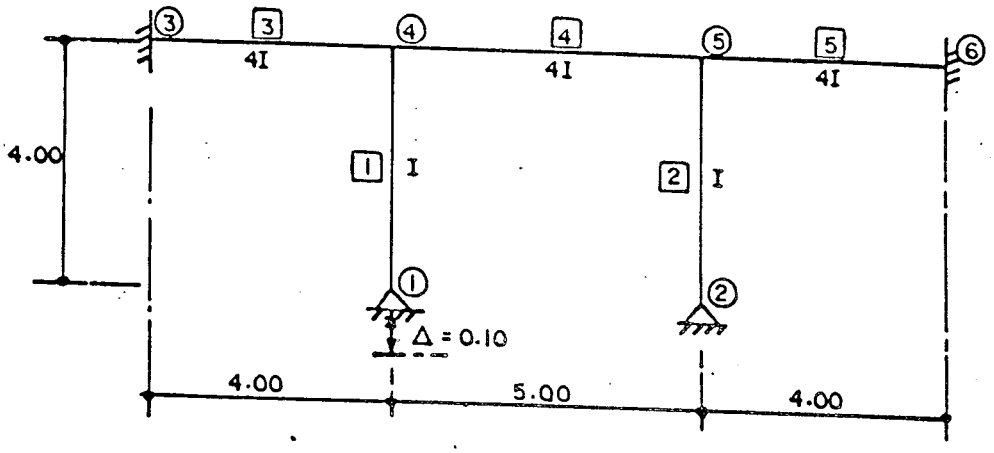
FILE NAME : EX.3
TITLE : SHEAR WALL

MEMBER NO.	NODE	AXIAL FORCE	SHEAR FORCE	MOMENT
1	1	-14219.6638	14358.5707	86328.8272
	3	14219.6638	-11358.5707	-47753.1150
2	2	14219.6637	9641.4290	73694.1975
	4	-14219.6637	-9641.4290	-44769.9103
3	3	550.5439	-1250.3447	-5640.3554
	4	-550.5439	1250.3447	-5612.7472
4	3	-12969.3190	11909.1148	53393.4699
	5	12969.3190	-8909.1148	-22166.1254
5	4	12969.3189	9090.8850	50382.6572
	6	-12969.3189	-9090.8850	-23110.0021
6	5	1015.8990	-1913.0868	-8623.2493
	6	-1015.8990	1913.0868	-8594.5324
7	5	-11056.2321	9925.0135	30789.3744
	7	11056.2321	-6925.0135	-5514.3337
8	6	11056.2321	8074.9860	31704.5341
	8	-11056.2321	-8074.9860	-7479.5757
9	7	1320.1018	-2174.1801	-9793.8858
	8	-1320.1018	2174.1801	-9773.7351
10	7	-8882.0519	8245.1156	15308.2192
	9	8882.0519	-5245.1156	4927.1276
11	8	8882.0519	6754.8842	17253.3111
	10	-8882.0519	-6754.8842	5011.3415
12	9	1477.7086	-2170.8806	-9773.7965
	10	-1477.7086	2170.8806	-9764.1292
13	9	-6711.1714	6722.8243	4846.6683
	11	6711.1714	-3722.8243	10821.8046
14	10	6711.1714	5277.1755	6752.7881
	12	-6711.1714	-5277.1755	9078.7386
15	11	1520.2441	-2008.3883	-9037.5465
	12	-1520.2441	2008.3883	-9037.9488
16	11	-4702.7828	5243.0681	-1784.2571
	13	4702.7828	-2243.0681	13013.4617
17	12	4702.7830	3756.9315	-40.7897
	14	-4702.7830	-3756.9315	11311.5845
18	13	1462.7060	-1772.6020	-7971.6727
	14	-1462.7060	1772.6020	-7981.7459
19	13	-2930.1809	3705.7743	-5041.7901
	15	2930.1809	-705.7742	11659.1132
20	14	2930.1809	2294.2256	-3329.8375
	16	-2930.1809	-2294.2256	10212.5146
21	15	1295.7729	-1540.5339	-6922.8110
	16	-1295.7729	1540.5339	-6941.9942
22	15	-1389.6470	2001.5471	-4736.3015
	17	1389.6470	998.4528	6240.9431
23	16	1389.6469	998.4525	-3270.5207
	18	-1389.6469	-998.4525	6265.8783
24	17	998.4524	-1389.6469	-6240.9442
	18	-998.4524	1389.6469	-6265.8784

********** NODAL DISPLACEMENTS IN GLOBAL COORDINATE **********

NODE	DX	DY	RZ
1	1.2858E-31	1.4219E-31	-8.5578E-31
2	9.6414E-32	-1.4219E-31	-7.3694E-31
3	3.5924E-05	7.1098E-06	-1.1048E-05
4	2.9318E-05	-7.1098E-06	-9.8720E-06
5	9.3993E-05	1.3594E-05	-1.7220E-05
6	8.1802E-05	-1.3594E-05	-1.5996E-05
7	1.6268E-04	1.9122E-05	-2.0120E-05
8	1.4684E-04	-1.9122E-05	-1.9261E-05
9	2.3430E-04	2.3563E-05	-2.0860E-05
10	2.1657E-04	-2.3563E-05	-2.0448E-05
11	3.0381E-04	2.6919E-05	-2.0237E-05
12	2.8557E-04	-2.6919E-05	-2.0254E-05
13	3.6812E-04	2.9270E-05	-1.8879E-05
14	3.5057E-04	-2.9270E-05	-1.9308E-05
15	4.2580E-04	3.0735E-05	-1.7362E-05
16	4.1025E-04	-3.0735E-05	-1.8180E-05
17	4.7708E-04	3.1430E-05	-1.6322E-05
18	4.6510E-04	-3.1430E-05	-1.7385E-05

ตัวอย่างที่ 4 เป็นโครงสร้างประเภทโครงข้อแข็งในระนาบที่มีการทรุดตัวที่จุดรองรับ ดังแสดงในรูปที่ ก-6



$E = 2.0X10^{9}$ kg/m^2

$I = 4.0X10^{-4}$ ม^4

$A_c = 0.06$ ม^2

$A_b = 0.1$ ม^2

รูปที่ ก-6

ตัวอย่างที่ 4 มีข้อมูลและผลการวิเคราะห์ดังนี้

DATA FILE NAME : EX.4
TITLE : FRAME - SETTLEMENT

NO. OF NODES = 6
NO. OF MEMBERS = 5
NO. OF LOADED MEMBERS = 0
NO. OF LOADED JOINTS = 0
NO. OF MATERIAL SETS = 2
NO. OF BOUNDARY JOINTS = 4
POISSON'S RATIO = .15

********** NODAL POINT COORDINATES **********

NODE	X - COOR.	Y - COOR.
1	4.0000	0.0000
2	9.0000	0.0000
3	0.0000	4.0000
4	4.0000	4.0000
5	9.0000	4.0000
6	13.0000	4.0000

********** MATERIAL SETS **********

MAT. NO.	YOUNG'S MODULUS	X-SECTION AREA	MOMENT INERTIA	RIGID ZONE OF NODE I	RIGID ZONE OF NODE J	SHEARING DEF-TION
1	2.0000E+09	0.0600	0.0004	0.0000	0.0000	NEGLECT
2	2.0000E+09	0.1000	0.0016	0.0000	0.0000	NEGLECT

********** NODE NO. AND PROPERTY OF ELEMENTS **********

ELEM. NO.	NODE I	NODE J	MAT. SET
1	1	4	1
2	2	5	1
3	3	4	2
4	4	5	2
5	5	6	2

********** BOUNDARY CONDITION AT JOINTS **********

CARD NO.	B.C.JOINT	X-DISPL.	Y-DISPL.	ROTATION
1	1	1	2	0
			-0.0500	
2	2	1	1	0
3	3	1	1	1
4	6	1	1	1

<0> = FREE : <1> = FIXED : <2> = KNOWN

********** MEMBER FORCES IN LOCAL COORDINATE **********

FILE NAME : EX.4
TITLE : FRAME - SETTLEMENT

MEMBER NO.	NODE	AXIAL FORCE	SHEAR FORCE	MOMENT
1	1	-36667.9460	-717.8844	0.0000
	4	36667.9460	717.8844	-2871.5378
2	2	21006.8948	1034.8259	0.0000
	5	-21006.8948	-1034.8259	4139.3036
3	3	-178.5889	23522.4940	50874.4194
	4	178.5889	-23522.4940	43215.5565
4	4	539.2954	-13145.4522	-40344.0188
	5	-539.2954	13145.4522	-25383.2426
5	5	-495.5304	7861.4426	21243.9389
	6	495.5304	-7861.4426	10201.8316

********** NODAL DISPLACEMENTS IN GLOBAL COORDINATE **********

NODE	DX	DY	RZ
1	-7.1788E-33	-5.0000E-02	2.3920E-03
2	1.0348E-32	-2.1006E-31	-3.4469E-03
3	1.7858E-33	-2.3522E-31	-5.0874E-31
4	3.5717E-06	-4.8777E-02	-4.7867E-03
5	-9.9106E-06	-7.0022E-04	6.9013E-03
6	-4.9553E-33	7.8614E-32	-1.0201E-31

