BEBO® Arch Systems

Technical Catalog

Standard E- and C-Series

CAN CSA S6-06

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The present Technical Catalog was developed by Bridge Design Services AG (BDS) on behalf of *BEBO* Arch of Canada AG (BEBOC).

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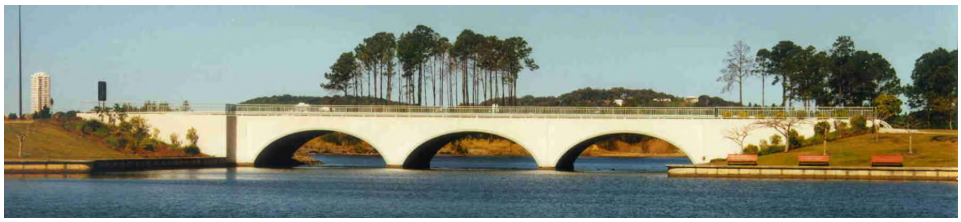


What is the *BEBO* Arch System?

The *BEBO* System is a patented precast concrete arch system for construction of earth overfilled bridges, culverts and underground structures. The fully pre-engineered *BEBO* System features the world's largest span precast concrete arches, offering spans from 3.6m up to 25.6m and more.

BEBO's experience and dedication over many decades as well as countless applications instil confidence – each standard shape has been applied numerous times. The fully pre-engineered system stands apart from other products through the strength of its distinctive arch action and extensive technical support by local *BEBO* Licensees and the *BEBO* Design Centre in Zurich, Switzerland.

Technical Background

For over 2,000 years, the arch has been recognized as a safe, durable, economical and aesthetic structural form. The Assyrians used the true arch as early as 800 B.C., in structures such as a large sewer at Khorsabad and a gateway at Nineveh. Roman engineers used the semi-circular stone arch so extensively that this design is still referred to today as the "Roman Arch". The picture on the left shows an aqueduct in Segovia, Spain built in the first century BC.

For an overfilled arch structure, the fill represents more than a loading. Through its "passive" resistance against lateral deflections, it contributes to the load carrying capacity of the arch and thus becomes a part of the structure. This phenomenon is commonly known as soil-structure-interaction. The *BEBO* System arch analysis makes wide use of soil-structure-interaction in its design. The thickness of the concrete section provides significant sectional load carrying capacity, yet it is small enough to allow deflections to mobilize passive resistance of the soil backfill.

Product History

Swiss Engineer Dr. Werner Heierli started designing slender overfilled concrete arch structures after his postgraduate studies at the Massachusetts Institute of Technology in 1961-62. His *BEBO* System design for overfilled precast reinforced concrete arch structures (*BEBO* is an abbreviation of the German word „**BE**ton**BO**gen", meaning concrete arch) was being considered for use for a whole series of underpasses on Swiss Federal Highway No 1 that was under construction at that time.

In order to verify the theoretical investigation results, the Swiss Federal Government - as the owner of the highway - required a full scale load test of the proposed system. This test was performed in 1965/66 in a gravel pit near Zurich. The *BEBO* System arch structure consisted of curved precast elements with a cast-in-place butt joint at the crown. The arch had a span of 14.3 meter (47 feet) and a rise of 5.2 meter (17 feet). The precast elements were 16 centimetre (6 1/4 inches) thick.

With the introduction of the *BEBO* System in Germany, a second full scale load test became necessary and was performed in 1973 in Recklinghausen (Germany) under the supervision of the German Government's Institute for Road Research. Instrumentation of a *BEBO* System arch structure in New South Wales, Australia in 1986, and the evaluation of the test results by the University of Adelaide's Department of Civil Engineering, as well as full scale load tests performed by the University of Massachusetts in Amherst, MA, in 1996, confirmed the validity of the *BEBO* System arch analysis approach and the huge carrying capacity of the overfilled *BEBO* arches.

Once overfilled, a **wide margin of safety** makes *BEBO System* arch structures **insensitive to overloading**. Grossly overloaded *BEBO System* structures may crack; however, the resulting plastic deformations are considerably larger than the elastic deformations that are considered in the design calculations and the structure develops additional resistance in the backfill, which further enhances stability. The mass of backfill on *BEBO System* structures makes them **mechanically well damped** and thus traffic vibrations do not appreciably affect the system.

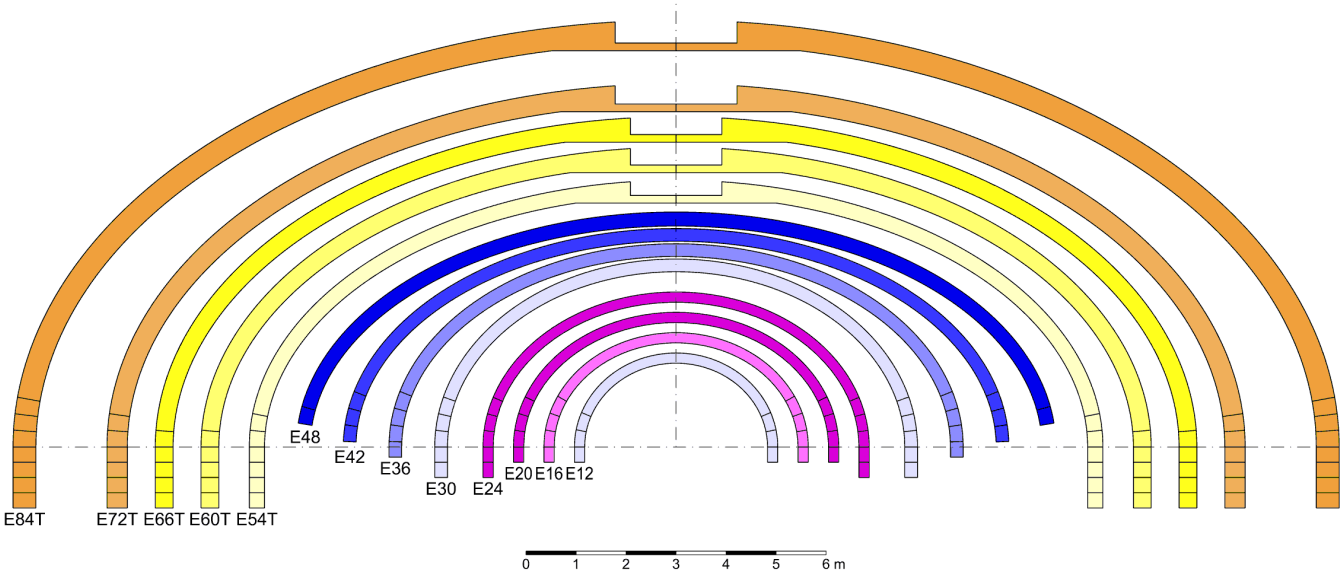
The *BEBO* Arch System has a proven and perfect track record and has been widely used all around the world for over 40 years. To date a total number of more than 1000 *BEBO* Structures have been built in Europe, the United States, Canada, South East Asia and Australia.

BEBO Offering - Arch Elements

The *BEBO* System consists of a **series of standard *BEBO* Types**. This versatile system offers a span range from 3.7 meter（12 feet）to 25.6 meter（84 feet）, variable heights and lengths determined by the number of elements placed end-to-end. The elements can also be set side-by-side for multiple span configurations.

E-Series - Elliptical Arch Shape

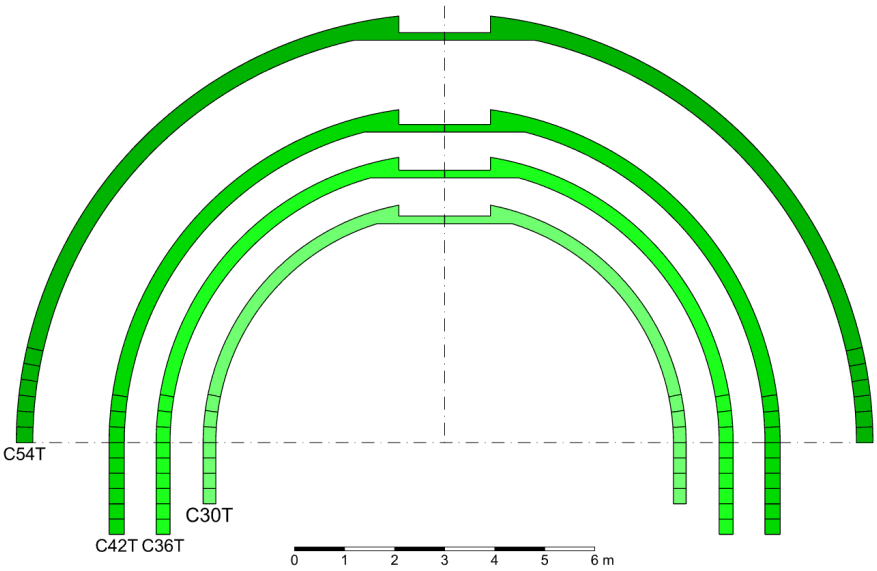
- Single Leaf Solutions
  For the smaller spans（up to the E48） **one arch element forms a complete arch ring**. The thickness of the concrete section along the development is constant.
- Twin Leaf Solutions
  For the larger spans（E54T up to E84T） **two arch elements form one complete arch ring**. The thickness of the concrete section is constant along the development except for the crown area. The connection of the two arch elements , the so- called crown joint, requires a thickened section to account for the cast-in-situ block-outs.
- Span Range
  3.6m（E12） to 14.6m（E48）for single leaf, and 16.5m（E54T）to 25.6m（E84T）for twin leaf applications.
- Overfill Heights
  The standard range of overfill above the arch crown is **0.6m（minimum）to 4.0m**. Foundation loads are given for fill heights up to 5.0m throughout, but arch designs for 5.0m overfill must be checked on a project specific basis.The smaller single leaf spans can handle **higher overfill**, subject to special designs on a project-to-project basis.



BEBO Offering - Arch Elements（continued）

C-Series - Circular Arch Shape

- Twin Leaf Solutions Only
  Due to the dimension of the circular-shaped arches （transportation）, for all spans, **two arch elements form one complete arch ring**. The thickness of the concrete section is constant along the development except for the crown area. The connection of the two arch elements , the so- called crown joint, requires a thickened section to account for the cast-in-situ block-outs.
- Span Range
  9.1m（C30T） to 16.4m（C54T）.
- Overfill Heights
  The standard range of overfill above the arch crown is **0.6m（minimum） to 5.0m**. C-Series Arches, however, can handle **considerably higher overfills up to 10m and more**. Such non-standard applications are investigated on a project-to-project basis.



BEBO Offering - Additional Features

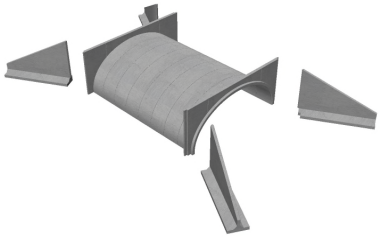
Arch End Elements

The Arch End Elements have the **same shape as the Standard Arch Elements**. In addition, the End Elements include a **curb on the outside face of the bridge** providing horizontal support for the spandrel wall. The Arch End Elements are designed to **take the same loads as the standard Arch Elements**.

Spandrel Walls

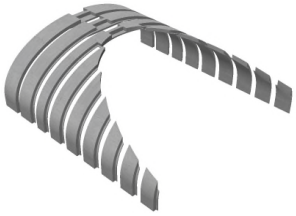
The earth retaining segmental spandrel wall is built from two **or three spandrel segments** resting on the Arch End Element. In addition the segments are horizontally supported by the lateral wing walls. The segmental spandrel wall attains its final stability once the structure is back- and overfilled.

Wing Walls



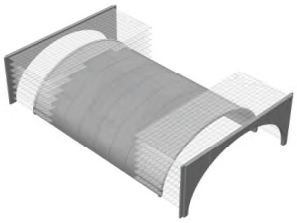
The wing wall element adjacent to the spandrel wall must both retain the earth fill behind it and support the lateral spandrel segment. The element is in turn mutually supported by the spandrel wall. Additional wing wall elements can be placed next to the first elements. They serve to retain earth only.

Bevelled Ends



The precast beveled end elements are a more recent *BEBO* development. The beveled end elements are formed using cut off arch elements which are connected by means of cast-in-situ loop joints. The loop-joints have been derived from early *BEBO* Technology, tested for both strength and fatigue.

MSE Wall Systems



MSE-type wall systems are a great addition to the *BEBO* product offering. Such segmental- or full height panel walls are in general self supporting, horizontal support by an arch end element curb is not required. MSE-type wall systems are feasible for both spandrel- and wing walls.

BEBO Offering - Summary

BEBO Structures are built from a number of **precast reinforced concrete arch elements** placed on previously cast footings, piers and/or abutments. After installation these elements are covered with well-compacted **earth back- and overfill**. The reinforced concrete arches have a thickness that is sufficient to provide substantial sectional capacity, but small enough to allow an **elastic deformation** that mobilizes the **passive resistance** of the backfill.

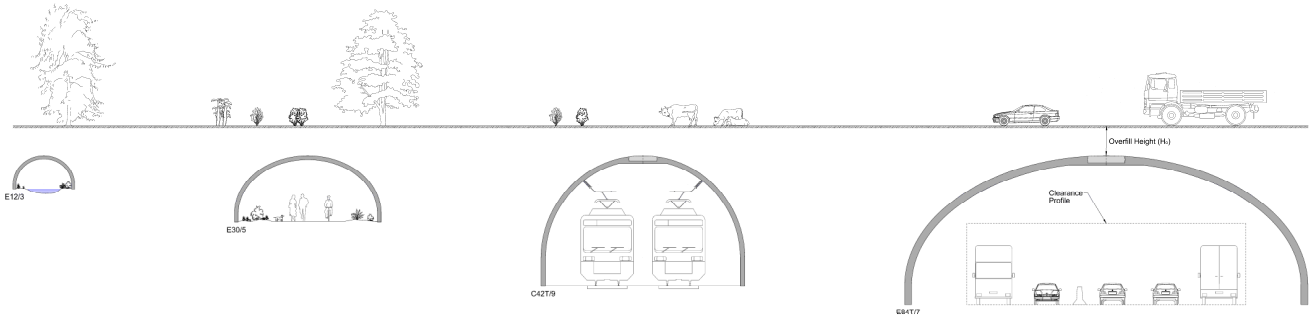
The arch sections used are slender in design, thereby providing **material economy** and relative **insensitivity to differential settlements**. The arch is designed for all stresses induced by handling, transportation and erection. Before, and during backfilling, the structure has enough strength to sustain loads from compaction equipment and a wide range of accidental loads without structural damage.

Once overfilled, a **exceptional margin of safety** makes *BEBO System* arch structures **insensitive to overloading**. Furthermore, the soil mass of fill around *BEBO System* structures makes them **mechanically well damped** and thus traffic vibrations do not appreciably affect the system.

Typical *BEBO* Applications

The recognized advantages of precast concrete and the arch shape provide an exceptional level of safety, durability, economy and low life cycle costs. The *BEBO* System is ideal for a broad range of applications:

- Small to medium span bridge constructions and stream crossings
- Overpasses and Underpasses for
  - Highways
  - Railroads
- Animal / Wildlife crossings
- Airport taxiway and runway culverts
- Underground containment, bunkers and vaults
- Storm water and glycol retention systems



Structural Design Precast Arch Elements

For an overfilled arch structure, the fill represents more than a loading. Through its **passive resistance**, it also contributes to the load carrying capacity of the arch and thus **becomes part of the structure**. This phenomenon is commonly known as **soil-structure-interaction**. The *BEBO System* arch analysis makes wide use of soil-structure-interaction in its design.

The structural design of the *BEBO* Arch System follows the **Canadian Highway Bridge Design Code CAN CSA S6-06**. Due to the nature of the structure – a reinforced concrete arch subject to soil-structure-interaction – a plane strain Finite Element Analysis (FEA) software (www.lusas.com) is used for the analysis of the structure for handling, installation, backfilling and the final state.

Overfilled structures experience a **wide range of loading conditions during the backfilling operation**, both from soil pressure and from backfill and compaction machinery. The detailed analysis of these construction load cases is important as such loading conditions may become governing in the structural design and continue to be part of the loading "history" of the completed structure.

CL-625 Live Load is applied to the *BEBO* Arch Structures in accordance with CAN CSA S6-06. The governing load cases comprise the **single axle (axle 4) and tandem axle (axles 2 and 3) centrally and eccentrically located above the crown**. Additional axles of the CL-625 vehicle are not applied, as they either have no, or a beneficial effect on the bending moments in the arch.

Craning load cases generate bending moments within the arch element, which have to be covered by design. Cable **forces** are also calculated for these load cases.

Foundations and Foundation Design

Any foundation design for *BEBO* Arch Structures must be based on **site specific geotechnical data** and can be performed by local engineers or by *BEBO* engineers based on relevant local geotechnical reports / recommendations. As for any other structure, foundations have to be such that the loads stemming from the arch can be safely transferred to the subsoil. Furthermore all foundations must be designed against relevant site specific risks such as scour, vehicle impact, slope stability issues, soil liquefaction (seismic design), etc.
Adequate consideration of such risks is the **duty of local engineers** and consultants and can't be covered by *BEBO* engineers due to the usually large geographic distance to *BEBO* construction sites.

Dimensions

Span S [m]

The arch span is defined as the distance between the lowest point of the arch legs inside faces. Since the *BEBO* Arch System has originally been designed to imperial units, the names of the different Arch types still refer to their span expressed in feet (e.g. E36: 36ft span).

Rise R [m]

The arch rise is defined as the vertical distance between the lowest point of the arch legs and the highest point of the arch inside surface. Every *BEBO* Arch type is divided into a number of subtypes defining a specific rise (e.g. E36/0: 2.79m rise; E36/4: 4.01m rise). The difference in rise between subtypes is 0.305m.

Development D [m]

The arch Development (developed length) is defined as the length of the inner arch face from one arch leg to the opposite. For Twin Leaf arches, the soffit includes the flat part of the crown joint.

Thickness t [mm]

The Thickness of the arch section is constant along the whole development. The crown joint area for the Twin Leaf Arches includes a thickened section in order to allow for casting of a monolithic connection of the arch elements, without the need for in-situ formwork.

Lay Length L [m]

The Lay Length is defined as the width of the installed arch element or the height of the arch element when lying in the as-cast position. The Lay Length for each Arch Type is optimised such as to maximise the element weight for regular non overweight transportation.

Overfill Heights H_o [m]

BEBO Arches are designed to handle a range of overfill heights plus the corresponding design code specific Live Loading. The overfill height H_o is measured from the uppermost point of the arch to the surface of the crossing roadway above the structure (including the pavement). For standard applications, a minimum overfill height of 0.6 meter above the arch has to be maintained, the maximum standard overfill height varies between 4 - 5 meters, depending on arch types.
Higher and shallower overfill heights can usually be accommodated upon request with the provision of additional reinforcement and/or other project specific modifications.

Specifications

Reinforcement Steel

Characteristic strength according to the Canadian Design Standards CAN CSA G30.18-M92; Table 2, Tensile Requirements. Grade 400: f_y=400 N/mm2 Characteristic Strength.

Concrete Volume [m^3/Arch Element]

Precast concrete volume for one *BEBO* Arch Element. For single leaf structures, one arch element equals one complete arch ring, whereas for twin leaf structures, one arch element equals one half arch ring. Two half arch rings form one complete arch ring.

In-Situ Concrete Crown Joint [m^3/Ring]

In-situ concrete volume in the crown pockets required to monolithically connect two *BEBO* Arch Elements. The tabulated volume is for one full *BEBO* Arch Ring. The total required in-situ concrete volume for the complete *BEBO* Structure can be determined by multiplying this volume by the total number of *BEBO* Arch Rings.

Handling

This section provides general information for a proper and safe handling of *BEBO* arch elements. **For more detailed information, please refer to the corresponding sections in the *BEBO* Installation manual**.

Arch Element Weight [kN and metric tons]

The total weight of the arch elements is determined based on the precast concrete volume obtained from a 3D CAD model and a specific weight for the concrete of 25kN/m^3 ≅ 2.5t/m^3. For single leaf structures, one Arch Element equals one complete arch ring, whereas for twin leaf structures, one arch element equals one half arch ring. Two half arch rings form one complete arch ring.

Cable Lengths [m]

Required cable lengths are provided to guarantee a safe handling, transportation and installation of the *BEBO* Arch elements.

For twin leaf structures, the cable arrangements with cables A & B guarantee a correct position of the hanging Arch Element for the installation. When lowered onto the foundation, the arch element can rotate around the foundation keyway until left and right arch elements connect at the crown.

Cable Forces [kN]

The listed cable forces are based on the geometrical arrangement for the specified cable lengths. The tabulated values are unfactored, i.e. working loads.

The forces for cables 1 & 2 are per cable (two cables total). The forces for cables A & B are per cable composition. Lifting into the as-installed-position requires two cable compositions, each equipped with a snatch block in order for the arch elements to be rotated.

Center of Gravity [m]

For a safe transportation on the truck platform and determination of required crane capacities, dimensions a - e are provided to define the Center of Gravity (CG) of the *BEBO* Arch Element.

Hydraulics

This section provides information to derive basic hydraulic parameters for the various *BEBO* arch shapes. Additional, non *BEBO*-specific information is however needed to calculate the hydraulic radius and for example the free flow discharge according to the Manning-Strickler Formula.

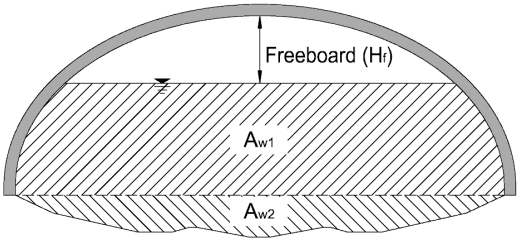
Freeboard H_f [m]

The freeboard H_f defines the maximum height of open cross section from the assumed water surface to the arch crown (inner arch face). For hydraulic applications a minimum freeboard of 1.0m is recommended in order to guarantee an efficient discharge in a flood water event.

Waterway Area A_w [m^2]

Area beneath the water surface and an assumed stream invert running through the *BEBO* structure. The tabulated values A_{w1} represent the area above the imaginary horizontal line between opposite arch legs. The value A_{w2} is a project specific value and represents the area below the imaginary horizontal line between opposite arch legs to the bottom of the stream bed.

- Waterway Area: $A_w = A_{w1} + A_{w2}$



Wetted Arch Length L_w [m]

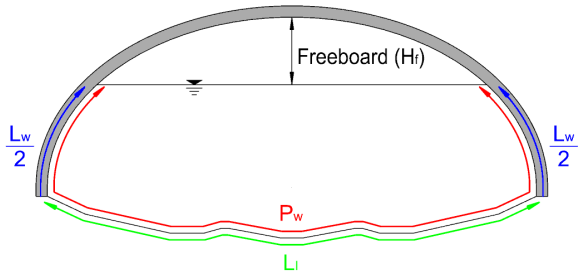
Based on the assumed freeboard (elevation of the water surface) the wetted arch length L_w is provided. This value adds up the two submerged development lengths on both the left and right arch leg. By adding the project specific wetted stream bed length L_l to the tabulated Wetted Arch Length L_w the complete wetted perimeter P_w can be determined.

- Wetted Perimeter: $P_w = L_w + L_l$
- Hydraulic Radius: $R_{hy} = A_w / P_w$
- Discharge [m³/s]: $Q = k_{st} \times R_{hy}^{2/3} \times I^{1/2} \times A_w$

  Manning Strickler Formula

  k_{st} = Strickler Coefficient / roughness

  I = Base slope [dH/dV]



The Strickler Coefficient is an empirical value which describes the roughness of a stream bed surface independent of the depth of the stream. Dimension of the Strickler Ceofficient is [m^1/3/s]. Typical values are:

- Natural stream bed: k_{st} = 30-40 (smooth surface); k_{st} = 20-30 (rough surface)
- Earth channel: k_{st} = 40-60 (smooth surface); k_{st} = 25-40 (rough surface)
- Concrete channel: k_{st} = 80-100 (smooth surface); k_{st} = 60-80 (rough surface)

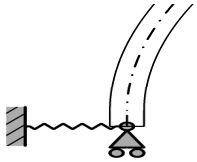
Foundation Loads

The unfactored and factored foundation loads for permanent- and live loads are tabulated in this section. The calculated load cases include overfill heights of 0.6m, 1.0m, 2.0m, 3.0m, 4.0m and 5.0m. For intermediate fill heights, the corresponding loads can be linearly interpolated. For higher overfill heights (C-Series and smaller span E-Series) contact BEBO Arch International AG for technical support.

The calculation of standard foundation loads is based on the following assumptions:

- Both arch legs are at the same elevation, i.e. the installed **arch rings are horizontal** and not set on the ground at an angle.
- The final **overfill surface above the arch is close to horizontal** (±3%)
- The **longitudinal slope of the structure is small** (≤3%)
- Shallow foundation (spread footings) on hard ground for the arch support. In case of a piled foundation, downdrag effects can increase the loads on the arch and therefore the foundation loads. **For estimation purposes,** the vertical foundation loads can be increased by appr. 20% in case of a piled foundation. **For a final design check, contact BEBO Arch International AG for confirmation.**
- Concrete specific weight of 25 kN/m³, Backfill specific weight of 22 kN/m³

- Design calculations for the arch elements are based on the following support conditions: Vertical Support: Fixed
  Horizontal Support: Spring Constant k_h = 50 kN/mm

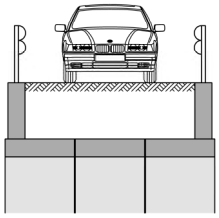


Such an arrangement reflects an arch support on either regular spread foundtions or on piles. **In case of an arch foundation on solid rock, the standard arch design can be non-conservative, i.e. arch section forces of the standard model can underestimate the real forces.**
For the design of *BEBO* arches founded on solid bedrock, please contact the *BEBO* Technical Support for clarification.

Situations Requiring Special Considerations (Including but not Limited To)

In the following circumstances always consult *BEBO* Arch International AG for project specific designs:

- Overfill Heights of less than 0.6m or more than 4.0m
- Soft soil pile foundations or foundations on solid rock
- Sloping fill (>3%) over the arch or within a distance less than two arch spans. This includes applications where *BEBO* structures cross sloping embankments at a skew angle (often the case)
- Longitudinally sloping foundation (>3%)
- Special live load arrangements, e.g. mining trucks, railroads, aircraft, etc.
- Narrow overpasses (e.g. single lane bridges; See sketch below).



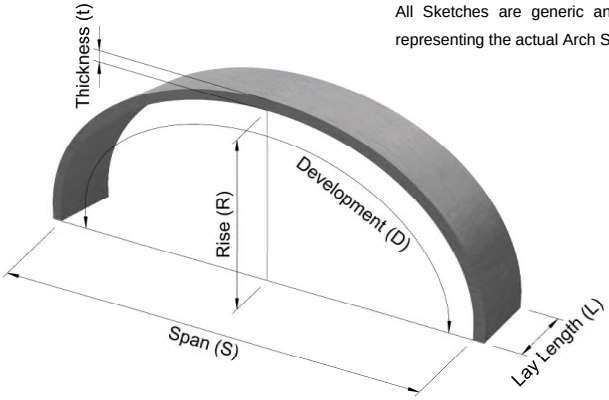
Typical Cross Section through a BEBO Bridge with one traffic lane.

E12/0

Dimensions

Span S	[m]	3.408
Rise R	[m]	1.067
Development D	[m]	4.260
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

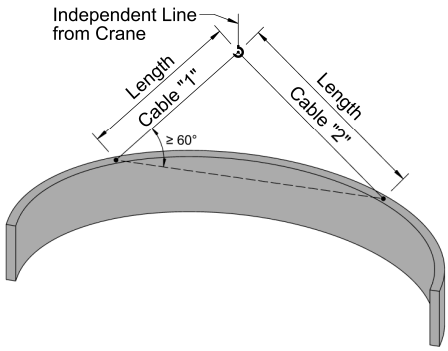


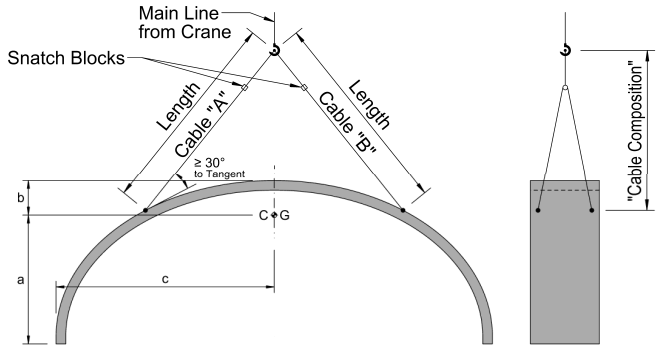
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	2.21

Handling

Arch Element Weight	[kN]	55.25 (5.5 metric tons)
Min. Length Cable A&B	[m]*	2.20
Cable Force A&B	[kN]*	32.14
Min. Length Cable 1&2	[m]	2.40
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	31.90
Center of Gravity a	[m]	0.78
Center of Gravity b	[m]	0.49
Center of Gravity c	[m]	1.89
Edge Anchor Distance	[m]	2.40

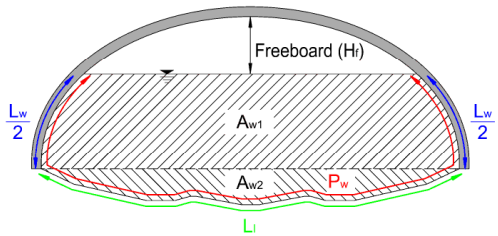




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	2.64	
1.0	0.23	0.15



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	5.7	10.9	6.8	13.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	16.0	53.3	19.7	66.1
LC41	0.6m OF + Single Axle C	37.3	87.7	55.9	124.5
LC42	0.6m OF + Single Axle Ecc	28.7	90.5	41.3	129.2
LC43	0.6m OF + Tandem C	44.3	102.2	67.8	149.2
LC44	0.6m OF + Tandem Ecc	34.4	105.0	51.1	153.9
LC50	1.0m OF Permanent Loads	21.5	64.5	26.6	80.1
LC51	1.0m OF + Single Axle C	36.9	92.4	52.8	127.6
LC52	1.0m OF + Single Axle Ecc	31.1	95.9	43.0	133.5
LC53	1.0m OF + Tandem C	43.4	107.4	63.8	152.9
LC54	1.0m OF + Tandem Ecc	35.8	108.7	51.0	155.2
LC60	2.0m OF Permanent Loads	37.0	110.8	45.9	137.9
LC61	2.0m OF + Single Axle C	45.1	127.1	59.7	165.7
LC62	2.0m OF + Single Axle Ecc	42.0	127.8	54.5	166.9
LC63	2.0m OF + Tandem C	49.0	136.2	66.3	181.2
LC64	2.0m OF + Tandem Ecc	44.9	136.6	59.4	181.8
LC70	3.0m OF Permanent Loads	51.5	155.2	64.1	193.5
LC71	3.0m OF + Single Axle C	56.8	166.7	73.2	213.1
LC72	3.0m OF + Single Axle Ecc	55.0	166.6	70.0	212.9
LC73	3.0m OF + Tandem C	59.6	173.2	77.8	224.1
LC74	3.0m OF + Tandem Ecc	57.1	173.0	73.5	223.7
LC80	4.0m OF Permanent Loads	66.4	200.3	82.7	249.8
LC81	4.0m OF + Single Axle C	70.1	208.8	89.1	264.3
LC82	4.0m OF + Single Axle Ecc	69.0	208.6	87.1	263.9
LC83	4.0m OF + Tandem C	72.1	213.7	92.5	272.6
LC84	4.0m OF + Tandem Ecc	70.5	213.3	89.7	272.0
LC90	5.0m OF Permanent Loads	81.6	246.0	101.7	306.9
LC91	5.0m OF + Single Axle C	84.3	252.5	106.3	318.0
LC92	5.0m OF + Single Axle Ecc	83.5	252.3	105.0	317.6
LC93	5.0m OF + Tandem C	85.8	256.2	108.9	324.4
LC94	5.0m OF + Tandem Ecc	84.7	255.9	107.0	323.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

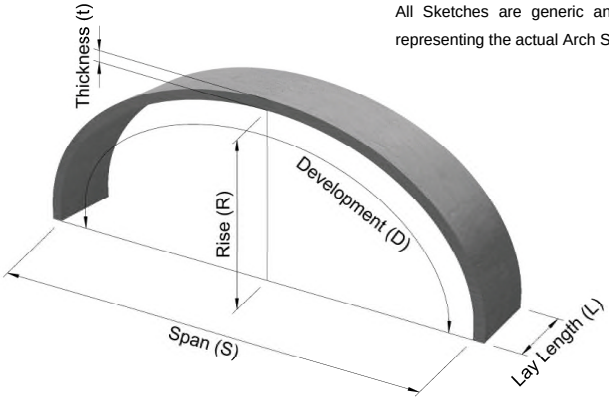
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E12/1

Dimensions

Span S	[m]	3.596
Rise R	[m]	1.372
Development D	[m]	4.890
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

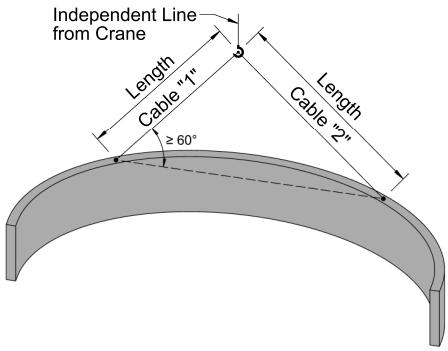


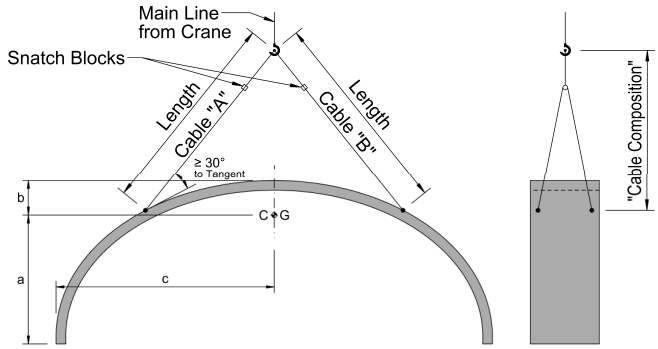
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	2.55

Handling

Arch Element Weight	[kN]	63.75 (6.4 metric tons)
Min. Length Cable A&B	[m]*	2.20
Cable Force A&B	[kN]*	37.00
Min. Length Cable 1&2	[m]	2.70
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	36.81
Center of Gravity a	[m]	0.97
Center of Gravity b	[m]	0.61
Center of Gravity c	[m]	2.00
Edge Anchor Distance	[m]	2.70

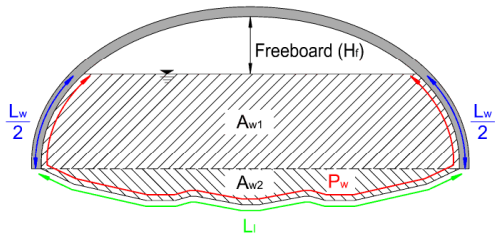




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	3.71	
1.0	1.30	0.78



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	5.4	12.6	6.5	15.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	12.5	62.4	15.3	77.4
LC41	0.6m OF + Single Axle C	30.3	95.7	45.7	134.0
LC42	0.6m OF + Single Axle Ecc	24.2	99.2	35.3	139.9
LC43	0.6m OF + Tandem C	36.1	108.2	55.5	155.3
LC44	0.6m OF + Tandem Ecc	29.3	115.1	43.8	167.0
LC50	1.0m OF Permanent Loads	16.3	73.0	20.2	90.6
LC51	1.0m OF + Single Axle C	29.6	100.9	42.8	138.0
LC52	1.0m OF + Single Axle Ecc	25.9	106.6	36.3	147.7
LC53	1.0m OF + Tandem C	35.6	116.2	52.8	164.1
LC54	1.0m OF + Tandem Ecc	30.2	120.5	43.7	171.4
LC60	2.0m OF Permanent Loads	29.7	124.5	36.9	155.0
LC61	2.0m OF + Single Axle C	37.0	141.3	49.2	183.6
LC62	2.0m OF + Single Axle Ecc	34.8	143.2	45.4	186.8
LC63	2.0m OF + Tandem C	40.5	151.0	55.3	200.1
LC64	2.0m OF + Tandem Ecc	37.5	152.9	50.1	203.3
LC70	3.0m OF Permanent Loads	42.5	174.7	52.8	217.8
LC71	3.0m OF + Single Axle C	47.3	186.9	61.0	238.5
LC72	3.0m OF + Single Axle Ecc	45.9	187.4	58.6	239.3
LC73	3.0m OF + Tandem C	49.8	193.9	65.3	250.4
LC74	3.0m OF + Tandem Ecc	47.8	194.5	61.9	251.3
LC80	4.0m OF Permanent Loads	55.7	226.0	69.3	281.9
LC81	4.0m OF + Single Axle C	59.1	235.2	75.1	297.6
LC82	4.0m OF + Single Axle Ecc	58.1	235.3	73.5	297.7
LC83	4.0m OF + Tandem C	60.9	240.6	78.3	306.6
LC84	4.0m OF + Tandem Ecc	59.6	240.6	76.0	306.7
LC90	5.0m OF Permanent Loads	69.2	278.3	86.2	347.2
LC91	5.0m OF + Single Axle C	71.7	285.4	90.5	359.4
LC92	5.0m OF + Single Axle Ecc	71.1	285.4	89.4	359.3
LC93	5.0m OF + Tandem C	73.1	289.6	92.9	366.4
LC94	5.0m OF + Tandem Ecc	72.2	289.5	91.4	366.3

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

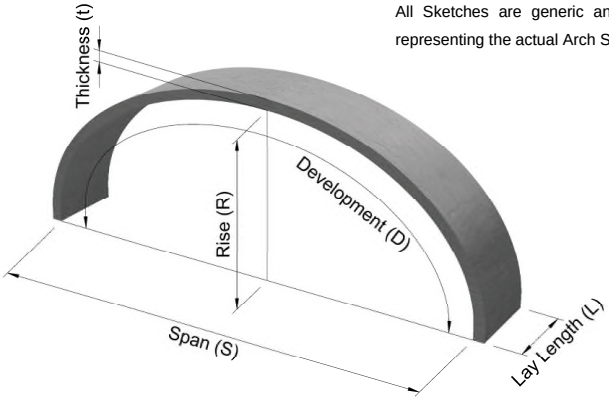
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E12/2

Dimensions

Span S	[m]	3.658
Rise R	[m]	1.676
Development D	[m]	5.510
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

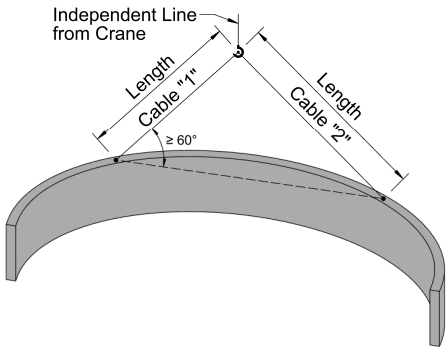


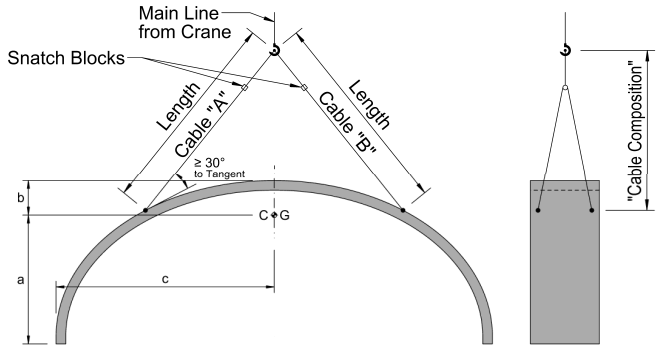
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	2.87

Handling

Arch Element Weight	[kN]	71.75 (7.2 metric tons)
Min. Length Cable A&B	[m]*	2.90
Cable Force A&B	[kN]*	39.81
Min. Length Cable 1&2	[m]	2.95
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	41.42
Center of Gravity a	[m]	1.15
Center of Gravity b	[m]	0.73
Center of Gravity c	[m]	2.03
Edge Anchor Distance	[m]	2.95

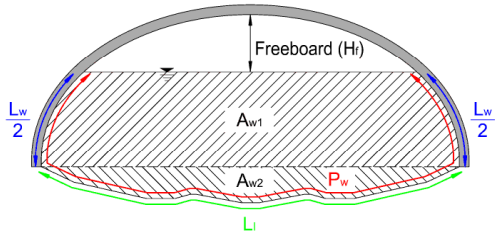




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	4.81	
1.0	2.41	1.40
1.5	0.64	0.36



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	4.6	14.2	5.6	17.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	6.6	69.0	8.0	85.5
LC41	0.6m OF + Single Axle C	20.1	100.8	31.0	139.6
LC42	0.6m OF + Single Axle Ecc	16.6	106.1	25.0	148.6
LC43	0.6m OF + Tandem C	24.6	112.3	38.7	159.2
LC44	0.6m OF + Tandem Ecc	20.5	122.4	31.6	176.3
LC50	1.0m OF Permanent Loads	9.0	79.6	11.1	98.8
LC51	1.0m OF + Single Axle C	19.2	106.5	28.4	144.5
LC52	1.0m OF + Single Axle Ecc	17.1	114.1	24.8	157.4
LC53	1.0m OF + Tandem C	23.9	121.6	36.3	170.2
LC54	1.0m OF + Tandem Ecc	20.6	128.4	30.7	181.7
LC60	2.0m OF Permanent Loads	18.5	133.7	22.9	166.4
LC61	2.0m OF + Single Axle C	24.1	150.5	32.5	194.9
LC62	2.0m OF + Single Axle Ecc	22.8	153.5	30.2	200.1
LC63	2.0m OF + Tandem C	27.0	160.4	37.4	211.8
LC64	2.0m OF + Tandem Ecc	25.1	163.8	34.1	217.6
LC70	3.0m OF Permanent Loads	27.6	187.8	34.3	234.0
LC71	3.0m OF + Single Axle C	31.4	200.0	40.7	254.9
LC72	3.0m OF + Single Axle Ecc	30.4	201.2	39.1	256.8
LC73	3.0m OF + Tandem C	33.4	207.3	44.2	267.2
LC74	3.0m OF + Tandem Ecc	32.1	208.7	41.9	269.6
LC80	4.0m OF Permanent Loads	37.1	243.1	46.2	303.2
LC81	4.0m OF + Single Axle C	39.8	252.5	50.8	319.2
LC82	4.0m OF + Single Axle Ecc	39.2	253.0	49.6	320.0
LC83	4.0m OF + Tandem C	41.3	258.1	53.3	328.6
LC84	4.0m OF + Tandem Ecc	40.4	258.7	51.7	329.6
LC90	5.0m OF Permanent Loads	47.0	299.7	58.5	373.9
LC91	5.0m OF + Single Axle C	49.0	307.1	61.9	386.5
LC92	5.0m OF + Single Axle Ecc	48.6	307.3	61.1	386.8
LC93	5.0m OF + Tandem C	50.1	311.4	63.8	393.7
LC94	5.0m OF + Tandem Ecc	49.5	311.6	62.7	394.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

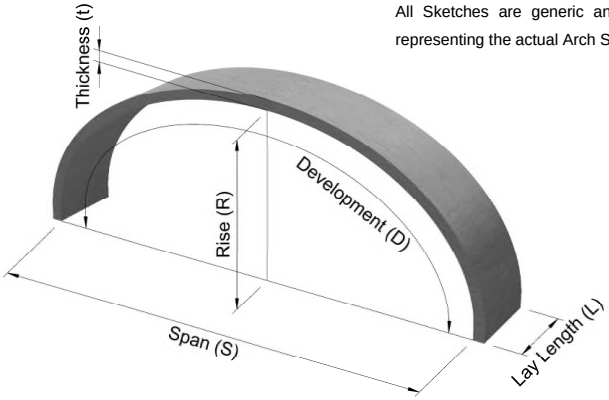
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E12/3

Dimensions

Span S	[m]	3.658
Rise R	[m]	1.981
Development D	[m]	6.120
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

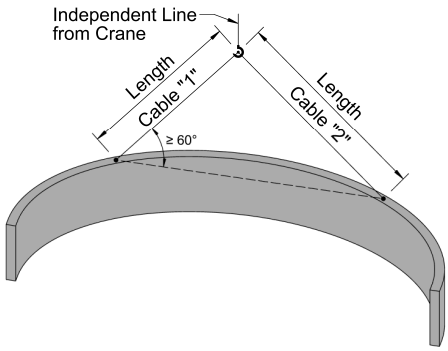


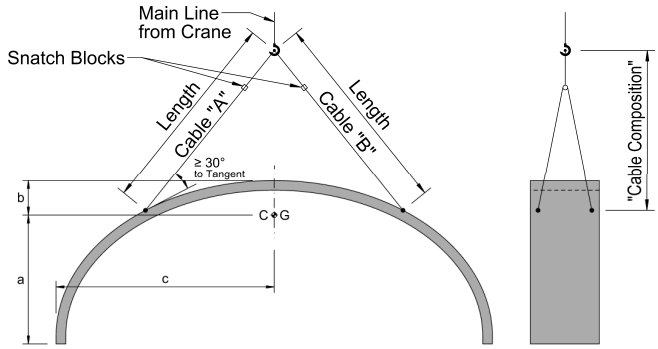
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.17

Handling

Arch Element Weight	[kN]	79.25 (7.9 metric tons)
Min. Length Cable A&B	[m]*	4.10
Cable Force A&B	[kN]*	42.33
Min. Length Cable 1&2	[m]	3.16
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	45.76
Center of Gravity a	[m]	1.33
Center of Gravity b	[m]	0.85
Center of Gravity c	[m]	2.03
Edge Anchor Distance	[m]	3.16

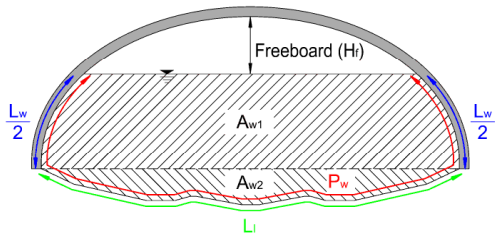




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	5.93	
1.0	3.52	2.00
1.5	1.76	0.96



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	3.9	15.7	4.6	18.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	0.9	73.9	0.9	91.6
LC41	0.6m OF + Single Axle C	10.9	104.0	17.9	142.7
LC42	0.6m OF + Single Axle Ecc	9.3	111.3	15.2	155.2
LC43	0.6m OF + Tandem C	14.6	115.4	24.3	162.2
LC44	0.6m OF + Tandem Ecc	12.2	127.5	20.2	182.7
LC50	1.0m OF Permanent Loads	2.6	85.0	3.0	105.5
LC51	1.0m OF + Single Axle C	10.1	110.7	15.8	149.2
LC52	1.0m OF + Single Axle Ecc	9.0	119.3	13.9	163.9
LC53	1.0m OF + Tandem C	13.6	125.3	21.8	173.9
LC54	1.0m OF + Tandem Ecc	11.7	133.7	18.5	188.2
LC60	2.0m OF Permanent Loads	8.4	140.6	10.3	174.9
LC61	2.0m OF + Single Axle C	12.6	157.0	17.5	202.8
LC62	2.0m OF + Single Axle Ecc	11.8	160.8	16.1	209.4
LC63	2.0m OF + Tandem C	14.8	166.8	21.2	219.6
LC64	2.0m OF + Tandem Ecc	13.6	171.3	19.2	227.2
LC70	3.0m OF Permanent Loads	14.1	196.9	17.4	245.4
LC71	3.0m OF + Single Axle C	16.9	209.1	22.2	266.0
LC72	3.0m OF + Single Axle Ecc	16.3	210.7	21.1	268.9
LC73	3.0m OF + Tandem C	18.4	216.3	24.8	278.4
LC74	3.0m OF + Tandem Ecc	17.6	218.4	23.3	281.9
LC80	4.0m OF Permanent Loads	20.0	254.8	24.9	317.7
LC81	4.0m OF + Single Axle C	22.0	264.2	28.3	333.7
LC82	4.0m OF + Single Axle Ecc	21.6	265.0	27.5	335.0
LC83	4.0m OF + Tandem C	23.1	269.7	30.1	343.0
LC84	4.0m OF + Tandem Ecc	22.5	270.7	29.0	344.7
LC90	5.0m OF Permanent Loads	26.3	314.0	32.6	391.7
LC91	5.0m OF + Single Axle C	27.7	321.4	35.2	404.3
LC92	5.0m OF + Single Axle Ecc	27.4	321.7	34.6	404.9
LC93	5.0m OF + Tandem C	28.6	325.6	36.6	411.5
LC94	5.0m OF + Tandem Ecc	28.1	326.1	35.8	412.3

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

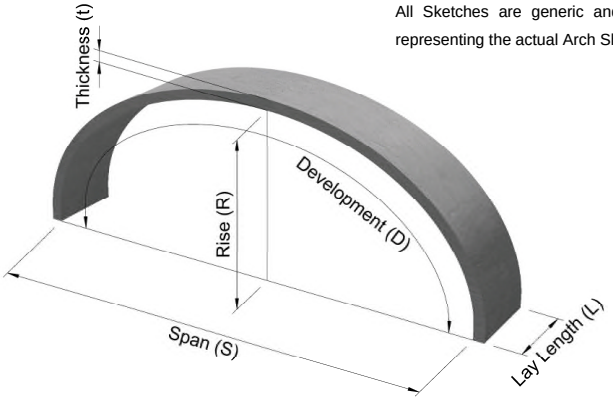
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E16/0

Dimensions

Span S	[m]	4.382
Rise R	[m]	1.168
Development D	[m]	5.197
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

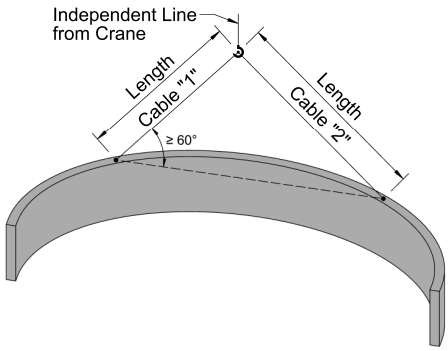


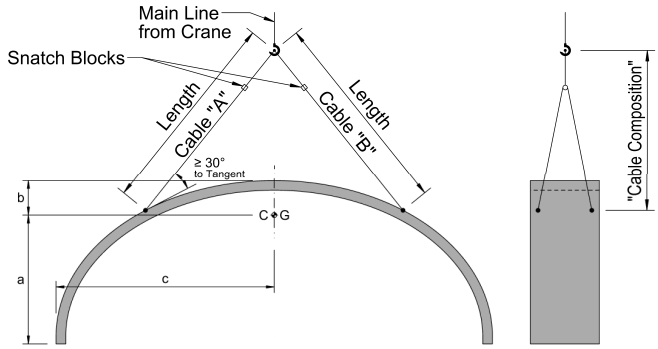
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	2.67

Handling

Arch Element Weight	[kN]	66.75 (6.7 metric tons)
Min. Length Cable A&B	[m]*	2.10
Cable Force A&B	[kN]*	40.73
Min. Length Cable 1&2	[m]	2.96
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	38.54
Center of Gravity a	[m]	0.86
Center of Gravity b	[m]	0.51
Center of Gravity c	[m]	2.37
Edge Anchor Distance	[m]	2.96

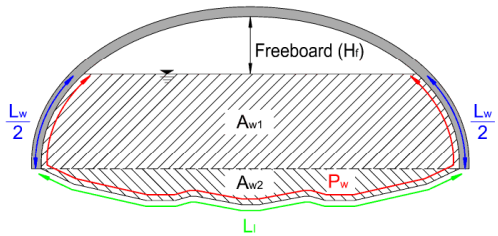




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	3.67	
1.0	0.72	0.40



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	8.9	13.2	10.7	15.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	26.8	66.3	33.0	82.3
LC41	0.6m OF + Single Axle C	54.1	101.0	79.5	141.2
LC42	0.6m OF + Single Axle Ecc	43.7	106.0	61.9	149.6
LC43	0.6m OF + Tandem C	65.2	116.9	98.4	168.2
LC44	0.6m OF + Tandem Ecc	52.7	124.1	77.1	180.5
LC50	1.0m OF Permanent Loads	36.9	82.7	45.6	102.7
LC51	1.0m OF + Single Axle C	56.8	111.0	79.6	150.8
LC52	1.0m OF + Single Axle Ecc	49.7	115.5	67.4	158.4
LC53	1.0m OF + Tandem C	66.5	126.8	95.9	177.8
LC54	1.0m OF + Tandem Ecc	56.9	131.6	79.7	185.8
LC60	2.0m OF Permanent Loads	62.0	139.4	77.1	173.6
LC61	2.0m OF + Single Axle C	73.1	156.6	95.9	202.8
LC62	2.0m OF + Single Axle Ecc	69.2	158.0	89.4	205.2
LC63	2.0m OF + Tandem C	78.9	166.5	105.7	219.6
LC64	2.0m OF + Tandem Ecc	73.5	168.3	96.6	222.7
LC70	3.0m OF Permanent Loads	85.2	193.2	106.1	240.8
LC71	3.0m OF + Single Axle C	92.7	205.6	118.7	261.9
LC72	3.0m OF + Single Axle Ecc	90.2	205.8	114.6	262.3
LC73	3.0m OF + Tandem C	96.6	212.7	125.5	274.0
LC74	3.0m OF + Tandem Ecc	93.2	213.1	119.6	274.7
LC80	4.0m OF Permanent Loads	108.3	246.9	134.9	307.9
LC81	4.0m OF + Single Axle C	113.5	256.2	143.8	323.8
LC82	4.0m OF + Single Axle Ecc	111.9	256.1	141.1	323.6
LC83	4.0m OF + Tandem C	116.4	261.5	148.7	332.8
LC84	4.0m OF + Tandem Ecc	114.1	261.5	144.9	332.8
LC90	5.0m OF Permanent Loads	131.3	300.6	163.7	375.1
LC91	5.0m OF + Single Axle C	135.2	307.9	170.3	387.4
LC92	5.0m OF + Single Axle Ecc	134.1	307.7	168.4	387.1
LC93	5.0m OF + Tandem C	137.4	312.0	174.0	394.4
LC94	5.0m OF + Tandem Ecc	135.8	311.8	171.3	394.2

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

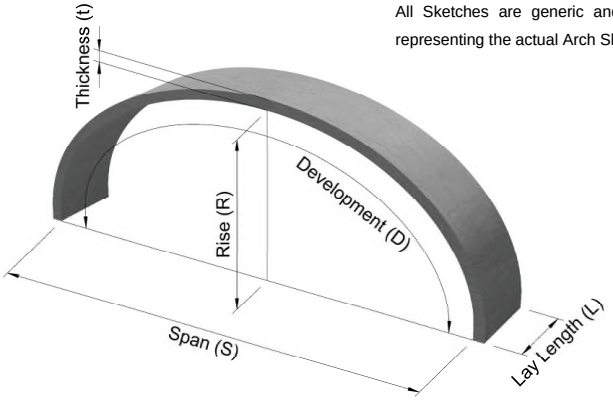
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E16/1

Dimensions

Span S	[m]	4.664
Rise R	[m]	1.473
Development D	[m]	5.870
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

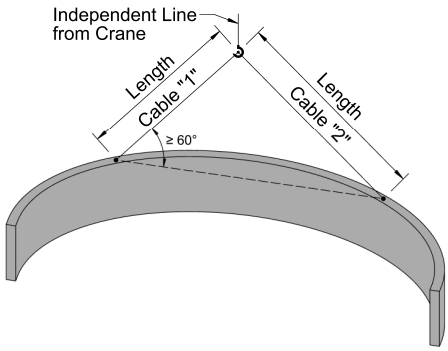


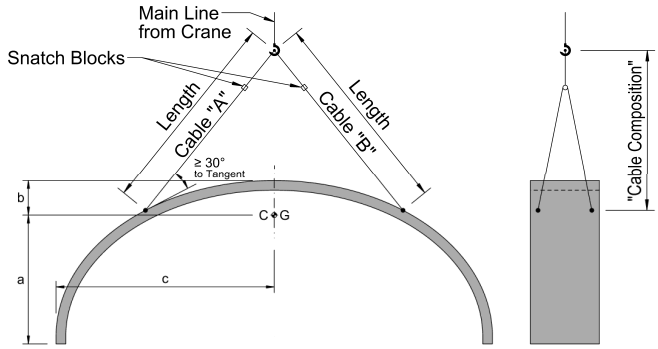
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.01

Handling

Arch Element Weight	[kN]	75.25 (7.5 metric tons)
Min. Length Cable A&B	[m]*	2.60
Cable Force A&B	[kN]*	44.71
Min. Length Cable 1&2	[m]	3.30
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	43.45
Center of Gravity a	[m]	1.05
Center of Gravity b	[m]	0.62
Center of Gravity c	[m]	2.52
Edge Anchor Distance	[m]	3.30

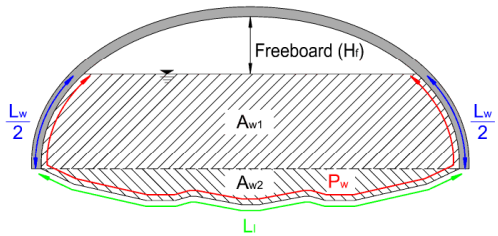




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	5.05	
1.0	2.10	1.08



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	8.6	14.9	10.3	17.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	22.5	75.6	27.7	93.7
LC41	0.6m OF + Single Axle C	45.3	109.6	66.4	151.6
LC42	0.6m OF + Single Axle Ecc	38.6	116.4	55.0	163.2
LC43	0.6m OF + Tandem C	54.7	124.6	82.4	177.0
LC44	0.6m OF + Tandem Ecc	46.5	135.5	68.5	195.5
LC50	1.0m OF Permanent Loads	30.7	93.1	37.9	115.6
LC51	1.0m OF + Single Axle C	47.7	121.1	66.9	163.2
LC52	1.0m OF + Single Axle Ecc	43.1	127.4	59.1	174.0
LC53	1.0m OF + Tandem C	56.2	137.0	81.3	190.2
LC54	1.0m OF + Tandem Ecc	49.9	144.6	70.5	203.1
LC60	2.0m OF Permanent Loads	52.7	154.3	65.4	192.1
LC61	2.0m OF + Single Axle C	62.5	172.1	82.2	222.4
LC62	2.0m OF + Single Axle Ecc	59.9	174.6	77.7	226.6
LC63	2.0m OF + Tandem C	67.8	182.4	91.1	239.9
LC64	2.0m OF + Tandem Ecc	64.0	185.7	84.6	245.6
LC70	3.0m OF Permanent Loads	73.9	214.6	91.9	267.5
LC71	3.0m OF + Single Axle C	80.6	227.6	103.3	289.6
LC72	3.0m OF + Single Axle Ecc	78.7	228.4	100.2	290.9
LC73	3.0m OF + Tandem C	84.2	235.1	109.5	302.4
LC74	3.0m OF + Tandem Ecc	81.6	236.4	105.1	304.5
LC80	4.0m OF Permanent Loads	95.1	275.1	118.4	343.1
LC81	4.0m OF + Single Axle C	99.9	285.0	126.6	360.0
LC82	4.0m OF + Single Axle Ecc	98.6	285.2	124.5	360.4
LC83	4.0m OF + Tandem C	102.6	290.8	131.2	369.8
LC84	4.0m OF + Tandem Ecc	100.8	291.2	128.1	370.6
LC90	5.0m OF Permanent Loads	116.4	336.1	145.1	419.3
LC91	5.0m OF + Single Axle C	120.1	343.9	151.3	432.7
LC92	5.0m OF + Single Axle Ecc	119.2	343.9	149.8	432.6
LC93	5.0m OF + Tandem C	122.1	348.4	154.7	440.3
LC94	5.0m OF + Tandem Ecc	120.8	348.5	152.6	440.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

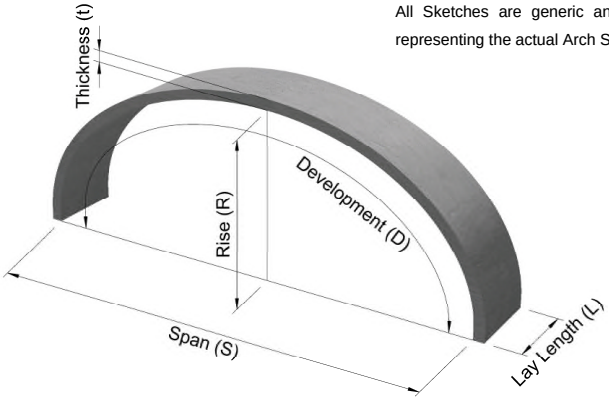
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E16/2

Dimensions

Span S	[m]	4.824
Rise R	[m]	1.778
Development D	[m]	6.501
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

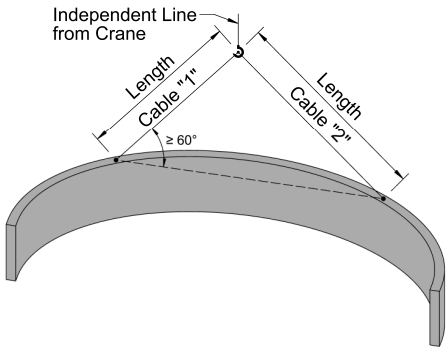


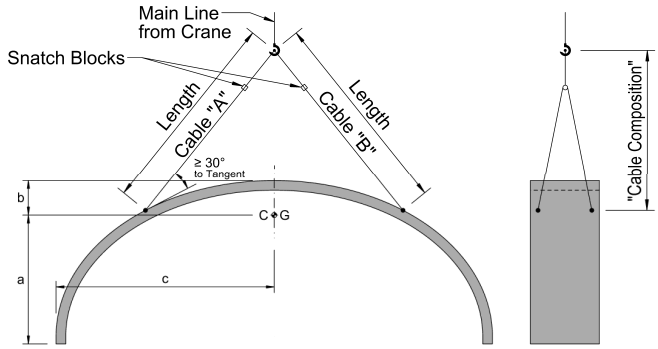
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.34

Handling

Arch Element Weight	[kN]	83.50 (8.4 metric tons)
Min. Length Cable A&B	[m]*	3.20
Cable Force A&B	[kN]*	47.74
Min. Length Cable 1&2	[m]	3.59
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	48.21
Center of Gravity a	[m]	1.24
Center of Gravity b	[m]	0.74
Center of Gravity c	[m]	2.61
Edge Anchor Distance	[m]	3.59

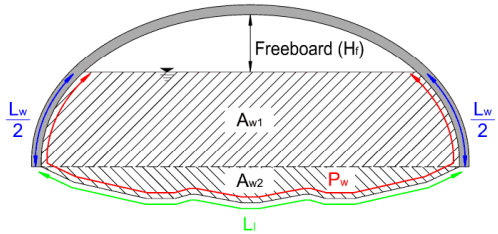




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	6.50	
1.0	3.55	1.70
1.5	1.32	0.58



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	7.8	16.5	9.4	19.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	16.0	82.8	19.6	102.7
LC41	0.6m OF + Single Axle C	34.2	115.5	50.5	158.2
LC42	0.6m OF + Single Axle Ecc	30.5	124.3	44.3	173.1
LC43	0.6m OF + Tandem C	41.9	129.3	63.7	181.7
LC44	0.6m OF + Tandem Ecc	37.3	143.4	55.8	205.7
LC50	1.0m OF Permanent Loads	22.4	100.7	27.6	125.1
LC51	1.0m OF + Single Axle C	36.2	128.0	51.1	171.5
LC52	1.0m OF + Single Axle Ecc	33.7	136.3	46.9	185.6
LC53	1.0m OF + Tandem C	43.3	143.7	63.1	198.1
LC54	1.0m OF + Tandem Ecc	39.7	154.0	57.0	215.7
LC60	2.0m OF Permanent Loads	40.3	165.6	49.9	206.2
LC61	2.0m OF + Single Axle C	48.4	183.3	63.8	236.3
LC62	2.0m OF + Single Axle Ecc	46.8	187.0	61.1	242.5
LC63	2.0m OF + Tandem C	52.8	193.7	71.3	253.9
LC64	2.0m OF + Tandem Ecc	50.5	198.8	67.3	262.6
LC70	3.0m OF Permanent Loads	57.7	230.3	71.7	287.1
LC71	3.0m OF + Single Axle C	63.3	243.5	81.2	309.4
LC72	3.0m OF + Single Axle Ecc	62.1	245.0	79.2	312.0
LC73	3.0m OF + Tandem C	66.4	251.2	86.5	322.6
LC74	3.0m OF + Tandem Ecc	64.7	253.5	83.6	326.5
LC80	4.0m OF Permanent Loads	75.2	295.6	93.6	368.7
LC81	4.0m OF + Single Axle C	79.3	305.9	100.6	386.1
LC82	4.0m OF + Single Axle Ecc	78.4	306.5	99.1	387.2
LC83	4.0m OF + Tandem C	81.6	311.9	104.5	396.3
LC84	4.0m OF + Tandem Ecc	80.3	312.9	102.3	398.2
LC90	5.0m OF Permanent Loads	93.1	362.0	116.0	451.7
LC91	5.0m OF + Single Axle C	96.2	370.2	121.2	465.5
LC92	5.0m OF + Single Axle Ecc	95.5	370.4	120.1	466.0
LC93	5.0m OF + Tandem C	97.9	374.9	124.2	473.6
LC94	5.0m OF + Tandem Ecc	97.0	375.5	122.7	474.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

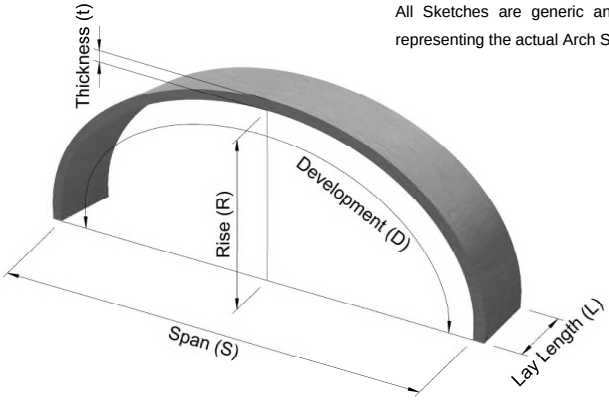
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E16/3

Dimensions

Span S	[m]	4.876
Rise R	[m]	2.083
Development D	[m]	7.114
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

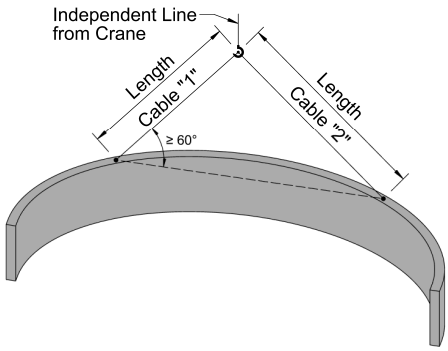


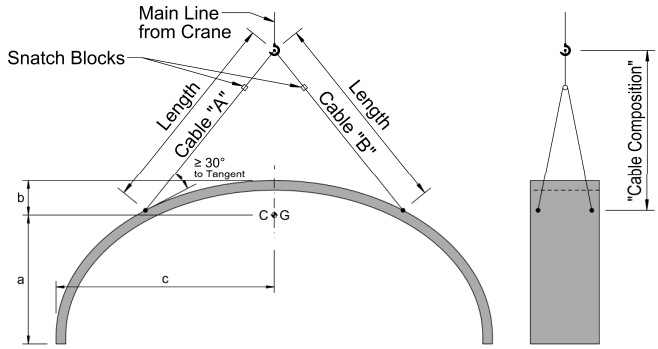
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.66

Handling

Arch Element Weight	[kN]	91.50 (9.2 metric tons)
Min. Length Cable A&B	[m]*	4.10
Cable Force A&B	[kN]*	50.56
Min. Length Cable 1&2	[m]	3.85
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	52.83
Center of Gravity a	[m]	1.43
Center of Gravity b	[m]	0.86
Center of Gravity c	[m]	2.64
Edge Anchor Distance	[m]	3.85

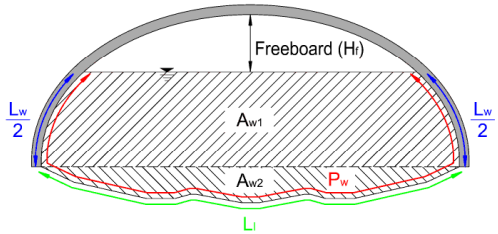




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	7.98	
1.0	5.03	2.32
1.5	2.81	1.18
2.0	0.40	0.16



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	6.7	18.1	8.1	21.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	8.2	88.3	10.0	109.5
LC41	0.6m OF + Single Axle C	21.9	118.8	33.2	161.2
LC42	0.6m OF + Single Axle Ecc	20.5	129.7	30.8	179.8
LC43	0.6m OF + Tandem C	27.9	131.3	43.5	182.6
LC44	0.6m OF + Tandem Ecc	25.8	148.4	39.9	211.7
LC50	1.0m OF Permanent Loads	13.0	106.4	15.9	132.0
LC51	1.0m OF + Single Axle C	23.4	132.3	33.6	176.1
LC52	1.0m OF + Single Axle Ecc	22.3	142.3	31.8	193.2
LC53	1.0m OF + Tandem C	28.8	147.3	42.8	201.6
LC54	1.0m OF + Tandem Ecc	27.1	160.3	39.9	223.7
LC60	2.0m OF Permanent Loads	25.8	173.5	31.9	216.0
LC61	2.0m OF + Single Axle C	32.0	190.7	42.4	245.2
LC62	2.0m OF + Single Axle Ecc	31.2	195.5	41.1	253.4
LC63	2.0m OF + Tandem C	35.4	200.9	48.2	262.5
LC64	2.0m OF + Tandem Ecc	34.2	207.7	46.2	274.1
LC70	3.0m OF Permanent Loads	38.2	240.9	47.4	300.2
LC71	3.0m OF + Single Axle C	42.5	253.9	54.7	322.3
LC72	3.0m OF + Single Axle Ecc	41.8	256.2	53.5	326.2
LC73	3.0m OF + Tandem C	44.9	261.6	58.9	335.4
LC74	3.0m OF + Tandem Ecc	43.9	265.0	57.1	341.3
LC80	4.0m OF Permanent Loads	50.9	309.6	63.3	386.1
LC81	4.0m OF + Single Axle C	54.1	319.8	68.6	403.4
LC82	4.0m OF + Single Axle Ecc	53.5	321.0	67.7	405.4
LC83	4.0m OF + Tandem C	55.9	325.8	71.7	413.7
LC84	4.0m OF + Tandem Ecc	55.1	327.6	70.4	416.8
LC90	5.0m OF Permanent Loads	63.9	379.5	79.5	473.5
LC91	5.0m OF + Single Axle C	66.3	387.7	83.6	487.4
LC92	5.0m OF + Single Axle Ecc	65.9	388.3	82.9	488.4
LC93	5.0m OF + Tandem C	67.7	392.5	86.0	495.5
LC94	5.0m OF + Tandem Ecc	67.1	393.5	84.9	497.2

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

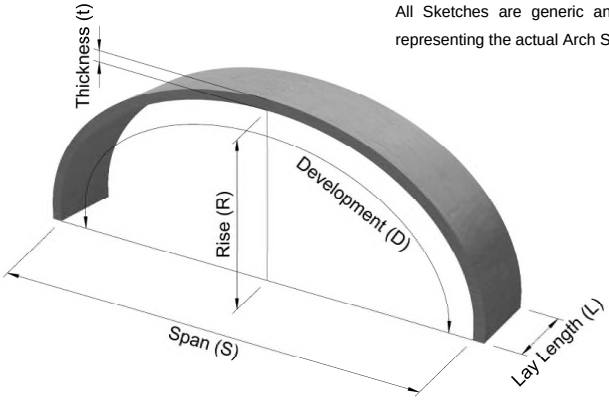
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E16/4

Dimensions

Span S	[m]	4.876
Rise R	[m]	2.388
Development D	[m]	7.724
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

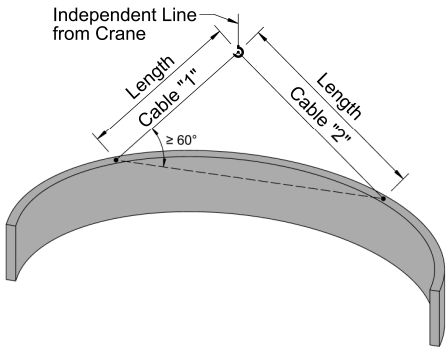


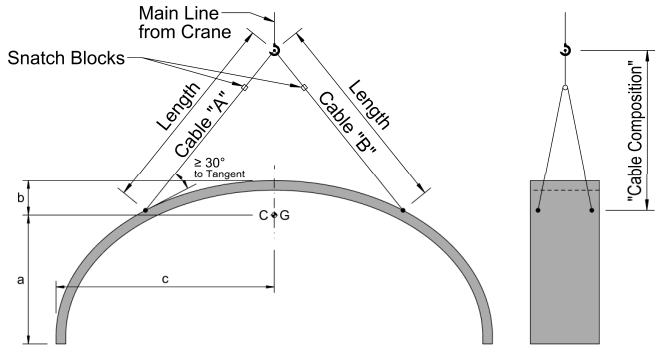
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.96

Handling

Arch Element Weight	[kN]	99.00 (9.9 metric tons)
Min. Length Cable A&B	[m]*	5.30
Cable Force A&B	[kN]*	53.08
Min. Length Cable 1&2	[m]	4.07
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	57.16
Center of Gravity a	[m]	1.61
Center of Gravity b	[m]	0.98
Center of Gravity c	[m]	2.64
Edge Anchor Distance	[m]	4.07

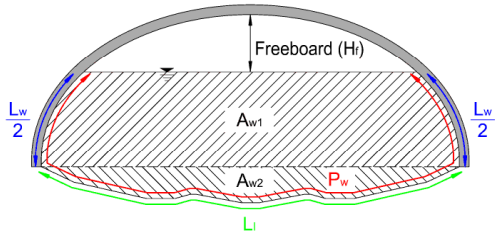




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	9.47	
1.0	6.52	2.92
1.5	4.29	1.80
2.0	1.89	0.78



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	5.7	19.6	6.8	23.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	1.2	92.7	1.2	114.9
LC41	0.6m OF + Single Axle C	11.1	121.4	18.0	163.8
LC42	0.6m OF + Single Axle Ecc	10.9	133.7	17.8	184.6
LC43	0.6m OF + Tandem C	15.8	133.5	26.0	184.2
LC44	0.6m OF + Tandem Ecc	15.1	152.2	24.8	216.1
LC50	1.0m OF Permanent Loads	4.5	111.8	5.3	138.8
LC51	1.0m OF + Single Axle C	12.1	136.3	18.2	180.4
LC52	1.0m OF + Single Axle Ecc	11.8	147.3	17.7	199.1
LC53	1.0m OF + Tandem C	16.1	150.5	25.0	204.6
LC54	1.0m OF + Tandem Ecc	15.4	164.9	23.9	229.0
LC60	2.0m OF Permanent Loads	12.9	180.5	15.8	224.7
LC61	2.0m OF + Single Axle C	17.4	196.8	23.5	252.4
LC62	2.0m OF + Single Axle Ecc	17.0	202.4	22.9	261.8
LC63	2.0m OF + Tandem C	19.9	206.7	27.8	269.1
LC64	2.0m OF + Tandem Ecc	19.3	214.6	26.8	282.6
LC70	3.0m OF Permanent Loads	20.8	249.3	25.7	310.7
LC71	3.0m OF + Single Axle C	24.0	261.9	31.1	332.0
LC72	3.0m OF + Single Axle Ecc	23.6	264.7	30.4	336.9
LC73	3.0m OF + Tandem C	25.8	269.5	34.2	344.9
LC74	3.0m OF + Tandem Ecc	25.2	273.6	33.2	352.0
LC80	4.0m OF Permanent Loads	29.0	319.9	36.0	398.9
LC81	4.0m OF + Single Axle C	31.3	329.9	39.9	415.8
LC82	4.0m OF + Single Axle Ecc	31.0	331.4	39.3	418.4
LC83	4.0m OF + Tandem C	32.6	335.7	42.2	425.8
LC84	4.0m OF + Tandem Ecc	32.1	337.9	41.3	429.6
LC90	5.0m OF Permanent Loads	37.4	391.7	46.5	488.6
LC91	5.0m OF + Single Axle C	39.2	399.7	49.5	502.2
LC92	5.0m OF + Single Axle Ecc	38.9	400.5	49.0	503.6
LC93	5.0m OF + Tandem C	40.2	404.3	51.2	510.0
LC94	5.0m OF + Tandem Ecc	39.8	405.5	50.5	512.2

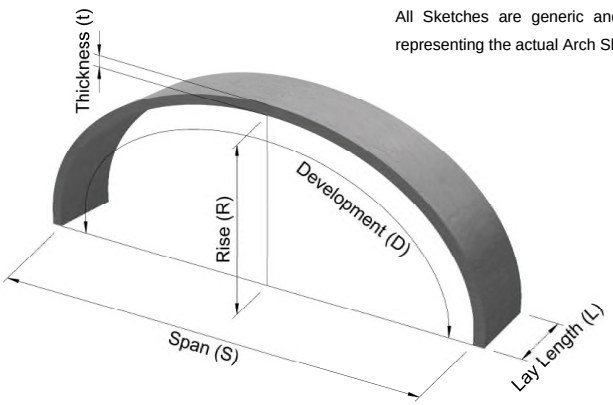
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	5.670
Rise R	[m]	1.575
Development D	[m]	6.828
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

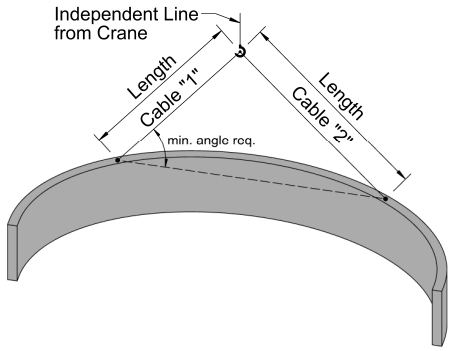


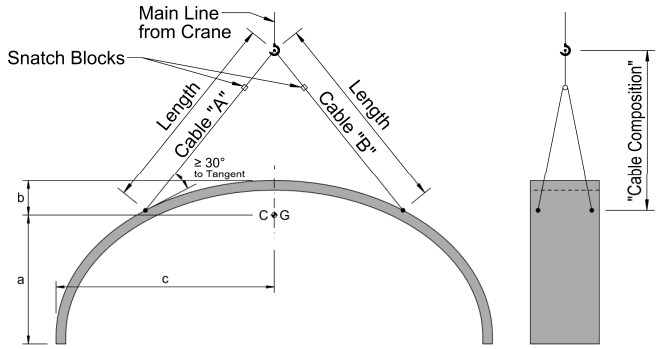
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.47

Handling

Arch Element Weight	[kN]	86.75 (8.7 metric tons)
Min. Length Cable A&B	[m]*	3.10
Cable Force A&B	[kN]*	52.28
Min. Length Cable 1&2	[m]	3.87
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	50.09
Center of Gravity a	[m]	1.13
Center of Gravity b	[m]	0.65
Center of Gravity c	[m]	3.02
Edge Anchor Distance	[m]	3.87

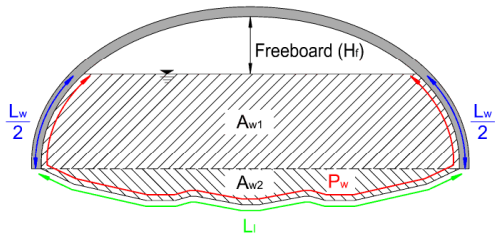




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	6.47	
1.0	3.06	1.40
1.5	0.42	0.16



