Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

September 28, 1981

Mr. Paul O'Connor, Project Manager
Operating Reactors-
U.S. Nuclear Regulatory Commission
Washington D.C. 20555

Subject: SEP Topic III-6, Seismic Design Considerations
Reactor-Turbine Building Complex

NRC Docket 50-237

In response to Tom Cheng's request of May 14, 1981 the following information was developed by URS/John A. Blume.

Dynamic Model

For their review of Dresden 2, the Lawrence Livermore Laboratory (LLL) developed a three-dimensional reactor-turbine building complex (RTBC) dynamic model for the orthogonal horizontal directions. This model is shown in Figure 1. The element stiffnesses and nodal masses of the model were modified by URS/Blume in an earlier study to reflect more accurately the as-built conditions, and the modified model was used to analyze the RTBC for the east-west component of ground motion. URS/Blume has used this same modified model to analyze the RTBC for the north-south component of ground motion.

Analytical Procedures

The modified LLL model was analyzed using a time-history modal superposition analysis. To be consistent with the LLL analysis, URS/Blume used the same acceleration time-history, which was forwarded to us by LLL, normalized to 0.2g (see Figure 2). Model structural damping of 10% of critical was used as did LLL in their analyses. Dynamic characterics (frequencies, mode shapes, and participation factors) and response quantities (story shears, story overturning moments, axial forces in floor diaphragms, and floor response spectra) of the modified LLL model for the north-south component of ground motion were calculated. Floor response spectra were generated for elevations 589 ft, 570 ft, 545 ft 6 in., and 517 ft 6 in. of the reactor building for equipment/piping damping values of 2%, 3%, and 7% of critical.

A035
s
1/1

Results and Discussion of Results

The frequencies and participation factors of the modified LLL model in the three orthogonal directions are given in Table 5 of Evaluation of Structural Parameters and Subsequent Reanalysis of the Reactor-Turbine Building Complex, Dresden Nuclear Power Station, Unit 2, Dated April 1981. This table also shows a comparison with these parameters as calculated by LLL.

Tables 1 and 2 give comparison of the story shears and story overturning moments calculated in the present URS/Blume analysis with those calculated in the LLL analysis. The LLL analysis results were supplied by Tom Nelson of LLL and they were calculated on the basis of the response spectrum method. Our results as mentioned above are on the basis of a modal superposition, time-history method. The story shears and story overturning moments calculated in URS/Blume analysis are lower than those calculated in the LLL analysis. The story shear and story overturning moment of the turbine building calculated in the URS/Blume analysis are approximately twice those calculated by LLL. However, the shear area and moment of inertia of this story in the URS/Blume model have increased by 2.23 times and 25.41 times, respectively, above those used in the LLL model. Hence stresses in this story will, in general, be lower than those calculated by LLL analysis.

Table 3 gives a comparison of axial forces in the roof level diaphragm and the operating floor level diaphragm obtained by the two analyses. The axial force calculated for the operating floor level diaphragm in the URS/Blume analysis is about five times larger than that calculated in the LLL analysis. This increase in axial force is attributed to the increased stiffness of the lowest story of the turbine building.

Figures 2 through 5 give comparison of the broadened and smoothed floor response spectra calculated by LLL (as presented in NUREG/CR-0891, Figures 5-12, 5-14, 5-16, and 5-18) with the raw floor response spectra calculated in the present URS/Blume analysis. The spectra calculated in the URS/Blume analysis are, in general, lower than those obtained in the LLL analysis except at the higher structural frequencies where the peaks as calculated by URS/BLume are higher than those calculated by LLL. The figures also show a frequency shift of the peaks of the spectra. The frequency shift is within the broadened portion of the LLL spectra and as such is covered by the 15% peak broadening procedure.

In summary, the structural responses calculated by URS/Blume using the modified LLL model for the north-south component of earthquake ground motion are, in general, lower than those calculated in the LLL analysis except as noted above.

In addition, Sargent and Lundy reviewed the Blume results and determined the ultimate capacity of the turbine building operating floor, El. 561'-6", and the reactor building/turbine building wall for the axial load of 31, 477 kips as listed in Table 3 of the Blume report.

