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DISE,D.P. Niagara Mohawk Power Corp.
RECIP.NAME RECIPIENT AFFILIATION
YOUNGBLOOD,B.J. Licensing Branch 1

SUBJECT: Forwards info provided at 810306 meeting w/NRC to discuss unstaggered splices re DYWIDAG Threadbear Sys.Approval by 810331 requested to use sys in unstaggered applications subj. to described limitations & conditions.

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MAR 25 1981

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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

March 18, 1981

Mr. B.J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Youngblood:

Re: Nine Mile Point Unit 2
Docket No. 50-410

Enclosed are the handouts provided at the March 6, 1981 meeting with members of the Commission Staff to address unstaggered splices. Your March 5, 1981 letter granted approval for the use of the DYWIDAG Threadbar System in staggered applications at Nine Mile Point Unit 2 provided the following conditions are met:

1) Compliance with the applicable provisions of Section III, Division 2 of ASME Boiler and Pressure Vessel Code, 1980 Edition, including the Summer 1980 addenda;

2) Compliance with the applicable provisions of Section 7.5 and 7.6 of ACI Code 349-76, "Code Requirements for Nuclear Safety Related Concrete Structures".

Additionally, Niagara Mohawk requests approval to utilize the DYWIDAG Threadbar System in unstaggered applications subject to the limitations and conditions described below:

1. Compliance with the above referenced codes.

2. Limited to bar sizes N6-N11.

3. Limited to doweling at slab to wall junctions as typically shown in Sketch 1.

4. The concrete design is in accordance with the strength method and allowable stresses as outlined in ACI-318-76 Code.

   All seismic Class I reinforced concrete structures are designed utilizing the load combinations for the operating design condition as specified in the Nine Mile Point Unit 2 Preliminary Safety Analysis Report Section 12.3.9. For Nine Mile Point Unit 2, the rebar dowels at wall slab junction of seismic Class I structures are designed for the maximum moment achieved from the worst loading combination for the operating or design condition.

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In case of unstaggered splices at wall slab junction for the Unit 2 Project, the stress level in the dowels will be below 50% of the specified yield strength (as required by ACI-349) under all applicable load conditions (i.e., less than 20 ksi). A typical design calculation showing the stress levels at wall slab junctions for two elevations in the Reactor Building is contained in the attached handouts from the March 6, 1981 meeting.

5. The minimum spacing criteria for splices that will be used to avoid the formation of voids during concrete placement is also contained in the attached handouts from the March 6, 1981 meeting.

As requested at the March 6, 1981 meeting, Attachment 1 compares the elongation and strain of spliced vs unspliced bars at stress levels of 50% of the specified yield strength. As shown by this table the elongation of a splice specimen is essentially identical with the elongation of the unspliced bar at this stress level.

The ACI 349-76 code assures that cracking in concrete due to slip in the splice is adequately controlled by:

1. Demonstrating through qualification testing that the strain in the spliced specimen at 0.9 of the specified yield strength does not exceed that of an unspliced specimen by more than 50%.

2. Limiting the maximum computed design load stress in the bar to less than 0.5 of the specified yield strength.

Therefore, Niagara Mohawk does not believe that group testing of unstaggered splices in concrete is necessary based on the commitment to comply with Sections 7.5 and 7.6 of ACI 349-76.

Based on the above, the approval for the limited use of the DYWIDAG Threadbar System in unstaggered splices as specified above, is requested by March 31, 1981.

Very truly yours,

Donald P. Dise

Donald P. Dise
Vice President
Engineering

PEF:bd

Niagara Mohawk Power Corporation
Nine Mile Point Unit 2
Docket No. 50-410

Presentation

DYWIDAG Threadbar

- Introduction
- Code Requirements
- Unstaggered Splices
  - Statistical Summary
  - Calculations
  - Spacing Criteria

- Use of DYWIDAG splices will comply with the requirements of ASME II Code, Division II and ACI 349.

- Test results have shown that DYWIDAG splice meets the requirements for unstaggered splices:

  1. Strain over length of the full connector at 90% yield is less than 150% of an unspliced bar.

  2. Maximum computed design load stress in spliced bar is less than .5 fy.

  3. Splices develop at least 125% of the specified yield strength of bar in tension.

DYWIDAG Threadbar, grade 60 ksi, Splice System

Statistical Summary of Elongation in a Spliced Bar Specimen versus Elongation of an Unspliced Bar Specimen at 90% of minimum required yield (54 ksi)

