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TEXAS UTILITIES GENERATING COMPANY

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July 16, 1984

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION
DOCKET NOS. 50-445 & 50-446
MOTIONS FOR SUMMARY DISPOSITION

REFERENCE: a. Transcript, Meeting of June 8, 1984
b. Transcript, Meeting of June 20, 1984

Dear Mr. Youngblood:

Attached for your review is additional information to address the questions remaining from the referenced meetings. This information pertains to action items (ASME vs AWS) and (Generic Stiffnesses).

Sincerely,

H C Schmidt

H.C. Schmidt
Manager, Nuclear Services

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Q Provide additional evidence thag CPSES weld designs meet the intent of Appendix XVII-2452.4 and .5 of the ASME Code.

The Staff's concern centered particularly on skewed-T welds, hence in our reply we are focusing on these welds. To provide the Staff with prompt reassurance that the Applicants' design process for such welds is appropriate, we established a program to review randomly selected skewed-T joints that would continue until certain systematic patterns would emerge. After reviewing 201 supports which utilise skewed T-joints (53-ITT, 78-PSE, and 70-NPSI), we felt that a systematic pattern of design approach was clearly identifiable, as discussed below. Examination of th e weld configurations for these supports yielded the following breakdown:

All around weld (4 sides)	-	180
2 side welds with an obtuse weld	-	12
2 side welds with an acute weld	-	1
2 side welds only	-	8

There were no weld joints that just consisted of an acute and obtuse weld. All welds had side welds. In the calculations for these supports, consideration was given to the skewed joint welds in accordance with the following:

1) For the all around welds
   a) Reduced effective throat was considered - 39
   b) Obtuse and acute welds neglected altogether - 76
      (Side welds only were used).
   c) Weld OK by engineering judgement (e.g. low loads) - 60
   d) Reduced effective throat not considered e g. - 5

2) For 2 side obtuse welds

   a) Obtuse weld neglected entirely - side welds only used - 7

   b) Weld OK by engineering judgement (e.g. low loads) - 5

3) For 2 side + acute weld

   a) Weld OK by engineering judgement (low load) - 1

The systematic pattern of design approach identified from the preceeding is that the engineer would consider effective throat reduction where necessary in conjunction with the side welds, but would altogether neglect the obtuse and acute weld if the side welds were sufficient. Further, where loads are very small, the engineer from his experience would qualify the weld by inspection. The exception to this pattern are five all around welds where the effective threat area of the obtuse and acute welds were not considered.

For the five all around welds where the reduced effective threat of the obtuse weld and the increased effective of the acute weld were not considered, the weld stress ratios were .331, .033, .059, .006, and .505 (when actual effective threats were used).

Applicants believe that this sample confirms that Applicants design processes for skewed T-joints meet the intent of Appendix XVII - 2452.4 and .5. In fact, in the majority of cases Applicants employ extremely conservative practices (note that in 76 cases for the all around welds, the engineer had qualified the joint using the side welds only even though he had obtuse and acute welds). There were no welds that did not have side welds.

Q. Provide additional information on tube steel utilized at CPSES which has a high D/2t ratio (D = width of tube steel and thickness).

We have identified all safety related supports in Unit 1 and common which utilize tube steel which has a D/2t ratio of 10 or more. There are 171 such supports. An evaluation of these supports was conducted and one support had a local stress condition which exceeded the AWS local failure allowable. The tube steel involved had a D/2t ratio of 16 (this was the highest ratio identified in any of the 171 supports). To assess the safety significance of this condition we reran the piping stress problem for this support with this support deleted from the analysis. There were no overstress conditions in the pipe or supports. It's obvious that this support was an isolated case. In any event we are conducting a similar review for all Unit 2 designs. The Unit 1 support is being modified.

Q Explain the difference between calculated stiffnesses and tested stiffnesses for those supports which were tested.

This NRC question was prompted by the discrepancy between the stiffness value calculated for support CC-2-011-708-A63R and that derived from test, as reported on Figure 1 and Table 1 of the Generic Stiffness Affidavit.

During the meeting we stated that this difference was probably due to play in the support during test, which should be taken up before measurement of the true stiffness is performed.

This was in fact the case. During the initial test, insufficient load had been applied to take up the play, thus resulting in a fictitiously low stiffness. The same support was tested, and the test stiffness is reported in the table below.

