APPENDIX D
GTSTRUDL INPUT FILES

STRUDL 'Model 101' ‘Type II Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 22.8 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 227 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 122818, ELEMENTS EXISTING 'G-10011' TO 'G-12288'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 76 ID 300 Z -900

GENERATE 3 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -67 -67
REPEAT 5 ID 100000 X 1524 Z -268
REPEAT 76 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 4 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 5 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1015' 1000 FROM 100023 100000 TO 200019 100000 TO 200319 100000 TO 100323 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 76 ELEMENTS ID 'P-7011' 10 FROM 700019 300 TO 700020 300 TO 700320 300 TO 700319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 76 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 122808 100000 TO 222805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 107608 499800 TO 207805 499800
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 207808 300500 TO 306905 300500
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306908 100700 TO 407605 100700

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 115208 499800 TO 215405 499800
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 215408 300500 TO 314505 300500
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 314508 100700 TO 415205 100700
```

```
$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7761' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1761' BY 10 'R-1002' TO 'R-1762' BY 10 AX 5000
 'R-2001' TO 'R-2761' BY 10 'R-2002' TO 'R-2762' BY 10 AX 5000
 'R-3001' TO 'R-3761' BY 10 'R-3002' TO 'R-3762' BY 10 AX 5000
 'R-4001' TO 'R-4761' BY 10 'R-4002' TO 'R-4762' BY 10 AX 5000
 'R-5001' TO 'R-5761' BY 10 'R-5002' TO 'R-5762' BY 10 AX 5000
 'R-6001' TO 'R-6761' BY 10 'R-6002' TO 'R-6762' BY 10 AX 5000
 'R-7001' TO 'R-7761' BY 10 'R-7002' TO 'R-7762' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 107601 TO 707601 BY 100000 107602 TO 707602 BY 100000 107603 TO 707603 BY 100000 107604 TO 707604 BY 100000 -
 115201 TO 715201 BY 100000 115202 TO 715202 BY 100000 115203 TO 715203 BY 100000 115204 TO 715204 BY 100000 -
 122801 TO 722801 BY 100000 122802 TO 722802 BY 100000 122803 TO 722803 BY 100000 122804 TO 722804 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 122819 TO 722819 BY 100000 122820 TO 722820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 122801 TO 122804 222801 TO 222804 322801 TO 322804 422801 TO 422804 522801 TO 522804 622801 TO 622804 722801 TO 722804
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 107601 TO 107604 207601 TO 207604 307601 TO 307604 407601 TO 407604 507601 TO 507604 607601 TO 607604 707601 TO 707604
MOMENT X Y Z
 115201 TO 115204 215201 TO 215204 315201 TO 315204 415201 TO 415204 515201 TO 515204 615201 TO 615204 715201 TO 715204
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42288' BODY FORCES GLOBAL BY -23.5616
```

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  EXISTING 'G-50011' TO 'G-52288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-60011' TO 'G-62288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7761' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203623 403620 FORCE Y -45.5
  205123 405120 FORCE Y -188.5
  206323 406320 FORCE Y -188.5
$ Truck 2
  403623 603620 FORCE Y -188.5
  405123 605120 FORCE Y -188.5
  406323 606320 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7761' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72283' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72284' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72285' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72288' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4


$===============================================================================================
$ Factored Loads
$===============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$===============================================================================================
$ Prepare and Generate Output
$===============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72288'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 102' ‘Type II Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 22.8 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 227 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 122818, ELEMENTS EXISTING 'G-10011' TO 'G-12288'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 76 ID 300 Z -900

GENERATE 3 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -67 -67
REPEAT 5 ID 100000 X 1524 Z -268
REPEAT 76 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 4 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 5 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1015' 1000 FROM 100023 100000 TO 200019 100000 TO 200319 100000 TO 100323 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 76 ELEMENTS ID 'P-7011' 10 FROM 700019 300 TO 700020 300 TO 700320 300 TO 700319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 76 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 122808 100000 TO 222805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 107608 499800 TO 207805 499800
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 207808 299900 TO 307505 299900
```

```
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 307508 100100 TO 407605 100100

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 115208 499800 TO 215405 499800
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 215408 299900 TO 315105 299900
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 315108 100100 TO 415205 100100

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7761' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1761' BY 10 'R-1002' TO 'R-1762' BY 10 AX 5000
 'R-2001' TO 'R-2761' BY 10 'R-2002' TO 'R-2762' BY 10 AX 5000
 'R-3001' TO 'R-3761' BY 10 'R-3002' TO 'R-3762' BY 10 AX 5000
 'R-4001' TO 'R-4761' BY 10 'R-4002' TO 'R-4762' BY 10 AX 5000
 'R-5001' TO 'R-5761' BY 10 'R-5002' TO 'R-5762' BY 10 AX 5000
 'R-6001' TO 'R-6761' BY 10 'R-6002' TO 'R-6762' BY 10 AX 5000
 'R-7001' TO 'R-7761' BY 10 'R-7002' TO 'R-7762' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 107601 TO 707601 BY 100000 107602 TO 707602 BY 100000 107603 TO 707603 BY 100000 107604 TO 707604 BY 100000 -
 115201 TO 715201 BY 100000 115202 TO 715202 BY 100000 115203 TO 715203 BY 100000 115204 TO 715204 BY 100000 -
 122801 TO 722801 BY 100000 122802 TO 722802 BY 100000 122803 TO 722803 BY 100000 122804 TO 722804 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 122819 TO 722819 BY 100000 122820 TO 722820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 122801 TO 122804 222801 TO 222804 322801 TO 322804 422801 TO 422804 522801 TO 522804 622801 TO 622804 722801 TO 722804
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 107601 TO 107604 207601 TO 207604 307601 TO 307604 407601 TO 407604 507601 TO 507604 607601 TO 607604 707601 TO 707604
MOMENT X Y Z
 115201 TO 115204 215201 TO 215204 315201 TO 315204 415201 TO 415204 515201 TO 515204 615201 TO 615204 715201 TO 715204
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12288' BODY FORCES GLOBAL BY -23.5616
```

```
  EXISTING 'G-20011' TO 'G-22288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-60011' TO 'G-62288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7761' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203623 403620 FORCE Y -45.5
  205123 405120 FORCE Y -188.5
  206323 406320 FORCE Y -188.5
$ Truck 2
  403623 603620 FORCE Y -188.5
  405123 605120 FORCE Y -188.5
  406323 606320 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7761' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72283' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72284' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72285' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72288' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4


$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72288'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 103' ‘Type II Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 22.8 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 227 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 122818, ELEMENTS EXISTING 'G-10011' TO 'G-12288'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 76 ID 300 Z -900

GENERATE 3 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -67 -67
REPEAT 5 ID 100000 X 1524 Z -268
REPEAT 76 ID 300 Z -900

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 4 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 5 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1015' 1000 FROM 100023 100000 TO 200019 100000 TO 200319 100000 TO 100323 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 76 ELEMENTS ID 'P-7011' 10 FROM 700019 300 TO 700020 300 TO 700320 300 TO 700319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 76 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 122810 100000 TO 222809 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 107610 499800 TO 207809 499800
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 207810 300500 TO 306909 300500
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306910 100700 TO 407609 100700

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 115210 499800 TO 215409 499800
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 215410 300500 TO 314509 300500
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 314510 100700 TO 415209 100700
```

```
$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7761' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1761' BY 10 'R-1002' TO 'R-1762' BY 10 AX 5000
 'R-2001' TO 'R-2761' BY 10 'R-2002' TO 'R-2762' BY 10 AX 5000
 'R-3001' TO 'R-3761' BY 10 'R-3002' TO 'R-3762' BY 10 AX 5000
 'R-4001' TO 'R-4761' BY 10 'R-4002' TO 'R-4762' BY 10 AX 5000
 'R-5001' TO 'R-5761' BY 10 'R-5002' TO 'R-5762' BY 10 AX 5000
 'R-6001' TO 'R-6761' BY 10 'R-6002' TO 'R-6762' BY 10 AX 5000
 'R-7001' TO 'R-7761' BY 10 'R-7002' TO 'R-7762' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 107601 TO 707601 BY 100000 107602 TO 707602 BY 100000 107603 TO 707603 BY 100000 107604 TO 707604 BY 100000 -
 115201 TO 715201 BY 100000 115202 TO 715202 BY 100000 115203 TO 715203 BY 100000 115204 TO 715204 BY 100000 -
 122801 TO 722801 BY 100000 122802 TO 722802 BY 100000 122803 TO 722803 BY 100000 122804 TO 722804 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 122819 TO 722819 BY 100000 122820 TO 722820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 122801 TO 122804 222801 TO 222804 322801 TO 322804 422801 TO 422804 522801 TO 522804 622801 TO 622804 722801 TO 722804
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 107601 TO 107604 207601 TO 207604 307601 TO 307604 407601 TO 407604 507601 TO 507604 607601 TO 607604 707601 TO 707604
MOMENT X Y Z
 115201 TO 115204 215201 TO 215204 315201 TO 315204 415201 TO 415204 515201 TO 515204 615201 TO 615204 715201 TO 715204
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42288' BODY FORCES GLOBAL BY -23.5616
```

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  EXISTING 'G-50011' TO 'G-52288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-60011' TO 'G-62288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7761' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203623 403620 FORCE Y -45.5
  205123 405120 FORCE Y -188.5
  206323 406320 FORCE Y -188.5
$ Truck 2
  403623 603620 FORCE Y -188.5
  405123 605120 FORCE Y -188.5
  406323 606320 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7761' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72283' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72284' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72285' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72288' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4