#6:			Elongation in 10 inch				Average
Spliced Specimen	0.0245	0.0270	0.0230	0.0265	0.0250	0.0210	0.0245
Unspliced Specimen	0.0195						
E in %	26	38	18	36	28	8	26
#7:			Elongation in 12 inch				Average
Spliced Specimen	0.028	0.025	0.0285	0.028	0.027	0.022	0.0264
Unspliced Specimen	0.026						
E in %	8	-4	10	8	4	-15	2
#8:			Elongation in 14 inch				Average
Spliced Specimen	0.037	0.0335	0.0365	0.033	0.032	0.031	0.0338
Unspliced Specimen	0.028						
E in %	32	20	30	18	14	11	21
#9			Elongation in 15 inch				Average
Spliced Specimen	0.038	0.0355	0.037	0.035	0.0365	0.039	0.0368
Unspliced Specimen	0.030						
E in %	27	18	23	17	22	30	23
#10			Elongation on 18 inch				Average
Spliced Specimen	0.0485	0.047	0.0465	0.0495	0.0465	0.045	0.0471
Unspliced Specimen	0.035						
E in %	39	34	33	41	33	29	35
#11			Elongation in 18 inch				Average
Spliced Specimen	0.0455	0.0475	0.039	0.0415	0.046	0.0395	0.0431
Unspliced Specimen	0.034						
E in %	34	40	15	22	35	16	27
#14			Elongation in 22 inch				Average
Spliced Specimen	0.045	0.050	0.051	0.0505	0.0495	0.050	0.0493
Unspliced Specimen	0.042						
E in %	7	19	21	20	18	19	17
#18			Elongation in 30 inch				Average
Spliced Specimen	0.0845	0.079	0.081	0.076	0.0845	0.082	0.0812
Unspliced Specimen	0.056						
E in %	51	41	45	36	51	46	45

CALCULATION SHEET

A5010 61

J.O./W.O./CALCULATION NO.	REVISION	PAGE
12177		1 OF 2

PREPARER/DATE	REVIEWER/CHECKER/DATE	INDEPENDENT REVIEWER/DATE
E.L. CHAO 3-1-81	Sam Chin 3/1/81	Sam Chin 3/1/81

SUBJECT/TITLE	QA CATEGORY/CODE CLASS
REVIEW REACTOR BUILDING FLOOR SLAB DESIGN @EL. 289'-0	1

REFERENCE EXISTING DESIGN, CALCULATION SHEET P. C33.5 ITEM 21

FOR FIXED END SPAN. $L = 6'\text{-}0$ $d = 8''$ $b = 12''$

$f'_c = 3{,}000$ psi. (@28 DAYS).

(1). TOP REINFORCEMENT: #8 @ 12" c/c. T. & B.

$M_{max} = 5.0^{K\text{-}FT.}$ A_s (REQ'D) = 0.67 □"

USE $A_s = 0.79$ □". $\rho = 0.79/8 \times 12 = 0.00823$ $\omega = 0.11$

$A_s = M_u / a_u \cdot d = 5.0 / a_u \times 8 = 0.79$.

$a_u = 5.0 / 0.79 \times 8 = 0.7912$

$a_u = \phi f_y (1 - 0.59\omega) / 12000 = 0.7912$.

$0.9 f_y (1 - 0.59 \times 0.11) / 12000 = 0.7912$

$\therefore f_y = 11{,}282$ psi

(2) BOTTOM REINFORCEMENT:

$M_{max.} = 1.67 (6)^2 / 8 = 7.515^{K\text{-}FT.}$ A_s (REQ'D) = 0.5 □"

USE $A_s = 0.79$□". $\rho = 0.00823$. $\omega = 0.11$

$A_s = M_u / a_u \cdot d = 7.515 / a_u \times 8 = 0.79$

$a_u = 7.515 / 0.79 \times 8 = 1.189$

$a_u = \phi f_y (1 - 0.59\omega) / 12000 = 1.189$.

$0.9 f_y (1 - 0.59 \times 0.11) / 12000 = 1.89$.

$\therefore f_y = 16{,}954$ psi

REFERENCE EXISTING DESIGN, CALCULATION SHEET P.C33-4. ITEM 23.

FOR FIXED END SPAN. $L = 6'0$ $d = 8"$; $b = 12"$

$f'_c = 3{,}000$ psi (@ 28 DAYS).

(1) TOP REINFORCEMENT: #8 @12" c/c, T. & B.

$M_{max.} = 7.344^{K\text{-}FT}$ REQ'D. $A_s = 0.32$ □"

USE $A_s = 0.79$ □" $\rho = 0.79/12 \times 8 = 0.00823$. USE $\omega = 0.11$.

$A_s = M_u / a_u \cdot d = 7.344 / a_u \times 8 = 0.79$.

$a_u = 7.344 / 0.79 \times 8 = 1.162$

$a_u = \phi f_y (1 - 0.59\omega) / 12000 = 1.162$.

$0.9 f_y (1 - 0.59 \times 0.11) / 12000 = 1.162$.

