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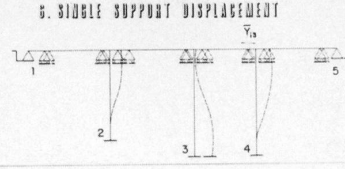
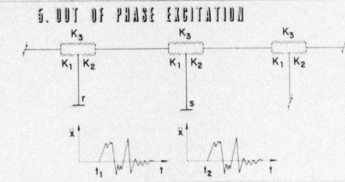
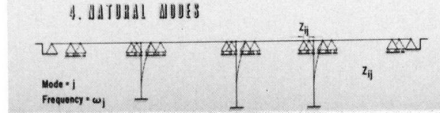
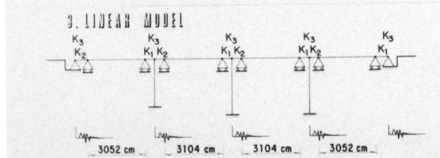
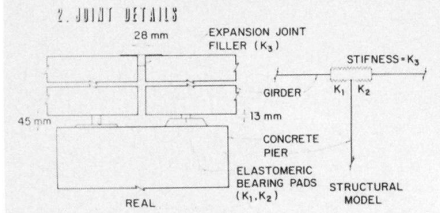
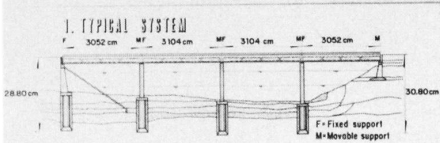
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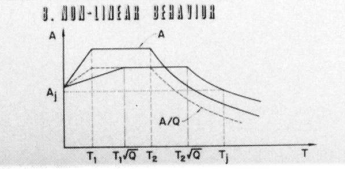
# SEISMIC SAFETY OF BRIDGES



**7. SUPERPOSITION**

$$D_{ij}^2 = \sum_r \sum_s \alpha_{sr} \alpha_{rs}^2 \cdot 2 \sum_k \sum_l \alpha_{kr} \alpha_{ls} \alpha_{kr} \alpha_{ls} \frac{A_{kr}}{\omega_k} \frac{A_{ls}}{\omega_l}$$

$\alpha_{kr}$  = Participation factor  
 $D_0$  = Peak ground displacement  
 $\alpha$ 's = Correlation coefficients



**9. RELIABILITY ANALYSIS**

1. Seismicity  
 Poisson process with mean rate function  $v_y(y)$  greater than  $y$   
 $\text{Log } v$  vs  $\text{Log } y$

2. Structural response for intensity  $Y$   
 $S = \phi Y$   
 $F_y(u) = P[\phi \leq u]$

3. Structural strength  $R$   
 $F_R(u) = P[R \leq u]$

4. Distribution of maximum intensity in 1 years  
 $F_{Tmax}(y, 1) = e^{-v(y) \cdot 1}$

1. Rate of occurrence of response values  $S$  greater than  $s$   
 $v_y(y) = \frac{\partial v_y(y)}{\partial y} \cdot y$   
 $P[S=s] = \int_y^\infty v_y(y) dy$   
 $P[\phi \leq -s/y] = P[\phi \leq -s/y]$

2. Failure probability ( $p_f$ )  
 A) Deterministic system  
 $p_f = 1 - e^{-v_y(M_d) \cdot 1}$   
 B) System with uncertain properties  
 $v_y(M_d)$  is function of system properties  
 $t_c$  and  $t_j$  (two-point probabilistic estimates)  
 $p_{R1} = 0.25$ ,  $p_{R2} = 1 - \frac{1}{1 + v_y(M_d) \cdot 1}$ ,  $p_{R3}$

**10. RESULTS**

1) Accounting for support stiffnesses

	$L_0$	$L_1$	$L_2$	Wave velocity (m/s)
Response	2500	1500	1000	500
$\Delta L_0$	0.52	0.53	0.56	0.61
$\Delta L_1$	0.08	0.08	0.08	0.08
$\Delta L_2$	4.92	4.83	4.76	4.64
$M_0$ (t-m)	398	394	386	375
$M_1$ (t-m)	351	350	345	336
$M_2$ (t-m)	282	282	282	282

2) Neglecting support stiffnesses

	$L_0$	$L_1$	$L_2$	Wave velocity (m/s)
Response	2500	1500	1000	500
$\Delta L_0$	5.8	6.35	6.7	7.1
$\Delta L_1$	8.5	8.5	8.5	8.5
$\Delta L_2$	7.2	7.2	7.2	7.3

(Discrete distributions)

Case	$t_c$ (kg/cm <sup>2</sup> )	$t_j$ (kg/cm <sup>2</sup> )	Resisting moment $M_R$ (t-m)
1	226.4	4915	4700
2	346.8	4915	4900
3	226.4	3941	4000
4	346.8	3941	4200
5	170	4000	3950

Deterministic case (nominal values of material properties)

Case	$P_f$ , 50 years	$P_f$ , 1 year
A	0.044	$90 \times 10^{-4}$
B	0.035	$80 \times 10^{-4}$

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