$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Delete Diaphragms
$=============================================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
ADDITIONS

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72288'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 104' ‘Type II Girder, 10° Bridge Skew, Girder Spacing 2.75 m, Span Length 16.8 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -325

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2748 Z -488

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -325

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 200019 1 X LIST 1910 2210 Y 916 Z -325
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 300019 1 X LIST 4658 4958 Y 916 Z -813
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 400019 1 X LIST 7406 7706 Y 916 Z -1301
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 500019 1 X LIST 9236 9536 Y 916 Z -1626
REPEAT 56 ID 300 Z -900

GENERATE 4 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -65 -65
REPEAT 1 ID 300000 X 7326 Z -1301
REPEAT 56 ID 300 Z -900

GENERATE 7 JOINTS ID 200021 1 X 2516 306 Y 916 0 Z -386 -61
REPEAT 1 ID 100000 X 2748 Z -488
REPEAT 56 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 5 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1016' 3000 FROM 100024 300000 TO 200019 300000 TO 200319 300000 TO 100324 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 8 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 2 ELEMENTS ID 'P-2019' 1000 FROM 200027 100000 TO 300019 100000 TO 300319 100000 TO 200327 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 301300 TO 204305 301300
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204308 101300 TO 305605 101300

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 301300 TO 209905 301300
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 209908 101300 TO 311205 101300

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y
```

```
$=============================================================================================================
$ Define Loading
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203622 303620 FORCE Y -45.5
  205122 305120 FORCE Y -188.5
  206322 306320 FORCE Y -188.5
$ Truck 2
  303623 403621 FORCE Y -188.5
  305123 405121 FORCE Y -188.5
  306323 406321 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 105' ‘Type II Girder, 10° Bridge Skew, Girder Spacing 2.75 m, Span Length 16.8 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -325

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2748 Z -488

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -325

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 200019 1 X LIST 1910 2210 Y 916 Z -325
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 300019 1 X LIST 4658 4958 Y 916 Z -813
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 400019 1 X LIST 7406 7706 Y 916 Z -1301
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 500019 1 X LIST 9236 9536 Y 916 Z -1626
REPEAT 56 ID 300 Z -900

GENERATE 4 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -65 -65
REPEAT 1 ID 300000 X 7326 Z -1301
REPEAT 56 ID 300 Z -900

GENERATE 7 JOINTS ID 200021 1 X 2516 306 Y 916 0 Z -386 -61
REPEAT 1 ID 100000 X 2748 Z -488
REPEAT 56 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 5 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1016' 3000 FROM 100024 300000 TO 200019 300000 TO 200319 300000 TO 100324 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 8 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2019' 1000 FROM 200027 100000 TO 300019 100000 TO 300319 100000 TO 200327 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 300200 TO 205405 300200
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 205408 100200 TO 305605 100200

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 300200 TO 211005 300200
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 211008 100200 TO 311205 100200

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y
```

```
$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203622 303620 FORCE Y -45.5
  205122 305120 FORCE Y -188.5
  206322 306320 FORCE Y -188.5
$ Truck 2
  303623 403621 FORCE Y -188.5
  305123 405121 FORCE Y -188.5
  306323 406321 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 106' ‘Type II Girder, 10° Bridge Skew, Girder Spacing 2.75 m, Span Length 16.8 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -325

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2748 Z -488

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -325

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 200019 1 X LIST 1910 2210 Y 916 Z -325
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 300019 1 X LIST 4658 4958 Y 916 Z -813
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 400019 1 X LIST 7406 7706 Y 916 Z -1301
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 500019 1 X LIST 9236 9536 Y 916 Z -1626
REPEAT 56 ID 300 Z -900

GENERATE 4 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -65 -65
REPEAT 1 ID 300000 X 7326 Z -1301
REPEAT 56 ID 300 Z -900

GENERATE 7 JOINTS ID 200021 1 X 2516 306 Y 916 0 Z -386 -61
REPEAT 1 ID 100000 X 2748 Z -488
REPEAT 56 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 5 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1016' 3000 FROM 100024 300000 TO 200019 300000 TO 200319 300000 TO 100324 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 8 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2019' 1000 FROM 200027 100000 TO 300019 100000 TO 300319 100000 TO 200327 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116810 100000 TO 216809 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105610 301300 TO 204309 301300
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204310 101300 TO 305609 101300

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111210 301300 TO 209909 301300
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 209910 101300 TO 311209 101300

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================
$ Define Loading
```

```
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203622 303620 FORCE Y -45.5
  205122 305120 FORCE Y -188.5
  206322 306320 FORCE Y -188.5
$ Truck 2
  303623 403621 FORCE Y -188.5
  305123 405121 FORCE Y -188.5
  306323 406321 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Delete Diaphragms
$=============================================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
ADDITIONS

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 107' ‘Type II Girder, 20° Bridge Skew, Girder Spacing 1.52 m, Span Length 22.8 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 227 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 122820, ELEMENTS EXISTING 'G-10011' TO 'G-12288'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -556

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 6 ID 100000 X 1524 Z -556
REPEAT 76 ID 300 Z -900

GENERATE 3 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -139 -139
REPEAT 5 ID 100000 X 1524 Z -556
REPEAT 76 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 4 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 5 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1015' 1000 FROM 100023 100000 TO 200019 100000 TO 200319 100000 TO 100323 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 76 ELEMENTS ID 'P-7011' 10 FROM 700019 300 TO 700020 300 TO 700320 300 TO 700319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 76 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 122808 100000 TO 222805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 107608 499600 TO 208005 499600
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 208008 300200 TO 307005 300200
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 307008 100600 TO 407605 100600

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 115208 499600 TO 215605 499600
```

```
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 215608 300200 TO 314605 300200
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 314608 100600 TO 415205 100600

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7761' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1761' BY 10 'R-1002' TO 'R-1762' BY 10 AX 5000
 'R-2001' TO 'R-2761' BY 10 'R-2002' TO 'R-2762' BY 10 AX 5000
 'R-3001' TO 'R-3761' BY 10 'R-3002' TO 'R-3762' BY 10 AX 5000

 'R-4001' TO 'R-4761' BY 10 'R-4002' TO 'R-4762' BY 10 AX 5000
 'R-5001' TO 'R-5761' BY 10 'R-5002' TO 'R-5762' BY 10 AX 5000
 'R-6001' TO 'R-6761' BY 10 'R-6002' TO 'R-6762' BY 10 AX 5000
 'R-7001' TO 'R-7761' BY 10 'R-7002' TO 'R-7762' BY 10 AX 5000

MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 107601 TO 707601 BY 100000 107602 TO 707602 BY 100000 107603 TO 707603 BY 100000 107604 TO 707604 BY 100000 -
 115201 TO 715201 BY 100000 115202 TO 715202 BY 100000 115203 TO 715203 BY 100000 115204 TO 715204 BY 100000 -
 122801 TO 722801 BY 100000 122802 TO 722802 BY 100000 122803 TO 722803 BY 100000 122804 TO 722804 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 122819 TO 722819 BY 100000 122820 TO 722820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 122801 TO 122804 222801 TO 222804 322801 TO 322804 422801 TO 422804 522801 TO 522804 622801 TO 622804 722801 TO 722804
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 107601 TO 107604 207601 TO 207604 307601 TO 307604 407601 TO 407604 507601 TO 507604 607601 TO 607604 707601 TO 707604
MOMENT X Y Z
 115201 TO 115204 215201 TO 215204 315201 TO 315204 415201 TO 415204 515201 TO 515204 615201 TO 615204 715201 TO 715204
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
MOMENT X Y


$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
```

```
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-60011' TO 'G-62288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7761' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203623 403620 FORCE Y -45.5
  205123 405120 FORCE Y -188.5
  206323 406320 FORCE Y -188.5
$ Truck 2
  403623 603620 FORCE Y -188.5
  405123 605120 FORCE Y -188.5
  406323 606320 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7761' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72283' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72284' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72285' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72288' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72288'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 108' ‘Type II Girder, 20° Bridge Skew, Girder Spacing 1.52 m, Span Length 22.8 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 227 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 122820, ELEMENTS EXISTING 'G-10011' TO 'G-12288'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -556

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 6 ID 100000 X 1524 Z -556
REPEAT 76 ID 300 Z -900

GENERATE 3 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -139 -139
REPEAT 5 ID 100000 X 1524 Z -556
REPEAT 76 ID 300 Z -900

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 4 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 5 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1015' 1000 FROM 100023 100000 TO 200019 100000 TO 200319 100000 TO 100323 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 76 ELEMENTS ID 'P-7011' 10 FROM 700019 300 TO 700020 300 TO 700320 300 TO 700319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 76 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 122808 100000 TO 222805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B3-1' 1 FROM 107608 100000 TO 207605 100000

GENERATE 6 MEMBERS ID 'B4-1' 1 FROM 115208 100000 TO 215205 100000
```

```
$===========================================================================================
$ Define Element Properties
$===========================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7761' TYPE 'SBCR' THICKNESS 200

