

Supplemental files for:

A practical multi-lane factor model of bridges based on multi-truck presence considering lane load disparities

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Table S1. The characteristic bridge LEs under different loading combinations of traffic lanes without the weight limit (unit: 10^3 kN·m).

structural effects	IL	span length	Lane 1	Lane 2	Lane 3	Lane 4	Lanes 1+2	Lanes 1+3	Lanes 1+4	Lanes 2+3	Lanes 2+4	Lanes 3+4	Lanes 1+2+3	Lanes 1+2+4	Lanes 1+3+4	Lanes 2+3+4	Lanes 1+2+3+4
mid-span	1	10 m	0.57	2.12	2.14	1.92	1.22	1.60	1.66	2.25	2.30	2.32	1.36	1.47	1.57	2.04	N/A
bending	2	20 m	1.75	6.33	6.25	5.75	4.15	4.55	4.53	6.48	6.76	6.73	4.30	4.44	5.34	6.48	N/A
moment	3	30 m	3.32	11.38	11.75	11.22	7.27	8.57	7.95	12.59	11.58	12.71	8.44	8.18	9.21	12.68	6.68
	4	40 m	5.06	16.23	18.10	15.41	10.69	13.27	11.34	19.49	16.83	19.79	14.10	12.33	13.62	18.69	10.85
	5	50 m	6.94	23.97	24.17	23.40	14.35	17.83	15.05	26.85	21.56	27.29	20.06	16.99	19.17	24.80	15.48
side-supp ort shear force	6	60 m	8.92	28.56	30.08	26.42	18.53	22.46	18.00	34.09	27.76	34.48	23.54	20.23	27.49	32.54	21.44
	7	10 m	0.22	0.78	0.79	0.77	0.45	0.57	0.59	0.76	0.90	0.89	0.50	0.46	0.52	0.77	N/A
	8	20 m	0.32	1.19	1.22	1.14	0.67	0.82	0.81	1.21	1.33	1.28	0.74	0.79	0.96	1.25	N/A
force	9	30 m	0.43	1.49	1.49	1.48	0.81	1.08	0.93	1.58	1.52	1.65	0.97	1.04	1.15	1.55	0.89
	10	40 m	0.50	1.62	1.67	1.53	0.92	1.22	0.99	1.83	1.67	1.96	1.16	1.19	1.25	1.79	1.10
	11	50 m	0.56	1.72	1.81	1.68	1.01	1.36	1.09	1.98	1.86	2.17	1.42	1.28	1.42	1.93	1.26
	12	60 m	0.60	1.93	1.92	1.83	1.08	1.45	1.20	2.10	2.02	2.31	1.55	1.32	1.69	2.09	1.43

Note: N/A is due to the very small size of data (<50) that may cause large deviations in extrapolation; Span length is the total length of the simply-supported beam bridges.

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Table S2. The calculated MLFs by bridge LEs under different loading combinations of traffic lanes without the weight limit.

Structural effects	IL	Span length	Lane 1	Lane 2	Lane 3	Lane 4	Lanes 1+2	Lanes 1+3	Lanes 1+4	Lanes 2+3	Lanes 2+4	Lanes 3+4	Lanes 1+2+3	Lanes 1+2+4	Lanes 1+3+4	Lanes 2+3+4	Lanes 1+2+3+4
Mid-span bending moment	1	10m	0.27	1.00	1.01	0.91	0.29	0.38	0.39	0.53	0.54	0.55	0.21	0.23	0.25	0.32	N/A
	2	20m	0.28	1.00	0.99	0.91	0.33	0.36	0.36	0.51	0.53	0.53	0.23	0.23	0.28	0.34	N/A
	3	30m	0.29	1.00	1.03	0.99	0.32	0.38	0.35	0.55	0.51	0.56	0.25	0.24	0.27	0.37	0.15
	4	40m	0.31	1.00	1.11	0.95	0.33	0.41	0.35	0.60	0.52	0.61	0.29	0.25	0.28	0.38	0.17
	5	50m	0.29	1.00	1.01	0.98	0.30	0.37	0.31	0.56	0.45	0.57	0.28	0.24	0.27	0.34	0.16
	6	60m	0.31	1.00	1.05	0.92	0.32	0.39	0.32	0.60	0.49	0.60	0.27	0.24	0.32	0.38	0.19
Side-support shear force	7	10m	0.28	1.00	1.01	0.99	0.28	0.37	0.38	0.48	0.57	0.57	0.21	0.20	0.22	0.33	N/A
	8	20m	0.27	1.00	1.03	0.95	0.28	0.35	0.34	0.51	0.56	0.54	0.21	0.22	0.27	0.35	N/A
	9	30m	0.28	1.00	1.00	0.99	0.27	0.36	0.31	0.53	0.51	0.55	0.22	0.23	0.26	0.35	0.15
	10	40m	0.31	1.00	1.03	0.94	0.28	0.38	0.31	0.56	0.52	0.61	0.24	0.24	0.26	0.37	0.17
	11	50m	0.32	1.00	1.05	0.98	0.29	0.40	0.32	0.57	0.54	0.63	0.28	0.25	0.28	0.37	0.18
	12	60m	0.31	1.00	0.99	0.95	0.28	0.38	0.31	0.54	0.52	0.60	0.27	0.23	0.29	0.36	0.18
Average value			0.29	1.00	1.03	0.96	0.30	0.38	0.34	0.55	0.52	0.58	0.25	0.23	0.27	0.36	0.17

Note: N/A is due to the very small size of data (<50) that may cause large deviations in extrapolation; Span length is the total length of the simply-supported beam bridges.

