

BEBO CONCRETE ARCHES

Precast component bridge system
providing strength and stability

TECHNICAL GUIDE



PRE-CON[®]

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BEBO CONCRETE ARCHES

BEBO arches are a precast component bridging system that provides great strength in relatively light concrete shell structures. Experience shows backfilled reinforced concrete arch bridges are extremely durable and require little maintenance.

First tested in 1965, the BEBO arch capitalizes on soil-structure interaction between the reinforced concrete arch/foundations and the surrounding fill. Spans range from 3.66m to 31m, and are uniquely capable of ultra low-profile geometries with span-to-rise ratios as low as 10:1. The versatility of the system makes it attractive for a multitude of applications.

BEBO structures are manufactured and sold under a licensing agreement with BEBO A.G. of Zurich, Switzerland.

TYPICAL APPLICATIONS

- Bridges
- Tunnels
- Grade separations
- Over/underpasses
- Stream enclosures
- Parking garages
- Mining tunnels

Product Features

- Virtually maintenance free
- Elimination of deck icing
- Fast, on-site installation
- Designed and fabricated by Pre-Con

Specifications

- Up to 14.5m span segments can be shipped in one arch element
- Nominal lay length of 1.22m to 2.44m per segment



DAYBREAK, UTAH - BEBO CONCRETE ARCH



CROSSROADS, WV - BEBO CONCRETE ARCH TYPE C54T

INSTALLATION

Although BEBO System structures can be used for a variety of different applications, many of the basic installation steps are similar. The following lists the steps for a typical C-Series or E-Series installation site.

1. Mobilize and prepare site
2. Excavate and pour cast-in-place concrete footings
3. Place shims into footing keyways
4. Place BEBO arch elements with a suitable crane and rigging, on shims
5. Align BEBO arch elements with wood wedges within the keyways
6. Bolt half-arch elements together at crown with curved threaded rod (twin leaf structures only)
7. Release crane connections
8. Pour grout into footing keyways
9. Install optional headwalls and wingwalls
10. Create permanent connection at crown (twin leaf structures only):
 - Tie exposed rebar at crown to additional overlapping rebar
 - Pour concrete into crown recesses
11. Waterproof or seal (if required) the structure:
 - Place butyl rubber tape into the tapered edges of butt joints, along outside surface of arches
 - Place external rubber sealing bands over top of butyl rubber tape and adjoining concrete surfaces and apply hand pressure to adhere mastic to concrete
12. Backfill in lifts according to contract

FOUNDATIONS

Various types of foundations can be used for BEBO System structures. The type selected depends on the circumstances that are encountered at each specific site. Most often, cast-in-place spread footings are used. These footings are normally slabs or slabs with pedestals.



QUEENSVILLE (HWY 404 EXTENSION), ON - BEBO CONCRETE ARCH



QUEENSVILLE (HWY 404 EXTENSION), ON - BEBO CONCRETE ARCH

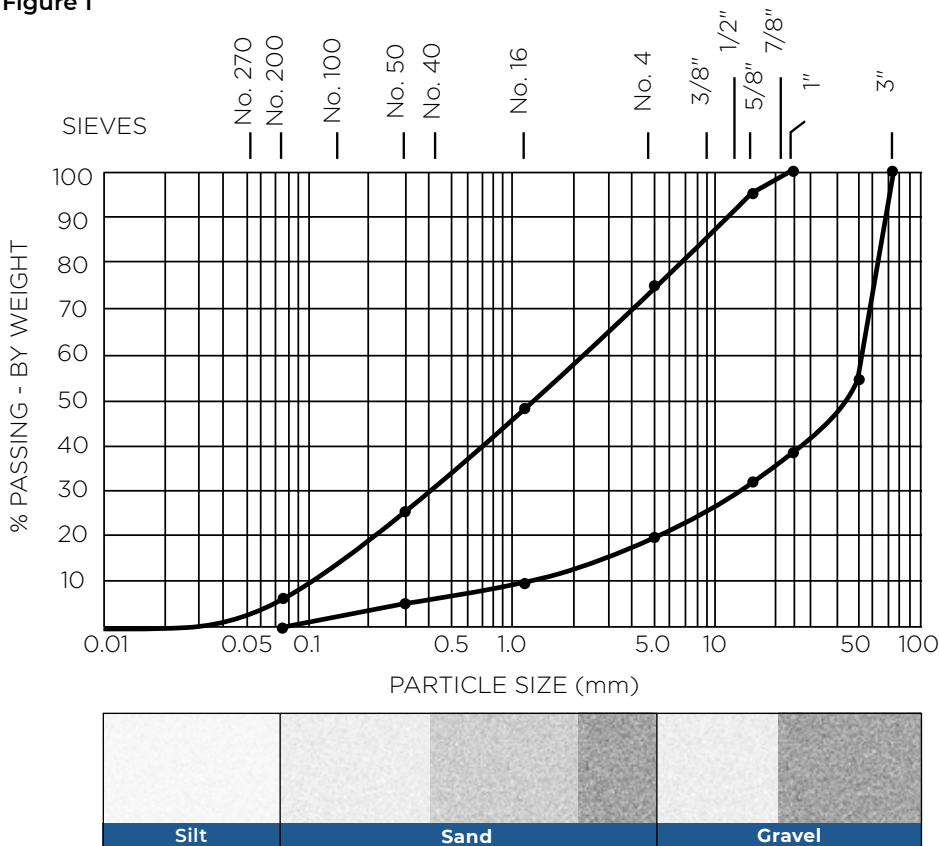
Typical Backfill Gradation Requirements for Critical Backfill Zone

