TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNTS
MANUAL CLASSIFIED JUNCTION TURNING COUNTS

MAY 2021
TRA/21/081

SITE: 04

DATE: 26th May 2021

LOCATION: R150/Bellewstown Road

DAY: Wednesday

	MOVEMENT 4							MOVEMENT 5							MOVEMENT 6						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
13:00	0	0	0	0	0	0	0	15	2	2	1	0	20	22	4	1	0	0	0	5	5
13:15	0	0	0	0	0	0	0	14	7	1	4	1	27	34	3	1	0	0	0	4	4
13:30	0	0	0	0	0	0	0	16	3	0	3	0	22	26	5	3	0	0	0	8	8
13:45	0	0	0	0	0	0	0	20	1	1	3	1	26	31	9	1	0	0	0	10	10
H/TOT	0	0	0	0	0	0	0	65	13	4	11	2	95	113	21	6	0	0	0	27	27
14:00	0	0	0	0	0	0	0	18	4	8	1	2	33	40	3	1	0	0	0	4	4
14:15	0	0	0	0	0	0	0	14	7	2	0	0	23	24	8	1	0	0	0	9	9
14:30	1	0	0	0	0	1	1	24	3	0	1	1	29	31	4	1	0	0	0	5	5
14:45	1	0	0	0	0	1	1	19	1	1	1	1	23	26	4	0	0	0	0	4	4
H/TOT	2	0	0	0	0	2	2	75	15	11	3	4	108	121	19	3	0	0	0	22	22
15:00	0	0	0	0	0	0	0	31	6	3	1	1	42	46	4	0	0	0	0	4	4
15:15	0	0	0	0	0	0	0	18	3	1	0	1	23	25	6	0	0	1	0	7	8
15:30	1	0	0	0	0	1	1	14	3	0	1	0	18	19	6	4	0	0	0	10	10
15:45	0	0	0	0	0	0	0	33	1	0	3	0	37	41	6	3	0	0	0	9	9
H/TOT	1	0	0	0	0	1	1	96	13	4	5	2	120	131	22	7	0	1	0	30	31
16:00	0	0	0	0	0	0	0	26	2	0	1	0	29	30	4	1	0	0	0	5	5
16:15	0	0	0	0	0	0	0	23	5	1	1	0	30	32	3	1	0	0	0	4	4
16:30	0	0	0	0	0	0	0	30	3	2	1	0	36	38	4	0	0	0	0	4	4
16:45	1	0	0	0	0	1	1	28	5	4	0	0	37	39	7	3	0	0	0	10	10
H/TOT	1	0	0	0	0	1	1	107	15	7	3	0	132	139	18	5	0	0	0	23	23
17:00	0	0	0	0	0	0	0	33	2	1	0	0	36	37	10	1	0	0	0	11	11
17:15	0	0	0	0	0	0	0	28	6	0	0	0	34	34	14	0	0	0	0	14	14
17:30	1	0	0	0	0	1	1	28	5	2	0	0	35	36	12	1	0	0	0	13	13
17:45	0	0	0	0	0	0	0	21	1	2	1	0	25	27	8	2	0	0	0	10	10
H/TOT	1	0	0	0	0	1	1	110	14	5	1	0	130	134	44	4	0	0	0	48	48
18:00	0	0	0	0	0	0	0	27	6	1	0	0	34	35	8	1	0	0	0	9	9
18:15	0	0	0	0	0	0	0	32	3	1	0	0	36	37	11	1	1	0	0	13	14
18:30	0	0	0	0	0	0	0	30	1	0	1	0	32	33	6	0	0	0	0	6	6
18:45	0	0	0	0	0	0	0	31	1	0	0	0	32	32	6	1	0	0	0	7	7
H/TOT	0	0	0	0	0	0	0	120	11	2	1	0	134	136	31	3	1	0	0	35	36
P/TOT	9	1	0	0	0	10	10	1092	170	64	67	14	1407	1540	254	49	7	4	1	315	325

TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNTS
MANUAL CLASSIFIED JUNCTION TURNING COUNTS

MAY 2021
TRA/21/081

SITE: 04

DATE: 26th May 2021

LOCATION: R150/Bellewstown Road

DAY: Wednesday

	MOVEMENT 7							MOVEMENT 8							MOVEMENT 9						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
13:00	2	0	0	0	0	2	2	0	0	0	0	0	0	0	2	0	0	0	0	2	2
13:15	7	0	0	0	0	7	7	0	0	0	0	0	0	0	4	0	0	0	0	4	4
13:30	5	2	0	0	0	7	7	0	0	0	0	0	0	0	4	0	0	0	0	4	4
13:45	6	0	0	0	0	6	6	0	0	0	0	0	0	0	3	2	0	0	0	5	5
H/TOT	20	2	0	0	0	22	22	0	0	0	0	0	0	0	13	2	0	0	0	15	15
14:00	5	2	0	0	0	7	7	0	0	0	0	0	0	0	4	1	0	0	0	5	5
14:15	5	2	0	0	0	7	7	0	0	0	0	0	0	0	4	1	0	0	0	5	5
14:30	6	0	0	0	0	6	6	0	0	0	0	0	0	0	3	0	0	0	0	3	3
14:45	6	0	0	0	0	6	6	0	0	0	0	0	0	0	2	0	0	1	0	3	4
H/TOT	22	4	0	0	0	26	26	0	0	0	0	0	0	0	13	2	0	1	0	16	17
15:00	5	1	0	0	0	6	6	0	0	0	0	0	0	0	2	0	0	0	0	2	2
15:15	3	3	0	0	0	6	6	0	0	0	0	0	0	0	2	1	1	0	0	4	5
15:30	7	1	0	0	0	8	8	0	0	0	0	0	0	0	3	0	0	0	0	3	3
15:45	6	2	0	1	0	9	10	0	0	0	0	0	0	0	1	0	0	0	0	1	1
H/TOT	21	7	0	1	0	29	30	0	0	0	0	0	0	0	8	1	1	0	0	10	11
16:00	5	1	0	0	0	6	6	1	0	0	0	0	1	1	3	0	0	0	0	3	3
16:15	12	1	0	0	0	13	13	1	0	0	0	0	1	1	4	0	1	0	0	5	6
16:30	8	0	0	0	0	8	8	0	0	0	0	0	0	0	4	0	0	0	0	4	4
16:45	7	2	0	0	0	9	9	0	0	0	0	0	0	0	3	1	0	0	0	4	4
H/TOT	32	4	0	0	0	36	36	2	0	0	0	0	2	2	14	1	1	0	0	16	17
17:00	3	0	0	0	0	3	3	0	0	0	0	0	0	0	6	0	0	0	0	6	6
17:15	5	1	0	0	0	6	6	0	0	0	0	0	0	0	2	1	0	0	0	3	3
17:30	6	1	0	0	0	7	7	0	0	0	0	0	0	0	5	1	0	0	0	6	6
17:45	7	3	0	0	0	10	10	0	0	0	0	0	0	0	4	1	0	0	0	5	5
H/TOT	21	5	0	0	0	26	26	0	0	0	0	0	0	0	17	3	0	0	0	20	20
18:00	6	1	0	0	0	7	7	0	0	0	0	0	0	0	4	1	0	0	0	5	5
18:15	6	0	1	0	0	7	8	0	0	0	0	0	0	0	3	0	0	0	0	3	3
18:30	5	2	0	0	0	7	7	0	0	0	0	0	0	0	5	0	1	0	0	6	7
18:45	7	1	1	0	0	9	10	0	0	0	0	0	0	0	3	1	0	0	0	4	4
H/TOT	24	4	2	0	0	30	31	0	0	0	0	0	0	0	15	2	1	0	0	18	19
P/TOT	251	45	8	2	0	306	313	2	0	0	0	0	2	2	142	19	7	4	0	172	181

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KILSARAN BELLEWSTOWN TRAFFIC COUNTS
MANUAL CLASSIFIED JUNCTION TURNING COUNTS

MAY 2021
TRA/21/081

SITE: 04

DATE: 26th May 2021

LOCATION: R150/Bellewstown Road

DAY: Wednesday

	MOVEMENT 10							MOVEMENT 11							MOVEMENT 12						
TIME	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU	CAR	LGV	OGV1	OGV2	BUS	TOT	PCU
13:00	4	0	0	0	0	4	4	13	3	2	0	1	19	21	0	0	0	0	0	0	0
13:15	2	0	1	0	0	3	4	20	3	0	2	0	25	28	1	0	0	0	0	1	1
13:30	3	0	0	0	0	3	3	22	5	2	0	0	29	30	0	0	0	0	0	0	0
13:45	7	0	0	0	0	7	7	22	2	2	1	0	27	29	0	0	0	0	0	0	0
H/TOT	16	0	1	0	0	17	18	77	13	6	3	1	100	108	1	0	0	0	0	1	1
14:00	4	0	1	0	0	5	6	27	4	2	3	0	36	41	0	0	0	0	0	0	0
14:15	1	0	0	0	0	1	1	22	5	2	1	1	31	34	0	0	0	0	0	0	0
14:30	3	1	1	0	0	5	6	18	5	1	3	0	27	31	0	0	0	0	0	0	0
14:45	4	0	0	0	0	4	4	23	5	2	1	1	32	35	0	0	0	0	0	0	0
H/TOT	12	1	2	0	0	15	16	90	19	7	8	2	126	142	0	0	0	0	0	0	0
15:00	4	0	0	0	0	4	4	23	3	2	0	1	29	31	0	0	0	0	0	0	0
15:15	1	1	0	0	0	2	2	37	7	1	1	0	46	48	0	0	0	0	0	0	0
15:30	3	0	0	0	0	3	3	33	3	3	0	1	40	43	1	0	0	0	0	1	1
15:45	4	0	0	0	0	4	4	30	6	1	1	1	39	42	0	0	0	0	0	0	0
H/TOT	12	1	0	0	0	13	13	123	19	7	2	3	154	163	1	0	0	0	0	1	1
16:00	5	0	0	0	1	6	7	29	7	6	1	1	44	49	0	0	0	0	0	0	0
16:15	5	0	0	0	0	5	5	27	8	1	2	0	38	41	0	1	0	0	0	1	1
16:30	5	0	0	0	0	5	5	39	6	4	0	0	49	51	0	0	1	0	0	1	2
16:45	7	0	0	0	0	7	7	40	14	0	0	0	54	54	0	0	0	0	0	0	0
H/TOT	22	0	0	0	1	23	24	135	35	11	3	1	185	195	0	1	1	0	0	2	3
17:00	1	0	0	0	0	1	1	43	13	0	0	0	56	56	0	0	0	0	0	0	0
17:15	3	0	0	0	0	3	3	27	3	3	1	1	35	39	2	0	0	0	0	2	2
17:30	4	0	0	0	0	4	4	51	5	0	0	0	56	56	1	0	0	0	0	1	1
17:45	4	0	0	0	0	4	4	34	10	1	0	0	45	46	0	0	0	0	0	0	0
H/TOT	12	0	0	0	0	12	12	155	31	4	1	1	192	196	3	0	0	0	0	3	3
18:00	5	0	0	0	0	5	5	23	4	0	0	0	27	27	0	0	0	0	0	0	0
18:15	3	0	0	0	0	3	3	24	3	2	0	0	29	30	0	0	0	0	0	0	0
18:30	0	0	0	0	0	0	0	31	5	1	0	0	37	38	0	0	0	0	0	0	0
18:45	1	0	0	0	0	1	1	21	7	0	0	0	28	28	0	0	0	0	0	0	0
H/TOT	9	0	0	0	0	9	9	99	19	3	0	0	121	123	0	0	0	0	0	0	0
P/TOT	132	8	6	1	1	148	153	1108	208	69	74	14	1473	1618	6	1	1	0	0	8	9

Traffic Survey Data – Automatic Traffic Counter Site L56172 Mullagh Road

TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SUMMARY

SITE 01

WEEK COMMENCING: Friday 21 May 2021
TRA/21/081

LOCATION: The Mullagh Road - Immediately North of the Kilsaran Quarry Access (Google Maps Ref: 53.803189, -6.394629)

SPEED SURVEY SUMMARY:

NORTHBOUND 85% Speed = 48.26 km/h, 95% Speed = 51.93 km/h, Median = 37.98 km/h — Maximum = 63.3 km/h, Minimum = 11.7 km/h, Mean = 36.8 km/h

SOUTHBOUND 85% Speed = 48.64 km/h, 95% Speed = 53.46 km/h, Median = 38.61 km/h — Maximum = 65.0 km/h, Minimum = 9.2 km/h, Mean = 37.5 km/h

VOLUMETRIC VEHICLE COUNTS:

Direction	Time	Friday 21 May 2021	Saturday 22 May 2021	Sunday 23 May 2021	Monday 24 May 2021	Tuesday 25 May 2021	Wednesday 26 May 2021	Thursday 27 May 2021	No. Vehicles	7 day Mean
NORTHBOUND	07-19	27	28	20	51	30	35	32	223	32
SOUTHBOUND	07-19	34	34	22	35	33	33	33	224	32
NORTHBOUND	00-00	34	30	28	60	37	42	37	268	38
SOUTHBOUND	00-00	39	40	29	42	44	43	40	277	40

PEAK FLOW SUMMARY:

Peak	AM	IP	PM
Most Frequent Peak Hour	0900	1400	1700
Average Vehicles per Peak Hour	2	5	6

TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 01
NORTHBOUND

WEEK COMMENCING: Friday 21 May 2021
TRA/21/081

TIME PERIOD	Friday 21 May 2021	Saturday 22 May 2021	Sunday 23 May 2021	Monday 24 May 2021	Tuesday 25 May 2021	Wednesday 26 May 2021	Thursday 27 May 2021	Average
0000	0	0	1	0	0	0	0	0
0100	0	0	1	0	0	0	0	0
0200	0	0	0	0	0	1	0	0
0300	1	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0
0500	1	0	0	0	0	0	0	0
0600	0	1	0	0	1	0	0	0
0700	0	1	0	0	1	2	0	1
0800	1	1	0	4	2	2	1	2
0900	3	1	2	2	3	1	1	2
1000	1	4	1	5	2	1	2	2
1100	2	3	3	3	0	2	4	2
1200	1	2	3	4	3	2	4	3
1300	3	2	3	6	4	4	6	4
1400	4	4	3	8	3	5	1	4
1500	3	2	1	2	1	1	4	2
1600	4	4	0	8	4	4	2	4
1700	5	3	4	5	5	9	6	5
1800	0	1	0	4	2	2	1	1
1900	1	1	1	1	1	3	0	1
2000	1	0	1	5	2	1	2	2
2100	1	0	1	1	0	1	2	1
2200	1	0	0	2	1	1	1	1
2300	1	0	3	0	2	0	0	1
07-19	27	28	20	51	30	35	32	32
06-22	30	30	23	58	34	40	36	36
06-00	32	30	26	60	37	41	37	38
00-00	34	30	28	60	37	42	37	38

TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 01
SOUTHBOUND

WEEK COMMENCING: Friday 21 May 2021
TRA/21/081

TIME PERIOD	Friday 21 May 2021	Saturday 22 May 2021	Sunday 23 May 2021	Monday 24 May 2021	Tuesday 25 May 2021	Wednesday 26 May 2021	Thursday 27 May 2021	Average
0000	1	0	0	0	0	0	0	0
0100	0	0	1	0	0	0	0	0
0200	0	0	0	0	0	0	0	0
0300	0	0	0	0	0	0	0	0
0400	0	0	0	0	0	0	0	0
0500	0	0	0	0	0	0	0	0
0600	2	1	0	2	3	3	3	2
0700	2	0	1	3	5	4	5	3
0800	2	0	0	1	3	1	2	1
0900	5	4	0	1	2	2	0	2
1000	2	1	2	1	3	2	2	2
1100	4	5	1	5	3	2	4	3
1200	3	5	7	3	6	3	6	5
1300	2	4	0	4	0	2	3	2
1400	2	4	4	5	2	3	3	3
1500	3	5	5	3	1	4	3	3
1600	3	3	1	4	1	5	1	3
1700	1	3	0	3	5	3	3	3
1800	5	0	1	2	2	2	1	2
1900	1	1	1	1	2	3	2	2
2000	0	1	4	2	2	1	0	1
2100	1	1	1	1	0	3	1	1
2200	0	1	0	0	2	0	1	1
2300	0	1	0	1	2	0	0	1
07-19	34	34	22	35	33	33	33	32
06-22	38	38	28	41	40	43	39	38
06-00	38	40	28	42	44	43	40	39
00-00	39	40	29	42	44	43	40	40

TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

WEEK COMMENCING: **Friday 21 May 2021**
TRA/21/081

SITE 01
NORTHBOUND

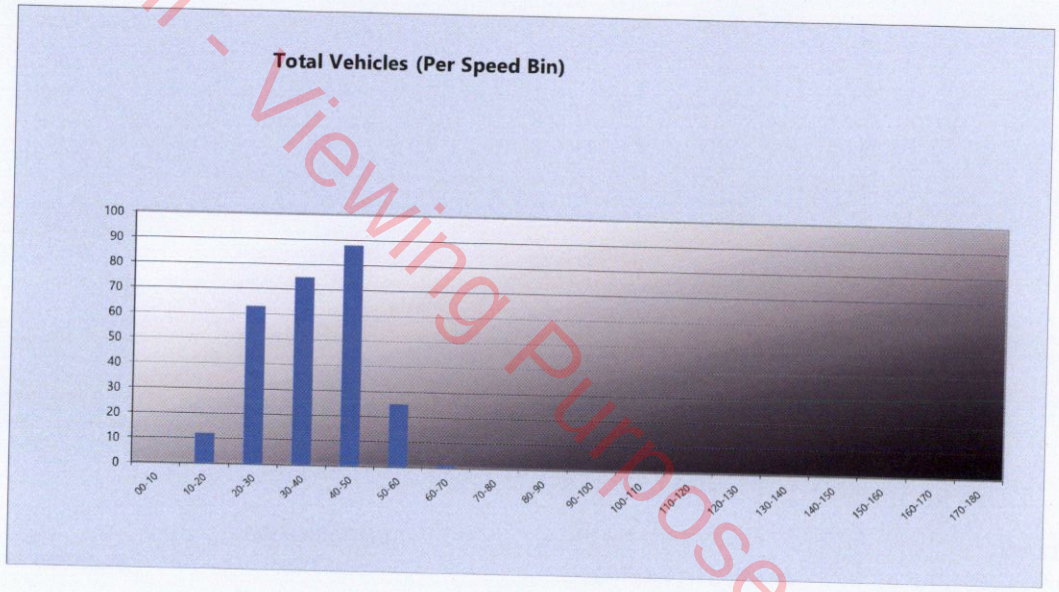
Profile:

Filter time: 00:00 21st May 2021 => 23:59 27th May 2021
Speed range: 0 - 200 km/h.
Separation: Greater than 4.00 seconds. - (Headway)
Units: Metric (meter, kilometer, m/s, km/h, kg, tonne)

Vehicles = 264
Maximum = 63.3 km/h, Minimum = 11.7 km/h, Mean = 36.8 km/h
85% Speed = 48.26 km/h, 95% Speed = 51.93 km/h, Median = 37.98 km/h
20 km/h Pace = 31 - 51, Number in Pace = 167 (63.26%)
Variance = 104.76, Standard Deviation = 10.24 km/h

Speed Bins:

Speed	Bin	
KPH	No.	%
00-10	0	0.0
10-20	12	4.5
20-30	63	23.9
30-40	75	28.4
40-50	88	33.3
50-60	25	9.5
60-70	1	0.4
70-80	0	0.0
80-90	0	0.0
90-100	0	0.0
100-110	0	0.0
110-120	0	0.0
120-130	0	0.0
130-140	0	0.0
140-150	0	0.0
150-160	0	0.0
160-170	0	0.0
170-180	0	0.0



TRAFFINOMICS LIMITED

KILSARAN BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

WEEK COMMENCING: **Friday 21 May 2021**
TRA/21/081

SITE 01
SOUTHBOUND

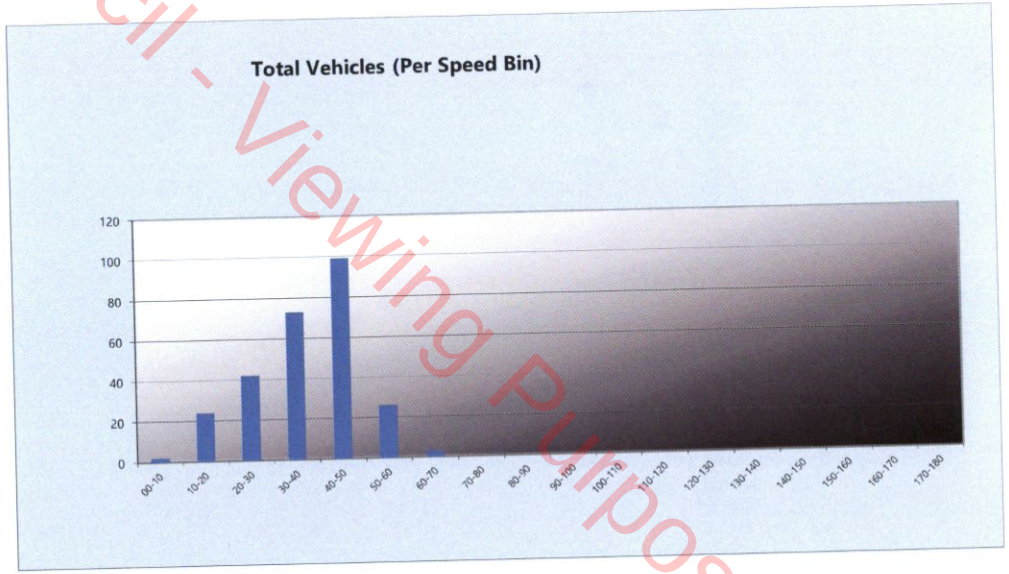
Profile:

Filter time: 00:00 21st May 2021 => 23:59 27th May 2021
Speed range: 0 - 200 km/h.
Separation: Greater than 4.00 seconds. - (Headway)
Units: Metric (meter, kilometer, m/s, km/h, kg, tonne)

Vehicles = 269
Maximum = 65.0 km/h, Minimum = 9.2 km/h, Mean = 37.5 km/h
85% Speed = 48.64 km/h, 95% Speed = 53.46 km/h, Median = 38.61 km/h
20 km/h Pace = 29 - 49, Number in Pace = 177 (65.80%)
Variance = 122.02, Standard Deviation = 11.05 km/h

Speed Bins:

Speed	Bin	
KPH	No.	%
00-10	2	0.7
10-20	24	8.9
20-30	42	15.6
30-40	73	27.1
40-50	99	36.8
50-60	26	9.7
60-70	3	1.1
70-80	0	0.0
80-90	0	0.0
90-100	0	0.0
100-110	0	0.0
110-120	0	0.0
120-130	0	0.0
130-140	0	0.0
140-150	0	0.0
150-160	0	0.0
160-170	0	0.0
170-180	0	0.0



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CLASSIFICATION SCHEMES:

Scheme F Classification Scheme (Non-metric)

Scheme F is an attempt to implement the FWHA's visual classification scheme as an axle-based classification scheme. This is one of several interpretations.

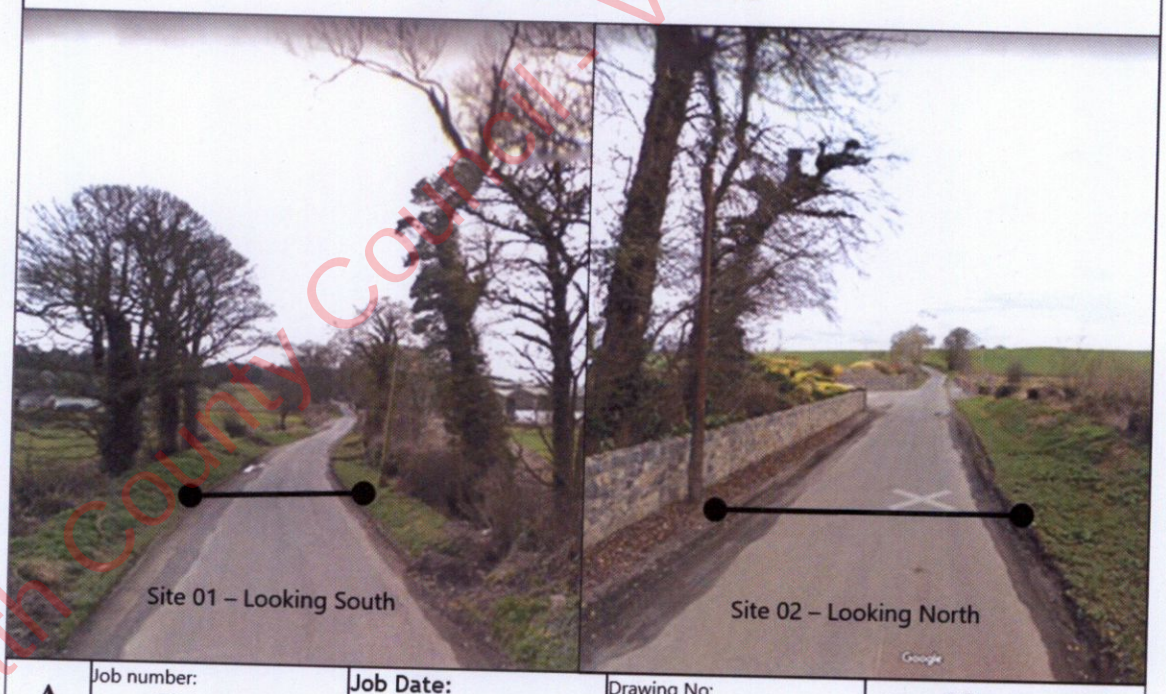
Vehicle Class	Class	Vehicle Type	No. of Axles	Axle spacing in feet				
				Axle 1 to 2	Axle 2 to 3	Axle 3 to 4	Axle 4 to 5	Axle 5 to 6
PCL/MCL	1	motorcycle	2	<6.0				
CAR*	2	passenger car	2	6.0 - 10.0				
		car + 1 axle trailer	3	<10.0	10.0 - 18.0			
		car + 2 axle trailer	4	<10.0		<3.5		
LGV**	3	pickup	2	10.0 - 15.0				
		pickup + 1 axle trailer	3	10.0 - 15.0	10.0 - 18.0			
		pickup + 2 axle trailer	4	10.0 -15.0		<3.5		
		pickup + 3 axle trailer	5	9.9 - 15.0			<3.5	
BUS	4	bus	2	>20.0				
		bus	3	>19.0				
OGV 1	5	single unit truck - dual rear axle	2	14.9 - 20.0			<3.5	
	6	3 axle truck	3		<18.0			
OGV 2	7	4 axle truck	4					
	8	2S1	3		>18.0			
		2S2	4		>5.0	>3.5		
		3S1	4		<5.0	>10.0		
	9	3S2	5		<6.1		3.5 - 8.0	
		5 axle combination	5					
	10	6 axle combination	6			3.5 - 5.0		
		3S3	6					
	11	2S1-2	5		>6.0			
	12	3S1-2	6					>10.0
	13	truck	7 or more					

Car* Cars and LGV based cars
LGV** Light Goods Vehicles with the exception of LGV based on cars

Traffic Survey Data – Automatic Traffic Counter Site L1615 Hilltown Great Road

Site Locations

Site Locations



	Job number: TRA/21/223	Job Date: Week Commencing Tuesday 23rd November 2021	Drawing No: TRA/21/223-01	traffinomics.ie
	Client: Trafficwise		Author: SPW	

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SUMMARY

SITE 01

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

LOCATION: L1615 North of Laburham Farm (Google Maps Ref: 53.656780, -6.355420)

SPEED SURVEY SUMMARY:

NORTHBOUND	85% Speed = 72.28 km/h, 95% Speed = 79.27 km/h, Median = 61.76 km/h	Maximum = 105.2 km/h, Minimum = 6.8 km/h, Mean = 61.7 km/h
SOUTHBOUND	85% Speed = 73.33 km/h, 95% Speed = 80.53 km/h, Median = 63.43 km/h	Maximum = 110.0 km/h, Minimum = 6.9 km/h, Mean = 63.43 km/h

VOLUMETRIC VEHICLE COUNTS:

Direction	Time	Tuesday 23 November 2021	Wednesday 24 November 2021	Thursday 25 November 2021	Friday 26 November 2021	Saturday 27 November 2021	Sunday 28 November 2021	Monday 29 November 2021	No. Vehicles	7 day Mean
NORTHBOUND	**07-19**	411	403	428	416	364	313	373	2708	387
SOUTHBOUND	**07-19**	410	415	394	399	369	313	372	2672	382
NORTHBOUND	**00-00**	483	479	496	483	439	369	433	3182	455
SOUTHBOUND	**00-00**	491	492	487	489	445	382	436	3222	460

PEAK FLOW SUMMARY:

Peak	AM	IP	PM
Most Frequent Peak Hour	0800	1200	1600
Average Vehicles per Peak Hour	39	41	39

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 01
NORTHBOUND

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

TIME PERIOD	Tuesday 23 November 2021	Wednesday 24 November 2021	Thursday 25 November 2021	Friday 26 November 2021	Saturday 27 November 2021	Sunday 28 November 2021	Monday 29 November 2021	Average
0000	1	0	0	1	2	3	2	1
0100	0	0	1	0	2	4	2	1
0200	1	1	0	0	2	2	0	1
0300	0	0	0	0	1	0	0	0
0400	0	0	2	0	0	2	1	1
0500	2	2	4	4	2	1	3	3
0600	15	11	13	10	4	1	12	9
0700	20	22	15	24	5	4	22	16
0800	53	49	50	47	21	7	41	38
0900	24	43	36	43	20	9	36	30
1000	31	32	32	39	28	30	27	31
1100	26	26	34	35	50	54	32	37
1200	38	29	36	38	44	47	37	38
1300	35	27	40	30	43	35	28	34
1400	46	36	38	31	40	25	32	35
1500	43	45	40	33	23	30	39	36
1600	39	42	42	28	40	31	32	36
1700	26	32	40	44	32	28	32	33
1800	30	20	25	24	18	13	15	21
1900	19	22	17	25	22	13	15	19
2000	10	27	15	12	22	11	11	15
2100	15	7	7	6	8	11	10	9
2200	6	5	5	9	6	7	4	6
2300	3	1	4	0	4	1	0	2
07-19	411	403	428	416	364	313	373	387
06-22	470	470	480	469	420	349	421	440
06-00	479	476	489	478	430	357	425	448
00-00	483	479	496	483	439	369	433	455

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 01
SOUTHBOUND

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

TIME PERIOD	Tuesday 23 November 2021	Wednesday 24 November 2021	Thursday 25 November 2021	Friday 26 November 2021	Saturday 27 November 2021	Sunday 28 November 2021	Monday 29 November 2021	Average
0000	0	0	1	2	6	9	3	3
0100	1	0	1	0	3	4	0	1
0200	0	0	0	0	1	1	0	0
0300	0	0	0	0	0	1	0	0
0400	1	0	0	0	0	1	0	0
0500	2	2	1	1	1	1	2	1
0600	8	7	12	12	3	0	7	7
0700	29	32	25	30	4	5	23	21
0800	44	43	40	27	18	12	40	32
0900	44	27	37	24	25	29	32	31
1000	32	24	30	23	33	16	23	26
1100	29	32	25	31	32	29	21	28
1200	34	41	35	38	43	39	43	39
1300	39	38	46	41	47	41	32	41
1400	38	32	25	37	25	36	24	31
1500	21	38	39	49	41	23	35	35
1600	39	34	32	31	38	42	40	37
1700	36	39	31	29	36	21	30	32
1800	25	35	29	39	27	20	29	29
1900	33	29	24	31	18	20	24	26
2000	14	19	30	16	14	15	11	17
2100	13	10	9	15	14	9	11	12
2200	6	7	5	10	7	5	3	6
2300	3	3	10	3	9	3	3	5
07-19	410	415	394	399	369	313	372	382
06-22	478	480	469	473	418	357	425	443
06-00	487	490	484	486	434	365	431	454
00-00	491	492	487	489	445	382	436	460

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

SITE 01
NORTHBOUND

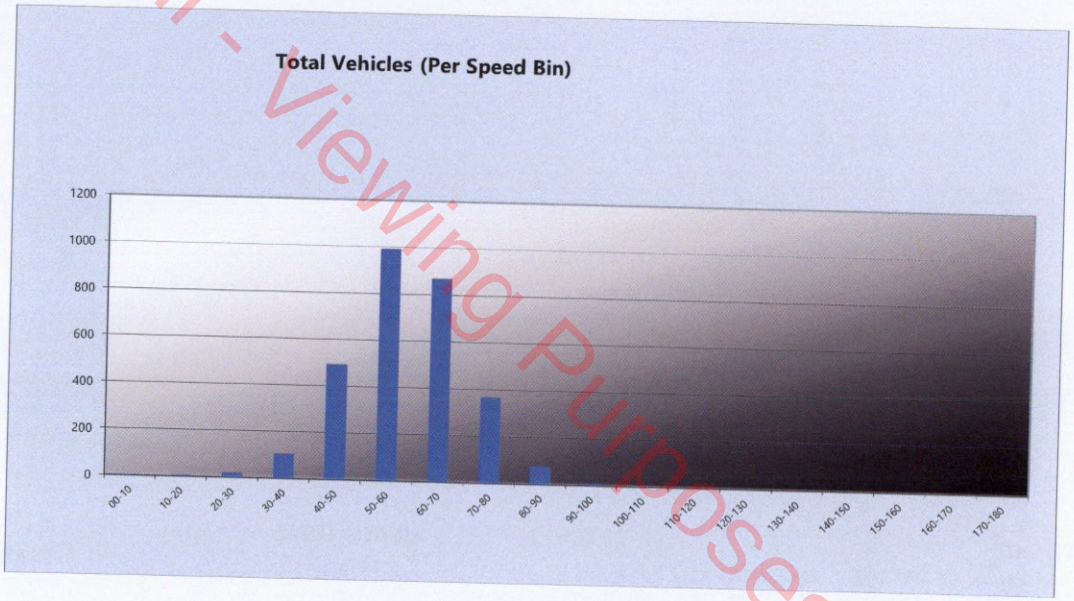
Profile:

Filter time: 00:00 23rd November 2021 => 23:59 29th November 2021
Speed range: 0 - 200 km/h.
Separation: Greater than 4.00 seconds. - (Headway)
Units: Metric (meter, kilometer, m/s, km/h, kg, tonne)

Vehicles = 2945
Maximum = 105.2 km/h, Minimum = 6.8 km/h, Mean = 61.7 km/h
85% Speed = 72.28 km/h, 95% Speed = 79.27 km/h, Median = 61.76 km/h
20 km/h Pace = 57 - 77, Number in Pace = 1885 (64.01%)

Speed Bins:

Speed	Bin	
KPH	No.	%
00-10	2	0.0
10-20	5	0.2
20-30	20	0.7
30-40	106	3.6
40-50	494	16.8
50-60	993	33.7
60-70	868	29.5
70-80	368	12.5
80-90	77	2.6
90-100	9	0.3
100-110	3	0.1
110-120	0	0.0
120-130	0	0.0
130-140	0	0.0
140-150	0	0.0
150-160	0	0.0
160-170	0	0.0
170-180	0	0.0



TRAFFINOMICS LIMITED

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 01
SOUTHBOUND

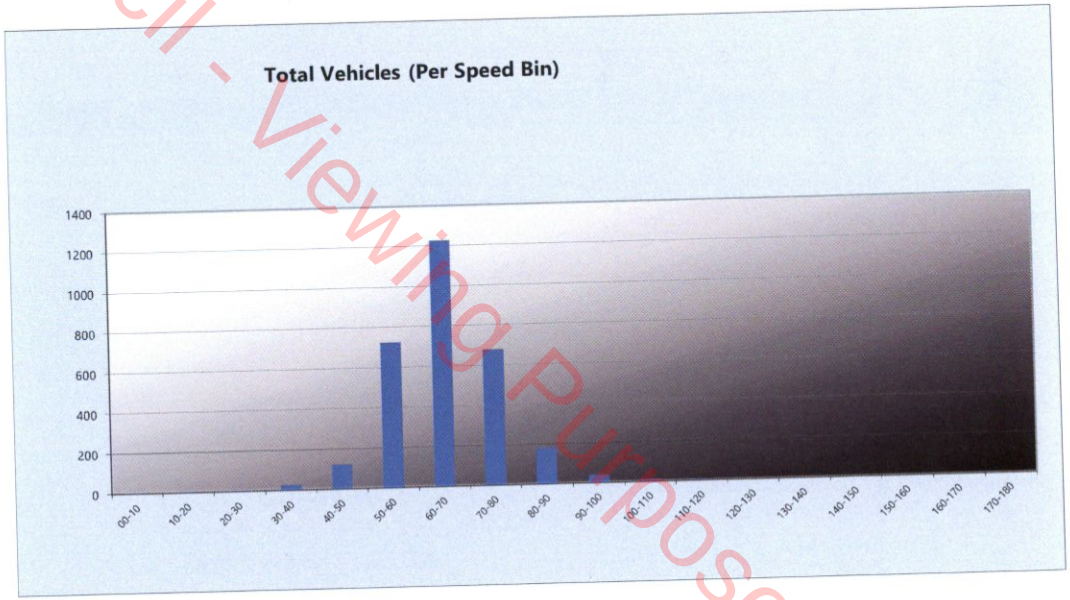
Profile:

Filter time: 00:00 23rd November 2021 => 23:59 29th November 2021
Speed range: 0 - 200 km/h.
Separation: Greater than 4.00 seconds. - (Headway)
Units: Metric (meter, kilometer, m/s, km/h, kg, tonne)

Vehicles = 3010
Maximum = 110.0 km/h, Minimum = 6.9 km/h, Mean = 63.6 km/h
85% Speed = 73.33 km/h, 95% Speed = 80.53 km/h, Median = 63.43 km/h
20 km/h Pace = 56 - 76, Number in Pace = 2153 (71.53%)

Speed Bins:

Speed	Bin	
KPH	No.	%
00-10	1	0.0
10-20	2	0.1
20-30	3	0.1
30-40	25	0.8
40-50	123	4.1
50-60	724	22.5
60-70	1228	40.8
70-80	678	24.1
80-90	178	5.9
90-100	38	1.3
100-110	9	0.2
110-120	1	0.1
120-130	0	0.0
130-140	0	0.0
140-150	0	0.0
150-160	0	0.0
160-170	0	0.0
170-180	0	0.0



TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SUMMARY

SITE 02

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

LOCATION: L1615 South of Laburham Farm (Google Maps Ref: 53.656780, -6.355420)

SPEED SURVEY SUMMARY:

NORTHBOUND 85% Speed = 76.40 km/h, 95% Speed = 86.93 km/h, Median = 64.79 km/h Maximum = 130.2 km/h, Minimum = 17.5 km/h, Mean = 64.9 km/h

SOUTHBOUND 85% Speed = 73.16 km/h, 95% Speed = 82.39 km/h, Median = 60.65 km/h Maximum = 122.0 km/h, Minimum = 0.0 km/h, Mean = 61.1 km/h

VOLUMETRIC VEHICLE COUNTS:

Direction	Time	Tuesday 23 November 2021	Wednesday 24 November 2021	Thursday 25 November 2021	Friday 26 November 2021	Saturday 27 November 2021	Sunday 28 November 2021	Monday 29 November 2021	No. Vehicles	7 day Mean
NORTHBOUND	07-19	411	403	428	416	364	313	373	2708	387
SOUTHBOUND	07-19	410	415	394	399	369	313	372	2672	382
NORTHBOUND	00-00	483	479	496	483	439	369	433	3182	455
SOUTHBOUND	00-00	491	492	487	489	445	382	436	3222	460

PEAK FLOW SUMMARY:

Peak	AM	IP	PM
Most Frequent Peak Hour	0800	1200	1600
Average Vehicles per Peak Hour	39	41	39

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 02
NORTHBOUND

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

TIME PERIOD	Tuesday 23 November 2021	Wednesday 24 November 2021	Thursday 25 November 2021	Friday 26 November 2021	Saturday 27 November 2021	Sunday 28 November 2021	Monday 29 November 2021	Average
0000	1	0	0	1	2	3	2	1
0100	0	0	1	0	2	4	2	1
0200	1	1	0	0	2	2	0	1
0300	0	0	0	0	1	0	0	0
0400	0	0	2	0	0	2	1	1
0500	2	2	4	4	2	1	3	3
0600	15	11	13	10	4	1	12	9
0700	20	22	15	24	5	4	22	16
0800	53	49	50	47	21	7	41	38
0900	24	43	36	43	20	9	36	30
1000	31	32	32	39	28	30	27	31
1100	26	26	34	35	50	54	32	37
1200	38	29	36	38	44	47	37	38
1300	35	27	40	30	43	35	28	34
1400	46	36	38	31	40	25	32	35
1500	43	45	40	33	23	30	39	36
1600	39	42	42	28	40	31	32	36
1700	26	32	40	44	32	28	32	33
1800	30	20	25	24	18	13	15	21
1900	19	22	17	25	22	13	15	19
2000	10	27	15	12	22	11	11	15
2100	15	7	7	6	8	11	10	9
2200	6	5	5	9	6	7	4	6
2300	3	1	4	0	4	1	0	2
07-19	411	403	428	416	364	313	373	387
06-22	470	470	480	469	420	349	421	440
06-00	479	476	489	478	430	357	425	448
00-00	483	479	496	483	439	369	433	455

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

SITE 02
SOUTHBOUND

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

TIME PERIOD	Tuesday 23 November 2021	Wednesday 24 November 2021	Thursday 25 November 2021	Friday 26 November 2021	Saturday 27 November 2021	Sunday 28 November 2021	Monday 29 November 2021	Average
0000	0	0	1	2	6	9	3	3
0100	1	0	1	0	3	4	0	1
0200	0	0	0	0	1	1	0	0
0300	0	0	0	0	0	1	0	0
0400	1	0	0	0	0	1	0	0
0500	2	2	1	1	1	1	2	1
0600	8	7	12	12	3	0	7	7
0700	29	32	25	30	4	5	23	21
0800	44	43	40	27	18	12	40	32
0900	44	27	37	24	25	29	32	31
1000	32	24	30	23	33	16	23	26
1100	29	32	25	31	32	29	21	28
1200	34	41	35	38	43	39	43	39
1300	39	38	46	41	47	41	32	41
1400	38	32	25	37	25	36	24	31
1500	21	38	39	49	41	23	35	35
1600	39	34	32	31	38	42	40	37
1700	36	39	31	29	36	21	30	32
1800	25	35	29	39	27	20	29	29
1900	33	29	24	31	18	20	24	26
2000	14	19	30	16	14	15	11	17
2100	13	10	9	15	14	9	11	12
2200	6	7	5	10	7	5	3	6
2300	3	3	10	3	9	3	3	5
07-19	410	415	394	399	369	313	372	382
06-22	478	480	469	473	418	357	425	443
06-00	487	490	484	486	434	365	431	454
00-00	491	492	487	489	445	382	436	460

TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

WEEK COMMENCING: **Tuesday 23 November 2021**
TRA/21/223

SITE 02
NORTHBOUND

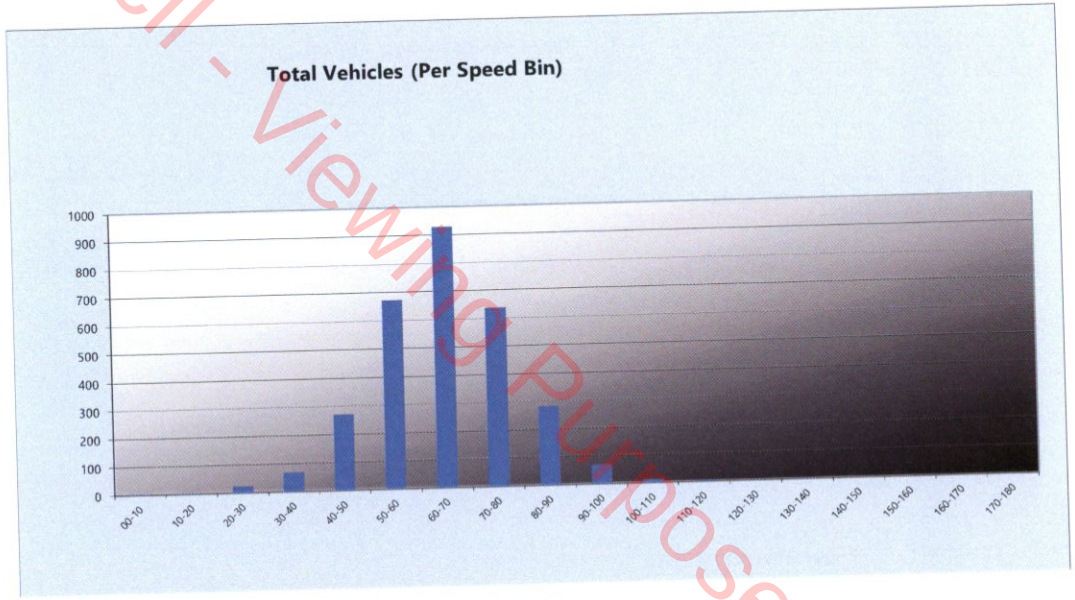
Profile:

Filter time: 00:00 23rd November 2021 => 23:59 29th November 2021
Speed range: 0 - 200 km/h.
Separation: Greater than 4.00 seconds. - (Headway)
Units: Metric (meter, kilometer, m/s, km/h, kg, tonne)

Vehicles = 2965
Maximum = 130.2 km/h, Minimum = 17.5 km/h, Mean = 64.9 km/h
85% Speed = 76.40 km/h, 95% Speed = 86.93 km/h, Median = 64.79 km/h
20 km/h Pace = 64 - 84, Number in Pace = 1700 (57.34%)
Variance = 182.40, Standard Deviation = 13.51 km/h

Speed Bins:

Speed	Bin	
KPH	No.	%
00-10	1	0.0
10-20	2	0.1
20-30	23	0.8
30-40	68	2.3
40-50	270	9.1
50-60	671	22.6
60-70	927	31.3
70-80	636	21.5
80-90	280	9.4
90-100	68	2.3
100-110	11	0.4
110-120	5	0.2
120-130	2	0.1
130-140	1	0.0
140-150	0	0.0
150-160	0	0.0
160-170	0	0.0
170-180	0	0.0



TRAFFINOMICS LIMITED

BELLEWSTOWN TRAFFIC COUNT/SPEED SURVEYS
AUTOMATIC TRAFFIC COUNTS

WEEK COMMENCING: Tuesday 23 November 2021
TRA/21/223

SITE 02
SOUTHBOUND

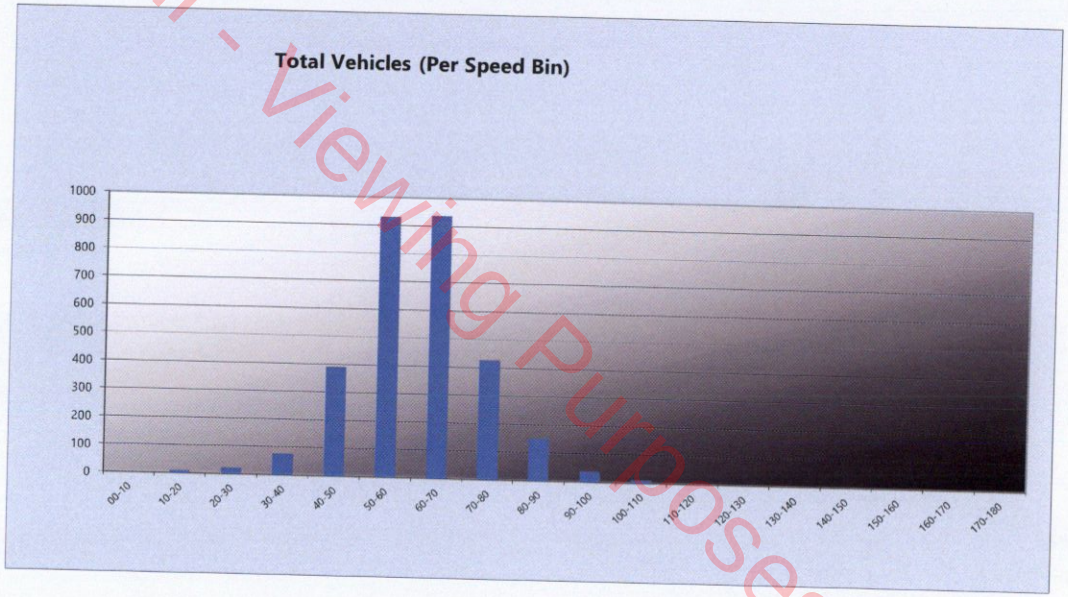
Profile:

Filter time: 00:00 23rd November 2021 => 23:59 29th November 2021
Speed range: 0 - 200 km/h.
Separation: Greater than 4.00 seconds. - (Headway)
Units: Metric (meter, kilometer, m/s, km/h, kg, tonne)

Vehicles = 3007
Maximum = 122.0 km/h, Minimum = 0.0 km/h, Mean = 61.1 km/h
85% Speed = 73.16 km/h, 95% Speed = 82.39 km/h, Median = 60.65 km/h
20 km/h Pace = 59 - 79, Number in Pace = 1878 (62.45%)
Variance = 162.42, Standard Deviation = 12.74 km/h

Speed Bins:

Speed	Bin	
KPH	No.	%
00-10	3	0.1
10-20	9	0.3
20-30	23	0.8
30-40	77	2.6
40-50	391	13.0
50-60	931	31.0
60-70	938	31.2
70-80	428	14.2
80-90	153	5.1
90-100	38	1.3
100-110	11	0.4
110-120	2	0.1
120-130	3	0.1
130-140	0	0.0
140-150	0	0.0
150-160	0	0.0
160-170	0	0.0
170-180	0	0.0



TRAFFINOMICS LIMITED

CLASSIFICATION SCHEMES:

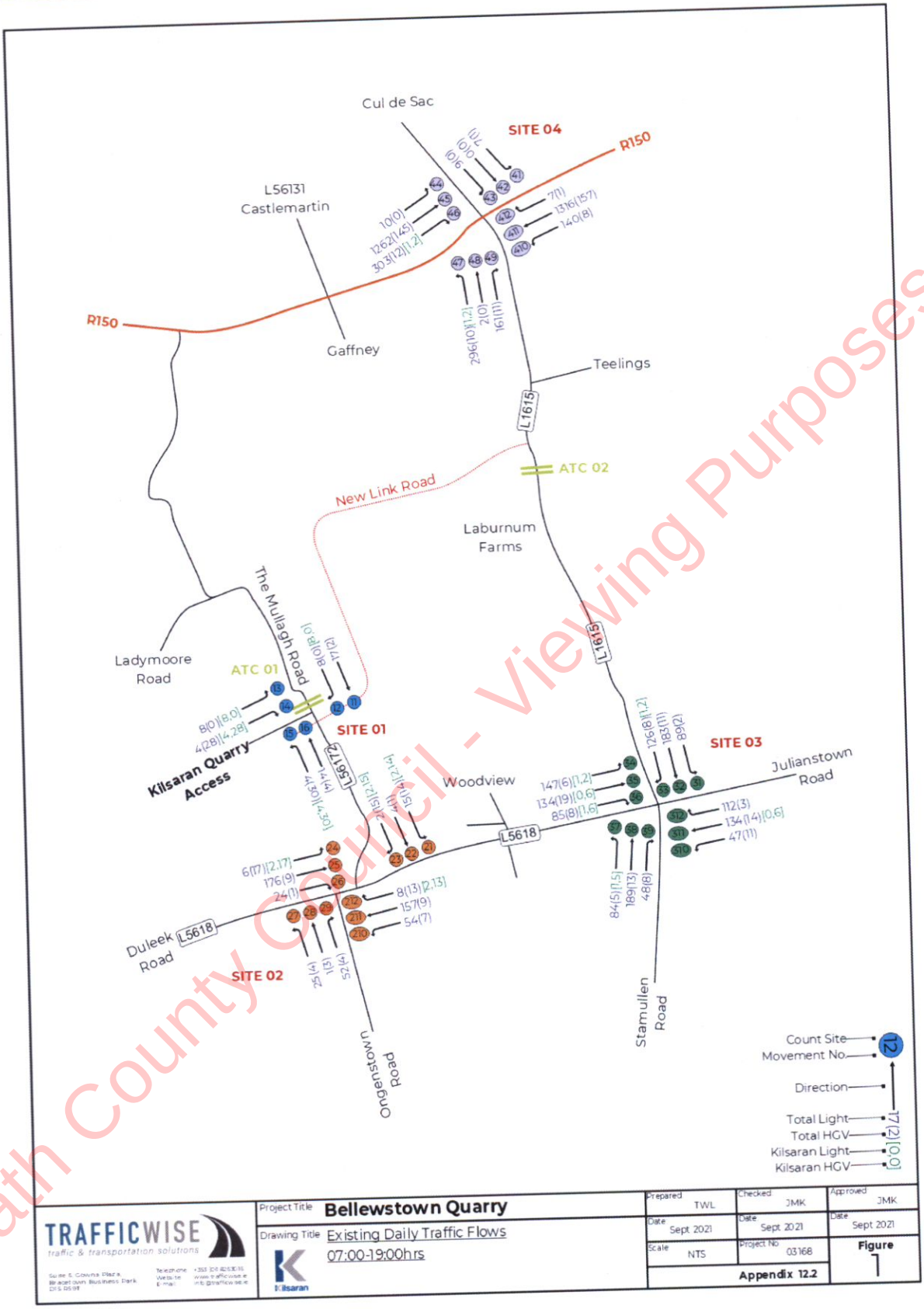
Scheme F Classification Scheme (Non-metric)

Scheme F is an attempt to implement the FWHA's visual classification scheme as an axle-based classification scheme. This is one of several interpretations.

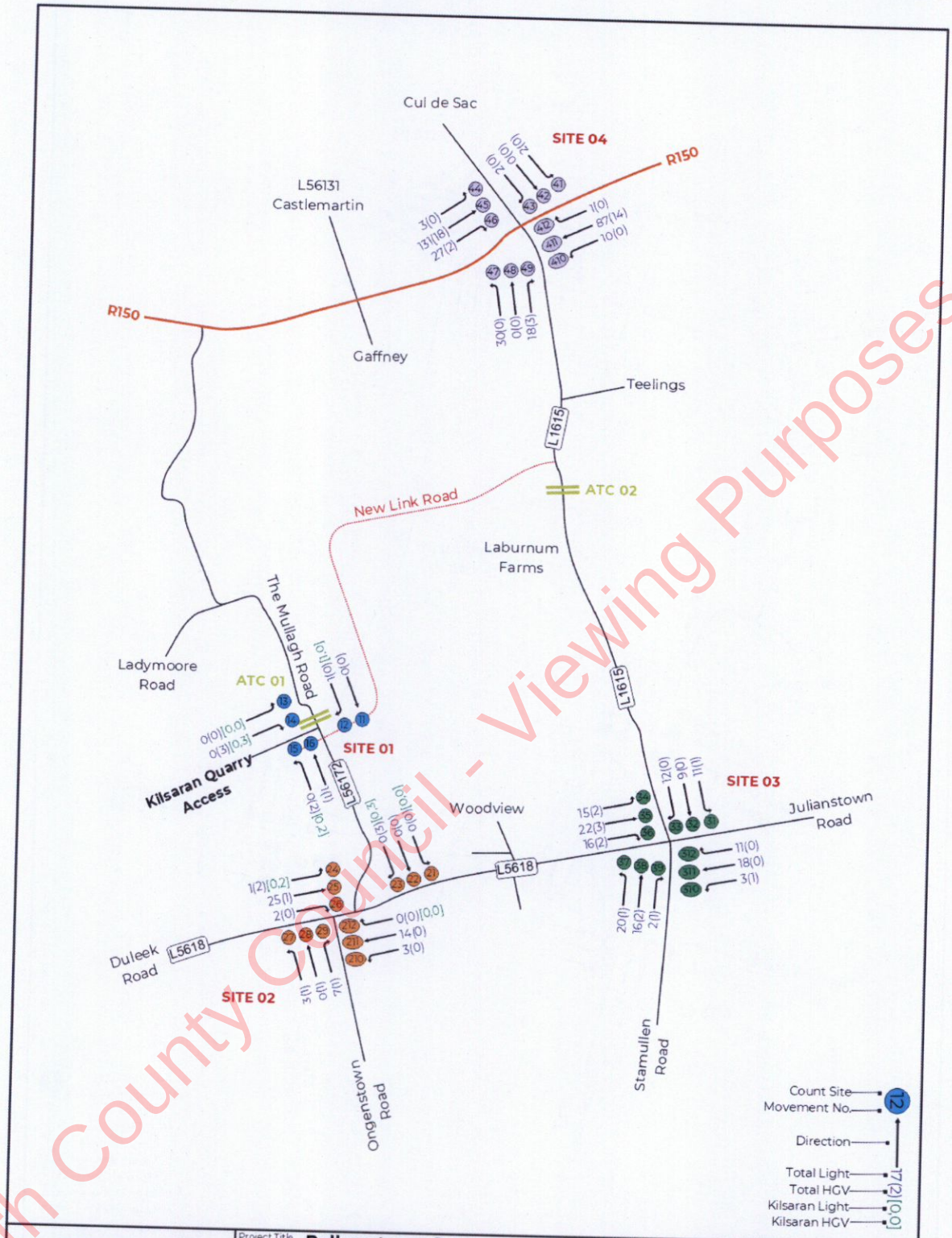
Vehicle Class	Class	Vehicle Type	No. of Axles	Axle spacing in feet				
				Axle 1 to 2	Axle 2 to 3	Axle 3 to 4	Axle 4 to 5	Axle 5 to 6
PCL/MCL	1	motorcycle	2	<6.0				
CAR*	2	passenger car	2	6.0 - 10.0				
		car + 1 axle trailer	3	<10.0	10.0 - 18.0			
		car + 2 axle trailer	4	<10.0		<3.5		
LGV**	3	pickup	2	10.0 - 15.0				
		pickup + 1 axle trailer	3	10.0 - 15.0	10.0 - 18.0			
		pickup + 2 axle trailer	4	10.0 -15.0		<3.5		
		pickup + 3 axle trailer	5	9.9 - 15.0			<3.5	
BUS	4	bus	2	>20.0				
		bus	3	>19.0				
OGV 1	5	single unit truck - dual rear axle	2	14.9 - 20.0			<3.5	
	6	3 axle truck	3		<18.0			
OGV 2	7	4 axle truck	4					
	8	2S1	3		>18.0			
		2S2	4		>5.0	>3.5		
		3S1	4		<5.0	>10.0		
	9	3S2	5		<6.1		3.5 - 8.0	
		5 axle combination	5			3.5 - 5.0		
	10	6 axle combination	6					
		3S3	6		>6.0			
	11	2S1-2	5					>10.0
	12	3S1-2	6					
	13	truck	7 or more					

Car* Cars and LGV based cars
LGV** Light Goods Vehicles with the exception of LGV based on cars

APPENDIX 12.2: TRAFFIC NETWORK FLOW DIAGRAMS



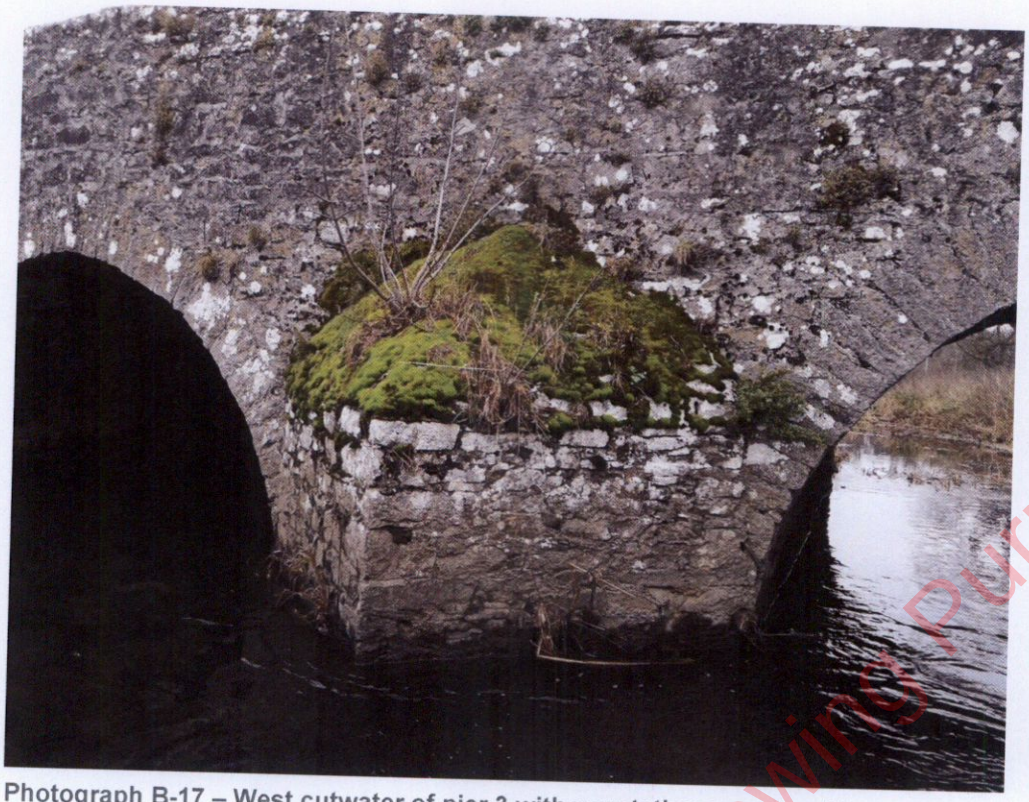
TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Existing Daily Traffic Flows 07:00-19:00hrs	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	**Figure**
			Appendix 12.2	



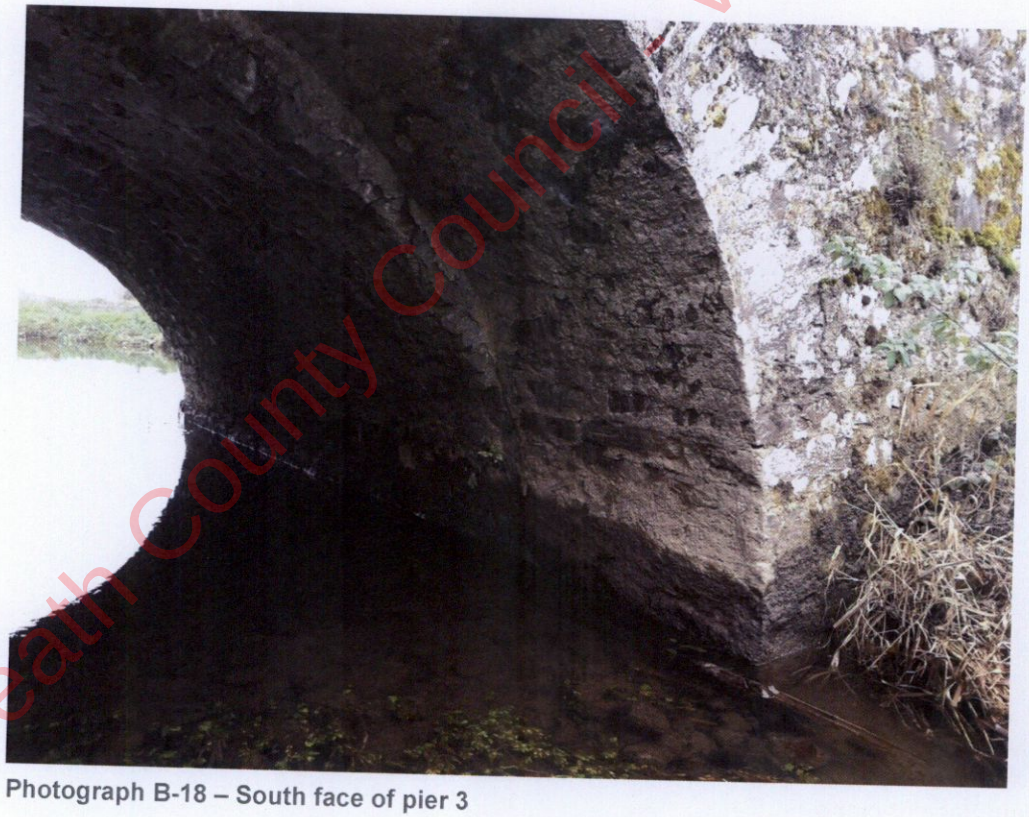
TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Morning Peak Hour Traffic Flows 08:00-09:00hrs	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	Figure 2
			Appendix 12.2	

Photograph B-19 – West cutwater of pier 4 with vegetation growth evident

Photograph B-20 – South face of pier 4

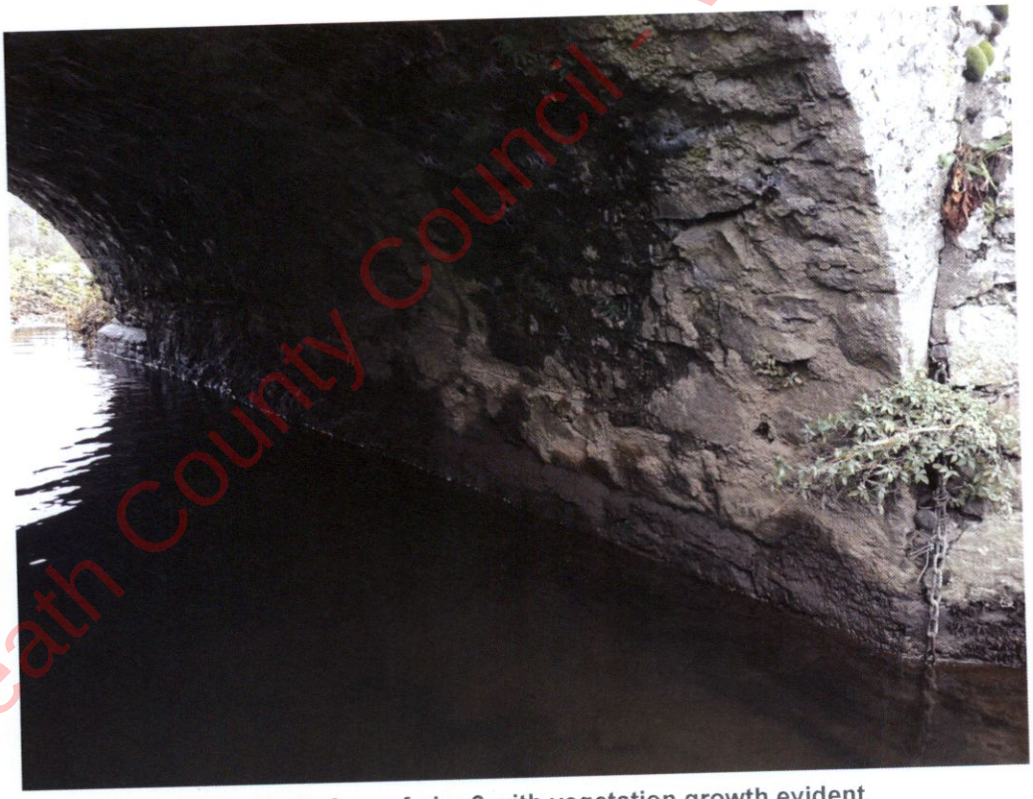


Photograph B-17 – West cutwater of pier 3 with vegetation growth evident

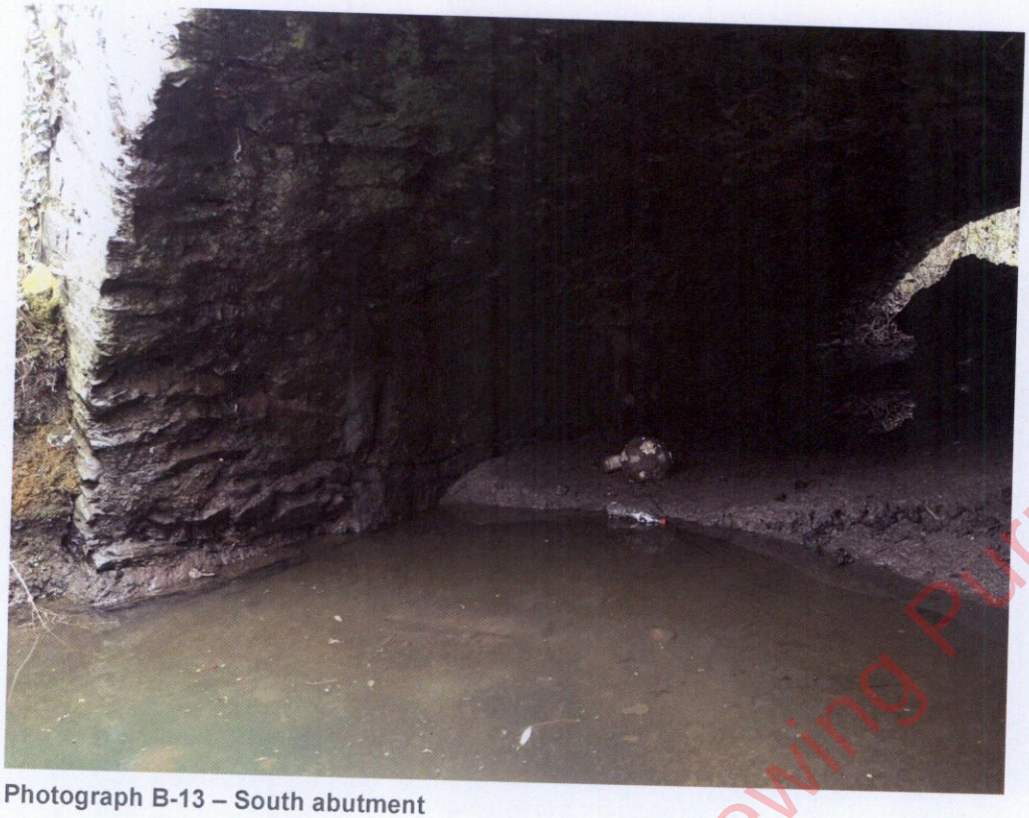


Photograph B-18 – South face of pier 3

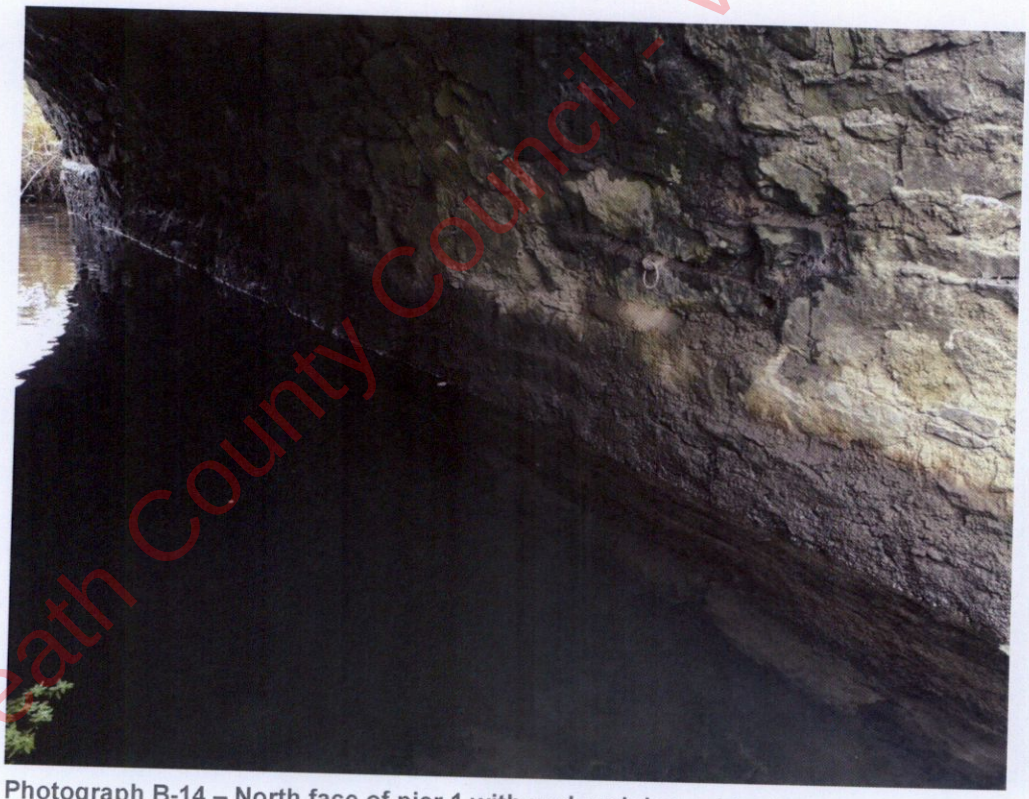
Photograph B-15 – West cutwater of pier 1 with vegetation growth evident



