00072090

ATTACHMENT I-2

TO

TECHNICAL REPORT

STRUCTURAL STRESSES INDUCED BY

DIFFERENTIAL SETTLEMENT OF THE

DIESEL GENERATOR BUILDING

MIDLAND PLANT UNITS 1 AND 2
ANALYSIS OF DIESEL GENERATOR BUILDING
FOR
ZERO SPRING CONDITION ANALYSIS

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MIDLAND PLANT UNITS 1 AND 2
ANALYSIS OF DIESEL GENERATOR BUILDING
FOR
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1.0 BACKGROUND

During the February 23 through 26, 1982, meeting with the NRC, it was requested that a finite-element analysis of the diesel generator building (DGB) be performed for the 40-year, dead load case, modified with zero and near-zero soil spring constants in areas to represent potential bridging. The primary purpose of this analysis would be to investigate the structure's ability to span any soft soil condition. It was subsequently decided that, in an attempt to approximate the predicted 40-year settlement profile of the south wall (as proposed by Dr. Affifi on February 23, 1982), a soil spring value of zero would be used at the junction of the south wall and east center wall. Soil spring values would then be linearly varied so that springs returned to their original 40-year values within a distance of approximately 15 feet from the zero spring (see Figure 1).

2.0 ANALYSIS PROCEDURE

A finite-element analysis of the DGB was therefore performed using 40-year soil spring values, modified along the south wall and east center interior partition wall as described above. Several analysis iterations were necessary to arrive at a settlement profile that approximated the desired "best fit" settlement profile (as obtained from a statistical analysis of Dr. Affifi's estimated 40-year settlement values). Figure 2 gives an isometric presentation of Dr. Affifi's 40-year settlement values and also the settlement values resulting from the finite-element analysis of the DGB for the zero spring condition.

Subsequent to the final analysis iteration, maximum rebar stress values were calculated for the dead load plus settlement case (i.e., "modified case"). These values were compared with the dead load plus settlement case previously calculated for the "unmodified" 40-year settlement case (see Table 1). Such a comparison shows that, except for an increase in the south wall, the footings, the box missile shield, and the south shield wall, the maximum rebar stress values remained essentially unchanged. Typically, stress level increases were limited to approximately 5 ksi except in the south shield wall, where the modeling technique causes the rebar stress value to increase 18 ksi, and in the footings where the nature of the analysis causes the rebar stress value to increase approximately 20 ksi.

As a result of this favorable comparison, it is apparent that it would be unnecessary to combine the "modified" 40-year settlement case with other load cases to form the load combinations of the FSAR and the response to Question 15 of the NRC Requests Regarding Plant Fill.

For comparative purposes, the last column of Table 1 also presents maximum rebar stress values for the governing load combinations of the FSAR and Question 15. A review of this table indicates that settlement stress is typically only a small portion of the overall maximum rebar stress values associated with the required load combinations (FSAR and Question 15).

Furthermore, because the maximum settlement stresses and maximum service load stresses generally do not occur at the same location, the component of settlement stress that actually exists in a maximum rebar stress value would typically be less than the values of Table 1.

3.0 CONCLUSIONS

As a result of the analysis performed, it can therefore be concluded that the DGB can successfully span the assumed soft soil spot introduced into the analysis without significantly increasing the rebar stress levels.

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TABLE 1

REBAR STRESS VALUES FOR THE DIESEL GENERATOR BUILDING
FOR ZERO SPRING CONDITION

Category	Tensile Rebar Stress Values (allowable = 54 ksi)		
	(D + T) for Unmodified 40-Year Case	(D + T) for Modified 40-Year Case	Max Rebar Stresses for FSAR and Q 15*
West wall	2.15	2.78	25.03
South wall	6.82	10.98	44.04
Slab at el 664'	16.94**	16.97**	39.15
Roof at el 680'-0"	5.61	6.19	36.06
South missile shield	10.79	28.82	42.79
Interior missile shield	5.51	5.30	28.06
North missile shield	2.71	2.72	13.85
East wall	2.24	2.80	23.64
North wall	3.85	4.26	21.90
Interior partition wall	3.71	4.01	16.66
Box missile shield	4.50	9.33	8.02
Footings (longitudinal bending)	14.35	37.14	20.95