ภาคผนวก ข

รายละเอียดโปรแกรมคอมพิวเตอร์

```
1000  REM  *** HEADING ***
1010  TEXT : HOME : VTAB 1
1020  GOTO 1040
1030  PRINT "****************************************": RETURN
1040  GOSUB 1030
1050  VTAB 4: PRINT "          ANALYSIS PROGRAM OF           "
1060  VTAB 6: PRINT "1. 2-D FRAME"
1070  VTAB 8: PRINT "2. 2-D FRAME-SHEAR WALLS INTERACTION"
1080  VTAB 10: PRINT "3. 2-D SHEAR WALLS WITH OPENING"
1090  VTAB 13: GOSUB 1030
1100  VTAB 22: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 22: HTAB 32: GET B$
1110  TEXT : HOME : VTAB 2: PRINT "PROGRAM SLOT  : 6": VTAB 3: HTAB 9: PRINT "DRIVE : "; VTAB 3: HTAB 1
   7: INPUT "";AA$: IF AA$ = "" THEN  PRINT  CHR$ (7): GOTO 1110
1120  IF AA$ <  > "1" AND AA$ <  > "2" THEN  PRINT  CHR$ (7): GOTO 1110
1130 AA =  VAL (AA$): POKE 34,3
1140  VTAB 5: PRINT "DATA   SLOT  : 6": VTAB 6: HTAB 9: PRINT "DRIVE : ": VTAB 6: HTAB 17: INPUT "";BB
   $: IF BB$ = "" THEN  PRINT  CHR$ (7): GOTO 1140
1150  IF BB$ <  > "1" AND BB$ <  > "2" THEN  PRINT  CHR$ (7): GOTO 1140
1160 BB =  VAL (BB$): TEXT
1170  VTAB 22: PRINT "CONFIRM BY TYPE : 'Y'"
1180  VTAB 22: HTAB 20: GET N$: IF N$ = "" THEN  PRINT  CHR$ (7): GOTO 1180
1190  IF N$ <  > "Y" THEN 1110
1200  HOME : POKE 779,AA: POKE 780,BB: FLASH : VTAB 2: PRINT ".WAITING.": NORMAL
1210 D$ =  CHR$ (13) +  CHR$ (4): PRINT D$;"RUN OPTIONS,D";AA
```

```
1000  REM  *** OPTIONS ***
1010  TEXT : HOME :AA =  PEEK (779):BB =  PEEK (780)
1020 D$ =  CHR$ (13) +  CHR$ (4)
1030  PRINT  TAB( 1)"---------------------------------------": PRINT
1040  PRINT "        COMMAND         NUMBER"
1050  PRINT "        -------         ------": PRINT
1060  PRINT "  - INPUT DATA            (1)": PRINT
1070  PRINT "  - EXECUTE DATA          (2)": PRINT
1080  PRINT "  - DISPLAY DATA          (3)": PRINT
1090  PRINT "  - CHANGE DATA           (4)": PRINT
1100  PRINT "  - PLOT DATA             (5)": PRINT
1110  PRINT "  - EXIT                  (6)": PRINT
1120  VTAB 22: PRINT "  CHOOSE NUMBER ( 1 - 6 )": VTAB 22: HTAB 27: GET CC$
1130 CC =  VAL (CC$)
1140  IF CC < 1 OR CC > 6 THEN  PRINT  CHR$ (7): GOTO 1120
1150  ON CC GOTO 1160,1170,1180,1190,1200,1210
1160  PRINT D$;"RUN INPUT DATA,D1"
1170  PRINT D$;"BLOAD RUNTIME" +  CHR$ (13) +  CHR$ (4) + "BRUN EXECUTE DATA.OBJ,D1"
1180  PRINT D$;"RUN DISPLAY DATA,D1"
1190  PRINT D$;"RUN CHANGE DATA,D1"
1200  PRINT D$;"RUN PLOT DATA,D1"
1210  END
```

```
1000  REM  *** INPUT DATA ***
1010 AA =  PEEK (779):BB =  PEEK (780)
1020  TEXT : HOME :AS$ = "                                                  ": GOTO 1040
1030  INVERSE : VTAB 1: PRINT AS$: RETURN
1040  GOSUB 1030
1050  VTAB 2: PRINT "              INPUT DATA              "
1060  GOTO 1080
1070  VTAB 3: PRINT AS$: NORMAL : RETURN
1080  GOSUB 1070: POKE 34,4: GOTO 1150
1090  POKE 34,22: VTAB 23: PRINT "ACCEPT DATA : 'Y'ES OR 'N'O"
1100  VTAB 23: HTAB 29: GET G$
1110  IF G$ = "" THEN 1140
1120  IF G$ <  > "Y" AND G$ <  > "N" THEN 1140
1130  HOME : RETURN
1140  PRINT  CHR$ (7): GOTO 1100
1150  VTAB 5: PRINT "TITLE : ";: INPUT "";F$
1160  VTAB 7: INPUT "NO. OF NODES           = ";NP
1170  INPUT "NO. OF MEMBERS          = ";NUEL
1180  INPUT "NO. OF LOADED MEMBERS   = ";LM
1190  INPUT "NO. OF LOADED JOINTS    = ";LJ
1200  INPUT "NO. OF MATERIAL SETS    = ";MS
1210  INPUT "NO. OF BOUNDARY JOINTS  = ";BJ
1215  INPUT "POISSON'S RATIO         = ";PT
1220  HOME
1230  VTAB 5: PRINT "TITLE : ";F$
1240  VTAB 7: PRINT "NO. OF NODES           = ";NP
1250  PRINT "NO. OF MEMBERS          = ";NUEL
1260  PRINT "NO. OF LOADED MEMBERS   = ";LM
1270  PRINT "NO. OF LOADED JOINTS    = ";LJ
1280  PRINT "NO. OF MATERIAL SETS    = ";MS
1290  PRINT "NO. OF BOUNDARY JOINTS  = ";BJ
1295  PRINT "POISSON'S RATIO         = ";PT
1300  GOSUB 1090
1310  IF G$ = "Y" THEN 1330
1320  POKE 34,4: HOME : GOTO 1150
1330  TEXT : HOME
1340  DIM X(NP),Y(NP),J(NUEL),K(NUEL),M5(NUEL),AREA(MS),IZ(MS),E(MS)
1350  DIM K1(LM),K2(LM),K3(LJ),K4(BJ),K5(MS)
1360  DIM ML(LM),T1(5,LM),T2(5,LM)
1370  DIM JR(MS),KR(MS),SHEAR$(MS),P(3,LJ),Q(3,BJ),QN(3,BJ)
1380  GOSUB 1030
1390  VTAB 2: PRINT "     INPUT NODAL POINT COORDINATE       "
1400  GOSUB 1070: POKE 34,4
1410  FOR J = 1 TO NP
1420  HOME : VTAB 5: PRINT "NODE NO. ";J
1430  VTAB 7: INPUT "X - COORDINATE    = ";X(J)
1440  INPUT "Y - COORDINATE    = ";Y(J)
1450  HOME : VTAB 5: PRINT "NODE NO. ";J
1460  VTAB 7: PRINT "X - COORDINATE    = ";X(J)
1470  PRINT "Y - COORDINATE    = ";Y(J)
1480  GOSUB 1090: POKE 34,4
1490  IF G$ = "N" THEN 1420
1500  NEXT J
1510  TEXT : HOME
1520  GOSUB 1030
```

```
1530  VTAB 2: PRINT "          INPUT MATERIAL SETS          "
1540  GOSUB 1070: POKE 34,4
1550  FOR J = 1 TO MS
1560  HOME : VTAB 5: PRINT "MATERIAL SET NO. ";J
1570  VTAB 7: INPUT "YOUNG's MODULUS       = ";E(J)
1580  INPUT "AREA                 = ";AREA(J)
1590  INPUT "MOMENT INERTIA       = ";IZ(J)
1600  INPUT "RIGID ZONE OF NODE I  = ";JR(J)
1610  INPUT "RIGID ZONE OF NODE J  = ";KR(J)
1620  POKE 34,5: HOME : VTAB 7: PRINT "SHEARING DEFORMATION : 'N'EGLECT"
1630  VTAB 8: PRINT "                    : 'I'NCLUDE"
1640  VTAB 9: PRINT "             ANSWER : ": VTAB 9: HTAB 25: GET SHEAR$(J): IF SHEAR$(J) = "" THEN 1
   660
1650  IF SHEAR$(J) = "I" OR SHEAR$(J) = "N" THEN 1670
1660  PRINT  CHR$ (7): GOTO 1620
1670  HOME : VTAB 7: PRINT "YOUNG's MODULUS       = ";E(J)
1680  PRINT "AREA                 = ";AREA(J)
1690  PRINT "MOMENT INERTIA       = ";IZ(J)
1700  PRINT "RIGID ZONE OF NODE I  = ";JR(J)
1710  PRINT "RIGID ZONE OF NODE J  = ";KR(J)
1720  IF SHEAR$(J) = "N" THEN  PRINT "SHEARING DEFORMATION  : NEGLECT": GOTO 1740
1730  PRINT "SHEARING DEFORMATION  : INCLUDE"
1740  GOSUB 1090: POKE 34,4
1750  IF G$ = "N" THEN 1560
1760  NEXT J
1770  TEXT : HOME
1780  GOSUB 1030
1790  VTAB 2: PRINT " INPUT NODE NO. AND PROPERTY OF ELEMENT "
1800  GOSUB 1070: POKE 34,4
1810  FOR J = 1 TO NUEL
1820  HOME : VTAB 5: PRINT "ELEMENT NO.";J: PRINT
1830  INPUT "NODE I          = ";J(J)
1840  INPUT "NODE J          = ";K(J)
1850  INPUT "MATERIAL SET    = ";M5(J)
1860  HOME : VTAB 5: PRINT "ELEMENT NO.";J: PRINT
1870  PRINT "NODE I          = ";J(J)
1880  PRINT "NODE J          = ";K(J)
1890  PRINT "MATERIAL SET    = ";M5(J)
1900  GOSUB 1090: POKE 34,4
1910  IF G$ = "N" THEN 1820
1920  NEXT J
1930  IF LM <  = 0 THEN 2240
1940  TEXT : HOME
1950  GOSUB 1030
1960  VTAB 2: PRINT " INPUT MEMBER LOADS IN LOCAL COORDINATE "
1970  VTAB 3: PRINT "                      ---------------- ": NORMAL
```

```
1980  VTAB 4: PRINT " PREVIOUS MEMBERS : ":HH = 21:VV = 4: POKE 34,8
1990  FOR J = 1 TO LM
2000  HOME : VTAB 9: INPUT "LOADED MEMBER NO.      = ";K1(J)
2010  INPUT "UNIF. LOAD             = ";ML(J)
2020  INPUT "NO. OF TRANSVERSE LOAD = ";K2(J)
2030  IF K2(J) <  = 5 THEN 2060
2040  PRINT  CHR$ (7): PRINT "NO. OF TRANSVERSE LOAD = 5 <MAXIMUM>"
2050  GOTO 2020
2060  IF K2(J) <  = 0 THEN 2180
2070  POKE 34,8
2080  FOR K = 1 TO K2(J)
2090  HOME : VTAB 9: PRINT "TRANSVERSE LOAD NO. ";K;"  = ";: INPUT "";T1(K,J)
2100  PRINT "DISTANCE FROM LEFT END = ";: INPUT "";T2(K,J)
2110  NEXT K
2120  HOME : VTAB 9: PRINT "LOADED MEMBER NO.      = ";K1(J)
2130  PRINT "UNIF. LOAD             = ";ML(J)
2140  PRINT "NO. OF TRANSVERSE LOAD = ";K2(J)
2150  FOR K = 1 TO K2(J)
2160  PRINT K;" TRANS. LOAD/DIST.    = ";T1(K,J);"/";T2(K,J)
2170  NEXT K
2180  GOSUB 1090: POKE 34,8
2190  IF G$ = "N" THEN 2000
2200  IF HH +  LEN ( STR$ (K1(J))) > 40 THEN VV = VV + 1:HH = 1
2210  IF VV > 7 THEN  TEXT : POKE 34,3: POKE 35,8: HOME : TEXT : VTAB 4: PRINT " PREVIOUS MEMBERS : ":H
   H = 21:VV = 4: POKE 34,8
2220  VTAB VV: HTAB HH: PRINT K1(J):HH = HH +  LEN ( STR$ (K1(J))) + 1
2230  NEXT J
2240  TEXT : HOME : IF LJ <  = 0 THEN 2440
2250  GOSUB 1030
2260  VTAB 2: PRINT "INPUT JOINTS LOADS IN GLOBAL COORDINATE "
2270  VTAB 3: PRINT "                          ---------------- ": NORMAL
2280  VTAB 4: PRINT "PREVIOUS JOINTS : ":HH = 20:VV = 4: POKE 34,8
2290  FOR J = 1 TO LJ
2300  HOME : VTAB 9: INPUT "LOADED JOINT NO.   = ";K3(J)
2310  INPUT "FORCE IN X         = ";P(1,J)
2320  INPUT "FORCE IN Y         = ";P(2,J)
2330  INPUT "MOMENT ABOUT Z     = ";P(3,J)
2340  HOME : VTAB 9: PRINT "LOADED JOINT NO.   = ";K3(J)
2350  PRINT "FORCE IN X         = ";P(1,J)
2360  PRINT "FORCE IN Y         = ";P(2,J)
2370  PRINT "MOMENT ABOUT Z     = ";P(3,J)
2380  GOSUB 1090: POKE 34,8
2390  IF G$ = "N" THEN 2300
2400  IF HH +  LEN ( STR$ (K3(J))) > 40 THEN VV = VV + 1:HH = 1
2410  IF VV > 7 THEN  TEXT : POKE 34,3: POKE 35,8: HOME : TEXT : VTAB 4: PRINT "PREVIOUS JOINTS : ":HH =
   20:VV = 4: POKE 34,8
2420  VTAB VV: HTAB HH: PRINT K3(J):HH = HH +  LEN ( STR$ (K3(J))) + 1
2430  NEXT J
2440  TEXT : HOME
2450  GOSUB 1030
2460  VTAB 2: PRINT "  INPUT BOUNDARY CONDITION AT JOINTS    "
2470  VTAB 3: PRINT "  FREE = 0 : FIXED = 1 : KNOWN = 2      ": NORMAL
2480  VTAB 5: PRINT "  PREVIOUS JOINTS : ":HH = 21:VV = 5: POKE 34,8
2490  FOR J = 1 TO BJ
2500  HOME : VTAB 9: INPUT "B.C. JOINT NO    = ";K4(J)
2510  INPUT "X - DISPL.       = ";Q(1,J)
```

```
2520  IF Q(1,J) = 0 OR Q(1,J) = 1 OR Q(1,J) = 2 THEN  GOTO 2540
2530  PRINT  CHR$ (7): GOTO 2510
2540  INPUT "Y - DISPL.       = ";Q(2,J)
2550  IF Q(2,J) = 0 OR Q(2,J) = 1 OR Q(2,J) = 2 THEN 2570
2560  PRINT  CHR$ (7): GOTO 2540
2570  INPUT "ROTATION         = ";Q(3,J)
2580  IF Q(3,J) = 0 OR Q(3,J) = 1 OR Q(3,J) = 2 THEN 2600
2590  PRINT  CHR$ (7): GOTO 2570
2600  HOME : VTAB 9: IF Q(1,J) <  = 1 THEN 2620
2610  INPUT "KNOWN X - DISPL. = ";QN(1,J)
2620  IF Q(2,J) <  = 1 THEN 2640
2630  INPUT "KNOWN Y - DISPL. = ";QN(2,J)
2640  IF Q(3,J) <  = 1 THEN 2660
2650  INPUT "KNOWN ROTATION   = ";QN(3,J)
2660  FOR I = 1 TO 3: IF Q(I,J) = 0 THEN A$(I) = "FREE"
2670  IF Q(I,J) = 1 THEN A$(I) = "FIXED"
2680  IF Q(I,J) = 2 THEN A$(I) = "KNOWN"
2690  NEXT I
2700  HOME : VTAB 9: PRINT "B.C. JOINT NO.   = ";K4(J)
2710  VTAB 10: PRINT "X - DISPL.       = ";A$(1)
2720  IF A$(1) = "KNOWN" THEN  VTAB 10: HTAB 26: PRINT ": ";QN(1,J)