It was determined that the connection is adequate to carry the above mentioned axial load under the following conditions:

1. The above mentioned axial load is applied to the turbine floor and the reactor/turbine building wall connection over the entire length of Units 2 & 3.

2. Other loads acting on the connection such as seismic shear or in-plant bending are negligible.

Please address any questions you may have concerning this matter to this office.

One (1) signed orginal and thirty-nine (39) copies of this transmittal have been provided for your use.

Very truly yours,

T.J. Rausch
Nuclear Licensing
Administrator
Boiling Water Reactors

NPS:mnh
0402a
cc: RIII Resident Inspector Dresden

TABLE 1

COMPARISON OF STORY SHEARS AND STORY OVERTURNING MOMENTS

REACTOR BUILDING

Element Number*	Node Connectivity*	Shear in N-S (kips)		Overturning Moment @ E-W (k-ft)	
		URS/Blume Analysis	LLL Analysis	URS/Blume Analysis	LLL Analysis
1	1	1,120	1,370	0	0
	2	1,120	1,370	22,760	27,640
2	2	1,460	1,710	22,760	27,640
	3	1,460	1,710	41,690	49,380
3	3	1,540	1,770	41,690	49,380
	4	1,540	1,770	61,770	71,980
4	4	19,470	21,230	61,770	71,980
	5	19,470	21,230	459,880	504,100
5	5	34,420	32,210	459,880	504,100
	34	34,420	32,210	935,980	944,800
6	34	33,860	31,326	935,980	944,800
	6	33,860	31,326	1,109,000	1,106,000
7	6	47,480	40,960	1,109,000	1,106,000
	35	47,480	40,960	1,500,300	1,450,000
8	35	16,010	49,780	1,500,300	1,450,000
	7	16,010	49,780	1,742,400	2,085,000
9	7	22,620	47,970	1,742,400	2,085,000
	8	22,620	47,970	2,366,300	3,398,000
10	8	31,570	60,290	2,366,300	3,398,000
	37	31,570	60,290	3,601,300	6,010,000

*Refer to Figure 1

TABLE 2

COMPARISON OF STORY SHEARS AND STORY OVERTURNING MOMENTS

TURBINE BUILDING

Element Number*	Node Connectivity*	Shear in N-S (kips)		Overturning Moment @ E-W (k-ft)	
		URS/Blume Analysis	LLL Analysis	URS/Blume Analysis	LLL Analysis
11	9	410	1,400	0	0
	10	410	1,400	8,790	30,130
12	10	50	50	8,790	30,130
	11	50	50	8,710	30,590
13	11	450	1,570	8,710	30,590
	12	450	1,570	0	0
14	12	50,990	25,730	0	0
	38	50,990	25,730	2,447,300	1,235,000

*Refer to Figure 1

TABLE 3

COMPARISON OF FLOOR DIAPHRAGM FORCES

Element Number*	Component	Axial Force (kips)	
		URS/Blume Analysis	LLL Analysis
15	Roof	3,628	4,490
16	Operating Floor	31,477	6,439

*Refer to Figure 1.