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	12.0	17.2	14.4	20.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	33.4	91.7	41.1	113.8
LC41	0.6m OF + Single Axle C	58.5	125.5	83.8	171.2
LC42	0.6m OF + Single Axle Ecc	51.8	131.9	72.5	182.1
LC43	0.6m OF + Tandem C	70.6	140.6	104.3	196.9
LC44	0.6m OF + Tandem Ecc	61.4	152.6	88.7	217.3
LC50	1.0m OF Permanent Loads	45.0	111.4	55.6	138.5
LC51	1.0m OF + Single Axle C	63.6	139.5	87.3	186.1
LC52	1.0m OF + Single Axle Ecc	58.7	146.1	78.9	197.4
LC53	1.0m OF + Tandem C	73.8	156.0	104.7	214.2
LC54	1.0m OF + Tandem Ecc	66.7	164.4	92.6	228.5
LC60	2.0m OF Permanent Loads	74.0	181.8	91.9	226.3
LC61	2.0m OF + Single Axle C	85.1	199.8	110.8	257.0
LC62	2.0m OF + Single Axle Ecc	82.1	202.4	105.7	261.4
LC63	2.0m OF + Tandem C	91.2	210.2	121.1	274.8
LC64	2.0m OF + Tandem Ecc	87.0	214.1	113.9	281.3
LC70	3.0m OF Permanent Loads	101.6	250.1	126.4	311.8
LC71	3.0m OF + Single Axle C	109.4	263.7	139.7	334.8
LC72	3.0m OF + Single Axle Ecc	107.3	264.5	136.1	336.2
LC73	3.0m OF + Tandem C	113.8	271.5	147.1	348.1
LC74	3.0m OF + Tandem Ecc	110.8	272.9	142.0	350.5
LC80	4.0m OF Permanent Loads	129.1	318.4	160.8	397.2
LC81	4.0m OF + Single Axle C	134.9	328.9	170.6	415.0
LC82	4.0m OF + Single Axle Ecc	133.4	329.1	168.1	415.3
LC83	4.0m OF + Tandem C	138.1	335.0	176.0	425.3
LC84	4.0m OF + Tandem Ecc	136.0	335.4	172.4	426.1
LC90	5.0m OF Permanent Loads	156.7	387.1	195.3	483.1
LC91	5.0m OF + Single Axle C	161.1	395.4	202.7	497.2
LC92	5.0m OF + Single Axle Ecc	160.0	395.4	200.9	497.1
LC93	5.0m OF + Tandem C	163.6	400.2	206.9	505.3
LC94	5.0m OF + Tandem Ecc	162.1	400.3	204.4	505.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

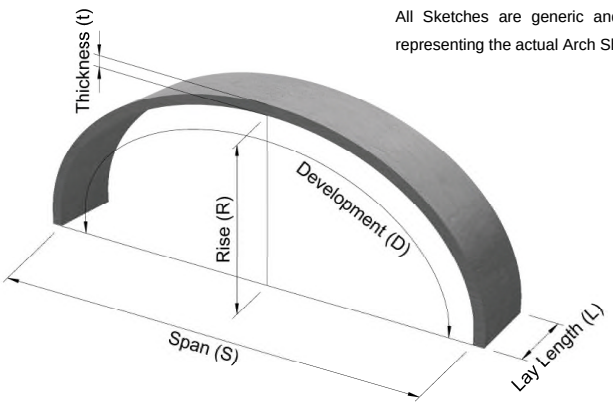
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E20/1

Dimensions

Span S	[m]	5.910
Rise R	[m]	1.880
Development D	[m]	7.483
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

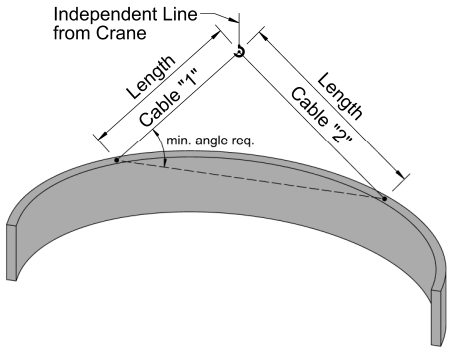


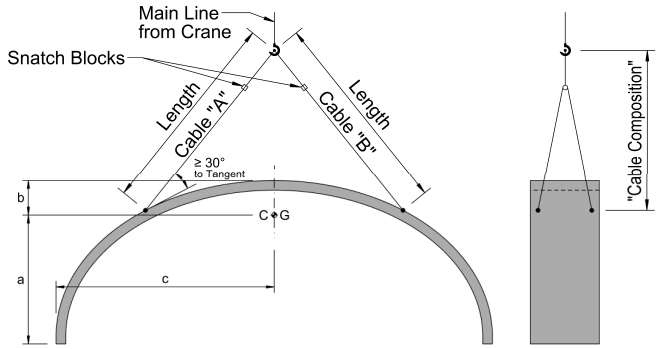
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.81

Handling

Arch Element Weight	[kN]	95.25 (9.5 metric tons)
Min. Length Cable A&B	[m]*	3.60
Cable Force A&B	[kN]*	55.58
Min. Length Cable 1&2	[m]	4.19
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	54.99
Center of Gravity a	[m]	1.33
Center of Gravity b	[m]	0.76
Center of Gravity c	[m]	3.15
Edge Anchor Distance	[m]	4.19

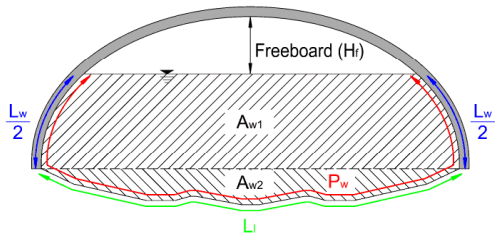




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	8.24	
1.0	4.82	2.06
1.5	2.19	0.82



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	11.2	18.8	13.4	22.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	26.6	101.6	32.7	126.1
LC41	0.6m OF + Single Axle C	46.5	134.2	66.4	181.5
LC42	0.6m OF + Single Axle Ecc	43.1	142.4	60.8	195.4
LC43	0.6m OF + Tandem C	56.0	147.7	82.7	204.4
LC44	0.6m OF + Tandem Ecc	51.3	163.1	74.7	230.6
LC50	1.0m OF Permanent Loads	35.6	121.2	43.9	150.5
LC51	1.0m OF + Single Axle C	50.7	148.6	69.6	197.2
LC52	1.0m OF + Single Axle Ecc	48.2	157.4	65.4	212.1
LC53	1.0m OF + Tandem C	59.1	165.0	83.9	225.0
LC54	1.0m OF + Tandem Ecc	55.4	176.5	77.5	244.5
LC60	2.0m OF Permanent Loads	60.0	195.9	74.4	243.9
LC61	2.0m OF + Single Axle C	69.1	213.9	90.0	274.6
LC62	2.0m OF + Single Axle Ecc	67.4	217.8	87.1	281.1
LC63	2.0m OF + Tandem C	74.2	224.5	98.6	292.5
LC64	2.0m OF + Tandem Ecc	71.8	230.3	94.5	302.4
LC70	3.0m OF Permanent Loads	83.3	269.2	103.6	335.6
LC71	3.0m OF + Single Axle C	89.9	283.0	114.7	359.0
LC72	3.0m OF + Single Axle Ecc	88.5	284.6	112.4	361.7
LC73	3.0m OF + Tandem C	93.5	291.0	121.0	372.6
LC74	3.0m OF + Tandem Ecc	91.7	293.6	117.8	377.1
LC80	4.0m OF Permanent Loads	106.9	343.3	133.1	428.2
LC81	4.0m OF + Single Axle C	111.8	354.1	141.4	446.6
LC82	4.0m OF + Single Axle Ecc	110.8	354.8	139.6	447.7
LC83	4.0m OF + Tandem C	114.5	360.4	146.1	457.3
LC84	4.0m OF + Tandem Ecc	113.1	361.7	143.6	459.4
LC90	5.0m OF Permanent Loads	130.8	418.3	162.9	521.9
LC91	5.0m OF + Single Axle C	134.5	426.9	169.3	536.6
LC92	5.0m OF + Single Axle Ecc	133.8	427.2	168.0	537.1
LC93	5.0m OF + Tandem C	136.7	432.0	172.9	545.2
LC94	5.0m OF + Tandem Ecc	135.6	432.5	171.1	546.2

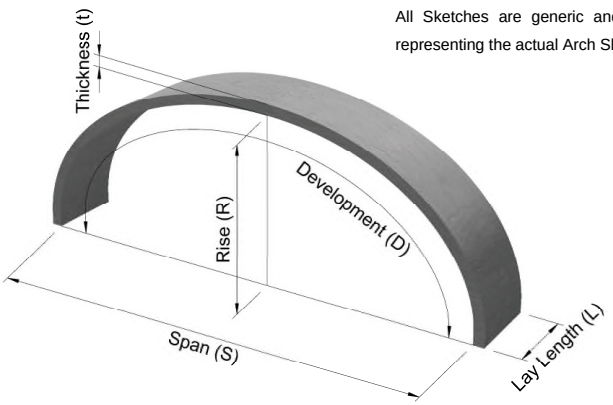
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	6.050
Rise R	[m]	2.185
Development D	[m]	8.108
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

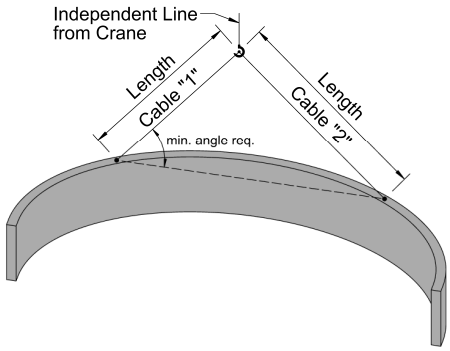


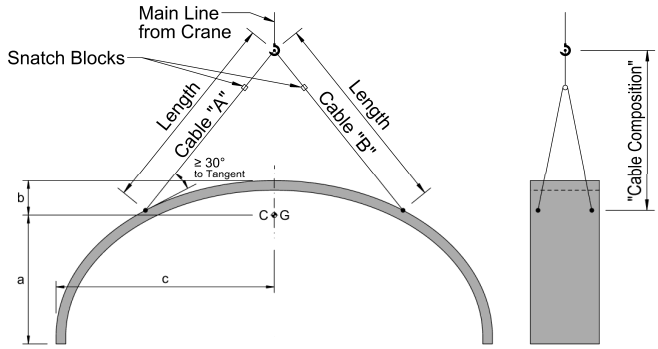
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.13

Handling

Arch Element Weight	[kN]	103.25 (10.3 metric tons)
Min. Length Cable A&B	[m]*	4.30
Cable Force A&B	[kN]*	58.56
Min. Length Cable 1&2	[m]	4.48
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	59.61
Center of Gravity a	[m]	1.52
Center of Gravity b	[m]	0.87
Center of Gravity c	[m]	3.23
Edge Anchor Distance	[m]	4.48

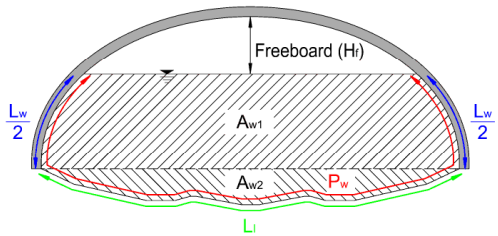




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	10.06	
1.0	6.65	2.68
1.5	4.01	1.44
2.0	1.11	0.38



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	10.1	20.4	12.1	24.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	18.8	109.4	23.0	135.7
LC41	0.6m OF + Single Axle C	34.2	140.1	49.1	188.0
LC42	0.6m OF + Single Axle Ecc	33.3	150.1	47.6	205.0
LC43	0.6m OF + Tandem C	41.8	152.1	62.1	208.3
LC44	0.6m OF + Tandem Ecc	40.2	170.7	59.4	240.0
LC50	1.0m OF Permanent Loads	25.9	129.0	31.9	160.2
LC51	1.0m OF + Single Axle C	37.8	155.3	52.0	204.9
LC52	1.0m OF + Single Axle Ecc	37.0	165.9	50.7	222.9
LC53	1.0m OF + Tandem C	44.5	171.0	63.4	231.7
LC54	1.0m OF + Tandem Ecc	43.1	185.2	61.0	255.7
LC60	2.0m OF Permanent Loads	45.3	206.5	56.1	257.1
LC61	2.0m OF + Single Axle C	52.6	224.1	68.5	287.1
LC62	2.0m OF + Single Axle Ecc	51.9	229.2	67.3	295.8
LC63	2.0m OF + Tandem C	56.7	234.6	75.5	304.8
LC64	2.0m OF + Tandem Ecc	55.6	242.2	73.7	317.8
LC70	3.0m OF Permanent Loads	64.0	283.5	79.5	353.4
LC71	3.0m OF + Single Axle C	69.2	297.1	88.4	376.5
LC72	3.0m OF + Single Axle Ecc	68.5	299.6	87.1	380.6
LC73	3.0m OF + Tandem C	72.2	305.1	93.5	390.1
LC74	3.0m OF + Tandem Ecc	71.2	309.1	91.8	396.8
LC80	4.0m OF Permanent Loads	82.9	361.7	103.2	451.2
LC81	4.0m OF + Single Axle C	86.9	372.6	109.9	469.5
LC82	4.0m OF + Single Axle Ecc	86.3	373.8	108.8	471.6
LC83	4.0m OF + Tandem C	89.2	378.9	113.7	480.3
LC84	4.0m OF + Tandem Ecc	88.3	381.0	112.3	483.9
LC90	5.0m OF Permanent Loads	102.2	441.1	127.3	550.3
LC91	5.0m OF + Single Axle C	105.3	449.8	132.5	565.2
LC92	5.0m OF + Single Axle Ecc	104.8	450.4	131.7	566.2
LC93	5.0m OF + Tandem C	107.1	454.9	135.5	573.9
LC94	5.0m OF + Tandem Ecc	106.4	456.0	134.3	575.8

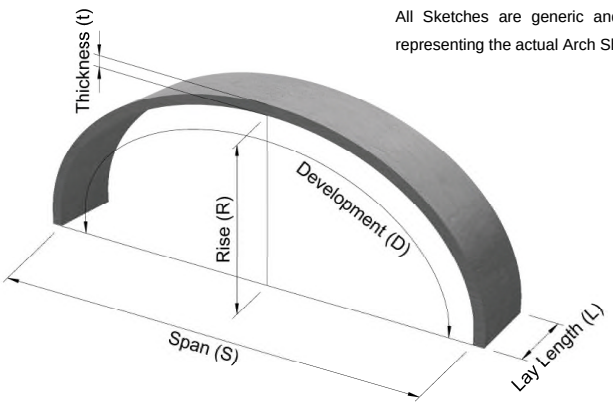
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	6.096
Rise R	[m]	2.489
Development D	[m]	8.720
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

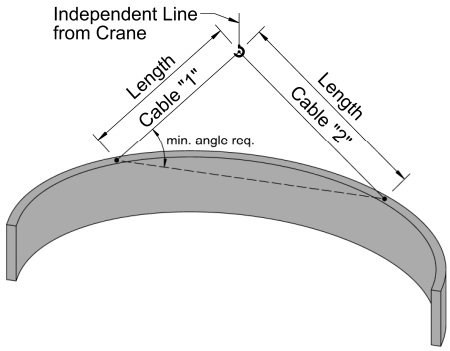


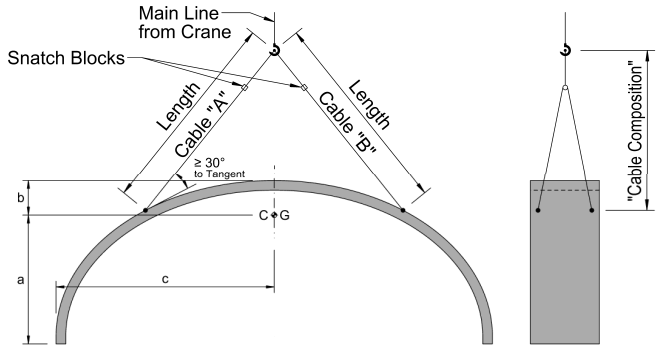
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.45

Handling

Arch Element Weight	[kN]	111.25 (11.1 metric tons)
Min. Length Cable A&B	[m]*	5.20
Cable Force A&B	[kN]*	61.35
Min. Length Cable 1&2	[m]	4.89
Min. Angle Required	[°]	61.00
Cable Forces 1&2	[kN]	63.60
Center of Gravity a	[m]	1.70
Center of Gravity b	[m]	0.99
Center of Gravity c	[m]	3.25
Edge Anchor Distance	[m]	4.75

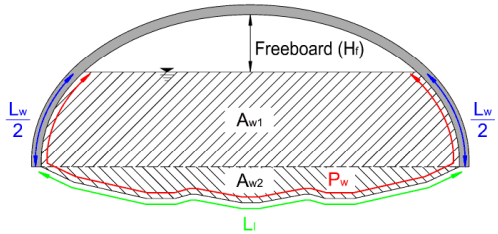




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	11.92	
1.0	8.50	3.30
1.5	5.87	2.06
2.0	2.96	0.98



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	8.8	22.0	10.6	26.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	10.0	115.0	12.1	142.6
LC41	0.6m OF + Single Axle C	21.2	142.9	31.0	190.2
LC42	0.6m OF + Single Axle Ecc	21.8	155.1	32.2	210.8
LC43	0.6m OF + Tandem C	27.1	153.9	41.1	208.8
LC44	0.6m OF + Tandem Ecc	27.3	175.2	41.5	245.0
LC50	1.0m OF Permanent Loads	15.4	134.9	18.9	167.6
LC51	1.0m OF + Single Axle C	24.1	159.6	33.5	209.5
LC52	1.0m OF + Single Axle Ecc	24.2	171.6	33.8	230.0
LC53	1.0m OF + Tandem C	29.0	174.3	42.0	234.5
LC54	1.0m OF + Tandem Ecc	29.0	190.7	41.9	262.4
LC60	2.0m OF Permanent Loads	29.3	214.3	36.2	266.8
LC61	2.0m OF + Single Axle C	34.6	231.0	45.3	295.2
LC62	2.0m OF + Single Axle Ecc	34.5	237.2	45.0	305.7
LC63	2.0m OF + Tandem C	37.7	241.0	50.5	312.2
LC64	2.0m OF + Tandem Ecc	37.5	250.4	50.1	328.1
LC70	3.0m OF Permanent Loads	42.5	293.4	52.7	365.6
LC71	3.0m OF + Single Axle C	46.4	306.5	59.3	387.9
LC72	3.0m OF + Single Axle Ecc	46.1	309.7	58.8	393.4
LC73	3.0m OF + Tandem C	48.6	314.3	63.1	401.2
LC74	3.0m OF + Tandem Ecc	48.2	319.4	62.4	409.8
LC80	4.0m OF Permanent Loads	56.0	374.1	69.6	466.5
LC81	4.0m OF + Single Axle C	59.0	384.6	74.6	484.4
LC82	4.0m OF + Single Axle Ecc	58.6	386.4	74.0	487.5
LC83	4.0m OF + Tandem C	60.7	390.9	77.5	495.0
LC84	4.0m OF + Tandem Ecc	60.2	393.6	76.7	499.7
LC90	5.0m OF Permanent Loads	69.8	456.0	86.8	568.9
LC91	5.0m OF + Single Axle C	72.1	464.6	90.7	583.5
LC92	5.0m OF + Single Axle Ecc	71.8	465.5	90.2	585.1
LC93	5.0m OF + Tandem C	73.4	469.5	92.9	591.9
LC94	5.0m OF + Tandem Ecc	73.0	471.1	92.2	594.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

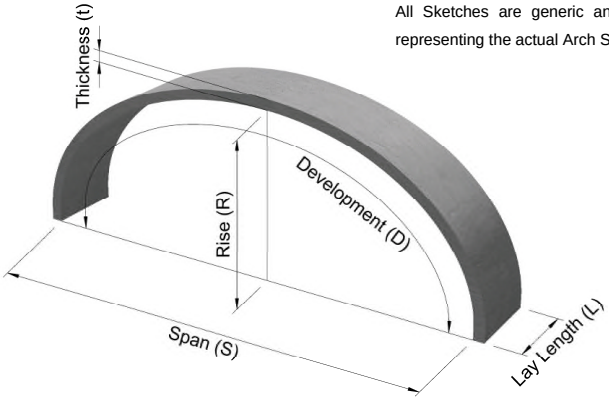
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E20/4

Dimensions

Span S	[m]	6.096
Rise R	[m]	2.794
Development D	[m]	9.330
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

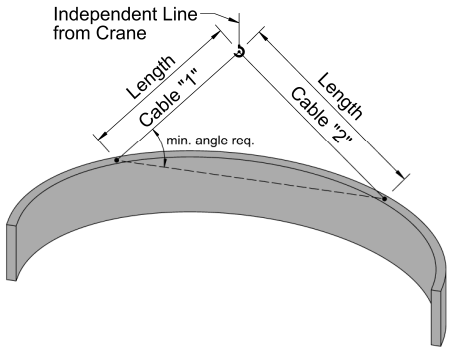


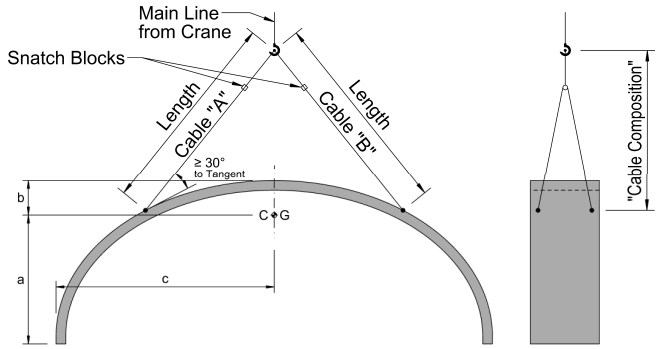
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.75

Handling

Arch Element Weight	[kN]	118.75 (11.9 metric tons)
Min. Length Cable A&B	[m]*	6.50
Cable Force A&B	[kN]*	63.88
Min. Length Cable 1&2	[m]	6.12
Min. Angle Required	[°]	66.00
Cable Forces 1&2	[kN]	64.99
Center of Gravity a	[m]	1.89
Center of Gravity b	[m]	1.11
Center of Gravity c	[m]	3.25
Edge Anchor Distance	[m]	4.98

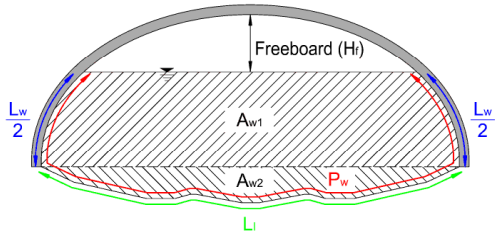




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	13.78	
1.0	10.36	3.90
1.5	7.73	2.68
2.0	4.82	1.60
2.5	1.79	0.58



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	7.6	23.5	9.1	28.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	2.1	119.3	2.2	147.9
LC41	0.6m OF + Single Axle C	9.7	146.7	15.2	194.5
LC42	0.6m OF + Single Axle Ecc	11.1	159.8	17.5	216.8
LC43	0.6m OF + Tandem C	14.1	156.8	22.7	211.8
LC44	0.6m OF + Tandem Ecc	15.1	179.5	24.4	250.3
LC50	1.0m OF Permanent Loads	5.7	141.5	6.8	175.7
LC51	1.0m OF + Single Axle C	11.8	164.5	17.1	214.9
LC52	1.0m OF + Single Axle Ecc	12.3	177.3	18.0	236.5
LC53	1.0m OF + Tandem C	15.3	178.3	23.0	238.3
LC54	1.0m OF + Tandem Ecc	15.8	195.8	24.0	268.0
LC60	2.0m OF Permanent Loads	14.7	221.6	17.9	275.8
LC61	2.0m OF + Single Axle C	18.4	237.5	24.3	302.9
LC62	2.0m OF + Single Axle Ecc	18.6	244.3	24.6	314.4
LC63	2.0m OF + Tandem C	20.6	247.1	28.1	319.2
LC64	2.0m OF + Tandem Ecc	20.8	257.3	28.4	336.6
LC70	3.0m OF Permanent Loads	23.2	302.1	28.6	376.4
LC71	3.0m OF + Single Axle C	25.9	314.6	33.2	397.8
LC72	3.0m OF + Single Axle Ecc	25.8	318.3	33.0	404.0
LC73	3.0m OF + Tandem C	27.5	322.2	35.9	410.6
LC74	3.0m OF + Tandem Ecc	27.3	327.7	35.7	419.9
LC80	4.0m OF Permanent Loads	31.8	384.0	39.4	478.9
LC81	4.0m OF + Single Axle C	33.8	394.2	42.9	496.2
LC82	4.0m OF + Single Axle Ecc	33.7	396.3	42.6	499.8
LC83	4.0m OF + Tandem C	35.0	400.3	44.9	506.5
LC84	4.0m OF + Tandem Ecc	34.8	403.4	44.5	511.8
LC90	5.0m OF Permanent Loads	40.6	467.5	50.3	583.3
LC91	5.0m OF + Single Axle C	42.2	476.0	53.0	597.7
LC92	5.0m OF + Single Axle Ecc	42.0	477.2	52.7	599.7
LC93	5.0m OF + Tandem C	43.0	480.9	54.5	605.9
LC94	5.0m OF + Tandem Ecc	42.8	482.7	54.1	609.1

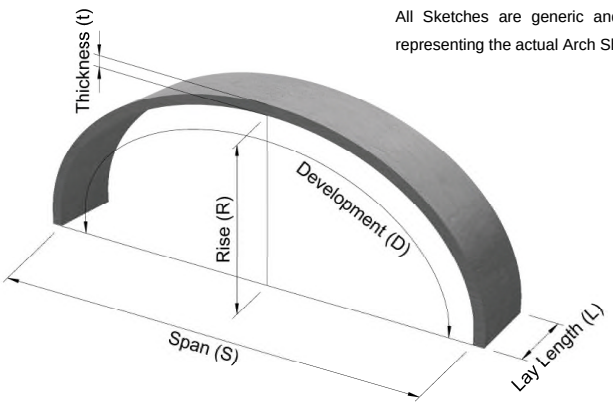
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	6.940
Rise R	[m]	1.981
Development D	[m]	8.449
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

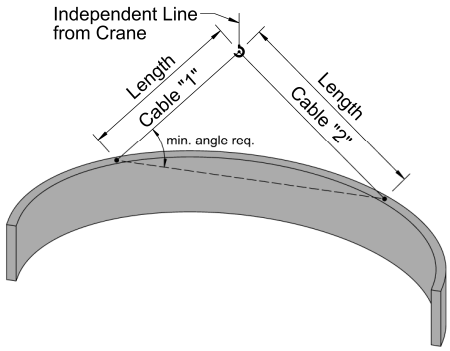


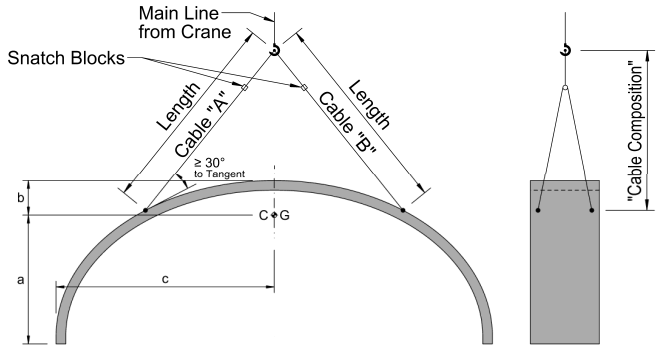
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.28

Handling

Arch Element Weight	[kN]	107.00 (10.7 metric tons)
Min. Length Cable A&B	[m]*	4.10
Cable Force A&B	[kN]*	63.27
Min. Length Cable 1&2	[m]	4.77
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	61.78
Center of Gravity a	[m]	1.40
Center of Gravity b	[m]	0.78
Center of Gravity c	[m]	3.66
Edge Anchor Distance	[m]	4.77

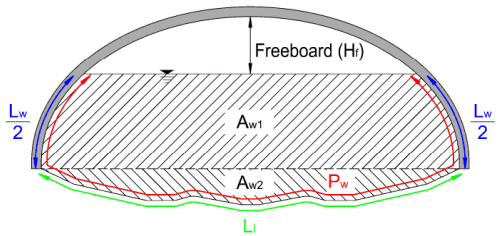




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	10.06	
1.0	6.22	2.44
1.5	3.22	1.10



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	14.7	21.2	17.6	25.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	39.8	114.6	49.0	142.2
LC41	0.6m OF + Single Axle C	65.4	148.8	92.5	200.4
LC42	0.6m OF + Single Axle Ecc	61.4	158.0	85.7	215.9
LC43	0.6m OF + Tandem C	79.8	166.0	117.0	229.6
LC44	0.6m OF + Tandem Ecc	73.0	181.1	105.5	255.3
LC50	1.0m OF Permanent Loads	55.1	141.2	68.1	175.4
LC51	1.0m OF + Single Axle C	74.5	169.5	101.2	223.6
LC52	1.0m OF + Single Axle Ecc	70.9	177.5	95.0	237.2
LC53	1.0m OF + Tandem C	85.8	186.8	120.4	252.9
LC54	1.0m OF + Tandem Ecc	80.3	198.0	111.0	272.1
LC60	2.0m OF Permanent Loads	91.5	227.2	113.6	283.0
LC61	2.0m OF + Single Axle C	103.4	246.1	133.9	315.0
LC62	2.0m OF + Single Axle Ecc	101.1	249.7	130.0	321.2
LC63	2.0m OF + Tandem C	110.4	257.2	145.7	333.9
LC64	2.0m OF + Tandem Ecc	106.9	263.1	139.9	343.9
LC70	3.0m OF Permanent Loads	126.1	311.4	156.9	388.2
LC71	3.0m OF + Single Axle C	134.8	326.0	171.7	412.9
LC72	3.0m OF + Single Axle Ecc	133.0	327.5	168.6	415.5
LC73	3.0m OF + Tandem C	139.8	334.4	180.2	427.2
LC74	3.0m OF + Tandem Ecc	137.1	337.1	175.6	431.8
LC80	4.0m OF Permanent Loads	160.6	395.8	200.0	493.6
LC81	4.0m OF + Single Axle C	167.1	407.2	211.1	513.1
LC82	4.0m OF + Single Axle Ecc	165.7	407.8	208.7	514.2
LC83	4.0m OF + Tandem C	170.8	413.9	217.4	524.4
LC84	4.0m OF + Tandem Ecc	168.8	415.1	213.9	526.6
LC90	5.0m OF Permanent Loads	195.0	480.4	243.0	599.4
LC91	5.0m OF + Single Axle C	200.0	489.6	251.6	615.1
LC92	5.0m OF + Single Axle Ecc	198.9	489.8	249.7	615.4
LC93	5.0m OF + Tandem C	202.9	494.9	256.5	624.2
LC94	5.0m OF + Tandem Ecc	201.4	495.5	253.9	625.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

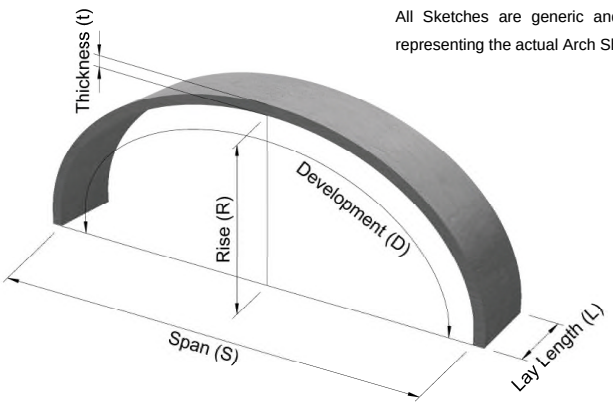
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E24/1

Dimensions

Span S	[m]	7.152
Rise R	[m]	2.286
Development D	[m]	9.095
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

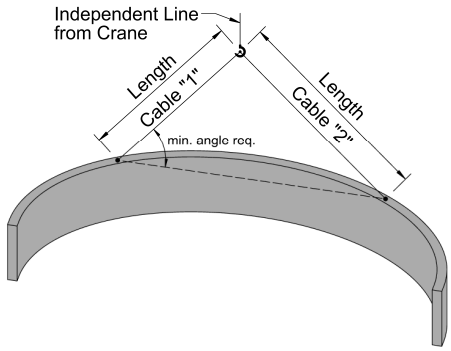


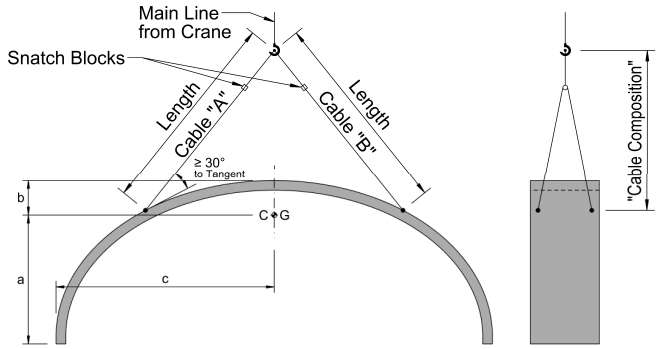
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.61

Handling

Arch Element Weight	[kN]	115.25 (11.5 metric tons)
Min. Length Cable A&B	[m]*	4.70
Cable Force A&B	[kN]*	66.45
Min. Length Cable 1&2	[m]	5.08
Min. Angle Required	[°]	60.00
Cable Forces 1&2	[kN]	66.54
Center of Gravity a	[m]	1.60
Center of Gravity b	[m]	0.89
Center of Gravity c	[m]	3.77
Edge Anchor Distance	[m]	5.08

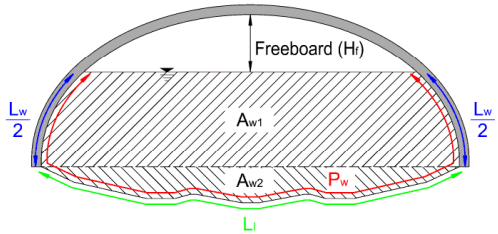




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	12.21	
1.0	8.37	3.08
1.5	5.37	1.74
2.0	2.02	0.60



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	13.6	22.8	16.3	27.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	31.3	122.4	38.4	151.9
LC41	0.6m OF + Single Axle C	51.8	154.9	73.4	207.2
LC42	0.6m OF + Single Axle Ecc	50.5	166.7	71.2	227.1
LC43	0.6m OF + Tandem C	63.5	171.2	93.2	234.8
LC44	0.6m OF + Tandem Ecc	60.6	189.9	88.3	266.5
LC50	1.0m OF Permanent Loads	43.6	149.5	53.9	185.7
LC51	1.0m OF + Single Axle C	59.5	177.0	80.9	232.5
LC52	1.0m OF + Single Axle Ecc	58.0	187.1	78.2	249.6
LC53	1.0m OF + Tandem C	68.9	193.8	96.8	261.1
LC54	1.0m OF + Tandem Ecc	66.4	208.2	92.5	285.5
LC60	2.0m OF Permanent Loads	74.3	239.4	92.2	298.1
LC61	2.0m OF + Single Axle C	84.2	257.9	109.0	329.6
LC62	2.0m OF + Single Axle Ecc	83.0	262.9	107.0	338.0
LC63	2.0m OF + Tandem C	90.0	269.0	118.9	348.4
LC64	2.0m OF + Tandem Ecc	88.3	276.9	116.0	361.9
LC70	3.0m OF Permanent Loads	103.7	328.2	129.0	409.1
LC71	3.0m OF + Single Axle C	111.0	342.6	141.3	433.7
LC72	3.0m OF + Single Axle Ecc	109.9	345.0	139.4	437.7
LC73	3.0m OF + Tandem C	115.2	351.1	148.4	448.1
LC74	3.0m OF + Tandem Ecc	113.6	355.2	145.8	455.1
LC80	4.0m OF Permanent Loads	133.2	417.6	165.8	520.9
LC81	4.0m OF + Single Axle C	138.7	429.2	175.2	540.6
LC82	4.0m OF + Single Axle Ecc	137.8	430.4	173.6	542.6
LC83	4.0m OF + Tandem C	141.9	436.0	180.6	552.1
LC84	4.0m OF + Tandem Ecc	140.6	438.2	178.4	555.9
LC90	5.0m OF Permanent Loads	162.8	507.9	202.8	633.7
LC91	5.0m OF + Single Axle C	167.1	517.3	210.1	649.7
LC92	5.0m OF + Single Axle Ecc	166.4	517.9	208.9	650.8
LC93	5.0m OF + Tandem C	169.6	522.8	214.4	659.1
LC94	5.0m OF + Tandem Ecc	168.6	524.0	212.6	661.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

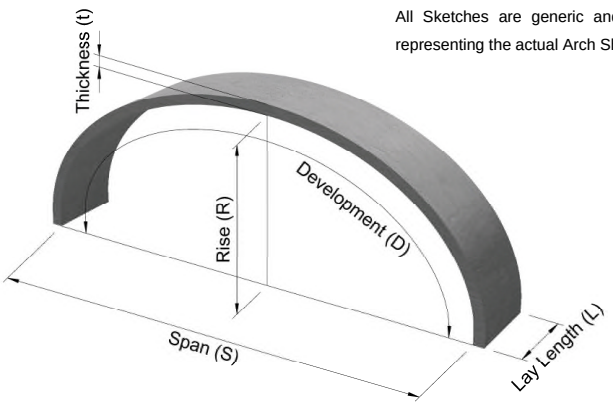
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E24/2

Dimensions

Span S	[m]	7.274
Rise R	[m]	2.591
Development D	[m]	9.717
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

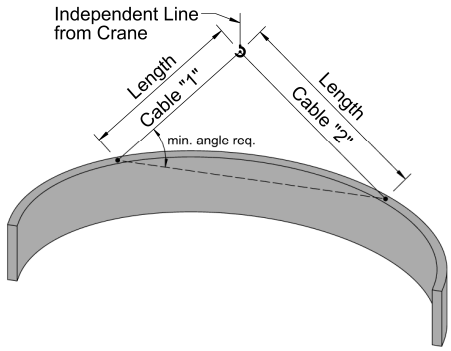


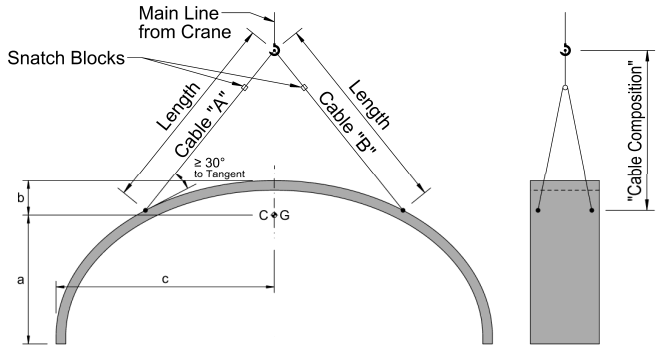
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.93

Handling

Arch Element Weight	[kN]	123.25 (12.3 metric tons)
Min. Length Cable A&B	[m]*	5.40
Cable Force A&B	[kN]*	69.36
Min. Length Cable 1&2	[m]	5.92
Min. Angle Required	[°]	63.00
Cable Forces 1&2	[kN]	69.16
Center of Gravity a	[m]	1.79
Center of Gravity b	[m]	1.00
Center of Gravity c	[m]	3.84
Edge Anchor Distance	[m]	5.37

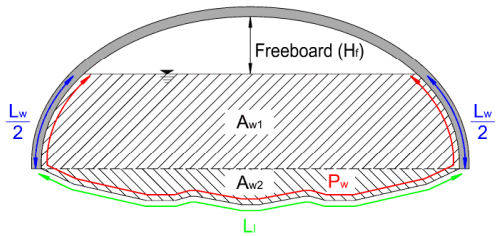




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	14.41	
1.0	10.57	3.70
1.5	7.57	2.36
2.0	4.22	1.22
2.5	0.66	0.18



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	12.3	24.4	14.8	29.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	22.3	128.4	27.2	159.3
LC41	0.6m OF + Single Axle C	38.3	159.0	54.5	211.3
LC42	0.6m OF + Single Axle Ecc	38.8	172.9	55.4	234.9
LC43	0.6m OF + Tandem C	47.6	175.0	70.2	238.4
LC44	0.6m OF + Tandem Ecc	47.2	196.6	69.6	275.1
LC50	1.0m OF Permanent Loads	32.0	156.9	39.4	194.9
LC51	1.0m OF + Single Axle C	44.5	183.1	60.7	239.4
LC52	1.0m OF + Single Axle Ecc	44.3	194.8	60.3	259.3
LC53	1.0m OF + Tandem C	52.0	199.2	73.4	266.7
LC54	1.0m OF + Tandem Ecc	51.5	215.9	72.5	295.3
LC60	2.0m OF Permanent Loads	56.5	249.1	70.0	310.2
LC61	2.0m OF + Single Axle C	64.3	267.1	83.3	340.7
LC62	2.0m OF + Single Axle Ecc	64.0	273.2	82.8	351.0
LC63	2.0m OF + Tandem C	69.0	277.9	91.3	359.0
LC64	2.0m OF + Tandem Ecc	68.5	287.6	90.5	375.6
LC70	3.0m OF Permanent Loads	80.1	341.0	99.5	425.1
LC71	3.0m OF + Single Axle C	85.9	355.2	109.3	449.2
LC72	3.0m OF + Single Axle Ecc	85.3	358.3	108.4	454.5
LC73	3.0m OF + Tandem C	89.3	363.6	115.1	463.4
LC74	3.0m OF + Tandem Ecc	88.6	368.9	113.9	472.5
LC80	4.0m OF Permanent Loads	103.8	434.0	129.1	541.3
LC81	4.0m OF + Single Axle C	108.2	445.5	136.7	560.8
LC82	4.0m OF + Single Axle Ecc	107.7	447.3	135.8	563.8
LC83	4.0m OF + Tandem C	110.9	452.3	141.1	572.3
LC84	4.0m OF + Tandem Ecc	110.1	455.3	139.9	577.5
LC90	5.0m OF Permanent Loads	127.7	528.1	159.0	658.9
LC91	5.0m OF + Single Axle C	131.2	537.5	165.0	674.9
LC92	5.0m OF + Single Axle Ecc	130.8	538.5	164.2	676.6
LC93	5.0m OF + Tandem C	133.3	542.9	168.5	684.1
LC94	5.0m OF + Tandem Ecc	132.6	544.7	167.4	687.1

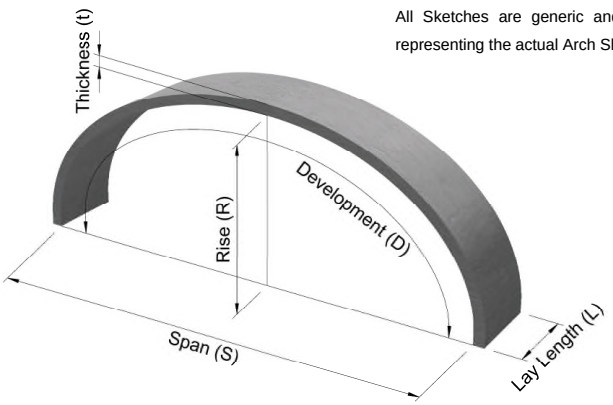
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	7.316
Rise R	[m]	2.896
Development D	[m]	10.330
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

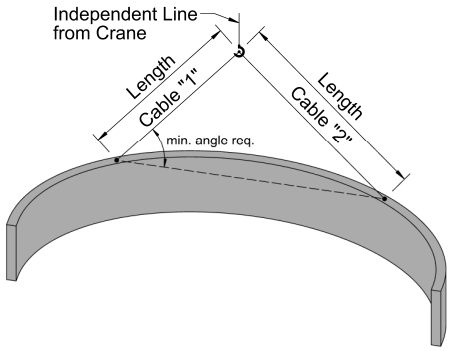


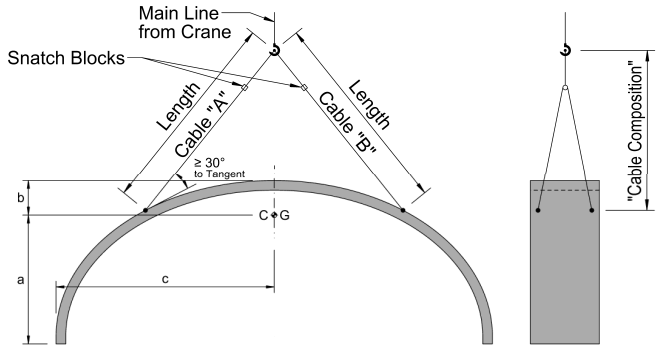
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.24

Handling

Arch Element Weight	[kN]	131.00 (13.1 metric tons)
Min. Length Cable A&B	[m]*	6.40
Cable Force A&B	[kN]*	72.10
Min. Length Cable 1&2	[m]	7.53
Min. Angle Required	[°]	68.00
Cable Forces 1&2	[kN]	70.64
Center of Gravity a	[m]	1.98
Center of Gravity b	[m]	1.12
Center of Gravity c	[m]	3.86
Edge Anchor Distance	[m]	5.65

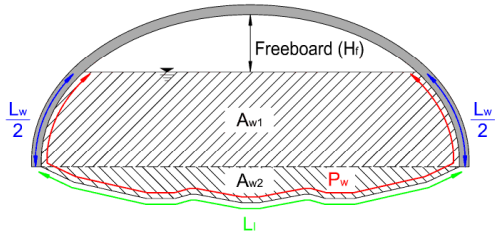




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	16.64	
1.0	12.80	4.32
1.5	9.80	2.98
2.0	6.45	1.84
2.5	2.88	0.80



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	10.9	25.9	13.1	31.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	12.1	133.6	14.6	165.7
LC41	0.6m OF + Single Axle C	23.8	162.7	34.5	215.3
LC42	0.6m OF + Single Axle Ecc	25.2	178.1	36.8	241.4
LC43	0.6m OF + Tandem C	30.7	177.6	46.1	240.6
LC44	0.6m OF + Tandem Ecc	31.6	201.5	47.7	281.1
LC50	1.0m OF Permanent Loads	19.1	163.9	23.3	203.6
LC51	1.0m OF + Single Axle C	28.3	188.2	39.0	244.8
LC52	1.0m OF + Single Axle Ecc	28.8	201.1	39.8	266.8
LC53	1.0m OF + Tandem C	33.9	203.0	48.5	270.0
LC54	1.0m OF + Tandem Ecc	34.4	221.7	49.4	301.9
LC60	2.0m OF Permanent Loads	36.8	257.1	45.5	320.1
LC61	2.0m OF + Single Axle C	42.6	273.9	55.3	348.7
LC62	2.0m OF + Single Axle Ecc	42.7	280.9	55.5	360.5
LC63	2.0m OF + Tandem C	46.2	284.2	61.4	366.1
LC64	2.0m OF + Tandem Ecc	46.3	295.3	61.7	385.1
LC70	3.0m OF Permanent Loads	53.8	350.2	66.7	436.5
LC71	3.0m OF + Single Axle C	58.1	363.8	74.1	459.5
LC72	3.0m OF + Single Axle Ecc	57.9	367.6	73.7	466.0
LC73	3.0m OF + Tandem C	60.7	371.8	78.5	473.2
LC74	3.0m OF + Tandem Ecc	60.5	378.0	78.1	483.8
LC80	4.0m OF Permanent Loads	70.9	444.8	88.1	554.7
LC81	4.0m OF + Single Axle C	74.3	455.9	93.8	573.5
LC82	4.0m OF + Single Axle Ecc	74.0	458.1	93.4	577.4
LC83	4.0m OF + Tandem C	76.2	462.3	97.2	584.5
LC84	4.0m OF + Tandem Ecc	75.9	466.0	96.5	590.8
LC90	5.0m OF Permanent Loads	88.2	540.6	109.7	674.4
LC91	5.0m OF + Single Axle C	90.9	549.7	114.2	689.9
LC92	5.0m OF + Single Axle Ecc	90.6	551.0	113.8	692.2
LC93	5.0m OF + Tandem C	92.4	554.9	116.8	698.7
LC94	5.0m OF + Tandem Ecc	92.0	557.0	116.2	702.4

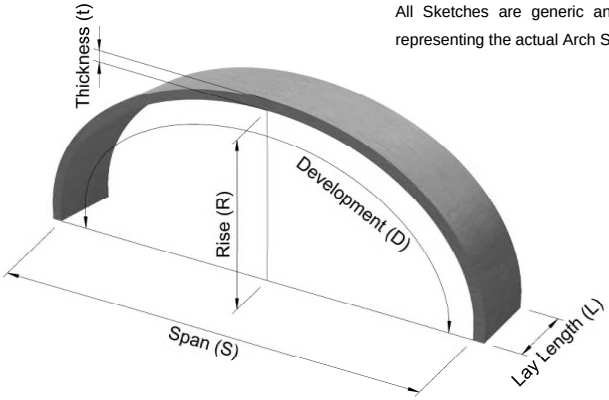
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	7.316
Rise R	[m]	3.200
Development D	[m]	10.939
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

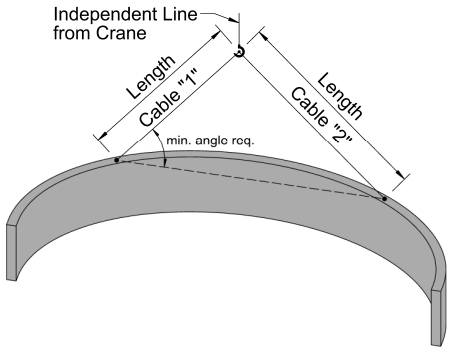


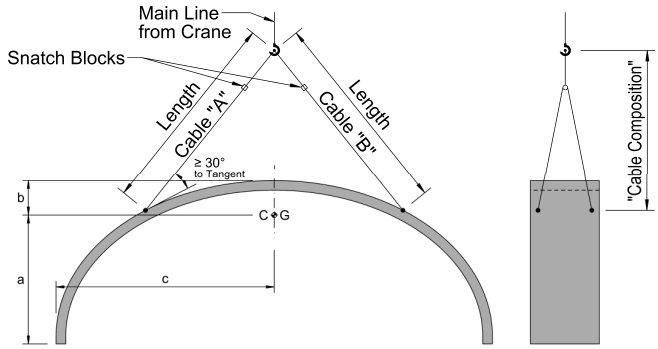
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.59

Handling

Arch Element Weight	[kN]	138.50 (14.0 metric tons)
Min. Length Cable A&B	[m]*	7.70
Cable Force A&B	[kN]*	74.65
Min. Length Cable 1&2	[m]	9.04
Min. Angle Required	[°]	71.00
Cable Forces 1&2	[kN]	73.24
Center of Gravity a	[m]	2.17
Center of Gravity b	[m]	1.23
Center of Gravity c	[m]	3.86
Edge Anchor Distance	[m]	5.89

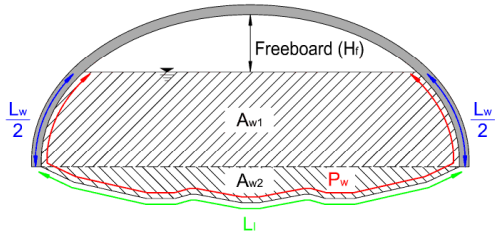




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	18.87	
1.0	15.03	4.92
1.5	12.03	3.60
2.0	8.68	2.44
2.5	5.11	1.40
3.0	1.47	0.40



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	9.6	27.4	11.5	32.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	3.0	138.4	3.3	171.6
LC41	0.6m OF + Single Axle C	11.1	165.5	17.0	217.8
LC42	0.6m OF + Single Axle Ecc	12.7	181.4	19.7	244.8
LC43	0.6m OF + Tandem C	15.9	179.7	25.2	241.9
LC44	0.6m OF + Tandem Ecc	17.3	204.6	27.7	284.2
LC50	1.0m OF Permanent Loads	7.4	169.8	8.8	210.9
LC51	1.0m OF + Single Axle C	14.0	192.3	19.9	249.0
LC52	1.0m OF + Single Axle Ecc	14.7	205.7	21.1	271.9
LC53	1.0m OF + Tandem C	17.9	205.9	26.7	272.2
LC54	1.0m OF + Tandem Ecc	18.8	225.5	28.2	305.5
LC60	2.0m OF Permanent Loads	19.1	262.9	23.5	327.3
LC61	2.0m OF + Single Axle C	23.3	278.7	30.4	354.1
LC62	2.0m OF + Single Axle Ecc	23.6	286.1	30.9	366.7
LC63	2.0m OF + Tandem C	25.8	288.9	34.7	371.4
LC64	2.0m OF + Tandem Ecc	26.2	300.6	35.5	391.4
LC70	3.0m OF Permanent Loads	30.3	356.9	37.4	444.8
LC71	3.0m OF + Single Axle C	33.3	370.4	42.5	467.6
LC72	3.0m OF + Single Axle Ecc	33.3	374.6	42.5	474.8
LC73	3.0m OF + Tandem C	35.1	378.5	45.5	481.4
LC74	3.0m OF + Tandem Ecc	35.1	384.9	45.5	492.4
LC80	4.0m OF Permanent Loads	41.3	453.2	51.1	565.2
LC81	4.0m OF + Single Axle C	43.6	464.4	55.1	584.2
LC82	4.0m OF + Single Axle Ecc	43.5	467.0	54.9	588.6
LC83	4.0m OF + Tandem C	45.0	470.9	57.4	595.2
LC84	4.0m OF + Tandem Ecc	44.8	474.8	57.1	601.8
LC90	5.0m OF Permanent Loads	52.4	551.2	65.1	687.6
LC91	5.0m OF + Single Axle C	54.3	560.4	68.2	703.2
LC92	5.0m OF + Single Axle Ecc	54.1	561.9	67.9	705.7
LC93	5.0m OF + Tandem C	55.3	565.5	70.0	712.0
LC94	5.0m OF + Tandem Ecc	55.1	567.9	69.6	716.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

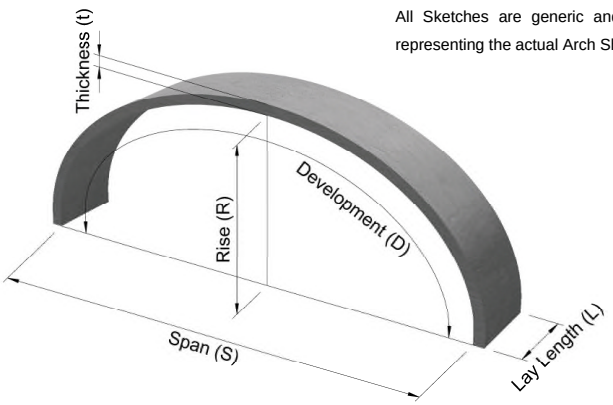
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E24/5

Dimensions

Span S	[m]	7.316
Rise R	[m]	3.505
Development D	[m]	11.549
Thickness t	[mm]	203
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

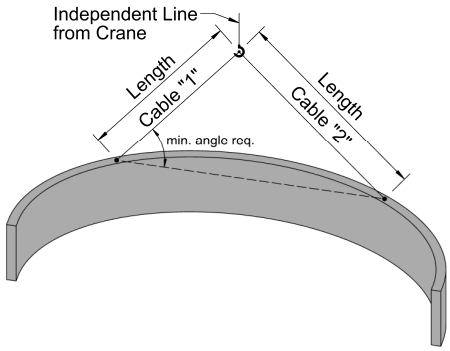


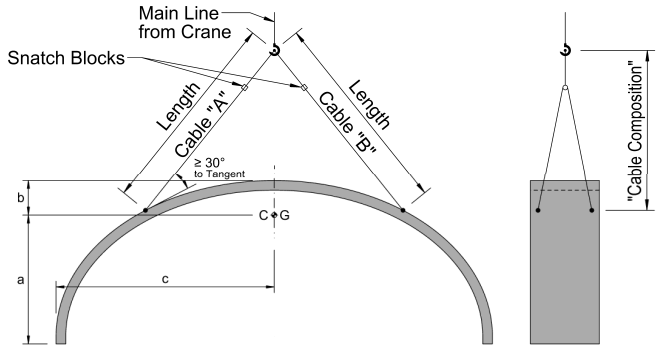
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.88

Handling

Arch Element Weight	[kN]	146.00 (14.7 metric tons)
Min. Length Cable A&B	[m]*	9.60
Cable Force A&B	[kN]*	77.20
Min. Length Cable 1&2	[m]	10.45
Min. Angle Required	[°]	73.00
Cable Forces 1&2	[kN]	76.34
Center of Gravity a	[m]	2.36
Center of Gravity b	[m]	1.35
Center of Gravity c	[m]	3.86
Edge Anchor Distance	[m]	6.11



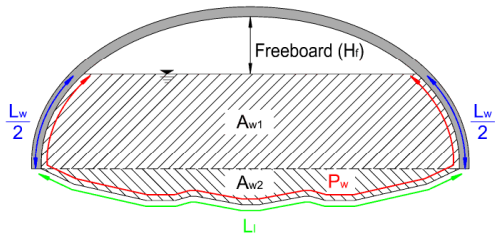


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	21.1	
1.0	17.26	5.54
1.5	14.26	4.20
2.0	10.90	3.06
2.5	7.34	2.02
3.0	3.70	1.02
3.5	0.04	0.01

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	8.5	28.9	10.2	34.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-5.2	144.1	-6.9	178.7
LC41	0.6m OF + Single Axle C	0.3	169.6	2.4	222.0
LC42	0.6m OF + Single Axle Ecc	1.8	185.5	5.0	249.0
LC43	0.6m OF + Tandem C	3.6	182.5	8.1	243.9
LC44	0.6m OF + Tandem Ecc	5.1	207.3	10.6	286.2
LC50	1.0m OF Permanent Loads	-2.6	175.1	-3.6	217.4
LC51	1.0m OF + Single Axle C	1.9	196.3	3.9	253.5
LC52	1.0m OF + Single Axle Ecc	2.6	209.8	5.2	276.4
LC53	1.0m OF + Tandem C	4.6	209.4	8.5	275.7
LC54	1.0m OF + Tandem Ecc	5.6	229.1	10.2	309.2
LC60	2.0m OF Permanent Loads	4.4	269.1	5.0	335.0
LC61	2.0m OF + Single Axle C	7.1	284.5	9.8	361.2
LC62	2.0m OF + Single Axle Ecc	7.5	292.1	10.3	374.0
LC63	2.0m OF + Tandem C	8.8	294.8	12.7	378.6
LC64	2.0m OF + Tandem Ecc	9.3	306.7	13.5	398.8
LC70	3.0m OF Permanent Loads	10.8	365.2	13.0	455.1
LC71	3.0m OF + Single Axle C	12.8	378.6	16.5	477.8
LC72	3.0m OF + Single Axle Ecc	12.8	383.0	16.6	485.2
LC73	3.0m OF + Tandem C	14.0	386.5	18.5	491.2
LC74	3.0m OF + Tandem Ecc	14.0	393.0	18.6	502.3
LC80	4.0m OF Permanent Loads	17.0	463.6	20.9	578.0
LC81	4.0m OF + Single Axle C	18.6	474.7	23.5	596.9
LC82	4.0m OF + Single Axle Ecc	18.5	477.3	23.4	601.3
LC83	4.0m OF + Tandem C	19.5	480.9	25.0	607.5
LC84	4.0m OF + Tandem Ecc	19.4	484.8	24.9	614.2
LC90	5.0m OF Permanent Loads	23.4	563.6	28.8	703.0
LC91	5.0m OF + Single Axle C	24.6	572.6	30.8	718.3
LC92	5.0m OF + Single Axle Ecc	24.5	574.1	30.7	720.9
LC93	5.0m OF + Tandem C	25.2	577.5	31.9	726.7
LC94	5.0m OF + Tandem Ecc	25.1	580.0	31.7	731.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

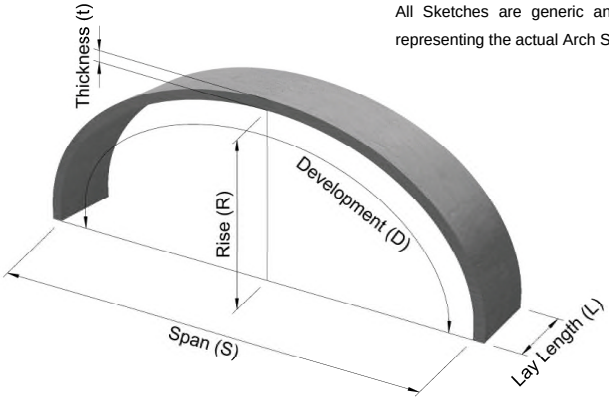
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E30/0

Dimensions

Span S	[m]	8.828
Rise R	[m]	2.591
Development D	[m]	10.875
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

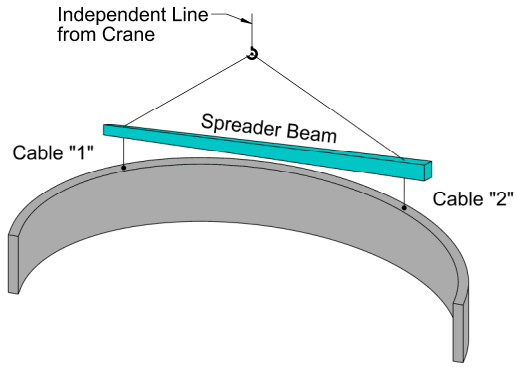


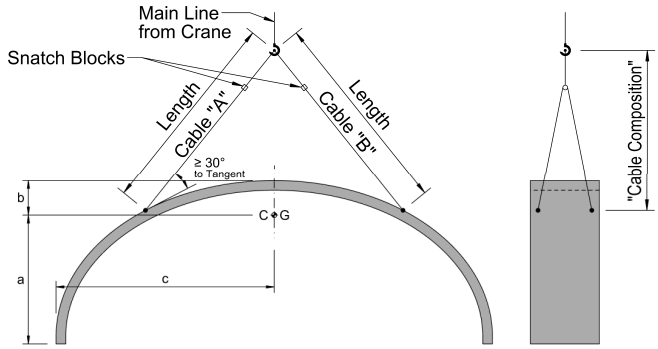
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.15

Handling

Arch Element Weight	[kN]	128.75 (13.0 metric tons)
Min. Length Cable A&B	[m]*	5.30
Cable Force A&B	[kN]*	76.09
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	64.38
Center of Gravity a	[m]	1.83
Center of Gravity b	[m]	1.01
Center of Gravity c	[m]	4.65
Edge Anchor Distance	[m]	6.15

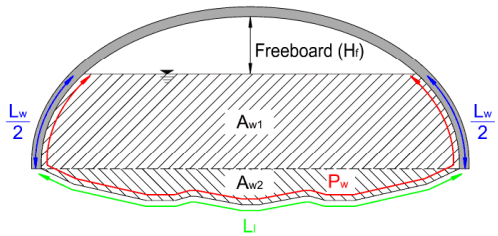




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	16.91	
1.0	12.51	4.06
1.5	9.01	2.58
2.0	5.06	1.32
2.5	0.80	0.20



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	22.7	34.1	27.3	40.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	52.8	175.2	64.8	217.3
LC41	0.6m OF + Single Axle C	75.3	208.4	103.2	273.7
LC42	0.6m OF + Single Axle Ecc	72.1	218.1	97.6	290.2
LC43	0.6m OF + Tandem C	87.9	223.4	124.6	299.2
LC44	0.6m OF + Tandem Ecc	82.5	241.0	115.3	329.1
LC50	1.0m OF Permanent Loads	68.8	209.1	84.8	259.7
LC51	1.0m OF + Single Axle C	86.6	237.3	115.1	307.6
LC52	1.0m OF + Single Axle Ecc	83.5	246.5	109.9	323.3
LC53	1.0m OF + Tandem C	97.0	254.1	132.9	336.1
LC54	1.0m OF + Tandem Ecc	92.8	268.6	125.6	360.8
LC60	2.0m OF Permanent Loads	109.7	318.1	135.9	395.9
LC61	2.0m OF + Single Axle C	121.2	337.9	155.5	429.6
LC62	2.0m OF + Single Axle Ecc	109.5	317.5	135.7	394.9
LC63	2.0m OF + Tandem C	127.9	349.4	167.0	449.2
LC64	2.0m OF + Tandem Ecc	125.3	358.1	162.5	464.0
LC70	3.0m OF Permanent Loads	149.5	426.9	185.8	531.9
LC71	3.0m OF + Single Axle C	158.2	442.6	200.5	558.6
LC72	3.0m OF + Single Axle Ecc	156.6	445.4	197.7	563.4
LC73	3.0m OF + Tandem C	163.1	451.5	208.8	573.7
LC74	3.0m OF + Tandem Ecc	160.9	456.3	205.0	581.9
LC80	4.0m OF Permanent Loads	189.0	535.6	235.2	667.8
LC81	4.0m OF + Single Axle C	195.7	548.3	246.5	689.4
LC82	4.0m OF + Single Axle Ecc	194.4	549.8	244.3	691.9
LC83	4.0m OF + Tandem C	199.5	555.5	253.0	701.7
LC84	4.0m OF + Tandem Ecc	197.7	558.3	249.9	706.3
LC90	5.0m OF Permanent Loads	228.6	644.9	284.6	804.4
LC91	5.0m OF + Single Axle C	233.8	655.3	293.5	822.0
LC92	5.0m OF + Single Axle Ecc	232.8	656.0	291.7	823.4
LC93	5.0m OF + Tandem C	236.9	661.2	298.7	832.1
LC94	5.0m OF + Tandem Ecc	235.4	662.7	296.1	834.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

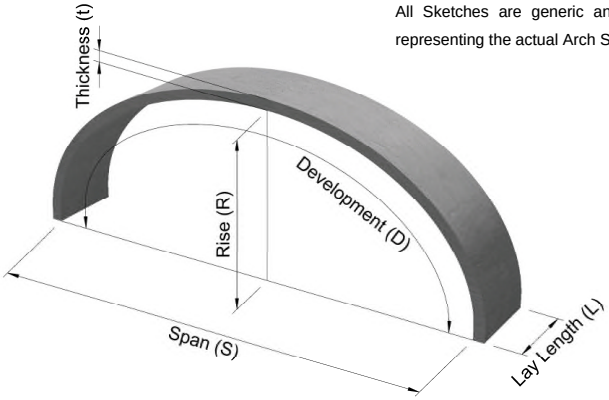
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E30/1

Dimensions

Span S	[m]	9.006
Rise R	[m]	2.895
Development D	[m]	11.515
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

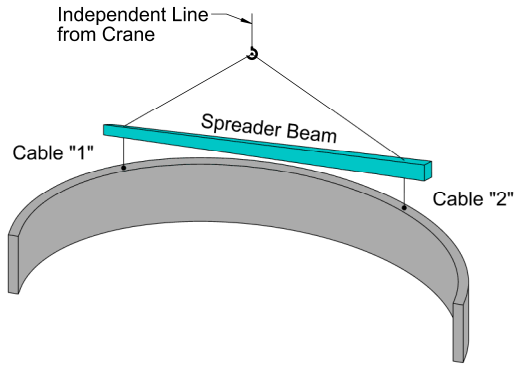


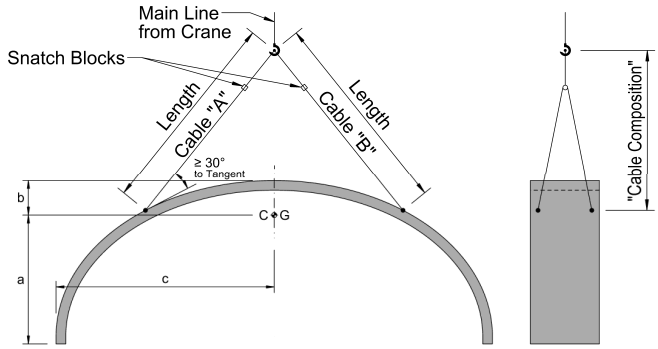
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.46

Handling

Arch Element Weight	[kN]	136.50 (13.8 metric tons)
Min. Length Cable A&B	[m]*	5.90
Cable Force A&B	[kN]*	79.20
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	68.25
Center of Gravity a	[m]	2.03
Center of Gravity b	[m]	1.12
Center of Gravity c	[m]	4.75
Edge Anchor Distance	[m]	6.46

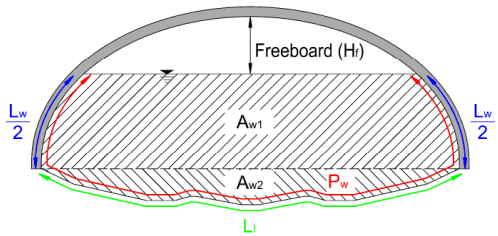




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	19.63	
1.0	15.22	4.70
1.5	11.73	3.20
2.0	7.78	1.94
2.5	3.52	0.82



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	21.1	36.1	25.3	43.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	43.4	185.1	53.2	229.6
LC41	0.6m OF + Single Axle C	62.7	216.9	85.9	283.7
LC42	0.6m OF + Single Axle Ecc	61.4	227.4	83.9	301.5
LC43	0.6m OF + Tandem C	73.6	230.7	104.5	307.0
LC44	0.6m OF + Tandem Ecc	71.1	249.6	100.2	339.3
LC50	1.0m OF Permanent Loads	57.4	218.9	70.7	271.8
LC51	1.0m OF + Single Axle C	72.7	246.3	96.7	318.4
LC52	1.0m OF + Single Axle Ecc	71.2	256.4	94.1	335.6
LC53	1.0m OF + Tandem C	81.8	262.6	112.1	346.2
LC54	1.0m OF + Tandem Ecc	79.8	278.6	108.7	373.3
LC60	2.0m OF Permanent Loads	93.2	330.4	115.4	411.2
LC61	2.0m OF + Single Axle C	103.2	350.0	132.4	444.4
LC62	2.0m OF + Single Axle Ecc	93.1	330.0	115.2	410.4
LC63	2.0m OF + Tandem C	109.1	361.3	142.5	463.8
LC64	2.0m OF + Tandem Ecc	107.9	371.2	140.4	480.6
LC70	3.0m OF Permanent Loads	128.3	442.7	159.4	551.6
LC71	3.0m OF + Single Axle C	135.9	458.3	172.3	578.1
LC72	3.0m OF + Single Axle Ecc	135.0	461.6	170.6	583.7
LC73	3.0m OF + Tandem C	140.3	467.1	179.6	593.0
LC74	3.0m OF + Tandem Ecc	139.0	472.7	177.4	602.5
LC80	4.0m OF Permanent Loads	163.3	555.2	203.1	692.2
LC81	4.0m OF + Single Axle C	169.3	567.9	213.2	713.7
LC82	4.0m OF + Single Axle Ecc	168.4	569.8	211.7	717.0
LC83	4.0m OF + Tandem C	172.7	575.1	219.0	726.0
LC84	4.0m OF + Tandem Ecc	171.5	578.4	217.0	731.6
LC90	5.0m OF Permanent Loads	198.5	668.6	247.1	833.9
LC91	5.0m OF + Single Axle C	203.3	679.0	255.2	851.7
LC92	5.0m OF + Single Axle Ecc	202.6	680.1	254.0	853.6
LC93	5.0m OF + Tandem C	206.0	685.0	259.8	861.8
LC94	5.0m OF + Tandem Ecc	205.0	686.9	258.1	865.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

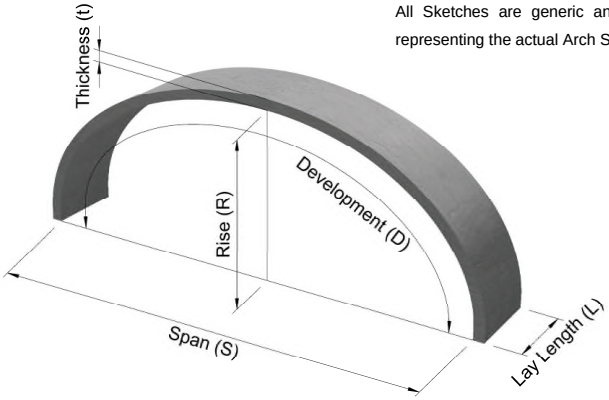
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E30/2

Dimensions

Span S	[m]	9.110
Rise R	[m]	3.200
Development D	[m]	12.131
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

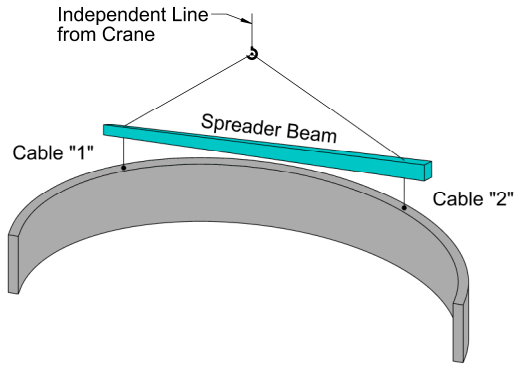


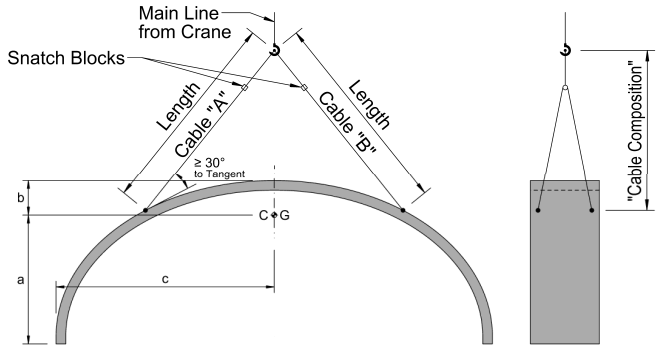
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.75

Handling

Arch Element Weight	[kN]	143.75 (14.6 metric tons)
Min. Length Cable A&B	[m]*	6.60
Cable Force A&B	[kN]*	81.65
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	71.88
Center of Gravity a	[m]	2.22
Center of Gravity b	[m]	1.23
Center of Gravity c	[m]	4.81
Edge Anchor Distance	[m]	6.75



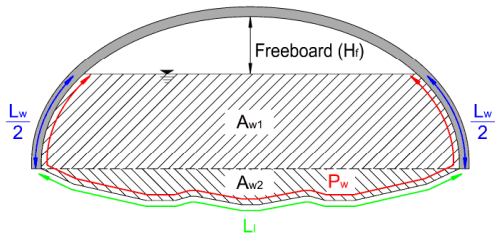


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	22.39	
1.0	17.99	5.32
1.5	14.50	3.82
2.0	10.54	2.56
2.5	6.28	1.44
3.0	1.82	0.40

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	19.4	38.1	23.2	45.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	32.0	193.2	39.0	239.6
LC41	0.6m OF + Single Axle C	47.5	223.0	65.5	290.3
LC42	0.6m OF + Single Axle Ecc	47.8	235.2	65.9	310.9
LC43	0.6m OF + Tandem C	56.5	235.6	80.7	311.6
LC44	0.6m OF + Tandem Ecc	56.1	256.9	80.0	347.8
LC50	1.0m OF Permanent Loads	43.5	227.2	53.4	282.1
LC51	1.0m OF + Single Axle C	55.9	253.3	74.5	326.5
LC52	1.0m OF + Single Axle Ecc	55.5	264.8	73.9	346.0
LC53	1.0m OF + Tandem C	63.3	268.9	87.1	352.9
LC54	1.0m OF + Tandem Ecc	62.9	286.7	86.4	383.3
LC60	2.0m OF Permanent Loads	72.7	340.5	89.9	423.7
LC61	2.0m OF + Single Axle C	80.9	359.4	103.8	455.9
LC62	2.0m OF + Single Axle Ecc	72.6	340.1	89.7	423.1
LC63	2.0m OF + Tandem C	85.7	370.5	112.1	474.7
LC64	2.0m OF + Tandem Ecc	85.5	381.7	111.7	493.8
LC70	3.0m OF Permanent Loads	101.5	455.3	125.9	567.3
LC71	3.0m OF + Single Axle C	107.8	470.6	136.5	593.2
LC72	3.0m OF + Single Axle Ecc	107.3	474.5	135.7	599.9
LC73	3.0m OF + Tandem C	111.3	479.1	142.6	607.7
LC74	3.0m OF + Tandem Ecc	110.7	485.6	141.6	618.6
LC80	4.0m OF Permanent Loads	130.2	570.5	161.8	711.2
LC81	4.0m OF + Single Axle C	135.2	583.0	170.2	732.5
LC82	4.0m OF + Single Axle Ecc	134.7	585.5	169.4	736.7
LC83	4.0m OF + Tandem C	138.0	590.1	175.0	744.6
LC84	4.0m OF + Tandem Ecc	137.3	594.0	173.8	751.2
LC90	5.0m OF Permanent Loads	159.2	687.0	198.1	856.8
LC91	5.0m OF + Single Axle C	163.2	697.4	204.7	874.4
LC92	5.0m OF + Single Axle Ecc	162.7	698.8	203.9	876.8
LC93	5.0m OF + Tandem C	165.4	703.1	208.5	884.2
LC94	5.0m OF + Tandem Ecc	164.7	705.5	207.4	888.3

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

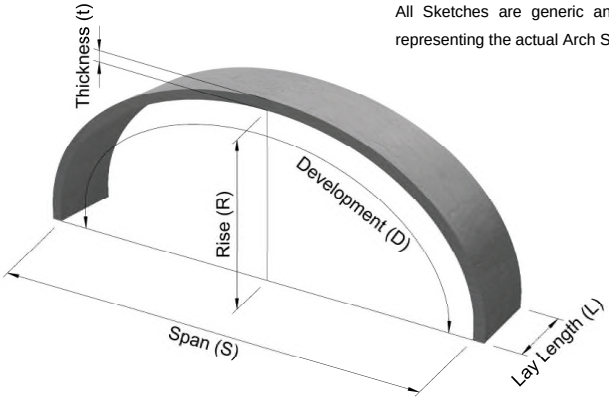
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E30/3

Dimensions

Span S	[m]	9.144
Rise R	[m]	3.505
Development D	[m]	12.744
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

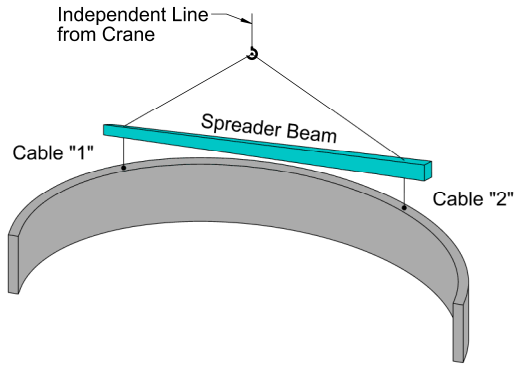


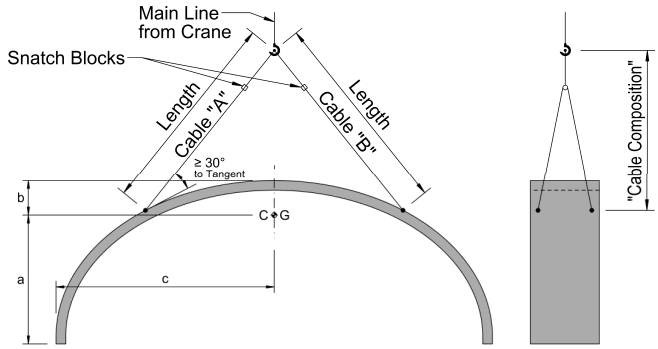
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.05

Handling

Arch Element Weight	[kN]	151.25 (15.3 metric tons)
Min. Length Cable A&B	[m]*	7.50
Cable Force A&B	[kN]*	84.19
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	75.63
Center of Gravity a	[m]	2.41
Center of Gravity b	[m]	1.35
Center of Gravity c	[m]	4.83
Edge Anchor Distance	[m]	7.03



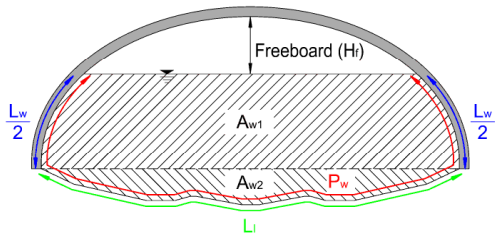


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	25.17	
1.0	20.77	5.92
1.5	17.28	4.44
2.0	13.33	3.18
2.5	9.06	2.06
3.0	4.60	1.02
3.5	0.05	0.01

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	17.5	40.0	21.0	48.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	19.8	199.6	23.8	247.5
LC41	0.6m OF + Single Axle C	31.7	227.4	44.2	294.8
LC42	0.6m OF + Single Axle Ecc	32.8	241.1	46.0	318.0
LC43	0.6m OF + Tandem C	38.7	239.8	56.0	315.9
LC44	0.6m OF + Tandem Ecc	39.5	263.1	57.3	355.4
LC50	1.0m OF Permanent Loads	28.5	235.3	34.8	292.1
LC51	1.0m OF + Single Axle C	38.2	259.7	51.1	333.5
LC52	1.0m OF + Single Axle Ecc	38.4	272.3	51.6	355.0
LC53	1.0m OF + Tandem C	43.9	274.0	60.9	358.0
LC54	1.0m OF + Tandem Ecc	44.4	293.6	61.8	391.2
LC60	2.0m OF Permanent Loads	50.7	349.3	62.5	434.6
LC61	2.0m OF + Single Axle C	57.0	367.2	73.3	465.0
LC62	2.0m OF + Single Axle Ecc	50.6	348.9	62.4	434.0
LC63	2.0m OF + Tandem C	60.8	377.7	79.7	483.0
LC64	2.0m OF + Tandem Ecc	61.2	390.0	80.3	503.9
LC70	3.0m OF Permanent Loads	72.5	465.1	89.8	579.4
LC71	3.0m OF + Single Axle C	77.4	479.8	98.1	604.3
LC72	3.0m OF + Single Axle Ecc	77.3	484.2	97.8	611.9
LC73	3.0m OF + Tandem C	80.2	487.8	102.9	618.0
LC74	3.0m OF + Tandem Ecc	80.0	494.9	102.5	630.0
LC80	4.0m OF Permanent Loads	94.3	581.3	117.0	724.6
LC81	4.0m OF + Single Axle C	98.1	593.4	123.6	745.2
LC82	4.0m OF + Single Axle Ecc	97.9	596.3	123.1	750.1
LC83	4.0m OF + Tandem C	100.3	600.1	127.3	756.6
LC84	4.0m OF + Tandem Ecc	99.9	604.3	126.6	763.7
LC90	5.0m OF Permanent Loads	116.3	699.0	144.4	871.7
LC91	5.0m OF + Single Axle C	119.3	708.9	149.7	888.6
LC92	5.0m OF + Single Axle Ecc	119.0	710.6	149.2	891.6
LC93	5.0m OF + Tandem C	121.0	714.4	152.6	897.9
LC94	5.0m OF + Tandem Ecc	120.6	717.1	151.9	902.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