2730  VTAB 11: PRINT "Y - DISPL.       = ";A$(2)
2740  IF A$(2) = "KNOWN" THEN  VTAB 11: HTAB 26: PRINT ": ";QN(2,J)
2750  VTAB 12: PRINT "ROTATION         = ";A$(3)
2760  IF A$(3) = "KNOWN" THEN  VTAB 12: HTAB 26: PRINT ": ";QN(3,J)
2770  GOSUB 1090: POKE 34,8
2780  IF G$ = "N" THEN 2500
2790  IF HH +  LEN ( STR$ (K4(J))) > 40 THEN VV = VV + 1:HH = 1
2800  IF VV > 7 THEN  TEXT : POKE 34,3: POKE 35,8: HOME : TEXT : VTAB 5: PRINT "  PREVIOUS JOINTS : ":H
   H = 21:VV = 5: POKE 34,8
2810  VTAB VV: HTAB HH: PRINT K4(J):HH = HH +  LEN ( STR$ (K4(J))) + 1
2820  NEXT J
2830  TEXT : HOME : GOSUB 1030
2840  VTAB 2: PRINT "              INPUT DATA              "
2850  GOSUB 1070: POKE 34,3
2860  IF BB = 2 THEN 2880
2870  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 2900: GOTO 2930
2880  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE # 1"
2890  VTAB 12: PRINT "INSERT DATA    DISK INTO DRIVE # 2": GOSUB 2900: GOTO 2930
2900  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: GET G$
2910  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 2900
2920  RETURN
2930  HOME : VTAB 5: PRINT "INPUT NAME OF DATA FILE TO BE SAVE"
2940  VTAB 7: PRINT "NOT MORE THAN 6 CHARACTERS"
2950  VTAB 9: PRINT "FILE NAME : ";: INPUT "";A1$
2960  IF  LEN (A1$) > 6 THEN 2930
2970 D$ =  CHR$ (13) +  CHR$ (4)
2980  PRINT D$;"MONC,I,O": VTAB 11: FLASH : PRINT ".WAITING.": NORMAL : POKE 34,11: HOME
2990  PRINT D$;"OPEN";A1$;",D";BB
3000  PRINT D$;"DELETE";A1$: PRINT D$;"OPEN";A1$
3010  PRINT D$;"WRITE";A1$
3020  PRINT F$: PRINT NP: PRINT NUEL: PRINT LM: PRINT LJ: PRINT MS: PRINT BJ: PRINT PT: FOR J = 1 TO NU
```

```
   EL: PRINT J(J): PRINT K(J): NEXT J
3030  FOR J = 1 TO NP: PRINT X(J): PRINT Y(J): NEXT J
3040  FOR J = 1 TO MS: PRINT E(J): PRINT AREA(J): PRINT IZ(J): PRINT JR(J): PRINT KR(J): PRINT SHEAR$(J
   ): NEXT J
3050  FOR J = 1 TO NUEL: PRINT M5(J): NEXT J
3060  IF LM <  = 0 THEN 3110
3070  FOR J = 1 TO LM: PRINT K1(J): PRINT ML(J): PRINT K2(J)
3080  IF K2(J) <  = 0 THEN 3100
3090  FOR K = 1 TO K2(J): PRINT T1(K,J): PRINT T2(K,J): NEXT K
3100  NEXT J
3110  IF LJ <  = 0 THEN 3130
3120  FOR J = 1 TO LJ: PRINT K3(J): PRINT P(1,J): PRINT P(2,J): PRINT P(3,J): NEXT J
3130  FOR J = 1 TO BJ: PRINT K4(J): PRINT Q(1,J): PRINT Q(2,J): PRINT Q(3,J)
3140  FOR I = 1 TO 3: IF Q(I,J) <  = 1 THEN 3160
3150  PRINT QN(I,J)
3160  NEXT I
3170  NEXT J
3180  PRINT D$;"CLOSE";A1$
3190  PRINT D$;"NOMON C,I,O": VTAB  PEEK (37): CALL  - 868: POKE 34,3
3200  HOME : IF BB = 2 THEN 3230
3210  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
3220  GOSUB 2900: HOME
3230  PRINT D$;"RUN OPTIONS,D";AA
3240  END
```

```
1000  REM   *** EXECUTE DATA ***  THIS SUBPROGRAM MUST BE CREATED BY TASC
1010  REM   ! DEFCOMMON A1$,MF,MMAX,MAXB,IQ,FT,F$,NP,NUEL,LM,LJ,MS,BJ,PT,AA,BB
1020  REM   ! DEFCOMMON X(80),Y(80),J(135),K(135),M5(135),AREA(15),IZ(15),E(15),JR(15),KR(15),SHEAR$(15)
    ,K1(75),K2(75),K3(25),K4(15),K5(15),ML(75),T1(5,75),T2(5,75),P(3,25),Q(3,15),QN(3,15)
1030  TEXT : HOME :AA =  PEEK (779):BB =  PEEK (780)
1040  IF BB = 2 THEN 1060
1050  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 1080: GOTO 1120
1060  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE # 1"
1070  VTAB 12: PRINT "INSERT DATA    DISK INTO DRIVE # 2": GOSUB 1080: GOTO 1120
1080  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE"
1090  VTAB 14: HTAB 32: INPUT "";G$
1100  IF G$ <  > "" THEN  PRINT  CHR$ (7): POKE 34,13: HOME : TEXT : POKE 34,6: GOTO 1080
1110  HOME : RETURN
1120 D$ =  CHR$ (4)
1130  VTAB 2: PRINT "NAME OF DATA FILE TO BE EXECUTED"
1140  VTAB 4: PRINT "FILE NAME : ";: INPUT "";A1$
1150  VTAB 6: FLASH : PRINT ".....EXECUTE DATA : PREFRONT.....": NORMAL : POKE 34,6
1160  FOR I = 1 TO 5: PRINT  CHR$ (7): NEXT I
1170  PRINT D$;"OPEN";A1$;",D";BB: PRINT D$;"READ";A1$
1180  INPUT F$,NP,NUEL,LM,LJ,MS,BJ,PT
1190  DIM J(135),K(135)
1200  FOR J = 1 TO NUEL: INPUT J(J),K(J): NEXT J
1210  PRINT D$;"CLOSE";A1$
1220 NODE = 2:ND = 3
1230 MI = NODE:MD = NODE * ND:NW = (MD * (MD + 1)) / 2 + MD
1240  REM  *** PREFRONT ***
1250 NC = 0:MF = 0:MN = 0:IW = 0:JQ = 0:MB = 256
1260 ME = (MD * (MD + 1)) / 2 + MD
1270  DIM IQ(2),IB(80),IC(80),LQ(14),MOC(14)
1280  FOR I = 1 TO NP:IB(I) = 0: NEXT I
1290  PRINT D$;"OPEN FRONT": PRINT D$;"DELETE FRONT": PRINT D$;"OPEN FRONT"
1300  FOR LZ = 1 TO NUEL:IQ(1) = J(LZ):IQ(2) = K(LZ)
1310  FOR I = 1 TO NODE:K = IQ(I):IB(K) = IB(K) + 1: NEXT I: NEXT LZ
1320  FOR I = 1 TO NP:IC(I) = IB(I): NEXT I
1330  FOR LZ = 1 TO NUEL:IQ(1) = J(LZ):IQ(2) = K(LZ)
1340  FOR I = 1 TO NODE:K = IQ(I):IC(K) = IC(K) - 1: NEXT I
1350  GOSUB 1400
1360  NEXT LZ
1370  GOSUB 1400: PRINT D$;"CLOSE FRONT"
1380  GOTO 1710
1390  REM  *** FRONT ***
1400 M = 0:N = 0: FOR I = 1 TO NP
1410  IF IB(I) = IC(I) THEN 1440
1420  IF IC(I) = 0 THEN IB(I) = 0
1430 N = N + 1:LQ(N) = I
1440  NEXT I
1450  IF N = 0 THEN 1530
1460  FOR I = 1 TO N:MOC(I) = 0:J = LQ(I)
1470  IF IC(J) <  > 0 THEN 1490
1480 LQ(I) = 0:M = M + 1:MOC(M) = J
1490  NEXT I
1500 J = M + 1: FOR I = 1 TO N: IF LQ(I) = 0 THEN 1520
```

```
1510 MOC(J) = LQ(I):LQ(I) = 0:J = J + 1
1520  NEXT I
1530 MQ = 0: IF M = 0 THEN 1550
1540  FOR I = 1 TO M:MQ = MQ + MD: NEXT I
1550 NQ = 0: IF N = 0 THEN 1570
1560  FOR I = 1 TO N:NQ = NQ + ND: NEXT I
1570 NF = NQ + (1 + 3) + MD + ME + (NQ * (NQ + 1)) / 2
1580 JW = MQ * NQ - ((MQ - 1) * MQ) / 2 + NQ - MQ
1590 JB = NQ - MQ + 1 + 4
1600  IF NF > NC THEN NC = NF
1610  IF NQ > MF THEN MF = NQ
1620  IF N > MN THEN MN = N
1630  IF JW > IW THEN IW = JW
1640  IF JB > MB THEN MB = JB
1650  IF MQ > JQ THEN JQ = MQ
1660  PRINT D$;"WRITE FRONT"
1670  PRINT MQ: PRINT NQ: PRINT M: PRINT N: PRINT N
1680  FOR I = 1 TO N: PRINT MOC(I): NEXT I: PRINT D$
1690  RETURN
1700  REM   *** FRONTIQ ***
1710 KS = 6
1720 MAXB = (KS + MF + 5) * 5
1730  PRINT D$;"OPEN FRONTIQ": PRINT D$;"DELETE FRONTIQ"
1740  PRINT D$;"OPEN FRONTIQ,L";MAXB:IQ = 0
1750  DIM AMOC(14),BMOC(14),LE(6),LF(42)
1760  PRINT D$;"OPEN FRONT": PRINT D$;"READ FRONT"
1770  INPUT MQ,NQ,M1,N1,NA: FOR I = 1 TO NA: INPUT AMOC(I): NEXT I
1780  PRINT D$: FOR LZ = 1 TO NUEL
1790  PRINT D$;"READ FRONT": INPUT MR,NR,M2,N2,NB
1800  FOR I = 1 TO NB: INPUT BMOC(I): NEXT I: PRINT D$
1810 IQ(1) = J(LZ):IQ(2) = K(LZ)
1820  IF LZ < (NUEL - 1) THEN  GOSUB 1870
1830  GOSUB 2050
1840  NEXT LZ
1850  GOTO 2320
1860  REM  *** GAPS ***
1870 K1 = M1 + 1:K2 = M2 + 1
1880  IF K1 > K2 THEN IX = K1
1890  IF K2 >  = K1 THEN IX = K2
1900  IF N1 < N2 THEN IY = N1
1910  IF N2 <  = N1 THEN IY = N2
1920  IF IX > IY THEN 2040
1930  FOR I = 1 TO N2:LQ(I) = BMOC(I):BMOC(I) = 0: NEXT I
1940  FOR I = IX TO IY:K = AMOC(I)
1950  FOR J = K2 TO N2: IF LQ(J) = K THEN 1970
1960  NEXT J: GOTO 1980
1970 BMOC(I) = K:LQ(J) = 0
1980  NEXT I
1990  FOR I = 1 TO N2: IF LQ(I) = 0 THEN 2030
2000  FOR J = 1 TO N2: IF BMOC(J) = 0 THEN 2020
2010  NEXT J
2020 BMOC(J) = LQ(I):LQ(I) = 0
2030  NEXT I
2040  RETURN
2050  REM  *** EXPAND ***
2060 KQ = MQ + 1
2070  FOR I = 1 TO NODE: FOR J = 1 TO NA
```

```
2080  IF IQ(I) = AMOC(J) THEN LQ(I) = J
2090  NEXT J: NEXT I
2100 L = 0: FOR I = 1 TO NODE:LP = IQ(I)
2110 J2 = 0: IF LQ(I) = 0 THEN 2130
2120  FOR J = 1 TO LQ(I):J2 = J2 + ND: NEXT J
2130 J1 = J2 - ND + 1
2140  FOR J = J1 TO J2:L = L + 1:LE(L) = J: NEXT J: NEXT I
2150 L = MQ: IF MQ < 1 THEN 2170
2160  FOR I = 1 TO MQ:LF(I) = 0: NEXT I
2170 K1 = M1 + 1: IF K1 > NA GOTO 2260: REM  CAN'T USE THEN
2180  FOR I = K1 TO NA: FOR J = 1 TO NB
2190  IF AMOC(I) = BMOC(J) THEN LQ(I) = J
2200  NEXT J: NEXT I
2210  FOR I = K1 TO NA:LP = AMOC(I)
2220 J2 = 0: IF LQ(I) = 0 THEN 2240
2230  FOR J = 1 TO LQ(I):J2 = J2 + ND: NEXT J
2240 J1 = J2 - ND + 1
2250  FOR J = J1 TO J2:L = L + 1:LF(L) = J: NEXT J: NEXT I
2260  PRINT D$;"WRITE FRONTIQ,R";IQ
2270  PRINT MQ: PRINT KQ: PRINT NQ: PRINT NR: PRINT KS
2280  FOR I = 1 TO KS: PRINT LE(I): NEXT I
2290  FOR I = 1 TO NQ: PRINT LF(I): NEXT I: PRINT D$
2300  FOR I = 1 TO NB:AMOC(I) = BMOC(I): NEXT I
2310 M1 = M2:N1 = N2:NA = NB:MQ = MR:NQ = NR:IQ = IQ + 1: RETURN
2320  PRINT D$;"CLOSE FRONT"
2330  PRINT D$;"CLOSE FRONTIQ"
2340  PRINT D$;"DELETE FRONT"
2350 XZ = JQ * MF - (JQ * (JQ - 1)) / 2
2360 MMAX = (XZ + JQ + 1) * 20
2370  IF BB = 2 THEN 2420
2380  TEXT : POKE 34,4: HOME : VTAB 6: INVERSE : PRINT ".....EXECUTE DATA : PREFRONT.....": NORMAL
   : POKE 34,6
2390  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
2400  GOSUB 1080
2410  TEXT : POKE 34,4: HOME : VTAB 6: FLASH : PRINT ".....EXECUTE DATA : FRONTST.....": NORMAL
   : POKE 34,6
2420  PRINT  CHR$ (4);"BRUN FRONTST.OBJ,D";AA
2430  END
```

```
1000  REM   *** FRONTST ***  THIS SUBPROGRAM MUST BE CREATED BY TASC
1010  REM   ! USECOMMON A1$,MF,MMAX,MAXB,IQ,FT,F$,NP,NUEL,LM,LJ,MS,BJ,PT,AA,BB
1020  REM   ! USECOMMON X(80),Y(80),J(135),K(135),M5(135),AREA(15),IZ(15),E(15),JR(15),KR(15),SHEAR$(15
    ),K1(75),K2(75),K3(25),K4(15),K5(15),ML(75),T1(5,75),T2(5,75),P(3,25),Q(3,15),QN(3,15)
1030 D$ =  CHR$ (4)
1040  IF BB = 2 THEN 1100
1050  TEXT : POKE 34,4: HOME : VTAB 6: INVERSE : PRINT ".....EXECUTE DATA : FRONTST.....": NORMAL
    : POKE 34,6
1060  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 1070: GOTO 1100
1070  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: INPUT "";G$
1080  IF G$ <  > "" THEN  PRINT  CHR$ (7): POKE 34,13: HOME : TEXT : POKE 34,6: GOTO 1070
1090  HOME : RETURN
1100  TEXT : POKE 34,4: HOME : VTAB 6: FLASH : PRINT ".....EXECUTE DATA : FRONTST.....": NORMAL
    : POKE 34,6
1110 NODE = 2:ND = 3:MI = NODE:MD = NODE * ND:NW = (MD * (MD + 1)) / 2 + MD:ME = NW
1120 MAXB = (6 + MF + 5) * 5
1130  PRINT D$;"OPEN";A1$;",D";BB: PRINT D$;"READ";A1$
1140  INPUT F$,NP,NUEL,LM,LJ,MS,BJ,PT: PRINT D$
1150  DIM X(80),Y(80),J(135),K(135),M5(135),AREA(15),IZ(15),E(15),JR(15),KR(15),SHEAR$(15)
1160  DIM K1(75),K2(75),K3(25),K4(15),K5(15),ML(75),T1(5,75),T2(5,75)
1170  DIM P(3,25),Q(3,15),QN(3,15)
1180  DIM LE(6),LF(42),NO(42),S(27),B(42),A(903),ST(6,6),FIXED(6)