Photograph B-16 – North face of pier 2 with vegetation growth evident

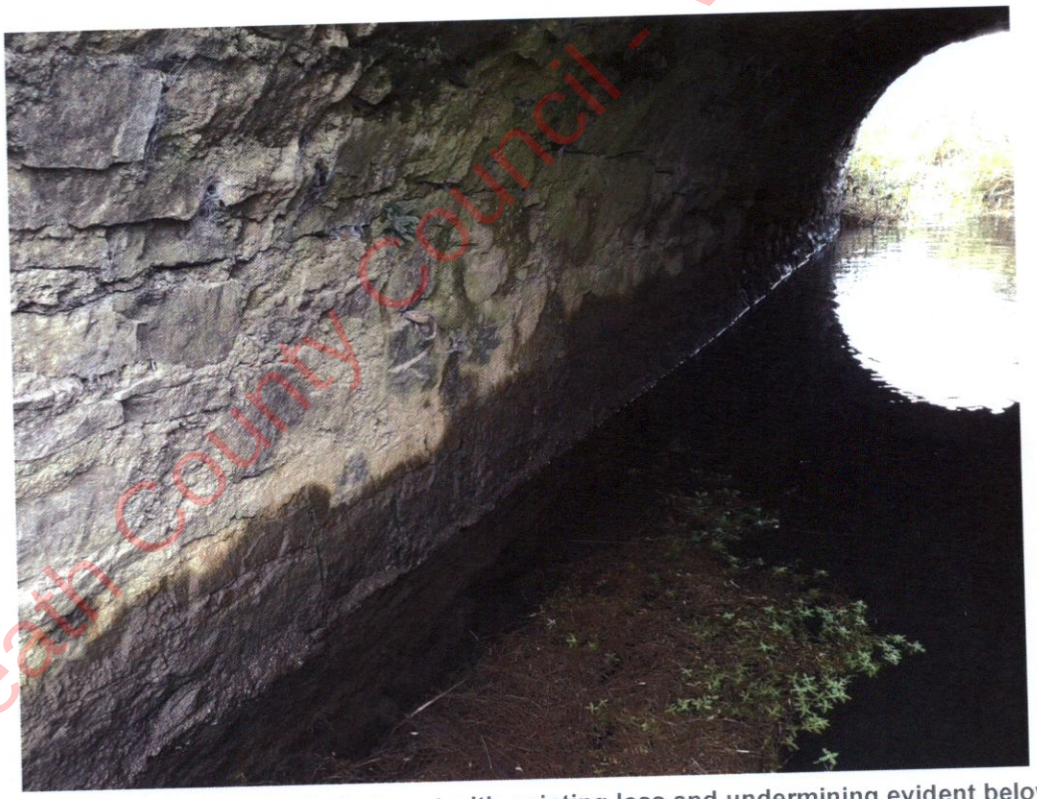


Photograph B-13 – South abutment



Photograph B-14 – North face of pier 1 with undermining evident

Photograph B-11 – East spandrel wall with minor vegetation growth evident



Photograph B-12 – North abutment with pointing loss and undermining evident below waterline

Photograph B-9 – SE embankment with overgrown vegetation evident

Photograph B-10 – West spandrel wall with minor vegetation growth evident

Photograph B-7 – NE embankment with overgrown vegetation evident

Photograph B-8 – SW embankment with overgrown vegetation evident

Photograph B-5 – East parapet and grass verge

Photograph B-6 – NW embankment with overgrown vegetation evident

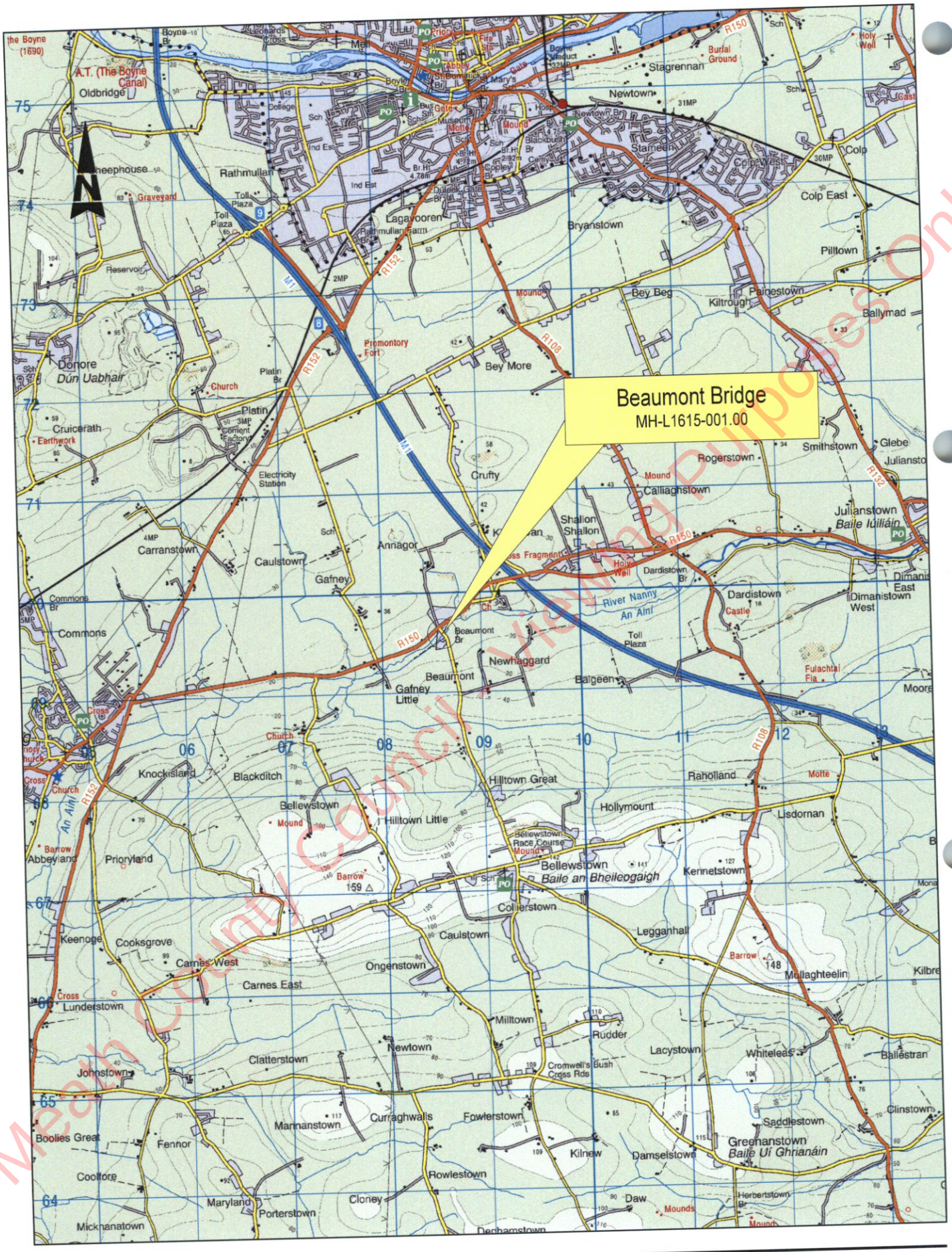
Photograph B-3 – Area of depression to carriageway surface above pier 3. Note tie into R150 road surfacing above arch 3.

Photograph B-4 – West parapet and grass verge

Appendix B. Inspection Photographs

Photograph B-1 – Bridge surface looking south

Photograph B-2 – Bridge surface looking north



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Beaumont Bridge Assessment

Appendix A. Structure Location Map

Appendices

Abutments/Piers

A qualitative assessment was carried out for the substructure elements with the areas of undermining to north abutment and northern piers giving the substructure an overall fair condition rating. Repair works to the areas of undermining are required to restore the substructure to a good condition, with the infilling of the scour damage at the west elevation also recommended.

5. Conclusions

The structure is in an overall fair condition with minor areas of masonry and pointing loss found to the arch barrels, piers and abutments. Repointing works should be undertaken in order to restore these key structural elements to a good condition.

The depression noted to the carriageway surfacing and the scour damage to the riverbed are the defects of most concern. Repairs are recommended to be undertaken to the areas of scour damage below the structure with the mainline carriageway surfacing previously only extended to arch 3 over the structure now extended to beyond the south abutment. The grass verges over the structure should be replaced by concrete verges to prevent further water ingress through the arch barrels.

The low 3t load capacity found for the existing structure is due to the shallow depths of fill over the structure, estimated to be less than 100mm in places. Investigation works are therefore recommended to determine the exact depth of fill above each barrel and the thickness of each arch in order to undertake a Stage 2 assessment. The investigation works should also confirm if there is existing backing present to the arch barrels, with backing recommended to be installed to the structure if not present.

As Beaumont Bridge is behaving satisfactorily under current loading no load restriction is recommended at this time, with further investigation and assessment recommended to confirm the load capacity for the structure. Consideration should also be given to the use of structural health monitoring to monitor the behaviour of the structure under the current loading.

6. Recommendations

The further investigation/assessment recommended to be undertaken to Beaumont Bridge are as follows:

- Trial pit excavations to the bridge surface to confirm the depth of fill and arch thickness of each arch barrel
- Trial pit excavations to the bridge surface to confirm presence of backing to arch barrels
- Stage 2 assessment of the structure in accordance with TII AM-STR-06057 Stage 2 Structural Assessment of Sub-Standard Road Structures

The recommended repair works for the structure are as follows:

- Masonry repointing to the arch barrels, piers and abutments
- Repairs to areas of undermining to the north abutment and northern piers
- Infilling of scour holes at the west elevation
- Removal of debris trapped at the west elevation of arch barrel 7
- Replacement of the grass verges with new concrete verges
- Vegetation removal and repointing to the parapets, spandrel walls and wing walls
- Vegetation clearance to the embankments
- Installation of backing to the arch barrels
- Replacement of carriageway surfacing over the structure

Based on a visual inspection and the recommendations of *AM-STR-06002* Annex D, the condition factors used in the arch assessment are summarised in Table 4-2 below.

Table 4-2 Condition factors to be used in the Assessment

Condition Factor		Reasoning
Barrel Factor, F_b	1.0	Limestone in good overall condition
Fill Factor, F_f	0.7	Well compacted material
Joint Width Factor, F_w	0.8	Joint widths greater than 12.5mm (conservative)
Joint Depth factor, F_d	0.8	Loss of pointing evident, average depths 20mm
Joint Mortar factor, F_{mo}	1.0	Mortar in good condition
Condition Factor, F_{cM}	0.9	Good overall condition with pointing loss evident

The Modified MEXE analysis gives a live load capacity varying between 18 and 40 tonnes Gross Vehicle Weight (GVW) for all arch barrels, see Table 4-3 below.

Table 4-3 Results of Modified MEXE Analysis

	Max Gross Vehicle Weight (tonnes)	
	Upper Bound	Lower Bound
Arch Barrel 1	40t	18t
Arch Barrel 2	40t	40t
Arch Barrel 3	18t	18t
Arch Barrel 4	18t	18t
Arch Barrel 5	40t	40t
Arch Barrel 6	40t	40t
Arch Barrel 7	40t	40t

As the structure is a multi-span arch structure the guidance given in *AM-STR-06026* was followed with the results from the MEXE analysis corroborated with the results of the three-hinge limit analysis method using Archie-M software. Archie-M analysis was carried out on the structure for both HA and SV assessment loading.

The Archie-M analysis carried out on the structure determined that the existing structure has a less than 3t load capacity for the lowerbound condition (0.6* voussoir thickness) and a 3t load capacity for the upperbound condition (full voussoir thickness). See Table 4-4 below for a summary of the Archie-M analysis results.

Table 4-4 Results of the Archie-M Analysis

		Present Condition	Good Condition	Backing Present
HA Loading	**Lowerbound**	Fails 3t	Fails 3t	44t
	Upperbound	3t	3t	44t
SV Loading	**Lowerbound**	Fails SV80	Fails SV80	SV80
	Upperbound	Fails SV80	Fails SV80	SV100

The results from the Archie-M analysis shows that the third condition comprising the presence of backing greatly increases the load capacity of the structure. Structural investigations are therefore recommended to both confirm the arch thickness dimensions and also to confirm if backing is present over the structure.

See Appendix C of this report for the calculations and outputs from both the MEXE and Archie-M analysis.

Abutments

The abutments are in a good overall condition apart from pointing loss and undermining to the north abutment below the waterline. The south abutment is mostly hidden below the mudline, see Photograph B-12 and B-13 for both abutments.

Piers

The piers are in a fair overall condition with minor areas of pointing loss to the pier faces and vegetation growth to the cutwaters. There is also 400mm deep undermining noted to pier 1 and 200mm deep undermining noted to pier 2 with masonry and pointing loss noted below the waterline, see Photograph B-14 to B-21 for the piers.

Arch Barrels

The masonry arch barrels are in a fair condition overall with minor masonry and pointing loss evident to localised areas throughout. Water ingress is evident to all arch barrels most likely due to the soft verges over the structure with a transverse crack also evident to the arch barrel of span 1 above the north abutment.

See Photograph B-22 to B-29 for the arch barrels.

Riverbed

The riverbed below the structure is in a poor condition due the extensive scour noted at the upstream elevation of spans 1 to 4, with scour depths of up to 500mm recorded. Undermining is evident to the piers in spans 1 and 2 as a result of the scour to the adjacent riverbed. Both the upstream and downstream watercourse are impacted by overgrown vegetation with the watercourse mainly channelled through arches 3 and 4 as a result.

See Photograph B-30 and B-31 for the riverbed.

Overall Structure

The structure is in an overall fair condition with minor areas of masonry and pointing loss found to the arch barrels, piers and abutments. The depression noted to the carriageway surfacing and the scour damage to the riverbed are the defects of most concern.

See Photograph B-32 and B-33 for both elevations of the structure.

4. Structural Assessment

A structural assessment in accordance with AM-STR-06056 Stage 1 Structural Assessment of Road Structures was undertaken to Beaumont Bridge in order to confirm the load carrying capacity of the structure.

Arch Barrels

A structural assessment of the masonry arch barrels was undertaken using the modified MEXE method outlined in *AM-STR-06002 The Assessment of Road Bridges and Structures*. The structure dimensions surveyed on site by Atkins and used in the assessment are listed below in Table 4-1.

Table 4-1 Structure dimensions used in the Assessment

	Dimension (m)						
	Arch 1	Arch 2	Arch 3	Arch 4	Arch 5	Arch 6	Arch 7
Span	2.360	2.890	4.220	4.510	2.310	2.570	2.720
Rise at Crown	1.170	1.280	1.930	2.010	1.150	1.190	1.350
Rise at Quarter Point	1.050	1.020	1.560	1.660	0.960	1.030	1.100
Ring Thickness*	0.350	0.370	0.420	0.440	0.370	0.370	0.450
Depth of Fill	0.100	0.150	0.100	0.100	0.400	0.380	0.200

* Lowerbound value (0.6x) of external voussoir thickness used for assessment purposes in accordance with *AM-STR-06056-01 Stage 1 Structural Assessment of Road Structures.*

1. Introduction

Kilsaran engaged Atkins to undertake the structural assessment of MH-L1615-001.00 Beaumont Bridge in accordance with TII Publication *AM-STR-06056 Stage 1 Structural Assessment of Road Structures* to determine the current condition and load capacity of the existing structure. The structural assessment of the structure was undertaken in accordance with TII Publication *AM-STR-06026 The Assessment of Road Bridges and Structures.*

2. Description of the Structure

MH-L1615-001.00 Beaumont Bridge is a seven span masonry arch structure carrying the L1615 local road over the River Nanny in the townland of Beaumont, Co. Meath. The structure has span widths varying between 2.31m and 4.51m with a total length of 44.65m and a width out to out of 7.5m. The structure shows evidence of historical widening works using masonry construction, with varying arch profiles and open joints evident below the structure.

The structure is a protected structure and is listed in the Record of Protected Structures within the Meath County Development Plan 2021-2027.

The location of the structure is shown on the location map in Appendix A of this report.

3. Visual Inspection

The Principal Inspection of the structure was undertaken in December 2021. The condition of each component of the structure is outlined below with photographs from the inspection provided in Appendix C of this report. For the purposes of inspection the arch barrels and piers and have been numbered in a north to south direction.

Bridge Surface

The carriageway surfacing over the structure is split into 2no. distinct sections, the local road surfacing and the newer tie in surfacing from the mainline R150 local road.

The newer tie in surfacing is in a good condition overall, with the local road surfacing showing a loss of skid resistance throughout with areas of surfacing loss and potholes forming. There is also an area of depression noted to the carriageway surface above pier 3. See Photograph B-1 to B-3 for details of the bridge surface.

Verges

Raised grass verges are present along the base of both parapets over the structure, with areas of water ingress noted to the arch barrels below. See Photograph B-4 and B-5 for both verges.

Parapets

The masonry parapets are in a good overall condition with minor vegetation removal and repointing required. See Photograph B-4 and B-5 for both parapets.

Embankments

The embankments at both elevations are in a fair overall condition with areas of vegetation clearance required to maintain access to the structure. See Photograph B-6 to B-9. There is large debris restricting access to arch 7, see Photograph B-29.

Wing/Spandrel walls

The wing and spandrel walls are in a fair condition overall with areas of vegetation growth and minor pointing loss evident. See Photograph B-10 and B-11 for the spandrel walls.

Executive Summary

MH-L1615-001.00 Beaumont Bridge is a seven span masonry arch structure carrying the L1615 local road over the River Nanny in the townland of Beaumont, Co. Meath. The structure has span widths varying between 2.31m and 4.51m with a total length of 44.65m and a width out to out of 7.5m. The structure shows evidence of historical widening works using masonry construction, with varying arch profiles and open joints evident below the structure.

The structure is a protected structure and is listed in the Record of Protected Structures within the Meath County Development Plan 2021-2027.

The structure is in an overall fair condition with minor areas of masonry and pointing loss found to the arch barrels, piers and abutments. Repointing works should be undertaken in order to restore these key structural elements to a good condition.

The depression noted to the carriageway surfacing and the scour damage to the riverbed are the defects of most concern. Repairs are recommended to be undertaken to the areas of scour damage below the structure with the mainline carriageway surfacing previously only extended to arch 3 over the structure now extended to beyond the south abutment. The grass verges over the structure should be replaced by concrete verges to prevent further water ingress through the arch barrels.

The structural assessment of the structure was undertaken in accordance with TII Publication AM-STR-06056 Stage 1 Structural Assessment of Road Structures. The structural assessment found the existing structure to have a reduced load capacity of <3t and 3t for the lowerbound and upperbound conditions respectively, mainly due to the shallow depth of fill above the structure, estimated to be less than 100mm in places. Investigation works are therefore recommended to determine the exact depth of fill above each barrel and the thickness of each arch in order to undertake a Stage 2 assessment.

The presence of backing to the arch barrels determined an increased load capacity of 44t, with site investigations recommended to be undertaken to confirm if existing backing is present to the arch barrels, with backing recommended to be installed to the structure if not present.

As Beaumont Bridge is behaving satisfactorily under current loading no load restriction is recommended at this time, with further investigation and assessment recommended to confirm the load capacity for the structure. Consideration should also be given to the use of structural health monitoring to monitor the behaviour of the structure under the current loading.

The further investigation/assessment recommended to be undertaken to Beaumont Bridge are as follows:

- Trial pit excavations to the bridge surface to confirm the depth of fill and arch thickness of each arch barrel
- Trial pit excavations to the bridge surface to confirm presence of backing to arch barrels
- Stage 2 assessment of the structure in accordance with TII AM-STR-06057 Stage 2 Structural Assessment of Sub-Standard Road Structures

The recommended repair works for the structure are as follows:

- Masonry repointing to the arch barrels, piers and abutments
- Repairs to areas of undermining to the north abutment and northern piers
- Infilling of scour holes at the west elevation
- Removal of debris trapped at the west elevation of arch barrel 7
- Replacement of the grass verges with new concrete verges
- Vegetation removal and repointing to the parapets, spandrel walls and wing walls
- Vegetation clearance to the embankments
- Installation of backing to the arch barrels
- Replacement of carriageway surfacing over the structure

Contents

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Notice

This document and its contents have been prepared and are intended solely as information for Kilsaran and use in relation to Beaumont Bridge Structural Assessment

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Document history

Revision	Purpose description	Origin-ated	Checked	Reviewed	Authorised	Date
Rev 1.0	Issue for Review	RMcS	MG	MJ	MJ	12/01/2022

Client signoff

Client	Kilsaran
Project	Beaumont Bridge Structural Assessment
Job number	5210920
Client signature / date	

ATKINS

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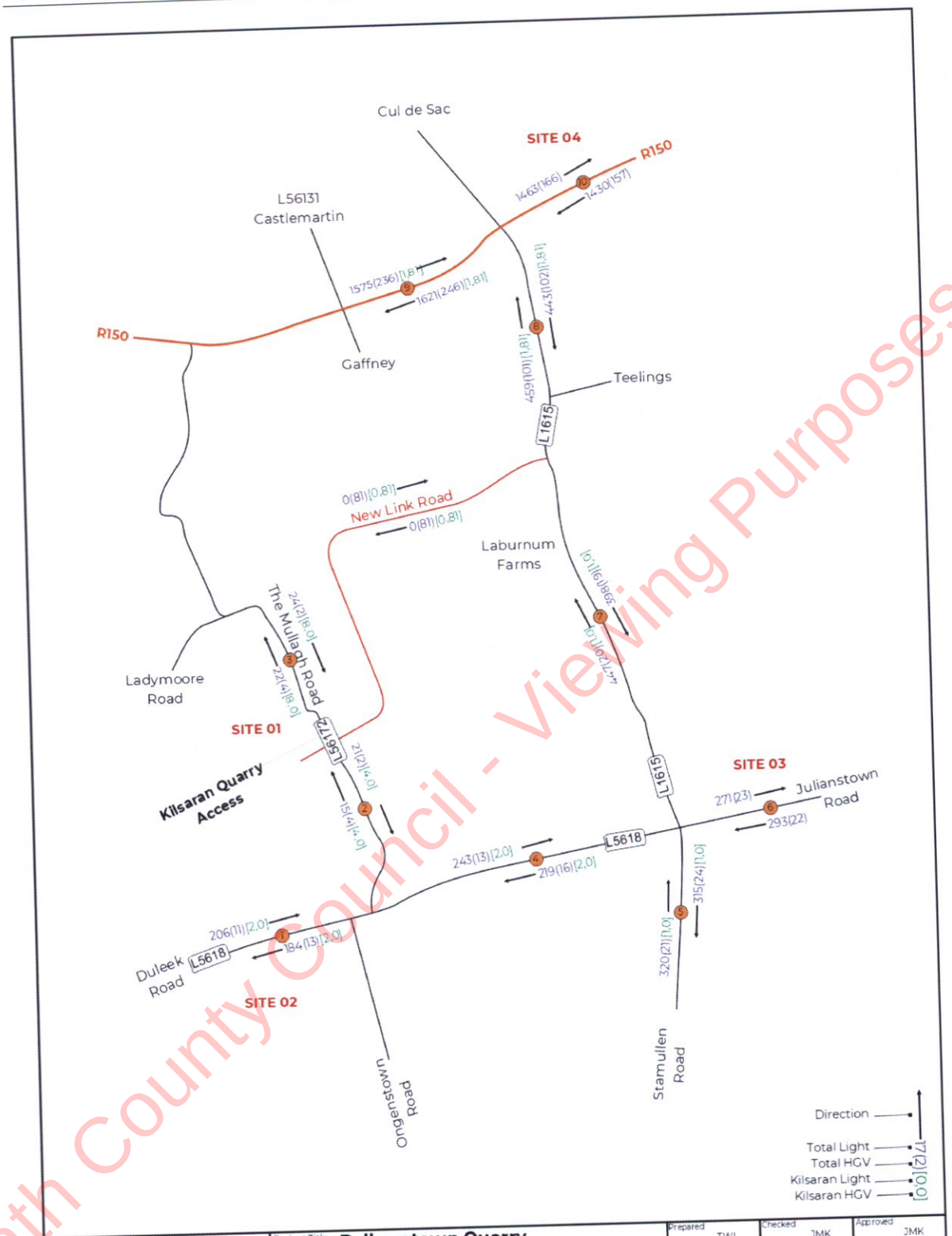
Beaumont Bridge Structural Assessment

Stage 1 Structural Assessment Report

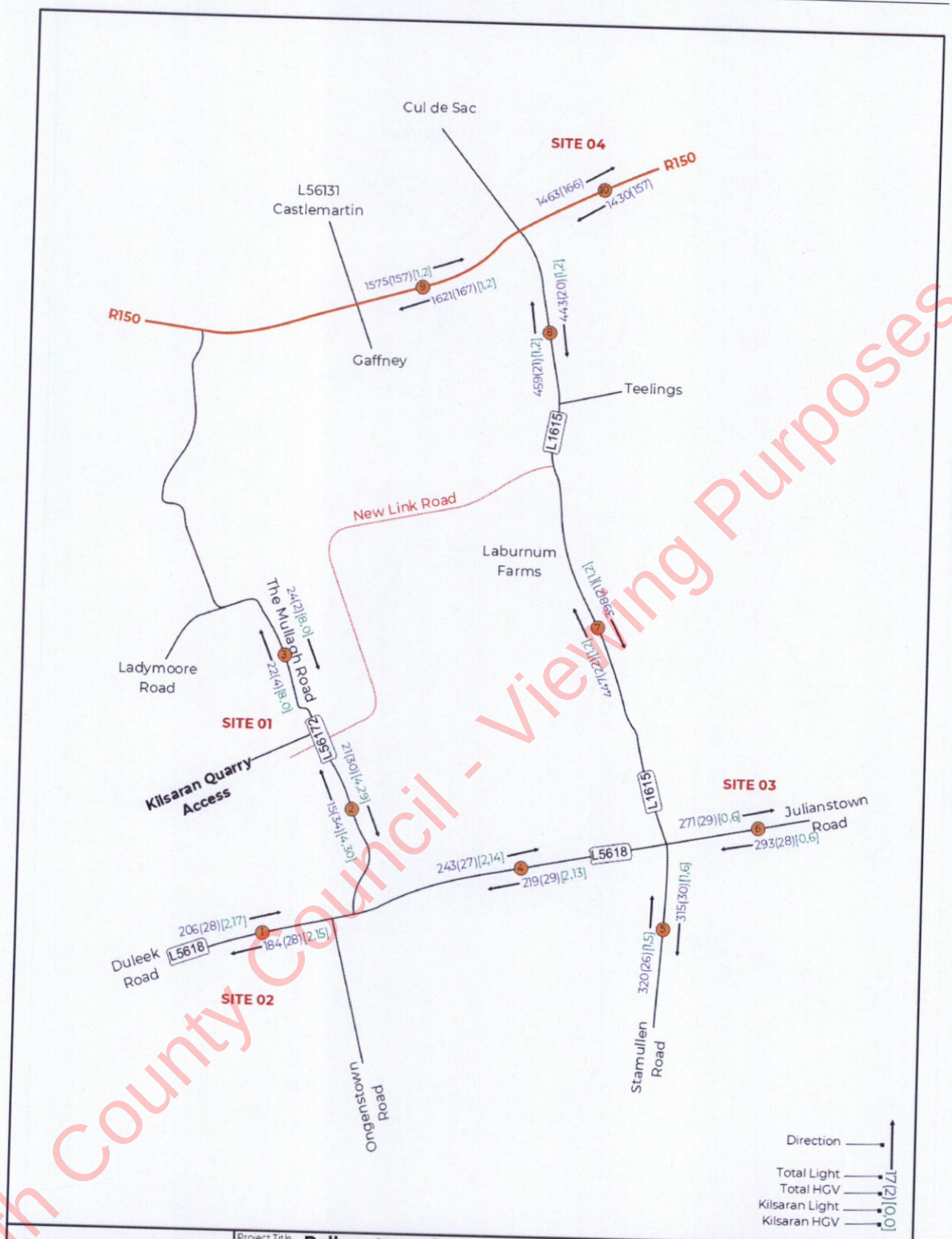
Kilsaran

January 2022

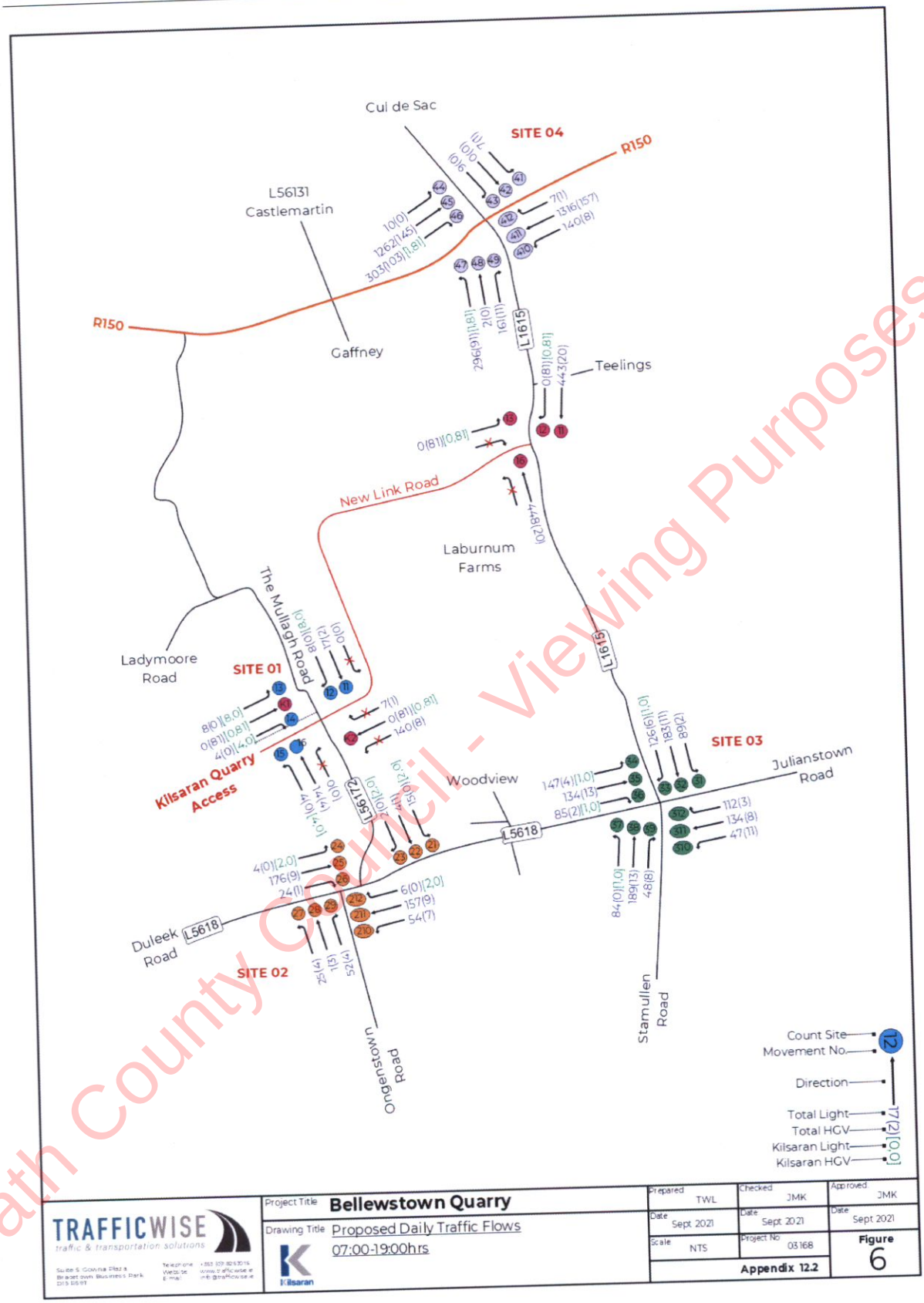
APPENDIX 12.3: ROAD SAFETY AUDIT



TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Future Daily Link Road Traffic Flows 07:00-19:00hrs Based upon 2021 Data (Not Factored)	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	Figure 8
			Appendix 12.2	

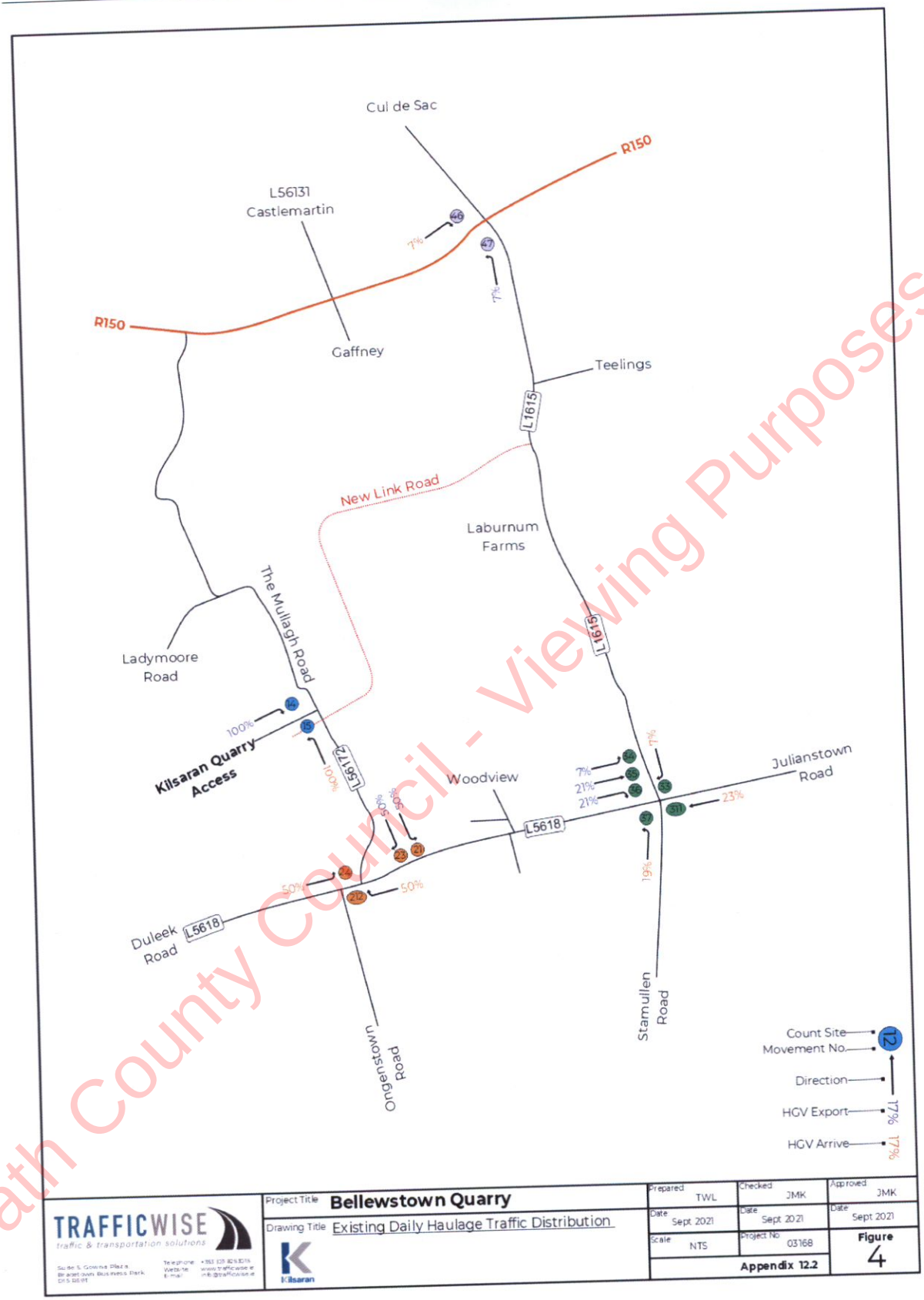


TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Existing Daily Link Road Traffic Flows 07:00-19:00hrs	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	**Figure 7**
			Appendix 12.2	

