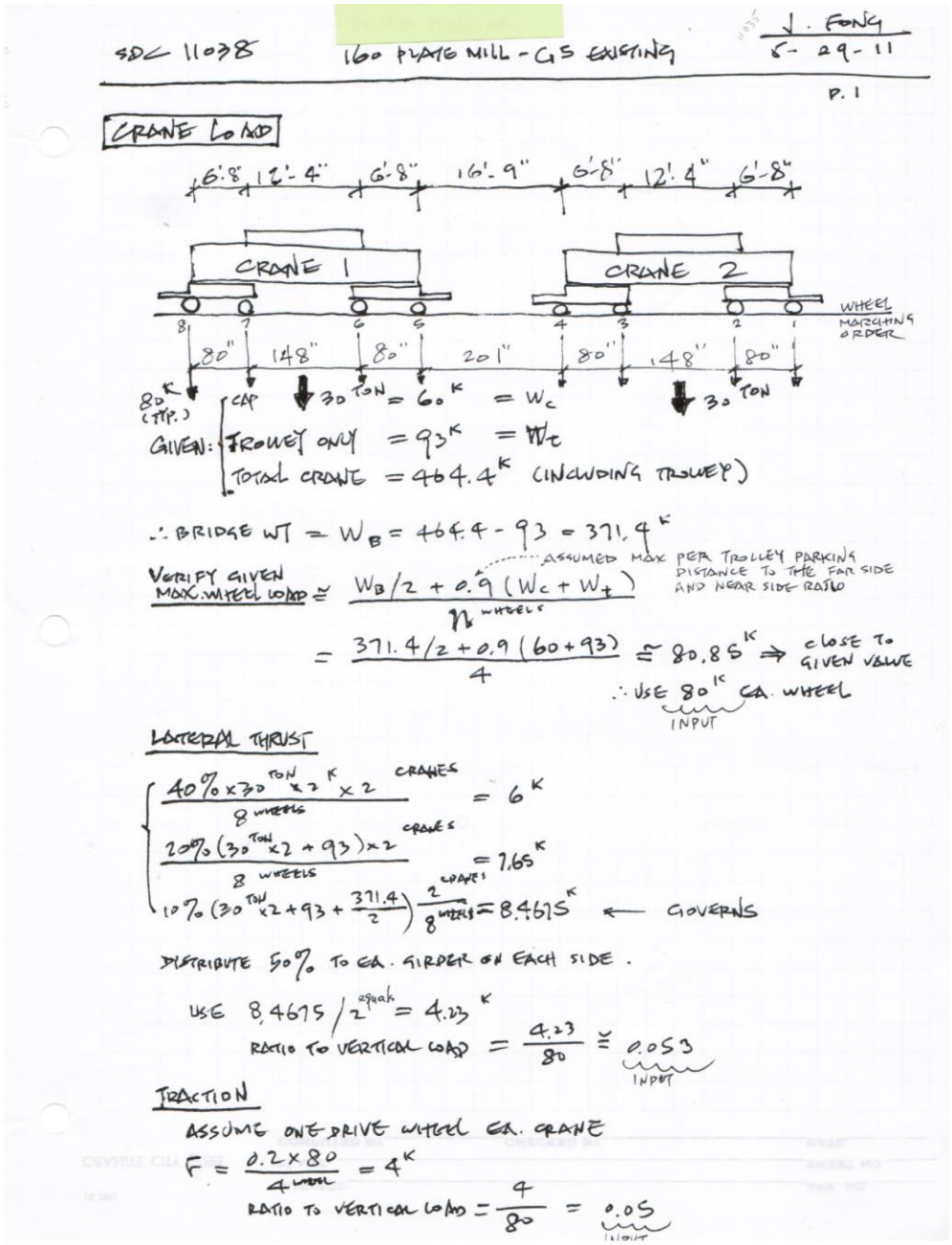
