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ON CONVENTIONAL AND ATC-6 ASEISMIC BRIDGE DESIGN

THE SEISMIC DESIGN OF BRIDGES IN TAIWAN HAS BEEN BASED ON THE STATIC SEISMIC COEFFICIENT METHOD. ALTHOUGH SIMPLE, BUT THE METHOD DOES NOT CONSIDER THE EFFECTS OF BRIDGE DYNAMIC BEHAVIOR AND LOCAL SOIL CONDITION. THE MAIN OBJECTIVE OF THIS PAPER IS TO ASSESS THE ADEQUACY OF THE BRIDGE DESIGN METHOD.

BASED ON THE NEW ATC-6 SEISMIC DESIGN PROVISION PROPOSED BY THE U.S. APPLIED TECHNOLOGY COUNCIL, SIX SELECTED BOX-GIRDER R.C. BRIDGES HAVE BEEN ANALYZED. THE RESULTING MEMBER FORCES AND THE REQUIRED PIER REINFORCEMENTS ARE COMPARED WITH THOSE OBTAINED BY USING THE CONVENTIONAL DESIGN METHOD. THE RESULTS INDICATE THAT THE DEGREE OF SEISMIC SAFETY (EVALUATED IN TERMS OF THE ATC-6 COMPATIBLE EQUIVALENT ACCELERATION COEFFICIENT) PROVIDED BY THE TRADITIONAL STATIC SEISMIC DESIGN METHOD VARIES SIGNIFICANTLY W.R.T. THE BRIDGE TYPES AND SOIL CHARACTERISTICS. THIS TENDS TO SUGGEST THAT THE CONVENTIONAL METHOD USED IN TAIWAN IS INADEQUATE FOR ASEISMIC BRIDGE DESIGN.

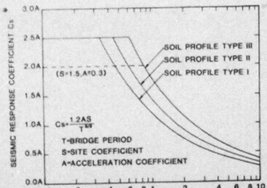

FIG 1 ATC6 ELASTIC SEISMIC DESIGN RESPONSE SPECTRA FOR BRIDGES

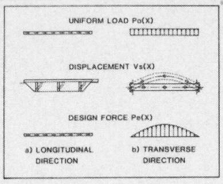

FIG 2 COMPUTATION ILLUSTRATION OF ATC6 SEISMIC DESIGN FORCE

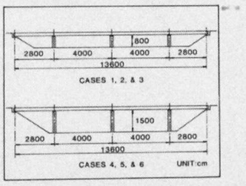

FIG 3 ELEVATIONS OF EXAMPLE FOUR-SPAN BOX-GIRDER BRIDGES

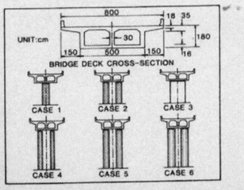

FIG 4 CROSS-SECTIONS OF EXAMPLE FOUR-SPAN BOX-GIRDER BRIDGES

	CASE NO.	1	2	3	4	5	6
	DESCRIPTION	180øx1 column	130øx2 columns	380x90 wall	100øx2 columns	140øx2 columns	180øx2 columns
LONGITUDINAL	α (cm)	156.7	178.7	229.2	3364.3	851.6	513.4
	β (t-cm)	202.4	232.3	297.9	4373.5	1107	667.4
	γ (t-cm)	23.2	30.5	50.2	1081.9	693.2	252
	PERIOD(sec)	0.774	0.829	0.609	3.599	1.811	1.406
	Cs(xAS)	1.423	1.359	1.251	0.511	0.808	0.966
	Pe(t/m,xAS)	18.5	17.67	16.26	6.64	10.5	12.43
TRANSVERSE	α (cm)	101.4	114.5	11.4	751.2	398.1	273.3
	δ (t-cm)	131.9	148.9	14.8	976.6	514.9	355.3
	γ (t-cm)	11.9	15.2	0.1	663	183.8	87.3
	PERIOD(sec)	0.686	0.731	0.227	1.886	1.367	1.136
	Cs(xAS)	1.54	1.478	3.229	0.786	0.974	1.103
	Pe(t/m,xAS)	24.68	23.77	33.54	12.98	16	18.04

TABLE 1 COMPUTATION OF ATC6 SEISMIC DESIGN FORCES FOR DIFFERENT CASES

	CASE NO.	1	2	3	4	5	6
LONGIT.	Mx(t-m)	—	—	—	—	—	—
	Mz(t-m)	2012.8	981.3	1769.5	677.5	1071	1267.8
	RESP MODIF.	3	3	3	3	3	3
TRANS.	Mx(t-m)	1326.7	627.3	2485.3	220.2	551.4	733.8
	Mz(t-m)	—	30.3	—	10.1	25.6	34.3
	RESP MODIF.	3	3	2	3	3	3
LOAD 1	Mx(t-m)	442.2	209.1	1228.2	73.4	183.8	244.6
	Mz(t-m)	201.3	106.2	177	71.1	115.6	138.2
	V(t)	547.9	280.1	571.5	282.9	310.1	327
LOAD 2	Mx(t-m)	132.7	62.7	368.4	22	55.1	73.4
	Mz(t-m)	670.9	323.5	589.8	223.5	359.6	426
	V(t)	547.9	280.1	571	282.9	310.1	327
REINFORCE.(cm)		884	451	904	432	423	432

TABLE 2 COMPUTATION OF REQUIRED PIER REINFORCEMENTS UNDER 0.3g ACCELERATION (S 1.0)

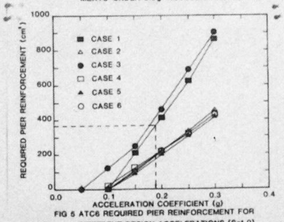

FIG 5 ATC6 REQUIRED PIER REINFORCEMENT FOR DIFFERENT DESIGN ACCELERATIONS (S=1.0)

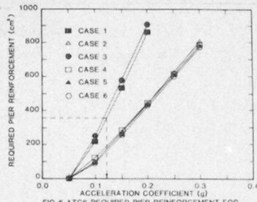

FIG 6 ATC6 REQUIRED PIER REINFORCEMENT FOR DIFFERENT DESIGN ACCELERATIONS (S=1.5)

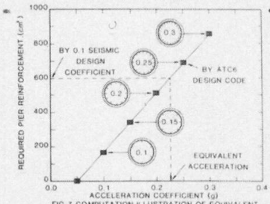

FIG 7 COMPUTATION ILLUSTRATION OF EQUIVALENT ACCELERATION COEFFICIENT

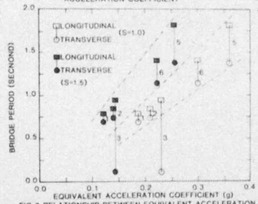

FIG 8 RELATIONSHIP BETWEEN EQUIVALENT ACCELERATION COEFFICIENT AND BRIDGE NATURAL PERIOD