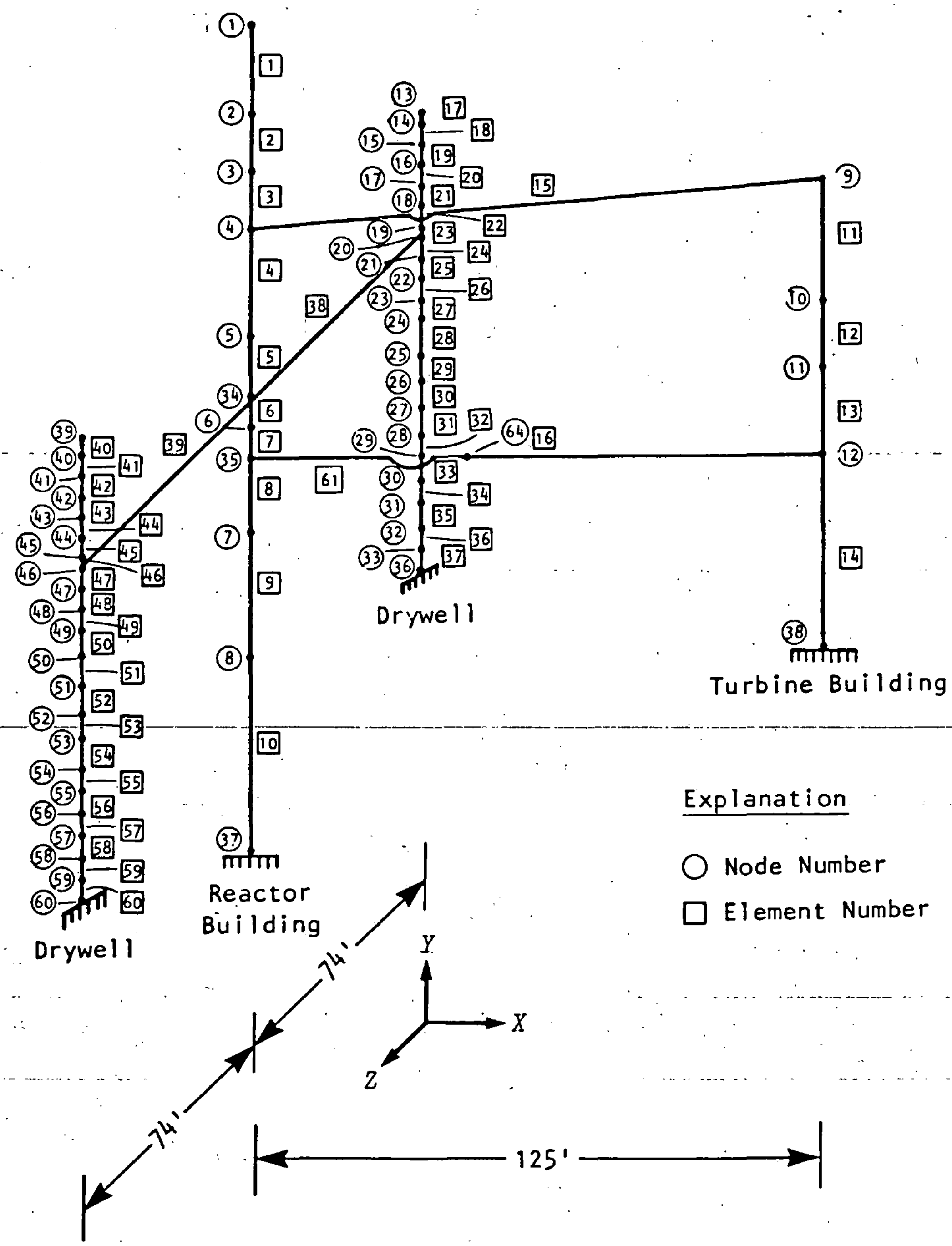

FIGURE 1 THREE-DIMENSIONAL LLL DYNAMIC MODEL OF THE REACTOR-TURBINE BUILDING COMPLEX, DRESDEN NUCLEAR POWER STATION, UNIT 2