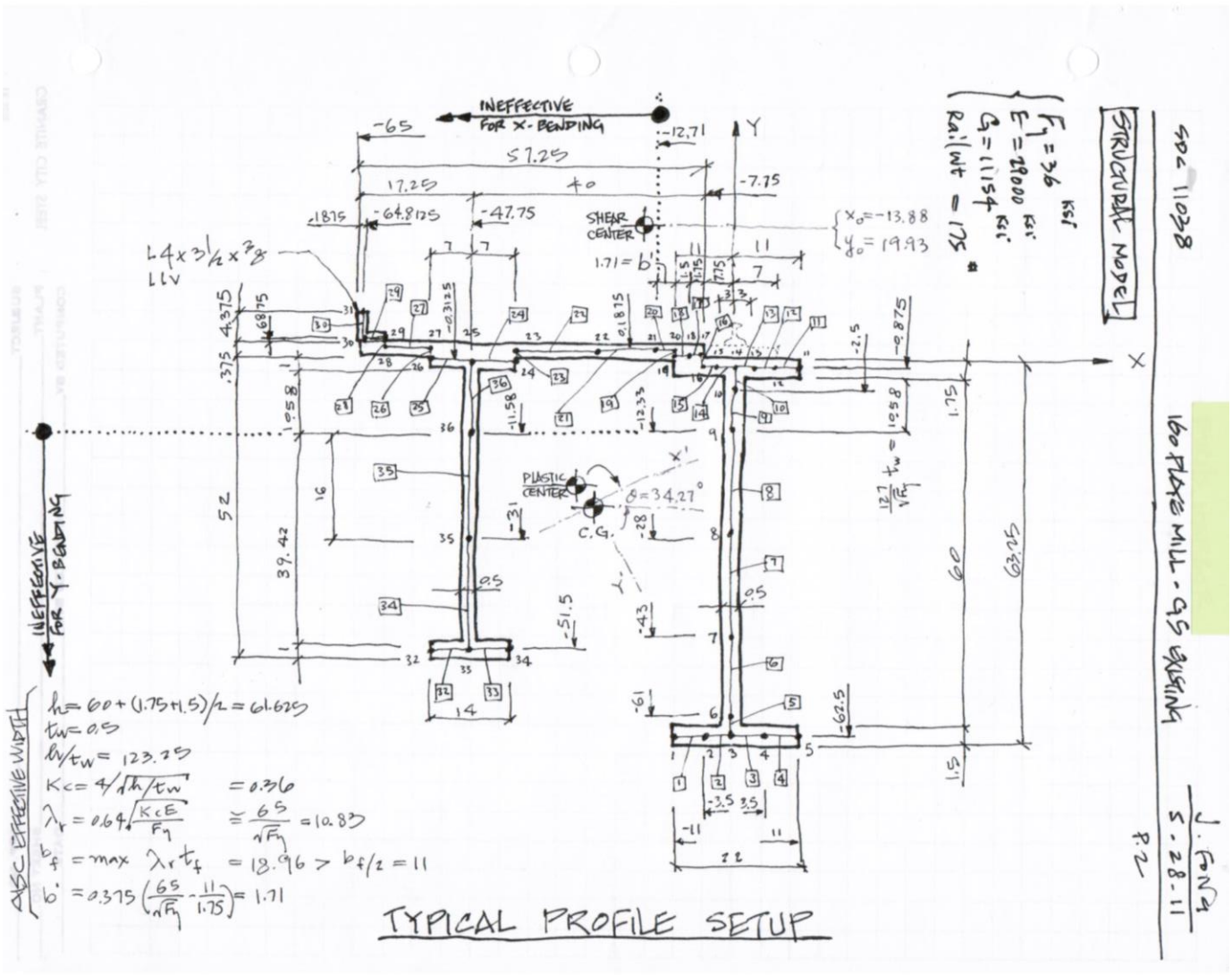
# ANALYSIS SUMMARY CALCULATION