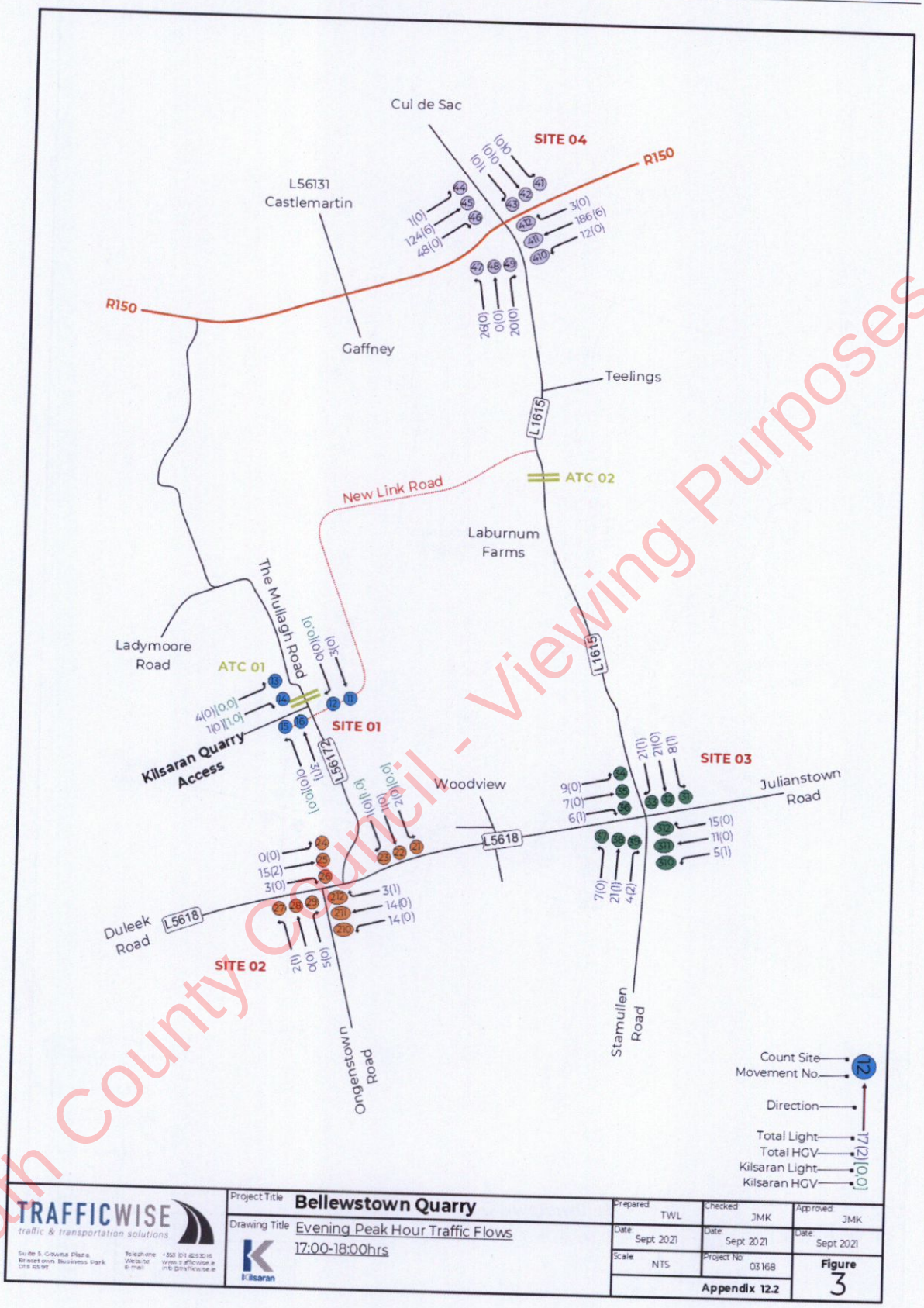


TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Proposed Daily Traffic Flows 07:00-19:00hrs	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	Figure 6
		Appendix 12.2		

TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Proposed Daily Haulage Traffic Distribution	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	Figure 5
			Appendix 12.2	



TRAFFICWISE traffic & transportation solutions	Project Title **Bellewstown Quarry**	Prepared TWL	Checked JMK	Approved JMK
	Drawing Title Existing Daily Haulage Traffic Distribution	Date Sept 2021	Date Sept 2021	Date Sept 2021
		Scale NTS	Project No 03168	Figure 4
			Appendix 12.2	



TRAFFICWISE traffic & transportation solutions	Project Title: **Bellewstown Quarry**	Prepared: TWL	Checked: JMK	Approved: JMK
	Drawing Title: Evening Peak Hour Traffic Flows 17:00-18:00hrs	Date: Sept 2021	Date: Sept 2021	Date: Sept 2021
		Scale: NTS	Project No: 03168	Figure 3
			Appendix 12.2	

Photograph B-21 – South face of pier 5

Photograph B-22 – Transverse crack to the bottom of arch barrel 1 above the north abutment

Photograph B-23 – Arch barrel 1 with pointing loss and water ingress evident

Photograph B-24 – Arch barrel 2 with pointing loss, minor masonry loss and water ingress evident

Photograph B-25 – Arch barrel 3 with dropped stones, minor masonry loss and pointing loss evident

Photograph B-26 – Arch barrel 4 with minor pointing loss evident and recent repointing works visible

Photograph B-27 – Arch barrel 5 with water ingress and minor pointing loss evident with a change in the arch profile evident

Photograph B-28 – Arch barrel 6 with water ingress and minor pointing loss evident

Photograph B-29 – Arch barrel 7 with water ingress and minor pointing loss evident and debris located at the west elevation with a change in the arch profile evident

Photograph B-30 – View of downstream riverbed

Photograph B-31 – View of upstream riverbed with watercourse main channel through arches 3 and 4

Photograph B-32 – View of east elevation

Photograph B-33 – View of west elevation

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Appendix C. Structural Assessment

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no.	rev 0
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 1**				
	Span	L in m		2.360	2.360
	Rise at Crown	r_c in m		1.170	1.170
	Rise at Quarter point	r_q in m		1.050	1.050
	Ring Thickness	d in m		0.350	0.210
	Depth of fill	h in m		0.100	0.240
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar, in m			0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.450	0.450
		L / r_c		2.017	2.017
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}} = \text{P.A.L.}$	49.08	49.08
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.587	0.587
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.933	0.840
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times \text{P.A.L}$	15.476	13.928
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.00	Allowable A.L	15.5	13.9
	2-Axle bogie	0.66	Allowable A.L	10.2	9.2
	3-Axle bogie	1.00	Allowable A.L	15.5	13.9
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**40**	**18**

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no. rev 0	
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 2**				
	Span	L in m		2.890	2.890
	Rise at Crown	r_c in m		1.280	1.280
	Rise at Quarter point	r_q in m		1.020	1.020
	Ring Thickness	d in m		0.370	0.222
	Depth of fill	h in m		0.150	0.298
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar,	in m		0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.520	0.520
		L / r_c		2.258	2.258
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}}$ = P.A.L.	50.36	50.36
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.884	0.884
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.913	0.828
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times$ P.A.L	23.419	21.230
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.00	Allowable A.L	23.4	21.2
	2-Axle bogie	0.66	Allowable A.L	15.5	14.0
	3-Axle bogie	1.00	Allowable A.L	23.4	21.2
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**40**	**40**

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no. rev 0	
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 3**				
	Span	L in m		4.220	4.220
	Rise at Crown	r_c in m		1.930	1.930
	Rise at Quarter point	r_q in m		1.560	1.560
	Ring Thickness	d in m		0.420	0.252
	Depth of fill	h in m		0.100	0.268
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar, in m			0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.520	0.520
		L / r_c		2.187	2.187
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}} = \text{P.A.L.}$	30.78	30.78
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.854	0.854
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.942	0.845
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times \text{P.A.L}$	14.265	12.797
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.03	Allowable A.L	14.7	13.2
	2-Axle bogie	0.66	Allowable A.L	9.5	8.5
	3-Axle bogie	1.00	Allowable A.L	14.3	12.8
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**18**	**18**

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no. rev 0	
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 4**				
	Span	L in m		4.510	4.510
	Rise at Crown	r_c in m		2.010	2.010
	Rise at Quarter point	r_q in m		1.660	1.660
	Ring Thickness	d in m		0.440	0.264
	Depth of fill	h in m		0.100	0.276
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar,	in m		0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.540	0.540
		L / r_c		2.244	2.244
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}}$ = P.A.L.	30.45	30.45
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.806	0.806
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.944	0.847
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times$ P.A.L	13.349	11.967
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.07	Allowable A.L	14.3	12.8
	2-Axle bogie	0.67	Allowable A.L	8.9	8.0
	3-Axle bogie	1.00	Allowable A.L	13.3	12.0
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**18**	**18**

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no.	rev 0
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 5**				
	Span	L in m		2.310	2.310
	Rise at Crown	r_c in m		1.150	1.150
	Rise at Quarter point	r_q in m		0.960	0.960
	Ring Thickness	d in m		0.370	0.222
	Depth of fill	h in m		0.400	0.548
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar,	in m		0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.770	0.770
		L / r_c		2.009	2.009
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}}$ = P.A.L.	70.00	70.00
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.781	0.781
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.844	0.786
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times$ P.A.L	26.577	24.762
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.00	Allowable A.L	26.6	24.8
	2-Axle bogie	0.66	Allowable A.L	17.5	16.3
	3-Axle bogie	1.00	Allowable A.L	26.6	24.8
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**40**	**40**

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no. rev 0	
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 6**				
	Span	L in m		2.570	2.570
	Rise at Crown	r_c in m		1.190	1.190
	Rise at Quarter point	r_q in m		1.030	1.030
	Ring Thickness	d in m		0.370	0.222
	Depth of fill	h in m		0.380	0.528
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar, in m			0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.750	0.750
		L / r_c		2.160	2.160
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}}$ = P.A.L.	70.00	70.00
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.690	0.690
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.848	0.789
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times$ P.A.L	23.593	21.946
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.00	Allowable A.L	23.6	21.9
	2-Axle bogie	0.66	Allowable A.L	15.6	14.5
	3-Axle bogie	1.00	Allowable A.L	23.6	21.9
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**40**	**40**

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Structure No. MH-L1615-001.00	Assessment using TII AM-STR-06002 MEXE Method		Calc sheet no. rev 0	
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations			Output Upper Bound	Output Lower Bound
TII AM-STR-06002	**Modified MEXE Method - Span 7**				
	Span	L in m		2.720	2.720
	Rise at Crown	r_c in m		1.350	1.350
	Rise at Quarter point	r_q in m		1.100	1.100
	Ring Thickness	d in m		0.450	0.270
	Depth of fill	h in m		0.200	0.380
	Barrel Factor	F_b		1.000	1.000
	Fill Factor	F_f		0.700	0.700
	Joint Width Factor	F_w		0.800	0.800
	Joint Mortar Factor	F_{mo}		1.000	1.000
	Horizontal Curve Radius	r in m		>600	>600
	$v^2 = \frac{1000\,r}{r + 150}$	Centrifugal Effect Factor	$F_A = 1 + \frac{0.20\,v^2}{r}$	1.000	1.000
	Joint Depth Factor	F_d			
	Average depth of missing mortar,	in m		0.020	0.020
Annex G	=>	F_d		0.800	0.800
	Condition Factor	F_{cM}		0.900	0.900
		h + d in m		0.650	0.650
		L / r_c		2.015	2.015
	From Fig. 3.2 Nonogram Provisional Axle Loading	P.A.L. or	$740 \times \frac{(d+h)^2}{L^{1.3}}$ = P.A.L.	70.00	70.00
From Fig. 3.3	Span/Rise Factor	F_{sr}		1.000	1.000
From Fig. 3.4	Profile Factor	F_p	$= 2.3 \times [(r_c - r_q)/r_c]^{0.6}$	0.836	0.836
	Material Factor	F_m	$= \frac{(F_b \times d) + (F_f \times h)}{h + d}$	0.908	0.825
	Joint Factor	F_j	$= F_w \times F_{mo} \times F_d$	0.640	0.640
	MODIFIED AXLE LOAD FOR 2-AXLE BOGIE (M.A.L)	M.A.L	$= F_{sr} \times F_p \times F_m \times F_j \times F_{cM} \times$ P.A.L	30.602	27.801
	AXLE FACTOR (A_f - see Fig 3.5a & 3.5b	Axle lift-off (Y/N)	Y		
	Single axle -	1.00	Allowable A.L	30.6	27.8
	2-Axle bogie	0.66	Allowable A.L	20.2	18.3
	3-Axle bogie	1.00	Allowable A.L	30.6	27.8
	LOAD CAPACITY	**Max G.V.W in tonnes =**		**40**	**40**

Summary of Load Cases (Highlighted in bold) Considered in ArchieM Analysis

If h<d Load Cases 1 & 2 are not required

Axle Lift Off: Yes/No? **Yes**

Case 1: Lower Bound - Most onerous AWR vehicle
1A : In present condition
1B : In perfect condition
1C : If backing is also present

Case 2: Upper Bound - Most onerous AWR vehicle
2A : In present condition
2B : In perfect condition
2C : If backing is also present

Case 3: Lower Bound (SV Loading)
3A : In present condition
3B : In perfect condition
3C : If backing is also present

Case 4: Upper Bound (SV Loading)
4A : In present condition
4B : In perfect condition
4C : If backing is also present

Summary of Results

1A	1B	1C
Fails 3t	Fails 3t	44t
2A	**2B**	**2C**
3t	3t	44t
3A	**3B**	**3C**
Fails SV80	Fails SV80	SV80
4A	**4B**	**4C**
Fails SV80	Fails SV80	SV100

ATKINS	Project	Beaumont Bridge Assessment		Job ref 5210920	
	Part of Structure MH-L1615-001.00	Archie M analysis		Calc sheet no. rev 0	
	Drawing Ref -	Calc By MG	Date 20-Dec-21	Check by MJ	Date 21-Dec-21

Ref	Calculations	Output
	Arch Assessment using ArchieM	*Remarks*
TII AM-STR-06026	***General Archie Input***	
Table 3.1	Thickness of road surfacing = 0.2 m — road surfacing only	
Table 4.1	Unit weight of road surfacing = 23 kN/m3	
Fig 4.3	Masonry comp. strength = 7 N/mm2	Material: Limestone
Table 4.1	Density = 22 kN/m^3	Ashlar/Random?: Random Rubble
	Unit weight of fill = 18 kN/m3 (default in Archie)	with lime mortar
	phi = 30 (default in Archie)	
	Arch Dimensions	
	Refer to MEXE Analysis for dimensions of each span	
	Lane & Load details	
TII AM-STR-06026	*Load assessment 40t vehicle*	
	Structure loaded with 40 t vehicle	
	Load per axle = 11.5 t	
	Lane width = 2.5 m (this is the most conservative lane width)	
6.22	Distributed width of wheel load = 1.5 +h	
6.23	As per Cl.6.23 TII AM-STR-06026 Axles have 1.8m track with 0.7m minimum spacing between the track width of adjacent vehicles	
TII AM-STR-06048	*Load assessment SV100 vehicle*	
	Archie M does not allow load assessment of SV100 vehicle on lanes less than 3.5m Use the more critical of 3.5m lanewidth or actual lane width in analysis	
	Structure loaded with 100 t vehicle	
	Load per axle = 16.5 t	
	Lane width = 3.5 m	
	Distributed width of wheel load = 1.5 +h	
	Axles assumed to have 3.0m track with 0.5m minimum spacing between the track width of adjacent vehicles	

Ref	Calculations	Output

TII AM-STR-06026

Details for Archie analysis

Condition factors, in present condition

Cl.6.2

Cl.6.2

	γ_{F3}	=	1	
	γ_m	=	1	no other recorded defects which might reduce strength of masonry
Joint width factor	Fw	=	0.8	
Mortar factor	Fmo	=	1	
Average mortar loss		=	0.02	mm (conservative as hidden by gunnite layer)
	Fd	=	1.00	taken as 1.0 as mortar loss is modelled directly in Archie
	Fj = (Fw*Fmo*Fd)	=	0.80	

- TII AM-STR-06026 Cl.6.2 gives a combined gFL factor of 3.4 which is made up a load factor of 1.9 and an impact factor of 1.8. Archie includes the 1.8 impact factor in the load definitions so γ_{FL} is taken as 1.9 in the analysis
- γ_{FL} factor is 2.0 for SV load assessment

			HA	SV
	γ_{FL}	=	1.9	2
Centrifugal effect	F_A	=	1.00	1.00
Condition factor	F_{cm}	=	0.9	0.9

Effective γ_{FL} = $\frac{\gamma_{FL}}{Fj*Fcm}$ xFa =

HA	SV
2.64	**2.78**

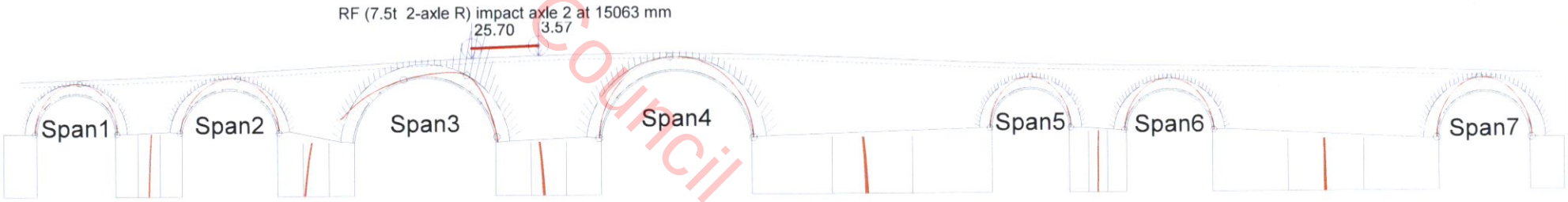
Condition factors, if repair works are carried out

	Fw	=	0.8	*joint width does not change*
	Fmo	=	1	
	Fd	=	1	
	Fj = (Fw*Fmo*Fd)	=	0.8	

best condition γ_{FL} factor

			HA	SV
	γ_{FL}	=	1.9	2
	F_A	=	1.00	1.00
	F_{cm}	=	1	1
	Effective γ_{FL}	=	**2.38**	**2.50**

Beaumont Bridge



Upperbound condition => <7.5t load capacity

gammaFl dead load: 1.00 RF (7.5t 2-axle R) impact axle 2 @ 15063 [mm]
gammaFl superimposed: 1.00
gammaFl live load: 2.38
gammaF3 load effect: 1.00
gammaM material: 1.00
File path: V:\5210920\7 Calcs\72 Model\Beaumont Bridge - UB.brg

NAME: Beaumont Bridge
LOCATION: Beaumont, Meath
NUMBER: MH-L1615-001.00
ATKINS
DATE: 20 December 2021
Printed on: Wednesday, January 12, 2022 15:35:51

Bridge Name: Beaumont Bridge Bridge Location: Beaumont, Meath
Bridge Number: MH-L1615-001.00
Number of spans: 7

SAFETY FACTORS
Factor for deadload: 1.00 Factor for superimposed deadload: 1.00 Factor for surfacing: 1.00
Factor for live load: 2.38 Factor for load effect: 1.00 Factor for material strength: 1.00

APPLIED LOAD CASES
1.RF (7.5t 2-axle R) impact axle 2 Total weight: 73.58 [kN] Position: 15063 [mm]
7.50 2 1.00 1.50 2.00 10.80 1.00 1.80 2.50
Effective lane width: 3350 [mm] Distribution length: 2847 [mm]

Applied distribution mode: Archie-M, BD21/97
Applied live load pressure: Active pressure

STRUCTURE PROPERTIES
Road shape: True shape (multi-point method)
Road points: (-500, 1950) (1180, 2000) (5805, 2200) (11660, 2550) (19175, 2750) (29755, 2370) (33895, 2290) (43290, 2070) (45000, 2000)
Depth of surfacing: 150Depth of overlay: 0
Surface unit weight: 23.00 [kN/m3] Overlay unit weight: 23.00 [kN/m3]
Lane width: 0

Fill unit weight: 18.00 [kN/m3] Fill phi: 30 degree

Left abutment Base level:-1500 [mm] Height: 380 [mm] Width: 1000 [mm]
Right abutment Base level:-1500 [mm] Height: 70 [mm] Width: 1000 [mm]

Right abutment Base level:-1500 [mm] Height: 70 [mm] Width: 1000 [mm]
Shape: Circular
Span: 2360 [mm] Rise: 1170 [mm] Q-rise: 1050 [mm]
Ring thickness at crown:350 [mm] Ring thickness at springing: 350 [mm] Mortar loss: 50 [mm]
Masonry unit weight:22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	0	380	-350	3831954	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.26	-29.02	-0.06	-0	4	296	
1	4	472	-344	5021954	1.67	-0.97	-0.09	0.00	-0.00	0.00	0.00	0.60	-28.05	-0.15	4	8	292	
2	16	563	-329	6211954	1.53	-1.20	-0.13	0.00	-0.00	0.00	0.00	-0.93	-26.85	-0.26	8	12	288	
3	35	654	-305	7381955	1.39	-1.39	-0.15	0.00	-0.00	0.00	0.00	-2.32	-25.46	-0.39	13	17	283	
4	60	742	-272	8531956	1.24	-1.53	-0.17	0.00	-0.00	0.00	0.00	-3.56	-23.93	-0.53	20	24	276	
5	93	828	-230	9641957	1.10	-1.64	-0.18	0.00	-0.00	0.00	0.00	-4.66	-22.29	-0.68	29	32	268	
6	132	912	-179	1073	1959	0.96	-1.71	-0.18	0.00	-0.00	0.00	0.00	-5.61	-20.58	-0.85	39	42	258
7	177	992	-120	1177	1961	0.82	-1.75	-0.18	0.00	-0.00	0.00	0.00	-6.43	-18.83	-1.03	52	54	246
8	229	1068	-53	1276	1963	0.69	-1.75	-0.17	0.00	-0.00	0.00	0.00	-7.13	-17.08	-1.21	66	69	231
9	286	1141	21	1369	1965	0.57	-1.73	-0.15	0.00	-0.00	0.00	0.00	-7.70	-15.35	-1.40	83	85	215
10	349	1208	103	1456	1968	0.47	-1.69	-0.14	0.00	-0.00	0.00	0.00	-8.17	-13.67	-1.59	102	104	196
11	417	1270	191	1537	1970	0.37	-1.63	-0.12	0.00	-0.00	0.00	0.00	-8.54	-12.04	-1.77	123	125	175
12	490	1327	285	1611	1972	0.29	-1.56	-0.10	0.00	-0.00	0.00	0.00	-8.83	-10.48	-1.95	145	147	153
13	566	1378	384	1677	1975	0.22	-1.48	-0.07	0.00	-0.00	0.00	0.00	-9.06	-9.00	-2.11	169	171	129
14	647	1423	489	1735	1978	0.16	-1.40	-0.05	0.00	-0.00	0.00	0.00	-9.22	-7.60	-2.26	193	195	105
15	731	1461	597	1785	1982	0.12	-1.33	-0.04	0.00	-0.00	0.00	0.00	-9.34	-6.27	-2.40	217	219	81
16	817	1493	710	1826	1985	0.08	-1.26	-0.02	0.00	-0.00	0.00	0.00	-9.42	-5.01	-2.52	239	241	59
17	906	1518	825	1858	1989	0.05	-1.20	-0.00	0.00	-0.00	0.00	0.00	-9.47	-3.81	-2.63	260	261	39
18	996	1536	942	1881	1992	0.03	-1.16	0.01	0.00	-0.00	0.00	0.00	-9.51	-2.66	-2.72	276	278	22
19	1088	1546	1061	1895	1996	0.02	-1.13	0.03	0.00	-0.00	0.00	0.00	-9.52	-1.53	-2.78	289	290	10
20	1180	1550	1180	1900	2000	0.01	-1.12	0.04	0.00	-0.00	0.00	0.00	-9.53	-0.41	-2.83	296	298	2
21	1272	1546	1299	1895	2003	-0.01	-1.13	0.06	-0.00	-0.00	0.00	0.00	-9.52	0.72	-2.86	299	300	-0 ***

22	1364	1536	1418	1881	2007	-0.02	-1.15	0.08	-0.00	-0.00	0.00	0.00	-9.50	1.87	-2.86	2952973
23	1454	1518	1535	1858	2011	-0.04	-1.20	0.10	-0.00	-0.00	0.00	0.00	-9.47	3.07	-2.85	28628812
24	1543	1493	1650	1826	2015	-0.06	-1.25	0.12	-0.00	-0.00	0.00	0.00	-9.40	4.32	-2.81	27227426
25	1629	1461	1763	1785	2019	-0.09	-1.33	0.14	-0.00	-0.00	0.00	0.00	-9.31	5.65	-2.74	25425644
26	1713	1423	1871	1735	2023	-0.14	-1.41	0.16	-0.00	-0.00	0.00	0.00	-9.18	7.05	-2.66	23323565
27	1794	1378	1976	1677	2026	-0.19	-1.49	0.19	-0.00	-0.00	0.00	0.00	-8.99	8.54	-2.55	20921189
28	1870	1327	2075	1611	2030	-0.25	-1.58	0.22	-0.00	-0.00	0.00	0.00	-8.73	10.12	-2.42	185187113
29	1943	1270	2169	1537	2034	-0.33	-1.66	0.24	-0.00	-0.00	0.00	0.00	-8.40	11.78	-2.27	161163137
30	2011	1208	2257	1456	2037	-0.42	-1.73	0.27	-0.00	-0.00	0.00	0.00	-7.98	13.52	-2.10	137139161
31	2074	1141	2339	1369	2040	-0.52	-1.79	0.29	-0.00	-0.00	0.00	0.00	-7.46	15.31	-1.91	115117183
32	2131	1068	2413	1276	2043	-0.64	-1.83	0.31	-0.00	-0.00	0.00	0.00	-6.82	17.14	-1.71	95 97 203
33	2183	9922480	1177	2045	-0.77	-1.85	0.33	-0.00	-0.00	0.00	0.00	-6.05	18.99	-1.50	76 79 221	
34	2228	9122539	1073	2047	-0.90	-1.84	0.34	-0.00	-0.00	0.00	0.00	-5.15	20.83	-1.29	60 63 237	
35	2267	8282590	9642049	-1.04	-1.79	0.35	-0.00	-0.00	0.00	0.00	-4.11	22.62	-1.08	46 50 250		
36	2300	7422632	8532051	-1.19	-1.71	0.35	-0.00	-0.00	0.00	0.00	-2.92	24.33	-0.86	34 38 262		
37	2325	6542665	7382052	-1.34	-1.59	0.34	-0.00	-0.00	0.00	0.00	-1.58	25.92	-0.65	24 27 273		
38	2344	5632689	6212053	-1.49	-1.43	0.32	-0.00	-0.00	0.00	0.00	-0.09	27.35	-0.45	15 19 281		
39	2356	4722704	5022053	-1.64	-1.23	0.30	-0.00	-0.00	0.00	0.00	1.55	28.58	-0.25	7 11 289		
40	2360	3802710	3832054	-1.77	-0.98	0.26	-0.00	-0.00	0.00	0.00	3.32	29.56	-0.06	0 4 296		

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 380 [mm] Thickness at top: 2000 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	2360	4360	380	-107.72	-4.00	-107.72	7.88	3425	3441	-0.04	-0.07	1065.42	919.19
1	2360	4360	-247	-27.57	-4.00	-135.29	5.37	3390	3409	-0.06	-0.08	1030.01	950.66
2	2360	4360	-873	-27.57	-4.00	-162.87	2.86	3366	3389	-0.08	-0.09	1005.92	970.81
3	2360	4360	-1500	-27.57	-4.00	-190.44	0.35	3348	3375	-0.09	-0.10	988.24	984.55

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2890 [mm] Rise: 1280 [mm] Q-rise: 1020 [mm]
Ring thickness at crown: 370 [mm] Ring thickness at springing: 370 [mm] Mortar loss: 50 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	4360	4003993	4452109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.68	-37.41	-0.10	-0	5	315		
1	4377	5044013	5752109	1.93	-1.58	-0.16	0.00	-0.00	0.00	0.00	-2.61	-35.83	-0.27	5	10	310		
2	4401	6074044	7042111	1.75	-1.79	-0.20	0.00	-0.00	0.00	0.00	-4.36	-34.04	-0.45	11	16	304		
3	4432	7084083	8302113	1.58	-1.95	-0.22	0.00	-0.00	0.00	0.00	-5.94	-32.09	-0.66	18	23	297		
4	4471	8064131	9542115	1.40	-2.07	-0.23	0.00	-0.00	0.00	0.00	-7.34	-30.02	-0.89	27	31	289		
5	4516	9014189	1073	2118	1.23	-2.15	-0.23	0.00	-0.00	0.00	0.00	-8.57	-27.88	-1.13	37	42	278	
6	4569	9934254	1188	2121	1.07	-2.19	-0.22	0.00	-0.00	0.00	0.00	-9.63	-25.69	-1.39	50	54	266	
7	4627	1080	4328	1298	2124	0.91	-2.19	-0.21	0.00	-0.00	0.00	0.00	-10.54	-23.50	-1.65	64	67	253
8	4693	1163	4410	1402	2128	0.77	-2.17	-0.19	0.00	-0.00	0.00	0.00	-11.31	-21.33	-1.92	80	83	237
9	4763	1241	4499	1500	2132	0.64	-2.12	-0.17	0.00	-0.00	0.00	0.00	-11.94	-19.21	-2.20	98	101	219
10	4840	1314	4594	1591	2137	0.52	-2.06	-0.15	0.00	-0.00	0.00	0.00	-12.46	-17.16	-2.46	117	120	200
11	4921	1381	4697	1675	2142	0.41	-1.97	-0.13	0.00	-0.00	0.00	0.00	-12.88	-15.18	-2.72	139	141	179
12	5007	1442	4805	1752	2147	0.33	-1.89	-0.10	0.00	-0.00	0.00	0.00	-13.20	-13.29	-2.97	161	164	156
13	5098	1497	4918	1820	2153	0.25	-1.79	-0.08	0.00	-0.00	0.00	0.00	-13.45	-11.50	-3.21	184	186	134
14	5192	1544	5036	1880	2159	0.19	-1.70	-0.05	0.00	-0.00	0.00	0.00	-13.64	-9.79	-3.43	207	209	111
15	5289	1585	5158	1931	2165	0.14	-1.62	-0.03	0.00	-0.00	0.00	0.00	-13.78	-8.17	-3.64	23	023	288
16	5389	1619	5283	1974	2172	0.10	-1.55	-0.01	0.00	-0.00	0.00	0.00	-13.88	-6.63	-3.83	25	125	367
17	5491	1646	5411	2007	2178	0.07	-1.49	0.01	0.00	-0.00	0.00	0.00	-13.94	-5.14	-4.00	27	127	347
18	5595	1665	5541	2031	2185	0.04	-1.45	0.03	0.00	-0.00	0.00	0.00	-13.99	-3.69	-4.15	28	829	030

19	5700	1676	5673	2045	2192	0.02	-1.42	0.05	0.00	-0.00	0.00	0.00	-14.01	-2.27	-4.28	30230416	
20	5805	1680	5805	2050	2199	0.01	-1.42	0.07	0.00	-0.00	0.00	0.00	-14.02	-0.85	-4.38	3123146	
21	5910	1676	5937	2045	2207	-0.01	-1.44	0.09	-0.00	-0.00	0.00	0.00	-14.01	0.59	-4.46	3173191	
22	6015	1665	6069	2031	2214	-0.03	-1.47	0.11	-0.00	-0.00	0.00	0.00	-13.98	2.06	-4.51	318320	-0 ***
23	6119	1646	6199	2007	2221	-0.05	-1.53	0.13	-0.00	-0.00	0.00	0.00	-13.93	3.59	-4.53	3143164	
24	6221	1619	6327	1974	2229	-0.08	-1.60	0.16	-0.00	-0.00	0.00	0.00	-13.85	5.20	-4.52	30530713	
25	6321	1585	6452	1931	2236	-0.12	-1.69	0.19	-0.00	-0.00	0.00	0.00	-13.73	6.89	-4.47	29229426	
26	6418	1544	6574	1880	2243	-0.17	-1.79	0.22	-0.00	-0.00	0.00	0.00	-13.55	8.68	-4.39	27427644	
27	6512	1497	6692	1820	2250	-0.24	-1.90	0.25	-0.00	-0.00	0.00	0.00	-13.32	10.58	-4.27	25325664	
28	6603	1442	6805	1752	2257	-0.31	-2.01	0.28	-0.00	-0.00	0.00	0.00	-13.00	12.58	-4.11	23023387	
29	6689	1381	6913	1675	2263	-0.40	-2.11	0.32	-0.00	-0.00	0.00	0.00	-12.60	14.69	-3.92	206208112	
30	6770	1314	7016	1591	2269	-0.51	-2.21	0.36	-0.00	-0.00	0.00	0.00	-12.09	16.90	-3.69	181184136	
31	6847	1241	7111	1500	2275	-0.63	-2.29	0.39	-0.00	-0.00	0.00	0.00	-11.46	19.20	-3.42	156159161	
32	6917	1163	7200	1402	2280	-0.77	-2.36	0.42	-0.00	-0.00	0.00	0.00	-10.69	21.55	-3.13	132135185	
33	6983	1080	7282	1298	2285	-0.91	-2.40	0.45	-0.00	-0.00	0.00	0.00	-9.78	23.95	-2.80	110113207	
34	7041	9937356	1188	2289	-1.07	-2.41	0.47	-0.00	-0.00	0.00	0.00	-8.70	26.37	-2.45	89	93	227
35	7094	9017421	1073	2293	-1.24	-2.39	0.48	-0.00	-0.00	0.00	0.00	-7.46	28.75	-2.08	70	74	246
36	7139	8067479	9542297		-1.42	-2.33	0.49	-0.00	-0.00	0.00	0.00	-6.04	31.09	-1.70	53	57	263
37	7178	7087527	8302300		-1.60	-2.23	0.49	-0.00	-0.00	0.00	0.00	-4.43	33.31	-1.31	37	42	278
38	7209	6077566	7042302		-1.79	-2.08	0.48	-0.00	-0.00	0.00	0.00	-2.64	35.40	-0.91	24	29	291
39	7233	5047597	5752304		-1.98	-1.89	0.45	-0.00	-0.00	0.00	0.00	-0.67	37.29	-0.51	11	16	304
40	7250	4007617	4452306		-2.16	-1.65	0.42	-0.00	-0.00	0.00	0.00	1.49	38.94	-0.11	-0	5	315

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 100 [mm] Thickness at top: 2300 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	7250	9550	100	-175.52	-39.88	-175.52	-21.74	8264	8289	-0.10	-0.05	1013.61	1261.32
1	7250	9550	-433	-26.99	-39.88	-202.51	-43.01	8173	8202	-0.14	-0.04	923.15	1347.92
2	7250	9550	-967	-26.99	-39.88	-229.50	-64.28	8104	8136	-0.17	-0.03	853.51	1413.71
3	7250	9550	-1500	-26.99	-39.88	-256.48	-85.55	8048	8085	-0.21	-0.01	798.12	1465.24