We have also retested the other tested supports to more accurately determine their stiffness. The results of the retests are also included in the table below.

SUPPORT	CALCULATED STIFFNESS (#/in)	TEST STIFFNESS (#/in) Old Test	New Test
CC2-011-001-A63R	$K = 8.1 \times 10^4$	7.1×10^4	(1)
CC2-011-708-A63R	$K = 5.0 \times 10^5$	7.0×10^4	2.3×10^5
	$K_2 = 7.6 \times 10^3$	4.8×10^3	4.9×10^3
CC2-011-713-A53R	$K_1 = 5.4 \times 10^5$	1.3×10^5	2.6×10^5
	$K_2 = 2.7 \times 10^6$	1.1×10^6	1.8×10^6
CC-011-719-A53R	$K_1 = 1.9 \times 10^5$	1.7×10^5	1.4×10^5

(1) Because of anomalies in test conditions, the results of this test were considered to be inaccurate, and, therefore, are not included.

Q Provide additional evidence that employment of generic stiffnesses is appropriate and that use of actual stiffnesses would not result in unacceptable increases in support loads, pipe stresses, or equipment nozzle loads.

Information presented in the Affidavit with regard to increases (or decreases) in pipe stresses, equipment nozzle loads, and pipe support loads clearly indicate that it is the latter which can experience the most significant changes. We have, therefore, fucussed our attention on the piping support reaction loads to provide further assurance to the Staff that employment of generic stiffnesses poses to safety concern for CPSES.

To provide this assurance we have randomly selected stress problems for pipe sizes not covered by the reanalyses reported in the Affidavit. Three stress problems were arbitrarily picked for each of the following pipe sizes: 2", 4", 10" and 24". We then selected one of the three stress problems per pipe size for reanalysis. This selection was not arbitrary, but was predicated on the following criteria intended to provide further evidence of the correctness of conclusions presented in the Affidavit.

1. Stress problems should contain the most lightly loaded supports- This was done to confirm that the lightly loaded supports would also have the lowest actual stiffness with respect to the generic one.

2. Stress problems should also contain highly loaded supports This was done to make sure that a range of stiffnesses from very low to very high would be covered in the same stress problem.

As discussed in the affidavit, piping stress problems exhibiting these conditions were most likely to produce the greatest changes in support loads when analyzed using actual rather than generic stiffnesses.

For the four stress problems thus selected, which are: 1-52X(2") 1-12D(4"), 1-87A(10"), -1-61B(24"), the actual stiffnesses have been calculated in the same manner as those of the stress problems

presented in the Affidavit.

These four stress problems contain a total of 188 supports. The range of stiffnesses seen in these supports is shown in the expanded Figure 1 (Figure 1 of the Affidavit expanded to include all of the stiffness of these additional supports)

The ratios of actual to generic stiffnesses for these supports range from 0.036 to 37.0(2"), 0. 196 to 94.6(4"), 0.063 to 4.56 (10"), and 0.009 tol.0(24") for the four stress problems

The range of stiffness ratios of interest is the low range, ie, actual stiffness less than generic stiffness, since as shown in Figures 1,2 and 3 of Attachment 2 of the Affidavit changes in support loads, pipe stresses, etc. for actual stiffnesses being higher than the generic ones, are small or negligible. This is also confirmed by the present analyses.

The lowest stiffness ratio for the stress problems presented in the Affidavit was 0.014. The lowest stiffness ratio in the additional stress problems in 0.009.

Thus the additional work performed by Applicants confirms the conclusion presented on p. 18 of the Affidavit that the actual stiffnesses for other piping systems will be in the range of stiffnesses of the first three problems.

To confirm the validity of the other conclusion reached on page 18 of the Affidavit, ie,"given the same range and variation of support stiffnesses in other systems, one can expect comparable variations in support loads and system response.....", we have plotted the results of the recent reanalyses on an expanded figure 2.

This expanded figure, attached, confirms that the heavily loaded supports in general experience increases which are less than 20 percent.

It further confirms that all supports which have been found to experience load increases of factors of 2 or more are very lightly loaded supports.

