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CONCRETE MEDIAN BARRIER RESEARCH

Vol. 2. Research Report

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Final Report

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16. Abstract

A comprehensive research program was conducted to appraise performance of concrete median barriers. Investigations included twenty-four crash tests which evaluated performance of barrier profiles, precast designs, and end treatments. Theoretical investigations using mathematical crash simulation program identified a new barrier shape which was crash tested to compare performance with currently used profiles. Load and stability criteria were determined from experiments and used to analyze barrier alternatives. Three crash tests examined performance of the CMB when impacted at 45 and 55 mph by a 40,000-lb intercity bus. Accident data were collected and analyzed for in-service performance of the concrete median barrier. State-of-the-art investigations provide summary of state practice and specimen CMB details. Cost factors are discussed for concrete median barrier construction. This research is considered applicable to concrete bridge parapets.

This volume is the second of two. The other volume is

Vol. No.	FHWA No.	Short Title	NTIS (PB) No.
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17. Key Words

Median barrier, safety, concrete, bridge parapet, bridge rail, accident

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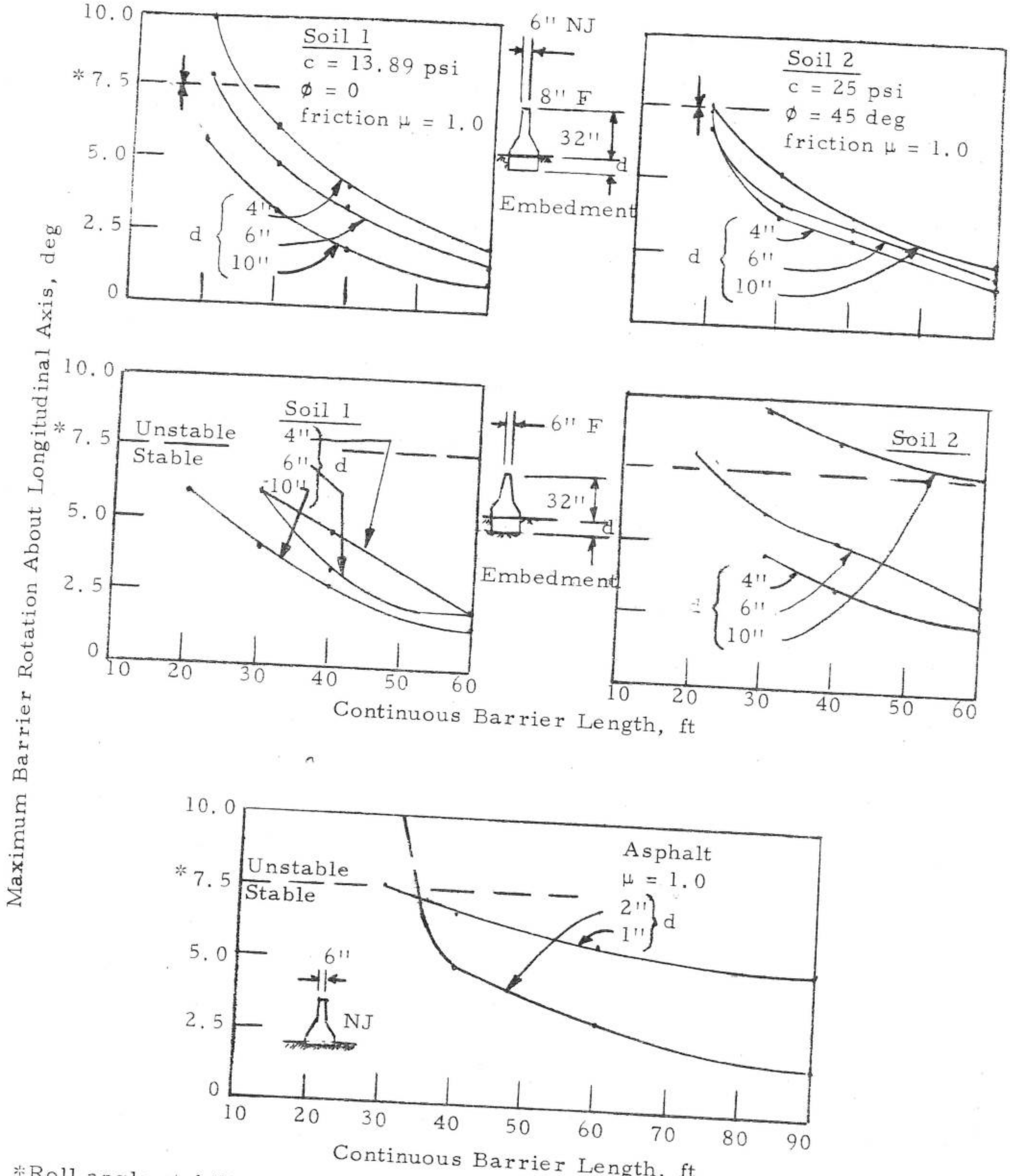
Stability. A reasonable math model was developed to evaluate CMB foundation restraint. Considerable difficulty was encountered in exercising this model due to boundary conditions which include complex interactions. Experimental results did not completely verify the model, but did give some confidence to the results in terms of judging acceptable values of barrier motion during simulated impacts. Results of experimental investigations were compared to establish validity of the model. A maximum roll angle of 7.5 deg indicated from the math model related to California Test 162 (see Table 20) was established as a threshold of barrier stability. No measurable roll angle in the reference test occurred; however, limitations of the math model preclude absolute correlation. Thus, the selection of the 7.5 deg angle is somewhat arbitrary, but should be on the conservative side. Since rolling of the barrier induces ramping, it is considered the least desirable when considering yawing or lateral displacements of the barrier. As shown in Figure 52 the roll angle of the barrier is related to embedment, but not in a direct sense. Due to the interaction of yaw and roll, and lateral displacements, it is difficult to predict barrier response without exercising the model.