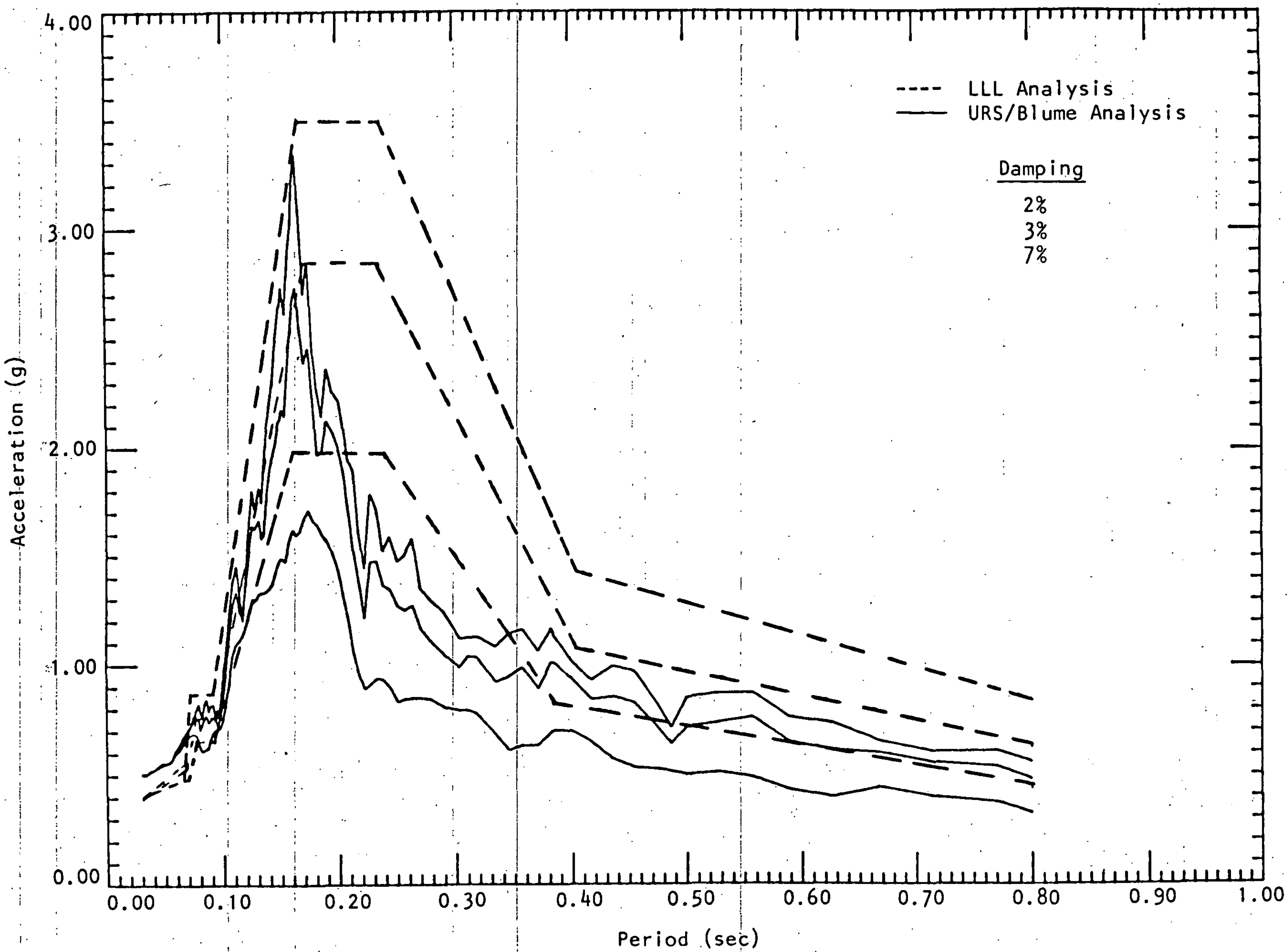

FIGURE 2 COMPARISON OF FLOOR RESPONSE SPECTRA, NORTH-SOUTH COMPONENT OF GROUND MOTION, NODE 5, EL 589 FT, REACTOR BUILDING, DRESDEN NUCLEAR POWER STATION, UNIT 2

