Field Dynamic Loading Studies of Highway Bridges in the U. S., 1948–1965

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A compilation of pertinent information is presented for all highway bridges on which experimental dynamic load data have been gathered in this country since 1948. The bridges are grouped as simple, continuous or cantilever span types in three general superstructure categories: steel girder, concrete and miscellaneous. The tabulation provides a brief summary of construction details, dynamic measurements taken and the velocities, positions, and magnitudes of test loads. This compilation of dynamic bridge research test parameters provides the bridge design and research engineer a ready guide to field bridge study information not previously available in one source.

•THE FOLLOWING tabulation of highway bridges provides a reference to bridge types and parameters on which dynamic vehicular loading performance data are available for the use of highway bridge design and research engineers. The tabulation was compiled from published and unpublished reports on completed studies and from advance information available on current studies.

The bridge descriptions are presented in three groups: simple, continuous and cantilever spans. In each group the bridges are listed by superstructure category: steel girder, concrete and miscellaneous. Within each category the listing is alphabetically by State. For additional detail the reader is referred to the pertinent publications available.

Bridges on which the personnel and equipment of the U. S. Bureau of Public Roads Structures and Applied Mechanics Division have been employed in a cooperative field endeavor with a State Highway Department are indicated by an asterisk. These studies bear a relationship to one another because of the uniformity of research procedures followed and, in recent years, the nearly identical loadings with a vehicle whose dynamic characteristics are carefully measured. The same continuity of research holds true for many of the bridges studied by the Michigan Highway Department and for the AASHO Road Test bridges studied.

The format is designed to permit a quick comparison of the essentials of the bridge studies. Related field studies on which only static data are sought have not been included. The information contained in the tabulation is somewhat varied due to the diverse scope of the different reports. The information has been tabulated for publication at the request of C. P. Siess, Chairman of Highway Research Board Committee on Bridge Dynamics, and L. T. Oehler, Chairman of Highway Research Board Committee on Field Testing of Bridges.

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TABLE 1A

SIMPLE SPANS

Steel Girder Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
Illinois (AASHO Road Test, 10 bridges) 1958-1961	All 50' span 1-lane bridges of 15' roadway; 8 non-composite (5 with cover plates) and 2 composite; 3 18 WF- or 21 WF-beams with $6^1/_2$" slab; designed for 27,000- and 35,000-psi stress level under applied loadings.	Deflections; top and bottom flange strains at midspan, at ends of cover plates and other sections; wheelpath profiles taken.	One vehicle path generally; various 2- and 3-axle loads; induced impact; extensive vehicle instrumentation; tests to failure; speeds from creep to 50 mph	15
*Maryland (Shawan Rd.) 1962	A 100' composite welded deck plate girder span; 3-lane 33' roadway on 7 beams of 54" depth; 7" slab with 2" bituminous wearing surface; H20-S16 design; on 3% grade; flange thickness transitioned.	Deflections; top and bottom flange strains at midspan; shear strains near bearing; fixed bearing reactions; strains at bottom flange transitions; wheelpath profiles taken.	BPR test vehicle; speeds to 50 mph on 9 paths for creep and 4 paths for other runs; induced impact; 73 K on axles (10, 33 and 30 K, at 13' and 20' spacing; axle housing gages calibrated by incremental loading.	23
Massachusetts (Conway-Shirkshire) 1953	A 69' non-composite rolled I-beam span; H15 design; 14' roadway with $6^1/_2$" slab on 4 33WF141 beams.	Midspan deflection at one point.	Speeds to 40 mph; 44 K on 2 axles (7 and 37 K) at 13' spacing; vehicle spring constants and natural frequency measured; centerline runs.	
Massachusetts (Gilbertville-	A 114' non-composite deck plate girder span; 24' roadway with	As above.	As above.	7