Sieve Size (mm)	Percent Passing Lower Limit	Percent Passing Upper Limit
75	100	100
59	55	100
25	38	100
16	32	95
5	20	75
1.2	10	48
0.3	5	25
0.075	0	7

NOTE

- Material to be granular with angular grains
- Sieve analysis to fall within the envelope noted in Figure 1
- Material to be well graded; uniform, skip or gap grading is not permitted

Figure 1



DESIGN STANDARDS

Canadian Highway Bridge Design Code (CHBDC)

Introduced in 2001, Section 7 – Buried Structures of the Canadian Highway Bridge Design Code (CAN/CSA S6) method is based upon limit states design procedures. It has become the recognized design standard for structures in Canada.

NOTE

- The full CHBDC code is available from CSA International as “CAN/CSA-S6 Canadian Highway Bridge Design Code”



EAST HIGH STREET, OHIO - BEBO CONCRETE ARCH TYPE E84T

BEBO ARCH SYSTEMS C-SERIES

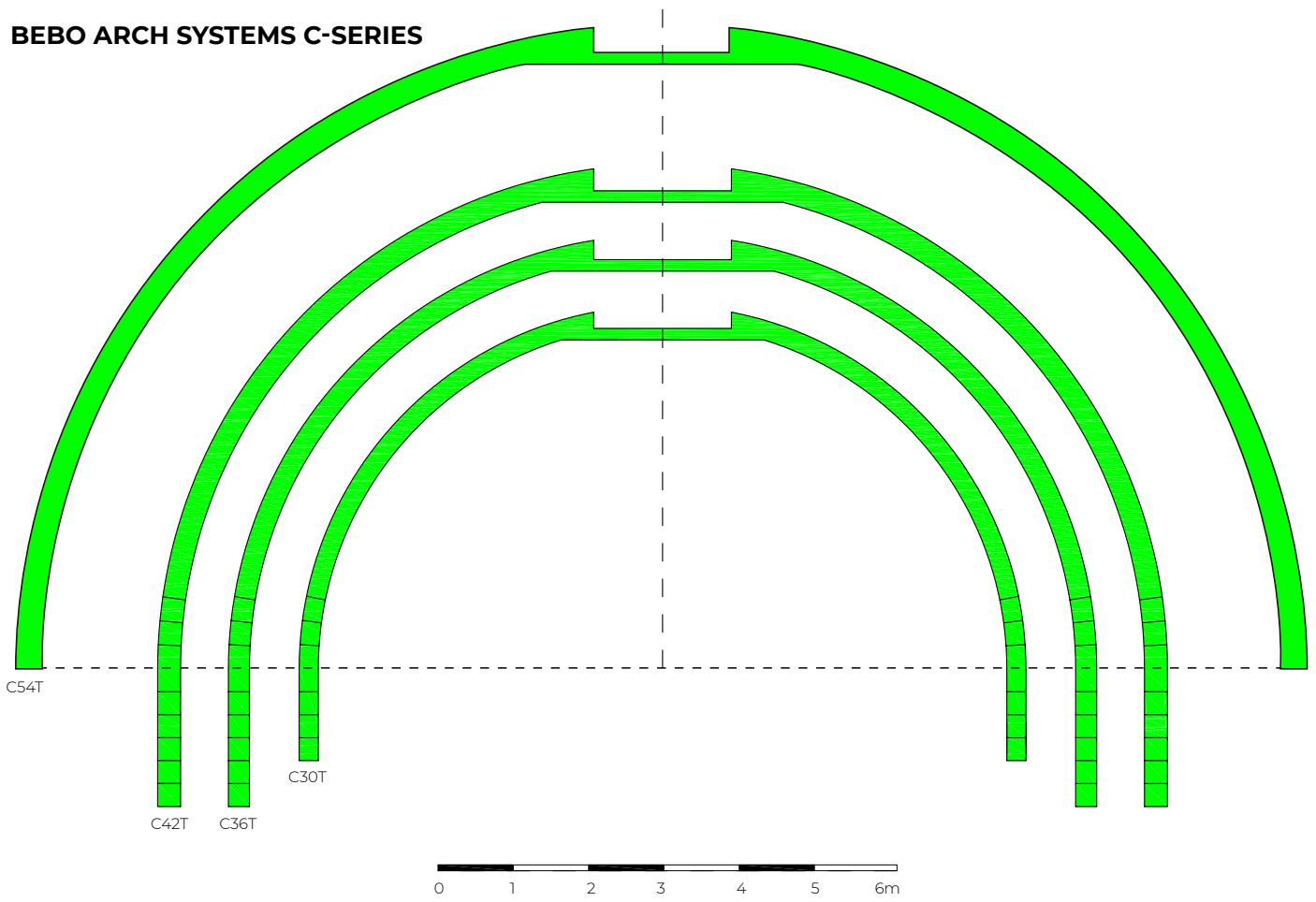
C-Series Twin Leaf

Series Type	Span	Rise	Lay Length	Arch Thickness	Mass	Waterway Area
	m	m	m	m	tonne	m ²
C30T/0	8.96	3.45	1.83	0.25	7.0	24.2
C30T/1	9.05	3.76	1.83	0.25	7.4	26.9
C30T/2	9.12	4.06	1.83	0.25	7.7	29.7
C30T/3	9.14	4.37	1.83	0.25	8.1	32.5
