ภาคผนวก ค

ตัวอย่างไฟล์การนำเข้าข้อมูลไฟไนต์เอลิเมนต์โปรแกรม STAAD.PRO
และผลจากการวิเคราะห์

ตัวอย่างไฟล์การนำเข้าข้อมูลไฟไนต์เอลิเมนต์ในการวิเคราะห์น้ำหนักวิกฤติของโครงสร้าง (Buckling analysis) สำหรับโครงสร้างรองรับท่อส่งปิโตรเลียมที่มีระยะค้ำยันที่ 6.5 เมตร จากตำแหน่งสูงสุดของโครงสร้างในความสูงของโครงสร้างเท่ากับ 14.652 เมตร มุมการวางขาหน้าเท่ากับ 17.912 องศาจากแนวดิ่ง มุมการวาง 2 ขาหลังเท่ากับ 9.177 องศา และความหนาของขารองรับโครงสร้างเท่ากับ 12 มิลลิเมตร

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STAAD SPACE
START JOB INFORMATION
JOB NAME SI
JOB CLIENT TCJ
ENGINEER NAME TCJ
CHECKER NAME TCJ
APPROVED NAME TCJ
JOB REV 0
ENGINEER DATE 25-10-14
JOB NO 1
JOB PART 3 PILES
CHECKER DATE 25-10-14
APPROVED DATE 25-10-14
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KG
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22 -1.1 6.5 -1.95; 23 -1.1 6.5 -1.65; 24 -1.1 6.5 -1.325; 25 -1.1 6.5 -1;
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29 -1.1 6.5 0.333333; 30 -1.1 6.5 0.666667; 31 -1.1 6.5 1; 32 -1.1 6.5 1.325;
33 -1.1 6.5 1.65; 34 -1.1 6.5 1.95; 35 -1.1 6.5 2.25; 38 -0.816667 6.5 -2.25;
39 -0.816667 6.5 -1.95; 40 -0.816667 6.5 -1.65; 41 -0.816667 6.5 -1.325;
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ELEMENT INCIDENCES SHELL

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69 90 91 107 106; 70 91 92 108 107; 71 92 93 109 108; 72 93 94 110 109;
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118 145 146 158 157; 119 146 147 159 158; 120 147 148 160 159;
121 148 149 161 160;
START GROUP DEFINITION
ELEMENT
_PLATETEST 10 TO 54 57 TO 60 63 TO 68 71 TO 74 77 TO 121
_PLATE_D 12 TO 21 26 TO 35 40 TO 49 54 TO 63 68 TO 77 82 TO 91 96 TO 99 102 -
103 TO 107 110 TO 113 116 TO 121
MEMBER
END GROUP DEFINITION
ELEMENT PROPERTY
10 TO 121 THICKNESS 1.5
DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 2.21467e+009
POISSON 0.17
DENSITY 2400
ALPHA 1e-005
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DAMP 0.05
ISOTROPIC STEEL
E 2.09e+010
POISSON 0.3
DENSITY 7850
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
MEMBER PROPERTY JAPANESE
139 140 143 145 244 TO 286 322 TO 426 TABLE ST PIPE OD 0.7 ID 0.676
132 133 158 TO 243 287 TO 321 427 TO 461 TABLE ST PIPE OD 0.7 ID 0.676
138 156 157 462 TO 539 TABLE ST PIP406.4X9.0
CONSTANTS
MATERIAL CONCRETE MEMB 10 TO 121
MATERIAL STEEL MEMB 132 133 138 TO 140 143 145 156 TO 539
SUPPORTS
17 18 168 FIXED
SLAVE RIGID MASTER 94 JOINT 91 94 97
*
DEFINE WIND LOAD
TYPE 1
INT 0 83.08 83.08 87.98 91.95 95.83 101.74 106.63 110.5 114.38 118.35 121.21 -
 123.25 HEIG  0  0.1  4.6  6.1  7.6  9.1  12.2  15.2  18  21.3  24.4  27.4 -
 30.5
*
************ BASIC LOAD CASE ******************
***********************************************
LOAD 1 LOADTYPE Dead  TITLE SELF WEIGHT STRUCTURE : SW
UNIT METER KN
JOINT LOAD
94 FY -1
UNIT METER KN
PERFORM BUCKLING ANALYSIS MAXSTEP 15 PRINT ALL
FINISH
***********************************************************
```

ตัวอย่างไฟล์การนำเข้าข้อมูลไฟไนต์เอลิเมนต์ในการวิเคราะห์หากำลังรับแรงของโครงสร้างตามข้อกำหนด AISC ปี 1989 ในวิธีหน่วยแรงที่ยอมให้ (Allowable stress design) สำหรับโครงสร้างรองรับท่อส่งปิโตรเลียมที่มีระยะค้ำยันที่ 6.5 เมตร จากตำแหน่งสูงสุดของโครงสร้างในความสูงของโครงสร้างเท่ากับ 14.652 เมตร มุมการวางขาหน้าเท่ากับ 17.912 องศาจากแนวดิ่ง มุมการวาง 2 ขาหลังเท่ากับ 9.177 องศา และความหนาของขารองรับโครงสร้างเท่ากับ 12 มิลลิเมตร