	60° skew; H20 design.			
Massachusetts (Ware-Malboeuf) 1953	A 77' non-composite through plate girder span; 18' roadway with $2\frac{1}{2}$" open steel-grating deck on 16WF45 floor beams carried on 2 54" deep girders.	As above.	As above.	7
Massachusetts (Townsend-South St.) 1953	An 86' non-composite through plate girder span; 24' roadway with 7" slab on two 84" deep beams; 17° skew; H15 design.	As above.	As above except 43 K on 2 axles (8 and 35 K) at 13' spacing.	7
Massachusetts (Townsend-Main St.) 1953	An 89' composite rolled I-beam span; 7" slab; 30' roadway on 8 36WF170 beams; 21° skew; H20 design; cover plated.	As above.	As above.	7
Michigan (Fennville) 1950, 1953	Six 60' spans; 5 non-composite, 1 composite; 28' roadway with 7" min. slab on 7 36WF182 beams.	First test: strains and deflections at midspan, all spans; strains in lateral deck reinforcing bars; strains in diaphragms. Second test: midspan deflections only; 1 gage per span except 2 spans with 1 gage per beam.	First test: three vehicle paths; induced impact; simulated load in 1 lane; 72 K on 3 axles (18, 32 and 32 K) at 14' spacings; speeds to 12 mph; also 38 K on 3 axles (8 and 30 K tandem) at 12' and 4' spacing; speeds to 25 mph. Second test: speeds to 50 mph on centerline only; 50 K on 3 axles (10, 18 and 22 K) at 14' spacings; 28 K on 2 axles (10 and 18 K) at 14' spacing.	2, 8
Michigan (B8-58-7-26) 1956	Three composite spans of 70', 60' and 72'; 36WF150 to 230 stringers spaced at 6' centers with 7" min. slab; 28° skew.	Deflections.	39 K on three axles (6, 15 and 18 K) at 13' and 14' spacings; speeds to 25 mph; axle housing gages calibrated under incremental loading.	24

TABLE 1A (Continued)

Site/Date	Specifications	Measurements	Loading	Ref.
Michigan (B2-39-3-8) 1957	A 45' non-composite span with $7\frac{1}{2}$" slab on 30WF108 beams at 58" centers; a 49' non-composite span with $7\frac{1}{2}$" slab on 30WF124 beams at 58" centers.	One midspan deflection gage in each of 2 spans.	40 K on 3 axles (6, 16 and 18 K) at 13' and 14' spacing; speeds to 45 mph on 1 path; axle housing gages calibrated under incremental loading.	13
Michigan (X3-33-6-1) 1957	Three 61' composite spans; $7\frac{1}{2}$" slab on 36WF170 beams at 64" centers.	One midspan deflection gage in each of 3 spans.	As above.	13
*Missouri (Burris Fork) 1955	A 45' non-composite span; 22' roadway; $6\frac{1}{4}$" slab on two 27WF94 exterior beams and two 27WF102 interior beams; H15 design.	Deflections; top and bottom flange strains at midspan and quarter point; wheelpath profiles taken.	Three vehicle paths; 65 K on four axles (6, 27 and 32 K tandem) at 13', 20' and 4' spacing; spring constants determined; speeds to 48 mph; induced impact.	14
*South Dakota (James R.) 1955	A 55' composite span; 24' roadway of 6" slab on 4 30WF108 beams; level grade; welded connections; H15 design.	As above.	Two vehicle paths; 71 K on 5 axles (7 K, 32 K tandem and 32 K tandem) at 11', 4', 17' and 4' spacing; 32 K on 2 axles (14 and 18 K) at 12' spacing; speeds to 40 mph; axle housing gages calibrated under incremental loading; induced	23

(P. & S. F.) 1962	framed grid on random spaced columns; 3° curve and 2% grade; 9 lines of 30WF108 and 30WF116 beams; transverse 30WF108 and 30WF132 members at 39', 30', 37', 39' and 34' spacing; two 24' roadways and 4' median; $6^1/_2$" slab; H20 design.	various points on longitudinal and transverse beams; column bending strains; wheelpath profiles taken.	vehicle paths; 68 K on 3 axles (9, 31 and 28 K) at 13' and 20' spacing; axle housing gages calibrated under incremental loading; speeds to 50 mph; some uncontrolled commercial traffic recorded.	
*Virginia (Weyers Cave) 1961	Three 67' composite spans; 24' roadway of $7^1/_2$" slab on 4 36WF160 cover plated beams; H20 design; 1.7% grade.	Deflections; top and bottom flange strains at midspan; pier top longitudinal deflections; flange strains at ends of cover plates and near bearing; wheelpath profiles taken.	BPR test vehicle; 3 vehicle paths; speeds to 45 mph; induced impact; 58 K on 3 axles (10, 24 and 24 K) at 13' and 20' spacing; 73 K on 3 axles 10, 32 and 31 K) at 13' and 20' spacing; spring constants determined.	19
*Virginia (Hazel R.) 1962	Two 63' and 1 67' composite spans; H20 design; nearly level grade; 24' roadway with $7^1/_2$" slab on 4 36WF150 beams in 63' spans and 36WF160 beams in 67' span; latter is an identical superstructure to Weyers Cave bridge above; all beams in all spans cover plated.	As above.	BPR test vehicle; 74 K on 3 axles (10, 32 and 32 K) at 13' and 20' spacing; axle housing gages calibrated under incremental loading; speeds to 30 mph; induced impact; 5 vehicle paths.	22