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 4220 [mm] Rise: 1930 [mm] Q-rise: 1560 [mm]
Ring thickness at crown: 420 [mm] Ring thickness at springing: 420 [mm] Mortar loss: 50 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	9550	1009132	1372400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-38.39	-70.11	-53.34	723734	-364 ***			
1	9570	2569155	3242401	3.71	-2.53	-0.20	0.00	-0.00	0.00	0.00	-42.10	-67.57	-47.80	645655	-285 ***			
2	9601	4099193	5082403	3.36	-2.96	-0.28	0.00	-0.00	0.00	0.00	-45.46	-64.61	-42.43	572583	-213 ***			
3	9643	5609244	6892407	3.01	-3.29	-0.33	0.00	-0.00	0.00	0.00	-48.47	-61.33	-37.27	504514	-144 ***			
4	9697	7089308	8662411	2.66	-3.52	-0.37	0.00	-0.00	0.00	0.00	-51.13	-57.80	-32.35	439450	-80 ***			
5	9761	8519385	1037 2415	2.32	-3.68	-0.38	0.00	-0.00	0.00	0.00	-53.45	-54.13	-27.70	378389	-19 ***			
6	9836	9899474	1203 2421	1.99	-3.75	-0.38	0.00	-0.00	0.00	0.00	-55.45	-50.37	-23.35	32133139				
7	9921	1121 9576	1361 2427	1.69	-3.76	-0.36	0.00	-0.00	0.00	0.00	-57.13	-46.62	-19.31	26727892				
8	10015	1247 9689	1511 2434	1.40	-3.70	-0.32	0.00	-0.00	0.00	0.00	-58.54	-42.92	-15.62	217227143				
9	10118	1365 9813	1653 2442	1.14	-3.59	-0.29	0.00	-0.00	0.00	0.00	-59.68	-39.32	-12.28	172181189				
10	10230	1475 9947	1785 2450	0.91	-3.45	-0.24	0.00	-0.00	0.00	0.00	-60.59	-35.88	-9.31	130140230				
11	10350	1576 10090	1906 2459	0.71	-3.27	-0.19	0.00	-0.00	0.00	0.00	-61.30	-32.61	-6.74	94	103267			
12	10477	1669 10242	2017 2468	0.54	-3.08	-0.15	0.00	-0.00	0.00	0.00	-61.85	-29.53	-4.58	63	72	298		
13	10610	1751 10402	2116 2478	0.40	-2.88	-0.10	0.00	-0.00	0.00	0.00	-62.24	-26.65	-2.84	37	47	323		
14	10749	1824 10568	2203 2487	0.29	-2.69	-0.06	0.00	-0.00	0.00	0.00	-62.53	-23.96	-1.54	18	28	342		
15	10893	1886 10741	2278 2498	0.20	-2.50	-0.02	0.00	-0.00	0.00	0.00	-62.73	-21.46	-0.69	6	15	355		

16	11041	1938	10919	2339	2508	0.13	-2.35	0.02	0.00	-0.00	0.00	0.00	-62.86	-19.11	-0.31	-0	9	361		
17	11193	1978	11100	2388	2518	0.08	-2.22	0.05	0.00	-0.00	0.00	0.00	-62.94	-16.89	-0.39	1	11	359		
18	11347	2007	11285	2422	2529	0.05	-2.13	0.08	0.00	-0.00	0.00	0.00	-62.99	-14.77	-0.94	10	19	351		
19	11503	2024	11472	2443	2539	0.03	-2.07	0.11	0.00	-0.00	0.00	0.00	-63.02	-12.69	-1.96	26	35	335		
20	11660	2030	11660	2450	2549	0.01	-2.06	0.15	0.00	-0.00	0.00	0.00	-63.03	-10.63	-3.44	50	59	311		
21	11817	2024	11848	2443	2560	-0.01	-2.10	0.18	-0.00	-0.00	0.00	0.00	-63.02	-8.53	-5.36	82	91	279		
22	11973	2007	12035	2422	2569	-0.03	-2.18	0.22	-0.00	-0.00	0.00	0.00	-62.98	-6.35	-7.72	121	130	240		
23	12127	1978	12220	2388	2579	-0.07	-2.29	0.27	-0.00	-0.00	0.00	0.00	-62.92	-4.06	-10.49	169	178	192		
24	12279	1938	12401	2339	2588	-0.11	-2.45	0.32	-0.01	-0.11	0.02	0.00	-62.80	-1.51	-13.66	225	233	137		
25	12427	1886	12579	2278	2597	-0.18	-2.63	0.38	-0.29	-2.52	0.47	0.00	-62.32	3.65	-17.23	28	629	476		
26	12571	1824	12752	2203	2605	-0.27	-2.84	0.45	-1.13	-7.87	1.48	0.00	-60.92	14.36	-20.92	33	834	624		
27	12710	1751	12918	2116	2614	-0.39	-3.07	0.52	-2.28	-13.09	2.58	0.00	-58.26	30.51	-24.01	361	370	-0	***	
28	12843	1669	13078	2017	2621	-0.53	-3.30	0.60	-3.23	-15.60	3.25	0.00	-54.50	49.40	-25.73	34	835	911		
29	12970	1576	13230	1906	2627	-0.70	-3.52	0.68	-3.55	-14.62	3.21	0.00	-50.25	67.55	-25.61	30	932	149		
30	13090	1475	13373	1785	2634	-0.91	-3.73	0.76	-3.15	-11.12	2.57	0.00	-46.20	82.39	-23.64	257	270	100		
31	13202	1365	13507	1653	2640	-1.14	-3.91	0.83	-2.24	-6.81	1.64	0.00	-42.82	93.11	-20.29	202	216	154		
32	13305	1247	13631	1511	2646	-1.40	-4.05	0.90	-1.22	-3.19	0.79	0.00	-40.20	100.35	-16.23	150	165	205		
33	13399	1121	13744	1361	2650	-1.70	-4.14	0.96	-0.45	-1.02	0.26	0.00	-38.05	105.51	-12.16	104	120	250		
34	13484	98	913	846	1203	2654	-2.01	-4.17	1.01	-0.13	-0.25	0.07	0.00	-35.91	109.93	-8.56	68	84	286	
35	13559	85	113	935	1037	2658	-2.35	-4.14	1.04	-0.12	-0.20	0.06	0.00	-33.44	114.27	-5.64	40	56	314	
36	13623	70	814	012	866	2661	-2.70	-4.02	1.06	-0.14	-0.19	0.06	0.00	-30.60	118.48	-3.44	20	37	333	
37	13677	56	014	076	689	2663	-3.06	-3.82	1.05	-0.16	-0.17	0.06	0.00	-27.38	122.47	-1.97	7	25	345	
38	13719	40	914	127	508	2665	-3.43	-3.52	1.02	-0.17	-0.14	0.05	0.00	-23.77	126.14	-1.23	0	19	351	
39	13750	25	614	165	324	2666	-3.80	-3.13	0.97	-0.18	-0.11	0.04	0.00	-19.79	129.39	-1.22	-0	19	351	
40	13770	10	014	188	137	2667	-4.16	-2.65	0.90	-0.19	-0.07	0.03	0.00	-15.44	132.11	-1.94	5	24	346	

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 100 [mm] Thickness at top: 3150 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	13770	16920	100	-333.83	18.58	-333.83	-86.05	15063	15111	-0.16	-0.05	1293.39	1808.92
1	13770	16920	-433	-36.96	18.58	-370.79	-76.14	15113	15166	-0.16	-0.07	1343.17	1753.86
2	13770	16920	-967	-36.96	18.58	-407.75	-66.23	15153	15212	-0.17	-0.09	1383.45	1708.30
3	13770	16920	-1500	-36.96	18.58	-444.71	-56.32	15187	15250	-0.18	-0.11	1416.60	1669.88

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 4510 [mm] Rise: 2010 [mm] Q-rise: 1660 [mm]
Ring thickness at crown: 440 [mm] Ring thickness at springing: 440 [mm] Mortar loss: 50 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	16920	20016483	2502735	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.80	-69.63	-0.34	-0	10	380		
1	16945	36316513	4452735	4.26	-3.05	-0.25	0.09	-0.04	-0.00	0.00	-1.55	-66.53	-1.51	18	28	362		
2	16982	52416556	6382736	3.87	-3.52	-0.34	0.08	-0.06	-0.01	0.00	-5.50	-62.96	-2.62	38	47	343		
3	17030	68216614	8262737	3.47	-3.88	-0.41	0.07	-0.07	-0.01	0.00	-9.05	-59.01	-3.66	58	66	324		
4	17090	83616685	1010	2738	3.08	-4.14	-0.44	0.06	-0.07	-0.01	0.00	-12.19	-54.80	-4.63	80	88	302	
5	17160	98616770	1189	2740	2.70	-4.31	-0.45	0.05	-0.07	-0.01	0.00	-14.94	-50.42	-5.53	103	111	279	
6	17242	1130	16867	1360	2741	2.33	-4.39	-0.45	0.04	-0.06	-0.01	0.00	-17.30	-45.97	-6.35	128	135	255
7	17333	1267	16976	1524	2743	1.98	-4.39	-0.42	0.02	-0.05	-0.01	0.00	-19.31	-41.53	-7.10	155	161	229
8	17435	1397	17097	1680	2745	1.66	-4.33	-0.38	0.01	-0.03	-0.00	0.00	-20.98	-37.17	-7.77	182	188	202
9	17545	1520	17229	1827	2746	1.36	-4.21	-0.34	0.00	-0.01	-0.00	0.00	-22.35	-32.95	-8.36	210	216	174
10	17665	1635	17372	1963	2748	1.10	-4.04	-0.28	0.00	-0.00	-0.00	0.00	-23.44	-28.90	-8.86	239	244	146
11	17792	1740	17524	2089	2749	0.87	-3.84	-0.22	0.00	-0.00	-0.00	0.00	-24.31	-25.06	-9.27	266	271	119
12	17926	1836	17684	2203	2750	0.66	-3.62	-0.17	-0.00	0.00	0.00	0.00	-24.97	-21.44	-9.61	29	229	793

13	18068	1922	17853	2306	2751	0.50	-3.38	-0.11	-0.00	0.00	0.00	0.00	-25.47	-18.06	-9.87	31632070	
14	18215	1997	18029	2396	2752	0.36	-3.15	-0.06	-0.00	0.00	0.00	0.00	-25.83	-14.91	-10.06	33734149	
15	18367	2061	18210	2472	2753	0.25	-2.93	-0.02	-0.00	0.00	0.00	0.00	-26.08	-11.98	-10.19	35435832	
16	18523	2114	18397	2536	2753	0.17	-2.73	0.03	-0.00	0.00	0.00	0.00	-26.24	-9.25	-10.27	36837218	
17	18683	2156	18588	2586	2753	0.10	-2.56	0.07	-0.00	0.00	0.00	0.00	-26.35	-6.69	-10.31	3773819	
18	18846	2186	18782	2621	2752	0.06	-2.42	0.10	-0.00	0.00	0.00	0.00	-26.41	-4.27	-10.31	3843873	
19	19010	2204	18978	2643	2751	0.03	-2.32	0.14	-0.00	0.00	0.00	0.00	-26.44	-1.95	-10.29	386390-0	***
20	19175	2210	19175	2650	2750	0.01	-2.27	0.17	-0.00	0.00	0.00	0.00	-26.45	0.32	-10.24	3853891	
21	19340	2204	19372	2643	2747	-0.01	-2.26	0.21	0.00	0.00	0.00	0.00	-26.44	2.58	-10.18	3813855	
22	19504	2186	19568	2621	2745	-0.03	-2.30	0.25	0.00	0.00	0.00	0.00	-26.41	4.89	-10.09	37437812	
23	19667	2156	19762	2586	2743	-0.06	-2.39	0.29	0.00	0.00	0.00	0.00	-26.35	7.27	-9.98	36336723	
24	19827	2114	19953	2536	2739	-0.10	-2.52	0.34	0.00	0.00	0.00	0.00	-26.25	9.79	-9.84	35035436	
25	19983	2061	20140	2472	2736	-0.16	-2.68	0.40	0.00	0.00	0.00	0.00	-26.09	12.47	-9.67	33333753	
26	20135	1997	20321	2396	2732	-0.24	-2.87	0.47	0.00	0.00	0.00	0.00	-25.86	15.34	-9.46	31431872	
27	20282	1922	20497	2306	2728	-0.34	-3.09	0.55	0.00	0.00	0.00	0.00	-25.52	18.42	-9.20	29229694	
28	20424	1836	20666	2203	2725	-0.47	-3.31	0.63	0.00	0.00	0.00	0.00	-25.04	21.74	-8.88	268273117	
29	20558	1740	20826	2089	2721	-0.64	-3.54	0.71	0.00	0.00	0.00	0.00	-24.41	25.28	-8.50	242247143	
30	20685	1635	20978	1963	2716	-0.83	-3.76	0.80	0.00	0.00	0.00	0.00	-23.58	29.04	-8.06	216221169	
31	20805	1520	21121	1827	2713	-1.06	-3.96	0.88	0.00	0.00	0.00	0.00	-22.52	33.00	-7.55	189195195	
32	20915	1397	21253	1680	2709	-1.32	-4.13	0.96	0.00	0.00	0.00	0.00	-21.20	37.13	-6.97	163169221	
33	21017	1267	21374	1524	2706	-1.61	-4.25	1.03	0.00	0.00	0.00	0.00	-19.59	41.38	-6.32	137144246	
34	21108	1130	21483	1360	2703	-1.93	-4.32	1.09	0.00	0.00	0.00	0.00	-17.67	45.70	-5.61	113120270	
35	21190	98621580		1189	2700	-2.27	-4.32	1.13	0.00	0.00	0.00	0.00	-15.40	50.02	-4.85	90	98 292
36	21260	83621665		1010	2697	-2.63	-4.25	1.16	0.00	0.00	0.00	0.00	-12.77	54.27	-4.03	69	77 313
37	21320	68221736		8262695		-3.01	-4.09	1.16	0.00	0.00	0.00	0.00	-9.75	58.36	-3.17	50	58 332
38	21368	52421794		6382693		-3.40	-3.83	1.14	0.00	0.00	0.00	0.00	-6.35	62.19	-2.26	32	41 349
39	21405	36321837		4452691		-3.79	-3.48	1.10	0.00	0.00	0.00	0.00	-2.56	65.67	-1.32	16	25 365
40	21430	20021867		2502690		-4.18	-3.03	1.03	0.00	0.00	0.00	0.00	1.63	68.70	-0.33	-0	10 380

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 200 [mm] Thickness at top: 7170 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	21430	28600	200	-388.25	1.53	-388.25	-105.13	24716	24772	-0.07	-0.04	3286.49	3828.04
1	21430	28600	-367	-89.39	1.53	-477.64	-104.26	24763	24831	-0.08	-0.05	3332.60	3769.16
2	21430	28600	-933	-89.39	1.53	-567.03	-103.39	24792	24873	-0.09	-0.07	3362.16	3726.84
3	21430	28600	-1500	-89.39	1.53	-656.41	-102.52	24812	24906	-0.10	-0.08	3381.93	3694.30

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2310 [mm] Rise: 1150 [mm] Q-rise: 960 [mm]
Ring thickness at crown: 370 [mm] Ring thickness at springing: 370 [mm] Mortar loss: 50 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	28600	45028230	4522422	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.16	-38.55	-0.11	0	6	314		
1	28604	54028235	5712422	2.10	-1.04	-0.09	-0.00	0.00	0.00	0.00	1.06	-37.52	-0.27	4	10	310		
2	28615	63028250	6892421	1.96	-1.33	-0.14	-0.00	0.00	0.00	0.00	-0.89	-36.18	-0.45	10	15	305		
3	28633	71928273	8062421	1.81	-1.59	-0.18	-0.00	0.00	0.00	0.00	-2.70	-34.60	-0.67	17	22	298		
4	28658	80628306	9212419	1.65	-1.80	-0.21	-0.00	0.00	0.00	0.00	-4.35	-32.80	-0.92	26	31	289		
5	28689	89028348	1033	2418	1.49	-1.97	-0.22	-0.00	0.00	0.00	0.00	-5.84	-30.83	-1.20	37	41	279	
6	28727	97228398	1141	2416	1.34	-2.10	-0.23	-0.00	0.00	0.00	0.00	-7.18	-28.74	-1.49	50	54	266	
7	28772	1051	28457	1245	2414	1.18	-2.19	-0.23	-0.00	0.00	0.00	0.00	-8.36	-26.55	-1.80	65	69	251
8	28822	1126	28524	1345	2411	1.03	-2.24	-0.22	-0.00	0.00	0.00	0.00	-9.40	-24.31	-2.12	83	86	234
9	28879	1197	28598	1438	2409	0.89	-2.27	-0.21	-0.00	0.00	0.00	0.00	-10.29	-22.04	-2.44	103	106	214

10	28940	1263	28679	1526	2406	0.76	-2.27	-0.19	-0.00	0.00	0.00	0.00	-11.05	-19.77	-2.76	125128192
11	29007	1325	28767	1607	2402	0.64	-2.24	-0.17	-0.00	0.00	0.00	0.00	-11.69	-17.53	-3.06	150153167
12	29078	1381	28861	1680	2399	0.53	-2.20	-0.14	-0.00	0.00	0.00	0.00	-12.22	-15.32	-3.35	176179141
13	29153	1431	28960	1746	2395	0.43	-2.15	-0.11	-0.00	0.00	0.00	0.00	-12.65	-13.17	-3.61	203205115
14	29232	1475	29064	1805	2391	0.35	-2.09	-0.09	-0.00	0.00	0.00	0.00	-13.00	-11.08	-3.84	23023288
15	29314	1513	29173	1855	2388	0.27	-2.03	-0.06	-0.00	0.00	0.00	0.00	-13.27	-9.05	-4.03	25525862
16	29399	1544	29285	1896	2384	0.21	-1.97	-0.03	-0.00	0.00	0.00	0.00	-13.47	-7.08	-4.19	27828040
17	29486	1568	29400	1928	2380	0.15	-1.91	-0.00	-0.00	0.00	0.00	0.00	-13.62	-5.17	-4.31	29729921
18	29575	1586	29517	1951	2376	0.10	-1.87	0.02	-0.00	0.00	0.00	0.00	-13.72	-3.30	-4.38	3103128
19	29665	1596	29636	1965	2373	0.06	-1.83	0.05	-0.00	0.00	0.00	0.00	-13.78	-1.47	-4.41	3183200
20	29755	1600	29755	1970	2369	0.02	-1.81	0.07	-0.00	0.00	0.00	0.00	-13.80	0.34	-4.40	318320-0 ***
21	29845	1596	29874	1965	2366	-0.02	-1.80	0.10	0.00	0.00	0.00	0.00	-13.78	2.14	-4.35	3123146
22	29935	1586	29993	1951	2363	-0.06	-1.81	0.12	0.00	0.00	0.00	0.00	-13.72	3.95	-4.25	29930119
23	30024	1568	30110	1928	2360	-0.10	-1.83	0.15	0.00	0.00	0.00	0.00	-13.63	5.78	-4.11	28128337
24	30111	1544	30225	1896	2357	-0.14	-1.86	0.17	0.00	0.00	0.00	0.00	-13.49	7.64	-3.94	25826060
25	30196	1513	30337	1855	2354	-0.19	-1.91	0.20	0.00	0.00	0.00	0.00	-13.29	9.55	-3.73	23323585
26	30278	1475	30446	1805	2351	-0.25	-1.96	0.23	0.00	0.00	0.00	0.00	-13.04	11.50	-3.48	206208112
27	30357	1431	30550	1746	2349	-0.32	-2.01	0.26	0.00	0.00	0.00	0.00	-12.72	13.51	-3.22	178181139
28	30432	1381	30649	1680	2346	-0.40	-2.06	0.29	0.00	0.00	0.00	0.00	-12.31	15.57	-2.93	152155165
29	30503	1325	30743	1607	2344	-0.49	-2.11	0.32	0.00	0.00	0.00	0.00	-11.82	17.68	-2.62	127130190
30	30570	1263	30831	1526	2342	-0.60	-2.15	0.35	0.00	0.00	0.00	0.00	-11.22	19.83	-2.31	104107213
31	30631	1197	30912	1438	2340	-0.71	-2.17	0.37	0.00	0.00	0.00	0.00	-10.52	22.00	-1.99	83 86 234
32	30688	1126	30986	1345	2339	-0.83	-2.17	0.39	0.00	0.00	0.00	0.00	-9.68	24.18	-1.68	65 68 252
33	30738	1051	31053	1245	2337	-0.97	-2.15	0.40	0.00	0.00	0.00	0.00	-8.71	26.33	-1.38	49 53 267
34	30783	97231112		1141	2336	-1.11	-2.10	0.41	0.00	0.00	0.00	0.00	-7.60	28.44	-1.10	36 40 280
35	30821	89031162		1033	2335	-1.26	-2.02	0.41	0.00	0.00	0.00	0.00	-6.35	30.46	-0.85	26 30 290
36	30852	80631204		9212334		-1.41	-1.90	0.41	0.00	0.00	0.00	0.00	-4.94	32.36	-0.62	17 22 298
37	30877	71931237		8062333		-1.56	-1.75	0.39	0.00	0.00	0.00	0.00	-3.38	34.11	-0.44	10 15 305
38	30895	63031260		6892333		-1.71	-1.55	0.37	0.00	0.00	0.00	0.00	-1.66	35.66	-0.29	6 11 309
39	30906	54031275		5712332		-1.86	-1.31	0.33	0.00	0.00	0.00	0.00	0.20	36.97	-0.18	2 7 313
40	30910	45031280		4522332		-2.00	-1.03	0.29	0.00	0.00	0.00	0.00	2.20	37.99	-0.10	-0 5 315

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 350 [mm] Thickness at top: 1700 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right

0	30910	32610	350	-115.20	-1.15	-115.20	1.95	31769	31785	-0.06	-0.07	858.70	824.84
1	30910	32610	-267	-23.06	-1.15	-138.26	1.24	31759	31779	-0.08	-0.08	849.08	831.17
2	30910	32610	-883	-23.06	-1.15	-161.32	0.53	31752	31775	-0.09	-0.10	841.74	835.21
3	30910	32610	-1500	-23.06	-1.15	-184.39	-0.19	31746	31772	-0.11	-0.11	835.83	837.83

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2570 [mm] Rise: 1190 [mm] Q-rise: 1030 [mm]
Ring thickness at crown: 370 [mm] Ring thickness at springing: 370 [mm] Mortar loss: 50 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust

0	32610	35032241	3782315	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.04	-41.16	-0.12	0	6	314
1	32621	44632255	5012314	2.12	-1.38	-0.14	-0.00	0.00	0.00	0.00	-1.08	-39.78	-0.33	5	11	309
2	32639	54032278	6232314	1.96	-1.65	-0.18	-0.00	0.00	0.00	0.00	-3.05	-38.13	-0.57	12	18	302
3	32664	63332311	7432313	1.80	-1.87	-0.21	-0.00	0.00	0.00	0.00	-4.85	-36.26	-0.84	21	26	294
4	32696	72432352	8602313	1.63	-2.04	-0.23	-0.00	0.00	0.00	0.00	-6.48	-34.22	-1.13	31	36	284
5	32735	81232402	9732312	1.47	-2.18	-0.24	-0.00	0.00	0.00	0.00	-7.95	-32.04	-1.45	43	47	273
6	32780	89732460	1083	2311	1.31	-2.28	-0.24	-0.00	0.00	0.00	0.00	-9.25	-29.76	-1.79	57	61 259

7 32831 97932526 1187 2310 1.15 -2.34 -0.23 -0.00 0.00 0.00 0.00 -10.40 -27.41 -2.14 73 77 243
8 32888 1056 32599 1287 2309 1.00 -2.37 -0.22 -0.00 0.00 0.00 0.00 -11.40 -25.04 -2.49 91 95 225
9 32951 1129 32680 1381 2308 0.86 -2.38 -0.20 -0.00 0.00 0.00 0.00 -12.26 -22.67 -2.84 112 116 204
10 33019 1197 32768 1468 2307 0.73 -2.35 -0.18 -0.00 0.00 0.00 0.00 -12.99 -20.31 -3.18 135 138 182
11 33092 1260 32862 1549 2305 0.61 -2.31 -0.16 -0.00 0.00 0.00 0.00 -13.60 -18.00 -3.51 159 162 158
12 33170 1317 32962 1622 2303 0.50 -2.26 -0.13 -0.00 0.00 0.00 0.00 -14.10 -15.74 -3.81 184 187 133
13 33251 1368 33067 1688 2302 0.41 -2.20 -0.10 -0.00 0.00 0.00 0.00 -14.51 -13.54 -4.08 210 213 107
14 33336 1413 33176 1746 2300 0.33 -2.13 -0.07 -0.00 0.00 0.00 0.00 -14.83 -11.41 -4.33 235 238 82
15 33425 1451 33290 1796 2298 0.25 -2.06 -0.05 -0.00 0.00 0.00 0.00 -15.09 -9.35 -4.53 258 261 59
16 33516 1483 33407 1836 2297 0.19 -2.00 -0.02 -0.00 0.00 0.00 0.00 -15.28 -7.35 -4.70 279 282 38
17 33609 1508 33526 1869 2295 0.14 -1.94 0.01 -0.00 0.00 0.00 0.00 -15.42 -5.42 -4.83 297 299 21
18 33703 1526 33648 1892 2293 0.09 -1.89 0.03 -0.00 0.00 0.00 0.00 -15.51 -3.52 -4.92 309 311 9
19 33799 1536 33771 1905 2291 0.05 -1.86 0.05 -0.00 0.00 0.00 0.00 -15.57 -1.66 -4.97 316 319 1
20 33895 1540 33895 1910 2290 0.02 -1.84 0.08 -0.00 0.00 0.00 0.00 -15.58 0.18 -4.97 318 320 -0 ***
21 33991 1536 34019 1905 2288 -0.02 -1.84 0.10 0.00 0.00 0.00 0.00 -15.57 2.02 -4.93 313 316 4
22 34087 1526 34142 1892 2286 -0.05 -1.85 0.13 0.00 0.00 0.00 0.00 -15.51 3.86 -4.85 303 306 14
23 34181 1508 34264 1869 2284 -0.09 -1.87 0.15 0.00 0.00 0.00 0.00 -15.42 5.74 -4.72 288 291 29
24 34274 1483 34383 1836 2282 -0.14 -1.91 0.18 0.00 0.00 0.00 0.00 -15.29 7.65 -4.56 269 271 49
25 34365 1451 34500 1796 2280 -0.19 -1.96 0.21 0.00 0.00 0.00 0.00 -15.10 9.61 -4.36 247 249 71
26 34454 1413 34614 1746 2279 -0.25 -2.02 0.24 0.00 0.00 0.00 0.00 -14.85 11.63 -4.12 222 225 95
27 34539 1368 34723 1688 2277 -0.31 -2.08 0.27 0.00 0.00 0.00 0.00 -14.54 13.72 -3.85 197 200 120
28 34620 1317 34828 1622 2276 -0.39 -2.15 0.30 0.00 0.00 0.00 0.00 -14.15 15.86 -3.56 171 174 146
29 34698 1260 34928 1549 2274 -0.48 -2.21 0.33 0.00 0.00 0.00 0.00 -13.66 18.07 -3.25 146 149 171
30 34771 1197 35022 1468 2273 -0.59 -2.26 0.36 0.00 0.00 0.00 0.00 -13.08 20.33 -2.92 123 126 194
31 34839 1129 35110 1381 2272 -0.70 -2.30 0.39 0.00 0.00 0.00 0.00 -12.38 22.63 -2.57 101 105 215
32 34902 1056 35191 1287 2270 -0.83 -2.32 0.41 0.00 0.00 0.00 0.00 -11.55 24.95 -2.23 82 85 235
33 34959 97935264 1187 2269 -0.96 -2.32 0.43 0.00 0.00 0.00 0.00 -10.59 27.27 -1.89 64 68 252
34 35010 89735330 1083 2268 -1.11 -2.29 0.44 0.00 0.00 0.00 0.00 -9.48 29.56 -1.56 49 54 266
35 35055 81235388 9732266 -1.26 -2.23 0.45 0.00 0.00 0.00 0.00 -8.22 31.80 -1.25 36 41 279
36 35094 72435438 8602266 -1.42 -2.14 0.45 0.00 0.00 0.00 0.00 -6.80 33.94 -0.96 26 30 290
37 35126 63335479 7432265 -1.58 -2.01 0.44 0.00 0.00 0.00 0.00 -5.21 35.95 -0.70 17 22 298
38 35151 54035512 6232265 -1.75 -1.84 0.42 0.00 0.00 0.00 0.00 -3.47 37.79 -0.47 10 15 305
39 35169 44635535 5012264 -1.91 -1.63 0.39 0.00 0.00 0.00 0.00 -1.56 39.41 -0.27 4 10 310
40 35180 35035549 3782264 -2.07 -1.37 0.36 0.00 0.00 0.00 0.00 0.51 40.78 -0.12 -0 6 314

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 70 [mm] Thickness at top: 6750 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

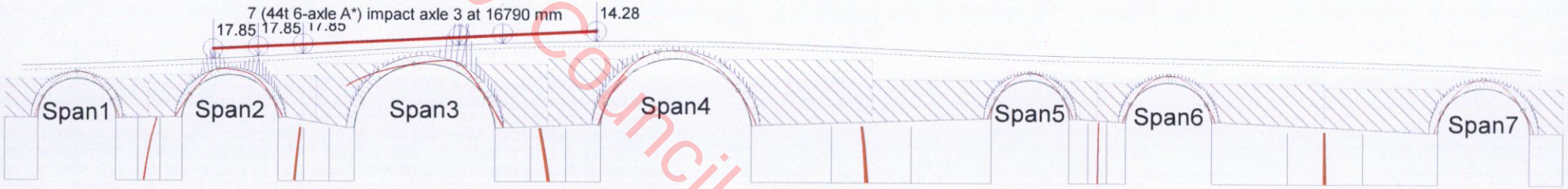
Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
0 35180 41930 70 -324.66 4.61 -324.66 -11.86 38495 38542 -0.05 -0.05 3315.28 3388.34
1 35180 41930 -453 -77.71 4.61 -402.37 -9.45 38503 38560 -0.06 -0.06 3322.78 3369.73
2 35180 41930 -977 -77.71 4.61 -480.09 -7.03 38506 38575 -0.07 -0.07 3326.06 3355.36
3 35180 41930 -1500 -77.71 4.61 -557.80 -4.62 38507 38587 -0.08 -0.08 3326.88 3343.44

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2720 [mm] Rise: 1350 [mm] Q-rise: 1100 [mm]
Ring thickness at crown: 450 [mm] Ring thickness at springing: 450 [mm] Mortar loss: 50 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
0 41930 70 41480 73 2132 0.00 0.00 0.00 0.00 0.00 0.00 0.00 5.12 -45.51 -0.15 0 6 394
1 41935 17641487 2152132 2.58 -1.47 -0.19 -0.00 0.00 0.00 0.00 2.54 -44.05 -0.46 7 14 386
2 41948 28241504 3552132 2.39 -1.82 -0.26 -0.00 0.00 0.00 0.00 0.16 -42.22 -0.79 16 22 378
3 41970 38641533 4942131 2.18 -2.12 -0.32 -0.00 0.00 0.00 0.00 -2.02 -40.10 -1.14 26 32 368

4	41999	48841572	6292129	1.97	-2.36	-0.36	-0.00	0.00	0.00	0.00	0.00	-3.99	-37.74	-1.52	38	44	356		
5	42036	58741622	7622128	1.76	-2.55	-0.38	-0.00	0.00	0.00	0.00	0.00	-5.75	-35.19	-1.91	52	57	343		
6	42081	68441682	8902126	1.55	-2.67	-0.39	-0.00	0.00	0.00	0.00	0.00	-7.30	-32.52	-2.31	69	74	326		
7	42134	77641751	1013	2124	1.35	-2.75	-0.38	-0.00	0.00	0.00	0.00	-8.65	-29.77	-2.71	89	93	307		
8	42193	86441830	1130	2122	1.15	-2.78	-0.36	-0.00	0.00	0.00	0.00	-9.80	-26.99	-3.12	111	115	285		
9	42259	94741918	1241	2119	0.97	-2.77	-0.33	-0.00	0.00	0.00	0.00	-10.77	-24.22	-3.52	137	140	260		
10	42332	1025	42015	1345	2115	0.81	-2.73	-0.30	-0.00	0.00	0.00	0.00	-11.58	-21.49	-3.90	165	169	231	
11	42410	1097	42119	1440	2112	0.66	-2.66	-0.26	-0.00	0.00	0.00	0.00	-12.24	-18.83	-4.26	196	199	201	
12	42494	1163	42230	1527	2108	0.52	-2.56	-0.22	-0.00	0.00	0.00	0.00	-12.76	-16.27	-4.58	229	232	168	
13	42582	1221	42348	1606	2104	0.41	-2.46	-0.17	-0.00	0.00	0.00	0.00	-13.17	-13.81	-4.87	263	266	134	
14	42675	1273	42472	1675	2100	0.31	-2.35	-0.13	-0.00	0.00	0.00	0.00	-13.48	-11.46	-5.12	296	299	101	
15	42772	1317	42600	1733	2096	0.23	-2.23	-0.09	-0.00	0.00	0.00	0.00	-13.71	-9.23	-5.33	32	83	070	
16	42872	1354	42733	1782	2091	0.17	-2.13	-0.05	-0.00	0.00	0.00	0.00	-13.88	-7.11	-5.48	35	53	743	
17	42974	1383	42869	1820	2086	0.11	-2.03	-0.02	-0.00	0.00	0.00	0.00	-13.99	-5.07	-5.59	37	73	921	
18	43078	1403	43008	1848	2081	0.07	-1.95	0.02	-0.00	0.00	0.00	0.00	-14.06	-3.12	-5.64	39	13	946	
19	43184	1416	43149	1864	2075	0.04	-1.89	0.05	-0.00	0.00	0.00	0.00	-14.10	-1.23	-5.65	398	400	-0	***
20	43290	1420	43290	1870	2070	0.01	-1.85	0.08	-0.00	0.00	0.00	0.00	-14.11	0.62	-5.60	39	63	982	
21	43396	1416	43431	1864	2064	-0.01	-1.84	0.11	0.00	0.00	0.00	0.00	-14.10	2.46	-5.51	38	53	871	3
22	43502	1403	43572	1848	2059	-0.04	-1.85	0.15	0.00	0.00	0.00	0.00	-14.06	4.31	-5.36	36	73	693	1
23	43606	1383	43711	1820	2053	-0.07	-1.88	0.18	0.00	0.00	0.00	0.00	-14.00	6.19	-5.18	34	33	455	5
24	43708	1354	43847	1782	2048	-0.10	-1.94	0.22	0.00	0.00	0.00	0.00	-13.90	8.13	-4.95	31	33	168	4
25	43808	1317	43980	1733	2042	-0.14	-2.01	0.26	0.00	0.00	0.00	0.00	-13.76	10.14	-4.68	281	283	117	
26	43905	1273	44108	1675	2036	-0.20	-2.10	0.30	0.00	0.00	0.00	0.00	-13.56	12.24	-4.38	247	250	150	
27	43998	1221	44232	1606	2031	-0.27	-2.19	0.35	0.00	0.00	0.00	0.00	-13.29	14.43	-4.05	213	216	184	
28	44086	1163	44350	1527	2026	-0.35	-2.29	0.39	0.00	0.00	0.00	0.00	-12.93	16.73	-3.69	181	184	216	
29	44170	1097	44461	1440	2022	-0.46	-2.39	0.44	0.00	0.00	0.00	0.00	-12.47	19.12	-3.32	150	153	247	
30	44248	1025	44565	1345	2018	-0.58	-2.48	0.49	0.00	0.00	0.00	0.00	-11.90	21.60	-2.94	123	126	274	
31	44321	94744662	1241	2014	-0.71	-2.55	0.53	0.00	0.00	0.00	0.00	-11.19	24.15	-2.56	98	102	298		
32	44387	86444750	1130	2010	-0.86	-2.60	0.57	0.00	0.00	0.00	0.00	-10.32	26.75	-2.19	77	81	319		
33	44446	77644829	1013	2006	-1.03	-2.62	0.60	0.00	0.00	0.00	0.00	-9.29	29.37	-1.82	59	63	337		
34	44499	68444898	8902004	-1.21	-2.60	0.62	0.00	0.00	0.00	0.00	-8.08	31.97	-1.48	44	48	352			
35	44544	58744958	7622002	-1.41	-2.54	0.63	0.00	0.00	0.00	0.00	-6.67	34.51	-1.17	31	36	364			
36	44581	48845008	629-1	-1.61	-2.43	0.63	0.00	0.00	0.00	0.00	-5.07	36.94	-0.89	22	27	373			
37	44610	38645047	494-1	-1.81	-2.27	0.61	0.00	0.00	0.00	0.00	-3.25	39.21	-0.64	14	19	381			
38	44632	28245076	355-1	-2.02	-2.06	0.58	0.00	0.00	0.00	0.00	-1.23	41.27	-0.44	8	14	386			
39	44645	17645093	215-1	-2.22	-1.78	0.53	0.00	0.00	0.00	0.00	0.99	43.05	-0.27	3	9	391			
40	44650	70	45100	73	-1	-2.42	-1.45	0.47	0.00	0.00	0.00	0.00	3.41	44.50	-0.14	-0	6	394	

Beaumont Bridge



Lowerbound condition with backing present => 44t load capacity

gammaFl dead load: 1.00 7 (44t 6-axle A*) impact axle 3 @ 16790 [mm]
gammaFl superimposed: 1.00
gammaFl live load: 2.38
gammaF3 load effect: 1.00
gammaM material: 1.00
File path: V:\5210920\7 Calcs\72 Model\Beaumont Bridge - UB w backing.brg