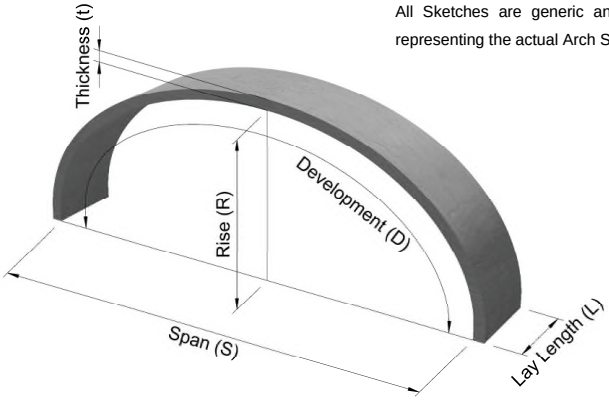
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E30/4

Dimensions

Span S	[m]	9.144
Rise R	[m]	3.810
Development D	[m]	13.353
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

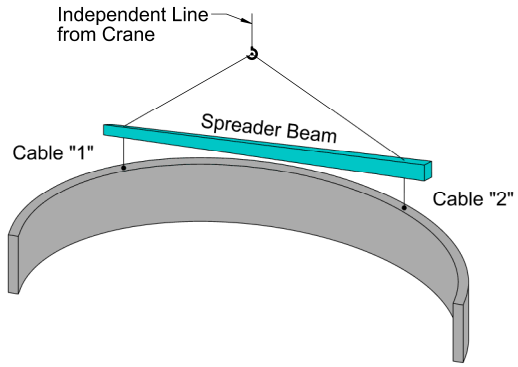


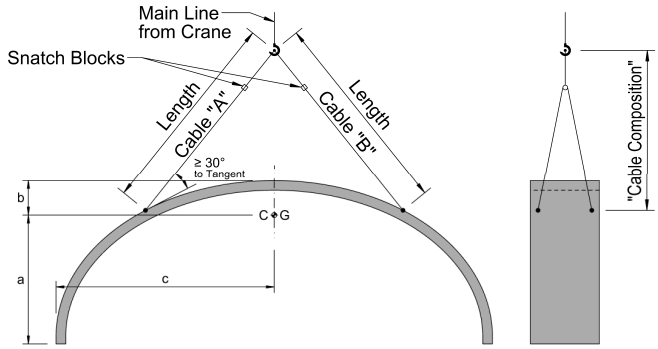
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.33

Handling

Arch Element Weight	[kN]	158.25 (16.0 metric tons)
Min. Length Cable A&B	[m]*	8.60
Cable Force A&B	[kN]*	86.53
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	79.13
Center of Gravity a	[m]	2.60
Center of Gravity b	[m]	1.46
Center of Gravity c	[m]	4.83
Edge Anchor Distance	[m]	7.28



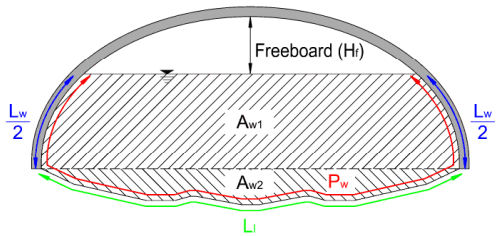


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	27.96	
1.0	23.56	6.54
1.5	20.07	5.04
2.0	16.12	3.78
2.5	11.85	2.66
3.0	7.39	1.62
3.5	2.83	0.62

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	15.7	41.9	18.9	50.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	8.4	205.5	9.8	254.7
LC41	0.6m OF + Single Axle C	17.3	231.6	24.9	299.2
LC42	0.6m OF + Single Axle Ecc	18.8	245.9	27.3	323.4
LC43	0.6m OF + Tandem C	22.7	242.9	33.9	318.5
LC44	0.6m OF + Tandem Ecc	24.0	267.4	36.3	360.0
LC50	1.0m OF Permanent Loads	14.8	241.8	17.7	300.2
LC51	1.0m OF + Single Axle C	22.0	264.6	30.0	338.9
LC52	1.0m OF + Single Axle Ecc	22.6	277.8	31.0	361.4
LC53	1.0m OF + Tandem C	26.4	278.0	37.4	361.6
LC54	1.0m OF + Tandem Ecc	27.3	298.4	39.0	396.3
LC60	2.0m OF Permanent Loads	30.8	356.2	37.7	443.1
LC61	2.0m OF + Single Axle C	35.5	373.0	45.8	471.7
LC62	2.0m OF + Single Axle Ecc	30.7	355.7	37.6	442.3
LC63	2.0m OF + Tandem C	38.4	383.4	50.6	489.4
LC64	2.0m OF + Tandem Ecc	39.0	396.2	51.6	511.1
LC70	3.0m OF Permanent Loads	46.4	472.6	57.2	588.6
LC71	3.0m OF + Single Axle C	50.0	487.1	63.3	613.4
LC72	3.0m OF + Single Axle Ecc	50.0	491.7	63.3	621.1
LC73	3.0m OF + Tandem C	52.0	494.9	66.8	626.5
LC74	3.0m OF + Tandem Ecc	52.1	502.1	66.8	638.9
LC80	4.0m OF Permanent Loads	61.7	590.1	76.4	735.5
LC81	4.0m OF + Single Axle C	64.6	602.2	81.3	756.2
LC82	4.0m OF + Single Axle Ecc	64.5	605.3	81.1	761.3
LC83	4.0m OF + Tandem C	66.2	608.8	84.0	767.3
LC84	4.0m OF + Tandem Ecc	66.0	613.0	83.6	774.5
LC90	5.0m OF Permanent Loads	77.2	709.4	95.8	884.6
LC91	5.0m OF + Single Axle C	79.5	719.3	99.6	901.5
LC92	5.0m OF + Single Axle Ecc	79.3	721.1	99.3	904.5
LC93	5.0m OF + Tandem C	80.8	724.6	101.7	910.5
LC94	5.0m OF + Tandem Ecc	80.5	727.5	101.3	915.4

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

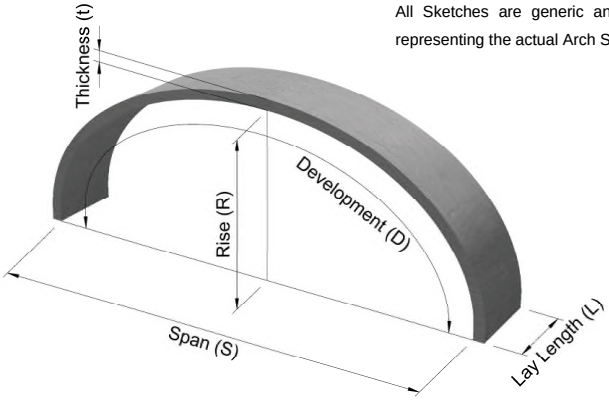
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E30/5

Dimensions

Span S	[m]	9.144
Rise R	[m]	4.115
Development D	[m]	13.966
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

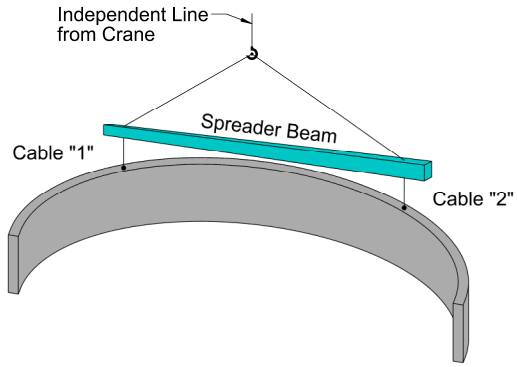


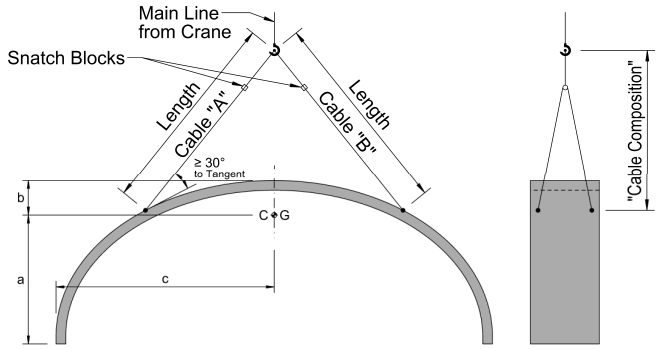
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.61

Handling

Arch Element Weight	[kN]	165.25 (16.7 metric tons)
Min. Length Cable A&B	[m]*	10.00
Cable Force A&B	[kN]*	88.91
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	82.63
Center of Gravity a	[m]	2.79
Center of Gravity b	[m]	1.58
Center of Gravity c	[m]	4.83
Edge Anchor Distance	[m]	7.53



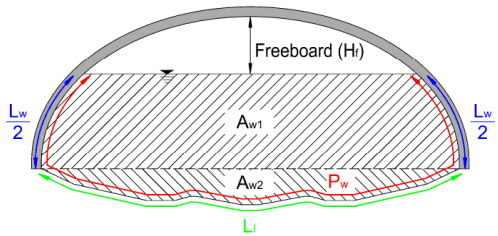


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	30.75	
1.0	26.35	7.14
1.5	22.85	5.66
2.0	18.90	4.40
2.5	14.64	3.28
3.0	10.18	2.24
3.5	5.62	1.22

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	14.3	43.7	17.1	52.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-1.7	212.0	-2.8	262.9
LC41	0.6m OF + Single Axle C	4.7	236.8	8.1	304.9
LC42	0.6m OF + Single Axle Ecc	6.3	251.4	10.7	329.7
LC43	0.6m OF + Tandem C	8.8	247.4	14.9	323.0
LC44	0.6m OF + Tandem Ecc	10.4	272.2	17.7	365.1
LC50	1.0m OF Permanent Loads	2.7	249.0	2.6	309.0
LC51	1.0m OF + Single Axle C	8.0	270.5	11.6	345.7
LC52	1.0m OF + Single Axle Ecc	8.7	284.0	12.8	368.5
LC53	1.0m OF + Tandem C	11.2	283.3	17.1	367.4
LC54	1.0m OF + Tandem Ecc	12.3	304.0	18.9	402.6
LC60	2.0m OF Permanent Loads	13.4	363.8	16.0	452.6
LC61	2.0m OF + Single Axle C	16.9	380.5	22.0	481.0
LC62	2.0m OF + Single Axle Ecc	13.3	364.0	15.9	452.9
LC63	2.0m OF + Tandem C	19.0	390.8	25.5	498.5
LC64	2.0m OF + Tandem Ecc	19.6	403.7	26.6	520.4
LC70	3.0m OF Permanent Loads	23.8	482.3	29.0	600.7
LC71	3.0m OF + Single Axle C	26.4	496.7	33.5	625.1
LC72	3.0m OF + Single Axle Ecc	26.5	501.1	33.6	632.7
LC73	3.0m OF + Tandem C	27.8	503.9	35.9	637.4
LC74	3.0m OF + Tandem Ecc	28.0	511.2	36.2	649.8
LC80	4.0m OF Permanent Loads	33.9	601.4	41.6	749.6
LC81	4.0m OF + Single Axle C	35.9	613.3	45.1	769.7
LC82	4.0m OF + Single Axle Ecc	35.9	616.2	45.1	774.7
LC83	4.0m OF + Tandem C	37.1	619.3	47.0	780.0
LC84	4.0m OF + Tandem Ecc	37.0	623.6	46.9	787.4
LC90	5.0m OF Permanent Loads	44.1	722.2	54.4	900.6
LC91	5.0m OF + Single Axle C	45.7	731.8	57.1	916.9
LC92	5.0m OF + Single Axle Ecc	45.6	733.6	57.0	920.0
LC93	5.0m OF + Tandem C	46.6	736.8	58.6	925.4
LC94	5.0m OF + Tandem Ecc	46.4	739.8	58.4	930.4

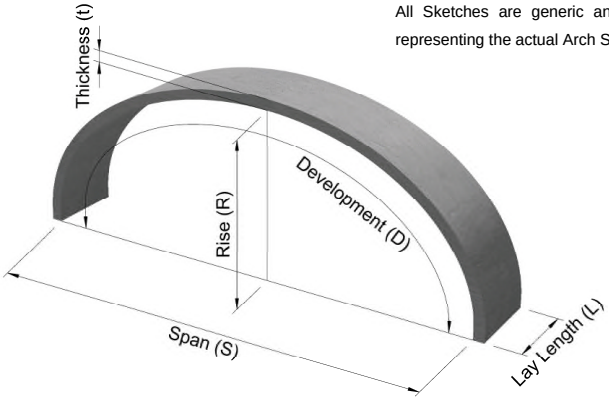
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	10.576
Rise R	[m]	2.794
Development D	[m]	12.640
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

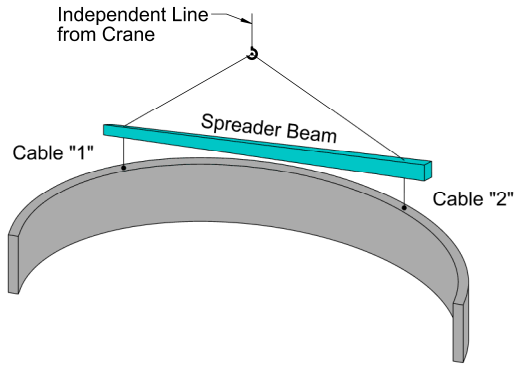


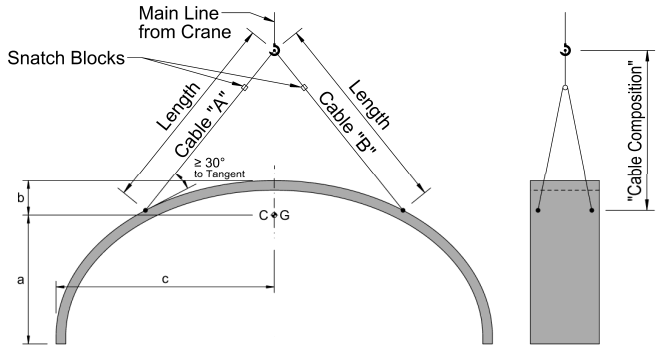
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.96

Handling

Arch Element Weight	[kN]	149.00 (15.1 metric tons)
Min. Length Cable A&B	[m]*	6.20
Cable Force A&B	[kN]*	89.31
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	74.50
Center of Gravity a	[m]	2.00
Center of Gravity b	[m]	1.05
Center of Gravity c	[m]	5.52
Edge Anchor Distance	[m]	7.24

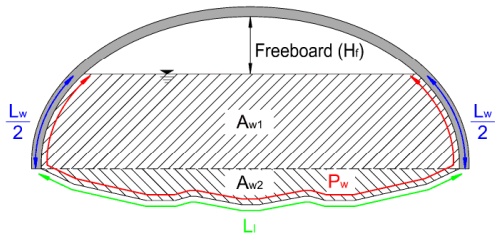




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	21.82	
1.0	16.73	4.86
1.5	12.68	3.21
2.0	8.07	1.84
2.5	3.07	0.65



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	29.9	39.4	35.9	47.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	74.3	210.3	91.4	260.9
LC41	0.6m OF + Single Axle C	99.3	243.5	133.9	317.4
LC42	0.6m OF + Single Axle Ecc	96.4	254.3	129.0	335.7
LC43	0.6m OF + Tandem C	113.9	259.0	158.7	343.6
LC44	0.6m OF + Tandem Ecc	108.6	277.6	149.7	375.3
LC50	1.0m OF Permanent Loads	96.2	250.8	118.8	311.5
LC51	1.0m OF + Single Axle C	116.0	279.5	152.5	360.3
LC52	1.0m OF + Single Axle Ecc	113.1	289.2	147.5	376.9
LC53	1.0m OF + Tandem C	128.0	296.9	172.8	389.9
LC54	1.0m OF + Tandem Ecc	123.9	312.7	165.8	416.8
LC60	2.0m OF Permanent Loads	150.7	379.1	186.9	471.9
LC61	2.0m OF + Single Axle C	163.7	399.7	209.0	506.8
LC62	2.0m OF + Single Axle Ecc	162.0	405.5	206.2	516.7
LC63	2.0m OF + Tandem C	171.4	411.2	222.1	526.5
LC64	2.0m OF + Tandem Ecc	169.0	420.9	218.1	543.0
LC70	3.0m OF Permanent Loads	203.4	506.3	252.7	630.9
LC71	3.0m OF + Single Axle C	213.4	522.9	269.8	659.2
LC72	3.0m OF + Single Axle Ecc	211.9	526.1	267.2	664.6
LC73	3.0m OF + Tandem C	219.2	532.3	279.6	675.1
LC74	3.0m OF + Tandem Ecc	217.0	537.7	275.9	684.3
LC80	4.0m OF Permanent Loads	255.5	633.8	317.9	790.3
LC81	4.0m OF + Single Axle C	263.3	647.3	331.2	813.2
LC82	4.0m OF + Single Axle Ecc	262.0	649.1	328.9	816.3
LC83	4.0m OF + Tandem C	267.8	654.9	338.8	826.2
LC84	4.0m OF + Tandem Ecc	265.9	658.1	335.6	831.6
LC90	5.0m OF Permanent Loads	307.0	761.0	382.3	949.2
LC91	5.0m OF + Single Axle C	313.2	772.0	392.7	968.0
LC92	5.0m OF + Single Axle Ecc	312.1	773.0	390.9	969.8
LC93	5.0m OF + Tandem C	316.7	778.3	398.8	978.7
LC94	5.0m OF + Tandem Ecc	315.1	780.1	396.0	981.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

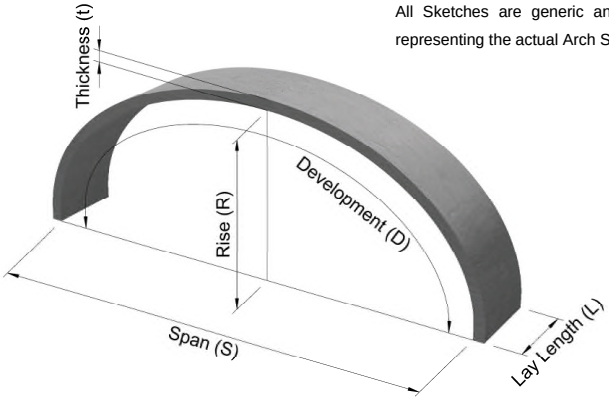
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E36/1

Dimensions

Span S	[m]	10.780
Rise R	[m]	3.099
Development D	[m]	13.295
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

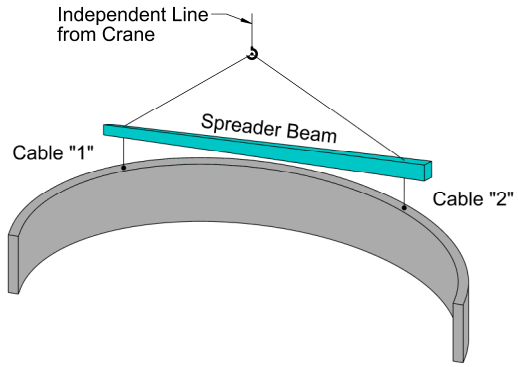


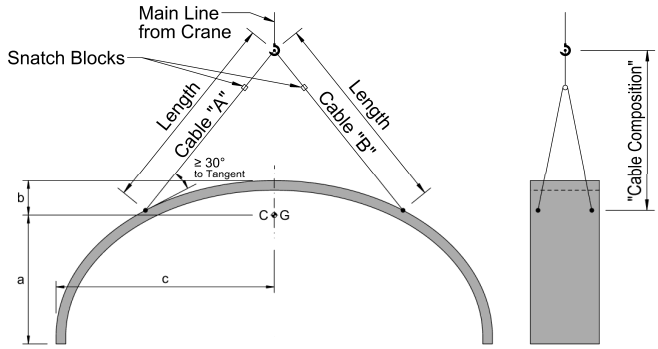
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.27

Handling

Arch Element Weight	[kN]	156.75 (15.8 metric tons)
Min. Length Cable A&B	[m]*	6.80
Cable Force A&B	[kN]*	92.29
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	78.38
Center of Gravity a	[m]	2.20
Center of Gravity b	[m]	1.16
Center of Gravity c	[m]	5.64
Edge Anchor Distance	[m]	7.58

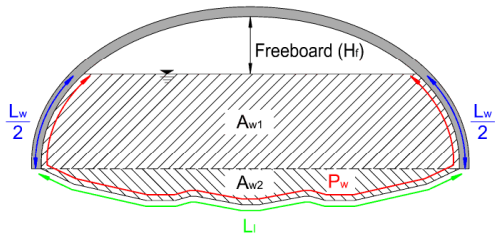




*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	25.08	
1.0	19.99	5.50
1.5	15.94	3.86
2.0	11.33	2.48
2.5	6.33	1.30
3.0	1.06	0.21



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	28.0	41.5	33.5	49.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	63.5	221.7	78.0	275.0
LC41	0.6m OF + Single Axle C	85.0	253.5	114.6	329.1
LC42	0.6m OF + Single Axle Ecc	84.2	265.0	113.1	348.6
LC43	0.6m OF + Tandem C	97.7	267.5	136.1	352.9
LC44	0.6m OF + Tandem Ecc	95.5	287.5	132.4	386.9
LC50	1.0m OF Permanent Loads	83.0	262.0	102.4	325.4
LC51	1.0m OF + Single Axle C	100.2	289.9	131.5	372.9
LC52	1.0m OF + Single Axle Ecc	98.8	300.5	129.2	390.9
LC53	1.0m OF + Tandem C	110.6	306.7	149.2	401.5
LC54	1.0m OF + Tandem Ecc	108.8	323.8	146.2	430.5
LC60	2.0m OF Permanent Loads	131.4	392.9	162.8	489.0
LC61	2.0m OF + Single Axle C	142.8	413.1	182.3	523.3
LC62	2.0m OF + Single Axle Ecc	142.1	419.5	181.1	534.3
LC63	2.0m OF + Tandem C	149.8	424.4	194.1	542.7
LC64	2.0m OF + Tandem Ecc	148.9	435.3	192.6	561.0
LC70	3.0m OF Permanent Loads	178.8	523.4	222.1	652.2
LC71	3.0m OF + Single Axle C	187.8	540.0	237.4	680.3
LC72	3.0m OF + Single Axle Ecc	187.0	543.7	236.0	686.7
LC73	3.0m OF + Tandem C	193.0	549.2	246.3	696.0
LC74	3.0m OF + Tandem Ecc	191.8	555.2	244.2	706.3
LC80	4.0m OF Permanent Loads	225.9	654.5	281.0	816.0
LC81	4.0m OF + Single Axle C	233.0	668.0	293.0	839.0
LC82	4.0m OF + Single Axle Ecc	232.2	670.2	291.6	842.8
LC83	4.0m OF + Tandem C	237.1	675.6	299.9	851.9
LC84	4.0m OF + Tandem Ecc	235.9	679.3	297.9	858.2
LC90	5.0m OF Permanent Loads	272.7	786.0	339.5	980.5
LC91	5.0m OF + Single Axle C	278.4	797.1	349.1	999.3
LC92	5.0m OF + Single Axle Ecc	277.6	798.5	347.9	1001.6
LC93	5.0m OF + Tandem C	281.6	803.4	354.6	1010.0
LC94	5.0m OF + Tandem Ecc	280.5	805.6	352.8	1013.8

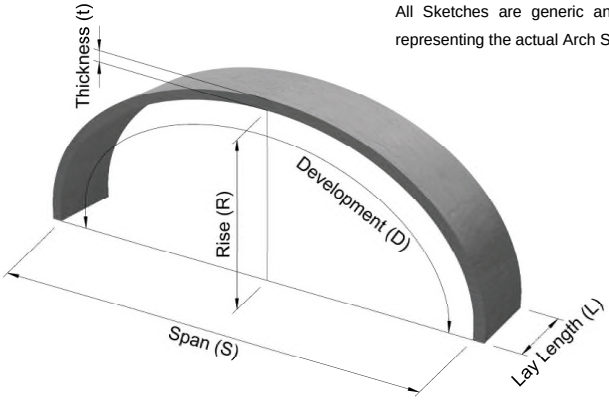
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	10.910
Rise R	[m]	3.404
Development D	[m]	13.905
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

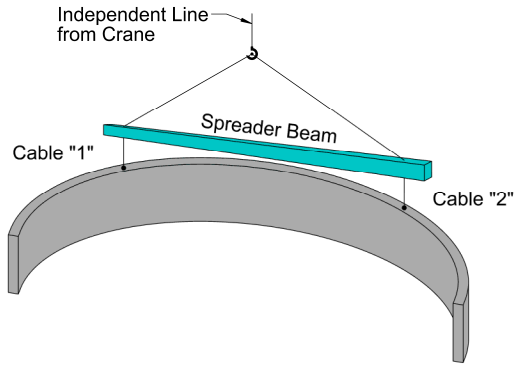


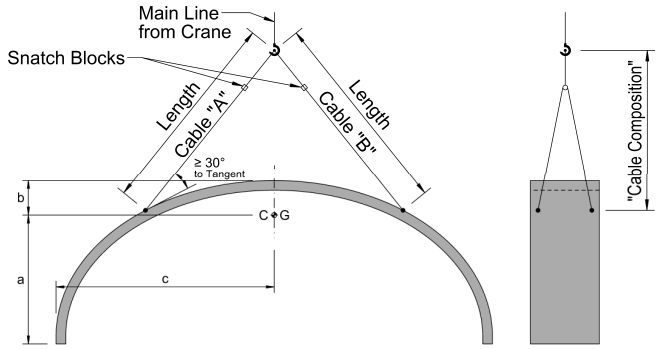
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.57

Handling

Arch Element Weight	[kN]	164.25 (16.7 metric tons)
Min. Length Cable A&B	[m]*	7.40
Cable Force A&B	[kN]*	95.03
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	82.13
Center of Gravity a	[m]	2.39
Center of Gravity b	[m]	1.26
Center of Gravity c	[m]	5.71
Edge Anchor Distance	[m]	7.90



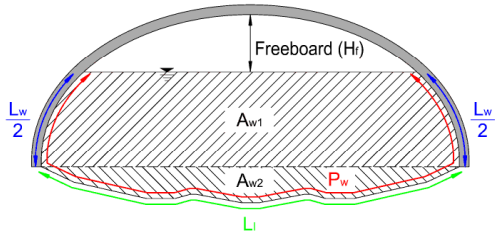


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	28.38	
1.0	23.30	6.14
1.5	19.24	4.48
2.0	14.64	3.10
2.5	9.64	1.92
3.0	4.37	0.82

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	25.8	43.5	31.0	52.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	50.6	230.9	61.9	286.5
LC41	0.6m OF + Single Axle C	68.0	260.5	91.6	336.8
LC42	0.6m OF + Single Axle Ecc	68.5	273.7	92.5	359.2
LC43	0.6m OF + Tandem C	78.3	273.1	109.0	358.2
LC44	0.6m OF + Tandem Ecc	78.3	295.7	109.0	396.6
LC50	1.0m OF Permanent Loads	66.6	271.2	82.0	336.9
LC51	1.0m OF + Single Axle C	80.7	297.8	105.9	382.0
LC52	1.0m OF + Single Axle Ecc	80.5	309.8	105.5	402.4
LC53	1.0m OF + Tandem C	89.3	313.7	120.5	409.0
LC54	1.0m OF + Tandem Ecc	89.1	332.8	120.3	441.5
LC60	2.0m OF Permanent Loads	106.9	403.8	132.4	502.6
LC61	2.0m OF + Single Axle C	116.4	423.3	148.5	535.7
LC62	2.0m OF + Single Axle Ecc	116.4	430.6	148.4	548.2
LC63	2.0m OF + Tandem C	122.1	434.2	158.1	554.2
LC64	2.0m OF + Tandem Ecc	122.2	446.4	158.4	575.0
LC70	3.0m OF Permanent Loads	146.5	536.6	181.9	668.6
LC71	3.0m OF + Single Axle C	154.1	552.9	194.7	696.2
LC72	3.0m OF + Single Axle Ecc	153.7	557.2	194.1	703.6
LC73	3.0m OF + Tandem C	158.4	561.7	202.0	711.2
LC74	3.0m OF + Tandem Ecc	157.9	568.5	201.2	722.8
LC80	4.0m OF Permanent Loads	186.1	670.3	231.3	835.7
LC81	4.0m OF + Single Axle C	192.0	683.6	241.4	858.4
LC82	4.0m OF + Single Axle Ecc	191.6	686.4	240.7	863.1
LC83	4.0m OF + Tandem C	195.4	691.0	247.2	870.9
LC84	4.0m OF + Tandem Ecc	194.7	695.1	246.0	877.8
LC90	5.0m OF Permanent Loads	225.5	804.7	280.5	1003.7
LC91	5.0m OF + Single Axle C	230.2	815.7	288.6	1022.4
LC92	5.0m OF + Single Axle Ecc	229.8	817.3	287.8	1025.2
LC93	5.0m OF + Tandem C	232.9	821.7	293.2	1032.5
LC94	5.0m OF + Tandem Ecc	232.2	824.3	292.0	1037.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

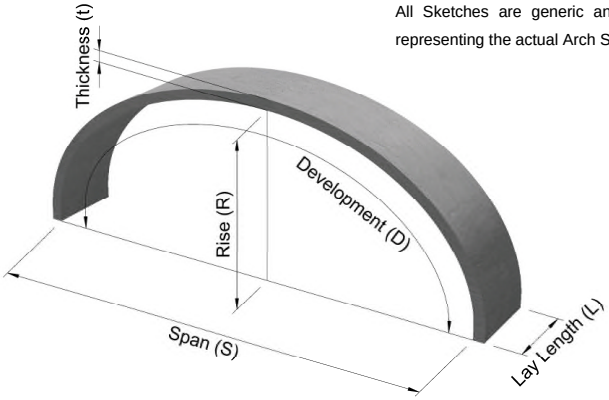
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E36/3

Dimensions

Span S	[m]	10.968
Rise R	[m]	3.708
Development D	[m]	14.518
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

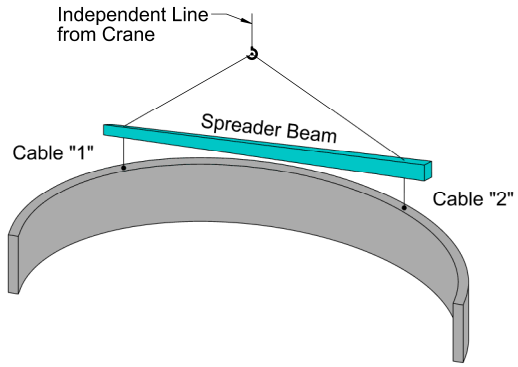


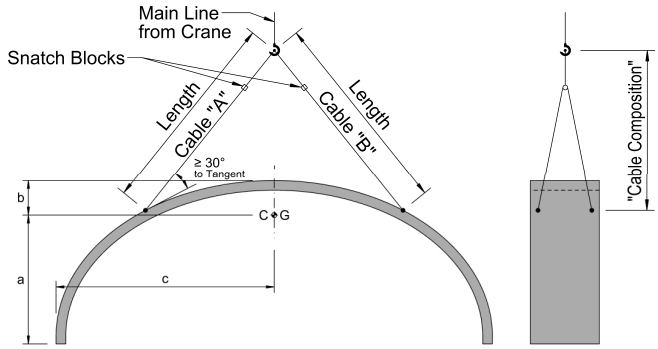
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.87

Handling

Arch Element Weight	[kN]	171.75 (17.3 metric tons)
Min. Length Cable A&B	[m]*	8.20
Cable Force A&B	[kN]*	97.63
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	85.88
Center of Gravity a	[m]	2.59
Center of Gravity b	[m]	1.37
Center of Gravity c	[m]	5.74
Edge Anchor Distance	[m]	8.20



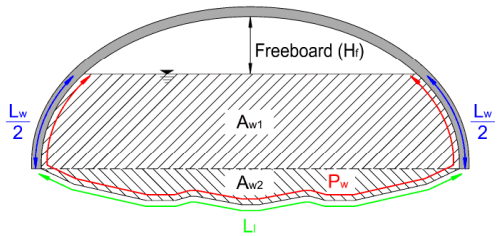


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	31.72	
1.0	26.63	6.74
1.5	22.58	5.08
2.0	17.97	3.72
2.5	12.97	2.52
3.0	7.71	1.44
3.5	2.28	0.42

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	23.6	45.4	28.3	54.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	36.4	237.7	44.3	294.9
LC41	0.6m OF + Single Axle C	49.9	265.2	67.2	341.6
LC42	0.6m OF + Single Axle Ecc	51.3	279.8	69.6	366.4
LC43	0.6m OF + Tandem C	57.8	277.5	80.6	362.5
LC44	0.6m OF + Tandem Ecc	59.1	302.6	82.9	405.2
LC50	1.0m OF Permanent Loads	48.8	279.8	59.8	347.4
LC51	1.0m OF + Single Axle C	59.8	304.3	78.5	389.2
LC52	1.0m OF + Single Axle Ecc	60.2	317.6	79.3	411.7
LC53	1.0m OF + Tandem C	66.5	318.9	89.9	414.0
LC54	1.0m OF + Tandem Ecc	67.3	339.8	91.3	449.5
LC60	2.0m OF Permanent Loads	80.4	412.3	99.3	513.1
LC61	2.0m OF + Single Axle C	87.8	430.6	111.9	544.3
LC62	2.0m OF + Single Axle Ecc	88.2	438.7	112.5	558.0
LC63	2.0m OF + Tandem C	92.2	440.8	119.5	561.5
LC64	2.0m OF + Tandem Ecc	93.0	454.2	120.7	584.4
LC70	3.0m OF Permanent Loads	111.5	545.8	138.2	679.9
LC71	3.0m OF + Single Axle C	117.4	561.3	148.3	706.3
LC72	3.0m OF + Single Axle Ecc	117.4	566.0	148.2	714.4
LC73	3.0m OF + Tandem C	120.7	569.4	153.9	720.2
LC74	3.0m OF + Tandem Ecc	120.7	577.0	153.9	733.0
LC80	4.0m OF Permanent Loads	142.5	680.3	177.0	848.1
LC81	4.0m OF + Single Axle C	147.2	693.2	185.0	870.1
LC82	4.0m OF + Single Axle Ecc	147.1	696.3	184.7	875.4
LC83	4.0m OF + Tandem C	149.8	700.3	189.4	882.1
LC84	4.0m OF + Tandem Ecc	149.5	704.7	188.9	889.5
LC90	5.0m OF Permanent Loads	173.4	815.9	215.6	1017.6
LC91	5.0m OF + Single Axle C	177.2	826.7	222.0	1035.9
LC92	5.0m OF + Single Axle Ecc	176.9	828.6	221.5	1039.2
LC93	5.0m OF + Tandem C	179.3	832.5	225.5	1045.9
LC94	5.0m OF + Tandem Ecc	178.8	835.5	224.8	1050.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

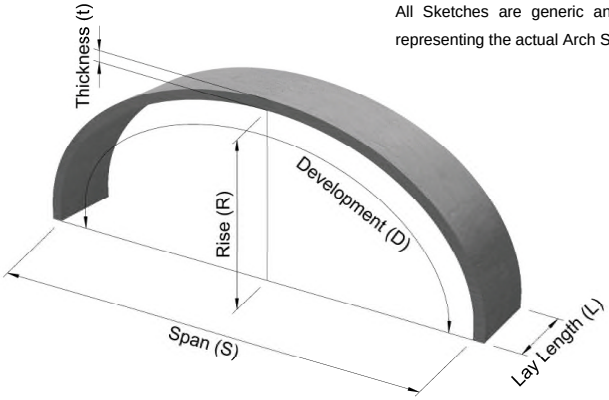
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E36/4

Dimensions

Span S	[m]	10.972
Rise R	[m]	4.013
Development D	[m]	15.127
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

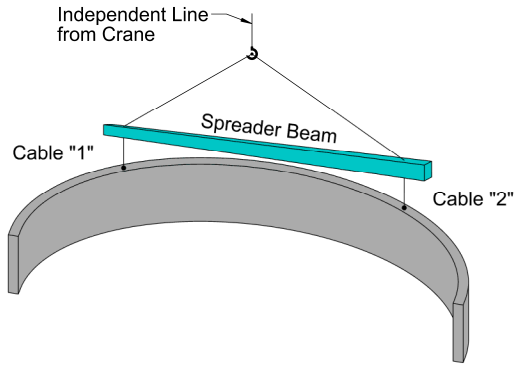


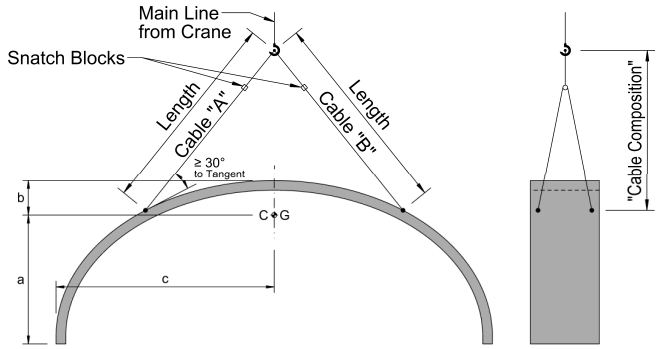
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.15

Handling

Arch Element Weight	[kN]	178.75 (18.0 metric tons)
Min. Length Cable A&B	[m]*	9.10
Cable Force A&B	[kN]*	99.99
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	89.38
Center of Gravity a	[m]	2.79
Center of Gravity b	[m]	1.48
Center of Gravity c	[m]	5.74
Edge Anchor Distance	[m]	8.48



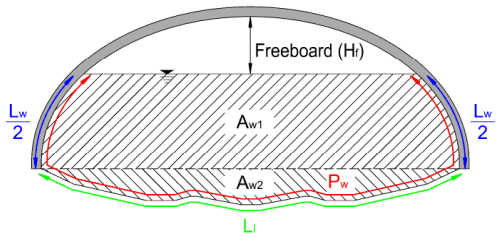


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	35.06	
1.0	30.00	7.36
1.5	25.92	5.70
2.0	21.32	4.34
2.5	16.32	3.14
3.0	11.05	2.06
3.5	5.63	1.02

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	21.4	47.3	25.6	56.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	22.2	243.5	26.7	302.0
LC41	0.6m OF + Single Axle C	32.3	269.2	43.8	345.7
LC42	0.6m OF + Single Axle Ecc	34.0	284.4	46.7	371.6
LC43	0.6m OF + Tandem C	38.2	280.4	53.8	364.7
LC44	0.6m OF + Tandem Ecc	40.1	306.6	57.1	409.4
LC50	1.0m OF Permanent Loads	31.2	285.9	38.0	355.0
LC51	1.0m OF + Single Axle C	39.6	308.8	52.2	393.9
LC52	1.0m OF + Single Axle Ecc	40.4	322.6	53.5	417.4
LC53	1.0m OF + Tandem C	44.6	322.3	60.7	416.8
LC54	1.0m OF + Tandem Ecc	45.9	344.1	63.0	453.9
LC60	2.0m OF Permanent Loads	54.6	418.0	67.2	520.1
LC61	2.0m OF + Single Axle C	60.3	435.6	76.8	550.0
LC62	2.0m OF + Single Axle Ecc	60.8	444.0	77.7	564.3
LC63	2.0m OF + Tandem C	63.6	445.8	82.5	567.3
LC64	2.0m OF + Tandem Ecc	64.6	459.7	84.2	591.1
LC70	3.0m OF Permanent Loads	77.7	552.5	96.0	688.2
LC71	3.0m OF + Single Axle C	82.2	568.0	103.7	714.7
LC72	3.0m OF + Single Axle Ecc	82.3	572.8	103.8	722.8
LC73	3.0m OF + Tandem C	84.6	575.8	107.8	727.9
LC74	3.0m OF + Tandem Ecc	84.9	583.7	108.2	741.3
LC80	4.0m OF Permanent Loads	100.6	688.6	124.6	858.4
LC81	4.0m OF + Single Axle C	104.1	701.5	130.7	880.3
LC82	4.0m OF + Single Axle Ecc	104.1	704.6	130.6	885.5
LC83	4.0m OF + Tandem C	106.1	708.1	134.0	891.5
LC84	4.0m OF + Tandem Ecc	105.9	712.6	133.8	899.2
LC90	5.0m OF Permanent Loads	123.4	825.7	153.2	1029.8
LC91	5.0m OF + Single Axle C	126.3	836.3	158.1	1047.7
LC92	5.0m OF + Single Axle Ecc	126.2	838.3	157.9	1051.2
LC93	5.0m OF + Tandem C	127.9	841.9	160.8	1057.3
LC94	5.0m OF + Tandem Ecc	127.7	844.9	160.4	1062.4

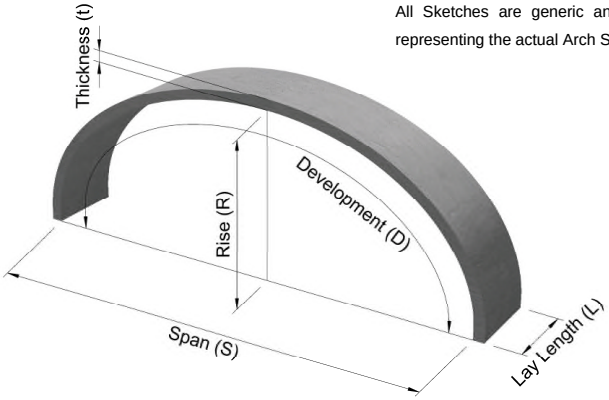
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	12.406
Rise R	[m]	3.098
Development D	[m]	14.630
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

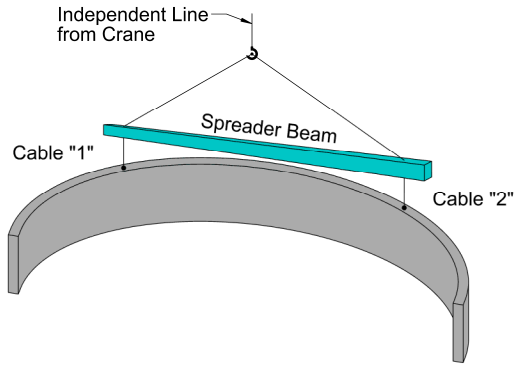


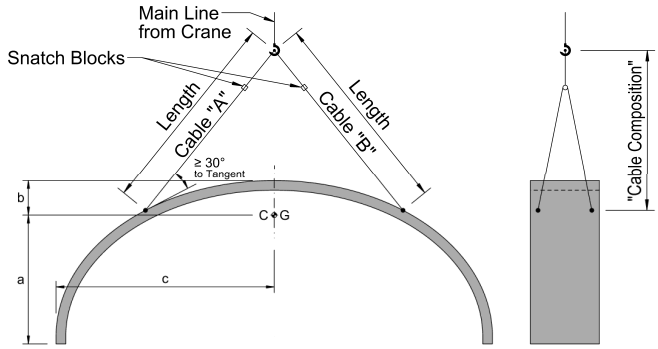
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.88

Handling

Arch Element Weight	[kN]	172.00 (17.3 metric tons)
Min. Length Cable A&B	[m]*	7.10
Cable Force A&B	[kN]*	104.35
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	86.00
Center of Gravity a	[m]	2.22
Center of Gravity b	[m]	1.13
Center of Gravity c	[m]	6.44
Edge Anchor Distance	[m]	8.46



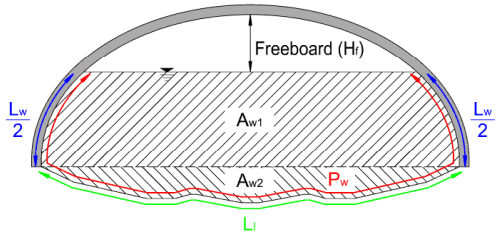


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	28.49	
1.0	22.76	5.94
1.5	18.17	4.12
2.0	12.94	2.64
2.5	7.24	1.36
3.0	1.21	0.22

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	36.9	45.5	44.3	54.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	90.2	244.1	110.9	302.9
LC41	0.6m OF + Single Axle C	116.1	276.4	154.9	357.8
LC42	0.6m OF + Single Axle Ecc	113.7	289.7	150.9	380.3
LC43	0.6m OF + Tandem C	131.1	292.6	180.5	385.4
LC44	0.6m OF + Tandem Ecc	127.1	314.3	173.7	422.2
LC50	1.0m OF Permanent Loads	117.3	293.9	144.8	365.1
LC51	1.0m OF + Single Axle C	138.0	322.7	179.9	414.1
LC52	1.0m OF + Single Axle Ecc	135.5	333.3	175.8	432.0
LC53	1.0m OF + Tandem C	150.7	340.1	201.5	443.6
LC54	1.0m OF + Tandem Ecc	147.1	357.2	195.5	472.7
LC60	2.0m OF Permanent Loads	183.7	442.9	227.7	551.4
LC61	2.0m OF + Single Axle C	197.5	463.9	251.3	587.1
LC62	2.0m OF + Single Axle Ecc	196.2	470.2	249.1	597.7
LC63	2.0m OF + Tandem C	205.9	475.9	265.5	607.4
LC64	2.0m OF + Tandem Ecc	204.1	486.3	262.5	625.1
LC70	3.0m OF Permanent Loads	248.1	590.5	308.2	735.8
LC71	3.0m OF + Single Axle C	258.9	607.8	326.6	765.2
LC72	3.0m OF + Single Axle Ecc	257.6	611.3	324.4	771.3
LC73	3.0m OF + Tandem C	265.2	617.4	337.4	781.6
LC74	3.0m OF + Tandem Ecc	263.3	623.0	334.1	791.2
LC80	4.0m OF Permanent Loads	311.3	737.7	387.2	919.8
LC81	4.0m OF + Single Axle C	319.8	751.9	401.8	944.0
LC82	4.0m OF + Single Axle Ecc	318.7	754.1	399.8	947.7
LC83	4.0m OF + Tandem C	324.8	759.8	410.2	957.5
LC84	4.0m OF + Tandem Ecc	323.0	763.2	407.2	963.3
LC90	5.0m OF Permanent Loads	373.5	884.6	465.0	1103.5
LC91	5.0m OF + Single Axle C	380.3	896.3	476.5	1123.3
LC92	5.0m OF + Single Axle Ecc	379.2	897.6	474.8	1125.5
LC93	5.0m OF + Tandem C	384.2	902.8	483.2	1134.4
LC94	5.0m OF + Tandem Ecc	382.7	905.0	480.6	1138.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

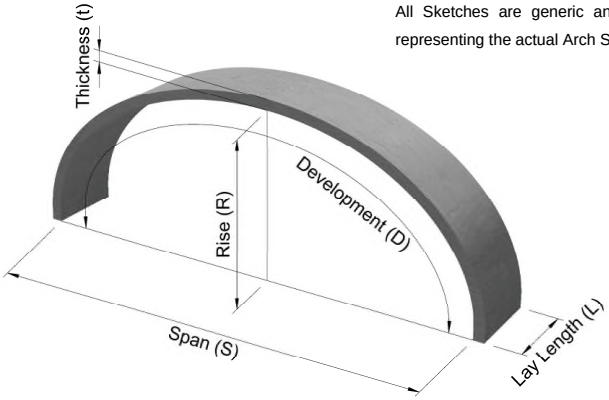
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E42/1

Dimensions

Span S	[m]	12.608
Rise R	[m]	3.404
Development D	[m]	15.274
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

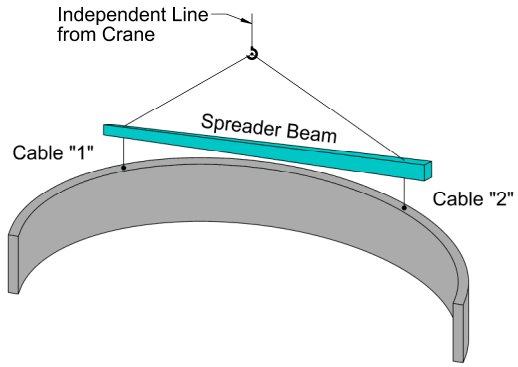


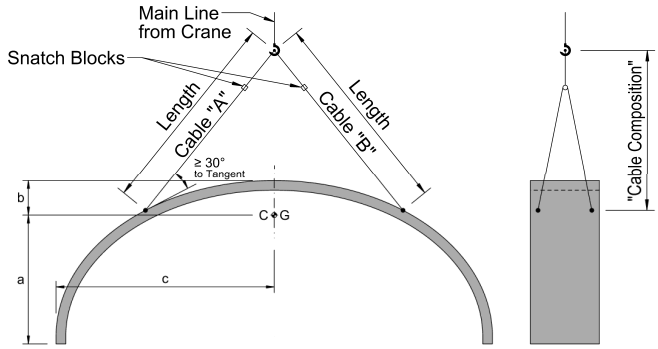
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.19

Handling

Arch Element Weight	[kN]	179.75 (18.1 metric tons)
Min. Length Cable A&B	[m]*	7.60
Cable Force A&B	[kN]*	107.34
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	89.88
Center of Gravity a	[m]	2.42
Center of Gravity b	[m]	1.23
Center of Gravity c	[m]	6.55
Edge Anchor Distance	[m]	8.81



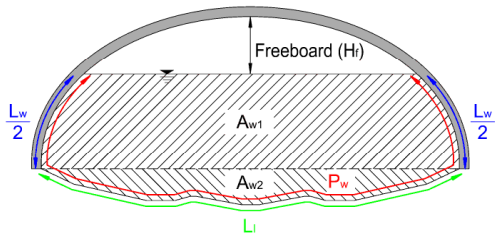


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	32.30	
1.0	26.57	6.58
1.5	21.99	4.76
2.0	16.76	3.28
2.5	11.06	2.00
3.0	5.02	0.86

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	34.5	47.5	41.4	57.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	78.1	253.9	95.9	315.0
LC41	0.6m OF + Single Axle C	100.3	284.4	133.6	366.9
LC42	0.6m OF + Single Axle Ecc	99.7	298.5	132.6	390.8
LC43	0.6m OF + Tandem C	113.4	300.4	155.8	394.1
LC44	0.6m OF + Tandem Ecc	112.1	323.2	153.7	432.9
LC50	1.0m OF Permanent Loads	102.2	304.6	126.0	378.4
LC51	1.0m OF + Single Axle C	120.0	332.5	156.3	425.8
LC52	1.0m OF + Single Axle Ecc	119.1	343.9	154.7	445.1
LC53	1.0m OF + Tandem C	131.1	349.0	175.2	453.9
LC54	1.0m OF + Tandem Ecc	129.8	367.3	172.9	485.0
LC60	2.0m OF Permanent Loads	161.3	455.7	199.9	567.2
LC61	2.0m OF + Single Axle C	173.6	476.2	220.8	602.2
LC62	2.0m OF + Single Axle Ecc	173.2	483.1	220.1	613.8
LC63	2.0m OF + Tandem C	181.1	487.9	233.6	622.0
LC64	2.0m OF + Tandem Ecc	180.7	499.3	232.9	641.3
LC70	3.0m OF Permanent Loads	219.5	606.3	272.7	755.4
LC71	3.0m OF + Single Axle C	229.5	623.5	289.6	784.8
LC72	3.0m OF + Single Axle Ecc	228.8	627.5	288.4	791.5
LC73	3.0m OF + Tandem C	235.2	632.8	299.3	800.6
LC74	3.0m OF + Tandem Ecc	234.2	639.0	297.6	811.1
LC80	4.0m OF Permanent Loads	277.3	757.1	344.9	944.0
LC81	4.0m OF + Single Axle C	285.2	771.3	358.3	968.2
LC82	4.0m OF + Single Axle Ecc	284.5	773.8	357.1	972.4
LC83	4.0m OF + Tandem C	289.7	779.0	365.9	981.3
LC84	4.0m OF + Tandem Ecc	288.5	782.6	364.0	987.3
LC90	5.0m OF Permanent Loads	334.3	907.9	416.1	1132.5
LC91	5.0m OF + Single Axle C	340.5	919.5	426.7	1152.2
LC92	5.0m OF + Single Axle Ecc	339.8	921.0	425.6	1154.7
LC93	5.0m OF + Tandem C	344.1	925.9	432.8	1163.1
LC94	5.0m OF + Tandem Ecc	343.1	928.1	431.0	1166.9

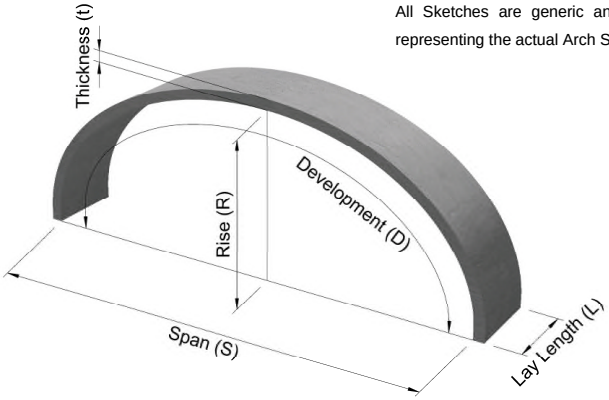
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	12.740
Rise R	[m]	3.708
Development D	[m]	15.898
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

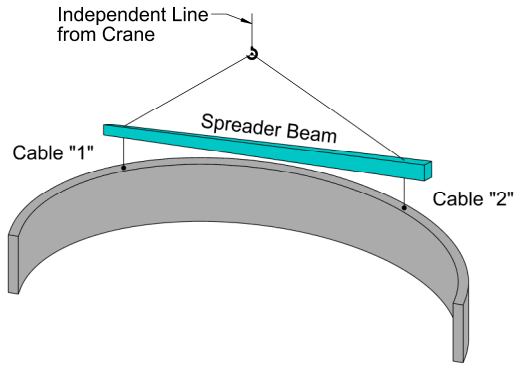


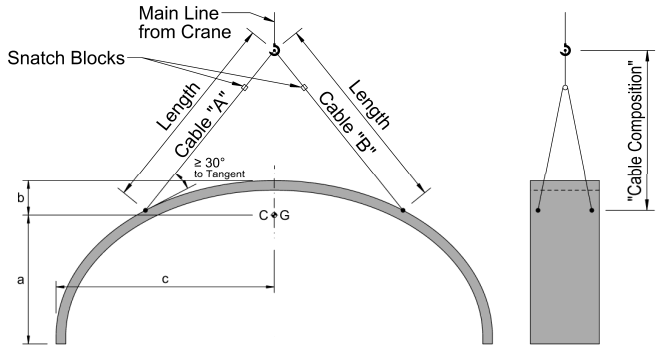
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.49

Handling

Arch Element Weight	[kN]	187.25 (18.9 metric tons)
Min. Length Cable A&B	[m]*	8.30
Cable Force A&B	[kN]*	110.10
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	93.63
Center of Gravity a	[m]	2.63
Center of Gravity b	[m]	1.34
Center of Gravity c	[m]	6.62
Edge Anchor Distance	[m]	9.14



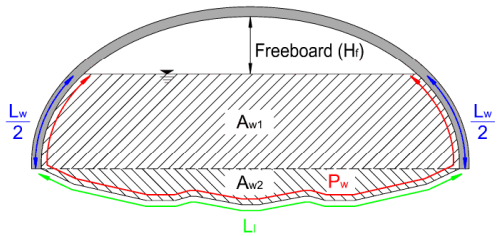


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	36.16	
1.0	30.44	7.20
1.5	25.85	5.38
2.0	20.62	3.90
2.5	14.92	2.62
3.0	8.89	1.48
3.5	2.63	0.42

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	32.0	49.5	38.4	59.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	63.3	261.4	77.6	324.3
LC41	0.6m OF + Single Axle C	81.1	289.2	107.8	371.5
LC42	0.6m OF + Single Axle Ecc	81.7	305.0	108.8	398.5
LC43	0.6m OF + Tandem C	91.3	306.1	125.0	400.2
LC44	0.6m OF + Tandem Ecc	91.9	331.0	126.1	442.6
LC50	1.0m OF Permanent Loads	82.7	313.9	101.7	389.9
LC51	1.0m OF + Single Axle C	97.2	340.1	126.5	434.4
LC52	1.0m OF + Single Axle Ecc	97.3	353.0	126.7	456.3
LC53	1.0m OF + Tandem C	106.1	355.3	141.7	460.3
LC54	1.0m OF + Tandem Ecc	106.4	375.9	142.1	495.3
LC60	2.0m OF Permanent Loads	131.9	465.8	163.3	579.8
LC61	2.0m OF + Single Axle C	142.1	485.6	180.6	613.4
LC62	2.0m OF + Single Axle Ecc	142.3	493.2	180.9	626.4
LC63	2.0m OF + Tandem C	148.3	496.5	191.1	632.0
LC64	2.0m OF + Tandem Ecc	148.8	509.3	192.0	653.7
LC70	3.0m OF Permanent Loads	180.8	618.1	224.4	770.2
LC71	3.0m OF + Single Axle C	189.0	634.9	238.4	798.6
LC72	3.0m OF + Single Axle Ecc	188.8	639.2	237.9	806.0
LC73	3.0m OF + Tandem C	193.6	643.4	246.2	813.2
LC74	3.0m OF + Tandem Ecc	193.4	650.5	245.8	825.1
LC80	4.0m OF Permanent Loads	229.3	770.9	285.1	961.2
LC81	4.0m OF + Single Axle C	235.9	784.7	296.3	984.6
LC82	4.0m OF + Single Axle Ecc	235.6	787.5	295.6	989.4
LC83	4.0m OF + Tandem C	239.6	791.9	302.5	996.8
LC84	4.0m OF + Tandem Ecc	239.0	795.8	301.4	1003.4
LC90	5.0m OF Permanent Loads	277.3	923.8	345.1	1152.3
LC91	5.0m OF + Single Axle C	282.6	935.1	354.0	1171.5
LC92	5.0m OF + Single Axle Ecc	282.2	936.9	353.3	1174.5
LC93	5.0m OF + Tandem C	285.5	941.1	359.0	1181.8
LC94	5.0m OF + Tandem Ecc	284.9	943.6	357.9	1185.9

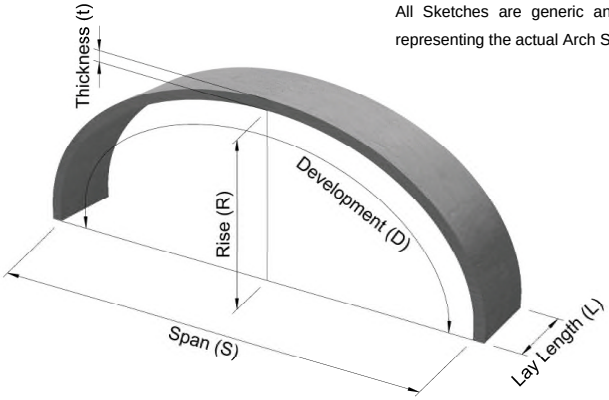
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

Span S	[m]	12.798
Rise R	[m]	4.013
Development D	[m]	16.511
Thickness t	[mm]	254
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

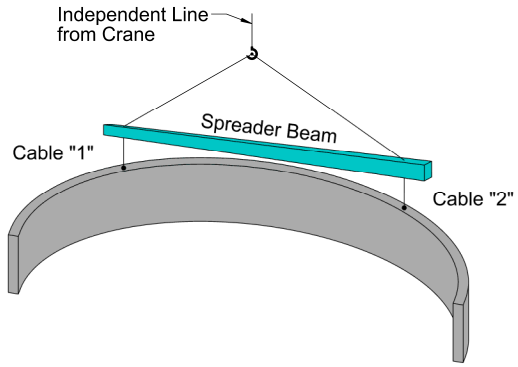


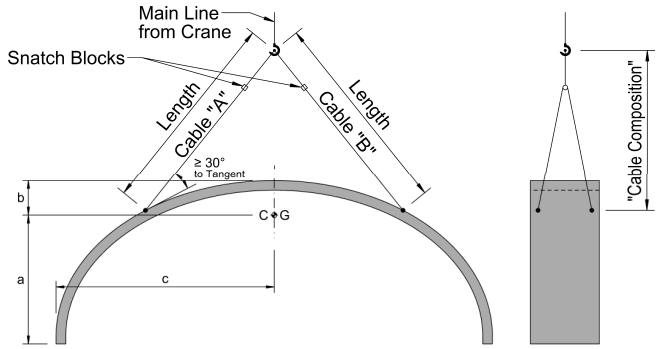
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.78

Handling

Arch Element Weight	[kN]	194.50 (19.6 metric tons)
Min. Length Cable A&B	[m]*	8.90
Cable Force A&B	[kN]*	112.66
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	97.25
Center of Gravity a	[m]	2.83
Center of Gravity b	[m]	1.44
Center of Gravity c	[m]	6.65
Edge Anchor Distance	[m]	9.46



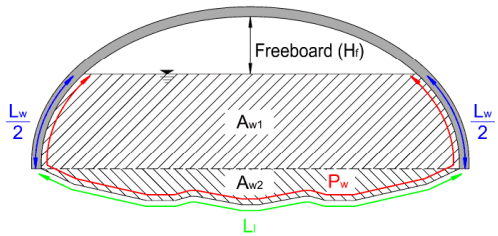


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	40.06	
1.0	34.33	7.82
1.5	29.75	6.00
2.0	24.52	4.52
2.5	18.81	3.24
3.0	12.78	2.10
3.5	6.53	1.04

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	29.3	51.5	35.2	61.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	47.2	266.9	57.5	331.0
LC41	0.6m OF + Single Axle C	60.5	293.6	80.2	376.5
LC42	0.6m OF + Single Axle Ecc	61.9	311.0	82.5	406.1
LC43	0.6m OF + Tandem C	68.1	309.4	93.1	403.2
LC44	0.6m OF + Tandem Ecc	70.1	337.5	96.5	451.1
LC50	1.0m OF Permanent Loads	61.6	321.1	75.6	398.9
LC51	1.0m OF + Single Axle C	73.0	344.9	94.9	439.2
LC52	1.0m OF + Single Axle Ecc	73.7	359.1	96.1	463.3
LC53	1.0m OF + Tandem C	79.9	358.6	106.6	462.5
LC54	1.0m OF + Tandem Ecc	81.0	380.6	108.4	500.0
LC60	2.0m OF Permanent Loads	100.2	471.2	123.8	586.4
LC61	2.0m OF + Single Axle C	108.2	489.6	137.4	617.7
LC62	2.0m OF + Single Axle Ecc	108.8	498.1	138.3	632.3
LC63	2.0m OF + Tandem C	113.0	500.8	145.5	636.7
LC64	2.0m OF + Tandem Ecc	114.1	514.9	147.3	660.8
LC70	3.0m OF Permanent Loads	138.8	624.3	172.0	777.9
LC71	3.0m OF + Single Axle C	145.1	640.9	182.8	806.0
LC72	3.0m OF + Single Axle Ecc	145.1	645.4	182.7	813.7
LC73	3.0m OF + Tandem C	148.6	649.6	188.7	820.8
LC74	3.0m OF + Tandem Ecc	148.8	657.3	189.0	833.9
LC80	4.0m OF Permanent Loads	176.8	779.0	219.6	971.2
LC81	4.0m OF + Single Axle C	182.0	792.8	228.3	994.6
LC82	4.0m OF + Single Axle Ecc	181.8	795.6	228.0	999.4
LC83	4.0m OF + Tandem C	184.7	799.8	232.9	1006.6
LC84	4.0m OF + Tandem Ecc	184.5	804.3	232.5	1014.2
LC90	5.0m OF Permanent Loads	214.6	934.0	266.8	1164.9
LC91	5.0m OF + Single Axle C	218.7	945.3	273.8	1184.1
LC92	5.0m OF + Single Axle Ecc	218.4	947.0	273.3	1187.0
LC93	5.0m OF + Tandem C	220.9	951.1	277.6	1194.0
LC94	5.0m OF + Tandem Ecc	220.6	953.8	276.9	1198.6

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

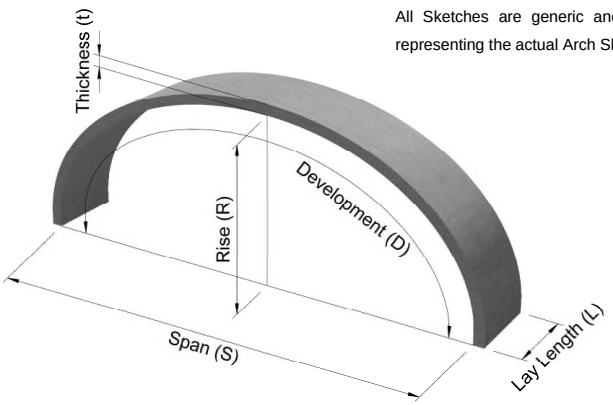
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E48/0

Dimensions

Span S	[m]	14.426
Rise R	[m]	3.683
Development D	[m]	17.224
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

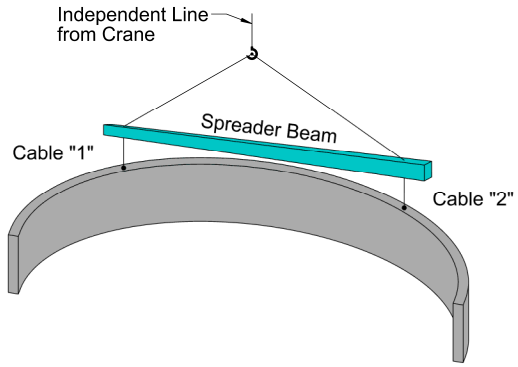


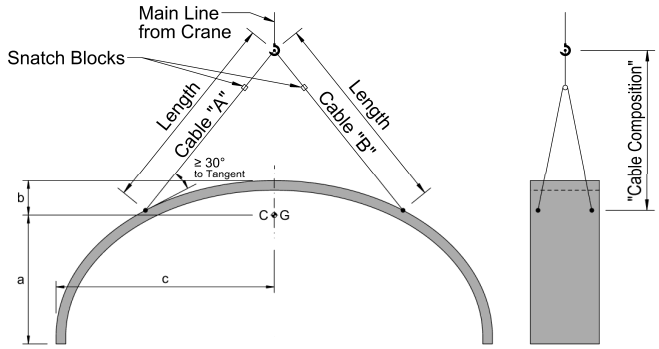
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.91

Handling

Arch Element Weight	[kN]	222.75 (22.3 metric tons)
Min. Length Cable A&B	[m]*	8.50
Cable Force A&B	[kN]*	134.62
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	111.38
Center of Gravity a	[m]	2.64
Center of Gravity b	[m]	1.32
Center of Gravity c	[m]	7.48
Edge Anchor Distance	[m]	10.02



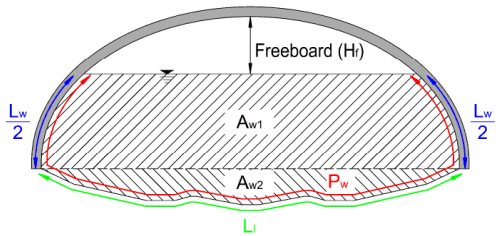


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	40.06	
1.0	33.73	7.66
1.5	28.64	5.68
2.0	22.82	4.06
2.5	16.45	2.69
3.0	9.68	1.48
3.5	2.63	0.38

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	45.4	58.8	54.5	70.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	103.3	315.2	126.8	391.0
LC41	0.6m OF + Single Axle C	125.9	344.7	165.4	441.2
LC42	0.6m OF + Single Axle Ecc	125.1	358.5	163.9	464.7
LC43	0.6m OF + Tandem C	139.2	358.5	188.0	464.7
LC44	0.6m OF + Tandem Ecc	137.9	382.9	185.6	506.1
LC50	1.0m OF Permanent Loads	131.2	371.6	161.7	461.5
LC51	1.0m OF + Single Axle C	149.6	398.8	193.0	507.8
LC52	1.0m OF + Single Axle Ecc	148.6	411.0	191.3	528.6
LC53	1.0m OF + Tandem C	161.0	414.8	212.5	535.0
LC54	1.0m OF + Tandem Ecc	159.7	434.7	210.2	568.9
LC60	2.0m OF Permanent Loads	200.6	541.8	248.4	674.3
LC61	2.0m OF + Single Axle C	213.8	562.8	270.9	710.0
LC62	2.0m OF + Single Axle Ecc	213.3	570.0	270.1	722.2
LC63	2.0m OF + Tandem C	221.7	574.1	284.4	729.3
LC64	2.0m OF + Tandem Ecc	221.3	586.3	283.7	750.0
LC70	3.0m OF Permanent Loads	269.4	712.2	334.5	887.3
LC71	3.0m OF + Single Axle C	279.8	729.6	352.1	916.8
LC72	3.0m OF + Single Axle Ecc	279.0	733.7	350.9	923.9
LC73	3.0m OF + Tandem C	285.8	738.7	362.3	932.4
LC74	3.0m OF + Tandem Ecc	284.9	745.5	360.8	944.0
LC80	4.0m OF Permanent Loads	337.1	882.6	419.1	1100.4
LC81	4.0m OF + Single Axle C	345.4	897.0	433.3	1124.8
LC82	4.0m OF + Single Axle Ecc	344.7	899.7	432.0	1129.4
LC83	4.0m OF + Tandem C	350.2	904.7	441.3	1137.8
LC84	4.0m OF + Tandem Ecc	349.0	908.6	439.4	1144.5
LC90	5.0m OF Permanent Loads	403.7	1052.9	502.3	1313.2
LC91	5.0m OF + Single Axle C	410.4	1064.7	513.7	1333.2
LC92	5.0m OF + Single Axle Ecc	409.6	1066.2	512.4	1335.8
LC93	5.0m OF + Tandem C	414.2	1070.9	520.2	1343.8
LC94	5.0m OF + Tandem Ecc	413.1	1073.4	518.3	1348.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

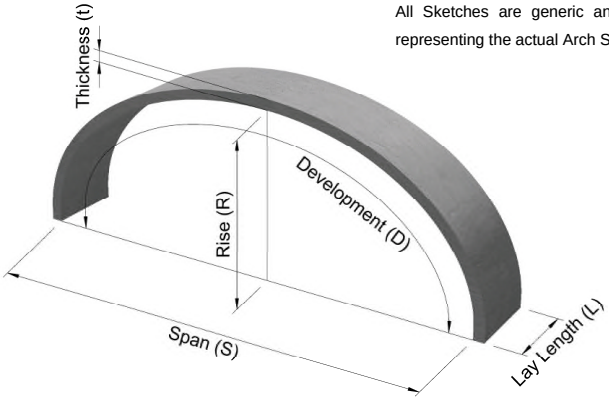
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E48/1

Dimensions

Span S	[m]	14.560
Rise R	[m]	3.988
Development D	[m]	17.846
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m Higher overfills feasible Contact BEBOI for detailed information

All Sketches are generic and not representing the actual Arch Shape.