TABLE 1B

SIMPLE SPANS

Concrete Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
California (Harrison St.) 1960	80' span 4-cell box girder; H20-S16 design; 28' roadway; 2" asphalt wearing surface on $6\frac{3}{8}$" deep slab; box 4' 10" deep; 2% grade and superelevated.	Concrete and steel flexural strains; shear strains near bearings; temperatures; tested before and after adding intermediate diaphragm.	58 K on 2 axles (12 and 46 K) at 13' spacing; speeds to 20 mph; induced impact; minor vehicle instrumentation.	23
Illinois (AASHO Road Test, 8 bridges) 1958 to 1961	All 50' span 1-lane bridges with $6\frac{1}{2}$" slab and 15' roadway; four prestressed bridges, each with 3 24" deep I-beams; 2 post- and 2 pretensioned; designed for 300- and 800-psi tensile stress; 4 T-beam bridges, each with 3 $11\frac{1}{2}$" wide by 20" monolithic beams; variable reinforcement; designed for 30,000- and 40,000-psi tensile stress in reinforcing bars.	Deflections; strains on reinforcing and prestressing steel; surface strains on prestressed concrete; wheelpath profiles taken.	One vehicle path generally; various 2- and 3-axle loads; induced impact; extensive vehicle instrumentation; tests to failure; speeds from creep to 50 mph.	15
Iowa (Des Moines R.) 1958	A 100' prestressed post-tensioned span; 30' roadway on 6 60" deep I-beams; level grade; 2 intermediate diaphragms; $6\frac{1}{4}$" slab.	Strains on bottom surface of beams at midspan; additional strains on web for neutral axis determination.	Four vehicle paths; speeds to 25 mph; 41 K on 3 axles (9 K and 32 K tandem) at 13' and 4' spacing; 74 K on 5 axles (9 K, 32 K tandem and 33 K tandem) at 11', 4', 19' and 4' spacing.	12
*Maryland	A 100' prestressed, post-	Deflections; surface strains	BPR test vehicle; 73	23

	centers; 3% grade; H20-S16 design.		speeds to 45 mph; induced impact; axle housing gages calibrated by incremental loading.	
*New York (Chili Ave.) 1965	A 66' T-beam span with 48' roadway and 7" slab on 7 beams 10" wide by 59" deep; H20-S16 design; 14° skew; A432 reinforcement; 3% grade; monolithic beams and slab.	Deflections; strain gages on tensile reinforcement; strain gages in slab; wheelpath profiles to be taken.	BPR test vehicle; 74 K on 3 axles (10, 32 and 32 K) at 13' and 20' spacing; other factors to be determined; axle housing gages calibrated under incremental loading.	25
Pennsylvania (Centerport Cr.) 1954	A 33' span of 9 pretensioned, prefabricated 21" by 36" beams, each with 2 12½" diameter hollow cores; level grade; 2" asphalt wearing course; 25' roadway; shear keys for lateral load distribution; designed for 80% of H20-S16 wheel load to each beam.	Deflections of center and edge beam at midspan and quarter span for dynamic runs.	Speeds to 25 mph; induced impact; 57 K on 3 axles (5, 18 and 34 K) at 13' and 22' spacing; centerline and curb lane vehicle paths.	5
*Pennsylvania (Little Schuylkill R.) 1964	A 61' span of 5 prestressed pretensioned box beams at 83" centers with 7½" slab; 30' roadway; H20-S16 design; 5 hollow rectangular beams, 48" wide and 33" deep with 5" walls; level grade; neoprene bearing pads.	Deflections; strain at various levels on beam sides, on bottom surface of beam, on top and bottom of slab and on curb and parapet all at 3.55' from midspan; similar strain measurements at a section 18' from bearing.	BPR test vehicle; 74 K on 3 axles (10, 32 and 32 K) at 13' and 20' spacing; also second vehicle with 74 K on 3 axles (9, 32 and 33 K) at 14' and 22' spacing; both run in parallel at 20 mph; speeds to 35 mph with BPR vehicle; 3 high-speed and 7 creep vehicle paths; induced impact.	23