1190  PRINT D$;"READ";A1$: FOR J = 1 TO NUEL: INPUT J(J),K(J): NEXT J
1200  FOR J = 1 TO NP: INPUT X(J),Y(J): NEXT J
1210  FOR J = 1 TO MS: INPUT E(J),AREA(J),IZ(J),JR(J),KR(J),SHEAR$(J): NEXT J
1220  FOR J = 1 TO NUEL: INPUT M5(J): NEXT J
1230  IF LM <  = 0 THEN 1280
1240  FOR J = 1 TO LM: INPUT K1(J),ML(J),K2(J)
1250  IF K2(J) <  = 0 THEN 1270
1260  FOR K = 1 TO K2(J): INPUT T1(K,J),T2(K,J): NEXT K
1270  NEXT J
1280  IF LJ <  = 0 THEN 1300
1290  FOR J = 1 TO LJ: INPUT K3(J),P(1,J),P(2,J),P(3,J): NEXT J
1300  FOR J = 1 TO BJ: INPUT K4(J),Q(1,J),Q(2,J),Q(3,J)
1310  FOR I = 1 TO 3: IF Q(I,J) <  = 1 THEN 1330
1320  INPUT QN(I,J)
1330  NEXT I
1340  NEXT J
1350  PRINT D$;"CLOSE";A1$
1360  PRINT D$;"OPEN FROST": PRINT D$;"DELETE FROST"
1370  PRINT D$;"OPEN FROST,L";MMAX:FT = 0
1380  PRINT D$;"OPEN FRONTIQ,L";MAXB:IQ = 0
1390 XJ = LM:YJ = LJ:ZJ = BJ
1400 ZL = K9:ZN = MF: GOSUB 1410:KMAX = 6: GOTO 1430
1410  FOR I = 1 TO ZL:A(I) = 0: NEXT I
1420  FOR I = 1 TO ZN:B(I) = 0: NEXT I: RETURN
1430  FOR LZ = 1 TO NUEL: PRINT D$;"READ FRONTIQ,R";IQ
1440  INPUT MQ,KQ,NQ,NR,KS: FOR I = 1 TO KS: INPUT LE(I): NEXT I
1450  FOR I = 1 TO MQ: INPUT LF(I): NEXT I: PRINT D$:IQ = IQ + 1
1460 L1 = X(K(LZ)) - X(J(LZ)):L2 = Y(K(LZ)) - Y(J(LZ))
1470 L =  SQR (L1 * L1 + L2 * L2):CT = L1 / L:ST = L2 / L
1480 DL = JR(M5(LZ)) / L:BL = KR(M5(LZ)) / L:CL = (1 - DL - BL)
1490 AE = AREA(M5(LZ)) / 1.2:E = E(M5(LZ)):IZ = IZ(M5(LZ)):AREA = AREA(M5(LZ)):G = E / (2 * (1 + PT))
```

```
1500 ALPHA = (12 * E * IZ) / (CL * CL * L * L * G * AE)
1510  IF SHEAR$(MS(LZ)) = "N" THEN ALPHA = 0
1520 ST(1,1) = E * AREA / L
1530 ST(1,4) =  - ST(1,1):ST(4,4) = ST(1,1)
1540 ST(2,2) = 12 * E * IZ / ((1 + ALPHA) * CL ^ 3 * L ^ 3):ST(5,5) = ST(2,2)
1550 ST(2,3) = 12 * E * IZ * DL / ((1 + ALPHA) * CL ^ 3 * L * L) + 6 * E * IZ / ((1 + ALPHA) * CL * CL *
   L * L)
1560 ST(3,5) =  - ST(2,3):ST(2,5) =  - ST(2,2)
1570 ST(2,6) = 12 * E * IZ * BL / ((1 + ALPHA) * CL ^ 3 * L * L) + 6 * E * IZ / ((1 + ALPHA) * CL * CL *
   L * L):ST(5,6) =  - ST(2,6)
1580 ST(3,3) = 12 * E * IZ * DL * DL / ((1 + ALPHA) * CL ^ 3 * L) + 12 * E * IZ * DL / ((1 + ALPHA) * C
   L * CL * L) + (4 + ALPHA) * E * IZ / ((1 + ALPHA) * CL * L)
1590 ST(3,6) = 12 * E * IZ * BL * DL / ((1 + ALPHA) * CL ^ 3 * L) + 6 * E * IZ * DL / ((1 + ALPHA) * CL
    * CL * L)
1600 ST(3,6) = ST(3,6) + 6 * E * IZ * BL / ((1 + ALPHA) * CL * CL * L) + (2 - ALPHA) * E * IZ / ((1 + A
   LPHA) * CL * L)
1610 ST(6,6) = 12 * E * IZ * BL * BL / ((1 + ALPHA) * CL ^ 3 * L) + 12 * E * IZ * BL / ((1 + ALPHA) * C
   L * CL * L) + (4 + ALPHA) * E * IZ / ((1 + ALPHA) * CL * L)
1620 S(1) = CT * CT * ST(1,1) + ST * ST * ST(2,2)
1630 S(2) = CT * ST * ST(1,1) - ST * CT * ST(2,2)
1640 S(3) =  - ST * ST(2,3)
1650 S(4) = CT * CT * ST(1,4) + ST * ST * ST(2,5)
1660 S(5) = CT * ST * ST(1,4) - ST * CT * ST(2,5)
1670 S(6) =  - ST * ST(2,6)
1680 S(7) = ST * ST * ST(1,1) + CT * CT * ST(2,2)
1690 S(8) = CT * ST(2,3)
1700 S(9) = CT * ST * ST(1,4) - CT * ST * ST(2,5)
1710 S(10) = ST * ST * ST(1,4) + CT * CT * ST(2,5)
1720 S(11) = CT * ST(2,6)
1730 S(12) = ST(3,3):S(13) =  - ST * ST(3,5):S(14) = CT * ST(3,5):S(15) = ST(3,6)
1740 S(16) = CT * CT * ST(4,4) + ST * ST * ST(5,5)
1750 S(17) = ST * CT * ST(4,4) - ST * CT * ST(5,5):S(18) =  - ST * ST(5,6)
1760 S(19) = ST * ST * ST(4,4) + CT * CT * ST(5,5)
1770 S(20) = CT * ST(5,6):S(21) = ST(6,6)
1780  FOR I = 1 TO MD:FIXED(I) = 0: NEXT I
1790  IF LM <  = 0 OR XJ = 0 THEN 1930
1800  FOR J = 1 TO LM: IF LZ = K1(J) THEN  GOSUB 1820
1810  NEXT J: GOTO 1930
1820 FIXED(2) = FIXED(2) + 0.5 * ML(J) * CL * L:FIXED(5) = FIXED(5) + 0.5 * ML(J) * CL * L
1830 FIXED(3) = FIXED(3) + (ML(J) * CL * CL * L * L / 12) + (0.5 * ML(J) * DL * CL * L * L):FIXED(6) =
   FIXED(6) - (ML(J) * CL * CL * L * L / 12) - (0.5 * ML(J) * BL * CL * L * L)
1840  IF K2(J) <  = 0 THEN 1920
1850  FOR K = 1 TO K2(J)
1860 PZ = T1(K,J):AZ = T2(K,J) - (DL * L):BZ = CL * L - AZ
1870 FIXED(2) = FIXED(2) + PZ * BZ * BZ * (3 * AZ + BZ) / (CL * CL * CL * L * L * L)
1880 FIXED(5) = FIXED(5) + PZ * AZ * AZ * (3 * BZ + AZ) / (CL * CL * CL * L * L * L)
1890 FIXED(3) = FIXED(3) + PZ * AZ * BZ * BZ / (CL * CL * L * L) + PZ * BZ * BZ * DL * (3 * AZ + BZ) /
   (CL * CL * CL * L * L)
1900 FIXED(6) = FIXED(6) - PZ * AZ * AZ * BZ / (CL * CL * L * L) - PZ * AZ * AZ * BL * (3 * BZ + AZ) /
   (CL * CL * CL * L * L)
1910  NEXT K
1920 XJ = XJ - 1:J = LM: RETURN
1930 FIXED(1) =  - ST * FIXED(2):FIXED(4) =  - ST * FIXED(5)
1940 FIXED(2) = CT * FIXED(2):FIXED(5) = CT * FIXED(5)
1950  IF LJ <  = 0 OR YJ <  = 0 THEN 2030
1960  FOR J = 1 TO LJ: IF J(LZ) = K3(J) THEN  GOSUB 1990
```

```
1970  IF K(LZ) = K3(J) THEN  GOSUB 2010
1980  NEXT J: GOTO 2030
1990  FOR I = 1 TO 3:FIXED(I) = FIXED(I) + P(I,J): NEXT I
2000 YJ = YJ - 1:K3(J) = 0: RETURN
2010  FOR I = 1 TO 3:II = I + 3:FIXED(II) = FIXED(II) + P(I,J): NEXT I
2020 YJ = YJ - 1:K3(J) = 0: RETURN
2030  IF ZJ <  = 0 THEN 2250
2040  FOR J = 1 TO 8J: IF J(LZ) = K4(J) THEN  GOSUB 2070
2050  IF K(LZ) = K4(J) THEN  GOSUB 2160
2060  NEXT J: GOTO 2250
2070  FOR I = 1 TO 3: IF I = 1 THEN K = 1
2080  IF I = 2 THEN K = 7
2090  IF I = 3 THEN K = 12
2100  GOSUB 2110: NEXT I:ZJ = ZJ - 1:K4(J) = 0: RETURN
2110  IF Q(I,J) < 2 THEN 2130
2120 S(K) = 1.E35:FIXED(I) = QN(I,J) * 1.E35: GOTO 2150
2130  IF Q(I,J) = 0 THEN 2150
2140 S(K) = 1.E35:FIXED(I) = 0
2150  RETURN
2160  FOR I = 1 TO 3: IF I = 1 THEN K = 16
2170  IF I = 2 THEN K = 19
2180  IF I = 3 THEN K = 21
2190  GOSUB 2200: NEXT I:ZJ = ZJ - 1:K4(J) = 0: RETURN
2200  IF Q(I,J) < 2 THEN 2220
2210 S(K) = 1.E35:FIXED(I + 3) = QN(I,J) * 1.E35: GOTO 2240
2220  IF Q(I,J) = 0 THEN 2240
2230 S(K) = 1.E35:FIXED(I + 3) = 0
2240  RETURN
2250  FOR I = 1 TO MD:K = I + 21:S(K) = FIXED(I): NEXT I
2260 NT = NQ: GOSUB 2270:NB = 0: GOTO 2300
2270 NO(1) = 1:LL = NT + 2: FOR I = 2 TO NT
2280 NO(I) = NO(I - 1) + LL - I: NEXT I: RETURN
2290  REM  *** ROW ***
2300 NB = NB + 1:IR = 1:NE = MQ * NQ - (MQ * (MQ - 1)) / 2:MW = 0:JR = NQ
2310  REM  *** SEMBLE ***
2320 J = NW - (KS + 1):L = 0
2330  FOR M = 1 TO KS:J = J + 1:I = LE(M)
2340  IF I < IR OR I > JR THEN 2360
2350 B(I) = B(I) + S(J + 1)
2360  FOR N = M TO KS:L = L + 1
2370  IF LE(M) < LE(N) THEN I = LE(M)
2380  IF LE(N) <  = LE(M) THEN I = LE(N)
2390  IF I < IR OR I > JR THEN 2430
2400  IF LE(M) > LE(N) THEN JJ = LE(M)
2410  IF LE(N) >  = LE(M) THEN JJ = LE(N)
2420 KK = NO(I) - I + JJ - MW:A(KK) = A(KK) + S(L)
2430  NEXT N: NEXT M
2440  IF NB = 1 THEN IR = 2
2450  IF MQ > 0 THEN  GOSUB 2480
2460  GOTO 2550
2470  REM  *** REDUCE ***
2480  FOR I = IR TO JR:ID = NO(I) - I - MW:J2 = I - 1
2490  IF I > MQ THEN J2 = MQ
2500  FOR J = 1 TO J2:JD = NO(J) - J:C =  - A(JD + I) / A(JD + J)
2510 B(I) = B(I) + B(J) * C
2520  FOR K = I TO NQ:A(ID + K) = A(ID + K) + A(JD + K) * C
2530  NEXT K: NEXT J: NEXT I
```

```
2540  RETURN
2550  IF MQ <  = 0 THEN 2600
2560  PRINT D$;"WRITE FROST,R";FT: PRINT NE
2570  FOR I = 1 TO NE: PRINT A(I): NEXT I
2580  FOR I = 1 TO MQ: PRINT B(I): NEXT I
2590  PRINT D$:FT = FT + 1
2600  IF MQ <  = 0 THEN 2620
2610 ZL = NE:ZN = MQ: GOSUB 1410
2620  IF LZ < NUEL THEN  GOSUB 2650
2630  GOTO 3100
2640  REM   *** SETCORE ***
2650 IN = NR - NQ
2660  IF IN < 0 THEN 2690
2670  IF IN = 0 THEN 3080
2680  IF IN > 0 THEN 3040
2690 NT = NQ: GOSUB 2710: GOTO 3000
2700  REM  *** SCRMBLE ***
2710 K = 0: IF NQ >  = NT THEN 2730
2720 J = NQ + 1: FOR I = J TO NT:LF(I) = 0: NEXT I
2730  FOR M = KQ TO NQ
2740 N = LF(M): IF N = M OR N = 0 THEN 2990
2750 LF(M) = LF(N):LF(N) = N
2760  IF M >  = N THEN 2780
2770 I = M:J = N: GOTO 2790
2780 I = N:J = M
2790 SM = I:SN = J: GOSUB 2810: GOTO 2970
2800  REM  *** SWITCH ***
2810 C = B(SM):B(SM) = B(SN)
2820 B(SN) = C:MS = NO(SM) - SM:NS = NO(SN) - SN
2830 C = A(MS + SM):A(MS + SM) = A(NS + SN):A(NS + SN) = C
2840  IF SM = 1 THEN 2880
2850 IY = SM - 1
2860  FOR I = 1 TO IY:IS = NO(I) - I:C = A(IS + SM)
2870 A(IS + SM) = A(IS + SN):A(IS + SN) = C: NEXT I
2880 J1 = SM + 1: IF J1 = SN THEN 2920
2890 J2 = SN - 1
2900  FOR J = J1 TO J2:JS = NO(J) - J:C = A(MS + J)
2910 A(MS + J) = A(JS + SN):A(JS + SN) = C: NEXT J
2920  IF SN = NT THEN 2960
2930 J1 = SN + 1
2940  FOR J = J1 TO NT:C = A(MS + J):A(MS + J) = A(NS + J)
2950 A(NS + J) = C: NEXT J
2960  RETURN
2970 K = K + 1: IF K > NT THEN  STOP
2980  GOTO 2740
2990  NEXT M: RETURN
3000 K = 0: FOR I = 2 TO NR:K = K + IN:M = NO(I)
3010 N = M + NR - I: FOR L = M TO N:A(L + K) = A(L)
3020 A(L) = 0: NEXT L: NEXT I
3030 NT = NR: GOSUB 2270: GOTO 3090
3040 M = NO(NQ) + 1:K = IN + NQ:L = NQ - 1
```

```
3050  FOR I = 1 TO L:M = M - I + 1:K = K - IN:N = M + K
3060  FOR J = 1 TO I:A(N - J) = A(M - J):A(M - J) = 0: NEXT J: NEXT I
3070 NT = NR: GOSUB 2270
3080 NT = NR: GOSUB 2710
3090  RETURN
3100  NEXT LI
3110 SUBMAX = (KMAX + 1) * 20
3120  PRINT D$;"CLOSE FROST": PRINT D$;"CLOSE FRONTIQ"
3130  IF BB = 2 THEN 3180
3140  TEXT : POKE 34,4: HOME : VTAB 6: INVERSE : PRINT ".........EXECUTE DATA : FRONTST.........": NORMAL
    : POKE 34,6
3150  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
3160  GOSUB 1070
3170  TEXT : POKE 34,4: HOME : VTAB 6: FLASH : PRINT ".........EXECUTE DATA : BACKSUB.........": NORMAL
    : POKE 34,6
3180  PRINT D$;"BRUN BACKSUB.OBJ,D";AA
3190  END
```

```
1000  REM   *** BACKSUB ***  THIS SUBPROGRAM MUST BE CREATED BY TASC
1010  REM    ! USECOMMON A1$,MF,MMAX,MAXB,IQ,FT,F$,NP,NUEL,LM,LJ,MS,BJ,PT,AA,BB
1020  REM  ! USECOMMON X(80),Y(80),J(135),K(135),M5(135),AREA(15),IZ(15),E(15),JR(15),KR(15),SHEAR$(15)
    ,K1(75),K2(75),K3(25),K4(15),K5(15),ML(75),T1(5,75),T2(5,75),P(3,25),Q(3,15),QN(3,15)
1030 D$ =  CHR$ (4)
1040  IF BB = 2 THEN 1100
1050  TEXT : POKE 34,4: HOME : VTAB 6: INVERSE : PRINT ".....EXECUTE DATA : BACKSUB.....": NORMAL
    : POKE 34,6
1060  VTAB 11: PRINT "INSERT DATA   DISK INTO DRIVE": GOSUB 1070: GOTO 1100
1070  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: INPUT "";G$