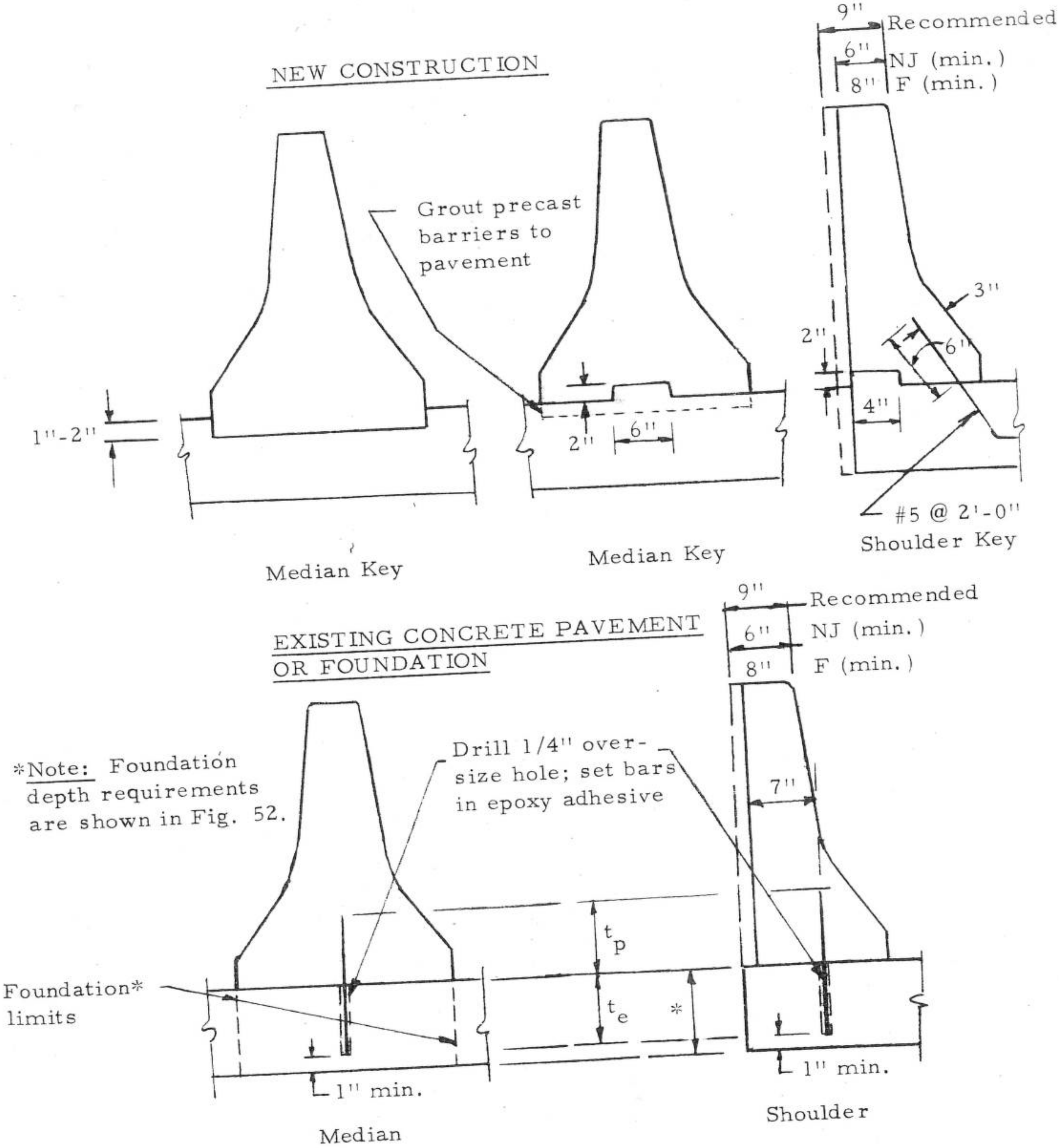
For Soil 1, the deeper embedment provides the better restraint; however for Soil 2, the 4-in. (100 mm) embedment is adequate for all New Jersey shape barrier lengths greater than 20 ft (6.1 m) where the values converge. For Configuration F, the 6-in. (38 mm) embedment is recommended for 20-ft (6.1 m) barriers and 4 in. (25mm) for barriers 30 ft (3.2 m) and greater. An asphalt layer of 1 in. (25mm) is adequate for lengths of 30 ft (3.2 m) in length.