∴ $f_y = 16{,}532$ psi

(2) BOTTOM REINFORCEMENT:

$M_{max.} = 6.76^{K\text{-}FT.}$ REQUIRED $A_s = 0.504$ □"

USE. $A_s = 0.79$ □" $\rho = 0.00823$. USE $\omega = 0.11$

$A_s = M_u / a_u \cdot d = 6.76 / a_u \times 8$

$a_u = 6.76 / 0.79 \times 8 = 1.07$.

$a_u = \phi f_y (1 - 0.59\omega) / 12000 = 1.07$.

$0.9 f_y (1 - 0.59 \times 0.11) / 12000 = 1.07$.

∴ $f_y = 15{,}257$ psi

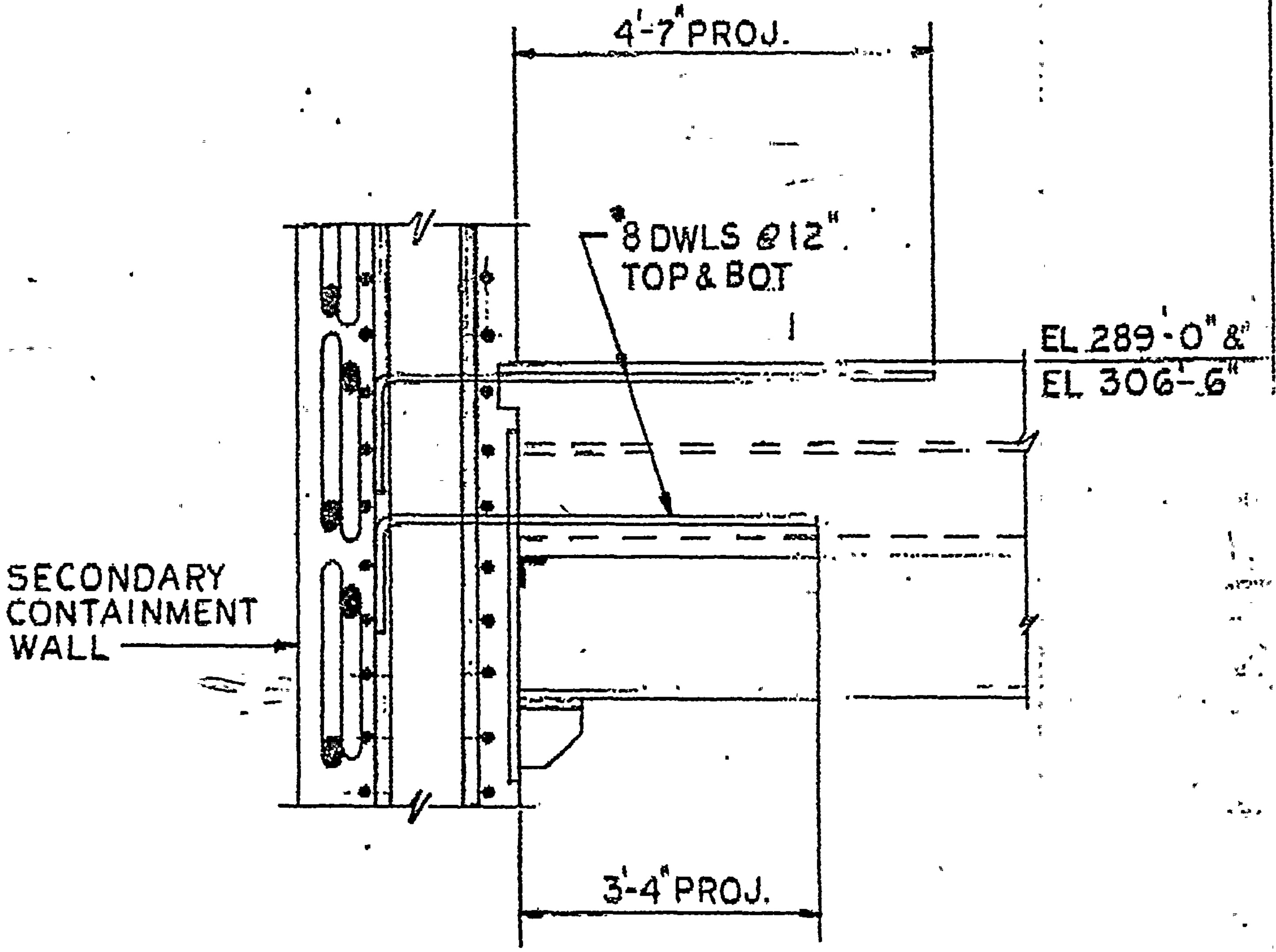
MINIMUM SPACING CRITERIA FOR SPLICES TO AVOID FORMATION OF VOIDS DURING CONCRETE PLACEMENT:

1. THE CLEAR DISTANCE BETWEEN PARALLEL SPLICES IN A LAYER SHALL BE NOT LESS THAN THE NOMINAL DIAMETER OF THE BARS, NOR 1 IN.