The following summary calculation was generated from the results of a CRANE GIRDER PRO structural analysis. The crane girder failed due to the type of cracks shown in Photograph #4 of the section on Crane Girder Failure. The analysis resulted in the replacement of over 10 crane runway girders in length of 50 [ft]. and 75 [ft].







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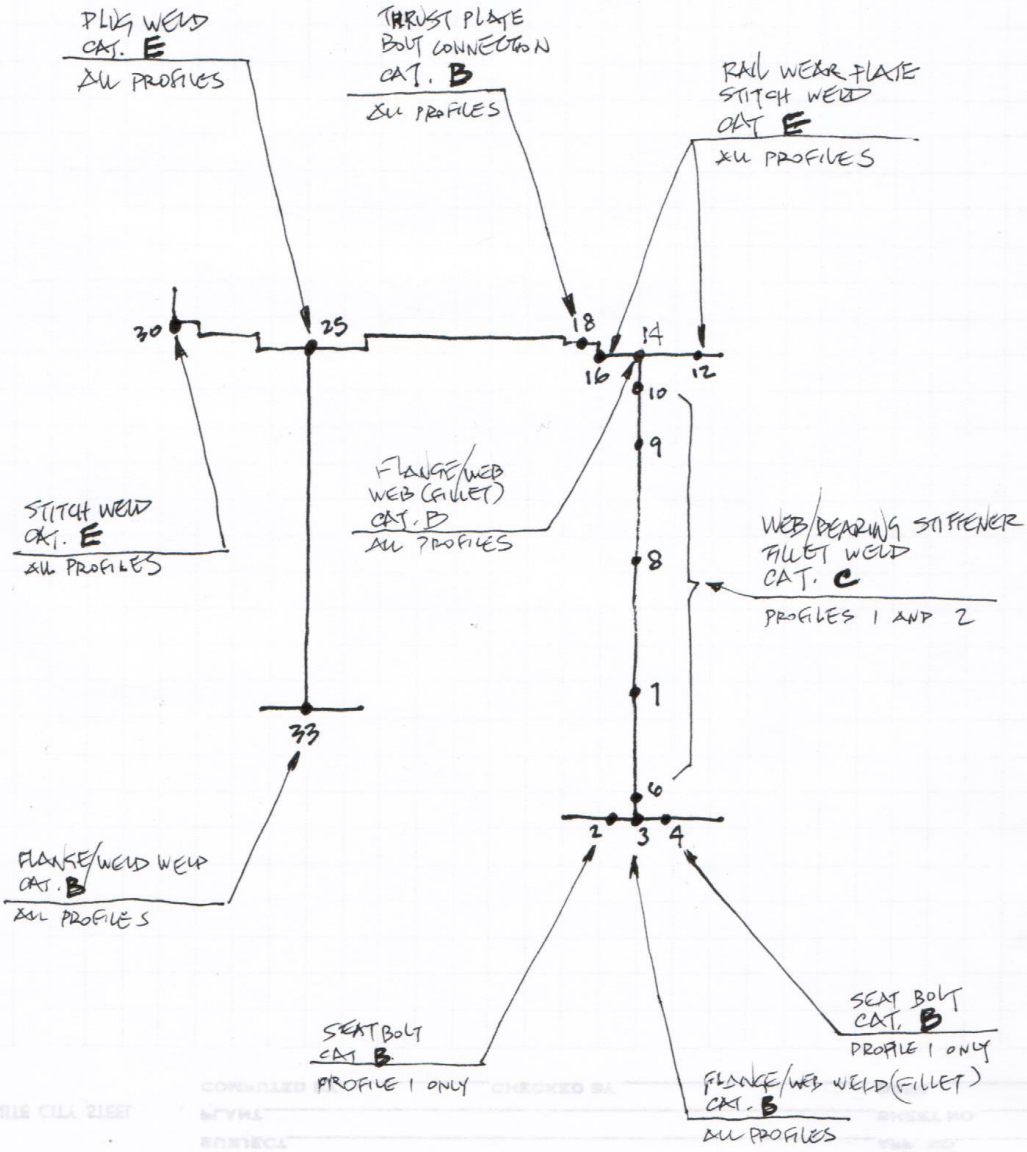
## PROFILE FATIGUE CATEGORY