$===========================================================================================
$ Define Member Properties
$===========================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1761' BY 10 'R-1002' TO 'R-1762' BY 10 AX 5000
 'R-2001' TO 'R-2761' BY 10 'R-2002' TO 'R-2762' BY 10 AX 5000
 'R-3001' TO 'R-3761' BY 10 'R-3002' TO 'R-3762' BY 10 AX 5000
 'R-4001' TO 'R-4761' BY 10 'R-4002' TO 'R-4762' BY 10 AX 5000
 'R-5001' TO 'R-5761' BY 10 'R-5002' TO 'R-5762' BY 10 AX 5000
 'R-6001' TO 'R-6761' BY 10 'R-6002' TO 'R-6762' BY 10 AX 5000
 'R-7001' TO 'R-7761' BY 10 'R-7002' TO 'R-7762' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$===========================================================================================
$ Define Supports
$===========================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 107601 TO 707601 BY 100000 107602 TO 707602 BY 100000 107603 TO 707603 BY 100000 107604 TO 707604 BY 100000 -
 115201 TO 715201 BY 100000 115202 TO 715202 BY 100000 115203 TO 715203 BY 100000 115204 TO 715204 BY 100000 -
 122801 TO 722801 BY 100000 122802 TO 722802 BY 100000 122803 TO 722803 BY 100000 122804 TO 722804 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 122819 TO 722819 BY 100000 122820 TO 722820 BY 100000

$===========================================================================================
$ Set Boundary Conditions
$===========================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 122801 TO 122804 222801 TO 222804 322801 TO 322804 422801 TO 422804 522801 TO 522804 622801 TO 622804 722801 TO 722804
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 107601 TO 107604 207601 TO 207604 307601 TO 307604 407601 TO 407604 507601 TO 507604 607601 TO 607604 707601 TO 707604
MOMENT X Y Z
 115201 TO 115204 215201 TO 215204 315201 TO 315204 415201 TO 415204 515201 TO 515204 615201 TO 615204 715201 TO 715204
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
MOMENT X Y


$===========================================================================================
$ Define Loading
$===========================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52288' BODY FORCES GLOBAL BY -23.5616
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  EXISTING 'G-60011' TO 'G-62288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7761' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203623 403620 FORCE Y -45.5
  205123 405120 FORCE Y -188.5
  206323 406320 FORCE Y -188.5
$ Truck 2
  403623 603620 FORCE Y -188.5
  405123 605120 FORCE Y -188.5
  406323 606320 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7761' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72283' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72284' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72285' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72288' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72288'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 109' ‘Type II Girder, 20° Bridge Skew, Girder Spacing 1.52 m, Span Length 22.8 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 227 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 122820, ELEMENTS EXISTING 'G-10011' TO 'G-12288'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -556

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 6 ID 100000 X 1524 Z -556
REPEAT 76 ID 300 Z -900

GENERATE 3 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -139 -139
REPEAT 5 ID 100000 X 1524 Z -556
REPEAT 76 ID 300 Z -900

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 4 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 5 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1015' 1000 FROM 100023 100000 TO 200019 100000 TO 200319 100000 TO 100323 100000
REPEAT 75 ID 10 FROM INCR 300 TO INCR 300

GENERATE 76 ELEMENTS ID 'P-7011' 10 FROM 700019 300 TO 700020 300 TO 700320 300 TO 700319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 76 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 122810 100000 TO 222809 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 107610 499600 TO 208009 499600
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 208010 300200 TO 307009 300200
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 307010 100600 TO 407609 100600

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 115210 499600 TO 215609 499600
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 215610 300200 TO 314609 300200
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 314610 100600 TO 415209 100600
```

```
$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72768' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6765' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7761' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1761' BY 10 'R-1002' TO 'R-1762' BY 10 AX 5000
 'R-2001' TO 'R-2761' BY 10 'R-2002' TO 'R-2762' BY 10 AX 5000
 'R-3001' TO 'R-3761' BY 10 'R-3002' TO 'R-3762' BY 10 AX 5000

 'R-4001' TO 'R-4761' BY 10 'R-4002' TO 'R-4762' BY 10 AX 5000
 'R-5001' TO 'R-5761' BY 10 'R-5002' TO 'R-5762' BY 10 AX 5000
 'R-6001' TO 'R-6761' BY 10 'R-6002' TO 'R-6762' BY 10 AX 5000
 'R-7001' TO 'R-7761' BY 10 'R-7002' TO 'R-7762' BY 10 AX 5000

MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 107601 TO 707601 BY 100000 107602 TO 707602 BY 100000 107603 TO 707603 BY 100000 107604 TO 707604 BY 100000 -
 115201 TO 715201 BY 100000 115202 TO 715202 BY 100000 115203 TO 715203 BY 100000 115204 TO 715204 BY 100000 -
 122801 TO 722801 BY 100000 122802 TO 722802 BY 100000 122803 TO 722803 BY 100000 122804 TO 722804 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 122819 TO 722819 BY 100000 122820 TO 722820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 122801 TO 122804 222801 TO 222804 322801 TO 322804 422801 TO 422804 522801 TO 522804 622801 TO 622804 722801 TO 722804
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 107601 TO 107604 207601 TO 207604 307601 TO 307604 407601 TO 407604 507601 TO 507604 607601 TO 607604 707601 TO 707604
MOMENT X Y Z
 115201 TO 115204 215201 TO 215204 315201 TO 315204 415201 TO 415204 515201 TO 515204 615201 TO 615204 715201 TO 715204
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 122819 TO 122820 222819 TO 222820 322819 TO 322820 422819 TO 422820 522819 TO 522820 622819 TO 622820 722819 TO 722820
MOMENT X Y


$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12288' BODY FORCES GLOBAL BY -23.5616
```

```
  EXISTING 'G-20011' TO 'G-22288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-60011' TO 'G-62288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72288' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6765' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7761' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203623 403620 FORCE Y -45.5
  205123 405120 FORCE Y -188.5
  206323 406320 FORCE Y -188.5
$ Truck 2
  403623 603620 FORCE Y -188.5
  405123 605120 FORCE Y -188.5
  406323 606320 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6765' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7761' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72283' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72284' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72285' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72288' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'    SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'     SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'   SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'   SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'    SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'     SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'             SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'               SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Delete Diaphragms
$=============================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
ADDITIONS

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72288'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 110' ‘Type II Girder, 20° Bridge Skew, Girder Spacing 2.75 m, Span Length 16.8 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -665

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2748 Z -1000

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -665

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 200019 1 X LIST 1910 2210 Y 916 Z -665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 300019 1 X LIST 4658 4958 Y 916 Z -1665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 400019 1 X LIST 7406 7706 Y 916 Z -2665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 500019 1 X LIST 9236 9536 Y 916 Z -3330
REPEAT 56 ID 300 Z -900

GENERATE 4 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -133 -133
REPEAT 1 ID 300000 X 7326 Z -2665
REPEAT 56 ID 300 Z -900

GENERATE 7 JOINTS ID 200021 1 X 2516 306 Y 916 0 Z -790 -125
REPEAT 1 ID 100000 X 2748 Z -1000
REPEAT 56 ID 300 Z -900

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 5 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1016' 3000 FROM 100024 300000 TO 200019 300000 TO 200319 300000 TO 100324 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 8 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2019' 1000 FROM 200027 100000 TO 300019 100000 TO 300319 100000 TO 200327 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 301200 TO 204405 301200
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204408 101200 TO 305605 101200

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 301200 TO 210005 301200
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 210008 101200 TO 311205 101200

$=============================================================================================================
$ Define Element Properties
$=============================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================================
$ Define Member Properties
$=============================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================================
$ Define Supports
$=============================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================================
$ Set Boundary Conditions
$=============================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================================
```

```
$ Define Loading
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
   EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
   MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
   203622 303620 FORCE Y -45.5
   205122 305120 FORCE Y -188.5
   206322 306320 FORCE Y -188.5
$ Truck 2
   303623 403621 FORCE Y -188.5
   305123 405121 FORCE Y -188.5
   306323 406321 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
   EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
   'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
   'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
   'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
   'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 111' ‘Type II Girder, 20° Bridge Skew, Girder Spacing 2.75 m, Span Length 16.8 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300


$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -665

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2748 Z -1000

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -665

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 200019 1 X LIST 1910 2210 Y 916 Z -665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 300019 1 X LIST 4658 4958 Y 916 Z -1665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 400019 1 X LIST 7406 7706 Y 916 Z -2665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 500019 1 X LIST 9236 9536 Y 916 Z -3330
REPEAT 56 ID 300 Z -900

GENERATE 4 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -133 -133
REPEAT 1 ID 300000 X 7326 Z -2665
REPEAT 56 ID 300 Z -900

GENERATE 7 JOINTS ID 200021 1 X 2516 306 Y 916 0 Z -790 -125
REPEAT 1 ID 100000 X 2748 Z -1000
REPEAT 56 ID 300 Z -900

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 5 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1016' 3000 FROM 100024 300000 TO 200019 300000 TO 200319 300000 TO 100324 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 8 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2019' 1000 FROM 200027 100000 TO 300019 100000 TO 300319 100000 TO 200327 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300
```

```
$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B3-1' 1 FROM 105608 100000 TO 205605 100000

GENERATE 4 MEMBERS ID 'B4-1' 1 FROM 111208 100000 TO 211205 100000

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
```

```
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203622 303620 FORCE Y -45.5
  205122 305120 FORCE Y -188.5
  206322 306320 FORCE Y -188.5
$ Truck 2
  303623 403621 FORCE Y -188.5
  305123 405121 FORCE Y -188.5
  306323 406321 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0