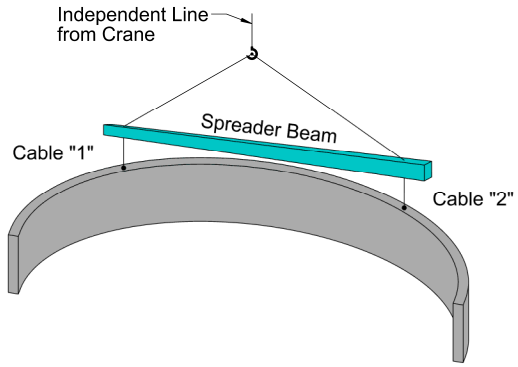


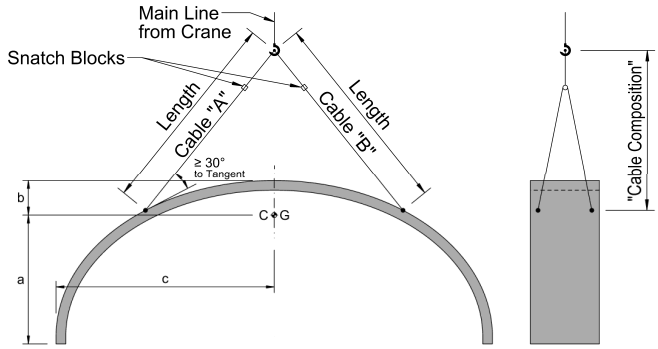
Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.24

Handling

Arch Element Weight	[kN]	231.00 (23.1 metric tons)
Min. Length Cable A&B	[m]*	9.10
Cable Force A&B	[kN]*	137.71
Min. Length Cable 1&2	[m]	-
Cable Forces 1&2	[kN]	115.50
Center of Gravity a	[m]	2.85
Center of Gravity b	[m]	1.42
Center of Gravity c	[m]	7.56
Edge Anchor Distance	[m]	10.37



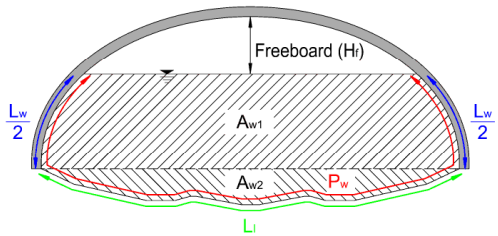


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	44.48	
1.0	38.15	8.28
1.5	33.06	3.30
2.0	27.24	4.68
2.5	20.87	3.32
3.0	14.10	2.11
3.5	7.05	1.01

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	42.3	61.0	50.8	73.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	86.6	324.1	106.2	402.1
LC41	0.6m OF + Single Axle C	105.6	351.4	138.5	448.6
LC42	0.6m OF + Single Axle Ecc	106.0	366.2	139.1	473.7
LC43	0.6m OF + Tandem C	116.8	364.2	157.5	470.3
LC44	0.6m OF + Tandem Ecc	117.4	390.4	158.5	514.8
LC50	1.0m OF Permanent Loads	110.7	380.5	136.2	472.6
LC51	1.0m OF + Single Axle C	126.2	406.4	162.6	516.6
LC52	1.0m OF + Single Axle Ecc	126.2	419.5	162.6	538.8
LC53	1.0m OF + Tandem C	136.0	421.4	179.3	542.1
LC54	1.0m OF + Tandem Ecc	136.2	442.6	179.6	578.0
LC60	2.0m OF Permanent Loads	170.8	551.5	211.4	686.3
LC61	2.0m OF + Single Axle C	182.4	571.9	231.1	720.9
LC62	2.0m OF + Single Axle Ecc	182.5	579.5	231.2	733.9
LC63	2.0m OF + Tandem C	189.4	582.6	242.9	739.2
LC64	2.0m OF + Tandem Ecc	189.9	595.6	243.8	761.3
LC70	3.0m OF Permanent Loads	231.6	723.7	287.4	901.6
LC71	3.0m OF + Single Axle C	240.9	740.5	303.1	930.2
LC72	3.0m OF + Single Axle Ecc	240.6	744.8	302.6	937.5
LC73	3.0m OF + Tandem C	246.1	749.1	312.0	944.7
LC74	3.0m OF + Tandem Ecc	245.9	756.4	311.6	957.1
LC80	4.0m OF Permanent Loads	291.7	896.0	362.5	1117.0
LC81	4.0m OF + Single Axle C	299.1	909.8	375.0	1140.4
LC82	4.0m OF + Single Axle Ecc	298.6	912.5	374.3	1144.9
LC83	4.0m OF + Tandem C	303.2	917.2	382.0	1153.0
LC84	4.0m OF + Tandem Ecc	302.6	921.6	381.0	1160.4
LC90	5.0m OF Permanent Loads	350.9	1068.8	436.5	1332.9
LC91	5.0m OF + Single Axle C	356.9	1079.9	446.8	1351.9
LC92	5.0m OF + Single Axle Ecc	356.4	1081.4	445.9	1354.4
LC93	5.0m OF + Tandem C	360.3	1086.0	452.5	1362.2
LC94	5.0m OF + Tandem Ecc	359.6	1088.8	451.3	1366.9

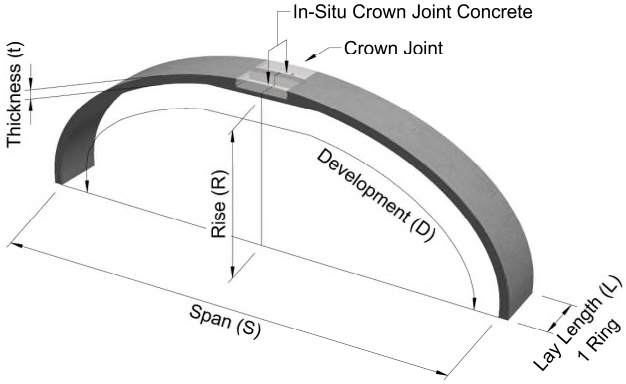
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/0

Dimensions

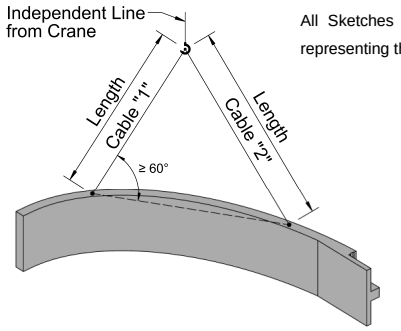
Span S	[m]	16.338
Rise R	[m]	4.267
Development D	[m]	19.888
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.58
In-Situ Concrete per Ring	[m³]	0.82

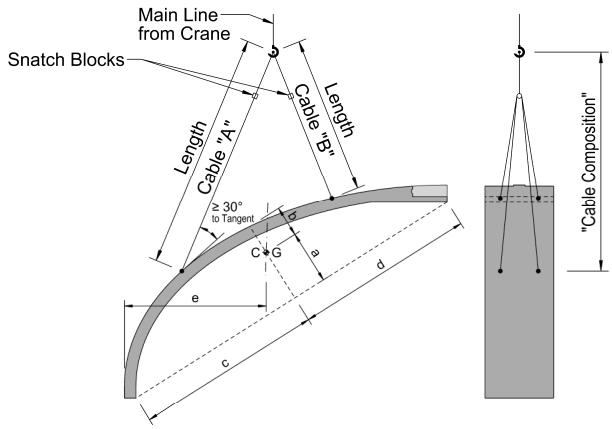
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	139.50 (14.0 metric tons)
Length Cable A	[m]*	9.00
Length Cable B	[m]*	6.70
Cable Force A	[kN]*	71.00
Cable Force B	[kN]*	74.80
Min. Length Cable 1&2	[m]	5.90
Cable Forces 1&2	[kN]	80.54
Center of Gravity a	[m]	1.20
Center of Gravity b	[m]	0.64
Center of Gravity c	[m]	4.47
Center of Gravity d	[m]	4.74
Center of Gravity e	[m]	3.71

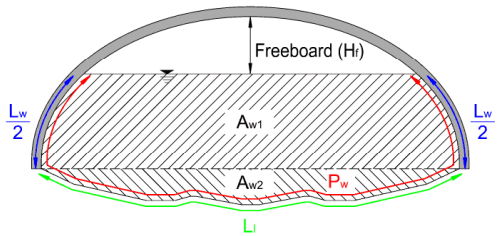


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	54.58	
1.0	51.41	11.66
2.0	46.73	9.08
3.0	41.04	7.08
4.0	34.60	5.44
5.0	27.59	4.02
6.0	20.13	2.76

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	67.5	79.5	81.0	95.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	111.5	390.6	136.0	484.3
LC41	0.6m OF + Single Axle C	126.5	417.7	161.4	530.4
LC42	0.6m OF + Single Axle Ecc	127.0	431.6	162.2	554.0
LC43	0.6m OF + Tandem C	135.0	430.0	175.9	551.3
LC44	0.6m OF + Tandem Ecc	136.0	454.8	177.7	593.4
LC50	1.0m OF Permanent Loads	133.3	453.6	163.2	563.0
LC51	1.0m OF + Single Axle C	145.9	480.4	184.7	608.6
LC52	1.0m OF + Single Axle Ecc	146.2	492.8	185.1	629.7
LC53	1.0m OF + Tandem C	153.7	495.5	198.0	634.2
LC54	1.0m OF + Tandem Ecc	154.2	515.6	198.8	668.4
LC60	2.0m OF Permanent Loads	189.4	645.2	233.4	802.5
LC61	2.0m OF + Single Axle C	199.0	666.0	249.6	837.9
LC62	2.0m OF + Single Axle Ecc	199.2	673.1	250.0	849.9
LC63	2.0m OF + Tandem C	204.7	677.3	259.5	857.1
LC64	2.0m OF + Tandem Ecc	205.3	689.4	260.5	877.7
LC70	3.0m OF Permanent Loads	246.2	837.4	304.4	1042.8
LC71	3.0m OF + Single Axle C	253.9	854.4	317.4	1071.7
LC72	3.0m OF + Single Axle Ecc	253.7	858.3	317.1	1078.3
LC73	3.0m OF + Tandem C	258.3	863.5	324.9	1087.2
LC74	3.0m OF + Tandem Ecc	258.2	870.2	324.8	1098.5
LC80	4.0m OF Permanent Loads	302.3	1029.2	374.4	1282.5
LC81	4.0m OF + Single Axle C	308.5	1043.3	385.0	1306.5
LC82	4.0m OF + Single Axle Ecc	308.2	1045.5	384.5	1310.2
LC83	4.0m OF + Tandem C	312.0	1050.7	390.9	1319.0
LC84	4.0m OF + Tandem Ecc	311.6	1054.5	390.3	1325.5
LC90	5.0m OF Permanent Loads	357.3	1220.3	443.3	1521.4
LC91	5.0m OF + Single Axle C	362.3	1231.7	451.7	1540.9
LC92	5.0m OF + Single Axle Ecc	361.9	1232.8	451.0	1542.7
LC93	5.0m OF + Tandem C	365.1	1237.7	456.5	1551.0
LC94	5.0m OF + Tandem Ecc	364.6	1240.2	455.6	1555.2

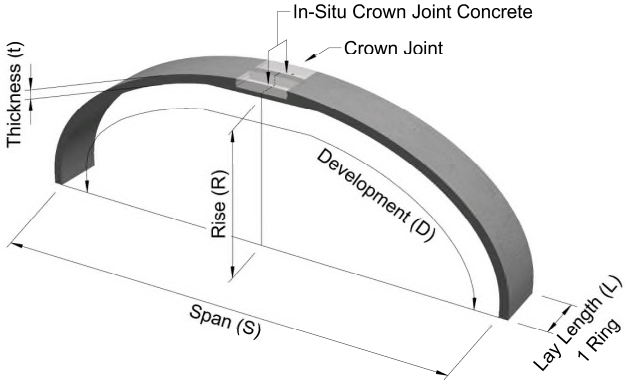
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/1

Dimensions

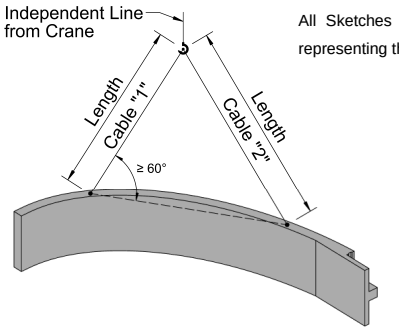
Span S	[m]	16.428
Rise R	[m]	4.572
Development D	[m]	20.507
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.76
In-Situ Concrete per Ring	[m³]	0.82

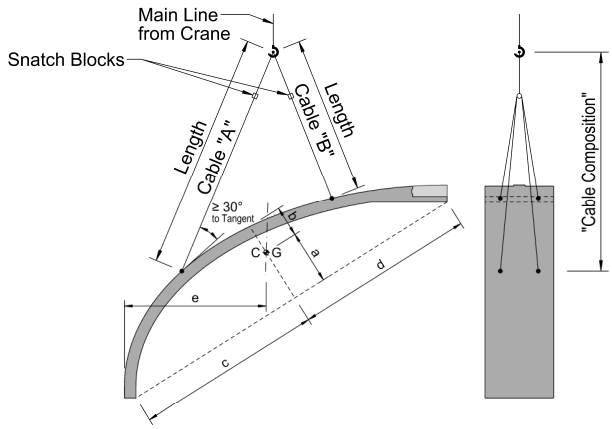
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	144.00 (14.4 metric tons)
Length Cable A	[m]*	8.60
Length Cable B	[m]*	6.40
Cable Force A	[kN]*	78.70
Cable Force B	[kN]*	72.60
Min. Length Cable 1&2	[m]	6.00
Cable Forces 1&2	[kN]	83.14
Center of Gravity a	[m]	1.29
Center of Gravity b	[m]	0.68
Center of Gravity c	[m]	4.54
Center of Gravity d	[m]	4.86
Center of Gravity e	[m]	3.64

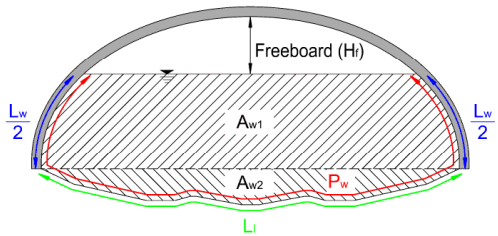


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	59.59	
1.0	56.42	12.28
2.0	51.74	9.7
3.0	46.05	7.7
4.0	39.61	6.06
5.0	32.6	4.64
6.0	25.14	3.38

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	63.9	81.8	76.7	98.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	93.8	399.2	114.1	495.0
LC41	0.6m OF + Single Axle C	105.9	423.9	134.6	536.8
LC42	0.6m OF + Single Axle Ecc	106.9	439.1	136.3	562.7
LC43	0.6m OF + Tandem C	112.8	434.5	146.3	554.9
LC44	0.6m OF + Tandem Ecc	114.7	461.3	149.5	600.5
LC50	1.0m OF Permanent Loads	111.8	461.2	136.6	572.4
LC51	1.0m OF + Single Axle C	122.2	486.2	154.2	614.9
LC52	1.0m OF + Single Axle Ecc	122.9	499.8	155.4	638.0
LC53	1.0m OF + Tandem C	128.7	500.2	165.3	638.8
LC54	1.0m OF + Tandem Ecc	129.9	522.0	167.2	675.7
LC60	2.0m OF Permanent Loads	159.4	652.8	196.0	811.9
LC61	2.0m OF + Single Axle C	167.7	672.6	210.1	845.5
LC62	2.0m OF + Single Axle Ecc	168.1	680.2	210.9	858.4
LC63	2.0m OF + Tandem C	172.6	683.3	218.5	863.8
LC64	2.0m OF + Tandem Ecc	173.6	696.4	220.2	886.1
LC70	3.0m OF Permanent Loads	208.6	845.4	257.5	1052.7
LC71	3.0m OF + Single Axle C	215.5	861.8	269.3	1080.5
LC72	3.0m OF + Single Axle Ecc	215.5	865.9	269.3	1087.5
LC73	3.0m OF + Tandem C	219.4	870.5	275.9	1095.3
LC74	3.0m OF + Tandem Ecc	219.6	877.9	276.3	1107.9
LC80	4.0m OF Permanent Loads	258.1	1038.3	319.4	1293.8
LC81	4.0m OF + Single Axle C	263.6	1052.1	328.8	1317.2
LC82	4.0m OF + Single Axle Ecc	263.4	1054.5	328.5	1321.3
LC83	4.0m OF + Tandem C	266.7	1059.5	334.0	1329.9
LC84	4.0m OF + Tandem Ecc	266.6	1064.0	333.8	1337.4
LC90	5.0m OF Permanent Loads	306.7	1231.4	380.2	1535.2
LC91	5.0m OF + Single Axle C	311.3	1242.7	387.9	1554.4
LC92	5.0m OF + Single Axle Ecc	311.0	1244.1	387.5	1556.7
LC93	5.0m OF + Tandem C	313.8	1248.8	392.3	1564.7
LC94	5.0m OF + Tandem Ecc	313.6	1251.8	391.9	1569.8

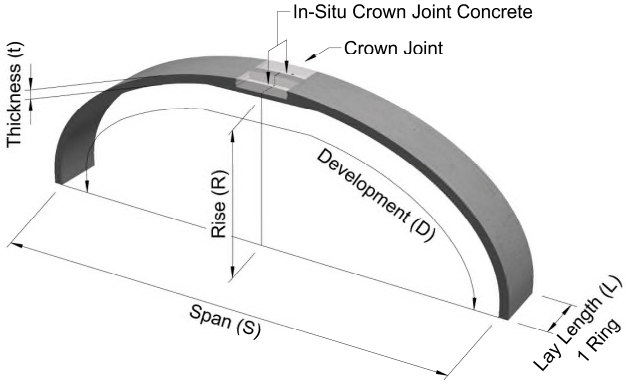
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/2

Dimensions

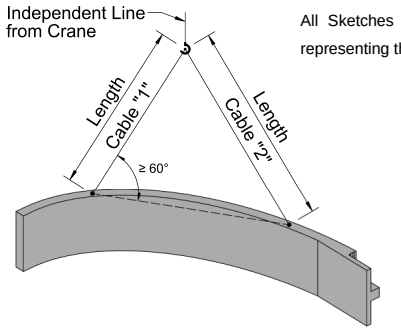
Span S	[m]	16.460
Rise R	[m]	4.877
Development D	[m]	21.117
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.93
In-Situ Concrete per Ring	[m³]	0.82

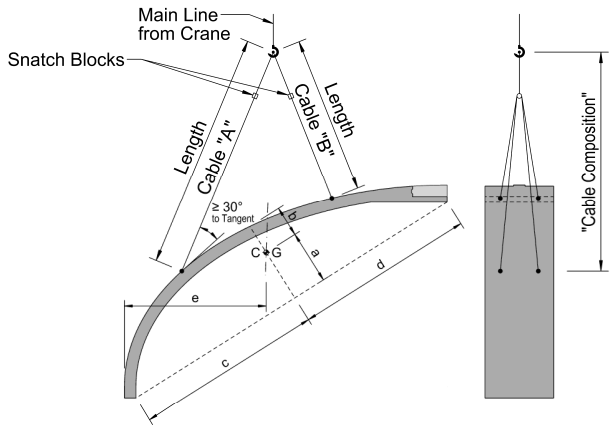
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	148.25 (14.8 metric tons)
Length Cable A	[m]*	8.10
Length Cable B	[m]*	6.00
Cable Force A	[kN]*	85.00
Cable Force B	[kN]*	70.80
Min. Length Cable 1&2	[m]	6.20
Cable Forces 1&2	[kN]	85.59
Center of Gravity a	[m]	1.38
Center of Gravity b	[m]	0.73
Center of Gravity c	[m]	4.60
Center of Gravity d	[m]	4.96
Center of Gravity e	[m]	3.56

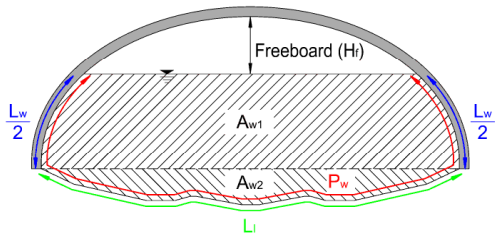


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	64.6	
1.0	61.44	12.88
2.0	56.75	10.30
3.0	51.06	8.32
4.0	44.62	6.68
5.0	37.61	5.26
6.0	30.16	4.00

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	60.2	84.2	72.2	101.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	73.6	403.8	89.0	500.5
LC41	0.6m OF + Single Axle C	82.5	425.0	104.1	536.5
LC42	0.6m OF + Single Axle Ecc	83.8	441.7	106.4	565.0
LC43	0.6m OF + Tandem C	87.3	435.6	112.3	554.5
LC44	0.6m OF + Tandem Ecc	89.5	464.9	116.1	604.5
LC50	1.0m OF Permanent Loads	86.8	465.9	105.5	578.1
LC51	1.0m OF + Single Axle C	94.7	488.2	118.8	616.1
LC52	1.0m OF + Single Axle Ecc	95.6	503.1	120.4	641.3
LC53	1.0m OF + Tandem C	99.4	501.3	126.9	638.4
LC54	1.0m OF + Tandem Ecc	100.9	525.0	129.5	678.6
LC60	2.0m OF Permanent Loads	123.2	654.9	151.0	814.4
LC61	2.0m OF + Single Axle C	129.4	673.7	161.5	846.4
LC62	2.0m OF + Single Axle Ecc	129.9	681.9	162.4	860.4
LC63	2.0m OF + Tandem C	132.9	684.7	167.5	865.0
LC64	2.0m OF + Tandem Ecc	134.0	698.7	169.3	888.9
LC70	3.0m OF Permanent Loads	160.9	847.2	198.1	1054.8
LC71	3.0m OF + Single Axle C	166.1	864.0	206.9	1083.4
LC72	3.0m OF + Single Axle Ecc	166.2	868.4	207.1	1090.9
LC73	3.0m OF + Tandem C	169.0	873.0	211.9	1098.6
LC74	3.0m OF + Tandem Ecc	169.4	881.2	212.6	1112.6
LC80	4.0m OF Permanent Loads	199.1	1042.0	245.9	1298.2
LC81	4.0m OF + Single Axle C	203.4	1055.8	253.1	1321.8
LC82	4.0m OF + Single Axle Ecc	203.3	1058.6	253.1	1326.4
LC83	4.0m OF + Tandem C	205.7	1063.0	257.1	1334.1
LC84	4.0m OF + Tandem Ecc	205.8	1068.2	257.3	1342.8
LC90	5.0m OF Permanent Loads	237.1	1236.2	293.4	1541.0
LC91	5.0m OF + Single Axle C	240.7	1247.5	299.5	1560.3
LC92	5.0m OF + Single Axle Ecc	240.6	1249.2	299.3	1563.1
LC93	5.0m OF + Tandem C	242.7	1253.5	302.8	1570.4
LC94	5.0m OF + Tandem Ecc	242.6	1257.0	302.7	1576.4

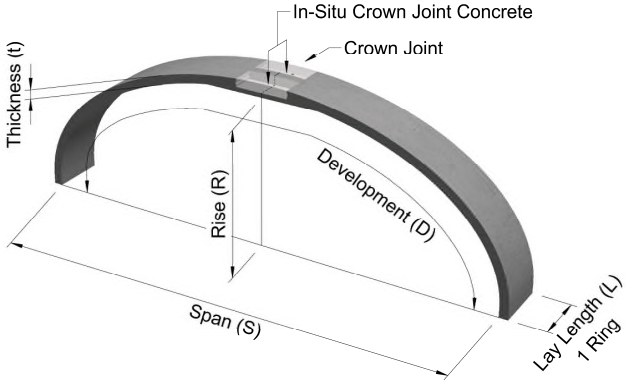
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/3

Dimensions

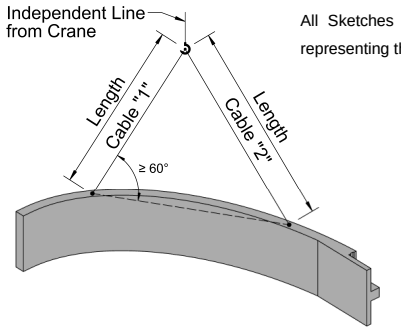
Span S	[m]	16.460
Rise R	[m]	5.182
Development D	[m]	21.726
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.10
In-Situ Concrete per Ring	[m³]	0.82

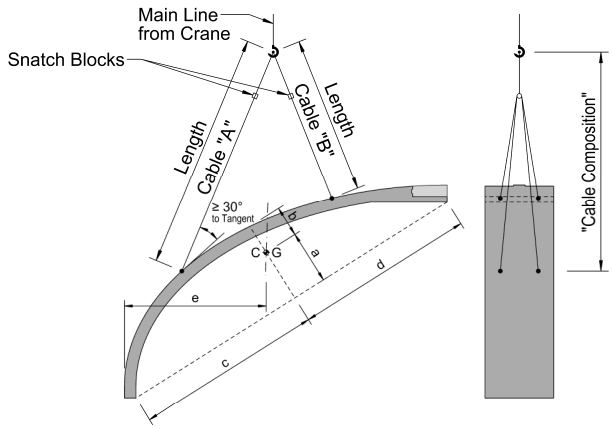
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	152.50 (15.3 metric tons)
Length Cable A	[m]*	7.80
Length Cable B	[m]*	5.70
Cable Force A	[kN]*	92.70
Cable Force B	[kN]*	69.10
Min. Length Cable 1&2	[m]	6.30
Cable Forces 1&2	[kN]	88.05
Center of Gravity a	[m]	1.48
Center of Gravity b	[m]	0.78
Center of Gravity c	[m]	4.66
Center of Gravity d	[m]	5.06
Center of Gravity e	[m]	3.46

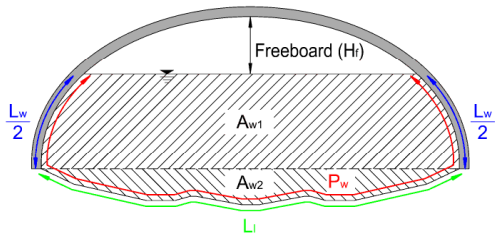


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	69.62	
1.0	66.45	13.5
2.0	61.77	10.92
3.0	56.08	8.95
4.0	49.64	7.28
5.0	42.63	5.86
6.0	35.18	4.60

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	56.8	86.4	68.2	103.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	55.4	407.9	66.5	505.6
LC41	0.6m OF + Single Axle C	61.7	427.2	77.1	538.4
LC42	0.6m OF + Single Axle Ecc	63.1	445.1	79.5	568.7
LC43	0.6m OF + Tandem C	64.8	437.6	82.3	555.9
LC44	0.6m OF + Tandem Ecc	67.1	468.7	86.4	608.8
LC50	1.0m OF Permanent Loads	64.5	470.8	77.8	584.1
LC51	1.0m OF + Single Axle C	70.3	490.7	87.6	617.9
LC52	1.0m OF + Single Axle Ecc	71.3	506.3	89.3	644.6
LC53	1.0m OF + Tandem C	73.5	503.3	93.1	639.5
LC54	1.0m OF + Tandem Ecc	75.1	528.2	95.8	681.8
LC60	2.0m OF Permanent Loads	91.0	657.3	110.9	817.3
LC61	2.0m OF + Single Axle C	95.3	676.1	118.3	849.3
LC62	2.0m OF + Single Axle Ecc	95.9	684.8	119.3	864.0
LC63	2.0m OF + Tandem C	97.8	686.6	122.5	867.2
LC64	2.0m OF + Tandem Ecc	98.9	701.4	124.4	892.2
LC70	3.0m OF Permanent Loads	118.5	850.2	145.3	1058.4
LC71	3.0m OF + Single Axle C	122.3	866.5	151.7	1086.2
LC72	3.0m OF + Single Axle Ecc	122.5	871.1	152.0	1094.0
LC73	3.0m OF + Tandem C	124.4	874.7	155.3	1100.1
LC74	3.0m OF + Tandem Ecc	124.9	883.5	156.2	1115.1
LC80	4.0m OF Permanent Loads	146.8	1044.9	180.6	1301.8
LC81	4.0m OF + Single Axle C	150.0	1058.3	186.2	1324.5
LC82	4.0m OF + Single Axle Ecc	150.1	1061.3	186.2	1329.6
LC83	4.0m OF + Tandem C	151.8	1065.0	189.2	1335.9
LC84	4.0m OF + Tandem Ecc	152.0	1070.5	189.6	1345.4
LC90	5.0m OF Permanent Loads	175.3	1239.2	216.3	1544.7
LC91	5.0m OF + Single Axle C	178.1	1250.3	221.0	1563.6
LC92	5.0m OF + Single Axle Ecc	178.0	1252.1	220.9	1566.6
LC93	5.0m OF + Tandem C	179.6	1255.8	223.5	1572.9
LC94	5.0m OF + Tandem Ecc	179.6	1259.7	223.6	1579.5

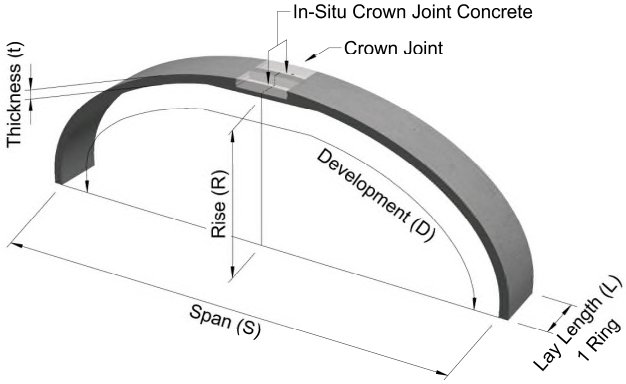
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/4

Dimensions

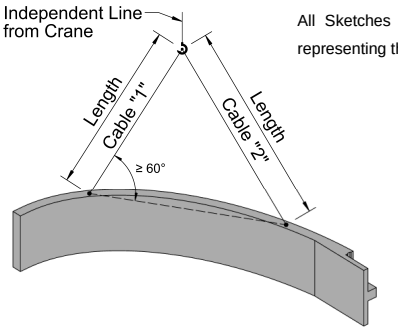
Span S	[m]	16.460
Rise R	[m]	5.487
Development D	[m]	22.336
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.27
In-Situ Concrete per Ring	[m³]	0.82

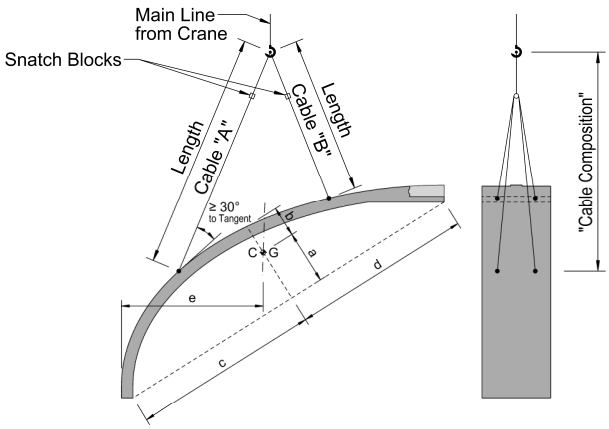
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	156.75 (15.7 metric tons)
Length Cable A	[m]*	7.40
Length Cable B	[m]*	5.40
Cable Force A	[kN]*	96.90
Cable Force B	[kN]*	70.10
Min. Length Cable 1&2	[m]	6.50
Cable Forces 1&2	[kN]	90.50
Center of Gravity a	[m]	1.57
Center of Gravity b	[m]	0.83
Center of Gravity c	[m]	4.74
Center of Gravity d	[m]	5.15
Center of Gravity e	[m]	3.37

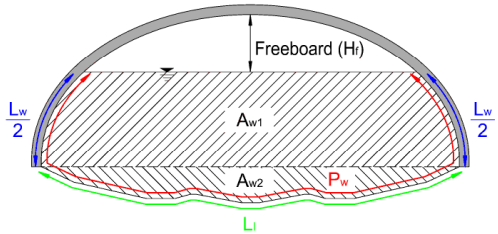


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	74.64	
1.0	71.47	14.1
2.0	66.79	11.52
3.0	61.1	9.54
4.0	54.66	7.9
5.0	47.65	6.48
6.0	40.19	5.22

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	53.8	88.6	64.6	106.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	39.1	413.3	46.2	512.2
LC41	0.6m OF + Single Axle C	43.3	431.2	53.3	542.6
LC42	0.6m OF + Single Axle Ecc	44.7	449.7	55.6	574.0
LC43	0.6m OF + Tandem C	45.2	440.4	56.6	558.3
LC44	0.6m OF + Tandem Ecc	47.4	472.5	60.3	612.8
LC50	1.0m OF Permanent Loads	44.9	476.0	53.5	590.6
LC51	1.0m OF + Single Axle C	49.0	494.1	60.5	621.3
LC52	1.0m OF + Single Axle Ecc	50.0	510.2	62.1	648.7
LC53	1.0m OF + Tandem C	51.1	506.3	64.0	642.0
LC54	1.0m OF + Tandem Ecc	52.6	531.9	66.5	685.5
LC60	2.0m OF Permanent Loads	63.1	661.5	76.1	822.4
LC61	2.0m OF + Single Axle C	65.9	679.5	81.0	853.1
LC62	2.0m OF + Single Axle Ecc	66.4	688.3	81.9	868.0
LC63	2.0m OF + Tandem C	67.5	689.2	83.6	869.6
LC64	2.0m OF + Tandem Ecc	68.5	704.3	85.3	895.2
LC70	3.0m OF Permanent Loads	81.7	854.0	99.4	1063.0
LC71	3.0m OF + Single Axle C	84.3	869.6	103.9	1089.7
LC72	3.0m OF + Single Axle Ecc	84.5	874.4	104.2	1097.7
LC73	3.0m OF + Tandem C	85.7	877.6	106.3	1103.2
LC74	3.0m OF + Tandem Ecc	86.2	886.7	107.1	1118.7
LC80	4.0m OF Permanent Loads	101.3	1048.8	123.9	1306.6
LC81	4.0m OF + Single Axle C	103.6	1061.8	127.9	1328.7
LC82	4.0m OF + Single Axle Ecc	103.7	1065.0	128.0	1334.0
LC83	4.0m OF + Tandem C	104.9	1068.4	130.1	1339.8
LC84	4.0m OF + Tandem Ecc	105.1	1074.2	130.4	1349.7
LC90	5.0m OF Permanent Loads	121.4	1243.8	149.0	1550.3
LC91	5.0m OF + Single Axle C	123.4	1254.5	152.4	1568.5
LC92	5.0m OF + Single Axle Ecc	123.4	1256.5	152.4	1571.8
LC93	5.0m OF + Tandem C	124.4	1259.8	154.2	1577.6
LC94	5.0m OF + Tandem Ecc	124.5	1264.0	154.4	1584.6

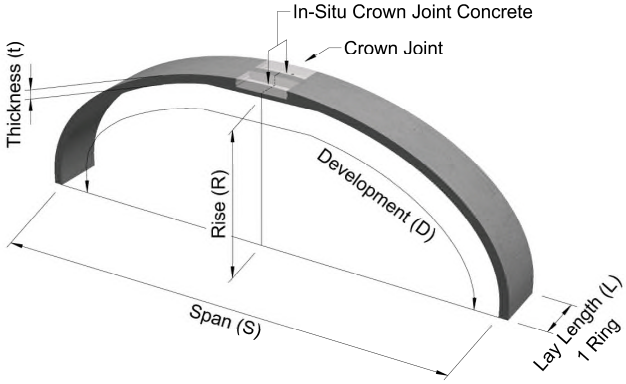
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/5

Dimensions

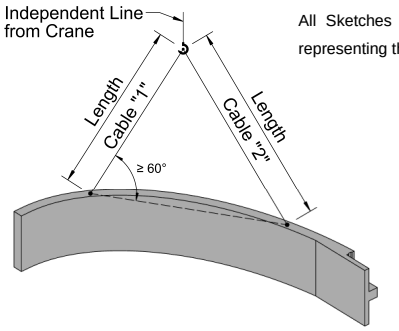
Span S	[m]	16.460
Rise R	[m]	5.792
Development D	[m]	22.945
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.44
In-Situ Concrete per Ring	[m³]	0.82

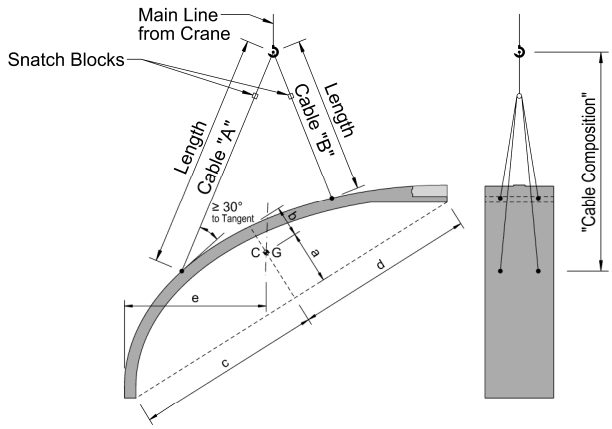
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	161.00 (16.1 metric tons)
Length Cable A	[m]*	7.10
Length Cable B	[m]*	5.10
Cable Force A	[kN]*	104.80
Cable Force B	[kN]*	66.40
Min. Length Cable 1&2	[m]	6.60
Cable Force 1&2	[kN]	92.95
Center of Gravity a	[m]	1.66
Center of Gravity b	[m]	0.89
Center of Gravity c	[m]	4.82
Center of Gravity d	[m]	5.24
Center of Gravity e	[m]	3.29

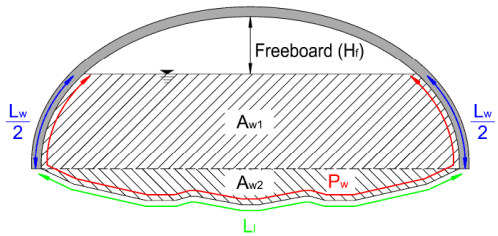


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	79.65	
1.0	76.49	14.72
2.0	71.81	12.14
3.0	66.11	10.14
4.0	59.68	8.50
5.0	52.66	7.08
6.0	45.21	5.82

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	51.1	90.9	61.4	109.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	24.3	420.0	27.8	520.5
LC41	0.6m OF + Single Axle C	27.0	436.4	32.4	548.3
LC42	0.6m OF + Single Axle Ecc	28.3	455.2	34.6	580.2
LC43	0.6m OF + Tandem C	28.1	444.2	34.4	561.7
LC44	0.6m OF + Tandem Ecc	30.2	476.8	37.8	617.1
LC50	1.0m OF Permanent Loads	27.8	481.8	32.2	597.7
LC51	1.0m OF + Single Axle C	30.6	498.7	37.0	626.4
LC52	1.0m OF + Single Axle Ecc	31.5	515.1	38.4	654.3
LC53	1.0m OF + Tandem C	31.8	510.4	39.0	646.4
LC54	1.0m OF + Tandem Ecc	33.2	536.5	41.4	690.6
LC60	2.0m OF Permanent Loads	39.3	667.4	46.5	829.7
LC61	2.0m OF + Single Axle C	40.9	684.4	49.3	858.7
LC62	2.0m OF + Single Axle Ecc	41.3	693.3	50.1	873.8
LC63	2.0m OF + Tandem C	41.8	693.6	50.8	874.2
LC64	2.0m OF + Tandem Ecc	42.6	708.8	52.2	900.1
LC70	3.0m OF Permanent Loads	50.6	859.7	60.7	1070.1
LC71	3.0m OF + Single Axle C	52.3	874.8	63.6	1095.7
LC72	3.0m OF + Single Axle Ecc	52.5	879.5	63.9	1103.8
LC73	3.0m OF + Tandem C	53.2	882.1	65.1	1108.1
LC74	3.0m OF + Tandem Ecc	53.7	891.4	65.9	1124.0
LC80	4.0m OF Permanent Loads	63.1	1054.6	76.3	1313.8
LC81	4.0m OF + Single Axle C	64.7	1067.2	79.0	1335.2
LC82	4.0m OF + Single Axle Ecc	64.8	1070.5	79.1	1340.7
LC83	4.0m OF + Tandem C	65.5	1073.4	80.4	1345.6
LC84	4.0m OF + Tandem Ecc	65.7	1079.3	80.8	1355.7
LC90	5.0m OF Permanent Loads	76.1	1250.0	92.6	1558.0
LC91	5.0m OF + Single Axle C	77.4	1260.5	94.8	1575.9
LC92	5.0m OF + Single Axle Ecc	77.5	1262.6	94.9	1579.4
LC93	5.0m OF + Tandem C	78.1	1265.6	96.0	1584.5
LC94	5.0m OF + Tandem Ecc	78.3	1270.0	96.2	1591.9

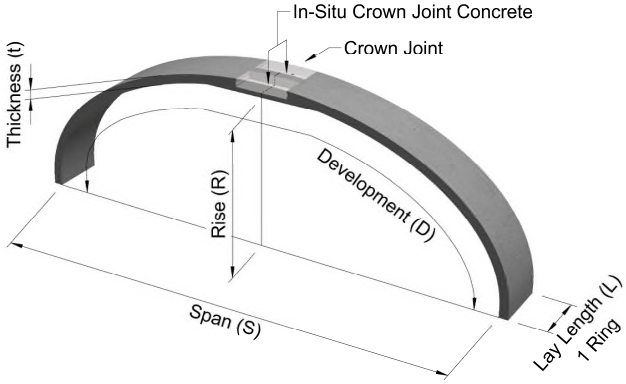
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E54T/6

Dimensions

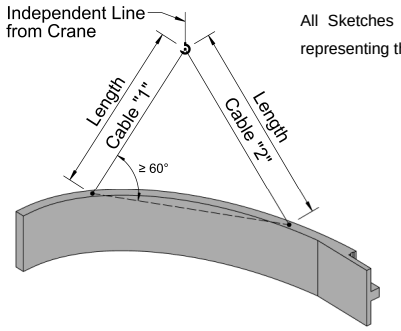
Span S	[m]	16.460
Rise R	[m]	6.096
Development D	[m]	23.555
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.74
In-Situ Concrete per Ring	[m³]	0.82

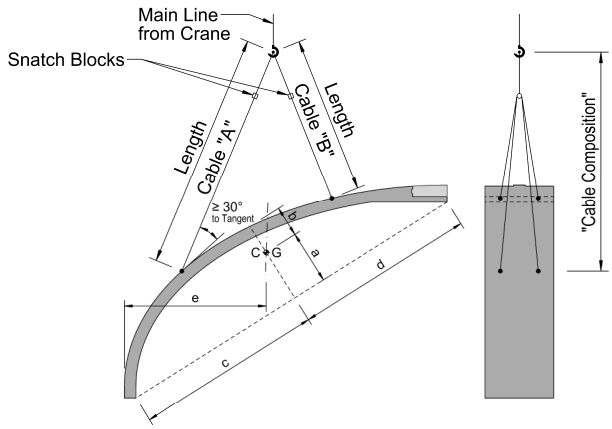
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	165.25 (16.3 metric tons)
Length Cable A	[m]*	6.70
Length Cable B	[m]*	4.90
Cable Force A	[kN]*	113.20
Cable Force B	[kN]*	65.10
Min. Length Cable 1&2	[m]	6.70
Cable Force 1&2	[kN]	95.41
Center of Gravity a	[m]	1.75
Center of Gravity b	[m]	0.95
Center of Gravity c	[m]	4.91
Center of Gravity d	[m]	5.32
Center of Gravity e	[m]	3.21

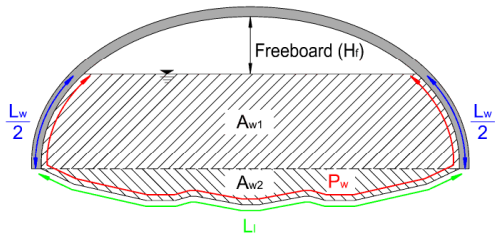


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	84.67	
1.0	81.51	15.32
2.0	76.82	12.74
3.0	71.13	10.76
4.0	64.69	9.12
5.0	57.68	7.70
6.0	50.23	6.44

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	48.7	93.1	58.5	111.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	10.7	428.6	10.9	531.1
LC41	0.6m OF + Single Axle C	12.3	443.4	13.6	556.3
LC42	0.6m OF + Single Axle Ecc	13.4	462.4	15.5	588.6
LC43	0.6m OF + Tandem C	12.9	449.6	14.7	566.7
LC44	0.6m OF + Tandem Ecc	14.7	482.4	17.7	622.5
LC50	1.0m OF Permanent Loads	12.4	488.8	13.1	606.3
LC51	1.0m OF + Single Axle C	14.3	504.8	16.2	633.5
LC52	1.0m OF + Single Axle Ecc	15.0	521.4	17.5	661.7
LC53	1.0m OF + Tandem C	14.9	515.8	17.3	652.3
LC54	1.0m OF + Tandem Ecc	16.1	542.1	19.3	697.0
LC60	2.0m OF Permanent Loads	18.8	675.1	21.1	839.2
LC61	2.0m OF + Single Axle C	19.6	691.1	22.4	866.4
LC62	2.0m OF + Single Axle Ecc	20.0	700.0	23.1	881.6
LC63	2.0m OF + Tandem C	20.0	699.4	23.1	880.5
LC64	2.0m OF + Tandem Ecc	20.7	714.8	24.3	906.7
LC70	3.0m OF Permanent Loads	24.5	866.9	28.2	1079.0
LC71	3.0m OF + Single Axle C	25.4	881.3	29.8	1103.4
LC72	3.0m OF + Single Axle Ecc	25.6	886.1	30.0	1111.6
LC73	3.0m OF + Tandem C	25.9	888.2	30.5	1115.2
LC74	3.0m OF + Tandem Ecc	26.2	897.7	31.1	1131.3
LC80	4.0m OF Permanent Loads	31.1	1062.4	36.4	1323.4
LC81	4.0m OF + Single Axle C	31.9	1074.6	37.9	1344.0
LC82	4.0m OF + Single Axle Ecc	32.0	1077.8	38.0	1349.5
LC83	4.0m OF + Tandem C	32.4	1080.5	38.6	1354.1
LC84	4.0m OF + Tandem Ecc	32.6	1086.6	38.9	1364.5
LC90	5.0m OF Permanent Loads	38.1	1258.7	45.1	1568.8
LC91	5.0m OF + Single Axle C	38.8	1269.0	46.5	1586.2
LC92	5.0m OF + Single Axle Ecc	38.9	1271.2	46.5	1589.9
LC93	5.0m OF + Tandem C	39.2	1274.0	47.1	1594.6
LC94	5.0m OF + Tandem Ecc	39.4	1278.4	47.3	1602.3

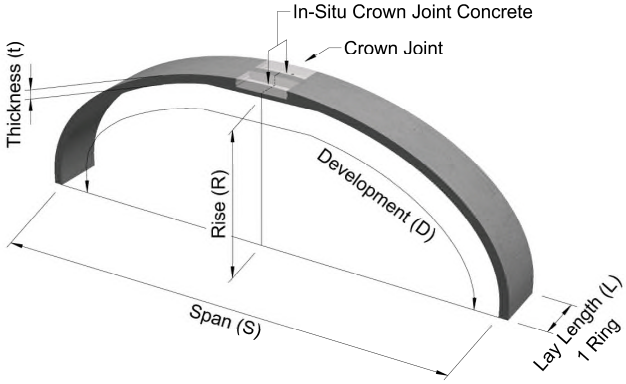
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E60T/0

Dimensions

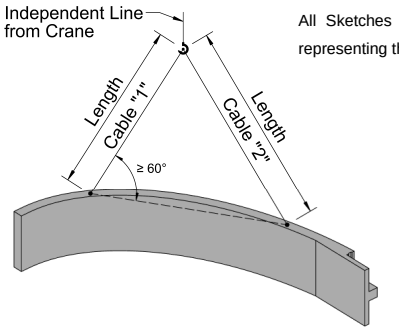
Span S	[m]	18.262
Rise R	[m]	5.182
Development D	[m]	22.924
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.49
In-Situ Concrete per Ring	[m³]	0.96

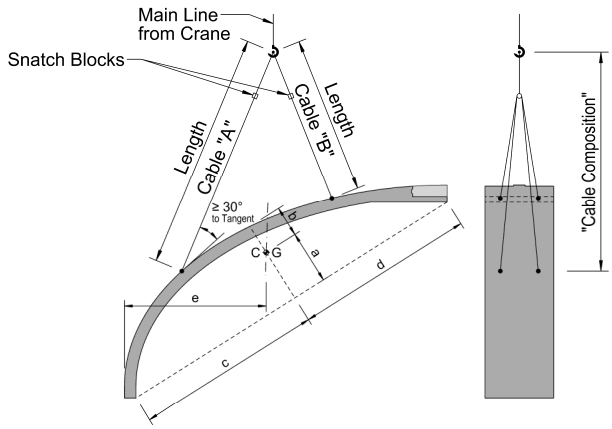
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

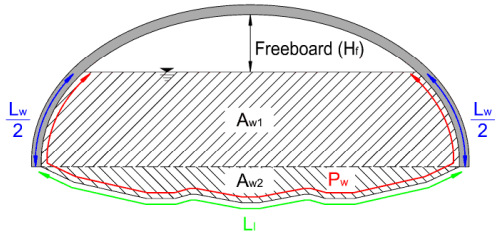
Arch Element Weight	[kN]	187.25 (18.7 metric tons)
Length Cable A	[m]*	8.40
Length Cable B	[m]*	6.10
Cable Force A	[kN]*	117.31
Cable Force B	[kN]*	84.01
Min. Length Cable 1&2	[m]	6.70
Cable Force 1&2	[kN]	108.11
Center of Gravity a	[m]	1.46
Center of Gravity b	[m]	0.78
Center of Gravity c	[m]	5.04
Center of Gravity d	[m]	5.45
Center of Gravity e	[m]	4.02



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	75.04	
1.0	66.76	11.54
2.0	53.88	7.68
3.0	38.40	4.80
4.0	21.30	2.46



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	79.8	105.6	95.8	126.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	108.7	492.6	131.9	610.4
LC41	0.6m OF + Single Axle C	119.3	513.9	150.0	646.7
LC42	0.6m OF + Single Axle Ecc	120.1	528.2	151.2	671.0
LC43	0.6m OF + Tandem C	125.6	524.5	160.6	664.7
LC44	0.6m OF + Tandem Ecc	127.1	550.6	163.1	709.1
LC50	1.0m OF Permanent Loads	127.4	563.8	155.2	699.5
LC51	1.0m OF + Single Axle C	136.5	586.1	170.8	737.4
LC52	1.0m OF + Single Axle Ecc	137.2	599.7	171.9	760.5
LC53	1.0m OF + Tandem C	142.2	599.1	180.5	759.4
LC54	1.0m OF + Tandem Ecc	143.3	620.8	182.3	796.3
LC60	2.0m OF Permanent Loads	175.6	775.2	215.5	963.7
LC61	2.0m OF + Single Axle C	182.5	791.8	227.2	992.0
LC62	2.0m OF + Single Axle Ecc	182.9	799.8	228.0	1005.6
LC63	2.0m OF + Tandem C	186.6	801.2	234.2	1008.0
LC64	2.0m OF + Tandem Ecc	187.5	814.9	235.8	1031.2
LC70	3.0m OF Permanent Loads	223.9	985.1	275.8	1226.1
LC71	3.0m OF + Single Axle C	229.6	999.5	285.7	1250.6
LC72	3.0m OF + Single Axle Ecc	229.7	1003.9	285.7	1258.0
LC73	3.0m OF + Tandem C	233.0	1007.2	291.3	1263.7
LC74	3.0m OF + Tandem Ecc	233.3	1015.5	291.9	1277.7
LC80	4.0m OF Permanent Loads	272.3	1194.7	336.4	1488.1
LC81	4.0m OF + Single Axle C	277.2	1208.1	344.8	1510.8
LC82	4.0m OF + Single Axle Ecc	277.2	1211.0	344.6	1515.8
LC83	4.0m OF + Tandem C	279.9	1214.6	349.4	1521.9
LC84	4.0m OF + Tandem Ecc	279.9	1219.8	349.4	1530.8
LC90	5.0m OF Permanent Loads	320.7	1407.3	396.9	1753.9
LC91	5.0m OF + Single Axle C	324.7	1418.6	403.8	1773.0
LC92	5.0m OF + Single Axle Ecc	324.6	1420.4	403.4	1776.0
LC93	5.0m OF + Tandem C	327.0	1424.1	407.5	1782.5
LC94	5.0m OF + Tandem Ecc	326.8	1427.9	407.3	1788.8

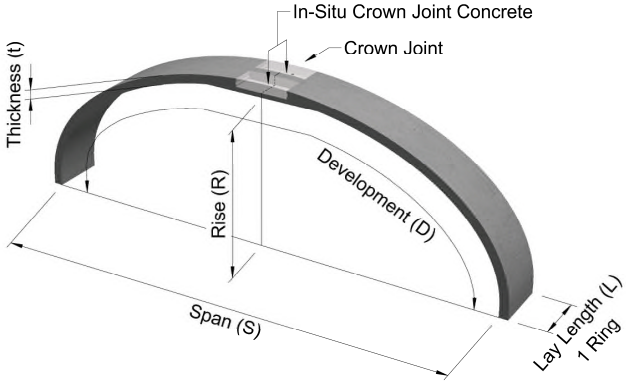
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E60T/1

Dimensions

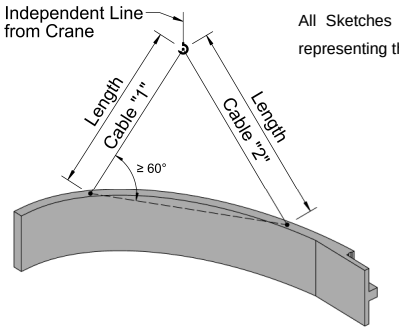
Span S	[m]	18.288
Rise R	[m]	5.486
Development D	[m]	23.534
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.70
In-Situ Concrete per Ring	[m³]	0.96

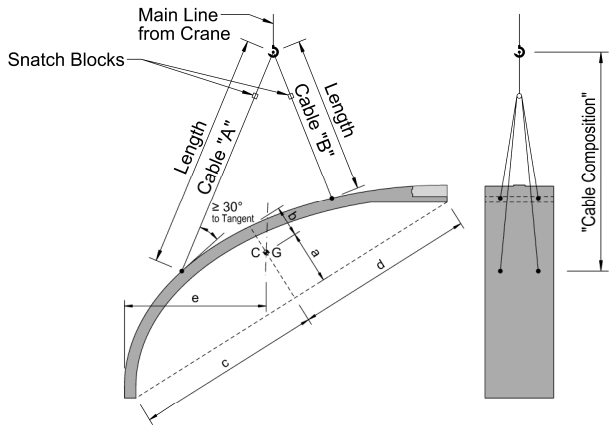
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

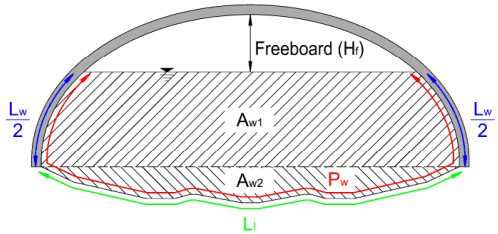
Arch Element Weight	[kN]	192.50 (19.3 metric tons)
Length Cable A	[m]*	8.00
Length Cable B	[m]*	5.80
Cable Force A	[kN]*	123.69
Cable Force B	[kN]*	83.83
Min. Length Cable 1&2	[m]	6.90
Cable Force 1&2	[kN]	111.14
Center of Gravity a	[m]	1.55
Center of Gravity b	[m]	0.82
Center of Gravity c	[m]	5.10
Center of Gravity d	[m]	5.56
Center of Gravity e	[m]	3.93



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	80.62	
1.0	72.33	12.14
2.0	59.46	8.28
3.0	43.97	5.42
4.0	26.87	3.06
5.0	8.88	0.98



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	75.7	108.3	90.8	130.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	88.7	500.8	107.1	620.6
LC41	0.6m OF + Single Axle C	97.2	519.7	121.6	652.7
LC42	0.6m OF + Single Axle Ecc	98.3	534.8	123.3	678.4
LC43	0.6m OF + Tandem C	102.2	528.6	130.1	667.8
LC44	0.6m OF + Tandem Ecc	104.2	556.2	133.4	714.8
LC50	1.0m OF Permanent Loads	103.9	570.5	126.0	707.7
LC51	1.0m OF + Single Axle C	111.3	590.9	138.7	742.5
LC52	1.0m OF + Single Axle Ecc	112.2	605.2	140.1	766.8
LC53	1.0m OF + Tandem C	115.9	603.0	146.5	763.0
LC54	1.0m OF + Tandem Ecc	117.3	625.9	148.8	801.8
LC60	2.0m OF Permanent Loads	143.6	780.1	175.8	969.7
LC61	2.0m OF + Single Axle C	149.5	795.9	185.7	996.6
LC62	2.0m OF + Single Axle Ecc	150.0	804.3	186.6	1010.8
LC63	2.0m OF + Tandem C	152.8	806.6	191.4	1014.8
LC64	2.0m OF + Tandem Ecc	154.0	821.0	193.3	1039.3
LC70	3.0m OF Permanent Loads	184.6	991.4	227.0	1233.9
LC71	3.0m OF + Single Axle C	189.6	1006.9	235.5	1260.2
LC72	3.0m OF + Single Axle Ecc	189.8	1011.5	235.7	1267.9
LC73	3.0m OF + Tandem C	192.5	1015.5	240.4	1274.7
LC74	3.0m OF + Tandem Ecc	193.0	1024.3	241.3	1289.7
LC80	4.0m OF Permanent Loads	226.5	1204.6	279.3	1500.4
LC81	4.0m OF + Single Axle C	230.8	1218.8	286.6	1524.4
LC82	4.0m OF + Single Axle Ecc	230.8	1221.9	286.7	1529.8
LC83	4.0m OF + Tandem C	233.2	1225.9	290.7	1536.5
LC84	4.0m OF + Tandem Ecc	233.3	1231.6	291.0	1546.2
LC90	5.0m OF Permanent Loads	268.6	1420.4	331.9	1770.1
LC91	5.0m OF + Single Axle C	272.2	1432.2	338.1	1790.1
LC92	5.0m OF + Single Axle Ecc	272.1	1434.2	338.0	1793.5
LC93	5.0m OF + Tandem C	274.2	1438.1	341.6	1800.2
LC94	5.0m OF + Tandem Ecc	274.3	1442.2	341.6	1807.1

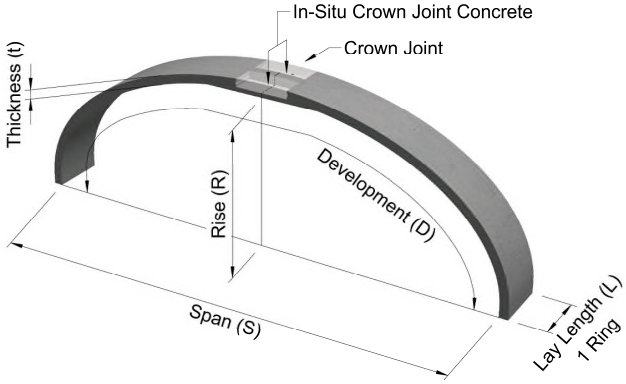
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E60T/2

Dimensions

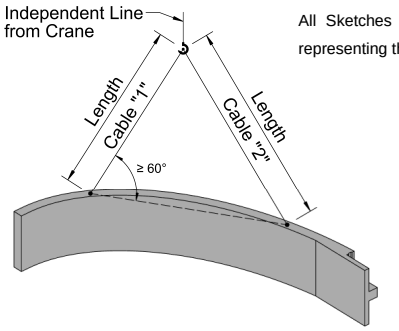
Span S	[m]	18.288
Rise R	[m]	5.791
Development D	[m]	24.143
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.90
In-Situ Concrete per Ring	[m³]	0.96

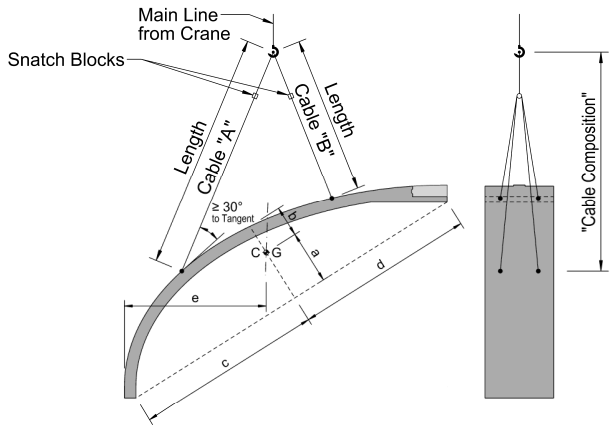
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

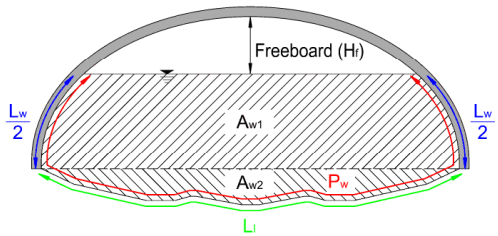
Arch Element Weight	[kN]	197.50 (19.8 metric tons)
Length Cable A	[m]*	7.70
Length Cable B	[m]*	5.50
Cable Force A	[kN]*	134.00
Cable Force B	[kN]*	80.09
Min. Length Cable 1&2	[m]	7.00
Cable Force 1&2	[kN]	114.03
Center of Gravity a	[m]	1.65
Center of Gravity b	[m]	0.87
Center of Gravity c	[m]	5.17
Center of Gravity d	[m]	5.65
Center of Gravity e	[m]	3.84



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	86.19	
1.0	77.91	12.76
2.0	65.03	8.90
3.0	49.55	6.02
4.0	32.45	3.68
5.0	14.46	1.58



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	71.9	110.9	86.3	133.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	69.3	505.3	83.1	626.1
LC41	0.6m OF + Single Axle C	75.7	521.9	93.9	654.3
LC42	0.6m OF + Single Axle Ecc	76.9	538.0	96.0	681.7
LC43	0.6m OF + Tandem C	79.2	530.8	99.9	669.4
LC44	0.6m OF + Tandem Ecc	81.4	560.0	103.5	719.1
LC50	1.0m OF Permanent Loads	80.6	575.1	97.2	713.3
LC51	1.0m OF + Single Axle C	86.3	593.4	106.8	744.5
LC52	1.0m OF + Single Axle Ecc	87.2	608.5	108.4	770.1
LC53	1.0m OF + Tandem C	89.6	605.2	112.4	764.4
LC54	1.0m OF + Tandem Ecc	91.1	629.2	115.0	805.2
LC60	2.0m OF Permanent Loads	110.9	782.2	135.1	972.2
LC61	2.0m OF + Single Axle C	115.1	798.0	142.2	999.0
LC62	2.0m OF + Single Axle Ecc	115.7	806.7	143.2	1013.8
LC63	2.0m OF + Tandem C	117.6	807.7	146.3	1015.5
LC64	2.0m OF + Tandem Ecc	118.7	822.8	148.3	1041.2
LC70	3.0m OF Permanent Loads	142.1	993.2	174.0	1235.9
LC71	3.0m OF + Single Axle C	145.9	1008.2	180.5	1261.4
LC72	3.0m OF + Single Axle Ecc	146.1	1012.9	180.8	1269.5
LC73	3.0m OF + Tandem C	148.0	1016.4	184.1	1275.3
LC74	3.0m OF + Tandem Ecc	148.6	1025.7	185.1	1291.2
LC80	4.0m OF Permanent Loads	174.3	1206.4	214.2	1502.5
LC81	4.0m OF + Single Axle C	177.6	1220.2	220.0	1525.8
LC82	4.0m OF + Single Axle Ecc	177.7	1223.5	220.1	1531.6
LC83	4.0m OF + Tandem C	179.5	1227.1	223.1	1537.6
LC84	4.0m OF + Tandem Ecc	179.7	1233.2	223.5	1548.1
LC90	5.0m OF Permanent Loads	207.1	1422.5	255.3	1772.6
LC91	5.0m OF + Single Axle C	210.0	1434.0	260.2	1792.0
LC92	5.0m OF + Single Axle Ecc	210.0	1436.2	260.2	1795.8
LC93	5.0m OF + Tandem C	211.5	1439.7	262.8	1801.8
LC94	5.0m OF + Tandem Ecc	211.7	1444.2	263.1	1809.4

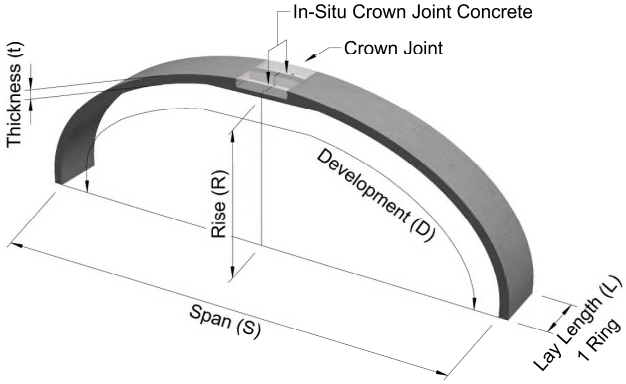
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E60T/3

Dimensions

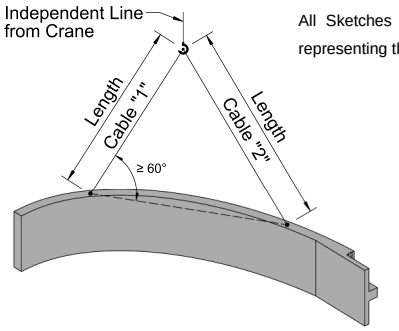
Span S	[m]	18.288
Rise R	[m]	6.096
Development D	[m]	24.753
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.09
In-Situ Concrete per Ring	[m³]	0.96

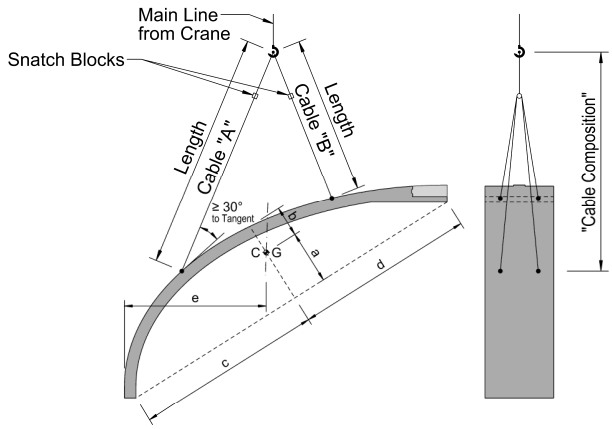
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	202.25 (20.2 metric tons)
Length Cable A	[m]*	7.40
Length Cable B	[m]*	5.30
Cable Force A	[kN]*	142.56
Cable Force B	[kN]*	79.99
Min. Length Cable 1&2	[m]	7.10
Cable Force 1&2	[kN]	116.77
Center of Gravity a	[m]	1.74
Center of Gravity b	[m]	0.92
Center of Gravity c	[m]	5.24
Center of Gravity d	[m]	5.75
Center of Gravity e	[m]	3.75

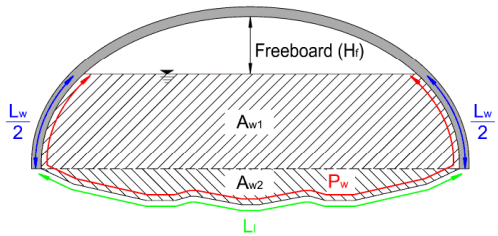


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	91.77	
1.0	83.49	13.36
2.0	70.61	9.50
3.0	55.13	6.64
4.0	38.03	4.28
5.0	20.38	2.20
6.0	1.75	0.20

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	71.9	110.9	86.3	133.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	69.3	505.3	83.1	626.1
LC41	0.6m OF + Single Axle C	75.7	521.9	93.9	654.3
LC42	0.6m OF + Single Axle Ecc	76.9	538.0	96.0	681.7
LC43	0.6m OF + Tandem C	79.2	530.8	99.9	669.4
LC44	0.6m OF + Tandem Ecc	81.4	560.0	103.5	719.1
LC50	1.0m OF Permanent Loads	80.6	575.1	97.2	713.3
LC51	1.0m OF + Single Axle C	86.3	593.4	106.8	744.5
LC52	1.0m OF + Single Axle Ecc	87.2	608.5	108.4	770.1
LC53	1.0m OF + Tandem C	89.6	605.2	112.4	764.4
LC54	1.0m OF + Tandem Ecc	91.1	629.2	115.0	805.2
LC60	2.0m OF Permanent Loads	110.9	782.2	135.1	972.2
LC61	2.0m OF + Single Axle C	115.1	798.0	142.2	999.0
LC62	2.0m OF + Single Axle Ecc	115.7	806.7	143.2	1013.8
LC63	2.0m OF + Tandem C	117.6	807.7	146.3	1015.5
LC64	2.0m OF + Tandem Ecc	118.7	822.8	148.3	1041.2
LC70	3.0m OF Permanent Loads	142.1	993.2	174.0	1235.9
LC71	3.0m OF + Single Axle C	145.9	1008.2	180.5	1261.4
LC72	3.0m OF + Single Axle Ecc	146.1	1012.9	180.8	1269.5
LC73	3.0m OF + Tandem C	148.0	1016.4	184.1	1275.3
LC74	3.0m OF + Tandem Ecc	148.6	1025.7	185.1	1291.2
LC80	4.0m OF Permanent Loads	174.3	1206.4	214.2	1502.5
LC81	4.0m OF + Single Axle C	177.6	1220.2	220.0	1525.8
LC82	4.0m OF + Single Axle Ecc	177.7	1223.5	220.1	1531.6
LC83	4.0m OF + Tandem C	179.5	1227.1	223.1	1537.6
LC84	4.0m OF + Tandem Ecc	179.7	1233.2	223.5	1548.1
LC90	5.0m OF Permanent Loads	207.1	1422.5	255.3	1772.6
LC91	5.0m OF + Single Axle C	210.0	1434.0	260.2	1792.0
LC92	5.0m OF + Single Axle Ecc	210.0	1436.2	260.2	1795.8
LC93	5.0m OF + Tandem C	211.5	1439.7	262.8	1801.8
LC94	5.0m OF + Tandem Ecc	211.7	1444.2	263.1	1809.4

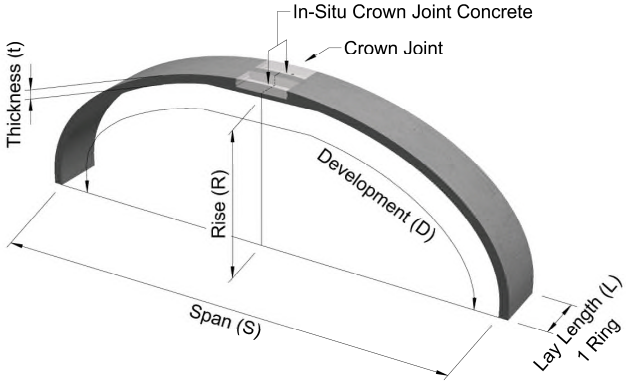
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E60T/4

Dimensions

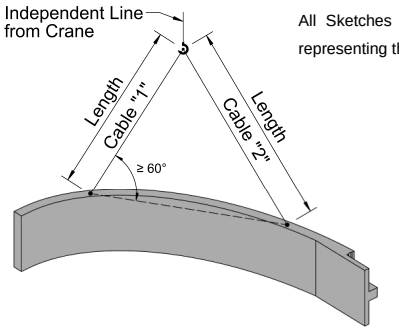
Span S	[m]	18.288
Rise R	[m]	6.400
Development D	[m]	25.362
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.29
In-Situ Concrete per Ring	[m³]	0.96

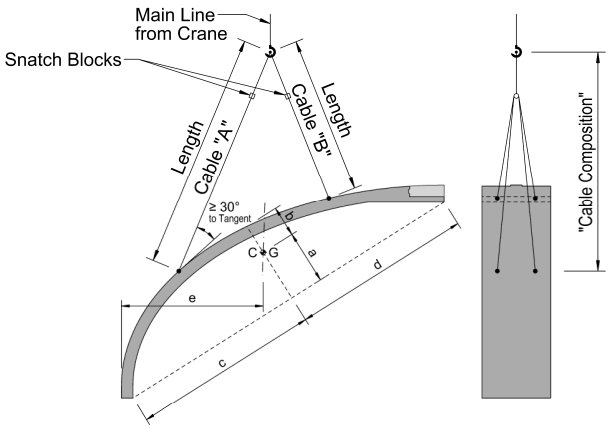
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	207.25 (20.7 metric tons)
Length Cable A	[m]*	7.00
Length Cable B	[m]*	5.10
Cable Force A	[kN]*	143.86
Cable Force B	[kN]*	76.67
Min. Length Cable 1&2	[m]	7.30
Cable Force 1&2	[kN]	119.66
Center of Gravity a	[m]	1.83
Center of Gravity b	[m]	0.98
Center of Gravity c	[m]	5.32
Center of Gravity d	[m]	5.83
Center of Gravity e	[m]	3.66

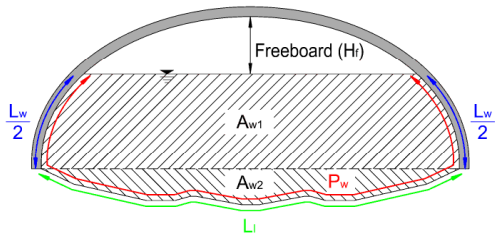


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	97.35	
1.0	89.06	13.98
2.0	76.19	10.10
3.0	70.70	7.24
4.0	43.61	4.90
5.0	25.62	2.80
6.0	7.33	0.80

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	71.9	110.9	86.3	133.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	69.3	505.3	83.1	626.1
LC41	0.6m OF + Single Axle C	75.7	521.9	93.9	654.3
LC42	0.6m OF + Single Axle Ecc	76.9	538.0	96.0	681.7
LC43	0.6m OF + Tandem C	79.2	530.8	99.9	669.4
LC44	0.6m OF + Tandem Ecc	81.4	560.0	103.5	719.1
LC50	1.0m OF Permanent Loads	80.6	575.1	97.2	713.3
LC51	1.0m OF + Single Axle C	86.3	593.4	106.8	744.5
LC52	1.0m OF + Single Axle Ecc	87.2	608.5	108.4	770.1
LC53	1.0m OF + Tandem C	89.6	605.2	112.4	764.4
LC54	1.0m OF + Tandem Ecc	91.1	629.2	115.0	805.2
LC60	2.0m OF Permanent Loads	110.9	782.2	135.1	972.2
LC61	2.0m OF + Single Axle C	115.1	798.0	142.2	999.0
LC62	2.0m OF + Single Axle Ecc	115.7	806.7	143.2	1013.8
LC63	2.0m OF + Tandem C	117.6	807.7	146.3	1015.5
LC64	2.0m OF + Tandem Ecc	118.7	822.8	148.3	1041.2
LC70	3.0m OF Permanent Loads	142.1	993.2	174.0	1235.9
LC71	3.0m OF + Single Axle C	145.9	1008.2	180.5	1261.4
LC72	3.0m OF + Single Axle Ecc	146.1	1012.9	180.8	1269.5
LC73	3.0m OF + Tandem C	148.0	1016.4	184.1	1275.3
LC74	3.0m OF + Tandem Ecc	148.6	1025.7	185.1	1291.2
LC80	4.0m OF Permanent Loads	174.3	1206.4	214.2	1502.5
LC81	4.0m OF + Single Axle C	177.6	1220.2	220.0	1525.8
LC82	4.0m OF + Single Axle Ecc	177.7	1223.5	220.1	1531.6
LC83	4.0m OF + Tandem C	179.5	1227.1	223.1	1537.6
LC84	4.0m OF + Tandem Ecc	179.7	1233.2	223.5	1548.1
LC90	5.0m OF Permanent Loads	207.1	1422.5	255.3	1772.6
LC91	5.0m OF + Single Axle C	210.0	1434.0	260.2	1792.0
LC92	5.0m OF + Single Axle Ecc	210.0	1436.2	260.2	1795.8
LC93	5.0m OF + Tandem C	211.5	1439.7	262.8	1801.8
LC94	5.0m OF + Tandem Ecc	211.7	1444.2	263.1	1809.4

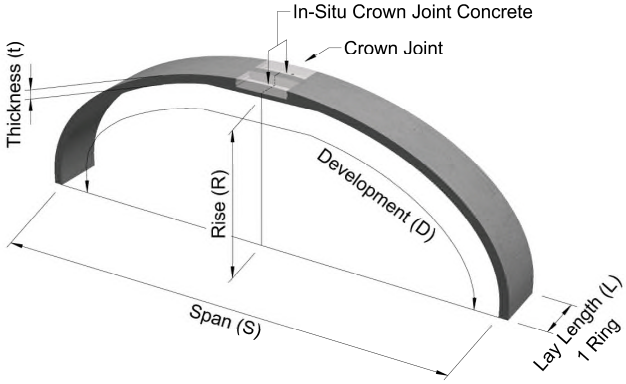
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E60T/5

Dimensions

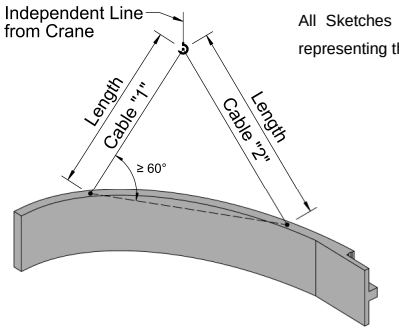
Span S	[m]	18.288
Rise R	[m]	6.705
Development D	[m]	25.972
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.49
In-Situ Concrete per Ring	[m³]	0.96

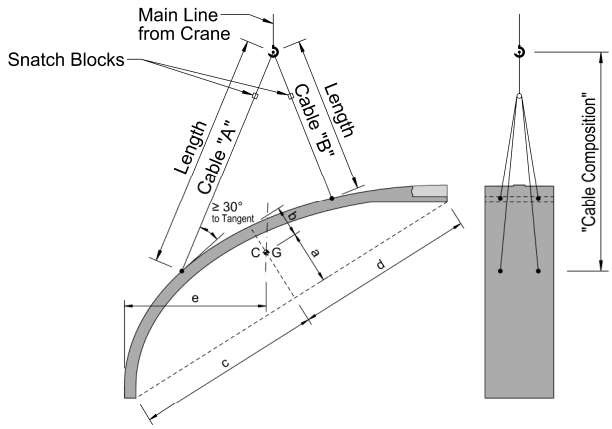
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	212.25 (21.2 metric tons)
Length Cable A	[m]*	6.70
Length Cable B	[m]*	4.90
Cable Force A	[kN]*	151.80
Cable Force B	[kN]*	80.23
Min. Length Cable 1&2	[m]	7.40
Cable Force 1&2	[kN]	122.54
Center of Gravity a	[m]	1.92
Center of Gravity b	[m]	1.03
Center of Gravity c	[m]	5.41
Center of Gravity d	[m]	5.92
Center of Gravity e	[m]	3.58

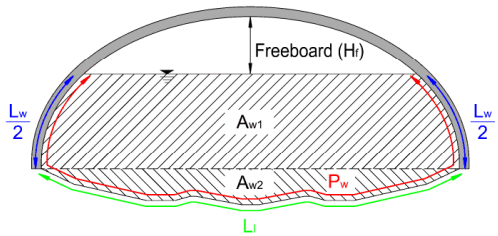


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	102.92	
1.0	94.64	14.58
2.0	81.76	10.72
3.0	66.28	7.86
4.0	49.18	5.50
5.0	31.19	3.42
6.0	12.90	1.42

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	71.9	110.9	86.3	133.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	69.3	505.3	83.1	626.1
LC41	0.6m OF + Single Axle C	75.7	521.9	93.9	654.3
LC42	0.6m OF + Single Axle Ecc	76.9	538.0	96.0	681.7
LC43	0.6m OF + Tandem C	79.2	530.8	99.9	669.4
LC44	0.6m OF + Tandem Ecc	81.4	560.0	103.5	719.1
LC50	1.0m OF Permanent Loads	80.6	575.1	97.2	713.3
LC51	1.0m OF + Single Axle C	86.3	593.4	106.8	744.5
LC52	1.0m OF + Single Axle Ecc	87.2	608.5	108.4	770.1
LC53	1.0m OF + Tandem C	89.6	605.2	112.4	764.4
LC54	1.0m OF + Tandem Ecc	91.1	629.2	115.0	805.2
LC60	2.0m OF Permanent Loads	110.9	782.2	135.1	972.2
LC61	2.0m OF + Single Axle C	115.1	798.0	142.2	999.0
LC62	2.0m OF + Single Axle Ecc	115.7	806.7	143.2	1013.8
LC63	2.0m OF + Tandem C	117.6	807.7	146.3	1015.5
LC64	2.0m OF + Tandem Ecc	118.7	822.8	148.3	1041.2
LC70	3.0m OF Permanent Loads	142.1	993.2	174.0	1235.9
LC71	3.0m OF + Single Axle C	145.9	1008.2	180.5	1261.4
LC72	3.0m OF + Single Axle Ecc	146.1	1012.9	180.8	1269.5
LC73	3.0m OF + Tandem C	148.0	1016.4	184.1	1275.3
LC74	3.0m OF + Tandem Ecc	148.6	1025.7	185.1	1291.2
LC80	4.0m OF Permanent Loads	174.3	1206.4	214.2	1502.5
LC81	4.0m OF + Single Axle C	177.6	1220.2	220.0	1525.8
LC82	4.0m OF + Single Axle Ecc	177.7	1223.5	220.1	1531.6
LC83	4.0m OF + Tandem C	179.5	1227.1	223.1	1537.6
LC84	4.0m OF + Tandem Ecc	179.7	1233.2	223.5	1548.1
LC90	5.0m OF Permanent Loads	207.1	1422.5	255.3	1772.6
LC91	5.0m OF + Single Axle C	210.0	1434.0	260.2	1792.0
LC92	5.0m OF + Single Axle Ecc	210.0	1436.2	260.2	1795.8
LC93	5.0m OF + Tandem C	211.5	1439.7	262.8	1801.8
LC94	5.0m OF + Tandem Ecc	211.7	1444.2	263.1	1809.4

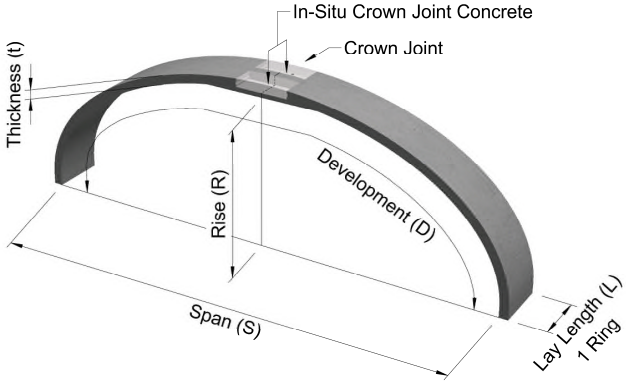
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E66T/0

Dimensions

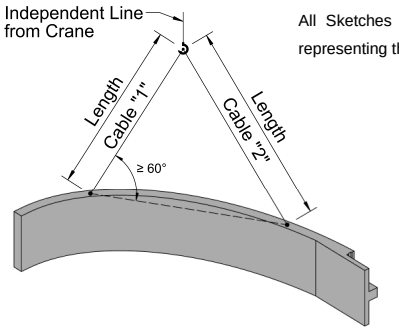
Span S	[m]	20.092
Rise R	[m]	5.791
Development D	[m]	25.356
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.28
In-Situ Concrete per Ring	[m³]	0.96

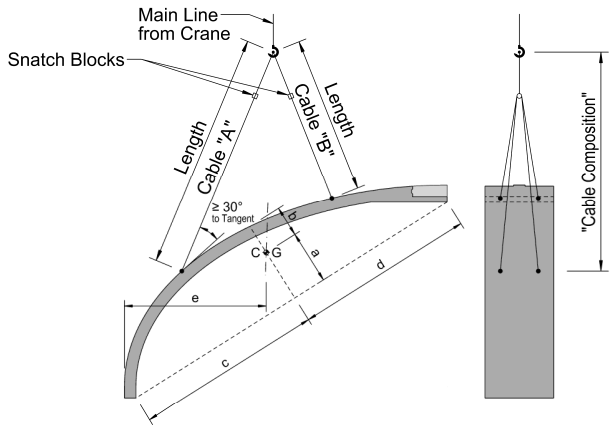
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

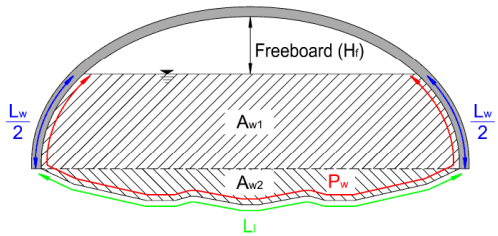
Arch Element Weight	[kN]	207.00 (20.7 metric tons)
Length Cable A	[m]*	8.90
Length Cable B	[m]*	6.40
Cable Force A	[kN]*	123.89
Cable Force B	[kN]*	97.61
Min. Length Cable 1&2	[m]	7.40
Cable Force 1&2	[kN]	119.51
Center of Gravity a	[m]	1.59
Center of Gravity b	[m]	0.84
Center of Gravity c	[m]	5.59
Center of Gravity d	[m]	6.00
Center of Gravity e	[m]	4.40



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	92.16	
1.0	83.48	13.41
2.0	69.93	9.32
3.0	53.51	6.28
4.0	35.24	3.79
5.0	15.82	1.61



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	86.2	116.1	103.4	139.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	111.0	548.4	134.5	679.7
LC41	0.6m OF + Single Axle C	120.7	571.7	150.9	719.2
LC42	0.6m OF + Single Axle Ecc	121.5	587.1	152.2	745.5
LC43	0.6m OF + Tandem C	126.0	582.9	160.0	738.4
LC44	0.6m OF + Tandem Ecc	127.8	610.1	162.9	784.6
LC50	1.0m OF Permanent Loads	129.1	628.8	157.1	780.2
LC51	1.0m OF + Single Axle C	137.7	651.8	171.7	819.3
LC52	1.0m OF + Single Axle Ecc	138.5	665.8	173.1	843.1
LC53	1.0m OF + Tandem C	142.8	664.4	180.3	840.7
LC54	1.0m OF + Tandem Ecc	144.3	687.2	182.8	879.6
LC60	2.0m OF Permanent Loads	178.0	857.0	218.2	1065.4
LC61	2.0m OF + Single Axle C	184.6	875.2	229.4	1096.4
LC62	2.0m OF + Single Axle Ecc	185.1	883.4	230.2	1110.2
LC63	2.0m OF + Tandem C	188.4	885.1	235.9	1113.3
LC64	2.0m OF + Tandem Ecc	189.5	899.0	237.7	1136.9
LC70	3.0m OF Permanent Loads	228.1	1086.9	280.8	1352.8
LC71	3.0m OF + Single Axle C	233.7	1103.2	290.4	1380.5
LC72	3.0m OF + Single Axle Ecc	233.8	1107.7	290.5	1388.2
LC73	3.0m OF + Tandem C	236.8	1111.2	295.7	1394.2
LC74	3.0m OF + Tandem Ecc	237.3	1119.8	296.4	1408.7
LC80	4.0m OF Permanent Loads	279.0	1319.8	344.4	1643.9
LC81	4.0m OF + Single Axle C	283.6	1333.9	352.3	1668.0
LC82	4.0m OF + Single Axle Ecc	283.6	1336.9	352.3	1673.0
LC83	4.0m OF + Tandem C	286.2	1341.1	356.7	1680.1
LC84	4.0m OF + Tandem Ecc	286.3	1346.7	356.9	1689.7
LC90	5.0m OF Permanent Loads	330.0	1554.3	408.2	1937.1
LC91	5.0m OF + Single Axle C	334.0	1566.5	415.0	1957.8
LC92	5.0m OF + Single Axle Ecc	333.9	1568.4	414.8	1961.0
LC93	5.0m OF + Tandem C	336.2	1572.9	418.8	1968.6
LC94	5.0m OF + Tandem Ecc	336.2	1576.8	418.7	1975.4

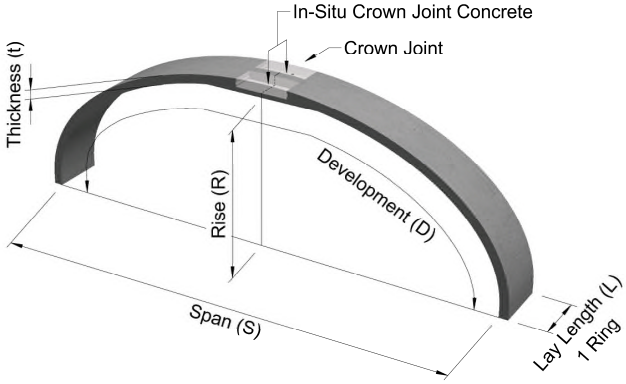
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E66T/1

Dimensions

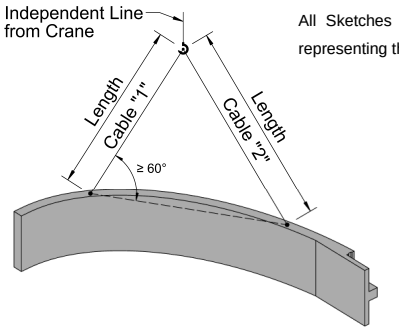
Span S	[m]	20.116
Rise R	[m]	6.096
Development D	[m]	25.966
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.49
In-Situ Concrete per Ring	[m³]	0.96

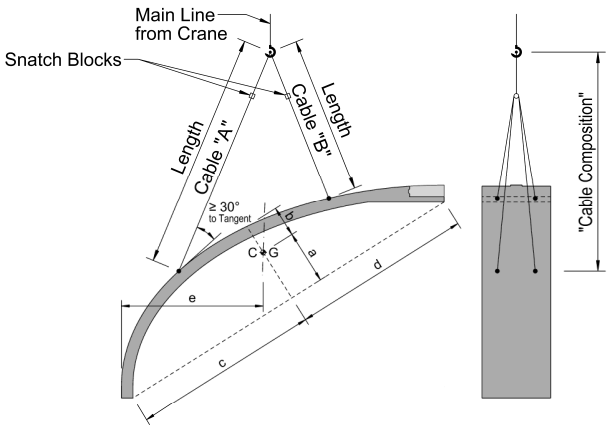
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	212.25 (21.2 metric tons)
Length Cable A	[m]*	8.50
Length Cable B	[m]*	6.10
Cable Force A	[kN]*	136.93
Cable Force B	[kN]*	95.39
Min. Length Cable 1&2	[m]	7.50
Cable Force 1&2	[kN]	122.54
Center of Gravity a	[m]	1.69
Center of Gravity b	[m]	0.89
Center of Gravity c	[m]	5.65
Center of Gravity d	[m]	6.11
Center of Gravity e	[m]	4.31

