M54 J3-2

Proactive maintenance

www.balvac.co.uk
enquiries.balvac@balvac.co.uk
01928 719 875

Balvac
Balfour Beatty

Balvac
Balfour Beatty

Vacuum Void Grouting executed by Balvac has extended pavement life of a 2km stretch of the M54.

Deteriorating road surface

A 2km stretch of the eastbound M54 near Telford was giving Kier Highways, and their client Highways England, significant cause for concern. Over a few years, 30% of the concrete slabs in lane 1 had totally failed and been replaced with temporary flexible construction. With the motorway only being 2 lanes and a hard shoulder wide, each intervention had required a total closure of the carriageway and been both disruptive and financially costly.

The Proposal

Balvac approached Kier Highways with a proposal for a preventative maintenance intervention and a joint representation was subsequently made to Highways England. After a series of meetings to refine an extensive testing regime, an initial Falling Weight Deflectometer (FWD) survey was commissioned to test across every transverse joint in lane 1 throughout the problematic section.

As expected, the FWD data confirmed the poor state of the carriageway. Using a bespoke positioning of geophones, the FWD data provides nine key parameters, including Void Intercepts, Absolute and Relative deflections and Load Transfer Efficiencies of joint performance. These are then scored and totalled to assist in ranking and identifying those most likely to cause slab failure due to instability.

Scope

Vacuum Void Grouting was subsequently undertaken to 65 joints specified by Highways England. The selection was generally based on the rankings but including a few that were already cracked and some at concrete to flexible transitions. A post-grouting FWD survey was then carried out to all joints to verify the degree of improvement. In order to be able to 'discount' temperature and time effects, the FWD survey also included all the non-grouted joints.

Outcome

As the sample of results below clearly demonstrate the improvement in joint performance because of carrying out Vacuum Void Grouting is remarkable. The left-hand side pre-grout readings for the 9 key parameters are predominantly red risk, whilst post-grout (RHS) these have mostly been transformed to green and amber risk (or lower levels of red risk).

Demonstrating improvement in joint condition of up to 81% and reducing a 15-week duration to just 2 weeks, the scheme was awarded 'Project of the year (value £0-1M) at the CECA 2018 Awards. Balvac have since completed more Vacuum Void Grouting on the M54 and further FWD surveys are planned to determine the next phase of works.

Before Grouting

		Pre VVG Joint Condition assessment								
		Absolute Deflection		Relative deflection (microns)	Load transfer		Void intercept		Slab curvature	
Chainage	Joint ID	Approach (microns)	Leave (microns)		Approach (%)	Leave (%)	Approach (microns)	Leave (microns)	Approach (microns)	Leave (microns)
74.50	14	444	972	528	9	6	126	233	-16	-27
116.25	21	430	880	450	7	23	138	408	-14	-20
134.85	25	515	1109	593	83	25	172	432	-15	-24
146.15	27	357	1098	741	10	10	105	487	-12	-25
152.15	28	593	952	358	28	32	287	237	-17	-22
199.80	36	663	1149	486	7	10	392	483	-21	-26
205.80	37	628	879	251	7	27	317	359	-17	-21
211.75	38	936	933	2	4	40	413	338	-27	-22
241.60	44	367	951	584	11	10	74	390	-15	-25
247.55	45	604	1030	425	10	20	229	344	-19	-26
445.30	80	565	552	13	42	52	121	110	-17	-17
451.30	81	408	930	522	53	27	142	168	-19	-26
523.35	93	397	1303	906	84	3	90	477	11	-32
656.20	118	459	818	359	25	18	112	186	-14	-22
674.30	121	532	903	370	10	19	212	366	-14	-22
680.35	122	305	824	519	16	10	53	306	-10	-21
686.35	123	373	859	486	10	6	85	236	-11	-25
692.40	124	516	1124	607	10	9	104	351	-18	-26
698.45	125	752	945	193	13	13	188	142	-21	-26
838.80	149	325	996	671	48	4	51	138	-4	-27
843.20	150	362	784	422	20	7	65	66	-13	-23
849.40	151	607	770	163	10	9	180	118	-19	-24
891.60	158	492	957	465	10	14	179	346	-15	-25
897.60	159	823	1199	376	8	7	269	389	-24	-32
903.70	160	1181	535	646	6	40	324	148	-30	-19

After Grouting

		Post VVG Joint Condition assessment								
		Absolute Deflection		Relative deflection (microns)	Load transfer		Void intercept		Slab curvature	
Chainage	Joint ID	Approach (microns)	Leave (microns)		Approach (%)	Leave (%)	Approach (microns)	Leave (microns)	Approach (microns)	Leave (microns)
74.50	14	115	115	0	76	82	0	4	-3	-2
116.25	21	140	101	39	42	68	10	0	-4	-3
134.85	25	113	119	7	77	68	2	2	-4	-4
146.15	27	144	125	19	44	50	4	0	-5	-4
152.15	28	139	214	75	42	21	0	2	-4	-8
199.80	36	88	83	5	84	86	1	0	-2	-2
205.80	37	96	94	2	71	68	0	0	-1	-2
211.75	38	70	69	2	83	84	1	0	0	-1
241.60	44	96	107	11	86	75	0	0	-3	-2
247.55	45	89	100	11	85	76	0	0	-2	-3
445.30	80	149	141	8	49	57	0	5	-5	-3
451.30	81	126	120	5	84	88	3	0	-3	-2
523.35	93	212	151	61	73	99	0	6	2	-4
656.20	118	112	114	2	82	95	12	30	-2	0
674.30	121	122	119	3	82	90	6	8	-2	-2
680.35	122	111	110	2	78	81	2	4	-2	-2
686.35	123	130	135	6	72	66	0	12	-3	-4
692.40	124	131	133	2	76	76	5	16	-3	-2
698.45	125	152	162	10	58	59	7	15	-4	-4
838.80	149	271	165	106	35	52	19	0	-15	-5
843.20	150	142	131	11	51	62	9	4	-4	-4
849.40	151	120	126	6	56	53	11	24	-3	-2
891.60	158	137	126	12	65	78	11	15	-4	-1
897.60	159	99	99	0	84	92	12	8	-1	0
903.70	160	119	142	23	70	66	2	28	-4	-1