Examination of the actual stiffness of the lightly loaded supports confirmed that in all instances the lightly loaded support have a low stiffness. Further, very large percentage increases in load always occur for the lightly loaded supports, which also have very low stiffness (there are lightly loaded supports which have relatively high stiffness). This confirms the conclusion presented in page 19 of the Affidavit.

In the analysis of these additional 188 supports, we found four more supports (in addition to the 4 mentioned in the Affidavit) which experienced an increase in load in excess of a factor of 2.0. As stated above, all were lightly loaded, and only one experienced a load increase which significantly exceeded allowables.

The one exception is again a snubber, just as in the three cases presented in the Affidavit. In fact, the lightly loaded, low stiffness supports which experience the large load increases (in excess of 200 pe. ıt) are snubbers.

Although applicants dc not have test data on the capacity of this snubber (PSA½) as they did for the PSA 1 snubbers mentioned in the Affidavit, the construction of the snubbers regardless of size is the same. Thus, on the basis of the test data on PSA 1 snubbers, Applicants would expect that the PSA ½ would be capable of accommodating an increase in dynamic load of approximately 230 percent. Accordingly, Applicants believe that the calculated increased load of this snubber would present no safety concern.

Nevertheless, Applicants have performed additional analyses of the stress problem containing this snubber (stress Problem 1-87A) and the stress problem containing the other snubber which showed significant overloading (stress Problem AB-1-032 in the Affidavit) with those snubbers being removed from the analyses.

Applicants performed these analyses to demonstrate that since the supports are very lightly loaded, their removal would not cause over-stressing of the pipe, the nozzles or other supports.

The analyses without the aforementioned supports have confirmed such conclusion.

In sum, the combination of the following trends and inherent safety factors have convinced Applicants that indeed the use of generic stiffnesses in the stress analysis is adequate to assure that there is no safety concern at CPSES:

(a) Only simultaneously lightly loaded and very low stiffness supports (more than one order of magnitude lower than generic stiffness) will experience load increases in excess of 200 percent.

(b) Of such supports, only those which are snubbers are likely to have been designed with relatively low marking to the initially calculated load (because the designer would specify the snubber size closest to the originally calculated load, ie, calculated with generic stiffness modelling) and thus can possibly be computed to be overloaded (with respect to allowable) if the orignially calculated load increases. No exception has been found to this conclusion after review of 248 supports.

(c) Mechanical snubbers have inherent capacity of accommodating significantly higher loads than those for which they are rated, and are thus likely to accommodate the load increases that one would compute using the actual stiffnesses.

(d) Removal of the lightly loaded supports, which would be computed to be overloaded, from the stress problem do not cause piping stresses or nozzle and other support loads to increase in an unacceptable manner.
This is a direct consequence of the light loading of the support to begin with.

(e) As stated in the Affidavit, these large load increases resulting from employment of actual stiffnesses are only due to seismic excitation. Applicants have demonstrated in their Affidavit on Safety Factors, that there are very significant conservatisms in seismic designs which would more than compensate for the computed increases.

During the 6/20 meeting discussion also centered on the two possible causes of the changes in load produced by employment of the actual stiffnesses. Applicant's position was that the major contributor to the change, the one which produces the very significant increases or decreases, is the variation between stiffnesses of adjacent supports or group of supports, with a less pronounced effect contributed by the overall variation of the stiffness (ie, all supports decreasing in stiffness by a similar amount). Although the staff did not appear to disagree with this position, their opinion seemed to be that a considerable fraction of the increase in load would be due less to a redistribution of load than to a significant decrease in local frequency of piping response, with an accompanying large change in input acceleration.

To test the two hypothesis, Applicants have expanded the generic charts presented in Attachment 2 of the Affidavit to multispan systems, subjected to both the uniform spectrum input (constant acceleration at all frequencies) used for the single span model of Attachment 2, and a typical floor response spectrum of Comanche Peak.

As can be seen from the attached figure, which compares the results obtained for both input spectra, the effect of local frequency lowering can be profound and for large decreases in stiffnesses as or more significant than the load redistribution effect. It is equally clear that if the overall system stiffness decreases significantly, loads on all supports will increase.