URS/Blume

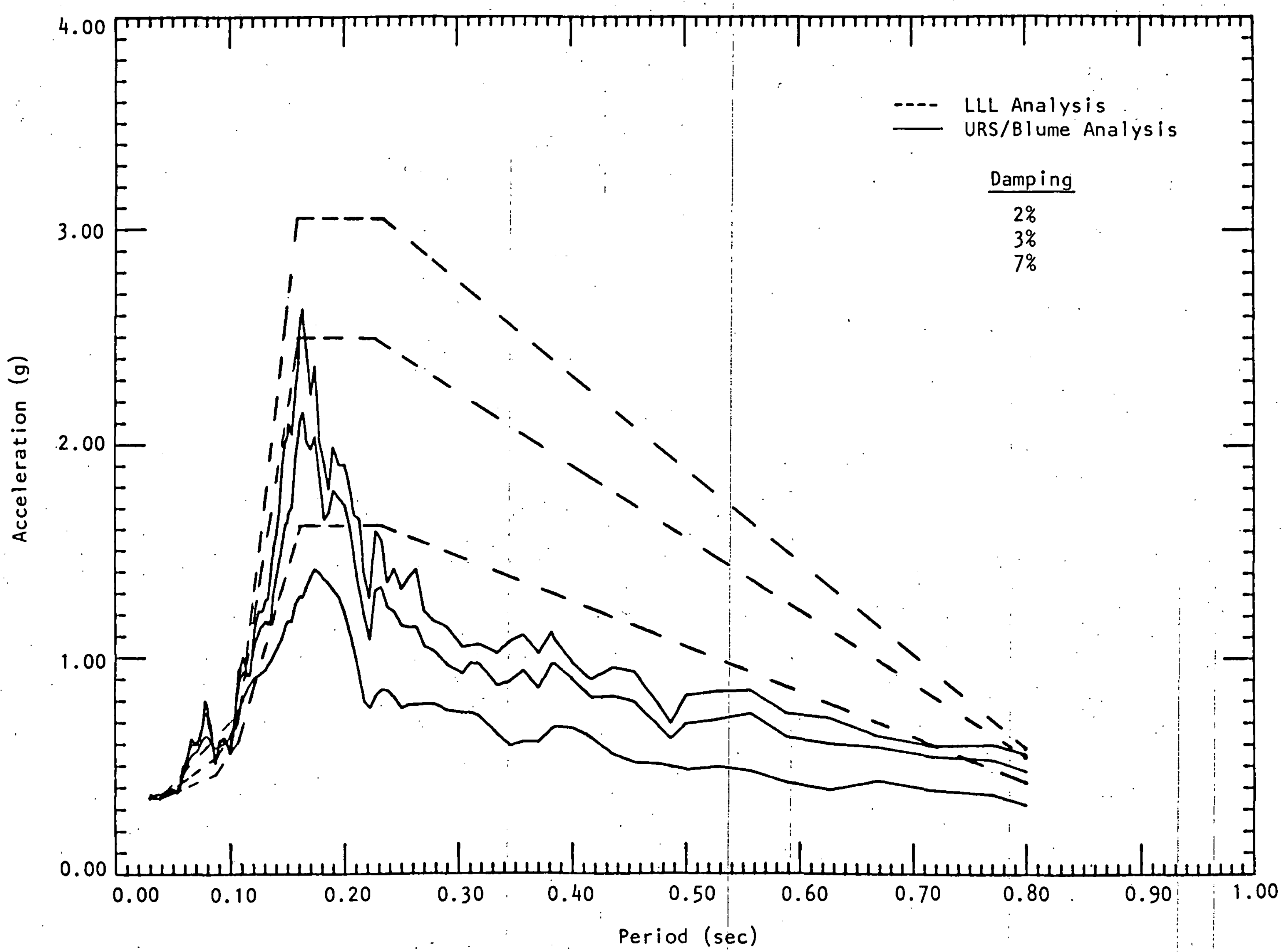

FIGURE 3 COMPARISON OF FLOOR RESPONSE SPECTRA, NORTH-SOUTH COMPONENT OF GROUND MOTION, NODE 6, EL 570 FT, REACTOR BUILDING, DRESDEN NUCLEAR POWER STATION, UNIT 2