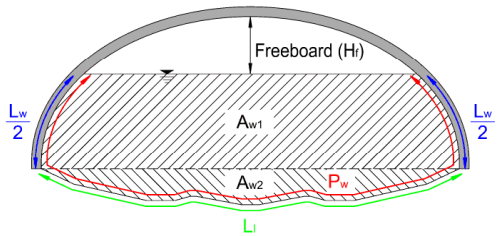


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	98.28	
1.0	89.61	14.02
2.0	76.06	9.93
3.0	59.64	6.89
4.0	41.37	4.40
5.0	21.95	2.22
6.0	1.94	0.19

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	82.1	118.8	98.5	142.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	90.1	554.0	108.5	686.6
LC41	0.6m OF + Single Axle C	97.7	574.8	121.4	721.9
LC42	0.6m OF + Single Axle Ecc	98.7	591.1	123.1	749.6
LC43	0.6m OF + Tandem C	101.9	584.0	128.5	737.6
LC44	0.6m OF + Tandem Ecc	103.8	612.8	131.9	786.5
LC50	1.0m OF Permanent Loads	104.5	632.3	126.5	784.4
LC51	1.0m OF + Single Axle C	111.3	653.2	138.1	820.0
LC52	1.0m OF + Single Axle Ecc	112.3	668.1	139.7	845.3
LC53	1.0m OF + Tandem C	115.3	664.7	144.9	839.5
LC54	1.0m OF + Tandem Ecc	116.9	688.8	147.6	880.4
LC60	2.0m OF Permanent Loads	144.0	857.3	175.9	1065.7
LC61	2.0m OF + Single Axle C	149.3	874.8	184.9	1095.4
LC62	2.0m OF + Single Axle Ecc	149.9	883.3	185.9	1109.9
LC63	2.0m OF + Tandem C	152.4	884.2	190.1	1111.5
LC64	2.0m OF + Tandem Ecc	153.5	898.9	192.0	1136.4
LC70	3.0m OF Permanent Loads	185.1	1087.6	227.3	1353.5
LC71	3.0m OF + Single Axle C	189.8	1104.4	235.2	1382.1
LC72	3.0m OF + Single Axle Ecc	190.0	1109.2	235.5	1390.2
LC73	3.0m OF + Tandem C	192.3	1113.0	239.6	1396.7
LC74	3.0m OF + Tandem Ecc	192.9	1122.1	240.5	1412.2
LC80	4.0m OF Permanent Loads	227.7	1323.8	280.6	1648.8
LC81	4.0m OF + Single Axle C	231.7	1338.4	287.3	1673.6
LC82	4.0m OF + Single Axle Ecc	231.8	1341.6	287.4	1679.1
LC83	4.0m OF + Tandem C	233.9	1345.8	291.1	1686.2
LC84	4.0m OF + Tandem Ecc	234.2	1351.8	291.5	1696.5
LC90	5.0m OF Permanent Loads	270.7	1561.0	334.3	1945.3
LC91	5.0m OF + Single Axle C	274.2	1573.3	340.2	1966.1
LC92	5.0m OF + Single Axle Ecc	274.2	1575.4	340.2	1969.8
LC93	5.0m OF + Tandem C	276.1	1579.4	343.4	1976.6
LC94	5.0m OF + Tandem Ecc	276.2	1583.8	343.6	1984.0

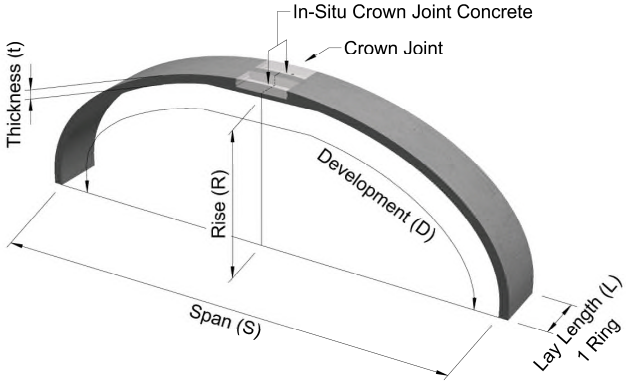
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E66T/2

Dimensions

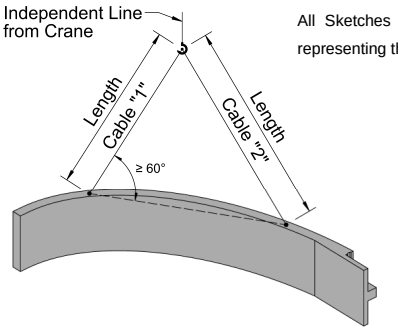
Span S	[m]	20.116
Rise R	[m]	6.401
Development D	[m]	26.576
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.69
In-Situ Concrete per Ring	[m³]	0.96

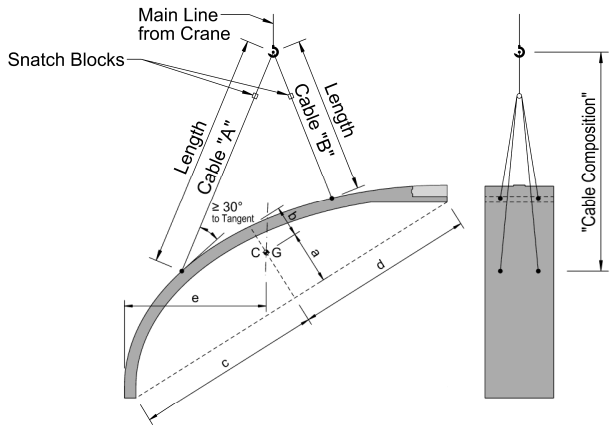
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	217.25 (21.7 metric tons)
Length Cable A	[m]*	8.10
Length Cable B	[m]*	5.80
Cable Force A	[kN]*	143.01
Cable Force B	[kN]*	93.32
Min. Length Cable 1&2	[m]	7.70
Cable Force 1&2	[kN]	125.43
Center of Gravity a	[m]	1.79
Center of Gravity b	[m]	0.94
Center of Gravity c	[m]	5.71
Center of Gravity d	[m]	6.21
Center of Gravity e	[m]	4.21

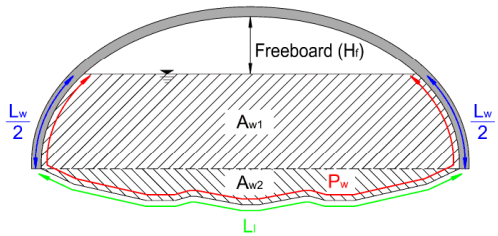


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	104.42	
1.0	95.75	14.63
2.0	82.19	10.54
3.0	65.78	7.50
4.0	47.51	5.01
5.0	28.08	2.83
6.0	8.08	0.80

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	78.4	121.4	94.1	145.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	70.5	558.9	84.2	692.6
LC41	0.6m OF + Single Axle C	76.1	577.2	93.8	723.7
LC42	0.6m OF + Single Axle Ecc	77.2	594.4	95.6	752.9
LC43	0.6m OF + Tandem C	79.2	584.9	99.0	736.8
LC44	0.6m OF + Tandem Ecc	81.2	615.1	102.5	788.2
LC50	1.0m OF Permanent Loads	81.3	635.3	97.7	788.0
LC51	1.0m OF + Single Axle C	86.4	654.1	106.4	820.0
LC52	1.0m OF + Single Axle Ecc	87.4	669.7	108.1	846.5
LC53	1.0m OF + Tandem C	89.3	664.8	111.2	838.3
LC54	1.0m OF + Tandem Ecc	90.9	690.0	114.1	881.0
LC60	2.0m OF Permanent Loads	110.9	857.3	134.7	1065.5
LC61	2.0m OF + Single Axle C	114.6	875.6	141.0	1096.7
LC62	2.0m OF + Single Axle Ecc	115.2	884.5	142.0	1111.8
LC63	2.0m OF + Tandem C	116.7	885.5	144.5	1113.5
LC64	2.0m OF + Tandem Ecc	117.8	900.7	146.4	1139.4
LC70	3.0m OF Permanent Loads	141.6	1089.5	173.0	1355.8
LC71	3.0m OF + Single Axle C	145.0	1106.0	178.9	1383.8
LC72	3.0m OF + Single Axle Ecc	145.3	1111.0	179.3	1392.3
LC73	3.0m OF + Tandem C	146.9	1114.0	182.2	1397.4
LC74	3.0m OF + Tandem Ecc	147.5	1123.7	183.2	1413.8
LC80	4.0m OF Permanent Loads	174.1	1325.4	213.7	1650.6
LC81	4.0m OF + Single Axle C	177.1	1339.2	218.9	1674.2
LC82	4.0m OF + Single Axle Ecc	177.2	1342.7	219.1	1680.1
LC83	4.0m OF + Tandem C	178.8	1346.0	221.7	1685.8
LC84	4.0m OF + Tandem Ecc	179.1	1352.5	222.2	1696.7
LC90	5.0m OF Permanent Loads	207.3	1561.9	255.3	1946.4
LC91	5.0m OF + Single Axle C	210.1	1573.7	259.9	1966.3
LC92	5.0m OF + Single Axle Ecc	210.1	1576.1	259.9	1970.4
LC93	5.0m OF + Tandem C	211.5	1579.5	262.4	1976.2
LC94	5.0m OF + Tandem Ecc	211.7	1584.2	262.7	1984.2

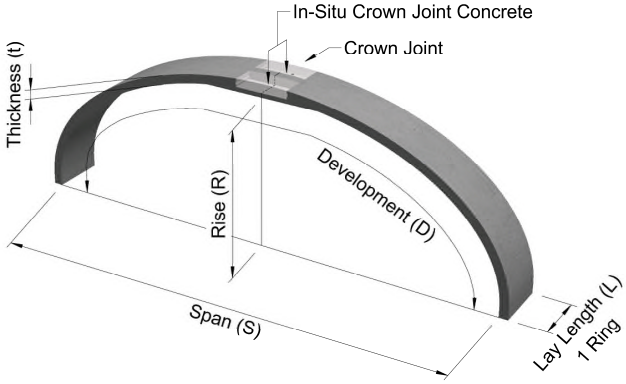
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E66T/3

Dimensions

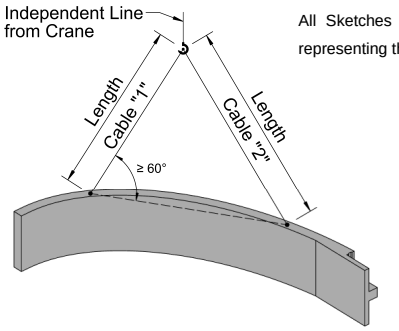
Span S	[m]	20.116
Rise R	[m]	6.71
Development D	[m]	27.185
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.88
In-Situ Concrete per Ring	[m³]	0.96

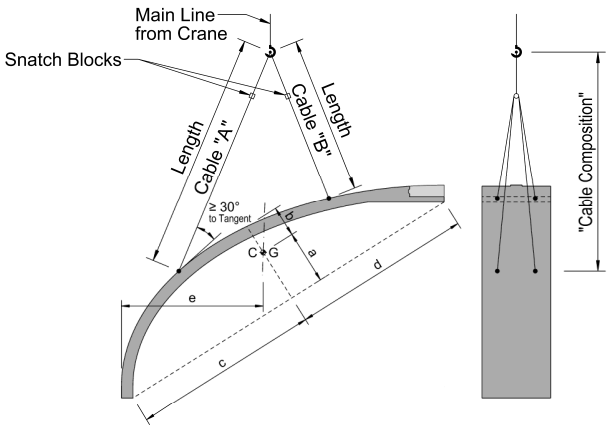
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	222.00 (22.2 metric tons)
Length Cable A	[m]*	7.80
Length Cable B	[m]*	5.60
Cable Force A	[kN]*	151.31
Cable Force B	[kN]*	92.22
Min. Length Cable 1&2	[m]	7.80
Cable Force 1&2	[kN]	128.17
Center of Gravity a	[m]	1.88
Center of Gravity b	[m]	0.99
Center of Gravity c	[m]	5.78
Center of Gravity d	[m]	6.30
Center of Gravity e	[m]	4.12

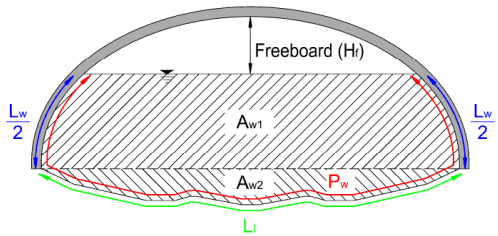


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	110.55	
1.0	101.88	15.24
2.0	88.32	11.15
3.0	71.91	8.11
4.0	53.64	5.62
5.0	34.21	3.44
6.0	14.21	1.41

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	75.0	124.0	90.0	148.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	52.4	565.2	61.8	700.3
LC41	0.6m OF + Single Axle C	56.6	581.0	68.8	727.2
LC42	0.6m OF + Single Axle Ecc	57.6	598.7	70.7	757.3
LC43	0.6m OF + Tandem C	58.7	587.6	72.4	738.5
LC44	0.6m OF + Tandem Ecc	60.7	618.8	75.8	791.5
LC50	1.0m OF Permanent Loads	60.2	639.7	71.5	793.5
LC51	1.0m OF + Single Axle C	64.0	657.2	78.0	823.1
LC52	1.0m OF + Single Axle Ecc	65.0	673.2	79.6	850.4
LC53	1.0m OF + Tandem C	65.9	668.0	81.2	841.6
LC54	1.0m OF + Tandem Ecc	67.5	693.8	83.9	885.5
LC60	2.0m OF Permanent Loads	81.3	861.6	97.9	1070.8
LC61	2.0m OF + Single Axle C	83.7	878.8	102.0	1100.0
LC62	2.0m OF + Single Axle Ecc	84.3	887.9	103.0	1115.5
LC63	2.0m OF + Tandem C	85.0	888.2	104.2	1116.0
LC64	2.0m OF + Tandem Ecc	86.1	903.8	106.0	1142.5
LC70	3.0m OF Permanent Loads	102.8	1092.7	124.7	1359.6
LC71	3.0m OF + Single Axle C	105.2	1108.8	128.9	1387.1
LC72	3.0m OF + Single Axle Ecc	105.5	1114.0	129.3	1395.9
LC73	3.0m OF + Tandem C	106.5	1116.6	131.1	1400.3
LC74	3.0m OF + Tandem Ecc	107.1	1126.5	132.0	1417.1
LC80	4.0m OF Permanent Loads	126.2	1328.6	154.0	1654.5
LC81	4.0m OF + Single Axle C	128.4	1342.2	157.8	1677.6
LC82	4.0m OF + Single Axle Ecc	128.6	1345.8	158.0	1683.8
LC83	4.0m OF + Tandem C	129.6	1348.8	159.9	1689.0
LC84	4.0m OF + Tandem Ecc	130.0	1355.6	160.4	1700.4
LC90	5.0m OF Permanent Loads	150.6	1565.5	184.5	1950.7
LC91	5.0m OF + Single Axle C	152.7	1577.2	188.0	1970.5
LC92	5.0m OF + Single Axle Ecc	152.7	1579.7	188.1	1974.9
LC93	5.0m OF + Tandem C	153.8	1582.9	189.9	1980.2
LC94	5.0m OF + Tandem Ecc	154.0	1587.9	190.2	1988.7

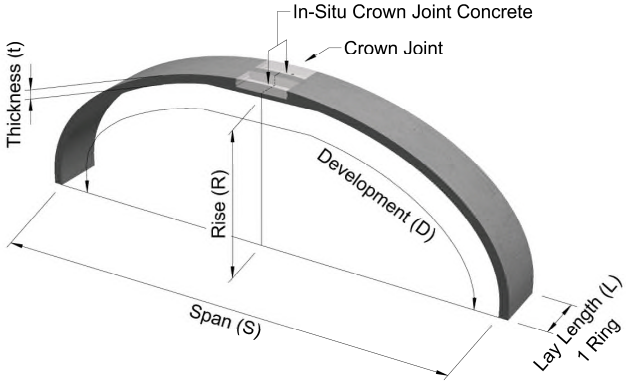
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E66T/4

Dimensions

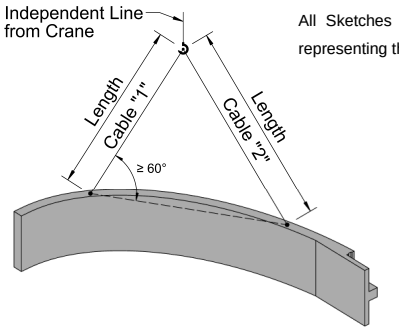
Span S	[m]	20.116
Rise R	[m]	7.010
Development D	[m]	27.795
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.08
In-Situ Concrete per Ring	[m³]	0.96

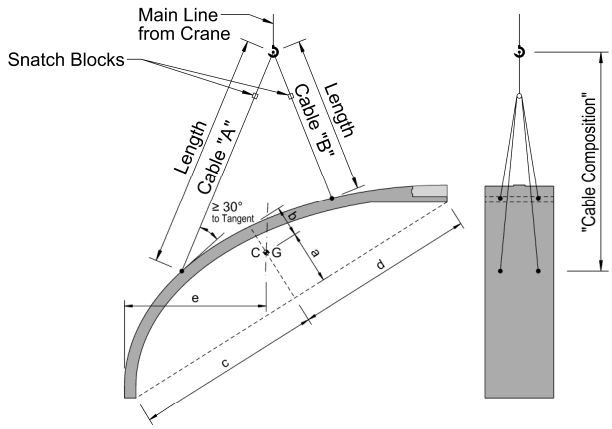
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	227.00 (22.7 metric tons)
Length Cable A	[m]*	7.60
Length Cable B	[m]*	5.50
Cable Force A	[kN]*	158.81
Cable Force B	[kN]*	90.38
Min. Length Cable 1&2	[m]	8.00
Cable Force 1&2	[kN]	131.06
Center of Gravity a	[m]	1.97
Center of Gravity b	[m]	1.05
Center of Gravity c	[m]	5.87
Center of Gravity d	[m]	6.39
Center of Gravity e	[m]	4.04

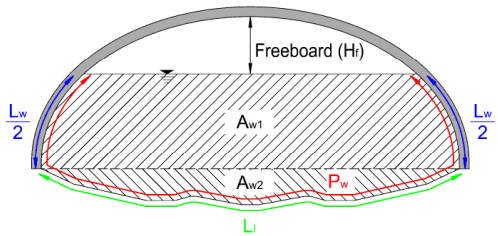


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	116.68	
1.0	108.01	15.85
2.0	94.45	11.76
3.0	78.04	8.72
4.0	59.77	6.23
5.0	40.34	4.05
6.0	20.34	2.02

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	71.9	126.6	86.3	151.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	35.6	572.8	40.9	709.7
LC41	0.6m OF + Single Axle C	38.6	586.9	45.9	733.7
LC42	0.6m OF + Single Axle Ecc	39.6	605.0	47.7	764.5
LC43	0.6m OF + Tandem C	40.0	592.8	48.3	743.7
LC44	0.6m OF + Tandem Ecc	41.8	624.6	51.5	797.7
LC50	1.0m OF Permanent Loads	41.0	646.5	47.6	801.8
LC51	1.0m OF + Single Axle C	43.6	663.1	52.1	830.0
LC52	1.0m OF + Single Axle Ecc	44.5	679.5	53.6	857.8
LC53	1.0m OF + Tandem C	44.9	673.2	54.3	847.1
LC54	1.0m OF + Tandem Ecc	46.3	699.4	56.7	891.8
LC60	2.0m OF Permanent Loads	55.2	868.2	65.5	1078.9
LC61	2.0m OF + Single Axle C	56.7	884.8	67.9	1107.2
LC62	2.0m OF + Single Axle Ecc	57.2	894.0	68.8	1122.8
LC63	2.0m OF + Tandem C	57.4	893.2	69.2	1121.4
LC64	2.0m OF + Tandem Ecc	58.3	909.0	70.7	1148.2
LC70	3.0m OF Permanent Loads	69.2	1098.3	82.8	1366.6
LC71	3.0m OF + Single Axle C	70.8	1113.2	85.7	1391.9
LC72	3.0m OF + Single Axle Ecc	71.1	1118.6	86.1	1401.0
LC73	3.0m OF + Tandem C	71.7	1120.8	87.1	1404.7
LC74	3.0m OF + Tandem Ecc	72.2	1130.9	88.0	1421.9
LC80	4.0m OF Permanent Loads	85.0	1333.6	102.7	1660.6
LC81	4.0m OF + Single Axle C	86.6	1346.9	105.3	1683.3
LC82	4.0m OF + Single Axle Ecc	86.7	1350.7	105.6	1689.7
LC83	4.0m OF + Tandem C	87.4	1353.4	106.7	1694.4
LC84	4.0m OF + Tandem Ecc	87.7	1360.4	107.2	1706.2
LC90	5.0m OF Permanent Loads	101.9	1571.0	123.7	1957.4
LC91	5.0m OF + Single Axle C	103.3	1582.4	126.1	1976.8
LC92	5.0m OF + Single Axle Ecc	103.3	1585.1	126.2	1981.4
LC93	5.0m OF + Tandem C	104.0	1588.0	127.3	1986.4
LC94	5.0m OF + Tandem Ecc	104.2	1593.2	127.7	1995.1

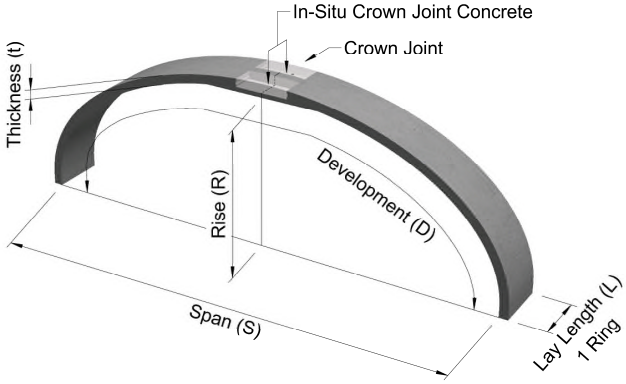
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E66T/5

Dimensions

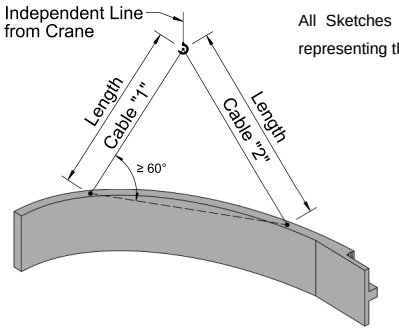
Span S	[m]	20.116
Rise R	[m]	7.315
Development D	[m]	28.404
Thickness t	[mm]	356
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.28
In-Situ Concrete per Ring	[m³]	0.96

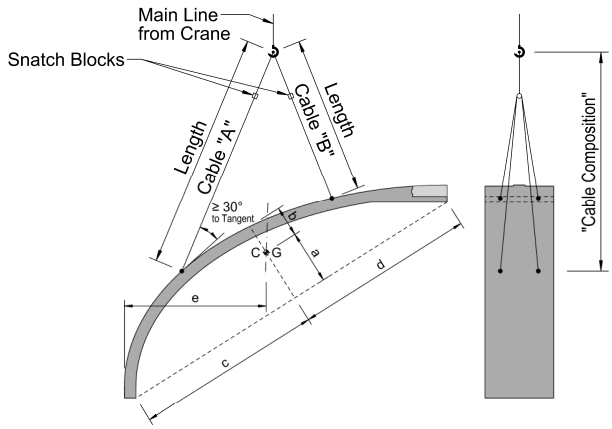
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	232.00 (23.2 metric tons)
Length Cable A	[m]*	7.40
Length Cable B	[m]*	5.30
Cable Force A	[kN]*	164.49
Cable Force B	[kN]*	89.93
Min. Length Cable 1&2	[m]	8.10
Cable Force 1&2	[kN]	133.95
Center of Gravity a	[m]	2.05
Center of Gravity b	[m]	1.11
Center of Gravity c	[m]	5.97
Center of Gravity d	[m]	6.46
Center of Gravity e	[m]	3.98

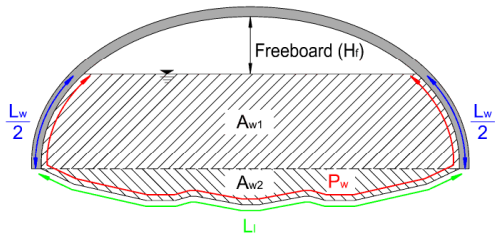


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	122.81	
1.0	114.14	16.46
2.0	100.58	12.37
3.0	84.17	9.33
4.0	65.90	6.84
5.0	46.47	4.66
6.0	26.47	2.63

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

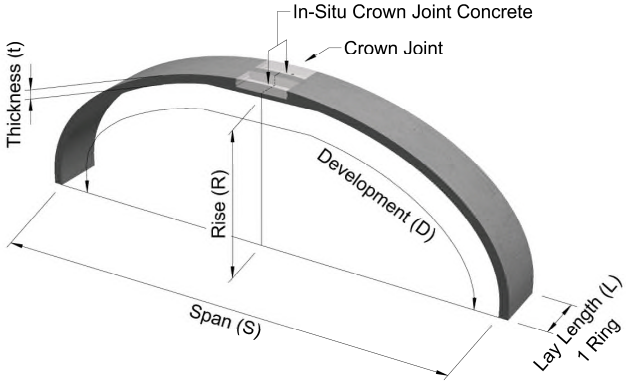
Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	69.0	129.2	82.8	155.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	20.3	581.7	22.0	720.7
LC41	0.6m OF + Single Axle C	22.3	594.7	25.3	742.8
LC42	0.6m OF + Single Axle Ecc	23.2	613.1	26.9	774.0
LC43	0.6m OF + Tandem C	23.1	600.2	26.7	752.1
LC44	0.6m OF + Tandem Ecc	24.8	632.4	29.5	806.9
LC50	1.0m OF Permanent Loads	23.6	655.4	26.1	812.7
LC51	1.0m OF + Single Axle C	25.4	671.2	29.1	839.6
LC52	1.0m OF + Single Axle Ecc	26.2	687.7	30.4	867.7
LC53	1.0m OF + Tandem C	26.2	680.3	30.4	855.1
LC54	1.0m OF + Tandem Ecc	27.5	706.8	32.6	900.2
LC60	2.0m OF Permanent Loads	32.5	876.5	37.2	1089.2
LC61	2.0m OF + Single Axle C	33.4	892.1	38.6	1115.7
LC62	2.0m OF + Single Axle Ecc	33.8	901.4	39.4	1131.5
LC63	2.0m OF + Tandem C	33.7	900.0	39.2	1129.1
LC64	2.0m OF + Tandem Ecc	34.5	915.9	40.5	1156.1
LC70	3.0m OF Permanent Loads	40.4	1106.1	47.1	1376.2
LC71	3.0m OF + Single Axle C	41.4	1120.6	48.7	1400.9
LC72	3.0m OF + Single Axle Ecc	41.6	1126.0	49.1	1410.0
LC73	3.0m OF + Tandem C	41.8	1127.5	49.5	1412.5
LC74	3.0m OF + Tandem Ecc	42.3	1137.8	50.3	1430.1
LC80	4.0m OF Permanent Loads	50.0	1341.2	59.0	1670.0
LC81	4.0m OF + Single Axle C	50.9	1354.0	60.6	1691.8
LC82	4.0m OF + Single Axle Ecc	51.0	1357.8	60.8	1698.3
LC83	4.0m OF + Tandem C	51.4	1360.1	61.4	1702.1
LC84	4.0m OF + Tandem Ecc	51.6	1367.1	61.8	1714.1
LC90	5.0m OF Permanent Loads	60.2	1578.7	71.8	1966.9
LC91	5.0m OF + Single Axle C	61.1	1589.8	73.3	1985.8
LC92	5.0m OF + Single Axle Ecc	61.1	1592.5	73.4	1990.4
LC93	5.0m OF + Tandem C	61.5	1595.0	74.1	1994.7
LC94	5.0m OF + Tandem Ecc	61.7	1600.3	74.3	2003.6

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

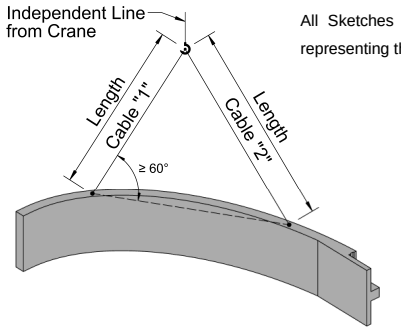
Span S	[m]	21.858
Rise R	[m]	6.045
Development D	[m]	27.160
Thickness t	[mm]	407
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.74
In-Situ Concrete per Ring	[m³]	0.98

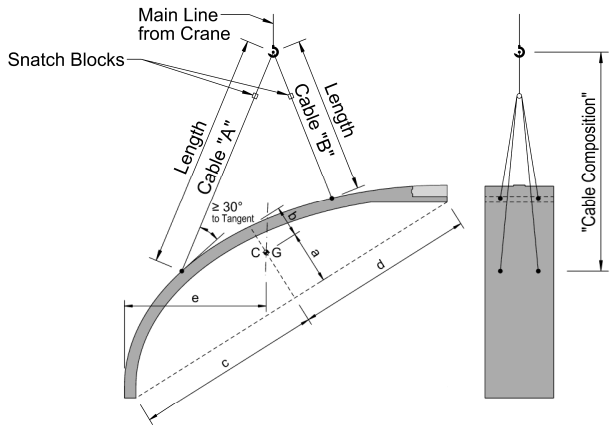
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	168.50 (16.8 metric tons)
Length Cable A	[m]*	10.50
Length Cable B	[m]*	7.70
Cable Force A	[kN]*	96.07
Cable Force B	[kN]*	82.03
Min. Length Cable 1&2	[m]	7.90
Cable Force 1&2	[kN]	97.28
Center of Gravity a	[m]	1.68
Center of Gravity b	[m]	0.89
Center of Gravity c	[m]	6.04
Center of Gravity d	[m]	6.45
Center of Gravity e	[m]	4.87

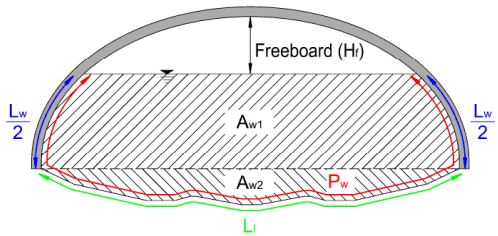


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	104.12	
1.0	94.69	14.42
2.0	80.28	10.22
3.0	62.86	7.04
4.0	43.40	4.44
5.0	22.59	2.16
6.0	1.00	0.10

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	114.0	144.2	136.9	173.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	154.5	650.0	187.4	805.3
LC41	0.6m OF + Single Axle C	166.1	675.3	207.1	848.3
LC42	0.6m OF + Single Axle Ecc	166.2	687.9	207.4	869.8
LC43	0.6m OF + Tandem C	172.6	687.4	218.2	869.0
LC44	0.6m OF + Tandem Ecc	173.6	710.7	219.8	908.5
LC50	1.0m OF Permanent Loads	177.9	739.5	216.7	917.2
LC51	1.0m OF + Single Axle C	188.1	764.5	234.0	959.7
LC52	1.0m OF + Single Axle Ecc	188.6	776.8	234.9	980.6
LC53	1.0m OF + Tandem C	194.1	778.0	244.3	982.6
LC54	1.0m OF + Tandem Ecc	195.2	798.5	246.1	1017.4
LC60	2.0m OF Permanent Loads	239.9	989.8	294.2	1230.0
LC61	2.0m OF + Single Axle C	247.7	1009.2	307.5	1263.1
LC62	2.0m OF + Single Axle Ecc	248.1	1016.9	308.2	1276.2
LC63	2.0m OF + Tandem C	252.3	1019.3	315.2	1280.3
LC64	2.0m OF + Tandem Ecc	253.2	1032.6	316.9	1302.8
LC70	3.0m OF Permanent Loads	303.4	1241.1	373.5	1544.2
LC71	3.0m OF + Single Axle C	310.0	1258.2	384.8	1573.3
LC72	3.0m OF + Single Axle Ecc	310.0	1262.7	384.8	1580.8
LC73	3.0m OF + Tandem C	313.7	1266.9	391.1	1588.1
LC74	3.0m OF + Tandem Ecc	314.1	1275.4	391.8	1602.4
LC80	4.0m OF Permanent Loads	367.7	1496.1	454.0	1862.9
LC81	4.0m OF + Single Axle C	373.3	1510.5	463.4	1887.4
LC82	4.0m OF + Single Axle Ecc	373.2	1513.5	463.3	1892.4
LC83	4.0m OF + Tandem C	376.4	1517.8	468.7	1899.9
LC84	4.0m OF + Tandem Ecc	376.5	1523.5	468.8	1909.5
LC90	5.0m OF Permanent Loads	432.0	1751.4	534.3	2182.0
LC91	5.0m OF + Single Axle C	436.8	1763.6	542.5	2202.8
LC92	5.0m OF + Single Axle Ecc	436.7	1765.5	542.2	2206.1
LC93	5.0m OF + Tandem C	439.5	1769.7	547.0	2213.2
LC94	5.0m OF + Tandem Ecc	439.4	1773.7	546.9	2220.0

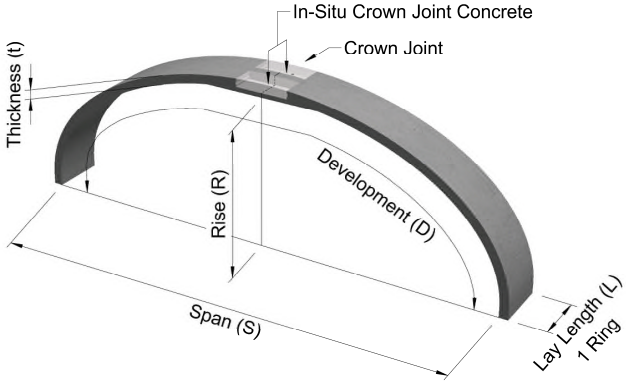
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E72T/1

Dimensions

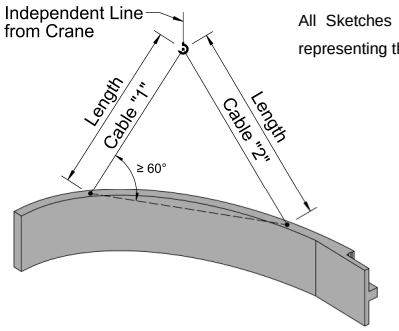
Span S	[m]	21.924
Rise R	[m]	6.350
Development D	[m]	27.773
Thickness t	[mm]	407
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.90
In-Situ Concrete per Ring	[m³]	0.98

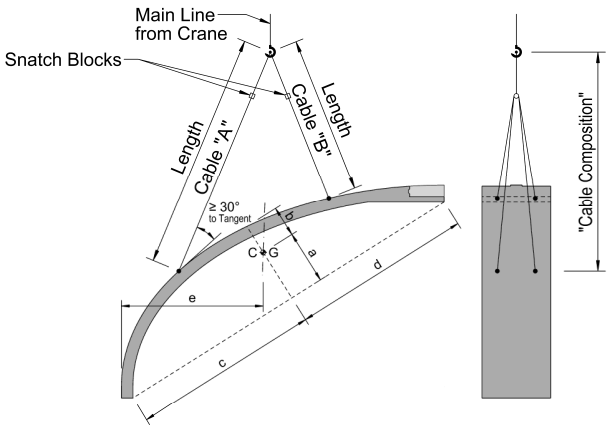
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	172.50 (17.2 metric tons)
Length Cable A	[m]*	9.70
Length Cable B	[m]*	7.10
Cable Force A	[kN]*	104.74
Cable Force B	[kN]*	80.04
Min. Length Cable 1&2	[m]	7.90
Cable Force 1&2	[kN]	99.59
Center of Gravity a	[m]	1.81
Center of Gravity b	[m]	0.91
Center of Gravity c	[m]	6.01
Center of Gravity d	[m]	6.66
Center of Gravity e	[m]	4.69

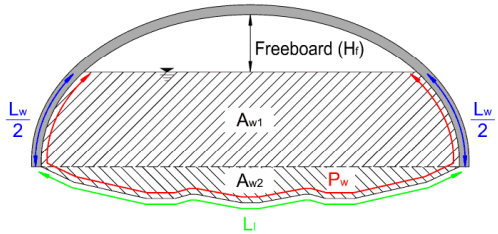


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	110.79	
1.0	101.36	15.02
2.0	86.95	10.82
3.0	69.53	7.66
4.0	50.07	5.06
5.0	29.26	2.78
6.0	7.65	0.70

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	109.4	147.3	131.3	176.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	133.1	660.2	160.8	817.9
LC41	0.6m OF + Single Axle C	142.7	683.8	177.3	857.9
LC42	0.6m OF + Single Axle Ecc	143.3	697.4	178.2	881.1
LC43	0.6m OF + Tandem C	148.1	694.7	186.5	876.5
LC44	0.6m OF + Tandem Ecc	149.6	719.6	188.9	918.9
LC50	1.0m OF Permanent Loads	153.0	749.2	185.7	929.1
LC51	1.0m OF + Single Axle C	161.6	772.6	200.4	968.9
LC52	1.0m OF + Single Axle Ecc	162.3	785.7	201.6	991.2
LC53	1.0m OF + Tandem C	166.6	785.1	209.0	990.1
LC54	1.0m OF + Tandem Ecc	168.1	806.6	211.4	1026.7
LC60	2.0m OF Permanent Loads	206.5	997.8	252.7	1239.9
LC61	2.0m OF + Single Axle C	213.3	1016.2	264.3	1271.2
LC62	2.0m OF + Single Axle Ecc	213.9	1024.4	265.2	1285.0
LC63	2.0m OF + Tandem C	217.3	1025.5	271.1	1286.9
LC64	2.0m OF + Tandem Ecc	218.5	1039.6	273.0	1310.9
LC70	3.0m OF Permanent Loads	262.6	1248.2	322.8	1552.8
LC71	3.0m OF + Single Axle C	268.6	1264.5	333.0	1580.7
LC72	3.0m OF + Single Axle Ecc	268.8	1269.3	333.3	1588.8
LC73	3.0m OF + Tandem C	272.0	1272.6	338.8	1594.4
LC74	3.0m OF + Tandem Ecc	272.6	1281.7	339.7	1609.9
LC80	4.0m OF Permanent Loads	320.6	1502.9	395.3	1871.3
LC81	4.0m OF + Single Axle C	325.7	1517.0	403.9	1895.1
LC82	4.0m OF + Single Axle Ecc	325.7	1520.2	403.9	1900.6
LC83	4.0m OF + Tandem C	328.5	1523.9	408.7	1907.0
LC84	4.0m OF + Tandem Ecc	328.7	1530.0	409.1	1917.3
LC90	5.0m OF Permanent Loads	378.7	1758.8	467.9	2191.1
LC91	5.0m OF + Single Axle C	383.0	1770.8	475.3	2211.5
LC92	5.0m OF + Single Axle Ecc	382.9	1772.9	475.1	2215.2
LC93	5.0m OF + Tandem C	385.4	1776.9	479.3	2221.9
LC94	5.0m OF + Tandem Ecc	385.5	1781.4	479.4	2229.5

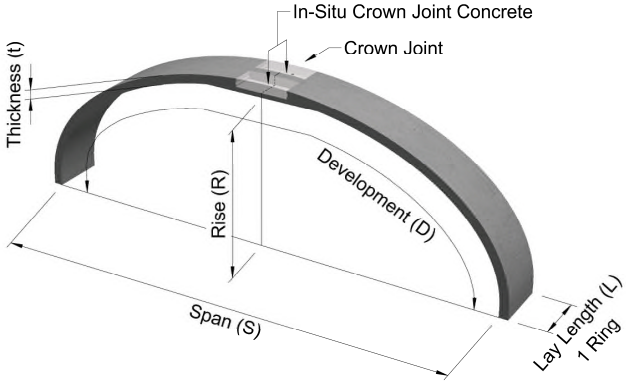
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E72T/2

Dimensions

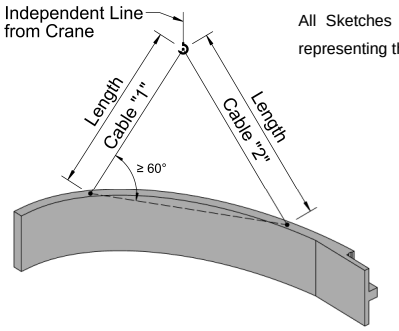
Span S	[m]	21.946
Rise R	[m]	6.655
Development D	[m]	28.383
Thickness t	[mm]	406
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.05
In-Situ Concrete per Ring	[m³]	0.98

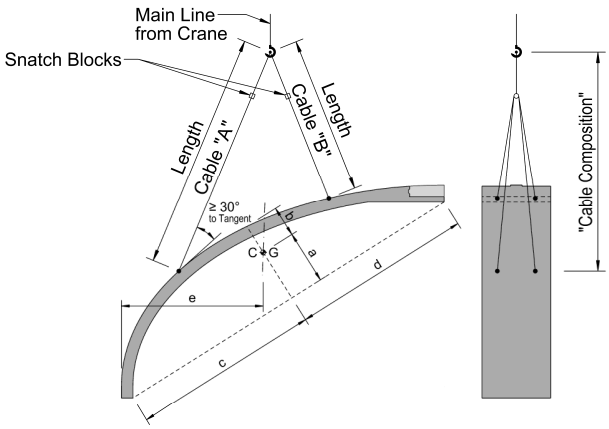
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	176.25 (17.6 metric tons)
Length Cable A	[m]*	9.70
Length Cable B	[m]*	7.10
Cable Force A	[kN]*	110.83
Cable Force B	[kN]*	78.67
Min. Length Cable 1&2	[m]	8.30
Cable Force 1&2	[kN]	101.76
Center of Gravity a	[m]	1.87
Center of Gravity b	[m]	0.99
Center of Gravity c	[m]	6.17
Center of Gravity d	[m]	6.66
Center of Gravity e	[m]	4.71

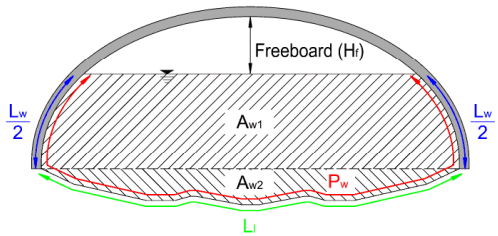


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	117.48	
1.0	108.05	15.64
2.0	93.64	11.44
3.0	76.22	8.26
4.0	56.76	5.66
5.0	35.95	3.40
6.0	14.33	1.32

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

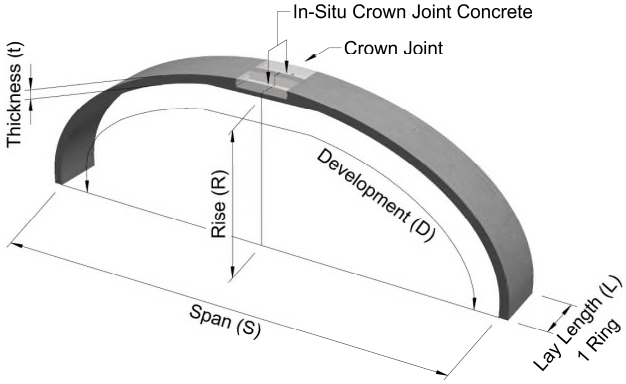
Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	104.7	150.5	125.6	180.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	109.7	666.8	131.9	826.0
LC41	0.6m OF + Single Axle C	117.4	687.7	144.9	861.6
LC42	0.6m OF + Single Axle Ecc	118.1	702.5	146.2	886.7
LC43	0.6m OF + Tandem C	121.6	697.0	152.1	877.4
LC44	0.6m OF + Tandem Ecc	123.3	723.6	155.0	922.6
LC50	1.0m OF Permanent Loads	125.6	753.6	151.8	934.4
LC51	1.0m OF + Single Axle C	132.4	774.9	163.4	970.7
LC52	1.0m OF + Single Axle Ecc	133.3	788.9	164.8	994.5
LC53	1.0m OF + Tandem C	136.4	786.2	170.1	989.9
LC54	1.0m OF + Tandem Ecc	137.9	809.2	172.7	1029.0
LC60	2.0m OF Permanent Loads	168.3	998.0	205.2	1240.0
LC61	2.0m OF + Single Axle C	173.7	1015.3	214.2	1269.4
LC62	2.0m OF + Single Axle Ecc	174.3	1023.9	215.3	1284.1
LC63	2.0m OF + Tandem C	176.7	1023.9	219.4	1283.9
LC64	2.0m OF + Tandem Ecc	177.9	1038.9	221.5	1309.4
LC70	3.0m OF Permanent Loads	213.1	1246.3	261.2	1550.4
LC71	3.0m OF + Single Axle C	217.8	1263.2	269.2	1579.0
LC72	3.0m OF + Single Axle Ecc	218.1	1268.3	269.6	1587.7
LC73	3.0m OF + Tandem C	220.4	1271.8	273.5	1593.8
LC74	3.0m OF + Tandem Ecc	221.0	1281.6	274.6	1610.3
LC80	4.0m OF Permanent Loads	259.6	1503.3	319.3	1871.5
LC81	4.0m OF + Single Axle C	263.6	1517.9	326.1	1896.4
LC82	4.0m OF + Single Axle Ecc	263.7	1521.3	326.3	1902.3
LC83	4.0m OF + Tandem C	265.8	1525.2	329.8	1908.8
LC84	4.0m OF + Tandem Ecc	266.2	1531.8	330.4	1920.0
LC90	5.0m OF Permanent Loads	306.6	1761.4	378.0	2194.2
LC91	5.0m OF + Single Axle C	310.1	1773.9	383.9	2215.4
LC92	5.0m OF + Single Axle Ecc	310.1	1776.3	384.0	2219.6
LC93	5.0m OF + Tandem C	312.0	1780.1	387.2	2226.0
LC94	5.0m OF + Tandem Ecc	312.2	1785.0	387.5	2234.4

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

Dimensions

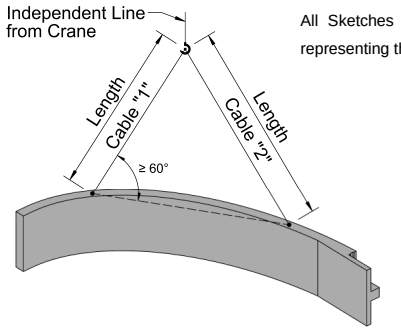
Span S	[m]	21.946
Rise R	[m]	6.960
Development D	[m]	28.993
Thickness t	[mm]	406
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.20
In-Situ Concrete per Ring	[m³]	0.98

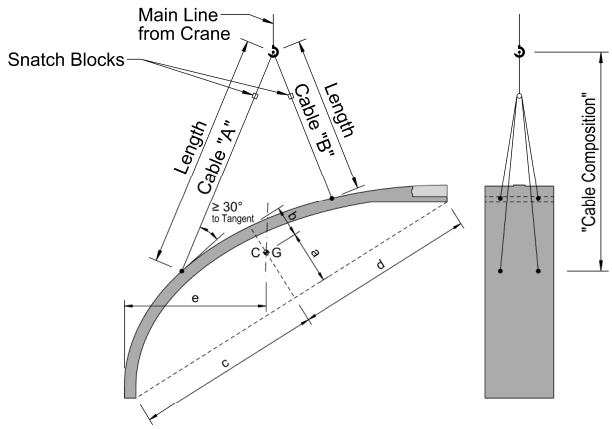
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	180.00 (18.0 metric tons)
Length Cable A	[m]*	9.30
Length Cable B	[m]*	6.70
Cable Force A	[kN]*	116.25
Cable Force B	[kN]*	77.19
Min. Length Cable 1&2	[m]	8.40
Cable Force 1&2	[kN]	103.92
Center of Gravity a	[m]	1.97
Center of Gravity b	[m]	1.04
Center of Gravity c	[m]	6.23
Center of Gravity d	[m]	6.76
Center of Gravity e	[m]	4.61

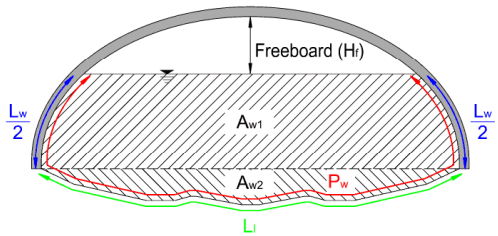


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	124.16	
1.0	114.73	16.26
2.0	100.32	12.04
3.0	89.90	8.88
4.0	63.44	6.28
5.0	42.63	4.00
6.0	21.02	1.92

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	100.4	153.4	120.4	184.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	88.6	672.2	105.7	832.5
LC41	0.6m OF + Single Axle C	94.5	690.7	115.8	864.1
LC42	0.6m OF + Single Axle Ecc	95.5	706.3	117.4	890.6
LC43	0.6m OF + Tandem C	97.7	698.5	121.2	877.4
LC44	0.6m OF + Tandem Ecc	99.6	726.6	124.4	925.1
LC50	1.0m OF Permanent Loads	101.0	757.0	121.2	938.6
LC51	1.0m OF + Single Axle C	106.4	776.5	130.3	971.8
LC52	1.0m OF + Single Axle Ecc	107.3	791.2	131.9	996.8
LC53	1.0m OF + Tandem C	109.3	786.9	135.4	989.4
LC54	1.0m OF + Tandem Ecc	111.0	811.0	138.2	1030.4
LC60	2.0m OF Permanent Loads	134.2	998.4	162.7	1240.4
LC61	2.0m OF + Single Axle C	138.1	1015.9	169.4	1270.1
LC62	2.0m OF + Single Axle Ecc	138.7	1024.9	170.5	1285.3
LC63	2.0m OF + Tandem C	140.3	1025.0	173.1	1285.6
LC64	2.0m OF + Tandem Ecc	141.5	1040.7	175.1	1312.1
LC70	3.0m OF Permanent Loads	168.7	1248.9	205.9	1553.5
LC71	3.0m OF + Single Axle C	172.4	1264.8	212.1	1580.5
LC72	3.0m OF + Single Axle Ecc	172.6	1270.2	212.5	1589.7
LC73	3.0m OF + Tandem C	174.3	1273.0	215.4	1594.4
LC74	3.0m OF + Tandem Ecc	175.0	1283.2	216.6	1611.8
LC80	4.0m OF Permanent Loads	205.3	1504.8	251.6	1873.4
LC81	4.0m OF + Single Axle C	208.4	1519.2	256.9	1897.7
LC82	4.0m OF + Single Axle Ecc	208.6	1522.9	257.2	1904.0
LC83	4.0m OF + Tandem C	210.1	1526.2	259.8	1909.8
LC84	4.0m OF + Tandem Ecc	210.5	1533.3	260.5	1921.8
LC90	5.0m OF Permanent Loads	242.6	1763.0	298.2	2196.1
LC91	5.0m OF + Single Axle C	245.3	1775.3	302.9	2216.9
LC92	5.0m OF + Single Axle Ecc	245.4	1778.0	303.0	2221.5
LC93	5.0m OF + Tandem C	246.9	1781.4	305.6	2227.3
LC94	5.0m OF + Tandem Ecc	247.1	1786.6	306.0	2236.2

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

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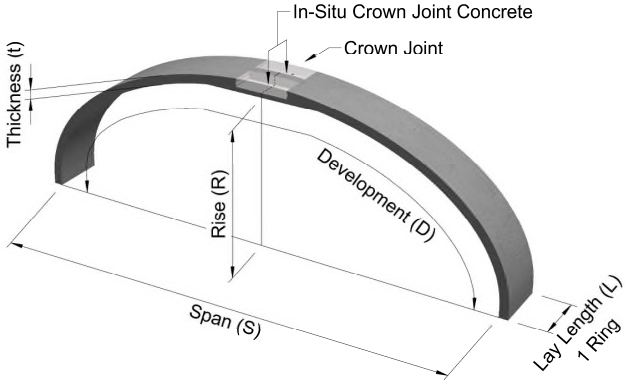
Dimensions

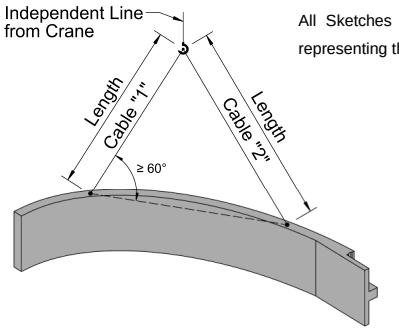
Span S	[m]	21.946
Rise R	[m]	7.265
Development D	[m]	29.602
Thickness t	[mm]	406
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.35
In-Situ Concrete per Ring	[m³]	0.98

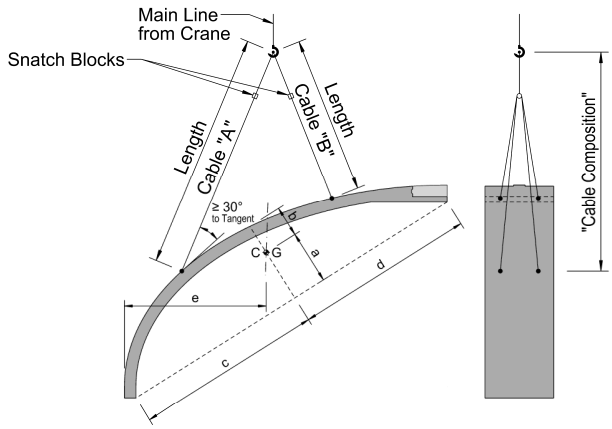
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	183.75 (18.4 metric tons)
Length Cable A	[m]*	9.00
Length Cable B	[m]*	6.50
Cable Force A	[kN]*	123.11
Cable Force B	[kN]*	75.61
Min. Length Cable 1&2	[m]	8.60
Cable Force 1&2	[kN]	106.09
Center of Gravity a	[m]	2.06
Center of Gravity b	[m]	1.09
Center of Gravity c	[m]	6.31
Center of Gravity d	[m]	6.85
Center of Gravity e	[m]	4.52

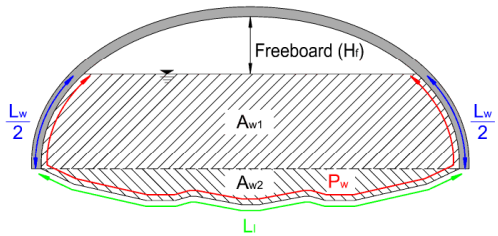


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	130.86	
1.0	121.42	16.86
2.0	107.01	12.66
3.0	89.59	9.48
4.0	70.13	6.88
5.0	49.32	4.62
6.0	27.71	2.54

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	96.4	156.4	115.6	187.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	69.0	679.3	81.4	841.3
LC41	0.6m OF + Single Axle C	73.5	695.7	89.1	869.1
LC42	0.6m OF + Single Axle Ecc	74.5	711.8	90.8	896.6
LC43	0.6m OF + Tandem C	75.9	702.7	93.1	881.0
LC44	0.6m OF + Tandem Ecc	77.8	731.7	96.4	930.3
LC50	1.0m OF Permanent Loads	78.4	762.7	93.2	945.5
LC51	1.0m OF + Single Axle C	82.5	780.8	100.1	976.4
LC52	1.0m OF + Single Axle Ecc	83.4	796.0	101.7	1002.1
LC53	1.0m OF + Tandem C	84.6	791.0	103.7	993.8
LC54	1.0m OF + Tandem Ecc	86.2	815.7	106.5	1035.7
LC60	2.0m OF Permanent Loads	103.2	1003.3	124.1	1246.3
LC61	2.0m OF + Single Axle C	105.8	1020.6	128.7	1275.6
LC62	2.0m OF + Single Axle Ecc	106.4	1029.7	129.7	1291.2
LC63	2.0m OF + Tandem C	107.3	1029.1	131.1	1290.1
LC64	2.0m OF + Tandem Ecc	108.4	1045.1	133.1	1317.4
LC70	3.0m OF Permanent Loads	128.4	1253.5	155.7	1559.1
LC71	3.0m OF + Single Axle C	131.1	1269.1	160.2	1585.6
LC72	3.0m OF + Single Axle Ecc	131.4	1274.7	160.8	1595.1
LC73	3.0m OF + Tandem C	132.5	1276.8	162.7	1598.7
LC74	3.0m OF + Tandem Ecc	133.2	1287.3	163.8	1616.6
LC80	4.0m OF Permanent Loads	155.9	1509.0	190.0	1878.4
LC81	4.0m OF + Single Axle C	158.3	1522.6	194.2	1901.5
LC82	4.0m OF + Single Axle Ecc	158.5	1526.4	194.5	1908.1
LC83	4.0m OF + Tandem C	159.6	1529.1	196.4	1912.7
LC84	4.0m OF + Tandem Ecc	160.0	1536.5	197.1	1925.1
LC90	5.0m OF Permanent Loads	184.4	1766.4	225.6	2200.2
LC91	5.0m OF + Single Axle C	186.6	1778.2	229.4	2220.2
LC92	5.0m OF + Single Axle Ecc	186.7	1781.0	229.5	2225.0
LC93	5.0m OF + Tandem C	187.8	1784.1	231.4	2230.2
LC94	5.0m OF + Tandem Ecc	188.0	1789.5	231.8	2239.4

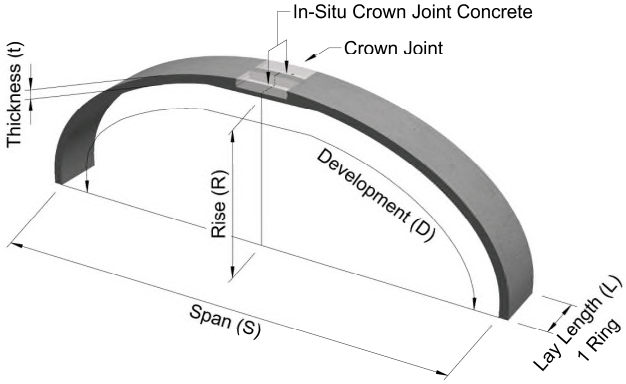
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E72T/5

Dimensions

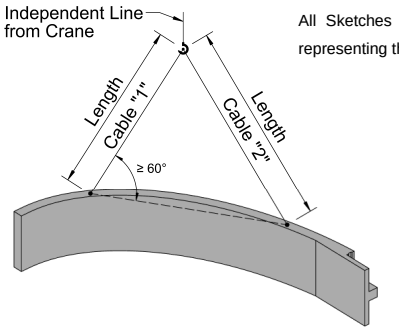
Span S	[m]	21.946
Rise R	[m]	7.569
Development D	[m]	30.212
Thickness t	[mm]	406
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.50
In-Situ Concrete per Ring	[m³]	0.98

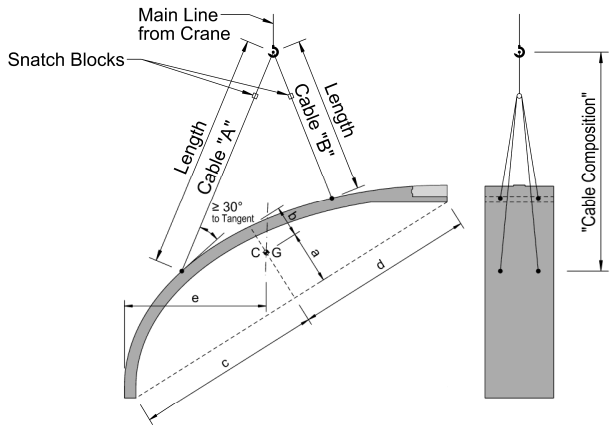
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	187.50 (18.8 metric tons)
Length Cable A	[m]*	8.70
Length Cable B	[m]*	6.30
Cable Force A	[kN]*	128.55
Cable Force B	[kN]*	74.53
Min. Length Cable 1&2	[m]	8.70
Cable Force 1&2	[kN]	108.25
Center of Gravity a	[m]	2.15
Center of Gravity b	[m]	1.14
Center of Gravity c	[m]	6.39
Center of Gravity d	[m]	6.94
Center of Gravity e	[m]	4.44

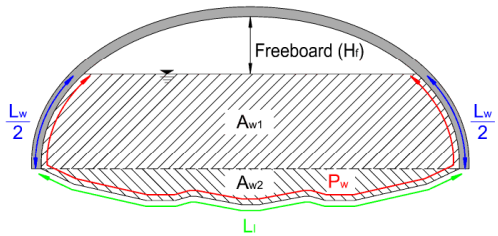


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	137.55	
1.0	128.11	17.48
2.0	113.70	13.26
3.0	96.28	10.10
4.0	76.82	7.50
5.0	56.01	5.22
6.0	34.40	3.14

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	92.7	159.4	111.2	191.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	50.6	687.5	58.6	851.4
LC41	0.6m OF + Single Axle C	54.0	702.5	64.3	876.9
LC42	0.6m OF + Single Axle Ecc	55.0	719.1	66.1	905.0
LC43	0.6m OF + Tandem C	55.6	708.7	67.1	887.4
LC44	0.6m OF + Tandem Ecc	57.5	738.5	70.4	938.1
LC50	1.0m OF Permanent Loads	57.5	770.3	67.2	954.9
LC51	1.0m OF + Single Axle C	60.5	787.6	72.4	984.3
LC52	1.0m OF + Single Axle Ecc	61.4	803.0	73.9	1010.5
LC53	1.0m OF + Tandem C	62.0	797.3	74.9	1000.8
LC54	1.0m OF + Tandem Ecc	63.5	822.4	77.5	1043.4
LC60	2.0m OF Permanent Loads	75.3	1010.6	89.5	1255.3
LC61	2.0m OF + Single Axle C	77.1	1027.3	92.6	1283.7
LC62	2.0m OF + Single Axle Ecc	77.7	1036.6	93.6	1299.5
LC63	2.0m OF + Tandem C	78.0	1035.5	94.1	1297.6
LC64	2.0m OF + Tandem Ecc	79.0	1051.8	95.9	1325.2
LC70	3.0m OF Permanent Loads	92.8	1260.3	111.4	1567.4
LC71	3.0m OF + Single Axle C	94.7	1275.2	114.6	1592.7
LC72	3.0m OF + Single Axle Ecc	95.0	1280.8	115.1	1602.3
LC73	3.0m OF + Tandem C	95.7	1282.5	116.3	1605.1
LC74	3.0m OF + Tandem Ecc	96.3	1293.2	117.3	1623.3
LC80	4.0m OF Permanent Loads	112.5	1515.3	136.0	1886.2
LC81	4.0m OF + Single Axle C	114.3	1528.8	139.0	1909.1
LC82	4.0m OF + Single Axle Ecc	114.4	1532.8	139.3	1915.9
LC83	4.0m OF + Tandem C	115.2	1535.3	140.6	1920.1
LC84	4.0m OF + Tandem Ecc	115.6	1542.8	141.2	1932.8
LC90	5.0m OF Permanent Loads	133.2	1773.4	161.9	2208.7
LC91	5.0m OF + Single Axle C	134.9	1785.0	164.7	2228.6
LC92	5.0m OF + Single Axle Ecc	135.0	1788.0	164.9	2233.6
LC93	5.0m OF + Tandem C	135.7	1790.6	166.2	2238.1
LC94	5.0m OF + Tandem Ecc	136.0	1796.2	166.6	2247.6

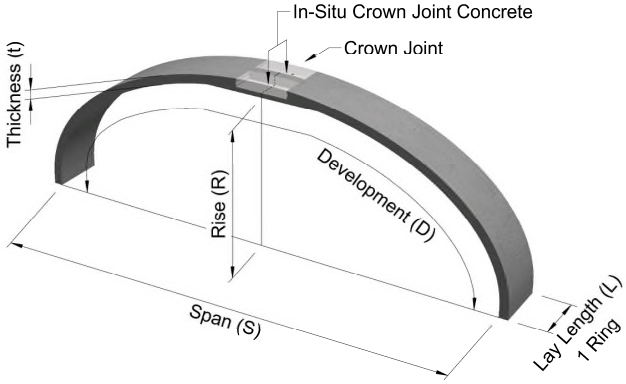
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E72T/6

Dimensions

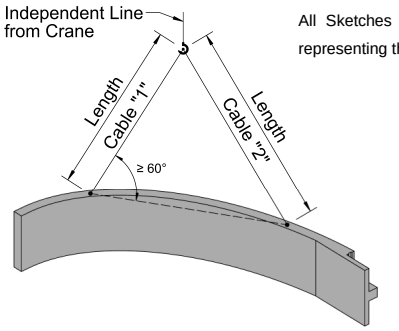
Span S	[m]	21.946
Rise R	[m]	7.874
Development D	[m]	30.821
Thickness t	[mm]	406
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.65
In-Situ Concrete per Ring	[m³]	0.98

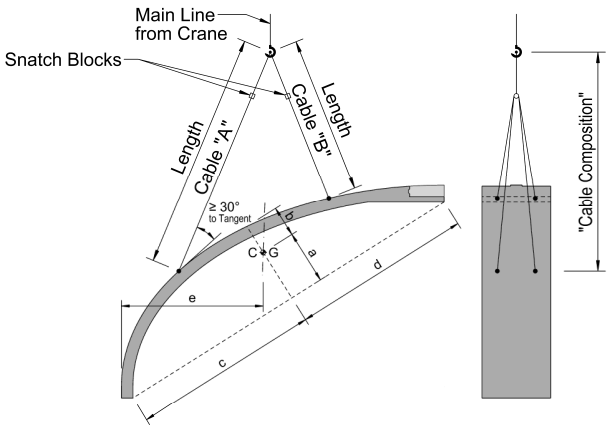
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	191.25 (19.1 metric tons)
Length Cable A	[m]*	8.50
Length Cable B	[m]*	6.20
Cable Force A	[kN]*	133.49
Cable Force B	[kN]*	74.80
Min. Length Cable 1&2	[m]	8.80
Cable Force 1&2	[kN]	110.42
Center of Gravity a	[m]	2.24
Center of Gravity b	[m]	1.20
Center of Gravity c	[m]	6.47
Center of Gravity d	[m]	7.03
Center of Gravity e	[m]	4.36

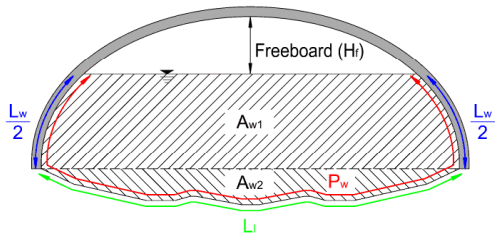


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	144.24	
1.0	134.80	18.08
2.0	120.40	13.86
3.0	102.97	10.70
4.0	83.51	8.10
5.0	62.70	5.84
6.0	41.09	3.72

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	89.3	162.3	107.1	194.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	33.3	697.1	37.2	863.2
LC41	0.6m OF + Single Axle C	35.7	711.0	41.2	886.9
LC42	0.6m OF + Single Axle Ecc	36.7	727.9	42.9	915.6
LC43	0.6m OF + Tandem C	36.8	717.0	43.1	897.1
LC44	0.6m OF + Tandem Ecc	38.6	747.1	46.1	948.3
LC50	1.0m OF Permanent Loads	38.0	779.8	43.0	966.6
LC51	1.0m OF + Single Axle C	40.1	796.4	46.7	994.9
LC52	1.0m OF + Single Axle Ecc	41.0	812.1	48.1	1021.5
LC53	1.0m OF + Tandem C	41.1	805.3	48.4	1010.0
LC54	1.0m OF + Tandem Ecc	42.6	830.7	50.8	1053.2
LC60	2.0m OF Permanent Loads	50.1	1019.5	58.2	1266.3
LC61	2.0m OF + Single Axle C	51.4	1035.4	60.3	1293.3
LC62	2.0m OF + Single Axle Ecc	51.9	1044.8	61.2	1309.3
LC63	2.0m OF + Tandem C	51.9	1043.0	61.2	1306.2
LC64	2.0m OF + Tandem Ecc	52.8	1059.4	62.8	1334.1
LC70	3.0m OF Permanent Loads	61.4	1268.2	72.3	1577.2
LC71	3.0m OF + Single Axle C	62.6	1282.8	74.3	1602.0
LC72	3.0m OF + Single Axle Ecc	62.9	1288.6	74.8	1611.8
LC73	3.0m OF + Tandem C	63.2	1289.9	75.3	1614.0
LC74	3.0m OF + Tandem Ecc	63.8	1300.8	76.3	1632.5
LC80	4.0m OF Permanent Loads	74.5	1523.5	88.6	1896.2
LC81	4.0m OF + Single Axle C	75.7	1536.6	90.7	1918.4
LC82	4.0m OF + Single Axle Ecc	75.9	1540.7	91.0	1925.4
LC83	4.0m OF + Tandem C	76.3	1542.7	91.8	1928.9
LC84	4.0m OF + Tandem Ecc	76.7	1550.3	92.4	1941.9
LC90	5.0m OF Permanent Loads	88.6	1781.7	106.2	2219.0
LC91	5.0m OF + Single Axle C	89.7	1793.0	108.1	2238.3
LC92	5.0m OF + Single Axle Ecc	89.8	1796.1	108.3	2243.4
LC93	5.0m OF + Tandem C	90.3	1798.4	109.1	2247.4
LC94	5.0m OF + Tandem Ecc	90.5	1804.1	109.5	2257.2

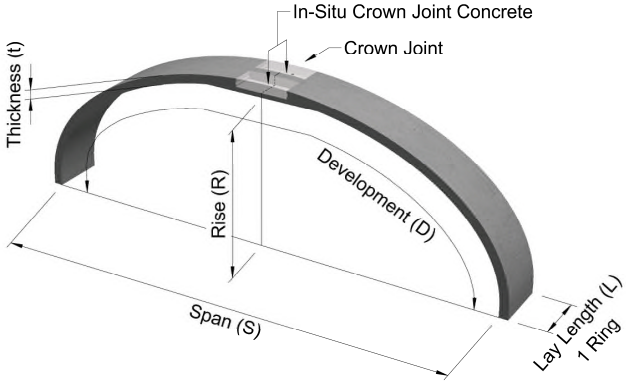
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/0

Dimensions

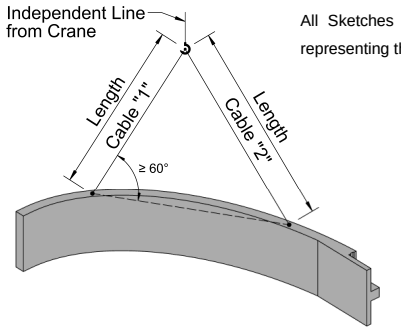
Span S	[m]	25.438
Rise R	[m]	6.960
Development D	[m]	31.379
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.75
In-Situ Concrete per Ring	[m³]	1.09

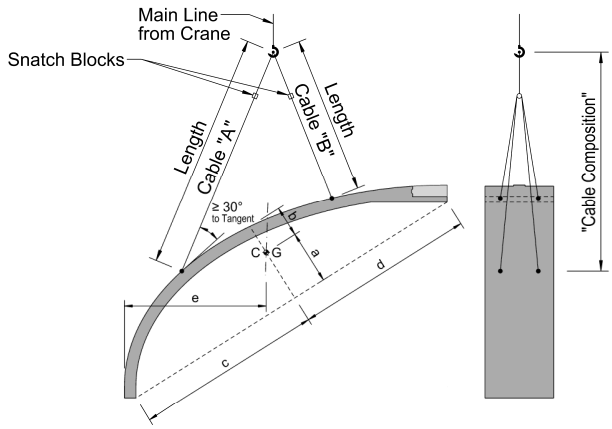
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	218.75 (21.9 metric tons)
Length Cable A	[m]*	17.20
Length Cable B	[m]*	13.40
Cable Force A	[kN]*	128.91
Cable Force B	[kN]*	99.63
Min. Length Cable 1&2	[m]	9.10
Cable Force 1&2	[kN]	126.30
Center of Gravity a	[m]	1.90
Center of Gravity b	[m]	1.01
Center of Gravity c	[m]	7.02
Center of Gravity d	[m]	7.48
Center of Gravity e	[m]	5.69

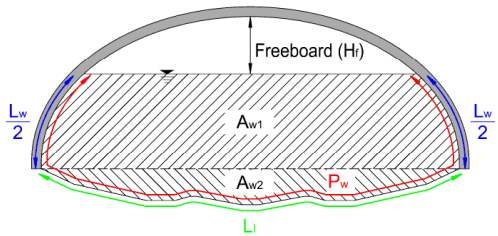


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	138.29	
1.0	128.11	17.64
2.0	112.45	13.06
3.0	93.38	9.58
4.0	71.88	6.70
5.0	48.64	4.22
6.0	24.19	2.00

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	146.4	184.1	175.7	220.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	197.4	842.1	239.4	1043.4
LC41	0.6m OF + Single Axle C	208.6	865.1	258.5	1082.5
LC42	0.6m OF + Single Axle Ecc	208.5	877.3	258.3	1103.2
LC43	0.6m OF + Tandem C	215.2	878.0	269.7	1104.4
LC44	0.6m OF + Tandem Ecc	215.5	899.0	270.2	1140.2
LC50	1.0m OF Permanent Loads	225.9	949.5	275.0	1177.6
LC51	1.0m OF + Single Axle C	235.8	971.7	291.8	1215.4
LC52	1.0m OF + Single Axle Ecc	236.1	983.6	292.5	1235.6
LC53	1.0m OF + Tandem C	241.6	984.1	301.8	1236.5
LC54	1.0m OF + Tandem Ecc	242.4	1003.7	303.2	1269.8
LC60	2.0m OF Permanent Loads	300.2	1239.2	367.9	1539.8
LC61	2.0m OF + Single Axle C	307.9	1255.2	381.0	1566.9
LC62	2.0m OF + Single Axle Ecc	308.2	1262.8	381.6	1580.0
LC63	2.0m OF + Tandem C	312.5	1264.8	388.9	1583.4
LC64	2.0m OF + Tandem Ecc	313.4	1278.2	390.4	1606.1
LC70	3.0m OF Permanent Loads	376.7	1529.4	463.5	1902.5
LC71	3.0m OF + Single Axle C	383.4	1543.8	474.9	1927.0
LC72	3.0m OF + Single Axle Ecc	383.4	1548.1	474.9	1934.3
LC73	3.0m OF + Tandem C	387.3	1552.0	481.6	1940.9
LC74	3.0m OF + Tandem Ecc	387.6	1560.5	482.2	1955.5
LC80	4.0m OF Permanent Loads	454.6	1820.9	560.9	2266.9
LC81	4.0m OF + Single Axle C	460.5	1835.7	571.0	2292.0
LC82	4.0m OF + Single Axle Ecc	460.4	1838.8	570.9	2297.4
LC83	4.0m OF + Tandem C	463.9	1843.2	576.8	2304.8
LC84	4.0m OF + Tandem Ecc	464.0	1849.1	576.9	2314.8
LC90	5.0m OF Permanent Loads	533.9	2118.0	660.1	2638.3
LC91	5.0m OF + Single Axle C	539.1	2130.5	668.9	2659.5
LC92	5.0m OF + Single Axle Ecc	539.0	2132.6	668.6	2663.0
LC93	5.0m OF + Tandem C	542.0	2136.8	673.8	2670.2
LC94	5.0m OF + Tandem Ecc	541.9	2141.0	673.7	2677.4

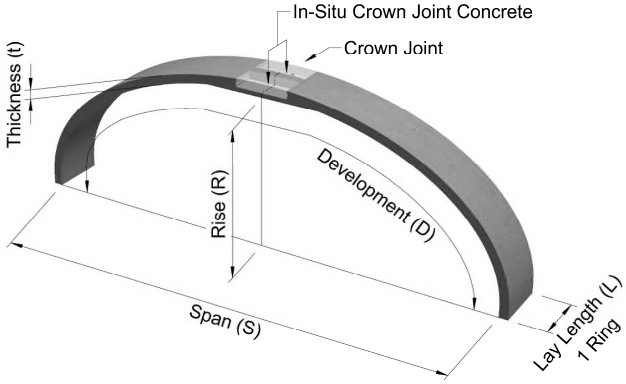
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/1

Dimensions

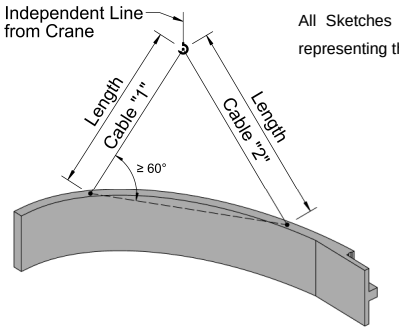
Span S	[m]	25.530
Rise R	[m]	7.264
Development D	[m]	31.995
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	8.93
In-Situ Concrete per Ring	[m³]	1.09

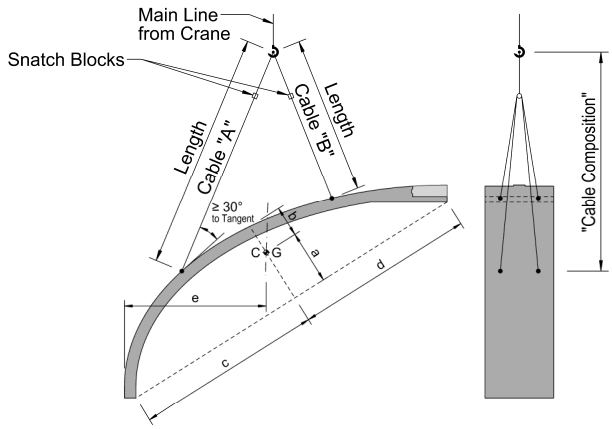
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	223.25 (22.3 metric tons)
Length Cable A	[m]*	16.60
Length Cable B	[m]*	13.00
Cable Force A	[kN]*	134.46
Cable Force B	[kN]*	98.83
Min. Length Cable 1&2	[m]	9.30
Cable Force 1&2	[kN]	128.89
Center of Gravity a	[m]	1.99
Center of Gravity b	[m]	1.05
Center of Gravity c	[m]	7.09
Center of Gravity d	[m]	7.59
Center of Gravity e	[m]	5.63

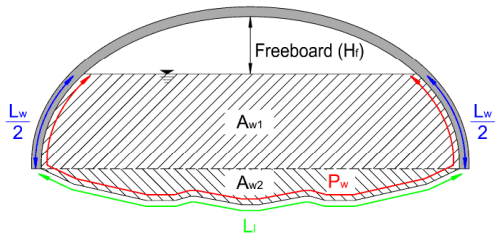


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	146.06	
1.0	135.88	18.26
2.0	120.22	13.66
3.0	101.15	10.18
4.0	79.65	7.32
5.0	56.41	4.84
6.0	31.96	2.62

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	141.5	187.6	169.8	225.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	174.9	854.1	211.5	1058.3
LC41	0.6m OF + Single Axle C	184.6	875.3	228.0	1094.3
LC42	0.6m OF + Single Axle Ecc	184.8	888.3	228.4	1116.3
LC43	0.6m OF + Tandem C	190.2	887.1	237.6	1114.3
LC44	0.6m OF + Tandem Ecc	191.1	909.6	239.0	1152.5
LC50	1.0m OF Permanent Loads	200.0	960.6	242.9	1191.4
LC51	1.0m OF + Single Axle C	208.6	981.6	257.6	1227.0
LC52	1.0m OF + Single Axle Ecc	209.2	994.2	258.6	1248.4
LC53	1.0m OF + Tandem C	213.7	993.3	266.2	1246.9
LC54	1.0m OF + Tandem Ecc	214.9	1014.0	268.2	1282.1
LC60	2.0m OF Permanent Loads	266.8	1250.0	326.4	1553.1
LC61	2.0m OF + Single Axle C	273.7	1265.0	338.2	1578.6
LC62	2.0m OF + Single Axle Ecc	274.2	1273.1	339.0	1592.4
LC63	2.0m OF + Tandem C	277.9	1274.1	345.3	1594.0
LC64	2.0m OF + Tandem Ecc	279.0	1288.3	347.2	1618.1
LC70	3.0m OF Permanent Loads	337.2	1539.1	414.4	1914.5
LC71	3.0m OF + Single Axle C	343.6	1553.4	425.3	1938.8
LC72	3.0m OF + Single Axle Ecc	343.7	1558.0	425.4	1946.6
LC73	3.0m OF + Tandem C	347.2	1561.0	431.5	1951.7
LC74	3.0m OF + Tandem Ecc	347.8	1570.2	432.4	1967.4
LC80	4.0m OF Permanent Loads	410.0	1830.6	505.4	2278.9
LC81	4.0m OF + Single Axle C	415.6	1844.7	515.0	2302.8
LC82	4.0m OF + Single Axle Ecc	415.7	1848.0	515.0	2308.5
LC83	4.0m OF + Tandem C	418.8	1851.6	520.3	2314.6
LC84	4.0m OF + Tandem Ecc	419.0	1858.0	520.7	2325.4
LC90	5.0m OF Permanent Loads	483.7	2128.0	597.5	2650.7
LC91	5.0m OF + Single Axle C	488.5	2140.2	605.7	2671.4
LC92	5.0m OF + Single Axle Ecc	488.4	2142.5	605.6	2675.3
LC93	5.0m OF + Tandem C	491.2	2146.3	610.3	2681.7
LC94	5.0m OF + Tandem Ecc	491.3	2150.9	610.5	2689.6