TABLE 1C

SIMPLE SPANS

Miscellaneous Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
California (Vacaville) 1964	A 26', 34' wide orthotropic deck plate span; 30° skew; longitudindal stiffeners at 18" centers; transverse stiffeners at 12" centers; one free edge; one elastically supported.	Deflections and strains under outside wheel track of curb lane.	Dynamic loading by random truck traffic; wheelbases and axle loads measured at weigh station.	23
Michigan (B2-61-3-21) 1956	A 108' and 110' through truss span; fabricated bridge floor on 16WF46 floor beams at 39" centers.	Deflections.	39 K on 3 axles (6, 15 and 18 K) at 13' and 14' spacings; speeds to 35 mph; axle housing gages calibrated under incremental loading.	24
Pennsylvania (Ft. Loudon) 1948	A 14' deep, 111' span riveted Warren through truss, H20 design; 23' roadway on I-beam stringers; 7" slab and 4" bituminous wearing course; 2% grade.	Strains and deflections at critical points on truss members, floor beams and stringers.	Speeds to 50 mph; 8 test vehicles; most loading by 96 K on 5 axles (9 K, 42 K tandem and 45 K tandem) at 14', 4', 15' and 4' spacing; centerline runs, both directions; braking runs.	1
Virginia (Statewide)	35 composite steel girder bridges of varying length and	Vibrations measured with a portable accelerometer at	Runs of 10 and 20 mph in several lanes; 20 K	16

*Virginia (Reynolds Bridge) 1963	Aluminum modified semi-monocoque of 5 modules in a 97' span; H20 and H15-S12 design; 28' roadway; 1% grade; 4' 10" deep modules; lateral bracing at 8' centers; longitudinally stiffened webs; 7¼" composite slab of light-weight concrete.	Deflections and strains at mid-span for each module; fixed bearing reactions; wheelpath profiles taken; shear strains.	BPR test vehicle; 75 K on 3 axles (10, 33 and 32 K) at 13' and 20' spacing; speeds to 30 mph; axle housing gages calibrated under incremental load; 4 vehicle paths; induced impact.	23
*Maryland (Fairchild Bridge) 1964	Aluminum semimonocoque of 5 modules in 93' span; H20-S16 design; 30' roadway; 5' 7" deep modules; 6" composite slab of lightweight concrete; on 3% portion of vertical curve.	Deflections and longitudinal strains at midspan for each module; shear strains at section 8' from bearing; wheelpath profiles taken.	BPR test vehicle; 75 K on 3 axles (10, 33 and 32 K) at 13' and 20' spacing; axle housing gages calibrated under incremental load; speeds to 63 mph on 3 vehicle paths; slower runs on 8 vehicle paths; induced impact.	23

The following bridges described in the continuous or cantilever span sections also include simple span portions:

Michigan - Jackson Bypass
Michigan - (B1-81-1-13)
Michigan - (B1-77-20-11)
Michigan - (B1-33-6-4)
Michigan - (B1-56-12-6)
Michigan - (B1-11-18-7)

TABLE 2A

CONTINUOUS SPANS

Steel Girder Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
California (San Leandro Cr.)	63' continuous spans; every third span has 46' suspended portion; 3 non-composite 36WF230 beams; 28' roadway; 8" slab; H20-S16 design; on 3% grade; cover plates over bearings.	Deflections; top and bottom flange strains in 1 continuous and 1 suspended span; positive and negative moment sections gaged; Carlson strain meters in concrete; strains on columns, diaphragms and girder webs; tested with diaphragms connected and disconnected.	Five vehicle paths; speeds to 25 mph; induced impact; 67 K on 2 axles (17 and 50 K) at 14' spacing; 85 K on 5 axles (9 K, 32 K tandem, and 44 K tandem) at 14', 4', 23' and 4' spacing.	3
Indiana (Purdue) 1953	63'-75'-63' non-composite continuous spans; 6 33WF130 beams; 28' roadway; 7" slab; H20 design; level grade.	Top and bottom flange strains in 3 positive and 2 negative moment sections; slip between slab and steel; deflections on 2 beams; concrete surface strains; web strains.	Two vehicle paths; speeds to 35 mph; induced impact; 49 K on 5 axles (5 K, 20 K tandem and 24 K tandem) at 12', 4', 12' and 4' spacing; also H15 and H20 loadings; sprung load frequency measured.	6
*Iowa (Miller's Cr.) 1956	55'-70'-55' composite continuous spans; 2 27WF94 exterior and 2 30WF116 interior beams; 28' roadway; 8" slab; H20-S16 design; level grade; cover plated at mid-span and at bearings.	Deflections; top and bottom flange strains at positive and negative moment sections; wheelpath profiles taken.	Centerline, curb and normal lane vehicle paths; speeds to 55 mph; induced impact; 23 K on 2 axles (5 and 18 K) at 12' spacing; 64 K on 5 axles (7 K, 25 K tandem and 32 K tandem) at 11', 4', 18', and 4' spacing; axle housing gages calibrated by incremental	11