C30T/4	9.14	4.67	1.83	0.25	8.4	35.3
C30T/5	9.14	4.98	1.83	0.25	8.7	38.0
C30T/6	9.14	5.28	1.83	0.25	9.1	40.8
C30T/7	9.14	5.59	1.83	0.25	9.4	43.6
C36T/0	10.82	4.37	1.83	0.28	9.5	36.9
C36T/1	10.91	4.67	1.83	0.28	9.9	40.2
C36T/2	10.96	4.98	1.83	0.28	10.3	43.5
C36T/3	10.97	5.28	1.83	0.28	10.6	46.9
C36T/4	10.97	5.59	1.83	0.28	11.0	50.2
C36T/5	10.97	5.89	1.83	0.28	11.4	53.6
C36T/6	10.97	6.20	1.83	0.28	11.8	56.9
C36T/7	10.97	6.50	1.83	0.28	12.1	60.3
C36T/8	10.97	6.81	1.83	0.28	12.5	63.6
C36T/9	10.97	7.11	1.83	0.28	12.9	66.9
C42T/0	12.67	5.28	1.83	0.30	12.5	52.2
C42T/1	12.74	5.59	1.83	0.30	12.9	56.1
C42T/2	12.79	5.89	1.83	0.30	13.3	60.0
C42T/3	12.80	6.20	1.83	0.30	13.7	63.9
C42T/4	12.80	6.50	1.83	0.30	14.1	67.8
C42T/5	12.80	6.81	1.83	0.30	14.5	71.7
C42T/6	12.80	7.11	1.83	0.30	14.9	75.6
C42T/7	12.80	7.42	1.83	0.30	15.3	79.5
C42T/8	12.80	7.72	1.83	0.30	15.7	83.4
C42T/9	12.80	8.03	1.83	0.30	16.1	87.3
C54T/0	16.04	6.20	1.83	0.33	18.0	76.0
C54T/1	16.17	6.50	1.83	0.33	18.4	80.9
C54T/2	16.28	6.81	1.83	0.33	18.9	85.9
C54T/3	16.36	7.11	1.83	0.33	19.3	90.9
C54T/4	16.41	7.42	1.83	0.33	19.7	95.7
C54T/5	16.45	7.72	1.83	0.33	20.2	100.9
C54T/6	16.46	8.03	1.83	0.33	20.6	105.9