$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7765'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42288'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52288'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 112' ‘Type II Girder, 20° Bridge Skew, Girde r Spacing 2.75 m, Span Length 16.8 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 155 305 460 Z 0
REPEAT 1 ID 4 Y 150
REPEAT 1 ID 100 Z -300

GENERATE 2 JOINTS ID 100009 1 X 155 150 Y 455 Z 0
REPEAT 1 ID 100 Z -300

GENERATE 4 JOINTS ID 100011 1 X LIST 80 155 305 380 Y 760 Z 0
REPEAT 1 ID 4 Y 155
REPEAT 1 ID 100 Z -300

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -300

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -665

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2748 Z -1000

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -665

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 80 380 Y 916 Z 0
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 200019 1 X LIST 1910 2210 Y 916 Z -665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 300019 1 X LIST 4658 4958 Y 916 Z -1665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 400019 1 X LIST 7406 7706 Y 916 Z -2665
REPEAT 56 ID 300 Z -900
GENERATE 2 JOINTS ID 500019 1 X LIST 9236 9536 Y 916 Z -3330
REPEAT 56 ID 300 Z -900

GENERATE 4 JOINTS ID 100021 1 X 686 306 Y 916 0 Z -133 -133
REPEAT 1 ID 300000 X 7326 Z -2665
REPEAT 56 ID 300 Z -900

GENERATE 7 JOINTS ID 200021 1 X 2516 306 Y 916 0 Z -790 -125
REPEAT 1 ID 100000 X 2748 Z -1000
REPEAT 56 ID 300 Z -900

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 5 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1016' 3000 FROM 100024 300000 TO 200019 300000 TO 200319 300000 TO 100324 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 8 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2019' 1000 FROM 200027 100000 TO 300019 100000 TO 300319 100000 TO 200327 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116810 100000 TO 216809 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105610 301200 TO 204409 301200
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204410 101200 TO 305609 101200

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111210 301200 TO 210009 301200
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 210010 101200 TO 311209 101200

$=============================================================================================================
$ Define Element Properties
$=============================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================================
$ Define Member Properties
$=============================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================================
$ Define Supports
$=============================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================================
$ Set Boundary Conditions
$=============================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================================
$ Define Loading
```

```
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  203622 303620 FORCE Y -45.5
  205122 305120 FORCE Y -188.5
  206322 306320 FORCE Y -188.5
$ Truck 2
  303623 403621 FORCE Y -188.5
  305123 405121 FORCE Y -188.5
  306323 406321 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Delete Diaphragms
$=============================================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
ADDITIONS

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 113' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION'  JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 203 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 120418, ELEMENTS EXISTING 'G-10011' TO 'G-12048'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 68 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -134 -268
REPEAT 68 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 68 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 120408 100000 TO 220405 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 106808 300000 TO 206905 300300
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 206908 300300 TO 306405 300300
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306408 300300 TO 406805 300000

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 113608 300000 TO 213705 300300
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 213708 300300 TO 313205 300300
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 313208 300300 TO 413605 300000
```

```
$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106801 TO 706801 BY 100000 106802 TO 706802 BY 100000 106803 TO 706803 BY 100000 106804 TO 706804 BY 100000 -
 113601 TO 713601 BY 100000 113602 TO 713602 BY 100000 113603 TO 713603 BY 100000 113604 TO 713604 BY 100000 -
 120401 TO 720401 BY 100000 120402 TO 720402 BY 100000 120403 TO 720403 BY 100000 120404 TO 720404 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120419 TO 720419 BY 100000 120420 TO 720420 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120401 TO 120404 220401 TO 220404 320401 TO 320404 420401 TO 420404 520401 TO 520404 620401 TO 620404 720401 TO 720404
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106801 TO 106804 206801 TO 206804 306801 TO 306804 406801 TO 406804 506801 TO 506804 606801 TO 606804 706801 TO 706804
MOMENT X Y Z
 113601 TO 113604 213601 TO 213604 313601 TO 313604 413601 TO 413604 513601 TO 513604 613601 TO 613604 713601 TO 713604
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52048' BODY FORCES GLOBAL BY -23.5616
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  EXISTING 'G-60011' TO 'G-62048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72043' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72044' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72045' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72048' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72048'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 114' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 203 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 120418, ELEMENTS EXISTING 'G-10011' TO 'G-12048'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 68 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -134 -268
REPEAT 68 ID 300 Z -1500

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 68 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 120408 100000 TO 220405 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 106808 300000 TO 206805 300000
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 206808 300000 TO 306805 300000
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306808 300000 TO 406805 300000

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 113608 300000 TO 213605 300000
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 213608 300000 TO 313605 300000
```

```
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 313608 300000 TO 413605 300000

$=============================================================================================================
$ Define Element Properties
$=============================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$=============================================================================================================
$ Define Member Properties
$=============================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================================
$ Define Supports
$=============================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106801 TO 706801 BY 100000 106802 TO 706802 BY 100000 106803 TO 706803 BY 100000 106804 TO 706804 BY 100000 -
 113601 TO 713601 BY 100000 113602 TO 713602 BY 100000 113603 TO 713603 BY 100000 113604 TO 713604 BY 100000 -
 120401 TO 720401 BY 100000 120402 TO 720402 BY 100000 120403 TO 720403 BY 100000 120404 TO 720404 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120419 TO 720419 BY 100000 120420 TO 720420 BY 100000

$=============================================================================================================
$ Set Boundary Conditions
$=============================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120401 TO 120404 220401 TO 220404 320401 TO 320404 420401 TO 420404 520401 TO 520404 620401 TO 620404 720401 TO 720404
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106801 TO 106804 206801 TO 206804 306801 TO 306804 406801 TO 406804 506801 TO 506804 606801 TO 606804 706801 TO 706804
MOMENT X Y Z
 113601 TO 113604 213601 TO 213604 313601 TO 313604 413601 TO 413604 513601 TO 513604 613601 TO 613604 713601 TO 713604
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
MOMENT X Y

$=============================================================================================================
$ Define Loading
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52048' BODY FORCES GLOBAL BY -23.5616
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  EXISTING 'G-60011' TO 'G-62048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72043' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72044' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72045' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72048' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72048'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 115' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 203 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 120418, ELEMENTS EXISTING 'G-10011' TO 'G-12048'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 68 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -134 -268
REPEAT 68 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 68 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 120410 100000 TO 220409 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 106810 300000 TO 206909 300300
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 206910 300300 TO 306409 300300
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306410 300300 TO 406809 300000

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 113610 300000 TO 213709 300300
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 213710 300300 TO 313209 300300
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 313210 300300 TO 413609 300000
```

```
$===========================================================================================================
$ Define Element Properties
$===========================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$===========================================================================================================
$ Define Member Properties
$===========================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$===========================================================================================================
$ Define Supports
$===========================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106801 TO 706801 BY 100000 106802 TO 706802 BY 100000 106803 TO 706803 BY 100000 106804 TO 706804 BY 100000 -
 113601 TO 713601 BY 100000 113602 TO 713602 BY 100000 113603 TO 713603 BY 100000 113604 TO 713604 BY 100000 -
 120401 TO 720401 BY 100000 120402 TO 720402 BY 100000 120403 TO 720403 BY 100000 120404 TO 720404 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120419 TO 720419 BY 100000 120420 TO 720420 BY 100000

$===========================================================================================================
$ Set Boundary Conditions
$===========================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120401 TO 120404 220401 TO 220404 320401 TO 320404 420401 TO 420404 520401 TO 520404 620401 TO 620404 720401 TO 720404
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106801 TO 106804 206801 TO 206804 306801 TO 306804 406801 TO 406804 506801 TO 506804 606801 TO 606804 706801 TO 706804
MOMENT X Y Z
 113601 TO 113604 213601 TO 213604 313601 TO 313604 413601 TO 413604 513601 TO 513604 613601 TO 613604 713601 TO 713604
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
MOMENT X Y

$===========================================================================================================
$ Define Loading
$===========================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52048' BODY FORCES GLOBAL BY -23.5616
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  EXISTING 'G-60011' TO 'G-62048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72043' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72044' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72045' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72048' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Delete Diaphragms
$=============================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
ADDITIONS

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72048'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 116' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 2.75 m, Span Length 28.0 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -324

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2750 Z -485

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -324

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 200019 1 X LIST 1905 2415 Y 1371 Z -324
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 300019 1 X LIST 4655 5163 Y 1371 Z -809
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 400019 1 X LIST 7405 7911 Y 1371 Z -1294
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 500019 1 X LIST 9235 9741 Y 1371 Z -1618
REPEAT 56 ID 300 Z -1500

GENERATE 2 JOINTS ID 100021 1 X 1025 440 Y 1371 0 Z -108 -108
REPEAT 1 ID 300000 X 7330 Z -1294
REPEAT 56 ID 300 Z -1500

GENERATE 4 JOINTS ID 200021 1 X 2863 448 Y 1371 0 Z -421 -97
REPEAT 1 ID 100000 X 2750 Z -485
REPEAT 56 ID 300 Z -1500

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 3 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1014' 3000 FROM 100022 300000 TO 200019 300000 TO 200319 300000 TO 100322 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 5 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2016' 1000 FROM 200024 100000 TO 300019 100000 TO 300319 100000 TO 200324 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 300800 TO 204805 300800
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204808 100800 TO 305605 100800

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 300800 TO 210405 300800
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 210408 100800 TO 311205 100800