* Consists of FSAR load combinations and load combinations contained in response to Question 15 of the NRC Requests Regarding Plant Fill

** A large portion of this value is attributable to the dead load component.

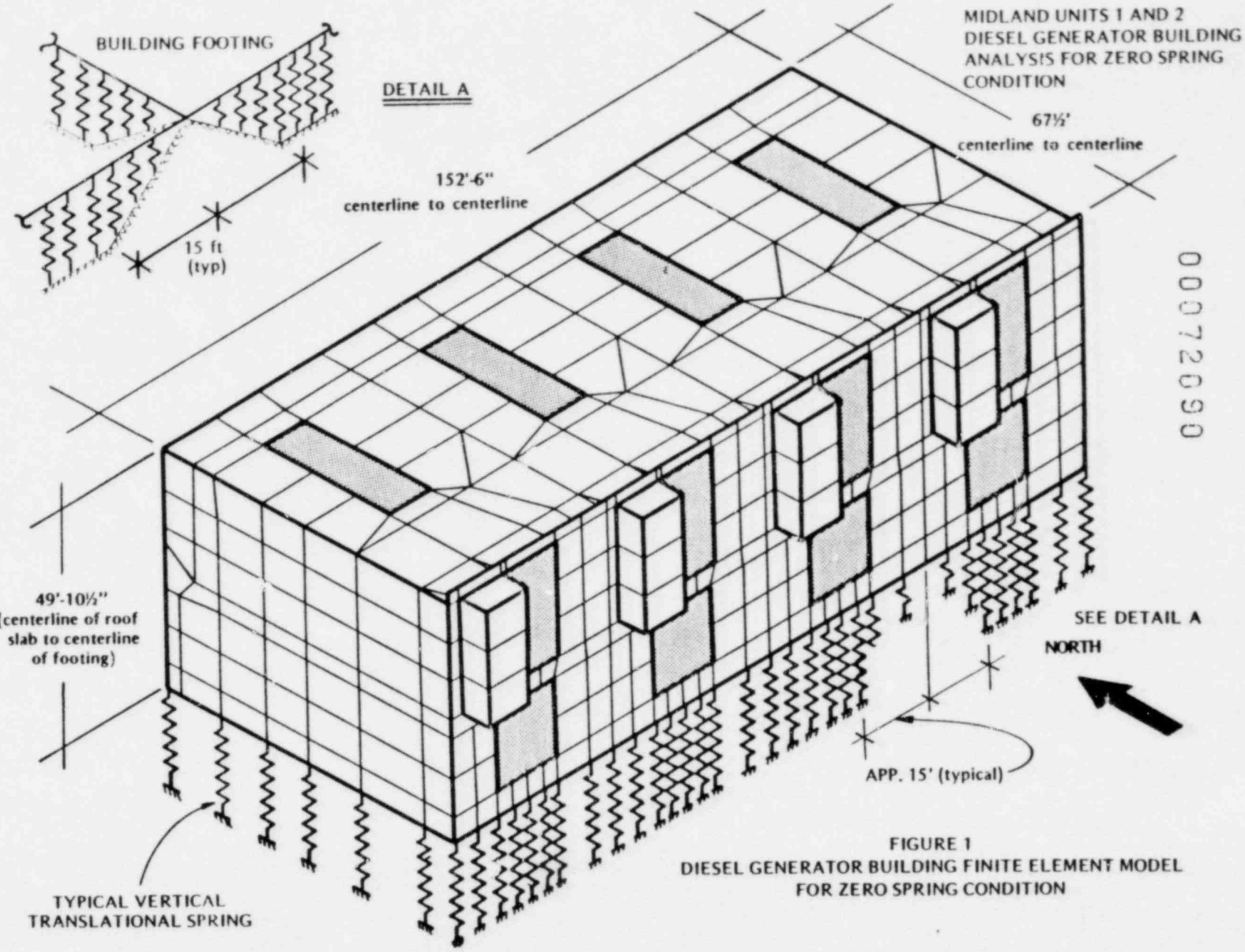
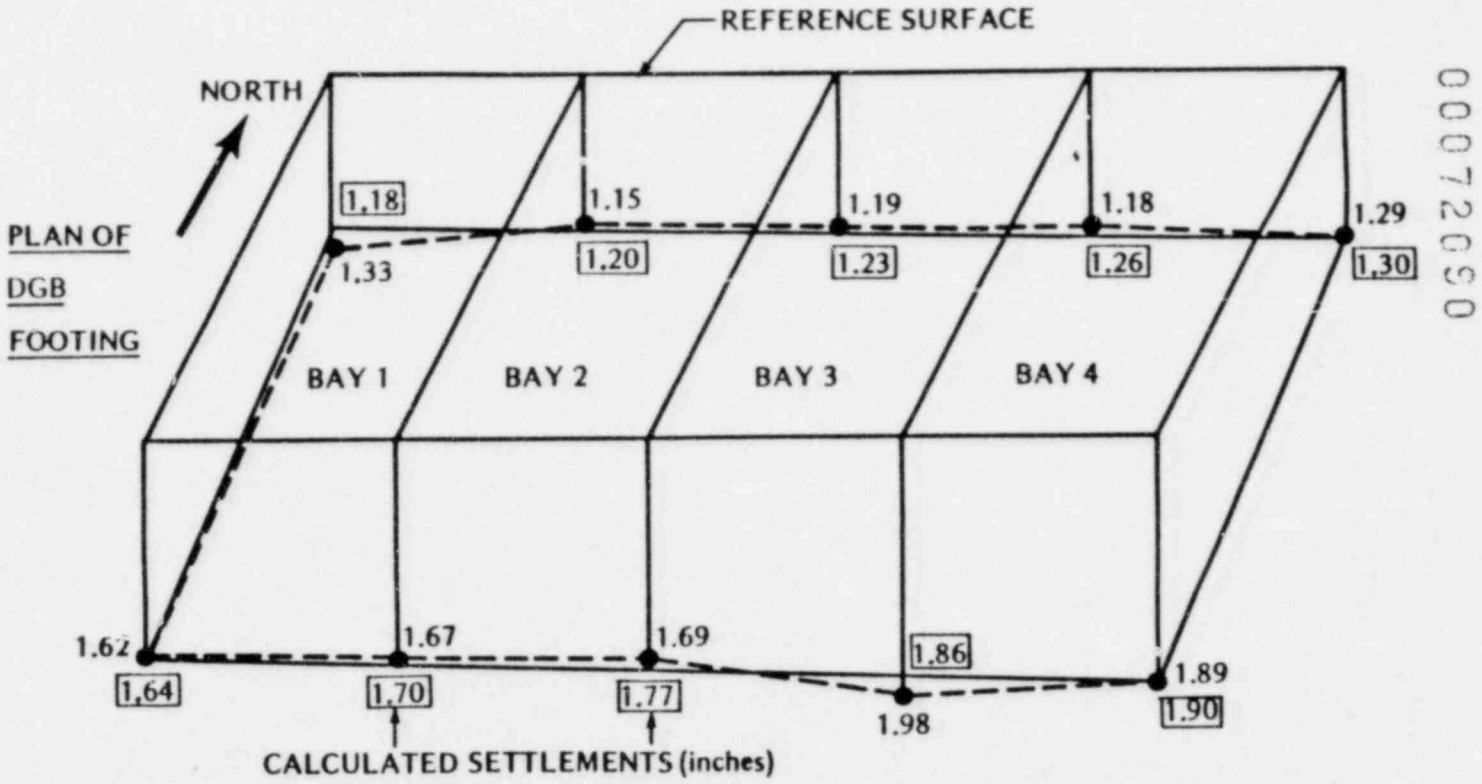


FIGURE 1
DIESEL GENERATOR BUILDING FINITE ELEMENT MODEL
FOR ZERO SPRING CONDITION

MIDLAND PLANT UNITS 1 AND 2
DIESEL GENERATORS BUILDING
ANALYSIS FOR ZERO SPRING CONDITION



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COMPARISON OF 40-YEAR ESTIMATED SETTLEMENT VALUES WITH SETTLEMENT
VALUES RESULTING FROM A FINITE ELEMENT ANALYSIS OF THE ZERO SPRING CONDITION

FIGURE 2