NOTE

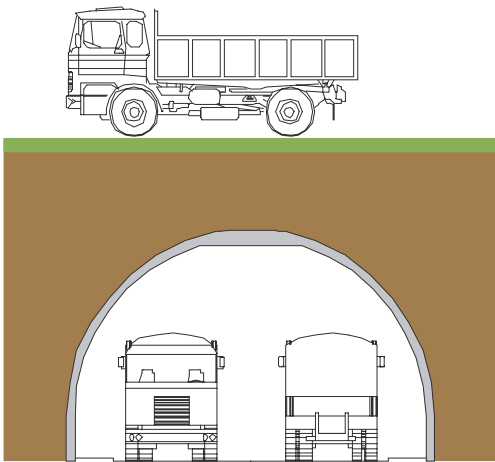
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- Masses/Weights are per piece
- Full arch is double the mass/weight shown

BEBO ARCH SYSTEMS C-SERIES

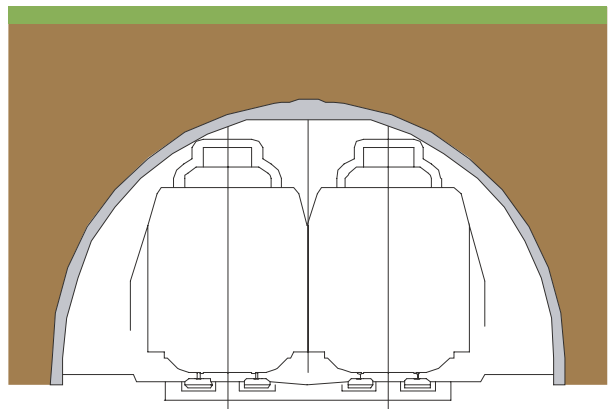


CONCRETE BACKFILLED ARCH STRUCTURES

Type C30T



Type C42T



NOTE

- Spans range from 9.1 to 16.5m with various rises for each span
- Twin leaf precast elements
- Standard fill heights of 0.6 to 6.0m
- Custom designs for up to 12m of fill

BEBO ARCH SYSTEMS E-SERIES

E-Series Single Leaf

Series Type	Span	Rise	Lay Length	Arch Thkns (Thickness)	Mass	Wtwy Area (Waterway)
	m	m	m	m	tonne	m ²
E12/0	3.41	1.07	2.44	0.20	53	2.6
E12/1	3.60	1.37	2.44	0.20	61	3.7
E12/2	3.66	1.68	2.44	0.20	69	4.8
E12/3	3.66	1.98	2.44	0.20	76	5.9
E16/0	4.38	1.17	2.44	0.20	64	3.7
E16/1	4.66	1.47	2.44	0.20	72	5.1
E16/2	4.82	1.78	2.44	0.20	80	8.0
E16/3	4.88	2.08	2.44	0.20	88	6.5
E16/4	4.88	2.39	2.44	0.20	95	9.5
E20/0	5.67	1.57	2.44	0.20	83	6.5
E20/1	5.91	1.88	2.44	0.20	92	8.2
E20/2	6.05	2.18	2.44	0.20	99	10.1
E20/3	6.10	2.49	2.44	0.20	107	11.9
E20/4	6.10	2.79	2.44	0.20	114	13.8
E24/0	6.94	1.98	2.44	0.20	103	10.1
E24/1	7.15	2.29	2.44	0.20	111	12.2
E24/2	7.27	2.59	2.44	0.20	118	14.4
E24/3	7.32	2.90	2.44	0.20	126	16.6
E24/4	7.32	3.20	2.44	0.20	133	18.9
E24/5	7.32	3.51	2.44	0.20	140	21.1
E30/0	8.83	2.59	1.83	0.25	124	16.9
E30/1	9.01	2.90	1.83	0.25	131	19.6
E30/2	9.11	3.20	1.83	0.25	138	22.4
E30/3	9.14	3.51	1.83	0.25	145	25.2
E30/4	9.14	3.81	1.83	0.25	152	28.0
E30/5	9.14	4.11	1.83	0.25	159	30.7
E36/0	10.58	2.79	1.83	0.25	143	21.8
E36/1	10.78	3.10	1.83	0.25	151	25.1
E36/2	10.91	3.40	1.83	0.25	158	28.4
E36/3	10.97	3.71	1.83	0.25	165	31.7
E36/4	10.97	4.01	1.83	0.25	172	35.1
E42/0	12.41	3.10	1.83	0.25	165	28.5
E42/1	12.61	3.40	1.83	0.25	173	32.3
E42/2	12.74	3.71	1.83	0.25	180	36.2
E42/3	12.80	4.01	1.83	0.25	187	40.1
E48/0	14.43	3.68	1.83	0.28	214	40.0
E48/1	14.56	3.99	1.83	0.28	222	44.5