PROFILE TYPE { 1, 2, 3 } APPLIES TO { GIRDER END W/ BEARING STIFFENERS; INTERMEDIATE SECTION W/ WEB STIFFENERS; INTERMEDIATE SECTION STIFFENER FREE }



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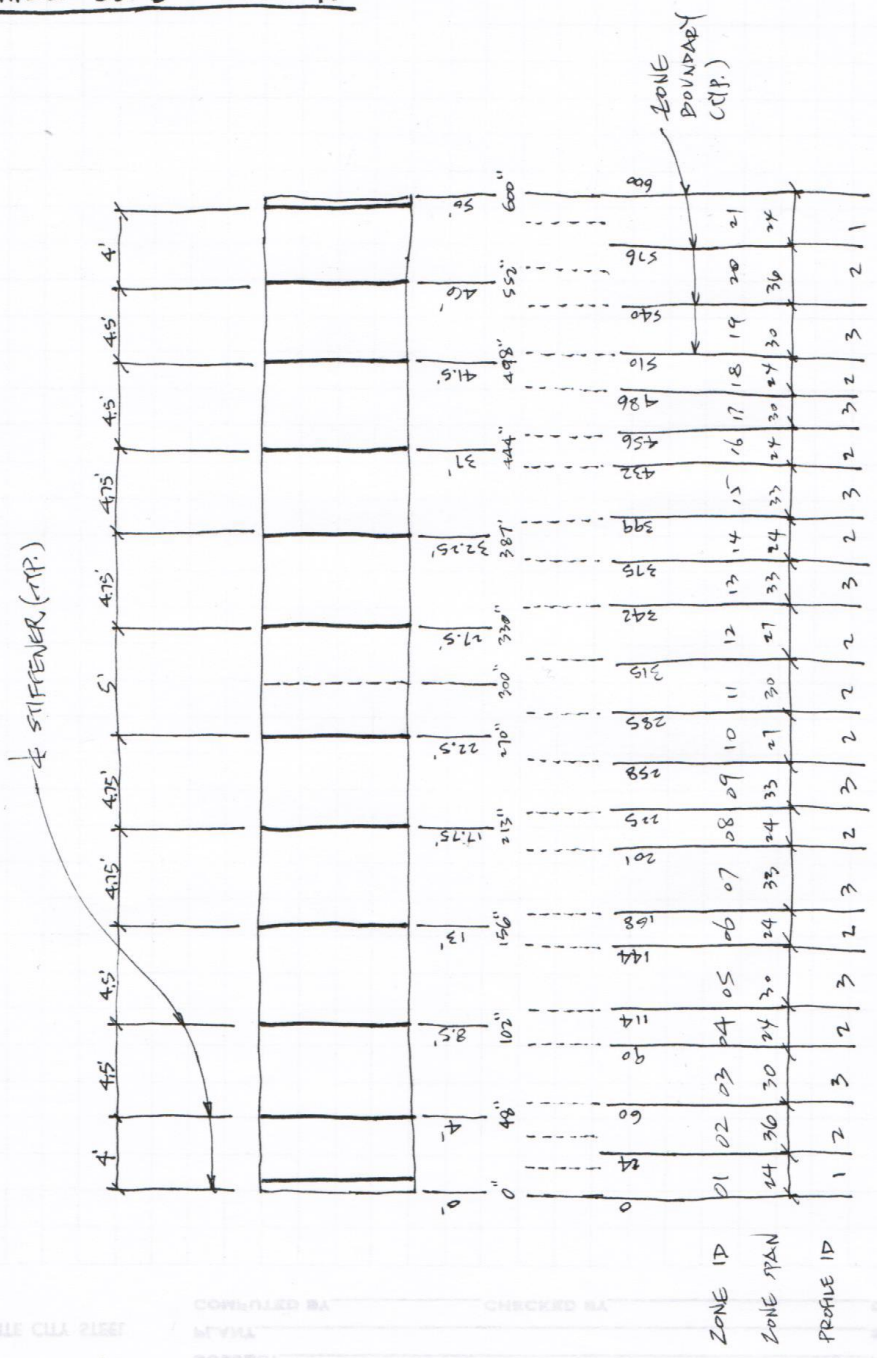
## GIRDER ZONE DEFINITION