NAME: Beaumont Bridge
LOCATION: Beaumont, Meath
NUMBER: MH-L1615-001.00
ATKINS
DATE: 20 December 2021
Printed on: Wednesday, January 12, 2022 15:19:02

Bridge Name: Beaumont Bridge Bridge Location: Beaumont, Meath
Bridge Number: MH-L1615-001.00
Number of spans: 7

SAFETY FACTORS
Factor for deadload: 1.00 Factor for superimposed deadload: 1.00 Factor for surfacing: 1.00
Factor for live load: 2.38 Factor for load effect: 1.00 Factor for material strength: 1.00

APPLIED LOAD CASES
1.7 (44t 6-axle A*) impact axle 3Total weight: 431.64 [kN] Position: 16790 [mm]
44.00 6 1.00 6.00 2.80 5.00 4.10 18.90 8.80 7.50 10.15 7.50 11.50 7.50 1.00 1.80 2.50
Effective lane width: 3350 [mm] Distribution length: 2400 [mm]

Applied distribution mode: Archie-M, BD21/97
Applied live load pressure: Active pressure

STRUCTURE PROPERTIES
Road shape: True shape (multi-point method)
Road points: (-500, 1950) (1180, 2000) (5805, 2200) (11660, 2550) (19175, 2750) (29755, 2370) (33895, 2290) (43290, 2070) (45000, 2000)
Depth of surfacing: 150Depth of overlay: 0
Surface unit weight: 23.00 [kN/m3] Overlay unit weight: 23.00 [kN/m3]
Lane width: 0

Fill unit weight: 18.00 [kN/m3] Fill phi: 30 degree

Left abutment Base level:-1500 [mm] Height: 380 [mm] Width: 1000 [mm]
Right abutment Base level:-1500 [mm] Height: 70 [mm] Width: 1000 [mm]

Right abutment Base level:-1500 [mm] Height: 70 [mm] Width: 1000 [mm]
Shape: Circular
Span: 2360 [mm] Rise: 1170 [mm] Q-rise: 1050 [mm]
Ring thickness at crown:210 [mm] Ring thickness at springing: 210 [mm] Mortar loss: 20 [mm]
Masonry unit weight:22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	0	380	-210	3821958	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-7.26	-24.30	-2.22	89	93	97	
1	4	472	-205	4901958	0.00	-0.63	-0.08	0.00	-0.00	0.00	0.00	-7.26	-23.66	-1.56	63	66	124	
2	16	563	-191	5981959	0.00	-0.87	-0.12	0.00	-0.00	0.00	0.00	-7.26	-22.79	-1.03	42	45	145	
3	35	654	-169	7041959	0.00	-1.08	-0.15	0.00	-0.00	0.00	0.00	-7.26	-21.71	-0.62	26	29	161	
4	60	742	-139	8081960	0.00	-1.24	-0.17	0.00	-0.00	0.00	0.00	-7.26	-20.48	-0.33	14	17	173	
5	93	828	-101	9101961	0.00	-1.36	-0.18	0.00	-0.00	0.00	0.00	-7.26	-19.12	-0.14	5	8	182	
6	132	912	-55	1008	1963	0.00	-1.44	-0.18	0.00	-0.00	0.00	0.00	-7.26	-17.68	-0.04	1	4	186
7	177	992	-1	1103	1964	0.00	-1.49	-0.18	0.00	-0.00	0.00	0.00	-7.26	-16.20	-0.02	-0	3	187
8	229	1068	60	1193	1966	0.00	-1.50	-0.17	0.00	-0.00	0.00	0.00	-7.26	-14.70	-0.06	3	5	185
9	286	1141	127	1278	1968	0.00	-1.49	-0.15	0.00	-0.00	0.00	0.00	-7.26	-13.21	-0.15	9	11	179
10	349	1208	201	1357	1970	0.00	-1.46	-0.13	0.00	-0.00	0.00	0.00	-7.26	-11.75	-0.28	20	22	168
11	417	1270	281	1430	1972	0.00	-1.41	-0.11	0.00	-0.00	0.00	0.00	-7.26	-10.35	-0.42	34	36	154
12	490	1327	367	1497	1975	0.00	-1.34	-0.09	0.00	-0.00	0.00	0.00	-7.26	-9.01	-0.58	52	53	137
13	566	1378	457	1557	1977	0.00	-1.27	-0.06	0.00	-0.00	0.00	0.00	-7.26	-7.73	-0.75	72	74	116
14	647	1423	552	1610	1980	0.21	-1.21	-0.01	0.00	-0.00	0.00	0.00	-7.47	-6.52	-0.94	97	98	92
15	731	1461	651	1655	1983	0.16	-1.16	0.00	0.00	-0.00	0.00	0.00	-7.63	-5.37	-1.10	120	121	69
16	817	1493	753	1693	1987	0.12	-1.11	0.01	0.00	-0.00	0.00	0.00	-7.75	-4.26	-1.24	142	143	47
17	906	1518	857	1722	1990	0.09	-1.07	0.02	0.00	-0.00	0.00	0.00	-7.83	-3.19	-1.34	160	161	29
18	996	1536	964	1743	1993	0.06	-1.04	0.03	0.00	-0.00	0.00	0.00	-7.89	-2.15	-1.43	175	176	14
19	1088	1546	1072	1756	1996	0.03	-1.02	0.04	0.00	-0.00	0.00	0.00	-7.92	-1.13	-1.48	185	186	4
20	1180	1550	1180	1760	2000	0.01	-1.01	0.04	0.00	-0.00	0.00	0.00	-7.94	-0.11	-1.50	189	190	-0 ***
21	1272	1546	1288	1756	2003	-0.01	-1.02	0.05	-0.00	-0.00	0.00	0.00	-7.92	0.91	-1.50	187	189	1

22	1364	1536	1396	1743	2006	-0.03	-1.04	0.06	-0.00	-0.00	0.00	0.00	-7.89	1.95	-1.47	1801828			
23	1454	1518	1503	1722	2010	-0.06	-1.07	0.07	-0.00	-0.00	0.00	0.00	-7.83	3.02	-1.40	16816921			
24	1543	1493	1607	1693	2014	-0.09	-1.11	0.08	-0.00	-0.00	0.00	0.00	-7.74	4.13	-1.31	15115238			
25	1629	1461	1709	1655	2017	-0.13	-1.17	0.09	-0.00	-0.00	0.00	0.00	-7.61	5.30	-1.18	13013159			
26	1713	1423	1808	1610	2020	-0.17	-1.22	0.11	-0.00	-0.00	0.00	0.00	-7.44	6.52	-1.02	10610783			
27	1794	1378	1903	1557	2024	-0.23	-1.28	0.12	-0.00	-0.00	0.00	0.00	-7.21	7.80	-0.83	81	82	108	
28	1870	1327	1993	1497	2027	0.00	-1.35	0.17	0.00	-0.00	0.00	0.00	-7.21	9.15	-0.66	58	60	130	
29	1943	1270	2079	1430	2030	0.00	-1.43	0.20	0.00	-0.00	0.00	0.00	-7.21	10.58	-0.50	39	41	149	
30	2011	1208	2159	1357	2033	0.00	-1.49	0.22	0.00	-0.00	0.00	0.00	-7.21	12.07	-0.34	24	26	164	
31	2074	1141	2233	1278	2036	0.00	-1.54	0.24	0.00	-0.00	0.00	0.00	-7.21	13.62	-0.20	12	14	176	
32	2131	1068	2300	1193	2038	0.00	-1.58	0.25	0.00	-0.00	0.00	0.00	-7.21	15.19	-0.09	4	7	183	
33	2183	9922361	1103	2041	0.00	-1.58	0.26	0.00	-0.00	0.00	0.00	-7.21	16.77	-0.03	0	3	187		
34	2228	9122415	1008	2043	0.00	-1.56	0.26	0.00	-0.00	0.00	0.00	-7.21	18.33	-0.03	-0	3	187		
35	2267	8282461	9102044	0.00	-1.51	0.25	0.00	-0.00	0.00	0.00	-7.21	19.84	-0.10	3	6	184			
36	2300	7422499	8082046	0.00	-1.41	0.24	0.00	-0.00	0.00	0.00	-7.21	21.25	-0.27	11	14	176			
37	2325	6542529	7042047	0.00	-1.28	0.21	0.00	-0.00	0.00	0.00	-7.21	22.54	-0.55	22	25	165			
38	2344	5632551	5982048	0.00	-1.11	0.18	0.00	-0.00	0.00	0.00	-7.21	23.65	-0.94	37	40	150			
39	2356	4722565	4902048	0.00	-0.90	0.14	0.00	-0.00	0.00	0.00	-7.21	24.54	-1.46	56	60	130			
40	2360	3802570	3822048	0.00	-0.64	0.08	0.00	-0.00	0.00	0.00	-7.21	25.18	-2.11	82	85	105			

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 380 [mm] Thickness at top: 2000 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right

0	2360	4360	380	-161.91	-40.20	-161.91	36.533574	3597	-0.03	-0.14	1214.05	762.82
1	2360	4360	-247	-27.57	-40.20	-189.48	11.33	3406	3433	-0.08	-0.11	1046.28	926.65
2	2360	4360	-873	-27.57	-40.20	-217.05	-13.86	3281	3312	-0.13	-0.09	920.64	1048.35
3	2360	4360	-1500	-27.57	-40.20	-244.63	-39.05	3183	3218	-0.18	-0.06	822.88	1142.18

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2890 [mm] Rise: 1280 [mm] Q-rise: 1020 [mm]
Ring thickness at crown: 222 [mm] Ring thickness at springing: 222 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust

0	4360	4004140	4272115	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-47.43	-77.46	-15.83	1861984					
1	4377	5044159	5472116	0.00	-1.22	-0.18	0.00	-0.00	0.00	0.00	-47.43	-76.25	-11.92	13614854					
2	4401	6074186	6652118	0.00	-1.45	-0.22	0.00	-0.00	0.00	0.00	-47.43	-74.80	-8.58	95	10795				
3	4432	7084223	7812119	0.00	-1.63	-0.24	0.00	-0.00	0.00	0.00	-47.43	-73.17	-5.82	63	75	127			
4	4471	8064267	8952121	0.00	-1.76	-0.25	0.00	-0.00	0.00	0.00	-47.43	-71.41	-3.64	37	49	153			
5	4516	9014320	1004	2124	0.00	-1.86	-0.25	0.00	-0.00	0.00	0.00	-47.43	-69.55	-2.04	18	30	172		
6	4569	9934380	1110	2126	0.00	-1.91	-0.24	0.00	-0.00	0.00	0.00	-47.43	-67.64	-0.98	6	18	184		
7	4627	1080	4448	1211	2130	0.00	-1.93	-0.23	0.00	-0.00	0.00	0.00	-47.43	-65.71	-0.47	-0	12	190	
8	4693	1163	4523	1306	2133	0.00	-1.92	-0.20	0.00	-0.00	0.00	0.00	-47.43	-63.79	-0.48	0	12	190	
9	4763	1241	4605	1396	2137	0.00	-1.88	-0.18	0.00	-0.00	0.00	0.00	-47.43	-61.92	-1.00	7	18	184	
10	4840	1314	4693	1480	2142	0.00	-1.82	-0.15	0.00	-0.00	0.00	0.00	-47.43	-60.10	-2.00	21	32	170	
11	4921	1381	4786	1557	2146	0.00	-1.74	-0.12	0.00	-0.02	-0.00	0.00	-47.43	-58.34	-3.47	42	53	149	
12	5007	1442	4886	1628	2151	0.00	-1.66	-0.09	0.00	-0.73	-0.04	0.00	-47.43	-55.95	-5.29	70	80	122	
13	5098	1497	4990	1691	2156	0.00	-1.57	-0.07	0.00	-2.85	-0.14	0.00	-47.43	-51.54	-7.17	10311389			
14	5192	1544	5098	1746	2162	0.24	-1.50	0.00	1.02	-5.98	-0.02	0.00	-48.69	-44.06	-8.98	13914854			
15	5289	1585	5210	1793	2168	0.19	-1.44	0.01	1.27	-9.08	0.02	0.00	-50.15	-33.55	-10.24	17017824			
16	5389	1619	5325	1832	2174	0.14	-1.38	0.02	1.22	-10.84	0.11	0.00	-51.51	-21.33	-10.77	1901984			
17	5491	1646	5443	1862	2180	0.10	-1.34	0.03	0.89	-10.33	0.18	0.00	-52.51	-9.66	-10.57	194202	-0	***	
18	5595	1665	5563	1884	2186	0.07	-1.31	0.04	0.47	-7.63	0.18	0.00	-53.04	-0.72	-9.85	18419111			

19	5700	1676	5683	1898	2192	0.04	-1.29	0.05	0.14	-3.89	0.11	0.00	-53.22	4.47	-8.93	16517329	
20	5805	1680	5805	1902	2199	0.01	-1.29	0.06	0.01	-0.92	0.02	0.00	-53.25	6.68	-8.10	14815646	
21	5910	1676	5927	1898	2206	-0.01	-1.31	0.07	-0.00	-0.01	0.00	0.00	-53.23	8.00	-7.52	13614458	
22	6015	1665	6047	1884	2213	-0.04	-1.34	0.09	-0.01	-0.28	0.03	0.00	-53.18	9.62	-7.23	13013864	
23	6119	1646	6167	1862	2219	-0.08	-1.38	0.10	-0.09	-1.49	0.13	0.00	-53.01	12.49	-7.17	12813666	
24	6221	1619	6285	1832	2227	-0.11	-1.44	0.11	-0.29	-3.36	0.31	0.00	-52.61	17.29	-7.22	12613468	
25	6321	1585	6400	1793	2233	-0.16	-1.51	0.13	-0.61	-5.39	0.54	0.00	-51.84	24.18	-7.21	12213171	
26	6418	1544	6512	1746	2240	-0.22	-1.58	0.15	-0.99	-7.02	0.75	0.00	-50.64	32.78	-6.98	11312181	
27	6512	1497	6620	1691	2246	-0.28	-1.66	0.17	-1.34	-7.91	0.90	0.00	-49.01	42.35	-6.39	96	10597
28	6603	1442	6724	1628	2252	0.00	-1.75	0.24	0.00	-7.94	1.19	0.00	-49.01	52.04	-5.77	78	88 114
29	6689	1381	6824	1557	2258	0.00	-1.85	0.27	0.00	-7.24	1.16	0.00	-49.01	61.13	-4.89	59	70 132
30	6770	1314	6917	1480	2263	0.00	-1.94	0.30	0.00	-6.08	1.02	0.00	-49.01	69.15	-3.83	41	52 150
31	6847	1241	7005	1396	2269	0.00	-2.02	0.33	0.00	-4.76	0.84	0.00	-49.01	75.93	-2.73	25	37 165
32	6917	1163	7087	1306	2274	0.00	-2.08	0.35	0.00	-3.53	0.65	0.00	-49.01	81.54	-1.75	12	25 177
33	6983	1080	7162	1211	2278	0.00	-2.11	0.37	0.00	-2.54	0.48	0.00	-49.01	86.19	-1.04	4	18 184
34	7041	9937230	1110	2282	0.00	-2.11	0.38	0.00	-1.83	0.36	0.00	-49.01	90.13	-0.75	-0	15 187	
35	7094	9017290	1004	2285	0.00	-2.08	0.38	0.00	-1.37	0.28	0.00	-49.01	93.59	-0.98	2	17 185	
36	7139	8067343	8952289	0.00	-2.01	0.37	0.00	-1.10	0.23	0.00	-49.01	96.71	-1.83	9	25 177		
37	7178	7087387	7812291	0.00	-1.90	0.35	0.00	-0.94	0.19	0.00	-49.01	99.55	-3.36	23	38 164		
38	7209	6077424	6652294	0.00	-1.74	0.32	0.00	-0.79	0.16	0.00	-49.01	102.08	-5.60	42	58 144		
39	7233	5047451	5472295	0.00	-1.54	0.27	0.00	-0.62	0.13	0.00	-49.01	104.24	-8.56	69	85 117		
40	7250	4007470	4272296	0.00	-1.28	0.22	0.00	-0.44	0.09	0.00	-49.01	105.95	-12.28	103	118 84		

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 100 [mm] Thickness at top: 2300 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	7250	9550	100	-326.18	-67.78	-326.18	-160.84	7884	7930	-0.32	0.04	633.59	1619.82
1	7250	9550	-433	-26.99	-67.78	-353.17	-197.00	7817	7867	-0.38	0.07	566.98	1682.57
2	7250	9550	-967	-26.99	-67.78	-380.15	-233.15	7760	7814	-0.43	0.10	509.55	1736.14
3	7250	9550	-1500	-26.99	-67.78	-407.14	-269.30	7709	7768	-0.48	0.13	459.48	1782.36

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 4220 [mm] Rise: 1930 [mm] Q-rise: 1560 [mm]
Ring thickness at crown: 252 [mm] Ring thickness at springing: 252 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	9550	1009299	1222410	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-113.51	-71.13	-160.03	1971	1983	-1751	***	
1	9570	2569321	2972411	0.00	-1.97	-0.34	0.00	-0.17	-0.04	0.00	-113.51	-68.99	-143.19	1649	1661	-1429	***	
2	9601	4099356	4692414	0.00	-2.45	-0.43	0.00	-0.25	-0.05	0.00	-113.51	-66.29	-127.18	1389	1403	-1171	***	
3	9643	5609404	6382416	0.00	-2.83	-0.48	0.00	-0.31	-0.06	0.00	-113.51	-63.15	-112.04	1174	1188	-956	***	
4	9697	7089463	8032420	0.00	-3.11	-0.51	0.00	-0.34	-0.06	0.00	-113.51	-59.70	-97.80	991	1005	-773	***	
5	9761	8519535	9632425	0.00	-3.30	-0.51	0.00	-0.33	-0.06	0.00	-113.51	-56.07	-84.48	833	847	-615	***	
6	9836	9899619	1117	2430	0.00	-3.40	-0.48	0.00	-0.30	-0.05	0.00	-113.51	-52.37	-72.09	694	708	-476	***
7	9921	1121	9714	1265	2436	0.00	-3.43	-0.44	0.00	-0.23	-0.04	0.00	-113.51	-48.70	-60.64	571	586	-354 ***
8	10015	1247	9819	1405	2442	0.00	-3.39	-0.39	0.00	-0.16	-0.02	0.00	-113.51	-45.16	-50.15	463	478	-246 ***
9	10118	1365	9935	1537	2449	0.00	-3.29	-0.33	0.00	-0.08	-0.01	0.00	-113.51	-41.79	-40.63	368	383	-151 ***
10	10230	1475	10060	1661	2457	0.00	-3.15	-0.27	0.00	-0.02	-0.00	0.00	-113.51	-38.61	-32.10	284	300	-68 ***
11	10350	1576	10194	1774	2465	0.00	-2.98	-0.21	0.00	-0.00	-0.00	0.00	-113.51	-35.63	-24.56	213	229	3
12	10477	1669	10336	1878	2474	0.00	-2.79	-0.15	0.00	-0.00	0.00	0.00	-113.51	-32.85	-18.02	152	168	64
13	10610	1751	10485	1970	2482	0.00	-2.58	-0.10	0.00	-0.00	0.00	0.00	-113.51	-30.26	-12.51	102	118	114
14	10749	1824	10641	2052	2492	0.38	-2.39	0.04	0.00	-0.00	0.00	0.00	-113.90	-27.87	-8.12	62	79	153
15	10893	1886	10802	2121	2501	0.28	-2.23	0.06	0.00	-0.00	0.00	0.00	-114.18	-25.64	-4.74	33	49	183

16	11041	1938	10968	2179	2511	0.21	-2.11	0.08	0.00	-0.00	0.00	0.00	-114.39	-23.53	-2.41	12	29	203	
17	11193	1978	11137	2224	2521	0.14	-2.01	0.09	0.00	-0.00	0.00	0.00	-114.53	-21.53	-1.14	2	18	214	
18	11347	2007	11310	2256	2530	0.10	-1.94	0.11	0.00	-0.00	0.00	0.00	-114.63	-19.59	-0.96	-0	17	215	
19	11503	2024	11485	2275	2540	0.05	-1.90	0.12	0.00	-0.00	0.00	0.00	-114.68	-17.69	-1.85	8	24	208	
20	11660	2030	11660	2282	2549	0.02	-1.89	0.14	0.00	-0.00	0.00	0.00	-114.70	-15.80	-3.82	25	41	191	
21	11817	2024	11835	2275	2559	-0.02	-1.92	0.16	-0.00	-0.00	0.00	0.00	-114.68	-13.88	-6.85	52	69	163	
22	11973	2007	12010	2256	2568	-0.06	-1.99	0.18	-0.00	-0.05	0.01	0.00	-114.62	-11.84	-10.92	90	106	126	
23	12127	1978	12183	2224	2577	-0.11	-2.08	0.21	-0.17	-2.78	0.39	0.00	-114.34	-6.97	-15.94	13	71	537	9
24	12279	1938	12352	2179	2586	-0.17	-2.21	0.24	-1.04	-11.73	1.55	0.00	-113.13	6.97	-21.26	18	52	013	1
25	12427	1886	12518	2121	2594	-0.25	-2.36	0.28	-2.57	-22.28	3.00	0.00	-110.31	31.60	-25.53	21	52	32	0
26	12571	1824	12679	2052	2602	-0.35	-2.53	0.32	-4.15	-28.82	4.05	0.00	-105.81	62.95	-27.38	21	52	32	-0 ***
27	12710	1751	12835	1970	2609	-0.47	-2.72	0.36	-4.98	-28.60	4.20	0.00	-100.36	94.28	-26.08	18	52	04	28
28	12843	1669	12984	1878	2617	0.00	-2.95	0.51	0.00	-22.57	4.19	0.00	-100.36	119.79	-23.05	14	31	64	68
29	12970	1576	13126	1774	2623	0.00	-3.17	0.58	0.00	-14.08	2.73	0.00	-100.36	137.05	-18.18	99	12	31	09
30	13090	1475	13260	1661	2629	0.00	-3.38	0.65	0.00	-6.70	1.35	0.00	-100.36	147.13	-12.70	61	86	146	
31	13202	1365	13385	1537	2635	0.00	-3.56	0.72	0.00	-2.52	0.53	0.00	-100.36	153.20	-7.82	30	56	176	
32	13305	1247	13501	1405	2640	0.00	-3.69	0.77	0.00	-1.57	0.36	0.00	-100.36	158.46	-4.38	10	37	195	
33	13399	1121	13606	1265	2645	0.00	-3.78	0.81	0.00	-1.51	0.35	0.00	-100.36	163.75	-2.65	0	28	204	
34	13484	98	913701	1117	2648	0.00	-3.79	0.82	0.00	-1.42	0.34	0.00	-100.36	168.96	-2.74	-0	28	204	
35	13559	85	113785	963	2651	0.00	-3.74	0.82	0.00	-1.28	0.31	0.00	-100.36	173.98	-4.72	9	38	194	
36	13623	70	813857	803	2654	0.00	-3.60	0.79	0.00	-1.12	0.27	0.00	-100.36	178.70	-8.68	28	57	175	
37	13677	56	013916	638	2657	0.00	-3.37	0.74	0.00	-0.94	0.23	0.00	-100.36	183.02	-14.69	57	86	146	
38	13719	40	913964	469	2659	0.00	-3.04	0.65	0.00	-0.75	0.18	0.00	-100.36	186.81	-22.82	97	126	106	
39	13750	25	613999	297	2660	0.00	-2.61	0.54	0.00	-0.55	0.13	0.00	-100.36	189.97	-33.09	148	17	75	5
40	13770	10	014021	122	2661	0.00	-2.07	0.40	0.00	-0.35	0.08	0.00	-100.36	192.39	-45.51	21	32	41	-9 ***

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 100 [mm] Thickness at top: 3150 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	13770	16920	100	-482.04	79.13	-482.04	-121.11	15059	15128	-0.23	-0.08	1289.32	1791.82
1	13770	16920	-433	-36.96	79.13	-519.00	-78.91	15156	15230	-0.21	-0.12	1385.89	1689.97
2	13770	16920	-967	-36.96	79.13	-555.96	-36.71	15239	15319	-0.20	-0.15	1469.27	1601.31
3	13770	16920	-1500	-36.96	79.13	-592.92	5.50	15312	15397	-0.18	-0.19	1541.92	1523.38

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 4510 [mm] Rise: 2010 [mm] Q-rise: 1660 [mm]
Ring thickness at crown: 264 [mm] Ring thickness at springing: 264 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	16920	20016	658	23027	38	0.00	0.00	0.00	0.00	0.00	0.00	-22.02	-84.63	-5.02	52	64	180	
1	16945	36316	686	41327	38	0.00	-2.45	-0.45	0.00	-0.61	-0.14	0.00	-22.02	-81.56	-2.85	28	40	204
2	16982	52416	726	59227	39	0.00	-2.97	-0.54	0.00	-0.90	-0.20	0.00	-22.02	-77.69	-1.40	12	23	221
3	17030	68216	780	76927	40	0.00	-3.38	-0.60	0.00	-1.19	-0.25	0.00	-22.02	-73.11	-0.61	3	13	231
4	17090	83616	847	94127	41	0.00	-3.69	-0.63	0.00	-1.47	-0.29	0.00	-22.02	-67.95	-0.36	-0	10	234
5	17160	98616	926	1107	2742	0.00	-3.89	-0.62	0.00	-1.74	-0.32	0.00	-22.02	-62.32	-0.55	4	13	231
6	17242	1130	17017	1268	2743	0.00	-4.00	-0.59	0.00	-1.97	-0.34	0.00	-22.02	-56.36	-1.06	14	22	222
7	17333	1267	17119	1421	2745	0.00	-4.02	-0.54	0.00	-2.15	-0.34	0.00	-22.02	-50.19	-1.77	29	37	207
8	17435	1397	17232	1567	2746	0.00	-3.97	-0.48	0.00	-2.26	-0.32	0.00	-22.02	-43.96	-2.57	50	57	187
9	17545	1520	17356	1704	2748	0.00	-3.86	-0.41	0.00	-2.28	-0.29	0.00	-22.02	-37.82	-3.37	76	82	162
10	17665	1635	17489	1832	2749	0.00	-3.70	-0.33	0.00	-2.20	-0.24	0.00	-22.02	-31.92	-4.10	106	112	132
11	17792	1740	17631	1949	2750	0.00	-3.50	-0.25	0.00	-2.02	-0.19	0.00	-22.02	-26.40	-4.71	138	143	101
12	17926	1836	17781	2056	2750	0.00	-3.27	-0.18	0.00	-1.74	-0.13	0.00	-22.02	-21.38	-5.17	169	174	70

13	18068	1922	17939	2152	2751	0.00	-3.02	-0.11	0.00	-1.38	-0.08	0.00	-22.02	-16.98	-5.48	19720143	
14	18215	1997	18103	2236	2752	0.45	-2.79	0.06	0.17	-0.99	-0.00	0.00	-22.64	-13.21	-5.78	22022321	
15	18367	2061	18273	2308	2753	0.34	-2.61	0.08	0.08	-0.60	0.00	0.00	-23.06	-10.00	-5.90	2332377	
16	18523	2114	18447	2367	2753	0.24	-2.45	0.10	0.03	-0.27	0.00	0.00	-23.33	-7.28	-5.90	2402431	
17	18683	2156	18626	2414	2752	0.17	-2.31	0.11	0.01	-0.06	0.00	0.00	-23.51	-4.91	-5.82	241244-0	***
18	18846	2186	18807	2447	2752	0.11	-2.20	0.13	0.00	-0.00	-0.00	0.00	-23.62	-2.71	-5.68	2372413	
19	19010	2204	18991	2467	2751	0.06	-2.12	0.15	-0.00	0.00	0.00	0.00	-23.68	-0.59	-5.49	23023410	
20	19175	2210	19175	2474	2750	0.02	-2.08	0.16	-0.00	0.00	0.00	0.00	-23.70	1.50	-5.26	22022420	
21	19340	2204	19359	2467	2748	-0.02	-2.08	0.18	0.00	0.00	0.00	0.00	-23.68	3.57	-4.99	20721133	
22	19504	2186	19543	2447	2745	-0.06	-2.11	0.20	0.00	0.00	0.00	0.00	-23.62	5.68	-4.68	19219549	
23	19667	2156	19724	2414	2743	-0.11	-2.18	0.23	0.00	0.00	0.00	0.00	-23.51	7.85	-4.34	17417866	
24	19827	2114	19903	2367	2740	-0.16	-2.28	0.26	0.00	0.00	0.00	0.00	-23.35	10.13	-3.95	15415886	
25	19983	2061	20077	2308	2737	-0.24	-2.41	0.30	0.00	0.00	0.00	0.00	-23.11	12.54	-3.50	133136108	
26	20135	1997	20247	2236	2734	-0.33	-2.56	0.34	0.00	0.00	0.00	0.00	-22.78	15.10	-3.00	109113131	
27	20282	1922	20411	2152	2730	-0.44	-2.73	0.38	0.00	0.00	0.00	0.00	-22.35	17.82	-2.43	84 88 156	
28	20424	1836	20569	2056	2727	0.00	-2.95	0.53	0.00	0.00	0.00	0.00	-22.35	20.78	-1.94	62 67 177	
29	20558	1740	20719	1949	2724	0.00	-3.21	0.61	0.00	0.00	0.00	0.00	-22.35	23.98	-1.45	43 47 197	
30	20685	1635	20861	1832	2720	0.00	-3.43	0.69	0.00	0.00	0.00	0.00	-22.35	27.41	-1.00	26 31 213	
31	20805	1520	20994	1704	2716	0.00	-3.63	0.76	0.00	0.00	0.00	0.00	-22.35	31.04	-0.60	13 19 225	
32	20915	1397	21118	1567	2713	0.00	-3.79	0.82	0.00	0.00	0.00	0.00	-22.35	34.83	-0.30	4 10 234	
33	21017	1267	21231	1421	2709	0.00	-3.90	0.87	0.00	0.00	0.00	0.00	-22.35	38.73	-0.14	-0 6 238	
34	21108	1130	21333	1268	2707	0.00	-3.96	0.90	0.00	0.00	0.00	0.00	-22.35	42.69	-0.19	1 7 237	
35	21190	98621424	1107	2704	0.00	-3.94	0.90	0.00	0.00	0.00	0.00	-22.35	46.62	-0.50	6 13 231		
36	21260	83621503	9412702	0.00	-3.83	0.88	0.00	0.00	0.00	0.00	-22.35	50.46	-1.15	17 25 219			
37	21320	68221570	7692700	0.00	-3.64	0.83	0.00	0.00	0.00	0.00	-22.35	54.10	-2.20	34 42 202			
38	21368	52421624	5922698	0.00	-3.34	0.76	0.00	0.00	0.00	0.00	-22.35	57.44	-3.72	56 65 179			
39	21405	36321664	4132697	0.00	-2.94	0.65	0.00	0.00	0.00	0.00	-22.35	60.39	-5.76	86 95 149			
40	21430	20021692	2302696	0.00	-2.43	0.51	0.00	0.00	0.00	0.00	-22.35	62.82	-8.38	124134110			

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 200 [mm] Thickness at top: 7170 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right

0	21430	28600	200	-431.51	11.84	-431.51	-126.17	24692	24753	-0.07	-0.05	3261.78	3846.57
1	21430	28600	-367	-89.39	11.84	-520.90	-119.46	24748	24823	-0.09	-0.06	3318.46	3777.13
2	21430	28600	-933	-89.39	11.84	-610.28	-112.75	24787	24874	-0.10	-0.07	3356.66	3726.16
3	21430	28600	-1500	-89.39	11.84	-699.67	-106.04	24813	24913	-0.11	-0.09	3383.47	3686.58

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2310 [mm] Rise: 1150 [mm] Q-rise: 960 [mm]
Ring thickness at crown: 222 [mm] Ring thickness at springing: 222 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust

0	28600	45028378	4512417	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.50	-32.96	-3.20	95 99 103			
1	28604	54028383	5592417	0.00	-0.67	-0.09	0.00	0.00	0.00	0.00	-10.50	-32.29	-2.27	66 71 131			
2	28615	63028396	6662416	0.00	-0.97	-0.15	0.00	0.00	0.00	0.00	-10.50	-31.32	-1.52	44 49 153			
3	28633	71928417	7712415	0.00	-1.23	-0.19	0.00	0.00	0.00	0.00	-10.50	-30.09	-0.93	27 32 170			
4	28658	80628447	8752414	0.00	-1.45	-0.22	0.00	0.00	0.00	0.00	-10.50	-28.64	-0.50	14 19 183			
5	28689	89028485	9762413	0.00	-1.62	-0.24	0.00	0.00	0.00	0.00	-10.50	-27.02	-0.22	6 10 192			
6	28727	97228530	1074	2411	0.00	-1.76	-0.25	0.00	0.00	0.00	0.00	-10.50	-25.26	-0.08	1 5 197		
7	28772	1051	28583	1168	2409	0.00	-1.85	-0.25	0.00	0.00	0.00	0.00	-10.50	-23.41	-0.05	-0 4 198	
8	28822	1126	28643	1257	2407	0.00	-1.92	-0.24	0.00	0.00	0.00	0.00	-10.50	-21.49	-0.11	3 6 196	
9	28879	1197	28710	1342	2404	0.00	-1.95	-0.22	0.00	0.00	0.00	0.00	-10.50	-19.55	-0.25	10 13 189	

10	28940	1263	28783	1421	2402	0.00	-1.95	-0.20	0.00	0.00	0.00	0.00	-10.50	-17.59	-0.45	21	24	178
11	29007	1325	28863	1494	2399	0.00	-1.94	-0.17	0.00	0.00	0.00	0.00	-10.50	-15.66	-0.68	36	39	163
12	29078	1381	28948	1560	2396	0.00	-1.90	-0.14	0.00	0.00	0.00	0.00	-10.50	-13.76	-0.93	55	58	144
13	29153	1431	29037	1620	2392	0.00	-1.86	-0.11	0.00	0.00	0.00	0.00	-10.50	-11.90	-1.20	78	80	122
14	29232	1475	29131	1673	2389	0.37	-1.82	-0.01	-0.00	0.00	0.00	0.00	-10.87	-10.08	-1.51	10	5	107
15	29314	1513	29229	1718	2386	0.30	-1.78	0.00	-0.00	0.00	0.00	0.00	-11.17	-8.31	-1.77	13	0	132
16	29399	1544	29331	1755	2383	0.23	-1.74	0.01	-0.00	0.00	0.00	0.00	-11.40	-6.57	-1.99	15	4	156
17	29486	1568	29434	1784	2379	0.17	-1.70	0.03	-0.00	0.00	0.00	0.00	-11.57	-4.86	-2.16	17	4	176
18	29575	1586	29540	1805	2376	0.12	-1.67	0.04	-0.00	0.00	0.00	0.00	-11.69	-3.19	-2.28	18	9	190
19	29665	1596	29647	1818	2372	0.07	-1.65	0.05	-0.00	0.00	0.00	0.00	-11.76	-1.54	-2.35	19	8	200
20	29755	1600	29755	1822	2369	0.02	-1.63	0.07	-0.00	0.00	0.00	0.00	-11.78	0.09	-2.37	20	0	202 -0 ***
21	29845	1596	29863	1818	2367	-0.02	-1.63	0.08	0.00	0.00	0.00	0.00	-11.76	1.72	-2.34	19	6	198
22	29935	1586	29970	1805	2363	-0.07	-1.63	0.09	0.00	0.00	0.00	0.00	-11.69	3.35	-2.25	18	6	187
23	30024	1568	30076	1784	2360	-0.11	-1.64	0.11	0.00	0.00	0.00	0.00	-11.58	4.99	-2.12	16	9	171
24	30111	1544	30179	1755	2358	-0.17	-1.66	0.12	0.00	0.00	0.00	0.00	-11.41	6.66	-1.93	14	9	151
25	30196	1513	30281	1718	2355	-0.22	-1.69	0.14	0.00	0.00	0.00	0.00	-11.19	8.35	-1.71	12	5	127
26	30278	1475	30379	1673	2353	-0.28	-1.72	0.15	0.00	0.00	0.00	0.00	-10.91	10.06	-1.44	10	0	102
27	30357	1431	30473	1620	2351	-0.35	-1.75	0.17	0.00	0.00	0.00	0.00	-10.55	11.81	-1.13	7	3	127
28	30432	1381	30562	1560	2348	0.00	-1.78	0.24	0.00	0.00	0.00	0.00	-10.55	13.60	-0.87	5	1	148
29	30503	1325	30647	1494	2346	0.00	-1.82	0.27	0.00	0.00	0.00	0.00	-10.55	15.42	-0.62	3	3	166
30	30570	1263	30727	1421	2344	0.00	-1.86	0.29	0.00	0.00	0.00	0.00	-10.55	17.28	-0.40	1	9	180
31	30631	1197	30800	1342	2343	0.00	-1.87	0.31	0.00	0.00	0.00	0.00	-10.55	19.15	-0.21	9	12	190
32	30688	1126	30867	1257	2341	0.00	-1.87	0.32	0.00	0.00	0.00	0.00	-10.55	21.02	-0.09	2	6	196
33	30738	1051	30927	1168	2340	0.00	-1.84	0.32	0.00	0.00	0.00	0.00	-10.55	22.87	-0.04	-0	4	198
34	30783	97230980	1074	2339	0.00	-1.79	0.32	0.00	0.00	0.00	0.00	-10.55	24.65	-0.09	2	5	197	
35	30821	89031025	9762338	0.00	-1.70	0.31	0.00	0.00	0.00	0.00	-10.55	26.35	-0.26	7	11	191		
36	30852	80631063	8752337	0.00	-1.57	0.28	0.00	0.00	0.00	0.00	-10.55	27.92	-0.55	16	21	181		
37	30877	71931093	7712336	0.00	-1.41	0.25	0.00	0.00	0.00	0.00	-10.55	29.33	-0.99	30	34	168		
38	30895	63031114	6662336	0.00	-1.20	0.21	0.00	0.00	0.00	0.00	-10.55	30.53	-1.59	48	52	150		
39	30906	54031127	5592335	0.00	-0.95	0.15	0.00	0.00	0.00	0.00	-10.55	31.48	-2.36	71	76	126		
40	30910	45031132	4512335	0.00	-0.66	0.09	0.00	0.00	0.00	0.00	-10.55	32.14	-3.29	100	105	97		