URS/Blume

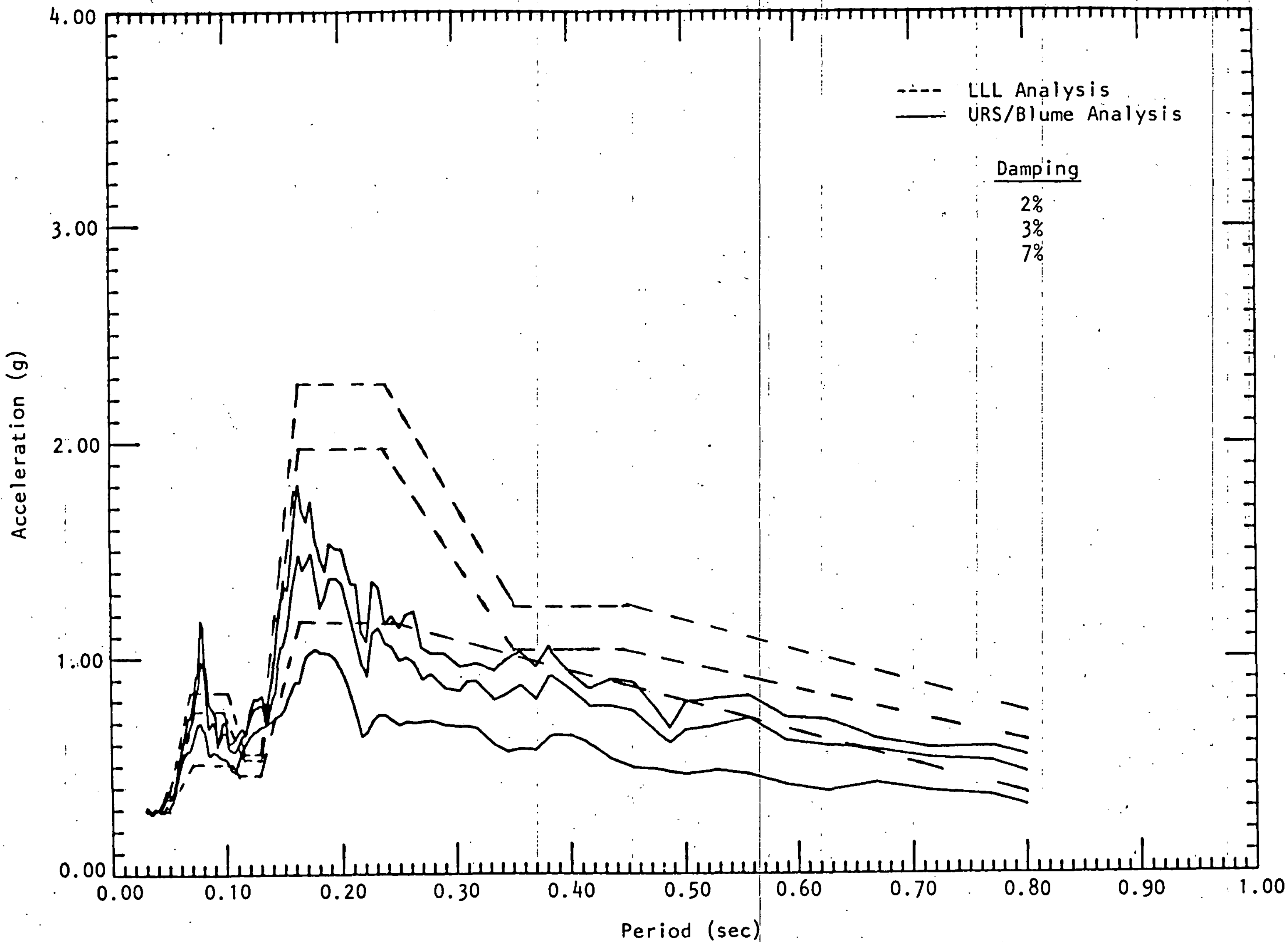

FIGURE 4 COMPARISON OF FLOOR RESPONSE SPECTRA, NORTH-SOUTH COMPONENT OF GROUND MOTION, NODE 7, EL 545 FT 6 IN., REACTOR BUILDING, DRESDEN NUCLEAR POWER STATION, UNIT 2