Iowa (Wapsipinicon R.) 1956	73'-94'-94'-94'-73' non-composite continuous spans; 2 33WF125 exterior and 2 36WF160 interior beams; 24' roadway; 8 " slab; H15 design; level grade; cover plated at bearings.	Positive moment section deflections and top and bottom flange strains in first 3 spans; negative moment top and bottom flange strains near interior pier; wheelpath profiles measured.	Centerline, curb and normal lane paths; speeds to 50 mph; induced impact; same vehicles as for Miller's Creek bridge above.	11
Iowa (Skunk River) 1957	73'-94'-73' composite continuous spans; 2 33WF141 and -152 exterior beams; 4 36WF194 interior beams; 48' roadway; $8\frac{1}{8}$" slab; cover plated at bearings.	Bottom flange strains at 1 positive and 1 negative moment section and near ends of cover plate.	Speeds to 50 mph; 14 creep-speed vehicle paths; 4 paths at higher speeds; 41 K on 3 axles (9 K and 32 K tandem) at 13' and 4' spacing.	10
Iowa (Ashworth Rd.) 1958	53'-67'-67'-53' composite continuous spans; 2 30WF108 exterior beams; 2 33WF130 interior beams; 28' roadway; $7\frac{1}{4}$" slab; level grade; cover plated at bearings.	Bottom flange strains at 2 positive and 2 negative moment sections; additional strains on web for neutral axis location.	Dynamic runs on centerline and on regular traffic lanes; speeds to 40 mph; 41 K on 3 axles (9 K and 32 K tandem) at 13' and 4' spacing; 74 K on 5 axles (9 K, 32 K tandem and 33 K tandem) at 11', 4', 19' and 4' spacing.	12
Michigan (Jackson Bypass) 1953	A 73'-92'-74' continuous portion and 5 76' to 84' simple spans; 2 29' roadways, each on 6 50" deep plate girders; cover plates; light vertical and horizontal curvature.	One point deflection at midspan of each span.	Speeds to 45 mph on 1 vehicle path in each roadway; induced impact; 28 K (10 and 18 K) on 2 axles at 14' spacing; 50 K on 3 axles (10, 18 and 22 K) at 14' spacings; also weighed and measured commercial traffic.	8
Michigan (B1-34-13-8) 1956	A 101' non-composite end span of a 3-span continuous deck plate girder bridge with floor beams and stringers; 7" min slab on 18WF50 stringers at 5' centers.	Deflections.	Speeds to 35 mph; 39 K on 3 axles (6, 15 and 18 K) at 13' and 14' spacings; axle housing gages calibrated under incremental loading.	24

TABLE 2A (Continued)

Site/Date	Specifications	Measurements	Loading	Ref.
Michigan (B1-70-7-3) 1957	A 69' end span of a 3-span non-composite skewed continuous plate girder; $7\frac{1}{2}$" slab on 66" deep girders at 94" centers.	One midspan deflection gage.	Speed to 45 mph on 1 path; 40 K on 3 axles (6, 16 and 18 K) at 13' and 14' spacings; axle housing gages calibrated under incremental loading.	13
Michigan (B2-38-1-14) 1957	42'-80'-42' non-composite continuous spans; $7\frac{1}{4}$" slab on 36WF170 beams at 62" centers.	One midspan deflection gage in center and 1 end span.	As above.	13
Minnesota (No. 6440) 1952	Two 85' end spans, 4 100' center span with 70' suspended portion on 15' cantilevers; continuous composite H20 design; 3-lane 27' roadway; $6\frac{1}{2}$" slab on 8 36WF150 beams.	Strains at 116 points.	One vehicle path in each direction; 51 and 30 K 2-axle vehicles; natural frequencies of sprung load determined; 50 mph for lighter and 20 mph for heavier vehicle; static loadings; induced impact; vehicles also run in tandem.	4
*Missouri (Burris Fork) 1955	60'-80'-60' non-composite continuous spans; 22' roadway of $6\frac{1}{4}$" slab on 4 beams; 33WF130 exterior, 33WF130 interior in end spans, and 33WF141 interior in center span; H15 design.	Deflections; top and bottom flange strains at 3 midspan sections; wheelpath profiles taken.	65 K on 4 axles (6, 27 and 32 K tandem) at 13', 20' and 4' spacings; spring constants determined; speeds to 51 mph; induced impact; 3 vehicle paths.	18
*Oregon (N. Dillard) 1953	121'-160'-121' composite continuous spans; 30' roadway of $6\frac{1}{2}$" slab on two variable depth (70" to 110") plate girders; nearly level grade; cover plated at positive and negative moment sections; 3 longitudinal lines of 16WF-stringers on	Series I: deflections and top and bottom flange girder strains in positive moment sections; Series II: negative moment girder strains; Series III: stringer strains; Series IV: floor beam strains; wheelpath profiles taken.	Two vehicle paths, curb lane and centerlane; 69 K on 5 axles (6 K, 31 K tandem and 32 K tandem) at 13', 3', 13', and 3' spacings; speeds to 30 mph; 71 K on 5 axles (9 K, 32 K tandem and 30 K tandem) at	9