1080  IF G$ <  > "" THEN  PRINT  CHR$ (7): POKE 34,13: HOME : TEXT : POKE 34,6: GOTO 1070
1090  HOME : RETURN
1100  TEXT : POKE 34,4: HOME : VTAB 6: FLASH : PRINT ".....EXECUTE DATA : BACKSUB.....": NORMAL
    : POKE 34,6
1110  DIM ET(6),VM(6),TP(6,6)
1120  DIM X(80),Y(80),J(135),K(135),M5(135),AREA(15),IZ(15),E(15),JR(15),KR(15),SHEAR$(15)
1130  DIM K1(75),K2(75),K3(25),K4(15),K5(15),ML(75),T1(5,75),T2(5,75)
1140  DIM P(3,25),Q(3,15),QN(3,15)
1150  DIM LE(6),LF(42),NO(42),B(42),A(1080),ST(6,6),FIXED(6),AF(1050)
1160  PRINT D$;"OPEN FROST,L";MMAX;",D";BB
1170  PRINT D$;"OPEN FRONTIQ,L";MAXB
1180 NODE = 2:ND = 3:MD = NODE * ND
1190 DX = NP:DY = DX + NP:XJ = LM
1200 HX = 241:HY = HX + NUEL:HZ = HY + NUEL:OX = HZ + NUEL:OY = DX + NUEL:OZ = OY + NUEL
1210  FOR BA = 1 TO NUEL:IQ = IQ - 1
1220  PRINT D$;"READ FRONTIQ,R";IQ
1230  INPUT MQ,KQ,NQ,NR,KS: FOR I = 1 TO KS: INPUT LE(I): NEXT I
1240  FOR I = 1 TO MQ: INPUT LF(I): NEXT I: PRINT D$
1250  IF MQ = NQ THEN 1280
1260  FOR I = KQ TO NQ:L = LF(I):NO(I) = B(L): NEXT I
1270  FOR I = KQ TO NQ:B(I) = NO(I): NEXT I
1280  IF MQ <  = 0 THEN 1460
1290 FT = FT - 1
1300  PRINT D$;"READ FROST,R";FT
1310  INPUT NE: FOR I = 1 TO NE: INPUT A(I): NEXT I
1320  FOR I = 1 TO MQ: INPUT B(I): NEXT I: PRINT D$
1330  GOSUB 1360
1340  GOTO 1460
1350  REM  *** BPASS ***
1360  DEF  FN NN(LL) = NQ * LL - (LL * (LL - 1)) / 2 + 1
1370  IF MQ = NQ THEN 1400
1380  FOR I = 1 TO MQ:K =  FN NN(I - 1) - I: FOR J = KQ TO NQ
1390 B(I) = B(I) - A(J + K) * B(J): NEXT J: NEXT I
1400 M = MQ + 1:I =  FN NN(MQ - 1):B(MQ) = B(MQ) / A(I)
1410  IF MQ = 1 THEN 1450
1420  FOR L = 2 TO MQ:I = M - L:J1 = I + 1:K =  FN NN(I - 1) - I
1430  FOR J = J1 TO MQ:B(I) = B(I) - A(J + K) * B(J): NEXT J
1440 K =  FN NN(I - 1):B(I) = B(I) / A(K): NEXT L
```

```
1450  RETURN
1460  FOR I = 1 TO KS:L = LE(I)
1470 ET(I) = B(L): NEXT I
1480 LZ = NUEL + 1 - BA
1490 AF(J(LZ)) = ET(1)
1500 AF(J(LZ) + DX) = ET(2)
1510 AF(J(LZ) + DY) = ET(3)
1520 AF(K(LZ)) = ET(4)
1530 AF(K(LZ) + DX) = ET(5)
1540 AF(K(LZ) + DY) = ET(6)
1550 L1 = X(K(LZ)) - X(J(LZ)):L2 = Y(K(LZ)) - Y(J(LZ))
1560 L =  SQR (L1 * L1 + L2 * L2):CT = L1 / L:ST = L2 / L
1570 DL = JR(M5(LZ)) / L:BL = KR(M5(LZ)) / L:CL = (1 - DL - BL)
1580 AE = AREA(M5(LZ)) / 1.2:E = E(M5(LZ)):IZ = IZ(M5(LZ)):AREA = AREA(M5(LZ)):G = E / (2 * (1 + PT))
1590 ALPHA = (12 * E * IZ) / (CL * CL * L * L * G * AE)
1600  IF SHEAR$(M5(LZ)) = "N" THEN ALPHA = 0
1610 ST(1,1) = E * AREA / L
1620 ST(1,2) = 0:ST(1,3) = 0:ST(1,5) = 0:ST(1,6) = 0:ST(2,4) = 0:ST(3,4) = 0:ST(4,5) = 0:ST(4,6) = 0
1630 ST(1,4) =  - ST(1,1):ST(4,4) = ST(1,1)
1640 ST(2,2) = 12 * E * IZ / ((1 + ALPHA) * CL ^ 3 * L ^ 3):ST(5,5) = ST(2,2)
1650 ST(2,3) = 12 * E * IZ * DL / ((1 + ALPHA) * CL ^ 3 * L * L) + 6 * E * IZ / ((1 + ALPHA) * CL * CL *
   L * L)
1660 ST(3,5) =  - ST(2,3):ST(2,5) =  - ST(2,2)
1670 ST(2,6) = 12 * E * IZ * BL / ((1 + ALPHA) * CL ^ 3 * L * L) + 6 * E * IZ / ((1 + ALPHA) * CL * CL *
   L * L):ST(5,6) =  - ST(2,6)
1680 ST(3,3) = 12 * E * IZ * DL * DL / ((1 + ALPHA) * CL ^ 3 * L) + 12 * E * IZ * DL / ((1 + ALPHA) * C
   L * CL * L) + (4 + ALPHA) * E * IZ / ((1 + ALPHA) * CL * L)
1690 ST(3,6) = 12 * E * IZ * BL * DL / ((1 + ALPHA) * CL ^ 3 * L) + 6 * E * IZ * DL / ((1 + ALPHA) * CL
    * CL * L)
1700 ST(3,6) = ST(3,6) + 6 * E * IZ * BL / ((1 + ALPHA) * CL * CL * L) + (2 - ALPHA) * E * IZ / ((1 + A
   LPHA) * CL * L)
1710 ST(6,6) = 12 * E * IZ * BL * BL / ((1 + ALPHA) * CL ^ 3 * L) + 12 * E * IZ * BL / ((1 + ALPHA) * C
   L * CL * L) + (4 + ALPHA) * E * IZ / ((1 + ALPHA) * CL * L)
1720  FOR I = 1 TO MD: FOR J = I TO MD
1730 ST(J,I) = ST(I,J): NEXT J: NEXT I
1740  FOR I = 1 TO MD: FOR J = 1 TO MD
1750 TP(I,J) = 0: NEXT J: NEXT I
1760 TP(1,1) = CT:TP(2,2) = CT:TP(4,4) = CT:TP(5,5) = CT
1770 TP(1,2) = ST:TP(2,1) =  - ST:TP(4,5) = ST:TP(5,4) =  - ST
1780 TP(3,3) = 1:TP(6,6) = 1
1790  FOR I = 1 TO MD: FOR K = 1 TO MD:VM(K) = ST(I,K): NEXT K
1800  FOR J = 1 TO MD:ST(I,J) = 0: FOR K = 1 TO MD
1810 ST(I,J) = ST(I,J) + VM(K) * TP(K,J): NEXT K: NEXT J: NEXT I
1820  FOR I = 1 TO MD:FIXED(I) = 0: NEXT I
1830  IF LM <  = 0 OR XJ = 0 THEN 1970
1840  FOR J = 1 TO LM: IF LZ = K1(J) THEN  GOSUB 1860
1850  NEXT J: GOTO 1970
1860 FIXED(2) = FIXED(2) - 0.5 * ML(J) * CL * L:FIXED(5) = FIXED(5) - 0.5 * ML(J) * CL * L
1870 FIXED(3) = FIXED(3) - (ML(J) * CL * CL * L * L / 12) - (0.5 * ML(J) * DL * CL * L * L):FIXED(6) =
   FIXED(6) + (ML(J) * CL * CL * L * L / 12) + (0.5 * ML(J) * BL * CL * L * L)
1880  IF K2(J) <  = 0 THEN 1960
1890  FOR K = 1 TO K2(J)
1900 PZ = T1(K,J):AZ = T2(K,J) - (DL * L):BZ = (CL * L) - AZ
1910 FIXED(2) = FIXED(2) - PZ * BZ * BZ * (3 * AZ + BZ) / (CL * CL * CL * L * L * L)
1920 FIXED(5) = FIXED(5) - PZ * AZ * AZ * (3 * BZ + AZ) / (CL * CL * CL * L * L * L)
1930 FIXED(3) = FIXED(3) - PZ * AZ * BZ * BZ / (CL * CL * L * L) - PZ * BZ * BZ * DL * (3 * AZ + BZ) /
   (CL * CL * CL * L * L)
1940 FIXED(6) = FIXED(6) + PZ * AZ * AZ * BZ / (CL * CL * L * L) + PZ * AZ * AZ * BL * (3 * BZ + AZ) /
   (CL * CL * CL * L * L)
1950  NEXT K
```

```
1960 XJ = XJ - 1:J = LM: RETURN
1970  FOR K = 1 TO MD:VM(K) = ET(K): NEXT K
1980  FOR I = 1 TO MD:ET(I) = 0: FOR K = 1 TO MD
1990 ET(I) = ET(I) + VM(K) * ST(I,K): NEXT K: NEXT I
2000 AF(LZ + HX) = ET(1) + FIXED(1)
2010 AF(LZ + HY) = ET(2) + FIXED(2)
2020 AF(LZ + HZ) = ET(3) + FIXED(3)
2030 AF(LZ + OX) = ET(4) + FIXED(4)
2040 AF(LZ + OY) = ET(5) + FIXED(5)
2050 AF(LZ + OZ) = ET(6) + FIXED(6)
2060  NEXT BA
2070  PRINT D$;"OPEN RESULT";A1$
2080  PRINT D$;"DELETE RESULT";A1$
2090  PRINT D$;"OPEN RESULT";A1$
2100  PRINT D$;"WRITE RESULT";A1$
2110  PRINT A1$: PRINT F$: PRINT NUEL: PRINT NP
2120  FOR LZ = 1 TO NUEL: PRINT J(LZ): PRINT K(LZ): PRINT AF(LZ + HX): PRINT AF(LZ + HY): PRINT AF(LZ +
   HZ): PRINT AF(LZ + OX): PRINT AF(LZ + OY): PRINT AF(LZ + OZ): NEXT LZ
2130  FOR LZ = 1 TO NP
2140  PRINT AF(LZ): PRINT AF(LZ + DX): PRINT AF(LZ + DY): NEXT LZ
2150  PRINT D$;"CLOSE RESULT";A1$
2160  POKE 779,AA: POKE 780,BB
2170 B8 =  LEN (A1$): POKE 769,B8:C8 = B8
2180  FOR I = 1 TO B8:YY$ =  RIGHT$ (A1$,C8)
2190 A4$ =  LEFT$ (YY$,1):J = I + 769:K =  ASC (A4$)
2200  POKE J,K:C8 = C8 - 1: NEXT I
2210  IF BB = 2 THEN 2260
2220  TEXT : POKE 34,4: HOME : VTAB 6: INVERSE : PRINT ".....EXECUTE DATA : BACKSUB.....": NORMAL
   : POKE 34,6
2230  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
2240  GOSUB 1070
2250  TEXT : POKE 34,4: HOME : VTAB 6: FLASH : PRINT ".....EXECUTE DATA : RESULT.....": NORMAL
   : POKE 34,6
2260  PRINT D$;"RUN RESULT1,D";AA
2270  END
```

```
1000  REM  ***RESULT1***
1010  HOME :D$ =  CHR$ (13) +  CHR$ (4)
1020 AA =  PEEK (779):BB =  PEEK (780)
1030 B8 =  PEEK (769):YY$ = "": FOR I = 1 TO B8:J = I + 769:K =  PEEK (J)
1040 A4$ =  CHR$ (K):YY$ = YY$ + A4$: NEXT I
1050 A1$ = YY$
1060  IF BB = 2 THEN 1150
1070  TEXT : POKE 34,4: HOME : VTAB 6: INVERSE : PRINT ".........EXECUTE DATA : RESULT..........": NORMAL
    : POKE 34,6
1080  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 1090: GOTO 1150
1090  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: GET G$
1100  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 1090
1110  HOME : RETURN
1120  VTAB 22: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 22: HTAB 32: GET G$
1130  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 1120
1140  RETURN
1150  TEXT : POKE 34,4: HOME : VTAB 6: FLASH : PRINT ".........EXECUTE DATA : RESULT..........": NORMAL
    : POKE 34,6
1160  DIM A1(200),A2(200),A3(200),A4(200),A5(200),A6(200),A7(200),A8(200),A9(200),J(200),K(200),A$(30)
1170  PRINT D$;"OPEN RESULT";A1$;",D";BB
1180  PRINT D$;"READ RESULT";A1$
1190  INPUT A1$,F$,NUEL,NP
1200  FOR LZ = 1 TO NUEL: INPUT J(LZ),K(LZ),A1(LZ),A2(LZ),A3(LZ),A4(LZ),A5(LZ),A6(LZ): NEXT LZ
1210  FOR LZ = 1 TO NP: INPUT A7(LZ),A8(LZ),A9(LZ): NEXT LZ
1220  PRINT D$;"CLOSE RESULT";A$(1)
1230  FOR I = 1 TO 5: PRINT  CHR$ (7): NEXT I
1240  HOME : VTAB 8: PRINT "PLEASE,TURN ON PRINTER": GOSUB 1090
1250  TEXT : HOME :WRITE = 52480: PR# 1: PRINT  CHR$ (0): PR# 1
1260  PRINT "-----------------------------------------------------------------"
1270  PRINT "****************** MEMBER FORCES IN LOCAL COORDINATE ****************"
1280  PRINT "-----------------------------------------------------------------"
1290  PRINT "FILE NAME : ";A1$
1300  PRINT "TITLE : ";F$: PRINT
1310  PRINT "MEMBER NO.     NODE      AXIAL FORCE      SHEAR FORCE         MOMENT"
1320  PRINT "----------     ----      -----------      -----------         ------"
1330  FOR LZ = 1 TO NUEL
1340  CALL WRITE:LZ;I8,"     ":
1350  CALL WRITE:J(LZ);I4,"     ":
1360  CALL WRITE:A1(LZ);F10.4,"     ":
1370  CALL WRITE:A2(LZ);F10.4,"   ":
1380  CALL WRITE:A3(LZ);F10.4, CHR$ (13):
1390  PRINT  SPC( 11): CALL WRITE:K(LZ);I7,"     ":
1400  CALL WRITE:A4(LZ);F10.4,"     ":
1410  CALL WRITE:A5(LZ);F10.4,"   ":
1420  CALL WRITE:A6(LZ);F10.4, CHR$ (13):
1430  NEXT LZ
```

```
1440  PRINT
1450  PRINT "-------------------------------------------------------------------"
1460  PRINT "************* NODAL DISPLACEMENTS IN GLOBAL COORDINATE *************"
1470  PRINT "-------------------------------------------------------------------"
1480  PRINT "NODE              DX              DY              RZ"
1490  PRINT "----              --              --              --"
1500  FOR LZ = 1 TO NP
1510  CALL WRITE:LZ;I3,"       ":
1520  CALL WRITE:A7(LZ);E5,"     ":
1530  CALL WRITE:A8(LZ);E5,"     ":
1540  CALL WRITE:A9(LZ);E5, CHR$ (13):
1550  NEXT LZ: POKE 53247,255
1560  POKE 34,6: PR# 0: PRINT : PRINT : PRINT : PRINT : GOSUB 1120
1570  IF BB = 2 THEN 1600
1580  TEXT : HOME : VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
1590  GOSUB 1090
1600  PRINT D$;"RUN OPTIONS,D";AA
1610  END
```

```
1000  REM  *** DISPLAY DATA ***
1010  TEXT : HOME :AA =  PEEK (779):BB =  PEEK (780)
1020  IF BB = 2 THEN 1040
1030  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 1060: GOTO 1090