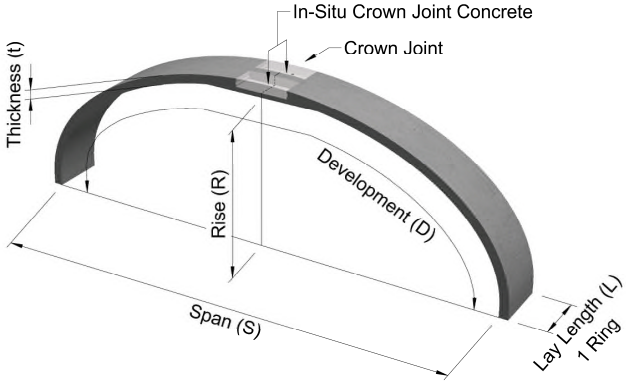
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/2

Dimensions

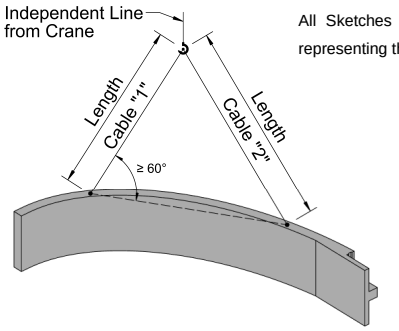
Span S	[m]	25.584
Rise R	[m]	7.569
Development D	[m]	32.608
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.10
In-Situ Concrete per Ring	[m³]	1.09

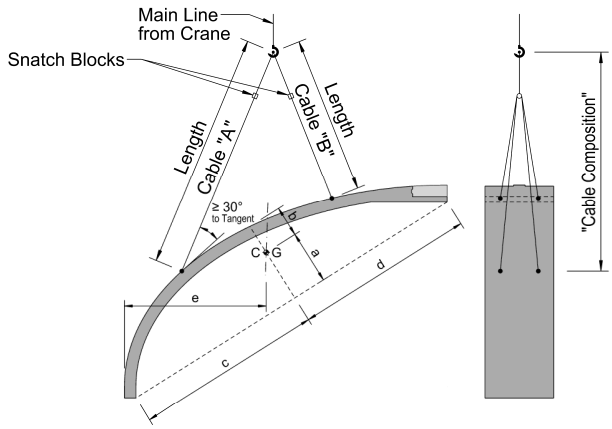
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	227.50 (22.8 metric tons)
Length Cable A	[m]*	16.20
Length Cable B	[m]*	12.60
Cable Force A	[kN]*	141.94
Cable Force B	[kN]*	97.37
Min. Length Cable 1&2	[m]	9.50
Cable Force 1&2	[kN]	131.35
Center of Gravity a	[m]	2.08
Center of Gravity b	[m]	1.10
Center of Gravity c	[m]	7.16
Center of Gravity d	[m]	7.70
Center of Gravity e	[m]	5.56

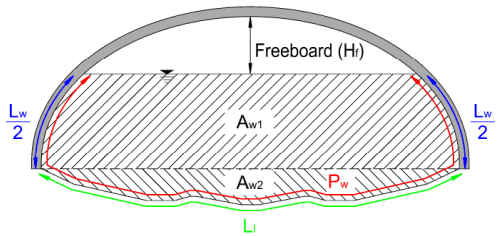


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	153.85	
1.0	143.67	18.88
2.0	128.01	14.28
3.0	108.94	10.80
4.0	87.44	7.94
5.0	64.20	5.46
6.0	39.75	3.24

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	136.6	191.1	163.9	229.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	150.1	863.9	180.7	1070.3
LC41	0.6m OF + Single Axle C	158.0	882.7	194.3	1102.3
LC42	0.6m OF + Single Axle Ecc	158.5	896.6	195.2	1125.9
LC43	0.6m OF + Tandem C	162.6	893.0	202.1	1119.9
LC44	0.6m OF + Tandem Ecc	163.9	917.3	204.2	1161.2
LC50	1.0m OF Permanent Loads	171.2	968.5	207.2	1201.1
LC51	1.0m OF + Single Axle C	178.2	987.7	219.1	1233.7
LC52	1.0m OF + Single Axle Ecc	179.0	1001.2	220.5	1256.6
LC53	1.0m OF + Tandem C	182.4	998.3	226.2	1251.7
LC54	1.0m OF + Tandem Ecc	183.8	1020.4	228.6	1289.3
LC60	2.0m OF Permanent Loads	227.3	1254.7	277.3	1558.8
LC61	2.0m OF + Single Axle C	232.9	1268.5	286.8	1582.3
LC62	2.0m OF + Single Axle Ecc	233.5	1277.1	287.8	1596.9
LC63	2.0m OF + Tandem C	236.3	1276.9	292.6	1596.5
LC64	2.0m OF + Tandem Ecc	237.5	1292.0	294.7	1622.2
LC70	3.0m OF Permanent Loads	286.7	1541.9	351.6	1917.9
LC71	3.0m OF + Single Axle C	292.0	1555.2	360.6	1940.5
LC72	3.0m OF + Single Axle Ecc	292.2	1560.2	360.9	1948.9
LC73	3.0m OF + Tandem C	295.1	1562.5	365.7	1952.8
LC74	3.0m OF + Tandem Ecc	295.7	1572.3	366.9	1969.5
LC80	4.0m OF Permanent Loads	348.6	1832.2	429.0	2280.7
LC81	4.0m OF + Single Axle C	353.4	1846.2	437.1	2304.5
LC82	4.0m OF + Single Axle Ecc	353.5	1849.9	437.2	2310.7
LC83	4.0m OF + Tandem C	356.0	1853.1	441.5	2316.2
LC84	4.0m OF + Tandem Ecc	356.4	1860.0	442.1	2328.0
LC90	5.0m OF Permanent Loads	411.7	2130.0	507.8	2653.0
LC91	5.0m OF + Single Axle C	415.8	2142.2	514.7	2673.6
LC92	5.0m OF + Single Axle Ecc	415.8	2144.8	514.7	2678.0
LC93	5.0m OF + Tandem C	418.0	2148.3	518.5	2684.1
LC94	5.0m OF + Tandem Ecc	418.2	2153.4	518.9	2692.7

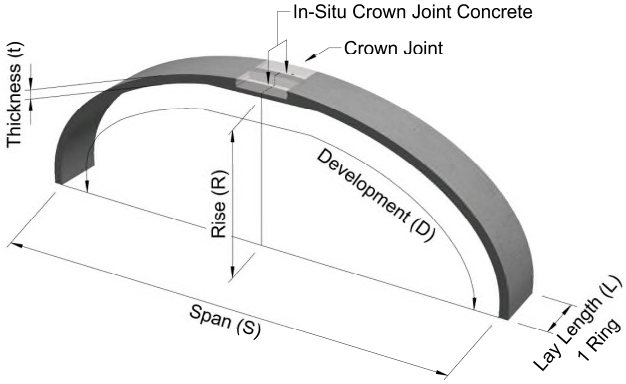
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/3

Dimensions

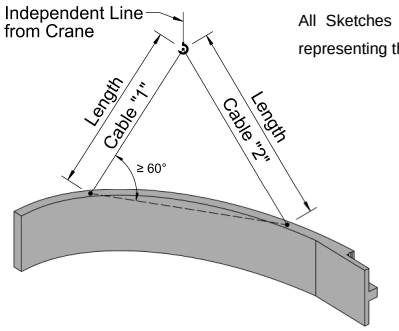
Span S	[m]	25.604
Rise R	[m]	7.874
Development D	[m]	33.217
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.28
In-Situ Concrete per Ring	[m³]	1.09

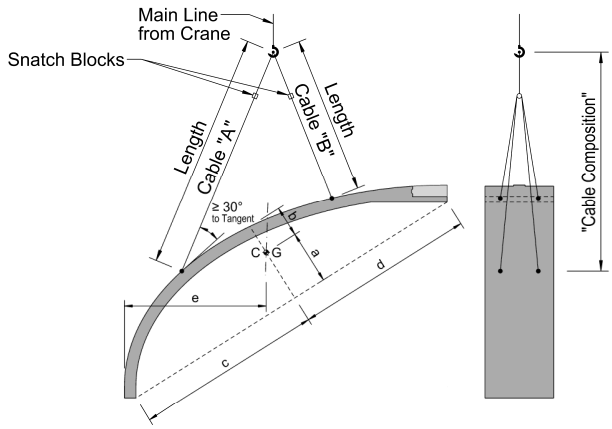
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	232.00 (23.2 metric tons)
Length Cable A	[m]*	15.70
Length Cable B	[m]*	12.20
Cable Force A	[kN]*	147.74
Cable Force B	[kN]*	96.85
Min. Length Cable 1&2	[m]	9.60
Cable Force 1&2	[kN]	133.95
Center of Gravity a	[m]	2.18
Center of Gravity b	[m]	1.15
Center of Gravity c	[m]	7.22
Center of Gravity d	[m]	7.80
Center of Gravity e	[m]	5.47

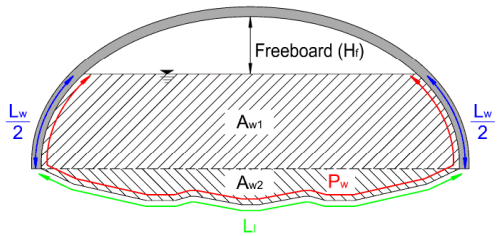


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	161.65	
1.0	151.47	19.48
2.0	135.82	14.90
3.0	116.74	11.42
4.0	95.24	8.54
5.0	72.00	6.06
6.0	47.55	3.84

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	131.6	194.6	157.9	233.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	123.9	871.5	148.3	1079.6
LC41	0.6m OF + Single Axle C	130.3	887.9	159.1	1107.5
LC42	0.6m OF + Single Axle Ecc	131.0	902.8	160.3	1132.9
LC43	0.6m OF + Tandem C	133.9	896.7	165.3	1122.5
LC44	0.6m OF + Tandem Ecc	135.4	922.7	167.9	1166.6
LC50	1.0m OF Permanent Loads	141.1	973.8	169.8	1207.6
LC51	1.0m OF + Single Axle C	146.8	991.1	179.5	1236.8
LC52	1.0m OF + Single Axle Ecc	147.7	1005.4	181.0	1261.2
LC53	1.0m OF + Tandem C	150.1	1000.5	185.0	1252.9
LC54	1.0m OF + Tandem Ecc	151.6	1023.8	187.7	1292.5
LC60	2.0m OF Permanent Loads	186.5	1254.6	226.5	1558.6
LC61	2.0m OF + Single Axle C	190.9	1267.5	234.1	1580.4
LC62	2.0m OF + Single Axle Ecc	191.6	1276.6	235.2	1595.9
LC63	2.0m OF + Tandem C	193.6	1275.1	238.6	1593.3
LC64	2.0m OF + Tandem Ecc	194.9	1291.0	240.8	1620.4
LC70	3.0m OF Permanent Loads	234.9	1539.5	287.1	1914.6
LC71	3.0m OF + Single Axle C	239.0	1552.3	294.1	1936.5
LC72	3.0m OF + Single Axle Ecc	239.3	1557.7	294.5	1945.5
LC73	3.0m OF + Tandem C	241.4	1559.7	298.1	1948.9
LC74	3.0m OF + Tandem Ecc	242.1	1570.2	299.3	1966.8
LC80	4.0m OF Permanent Loads	285.2	1830.8	349.9	2278.7
LC81	4.0m OF + Single Axle C	289.0	1844.7	356.3	2302.4
LC82	4.0m OF + Single Axle Ecc	289.1	1848.6	356.6	2309.1
LC83	4.0m OF + Tandem C	291.0	1851.9	359.8	2314.7
LC84	4.0m OF + Tandem Ecc	291.5	1859.3	360.6	2327.3
LC90	5.0m OF Permanent Loads	336.8	2130.8	414.4	2653.7
LC91	5.0m OF + Single Axle C	340.1	2143.4	420.0	2675.2
LC92	5.0m OF + Single Axle Ecc	340.2	2146.3	420.1	2680.1
LC93	5.0m OF + Tandem C	341.9	2149.8	423.1	2686.1
LC94	5.0m OF + Tandem Ecc	342.2	2155.3	423.5	2695.4

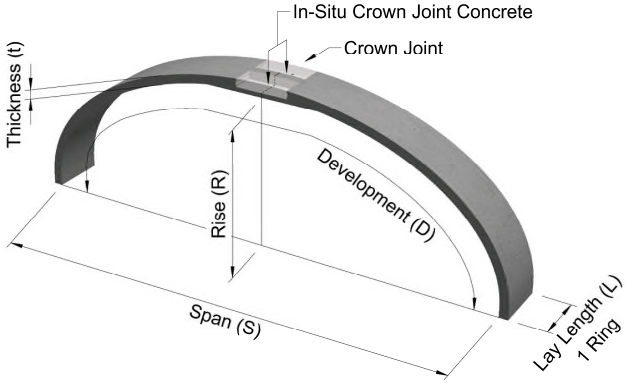
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/4

Dimensions

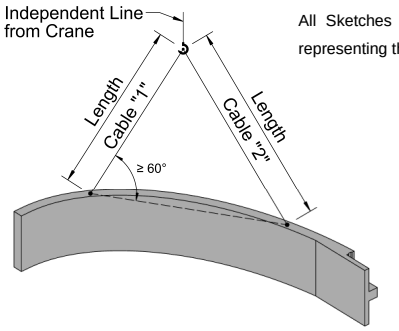
Span S	[m]	25.604
Rise R	[m]	8.179
Development D	[m]	33.827
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.45
In-Situ Concrete per Ring	[m³]	1.09

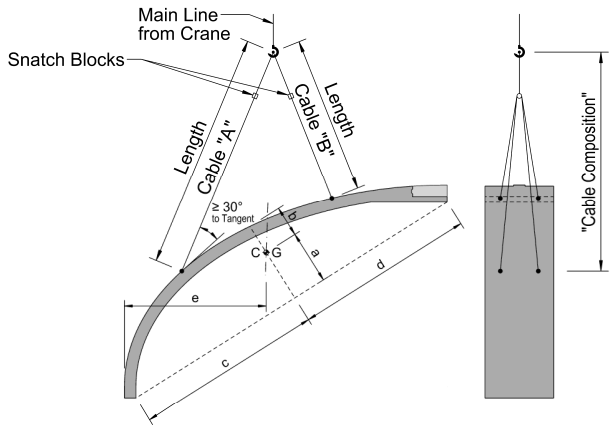
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	236.25 (23.6 metric tons)
Length Cable A	[m]*	15.30
Length Cable B	[m]*	11.80
Cable Force A	[kN]*	152.56
Cable Force B	[kN]*	95.84
Min. Length Cable 1&2	[m]	9.80
Cable Force 1&2	[kN]	136.40
Center of Gravity a	[m]	2.27
Center of Gravity b	[m]	1.20
Center of Gravity c	[m]	7.29
Center of Gravity d	[m]	7.90
Center of Gravity e	[m]	5.37

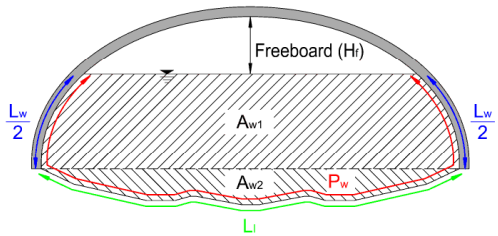


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	169.45	
1.0	159.27	20.10
2.0	143.62	15.50
3.0	124.54	12.02
4.0	103.05	9.16
5.0	79.81	6.68
6.0	55.35	4.44

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	126.9	198.0	152.3	237.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	100.4	877.7	119.2	1087.2
LC41	0.6m OF + Single Axle C	105.4	891.9	127.7	1111.3
LC42	0.6m OF + Single Axle Ecc	106.3	907.6	129.1	1138.1
LC43	0.6m OF + Tandem C	108.2	899.4	132.5	1124.1
LC44	0.6m OF + Tandem Ecc	109.9	926.7	135.3	1170.5
LC50	1.0m OF Permanent Loads	114.2	977.8	136.4	1212.4
LC51	1.0m OF + Single Axle C	118.7	993.4	144.0	1238.8
LC52	1.0m OF + Single Axle Ecc	119.6	1008.3	145.6	1264.2
LC53	1.0m OF + Tandem C	121.2	1001.9	148.4	1253.2
LC54	1.0m OF + Tandem Ecc	122.9	1026.2	151.1	1294.6
LC60	2.0m OF Permanent Loads	150.4	1254.1	181.6	1557.7
LC61	2.0m OF + Single Axle C	153.7	1266.5	187.2	1578.8
LC62	2.0m OF + Single Axle Ecc	154.3	1275.9	188.3	1594.9
LC63	2.0m OF + Tandem C	155.6	1274.3	190.5	1592.0
LC64	2.0m OF + Tandem Ecc	156.9	1290.8	192.7	1620.1
LC70	3.0m OF Permanent Loads	188.7	1539.4	229.5	1914.4
LC71	3.0m OF + Single Axle C	191.8	1552.7	234.8	1937.0
LC72	3.0m OF + Single Axle Ecc	192.1	1558.3	235.3	1946.4
LC73	3.0m OF + Tandem C	193.5	1560.4	237.7	1950.1
LC74	3.0m OF + Tandem Ecc	194.3	1571.4	239.0	1968.7
LC80	4.0m OF Permanent Loads	228.7	1832.8	279.5	2281.1
LC81	4.0m OF + Single Axle C	231.6	1846.4	284.6	2304.3
LC82	4.0m OF + Single Axle Ecc	231.8	1850.6	284.9	2311.4
LC83	4.0m OF + Tandem C	233.3	1853.4	287.3	2316.0
LC84	4.0m OF + Tandem Ecc	233.7	1861.1	288.1	2329.3
LC90	5.0m OF Permanent Loads	270.4	2132.1	331.7	2655.3
LC91	5.0m OF + Single Axle C	273.1	2144.2	336.3	2675.7
LC92	5.0m OF + Single Axle Ecc	273.2	2147.3	336.5	2681.0
LC93	5.0m OF + Tandem C	274.6	2150.2	338.8	2686.0
LC94	5.0m OF + Tandem Ecc	274.9	2156.0	339.3	2695.8

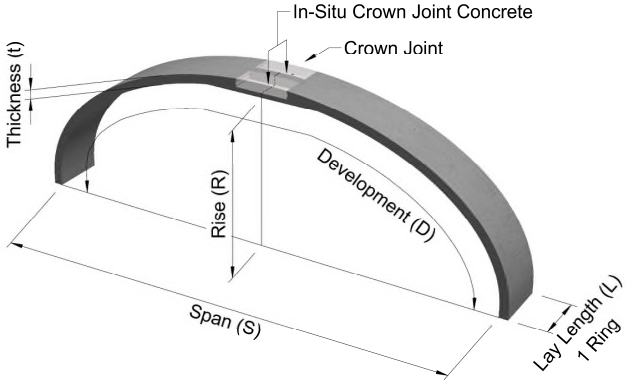
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/5

Dimensions

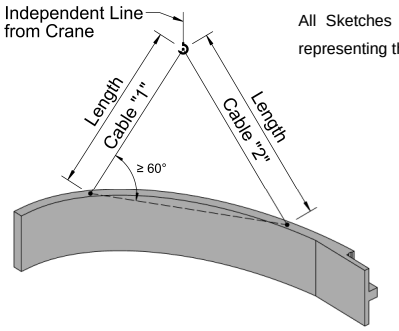
Span S	[m]	25.604
Rise R	[m]	8.484
Development D	[m]	34.436
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.61
In-Situ Concrete per Ring	[m³]	1.09

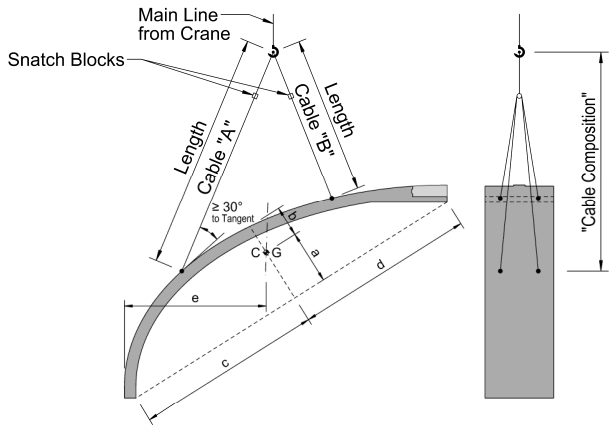
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	240.25 (24.0 metric tons)
Length Cable A	[m]*	14.90
Length Cable B	[m]*	11.50
Cable Force A	[kN]*	158.96
Cable Force B	[kN]*	95.30
Min. Length Cable 1&2	[m]	9.90
Cable Force 1&2	[kN]	138.71
Center of Gravity a	[m]	2.37
Center of Gravity b	[m]	1.25
Center of Gravity c	[m]	7.36
Center of Gravity d	[m]	7.99
Center of Gravity e	[m]	5.28

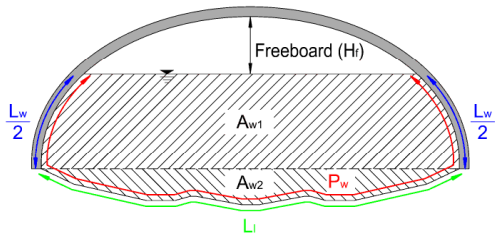


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	177.26	
1.0	167.08	10.70
2.0	151.42	16.10
3.0	132.35	12.64
4.0	110.85	9.76
5.0	87.61	7.28
6.0	63.16	5.06

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	122.6	201.3	147.1	241.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	78.5	885.6	92.0	1096.9
LC41	0.6m OF + Single Axle C	82.3	898.0	98.5	1118.0
LC42	0.6m OF + Single Axle Ecc	83.2	914.3	100.0	1145.7
LC43	0.6m OF + Tandem C	84.5	904.5	102.2	1129.0
LC44	0.6m OF + Tandem Ecc	86.2	932.8	105.1	1177.1
LC50	1.0m OF Permanent Loads	89.2	984.0	105.4	1220.0
LC51	1.0m OF + Single Axle C	92.7	998.1	111.3	1243.9
LC52	1.0m OF + Single Axle Ecc	93.7	1013.5	113.0	1270.0
LC53	1.0m OF + Tandem C	94.7	1005.6	114.7	1256.7
LC54	1.0m OF + Tandem Ecc	96.3	1030.6	117.4	1299.1
LC60	2.0m OF Permanent Loads	117.5	1258.4	140.7	1563.0
LC61	2.0m OF + Single Axle C	119.6	1270.6	144.3	1583.6
LC62	2.0m OF + Single Axle Ecc	120.2	1280.3	145.4	1600.2
LC63	2.0m OF + Tandem C	120.9	1278.1	146.5	1596.4
LC64	2.0m OF + Tandem Ecc	122.0	1295.0	148.5	1625.2
LC70	3.0m OF Permanent Loads	146.0	1544.0	176.4	1919.9
LC71	3.0m OF + Single Axle C	148.3	1557.0	180.2	1942.0
LC72	3.0m OF + Single Axle Ecc	148.6	1562.7	180.7	1951.7
LC73	3.0m OF + Tandem C	149.6	1564.3	182.4	1954.4
LC74	3.0m OF + Tandem Ecc	150.3	1575.6	183.6	1973.6
LC80	4.0m OF Permanent Loads	176.7	1837.0	214.8	2286.1
LC81	4.0m OF + Single Axle C	179.0	1850.4	218.7	2309.0
LC82	4.0m OF + Single Axle Ecc	179.2	1854.8	219.0	2316.4
LC83	4.0m OF + Tandem C	180.3	1857.2	220.8	2320.5
LC84	4.0m OF + Tandem Ecc	180.7	1865.2	221.6	2334.1
LC90	5.0m OF Permanent Loads	209.3	2136.4	255.5	2660.4
LC91	5.0m OF + Single Axle C	211.4	2148.3	259.1	2680.7
LC92	5.0m OF + Single Axle Ecc	211.6	2151.5	259.4	2686.2
LC93	5.0m OF + Tandem C	212.6	2154.2	261.1	2690.7
LC94	5.0m OF + Tandem Ecc	212.9	2160.2	261.6	2700.9

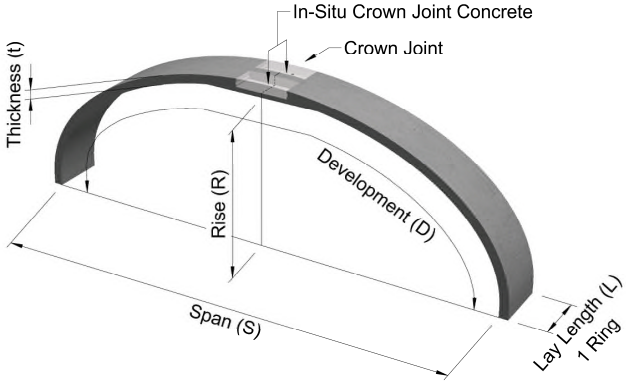
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/6

Dimensions

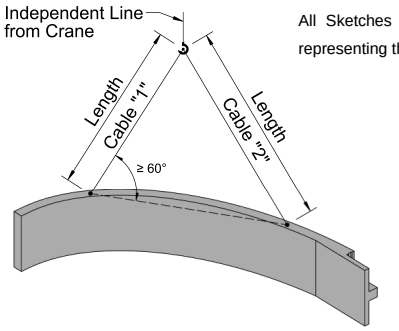
Span S	[m]	25.604
Rise R	[m]	8.788
Development D	[m]	35.046
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.78
In-Situ Concrete per Ring	[m³]	1.09

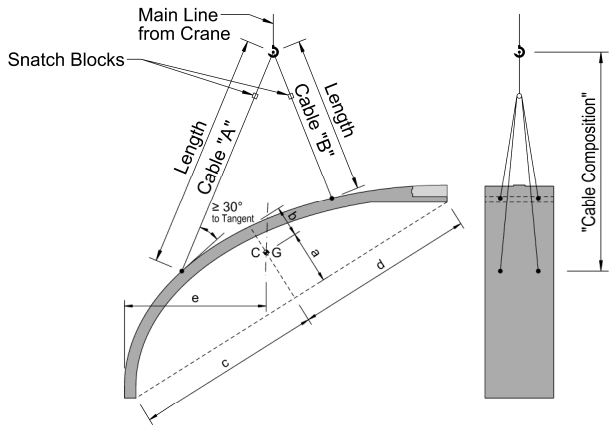
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	244.50 (24.4 metric tons)
Length Cable A	[m]*	14.50
Length Cable B	[m]*	11.20
Cable Force A	[kN]*	166.20
Cable Force B	[kN]*	93.19
Min. Length Cable 1&2	[m]	10.10
Cable Force 1&2	[kN]	141.16
Center of Gravity a	[m]	2.46
Center of Gravity b	[m]	1.30
Center of Gravity c	[m]	7.44
Center of Gravity d	[m]	8.08
Center of Gravity e	[m]	5.20

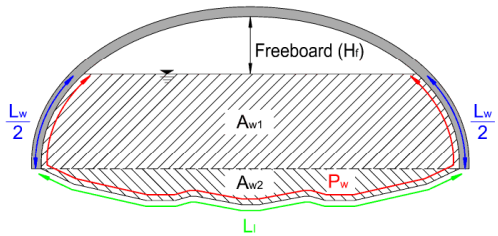


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	185.06	
1.0	174.88	21.32
2.0	159.23	16.72
3.0	140.15	13.24
4.0	118.66	10.38
5.0	95.42	7.90
6.0	70.96	5.66

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	118.5	204.7	142.2	245.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	57.6	895.4	66.1	1109.0
LC41	0.6m OF + Single Axle C	60.5	906.4	70.9	1127.7
LC42	0.6m OF + Single Axle Ecc	61.4	923.0	72.6	1156.0
LC43	0.6m OF + Tandem C	62.1	911.8	73.7	1136.9
LC44	0.6m OF + Tandem Ecc	63.8	940.7	76.6	1186.1
LC50	1.0m OF Permanent Loads	65.8	992.4	76.3	1230.3
LC51	1.0m OF + Single Axle C	68.4	1005.6	80.8	1252.6
LC52	1.0m OF + Single Axle Ecc	69.3	1021.3	82.3	1279.4
LC53	1.0m OF + Tandem C	69.8	1012.8	83.2	1264.8
LC54	1.0m OF + Tandem Ecc	71.4	1038.2	85.8	1308.1
LC60	2.0m OF Permanent Loads	87.0	1266.3	102.9	1572.7
LC61	2.0m OF + Single Axle C	88.5	1277.9	105.4	1592.3
LC62	2.0m OF + Single Axle Ecc	89.1	1287.8	106.4	1609.1
LC63	2.0m OF + Tandem C	89.3	1285.3	106.7	1604.8
LC64	2.0m OF + Tandem Ecc	90.4	1302.5	108.6	1634.1
LC70	3.0m OF Permanent Loads	107.5	1551.7	128.4	1929.4
LC71	3.0m OF + Single Axle C	109.0	1563.9	131.1	1950.2
LC72	3.0m OF + Single Axle Ecc	109.4	1569.8	131.6	1960.2
LC73	3.0m OF + Tandem C	109.9	1571.0	132.6	1962.2
LC74	3.0m OF + Tandem Ecc	110.6	1582.5	133.8	1981.7
LC80	4.0m OF Permanent Loads	130.2	1843.9	156.8	2294.6
LC81	4.0m OF + Single Axle C	131.9	1856.8	159.7	2316.6
LC82	4.0m OF + Single Axle Ecc	132.1	1861.3	160.1	2324.3
LC83	4.0m OF + Tandem C	132.8	1863.3	161.3	2327.7
LC84	4.0m OF + Tandem Ecc	133.3	1871.6	162.0	2341.7
LC90	5.0m OF Permanent Loads	154.8	2143.0	187.5	2668.5
LC91	5.0m OF + Single Axle C	156.4	2154.8	190.2	2688.6
LC92	5.0m OF + Single Axle Ecc	156.5	2158.1	190.5	2694.3
LC93	5.0m OF + Tandem C	157.2	2160.6	191.7	2698.4
LC94	5.0m OF + Tandem Ecc	157.5	2166.7	192.2	2708.8

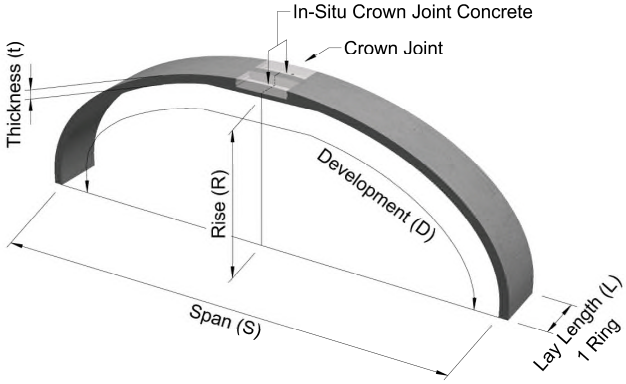
(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

E84T/7

Dimensions

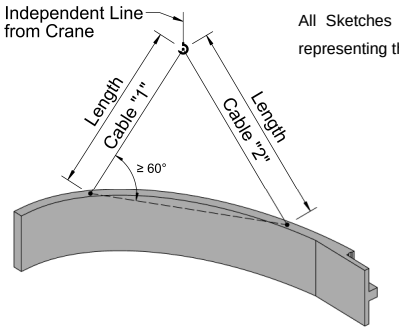
Span S	[m]	25.604
Rise R	[m]	9.093
Development D	[m]	35.656
Thickness t	[mm]	475
Lay Length L	[m]	1.207
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	9.95
In-Situ Concrete per Ring	[m³]	1.09

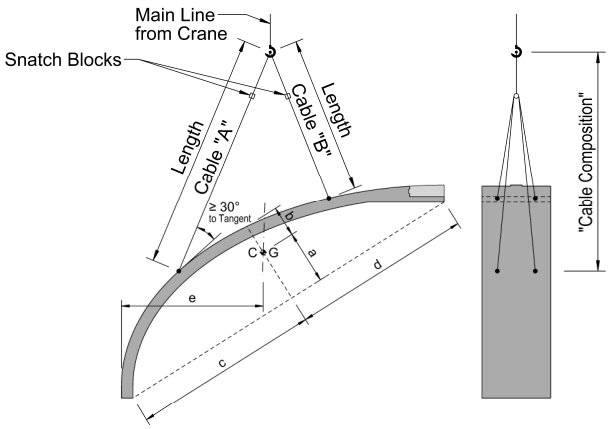
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

Arch Element Weight	[kN]	248.75 (24.9 metric tons)
Length Cable A	[m]*	14.20
Length Cable B	[m]*	10.90
Cable Force A	[kN]*	171.15
Cable Force B	[kN]*	92.48
Min. Length Cable 1&2	[m]	10.20
Cable Force 1&2	[kN]	143.62
Center of Gravity a	[m]	2.55
Center of Gravity b	[m]	1.35
Center of Gravity c	[m]	7.52
Center of Gravity d	[m]	8.17
Center of Gravity e	[m]	5.11

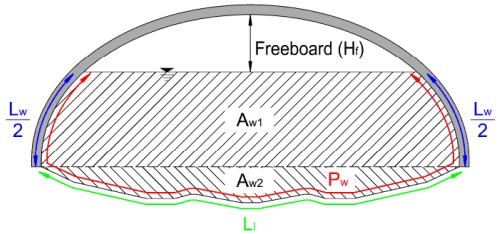


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	192.86	
1.0	182.68	21.92
2.0	167.03	17.32
3.0	147.96	13.48
4.0	126.46	10.98
5.0	103.22	8.50
6.0	78.77	6.28

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	114.7	208.0	137.7	249.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	38.5	906.2	42.3	1122.4
LC41	0.6m OF + Single Axle C	40.5	916.4	45.9	1139.7
LC42	0.6m OF + Single Axle Ecc	41.5	933.4	47.5	1168.6
LC43	0.6m OF + Tandem C	41.7	921.2	47.8	1147.9
LC44	0.6m OF + Tandem Ecc	43.4	950.7	50.7	1197.9
LC50	1.0m OF Permanent Loads	44.4	1002.9	49.7	1243.2
LC51	1.0m OF + Single Axle C	46.3	1015.4	53.0	1264.4
LC52	1.0m OF + Single Axle Ecc	47.1	1031.3	54.4	1291.6
LC53	1.0m OF + Tandem C	47.3	1022.3	54.6	1276.1
LC54	1.0m OF + Tandem Ecc	48.7	1048.1	57.1	1320.1
LC60	2.0m OF Permanent Loads	59.7	1276.6	68.9	1585.3
LC61	2.0m OF + Single Axle C	60.6	1287.5	70.5	1603.8
LC62	2.0m OF + Single Axle Ecc	61.2	1297.4	71.4	1620.8
LC63	2.0m OF + Tandem C	61.1	1294.5	71.3	1615.8
LC64	2.0m OF + Tandem Ecc	62.1	1312.0	73.0	1645.5
LC70	3.0m OF Permanent Loads	73.7	1561.5	86.4	1941.5
LC71	3.0m OF + Single Axle C	74.6	1573.4	88.0	1961.6
LC72	3.0m OF + Single Axle Ecc	74.9	1579.4	88.5	1971.9
LC73	3.0m OF + Tandem C	75.2	1580.0	88.9	1972.9
LC74	3.0m OF + Tandem Ecc	75.8	1591.7	90.0	1992.7
LC80	4.0m OF Permanent Loads	89.4	1853.0	106.0	2305.9
LC81	4.0m OF + Single Axle C	90.6	1865.6	108.1	2327.2
LC82	4.0m OF + Single Axle Ecc	90.8	1870.2	108.4	2335.0
LC83	4.0m OF + Tandem C	91.2	1871.9	109.1	2338.0
LC84	4.0m OF + Tandem Ecc	91.7	1880.3	109.9	2352.2
LC90	5.0m OF Permanent Loads	107.0	2152.2	128.0	2679.8
LC91	5.0m OF + Single Axle C	108.1	2163.6	129.9	2699.2
LC92	5.0m OF + Single Axle Ecc	108.3	2167.0	130.2	2705.1
LC93	5.0m OF + Tandem C	108.7	2169.2	130.9	2708.7
LC94	5.0m OF + Tandem Ecc	109.0	2175.4	131.4	2719.4

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

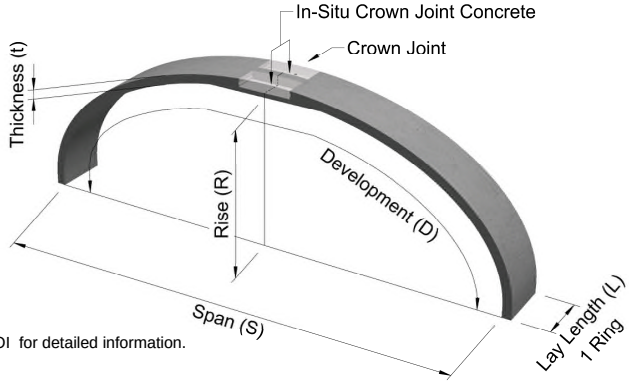
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/0

Dimensions

Span S	[m]	8.960
Rise R	[m]	3.454
Development D	[m]	12.482
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

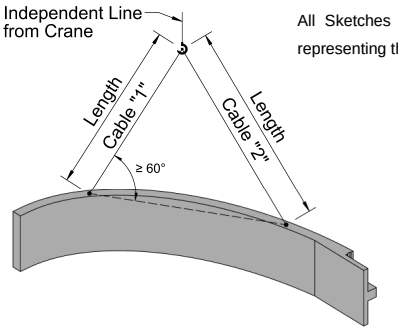


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.87
In-Situ Concrete per Ring	[m³]	1.08

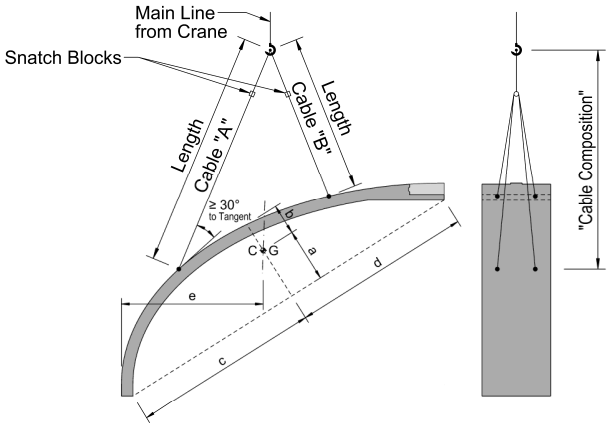
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

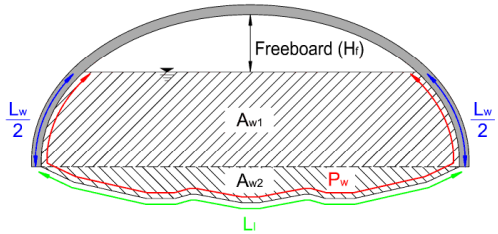
Arch Element Weight	[kN]	96.75 (9.7 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	2.90
Cable Force A	[kN]*	67.43
Cable Force B	[kN]*	33.15
Min. Length Cable 1&2	[m]	3.70
Cable Force 1&2	[kN]	55.86
Center of Gravity a	[m]	0.87
Center of Gravity b	[m]	0.49
Center of Gravity c	[m]	2.80
Center of Gravity d	[m]	2.85
Center of Gravity e	[m]	1.94



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	24.16	
1.0	19.42	5.74
2.0	12.34	3.14
3.0	4.02	0.94



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	24.4	43.7	29.2	52.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	31.3	216.5	37.9	268.4
LC41	0.6m OF + Single Axle C	44.5	247.1	60.3	320.5
LC42	0.6m OF + Single Axle Ecc	44.0	254.4	59.5	332.9
LC43	0.6m OF + Tandem C	51.5	258.4	72.2	339.6
LC44	0.6m OF + Tandem Ecc	50.9	275.2	71.2	368.2
LC50	1.0m OF Permanent Loads	40.1	248.7	48.8	308.7
LC51	1.0m OF + Single Axle C	50.7	275.3	67.0	353.9
LC52	1.0m OF + Single Axle Ecc	50.4	285.0	66.5	370.4
LC53	1.0m OF + Tandem C	57.0	290.7	77.6	380.0
LC54	1.0m OF + Tandem Ecc	56.7	306.1	77.1	406.2
LC60	2.0m OF Permanent Loads	65.1	362.7	80.1	451.2
LC61	2.0m OF + Single Axle C	72.3	381.9	92.4	483.7
LC62	2.0m OF + Single Axle Ecc	72.1	388.0	92.1	494.2
LC63	2.0m OF + Tandem C	76.4	392.8	99.4	502.3
LC64	2.0m OF + Tandem Ecc	76.3	403.0	99.2	519.6
LC70	3.0m OF Permanent Loads	90.1	478.1	111.5	595.4
LC71	3.0m OF + Single Axle C	95.6	493.4	120.8	621.5
LC72	3.0m OF + Single Axle Ecc	95.2	496.8	120.1	627.3
LC73	3.0m OF + Tandem C	98.8	502.2	126.1	636.3
LC74	3.0m OF + Tandem Ecc	98.3	508.1	125.4	646.4
LC80	4.0m OF Permanent Loads	115.6	595.1	143.3	741.7
LC81	4.0m OF + Single Axle C	119.9	607.6	150.6	762.9
LC82	4.0m OF + Single Axle Ecc	119.5	609.6	149.8	766.3
LC83	4.0m OF + Tandem C	122.4	614.8	154.8	775.2
LC84	4.0m OF + Tandem Ecc	121.8	618.2	153.8	780.9
LC90	5.0m OF Permanent Loads	141.5	713.5	175.6	889.7
LC91	5.0m OF + Single Axle C	144.9	723.9	181.5	907.3
LC92	5.0m OF + Single Axle Ecc	144.5	725.0	180.7	909.2
LC93	5.0m OF + Tandem C	146.9	729.8	184.8	917.3
LC94	5.0m OF + Tandem Ecc	146.3	731.7	183.8	920.6

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

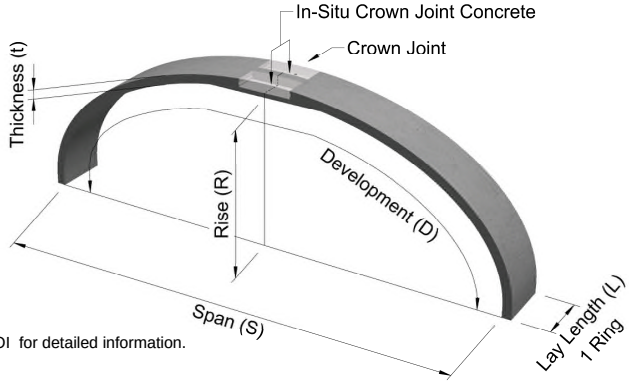
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/1

Dimensions

Span S	[m]	9.062
Rise R	[m]	3.759
Development D	[m]	13.100
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

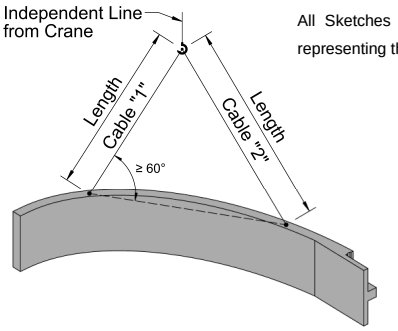


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.07
In-Situ Concrete per Ring	[m³]	1.08

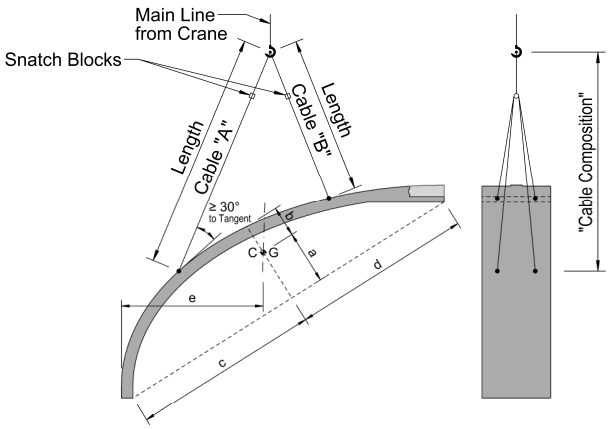
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

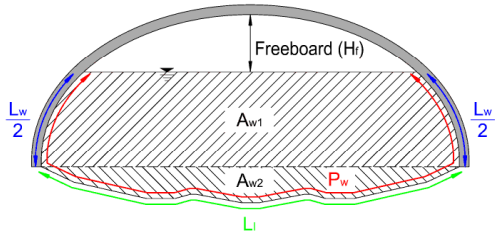
Arch Element Weight	[kN]	101.75 (10.2 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.00
Cable Force A	[kN]*	73.39
Cable Force B	[kN]*	33.63
Min. Length Cable 1&2	[m]	3.80
Cable Force 1&2	[kN]	58.75
Center of Gravity a	[m]	0.94
Center of Gravity b	[m]	0.52
Center of Gravity c	[m]	2.92
Center of Gravity d	[m]	2.96
Center of Gravity e	[m]	1.90



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	26.91	
1.0	22.17	6.36
2.0	15.09	3.74
3.0	6.77	1.56



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	23.1	45.7	27.7	54.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	22.3	227.5	26.7	282.1
LC41	0.6m OF + Single Axle C	33.4	257.2	45.5	332.6
LC42	0.6m OF + Single Axle Ecc	33.7	264.8	46.2	345.5
LC43	0.6m OF + Tandem C	39.4	267.7	55.8	350.5
LC44	0.6m OF + Tandem Ecc	39.9	285.2	56.7	380.1
LC50	1.0m OF Permanent Loads	29.8	260.3	36.1	323.1
LC51	1.0m OF + Single Axle C	38.8	286.3	51.5	367.3
LC52	1.0m OF + Single Axle Ecc	39.1	296.4	51.9	384.5
LC53	1.0m OF + Tandem C	44.1	301.4	60.5	392.9
LC54	1.0m OF + Tandem Ecc	44.7	317.3	61.4	420.0
LC60	2.0m OF Permanent Loads	51.1	377.0	62.8	469.0
LC61	2.0m OF + Single Axle C	57.3	395.8	73.2	501.0
LC62	2.0m OF + Single Axle Ecc	57.4	402.4	73.5	512.1
LC63	2.0m OF + Tandem C	60.8	406.6	79.2	519.3
LC64	2.0m OF + Tandem Ecc	61.2	417.4	80.0	537.7
LC70	3.0m OF Permanent Loads	72.5	495.3	89.5	616.9
LC71	3.0m OF + Single Axle C	77.2	510.4	97.5	642.6
LC72	3.0m OF + Single Axle Ecc	77.1	514.2	97.3	648.9
LC73	3.0m OF + Tandem C	80.0	519.2	102.2	657.5
LC74	3.0m OF + Tandem Ecc	79.9	525.3	101.9	667.8
LC80	4.0m OF Permanent Loads	94.3	615.2	116.7	766.7
LC81	4.0m OF + Single Axle C	98.0	627.6	123.0	787.9
LC82	4.0m OF + Single Axle Ecc	97.8	629.9	122.6	791.7
LC83	4.0m OF + Tandem C	100.2	634.8	126.7	800.1
LC84	4.0m OF + Tandem Ecc	99.8	638.3	126.1	805.9
LC90	5.0m OF Permanent Loads	116.5	736.7	144.4	918.6
LC91	5.0m OF + Single Axle C	119.5	747.0	149.5	936.2
LC92	5.0m OF + Single Axle Ecc	119.2	748.3	149.0	938.3
LC93	5.0m OF + Tandem C	121.2	752.8	152.4	946.0
LC94	5.0m OF + Tandem Ecc	120.8	754.9	151.7	949.6

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

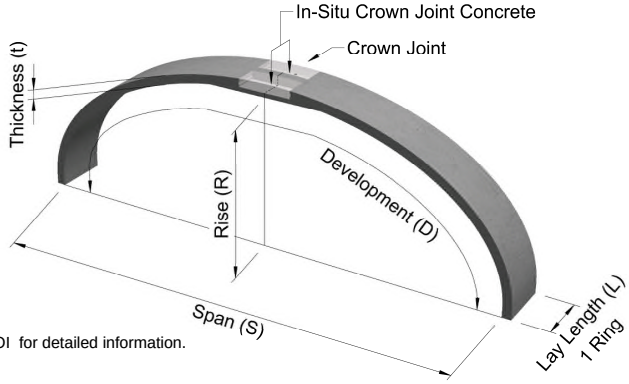
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/2

Dimensions

Span S	[m]	9.124
Rise R	[m]	4.064
Development D	[m]	13.713
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

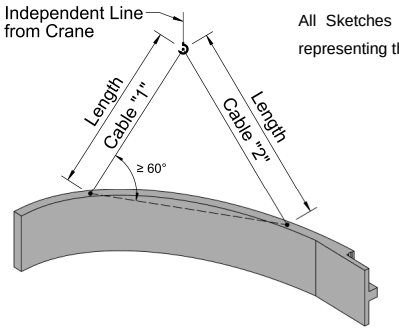


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.26
In-Situ Concrete per Ring	[m³]	1.08

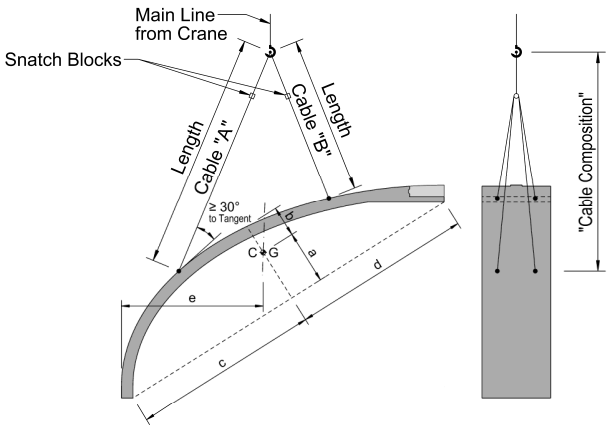
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

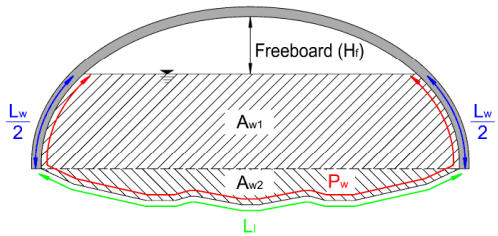
Arch Element Weight	[kN]	106.50 (10.7 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.00
Cable Force A	[kN]*	80.56
Cable Force B	[kN]*	31.40
Min. Length Cable 1&2	[m]	4.00
Cable Force 1&2	[kN]	61.49
Center of Gravity a	[m]	1.00
Center of Gravity b	[m]	0.56
Center of Gravity c	[m]	3.04
Center of Gravity d	[m]	3.07
Center of Gravity e	[m]	1.85



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	29.68	
1.0	24.94	6.96
2.0	17.86	4.37
3.0	9.54	2.17
4.0	0.58	0.13



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	21.8	47.6	26.1	57.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	12.4	237.0	14.4	293.9
LC41	0.6m OF + Single Axle C	21.3	265.2	29.5	341.9
LC42	0.6m OF + Single Axle Ecc	22.2	273.6	31.1	356.1
LC43	0.6m OF + Tandem C	26.2	275.0	37.9	358.4
LC44	0.6m OF + Tandem Ecc	27.4	293.7	40.0	390.3
LC50	1.0m OF Permanent Loads	18.5	270.6	22.1	335.8
LC51	1.0m OF + Single Axle C	25.8	295.5	34.4	378.2
LC52	1.0m OF + Single Axle Ecc	26.4	306.2	35.4	396.5
LC53	1.0m OF + Tandem C	30.1	309.9	41.7	402.7
LC54	1.0m OF + Tandem Ecc	31.1	326.8	43.4	431.4
LC60	2.0m OF Permanent Loads	35.5	389.1	43.3	484.0
LC61	2.0m OF + Single Axle C	40.5	407.4	51.7	515.0
LC62	2.0m OF + Single Axle Ecc	40.8	414.4	52.4	527.0
LC63	2.0m OF + Tandem C	43.4	417.9	56.7	532.9
LC64	2.0m OF + Tandem Ecc	44.0	429.2	57.8	552.2
LC70	3.0m OF Permanent Loads	52.6	509.6	64.6	634.6
LC71	3.0m OF + Single Axle C	56.4	524.3	71.1	659.7
LC72	3.0m OF + Single Axle Ecc	56.4	528.5	71.2	666.8
LC73	3.0m OF + Tandem C	58.6	532.9	74.9	674.3
LC74	3.0m OF + Tandem Ecc	58.7	539.2	75.0	684.9
LC80	4.0m OF Permanent Loads	69.9	631.6	86.3	787.1
LC81	4.0m OF + Single Axle C	72.9	643.8	91.4	807.8
LC82	4.0m OF + Single Axle Ecc	72.8	646.3	91.3	812.1
LC83	4.0m OF + Tandem C	74.7	650.8	94.4	819.7
LC84	4.0m OF + Tandem Ecc	74.5	654.4	94.1	825.9
LC90	5.0m OF Permanent Loads	87.6	755.4	108.4	941.8
LC91	5.0m OF + Single Axle C	90.0	765.5	112.5	959.1
LC92	5.0m OF + Single Axle Ecc	89.8	766.9	112.2	961.4
LC93	5.0m OF + Tandem C	91.4	771.1	114.8	968.5
LC94	5.0m OF + Tandem Ecc	91.1	773.4	114.4	972.4

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

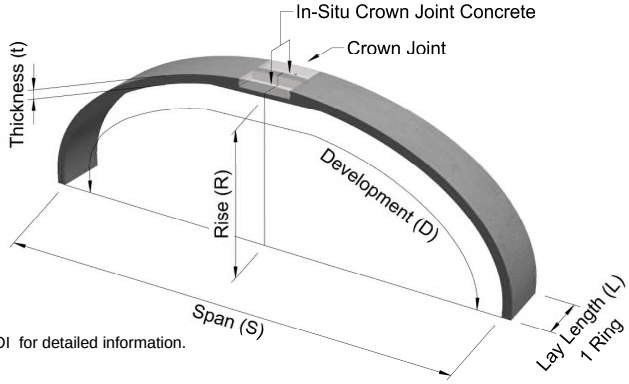
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/3

Dimensions

Span S	[m]	9.144
Rise R	[m]	4.369
Development D	[m]	14.323
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

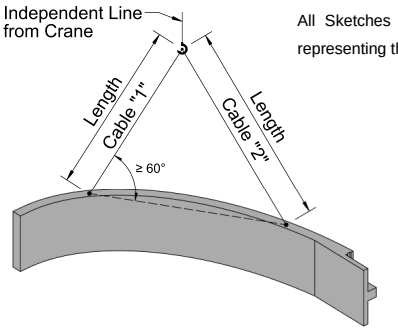


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.46
In-Situ Concrete per Ring	[m³]	1.08

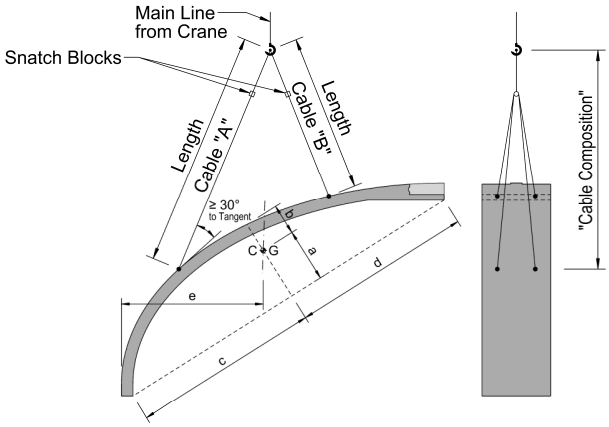
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

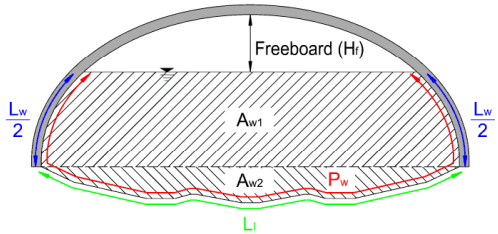
Arch Element Weight	[kN]	111.50 (11.2 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.10
Cable Force A	[kN]*	94.55
Cable Force B	[kN]*	23.20
Min. Length Cable 1&2	[m]	4.10
Cable Force 1&2	[kN]	64.37
Center of Gravity a	[m]	1.07
Center of Gravity b	[m]	0.60
Center of Gravity c	[m]	3.15
Center of Gravity d	[m]	3.17
Center of Gravity e	[m]	1.79



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	32.47	
1.0	27.73	7.58
2.0	20.65	4.98
3.0	12.33	2.78
4.0	3.37	0.74



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	20.4	49.5	24.5	59.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	2.0	245.8	1.4	304.8
LC41	0.6m OF + Single Axle C	8.7	272.1	12.9	349.4
LC42	0.6m OF + Single Axle Ecc	9.9	281.2	14.9	365.0
LC43	0.6m OF + Tandem C	12.6	281.0	19.6	364.6
LC44	0.6m OF + Tandem Ecc	14.1	300.8	22.1	398.3
LC50	1.0m OF Permanent Loads	6.5	279.7	7.2	347.2
LC51	1.0m OF + Single Axle C	12.1	303.4	16.6	387.4
LC52	1.0m OF + Single Axle Ecc	12.8	314.6	17.8	406.5
LC53	1.0m OF + Tandem C	15.4	317.0	22.2	410.6
LC54	1.0m OF + Tandem Ecc	16.5	334.5	24.2	440.3
LC60	2.0m OF Permanent Loads	18.9	399.4	22.7	496.7
LC61	2.0m OF + Single Axle C	22.8	416.9	29.2	526.5
LC62	2.0m OF + Single Axle Ecc	23.2	424.3	29.9	539.1
LC63	2.0m OF + Tandem C	25.0	427.0	33.0	543.7
LC64	2.0m OF + Tandem Ecc	25.8	438.6	34.2	563.5
LC70	3.0m OF Permanent Loads	31.4	521.2	38.3	649.0
LC71	3.0m OF + Single Axle C	34.4	535.5	43.3	673.3
LC72	3.0m OF + Single Axle Ecc	34.5	539.9	43.5	680.9
LC73	3.0m OF + Tandem C	36.1	543.7	46.2	687.3
LC74	3.0m OF + Tandem Ecc	36.3	550.1	46.5	698.2
LC80	4.0m OF Permanent Loads	44.1	644.6	54.1	803.3
LC81	4.0m OF + Single Axle C	46.5	656.5	58.1	823.6
LC82	4.0m OF + Single Axle Ecc	46.4	659.2	58.1	828.1
LC83	4.0m OF + Tandem C	47.8	663.3	60.4	835.1
LC84	4.0m OF + Tandem Ecc	47.7	667.1	60.2	841.4
LC90	5.0m OF Permanent Loads	57.0	770.1	70.2	960.1
LC91	5.0m OF + Single Axle C	58.9	780.1	73.4	977.1
LC92	5.0m OF + Single Axle Ecc	58.8	781.5	73.2	979.6
LC93	5.0m OF + Tandem C	59.9	785.5	75.1	986.4
LC94	5.0m OF + Tandem Ecc	59.7	787.9	74.9	990.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

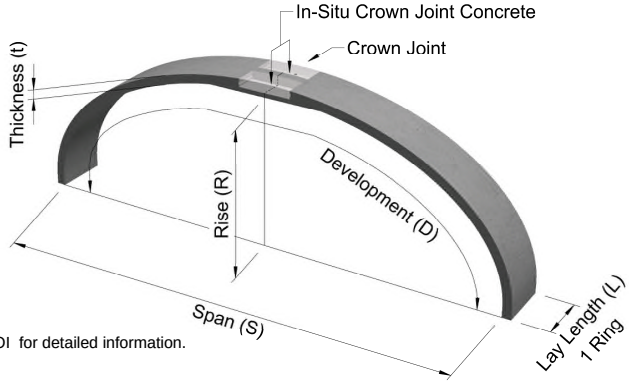
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/4

Dimensions

Span S	[m]	9.144
Rise R	[m]	4.674
Development D	[m]	14.932
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

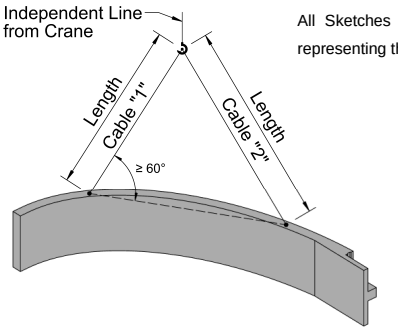


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.65
In-Situ Concrete per Ring	[m³]	1.08

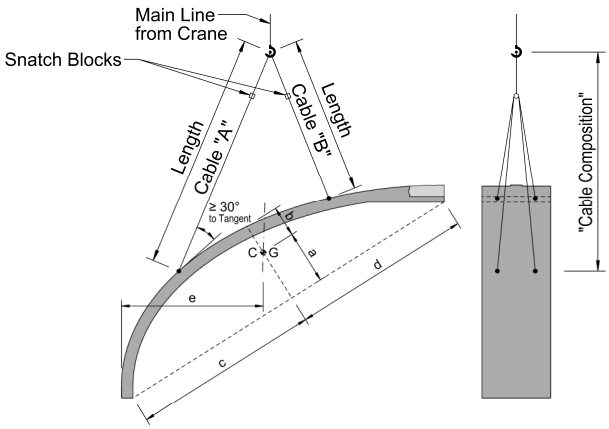
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

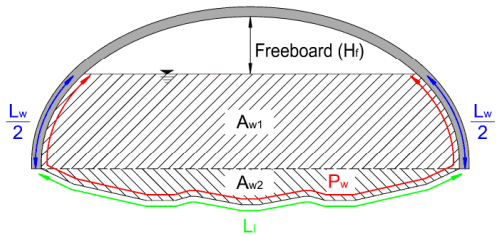
Arch Element Weight	[kN]	116.25 (11.6 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.10
Cable Force A	[kN]*	95.96
Cable Force B	[kN]*	25.35
Min. Length Cable 1&2	[m]	4.30
Cable Force 1&2	[kN]	67.12
Center of Gravity a	[m]	1.14
Center of Gravity b	[m]	0.63
Center of Gravity c	[m]	3.26
Center of Gravity d	[m]	3.27
Center of Gravity e	[m]	1.72



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	35.25	
1.0	30.52	8.18
2.0	23.43	5.59
3.0	15.11	3.39
4.0	6.16	1.35



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	19.2	51.4	23.0	61.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-7.8	253.5	-10.7	314.3
LC41	0.6m OF + Single Axle C	-2.8	278.1	-2.3	356.2
LC42	0.6m OF + Single Axle Ecc	-1.6	287.7	-0.1	372.5
LC43	0.6m OF + Tandem C	0.1	286.7	2.8	370.7
LC44	0.6m OF + Tandem Ecc	1.6	307.0	5.3	405.2
LC50	1.0m OF Permanent Loads	-4.6	288.1	-6.8	357.6
LC51	1.0m OF + Single Axle C	-0.5	310.6	0.2	395.9
LC52	1.0m OF + Single Axle Ecc	0.2	322.1	1.4	415.4
LC53	1.0m OF + Tandem C	1.9	323.6	4.3	417.9
LC54	1.0m OF + Tandem Ecc	3.0	341.3	6.3	448.1
LC60	2.0m OF Permanent Loads	3.7	408.8	3.6	508.4
LC61	2.0m OF + Single Axle C	6.5	425.6	8.4	537.0
LC62	2.0m OF + Single Axle Ecc	6.9	433.1	9.2	549.8
LC63	2.0m OF + Tandem C	8.1	435.5	11.2	553.8
LC64	2.0m OF + Tandem Ecc	8.8	447.2	12.4	573.8
LC70	3.0m OF Permanent Loads	11.9	531.7	14.0	662.1
LC71	3.0m OF + Single Axle C	14.1	546.1	17.7	686.5
LC72	3.0m OF + Single Axle Ecc	14.3	550.6	17.9	694.1
LC73	3.0m OF + Tandem C	15.3	554.3	19.8	700.5
LC74	3.0m OF + Tandem Ecc	15.5	560.8	20.1	711.5
LC80	4.0m OF Permanent Loads	20.3	657.3	24.4	819.1
LC81	4.0m OF + Single Axle C	22.0	669.4	27.3	839.6
LC82	4.0m OF + Single Axle Ecc	22.0	672.0	27.3	844.1
LC83	4.0m OF + Tandem C	23.0	675.9	28.9	850.7
LC84	4.0m OF + Tandem Ecc	22.9	679.7	28.9	857.2
LC90	5.0m OF Permanent Loads	28.8	785.0	35.1	978.7
LC91	5.0m OF + Single Axle C	30.2	794.8	37.4	995.4
LC92	5.0m OF + Single Axle Ecc	30.1	796.3	37.3	998.0
LC93	5.0m OF + Tandem C	30.9	800.0	38.6	1004.2
LC94	5.0m OF + Tandem Ecc	30.8	802.5	38.4	1008.4

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

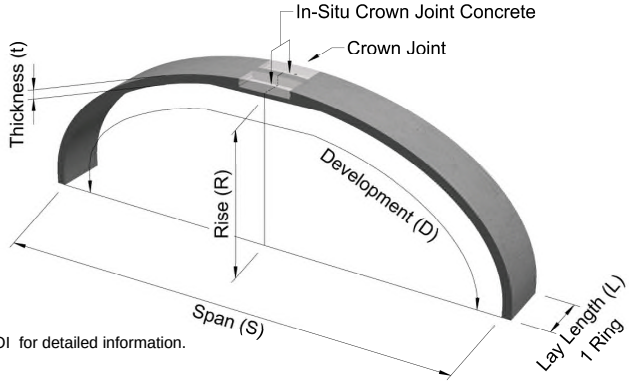
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/5

Dimensions

Span S	[m]	9.144
Rise R	[m]	4.979
Development D	[m]	15.542
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

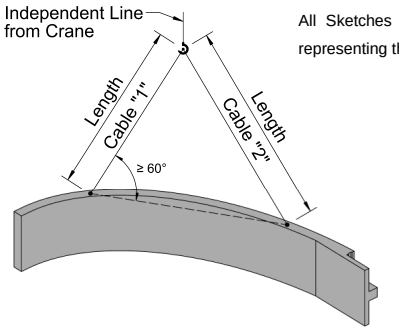
Higher overfills feasible. Contact BEBOI for detailed information.



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.83
In-Situ Concrete per Ring	[m³]	1.08

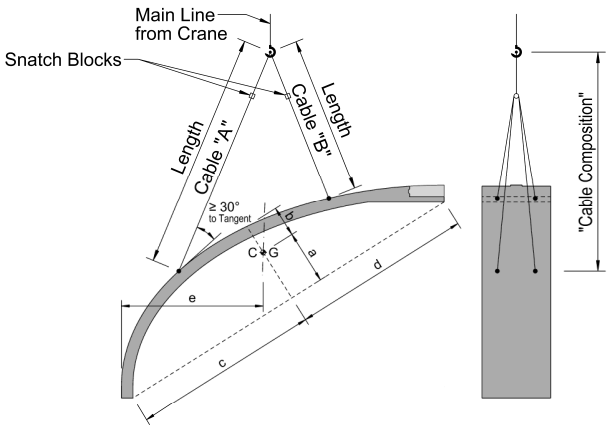
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

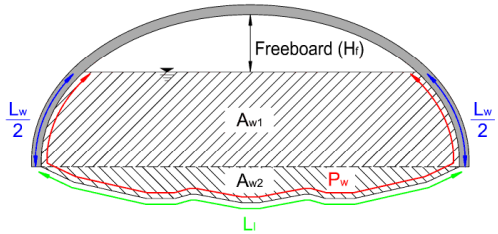
Arch Element Weight	[kN]	120.75 (12.1 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.20
Cable Force A	[kN]*	102.62
Cable Force B	[kN]*	23.03
Min. Length Cable 1&2	[m]	4.40
Cable Force 1&2	[kN]	69.72
Center of Gravity a	[m]	1.20
Center of Gravity b	[m]	0.67
Center of Gravity c	[m]	3.39
Center of Gravity d	[m]	3.37
Center of Gravity e	[m]	1.66



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	38.04	
1.0	33.20	8.80
2.0	26.22	6.20
3.0	17.90	4.00
4.0	8.94	1.96



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	18.1	53.2	21.7	63.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-16.9	262.0	-22.1	324.8
LC41	0.6m OF + Single Axle C	-13.4	285.7	-16.0	365.2
LC42	0.6m OF + Single Axle Ecc	-12.1	295.4	-13.9	381.6
LC43	0.6m OF + Tandem C	-11.2	293.7	-12.3	378.8
LC44	0.6m OF + Tandem Ecc	-9.7	314.2	-9.9	413.5
LC50	1.0m OF Permanent Loads	-15.0	297.4	-19.6	369.1
LC51	1.0m OF + Single Axle C	-12.0	319.1	-14.6	406.0
LC52	1.0m OF + Single Axle Ecc	-11.4	330.6	-13.5	425.6
LC53	1.0m OF + Tandem C	-10.3	331.5	-11.6	427.1
LC54	1.0m OF + Tandem Ecc	-9.2	349.3	-9.8	457.3
LC60	2.0m OF Permanent Loads	-10.0	419.5	-13.4	521.7
LC61	2.0m OF + Single Axle C	-8.0	436.0	-10.0	549.7
LC62	2.0m OF + Single Axle Ecc	-7.6	443.5	-9.3	562.5
LC63	2.0m OF + Tandem C	-6.9	445.8	-8.1	566.5
LC64	2.0m OF + Tandem Ecc	-6.2	457.6	-7.0	586.5
LC70	3.0m OF Permanent Loads	-5.2	544.5	-7.4	678.0
LC71	3.0m OF + Single Axle C	-3.7	558.9	-4.8	702.4
LC72	3.0m OF + Single Axle Ecc	-3.5	563.2	-4.6	709.8
LC73	3.0m OF + Tandem C	-2.8	566.6	-3.4	715.5
LC74	3.0m OF + Tandem Ecc	-2.6	573.2	-3.0	726.7
LC80	4.0m OF Permanent Loads	-0.4	672.2	-1.3	837.6
LC81	4.0m OF + Single Axle C	0.9	684.1	0.7	857.8
LC82	4.0m OF + Single Axle Ecc	0.9	686.6	0.7	862.1
LC83	4.0m OF + Tandem C	1.5	690.2	1.8	868.2
LC84	4.0m OF + Tandem Ecc	1.5	694.0	1.8	874.6
LC90	5.0m OF Permanent Loads	4.6	801.7	4.9	999.5
LC91	5.0m OF + Single Axle C	5.5	811.4	6.5	1016.0
LC92	5.0m OF + Single Axle Ecc	5.5	812.9	6.4	1018.4
LC93	5.0m OF + Tandem C	6.0	816.4	7.3	1024.4
LC94	5.0m OF + Tandem Ecc	6.0	818.8	7.2	1028.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

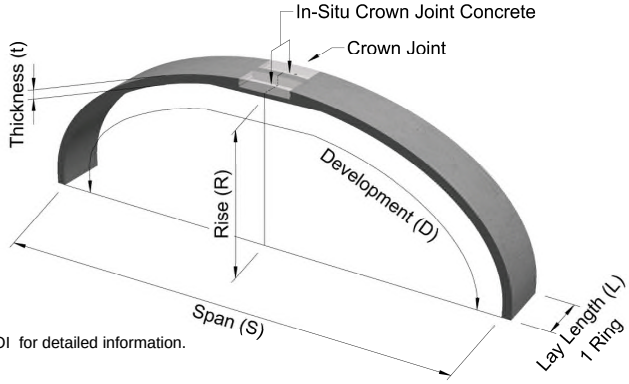
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/6

Dimensions

Span S	[m]	9.144
Rise R	[m]	5.283
Development D	[m]	16.152
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

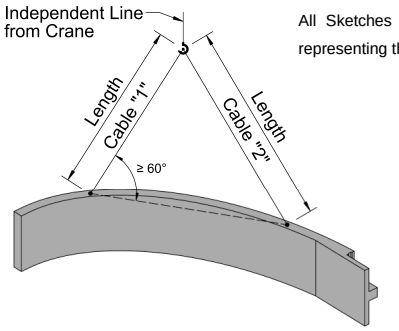


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.02
In-Situ Concrete per Ring	[m³]	1.08

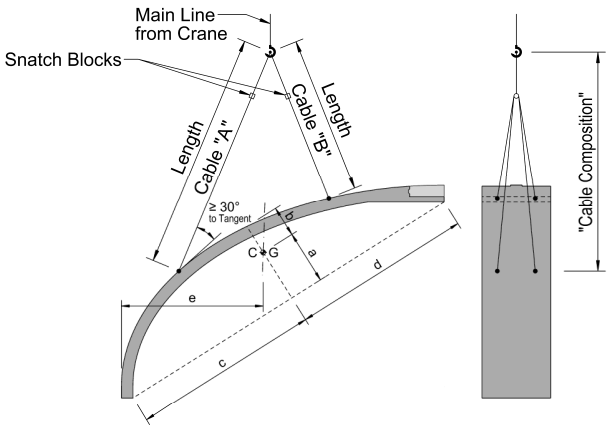
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

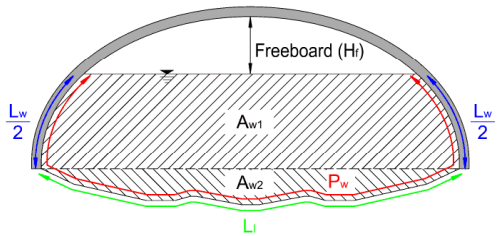
Arch Element Weight	[kN]	125.50 (12.6 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.20
Cable Force A	[kN]*	108.60
Cable Force B	[kN]*	22.37
Min. Length Cable 1&2	[m]	4.60
Cable Force 1&2	[kN]	72.46
Center of Gravity a	[m]	1.26
Center of Gravity b	[m]	0.71
Center of Gravity c	[m]	3.52
Center of Gravity d	[m]	3.47
Center of Gravity e	[m]	1.60



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	40.83	
1.0	36.09	9.40
2.0	29.01	6.81
3.0	20.69	4.61
4.0	11.73	2.56
5.0	2.59	0.56



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	17.1	55.1	20.5	66.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-25.5	271.8	-32.7	337.0
LC41	0.6m OF + Single Axle C	-23.1	294.5	-28.6	375.5
LC42	0.6m OF + Single Axle Ecc	-22.0	304.1	-26.7	392.0
LC43	0.6m OF + Tandem C	-21.5	301.8	-25.8	387.9
LC44	0.6m OF + Tandem Ecc	-20.2	322.4	-23.7	423.0
LC50	1.0m OF Permanent Loads	-24.5	307.2	-31.5	381.2
LC51	1.0m OF + Single Axle C	-22.5	328.2	-28.1	416.9
LC52	1.0m OF + Single Axle Ecc	-21.9	339.5	-27.1	436.2
LC53	1.0m OF + Tandem C	-21.3	340.2	-26.0	437.4
LC54	1.0m OF + Tandem Ecc	-20.3	358.1	-24.4	467.8
LC60	2.0m OF Permanent Loads	-22.3	431.0	-28.8	536.0
LC61	2.0m OF + Single Axle C	-20.9	447.4	-26.4	563.8
LC62	2.0m OF + Single Axle Ecc	-20.6	454.9	-25.8	576.5
LC63	2.0m OF + Tandem C	-20.2	457.0	-25.1	580.2
LC64	2.0m OF + Tandem Ecc	-19.6	468.7	-24.2	600.1
LC70	3.0m OF Permanent Loads	-20.2	558.4	-26.1	695.3
LC71	3.0m OF + Single Axle C	-19.2	572.6	-24.4	719.4
LC72	3.0m OF + Single Axle Ecc	-19.1	576.8	-24.2	726.5
LC73	3.0m OF + Tandem C	-18.6	580.0	-23.4	731.9
LC74	3.0m OF + Tandem Ecc	-18.4	586.6	-23.1	743.1
LC80	4.0m OF Permanent Loads	-18.2	688.3	-23.6	857.7
LC81	4.0m OF + Single Axle C	-17.3	700.1	-22.2	877.6
LC82	4.0m OF + Single Axle Ecc	-17.3	702.4	-22.2	881.6
LC83	4.0m OF + Tandem C	-16.9	705.9	-21.5	887.5
LC84	4.0m OF + Tandem Ecc	-16.9	709.6	-21.5	893.9
LC90	5.0m OF Permanent Loads	-16.0	820.0	-20.9	1022.3
LC91	5.0m OF + Single Axle C	-15.4	829.5	-19.8	1038.4
LC92	5.0m OF + Single Axle Ecc	-15.5	830.9	-19.9	1040.8
LC93	5.0m OF + Tandem C	-15.1	834.2	-19.3	1046.4
LC94	5.0m OF + Tandem Ecc	-15.2	836.7	-19.4	1050.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

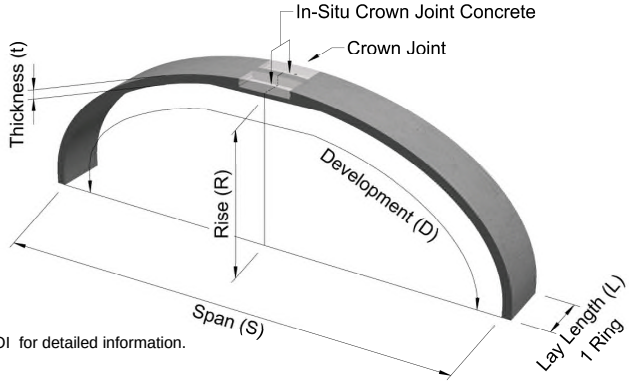
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C30T/7

Dimensions

Span S	[m]	9.144
Rise R	[m]	5.588
Development D	[m]	16.761
Thickness t	[mm]	254
Lay Length L	[m]	2.426
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

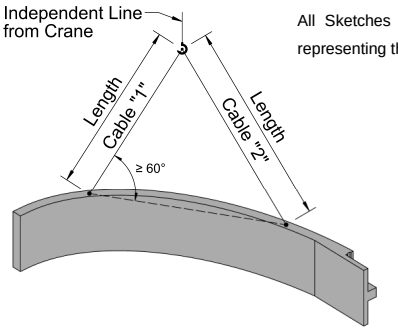


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.21
In-Situ Concrete per Ring	[m³]	1.08

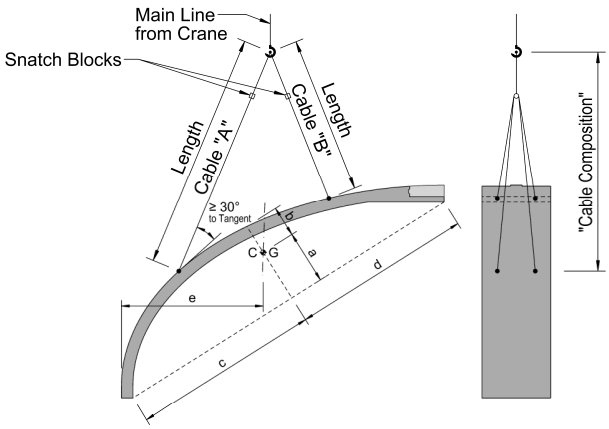
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

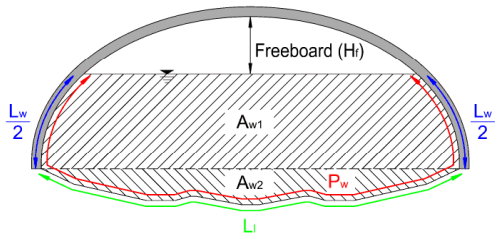
Arch Element Weight	[kN]	130.25 (13.0 metric tons)
Length Cable A	[m]*	4.20
Length Cable B	[m]*	3.20
Cable Force A	[kN]*	109.25
Cable Force B	[kN]*	23.20
Min. Length Cable 1&2	[m]	4.70
Cable Force 1&2	[kN]	75.20
Center of Gravity a	[m]	1.31
Center of Gravity b	[m]	0.75
Center of Gravity c	[m]	3.65
Center of Gravity d	[m]	3.56
Center of Gravity e	[m]	1.55



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	43.61	
1.0	38.88	10.01
2.0	31.8	7.42
3.0	23.48	5.22
4.0	14.52	3.18
5.0	5.38	1.18