			weighed and measured commercial traffic.	
*Oregon (Troutdale) 1953	As above.	Deflections; top and bottom flange girder strains in 2 positive moment sections; wheelpath profiles taken.	As above.	9
*South Dakota (James R.) 1955	70'-90'-70' composite continuous spans; 24' roadway of 6" slab on 4 30WF108 beams; H15 design; level grade; welded connections; cover plated in negative moment sections.	Deflections and top and bottom flange strains at positive moment sections; wheelpath profiles taken.	Two vehicle paths; 71 K on 5 axles (7 K, 32 K tandem and 32 K tandem) at 11', 4', 17' and 4' spacings; 32 K on 2 axles (14 and 18 K) at 12' spacing; speeds to 40 mph; induced impact; axle housing gages calibrated under incremental loading.	23
*Texas (P. & S. F.) 1962	40'-51'-40' non-composite continuous spans; 2 24' roadways and 4' median on 9 27WF94 beams; 6½" slab; 4% grade and 3° curve; cover plated over piers; H20 design.	Deflections; positive and negative moment section top and bottom flange strains; pier top longitudinal deflections; wheelpath profiles taken.	BPR test vehicle; 68 K on 3 axles (9, 31 and 28 K) at 13' and 20' spacing; 8 creep speed paths; 4 paths at other speeds up to 50 mph; axle housing gages calibrated under incremental loading; some uncontrolled commercial traffic recorded.	20
*Texas (T. & N. O.) 1962	50'-65'-65'-50' continuous composite spans; H20-S16 design with 43° skew; 52' roadway of 6½" slab on 7 beams; 33WF130 in end spans and 33WF141 in interior spans; level grade; cover plated over piers.	Top and bottom flange strains and deflections at midspan of end and intermediate spans on skewed and normal sections; top and bottom flange negative moment strains; slab soffit strains; pier top longitudinal deflections; wheelpath profiles taken.	BPR test vehicle; 68 K on 3 axles (9, 31 and 28 K) at 13' and 20' spacing; 3 vehicle paths; centerline and each curb lane; speeds to 35 mph; axle housing gages calibrated under incremental loading.	21

TABLE 2B

CONTINUOUS SPANS

Concrete Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
*Alabama (Auburn Univ.) 1965	44'-55'-44' continuous T-beam spans with 6" slab on 2 16¾" wide haunched beams at 8' centers; 16' roadway; no curbs; for testing only; level grade.	Positive and negative moment section steel reinforcement strains; temperatures; deflections; concrete strains; reactions; all measurements on one-half of bridge; wheelpath profiles to be taken.	BPR test vehicle; 74 K on 3 axles (10, 32 and 32 K) at 13' and 20' axle spacing; other factors to be determined; axle housing gages calibrated by incremental loading.	25
Iowa (Cumming Interchange) 1958	43'-56'-56'-43' pretensioned, prestressed spans made partially continuous by poured diaphragms at bearings and by continuous slab; 6 28" deep I-beams; 24' roadway with 5½" slab; at crest of vertical curve; 1 interior diaphragm per span.	Strains on bottom surface of each beam at 2 positive and 2 negative moment sections; additional strains on web for neutral axis determination.	Four vehicle paths; speeds to 35 mph; 41 K on 3 axles (9 K and 32 K tandem) at 13' and 4' spacing; 74 K on 5 axles (9 K, 32 K tandem and 33 K tandem) at 11', 4', 19' and 4' spacing.	12
Michigan (B1-38-11-25)	42'-58'-42' continuous T-beam spans; beams on 81½" centers; 8" slab; beams 33" deep at midspan.	Deflections at midspan in center and 1 end span.	Speeds to 45 mph in 1 lane; 39 K on 3 axles (6, 15 and 18 K) at 13' and 14' spacing; axle housing gages calibrated by incremental loading.	13
Michigan (B5-81-11-8) 1957	39'-53'-53'-39' continuous T-beam spans; 28" midspan depth; beams at 74¼" centers; 8" slab.	Deflections at midspan in 2 spans.	As above.	
*New York (Elmwood Ave.) 1964	35'-60'-60'-35' continuous T-beam spans; 4° skew; 7" slab; 48' roadway on 10 beams 10" wide by 37" deep; H20-S16 design; A432 reinforcement; monolithic beam and slab; on V.C. with 4% ascending	Deflections; strain in one quarter of bridge layout at 2 positive and 2 negative moment sections; strains measured on reinforcing steel; wheelpath profiles taken; deck and web concrete surface strains.	BPR test vehicle; 73 K on 3 axles (10, 32 and 31 K) at 13' and 20' spacing; 5 vehicle paths; speeds to 30 mph; induced impact; axle housing gagali	23