ZONE 11 RESULT OVERVIEW

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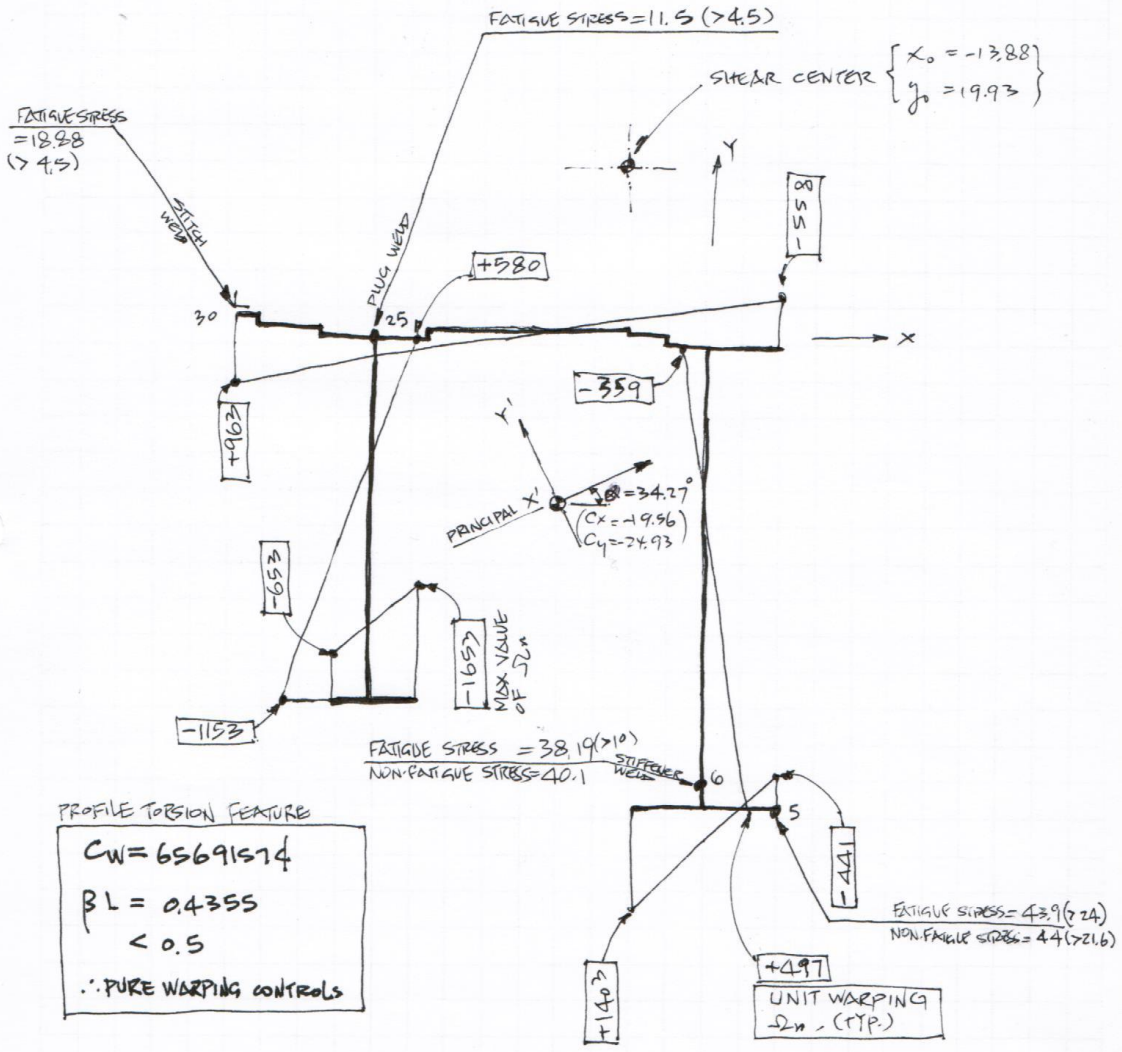
## EXISTING G5 MODEL ANALYSIS