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust

Base level: -1500 [mm] Top level: 350 [mm] Thickness at top: 1700 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	30910	32610	350	-120.08	-1.47	-120.08	3.94	31784	31801	-0.06	-0.08	874.23	808.61
1	30910	32610	-267	-23.06	-1.47	-143.15	3.03	31771	31791	-0.08	-0.09	860.96	818.59
2	30910	32610	-883	-23.06	-1.47	-166.21	2.12	31761	31785	-0.09	-0.10	850.91	825.35
3	30910	32610	-1500	-23.06	-1.47	-189.27	1.22	31753	31780	-0.11	-0.11	842.91	830.06

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right

Shape: Circular
Span: 2570 [mm] Rise: 1190 [mm] Q-rise: 1030 [mm]
Ring thickness at crown: 222 [mm] Ring thickness at springing: 222 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	32610	35032389	3672312	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-12.02	-35.69	-3.01	8	0	85	117	
1	32621	44632401	4792312	0.00	-1.01	-0.15	0.00	0.00	0.00	0.00	-12.02	-34.68	-2.07	5	5	60	142	
2	32639	54032423	5902312	0.00	-1.29	-0.20	0.00	0.00	0.00	0.00	-12.02	-33.39	-1.33	3	5	40	162	
3	32664	63332452	6992311	0.00	-1.52	-0.23	0.00	0.00	0.00	0.00	-12.02	-31.87	-0.77	2	0	25	177	
4	32696	72432489	8052311	0.00	-1.71	-0.26	0.00	0.00	0.00	0.00	-12.02	-30.16	-0.39	1	0	14	188	
5	32735	81232535	9092310	0.00	-1.85	-0.27	0.00	0.00	0.00	0.00	-12.02	-28.31	-0.16	3	7	195		
6	32780	89732588	1008	2309	0.00	-1.96	-0.27	0.00	0.00	0.00	0.00	-12.02	-26.35	-0.06	-0	4	198	

7 32831 97932648 1104 2308 0.00 -2.03 -0.26 0.00 0.00 0.00 0.00 -12.02 -24.32 -0.08 1 5 197
8 32888 1056 32715 1195 2307 0.00 -2.06 -0.24 0.00 0.00 0.00 0.00 -12.02 -22.26 -0.19 6 9 193
9 32951 1129 32789 1280 2306 0.00 -2.07 -0.22 0.00 0.00 0.00 0.00 -12.02 -20.19 -0.37 14 18 184
10 33019 1197 32868 1360 2305 0.00 -2.06 -0.19 0.00 0.00 0.00 0.00 -12.02 -18.13 -0.60 27 30 172
11 33092 1260 32954 1433 2303 0.00 -2.02 -0.16 0.00 0.00 0.00 0.00 -12.02 -16.11 -0.86 43 46 156
12 33170 1317 33045 1500 2302 0.00 -1.97 -0.13 0.00 0.00 0.00 0.00 -12.02 -14.13 -1.15 63 65 137
13 33251 1368 33140 1560 2301 0.00 -1.92 -0.10 0.00 0.00 0.00 0.00 -12.02 -12.22 -1.43 85 88 114
14 33336 1413 33240 1613 2299 0.36 -1.87 -0.00 -0.00 0.00 0.00 0.00 -12.38 -10.35 -1.75 111 113 89
15 33425 1451 33344 1658 2297 0.29 -1.82 0.01 -0.00 0.00 0.00 0.00 -12.67 -8.53 -2.03 135 138 64
16 33516 1483 33450 1695 2296 0.22 -1.78 0.02 -0.00 0.00 0.00 0.00 -12.89 -6.75 -2.26 157 159 43
17 33609 1508 33559 1724 2294 0.16 -1.74 0.04 -0.00 0.00 0.00 0.00 -13.06 -5.01 -2.44 176 178 24
18 33703 1526 33670 1745 2292 0.11 -1.71 0.05 -0.00 0.00 0.00 0.00 -13.17 -3.30 -2.57 189 191 11
19 33799 1536 33782 1758 2291 0.07 -1.68 0.06 -0.00 0.00 0.00 0.00 -13.23 -1.61 -2.64 198 200 2
20 33895 1540 33895 1762 2290 0.02 -1.67 0.07 -0.00 0.00 0.00 0.00 -13.26 0.06 -2.67 200 202 -0 ***
21 33991 1536 34008 1758 2288 -0.02 -1.67 0.09 0.00 0.00 0.00 0.00 -13.23 1.73 -2.63 197 199 3
22 34087 1526 34120 1745 2286 -0.07 -1.68 0.10 0.00 0.00 0.00 0.00 -13.17 3.40 -2.55 187 189 13
23 34181 1508 34231 1724 2285 -0.11 -1.69 0.12 0.00 0.00 0.00 0.00 -13.06 5.09 -2.41 173 175 27
24 34274 1483 34340 1695 2283 -0.16 -1.72 0.13 0.00 0.00 0.00 0.00 -12.90 6.81 -2.22 154 156 46
25 34365 1451 34446 1658 2281 -0.22 -1.75 0.15 0.00 0.00 0.00 0.00 -12.68 8.56 -1.99 132 134 68
26 34454 1413 34550 1613 2280 -0.28 -1.79 0.16 0.00 0.00 0.00 0.00 -12.40 10.35 -1.70 108 110 92
27 34539 1368 34650 1560 2278 -0.35 -1.83 0.18 0.00 0.00 0.00 0.00 -12.05 12.18 -1.38 82 85 117
28 34620 1317 34745 1500 2277 0.00 -1.88 0.26 0.00 0.00 0.00 0.00 -12.05 14.06 -1.10 60 63 139
29 34698 1260 34836 1433 2276 0.00 -1.93 0.28 0.00 0.00 0.00 0.00 -12.05 15.99 -0.82 41 44 158
30 34771 1197 34922 1360 2274 0.00 -1.98 0.30 0.00 0.00 0.00 0.00 -12.05 17.96 -0.56 25 28 174
31 34839 1129 35001 1280 2273 0.00 -2.01 0.33 0.00 0.00 0.00 0.00 -12.05 19.97 -0.33 13 16 186
32 34902 1056 35075 1195 2272 0.00 -2.03 0.34 0.00 0.00 0.00 0.00 -12.05 22.00 -0.16 5 8 194
33 34959 97935142 1104 2271 0.00 -2.02 0.35 0.00 0.00 0.00 0.00 -12.05 24.02 -0.06 0 4 198
34 35010 89735202 1008 2270 0.00 -1.99 0.35 0.00 0.00 0.00 0.00 -12.05 26.01 -0.06 -0 4 198
35 35055 81235255 9092269 0.00 -1.92 0.35 0.00 0.00 0.00 0.00 -12.05 27.93 -0.17 3 8 194
36 35094 72435301 8052268 0.00 -1.82 0.33 0.00 0.00 0.00 0.00 -12.05 29.75 -0.41 10 15 187
37 35126 63335338 6992267 0.00 -1.68 0.30 0.00 0.00 0.00 0.00 -12.05 31.43 -0.81 22 26 176
38 35151 54035367 5902267 0.00 -1.50 0.27 0.00 0.00 0.00 0.00 -12.05 32.92 -1.37 37 42 160
39 35169 44635389 4792266 0.00 -1.27 0.22 0.00 0.00 0.00 0.00 -12.05 34.19 -2.12 57 62 140
40 35180 35035401 3672266 0.00 -1.00 0.16 0.00 0.00 0.00 0.00 -12.05 35.20 -3.06 82 88 114

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 70 [mm] Thickness at top: 6750 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

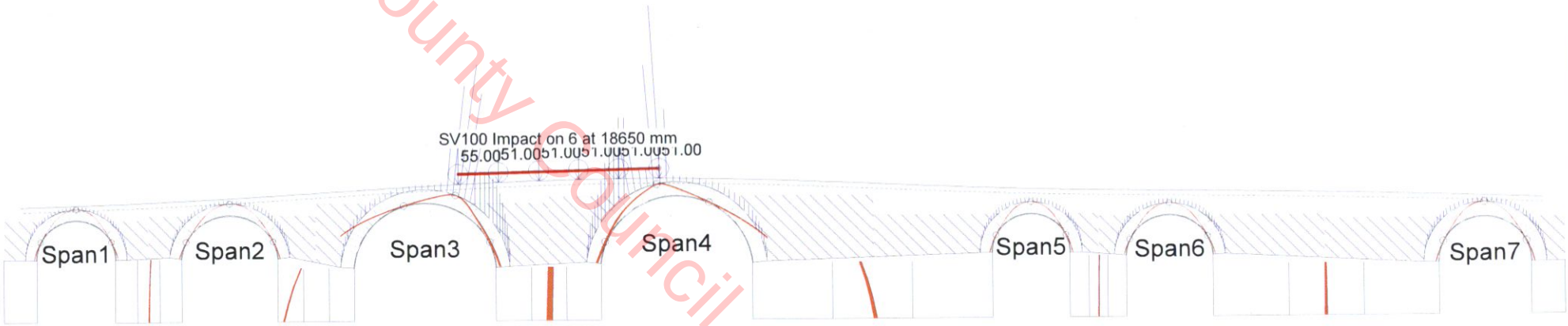
Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
0 35180 41930 70 -355.30 1.25 -355.30 -8.36 38506 38557 -0.05 -0.05 3326.09 3373.16
1 35180 41930 -453 -77.71 1.25 -433.02 -7.71 38506 38568 -0.07 -0.06 3326.27 3361.87
2 35180 41930 -977 -77.71 1.25 -510.73 -7.05 38505 38578 -0.08 -0.07 3324.71 3352.33
3 35180 41930 -1500 -77.71 1.25 -588.45 -6.40 38502 38586 -0.09 -0.09 3322.09 3343.85

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2720 [mm] Rise: 1350 [mm] Q-rise: 1100 [mm]
Ring thickness at crown: 270 [mm] Ring thickness at springing: 270 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
0 41930 70 41660 72 2127 0.00 0.00 0.00 0.00 0.00 0.00 0.00 -10.80 -38.41 -3.74 94 100 150
1 41935 17641666 1992127 0.00 -0.94 -0.16 0.00 0.00 0.00 0.00 -10.80 -37.47 -2.61 65 71 179
2 41948 28241682 3262126 0.00 -1.31 -0.24 0.00 0.00 0.00 0.00 -10.80 -36.16 -1.70 43 48 202
3 41970 38641707 4502125 0.00 -1.62 -0.30 0.00 0.00 0.00 0.00 -10.80 -34.54 -1.00 25 30 220

4	41999	48841743	5732124	0.00	-1.87	-0.35	0.00	0.00	0.00	0.00	-10.80	-32.67	-0.51	12	17	233			
5	42036	58741788	6922123	0.00	-2.07	-0.37	0.00	0.00	0.00	0.00	-10.80	-30.60	-0.21	4	9	241			
6	42081	68441841	8072121	0.00	-2.21	-0.38	0.00	0.00	0.00	0.00	-10.80	-28.39	-0.07	-0	4	246			
7	42134	77641904	9182119	0.00	-2.30	-0.37	0.00	0.00	0.00	0.00	-10.80	-26.09	-0.06	0	4	246			
8	42193	86441976	1024	2117	0.00	-2.35	-0.35	0.00	0.00	0.00	0.00	-10.80	-23.74	-0.18	5	9	241		
9	42259	94742055	1124	2114	0.00	-2.35	-0.32	0.00	0.00	0.00	0.00	-10.80	-21.39	-0.38	15	18	232		
10	42332	1025	42142	1217	2111	0.00	-2.32	-0.28	0.00	0.00	0.00	0.00	-10.80	-19.07	-0.65	29	32	218	
11	42410	1097	42235	1303	2108	0.00	-2.26	-0.24	0.00	0.00	0.00	0.00	-10.80	-16.81	-0.95	48	51	199	
12	42494	1163	42336	1382	2104	0.00	-2.18	-0.20	0.00	0.00	0.00	0.00	-10.80	-14.63	-1.28	73	75	175	
13	42582	1221	42442	1452	2101	0.00	-2.09	-0.15	0.00	0.00	0.00	0.00	-10.80	-12.54	-1.61	101	103	147	
14	42675	1273	42553	1514	2097	0.37	-2.01	-0.02	-0.00	0.00	0.00	0.00	-11.17	-10.53	-1.99	134	136	114	
15	42772	1317	42669	1567	2093	0.28	-1.94	-0.01	-0.00	0.00	0.00	0.00	-11.46	-8.60	-2.31	166	168	82	
16	42872	1354	42789	1611	2089	0.21	-1.86	0.01	-0.00	0.00	0.00	0.00	-11.67	-6.73	-2.57	194	196	54	
17	42974	1383	42911	1645	2084	0.15	-1.80	0.03	-0.00	0.00	0.00	0.00	-11.83	-4.94	-2.77	218	220	30	
18	43078	1403	43036	1670	2080	0.10	-1.74	0.05	-0.00	0.00	0.00	0.00	-11.93	-3.19	-2.91	236	238	12	
19	43184	1416	43163	1685	2075	0.06	-1.70	0.06	-0.00	0.00	0.00	0.00	-11.99	-1.50	-2.98	246	248	2	
20	43290	1420	43290	1690	2070	0.02	-1.67	0.08	-0.00	0.00	0.00	0.00	-12.01	0.17	-2.99	248	250	-0	***
21	43396	1416	43417	1685	2064	-0.02	-1.66	0.10	0.00	0.00	0.00	0.00	-11.99	1.83	-2.94	242	244	6	
22	43502	1403	43544	1670	2060	-0.06	-1.66	0.11	0.00	0.00	0.00	0.00	-11.93	3.50	-2.83	229	231	19	
23	43606	1383	43669	1645	2054	-0.10	-1.69	0.13	0.00	0.00	0.00	0.00	-11.83	5.18	-2.66	209	211	39	
24	43708	1354	43791	1611	2050	-0.14	-1.72	0.15	0.00	0.00	0.00	0.00	-11.69	6.90	-2.44	183	185	65	
25	43808	1317	43911	1567	2045	-0.20	-1.77	0.17	0.00	0.00	0.00	0.00	-11.49	8.67	-2.16	154	156	94	
26	43905	1273	44027	1514	2040	-0.26	-1.83	0.20	0.00	0.00	0.00	0.00	-11.23	10.50	-1.83	123	125	125	
27	43998	1221	44138	1452	2035	-0.33	-1.89	0.22	0.00	0.00	0.00	0.00	-10.90	12.39	-1.46	91	94	156	
28	44086	1163	44244	1382	2031	0.00	-1.96	0.32	0.00	0.00	0.00	0.00	-10.90	14.35	-1.13	65	67	183	
29	44170	1097	44345	1303	2026	0.00	-2.04	0.35	0.00	0.00	0.00	0.00	-10.90	16.38	-0.82	42	45	205	
30	44248	1025	44438	1217	2023	0.00	-2.12	0.39	0.00	0.00	0.00	0.00	-10.90	18.50	-0.54	24	27	223	
31	44321	94744525	1124	2019	0.00	-2.18	0.42	0.00	0.00	0.00	0.00	-10.90	20.68	-0.30	12	15	235		
32	44387	86444604	1024	2016	0.00	-2.21	0.45	0.00	0.00	0.00	0.00	-10.90	22.89	-0.13	3	7	243		
33	44446	77644676	9182013	0.00	-2.21	0.46	0.00	0.00	0.00	0.00	-10.90	25.10	-0.05	-0	4	246			
34	44499	68444739	8072010	0.00	-2.18	0.47	0.00	0.00	0.00	0.00	-10.90	27.28	-0.09	1	5	245			
35	44544	58744792	6922008	0.00	-2.10	0.45	0.00	0.00	0.00	0.00	-10.90	29.38	-0.27	6	11	239			
36	44581	48844837	5732006	0.00	-1.98	0.43	0.00	0.00	0.00	0.00	-10.90	31.36	-0.61	16	21	229			
37	44610	38644873	4502005	0.00	-1.80	0.38	0.00	0.00	0.00	0.00	-10.90	33.15	-1.13	30	35	215			
38	44632	28244898	3262004	0.00	-1.57	0.32	0.00	0.00	0.00	0.00	-10.90	34.72	-1.85	49	54	196			
39	44645	17644914	1992003	0.00	-1.27	0.25	0.00	0.00	0.00	0.00	-10.90	35.99	-2.78	73	78	172			
40	44650	70	44920	72	2003	0.00	-0.93	0.16	0.00	0.00	0.00	0.00	-10.90	36.92	-3.93	104	109	141	

Beaumont Bridge



Upperbound condition with backing present => SV100 load capacity

gammaFl dead load: 1.00 SV100 Impact on 6 @ 18650 [mm]
gammaFl superimposed: 1.00
gammaFl live load: 2.50
gammaF3 load effect: 1.00
gammaM material: 1.00
File path: V:\5210920\7 Calcs\72 Model\Beaumont Bridge - UB w backing.brg

NAME: Beaumont Bridge
LOCATION: Beaumont, Meath
NUMBER: MH-L1615-001.00
ATKINS
DATE: 20 December 2021
Printed on: Wednesday, January 12, 2022 15:27:00

Bridge Name: Beaumont Bridge Bridge Location: Beaumont, Meath
Bridge Number: MH-L1615-001.00
Number of spans: 7

SAFETY FACTORS
Factor for deadload: 1.00 Factor for superimposed deadload: 1.00 Factor for surfacing: 1.00
Factor for live load: 2.50 Factor for load effect: 1.00 Factor for material strength: 1.00

APPLIED LOAD CASES
1.SV100 Impact on 6 Total weight: 1216.44 [kN] Position: 18650 [mm]
124.00 6 1.00 20.40 1.20 20.40 2.40 20.40 3.60 20.40 4.80 20.40 6.00 22.00 1.00 2.65 3.00
Effective lane width: 3350 [mm] Distribution length: 2827 [mm]

Applied distribution mode: Archie-M, BD21/97
Applied live load pressure: Active pressure

STRUCTURE PROPERTIES
Road shape: True shape (multi-point method)
Road points: (-500, 1950) (1180, 2000) (5805, 2200) (11660, 2550) (19175, 2750) (29755, 2370) (33895, 2290) (43290, 2070) (45000, 2000)
Depth of surfacing: 150Depth of overlay: 0
Surface unit weight: 23.00 [kN/m3] Overlay unit weight: 23.00 [kN/m3]
Lane width: 0

Fill unit weight: 18.00 [kN/m3] Fill phi: 30 degree

Left abutment Base level:-1500 [mm] Height: 380 [mm] Width: 1000 [mm]
Right abutment Base level:-1500 [mm] Height: 70 [mm] Width: 1000 [mm]

Right abutment Base level:-1500 [mm] Height: 70 [mm] Width: 1000 [mm]
Shape: Circular
Span: 2360 [mm] Rise: 1170 [mm] Q-rise: 1050 [mm]
Ring thickness at crown:350 [mm] Ring thickness at springing: 350 [mm] Mortar loss: 20 [mm]
Masonry unit weight:22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	0	380	-350	3831954	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.80	-29.56	-2.05	67	72	258	
1	4	472	-344	5021954	0.00	-1.00	-0.21	0.00	-0.00	0.00	0.00	-5.80	-28.56	-1.43	47	52	278	
2	16	563	-329	6211954	0.00	-1.26	-0.29	0.00	-0.00	0.00	0.00	-5.80	-27.30	-0.93	31	35	295	
3	35	654	-305	7381955	0.00	-1.47	-0.34	0.00	-0.00	0.00	0.00	-5.80	-25.83	-0.54	19	22	308	
4	60	742	-272	8531956	0.00	-1.63	-0.38	0.00	-0.00	0.00	0.00	-5.80	-24.19	-0.27	9	13	317	
5	93	828	-230	9641957	0.00	-1.75	-0.40	0.00	-0.00	0.00	0.00	-5.80	-22.44	-0.10	3	6	324	
6	132	912	-179	1073	1959	0.00	-1.82	-0.40	0.00	-0.00	0.00	0.00	-5.80	-20.63	-0.03	-0	3	327
7	177	992	-120	1177	1961	0.00	-1.85	-0.38	0.00	-0.00	0.00	0.00	-5.80	-18.78	-0.04	1	4	326
8	229	1068	-53	1276	1963	0.00	-1.84	-0.36	0.00	-0.00	0.00	0.00	-5.80	-16.94	-0.13	6	9	321
9	286	1141	21	1369	1965	0.00	-1.80	-0.32	0.00	-0.00	0.00	0.00	-5.80	-15.15	-0.27	16	19	311
10	349	1208	103	1456	1968	0.00	-1.73	-0.28	0.00	-0.00	0.00	0.00	-5.80	-13.42	-0.45	32	34	296
11	417	1270	191	1537	1970	0.00	-1.65	-0.23	0.00	-0.00	0.00	0.00	-5.80	-11.77	-0.67	55	56	274
12	490	1327	285	1611	1972	0.29	-1.56	-0.10	0.00	-0.00	0.00	0.00	-6.09	-10.21	-0.97	88	89	241
13	566	1378	384	1677	1975	0.22	-1.48	-0.08	0.00	-0.00	0.00	0.00	-6.31	-8.73	-1.24	124	125	205
14	647	1423	489	1735	1978	0.16	-1.40	-0.06	0.00	-0.00	0.00	0.00	-6.48	-7.33	-1.48	163	164	166
15	731	1461	597	1785	1982	0.12	-1.33	-0.04	0.00	-0.00	0.00	0.00	-6.59	-6.00	-1.70	202	203	127
16	817	1493	710	1826	1985	0.08	-1.26	-0.02	0.00	-0.00	0.00	0.00	-6.68	-4.74	-1.88	240	241	89
17	906	1518	825	1858	1989	0.05	-1.20	-0.00	0.00	-0.00	0.00	0.00	-6.73	-3.54	-2.02	274	275	55
18	996	1536	942	1881	1992	0.03	-1.16	0.01	0.00	-0.00	0.00	0.00	-6.76	-2.38	-2.13	302	303	27
19	108	8	1546	1061	1895	1996	0.02	-1.13	0.03	0.00	-0.00	0.00	0.00	-6.78	-1.26	-2.20	321	322	28
20	118	0	1550	1180	1900	2000	0.01	-1.12	0.04	0.00	-0.00	0.00	0.00	-6.79	-0.14	-2.24	329	330	-0 ***
21	127	2	1546	1299	1895	2003	-0.01	-1.13	0.06	-0.00	-0.00	0.00	0.00	-6.78	0.99	-2.23	325	326	4

22	1364	1536	1418	1881	2007	-0.02	-1.15	0.08	-0.00	-0.00	0.00	0.00	-6.76	2.14	-2.18	310	311	19
23	1454	1518	1535	1858	2011	-0.04	-1.20	0.10	-0.00	-0.00	0.00	0.00	-6.72	3.34	-2.09	285	287	43
24	1543	1493	1650	1826	2015	-0.06	-1.25	0.12	-0.00	-0.00	0.00	0.00	-6.66	4.59	-1.96	253	254	76
25	1629	1461	1763	1785	2019	-0.09	-1.33	0.14	-0.00	-0.00	0.00	0.00	-6.57	5.92	-1.79	215	216	114
26	1713	1423	1871	1735	2023	-0.14	-1.41	0.17	-0.00	-0.00	0.00	0.00	-6.43	7.33	-1.59	175	176	154
27	1794	1378	1976	1677	2026	-0.19	-1.49	0.19	-0.00	-0.00	0.00	0.00	-6.24	8.82	-1.34	135	136	194
28	1870	1327	2075	1611	2030	-0.25	-1.58	0.22	-0.00	-0.00	0.00	0.00	-5.99	10.39	-1.06	96	98	232
29	1943	1270	2169	1537	2034	-0.33	-1.66	0.25	-0.00	-0.00	0.00	0.00	-5.66	12.06	-0.75	61	63	267
30	2011	1208	2257	1456	2037	0.00	-1.75	0.37	0.00	-0.00	0.00	0.00	-5.66	13.81	-0.52	37	39	291
31	2074	1141	2339	1369	2040	0.00	-1.84	0.41	0.00	-0.00	0.00	0.00	-5.66	15.65	-0.33	20	22	308
32	2131	1068	2413	1276	2043	0.00	-1.90	0.45	0.00	-0.00	0.00	0.00	-5.66	17.55	-0.17	8	11	319
33	2183	992	2480	1177	2045	0.00	-1.94	0.48	0.00	-0.00	0.00	0.00	-5.66	19.48	-0.07	2	5	325
34	2228	912	2539	1073	2047	0.00	-1.94	0.50	0.00	-0.00	0.00	0.00	-5.66	21.42	-0.03	0	3	327
35	2267	828	2590	964	2049	0.00	-1.90	0.50	0.00	-0.00	0.00	0.00	-5.66	23.32	-0.08	2	5	325
36	2300	742	2632	853	2051	0.00	-1.82	0.48	0.00	-0.00	0.00	0.00	-5.66	25.14	-0.23	7	11	319
37	2325	654	2665	738	2052	0.00	-1.69	0.44	0.00	-0.00	0.00	0.00	-5.66	26.83	-0.48	16	20	310
38	2344	563	2689	621	2053	0.00	-1.51	0.39	0.00	-0.00	0.00	0.00	-5.66	28.34	-0.85	27	31	299
39	2356	472	2704	502	2053	0.00	-1.29	0.31	0.00	-0.00	0.00	0.00	-5.66	29.63	-1.34	42	47	283
40	2360	380	2710	383	2054	0.00	-1.01	0.21	0.00	-0.00	0.00	0.00	-5.66	30.64	-1.94	61	66	264

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 380 [mm] Thickness at top: 2000 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	2360	4360	380	-115.65	-3.36	-115.65	7.15	3414	3430	-0.05	-0.07	1053.57	929.91
1	2360	4360	-247	-27.57	-3.36	-143.22	5.05	3385	3405	-0.06	-0.08	1025.00	954.54
2	2360	4360	-873	-27.57	-3.36	-170.79	2.94	3365	3389	-0.08	-0.09	1005.02	970.58
3	2360	4360	-1500	-27.57	-3.36	-198.37	0.84	3350	3378	-0.10	-0.10	990.05	981.61

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2890 [mm] Rise: 1280 [mm] Q-rise: 1020 [mm]
Ring thickness at crown: 370 [mm] Ring thickness at springing: 370 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	4360	400	3993	445	2109	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-9.02	-38.10	-2.17	53	59	291
1	4377	504	4013	575	2109	0.00	-1.68	-0.41	0.00	-0.00	0.00	0.00	-9.02	-36.42	-1.42	35	40	310
2	4401	607	4044	704	2111	0.00	-1.91	-0.48	0.00	-0.00	0.00	0.00	-9.02	-34.51	-0.84	21	26	324
3	4432	708	4083	830	2113	0.00	-2.09	-0.52	0.00	-0.00	0.00	0.00	-9.02	-32.42	-0.43	10	15	335
4	4471	806	4131	954	2115	0.00	-2.22	-0.54	0.00	-0.00	0.00	0.00	-9.02	-30.20	-0.17	3	8	342
5	4516	901	4189	1073	2118	0.00	-2.30	-0.54	0.00	-0.00	0.00	0.00	-9.02	-27.90	-0.06	-0	4	346
6	4569	993	4254	1188	2121	0.00	-2.33	-0.51	0.00	-0.00	0.00	0.00	-9.02	-25.57	-0.07	1	4	346
7	4627	1080	4328	1298	2124	0.00	-2.32	-0.48	0.00	-0.00	0.00	0.00	-9.02	-23.25	-0.17	6	9	341
8	4693	1163	4410	1402	2128	0.00	-2.28	-0.43	0.00	-0.00	0.00	0.00	-9.02	-20.97	-0.37	15	18	332
9	4763	1241	4499	1500	2132	0.00	-2.20	-0.38	0.00	-0.00	0.00	0.00	-9.02	-18.77	-0.62	30	33	317
10	4840	1314	4594	1591	2137	0.00	-2.11	-0.32	0.00	-0.00	0.00	0.00	-9.02	-16.66	-0.92	51	53	297
11	4921	1381	4697	1675	2142	0.00	-1.99	-0.27	0.00	-0.00	0.00	0.00	-9.02	-14.67	-1.25	77	79	271
12	5007	1442	4805	1752	2147	0.33	-1.89	-0.11	0.00	-0.00	0.00	0.00	-9.34	-12.78	-1.68	112	115	235
13	5098	1497	4918	1820	2153	0.25	-1.79	-0.08	0.00	-0.00	0.00	0.00	-9.59	-10.98	-2.07	150	152	198
14	5192	1544	5036	1880	2159	0.19	-1.70	-0.06	0.00	-0.00	0.00	0.00	-9.78	-9.28	-2.42	189	191	159
15	5289	1585	5158	1931	2165	0.14	-1.62	-0.04	0.00	-0.00	0.00	0.00	-9.92	-7.66	-2.73	227	229	121
16	5389	1619	5283	1974	2172	0.10	-1.55	-0.01	0.00	-0.00	0.00	0.00	-10.02	-6.11	-2.99	263	265	85
17	5491	1646	5411	2007	2178	0.07	-1.49	0.01	0.00	-0.00	0.00	0.00	-10.08	-4.62	-3.21	295	297	53
18	5595	1665	5541	2031	2185	0.04	-1.45	0.03	0.00	-0.00	0.00	0.00	-10.13	-3.17	-3.37	321	323	27

19	5700	1676	5673	2045	2192	0.02	-1.42	0.05	0.00	-0.00	0.00	0.00	-10.15	-1.75	-3.49	3393419			
20	5805	1680	5805	2050	2199	0.01	-1.42	0.07	0.00	-0.00	0.00	0.00	-10.16	-0.33	-3.55	349350-0	***		
21	5910	1676	5937	2045	2207	-0.01	-1.44	0.09	-0.00	-0.00	0.00	0.00	-10.15	1.10	-3.56	3483491			
22	6015	1665	6069	2031	2214	-0.03	-1.47	0.11	-0.00	-0.00	0.00	0.00	-10.13	2.58	-3.51	33733812			
23	6119	1646	6199	2007	2221	-0.05	-1.53	0.13	-0.00	-0.00	0.00	0.00	-10.07	4.11	-3.40	31731832			
24	6221	1619	6327	1974	2229	-0.08	-1.60	0.16	-0.00	-0.00	0.00	0.00	-9.99	5.71	-3.24	28829060			
25	6321	1585	6452	1931	2236	-0.12	-1.69	0.19	-0.00	-0.00	0.00	0.00	-9.87	7.40	-3.02	25425595			
26	6418	1544	6574	1880	2243	-0.17	-1.79	0.22	-0.00	-0.00	0.00	0.00	-9.69	9.20	-2.73	215217133			
27	6512	1497	6692	1820	2250	-0.24	-1.90	0.26	-0.00	-0.00	0.00	0.00	-9.46	11.09	-2.39	174176174			
28	6603	1442	6805	1752	2257	-0.31	-2.01	0.29	-0.00	-0.00	0.00	0.00	-9.14	13.10	-1.99	133135215			
29	6689	1381	6913	1675	2263	-0.41	-2.11	0.33	-0.00	-0.00	0.00	0.00	-8.74	15.21	-1.53	93	96	254	
30	6770	1314	7016	1591	2269	0.00	-2.23	0.49	0.00	-0.00	0.00	0.00	-8.74	17.44	-1.17	64	66	284	
31	6847	1241	7111	1500	2275	0.00	-2.34	0.55	0.00	-0.00	0.00	0.00	-8.74	19.78	-0.84	40	43	307	
32	6917	1163	7200	1402	2280	0.00	-2.44	0.61	0.00	-0.00	0.00	0.00	-8.74	22.22	-0.54	22	26	324	
33	6983	1080	7282	1298	2285	0.00	-2.51	0.65	0.00	-0.00	0.00	0.00	-8.74	24.73	-0.30	10	14	336	
34	7041	9937356	1188	2289	0.00	-2.54	0.69	0.00	-0.00	0.00	0.00	-8.74	27.27	-0.13	3	7	343		
35	7094	9017421	1073	2293	0.00	-2.53	0.70	0.00	-0.00	0.00	0.00	-8.74	29.81	-0.07	-0	4	346		
36	7139	8067479	9542297	0.00	-2.48	0.70	0.00	-0.00	0.00	0.00	-8.74	32.29	-0.12	1	6	344			
37	7178	7087527	8302300	0.00	-2.38	0.68	0.00	-0.00	0.00	0.00	-8.74	34.67	-0.31	6	11	339			
38	7209	6077566	7042302	0.00	-2.23	0.63	0.00	-0.00	0.00	0.00	-8.74	36.90	-0.66	15	20	330			
39	7233	5047597	5752304	0.00	-2.02	0.56	0.00	-0.00	0.00	0.00	-8.74	38.92	-1.19	27	33	317			
40	7250	4007617	4452306	0.00	-1.75	0.47	0.00	-0.00	0.00	0.00	-8.74	40.66	-1.90	43	49	301			

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 100 [mm] Thickness at top: 2300 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right

0	7250	9550	100	-211.35	-118.12	-211.35	-96.68	7927	7958	-0.20	0.02	677.44	1592.37	
1	7250	9550	-433	-26.99	-118.12	-238.34	-159.68	7713	7747	-0.28	0.08	462.98	1802.98	
2	7250	9550	-967	-26.99	-118.12	-265.32	-222.68	7542	7580	-0.37	0.14	291.75	1970.35	
3	7250	9550	-1500	-26.99	-118.12	-292.31	-285.68	7402	7444	-0.45	0.20	151.78	2106.46	

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 4220 [mm] Rise: 1930 [mm] Q-rise: 1560 [mm]
Ring thickness at crown: 420 [mm] Ring thickness at springing: 420 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust

0	9550	1009132	1372400	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-126.86	-94.77	-159.93	1506	1521	-1121	***		
1	9570	2569155	3242401	0.00	-2.70	-0.76	0.00	-0.00	0.00	0.00	-126.86	-92.07	-141.07	1258	1274	-874	***		
2	9601	4099193	5082403	0.00	-3.20	-0.92	0.00	-0.00	0.00	0.00	-126.86	-88.87	-123.26	1053	1069	-669	***		
3	9643	5609244	6892407	0.00	-3.58	-1.02	0.00	-0.00	0.00	0.00	-126.86	-85.29	-106.56	879896	-496	***			
4	9697	7089308	8662411	0.00	-3.85	-1.07	0.00	-0.00	0.00	0.00	-126.86	-81.44	-91.01	730748	-348	***			
5	9761	8519385	1037	2415	0.00	-4.01	-1.07	0.00	-0.00	0.00	0.00	-126.86	-77.43	-76.64	601619	-219	***		
6	9836	9899474	1203	2421	0.00	-4.08	-1.03	0.00	-0.00	0.00	0.00	-126.86	-73.35	-63.48	488506	-106	***		
7	9921	1121	9576	1361	2427	0.00	-4.06	-0.95	0.00	-0.00	0.00	0.00	-126.86	-69.29	-51.55	389408	-8	***	
8	10015	1247	9689	1511	2434	0.00	-3.97	-0.85	0.00	-0.00	0.00	0.00	-126.86	-65.32	-40.86	30332278			
9	10118	1365	9813	1653	2442	0.00	-3.81	-0.73	0.00	-0.00	0.00	0.00	-126.86	-61.51	-31.42	229248152			
10	10230	1475	9947	1785	2450	0.00	-3.61	-0.61	0.00	-0.00	0.00	0.00	-126.86	-57.90	-23.24	166185215			
11	10350	1576	10090	1906	2459	0.00	-3.38	-0.49	0.00	-0.00	0.00	0.00	-126.86	-54.52	-16.33	113132268			
12	10477	1669	10242	2017	2468	0.00	-3.12	-0.37	0.00	-0.00	0.00	0.00	-126.86	-51.40	-10.71	70	90	310	
13	10610	1751	10402	2116	2478	0.40	-2.88	-0.11	0.00	-0.00	0.00	0.00	-127.26	-48.52	-6.49	39	58	342	
14	10749	1824	10568	2203	2487	0.29	-2.69	-0.07	0.00	-0.00	0.00	0.00	-127.55	-45.83	-3.50	16	36	364	
15	10893	1886	10741	2278	2498	0.20	-2.50	-0.02	0.00	-0.00	0.00	0.00	-127.75	-43.33	-1.76	3	23	377	

16	11041	1938	10919	2339	2508	0.13	-2.35	0.01	0.00	-0.00	0.00	0.00	-127.88	-40.98	-1.28	-0	19	381
17	11193	1978	11100	2388	2518	0.08	-2.22	0.05	0.00	-0.00	0.00	0.00	-127.96	-38.76	-2.06	6	25	375
18	11347	2007	11285	2422	2529	0.05	-2.13	0.08	0.00	-0.00	0.00	0.00	-128.01	-36.64	-4.11	22	41	359
19	11503	2024	11472	2443	2539	0.03	-2.07	0.11	0.00	-0.00	0.00	0.00	-128.04	-34.56	-7.42	48	66	334
20	11660	2030	11660	2450	2549	0.01	-2.06	0.15	0.00	-0.00	0.00	0.00	-128.05	-32.50	-11.96	84	103297	
21	11817	2024	11848	2443	2560	-0.01	-2.10	0.18	-0.00	-0.00	0.00	0.00	-128.04	-30.40	-17.70	132150250		
22	11973	2007	12035	2422	2569	-0.03	-2.18	0.22	-0.00	-0.00	0.00	0.00	-128.00	-28.22	-24.62	192210190		
23	12127	1978	12220	2388	2579	-0.07	-2.29	0.27	-0.08	-1.31	0.25	0.00	-127.86	-24.62	-32.70	266283117		
24	12279	1938	12401	2339	2588	-0.11	-2.45	0.32	-1.54	-17.41	2.94	0.00	-126.20	-4.76	-41.82	34235941		
25	12427	1886	12579	2278	2597	-0.18	-2.63	0.38	-4.80	-41.60	7.19	0.00	-121.22	39.48	-49.77	382400	-0	***
26	12571	1824	12752	2203	2605	-0.27	-2.84	0.45	-7.37	-51.20	9.36	0.00	-113.58	93.52	-53.11	36238218		
27	12710	1751	12918	2116	2614	-0.39	-3.07	0.53	-6.96	-39.93	7.73	0.00	-106.24	136.52	-50.00	30132476		
28	12843	1669	13078	2017	2621	-0.53	-3.30	0.61	-4.32	-20.89	4.28	0.00	-101.39	160.71	-41.74	228252148		
29	12970	1576	13230	1906	2627	0.00	-3.56	0.90	0.00	-10.78	3.20	0.00	-101.39	175.05	-32.89	162188212		
30	13090	1475	13373	1785	2634	0.00	-3.83	1.04	0.00	-11.62	3.74	0.00	-101.39	190.50	-25.05	109138262		
31	13202	1365	13507	1653	2640	0.00	-4.07	1.17	0.00	-13.15	4.45	0.00	-101.39	207.72	-18.51	68	100300	
32	13305	1247	13631	1511	2646	0.00	-4.27	1.29	0.00	-13.88	4.91	0.00	-101.39	225.87	-13.24	38	72	328
33	13399	1121	13744	1361	2650	0.00	-4.41	1.39	0.00	-13.83	5.09	0.00	-101.39	244.11	-9.32	18	55	345
34	13484	98913846	1203	2654	0.00	-4.48	1.45	0.00	-13.14	4.99	0.00	-101.39	261.73	-6.88	5	45	355	
35	13559	85113935	1037	2658	0.00	-4.46	1.48	0.00	-11.96	4.66	0.00	-101.39	278.16	-6.15	-0	42	358	
36	13623	70814012	8662661	0.00	-4.35	1.46	0.00	-10.48	4.16	0.00	-101.39	292.99	-7.40	2	46	354		
37	13677	56014076	6892663	0.00	-4.14	1.39	0.00	-8.79	3.54	0.00	-101.39	305.91	-10.88	11	57	343		
38	13719	40914127	5082665	0.00	-3.82	1.27	0.00	-6.98	2.84	0.00	-101.39	316.71	-16.86	27	75	325		
39	13750	25614165	3242666	0.00	-3.38	1.09	0.00	-5.12	2.08	0.00	-101.39	325.20	-25.53	52	100300			
40	13770	10014188	1372667	0.00	-2.82	0.86	0.00	-3.23	1.31	0.00	-101.39	331.24	-37.03	85	133267			

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 100 [mm] Thickness at top: 3150 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	13770	16920	100	-1123.17	-27.31	-1123.17	54.98	15314	15474	-0.32	-0.39	1543.72	1445.83
1	13770	16920	-433	-36.96	-27.31	-1160.13	40.41	15297	15463	-0.34	-0.39	1526.97	1457.30
2	13770	16920	-967	-36.96	-27.31	-1197.09	25.85	15281	15452	-0.36	-0.40	1511.09	1467.90
3	13770	16920	-1500	-36.96	-27.31	-1234.05	11.29	15266	15442	-0.38	-0.40	1496.00	1477.71

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 4510 [mm] Rise: 2010 [mm] Q-rise: 1660 [mm]
Ring thickness at crown: 440 [mm] Ring thickness at springing: 440 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Intrados.x	Intrados.z	Extrados.x	Extrados.z	Road.z	Fx dead	Fz dead	My dead	Fx live	Fz live	My live	Fx passive	Fx total	Fz total	My total	Thrust in	Thrust out	Extra-Thrust
0	16920	20016483	2502735	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-133.38		-377.52	-45.14	88	144276		
1	16945	36316513	4452735	0.00	-3.27	-0.98	0.00	-2.44	-0.98	0.00	-133.38		-371.81	-30.53	50	106314		
2	16982	52416556	6382736	0.00	-3.81	-1.16	0.00	-3.50	-1.37	0.00	-133.38		-364.50	-19.82	24	79	341	
3	17030	68216614	8262737	0.00	-4.22	-1.27	0.00	-4.45	-1.68	0.00	-133.38		-355.83	-12.96	7	61	359	
4	17090	83616685	1010	2738	0.00	-4.51	-1.31	0.00	-5.38	-1.94	0.00	-133.38		-345.94	-9.80	-0	53	367
5	17160	98616770	1189	2740	0.00	-4.68	-1.31	0.00	-6.72	-2.31	0.00	-133.38		-334.53	-9.96	2	53	367
6	17242	1130	16867	1360	2741	0.00	-4.75	-1.25	0.00	-8.94	-2.88	0.00	-133.38		-320.84	-12.83	13	62	358
7	17333	1267	16976	1524	2743	0.00	-4.73	-1.16	0.00	-12.43	-3.74	0.00	-133.38		-303.68	-17.51	31	77	343
8	17435	1397	17097	1680	2745	0.00	-4.63	-1.03	0.00	-17.28	-4.80	0.00	-133.38		-281.77	-22.95	55	98	322
9	17545	1520	17229	1827	2746	0.00	-4.45	-0.89	0.00	-22.96	-5.83	0.00	-133.38		-254.36	-28.09	82	122298	
10	17665	1635	17372	1963	2748	0.00	-4.22	-0.74	0.00	-28.14	-6.45	0.00	-133.38		-222.00	-32.21	113	148272	
11	17792	1740	17524	2089	2749	0.00	-3.95	-0.59	0.00	-30.94	-6.31	0.00	-133.38		-187.10	-35.15	144	176244	
12	17926	1836	17684	2203	2750	0.00	-3.66	-0.45	0.00	-29.50	-5.25	0.00	-133.38		-153.95	-37.45	177	205215	

13	18068	1922	17853	2306	2751	0.50	-3.39	-0.13	4.72	-23.29	-1.67	0.00	-138.59	-127.27	-41.79	215241179	
14	18215	1997	18029	2396	2752	0.36	-3.15	-0.07	2.37	-13.90	-0.82	0.00	-141.32	-110.21	-46.51	254279141	
15	18367	2061	18210	2472	2753	0.25	-2.93	-0.02	0.70	-4.96	-0.26	0.00	-142.27	-102.32	-52.70	29932397	
16	18523	2114	18397	2536	2753	0.17	-2.73	0.02	0.58	-5.12	0.22	0.00	-143.02	-94.47	-60.18	35537842	
17	18683	2156	18588	2586	2753	0.10	-2.56	0.06	4.04	-46.48	1.41	0.00	-147.16	-45.44	-62.79	398420	-0 ***
18	18846	2186	18782	2621	2752	0.06	-2.42	0.10	4.32	-70.48	2.01	0.00	-151.54	27.46	-55.83	37239327	
19	19010	2204	18978	2643	2751	0.03	-2.32	0.13	1.01	-27.60	0.55	0.00	-152.58	57.38	-44.24	288309111	
20	19175	2210	19175	2650	2750	0.01	-2.27	0.17	0.00	-0.35	-0.00	0.00	-152.60	60.00	-33.48	209230190	
21	19340	2204	19372	2643	2747	-0.01	-2.26	0.21	0.00	0.00	0.00	0.00	-152.59	62.27	-24.24	144166254	
22	19504	2186	19568	2621	2745	-0.03	-2.30	0.25	0.00	0.00	0.00	0.00	-152.56	64.57	-16.56	92	115305
23	19667	2156	19762	2586	2743	-0.06	-2.39	0.29	0.00	0.00	0.00	0.00	-152.50	66.96	-10.48	52	76 344
24	19827	2114	19953	2536	2739	-0.10	-2.52	0.35	0.00	0.00	0.00	0.00	-152.40	69.48	-6.03	24	48 372
25	19983	2061	20140	2472	2736	-0.16	-2.68	0.41	0.00	0.00	0.00	0.00	-152.24	72.15	-3.21	7	31 389
26	20135	1997	20321	2396	2732	-0.24	-2.87	0.48	0.00	0.00	0.00	0.00	-152.01	75.02	-2.05	-0	24 396
27	20282	1922	20497	2306	2728	-0.34	-3.09	0.55	0.00	0.00	0.00	0.00	-151.66	78.11	-2.53	3	27 393
28	20424	1836	20666	2203	2725	-0.47	-3.31	0.64	0.00	0.00	0.00	0.00	-151.19	81.42	-4.66	15	39 381
29	20558	1740	20826	2089	2721	0.00	-3.58	0.92	0.00	0.00	0.00	0.00	-151.19	85.01	-8.66	38	63 357
30	20685	1635	20978	1963	2716	0.00	-3.87	1.07	0.00	0.00	0.00	0.00	-151.19	88.88	-14.39	71	96 324
31	20805	1520	21121	1827	2713	0.00	-4.14	1.22	0.00	0.00	0.00	0.00	-151.19	93.02	-21.86	115	139281
32	20915	1397	21253	1680	2709	0.00	-4.37	1.36	0.00	0.00	0.00	0.00	-151.19	97.39	-31.07	169	193227
33	21017	1267	21374	1524	2706	0.00	-4.55	1.47	0.00	0.00	0.00	0.00	-151.19	101.94	-42.01	233	258162
34	21108	1130	21483	1360	2703	0.00	-4.66	1.56	0.00	0.00	0.00	0.00	-151.19	106.59	-54.69	31	033486
35	21190	98621580	1189	2700	0.00	-4.69	1.61	0.00	0.00	0.00	0.00	-151.19	111.28	-69.09	398422	-2 ***	
36	21260	83621665	1010	2697	0.00	-4.62	1.61	0.00	0.00	0.00	0.00	-151.19	115.90	-85.21	501525	-105 ***	
37	21320	68221736	8262695	0.00	-4.45	1.56	0.00	0.00	0.00	0.00	-151.19	120.35	-103.02	620643	-223 ***		
38	21368	52421794	6382693	0.00	-4.17	1.45	0.00	0.00	0.00	0.00	-151.19	124.53	-122.51	758781	-361 ***		
39	21405	36321837	4452691	0.00	-3.77	1.28	0.00	0.00	0.00	0.00	-151.19	128.30	-143.61	920942	-522 ***		
40	21430	20021867	2502690	0.00	-3.25	1.05	0.00	0.00	0.00	0.00	-151.19	131.55	-166.27	1113	1134	-714 ***	

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 200 [mm] Thickness at top: 7170 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	21430	28600	200	-491.56	143.16	-491.56	-180.08	24614	24684	-0.09	-0.05	3183.55	3916.22
1	21430	28600	-367	-89.39	143.16	-580.95	-98.95	24803	24886	-0.09	-0.07	3373.18	3713.83
2	21430	28600	-933	-89.39	143.16	-670.33	-17.82	24941	25036	-0.10	-0.09	3510.53	3563.71
3	21430	28600	-1500	-89.39	143.16	-759.72	63.3025044	25153	-0.10	-0.11	3614.06	3447.41	

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2310 [mm] Rise: 1150 [mm] Q-rise: 960 [mm]
Ring thickness at crown: 370 [mm] Ring thickness at springing: 370 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust

0	28600	45028230	4522422	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-8.03	-39.54	-2.66	64	70 280		
1	28604	54028235	5712422	0.00	-1.06	-0.23	0.00	0.00	0.00	0.00	-8.03	-38.48	-1.84	44	50 300		
2	28615	63028250	6892421	0.00	-1.39	-0.34	0.00	0.00	0.00	0.00	-8.03	-37.09	-1.18	29	34 316		
3	28633	71928273	8062421	0.00	-1.67	-0.43	0.00	0.00	0.00	0.00	-8.03	-35.42	-0.68	16	21 329		
4	28658	80628306	9212419	0.00	-1.89	-0.49	0.00	0.00	0.00	0.00	-8.03	-33.53	-0.33	7	12 338		
5	28689	89028348	1033	2418	0.00	-2.07	-0.52	0.00	0.00	0.00	0.00	-8.03	-31.46	-0.13	2	6 344	
6	28727	97228398	1141	2416	0.00	-2.20	-0.53	0.00	0.00	0.00	0.00	-8.03	-29.26	-0.06	-0	4 346	
7	28772	1051	28457	1245	2414	0.00	-2.28	-0.53	0.00	0.00	0.00	0.00	-8.03	-26.97	-0.11	2	6 344
8	28822	1126	28524	1345	2411	0.00	-2.32	-0.51	0.00	0.00	0.00	0.00	-8.03	-24.65	-0.26	9	12 338
9	28879	1197	28598	1438	2409	0.00	-2.33	-0.47	0.00	0.00	0.00	0.00	-8.03	-22.32	-0.48	20	23 327

10	28940	1263	28679	1526	2406	0.00	-2.31	-0.42	0.00	0.00	0.00	0.00	-8.03	-20.01	-0.77	38	40	310
11	29007	1325	28767	1607	2402	0.00	-2.26	-0.37	0.00	0.00	0.00	0.00	-8.03	-17.76	-1.11	62	64	286
12	29078	1381	28861	1680	2399	0.53	-2.20	-0.15	-0.00	0.00	0.00	0.00	-8.56	-15.55	-1.59	98	100	250
13	29153	1431	28960	1746	2395	0.43	-2.15	-0.13	-0.00	0.00	0.00	0.00	-8.99	-13.40	-2.03	138	140	210
14	29232	1475	29064	1805	2391	0.35	-2.09	-0.10	-0.00	0.00	0.00	0.00	-9.33	-11.31	-2.43	180	181	169
15	29314	1513	29173	1855	2388	0.27	-2.03	-0.07	-0.00	0.00	0.00	0.00	-9.60	-9.28	-2.77	222	224	126
16	29399	1544	29285	1896	2384	0.21	-1.97	-0.04	-0.00	0.00	0.00	0.00	-9.81	-7.31	-3.05	262	264	86
17	29486	1568	29400	1928	2380	0.15	-1.91	-0.01	-0.00	0.00	0.00	0.00	-9.96	-5.40	-3.27	298	300	50
18	29575	1586	29517	1951	2376	0.10	-1.87	0.02	-0.00	0.00	0.00	0.00	-10.06	-3.53	-3.43	326	328	22
19	29665	1596	29636	1965	2373	0.06	-1.83	0.04	-0.00	0.00	0.00	0.00	-10.12	-1.70	-3.52	34	34	55
20	29755	1600	29755	1970	2369	0.02	-1.81	0.07	-0.00	0.00	0.00	0.00	-10.13	0.11	-3.54	34	93	50-0 ***
21	29845	1596	29874	1965	2366	-0.02	-1.80	0.10	0.00	0.00	0.00	0.00	-10.12	1.91	-3.50	34	134	28
22	29935	1586	29993	1951	2363	-0.06	-1.81	0.12	0.00	0.00	0.00	0.00	-10.06	3.72	-3.39	32	132	327
23	30024	1568	30110	1928	2360	-0.10	-1.83	0.15	0.00	0.00	0.00	0.00	-9.96	5.55	-3.21	29	229	357
24	30111	1544	30225	1896	2357	-0.14	-1.86	0.18	0.00	0.00	0.00	0.00	-9.82	7.41	-2.98	25	525	793
25	30196	1513	30337	1855	2354	-0.19	-1.91	0.21	0.00	0.00	0.00	0.00	-9.63	9.32	-2.68	215	216	134
26	30278	1475	30446	1805	2351	-0.25	-1.96	0.24	0.00	0.00	0.00	0.00	-9.37	11.27	-2.34	173	175	175
27	30357	1431	30550	1746	2349	-0.32	-2.01	0.27	0.00	0.00	0.00	0.00	-9.05	13.28	-1.95	132	134	216
28	30432	1381	30649	1680	2346	-0.40	-2.06	0.30	0.00	0.00	0.00	0.00	-8.65	15.34	-1.51	93	95	255
29	30503	1325	30743	1607	2344	-0.49	-2.11	0.33	0.00	0.00	0.00	0.00	-8.16	17.45	-1.04	58	61	289
30	30570	1263	30831	1526	2342	0.00	-2.16	0.50	0.00	0.00	0.00	0.00	-8.16	19.62	-0.71	35	38	312
31	30631	1197	30912	1438	2340	0.00	-2.21	0.54	0.00	0.00	0.00	0.00	-8.16	21.82	-0.44	18	21	329
32	30688	1126	30986	1345	2339	0.00	-2.24	0.57	0.00	0.00	0.00	0.00	-8.16	24.06	-0.22	7	11	339
33	30738	1051	31053	1245	2337	0.00	-2.24	0.60	0.00	0.00	0.00	0.00	-8.16	26.30	-0.09	1	5	345
34	30783	97231112		1141	2336	0.00	-2.20	0.60	0.00	0.00	0.00	0.00	-8.16	28.50	-0.06	-0	4	346
35	30821	89031162		1033	2335	0.00	-2.13	0.59	0.00	0.00	0.00	0.00	-8.16	30.62	-0.15	2	7	343
36	30852	80631204		9212334		0.00	-2.01	0.57	0.00	0.00	0.00	0.00	-8.16	32.63	-0.37	9	13	337
37	30877	71931237		8062333		0.00	-1.84	0.51	0.00	0.00	0.00	0.00	-8.16	34.47	-0.73	18	23	327
38	30895	63031260		6892333		0.00	-1.63	0.44	0.00	0.00	0.00	0.00	-8.16	36.10	-1.25	31	36	314
39	30906	54031275		5712332		0.00	-1.37	0.35	0.00	0.00	0.00	0.00	-8.16	37.47	-1.92	48	53	297
40	30910	45031280		4522332		0.00	-1.05	0.24	0.00	0.00	0.00	0.00	-8.16	38.52	-2.76	69	74	276

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 350 [mm] Thickness at top: 1700 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment	Left x	Right x	z	Weight	Fx	Fz	My	Thrust left	Thrust right	Stress left	Stress right	Dist. left	Dist. right
0	30910	32610	350	-121.22	-1.39	-121.22	3.76	31782	31800	-0.06	-0.08	872.37	810.31
1	30910	32610	-267	-23.06	-1.39	-144.29	2.91	31770	31790	-0.08	-0.09	859.84	819.55
2	30910	32610	-883	-23.06	-1.39	-167.35	2.05	31760	31784	-0.09	-0.10	850.31	825.79
3	30910	32610	-1500	-23.06	-1.39	-190.41	1.20	31753	31780	-0.11	-0.11	842.68	830.12

Segment Left xRight x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2570 [mm] Rise: 1190 [mm] Q-rise: 1030 [mm]
Ring thickness at crown: 370 [mm] Ring thickness at springing: 370 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx totalFz totalMy total Thrust in Thrust out Extra-Thrust

0	32610	35032241		3782315		0.00	0.00	0.00	0.00	0.00	0.00	0.00	-9.54	-42.22	-2.45	54	60	290
1	32621	44632255		5012314		0.00	-1.44	-0.35	0.00	0.00	0.00	0.00	-9.54	-40.78	-1.62	36	42	308
2	32639	54032278		6232314		0.00	-1.74	-0.44	0.00	0.00	0.00	0.00	-9.54	-39.04	-0.98	22	27	323
3	32664	63332311		7432313		0.00	-1.98	-0.51	0.00	0.00	0.00	0.00	-9.54	-37.06	-0.52	11	16	334
4	32696	72432352		8602313		0.00	-2.17	-0.55	0.00	0.00	0.00	0.00	-9.54	-34.90	-0.22	4	9	341
5	32735	81232402		9732312		0.00	-2.31	-0.57	0.00	0.00	0.00	0.00	-9.54	-32.59	-0.08	-0	5	345
6	32780	89732460		1083	2311	0.00	-2.40	-0.56	0.00	0.00	0.00	0.00	-9.54	-30.19	-0.08	0	5	345

7 32831 97932526 1187 2310 0.00 -2.45 -0.54 0.00 0.00 0.00 0.00 -9.54 -27.74 -0.19 5 9 341
8 32888 1056 32599 1287 2309 0.00 -2.46 -0.51 0.00 0.00 0.00 0.00 -9.54 -25.28 -0.40 14 17 333
9 32951 1129 32680 1381 2308 0.00 -2.44 -0.46 0.00 0.00 0.00 0.00 -9.54 -22.84 -0.69 28 31 319
10 33019 1197 32768 1468 2307 0.00 -2.39 -0.41 0.00 0.00 0.00 0.00 -9.54 -20.44 -1.03 48 51 299
11 33092 1260 32862 1549 2305 0.00 -2.33 -0.35 0.00 0.00 0.00 0.00 -9.54 -18.11 -1.41 74 77 273
12 33170 1317 32962 1622 2303 0.50 -2.26 -0.14 -0.00 0.00 0.00 0.00 -10.04 -15.85 -1.94 111 114 236
13 33251 1368 33067 1688 2302 0.41 -2.20 -0.11 -0.00 0.00 0.00 0.00 -10.45 -13.66 -2.41 151 153 197
14 33336 1413 33176 1746 2300 0.33 -2.13 -0.08 -0.00 0.00 0.00 0.00 -10.78 -11.53 -2.83 192 194 156
15 33425 1451 33290 1796 2298 0.25 -2.06 -0.05 -0.00 0.00 0.00 0.00 -11.03 -9.47 -3.20 232 234 116
16 33516 1483 33407 1836 2297 0.19 -2.00 -0.03 -0.00 0.00 0.00 0.00 -11.22 -7.47 -3.50 27 027 179
17 33609 1508 33526 1869 2295 0.14 -1.94 0.00 -0.00 0.00 0.00 0.00 -11.36 -5.53 -3.73 30 230 446
18 33703 1526 33648 1892 2293 0.09 -1.89 0.03 -0.00 0.00 0.00 0.00 -11.46 -3.64 -3.90 32 832 921
19 33799 1536 33771 1905 2291 0.05 -1.86 0.05 -0.00 0.00 0.00 0.00 -11.51 -1.78 -4.00 3 433 455
20 33895 1540 33895 1910 2290 0.02 -1.84 0.08 -0.00 0.00 0.00 0.00 -11.53 0.06 -4.03 348 350 -0 ***
21 33991 1536 34019 1905 2288 -0.02 -1.84 0.10 0.00 0.00 0.00 0.00 -11.51 1.90 -3.98 3 423 446
22 34087 1526 34142 1892 2286 -0.05 -1.85 0.13 0.00 0.00 0.00 0.00 -11.46 3.75 -3.87 32 532 723
23 34181 1508 34264 1869 2284 -0.09 -1.87 0.15 0.00 0.00 0.00 0.00 -11.37 5.62 -3.69 29 930 050
24 34274 1483 34383 1836 2282 -0.14 -1.91 0.18 0.00 0.00 0.00 0.00 -11.23 7.53 -3.45 26 526 783
25 34365 1451 34500 1796 2280 -0.19 -1.96 0.21 0.00 0.00 0.00 0.00 -11.04 9.50 -3.14 227 229 121
26 34454 1413 34614 1746 2279 -0.25 -2.02 0.24 0.00 0.00 0.00 0.00 -10.80 11.52 -2.77 187 189 161
27 34539 1368 34723 1688 2277 -0.31 -2.08 0.28 0.00 0.00 0.00 0.00 -10.49 13.60 -2.35 147 149 201
28 34620 1317 34828 1622 2276 -0.39 -2.15 0.31 0.00 0.00 0.00 0.00 -10.09 15.75 -1.88 108 110 240
29 34698 1260 34928 1549 2274 -0.48 -2.21 0.34 0.00 0.00 0.00 0.00 -9.61 17.96 -1.36 72 74 276
30 34771 1197 35022 1468 2273 0.00 -2.27 0.51 0.00 0.00 0.00 0.00 -9.61 20.23 -0.99 46 49 301
31 34839 1129 35110 1381 2272 0.00 -2.34 0.56 0.00 0.00 0.00 0.00 -9.61 22.57 -0.65 27 30 320
32 34902 1056 35191 1287 2270 0.00 -2.39 0.60 0.00 0.00 0.00 0.00 -9.61 24.96 -0.37 13 16 334
33 34959 97935264 1187 2269 0.00 -2.41 0.63 0.00 0.00 0.00 0.00 -9.61 27.36 -0.17 4 8 342
34 35010 89735330 1083 2268 0.00 -2.40 0.65 0.00 0.00 0.00 0.00 -9.61 29.76 -0.07 -0 4 346
35 35055 81235388 9732266 0.00 -2.35 0.66 0.00 0.00 0.00 0.00 -9.61 32.12 -0.08 0 5 345
36 35094 72435438 8602266 0.00 -2.26 0.64 0.00 0.00 0.00 0.00 -9.61 34.38 -0.24 4 9 341
37 35126 63335479 7432265 0.00 -2.13 0.61 0.00 0.00 0.00 0.00 -9.61 36.51 -0.54 12 17 333
38 35151 54035512 6232265 0.00 -1.95 0.55 0.00 0.00 0.00 0.00 -9.61 38.46 -1.02 23 29 321
39 35169 44635535 5012264 0.00 -1.72 0.47 0.00 0.00 0.00 0.00 -9.61 40.18 -1.67 38 44 306
40 35180 35035549 3782264 0.00 -1.43 0.37 0.00 0.00 0.00 0.00 -9.61 41.61 -2.51 56 62 288

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
Base level: -1500 [mm] Top level: 70 [mm] Thickness at top: 6750 [mm]
Batter: 1:0
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
0 35180 41930 70 -356.72 1.40 -356.72 -7.57 38508 38559 -0.05 -0.05 3328.31 3370.73
1 35180 41930 -453 -77.71 1.40 -434.44 -6.83 38508 38570 -0.07 -0.06 3328.24 3359.70
2 35180 41930 -977 -77.71 1.40 -512.15 -6.10 38507 38580 -0.08 -0.08 3326.51 3350.33
3 35180 41930 -1500 -77.71 1.40 -589.87 -5.37 38504 38588 -0.09 -0.09 3323.77 3341.96

Segment Left x Right x z Weight Fx Fz My Thrust left Thrust right Stress left Stress right Dist. left Dist. right
Shape: Circular
Span: 2720 [mm] Rise: 1350 [mm] Q-rise: 1100 [mm]
Ring thickness at crown: 450 [mm] Ring thickness at springing: 450 [mm] Mortar loss: 20 [mm]
Masonry unit weight: 22.00 [kN/m3] Masonry strength: 7.00 [MPa]

Segment Intrados.x Intrados.z Extrados.x Extrados.z Road.z Fx dead Fz dead My dead Fx live Fz live My live Fx passive Fx total Fz total My total Thrust in Thrust out Extra-Thrust
0 41930 70 41480 73 2132 0.00 0.00 0.00 0.00 0.00 0.00 0.00 -8.21 -46.97 -3.47 70 77 353
1 41935 17641487 2152132 0.00 -1.50 -0.40 0.00 0.00 0.00 0.00 -8.21 -45.47 -2.41 49 56 374
2 41948 28241504 3552132 0.00 -1.90 -0.56 0.00 0.00 0.00 0.00 -8.21 -43.57 -1.55 32 38 392
3 41970 38641533 4942131 0.00 -2.24 -0.68 0.00 0.00 0.00 0.00 -8.21 -41.33 -0.90 18 24 406

4	41999	48841572	6292129	0.00	-2.50	-0.77	0.00	0.00	0.00	0.00	-8.21	-38.84	-0.44	8	14	416				
5	42036	58741622	7622128	0.00	-2.69	-0.81	0.00	0.00	0.00	0.00	-8.21	-36.15	-0.18	2	7	423				
6	42081	68441682	8902126	0.00	-2.82	-0.82	0.00	0.00	0.00	0.00	-8.21	-33.33	-0.08	0	5	425				
7	42134	77641751	1013 2124	0.00	-2.88	-0.80	0.00	0.00	0.00	0.00	-8.21	-30.45	-0.13	2	7	423				
8	42193	86441830	1130 2122	0.00	-2.89	-0.75	0.00	0.00	0.00	0.00	-8.21	-27.56	-0.31	10	14	416				
9	42259	94741918	1241 2119	0.00	-2.85	-0.68	0.00	0.00	0.00	0.00	-8.21	-24.70	-0.60	23	27	403				
10	42332	1025 42015	1345 2115	0.00	-2.78	-0.60	0.00	0.00	0.00	0.00	-8.21	-21.93	-0.97	44	47	383				
11	42410	1097 42119	1440 2112	0.00	-2.67	-0.51	0.00	0.00	0.00	0.00	-8.21	-19.26	-1.38	73	75	355				
12	42494	1163 42230	1527 2108	0.52	-2.56	-0.23	-0.00	0.00	0.00	0.00	-8.73	-16.69	-1.99	117	119	311				
13	42582	1221 42348	1606 2104	0.41	-2.46	-0.19	-0.00	0.00	0.00	0.00	-9.14	-14.23	-2.54	166	168	262				
14	42675	1273 42472	1675 2100	0.31	-2.35	-0.14	-0.00	0.00	0.00	0.00	-9.45	-11.89	-3.02	218	220	210				
15	42772	1317 42600	1733 2096	0.23	-2.23	-0.10	-0.00	0.00	0.00	0.00	-9.68	-9.66	-3.43	271	273	157				
16	42872	1354 42733	1782 2091	0.17	-2.13	-0.06	-0.00	0.00	0.00	0.00	-9.85	-7.53	-3.77	322	323	107				
17	42974	1383 42869	1820 2086	0.11	-2.03	-0.02	-0.00	0.00	0.00	0.00	-9.96	-5.50	-4.03	36	736	862				
18	43078	1403 43008	1848 2081	0.07	-1.95	0.02	-0.00	0.00	0.00	0.00	-10.03	-3.55	-4.21	40	240	327				
19	43184	1416 43149	1864 2075	0.04	-1.89	0.05	-0.00	0.00	0.00	0.00	-10.07	-1.66	-4.31	4	234	255				
20	43290	1420 43290	1870 2070	0.01	-1.85	0.08	-0.00	0.00	0.00	0.00	-10.09	0.20	-4.33	429	430	-0	***			
21	43396	1416 43431	1864 2064	-0.01	-1.84	0.11	0.00	0.00	0.00	0.00	-10.07	2.04	-4.27	41	841	911				
22	43502	1403 43572	1848 2059	-0.04	-1.85	0.15	0.00	0.00	0.00	0.00	-10.04	3.89	-4.13	39	139	337				
23	43606	1383 43711	1820 2053	-0.07	-1.88	0.18	0.00	0.00	0.00	0.00	-9.97	5.77	-3.91	35	335	575				
24	43708	1354 43847	1782 2048	-0.10	-1.94	0.22	0.00	0.00	0.00	0.00	-9.87	7.71	-3.62	307	308	122				
25	43808	1317 43980	1733 2042	-0.14	-2.01	0.26	0.00	0.00	0.00	0.00	-9.73	9.72	-3.26	256	257	173				
26	43905	1273 44108	1675 2036	-0.20	-2.10	0.31	0.00	0.00	0.00	0.00	-9.53	11.81	-2.83	204	206	224				
27	43998	1221 44232	1606 2031	-0.27	-2.19	0.35	0.00	0.00	0.00	0.00	-9.26	14.01	-2.35	154	156	274				
28	44086	1163 44350	1527 2026	-0.35	-2.29	0.40	0.00	0.00	0.00	0.00	-8.90	16.30	-1.82	107	110	320				
29	44170	1097 44461	1440 2022	-0.46	-2.39	0.45	0.00	0.00	0.00	0.00	-8.45	18.69	-1.24	66	68	362				
30	44248	1025 44565	1345 2018	0.00	-2.50	0.66	0.00	0.00	0.00	0.00	-8.45	21.19	-0.84	39	42	388				
31	44321	94744662	1241 2014	0.00	-2.60	0.74	0.00	0.00	0.00	0.00	-8.45	23.79	-0.50	20	23	407				
32	44387	86444750	1130 2010	0.00	-2.68	0.81	0.00	0.00	0.00	0.00	-8.45	26.47	-0.24	7	11	419				
33	44446	77644829	1013 2006	0.00	-2.73	0.86	0.00	0.00	0.00	0.00	-8.45	29.20	-0.09	1	5	425				
34	44499	68444898	8902004	0.00	-2.73	0.89	0.00	0.00	0.00	0.00	-8.45	31.93	-0.07	-0	5	425				
35	44544	58744958	7622002	0.00	-2.68	0.89	0.00	0.00	0.00	0.00	-8.45	34.62	-0.21	3	8	422				
36	44581	48845008	629-1	0.00	-2.57	0.86	0.00	0.00	0.00	0.00	-8.45	37.19	-0.51	11	16	414				
37	44610	38645047	494-1	0.00	-2.41	0.80	0.00	0.00	0.00	0.00	-8.45	39.60	-1.01	22	28	402				
38	44632	28245076	355-1	0.00	-2.17	0.70	0.00	0.00	0.00	0.00	-8.45	41.77	-1.69	37	43	387				
39	44645	17645093	215-1	0.00	-1.86	0.57	0.00	0.00	0.00	0.00	-8.45	43.63	-2.58	55	62	368				
40	44650	70 45100	73 -1	0.00	-1.48	0.40	0.00	0.00	0.00	0.00	-8.45	45.11	-3.67	78	84	346				

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