1040  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE#1"
1050  VTAB 12: PRINT "INSERT DATA    DISK INTO DRIVE#2": GOSUB 1060: GOTO 1090
1060  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: GET G$
1070  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 1060
1080  RETURN
1090 D$ =  CHR$ (13) +  CHR$ (4): GOTO 1130
1100  VTAB 22: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 22: HTAB 32: GET G$
1110  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 1100
1120  RETURN
1130  TEXT : HOME : VTAB 2: PRINT "INPUT NAME OF DATA FILE TO BE DISPLAYED"
1140  VTAB 4: PRINT "FILE NAME : ";: INPUT "";A1$
1150  VTAB 6: FLASH : PRINT ".WAITING.": NORMAL
1160  PRINT D$;"OPEN";A1$;",D";BB
1170  PRINT D$;"READ";A1$: INPUT F$,NP,NUEL,LM,LJ,MS,BJ,PT
1180  DIM X(NP),Y(NP),J(NUEL),K(NUEL),M5(NUEL),AREA(MS),IZ(MS),E(MS)
1190  DIM K1(LM),K2(LM),K3(LJ),K4(BJ)
1200  DIM ML(LM),T1(5,LM),T2(5,LM)
1210  DIM JR(MS),KR(MS),SHEAR$(MS),P(3,LJ),Q(3,BJ),QN(3,BJ)
1220  FOR J = 1 TO NUEL: INPUT J(J),K(J): NEXT J
1230  FOR J = 1 TO NP: INPUT X(J),Y(J): NEXT J
1240  FOR J = 1 TO MS: INPUT E(J),AREA(J),IZ(J),JR(J),KR(J),SHEAR$(J): NEXT J
1250  FOR J = 1 TO NUEL: INPUT M5(J): NEXT J
1260  IF LM <  = 0 THEN 1310
1270  FOR J = 1 TO LM: INPUT K1(J),ML(J),K2(J)
1280  IF K2(J) <  = 0 THEN 1300
1290  FOR K = 1 TO K2(J): INPUT T1(K,J),T2(K,J): NEXT K
1300  NEXT J
1310  IF LJ <  = 0 THEN 1330
1320  FOR J = 1 TO LJ: INPUT K3(J),P(1,J),P(2,J),P(3,J): NEXT J
1330  FOR J = 1 TO BJ: INPUT K4(J),Q(1,J),Q(2,J),Q(3,J)
1340  FOR I = 1 TO 3: IF Q(I,J) <  = 1 THEN 1360
1350  INPUT QN(I,J)
1360  NEXT I
1370  NEXT J
1380  PRINT D$;"CLOSE";A1$:WRITE = 49568
1390 AA$ = "                                        "
1400  POKE 34,4: HOME : VTAB 6: PRINT "PLEASE,TURN ON PRINTER"
```

```
1410  PR# 1: PRINT  CHR$ (0);: PR# 0: GOSUB 1520: POKE 34,21: HOME
1420  VTAB 22: PRINT "HARD COPY OF THESE DATA : 'Y'ES OR 'N'O"
1430  VTAB 22: HTAB 40: GET G$
1440  IF G$ = "" THEN  PRINT  CHR$ (7): GOTO 1430
1450  IF G$ <  > "Y" AND G$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 1430
1460  IF G$ = "N" THEN 1480
1470  PR# 1: PRINT  CHR$ (0);: GOSUB 2680: PR# 0: TEXT : HOME : GOSUB 1100: HOME
1480  IF BB = 2 THEN 1510
1490  TEXT : HOME : VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
1500  GOSUB 1060
1510  PRINT D$;"RUN OPTIONS,D";AA
1520  TEXT : HOME
1530  VTAB 2: PRINT "DATA FILE NAME : ";A1$
1540  VTAB 4: PRINT "TITLE          : ";F$
1550  VTAB 6: PRINT "NO. OF NODES           = ";NP
1560  PRINT "NO. OF MEMBERSS         = ";NUEL
1570  PRINT "NO. OF LOADED MEMBERS   = ";LM
1580  PRINT "NO. OF LOADED JOINTS    = ";LJ
1590  PRINT "NO. OF MATERIAL SETS    = ";MS
1600  PRINT "NO. OF BOUNDARY JOINTS  = ";BJ
1605  PRINT "POISSON'S RATIO         = ";PT
1610  GOSUB 1100
1620  TEXT : HOME
1630  VTAB 1: INVERSE : PRINT AA$
1640  VTAB 2: PRINT "       NODAL POINT COORDINATES        "
1650  VTAB 3: PRINT AA$: NORMAL
1660  VTAB 5: PRINT "NODE       X - COOR.     Y - COOR."
1670  VTAB 6: PRINT "----       ---------     ---------"
1680  POKE 34,6
1690  FOR J = 1 TO NP
1700  CALL WRITE:J;I3,"    ":
1710  CALL WRITE:X(J);F10.4,"  ":
1720  CALL WRITE:Y(J);F10.4, CHR$ (13):
1730  NEXT J
1740  PRINT : PRINT : PRINT : GOSUB 1100
1750  TEXT : HOME
1760  VTAB 1: INVERSE : PRINT AA$
1770  VTAB 2: PRINT "            MATERIAL SETS            "
1780  VTAB 3: PRINT AA$: NORMAL
1790  POKE 34,4
1800  FOR J = 1 TO MS: HOME : VTAB 5
1810  PRINT "MATERIAL SET NO."J
1820  PRINT "YOUNG's MODULUS       = ";E(J)
1830  PRINT "AREA                  = ";AREA(J)
1840  PRINT "MOMENT INERTIA        = ";IZ(J)
```

```
1850  PRINT "RIGID ZONE OF NODE I  = ";JR(J)
1860  PRINT "RIGID ZONE OF NODE J  = ";KR(J)
1870  IF SHEAR$(J) = "N" THEN  PRINT "SHEARING DEFORMATION  : NEGLECT": GOTO 1890
1880  PRINT "SHEARING DEFORMATION  : INCLUDE"
1890  GOSUB 1100
1900  NEXT J
1910  TEXT : HOME
1920  VTAB 1: INVERSE : PRINT AA$
1930  VTAB 2: PRINT "    NODE NO. AND PROPERTY OF ELEMENT    "
1940  VTAB 3: PRINT AA$: NORMAL
1950  VTAB 5: PRINT "ELEM. NO.   NODE I   NODE J   MAT. SET"
1960  VTAB 6: PRINT "---------   ------   ------   --------"
1970  POKE 34,6
1980  FOR J = 1 TO NUEL
1990  CALL WRITE:J;I7,"   ":
2000  CALL WRITE:J(J);I6,"  ":
2010  CALL WRITE:K(J);I6,"    ":
2020  CALL WRITE:M5(J);I6, CHR$ (13):
2030  NEXT J
2040  PRINT : PRINT : PRINT : GOSUB 1100
2050  TEXT : HOME
2060  IF LM <  = 0 THEN 2280
2070  VTAB 1: INVERSE : PRINT AA$
2080  VTAB 2: PRINT "    MEMBER LOADS IN LOCAL COORDINATE    "
2090  VTAB 3: PRINT AA$: NORMAL
2100  VTAB 5: PRINT "CARD ELEM.    UNIF.  NO.   TRAN.   DIST."
2110  VTAB 6: PRINT " NO.   NO.    LOAD TRAN.   LOAD   -LEFT "
2120  VTAB 7: PRINT "---- -----    ---- -----   -----  ------"
2130  POKE 34,7
2140  FOR J = 1 TO LM
2150  CALL WRITE:J;I3," ":
2160  CALL WRITE:K1(J);I3," ":
2170  CALL WRITE:ML(J);F6.2," ":
2180  CALL WRITE:K2(J);I3, CHR$ (13):
2190  IF K2(J) <  = 0 THEN 2250
2200  FOR K = 1 TO K2(J)
2210  CALL WRITE,"                  ":K;I3:
2220  CALL WRITE:T1(K,J);F6.2:
2230  CALL WRITE:T2(K,J);F6.2, CHR$ (13):
2240  NEXT K
2250  NEXT J
2260  PRINT : PRINT : PRINT : GOSUB 1100
2270  TEXT : HOME
2280  IF LJ <  = 0 THEN 2440
2290  VTAB 1: INVERSE : PRINT AA$
2300  VTAB 2: PRINT "    JOINT LOADS IN GLOBAL COORDINATE    "
2310  VTAB 3: PRINT AA$: NORMAL
2320  VTAB 5: PRINT "CARD  NODE     FORCE     FORCE    MOMENT"
2330  VTAB 6: PRINT " NO.   NO.      IN-X      IN-Y     AB.-Z"
2340  VTAB 7: PRINT "----  ----     -----     -----    ------"
```

```
2350  POKE 34,7
2360  FOR J = 1 TO LJ
2370  CALL WRITE:J;I3,"  ":
2380  CALL WRITE:K3(J);I3:
2390  CALL WRITE:P(1,J);F8.4:
2400  CALL WRITE:P(2,J);F8.4:
2410  CALL WRITE:P(3,J);F8.4, CHR$ (13):
2420  NEXT J
2430  PRINT : PRINT : PRINT : GOSUB 1100
2440  TEXT : HOME
2450  VTAB 1: INVERSE : PRINT AA$
2460  VTAB 2: PRINT "      BOUNDARY CONDITION AT JOINTS
2470  VTAB 3: PRINT AA$: NORMAL
2480  POKE 34,4
2490  FOR J = 1 TO BJ: HOME
2500  FOR I = 1 TO 3: IF Q(I,J) = 0 THEN AB$(I) = "FREE"
2510  IF Q(I,J) = 1 THEN AB$(I) = "FIXED"
2520  IF Q(I,J) = 2 THEN AB$(I) = "KNOWN"
2530  NEXT I
2540  VTAB 5: PRINT "B.C. CARD NO.";J
2550  PRINT "B.C. JOINT NO.   = ";K4(J)
2560  IF AB$(1) = "KNOWN" THEN 2580
2570  PRINT "X - DISPL.       = ";AB$(1): GOTO 2590
2580  PRINT "X - DISPL.       = ";AB$(1);": ";QN(1,J)
2590  IF AB$(2) = "KNOWN" THEN 2610
2600  PRINT "Y - DISPL.       = ";AB$(2): GOTO 2620
2610  PRINT "Y - DISPL.       = ";AB$(2);": ";QN(2,J)
2620  IF AB$(3) = "KNOWN" THEN 2640
2630  PRINT "ROTATION         = ";AB$(3): GOTO 2650
2640  PRINT "ROTATION         = ";AB$(3);": ";QN(3,J)
2650  PRINT : PRINT : PRINT : GOSUB 1100
2660  NEXT J
2670  RETURN
2680  TEXT : HOME :AA$ = "--------------------------------------------------------------------------------"
2690  PRINT : PRINT AA$: PRINT
2700  PRINT "DATA FILE NAME : ";A1$
2710  PRINT "TITLE          : ";F$
2720  PRINT : PRINT "NO. OF NODES            = ";NP
2730  PRINT "NO. OF MEMBERS          = ";NUEL
2740  PRINT "NO. OF LOADED MEMBERS   = ";LM
2750  PRINT "NO. OF LOADED JOINTS    = ";LJ
2760  PRINT "NO. OF MATERIAL SETS    = ";MS
2770  PRINT "NO. OF BOUNDARY JOINTS  = ";BJ
2775  PRINT "POISSON'S RATIO         = ";PT
2780  PRINT : PRINT
2790  PRINT AA$
2800  PRINT "************************ NODAL POINT COORDINATES ************************"
```

```
2810  PRINT AA$
2820  PRINT "NODE       X - COOR.      Y - COOR."
2830  PRINT "----       ---------      ---------"
2840  FOR J = 1 TO NP
2850  CALL WRITE:J;I3,"    ":
2860  CALL WRITE:X(J);F10.4,"  ":
2870  CALL WRITE:Y(J);F10.4, CHR$ (13):
2880  NEXT J
2890  PRINT : PRINT
2900  PRINT AA$
2910  PRINT "****************************** MATERIAL SETS ******************************"
2920  PRINT AA$
2930  PRINT "MAT.    YOUNG'S  X-SECTION      MOMENT  RIGID ZONE  RIGID ZONE   SHEARING"
2940  PRINT " NO.    MODULUS       AREA     INERTIA   OF NODE I   OF NODE J   DEF-TION"
2950  PRINT "----    -------   ---------      ------  ----------  ----------   --------"
2960  FOR J = 1 TO MS
2970  CALL WRITE:J;T2," ":
2980  CALL WRITE:E(J);E5,"":
2990  CALL WRITE:AREA(J);F10.4,"":
3000  CALL WRITE:IZ(J);F10.4,"":
3010  CALL WRITE:JR(J);F10.4,"":
3020  IF SHEAR$(J) = "I" THEN 3050
3030  CALL WRITE:KR(J);F10.4,"    NEGLECT", CHR$ (13):
3040  GOTO 3060
3050  CALL WRITE:KR(J);F10.4,"    INCLUDE", CHR$ (13):
3060  NEXT J
3070  PRINT : PRINT
3080  PRINT AA$
3090  PRINT "******************** NODE NO. AND PROPERTY OF ELEMENTS ********************"
3100  PRINT AA$
3110  PRINT "ELEM. NO.   NODE I   NODE J   MAT. SET"
3120  PRINT "---------   ------   ------   --------"
3130  FOR J = 1 TO NUEL
3140  CALL WRITE:J;I7,"   ":
3150  CALL WRITE:J(J);I6,"  ":
3160  CALL WRITE:K(J);I6,"    ":
3170  CALL WRITE:M5(J);I6, CHR$ (13):
3180  NEXT J
3190  IF LM <  = 0 THEN 3380
3200  PRINT : PRINT
3210  PRINT AA$
3220  PRINT "******************** MEMBER LOADS IN LOCAL COORDINATE ********************"
3230  PRINT AA$
3240  PRINT "CARD       ELEMENT          UNIF.          NO.         TRANV.         DIST."
3250  PRINT " NO.           NO.          LOAD         TRANV.          LOAD        -LEFT "
3260  PRINT "----       -------          -----        ------         ------       ------"
3270  FOR J = 1 TO LM
3280  CALL WRITE:J;I3,"          ":
3290  CALL WRITE:K1(J);I3,"  ":
3300  CALL WRITE:ML(J);F10.4,"          ":
3310  CALL WRITE:K2(J);I3, CHR$ (13):
3320  IF K2(J) <  = 0 THEN 3370
3330  FOR K = 1 TO K2(J)
3340  CALL WRITE,"                                                  ":T1(K,J);F10.4,"  ":
3350  CALL WRITE:T2(K,J);F10.4, CHR$ (13):
3360  NEXT K
3370  NEXT J
3380  IF LJ <  = 0 THEN 3530
```

```
3390  PRINT : PRINT
3400  PRINT AA$
3410  PRINT "******************** JOINT LOADS IN GLOBAL COORDINATE ********************"
3420  PRINT AA$
3430  PRINT "CARD      NODE         FORCE         FORCE        MOMENT"
3440  PRINT " NO.       NO.          IN-X          IN-Y         AB.-Z"