RUN ID G5EXFLD4 (FOR FATIGUE LOAD CONDITION 4)
G5EXFLD3 (FOR FATIGUE LOAD CONDITION 3)




ZONE 11 RESULT OVERVIEW

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## EXISTING GIRDER EVALUATION COMMENTS GSEXFLD4

1. GIRDER PROFILE RESEMBLES AN UPSIDE-DOWN U OR A LAY-DOWN CHANNEL SECTION, FOR WHICH THE SHEAR CENTER IS WAY ABOVE THE CHANNEL WEB. THEREFORE THE ENTIRE GIRDER SECTION IS PREDISPOSED TO ROTATE ABOUT THE SHEAR CENTER WHEN LOADED AT TOP OF THE RAIL FROM THAT THE RESULTANT "RARELY" PASSES THROUGH THE SHEAR CENTER.

2. TORSION CHARACTERISTIC CONSTANT $\beta = 0.0007258$, LENGTH $L = 600$. $\beta L = 0.4355$. ANY SUCH $\beta L$ MAGNITUDE, LESS THAN 0.5, WOULD CLEARLY INDICATE THAT ST. VENANT TORSION (COMPARING WITH WARPING) IS RELATIVELY MUCH TOO SMALL TO HAVE PRONOUNCED EFFECT. THEREFORE THE GIRDER'S TORSIONAL BEHAVIOR WOULD BE CONTROLLED BY "PURE WARPING".

3. FIBER STRESS AT NODES IN THE BOTTOM FLANGE AND THE LOCALITY IS GENERALLY HIGHER THAN THAT ELSEWHERE. THIS IS TRUE FOR ALL ZONES DUE TO THE FACT THAT THE DISTANCE TO THE CENTROID AND/OR SHEAR CENTER FROM THESE NODES ARE INHERENTLY FARTHER THAN THAT FROM OTHER NODES.

4. EXCEPT FOR THE END ZONES (1, 2, 20, 21) UP TO ABOUT 5 ft FROM THE SUPPORTS, THE GIRDER IS FOUND OVERSTRESSED UNDER NON-FATIGUE LOAD AT VARIOUS HOT SPOTS IN ALL OTHER ZONES. TYPICALLY, HOT SPOT INCREASES IN NUMBER FROM MINIMA IN ZONE 3/19 TO THE MAXIMA TOWARDS CENTER ZONE 11.

5. SUBJECTED TO REPEATED STRESS FLUCTUATIONS, THE BASE METAL SHOULD DEVELOP CRACKS AT MOST HOT SPOTS ESPECIALLY IN ZONE 11. LISTED AS FOLLOWS ARE SOME OF THE HIGHEST RATIO OF BASE METAL FATIGUE STRESS (REVERSAL) TO DISC ALLOWABLE $F_{SR}$ VALUES UNDER FATIGUE LOAD CONDITION 4 ARE:

| | | | |
|---|---|---|---|
| 4.2 (= 18.8/4.5) | AT NODE | 30 | – KICK ANGLE/℄ STITCH WELD |
| 3.82 (= 38.19/10) | | 6 | – WEB STIFFENER BASE WELD |
| 2.56 (= 11.5/4.5) | | 25 | – SUPPORT BEAM/℄ PLUG WELD |
| 1.83 (= 43.9/24) | AT NODE | 5 | – BOTTOM FLANGE TIP (NO WELD) |

 