*Texas (Hillsboro) 1963	55'-88'-88'-55' continuous T-beam spans; 7" slab; 30° skew; 24' roadway on 3 28½" wide haunched girders 20" deep at midspan; on 0 to 5% V. C.; H15 design with A432 reinforcement in superstructure only.	Numerous positive and negative moment section reinforcing steel strain gages throughout; gages at top and bottom of columns on vertical bars; deflections in all spans; crack surveys at regular intervals.	BPR test vehicle; speeds to 25 mph; 5 vehicle paths; induced impact; first, 50 K on 3 axles (10, 25 and 25 K) at 13' and 20' spacings and then 73 K (10, 33 and 30 K).	23

TABLE 2C

CONTINUOUS SPANS

Miscellaneous Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
Iowa (Clive Rd.) 1958	41'-69'-69'-41' continuous composite aluminum plate girder spans; 30' roadway with 8" slab on 2 36" deep interior and 2 34" deep exterior girders at 9' 6" centers; cover plates at bearings; diaphragms at 13' centers; H20-S16 design.	Bottom flange strains at 2 positive and 2 negative moment sections; additional web strains for neutral axis location.	Speeds to 40 mph on 4 paths; 41 K on 3 axles (9 K and 32 K tandem) at 13' and 4' spacings; 74 K on 5 axles (9 K, 32 K tandem and 33 K tandem) at 11', 4', 19' and 4' spacings.	12

TABLE 3

CANTILEVER SPANS

Steel Girder Superstructures

Site/Date	Specifications	Measurements	Loading	Ref.
Michigan (B1-81-1-13) 1956	Two 98' non-composite anchor spans of cantilever deck plate girder with floor beams and stringers; 7" min slab; 53" min. girder depth; 66' non-composite suspended span on 26' cantilevers; 7" min. slab on 53" girders; 2 60' composite simple spans with $7^1/_2$" min. slab on 36WF182 beams at 6' centers.	Deflections.	Speeds to 25 mph; 39 K on 3 axles (6, 15 and 18 K) at 13' and 14' spacings; axle housing gages calibrated under incremental loading.	24
Michigan (X3-56-7-26) 1956	A 65' composite center anchor span; 7" min. slab on 36WF170 beams at 6' centers; 53' composite end span on 5.5' cantilever with 7" min. slab on 36WF230 beams at 6' centers; 67' composite end span on 5.5' cantilever with 7" min. slab on 36WF230 beams at 6' centers; 30° skew.	Deflections.	As above; speeds to 40 mph.	24
Michigan (B1-77-20-11) 1956	A 100' non-composite anchor span of a cantilever deck plate girder with floor beams and stringers; 78" min. girder depth; 7" min. slab on 18WF50 stringers at 61" centers; 18° skew; two 60' non-composite simple spans; 7" min. slab on	Deflections.	As above; speeds to 30 mph.	24

Michigan (B1-64-10-11) 1956	A 84' non-composite anchor span of cantilever deck plate girder of 67" min. depth with floor beams and stringers; stringers at 55" centers; 60' non-composite suspended span on 21' cantilevers; 7" min. slab.	Deflections.	As above.	24
Michigan (B1-18-12-2) 1956	A 67' composite anchor span of cantilever bridge; 7" min. slab on 36WF160 beams at 5' centers; 69' composite suspended span on 8.5' cantilevers; 7" min. slab on 36WF194 beams at 5' centers.	Forty strain gage positions at midspan and over pier; deflections.	Speeds to 50 mph on 7 paths; 39 K on 3 axles (6, 15 and 18 K) at 13' and 14' spacings; induced impact; axle housing gages calibrated under incremental loading.	24
Michigan (B1-18-12-2) 1957	As above.	One midspan deflection gage in each of 2 spans.	Speeds to 45 mph on 1 path; 40 K on 3 axles (6, 16 and 18 K) at 13' and 14' spacing; axle housing gages calibrated under incremental loading.	13
Michigan (B1-33-6-4) 1957	One composite 70' anchor span of cantilever bridge; 7" slab on 36WF230 beams at 5' centers; 4 composite 65' simple spans with 7" slab on 36WF170 beams at 5' centers.	One midspan deflection gage in each of 5 spans.	As above.	13
Michigan (B1-34-6-1) 1957	A 74' non-composite anchor span of cantilever bridge; 7" slab on 48" deep plate girders at 6' centers; 47' non-composite suspended span on 14' cantilevers; 7" slab on 36WF160 beams at 6' centers.	One midspan deflection gage in each of 2 spans.	As above.	13