3450  PRINT "----      ----         -----         -----        ------"
3460  FOR J = 1 TO LJ
3470  CALL WRITE:J;I3,"      ":
3480  CALL WRITE:K3(J);I3,"  ":
3490  CALL WRITE:P(1,J);F10.4,"  ":
3500  CALL WRITE:P(2,J);F10.4,"  ":
3510  CALL WRITE:P(3,J);F10.4, CHR$ (13):
3520  NEXT J
3530  PRINT : PRINT
3540  PRINT AA$
3550  PRINT "********************** BOUNDARY CONDITION AT JOINTS **********************"
3560  PRINT AA$
3570  PRINT "CARD NO. B.C.JOINT     X-DISPL.      Y-DISPL.     ROTATION"
3580  PRINT "-------  ---------     -------       -------      --------"
3590  FOR J = 1 TO BJ
3600  CALL WRITE:J;I6,"       ":
3610  CALL WRITE:K4(J);I3,"       ":
3620  CALL WRITE:Q(1,J);I4,"        ":
3630  CALL WRITE:Q(2,J);I4,"        ":
3640  CALL WRITE:Q(3,J);I4, CHR$ (13):
3650  IF Q(1,J) <  > 2 AND Q(2,J) <  > 2 AND Q(3,J) <  > 2 THEN 3740
3660  IF Q(1,J) <  > 2 THEN  PRINT  SPC( 31): GOTO 3680
3670  PRINT  SPC( 18): CALL WRITE:QN(1,J);F10.4," ":
3680  IF Q(2,J) <  > 2 THEN  PRINT  SPC( 13): GOTO 3700
3690  CALL WRITE:QN(2,J);F10.4," ":
3700  IF Q(3,J) <  > 2 THEN 3720
3710  CALL WRITE:QN(3,J);F10.4:
3720  IF Q(1,J) <  > 2 AND Q(2,J) <  > 2 AND Q(3,J) <  > 2 THEN 3740
3730  CALL WRITE, CHR$ (13):
3740  NEXT J
3750  PRINT : PRINT "<0> = FREE : <1> = FIXED : <2> = KNOWN"
3760  PRINT : PRINT AA$
3770  RETURN
```

```
1000  REM ***CHANGE DATA***
1010 AA =  PEEK (779):BB =  PEEK (780): TEXT : HOME
1020  IF BB = 2 THEN 1040
1030  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 1060: GOTO 1090
1040  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE#1"
1050  VTAB 12: PRINT "INSERT DATA    DISK INTO DRIVE#2": GOSUB 1060: GOTO 1090
1060  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: GET G$
1070  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 1060
1080  RETURN
1090  TEXT :D$ =  CHR$ (13) +  CHR$ (4): GOTO 1170
1100  POKE 34,21: VTAB 22: PRINT "CONFIRM BY TYPE 'Y'"
1110  VTAB 22: HTAB 18: GET G$
1120  HOME : RETURN
1130  POKE 34,21: VTAB 22: PRINT "ACCEPT THESE DATA : 'Y'ES OR 'N'O"
1140  VTAB 22: HTAB 35: GET G$
1150  IF G$ <  > "Y" AND G$ <  > "N" THEN  PRINT  CHR$ (7): HOME : GOTO 1130
1160  HOME : RETURN
1170  TEXT : HOME : VTAB 2: PRINT "INPUT NAME OF DATA FILE TO BE CHANGED"
1180  VTAB 4: PRINT "FILE NAME : ";: INPUT "";A1$
1190  VTAB 6: FLASH : PRINT ".WAITING.": NORMAL
1200  PRINT D$;"OPEN";A1$;",D";BB
1210  PRINT D$;"READ";A1$: INPUT F$,N1,N2,L1,L2,M1,B1,P4: PRINT D$;"CLOSE";A1$
1220  TEXT : HOME :A0$ = "
1230  VTAB 1: INVERSE : PRINT A0$
1240  VTAB 2: PRINT "              CHANGE DATA              "
1250  VTAB 3: PRINT A0$: NORMAL : POKE 34,3
1260  VTAB 5: PRINT "DATA FILE NAME : ";A1$
1270  VTAB 7: PRINT "TITLE          : ";F$
1280  VTAB 9: PRINT "NO. OF NODES           = ";N1
1290  PRINT "NO. OF MEMBERS         = ";N2
1300  PRINT "NO. OF LOEDED MEMBERS  = ";L1
1310  PRINT "NO. OF LOEDED JOINTS   = ";L2
1320  PRINT "NO. OF MATERIAL SETS   = ";M1
1330  PRINT "NO. OF BOUNDARY JOINTS = ";B1
1335  PRINT "POISSON'S RATIO        = ";P4
1340  POKE 34,16: VTAB 17: PRINT "CHANGE THESE DATA : 'Y'ES OR 'N'O"
1350  VTAB 17: HTAB 35: GET G$
1360  IF G$ = "" THEN  PRINT  CHR$ (7): GOTO 1350
1370  IF G$ <  > "Y" AND G$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 1350
1380  IF G$ = "N" THEN N3 = N1:N4 = N2:L3 = L1:L4 = L2:M2 = M1:B2 = B1:PT = P4:NP = N1:NUEL = N2:LM = L
   1:LJ = L2:MS = M1:BJ = B1: GOTO 1560
1390  TEXT : POKE 34,3
1400  HOME : VTAB 5: PRINT "TITLE : ";: INPUT "";F$
1410  VTAB 7: INPUT "NO. OF NODES           = ";NP
1420  INPUT "NO. OF MEMBERS         = ";NUEL
1430  INPUT "NO. OF LOADED MEMBERS  = ";LM
1440  INPUT "NO. OF LOADED JOINTS   = ";LJ
1450  INPUT "NO. OF MATERIAL SETS   = ";MS
1460  INPUT "NO. OF BOUNDARY JOINTS = ";BJ
1465  INPUT "POISSON'S RATIO        = ";PT
```

```
1470  GOSUB 1100: POKE 34,3
1480  IF G$ = "Y" THEN 1500
1490  GOTO 1400
1500 N3 = NP:N4 = NUEL:L3 = LM:L4 = LJ:M2 = MS:B2 = BJ
1505  IF N3 <  = N1 THEN N3 = N1
1510  IF N4 <  = N2 THEN N4 = N2
1520  IF L3 <  = L1 THEN L3 = L1
1530  IF L4 <  = L2 THEN L4 = L2
1540  IF M2 <  = M1 THEN M2 = M1
1550  IF B2 <  = B1 THEN B2 = B1
1560  DIM X(N3),Y(N3),J(N4),K(N4),M5(N4),AREA(M2),IZ(M2),E(M2)
1570  DIM K1(L3),K2(L3),K3(L4),K4(B2)
1580  DIM ML(L3),T1(5,L3),T2(5,L3)
1590  DIM JR(M2),KR(M2),SHEAR$(M2),P(3,L4),Q(3,B2),QN(3,B2)
1600  PRINT D$;"OPEN";A1$
1610  PRINT D$;"READ";A1$: INPUT F$,N1,N2,L1,L2,M1,B1,P4
1620  FOR J = 1 TO N2: INPUT J(J),K(J): NEXT J
1630  FOR J = 1 TO N1: INPUT X(J),Y(J): NEXT J
1640  FOR J = 1 TO M1: INPUT E(J),AREA(J),IZ(J),JR(J),KR(J),SHEAR$(J): NEXT J
1650  FOR J = 1 TO N2: INPUT M5(J): NEXT J
1660  IF L1 <  = 0 THEN 1710
1670  FOR J = 1 TO L1: INPUT K1(J),ML(J),K2(J)
1680  IF K2(J) <  = 0 THEN 1700
1690  FOR K = 1 TO K2(J): INPUT T1(K,J),T2(K,J): NEXT K
1700  NEXT J
1710  IF L2 <  = 0 THEN 1730
1720  FOR J = 1 TO L2: INPUT K3(J),P(1,J),P(2,J),P(3,J): NEXT J
1730  FOR J = 1 TO B1: INPUT K4(J),Q(1,J),Q(2,J),Q(3,J)
1740  FOR I = 1 TO 3: IF Q(I,J) <  = 1 THEN 1760
1750  INPUT QN(I,J)
1760  NEXT I
1770  NEXT J
1780  PRINT D$;"CLOSE";A1$
1790  POKE 34,3: HOME : VTAB 5: HTAB 1: PRINT "CHANGE NODAL COOR. : 'Y'ES OR 'N'O"
1800  VTAB 5: HTAB 36: GET G1$
1810  IF G1$ = "" THEN  PRINT  CHR$ (7): GOTO 1800
1820  IF G1$ <  > "Y" AND G1$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 1800
1830  IF G1$ = "N" THEN 2060
1840  VTAB 6: HTAB 1: PRINT "NO. OF NODAL POINTS TO BE CHANGED ";: INPUT "";K
1850  IF K < 0 OR K > NP THEN  PRINT  CHR$ (7): POKE 34,5: HOME : GOTO 1840
1860  GOSUB 1100
1870  IF G$ = "Y" THEN 1890
1880  PRINT  CHR$ (7): GOTO 1790
1890  POKE 34,3: HOME
1900  VTAB 4: PRINT "PREVIOUS NODES     : ":HH = 22:VV = 4: POKE 34,8
1910  FOR J = 1 TO K
1920  HOME : VTAB 9: INPUT "NODE NO.";JJ
1930  IF JJ < 0 OR JJ > NP THEN  PRINT  CHR$ (7): GOTO 1920
1940  INPUT "X - COORDINATE    = ";CC(1)
1950  INPUT "Y - COORDINATE    = ";CC(2)
1960  GOSUB 1130: POKE 34,8
1970  IF G$ = "N" THEN 1920
1980  IF HH +  LEN ( STR$ (JJ)) > 40 THEN VV = VV + 1:HH = 1
1990  IF VV > 8 THEN AA$ = "PREVIOUS NODES     : ": GOSUB 2030
2000  VTAB VV: HTAB HH: PRINT JJ:HH = HH +  LEN ( STR$ (JJ)) + 1
```

```
2010 X(JJ) = CC(1):Y(JJ) = CC(2)
2020  NEXT J: GOTO 2060
2030  POKE 34,3: POKE 35,8: HOME : TEXT
2040  VTAB 4: PRINT AA$:HH = 22:VV = 4: POKE 34,8
2050  RETURN
2060  POKE 34,3: HOME : VTAB 5: HTAB 1: PRINT "CHANGE MATERIAL SETS : 'Y'ES OR 'N'O"
2070  VTAB 5: HTAB 38: GET G1$
2080  IF G1$ = "" THEN  PRINT  CHR$ (7): GOTO 2070
2090  IF G1$ <  > "Y" AND G1$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 2070
2100  IF G1$ = "N" THEN 2440
2110  VTAB 6: HTAB 1: PRINT "NO. OF MATERIAL SETS TO BE CHANGED ";: INPUT "";K
2120  IF K < 0 OR K > MS THEN  PRINT  CHR$ (7): POKE 34,5: HOME : GOTO 2110
2130  GOSUB 1100
2140  IF G$ = "Y" THEN 2160
2150  PRINT  CHR$ (7): GOTO 2060
2160  POKE 34,3: HOME
2170  VTAB 4: PRINT "PREVIOUS MAT. SETS : ":HH = 22:VV = 4: POKE 34,8
2180  FOR J = 1 TO K
2190  HOME : VTAB 9: INPUT "MATERIAL SETS NO.";JJ
2200  IF JJ < 0 OR JJ > MS THEN  PRINT  CHR$ (7): GOTO 2190
2210  INPUT "YOUNG's MODULUS       = ";CC(1)
2220  INPUT "AREA                  = ";CC(2)
2230  INPUT "MOMENT INERTIA        = ";CC(3)
2240  INPUT "RIGID ZONE OF NODE I  = ";CC(4)
2250  INPUT "RIGID ZONE OF NODE J  = ";CC(5)
2260  POKE 34,9: HOME : VTAB 11: PRINT "SHEARING DEFORMATION : 'N'EGLECT"
2270  VTAB 12: PRINT "                        : 'I'NCLUDE"
2280  VTAB 13: PRINT "              ANSWER : ": VTAB 13: HTAB 25: GET C$: IF  LEFT$ (C$,1) = "" THEN  PRINT
    CHR$ (7): GOTO 2260
2290  IF  LEFT$ (C$,1) <  > "I" AND  LEFT$ (C$,1) <  > "N" THEN  PRINT  CHR$ (7): GOTO 2260
2300  HOME : VTAB 10: PRINT "YOUNG's MODULUS       = ";CC(1)
2310  PRINT "AREA                  = ";CC(2)
2320  PRINT "MOMENT OF INERTIA     = ";CC(3)
2330  PRINT "RIGID ZONE OF NODE I  = ";CC(4)
2340  PRINT "RIGID ZONE OF NODE J  = ";CC(5)
2350  IF C$ = "N" THEN  PRINT "SHEARING DEFORMATION  : NEGLECT": GOTO 2370
2360  PRINT "SHEARING DEFORMATION  : INCLUDE"
2370  GOSUB 1130: POKE 34,8
2380  IF G$ = "N" THEN 2190
2390  IF HH +  LEN ( STR$ (JJ)) > 40 THEN VV = VV + 1:HH = 1
2400  IF VV > 8 THEN AA$ = "PREVIOUS MAT. SETS : ": GOSUB 2030
2410  VTAB VV: HTAB HH: PRINT JJ:HH = HH +  LEN ( STR$ (JJ)) + 1
2420 E(JJ) = CC(1):AREA(JJ) = CC(2):IZ(JJ) = CC(3):JR(JJ) = CC(4):KR(JJ) = CC(5):SHEAR$(JJ) =  LEFT$ (C
   $,1)
2430  NEXT J
2440  POKE 34,3: HOME : VTAB 5: HTAB 1: PRINT "CHANGE NODE NO. &  PROP. OF ELEMENTS"
2450  VTAB 6: PRINT "'Y'ES OR 'N'O"
2460  VTAB 6: HTAB 15: GET G1$
2470  IF G1$ = "" THEN  PRINT  CHR$ (7): GOTO 2460
2480  IF G1$ <  > "Y" AND G1$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 2460
2490  IF G1$ = "N" THEN 2710
2500  VTAB 7: HTAB 1: PRINT "NO. OF ELEMENTS TO BE CHANGED ";: INPUT "";K
2510  IF K < 0 OR K > NUEL THEN  PRINT  CHR$ (7): POKE 34,6: HOME : GOTO 2500
2520  GOSUB 1100
2530  IF G$ = "Y" THEN 2550
2540  PRINT  CHR$ (7): GOTO 2440
2550  POKE 34,3: HOME
2560  VTAB 4: PRINT "PREVIOUS ELEMENTS  : ":HH = 22:VV = 4: POKE 34,8
2570  FOR J = 1 TO K
2580  HOME : VTAB 9: INPUT "ELEMENT NO.";JJ
```

```
2590  IF JJ < 0 OR JJ > NUEL THEN  PRINT  CHR$ (7): GOTO 2580
2600  INPUT "NODE I         = ";CC(1)
2610  INPUT "NODE J         = ";CC(2)
2620  INPUT "MATERIAL SET   = ";CC(3)
2630  IF CC(3) < 0 OR CC(3) > MS THEN  PRINT  CHR$ (7): GOTO 2580
2640  GOSUB 1130: POKE 34,8
2650  IF  LEFT$ (G$,1) = "N" THEN  PRINT  CHR$ (7): GOTO 2580
2660  IF HH +  LEN ( STR$ (JJ)) > 40 THEN VV = VV + 1:HH = 1
2670  IF VV > 8 THEN AA$ = "PREVIOUS ELEMENT : ": GOSUB 2030
2680  VTAB VV: HTAB HH: PRINT JJ:HH = HH +  LEN ( STR$ (JJ)) + 1
2690 J(JJ) = CC(1):K(JJ) = CC(2):M5(JJ) = CC(3)
2700  NEXT J
2710  IF LM <  = 0 THEN 3160
2720  POKE 34,3: HOME : VTAB 5: HTAB 1: PRINT "CHANGE MEMBER LOADS IN LOCAL COORDINATE"
2730  VTAB 6: PRINT "'Y'ES OR 'N'O"
2740  VTAB 6: HTAB 15: GET G1$