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	16.2	56.9	19.5	68.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-33.6	281.7	-42.8	349.3
LC41	0.6m OF + Single Axle C	-32.0	303.7	-40.1	386.7
LC42	0.6m OF + Single Axle Ecc	-31.0	313.3	-38.4	403.0
LC43	0.6m OF + Tandem C	-30.8	310.3	-38.1	397.9
LC44	0.6m OF + Tandem Ecc	-29.7	330.9	-36.3	433.0
LC50	1.0m OF Permanent Loads	-33.4	317.5	-42.5	394.0
LC51	1.0m OF + Single Axle C	-32.0	338.0	-40.3	429.0
LC52	1.0m OF + Single Axle Ecc	-31.5	349.4	-39.4	448.3
LC53	1.0m OF + Tandem C	-31.2	349.9	-38.9	449.1
LC54	1.0m OF + Tandem Ecc	-30.4	367.7	-37.6	479.3
LC60	2.0m OF Permanent Loads	-33.3	443.7	-42.4	551.8
LC61	2.0m OF + Single Axle C	-32.4	459.8	-40.9	579.1
LC62	2.0m OF + Single Axle Ecc	-32.1	467.2	-40.4	591.7
LC63	2.0m OF + Tandem C	-31.9	469.0	-40.0	594.8
LC64	2.0m OF + Tandem Ecc	-31.5	480.5	-39.3	614.4
LC70	3.0m OF Permanent Loads	-33.3	573.1	-42.5	713.6
LC71	3.0m OF + Single Axle C	-32.7	587.2	-41.3	737.4
LC72	3.0m OF + Single Axle Ecc	-32.6	591.1	-41.2	744.2
LC73	3.0m OF + Tandem C	-32.3	594.1	-40.8	749.3
LC74	3.0m OF + Tandem Ecc	-32.2	600.7	-40.5	760.4
LC80	4.0m OF Permanent Loads	-33.4	705.3	-42.6	878.7
LC81	4.0m OF + Single Axle C	-32.9	716.8	-41.7	898.4
LC82	4.0m OF + Single Axle Ecc	-32.9	719.0	-41.7	902.0
LC83	4.0m OF + Tandem C	-32.7	722.2	-41.3	907.6
LC84	4.0m OF + Tandem Ecc	-32.6	726.1	-41.3	914.1
LC90	5.0m OF Permanent Loads	-33.5	839.3	-42.7	1046.3
LC91	5.0m OF + Single Axle C	-33.1	848.6	-42.0	1062.1
LC92	5.0m OF + Single Axle Ecc	-33.1	849.9	-42.1	1064.3
LC93	5.0m OF + Tandem C	-32.9	853.0	-41.7	1069.7
LC94	5.0m OF + Tandem Ecc	-33.0	855.5	-41.8	1073.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

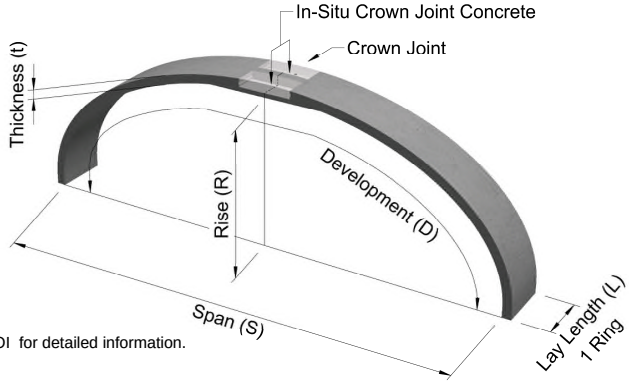
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/0

Dimensions

Span S	[m]	10.820
Rise R	[m]	4.369
Development D	[m]	15.362
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

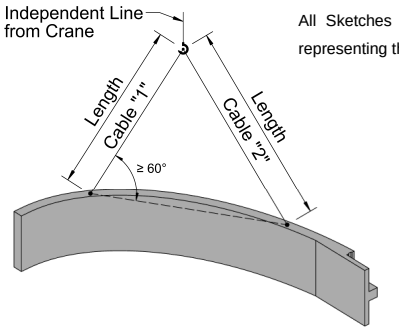


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	3.95
In-Situ Concrete per Ring	[m³]	0.85

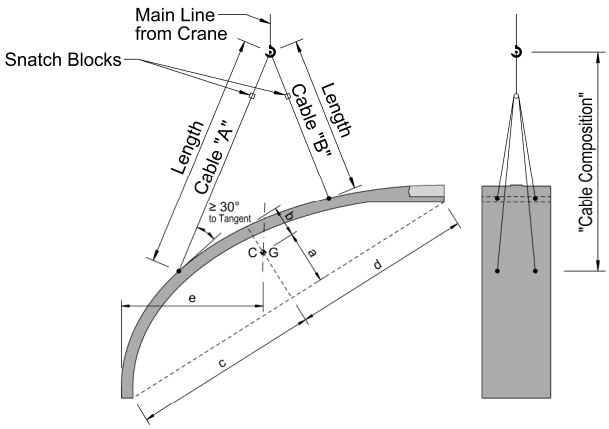
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

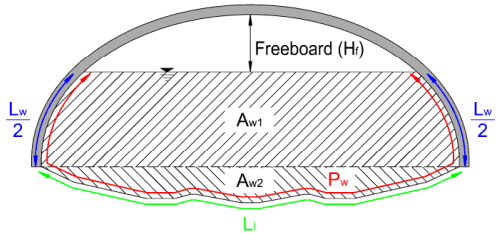
Arch Element Weight	[kN]	98.75 (9.9 metric tons)
Length Cable A	[m]*	5.00
Length Cable B	[m]*	3.70
Cable Force A	[kN]*	61.80
Cable Force B	[kN]*	41.28
Min. Length Cable 1&2	[m]	4.50
Cable Force 1&2	[kN]	57.01
Center of Gravity a	[m]	1.06
Center of Gravity b	[m]	0.59
Center of Gravity c	[m]	3.45
Center of Gravity d	[m]	3.50
Center of Gravity e	[m]	2.29



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	36.89	
1.0	31.66	4.00
2.0	23.76	2.60
3.0	14.33	1.44
4.0	3.97	0.38



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	29.8	57.6	35.8	69.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	31.9	292.2	38.4	362.4
LC41	0.6m OF + Single Axle C	43.0	321.5	57.2	412.2
LC42	0.6m OF + Single Axle Ecc	42.9	327.3	57.1	422.0
LC43	0.6m OF + Tandem C	48.8	330.9	67.2	428.2
LC44	0.6m OF + Tandem Ecc	49.3	347.7	67.9	456.8
LC50	1.0m OF Permanent Loads	41.1	331.7	49.8	411.7
LC51	1.0m OF + Single Axle C	50.2	357.5	65.4	455.7
LC52	1.0m OF + Single Axle Ecc	50.5	367.7	65.9	473.0
LC53	1.0m OF + Tandem C	55.6	372.6	74.6	481.3
LC54	1.0m OF + Tandem Ecc	56.2	388.8	75.5	508.8
LC60	2.0m OF Permanent Loads	67.3	468.7	82.7	582.9
LC61	2.0m OF + Single Axle C	73.7	487.8	93.5	615.5
LC62	2.0m OF + Single Axle Ecc	74.0	494.7	93.9	627.2
LC63	2.0m OF + Tandem C	77.3	498.5	99.6	633.7
LC64	2.0m OF + Tandem Ecc	77.9	510.2	100.7	653.5
LC70	3.0m OF Permanent Loads	93.7	607.2	115.7	756.1
LC71	3.0m OF + Single Axle C	98.7	622.9	124.1	782.7
LC72	3.0m OF + Single Axle Ecc	98.6	627.0	124.0	789.8
LC73	3.0m OF + Tandem C	101.5	631.7	128.9	797.8
LC74	3.0m OF + Tandem Ecc	101.5	638.4	128.9	809.2
LC80	4.0m OF Permanent Loads	120.4	747.3	149.1	931.3
LC81	4.0m OF + Single Axle C	124.4	760.3	155.8	953.4
LC82	4.0m OF + Single Axle Ecc	124.2	763.0	155.5	957.9
LC83	4.0m OF + Tandem C	126.7	767.8	159.7	966.0
LC84	4.0m OF + Tandem Ecc	126.4	771.8	159.2	972.8
LC90	5.0m OF Permanent Loads	147.6	889.3	183.0	1108.7
LC91	5.0m OF + Single Axle C	150.8	900.1	188.5	1127.2
LC92	5.0m OF + Single Axle Ecc	150.6	901.6	188.0	1129.7
LC93	5.0m OF + Tandem C	152.6	906.1	191.6	1137.3
LC94	5.0m OF + Tandem Ecc	152.3	908.7	191.0	1141.7

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

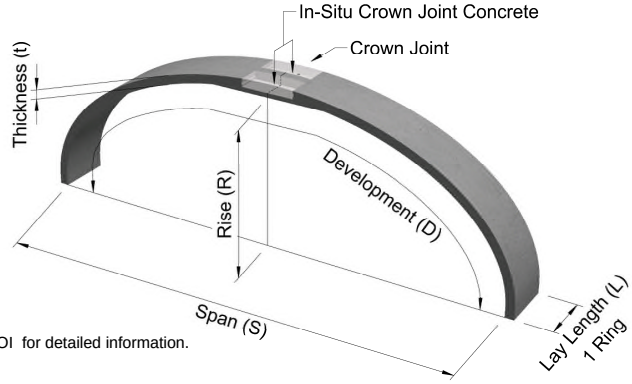
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/1

Dimensions

Span S	[m]	10.904
Rise R	[m]	4.674
Development D	[m]	15.977
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

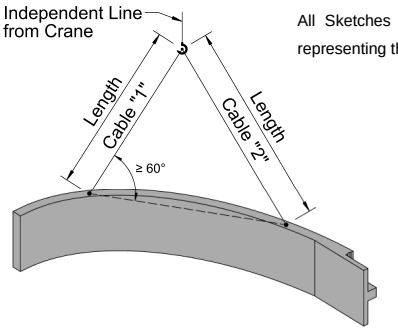


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.11
In-Situ Concrete per Ring	[m³]	0.85

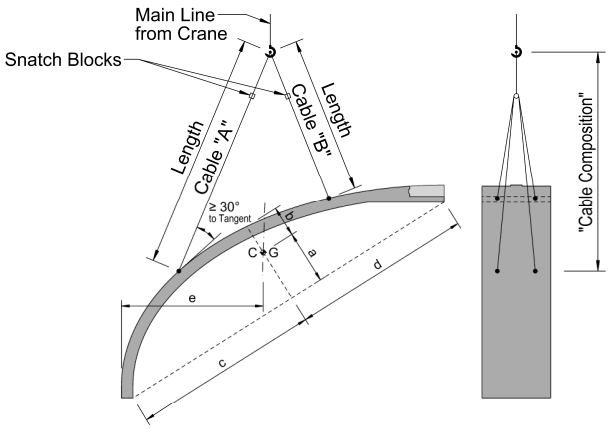
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

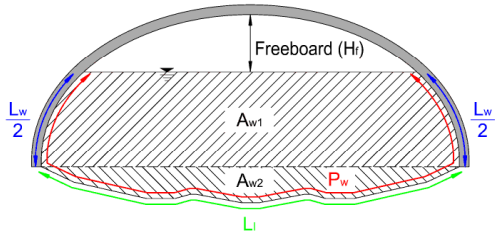
Arch Element Weight	[kN]	102.75 (10.3 metric tons)
Length Cable A	[m]*	5.00
Length Cable B	[m]*	3.70
Cable Force A	[kN]*	67.28
Cable Force B	[kN]*	39.43
Min. Length Cable 1&2	[m]	4.60
Cable Force 1&2	[kN]	59.32
Center of Gravity a	[m]	1.13
Center of Gravity b	[m]	0.62
Center of Gravity c	[m]	3.57
Center of Gravity d	[m]	3.61
Center of Gravity e	[m]	2.25



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	40.20	
1.0	34.97	4.30
2.0	27.07	2.91
3.0	17.64	1.74
4.0	7.28	0.68



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	28.5	59.7	34.2	71.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	21.7	304.0	25.7	377.0
LC41	0.6m OF + Single Axle C	31.1	332.5	41.6	425.5
LC42	0.6m OF + Single Axle Ecc	31.6	338.7	42.5	436.0
LC43	0.6m OF + Tandem C	36.1	341.4	50.2	440.6
LC44	0.6m OF + Tandem Ecc	37.2	358.7	52.0	470.0
LC50	1.0m OF Permanent Loads	29.6	344.3	35.5	427.3
LC51	1.0m OF + Single Axle C	37.3	369.6	48.8	470.4
LC52	1.0m OF + Single Axle Ecc	37.9	380.0	49.8	488.2
LC53	1.0m OF + Tandem C	41.9	384.2	56.6	495.3
LC54	1.0m OF + Tandem Ecc	43.0	400.8	58.3	523.5
LC60	2.0m OF Permanent Loads	52.1	483.9	63.7	601.8
LC61	2.0m OF + Single Axle C	57.5	502.6	72.8	633.8
LC62	2.0m OF + Single Axle Ecc	57.9	509.8	73.6	645.9
LC63	2.0m OF + Tandem C	60.6	513.2	78.1	651.8
LC64	2.0m OF + Tandem Ecc	61.5	525.0	79.6	671.9
LC70	3.0m OF Permanent Loads	74.6	624.8	91.8	778.0
LC71	3.0m OF + Single Axle C	78.9	640.3	99.1	804.4
LC72	3.0m OF + Single Axle Ecc	79.0	644.7	99.3	811.8
LC73	3.0m OF + Tandem C	81.3	649.1	103.2	819.4
LC74	3.0m OF + Tandem Ecc	81.5	655.8	103.5	830.8
LC80	4.0m OF Permanent Loads	97.5	767.6	120.4	956.6
LC81	4.0m OF + Single Axle C	100.9	780.6	126.2	978.5
LC82	4.0m OF + Single Axle Ecc	100.8	783.3	126.1	983.1
LC83	4.0m OF + Tandem C	102.8	787.8	129.5	990.8
LC84	4.0m OF + Tandem Ecc	102.7	791.8	129.3	997.6
LC90	5.0m OF Permanent Loads	120.7	912.3	149.5	1137.3
LC91	5.0m OF + Single Axle C	123.5	923.1	154.2	1155.7
LC92	5.0m OF + Single Axle Ecc	123.3	924.6	153.9	1158.4
LC93	5.0m OF + Tandem C	125.1	928.9	156.9	1165.6
LC94	5.0m OF + Tandem Ecc	124.8	931.5	156.5	1170.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

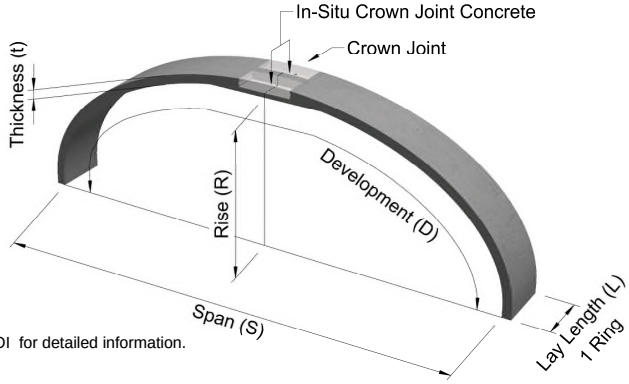
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/2

Dimensions

Span S	[m]	10.956
Rise R	[m]	4.978
Development D	[m]	16.589
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

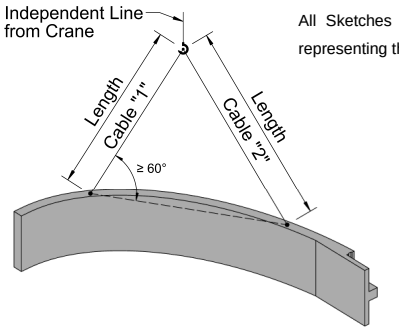


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.27
In-Situ Concrete per Ring	[m³]	0.85

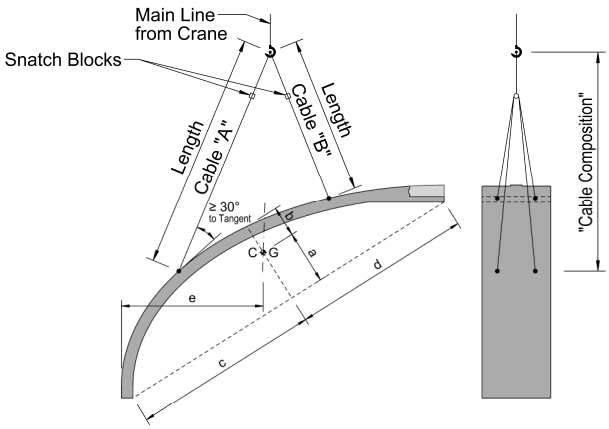
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

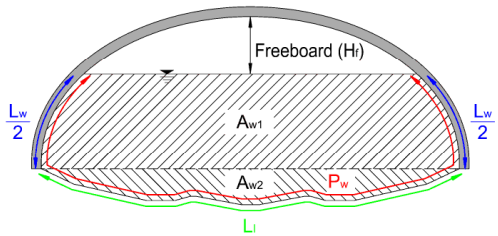
Arch Element Weight	[kN]	106.75 (10.7 metric tons)
Length Cable A	[m]*	5.00
Length Cable B	[m]*	3.70
Cable Force A	[kN]*	74.60
Cable Force B	[kN]*	36.32
Min. Length Cable 1&2	[m]	4.80
Cable Force 1&2	[kN]	61.63
Center of Gravity a	[m]	1.19
Center of Gravity b	[m]	0.66
Center of Gravity c	[m]	3.68
Center of Gravity d	[m]	3.72
Center of Gravity e	[m]	2.20



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	43.54	
1.0	38.31	4.61
2.0	30.40	3.22
3.0	20.97	2.05
4.0	10.61	0.99



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	27.1	61.8	32.5	74.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	10.6	314.6	11.9	390.2
LC41	0.6m OF + Single Axle C	18.1	341.7	24.7	436.2
LC42	0.6m OF + Single Axle Ecc	19.0	348.7	26.2	448.1
LC43	0.6m OF + Tandem C	22.3	349.9	31.8	450.2
LC44	0.6m OF + Tandem Ecc	23.7	368.2	34.3	481.3
LC50	1.0m OF Permanent Loads	17.0	355.5	19.9	441.3
LC51	1.0m OF + Single Axle C	23.3	379.9	30.6	482.8
LC52	1.0m OF + Single Axle Ecc	24.0	390.8	31.9	501.3
LC53	1.0m OF + Tandem C	27.0	393.9	36.9	506.6
LC54	1.0m OF + Tandem Ecc	28.2	411.0	39.0	535.6
LC60	2.0m OF Permanent Loads	35.0	496.3	42.3	617.3
LC61	2.0m OF + Single Axle C	39.4	514.6	49.8	648.4
LC62	2.0m OF + Single Axle Ecc	39.9	522.1	50.8	661.1
LC63	2.0m OF + Tandem C	41.9	525.0	54.2	666.0
LC64	2.0m OF + Tandem Ecc	42.9	537.2	55.9	686.8
LC70	3.0m OF Permanent Loads	53.1	639.4	65.0	796.2
LC71	3.0m OF + Single Axle C	56.6	654.6	71.0	822.0
LC72	3.0m OF + Single Axle Ecc	56.8	659.2	71.3	829.8
LC73	3.0m OF + Tandem C	58.6	663.1	74.4	836.5
LC74	3.0m OF + Tandem Ecc	58.9	670.1	74.9	848.2
LC80	4.0m OF Permanent Loads	71.5	784.2	88.0	977.2
LC81	4.0m OF + Single Axle C	74.3	796.9	92.8	998.7
LC82	4.0m OF + Single Axle Ecc	74.3	799.7	92.8	1003.5
LC83	4.0m OF + Tandem C	75.9	803.8	95.5	1010.4
LC84	4.0m OF + Tandem Ecc	75.9	807.9	95.4	1017.4
LC90	5.0m OF Permanent Loads	90.2	930.8	111.4	1160.4
LC91	5.0m OF + Single Axle C	92.5	941.3	115.2	1178.3
LC92	5.0m OF + Single Axle Ecc	92.4	942.9	115.1	1181.0
LC93	5.0m OF + Tandem C	93.7	946.8	117.3	1187.7
LC94	5.0m OF + Tandem Ecc	93.5	949.5	117.1	1192.2

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

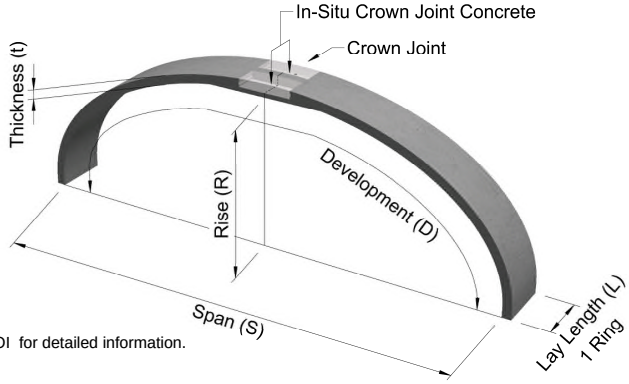
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/3

Dimensions

Span S	[m]	10.972
Rise R	[m]	5.283
Development D	[m]	17.199
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

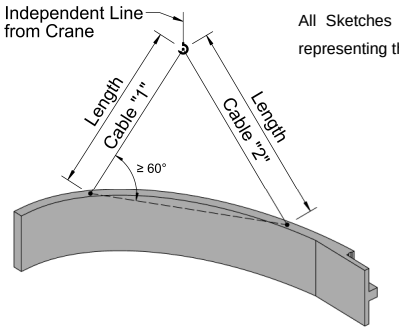


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.43
In-Situ Concrete per Ring	[m³]	0.85

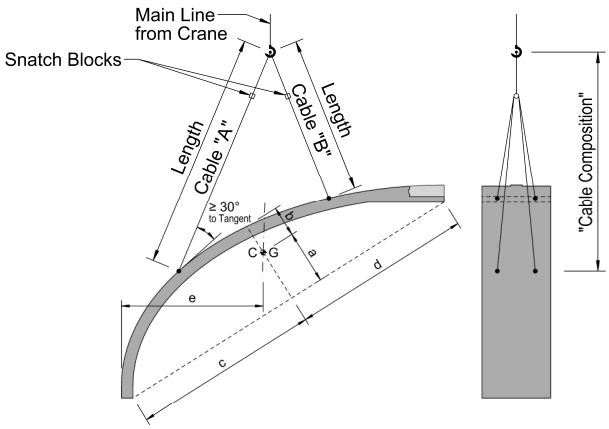
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

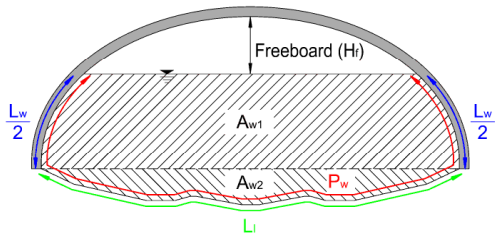
Arch Element Weight	[kN]	110.75 (11.1 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	2.80
Cable Force A	[kN]*	79.60
Cable Force B	[kN]*	34.72
Min. Length Cable 1&2	[m]	4.90
Cable Force 1&2	[kN]	63.94
Center of Gravity a	[m]	1.26
Center of Gravity b	[m]	0.70
Center of Gravity c	[m]	3.79
Center of Gravity d	[m]	3.82
Center of Gravity e	[m]	2.13



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	46.88	
1.0	41.65	4.91
2.0	33.74	3.52
3.0	24.31	2.36
4.0	13.95	1.30
5.0	3.11	0.28



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	25.7	63.9	30.8	76.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-1.1	324.0	-2.7	401.8
LC41	0.6m OF + Single Axle C	4.7	349.5	7.2	445.2
LC42	0.6m OF + Single Axle Ecc	5.7	357.2	9.0	458.2
LC43	0.6m OF + Tandem C	8.0	357.0	12.8	457.9
LC44	0.6m OF + Tandem Ecc	9.6	376.1	15.5	490.4
LC50	1.0m OF Permanent Loads	3.7	365.4	3.4	453.6
LC51	1.0m OF + Single Axle C	8.6	388.7	11.7	493.1
LC52	1.0m OF + Single Axle Ecc	9.4	400.0	13.0	512.3
LC53	1.0m OF + Tandem C	11.5	401.9	16.6	515.6
LC54	1.0m OF + Tandem Ecc	12.8	419.4	18.7	545.3
LC60	2.0m OF Permanent Loads	17.1	507.3	20.1	630.9
LC61	2.0m OF + Single Axle C	20.6	524.9	26.0	660.8
LC62	2.0m OF + Single Axle Ecc	21.1	532.5	26.9	673.9
LC63	2.0m OF + Tandem C	22.6	534.8	29.4	677.6
LC64	2.0m OF + Tandem Ecc	23.5	547.2	31.0	698.8
LC70	3.0m OF Permanent Loads	30.6	651.6	37.0	811.3
LC71	3.0m OF + Single Axle C	33.4	666.3	41.7	836.3
LC72	3.0m OF + Single Axle Ecc	33.6	670.9	42.1	844.1
LC73	3.0m OF + Tandem C	34.9	674.2	44.3	849.8
LC74	3.0m OF + Tandem Ecc	35.2	681.3	44.8	861.8
LC80	4.0m OF Permanent Loads	44.3	797.5	54.2	993.7
LC81	4.0m OF + Single Axle C	46.5	809.9	57.9	1014.8
LC82	4.0m OF + Single Axle Ecc	46.6	812.7	57.9	1019.6
LC83	4.0m OF + Tandem C	47.7	816.5	59.9	1026.0
LC84	4.0m OF + Tandem Ecc	47.7	820.6	59.9	1033.0
LC90	5.0m OF Permanent Loads	58.2	945.5	71.5	1178.7
LC91	5.0m OF + Single Axle C	60.0	955.9	74.4	1196.3
LC92	5.0m OF + Single Axle Ecc	59.9	957.5	74.3	1199.1
LC93	5.0m OF + Tandem C	60.9	961.3	76.0	1205.4
LC94	5.0m OF + Tandem Ecc	60.8	964.0	75.9	1210.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

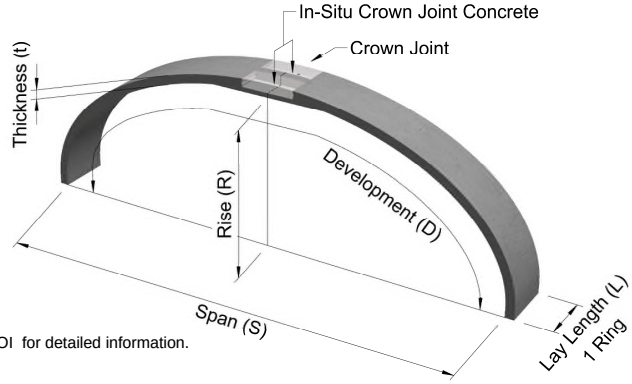
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/4

Dimensions

Span S	[m]	10.972
Rise R	[m]	5.588
Development D	[m]	17.809
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

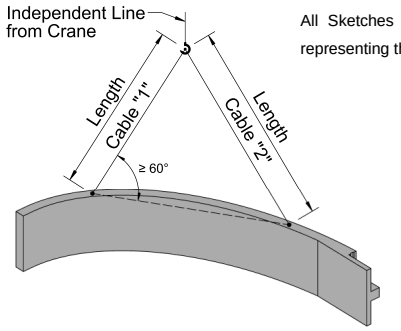
Higher overfills feasible. Contact BEBOI for detailed information.



Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.58
In-Situ Concrete per Ring	[m³]	0.85

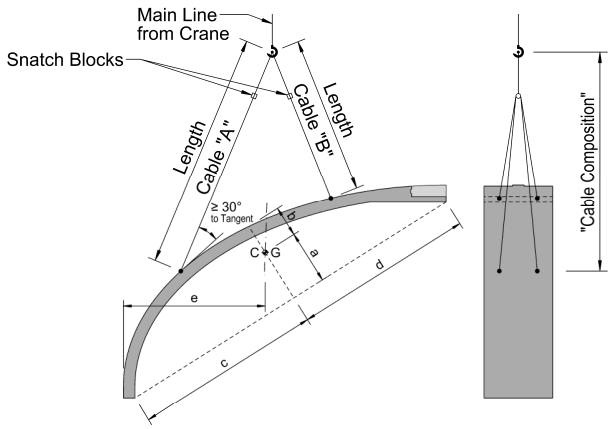
1 Ring = 2 Arch Elements



All Sketches are generic and not representing the actual Arch Shape.

Handling

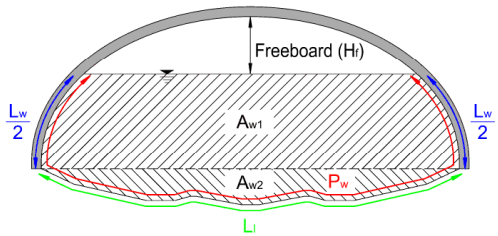
Arch Element Weight	[kN]	114.50 (11.5 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	2.90
Cable Force A	[kN]*	89.33
Cable Force B	[kN]*	30.60
Min. Length Cable 1&2	[m]	5.10
Cable Force 1&2	[kN]	66.11
Center of Gravity a	[m]	1.33
Center of Gravity b	[m]	0.73
Center of Gravity c	[m]	3.90
Center of Gravity d	[m]	3.92
Center of Gravity e	[m]	2.07



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	50.22	
1.0	44.99	5.22
2.0	37.09	3.82
3.0	27.66	2.66
4.0	17.30	1.60
5.0	6.45	0.59



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	24.4	65.9	29.2	79.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-12.1	333.0	-16.4	413.0
LC41	0.6m OF + Single Axle C	-7.8	357.1	-9.0	453.9
LC42	0.6m OF + Single Axle Ecc	-6.7	365.2	-7.2	467.7
LC43	0.6m OF + Tandem C	-5.3	363.9	-4.7	465.5
LC44	0.6m OF + Tandem Ecc	-3.7	383.5	-2.0	498.8
LC50	1.0m OF Permanent Loads	-8.7	374.8	-12.1	465.2
LC51	1.0m OF + Single Axle C	-5.1	397.0	-5.9	503.0
LC52	1.0m OF + Single Axle Ecc	-4.3	408.5	-4.6	522.5
LC53	1.0m OF + Tandem C	-2.9	409.6	-2.2	524.4
LC54	1.0m OF + Tandem Ecc	-1.7	427.3	-0.2	554.4
LC60	2.0m OF Permanent Loads	0.5	517.4	-0.6	643.5
LC61	2.0m OF + Single Axle C	3.1	534.4	3.8	672.3
LC62	2.0m OF + Single Axle Ecc	3.6	542.2	4.7	685.5
LC63	2.0m OF + Tandem C	4.6	544.1	6.4	688.8
LC64	2.0m OF + Tandem Ecc	5.4	556.6	7.8	710.2
LC70	3.0m OF Permanent Loads	9.8	663.1	11.1	825.5
LC71	3.0m OF + Single Axle C	11.9	677.7	14.5	850.4
LC72	3.0m OF + Single Axle Ecc	12.1	682.2	14.9	858.0
LC73	3.0m OF + Tandem C	13.0	685.4	16.4	863.6
LC74	3.0m OF + Tandem Ecc	13.3	692.6	16.9	875.7
LC80	4.0m OF Permanent Loads	19.2	811.0	22.7	1010.4
LC81	4.0m OF + Single Axle C	20.8	823.4	25.5	1031.6
LC82	4.0m OF + Single Axle Ecc	20.8	826.0	25.5	1036.0
LC83	4.0m OF + Tandem C	21.6	829.6	26.9	1042.1
LC84	4.0m OF + Tandem Ecc	21.7	833.8	27.0	1049.2
LC90	5.0m OF Permanent Loads	28.6	960.9	34.5	1197.8
LC91	5.0m OF + Single Axle C	29.9	971.1	36.7	1215.2
LC92	5.0m OF + Single Axle Ecc	29.8	972.7	36.7	1217.9
LC93	5.0m OF + Tandem C	30.6	976.2	37.8	1223.9
LC94	5.0m OF + Tandem Ecc	30.5	978.9	37.8	1228.5

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

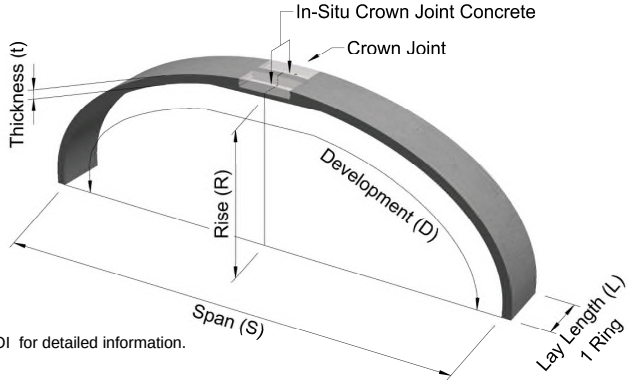
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/5

Dimensions

Span S	[m]	10.972
Rise R	[m]	5.893
Development D	[m]	18.418
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

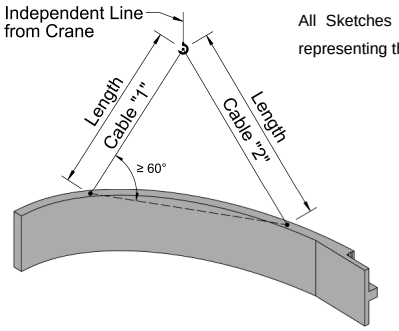


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.74
In-Situ Concrete per Ring	[m³]	0.85

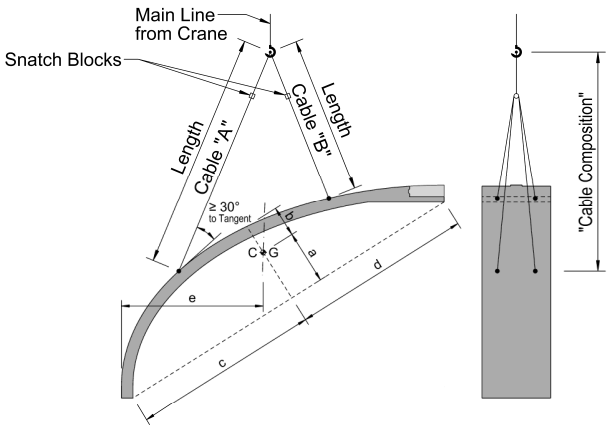
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

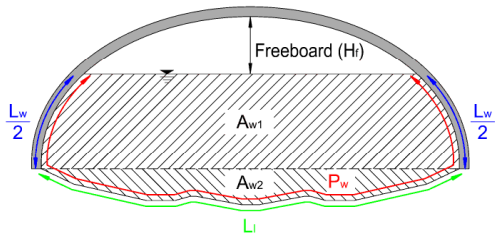
Arch Element Weight	[kN]	118.50 (11.9 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	2.90
Cable Force A	[kN]*	93.25
Cable Force B	[kN]*	28.84
Min. Length Cable 1&2	[m]	5.20
Cable Force 1&2	[kN]	68.42
Center of Gravity a	[m]	1.39
Center of Gravity b	[m]	0.77
Center of Gravity c	[m]	4.03
Center of Gravity d	[m]	4.02
Center of Gravity e	[m]	2.00



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	53.57	
1.0	48.34	5.52
2.0	40.43	4.13
3.0	31.00	2.96
4.0	20.64	1.91
5.0	9.80	0.89



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	23.2	68.0	27.8	81.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-22.5	342.7	-29.2	424.9
LC41	0.6m OF + Single Axle C	-19.3	365.7	-23.9	464.1
LC42	0.6m OF + Single Axle Ecc	-18.2	373.9	-22.1	478.1
LC43	0.6m OF + Tandem C	-17.4	372.0	-20.6	474.9
LC44	0.6m OF + Tandem Ecc	-15.9	391.8	-18.1	508.4
LC50	1.0m OF Permanent Loads	-20.3	384.9	-26.5	477.8
LC51	1.0m OF + Single Axle C	-17.6	406.4	-21.9	514.2
LC52	1.0m OF + Single Axle Ecc	-16.9	417.9	-20.8	533.9
LC53	1.0m OF + Tandem C	-16.0	418.5	-19.3	534.8
LC54	1.0m OF + Tandem Ecc	-14.9	436.2	-17.4	564.9
LC60	2.0m OF Permanent Loads	-14.5	528.9	-19.3	657.7
LC61	2.0m OF + Single Axle C	-12.6	545.6	-16.1	686.1
LC62	2.0m OF + Single Axle Ecc	-12.2	553.3	-15.3	699.3
LC63	2.0m OF + Tandem C	-11.5	555.0	-14.2	702.1
LC64	2.0m OF + Tandem Ecc	-10.8	567.6	-13.0	723.5
LC70	3.0m OF Permanent Loads	-8.7	676.5	-12.1	842.2
LC71	3.0m OF + Single Axle C	-7.3	691.1	-9.6	867.1
LC72	3.0m OF + Single Axle Ecc	-7.1	695.4	-9.3	874.4
LC73	3.0m OF + Tandem C	-6.5	698.4	-8.3	879.4
LC74	3.0m OF + Tandem Ecc	-6.2	705.5	-7.8	891.6
LC80	4.0m OF Permanent Loads	-3.0	826.4	-4.9	1029.5
LC81	4.0m OF + Single Axle C	-1.8	838.5	-2.9	1050.2
LC82	4.0m OF + Single Axle Ecc	-1.8	841.0	-2.9	1054.4
LC83	4.0m OF + Tandem C	-1.3	844.3	-2.0	1060.0
LC84	4.0m OF + Tandem Ecc	-1.2	848.5	-1.8	1067.3
LC90	5.0m OF Permanent Loads	2.8	978.1	2.3	1219.2
LC91	5.0m OF + Single Axle C	3.7	988.1	3.9	1236.2
LC92	5.0m OF + Single Axle Ecc	3.7	989.6	3.8	1238.8
LC93	5.0m OF + Tandem C	4.2	993.0	4.7	1244.5
LC94	5.0m OF + Tandem Ecc	4.1	995.7	4.6	1249.1

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

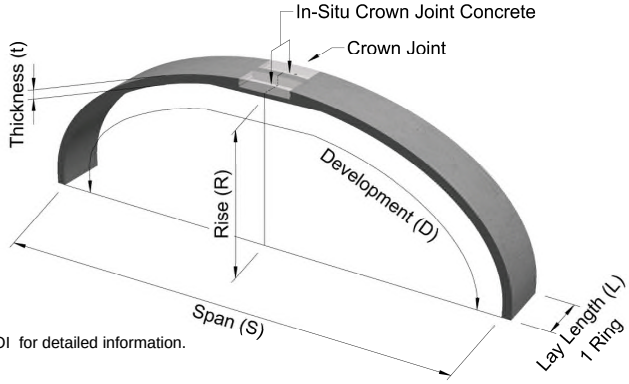
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/6

Dimensions

Span S	[m]	10.972
Rise R	[m]	6.197
Development D	[m]	19.028
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

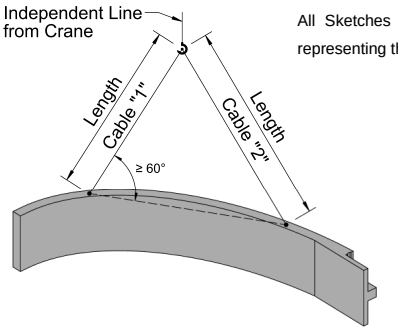


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	4.89
In-Situ Concrete per Ring	[m³]	0.85

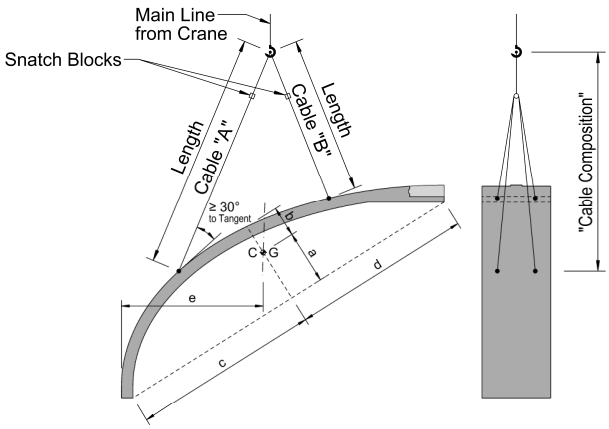
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	122.25 (12.2 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	2.90
Cable Force A	[kN]*	100.46
Cable Force B	[kN]*	27.55
Min. Length Cable 1&2	[m]	5.40
Cable Force 1&2	[kN]	70.58
Center of Gravity a	[m]	1.45
Center of Gravity b	[m]	0.81
Center of Gravity c	[m]	4.15
Center of Gravity d	[m]	4.12
Center of Gravity e	[m]	1.94

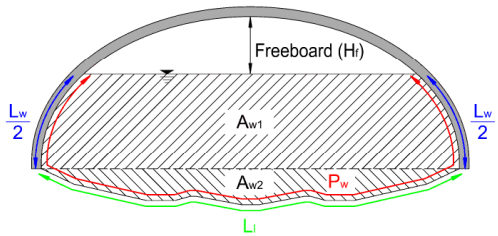


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	56.91	
1.0	51.68	5.83
2.0	43.78	4.43
3.0	34.35	3.27
4.0	23.99	2.21
5.0	13.14	1.20
6.0	1.67	0.15

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	22.1	70.0	26.5	84.0
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-32.2	353.4	-41.4	438.3
LC41	0.6m OF + Single Axle C	-30.1	375.4	-37.7	475.7
LC42	0.6m OF + Single Axle Ecc	-29.1	383.7	-36.0	489.7
LC43	0.6m OF + Tandem C	-28.6	381.2	-35.3	485.4
LC44	0.6m OF + Tandem Ecc	-27.3	400.9	-33.1	519.0
LC50	1.0m OF Permanent Loads	-31.1	395.9	-39.9	491.4
LC51	1.0m OF + Single Axle C	-29.2	416.8	-36.7	526.9
LC52	1.0m OF + Single Axle Ecc	-28.6	428.4	-35.7	546.6
LC53	1.0m OF + Tandem C	-28.1	428.5	-34.9	546.8
LC54	1.0m OF + Tandem Ecc	-27.1	446.2	-33.2	576.8
LC60	2.0m OF Permanent Loads	-28.1	541.6	-36.3	673.5
LC61	2.0m OF + Single Axle C	-26.8	558.0	-34.0	701.4
LC62	2.0m OF + Single Axle Ecc	-26.4	565.7	-33.4	714.5
LC63	2.0m OF + Tandem C	-26.1	567.1	-32.8	716.9
LC64	2.0m OF + Tandem Ecc	-25.5	579.6	-31.7	738.0
LC70	3.0m OF Permanent Loads	-25.3	691.2	-32.7	860.5
LC71	3.0m OF + Single Axle C	-24.2	705.6	-30.9	885.0
LC72	3.0m OF + Single Axle Ecc	-24.1	709.7	-30.7	892.0
LC73	3.0m OF + Tandem C	-23.7	712.5	-30.1	896.6
LC74	3.0m OF + Tandem Ecc	-23.5	719.6	-29.7	908.8
LC80	4.0m OF Permanent Loads	-22.4	843.1	-29.2	1050.4
LC81	4.0m OF + Single Axle C	-21.6	855.1	-27.8	1070.8
LC82	4.0m OF + Single Axle Ecc	-21.6	857.3	-27.8	1074.6
LC83	4.0m OF + Tandem C	-21.3	860.5	-27.2	1080.0
LC84	4.0m OF + Tandem Ecc	-21.2	864.8	-27.1	1087.2
LC90	5.0m OF Permanent Loads	-19.6	996.9	-25.6	1242.7
LC91	5.0m OF + Single Axle C	-19.0	1006.7	-24.6	1259.3
LC92	5.0m OF + Single Axle Ecc	-19.0	1008.1	-24.6	1261.7
LC93	5.0m OF + Tandem C	-18.7	1011.3	-24.1	1267.1
LC94	5.0m OF + Tandem Ecc	-18.7	1014.0	-24.1	1271.7

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

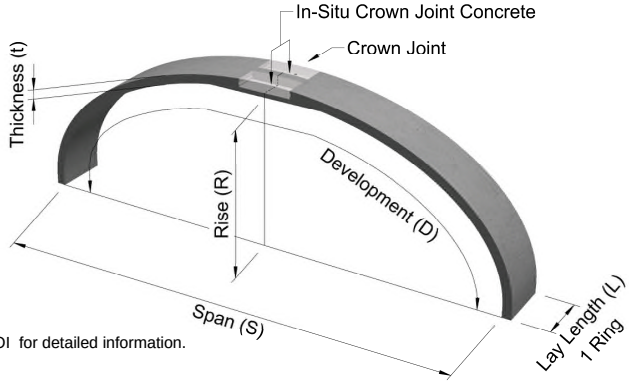
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/7

Dimensions

Span S	[m]	10.972
Rise R	[m]	6.502
Development D	[m]	19.637
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

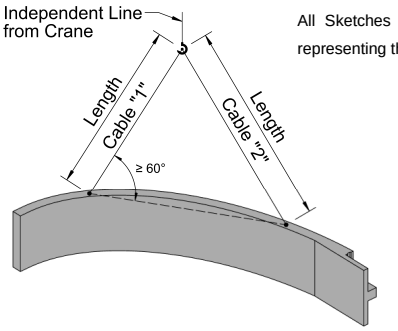


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.05
In-Situ Concrete per Ring	[m³]	0.85

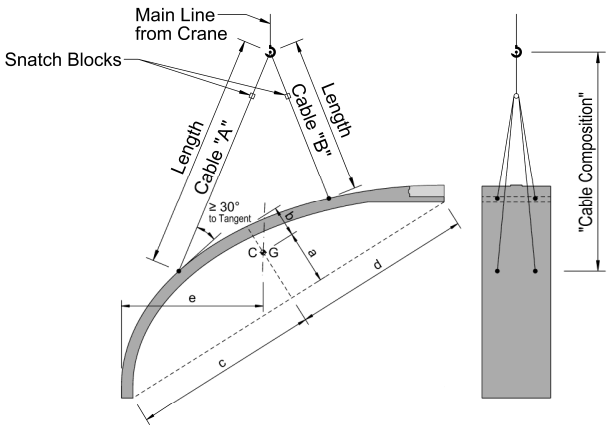
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	126.25 (12.7 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	3.00
Cable Force A	[kN]*	103.33
Cable Force B	[kN]*	25.48
Min. Length Cable 1&2	[m]	5.50
Cable Force 1&2	[kN]	72.89
Center of Gravity a	[m]	1.51
Center of Gravity b	[m]	0.85
Center of Gravity c	[m]	4.29
Center of Gravity d	[m]	4.22
Center of Gravity e	[m]	1.89

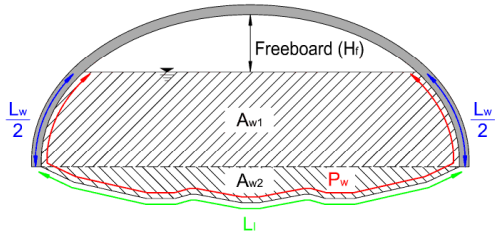


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	60.26	
1.0	55.03	6.13
2.0	47.12	4.74
3.0	37.69	3.57
4.0	27.33	2.51
5.0	16.49	1.50
6.0	5.02	0.46

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	21.1	72.0	25.3	86.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-41.6	364.3	-53.0	451.8
LC41	0.6m OF + Single Axle C	-40.1	385.8	-50.6	488.3
LC42	0.6m OF + Single Axle Ecc	-39.2	394.2	-49.0	502.5
LC43	0.6m OF + Tandem C	-39.1	391.4	-48.8	497.9
LC44	0.6m OF + Tandem Ecc	-38.0	411.2	-46.9	531.5
LC50	1.0m OF Permanent Loads	-41.2	407.7	-52.6	506.1
LC51	1.0m OF + Single Axle C	-40.0	428.2	-50.4	540.8
LC52	1.0m OF + Single Axle Ecc	-39.4	439.8	-49.6	560.5
LC53	1.0m OF + Tandem C	-39.2	439.7	-49.2	560.3
LC54	1.0m OF + Tandem Ecc	-38.4	457.2	-47.8	590.2
LC60	2.0m OF Permanent Loads	-40.6	555.6	-51.8	690.9
LC61	2.0m OF + Single Axle C	-39.6	571.6	-50.2	718.0
LC62	2.0m OF + Single Axle Ecc	-39.3	579.2	-49.7	731.0
LC63	2.0m OF + Tandem C	-39.2	580.4	-49.4	733.1
LC64	2.0m OF + Tandem Ecc	-38.7	592.7	-48.5	754.0
LC70	3.0m OF Permanent Loads	-39.9	707.1	-51.0	880.2
LC71	3.0m OF + Single Axle C	-39.3	721.2	-49.9	904.3
LC72	3.0m OF + Single Axle Ecc	-39.2	725.1	-49.7	910.8
LC73	3.0m OF + Tandem C	-39.0	727.7	-49.3	915.2
LC74	3.0m OF + Tandem Ecc	-38.8	734.9	-49.0	927.5
LC80	4.0m OF Permanent Loads	-39.4	861.1	-50.4	1072.8
LC81	4.0m OF + Single Axle C	-38.9	872.9	-49.5	1092.9
LC82	4.0m OF + Single Axle Ecc	-38.9	874.9	-49.5	1096.2
LC83	4.0m OF + Tandem C	-38.7	878.0	-49.1	1101.4
LC84	4.0m OF + Tandem Ecc	-38.7	882.3	-49.0	1108.7
LC90	5.0m OF Permanent Loads	-38.9	1017.1	-49.7	1267.7
LC91	5.0m OF + Single Axle C	-38.5	1026.7	-49.1	1284.1
LC92	5.0m OF + Single Axle Ecc	-38.6	1028.0	-49.1	1286.3
LC93	5.0m OF + Tandem C	-38.4	1031.1	-48.8	1291.5
LC94	5.0m OF + Tandem Ecc	-38.4	1033.8	-48.8	1296.2

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

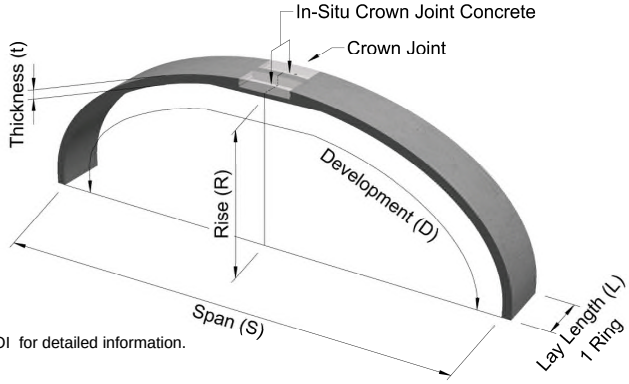
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C36T/8

Dimensions

Span S	[m]	10.970
Rise R	[m]	6.807
Development D	[m]	20.247
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

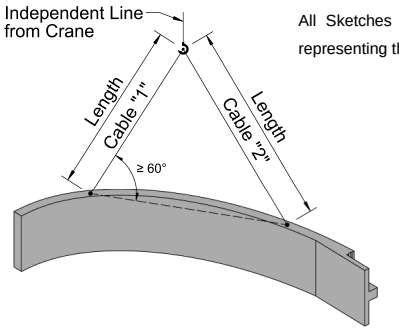


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.20
In-Situ Concrete per Ring	[m³]	0.85

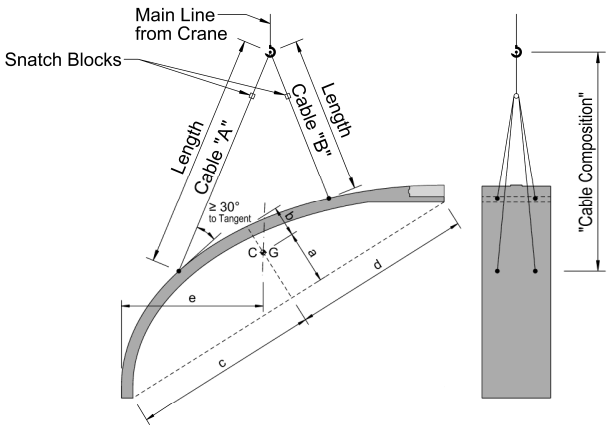
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	130.00 (13.0 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	3.00
Cable Force A	[kN]*	116.91
Cable Force B	[kN]*	22.12
Min. Length Cable 1&2	[m]	5.60
Cable Force 1&2	[kN]	75.06
Center of Gravity a	[m]	1.56
Center of Gravity b	[m]	0.88
Center of Gravity c	[m]	4.42
Center of Gravity d	[m]	4.32
Center of Gravity e	[m]	1.84

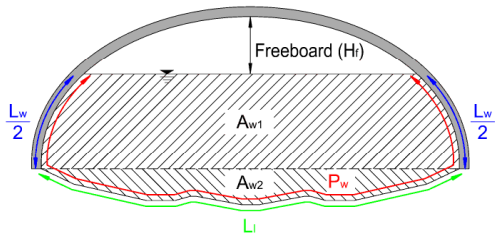


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	63.60	
1.0	58.37	6.44
2.0	50.47	5.04
3.0	41.03	3.88
4.0	30.68	2.82
5.0	19.83	1.81
6.0	8.36	0.76

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	20.2	74.1	24.2	88.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-50.6	375.7	-64.2	465.9
LC41	0.6m OF + Single Axle C	-49.7	396.7	-62.7	501.6
LC42	0.6m OF + Single Axle Ecc	-48.9	405.2	-61.4	516.0
LC43	0.6m OF + Tandem C	-49.0	402.1	-61.6	510.8
LC44	0.6m OF + Tandem Ecc	-48.1	421.9	-60.0	544.4
LC50	1.0m OF Permanent Loads	-50.9	420.0	-64.7	521.3
LC51	1.0m OF + Single Axle C	-50.1	440.2	-63.3	555.6
LC52	1.0m OF + Single Axle Ecc	-49.7	451.7	-62.6	575.2
LC53	1.0m OF + Tandem C	-49.7	451.4	-62.5	574.8
LC54	1.0m OF + Tandem Ecc	-49.0	468.9	-61.4	604.5
LC60	2.0m OF Permanent Loads	-52.1	570.3	-66.1	709.2
LC61	2.0m OF + Single Axle C	-51.5	586.2	-65.1	736.1
LC62	2.0m OF + Single Axle Ecc	-51.2	593.7	-64.7	748.9
LC63	2.0m OF + Tandem C	-51.1	594.5	-64.5	750.3
LC64	2.0m OF + Tandem Ecc	-50.8	606.8	-63.9	771.2
LC70	3.0m OF Permanent Loads	-53.2	723.9	-67.5	901.2
LC71	3.0m OF + Single Axle C	-52.7	737.7	-66.7	924.5
LC72	3.0m OF + Single Axle Ecc	-52.7	741.3	-66.6	930.7
LC73	3.0m OF + Tandem C	-52.6	743.7	-66.5	934.8
LC74	3.0m OF + Tandem Ecc	-52.4	750.8	-66.2	946.9
LC80	4.0m OF Permanent Loads	-54.4	880.0	-69.1	1096.3
LC81	4.0m OF + Single Axle C	-54.1	891.6	-68.5	1116.0
LC82	4.0m OF + Single Axle Ecc	-54.1	893.4	-68.5	1119.1
LC83	4.0m OF + Tandem C	-54.0	896.3	-68.4	1124.0
LC84	4.0m OF + Tandem Ecc	-54.0	900.6	-68.3	1131.4
LC90	5.0m OF Permanent Loads	-55.7	1038.3	-70.7	1294.1
LC91	5.0m OF + Single Axle C	-55.5	1047.8	-70.3	1310.3
LC92	5.0m OF + Single Axle Ecc	-55.5	1049.0	-70.4	1312.4
LC93	5.0m OF + Tandem C	-55.4	1052.0	-70.2	1317.4
LC94	5.0m OF + Tandem Ecc	-55.5	1054.7	-70.2	1322.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

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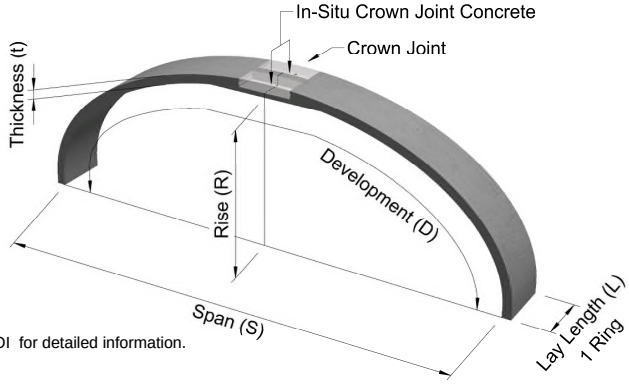
Dimensions

Span S	[m]	10.970
Rise R	[m]	7.112
Development D	[m]	20.857
Thickness t	[mm]	279
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

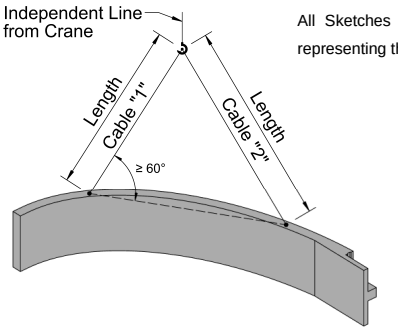


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.35
In-Situ Concrete per Ring	[m³]	0.85

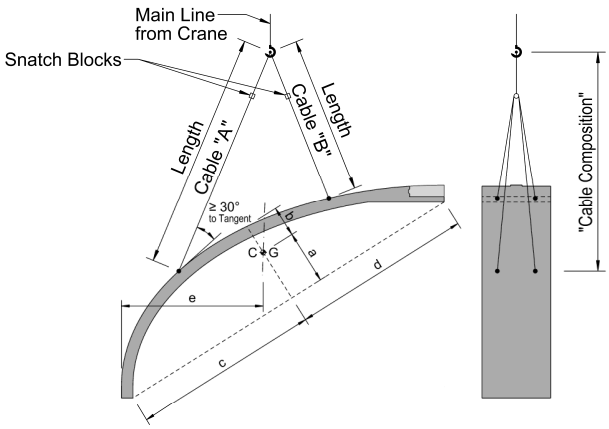
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	133.75 (13.4 metric tons)
Length Cable A	[m]*	4.00
Length Cable B	[m]*	3.00
Cable Force A	[kN]*	122.00
Cable Force B	[kN]*	20.88
Min. Length Cable 1&2	[m]	5.80
Cable Force 1&2	[kN]	77.22
Center of Gravity a	[m]	1.61
Center of Gravity b	[m]	0.92
Center of Gravity c	[m]	4.56
Center of Gravity d	[m]	4.42
Center of Gravity e	[m]	1.79

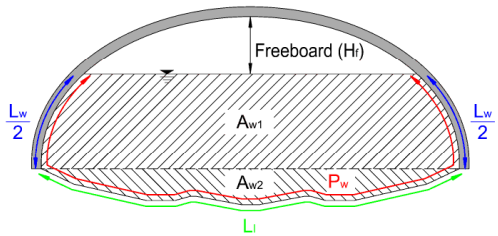


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	66.95	
1.0	61.72	6.74
2.0	53.81	5.35
3.0	44.38	4.18
4.0	34.02	3.12
5.0	23.18	2.11
6.0	11.71	1.07

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	19.4	76.1	23.3	91.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-59.4	387.5	-75.3	480.6
LC41	0.6m OF + Single Axle C	-58.9	408.2	-74.4	515.8
LC42	0.6m OF + Single Axle Ecc	-58.3	416.7	-73.3	530.1
LC43	0.6m OF + Tandem C	-58.5	413.4	-73.7	524.7
LC44	0.6m OF + Tandem Ecc	-57.7	433.2	-72.4	558.2
LC50	1.0m OF Permanent Loads	-60.3	432.8	-76.3	537.2
LC51	1.0m OF + Single Axle C	-59.8	452.8	-75.6	571.1
LC52	1.0m OF + Single Axle Ecc	-59.5	464.3	-75.0	590.7
LC53	1.0m OF + Tandem C	-59.6	463.9	-75.1	590.0
LC54	1.0m OF + Tandem Ecc	-59.0	481.2	-74.2	619.4
LC60	2.0m OF Permanent Loads	-62.8	585.7	-79.4	728.3
LC61	2.0m OF + Single Axle C	-62.4	601.5	-78.9	755.1
LC62	2.0m OF + Single Axle Ecc	-62.3	608.9	-78.6	767.8
LC63	2.0m OF + Tandem C	-62.3	609.7	-78.6	769.2
LC64	2.0m OF + Tandem Ecc	-62.0	621.9	-78.1	789.8
LC70	3.0m OF Permanent Loads	-65.3	742.0	-82.5	923.7
LC71	3.0m OF + Single Axle C	-65.0	755.3	-82.1	946.3
LC72	3.0m OF + Single Axle Ecc	-64.9	758.7	-82.0	952.0
LC73	3.0m OF + Tandem C	-64.9	760.8	-82.0	955.7
LC74	3.0m OF + Tandem Ecc	-64.8	767.9	-81.7	967.7
LC80	4.0m OF Permanent Loads	-67.8	899.8	-85.8	1120.9
LC81	4.0m OF + Single Axle C	-67.7	911.2	-85.5	1140.3
LC82	4.0m OF + Single Axle Ecc	-67.7	912.8	-85.5	1143.1
LC83	4.0m OF + Tandem C	-67.6	915.6	-85.4	1147.8
LC84	4.0m OF + Tandem Ecc	-67.6	920.0	-85.4	1155.3
LC90	5.0m OF Permanent Loads	-70.5	1060.6	-89.1	1321.9
LC91	5.0m OF + Single Axle C	-70.4	1069.9	-89.0	1337.7
LC92	5.0m OF + Single Axle Ecc	-70.5	1071.0	-89.0	1339.6
LC93	5.0m OF + Tandem C	-70.4	1073.8	-88.9	1344.3
LC94	5.0m OF + Tandem Ecc	-70.4	1076.5	-89.0	1349.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

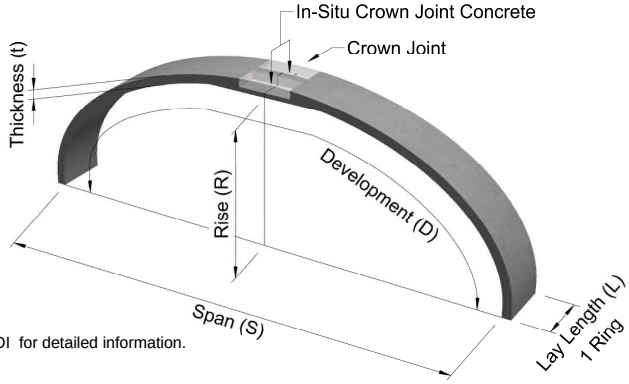
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/0

Dimensions

Span S	[m]	12.670
Rise R	[m]	5.283
Development D	[m]	18.239
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

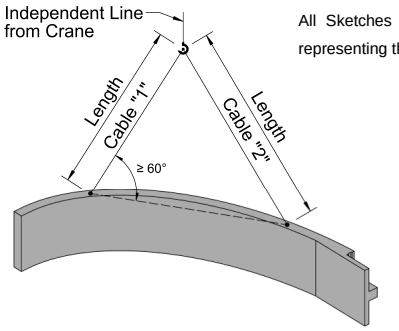


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.11
In-Situ Concrete per Ring	[m³]	0.93

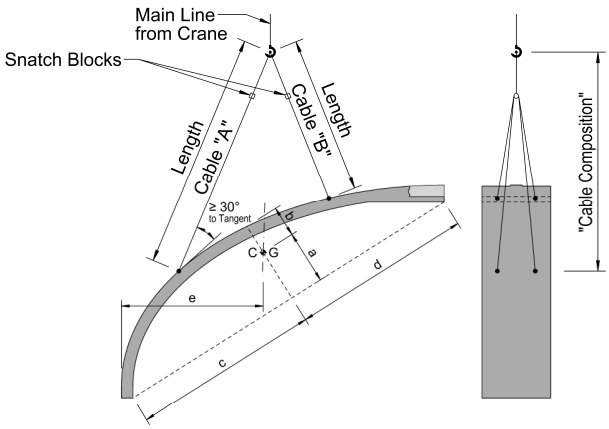
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

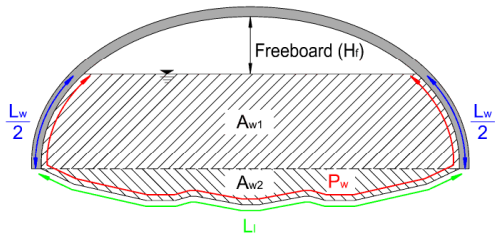
Arch Element Weight	[kN]	127.75 (12.8 metric tons)
Length Cable A	[m]*	7.10
Length Cable B	[m]*	5.30
Cable Force A	[kN]*	83.25
Cable Force B	[kN]*	48.78
Min. Length Cable 1&2	[m]	5.20
Cable Force 1&2	[kN]	73.76
Center of Gravity a	[m]	1.25
Center of Gravity b	[m]	0.69
Center of Gravity c	[m]	4.10
Center of Gravity d	[m]	4.15
Center of Gravity e	[m]	2.64



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	52.26	
1.0	46.57	10.28
2.0	37.92	7.32
3.0	27.50	4.86
4.0	15.90	2.65
5.0	3.58	0.58



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	36.7	73.8	44.1	88.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	30.1	372.5	35.8	462.0
LC41	0.6m OF + Single Axle C	39.6	400.4	51.9	509.4
LC42	0.6m OF + Single Axle Ecc	39.8	407.4	52.2	521.2
LC43	0.6m OF + Tandem C	44.7	410.7	60.6	526.9
LC44	0.6m OF + Tandem Ecc	45.7	427.9	62.3	556.1
LC50	1.0m OF Permanent Loads	39.9	422.5	48.0	524.4
LC51	1.0m OF + Single Axle C	47.9	447.8	61.6	567.4
LC52	1.0m OF + Single Axle Ecc	48.5	458.2	62.6	585.2
LC53	1.0m OF + Tandem C	52.6	462.3	69.6	592.0
LC54	1.0m OF + Tandem Ecc	53.6	479.1	71.4	620.7
LC60	2.0m OF Permanent Loads	67.2	581.9	82.2	723.7
LC61	2.0m OF + Single Axle C	72.9	601.0	91.8	756.2
LC62	2.0m OF + Single Axle Ecc	73.4	608.4	92.7	768.7
LC63	2.0m OF + Tandem C	76.1	611.7	97.3	774.3
LC64	2.0m OF + Tandem Ecc	77.2	624.4	99.1	795.9
LC70	3.0m OF Permanent Loads	94.8	743.6	116.6	925.8
LC71	3.0m OF + Single Axle C	99.3	759.4	124.3	952.7
LC72	3.0m OF + Single Axle Ecc	99.5	764.2	124.6	960.8
LC73	3.0m OF + Tandem C	101.9	768.3	128.7	967.8
LC74	3.0m OF + Tandem Ecc	102.2	775.6	129.2	980.2
LC80	4.0m OF Permanent Loads	122.6	906.7	151.4	1129.6
LC81	4.0m OF + Single Axle C	126.3	920.0	157.7	1152.2
LC82	4.0m OF + Single Axle Ecc	122.7	906.8	151.5	1129.9
LC83	4.0m OF + Tandem C	128.5	927.9	161.4	1165.8
LC84	4.0m OF + Tandem Ecc	128.4	932.1	161.2	1172.9
LC90	5.0m OF Permanent Loads	151.0	1072.3	186.9	1336.6
LC91	5.0m OF + Single Axle C	153.9	1083.4	191.9	1355.5
LC92	5.0m OF + Single Axle Ecc	153.8	1085.0	191.6	1358.2
LC93	5.0m OF + Tandem C	143.3	1025.0	173.8	1256.2
LC94	5.0m OF + Tandem Ecc	155.3	1091.8	194.2	1369.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

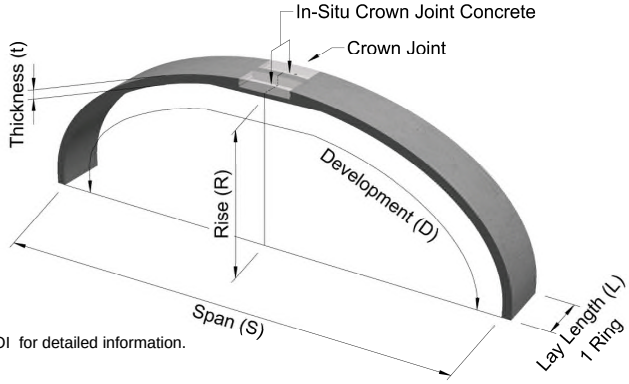
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/1

Dimensions

Span S	[m]	12.744
Rise R	[m]	5.588
Development D	[m]	18.853
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

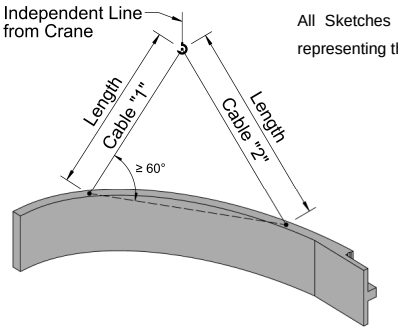


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.28
In-Situ Concrete per Ring	[m³]	0.93

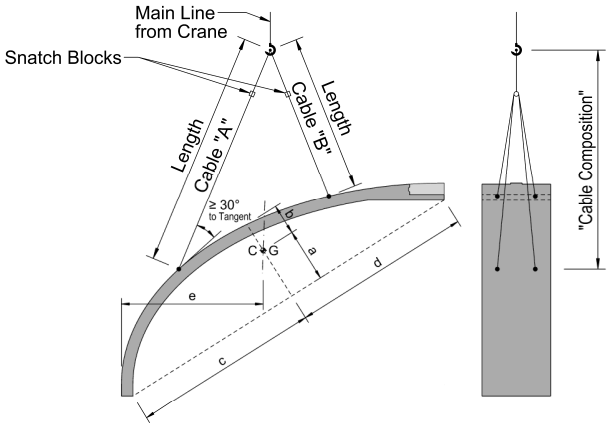
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

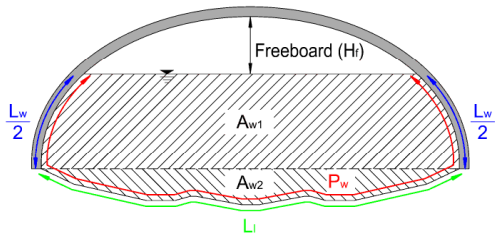
Arch Element Weight	[kN]	132.00 (13.2 metric tons)
Length Cable A	[m]*	6.40
Length Cable B	[m]*	4.70
Cable Force A	[kN]*	91.64
Cable Force B	[kN]*	44.67
Min. Length Cable 1&2	[m]	5.40
Cable Force 1&2	[kN]	76.21
Center of Gravity a	[m]	1.32
Center of Gravity b	[m]	0.72
Center of Gravity c	[m]	4.21
Center of Gravity d	[m]	4.26
Center of Gravity e	[m]	2.60



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	56.13	
1.0	50.45	10.91
2.0	41.79	7.93
3.0	31.37	5.48
4.0	19.78	3.26
5.0	7.45	1.19



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	35.3	76.1	42.3	91.4
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	18.9	384.7	21.9	477.0
LC41	0.6m OF + Single Axle C	27.0	411.8	35.6	523.1
LC42	0.6m OF + Single Axle Ecc	27.5	418.7	36.4	534.9
LC43	0.6m OF + Tandem C	31.3	421.4	42.9	539.5
LC44	0.6m OF + Tandem Ecc	32.7	439.2	45.4	569.8
LC50	1.0m OF Permanent Loads	27.3	435.4	32.3	540.4
LC51	1.0m OF + Single Axle C	34.1	460.2	43.9	582.5
LC52	1.0m OF + Single Axle Ecc	34.9	470.8	45.2	600.6
LC53	1.0m OF + Tandem C	38.1	474.4	50.8	606.7
LC54	1.0m OF + Tandem Ecc	39.4	491.5	53.0	635.8
LC60	2.0m OF Permanent Loads	50.8	597.5	61.7	743.1
LC61	2.0m OF + Single Axle C	55.6	616.3	70.0	775.0
LC62	2.0m OF + Single Axle Ecc	56.3	623.8	71.0	787.7
LC63	2.0m OF + Tandem C	58.4	626.6	74.7	792.6
LC64	2.0m OF + Tandem Ecc	59.6	639.4	76.6	814.3
LC70	3.0m OF Permanent Loads	74.4	761.4	91.2	947.9
LC71	3.0m OF + Single Axle C	78.3	777.0	97.9	974.5
LC72	3.0m OF + Single Axle Ecc	78.6	781.8	98.3	982.6
LC73	3.0m OF + Tandem C	80.5	785.6	101.6	989.2
LC74	3.0m OF + Tandem Ecc	80.9	792.8	102.2	1001.3
LC80	4.0m OF Permanent Loads	98.3	926.7	121.1	1154.6
LC81	4.0m OF + Single Axle C	101.4	939.8	126.5	1176.9
LC82	4.0m OF + Single Axle Ecc	98.3	926.9	121.2	1154.9
LC83	4.0m OF + Tandem C	103.3	947.7	129.7	1190.3
LC84	4.0m OF + Tandem Ecc	103.3	951.7	129.6	1197.0
LC90	5.0m OF Permanent Loads	122.6	1094.8	151.5	1364.7
LC91	5.0m OF + Single Axle C	125.2	1105.7	155.9	1383.3
LC92	5.0m OF + Single Axle Ecc	125.1	1107.3	155.7	1385.9
LC93	5.0m OF + Tandem C	115.6	1045.3	139.5	1280.5
LC94	5.0m OF + Tandem Ecc	126.3	1113.8	157.8	1397.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

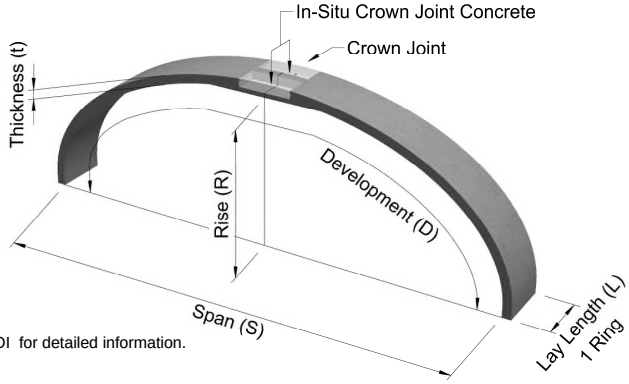
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/2

Dimensions

Span S	[m]	12.788
Rise R	[m]	5.893
Development D	[m]	19.465
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

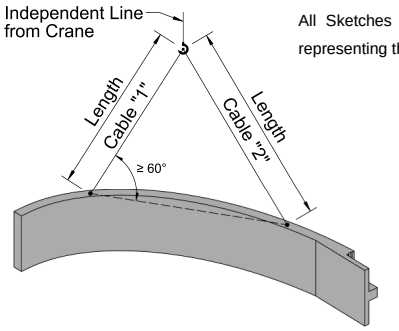


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.46
In-Situ Concrete per Ring	[m³]	0.93

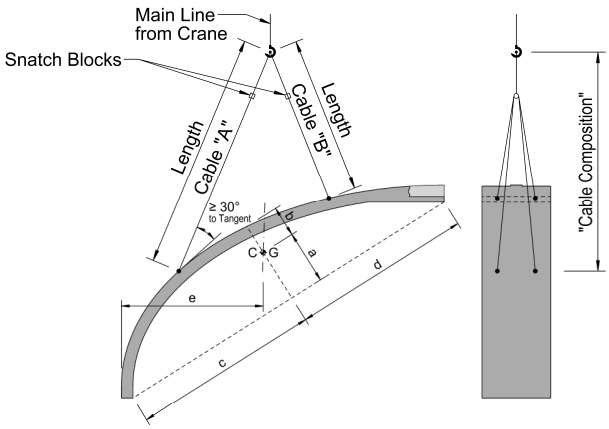
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

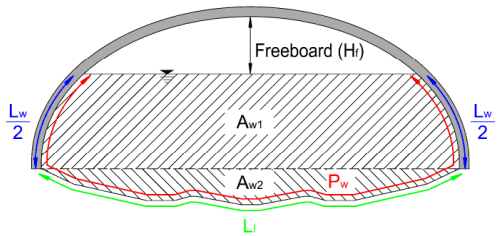
Arch Element Weight	[kN]	136.50 (13.7 metric tons)
Length Cable A	[m]*	5.90
Length Cable B	[m]*	4.20
Cable Force A	[kN]*	82.63
Cable Force B	[kN]*	46.29
Min. Length Cable 1&2	[m]	5.60
Cable Force 1&2	[kN]	78.81
Center of Gravity a	[m]	1.38
Center of Gravity b	[m]	0.76
Center of Gravity c	[m]	4.32
Center of Gravity d	[m]	4.37
Center of Gravity e	[m]	2.54



*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	60.02	
1.0	54.34	11.52
2.0	45.69	8.55
3.0	35.26	6.09
4.0	23.67	3.88
5.0	11.34	1.80



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	33.8	78.4	40.6	94.1
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	6.8	395.6	6.9	490.5
LC41	0.6m OF + Single Axle C	13.4	421.5	18.0	534.5
LC42	0.6m OF + Single Axle Ecc	14.1	428.8	19.2	547.0
LC43	0.6m OF + Tandem C	16.9	430.2	24.0	549.3
LC44	0.6m OF + Tandem Ecc	18.6	448.9	26.8	581.2
LC50	1.0m OF Permanent Loads	13.6	446.9	15.3	554.7
LC51	1.0m OF + Single Axle C	19.2	470.7	24.8	595.2
LC52	1.0m OF + Single Axle Ecc	20.0	481.7	26.2	613.9
LC53	1.0m OF + Tandem C	22.5	484.3	30.4	618.3
LC54	1.0m OF + Tandem Ecc	23.9	501.9	32.8	648.3
LC60	2.0m OF Permanent Loads	32.7	610.5	39.1	759.2
LC61	2.0m OF + Single Axle C	36.7	628.6	45.9	790.0
LC62	2.0m OF + Single Axle Ecc	37.3	636.3	47.0	803.2
LC63	2.0m OF + Tandem C	38.9	638.6	49.8	807.0
LC64	2.0m OF + Tandem Ecc	40.1	651.6	51.7	829.1
LC70	3.0m OF Permanent Loads	51.8	776.0	63.1	966.1
LC71	3.0m OF + Single Axle C	55.0	791.3	68.6	992.0
LC72	3.0m OF + Single Axle Ecc	55.3	796.0	69.0	1000.0
LC73	3.0m OF + Tandem C	56.8	799.3	71.5	1005.7
LC74	3.0m OF + Tandem Ecc	57.2	806.7	72.3	1018.3
LC80	4.0m OF Permanent Loads	71.2	943.0	87.3	1174.8
LC81	4.0m OF + Single Axle C	73.8	955.8	91.7	1196.6
LC82	4.0m OF + Single Axle Ecc	71.2	943.1	87.4	1175.1
LC83	4.0m OF + Tandem C	75.3	963.4	94.4	1209.6
LC84	4.0m OF + Tandem Ecc	75.3	967.3	94.3	1216.1
LC90	5.0m OF Permanent Loads	90.9	1112.7	112.0	1387.0
LC91	5.0m OF + Single Axle C	93.0	1123.3	115.5	1404.9
LC92	5.0m OF + Single Axle Ecc	92.9	1124.8	115.4	1407.5
LC93	5.0m OF + Tandem C	84.7	1061.0	101.4	1299.1
LC94	5.0m OF + Tandem Ecc	93.9	1130.9	117.1	1418.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

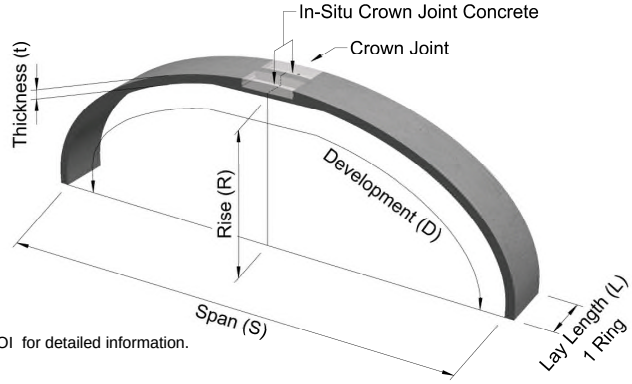
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/3

Dimensions

Span S	[m]	12.802
Rise R	[m]	6.197
Development D	[m]	20.074
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

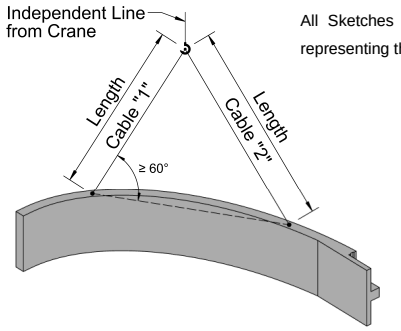


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.63
In-Situ Concrete per Ring	[m³]	0.93