$=============================================================================================================
$ Define Element Properties
$=============================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================================
$ Define Member Properties
$=============================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================================
$ Define Supports
$=============================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -


 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================================
$ Set Boundary Conditions
$=============================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================================
```

```
$ Define Loading
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  202122 302120 FORCE Y -45.5
  203022 303020 FORCE Y -188.5
  203922 303920 FORCE Y -188.5
$ Truck 2
  302123 402121 FORCE Y -188.5
  303023 403021 FORCE Y -188.5
  303923 403921 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 117' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 2.75 m, Span Length 28.0 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -324

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2750 Z -485

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -324

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 200019 1 X LIST 1905 2415 Y 1371 Z -324
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 300019 1 X LIST 4655 5163 Y 1371 Z -809
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 400019 1 X LIST 7405 7911 Y 1371 Z -1294
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 500019 1 X LIST 9235 9741 Y 1371 Z -1618
REPEAT 56 ID 300 Z -1500

GENERATE 2 JOINTS ID 100021 1 X 1025 440 Y 1371 0 Z -108 -108
REPEAT 1 ID 300000 X 7330 Z -1294
REPEAT 56 ID 300 Z -1500

GENERATE 4 JOINTS ID 200021 1 X 2863 448 Y 1371 0 Z -421 -97
REPEAT 1 ID 100000 X 2750 Z -485
REPEAT 56 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 3 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1014' 3000 FROM 100022 300000 TO 200019 300000 TO 200319 300000 TO 100322 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 5 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2016' 1000 FROM 200024 100000 TO 300019 100000 TO 300319 100000 TO 200324 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300
```

```
$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 300200 TO 205405 300200
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 205408 100200 TO 305605 100200

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 300200 TO 211005 300200
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 211008 100200 TO 311205 100200

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -


 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================
```

```
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  202122 302120 FORCE Y -45.5
  203022 303020 FORCE Y -188.5
  203922 303920 FORCE Y -188.5
$ Truck 2
  302123 402121 FORCE Y -188.5
  303023 403021 FORCE Y -188.5
  303923 403921 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 118' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 2.75 m, Span Length 28.0 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -324

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2750 Z -485

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -324

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 200019 1 X LIST 1905 2415 Y 1371 Z -324
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 300019 1 X LIST 4655 5163 Y 1371 Z -809
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 400019 1 X LIST 7405 7911 Y 1371 Z -1294
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 500019 1 X LIST 9235 9741 Y 1371 Z -1618
REPEAT 56 ID 300 Z -1500

GENERATE 2 JOINTS ID 100021 1 X 1025 440 Y 1371 0 Z -108 -108
REPEAT 1 ID 300000 X 7330 Z -1294
REPEAT 56 ID 300 Z -1500

GENERATE 4 JOINTS ID 200021 1 X 2863 448 Y 1371 0 Z -421 -97
REPEAT 1 ID 100000 X 2750 Z -485
REPEAT 56 ID 300 Z -1500

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 3 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1014' 3000 FROM 100022 300000 TO 200019 300000 TO 200319 300000 TO 100322 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 5 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2016' 1000 FROM 200024 100000 TO 300019 100000 TO 300319 100000 TO 200324 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116810 100000 TO 216809 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105610 300800 TO 204809 300800
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204810 100800 TO 305609 100800

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111210 300800 TO 210409 300800
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 210410 100800 TO 311209 100800

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -


 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================
```

```
$ Define Loading
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
   EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
   EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
   MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
   202122 302120 FORCE Y -45.5
   203022 303020 FORCE Y -188.5
   203922 303920 FORCE Y -188.5
$ Truck 2
   302123 402121 FORCE Y -188.5
   303023 403021 FORCE Y -188.5
   303923 403921 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
   EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
   EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
   'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
   'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
   'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
   'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Delete Diaphragms
$=============================================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
ADDITIONS

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 119' ‘Type IV Girder, 20° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================================
$ Generate Girder Brick Elements
$=============================================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 203 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 120418, ELEMENTS EXISTING 'G-10011' TO 'G-12048'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -556

$=============================================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -556
REPEAT 68 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -278 -556
REPEAT 68 ID 300 Z -1500

$=============================================================================================================
$ Generate Deck Plate Elements
$=============================================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 68 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 120408 100000 TO 220405 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 106808 300000 TO 207005 300100
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 207008 300100 TO 306505 300100
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306508 300100 TO 406805 300000

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 113608 300000 TO 213805 300100
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 213808 300100 TO 313305 300100
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 313308 300100 TO 413605 300000
```

```
$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106801 TO 706801 BY 100000 106802 TO 706802 BY 100000 106803 TO 706803 BY 100000 106804 TO 706804 BY 100000 -
 113601 TO 713601 BY 100000 113602 TO 713602 BY 100000 113603 TO 713603 BY 100000 113604 TO 713604 BY 100000 -
 120401 TO 720401 BY 100000 120402 TO 720402 BY 100000 120403 TO 720403 BY 100000 120404 TO 720404 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120419 TO 720419 BY 100000 120420 TO 720420 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120401 TO 120404 220401 TO 220404 320401 TO 320404 420401 TO 420404 520401 TO 520404 620401 TO 620404 720401 TO 720404
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106801 TO 106804 206801 TO 206804 306801 TO 306804 406801 TO 406804 506801 TO 506804 606801 TO 606804 706801 TO 706804
MOMENT X Y Z
 113601 TO 113604 213601 TO 213604 313601 TO 313604 413601 TO 413604 513601 TO 513604 613601 TO 613604 713601 TO 713604
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52048' BODY FORCES GLOBAL BY -23.5616
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  EXISTING 'G-60011' TO 'G-62048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72043' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72044' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72045' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72048' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72048'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 120' ‘Type IV Girder, 20° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 203 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 120418, ELEMENTS EXISTING 'G-10011' TO 'G-12048'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -556

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -556
REPEAT 68 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -278 -556
REPEAT 68 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 68 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 120408 100000 TO 220405 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 106808 300000 TO 206805 300000
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 206808 300000 TO 306805 300000
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306808 300000 TO 406805 300000

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 113608 300000 TO 213605 300000
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 213608 300000 TO 313605 300000
```

```
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 313608 300000 TO 413605 300000

$=============================================================================================================
$ Define Element Properties
$=============================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$=============================================================================================================
$ Define Member Properties
$=============================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================================
$ Define Supports
$=============================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106801 TO 706801 BY 100000 106802 TO 706802 BY 100000 106803 TO 706803 BY 100000 106804 TO 706804 BY 100000 -
 113601 TO 713601 BY 100000 113602 TO 713602 BY 100000 113603 TO 713603 BY 100000 113604 TO 713604 BY 100000 -
 120401 TO 720401 BY 100000 120402 TO 720402 BY 100000 120403 TO 720403 BY 100000 120404 TO 720404 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120419 TO 720419 BY 100000 120420 TO 720420 BY 100000

$=============================================================================================================
$ Set Boundary Conditions
$=============================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120401 TO 120404 220401 TO 220404 320401 TO 320404 420401 TO 420404 520401 TO 520404 620401 TO 620404 720401 TO 720404
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106801 TO 106804 206801 TO 206804 306801 TO 306804 406801 TO 406804 506801 TO 506804 606801 TO 606804 706801 TO 706804
MOMENT X Y Z
 113601 TO 113604 213601 TO 213604 313601 TO 313604 413601 TO 413604 513601 TO 513604 613601 TO 613604 713601 TO 713604
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
MOMENT X Y

$=============================================================================================================
$ Define Loading
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52048' BODY FORCES GLOBAL BY -23.5616
```

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  EXISTING 'G-60011' TO 'G-62048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72043' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72044' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72045' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72048' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72048'

LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 121' ‘Type IV Girder, 20° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 203 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 120418, ELEMENTS EXISTING 'G-10011' TO 'G-12048'
COPY OBJECT 'GIRDER A' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -556

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -556
REPEAT 68 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -278 -556
REPEAT 68 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 67 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 6 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 68 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 6 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 6 MEMBERS ID 'B5-1' 1 FROM 120410 100000 TO 220409 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 5 FROM 106810 300000 TO 207009 300100
GENERATE 2 MEMBERS ID 'B3-2' 3 FROM 207010 300100 TO 306509 300100
GENERATE 2 MEMBERS ID 'B3-3' 1 FROM 306510 300100 TO 406809 300000

GENERATE 2 MEMBERS ID 'B4-1' 5 FROM 113610 300000 TO 213809 300100
GENERATE 2 MEMBERS ID 'B4-2' 3 FROM 213810 300100 TO 313309 300100
GENERATE 2 MEMBERS ID 'B4-3' 1 FROM 313310 300100 TO 413609 300000
```

```
$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-12048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-22048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-32048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-42048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-52048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-62048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-72048' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-6' AX 219600
 'B3-1' TO 'B3-6' AX 219600
 'B4-1' TO 'B4-6' AX 219600
 'B5-1' TO 'B5-6' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106801 TO 706801 BY 100000 106802 TO 706802 BY 100000 106803 TO 706803 BY 100000 106804 TO 706804 BY 100000 -
 113601 TO 713601 BY 100000 113602 TO 713602 BY 100000 113603 TO 713603 BY 100000 113604 TO 713604 BY 100000 -
 120401 TO 720401 BY 100000 120402 TO 720402 BY 100000 120403 TO 720403 BY 100000 120404 TO 720404 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120419 TO 720419 BY 100000 120420 TO 720420 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120401 TO 120404 220401 TO 220404 320401 TO 320404 420401 TO 420404 520401 TO 520404 620401 TO 620404 720401 TO 720404
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106801 TO 106804 206801 TO 206804 306801 TO 306804 406801 TO 406804 506801 TO 506804 606801 TO 606804 706801 TO 706804
MOMENT X Y Z
 113601 TO 113604 213601 TO 213604 313601 TO 313604 413601 TO 413604 513601 TO 513604 613601 TO 613604 713601 TO 713604
MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120419 TO 120420 220419 TO 220420 320419 TO 320420 420419 TO 420420 520419 TO 520420 620419 TO 620420 720419 TO 720420
MOMENT X Y

$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-12048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-22048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-32048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-42048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-52048' BODY FORCES GLOBAL BY -23.5616
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  EXISTING 'G-60011' TO 'G-62048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-72048' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-72043' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-72044' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-72045' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-72048' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Delete Diaphragms
$=============================================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
ADDITIONS

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-12048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-22048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-32048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-42048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-52048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-62048'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-72048'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-6' 'B3-1' TO 'B3-6' 'B4-1' TO 'B4-6' 'B5-1' TO 'B5-6'
```