NOTE

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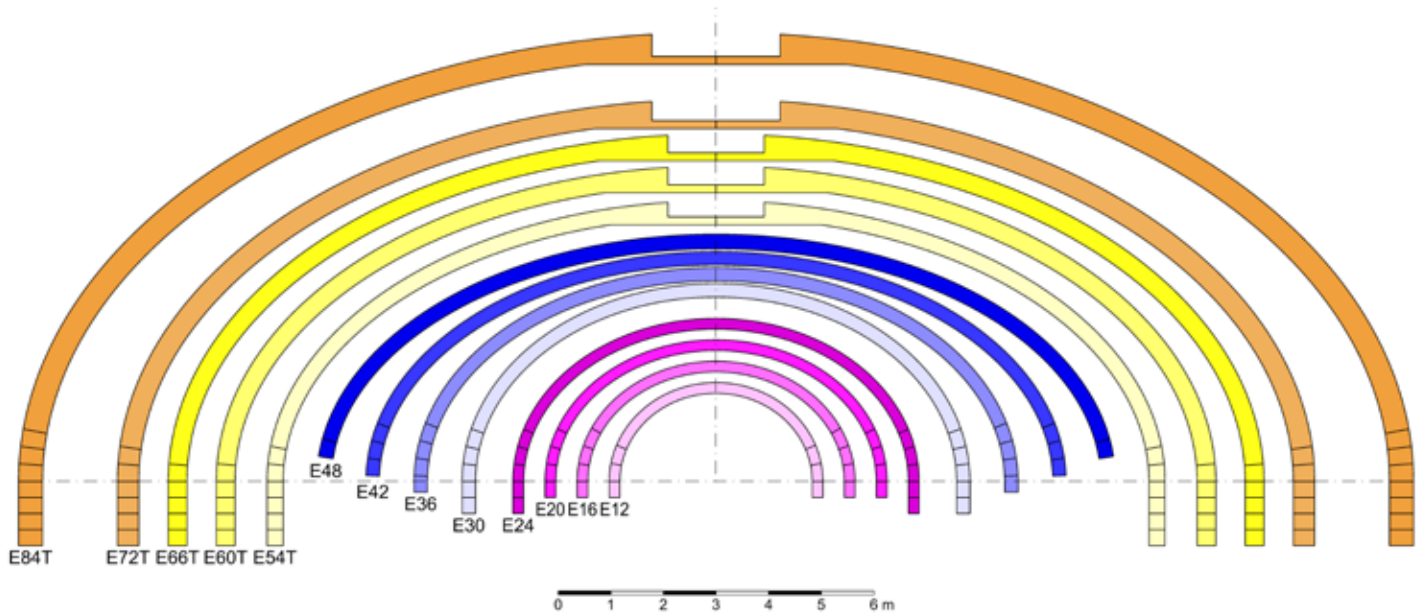
E-Series Twin Leaf