2750  IF G1$ = "" THEN  PRINT  CHR$ (7): GOTO 2740
2760  IF G1$ <  > "Y" AND G1$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 2740
2770  IF G1$ = "N" THEN 3160
2780  VTAB 7: HTAB 1: PRINT "NO. OF MEMBER LOADS TO BE CHANGED ";: INPUT "";K
2790  IF K < 0 OR K > LM THEN  PRINT  CHR$ (7): POKE 34,6: HOME : GOTO 2780
2800  GOSUB 1100
2810  IF G$ = "Y" THEN 2830
2820  PRINT  CHR$ (7): GOTO 2710
2830  POKE 34,3: HOME
2840  VTAB 4: PRINT "PREVIOUS MEMBERS   : ":HH = 22:VV = 4: POKE 34,8
2850  FOR J = 1 TO K
2860  HOME : VTAB 9: INPUT "LOADED CARD NO.";JJ
2870  IF JJ < 0 OR JJ > LM THEN  PRINT  CHR$ (7): GOTO 2860
2880  INPUT "LOADED MEMBER NO.      = ";JS
2890  IF JS < 0 OR JS > NUEL THEN  PRINT  CHR$ (7): GOTO 2860
2900  INPUT "UNIF. LOAD             = ";CC(1)
2910  INPUT "NO. OF TRANSVERSE LOAD = ";CC(2)
2920  IF CC(2) <  = 5 THEN 2950
2930  PRINT  CHR$ (7): PRINT "NO. OF TRANSVERSE LOAD = 5 <MAXIMUM>"
2940  GOTO 2910
2950  IF CC(2) <  = 0 THEN 3080
2960  POKE 34,8
2970  FOR M = 1 TO CC(2)
2980  HOME : VTAB 9: HTAB 1: PRINT "TRANSVERSE LOAD NO.";M;"  = ";: INPUT "";D8(M)
2990  PRINT "DISTANCE FROM LEFT END = ";: INPUT "";D9(M)
3000  NEXT M
3010  HOME : PRINT "LOADED CARD NO.";JJ
3020  PRINT "LOADED MEMBER NO.      = ";JS
3030  PRINT "UNIF. LOAD             = ";CC(1)
3040  PRINT "NO. OF TRANSVERSE LOAD = ";CC(2)
3050  FOR M = 1 TO CC(3)
3060  PRINT M;" TRANS. LOAD/DIST.    = ";D8(M);"/";D9(M)
3070  NEXT M
3080  GOSUB 1130: POKE 34,8
3090  IF G$ = "N" THEN  PRINT  CHR$ (7): GOTO 2860
3100  IF HH +  LEN ( STR$ (JJ)) > 40 THEN VV = VV + 1:HH = 1
3110  IF VV > 8 THEN AA$ = "PREVIOUS MEMBERS   : ": GOSUB 2030
```

```
3120  VTAB VV: HTAB HH: PRINT JJ;HH = HH +  LEN ( STR$ (JJ)) + 1
3130 K1(JJ) = JS:ML(JJ) = CC(1):K2(JJ) = CC(2)
3140  FOR M = 1 TO K2(JJ):T1(M,JJ) = D8(M):T2(M,JJ) = D9(M): NEXT M
3150  NEXT J
3160  IF LJ =  < 0 THEN 3450
3170  POKE 34,3: HOME : VTAB 5: PRINT "CHANGE JOINT LOADS IN GLOBAL COORDINATE"
3180  VTAB 6: PRINT "'Y'ES OR 'N'O"
3190  VTAB 6: HTAB 15: GET G1$
3200  IF G1$ = "" THEN  PRINT  CHR$ (7): GOTO 3190
3210  IF G1$ <  > "Y" AND G1$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 3190
3220  IF G1$ = "N" THEN 3450
3230  VTAB 7: HTAB 1: PRINT "NO. OF JOINT LOADS TO BE CHANGED ";: INPUT "";K
3240  IF K < 0 OR K > LJ THEN  PRINT  CHR$ (7): POKE 34,5: HOME : GOTO 3020
3250  GOSUB 1100
3260  IF G$ = "Y" THEN 3280
3270  PRINT  CHR$ (7): GOTO 3160
3280  POKE 34,3: HOME
3290  VTAB 4: PRINT "PREVIOUS JOINTS     : ":HH = 22:VV = 4: POKE 34,8
3300  FOR J = 1 TO K
3310  HOME : VTAB 9: INPUT "LOADED CARD NO.";JJ
3320  IF JJ < 0 OR JJ > LJ THEN  PRINT  CHR$ (7): GOTO 3310
3330  INPUT "LOADED JOINT NO.   = ";JS
3340  IF JS < 0 OR JS > NP THEN  PRINT  CHR$ (7): GOTO 3310
3350  INPUT "FORCE IN X         = ";CC(1)
3360  INPUT "FORCE IN Y         = ";CC(2)
3370  INPUT "MOMENT ABOUT Z     = ";CC(3)
3380  GOSUB 1100: POKE 34,8
3390  IF G$ = "N" THEN  PRINT  CHR$ (7): GOTO 3310
3400  IF HH +  LEN ( STR$ (JJ)) > 40 THEN VV = VV + 1:HH = 1
3410  IF VV > 8 THEN AA$ = "PREVIOUS JOINTS     : ": GOSUB 2030
3420  VTAB VV: HTAB HH: PRINT JS:HH = HH +  LEN ( STR$ (JS)) + 1
3430 K3(JJ) = JS:P(1,JJ) = CC(1):P(2,JJ) = CC(2):P(3,JJ) = CC(3)
3440  NEXT J
3450  POKE 34,3: HOME : VTAB 5: PRINT "CHANGE B.C. AT JOINTS : 'Y'ES OR 'N'O"
3460  VTAB 5: HTAB 39: GET G1$
3470  IF G1$ = "" THEN  PRINT  CHR$ (7): GOTO 3460
3480  IF G1$ <  > "Y" AND G1$ <  > "N" THEN 3460
3490  IF G1$ = "N" THEN 3980
3500  VTAB 6: HTAB 1: PRINT "NO. OF B.C. JOINTS TO BE CHANGED ";: INPUT "";K
3510  IF K < 0 OR K > BJ THEN  PRINT  CHR$ (7): GOTO 3500
3520  GOSUB 1100
3530  IF G$ = "Y" THEN 3550
3540  PRINT  CHR$ (7): GOTO 3450
3550  POKE 34,2: HOME
3560  VTAB 3: INVERSE : PRINT "FREE = 0 : FIXED = 1 : KNOWN = 2        ": NORMAL : POKE 34,3
3570  VTAB 4: PRINT "PREVIOUS JOINTS : ":HH = 22:VV = 4: POKE 34,8
3580  FOR J = 1 TO K
3590  HOME : VTAB 9: INPUT "B.C. CARD NO.";JJ
3600  IF JJ < 0 OR JJ > BJ THEN  PRINT  CHR$ (7): GOTO 3590
```

```
3610  INPUT "B.C. JOINT NO.   = ";JS
3620  IF JS < 0 OR JS > NP THEN  PRINT  CHR$ (7): GOTO 3590
3630  INPUT "X - DISPL.       = ";CC(1)
3640  IF CC(1) = 0 OR CC(1) = 1 OR CC(1) = 2 THEN 3650
3645  PRINT  CHR$ (7): GOTO 3630
3650  INPUT "Y - DISPL.       = ";CC(2)
3660  IF CC(2) = 0 OR CC(2) = 1 OR CC(2) = 2 THEN 3670
3665  PRINT  CHR$ (7): GOTO 3650
3670  INPUT "ROTATION         = ";CC(3)
3680  IF CC(3) = 0 OR CC(3) = 1 OR CC(3) = 2 THEN 3690
3685  PRINT  CHR$ (7): GOTO 3670
3690  HOME : VTAB 9: IF CC(1) <  = 1 THEN 3710
3700  INPUT "KNOWN X - DISPL. = ";CC(4)
3710  IF CC(2) <  = 1 THEN 3730
3720  INPUT "KNOWN Y - DISPL. = ";CC(5)
3730  IF CC(3) <  = 1 THEN 3750
3740  INPUT "KNOWN ROTATION   = ";CC(6)
3750  FOR I = 1 TO 3: IF CC(I) = 0 THEN AR$(I) = "FREE"
3760  IF CC(I) = 1 THEN AR$(I) = "FIXED"
3770  IF CC(I) = 2 THEN AR$(I) = "KNOWN"
3780  NEXT I
3790  HOME : VTAB 9: PRINT "B.C. CARD NO. ";JJ
3800  PRINT "B.C. JOINT NO.   = ";JS
3810  VTAB 11: PRINT "X - DISPL.       = ";AR$(1)
3820  IF AR$(1) = "KNOWN" THEN  VTAB 11: HTAB 26: PRINT ": ";CC(4)
3830  VTAB 12: PRINT "Y - DISPL.       = ";AR$(2)
3840  IF AR$(2) = "KNOWN" THEN  VTAB 12: HTAB 26: PRINT ": ";CC(5)
3850  VTAB 13: PRINT "ROTATION         = ";AR$(3)
3860  IF AR$(3) = "KNOWN" THEN  VTAB 13: HTAB 26: PRINT ": ";CC(6)
3870  GOSUB 1130: POKE 34,8
3880  IF 6$ = "N" THEN 3590
3890  IF HH +  LEN ( STR$ (JS)) > 40 THEN VV = VV + 1:HH = 1
3900  IF VV > 7 THEN AA$ = "PREVIOUS JOINTS   : ": GOSUB 2030
3910  VTAB VV: HTAB HH: PRINT JS:HH = HH +  LEN (( STR$ (JS))) + 1
3920 K4(JJ) = JS: FOR I = 1 TO 3:Q(I,JJ) = CC(I): NEXT I
3930  FOR I = 1 TO 3:II = I + 3
3940  IF Q(I,JJ) <  = 1 THEN 3960
3950 QN(I,JJ) = CC(II)
3960  NEXT I
3970  NEXT J
3980  POKE 34,2: HOME
3990  VTAB 3: INVERSE : PRINT AD$: NORMAL : POKE 34,3
4000  VTAB 5: HTAB 1: PRINT "INPUT NAME OF DATA FILE TO BE SAVE"
4010  VTAB 7: PRINT "NOT MORE THAN 6 CHARACTERS"
4020  VTAB 9: PRINT "FILE NAME : ";: INPUT "";A1$
4030  IF  LEN (A1$) > 6 THEN  PRINT  CHR$ (7): GOTO 3980
4040  PRINT D$;"MONC,I,O": VTAB 11: FLASH : PRINT ".WAITING.": NORMAL : POKE 34,11: HOME
```

```
4050  PRINT D$;"OPEN";A1$;",D";BB
4060  PRINT D$;"DELETE";A1$: PRINT D$;"OPEN";A1$
4070  PRINT D$;"WRITE";A1$
4080  PRINT F$: PRINT NP: PRINT NUEL: PRINT LM: PRINT LJ: PRINT MS: PRINT BJ: PRINT PT: FOR J = 1 TO NU
   EL: PRINT J(J): PRINT K(J): NEXT J
4090  FOR J = 1 TO NP: PRINT X(J): PRINT Y(J): NEXT J
4100  FOR J = 1 TO MS: PRINT E(J): PRINT AREA(J): PRINT IZ(J): PRINT JR(J): PRINT KR(J): PRINT SHEAR$(J
   ): NEXT J
4110  FOR J = 1 TO NUEL: PRINT M5(J): NEXT J
4120  IF LM <  = 0 THEN 4170
4130  FOR J = 1 TO LM: PRINT K1(J): PRINT ML(J): PRINT K2(J)
4140  IF K2(J) <  = 0 THEN 4160
4150  FOR K = 1 TO K2(J): PRINT T1(K,J): PRINT T2(K,J): NEXT K
4160  NEXT J
4170  IF LJ <  = 0 THEN 4190
4180  FOR J = 1 TO LJ: PRINT K3(J): FOR I = 1 TO 3: PRINT P(I,J): NEXT I: NEXT J
4190  FOR J = 1 TO BJ: PRINT K4(J): FOR I = 1 TO 3: PRINT Q(I,J): NEXT I
4200  FOR I = 1 TO 3: IF Q(I,J) <  = 1 THEN 4220
4210  PRINT QN(I,J)
4220  NEXT I
4230  NEXT J
4240  PRINT D$;"CLOSE";A1$
4250  PRINT D$;"NOMON C,I,O": VTAB  PEEK (37): CALL  - 868: TEXT
4260  HOME : IF BB = 2 THEN 4290
4270  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
4280  GOSUB 1060: HOME
4290  PRINT D$;"RUN OPTIONS,D";AA
4300  END
```

```
1000  REM  ***PLOT DATA***
1010 AA =  PEEK (779):BB =  PEEK (780): TEXT : HOME
1020  IF BB = 2 THEN 1040
1030  VTAB 11: PRINT "INSERT DATA    DISK INTO DRIVE": GOSUB 1060: GOTO 1090
1040  VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE#1"
1050  VTAB 12: PRINT "INSERT DATA    DISK INTO DRIVE#2": GOSUB 1060: GOTO 1090
1060  VTAB 14: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: GET G$
1070  IF  ASC (G$) <  > 13 THEN  PRINT  CHR$ (7): GOTO 1060
1080  RETURN
1090 D$ =  CHR$ (13) +  CHR$ (4)
1100  TEXT : HOME : VTAB 2: PRINT "INPUT NAME OF DATA FILE TO BE PLOTED"
1110  VTAB 4: PRINT "FILE NAME : ";: INPUT "";A1$
1120  VTAB 6: FLASH : PRINT ".............PLOT DATA.............": NORMAL
1130  PRINT D$;"OPEN";A1$;",D";BB
1140  PRINT D$;"READ";A1$: INPUT F$,NP,NUEL,LM,LJ,MS,BJ,PT
1150  DIM X(NP),Y(NP),J(NUEL),K(NUEL)
1160  FOR J = 1 TO NUEL: INPUT J(J),K(J): NEXT J
1170  FOR J = 1 TO NP: INPUT X(J),Y(J): NEXT J
1180  PRINT D$;"CLOSE";A1$: TEXT : HOME
1190 P$ = "N"
1200 P = 0:Q = 0:R = 0:S = 0
1210  FOR J = 1 TO NP
1220  IF X(J) > P THEN P = X(J)
1230  IF X(J) < Q THEN Q = X(J)
1240  IF Y(J) > R THEN R = Y(J)
1250  IF Y(J) < S THEN S = Y(J)
1260  NEXT J
1270 X = P - Q:Y = R - S:Z = X
1280  IF Y > X THEN Z = Y
1290 W = 150 / Z:P = 0:R = 0
1300  IF Q < 0 THEN P =  - Q
1310  IF S < 0 THEN R =  - S
1320  TEXT : HOME
1330  HCOLOR= 7
1340  HGR
1350  FOR L = 1 TO NUEL
1360 I = J(L):J = K(L)
1370 X1 = (X(I) + P) * W + 20:X2 = (X(J) + P) * W + 20
1380 Y1 = 155 - ((Y(I) + R) * W):Y2 = 155 - ((Y(J) + R) * W)
1390  HPLOT X1,Y1 TO X2,Y2
1400  NEXT L
1410  IF P$ = "Y" THEN 1510
1420  VTAB 22: PRINT "PRESS 'RETURN KEY' TO CONTINUE": VTAB 14: HTAB 32: GET G$
1430  TEXT : HOME : VTAB 20: PRINT "PLEASE,TURN ON PRINTER"
1440  VTAB 22: PRINT "HARD COPY OF THIS PLOT : 'Y'ES OR 'N'O"
1450  VTAB 22: HTAB 40: GET G$
1460  IF G$ = "" THEN  PRINT  CHR$ (7): GOTO 1440
1470  IF G$ <  > "Y" AND G$ <  > "N" THEN  PRINT  CHR$ (7): GOTO 1440
1480  IF G$ = "N" THEN 1520
1490 P$ = "Y"
1500  PRINT D$;"PR#1": GOTO 1320
1510  PRINT  CHR$ (17): PRINT D$;"PR#0"
1520  IF BB = 2 THEN 1550
1530  TEXT : HOME : VTAB 11: PRINT "INSERT PROGRAM DISK INTO DRIVE"
1540  GOSUB 1060
1550  PRINT D$;"RUN OPTIONS";",D";AA
1560  END
```

ประวัติ

นายวินิจ เจียรสถาวงศ์ เกิดเมื่อวันที่ 21 พฤษภาคม พ.ศ. 2500 ที่กรุงเทพมหานคร สำเร็จการศึกษาชั้นมัธยมศึกษาตอนปลาย (ม.ศ.5) จากโรงเรียนเตรียมอุดมศึกษา ในเดือนมีนาคม พ.ศ. 2520 สำเร็จการศึกษาวิศวกรรมศาสตร์บัณฑิต สาขาวิศวกรรมโยธาจากจุฬาลงกรณ์มหาวิทยาลัย ในเดือนเมษายน พ.ศ. 2524 ทำงานครั้งแรกด้านการออกแบบอาคารที่ บริษัทแบล็คแอนด์วีทช์ (เอเชีย)