STRUDL 'Model 122' ‘Type IV Girder, 20° Bridge Skew, Girder Spacing 2.75 m, Span Length 28.0 m, 30° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -666

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2750 Z -1000

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -666

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 200019 1 X LIST 1905 2415 Y 1371 Z -666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 300019 1 X LIST 4655 5163 Y 1371 Z -1666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 400019 1 X LIST 7405 7911 Y 1371 Z -2666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 500019 1 X LIST 9235 9741 Y 1371 Z -3332
REPEAT 56 ID 300 Z -1500

GENERATE 2 JOINTS ID 100021 1 X 1025 440 Y 1371 0 Z -222 -222
REPEAT 1 ID 300000 X 7330 Z -2666
REPEAT 56 ID 300 Z -1500

GENERATE 4 JOINTS ID 200021 1 X 2863 448 Y 1371 0 Z -866 -200
REPEAT 1 ID 100000 X 2750 Z -1000
REPEAT 56 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 3 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1014' 3000 FROM 100022 300000 TO 200019 300000 TO 200319 300000 TO 100322 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 5 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2016' 1000 FROM 200024 100000 TO 300019 100000 TO 300319 100000 TO 200324 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 300700 TO 204905 300700
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204908 100700 TO 305605 100700

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 300700 TO 210505 300700
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 210508 100700 TO 311205 100700

$=============================================================================================================
$ Define Element Properties
$=============================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================================
$ Define Member Properties
$=============================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================================
$ Define Supports
$=============================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================================
$ Set Boundary Conditions
$=============================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================================
$ Define Loading
```

```
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  202122 302120 FORCE Y -45.5
  203022 303020 FORCE Y -188.5
  203922 303920 FORCE Y -188.5
$ Truck 2
  302123 402121 FORCE Y -188.5
  303023 403021 FORCE Y -188.5
  303923 403921 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 123' ‘Type IV Girder, 20° Bridge Skew, Girder Spacing 2.75 m, Span Length 28.0 m, 65° Diaphragm Skew’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -666

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2750 Z -1000

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -666

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 200019 1 X LIST 1905 2415 Y 1371 Z -666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 300019 1 X LIST 4655 5163 Y 1371 Z -1666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 400019 1 X LIST 7405 7911 Y 1371 Z -2666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 500019 1 X LIST 9235 9741 Y 1371 Z -3332
REPEAT 56 ID 300 Z -1500

GENERATE 2 JOINTS ID 100021 1 X 1025 440 Y 1371 0 Z -222 -222
REPEAT 1 ID 300000 X 7330 Z -2666
REPEAT 56 ID 300 Z -1500

GENERATE 4 JOINTS ID 200021 1 X 2863 448 Y 1371 0 Z -866 -200
REPEAT 1 ID 100000 X 2750 Z -1000
REPEAT 56 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 3 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1014' 3000 FROM 100022 300000 TO 200019 300000 TO 200319 300000 TO 100322 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 5 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2016' 1000 FROM 200024 100000 TO 300019 100000 TO 300319 100000 TO 200324 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300
```

```
$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Top of Bottom Flange
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100008 100000 TO 200005 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116808 100000 TO 216805 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105608 300000 TO 205605 300000
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 205608 100000 TO 305605 100000

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111208 300000 TO 211205 300000
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 211208 100000 TO 311205 100000

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================
$ Define Loading
```

```
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  202122 302120 FORCE Y -45.5
  203022 303020 FORCE Y -188.5
  203922 303920 FORCE Y -188.5
$ Truck 2
  302123 402121 FORCE Y -188.5
  303023 403021 FORCE Y -188.5
  303923 403921 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 124' ‘Type IV Girder, 20° Bridge Skew, Girder Spacing 2.75 m, Span Length 28.0 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 167 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER A' JOINTS EXISTING 100001 TO 116818, ELEMENTS EXISTING 'G-10011' TO 'G-11688'
COPY OBJECT 'GIRDER A' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -666

DEFINE OBJECT 'GIRDER B' JOINTS EXISTING 200001 TO 216818, ELEMENTS EXISTING 'G-20011' TO 'G-21688'
COPY OBJECT 'GIRDER B' REPEAT 2 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 2750 Z -1000

DEFINE OBJECT 'GIRDER D' JOINTS EXISTING 400001 TO 416818, ELEMENTS EXISTING 'G-40011' TO 'G-41688'
COPY OBJECT 'GIRDER D' REPEAT 1 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1830 Z -666

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 200019 1 X LIST 1905 2415 Y 1371 Z -666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 300019 1 X LIST 4655 5163 Y 1371 Z -1666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 400019 1 X LIST 7405 7911 Y 1371 Z -2666
REPEAT 56 ID 300 Z -1500
GENERATE 2 JOINTS ID 500019 1 X LIST 9235 9741 Y 1371 Z -3332
REPEAT 56 ID 300 Z -1500

GENERATE 2 JOINTS ID 100021 1 X 1025 440 Y 1371 0 Z -222 -222
REPEAT 1 ID 300000 X 7330 Z -2666
REPEAT 56 ID 300 Z -1500

GENERATE 4 JOINTS ID 200021 1 X 2863 448 Y 1371 0 Z -866 -200
REPEAT 1 ID 100000 X 2750 Z -1000
REPEAT 56 ID 300 Z -1500

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 3 ELEMENTS ID 'P-1011' 1 FROM 100019 1 TO 100020 1 TO 100320 1 TO 100319 1
REPEAT 1 ID 3000 FROM INCR 300000 TO INCR 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-1014' 3000 FROM 100022 300000 TO 200019 300000 TO 200319 300000 TO 100322 300000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 5 ELEMENTS ID 'P-2011' 1 FROM 200019 1 TO 200020 1 TO 200320 1 TO 200319 1
REPEAT 1 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300

GENERATE 2 ELEMENTS ID 'P-2016' 1000 FROM 200024 100000 TO 300019 100000 TO 300319 100000 TO 200324 100000
REPEAT 55 ID 10 FROM INCR 300 TO INCR 300
```

```
GENERATE 56 ELEMENTS ID 'P-5011' 10 FROM 500019 300 TO 500020 300 TO 500320 300 TO 500319 300

$=============================================================================================
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=============================================================================================
TYPE SPACE TRUSS

GENERATE 2 MEMBERS ID 'R-1001' 1 FROM 100015 3 TO 100019 1
REPEAT 4 ID 1000 FROM INCR 100000 TO INCR 100000
REPEAT 56 ID 10 FROM INCR 300 TO INCR 300

$=============================================================================================
$ Generate Diaphragm Members at Mid Height of Web
$=============================================================================================
$ END DIAPHRAGMS
GENERATE 4 MEMBERS ID 'B2-1' 1 FROM 100010 100000 TO 200009 100000
GENERATE 4 MEMBERS ID 'B5-1' 1 FROM 116810 100000 TO 216809 100000

$ INTERMEDIATE DIAPHRAGMS
GENERATE 2 MEMBERS ID 'B3-1' 3 FROM 105610 300700 TO 204909 300700
GENERATE 2 MEMBERS ID 'B3-2' 1 FROM 204910 100700 TO 305609 100700

GENERATE 2 MEMBERS ID 'B4-1' 3 FROM 111210 300700 TO 210509 300700
GENERATE 2 MEMBERS ID 'B4-2' 1 FROM 210510 100700 TO 311209 100700

$=============================================================================================
$ Define Element Properties
$=============================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51688' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3569' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4566' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5561' TYPE 'SBCR' THICKNESS 200

$=============================================================================================
$ Define Member Properties
$=============================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1561' BY 10 'R-1002' TO 'R-1562' BY 10 AX 5000
 'R-2001' TO 'R-2561' BY 10 'R-2002' TO 'R-2562' BY 10 AX 5000
 'R-3001' TO 'R-3561' BY 10 'R-3002' TO 'R-3562' BY 10 AX 5000
 'R-4001' TO 'R-4561' BY 10 'R-4002' TO 'R-4562' BY 10 AX 5000
 'R-5001' TO 'R-5561' BY 10 'R-5002' TO 'R-5562' BY 10 AX 5000
MEMBER PROPERTIES PRISMATIC
 'B2-1' TO 'B2-4' AX 219600
 'B3-1' TO 'B3-4' AX 219600
 'B4-1' TO 'B4-4' AX 219600
 'B5-1' TO 'B5-4' AX 219600