```
STAAD SPACE
START JOB INFORMATION
JOB NAME SI
JOB CLIENT TCJ
ENGINEER NAME TCJ
CHECKER NAME TCJ
APPROVED NAME TCJ
JOB REV 0
ENGINEER DATE 25-10-14
JOB NO 1
JOB PART 3 PILES
CHECKER DATE 25-10-14
APPROVED DATE 25-10-14
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KG
JOINT COORDINATES
17 -2.3674 -8.152 -5.1015; 18 -2.3674 -8.15189 5.1015; 21 -1.1 6.5 -2.25;
22 -1.1 6.5 -1.95; 23 -1.1 6.5 -1.65; 24 -1.1 6.5 -1.325; 25 -1.1 6.5 -1;
26 -1.1 6.5 -0.666667; 27 -1.1 6.5 -0.333333; 28 -1.1 6.5 0;
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109 134 135 153 152; 110 135 136 154 153; 111 136 137 155 154;
112 138 139 162 161; 113 139 140 163 162; 114 140 141 164 163;
115 141 142 165 164; 116 143 144 156 155; 117 144 145 157 156;
118 145 146 158 157; 119 146 147 159 158; 120 147 148 160 159;
121 148 149 161 160;
START GROUP DEFINITION
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_PLATETEST 10 TO 54 57 TO 60 63 TO 68 71 TO 74 77 TO 121
_PLATE_D 12 TO 21 26 TO 35 40 TO 49 54 TO 63 68 TO 77 82 TO 91 96 TO 99 102 -
103 TO 107 110 TO 113 116 TO 121
MEMBER
END GROUP DEFINITION
ELEMENT PROPERTY
10 TO 121 THICKNESS 1.5
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DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 2.21467e+009
POISSON 0.17
DENSITY 2400
ALPHA 1e-005
DAMP 0.05
ISOTROPIC STEEL
E 2.09e+010
POISSON 0.3
DENSITY 7850
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
MEMBER PROPERTY JAPANESE
139 140 143 145 TABLE ST PIPE OD 0.7 ID 0.676
132 133 TABLE ST PIPE OD 0.7 ID 0.676
138 157 489 TABLE ST PIP406.4X9.0
CONSTANTS
MATERIAL CONCRETE MEMB 10 TO 121
MATERIAL STEEL MEMB 132 132 133 138 TO 140 143 145 157 489
SUPPORTS
17 18 168 FIXED
SLAVE RIGID MASTER 94 JOINT 91 94 97
DEFINE WIND LOAD
TYPE 1
INT 0 83.08 83.08 87.98 91.95 95.83 101.74 106.63 110.5 114.38 118.35 121.21 -
 123.25 HEIG  0  0.1  4.6  6.1  7.6  9.1  12.2  15.2  18  21.3  24.4  27.4 -
 30.5
*
*
**********************************************
************ BASIC LOAD CASE ******************
**********************************************
* <<<<< >>>>>
**********************************************
```