2. IN CASE OF COMPRESSION MEMBERS, THE CLEAR DISTANCE BETWEEN LONGITUDINAL SPLICES SHALL NOT BE LESS THAN ONE AND ONE HALF TIMES THE NOMINAL BAR DIAMETER, NOR 1 1/2 IN.

THE ABOVE CRITERIA IS IN COMPLIANCE WITH ACI-349-76.

FOR NINE MILE POINT UNIT 2, THE MINIMUM CLEAR DISTANCE BETWEEN PARALLEL SPLICES WILL NOT BE LESS THAN SIX TIMES THE NOMINAL DIAMETER OF THE BAR NOR 6 IN.



NINE MILE POINT NUCLEAR STATION - UNIT 2
NIAGAGRA MOHAWK POWER CORPORATION
J.O. 12177

POWER INDUSTRY GROUP	TITLE: WALL-SLAB JUNCTION SEC. CONMT. WALL-REACTOR BLDG.	SCALE:
CHECKED		DATE:
CORRECT		
APPROVED		SKETCH NUMBER: 1
REVISIONS (2)	(3) (4) (5)	

ATTACHMENT 1
DYWIDAG Threadbar, Grade 60 ksi, Splice System

Statistical Summary of Elongation in a Spliced Bar Specimen versus Elongation of an Unspliced Bar Specimen at 50 percent of minimum required yield (30 ksi)

No. 6	Elongation in 10 inch						Average
Spliced Specimen	0.010	0.011	0.008	0.010	0.010	0.008	0.0095
Unspliced Specimen	0.011						
Difference in 10 in.	0.001	0.0	-0.003	-0.001	-0.001	-0.003	-0.0015
Difference in Strain (in./in.)	0.0001	0.0	-0.0003	-0.0001	-0.0001	-0.0003	-0.00015

No. 7	Elongation in 12 inch						
Spliced Specimen	0.012	0.012	0.013	0.013	0.013	0.011	0.0123
Unspliced Specimen	0.015						
Difference in 12 in.	-0.003	-0.003	-0.002	-0.002	-0.002	-0.004	-0.0027
Difference in Strain (in./in.)	-0.00025	-0.00025	-0.00017	-0.00017	-0.00017	-0.00033	-0.00023

No. 8	Elongation in 14 inch						
Spliced Specimen	0.013	0.012	0.013	0.012	0.012	0.012	0.0123
Unspliced Specimen	0.017						
Difference in 14 in.	-0.004	-0.005	-0.004	-0.005	-0.005	-0.005	0.0047
Difference in Strain (in./in.)	-0.00029	-0.00036	-0.00029	-0.00036	-0.00036	-0.00036	-0.00034

No. 9	Elongation in 15 in.						
Spliced Specimen	0.017	0.017	0.017	0.017	0.015	0.017	0.0167
Unspliced Specimen	0.017						
Difference in 15 in.	0.0	0.0	0.0	0.0	-0.002	0.0	-0.0003
Difference in Strain (in./in.)	0.0	0.0	0.0	0.0	-0.00013	0.0	-0.00002

No. 10	Elongation in 18 inch						
Spliced Specimen	0.021	0.021	0.019	0.022	0.020	0.020	0.0205
Unspliced Specimen	0.019						
Difference in 18 in.	+0.002	+0.002	0.0	+0.003	+0.001	+0.001	+0.0015
Difference in Strain (in./in)	+0.0001	+0.00011	0.0	+0.00017	+0.00006	+0.00006	+0.00008

No. 11	Elongation in 18 inch						
Spliced Specimen	0.019	0.022	0.018	0.018	0.020	0.017	0.019
Unspliced Specimen	0.019						
Difference in 18 in.	0.0	+0.003	-0.001	-0.001	+0.001	-0.002	0.0
Difference in Strain (in./in.)	0.0	+0.00017	-0.00006	-0.00006	+0.00006	0.00011	0.0

No. 14	Elongation in 22 inch						
Spliced Specimen	0.020	0.021	0.021	0.023	0.021	0.022	0.0213
Unspliced Specimen	0.023						
Difference in 22 in.	-0.003	-0.002	-0.002	0.0	-0.002	-0.001	-0.0017
Difference in Strain (in./in.)	-0.00014	-0.00009	-0.00009	0.0	-0.00009	-0.00005	-0.00008

No. 18	Elongation in 30 inch						
Spliced Specimen	0.033	0.032	0.031	0.029	0.033	0.031	0.0315
Unspliced Specimen	0.031						
Difference in 30 in.	+0.002	+0.001	0.0	-0.002	+0.002	0.0	+0.0005
Difference in Strain (in./in.)	+0.00007	+0.00003	0.0	-0.00007	+0.00007	0.0	+0.00002

[illegible]

[illegible]