Series Type	Span	Rise	Lay Length	Arch Thkns (Thickness)	Mass	Wtwy Area (Waterway)
	m	m	m	m	tonne	m ²
E54T/0	16.34	4.27	1.83	0.30	13.4	54.6
E54T/1	16.43	4.57	1.83	0.30	13.8	59.6
E54T/2	16.46	4.88	1.83	0.30	14.3	64.6
E54T/3	16.46	5.18	1.83	0.30	14.7	69.6
E54T/4	16.46	5.49	1.83	0.30	15.1	74.6
E54T/5	16.46	5.79	1.83	0.30	15.5	79.6
E54T/6	16.46	6.10	1.83	0.30	15.9	84.7
E60T/0	18.26	5.18	1.83	0.36	18.0	75.0
E60T/1	18.29	5.49	1.83	0.36	18.5	80.6
E60T/2	18.29	5.79	1.83	0.36	19.0	86.1
E60T/3	18.29	6.10	1.83	0.36	19.4	91.7
E60T/4	18.29	6.40	1.83	0.36	19.9	97.3
E60T/5	18.29	6.71	1.83	0.36	20.4	102.9
E66T/0	20.09	5.79	1.83	0.36	19.9	92.1
E66T/1	20.12	6.10	1.83	0.36	20.4	98.3
E66T/2	20.12	6.40	1.83	0.36	20.9	104.4
E66T/3	20.12	6.71	1.83	0.36	21.3	110.5
E66T/4	20.12	7.01	1.83	0.36	21.8	116.7
E66T/5	20.12	7.32	1.83	0.36	22.3	122.8
E72T/0	21.86	6.05	1.22	0.41	16.2	104.1
E72T/1	21.92	6.35	1.22	0.41	16.6	110.8
E72T/2	21.95	6.65	1.22	0.41	17.0	117.5
E72T/3	21.95	6.96	1.22	0.41	17.3	124.1
E72T/4	21.95	7.26	1.22	0.41	17.7	130.8
E72T/5	21.95	7.57	1.22	0.41	18.0	137.5
E72T/6	21.95	7.87	1.22	0.41	18.4	144.2
E78T/0	23.70	6.65	1.22	0.41	17.7	124.2
E78T/1	23.76	6.96	1.22	0.41	18.1	131.4
E78T/2	23.77	7.26	1.22	0.41	18.4	138.7
E78T/3	23.77	7.57	1.22	0.41	18.8	145.9
E78T/4	23.77	7.87	1.22	0.41	19.1	153.2
E78T/5	23.77	8.18	1.22	0.41	19.5	160.4
E78T/6	23.77	8.48	1.22	0.41	19.9	167.7
E84T/0	25.44	6.96	1.22	0.46	21.0	138.3
E84T/1	25.53	7.26	1.22	0.46	21.5	146.1
E84T/2	25.58	7.57	1.22	0.46	21.9	153.8
E84T/3	25.60	7.87	1.22	0.46	22.3	161.6
E84T/4	25.60	8.18	1.22	0.46	22.7	169.4
E84T/5	25.60	8.48	1.22	0.46	23.1	177.3
E84T/6	25.60	8.79	1.22	0.46	23.5	185.1
E84T/7	25.60	9.09	1.22	0.46	23.9	192.9

NOTE

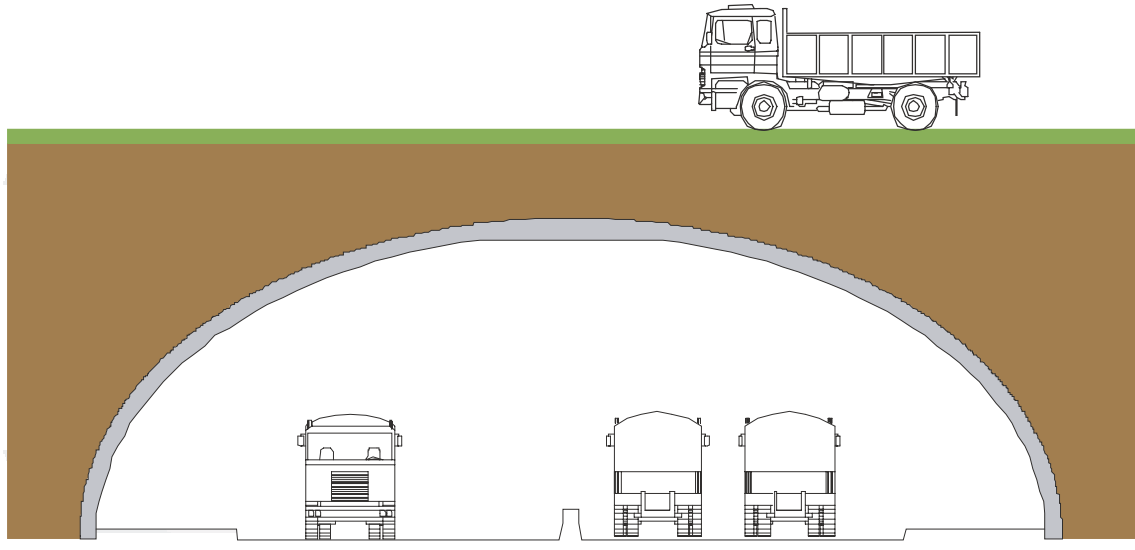
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BEBO ARCH SYSTEMS E-SERIES