$=============================================================================================
$ Define Supports
$=============================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 500001 BY 100000 100002 TO 500002 BY 100000 100003 TO 500003 BY 100000 100004 TO 500004 BY 100000 -
 105601 TO 505601 BY 100000 105602 TO 505602 BY 100000 105603 TO 505603 BY 100000 105604 TO 505604 BY 100000 -
 111201 TO 511201 BY 100000 111202 TO 511202 BY 100000 111203 TO 511203 BY 100000 111204 TO 511204 BY 100000 -
 116801 TO 516801 BY 100000 116802 TO 516802 BY 100000 116803 TO 516803 BY 100000 116804 TO 516804 BY 100000 -

 100019 TO 500019 BY 100000 100020 TO 500020 BY 100000 -
 116819 TO 516819 BY 100000 116820 TO 516820 BY 100000

$=============================================================================================
$ Set Boundary Conditions
$=============================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 MOMENT X Y
 116801 TO 116804 216801 TO 216804 316801 TO 316804 416801 TO 416804 516801 TO 516804 MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 105601 TO 105604 205601 TO 205604 305601 TO 305604 405601 TO 405604 505601 TO 505604 MOMENT X Y Z
 111201 TO 111204 211201 TO 211204 311201 TO 311204 411201 TO 411204 511201 TO 511204 MOMENT X Y Z


$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 FORCE Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 MOMENT X Y
 116819 TO 116820 216819 TO 216820 316819 TO 316820 416819 TO 416820 516819 TO 516820 MOMENT X Y

$=============================================================================================
$ Define Loading
```

```
$=============================================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'
 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51688' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3569' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4566' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5561' BODY FORCES GLOBAL BY -23.5616
DEAD LOAD 'DC2' 'DEAD LOAD STRUCTURAL COMPONENTS OF MEMBERS' DIRECTION -Y -
  MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  202122 302120 FORCE Y -45.5
  203022 303020 FORCE Y -188.5
  203922 303920 FORCE Y -188.5
$ Truck 2
  302123 402121 FORCE Y -188.5
  303023 403021 FORCE Y -188.5
  303923 403921 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3569' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4566' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5561' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-50013' TO 'G-51683' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50014' TO 'G-51684' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50015' TO 'G-51685' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-50018' TO 'G-51688' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================================
$ Factored Loads
$=============================================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'  SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'  SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'   SPECS 'DC1' 0.9  'DC2' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'    SPECS 'DC1' 1.25 'DC2' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'            SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'           SPECS 'DC1' 1.0  'DC2' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'              SPECS 'DC1' 0.0  'DC2' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================================
$ Delete Diaphragms
$=============================================================================================================
DELETIONS
MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
ADDITIONS

$=============================================================================================================
$ Prepare and Generate Output
$=============================================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-5565'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41688'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51688'

$LIST FORCES MEMBERS 'B2-1' TO 'B2-4' 'B3-1' TO 'B3-4' 'B4-1' TO 'B4-4' 'B5-1' TO 'B5-4'
```

STRUDL 'Model 125' ‘Type IV Girder, 10° Bridge Skew, Girder Spacing 1.52 m, Span Length 34.0 m, No Diaphragm’

```
UNITS MM
PRINT GENERATE OFF

$=============================================================================================
$ Generate Joints to Connect Girder Brick Elements
$=============================================================================================
GENERATE 4 JOINTS ID 100001 1 X LIST 0 230 430 660 Y 0 Z 0
REPEAT 1 ID 4 Y 205
REPEAT 1 ID 100 Z -500

GENERATE 2 JOINTS ID 100009 1 X LIST 230 430 Y 687.5 Z 0
REPEAT 1 ID 100 Z -500

GENERATE 4 JOINTS ID 100011 1 X LIST 75 230 430 585 Y 1170 Z 0
REPEAT 1 ID 4 Y 200
REPEAT 1 ID 100 Z -500

$=============================================================================================
$ Generate Girder Brick Elements
$=============================================================================================
TYPE TRIDEMINSIONAL
GENERATE 3 ELEMENTS ID 'G-10011' 1 FROM 100001 1 TO 100002 1 TO 100006 1 TO 100005 1 TO 100101 1 TO 100102 1 TO 100106 1 TO
100105 1
GENERATE 2 ELEMENTS ID 'G-10014' 1 FROM 100006 3 TO 100007 3 TO 100010 3 TO 100009 3 TO 100106 3 TO 100107 3 TO 100110 3 TO
100109 3
GENERATE 3 ELEMENTS ID 'G-10016' 1 FROM 100011 1 TO 100012 1 TO 100016 1 TO 100015 1 TO 100111 1 TO 100112 1 TO 100116 1 TO
100115 1

$=============================================================================================
$ Copy Generated Girder Section and Copy it Down Entire Length of Bridge
$=============================================================================================
DEFINE OBJECT 'SECTION' JOINTS 100001 TO 100018 100101 TO 100118, ELEMENTS 'G-10011' TO 'G-10018'
COPY OBJECT 'SECTION' REPEAT 65 TIMES JOINT INCR 100 ELEMENT INCR 10 TRANSLATE Z -500

DEFINE OBJECT 'SPAN' JOINTS EXISTING 100001 TO 106618, ELEMENTS EXISTING 'G-10011' TO 'G-10668'
COPY OBJECT 'SPAN' REPEAT 2 TIMES JOINT INCR 6700 ELEMENT INCR 660 TRANSLATE Z -33050

$=============================================================================================
$ Copy Generated Girder and Copy it Across The Entire Width of Bridge
$=============================================================================================
DEFINE OBJECT 'GIRDER' JOINTS EXISTING 100001 TO 120018, ELEMENTS EXISTING 'G-10011' TO 'G-11988'
COPY OBJECT 'GIRDER' REPEAT 6 TIMES JOINT INCR 100000 ELEMENT INCR 10000 TRANSLATE X 1524 Z -268

$=============================================================================================
$ Generate Joints to Connect Deck Plate Elements
$=============================================================================================
GENERATE 2 JOINTS ID 100019 1 X LIST 75 585 Y 1371 Z 0
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 22 ID 300 Z -1500

GENERATE 2 JOINTS ID 106719 1 X LIST 75 585 Y 1371 Z -33050
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 22 ID 300 Z -1500

GENERATE 2 JOINTS ID 113419 1 X LIST 75 585 Y 1371 Z -66100
REPEAT 6 ID 100000 X 1524 Z -268
REPEAT 22 ID 300 Z -1500

GENERATE 6 JOINTS ID 100021 100000 X 1092 1524 Y 1371 0 Z -134 -268
REPEAT 22 ID 300 Z -1500
REPEAT 2 ID 6700 Z -33050

$=============================================================================================
$ Generate Deck Plate Elements
$=============================================================================================
TYPE PLATE

GENERATE 7 ELEMENTS ID 'P-1011' 1000 FROM 100019 100000 TO 100020 100000 TO 100320 100000 TO 100319 100000
REPEAT 21 ID 10 FROM 300 TO 300
REPEAT 2 ID 230 FROM 6700 TO 6700

GENERATE 6 ELEMENTS ID 'P-1012' 1000 FROM 100020 100000 TO 100021 100000 TO 100321 100000 TO 100320 100000
REPEAT 21 ID 10 FROM 300 TO 300
REPEAT 2 ID 230 FROM 6700 TO 6700

GENERATE 6 ELEMENTS ID 'P-1013' 1000 FROM 100021 100000 TO 200019 100000 TO 200319 100000 TO 100321 100000
REPEAT 21 ID 10 FROM 300 TO 300
REPEAT 2 ID 230 FROM 6700 TO 6700

GENERATE 7 ELEMENTS ID 'P-1231' 1000 FROM 106619 100000 TO 106620 100000 TO 106720 100000 TO 106719 100000
REPEAT 1 ID 230 FROM 6700 TO 6700

GENERATE 6 ELEMENTS ID 'P-1232' 1000 FROM 106620 100000 TO 106621 100000 TO 106721 100000 TO 106720 100000
REPEAT 1 ID 230 FROM 6700 TO 6700

GENERATE 6 ELEMENTS ID 'P-1233' 1000 FROM 106621 100000 TO 206619 100000 TO 206719 100000 TO 106721 100000
REPEAT 1 ID 230 FROM 6700 TO 6700

$=============================================================================================
```

```
$ Generate Rigid Members to Connect Girder Elements to Plate Elements
$=================================================================================================
TYPE SPACE TRUSS

GENERATE 7 MEMBERS ID 'R-1001' 1000 FROM 100015 100000 TO 100019 100000
REPEAT 22 ID 10 FROM INCR 300 TO INCR 300
REPEAT 2 ID 230 FROM INCR 6700 TO INCR 6700

GENERATE 7 MEMBERS ID 'R-1002' 1000 FROM 100018 100000 TO 100020 100000
REPEAT 22 ID 10 FROM INCR 300 TO INCR 300
REPEAT 2 ID 230 FROM INCR 6700 TO INCR 6700