```
********** SELF WEIGHT **********
**********************************************
LOAD 1 LOADTYPE Dead  TITLE SELF WEIGHT STRUCTURE : SW
UNIT METER KN
JOINT LOAD
94 FY -9137
PERFORM ANALYSIS
PARAMETER 1
CODE AISC
FYLD 235000 ALL
CHECK CODE ALL
FINISH
**********************************************************
```

ตัวอย่างผลจากการวิเคราะห์การโก่งเดาะของโครงสร้าง (Buckling analysis) สำหรับโครงสร้างรองรับท่อส่งปิโตรเลียมที่มีระยะค้ำยันที่ 6.5 เมตร จากตำแหน่งสูงสุดของโครงสร้างในความสูงของโครงสร้างเท่ากับ 14.652 เมตร มุมการวางขาหน้าเท่ากับ 17.912 องศาจากแนวดิ่ง มุมการวาง 2 ขาหลังเท่ากับ 9.177 องศา และความหนาของขารองรับโครงสร้างเท่ากับ 12 มิลลิเมตร ในฐานรองรับแบบยึดแน่น

```
        CALCULATED BUCKLING FACTORS FOR LOAD CASE      1

   MODE          BUCKLING FACTOR

     1            83841.78910
     2           102718.80450
     3           134633.85522
     4           201545.85290
```

ตัวอย่างผลจากการวิเคราะห์หากำลังรับแรงของโครงสร้างตามข้อกำหนด AISC ปี 1989 ในวิธีหน่วยแรงที่ยอมให้ (Allowable stress design) สำหรับโครงสร้างรองรับท่อส่งปิโตรเลียมที่มีระยะค้ำยันที่ 6.5 เมตร จากตำแหน่งสูงสุดของโครงสร้างในความสูงของโครงสร้างเท่ากับ 14.652 เมตร มุมการวางขาหน้าเท่ากับ 17.912 องศาจากแนวดิ่ง มุมการวาง 2 ขาหลังเท่ากับ 9.177 องศา และความหนาของขารองรับโครงสร้างเท่ากับ 12 มิลลิเมตรในฐานรองรับแบบยึดแน่น

```
              STAAD.Pro CODE CHECKING - (AISC 9TH EDITION)   v1.0
              **********************
ALL UNITS ARE - KN   METE (UNLESS OTHERWISE Noted)

 MEMBER    TABLE      RESULT/  CRITICAL COND/     RATIO/     LOADING/
              FX          MY          MZ      LOCATION
 =========================================================================


  132  ST   PIP E               (JAPANESE SECTIONS)
                PASS     AISC- H1-1        0.999        1
            3215.85 C        -0.35         22.92        8.57
  133  ST   PIP E               (JAPANESE SECTIONS)
                PASS     AISC- H1-1        1.000        1
```

```
              3215.84 C         0.36         22.94        8.57
  138  ST   PIP406.4X9.0           (JAPANESE SECTIONS)
                  PASS     AISC- H1-3         0.022         1
               0.70 C         0.01         -3.68        5.64
  139  ST   PIP E                 (JAPANESE SECTIONS)
                  PASS     AISC- H1-1         0.982         1
              3215.82 C         0.05         -28.47        0.00
  140  ST   PIP E                 (JAPANESE SECTIONS)
                  PASS     AISC- H1-1         0.982         1
              3215.82 C        -0.05         -28.47        0.00
  143  ST   PIP E                 (JAPANESE SECTIONS)
                  PASS     AISC- H1-1         0.981         1
              3213.41 C         0.00         -28.31        6.83
* 145  ST   PIP E                 (JAPANESE SECTIONS)
                  FAIL     AISC- H1-1         1.000         1
              3215.06 C         0.01         23.44         0.00
  157  ST   PIP406.4X9.0           (JAPANESE SECTIONS)
                  PASS     AISC- H1-3         0.036         1
               1.27 C         0.04         -5.98         0.00
  489  ST   PIP406.4X9.0           (JAPANESE SECTIONS)
                  PASS     AISC- H1-3         0.036         1
               1.28 C        -0.04         -5.99         0.00
```