CONCRETE BACKFILLED ARCH STRUCTURES

Type E84T



NOTE

- Spans range from 3.6 to 25.5m with various rises for each span
- Single and twin leaf precast elements
- Other span/cover solutions available
- Standard fill heights of 0.6 to 4.5m
- Custom designs for higher heights of fill

BEBO ARCH SYSTEMS T-SERIES

T-Series Single Leaf

Series Type	Span	Minimum Rise	Lay Length	Arch Thickness	Waterway Area
	m	m	m	m	m ²
T22	6.71	0.79	1.83	0.25	3.6
T24	7.32	0.97	1.83	0.25	5.0
T26	7.92	0.97	2.44	0.23	5.2
T28	8.53	1.14	2.44	0.23	6.6
T30	9.14	1.32	2.44	0.23	8.2
T32	9.75	1.52	2.44	0.23	10.1
T34	10.36	1.22	2.44	0.25	8.5
T36	10.97	1.37	2.44	0.25	10.2
T38	11.58	1.55	2.44	0.25	12.2
T40	12.19	1.73	2.44	0.25	14.3
T42	12.80	1.93	2.44	0.25	16.8
T44	13.41	1.63	1.83	0.30	14.7
T46	14.02	1.78	1.83	0.30	16.9
T48	14.63	1.96	1.83	0.30	19.4
T50	15.24	2.13	1.83	0.30	22.1
T52	15.85	2.34	1.83	0.30	25.1
T54	16.46	2.03	1.22	0.30	22.6
T56	17.07	2.21	1.22	0.30	25.3
T58	17.68	2.36	1.22	0.30	28.3
T60	18.29	2.54	1.22	0.30	31.5
T62	18.90	2.74	1.22	0.30	35.0

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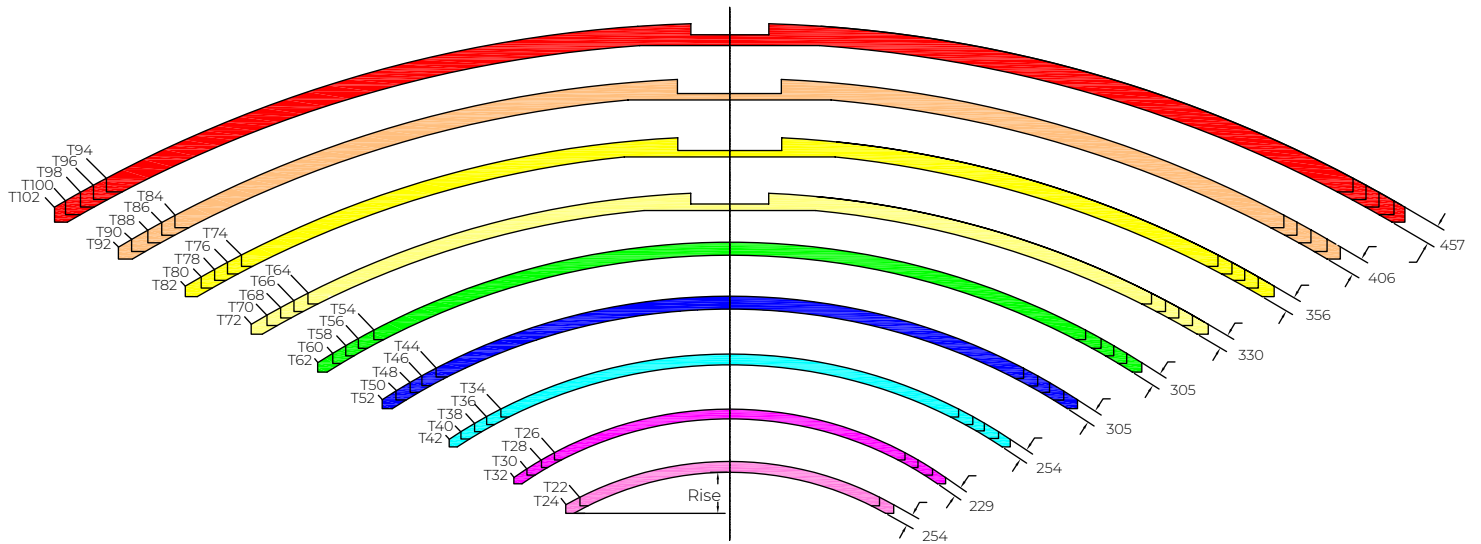
T-Series Twin Leaf