$=================================================================================================
$ Define Element Properties
$=================================================================================================
MATERIAL CONCRETE ALL ELEMENTS
ELEMENT PROPERTIES
 EXISTING 'G-10011' TO 'G-11988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-20011' TO 'G-21988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-30011' TO 'G-31988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-40011' TO 'G-41988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-50011' TO 'G-51988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-60011' TO 'G-61988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'G-70011' TO 'G-71988' TYPE 'IPSL' INTEGRATION ORDER 3
 EXISTING 'P-1011' TO 'P-1685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-2011' TO 'P-2685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-3011' TO 'P-3685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-4011' TO 'P-4685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-5011' TO 'P-5685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-6011' TO 'P-6685' TYPE 'SBCR' THICKNESS 200
 EXISTING 'P-7011' TO 'P-7681' TYPE 'SBCR' THICKNESS 200

$=================================================================================================
$ Define Member Properties
$=================================================================================================
MATERIAL CONCRETE ALL MEMBERS
MEMBER PROPERTIES PRISMATIC
 'R-1001' TO 'R-1681' BY 10 'R-1002' TO 'R-1682' BY 10 AX 5000
 'R-2001' TO 'R-2681' BY 10 'R-2002' TO 'R-2682' BY 10 AX 5000
 'R-3001' TO 'R-3681' BY 10 'R-3002' TO 'R-3682' BY 10 AX 5000
 'R-4001' TO 'R-4681' BY 10 'R-4002' TO 'R-4682' BY 10 AX 5000
 'R-5001' TO 'R-5681' BY 10 'R-5002' TO 'R-5682' BY 10 AX 5000
 'R-6001' TO 'R-6681' BY 10 'R-6002' TO 'R-6682' BY 10 AX 5000
 'R-7001' TO 'R-7681' BY 10 'R-7002' TO 'R-7682' BY 10 AX 5000

$=================================================================================================
$ Define Supports
$=================================================================================================
STATUS SUPPORT JOINTS -
 100001 TO 700001 BY 100000 100002 TO 700002 BY 100000 100003 TO 700003 BY 100000 100004 TO 700004 BY 100000 -
 106601 TO 706601 BY 100000 106602 TO 706602 BY 100000 106603 TO 706603 BY 100000 106604 TO 706604 BY 100000 -
 106701 TO 706701 BY 100000 106702 TO 706702 BY 100000 106703 TO 706703 BY 100000 106704 TO 706704 BY 100000 -
 113301 TO 713301 BY 100000 113302 TO 713302 BY 100000 113303 TO 713303 BY 100000 113304 TO 713304 BY 100000 -
 113401 TO 713401 BY 100000 113402 TO 713402 BY 100000 113403 TO 713403 BY 100000 113404 TO 713404 BY 100000 -
 120001 TO 720001 BY 100000 120002 TO 720002 BY 100000 120003 TO 720003 BY 100000 120004 TO 720004 BY 100000 -

 100019 TO 700019 BY 100000 100020 TO 700020 BY 100000 -
 120019 TO 720019 BY 100000 120020 TO 720020 BY 100000

$=================================================================================================
$ Set Boundary Conditions
$=================================================================================================
JOINT RELEASES

$ GIRDER BASE
$  END PIN CONDITIONS
 100001 TO 100004 200001 TO 200004 300001 TO 300004 400001 TO 400004 500001 TO 500004 600001 TO 600004 700001 TO 700004
MOMENT X Y
 120001 TO 120004 220001 TO 220004 320001 TO 320004 420001 TO 420004 520001 TO 520004 620001 TO 620004 720001 TO 720004
MOMENT X Y

$  INTERMEDIATE PIN CONDITIONS
 106601 TO 106604 206601 TO 206604 306601 TO 306604 406601 TO 406604 506601 TO 506604 606601 TO 606604 706601 TO 706604
MOMENT X Y Z
 106701 TO 106704 206701 TO 206704 306701 TO 306704 406701 TO 406704 506701 TO 506704 606701 TO 606704 706701 TO 706704
MOMENT X Y Z
 113301 TO 113304 213301 TO 213304 313301 TO 313304 413301 TO 413304 513301 TO 513304 613301 TO 613304 713301 TO 713304
MOMENT X Y Z
 113401 TO 113404 213401 TO 213404 313401 TO 313404 413401 TO 413404 513401 TO 513404 613401 TO 613404 713401 TO 713404
MOMENT X Y Z

$ DECK BASE
$  END CONDITIONS
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
FORCE Y
 120019 TO 120020 220019 TO 220020 320019 TO 320020 420019 TO 420020 520019 TO 520020 620019 TO 620020 720019 TO 720020
FORCE Y
 100019 TO 100020 200019 TO 200020 300019 TO 300020 400019 TO 400020 500019 TO 500020 600019 TO 600020 700019 TO 700020
MOMENT X Y
 120019 TO 120020 220019 TO 220020 320019 TO 320020 420019 TO 420020 520019 TO 520020 620019 TO 620020 720019 TO 720020
MOMENT X Y
```

```
$=============================================================================================
$ Define Loading
$=============================================================================================
UNITS KN M
LOADING 'DC1' 'DEAD LOAD STRUCTURAL COMPONENTS OF ELEMENTS'

 ELEMENT LOADS
  EXISTING 'G-10011' TO 'G-11988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-20011' TO 'G-21988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-30011' TO 'G-31988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-40011' TO 'G-41988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-50011' TO 'G-51988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-60011' TO 'G-61988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'G-70011' TO 'G-71988' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-1011' TO 'P-1685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-2011' TO 'P-2685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-3011' TO 'P-3685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-4011' TO 'P-4685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-5011' TO 'P-5685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-6011' TO 'P-6685' BODY FORCES GLOBAL BY -23.5616
  EXISTING 'P-7011' TO 'P-7681' BODY FORCES GLOBAL BY -23.5616
LOADING 'LL' 'VEHICULAR LIVE LOAD'
 JOINT LOADS
$ Truck 1
  302119 402120 FORCE Y -45.5
  303019 403020 FORCE Y -188.5
  303919 403920 FORCE Y -188.5
$ Truck 2
  502119 602120 FORCE Y -188.5
  503019 603020 FORCE Y -188.5
  503919 603920 FORCE Y -45.5
LOADING 'LS' 'LIVE LOAD SURCHARGE'
 ELEMENT LOADS
  EXISTING 'P-1011' TO 'P-1685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-2011' TO 'P-2685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-3011' TO 'P-3685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-4011' TO 'P-4685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-5011' TO 'P-5685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-6011' TO 'P-6685' SURFACE FORCES GLOBAL PY -3.9269
  EXISTING 'P-7011' TO 'P-7681' SURFACE FORCES GLOBAL PY -3.9269
LOADING 'WS' 'WIND LOAD ON STRUCTURE'
 ELEMENT LOADS
  'G-70013' TO 'G-71983' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70014' TO 'G-71984' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70015' TO 'G-71985' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4
  'G-70018' TO 'G-71988' BY 10 SURFACE FORCES FACE 4 GLOBAL PX -2.4

$=============================================================================================
$ Factored Loads
$=============================================================================================
$LOADING COMBINATION 10 'STRENGTH I MINIMUM'    SPECS 'DC1' 0.9  'LL' 1.75 'LS' 1.75 'WS' 0.0
LOADING COMBINATION 11 'STRENGTH I MAXIMUM'     SPECS 'DC1' 1.25 'LL' 1.75 'LS' 1.75 'WS' 0.0
$LOADING COMBINATION 12 'STRENGTH II MINIMUM'   SPECS 'DC1' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 13 'STRENGTH II MAXIMUM'   SPECS 'DC1' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.0
$LOADING COMBINATION 14 'STRENGTH III MINIMUM' SPECS 'DC1' 0.9  'LL' 0.0  'LS' 0.0  'WS' 1.4
LOADING COMBINATION 15 'STRENGTH III MAXIMUM'   SPECS 'DC1' 1.25 'LL' 0.0  'LS' 0.0  'WS' 1.4
$LOADING COMBINATION 16 'STRENGTH V MINIMUM'    SPECS 'DC1' 0.9  'LL' 1.35 'LS' 1.35 'WS' 0.4
LOADING COMBINATION 17 'STRENGTH V MAXIMUM'     SPECS 'DC1' 1.25 'LL' 1.35 'LS' 1.35 'WS' 0.4
$LOADING COMBINATION 18 'SERVICE I'             SPECS 'DC1' 1.0  'LL' 1.0  'LS' 1.0  'WS' 0.3
$LOADING COMBINATION 19 'SERVICE II'            SPECS 'DC1' 1.0  'LL' 1.3  'LS' 1.3  'WS' 0.0
$LOADING COMBINATION 20 'FATIGUE'               SPECS 'DC1' 0.0  'LL' 0.75 'LS' 0.75 'WS' 0.0

$=============================================================================================
$ Prepare and Generate Output
$=============================================================================================
QUERY
STIFFNESS ANALYSIS

LIST SUMMATION OF REACTIONS
LIST REACTIONS

CALCULATE AVERAGE STRESS AT TOP SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'
CALCULATE AVERAGE STRESS AT BOTTOM SURFACE FOR ELEMENTS EXISTING 'P-1011' TO 'P-7683'

CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-10011' TO 'G-11988'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-20011' TO 'G-21988'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-30011' TO 'G-31988'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-40011' TO 'G-41988'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-50011' TO 'G-51988'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-60011' TO 'G-61988'
CALCULATE AVERAGE STRESS AT MIDDLE SURFACE FOR ELEMENTS EXISTING 'G-70011' TO 'G-71988'
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