This last effect is seen clearly in stress Problem 1-61B, wherein virtually all actual stiffnesses were found to be below the generic stiffness by about 12 percent of the generic stiffness.
Virtually all supports in the stress problem experienced an increase in load, with the average increase being about 40 percent and maximum increase of a factor of 3, which roughly corresponds to the increase which may be expected from a change in stiffness of a factor of 10. (Generic dimensionless stiffness for this problem is $1.2x10^3$ for rigid supports and $6.1x10^2$ for snubbers).
Conversely, stress problem 1-12D, which had a considerable number of supports with stiffnesses in excess of the generic stiffness, exhibited a general decrease in support loads (actual system is stiffer than generic system) averaging - 40%. No very large increases were experienced for this stress problem, indicating that local low frequency response effects are not as signific as load redistribution. From the preceding we conclude that the large changes occur when both load redistribution and local frequency shift are coincident. This situation arises when groups of supports of low stiffness are surrounded by relatively stiff supports, and is the condition that we have focussed on in performing the additional analyses.

Figure 1

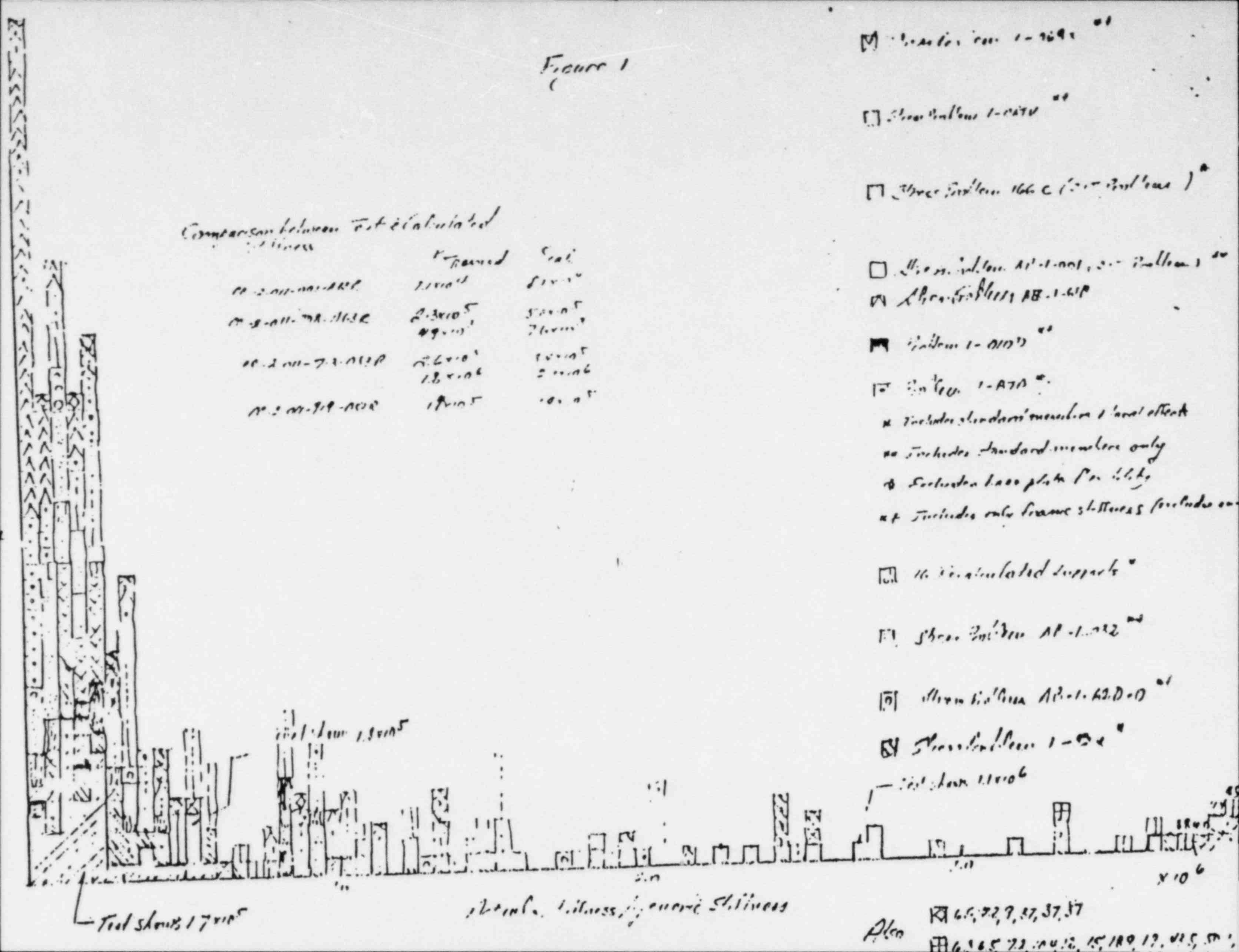
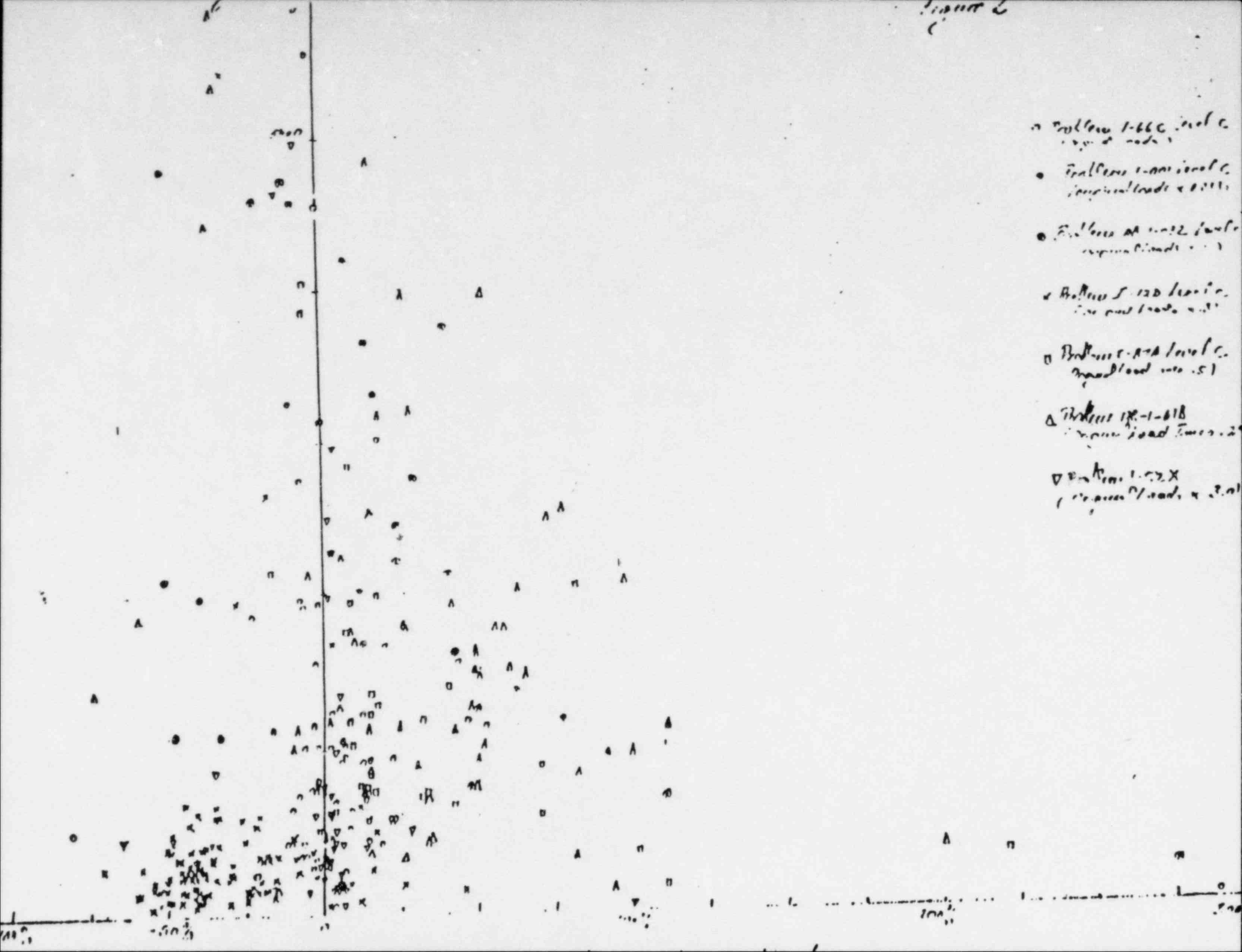