Concrete barriers are placed on new and existing paved medians. For new medians, the use of keyways is recommended in lieu of dowels except for the shoulder barrier detail as shown in Figure 53. It may be economically advantageous to use a full section barrier even on shoulders due to stability considerations. For existing concrete medians, dowels installed into the existing pavement can be used as shown in Figure 53. Deformed bars are recommended to take advantage of the bar tension load in reacting barrier overturning forces. For asphalt pavements, it is recommended that a 1-2-in. (25-50mm) course of asphalt be placed at the barrier base as presented in Figure 52. Precast barriers with adequate joint strength can be sufficiently anchored by 1-2 in. (25-50mm) of asphalt or 1-in. (25mm) grout bed discussed previously. Barriers placed on existing foundations (i.e., approximately the same width as the barrier) have the same requirements regarding foundation depth in soil as given in Figure 52. Shoulder barriers (half sections) are not recommended for placement on foundations of the same width. A full section barrier is considered necessary for shoulder barriers not placed on continuous pavements.



*Roll angle stability threshold - 7.5°.

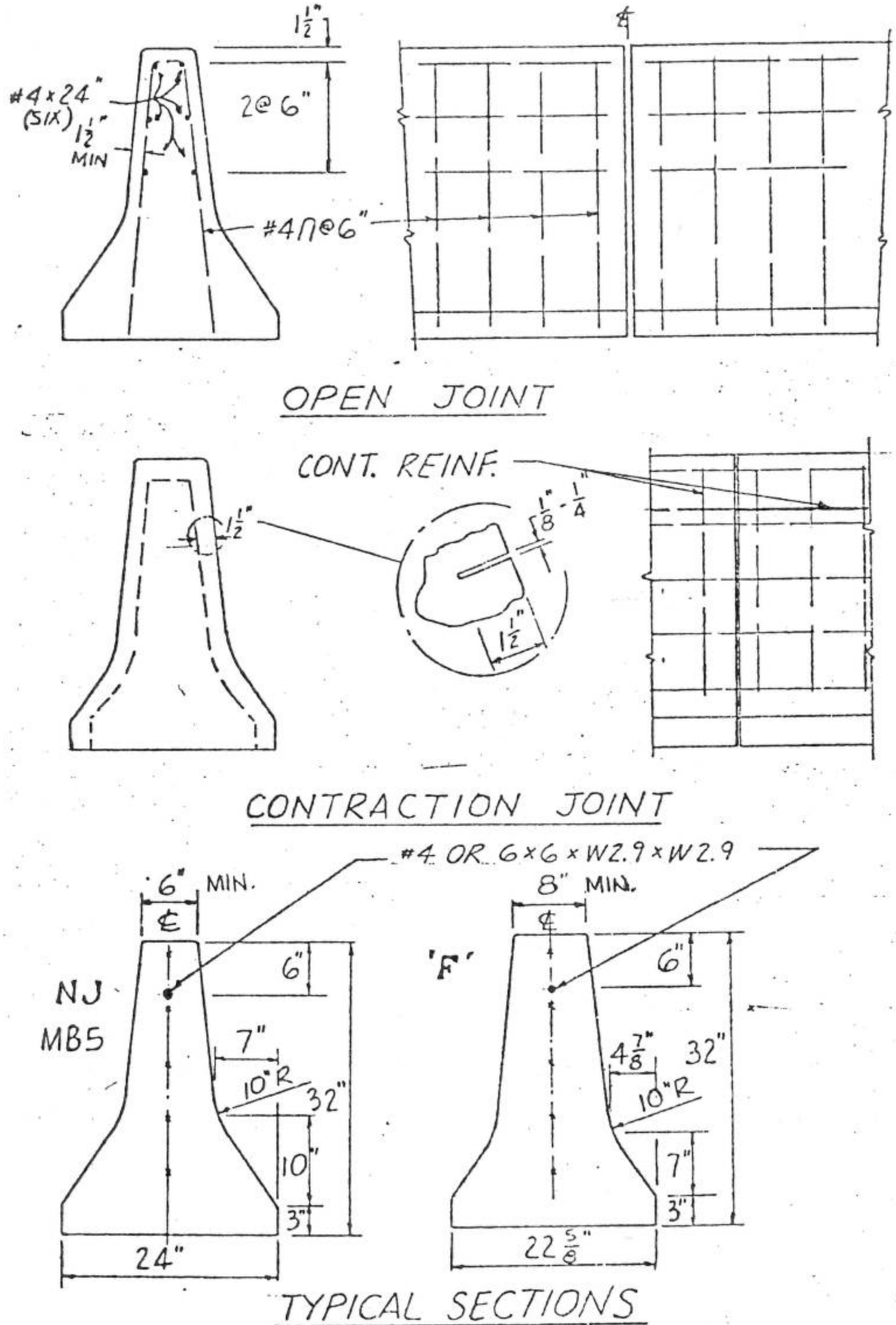
FIGURE 52. BARRIER STABILITY CURVES



t_e (in.)	t_p (in.)	Bars	Spacing
3	3	#8	1'-0"
4	4	#8	1'-6"
5	5	#4	2'-0"
6	6	#4	2'-6"

Bars	Spacing
#8	1'-0"
#8	1'-6"
#5	2'-0"
#5	2'-6"

FIGURE 53. BARRIER STABILITY DETAILS



Notes:

1. Barrier reinforcement is for severe impacts where fracture of barrier occurs. Either one rebar or welded wire fabric is recommended to hold barrier together. Adequate splice length of reinforcement is required across construction joints.
2. Corner reinforcement at open joints is required for equivalent strength of typical section.
3. Barriers shown are structurally adequate for standard strength test conditions with concrete strength f'_c = 3000 psi.
4. Foundation requirements are shown in Figure 52

FIGURE 55. RECOMMENDED MEDIAN BARRIER DESIGN, SLIPFORM AND CAST-IN-PLACE