Series Type	Span	Minimum Rise	Lay Length	Arch Thickness	Waterway Area
	m	m	m	m	m ²
T64	19.51	2.29	1.83	0.33	32.1
T66	20.12	2.44	1.83	0.33	35.4
T68	20.73	2.62	1.83	0.33	38.9
T70	21.34	2.79	1.83	0.33	42.7
T72	21.95	2.97	1.83	0.36	39.7
T74	22.56	2.69	1.83	0.36	43.3
T76	23.16	2.87	1.83	0.36	47.1
T78	23.77	3.02	1.83	0.36	51.2
T80	24.38	3.20	1.22	0.36	55.5
T82	24.99	3.38	1.22	0.41	52.1
T84	25.60	3.10	1.22	0.41	56.2
T86	26.21	3.25	1.22	0.41	60.6
T88	26.82	3.43	1.22	0.41	65.2
T90	27.43	3.48	1.22	0.41	70.0
T92	28.04	3.78	1.22	0.46	66.1
T94	28.65	3.51	1.22	0.46	70.8
T96	29.26	3.66	1.22	0.46	75.7
T98	29.87	3.84	1.22	0.46	80.8
T100	30.48	4.01	1.22	0.46	86.2
T102	31.09	4.19	1.22	0.46	91.9

NOTE

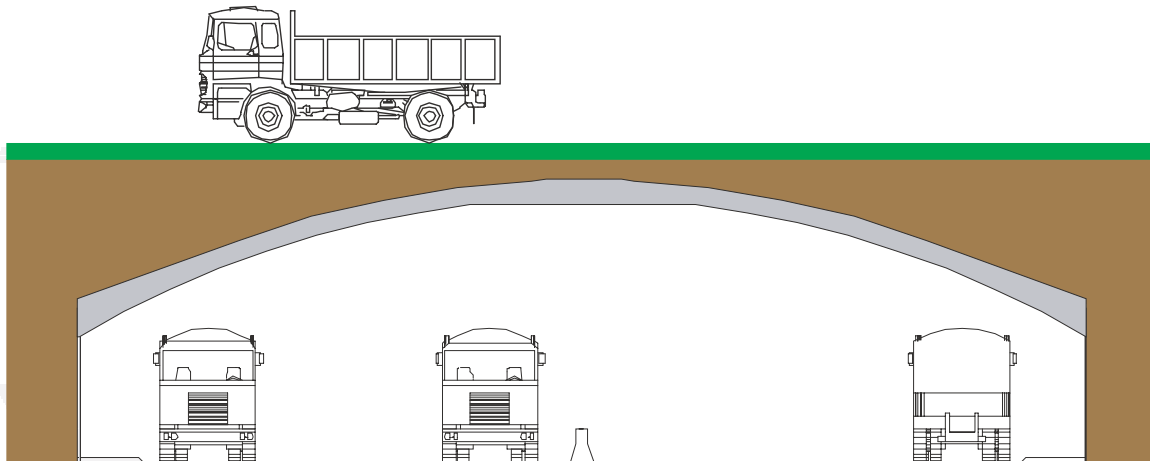
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BEBO ARCH SYSTEMS T-SERIES



CONCRETE BACKFILLED ARCH STRUCTURES

Type T84T



NOTES:

- Shallow arch shapes: span to rise ratios up to 10:1
- Any span between 7m and 31m
- Ideal for low cover applications
- Minimum cover 0.6m

As a leading provider of architectural and structural precast solutions in Ontario, Pre-Con brings a wealth of experience to every project. We provide innovative design, fabrication and construction services in a variety of market sectors with a commitment to quality and safety. When performance counts, **Pre-Con is ready to deliver.**

PRE-CON[®]

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