Comparison between Test & Calculated Stiffness
Includes standard members only
Test shows 1.7x10^5
x 10^6
Also

Figure 2



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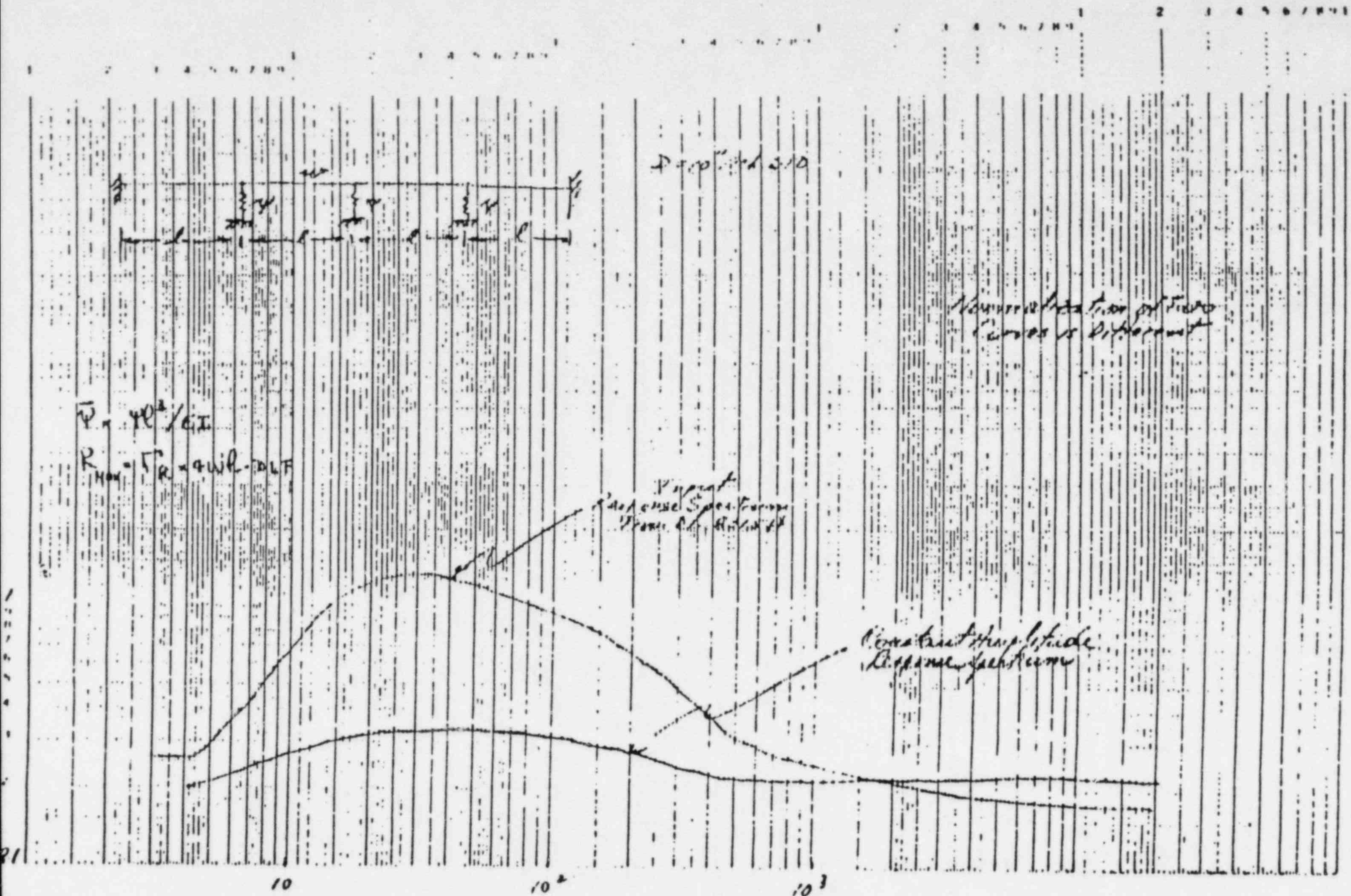
Normalization of Two
Curves is Different
Response Spectrum
Constant Amplitude
Response Spectrum
10
10²
10³