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Table S3. The characteristic bridge load effects under different loading combinations of traffic lanes with the weight limit (unit: 10^3kN.m).

Structural effects	IL	Span length	Lane 1	Lane 2	Lane 3	Lane 4	Lanes 1+2	Lanes 1+3	Lanes 1+4	Lanes 2+3	Lanes 2+4	Lanes 3+4	Lanes 1+2+3	Lanes 1+2+4	Lanes 1+3+4	Lanes 2+3+4	Lanes 1+2+3+4
Mid-span bending moment	1	10m	0.57	1.01	1.06	1.06	1.22	1.45	1.41	1.92	1.85	2.21	1.27	1.25	1.27	2.54	N/A
	2	20m	1.75	3.05	3.09	3.06	3.85	4.27	4.54	6.49	5.93	6.20	4.04	4.63	4.10	7.37	N/A
	3	30m	3.32	5.33	5.83	5.91	6.61	7.93	7.99	11.93	11.21	11.24	8.10	7.91	7.88	13.75	8.33
	4	40m	5.06	8.21	8.89	9.05	10.52	11.75	11.66	18.58	16.84	17.46	11.96	12.12	11.94	21.88	12.25
	5	50m	6.94	11.64	12.10	12.51	14.43	15.61	16.51	24.21	23.09	23.60	16.59	16.18	17.56	29.72	17.01
	6	60m	8.92	14.78	15.52	15.90	19.21	20.22	19.11	31.88	29.35	31.53	19.41	20.56	21.48	40.72	19.81
Side-support shear force	7	10m	0.22	0.42	0.41	0.41	0.49	0.54	0.52	0.75	0.78	0.78	0.49	0.50	0.50	0.98	N/A
	8	20m	0.32	0.61	0.60	0.62	0.68	0.81	0.76	1.07	1.23	1.16	0.72	0.80	0.74	1.42	N/A
	9	30m	0.43	0.70	0.75	0.77	0.85	1.05	0.97	1.45	1.45	1.47	0.90	0.97	0.97	1.74	0.98
	10	40m	0.50	0.78	0.85	0.88	0.95	1.22	1.06	1.67	1.71	1.72	1.08	1.16	1.13	2.06	1.19
	11	50m	0.56	0.88	0.93	0.96	1.03	1.34	1.17	1.82	1.97	1.91	1.20	1.23	1.36	2.30	1.30
	12	60m	0.60	1.00	0.99	1.01	1.12	1.42	1.22	1.97	2.16	2.04	1.32	1.30	1.40	2.49	1.43

Note: N/A is due to the very small size of data (<50) that may cause large deviations in extrapolation; Span length is the total length of the simply-supported beam bridges.

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Table S4. The calculated MLFs by bridge load effects under different loading combinations of traffic lanes with the weight limit.

Structural effects	IL	Span length	Lane 1	Lane 2	Lane 3	Lane 4	Lanes 1+2	Lanes 1+3	Lanes 1+4	Lanes 2+3	Lanes 2+4	Lanes 3+4	Lanes 1+2+3	Lanes 1+2+4	Lanes 1+3+4	Lanes 2+3+4	Lanes 1+2+3+4
Mid-span bending moment	1	10m	0.56	1.00	1.05	1.05	0.60	0.72	0.70	0.95	0.92	1.09	0.42	0.41	0.42	0.84	N/A
	2	20m	0.58	1.00	1.02	1.01	0.63	0.70	0.75	1.07	0.97	1.02	0.44	0.51	0.45	0.81	N/A
	3	30m	0.62	1.00	1.09	1.11	0.62	0.74	0.75	1.12	1.05	1.05	0.51	0.49	0.49	0.86	0.39
	4	40m	0.62	1.00	1.08	1.10	0.64	0.71	0.71	1.13	1.02	1.06	0.49	0.49	0.48	0.89	0.37
	5	50m	0.60	1.00	1.04	1.07	0.62	0.67	0.71	1.04	0.99	1.01	0.47	0.46	0.50	0.85	0.37
	6	60m	0.60	1.00	1.05	1.08	0.65	0.68	0.65	1.08	0.99	1.07	0.44	0.46	0.48	0.92	0.33
Side-support shear force	7	10m	0.52	1.00	0.96	0.97	0.58	0.63	0.61	0.88	0.92	0.92	0.38	0.40	0.39	0.77	N/A
	8	20m	0.54	1.00	0.99	1.01	0.56	0.67	0.63	0.89	1.01	0.96	0.39	0.44	0.41	0.78	N/A
	9	30m	0.61	1.00	1.07	1.11	0.61	0.75	0.69	1.04	1.04	1.06	0.43	0.46	0.46	0.83	0.35
	10	40m	0.64	1.00	1.09	1.13	0.61	0.78	0.68	1.07	1.09	1.10	0.46	0.50	0.48	0.88	0.38
	11	50m	0.63	1.00	1.05	1.08	0.58	0.76	0.66	1.03	1.12	1.08	0.45	0.47	0.51	0.87	0.37
	12	60m	0.60	1.00	0.99	1.02	0.56	0.71	0.61	0.99	1.08	1.03	0.44	0.44	0.47	0.83	0.36
Average value			0.59	1.00	1.04	1.06	0.61	0.71	0.68	1.02	1.02	1.04	0.44	0.46	0.46	0.84	0.37

Note: N/A is due to the very small size of data (<50) that may cause large deviations in extrapolation; Span length is the total length of the simply-supported beam bridges.

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Figure S1. The correlations between truck weight and maximal truck load effect: the results of one-day WIM data loading.