URS/Blume

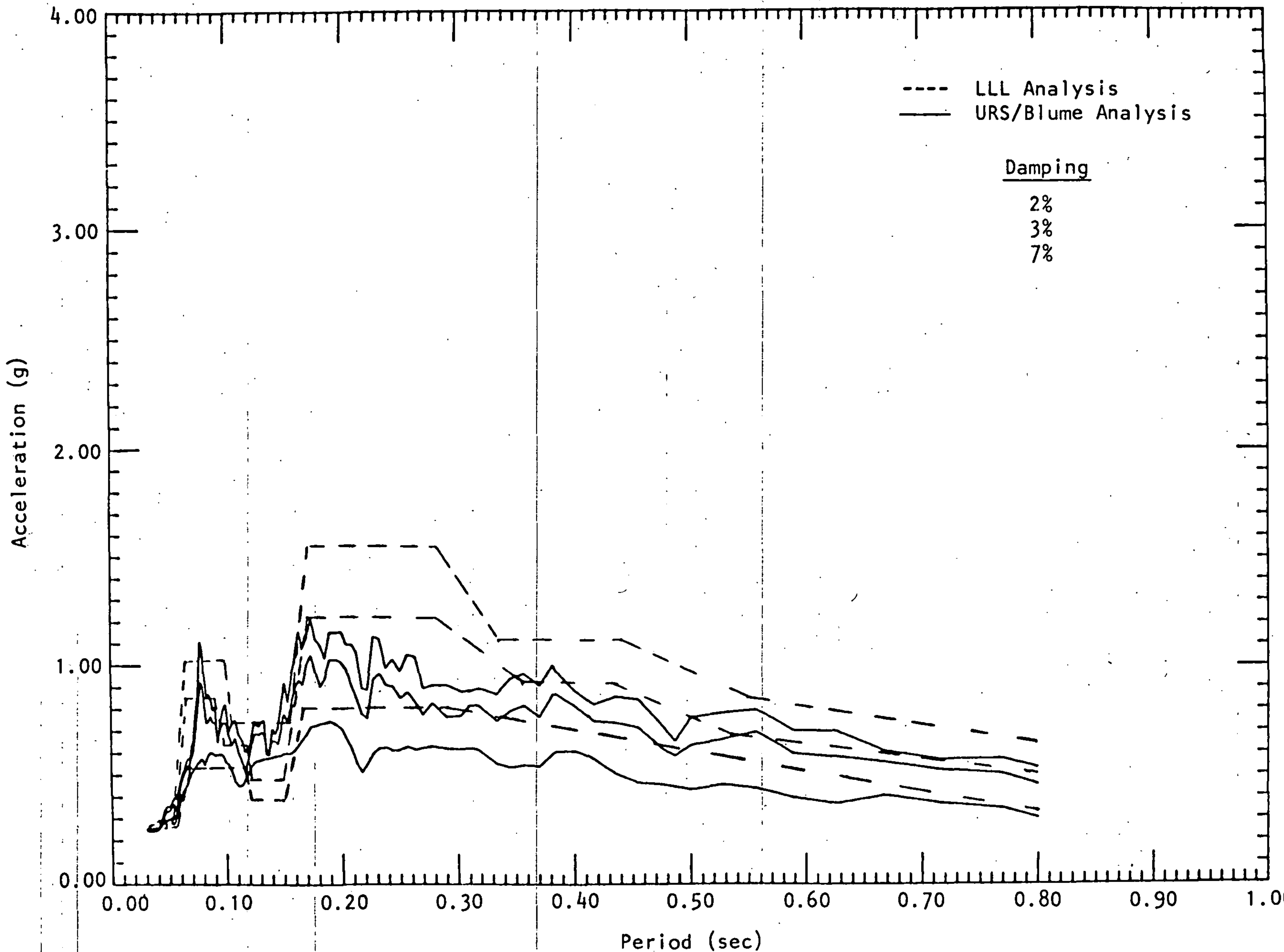

FIGURE 5 COMPARISON OF FLOOR RESPONSE SPECTRA, NORTH-SOUTH COMPONENT OF GROUND MOTION, NODE 8, EL 517 FT 6 IN., REACTOR BUILDING, DRESDEN NUCLEAR POWER STATION, UNIT 2

URS/Blume