TABLE 3 (Continued)

Site/Date	Specifications	Measurements	Loading	Ref.
Michigan (B1-73-20-2) 1957	A composite 74' end anchor span of 5-span cantilever bridge with 36WF182 beams at 60" centers; 58' suspended span with 33WF141 beams at 60" centers on 8.5' cantilevers; 75' center anchor span with 36WF170 beams; 7" slab.	One midspan deflection gage in each of 3 spans.	As above.	13
Michigan (B1-39-5-8) 1957	A 57' non-composite anchor span of a cantilever bridge; 7" slab on 36WF150 beams at 58" centers; 61' non-composite suspended span on 9' cantilevers; 7" slab on 36WF160 beams at 58" centers.	One midspan deflection gage in each of 2 spans.	As above.	13
Michigan (B1-56-12-6) 1957	A 74' anchor span of a non-composite deck cantilever plate girder; 7" slab on 2 66" min. deep plate girders; two composite 56' simple spans with 7" slab on 36WF150 beams at 66" centers.	One midspan deflection gage in each of 3 spans.	As above.	13
Michigan (B1-62-12-1) 1957	A 97' anchor span of non-composite deck cantilever plate girder; 7" slab; 24' roadway on 2 81' min. deep plate girders.	One midspan deflection gage.	As above.	13
Michigan (B2-73-20-2) 1957	A 74' anchor span of 3-span composite cantilever; 7" slab on 36WF182 beams at 60" centers; 58' suspended span with 33WF150 beams at 60" centers on 8.5 cantilevers.	One midspan deflection gage in each of 2 spans.	As above.	13
Michigan	A 50' anchor span of 3-span	As above.	As above.	13

	48" centers; a 65' composite suspended span with 36WF160 beams on 7.5' cantilevers.			
Michigan (B1-11-18-7) 1958	A 128' non-composite anchor span of a bascule bridge; a deck plate girder with floor beams and stringers; 7" min. slab on stringers spaced at 63" centers; a 68' non-composite simple span with 7" min. slab on 36WF182 beams at 54" centers.	Deflections.	Speeds to 3 mph; 26 K on two axles (6 and 20 K) at 14' spacing; differential pressure cell on rear tires for dynamic axle load measurements; some commercial traffic records taken.	24
*Nebraska (Center Cr.) 1956	A 3-span non-composite cantilever bridge; 26' roadway of $6^1/_2$" slab on 5 30WF132 beams; 62' anchor span; 54' suspended span on 11' cantilevers; H15 design; level grade.	Deflections; top and bottom flange strains at midspan sections of suspended and anchor span; strains at negative moment section and through both hanger links; wheelpath profiles taken.	Two vehicle paths, centerline and curb, in each direction; speeds to 50 mph; 35 K on 2 axles (8 and 27 K) at 14' spacing; 53 K and 62 K on 4 axles (5 K, 24 K and 24 K tandem, also 4 K, 26 K and 32 K tandem) at 14', 12' and 4' spacing; axle housing gages calibrated by incremental loading.	17
*Nebraska (Loup R.) 1956	A 7-span non-composite cantilever bridge; 21' roadway of $7^1/_2$" slab on 4 beams; 72' end span beams 36WF150 second span beams 36WF194 with 68' suspended span on 14.5' and 22.5' cantilevers; 105' third span beams 36WF230; fourth span beams 36WF230 with 73' suspended span on 21' cantilevers; H12.5 design.	Deflections; top and bottom flange strains at center of suspended span; strains on hangers; strains at center and near bearing on 105' span; wheelpath profiles taken.	Two vehicle paths, centerline and curb, in each direction; 53 K 4-axle vehicle above; 30 K on 2 axles (6 and 24 K) at 14' spacing; axle housing gages calibrated by incremental loading; speeds to 50 mph.	

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