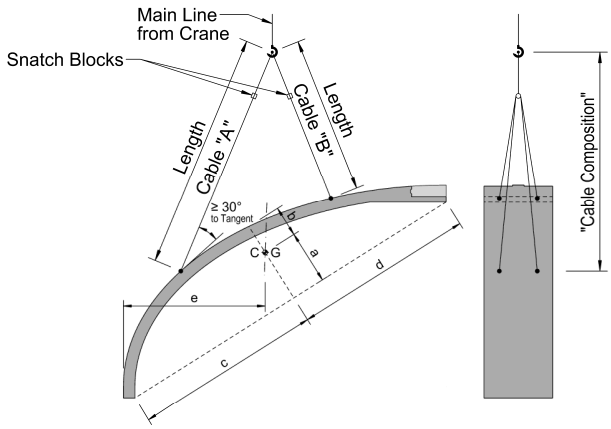
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	140.75 (14.1 metric tons)
Length Cable A	[m]*	5.20
Length Cable B	[m]*	3.60
Cable Force A	[kN]*	110.16
Cable Force B	[kN]*	38.77
Min. Length Cable 1&2	[m]	5.70
Cable Force 1&2	[kN]	81.26
Center of Gravity a	[m]	1.45
Center of Gravity b	[m]	0.80
Center of Gravity c	[m]	4.43
Center of Gravity d	[m]	4.47
Center of Gravity e	[m]	2.48

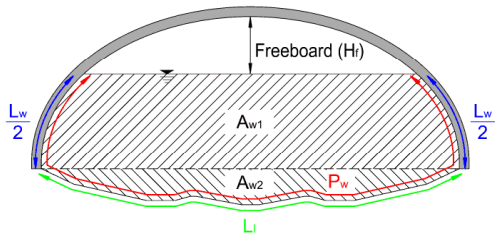


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	63.92	
1.0	58.24	12.13
2.0	49.59	9.15
3.0	39.16	6.70
4.0	27.57	4.49
5.0	15.24	2.41
6.0	2.53	0.40

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	32.3	80.7	38.7	96.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-5.7	405.9	-8.7	503.4
LC41	0.6m OF + Single Axle C	-0.6	430.0	-0.1	544.4
LC42	0.6m OF + Single Axle Ecc	0.2	437.7	1.3	557.3
LC43	0.6m OF + Tandem C	2.2	437.8	4.6	557.5
LC44	0.6m OF + Tandem Ecc	3.8	457.3	7.4	590.6
LC50	1.0m OF Permanent Loads	-0.6	457.1	-2.4	567.3
LC51	1.0m OF + Single Axle C	3.8	479.8	5.1	606.0
LC52	1.0m OF + Single Axle Ecc	4.6	491.2	6.5	625.3
LC53	1.0m OF + Tandem C	6.4	492.7	9.5	627.8
LC54	1.0m OF + Tandem Ecc	7.7	510.8	11.8	658.7
LC60	2.0m OF Permanent Loads	13.8	621.5	15.6	772.8
LC61	2.0m OF + Single Axle C	17.0	639.0	21.0	802.7
LC62	2.0m OF + Single Axle Ecc	17.6	646.9	22.0	816.0
LC63	2.0m OF + Tandem C	18.7	648.6	24.1	818.9
LC64	2.0m OF + Tandem Ecc	19.8	661.7	25.8	841.2
LC70	3.0m OF Permanent Loads	28.4	788.2	33.8	981.2
LC71	3.0m OF + Single Axle C	30.9	803.0	38.2	1006.3
LC72	3.0m OF + Single Axle Ecc	31.1	807.5	38.6	1014.0
LC73	3.0m OF + Tandem C	32.2	810.3	40.4	1018.8
LC74	3.0m OF + Tandem Ecc	32.7	818.0	41.2	1031.9
LC80	4.0m OF Permanent Loads	43.0	956.2	52.2	1191.2
LC81	4.0m OF + Single Axle C	45.1	968.7	55.7	1212.5
LC82	4.0m OF + Single Axle Ecc	43.1	956.4	52.2	1191.6
LC83	4.0m OF + Tandem C	46.3	976.2	57.7	1225.3
LC84	4.0m OF + Tandem Ecc	46.3	979.8	57.7	1231.4
LC90	5.0m OF Permanent Loads	57.9	1127.2	70.8	1405.0
LC91	5.0m OF + Single Axle C	59.6	1137.7	73.6	1422.7
LC92	5.0m OF + Single Axle Ecc	59.5	1139.0	73.5	1425.0
LC93	5.0m OF + Tandem C	52.7	1073.7	61.9	1314.0
LC94	5.0m OF + Tandem Ecc	60.3	1144.8	74.8	1434.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

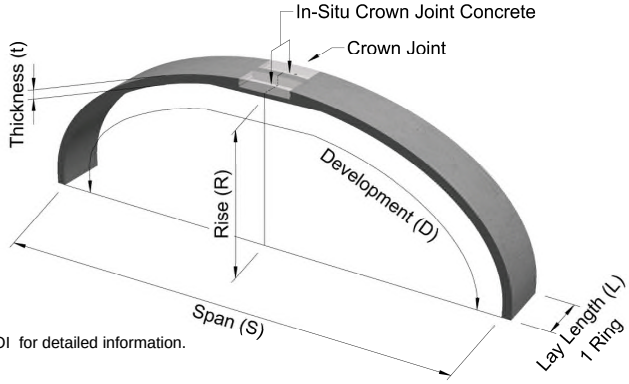
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/4

Dimensions

Span S	[m]	12.802
Rise R	[m]	6.502
Development D	[m]	20.684
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

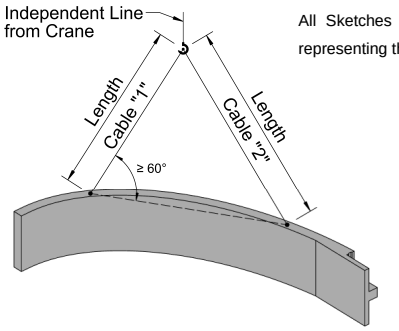


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.80
In-Situ Concrete per Ring	[m³]	0.93

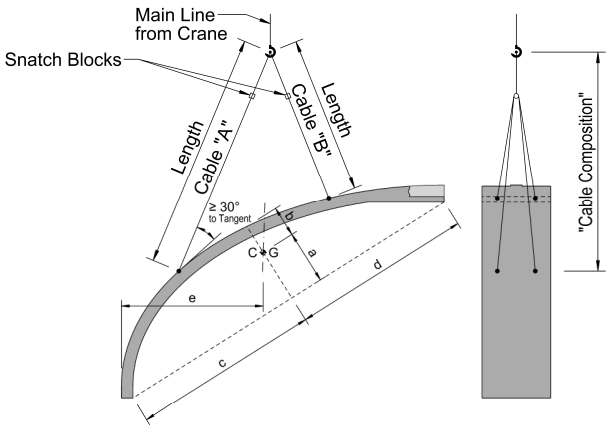
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	145.00 (14.5 metric tons)
Length Cable A	[m]*	4.70
Length Cable B	[m]*	3.30
Cable Force A	[kN]*	115.17
Cable Force B	[kN]*	36.63
Min. Length Cable 1&2	[m]	5.90
Cable Force 1&2	[kN]	83.72
Center of Gravity a	[m]	1.52
Center of Gravity b	[m]	0.83
Center of Gravity c	[m]	4.55
Center of Gravity d	[m]	4.57
Center of Gravity e	[m]	2.41

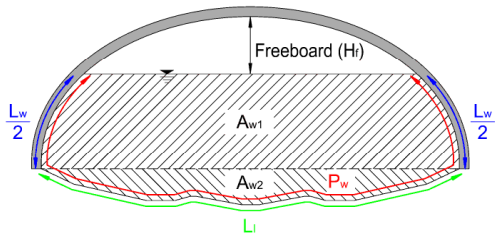


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	67.82	
1.0	62.14	12.74
2.0	53.49	9.76
3.0	43.06	7.30
4.0	31.47	5.10
5.0	19.14	3.02
6.0	6.43	1.01

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	30.8	83.0	37.0	99.5
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-17.8	415.8	-23.8	515.6
LC41	0.6m OF + Single Axle C	-14.0	438.6	-17.3	554.4
LC42	0.6m OF + Single Axle Ecc	-13.2	446.5	-15.9	567.8
LC43	0.6m OF + Tandem C	-11.9	445.6	-13.7	566.2
LC44	0.6m OF + Tandem Ecc	-10.3	465.5	-11.0	600.1
LC50	1.0m OF Permanent Loads	-14.2	467.1	-19.3	579.7
LC51	1.0m OF + Single Axle C	-10.9	488.9	-13.7	616.8
LC52	1.0m OF + Single Axle Ecc	-10.1	500.4	-12.4	636.4
LC53	1.0m OF + Tandem C	-9.0	501.2	-10.4	637.6
LC54	1.0m OF + Tandem Ecc	-7.7	519.5	-8.2	668.8
LC60	2.0m OF Permanent Loads	-4.0	632.3	-6.6	786.2
LC61	2.0m OF + Single Axle C	-1.6	649.3	-2.5	815.1
LC62	2.0m OF + Single Axle Ecc	-1.1	657.2	-1.5	828.6
LC63	2.0m OF + Tandem C	-0.2	658.4	-0.2	830.6
LC64	2.0m OF + Tandem Ecc	0.7	671.6	1.4	853.0
LC70	3.0m OF Permanent Loads	6.3	800.0	6.4	995.8
LC71	3.0m OF + Single Axle C	8.3	814.6	9.6	1020.7
LC72	3.0m OF + Single Axle Ecc	8.5	819.0	10.0	1028.1
LC73	3.0m OF + Tandem C	9.2	821.6	11.3	1032.6
LC74	3.0m OF + Tandem Ecc	9.6	829.3	12.0	1045.7
LC80	4.0m OF Permanent Loads	16.6	969.7	19.3	1208.0
LC81	4.0m OF + Single Axle C	18.2	982.2	21.9	1229.3
LC82	4.0m OF + Single Axle Ecc	16.6	970.3	19.2	1209.0
LC83	4.0m OF + Tandem C	19.1	989.7	23.4	1241.9
LC84	4.0m OF + Tandem Ecc	19.1	992.9	23.4	1247.4
LC90	5.0m OF Permanent Loads	27.1	1142.5	32.3	1424.0
LC91	5.0m OF + Single Axle C	28.3	1152.8	34.4	1441.5
LC92	5.0m OF + Single Axle Ecc	28.2	1154.0	34.3	1443.5
LC93	5.0m OF + Tandem C	22.8	1087.3	25.1	1330.0
LC94	5.0m OF + Tandem Ecc	28.8	1159.5	35.2	1452.9

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

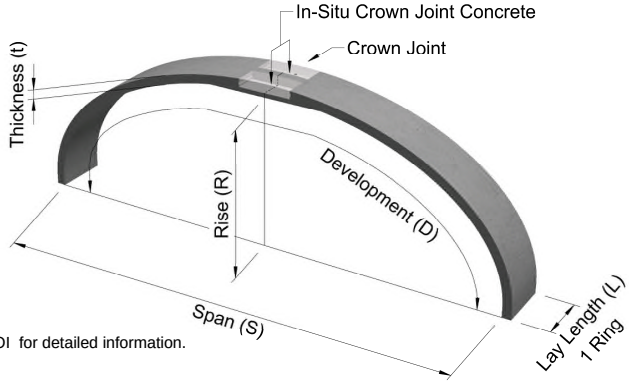
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/5

Dimensions

Span S	[m]	12.802
Rise R	[m]	6.807
Development D	[m]	21.294
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

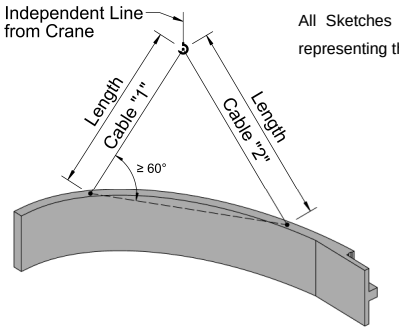


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	5.97
In-Situ Concrete per Ring	[m³]	0.93

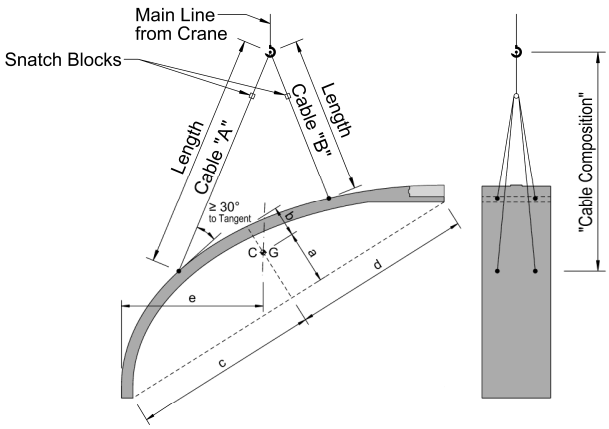
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	149.25 (14.9 metric tons)
Length Cable A	[m]*	4.30
Length Cable B	[m]*	3.00
Cable Force A	[kN]*	117.53
Cable Force B	[kN]*	30.36
Min. Length Cable 1&2	[m]	6.00
Cable Force 1&2	[kN]	86.17
Center of Gravity a	[m]	1.58
Center of Gravity b	[m]	0.87
Center of Gravity c	[m]	4.67
Center of Gravity d	[m]	4.67
Center of Gravity e	[m]	2.35

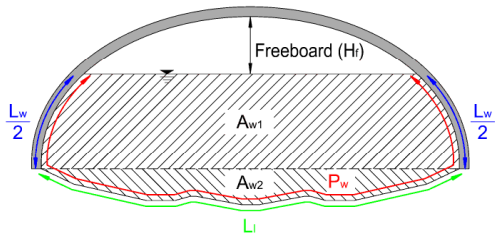


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	71.72	
1.0	66.04	13.35
2.0	57.39	10.38
3.0	46.97	7.92
4.0	35.37	5.70
5.0	23.05	3.62
6.0	10.33	1.61

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	29.5	85.2	35.4	102.2
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-29.5	426.1	-38.4	528.4
LC41	0.6m OF + Single Axle C	-26.7	448.0	-33.6	565.6
LC42	0.6m OF + Single Axle Ecc	-25.9	456.0	-32.2	579.2
LC43	0.6m OF + Tandem C	-25.1	454.4	-30.9	576.4
LC44	0.6m OF + Tandem Ecc	-23.7	474.5	-28.4	610.7
LC50	1.0m OF Permanent Loads	-27.2	477.9	-35.5	593.1
LC51	1.0m OF + Single Axle C	-24.8	499.0	-31.3	629.0
LC52	1.0m OF + Single Axle Ecc	-24.1	510.6	-30.1	648.7
LC53	1.0m OF + Tandem C	-23.3	510.8	-28.9	649.0
LC54	1.0m OF + Tandem Ecc	-22.2	529.0	-26.9	680.0
LC60	2.0m OF Permanent Loads	-20.6	644.0	-27.2	800.8
LC61	2.0m OF + Single Axle C	-18.8	660.6	-24.1	829.0
LC62	2.0m OF + Single Axle Ecc	-18.3	668.5	-23.3	842.4
LC63	2.0m OF + Tandem C	-17.8	669.5	-22.4	844.0
LC64	2.0m OF + Tandem Ecc	-17.0	682.7	-21.1	866.5
LC70	3.0m OF Permanent Loads	-13.8	813.6	-18.8	1012.8
LC71	3.0m OF + Single Axle C	-12.4	828.0	-16.3	1037.2
LC72	3.0m OF + Single Axle Ecc	-12.2	832.1	-16.1	1044.2
LC73	3.0m OF + Tandem C	-11.7	834.7	-15.2	1048.6
LC74	3.0m OF + Tandem Ecc	-11.4	842.5	-14.6	1061.8
LC80	4.0m OF Permanent Loads	-7.2	985.4	-10.5	1227.5
LC81	4.0m OF + Single Axle C	-6.1	997.6	-8.5	1248.3
LC82	4.0m OF + Single Axle Ecc	-7.2	986.0	-10.5	1228.5
LC83	4.0m OF + Tandem C	-5.4	1004.9	-7.4	1260.6
LC84	4.0m OF + Tandem Ecc	-5.4	1007.9	-7.4	1265.7
LC90	5.0m OF Permanent Loads	-0.5	1159.8	-2.0	1445.5
LC91	5.0m OF + Single Axle C	0.4	1169.9	-0.5	1462.6
LC92	5.0m OF + Single Axle Ecc	0.4	1170.9	-0.7	1464.4
LC93	5.0m OF + Tandem C	-3.9	1102.6	-7.9	1348.3
LC94	5.0m OF + Tandem Ecc	0.8	1176.3	0.1	1473.6

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

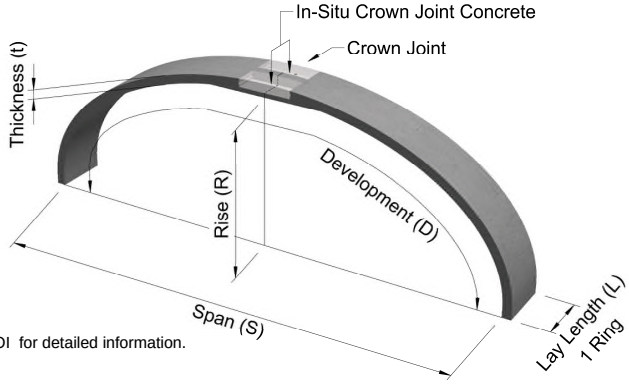
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/6

Dimensions

Span S	[m]	12.802
Rise R	[m]	7.112
Development D	[m]	21.903
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

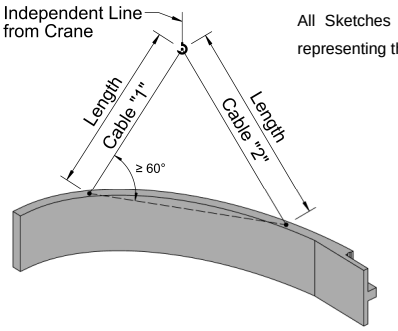


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.14
In-Situ Concrete per Ring	[m³]	0.93

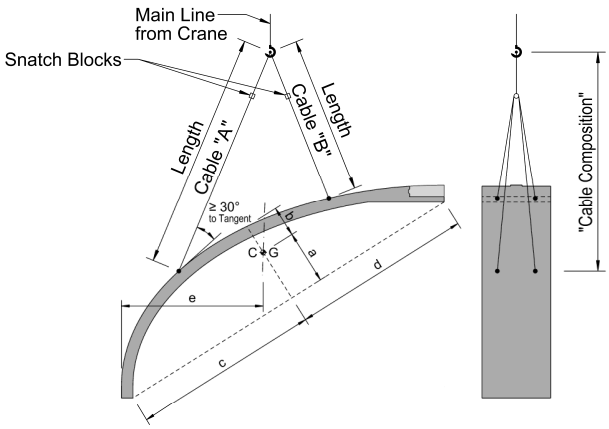
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	153.50 (15.4 metric tons)
Length Cable A	[m]*	3.90
Length Cable B	[m]*	2.70
Cable Force A	[kN]*	132.66
Cable Force B	[kN]*	32.78
Min. Length Cable 1&2	[m]	6.20
Cable Force 1&2	[kN]	88.62
Center of Gravity a	[m]	1.65
Center of Gravity b	[m]	0.91
Center of Gravity c	[m]	4.79
Center of Gravity d	[m]	4.77
Center of Gravity e	[m]	2.29

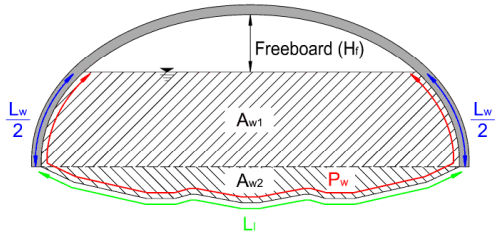


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	75.63	
1.0	69.95	13.96
2.0	61.29	10.99
3.0	50.87	8.52
4.0	39.28	6.32
5.0	26.95	4.24
6.0	14.23	2.22

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	28.3	87.4	34.0	104.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-40.7	436.7	-52.3	541.5
LC41	0.6m OF + Single Axle C	-38.7	457.8	-48.9	577.4
LC42	0.6m OF + Single Axle Ecc	-38.0	466.0	-47.6	591.4
LC43	0.6m OF + Tandem C	-37.6	463.9	-47.0	587.8
LC44	0.6m OF + Tandem Ecc	-36.3	484.1	-44.8	622.0
LC50	1.0m OF Permanent Loads	-39.5	489.1	-50.8	607.0
LC51	1.0m OF + Single Axle C	-37.7	509.6	-47.8	641.9
LC52	1.0m OF + Single Axle Ecc	-37.1	521.3	-46.7	661.7
LC53	1.0m OF + Tandem C	-36.7	521.0	-46.0	661.3
LC54	1.0m OF + Tandem Ecc	-35.7	539.4	-44.3	692.5
LC60	2.0m OF Permanent Loads	-35.8	657.0	-46.2	816.9
LC61	2.0m OF + Single Axle C	-34.5	673.3	-43.9	844.6
LC62	2.0m OF + Single Axle Ecc	-34.1	681.1	-43.3	857.8
LC63	2.0m OF + Tandem C	-33.8	681.8	-42.7	859.1
LC64	2.0m OF + Tandem Ecc	-33.1	694.9	-41.6	881.3
LC70	3.0m OF Permanent Loads	-32.0	828.3	-41.5	1031.1
LC71	3.0m OF + Single Axle C	-31.0	842.6	-39.8	1055.2
LC72	3.0m OF + Single Axle Ecc	-30.9	846.4	-39.5	1061.8
LC73	3.0m OF + Tandem C	-30.6	848.8	-39.0	1065.8
LC74	3.0m OF + Tandem Ecc	-30.3	856.5	-38.5	1079.0
LC80	4.0m OF Permanent Loads	-28.4	1002.0	-37.0	1248.2
LC81	4.0m OF + Single Axle C	-27.6	1014.1	-35.6	1268.7
LC82	4.0m OF + Single Axle Ecc	-28.5	1002.6	-37.0	1249.2
LC83	4.0m OF + Tandem C	-27.2	1021.2	-34.8	1280.7
LC84	4.0m OF + Tandem Ecc	-27.2	1024.0	-34.8	1285.6
LC90	5.0m OF Permanent Loads	-24.8	1178.5	-32.4	1468.7
LC91	5.0m OF + Single Axle C	-24.2	1188.3	-31.3	1485.4
LC92	5.0m OF + Single Axle Ecc	-24.2	1189.2	-31.4	1486.9
LC93	5.0m OF + Tandem C	-27.4	1119.2	-36.9	1367.9
LC94	5.0m OF + Tandem Ecc	-23.9	1194.4	-30.9	1495.9

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

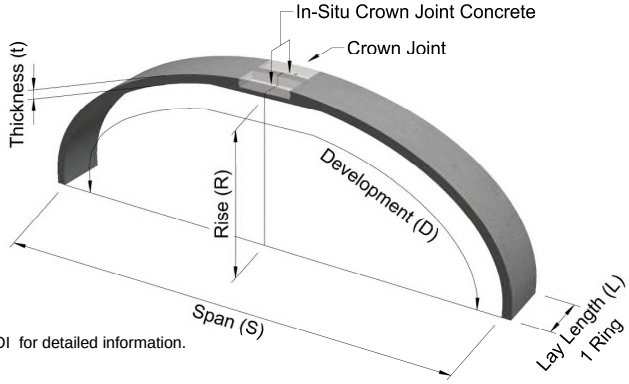
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/7

Dimensions

Span S	[m]	12.802
Rise R	[m]	7.417
Development D	[m]	22.513
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

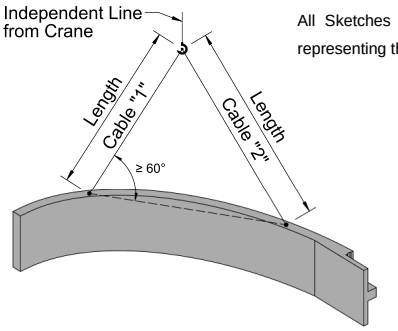


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.30
In-Situ Concrete per Ring	[m³]	0.93

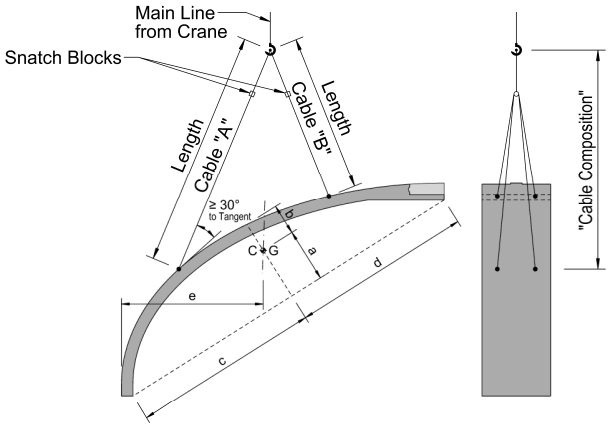
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	157.50 (15.8 metric tons)
Length Cable A	[m]*	3.60
Length Cable B	[m]*	2.50
Cable Force A	[kN]*	142.12
Cable Force B	[kN]*	30.62
Min. Length Cable 1&2	[m]	6.30
Cable Force 1&2	[kN]	90.93
Center of Gravity a	[m]	1.70
Center of Gravity b	[m]	0.95
Center of Gravity c	[m]	4.92
Center of Gravity d	[m]	4.87
Center of Gravity e	[m]	2.23

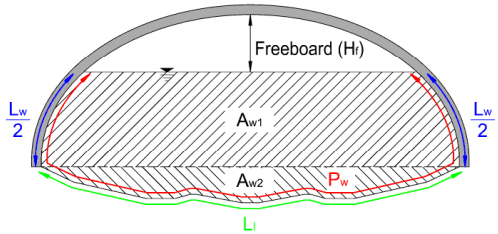


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	79.53	
1.0	73.85	14.57
2.0	65.19	11.60
3.0	54.77	9.13
4.0	43.18	6.92
5.0	30.85	4.85
6.0	18.14	2.83

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	27.2	89.6	32.6	107.6
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-51.4	448.7	-65.6	556.3
LC41	0.6m OF + Single Axle C	-50.1	469.2	-63.3	591.2
LC42	0.6m OF + Single Axle Ecc	-49.4	477.3	-62.1	605.1
LC43	0.6m OF + Tandem C	-49.3	474.8	-62.0	600.8
LC44	0.6m OF + Tandem Ecc	-48.1	495.0	-60.1	635.2
LC50	1.0m OF Permanent Loads	-51.1	501.6	-65.2	622.5
LC51	1.0m OF + Single Axle C	-49.8	521.8	-63.1	656.8
LC52	1.0m OF + Single Axle Ecc	-49.3	533.4	-62.2	676.6
LC53	1.0m OF + Tandem C	-49.1	532.9	-61.9	675.7
LC54	1.0m OF + Tandem Ecc	-48.3	551.1	-60.5	706.7
LC60	2.0m OF Permanent Loads	-49.8	671.6	-63.6	835.1
LC61	2.0m OF + Single Axle C	-48.8	687.6	-62.0	862.2
LC62	2.0m OF + Single Axle Ecc	-48.5	695.4	-61.4	875.4
LC63	2.0m OF + Tandem C	-48.3	695.8	-61.2	876.1
LC64	2.0m OF + Tandem Ecc	-47.8	708.8	-60.2	898.2
LC70	3.0m OF Permanent Loads	-48.4	845.0	-61.9	1051.7
LC71	3.0m OF + Single Axle C	-47.7	858.8	-60.7	1075.3
LC72	3.0m OF + Single Axle Ecc	-47.6	862.5	-60.5	1081.6
LC73	3.0m OF + Tandem C	-47.4	864.7	-60.2	1085.3
LC74	3.0m OF + Tandem Ecc	-47.2	872.4	-59.8	1098.3
LC80	4.0m OF Permanent Loads	-47.2	1020.6	-60.4	1271.2
LC81	4.0m OF + Single Axle C	-46.7	1032.4	-59.5	1291.4
LC82	4.0m OF + Single Axle Ecc	-47.3	1021.1	-60.5	1272.1
LC83	4.0m OF + Tandem C	-46.4	1039.4	-59.0	1303.2
LC84	4.0m OF + Tandem Ecc	-46.4	1042.0	-59.0	1307.7
LC90	5.0m OF Permanent Loads	-46.1	1199.0	-58.9	1494.3
LC91	5.0m OF + Single Axle C	-45.6	1208.7	-58.2	1510.7
LC92	5.0m OF + Single Axle Ecc	-45.7	1209.4	-58.3	1512.0
LC93	5.0m OF + Tandem C	-48.1	1137.6	-62.4	1389.9
LC94	5.0m OF + Tandem Ecc	-45.5	1214.6	-58.0	1520.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

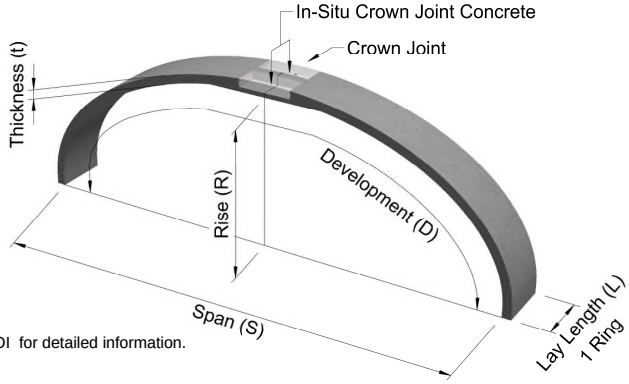
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/8

Dimensions

Span S	[m]	12.802
Rise R	[m]	7.722
Development D	[m]	23.122
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

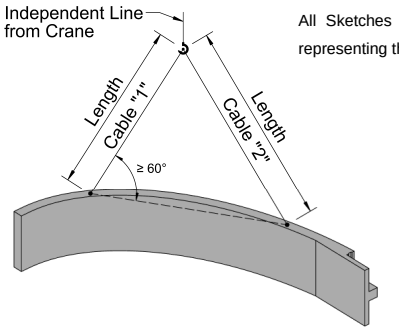


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.47
In-Situ Concrete per Ring	[m³]	0.93

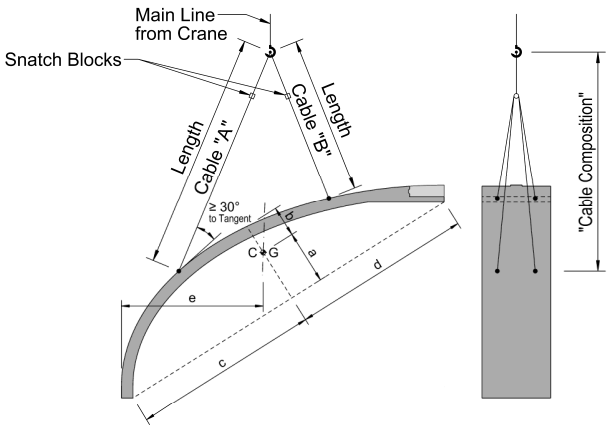
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	161.75 (16.2 metric tons)
Length Cable A	[m]*	3.00
Length Cable B	[m]*	2.30
Cable Force A	[kN]*	150.22
Cable Force B	[kN]*	30.74
Min. Length Cable 1&2	[m]	6.40
Cable Force 1&2	[kN]	93.39
Center of Gravity a	[m]	1.76
Center of Gravity b	[m]	0.99
Center of Gravity c	[m]	5.05
Center of Gravity d	[m]	4.97
Center of Gravity e	[m]	2.17

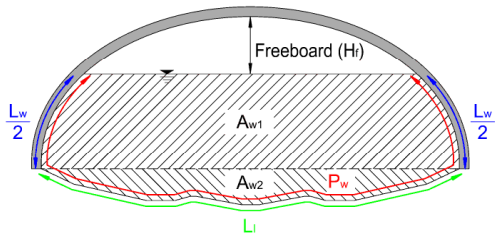


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	83.43	
1.0	77.75	15.18
2.0	69.10	12.20
3.0	58.67	9.74
4.0	47.08	7.54
5.0	34.75	5.46
6.0	22.04	3.44

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	26.2	91.9	31.4	110.3
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-61.8	461.0	-78.5	571.7
LC41	0.6m OF + Single Axle C	-60.9	481.1	-77.1	605.8
LC42	0.6m OF + Single Axle Ecc	-60.3	489.2	-76.0	619.6
LC43	0.6m OF + Tandem C	-60.4	486.6	-76.2	615.1
LC44	0.6m OF + Tandem Ecc	-59.4	506.7	-74.5	649.4
LC50	1.0m OF Permanent Loads	-62.1	514.8	-79.0	639.0
LC51	1.0m OF + Single Axle C	-61.3	534.7	-77.6	672.7
LC52	1.0m OF + Single Axle Ecc	-60.9	546.3	-76.9	692.4
LC53	1.0m OF + Tandem C	-60.9	545.5	-76.8	691.1
LC54	1.0m OF + Tandem Ecc	-60.2	563.7	-75.6	722.1
LC60	2.0m OF Permanent Loads	-62.7	687.2	-79.7	854.4
LC61	2.0m OF + Single Axle C	-62.1	703.0	-78.7	881.3
LC62	2.0m OF + Single Axle Ecc	-61.9	710.6	-78.3	894.2
LC63	2.0m OF + Tandem C	-61.8	710.9	-78.2	894.7
LC64	2.0m OF + Tandem Ecc	-61.4	723.8	-77.4	916.6
LC70	3.0m OF Permanent Loads	-63.3	862.6	-80.4	1073.6
LC71	3.0m OF + Single Axle C	-62.9	876.3	-79.7	1096.9
LC72	3.0m OF + Single Axle Ecc	-62.8	879.7	-79.6	1102.7
LC73	3.0m OF + Tandem C	-62.7	881.6	-79.4	1105.9
LC74	3.0m OF + Tandem Ecc	-62.5	889.2	-79.1	1118.9
LC80	4.0m OF Permanent Loads	-64.1	1040.2	-81.4	1295.6
LC81	4.0m OF + Single Axle C	-63.7	1051.8	-80.8	1315.3
LC82	4.0m OF + Single Axle Ecc	-64.1	1040.5	-81.5	1296.1
LC83	4.0m OF + Tandem C	-63.5	1058.6	-80.5	1326.9
LC84	4.0m OF + Tandem Ecc	-63.5	1061.1	-80.5	1331.1
LC90	5.0m OF Permanent Loads	-64.8	1220.9	-82.4	1521.5
LC91	5.0m OF + Single Axle C	-64.6	1230.4	-81.9	1537.6
LC92	5.0m OF + Single Axle Ecc	-64.6	1230.9	-82.0	1538.6
LC93	5.0m OF + Tandem C	-66.4	1157.2	-85.0	1413.2
LC94	5.0m OF + Tandem Ecc	-64.5	1236.1	-81.8	1547.4

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

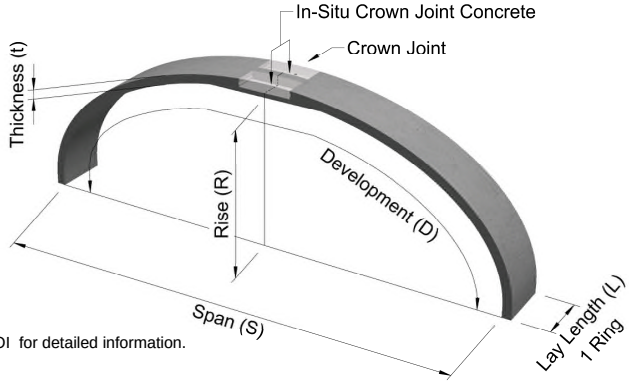
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C42T/9

Dimensions

Span S	[m]	12.802
Rise R	[m]	8.027
Development D	[m]	23.732
Thickness t	[mm]	305
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

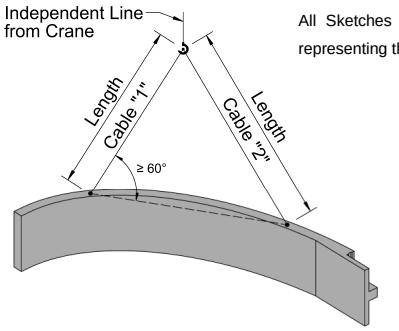


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.64
In-Situ Concrete per Ring	[m³]	0.93

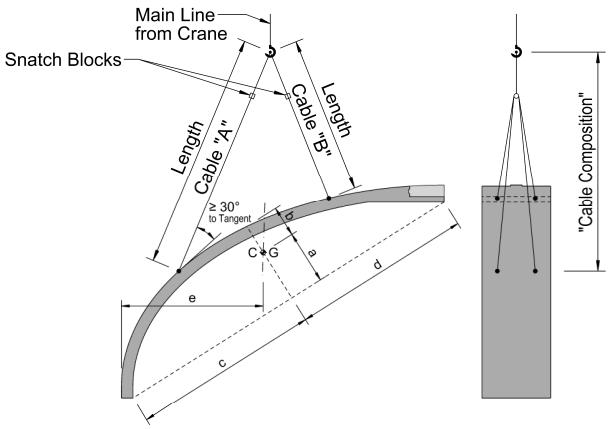
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	166.00 (16.6 metric tons)
Length Cable A	[m]*	2.90
Length Cable B	[m]*	2.20
Cable Force A	[kN]*	160.43
Cable Force B	[kN]*	34.76
Min. Length Cable 1&2	[m]	6.60
Cable Force 1&2	[kN]	95.84
Center of Gravity a	[m]	1.81
Center of Gravity b	[m]	1.02
Center of Gravity c	[m]	5.19
Center of Gravity d	[m]	5.07
Center of Gravity e	[m]	2.12

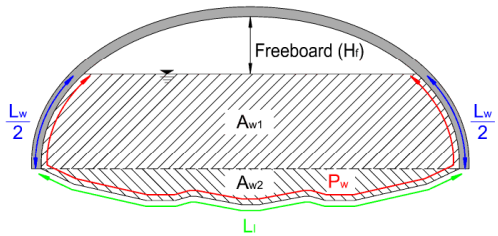


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	87.33	
1.0	81.65	15.79
2.0	73.00	12.81
3.0	62.57	10.35
4.0	50.98	8.14
5.0	38.65	6.07
6.0	25.94	4.05

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	25.2	94.1	30.3	112.9
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-71.9	474.2	-91.1	588.1
LC41	0.6m OF + Single Axle C	-71.4	494.0	-90.3	621.6
LC42	0.6m OF + Single Axle Ecc	-70.9	502.0	-89.4	635.3
LC43	0.6m OF + Tandem C	-71.1	499.1	-89.8	630.3
LC44	0.6m OF + Tandem Ecc	-70.3	519.2	-88.4	664.5
LC50	1.0m OF Permanent Loads	-72.8	528.8	-92.3	656.3
LC51	1.0m OF + Single Axle C	-72.3	548.5	-91.5	689.7
LC52	1.0m OF + Single Axle Ecc	-72.0	560.1	-90.9	709.4
LC53	1.0m OF + Tandem C	-72.1	559.1	-91.1	707.9
LC54	1.0m OF + Tandem Ecc	-71.5	577.3	-90.0	738.7
LC60	2.0m OF Permanent Loads	-74.9	704.0	-94.9	875.3
LC61	2.0m OF + Single Axle C	-74.6	719.6	-94.3	901.9
LC62	2.0m OF + Single Axle Ecc	-74.4	727.2	-94.0	914.7
LC63	2.0m OF + Tandem C	-74.4	727.3	-94.0	915.0
LC64	2.0m OF + Tandem Ecc	-74.1	740.1	-93.5	936.7
LC70	3.0m OF Permanent Loads	-77.0	881.9	-97.6	1097.6
LC71	3.0m OF + Single Axle C	-76.8	895.1	-97.1	1120.0
LC72	3.0m OF + Single Axle Ecc	-76.7	898.2	-97.0	1125.4
LC73	3.0m OF + Tandem C	-76.7	900.0	-97.0	1128.4
LC74	3.0m OF + Tandem Ecc	-76.5	907.6	-96.7	1141.4
LC80	4.0m OF Permanent Loads	-79.2	1061.2	-100.3	1321.8
LC81	4.0m OF + Single Axle C	-79.1	1072.5	-100.0	1341.0
LC82	4.0m OF + Single Axle Ecc	-79.3	1061.3	-100.4	1321.9
LC83	4.0m OF + Tandem C	-79.0	1079.2	-99.8	1352.4
LC84	4.0m OF + Tandem Ecc	-79.0	1081.5	-99.9	1356.3
LC90	5.0m OF Permanent Loads	-81.5	1244.1	-103.2	1550.5
LC91	5.0m OF + Single Axle C	-81.4	1253.5	-103.0	1566.3
LC92	5.0m OF + Single Axle Ecc	-81.5	1253.9	-103.0	1567.1
LC93	5.0m OF + Tandem C	-82.7	1178.1	-105.1	1438.2
LC94	5.0m OF + Tandem Ecc	-81.4	1259.0	-102.9	1575.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

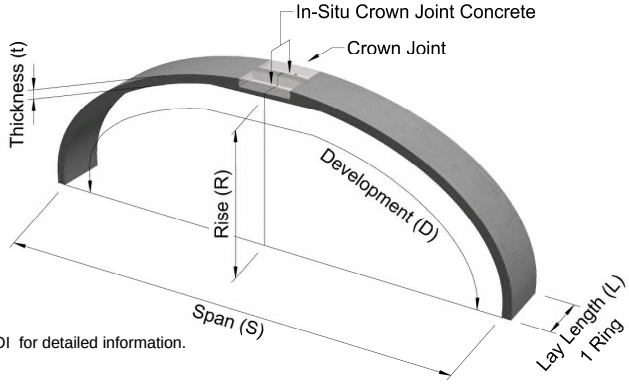
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/0

Dimensions

Span S	[m]	16.048
Rise R	[m]	6.197
Development D	[m]	22.135
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

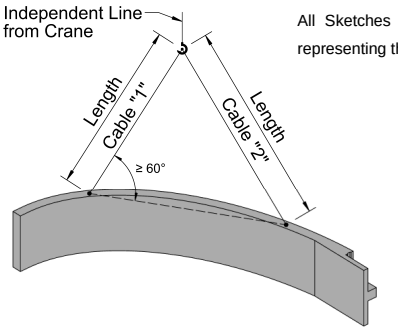


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.71
In-Situ Concrete per Ring	[m³]	1.01

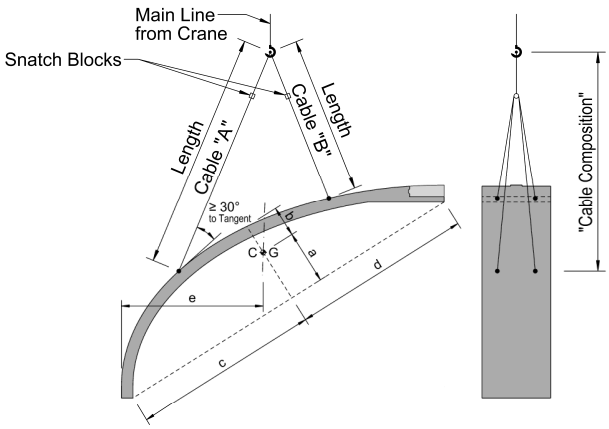
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	167.75 (16.8 metric tons)
Length Cable A	[m]*	11.80
Length Cable B	[m]*	9.30
Cable Force A	[kN]*	96.05
Cable Force B	[kN]*	77.76
Min. Length Cable 1&2	[m]	6.40
Cable Force 1&2	[kN]	96.85
Center of Gravity a	[m]	1.43
Center of Gravity b	[m]	0.78
Center of Gravity c	[m]	5.04
Center of Gravity d	[m]	5.09
Center of Gravity e	[m]	3.44

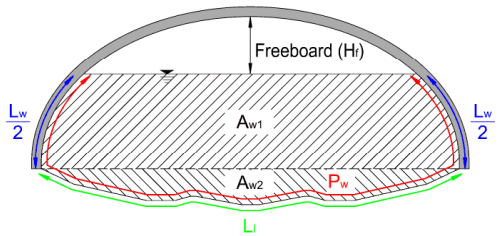


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	76.05	
1.0	69.57	13.16
2.0	59.6	9.84
3.0	47.43	7.14
4.0	33.7	4.74
5.0	18.85	2.52
6.0	3.20	0.42

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored		factored (*)	
		H [kN/m]	V [kN/m]	H [kN/m]	V [kN/m]
LC2	Arch Installation	52.8	95.7	63.4	114.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	49.6	504.4	59.4	625.7
LC41	0.6m OF + Single Axle C	58.2	533.2	73.9	674.7
LC42	0.6m OF + Single Axle Ecc	58.0	539.8	73.7	685.9
LC43	0.6m OF + Tandem C	62.5	545.8	81.4	696.1
LC44	0.6m OF + Tandem Ecc	63.2	560.9	82.5	721.7
LC50	1.0m OF Permanent Loads	62.0	571.4	74.9	709.5
LC51	1.0m OF + Single Axle C	69.4	597.8	87.5	754.4
LC52	1.0m OF + Single Axle Ecc	69.9	607.0	88.3	769.9
LC53	1.0m OF + Tandem C	73.6	612.5	94.6	779.3
LC54	1.0m OF + Tandem Ecc	74.6	627.8	96.2	805.3
LC60	2.0m OF Permanent Loads	96.5	767.0	118.0	954.0
LC61	2.0m OF + Single Axle C	101.9	787.3	127.2	988.5
LC62	2.0m OF + Single Axle Ecc	102.4	793.9	127.9	999.7
LC63	2.0m OF + Tandem C	104.9	798.5	132.3	1007.6
LC64	2.0m OF + Tandem Ecc	105.8	809.5	133.7	1026.1
LC70	3.0m OF Permanent Loads	131.2	964.3	161.3	1200.6
LC71	3.0m OF + Single Axle C	135.5	981.4	168.7	1229.6
LC72	3.0m OF + Single Axle Ecc	135.7	985.4	169.0	1236.5
LC73	3.0m OF + Tandem C	137.9	990.6	172.8	1245.3
LC74	3.0m OF + Tandem Ecc	138.2	997.3	173.3	1256.6
LC80	4.0m OF Permanent Loads	166.0	1163.0	204.8	1449.0
LC81	4.0m OF + Single Axle C	169.5	1177.3	210.9	1473.3
LC82	4.0m OF + Single Axle Ecc	169.6	1180.1	210.9	1478.0
LC83	4.0m OF + Tandem C	171.5	1185.2	214.3	1486.7
LC84	4.0m OF + Tandem Ecc	171.5	1189.4	214.3	1493.8
LC90	5.0m OF Permanent Loads	201.1	1363.3	248.8	1699.3
LC91	5.0m OF + Single Axle C	204.1	1375.4	253.9	1719.9
LC92	5.0m OF + Single Axle Ecc	204.1	1377.2	253.7	1723.0
LC93	5.0m OF + Tandem C	205.8	1382.0	256.7	1731.2
LC94	5.0m OF + Tandem Ecc	205.7	1384.8	256.5	1736.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

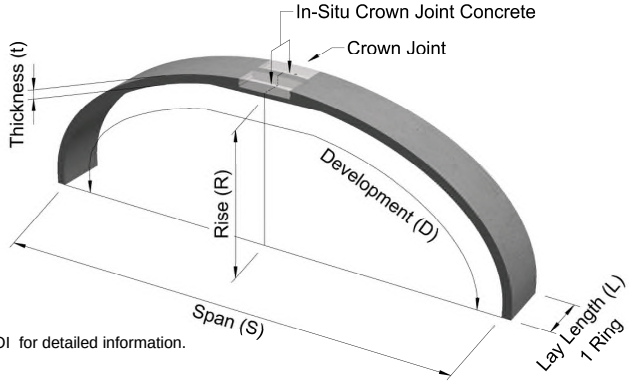
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/1

Dimensions

Span S	[m]	16.174
Rise R	[m]	6.502
Development D	[m]	22.758
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

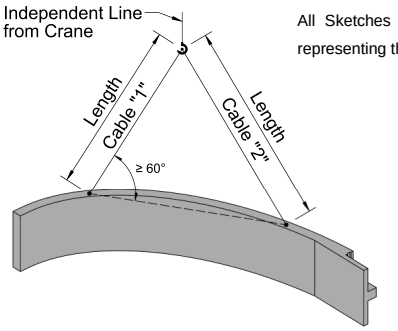


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	6.91
In-Situ Concrete per Ring	[m³]	1.01

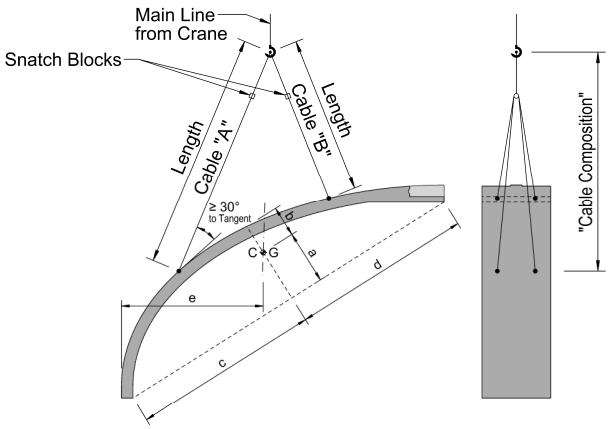
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	172.75 (17.3 metric tons)
Length Cable A	[m]*	11.20
Length Cable B	[m]*	8.70
Cable Force A	[kN]*	103.06
Cable Force B	[kN]*	73.08
Min. Length Cable 1&2	[m]	6.50
Cable Force 1&2	[kN]	99.74
Center of Gravity a	[m]	1.49
Center of Gravity b	[m]	0.81
Center of Gravity c	[m]	5.17
Center of Gravity d	[m]	5.21
Center of Gravity e	[m]	3.42

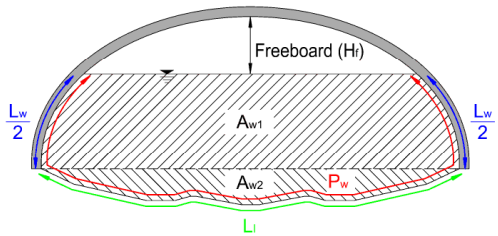


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	80.96	
1.0	74.48	13.78
2.0	64.51	10.46
3.0	52.34	7.76
4.0	38.62	3.36
5.0	23.76	3.14
6.0	8.11	1.04

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	51.3	98.2	61.6	117.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	38.9	520.4	46.1	645.5
LC41	0.6m OF + Single Axle C	46.5	548.5	59.0	693.3
LC42	0.6m OF + Single Axle Ecc	46.6	555.5	59.1	705.2
LC43	0.6m OF + Tandem C	50.3	560.5	65.5	713.8
LC44	0.6m OF + Tandem Ecc	51.3	576.4	67.2	740.7
LC50	1.0m OF Permanent Loads	50.2	588.3	60.1	730.4
LC51	1.0m OF + Single Axle C	56.8	614.2	71.3	774.5
LC52	1.0m OF + Single Axle Ecc	57.4	623.7	72.4	790.7
LC53	1.0m OF + Tandem C	60.5	628.5	77.7	798.9
LC54	1.0m OF + Tandem Ecc	61.7	644.4	79.7	825.9
LC60	2.0m OF Permanent Loads	81.7	786.8	99.5	978.6
LC61	2.0m OF + Single Axle C	86.5	806.8	107.7	1012.7
LC62	2.0m OF + Single Axle Ecc	87.0	813.7	108.6	1024.2
LC63	2.0m OF + Tandem C	89.2	817.8	112.3	1031.3
LC64	2.0m OF + Tandem Ecc	90.2	829.1	113.9	1050.4
LC70	3.0m OF Permanent Loads	113.3	987.1	139.1	1229.0
LC71	3.0m OF + Single Axle C	117.3	1004.1	145.8	1257.8
LC72	3.0m OF + Single Axle Ecc	117.5	1008.2	146.1	1264.8
LC73	3.0m OF + Tandem C	119.4	1013.0	149.4	1273.0
LC74	3.0m OF + Tandem Ecc	119.8	1019.8	150.1	1284.6
LC80	4.0m OF Permanent Loads	145.3	1189.0	179.1	1481.4
LC81	4.0m OF + Single Axle C	148.6	1203.3	184.6	1505.6
LC82	4.0m OF + Single Axle Ecc	148.6	1206.1	184.7	1510.3
LC83	4.0m OF + Tandem C	150.4	1210.9	187.7	1518.6
LC84	4.0m OF + Tandem Ecc	150.4	1215.0	187.8	1525.5
LC90	5.0m OF Permanent Loads	177.6	1392.4	219.5	1735.6
LC91	5.0m OF + Single Axle C	180.4	1404.5	224.1	1756.1
LC92	5.0m OF + Single Axle Ecc	180.3	1406.3	224.1	1759.2
LC93	5.0m OF + Tandem C	181.9	1410.9	226.7	1767.0
LC94	5.0m OF + Tandem Ecc	181.8	1413.7	226.5	1771.8

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

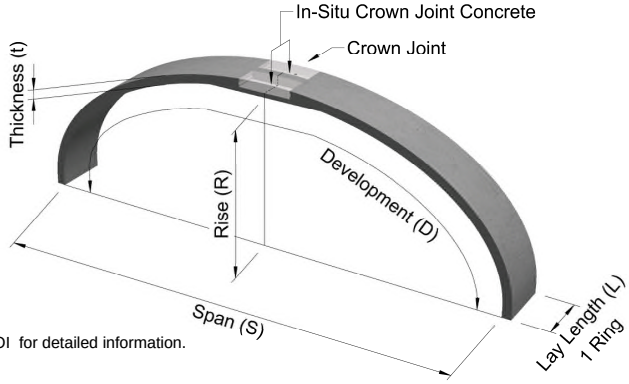
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/2

Dimensions

Span S	[m]	16.278
Rise R	[m]	6.807
Development D	[m]	23.376
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

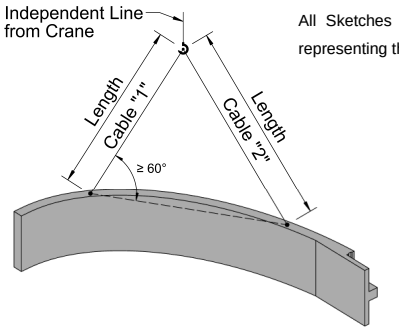


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.09
In-Situ Concrete per Ring	[m³]	1.01

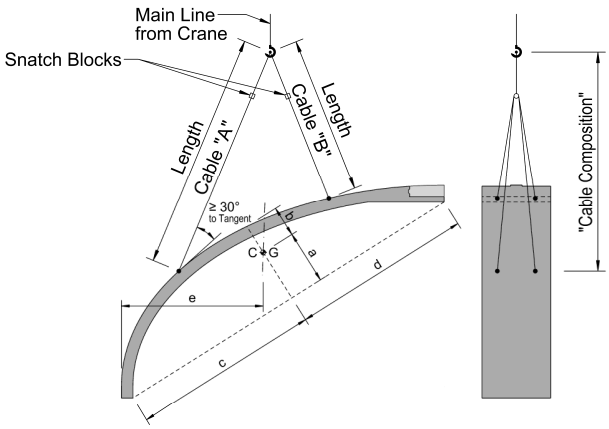
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	177.25 (17.7 metric tons)
Length Cable A	[m]*	10.60
Length Cable B	[m]*	8.20
Cable Force A	[kN]*	108.25
Cable Force B	[kN]*	73.64
Min. Length Cable 1&2	[m]	6.70
Cable Force 1&2	[kN]	102.34
Center of Gravity a	[m]	1.55
Center of Gravity b	[m]	0.85
Center of Gravity c	[m]	5.28
Center of Gravity d	[m]	5.33
Center of Gravity e	[m]	3.38

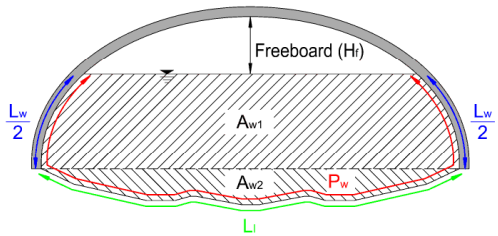


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	85.91	
1.0	79.43	14.40
2.0	69.45	11.08
3.0	57.29	8.38
4.0	43.56	5.98
5.0	28.71	3.76
6.0	13.05	1.66

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	49.8	100.7	59.8	120.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	27.3	535.2	31.6	663.9
LC41	0.6m OF + Single Axle C	33.8	562.2	42.6	709.9
LC42	0.6m OF + Single Axle Ecc	34.0	569.9	43.1	722.9
LC43	0.6m OF + Tandem C	37.0	573.6	48.2	729.3
LC44	0.6m OF + Tandem Ecc	38.1	589.8	50.0	756.8
LC50	1.0m OF Permanent Loads	37.0	603.1	43.8	748.8
LC51	1.0m OF + Single Axle C	42.7	628.2	53.5	791.6
LC52	1.0m OF + Single Axle Ecc	43.4	638.4	54.7	808.8
LC53	1.0m OF + Tandem C	46.0	642.3	59.0	815.4
LC54	1.0m OF + Tandem Ecc	47.2	659.1	61.2	844.0
LC60	2.0m OF Permanent Loads	64.8	804.4	78.5	1000.5
LC61	2.0m OF + Single Axle C	69.0	824.0	85.7	1033.9
LC62	2.0m OF + Single Axle Ecc	69.6	831.1	86.6	1045.8
LC63	2.0m OF + Tandem C	71.4	834.6	89.6	1051.8
LC64	2.0m OF + Tandem Ecc	72.4	846.3	91.3	1071.8
LC70	3.0m OF Permanent Loads	92.8	1007.4	113.5	1254.2
LC71	3.0m OF + Single Axle C	96.2	1024.1	119.3	1282.6
LC72	3.0m OF + Single Axle Ecc	96.5	1028.4	119.8	1289.8
LC73	3.0m OF + Tandem C	98.1	1032.7	122.5	1297.3
LC74	3.0m OF + Tandem Ecc	98.5	1039.7	123.2	1309.2
LC80	4.0m OF Permanent Loads	120.9	1211.9	148.7	1509.9
LC81	4.0m OF + Single Axle C	123.8	1226.0	153.5	1533.8
LC82	4.0m OF + Single Axle Ecc	123.8	1228.8	153.6	1538.5
LC83	4.0m OF + Tandem C	125.3	1233.3	156.0	1546.2
LC84	4.0m OF + Tandem Ecc	125.4	1237.5	156.2	1553.4
LC90	5.0m OF Permanent Loads	149.4	1418.1	184.2	1767.6
LC91	5.0m OF + Single Axle C	151.8	1430.0	188.3	1787.8
LC92	5.0m OF + Single Axle Ecc	151.7	1431.8	188.2	1790.9
LC93	5.0m OF + Tandem C	153.0	1436.1	190.4	1798.2
LC94	5.0m OF + Tandem Ecc	153.0	1438.9	190.3	1802.9

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

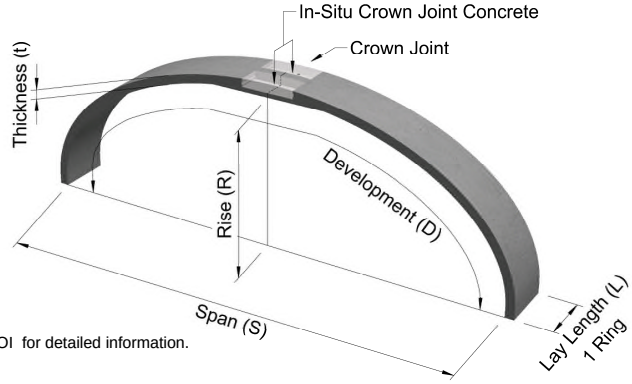
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/3

Dimensions

Span S	[m]	16.358
Rise R	[m]	7.112
Development D	[m]	23.991
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

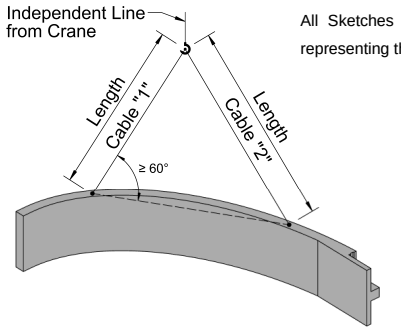


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.28
In-Situ Concrete per Ring	[m³]	1.01

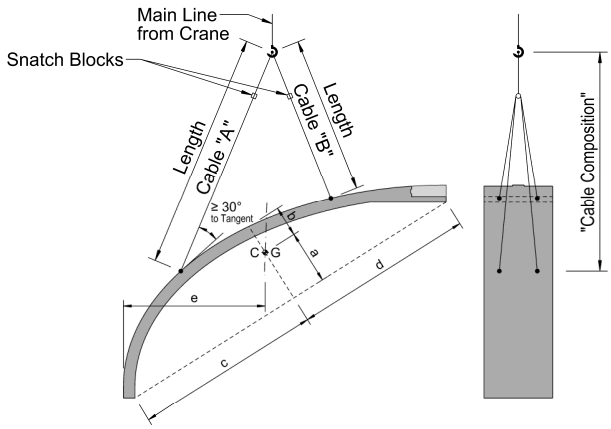
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	182.00 (18.2 metric tons)
Length Cable A	[m]*	10.00
Length Cable B	[m]*	7.60
Cable Force A	[kN]*	117.06
Cable Force B	[kN]*	70.10
Min. Length Cable 1&2	[m]	6.80
Cable Force 1&2	[kN]	105.08
Center of Gravity a	[m]	1.62
Center of Gravity b	[m]	0.88
Center of Gravity c	[m]	5.40
Center of Gravity d	[m]	5.44
Center of Gravity e	[m]	3.34

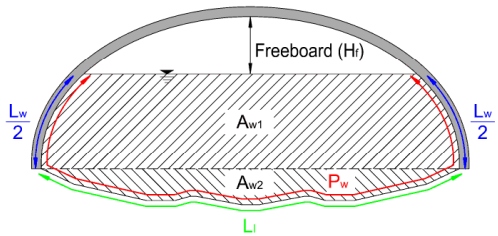


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	90.88	
1.0	84.40	15.02
2.0	74.43	11.70
3.0	62.26	8.98
4.0	48.54	6.58
5.0	33.68	4.38
6.0	18.03	2.26

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	48.3	103.2	58.0	123.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	14.6	549.9	15.9	682.2
LC41	0.6m OF + Single Axle C	20.1	575.8	25.2	726.2
LC42	0.6m OF + Single Axle Ecc	20.5	583.9	25.8	740.0
LC43	0.6m OF + Tandem C	22.8	586.3	29.8	744.1
LC44	0.6m OF + Tandem Ecc	24.0	603.3	31.8	773.1
LC50	1.0m OF Permanent Loads	22.9	618.1	26.2	767.5
LC51	1.0m OF + Single Axle C	27.7	642.4	34.4	808.8
LC52	1.0m OF + Single Axle Ecc	28.5	653.0	35.7	826.9
LC53	1.0m OF + Tandem C	30.5	655.9	39.1	831.7
LC54	1.0m OF + Tandem Ecc	31.8	673.4	41.3	861.5
LC60	2.0m OF Permanent Loads	46.9	821.5	56.2	1021.7
LC61	2.0m OF + Single Axle C	50.5	840.6	62.3	1054.3
LC62	2.0m OF + Single Axle Ecc	51.0	847.9	63.2	1066.6
LC63	2.0m OF + Tandem C	52.4	850.8	65.6	1071.5
LC64	2.0m OF + Tandem Ecc	53.4	862.9	67.3	1092.1
LC70	3.0m OF Permanent Loads	71.0	1026.6	86.3	1278.1
LC71	3.0m OF + Single Axle C	73.9	1043.0	91.3	1305.9
LC72	3.0m OF + Single Axle Ecc	74.1	1047.3	91.7	1313.2
LC73	3.0m OF + Tandem C	75.4	1051.1	93.9	1319.8
LC74	3.0m OF + Tandem Ecc	75.9	1058.4	94.7	1332.1
LC80	4.0m OF Permanent Loads	95.2	1233.4	116.6	1536.6
LC81	4.0m OF + Single Axle C	97.7	1247.3	120.8	1560.1
LC82	4.0m OF + Single Axle Ecc	97.7	1249.9	120.9	1564.6
LC83	4.0m OF + Tandem C	98.9	1254.0	122.8	1571.6
LC84	4.0m OF + Tandem Ecc	99.0	1258.4	123.1	1579.1
LC90	5.0m OF Permanent Loads	119.7	1441.8	147.2	1797.1
LC91	5.0m OF + Single Axle C	121.7	1453.5	150.6	1817.0
LC92	5.0m OF + Single Axle Ecc	121.6	1455.2	150.5	1819.8
LC93	5.0m OF + Tandem C	122.7	1459.2	152.3	1826.6
LC94	5.0m OF + Tandem Ecc	122.7	1461.9	152.3	1831.3

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

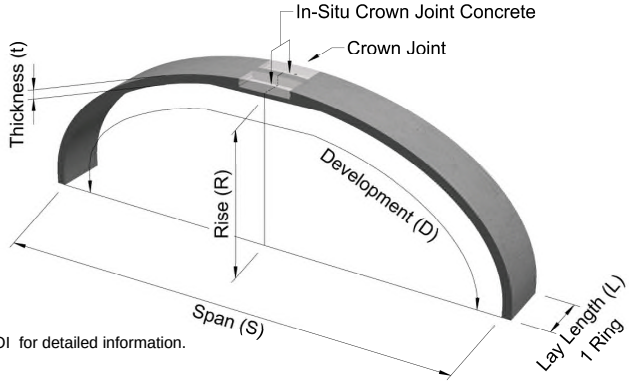
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/4

Dimensions

Span S	[m]	16.414
Rise R	[m]	7.417
Development D	[m]	24.604
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

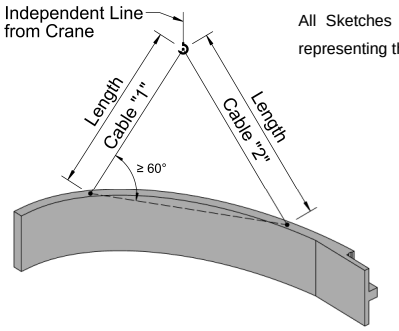


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.47
In-Situ Concrete per Ring	[m³]	1.01

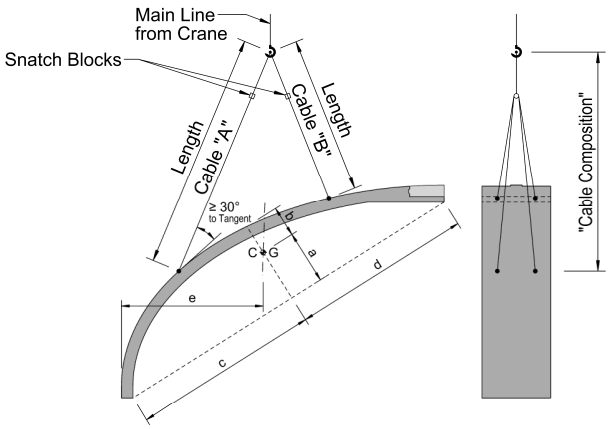
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	186.75 (18.7 metric tons)
Length Cable A	[m]*	9.50
Length Cable B	[m]*	7.10
Cable Force A	[kN]*	128.26
Cable Force B	[kN]*	65.61
Min. Length Cable 1&2	[m]	7.00
Cable Force 1&2	[kN]	107.82
Center of Gravity a	[m]	1.69
Center of Gravity b	[m]	0.92
Center of Gravity c	[m]	5.51
Center of Gravity d	[m]	5.55
Center of Gravity e	[m]	3.29

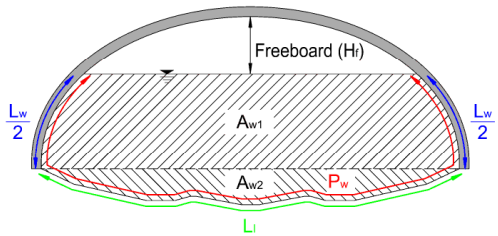


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	95.87	
1.0	89.40	15.62
2.0	79.42	12.32
3.0	67.26	9.60
4.0	53.53	7.20
5.0	38.67	4.98
6.0	23.02	2.88

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	46.8	105.6	56.1	126.8
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	1.5	563.4	-0.4	699.0
LC41	0.6m OF + Single Axle C	6.0	588.2	7.2	741.0
LC42	0.6m OF + Single Axle Ecc	6.5	596.7	7.9	755.5
LC43	0.6m OF + Tandem C	8.2	597.9	10.9	757.6
LC44	0.6m OF + Tandem Ecc	9.4	615.7	12.9	787.9
LC50	1.0m OF Permanent Loads	8.4	631.9	8.1	784.6
LC51	1.0m OF + Single Axle C	12.4	655.4	14.9	824.5
LC52	1.0m OF + Single Axle Ecc	13.1	666.4	16.2	843.2
LC53	1.0m OF + Tandem C	14.6	668.3	18.8	846.4
LC54	1.0m OF + Tandem Ecc	15.9	686.5	20.9	877.3
LC60	2.0m OF Permanent Loads	28.4	836.9	33.1	1040.9
LC61	2.0m OF + Single Axle C	31.3	855.6	38.2	1072.6
LC62	2.0m OF + Single Axle Ecc	31.9	863.0	39.1	1085.2
LC63	2.0m OF + Tandem C	33.0	865.2	41.0	1089.0
LC64	2.0m OF + Tandem Ecc	33.9	877.7	42.5	1110.2
LC70	3.0m OF Permanent Loads	48.5	1043.9	58.3	1299.6
LC71	3.0m OF + Single Axle C	51.0	1059.9	62.5	1326.8
LC72	3.0m OF + Single Axle Ecc	51.2	1064.1	62.9	1333.9
LC73	3.0m OF + Tandem C	52.2	1067.5	64.6	1339.6
LC74	3.0m OF + Tandem Ecc	52.7	1075.0	65.3	1352.4
LC80	4.0m OF Permanent Loads	68.8	1252.5	83.7	1560.3
LC81	4.0m OF + Single Axle C	70.8	1266.0	87.1	1583.3
LC82	4.0m OF + Single Axle Ecc	70.9	1268.5	87.2	1587.5
LC83	4.0m OF + Tandem C	71.8	1272.2	88.8	1593.8
LC84	4.0m OF + Tandem Ecc	72.0	1276.8	89.1	1601.6
LC90	5.0m OF Permanent Loads	89.2	1462.7	109.2	1823.1
LC91	5.0m OF + Single Axle C	90.9	1474.1	112.1	1842.5
LC92	5.0m OF + Single Axle Ecc	90.9	1475.5	112.0	1844.9
LC93	5.0m OF + Tandem C	91.7	1479.2	113.4	1851.2
LC94	5.0m OF + Tandem Ecc	91.7	1482.0	113.4	1856.0

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

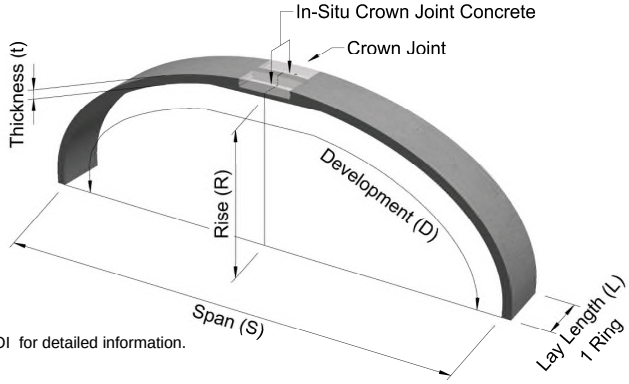
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/5

Dimensions

Span S	[m]	16.448
Rise R	[m]	7.721
Development D	[m]	25.214
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

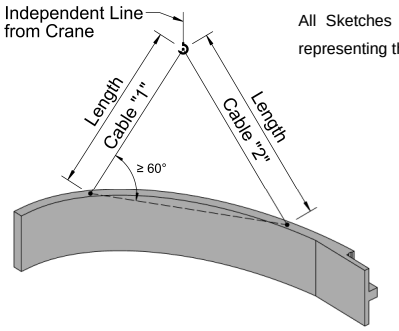


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.66
In-Situ Concrete per Ring	[m³]	1.01

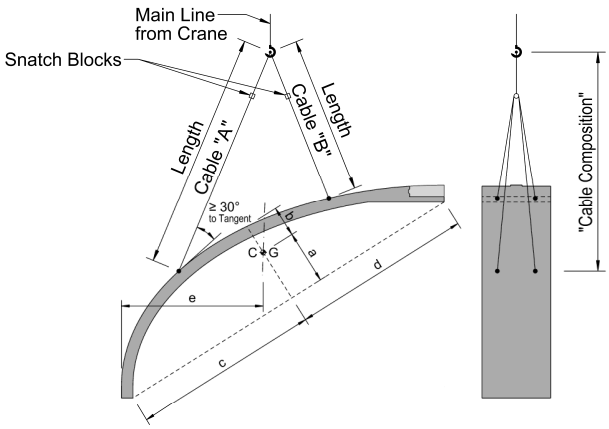
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	191.50 (19.2 metric tons)
Length Cable A	[m]*	9.00
Length Cable B	[m]*	6.60
Cable Force A	[kN]*	132.84
Cable Force B	[kN]*	64.89
Min. Length Cable 1&2	[m]	7.20
Cable Force 1&2	[kN]	110.56
Center of Gravity a	[m]	1.75
Center of Gravity b	[m]	0.95
Center of Gravity c	[m]	5.63
Center of Gravity d	[m]	5.66
Center of Gravity e	[m]	3.23

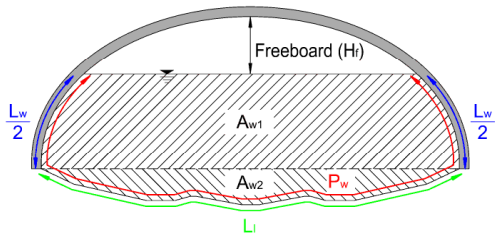


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	100.88	
1.0	94.41	16.24
2.0	84.43	12.92
3.0	72.26	10.22
4.0	58.54	7.80
5.0	43.68	5.60
6.0	28.03	3.48

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	45.2	108.1	54.2	129.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-12.0	576.0	-17.3	714.6
LC41	0.6m OF + Single Axle C	-8.4	599.6	-11.2	754.7
LC42	0.6m OF + Single Axle Ecc	-8.0	608.5	-10.5	769.9
LC43	0.6m OF + Tandem C	-6.8	608.4	-8.3	769.7
LC44	0.6m OF + Tandem Ecc	-5.6	627.0	-6.4	801.3
LC50	1.0m OF Permanent Loads	-6.7	644.8	-10.6	800.6
LC51	1.0m OF + Single Axle C	-3.5	667.3	-5.2	838.8
LC52	1.0m OF + Single Axle Ecc	-2.8	678.7	-4.0	858.2
LC53	1.0m OF + Tandem C	-1.7	679.6	-2.1	859.7
LC54	1.0m OF + Tandem Ecc	-0.5	698.3	-0.1	891.6
LC60	2.0m OF Permanent Loads	9.3	851.0	9.3	1058.3
LC61	2.0m OF + Single Axle C	11.7	869.0	13.5	1089.0
LC62	2.0m OF + Single Axle Ecc	12.2	876.5	14.2	1101.8
LC63	2.0m OF + Tandem C	13.0	878.2	15.7	1104.5
LC64	2.0m OF + Tandem Ecc	13.8	890.9	17.0	1126.1
LC70	3.0m OF Permanent Loads	25.4	1059.2	29.5	1318.6
LC71	3.0m OF + Single Axle C	27.4	1074.7	32.9	1345.0
LC72	3.0m OF + Single Axle Ecc	27.6	1078.8	33.2	1351.9
LC73	3.0m OF + Tandem C	28.4	1081.7	34.5	1356.8
LC74	3.0m OF + Tandem Ecc	28.8	1089.4	35.2	1369.9
LC80	4.0m OF Permanent Loads	41.6	1269.0	49.8	1580.8
LC81	4.0m OF + Single Axle C	43.3	1282.2	52.6	1603.2
LC82	4.0m OF + Single Axle Ecc	43.3	1284.3	52.6	1606.9
LC83	4.0m OF + Tandem C	44.0	1287.7	53.9	1612.6
LC84	4.0m OF + Tandem Ecc	44.2	1292.4	54.1	1620.7
LC90	5.0m OF Permanent Loads	58.0	1480.4	70.2	1845.1
LC91	5.0m OF + Single Axle C	59.3	1491.5	72.5	1863.9
LC92	5.0m OF + Single Axle Ecc	59.3	1492.7	72.4	1865.9
LC93	5.0m OF + Tandem C	59.9	1496.1	73.5	1871.7
LC94	5.0m OF + Tandem Ecc	59.9	1498.9	73.5	1876.6

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

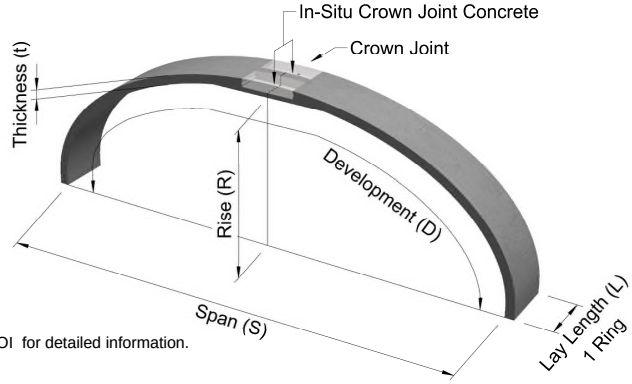
$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

C54T/6

Dimensions

Span S	[m]	16.460
Rise R	[m]	8.029
Development D	[m]	25.826
Thickness t	[mm]	330
Lay Length L	[m]	1.816
Overfill Heights H_o	[m]	min. 0.6 m - 5.0 m

Higher overfills feasible. Contact BEBOI for detailed information.

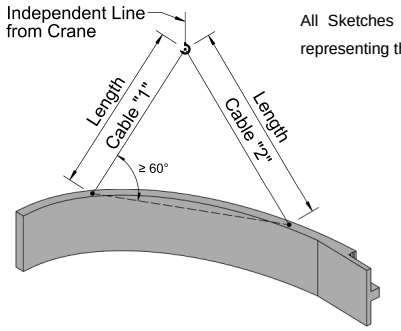


Specifications

Reinforcement Steel		Grade 400
Concrete Volume per Arch Element	[m³]	7.84
In-Situ Concrete per Ring	[m³]	1.01

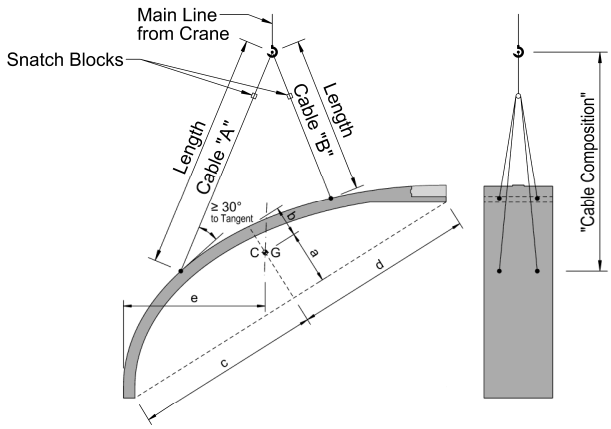
1 Ring = 2 Arch Elements

All Sketches are generic and not representing the actual Arch Shape.



Handling

Arch Element Weight	[kN]	196.00 (19.6 metric tons)
Length Cable A	[m]*	8.40
Length Cable B	[m]*	6.20
Cable Force A	[kN]*	140.07
Cable Force B	[kN]*	62.31
Min. Length Cable 1&2	[m]	7.30
Cable Force 1&2	[kN]	113.16
Center of Gravity a	[m]	1.82
Center of Gravity b	[m]	0.99
Center of Gravity c	[m]	5.73
Center of Gravity d	[m]	5.77
Center of Gravity e	[m]	3.16

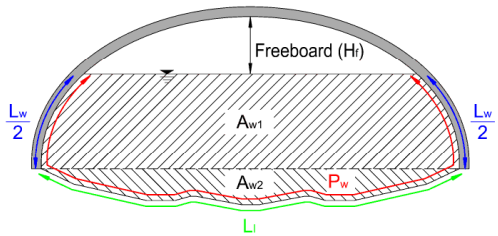


*) For Cables A/B: Per Cable Composition

Hydraulics

Freeboard H_f [m]	Waterway Area A_{w1} [m²]	Wetted Arch Length L_w [m]
Full Area **	105.90	
1.0	99.42	16.86
2.0	89.45	13.54
3.0	77.28	10.82
4.0	63.55	8.42
5.0	48.70	6.20
6.0	33.05	4.10

**) Not recommended for Hydraulic Applications.
Leave at least 1m Freeboard.



A_{w2}: Area below imaginary horizontal line between opposite arch legs and bottom of stream bed (project specific value).

L_i: Length of stream bed (project specific value)

P_w: Wetted Perimeter (= $L_w + L_i$)

Basic hydraulic calculation methods using the tabulated values to estimate the free surface flow/discharge can be found in the explanation section of the catalogue.

Load Case ID		unfactored H [kN/m]	unfactored V [kN/m]	factored (*) H [kN/m]	factored (*) V [kN/m]
LC2	Arch Installation	43.6	110.6	52.3	132.7
LC10-LC39	Backfill Process	Generally not governing (contact BEBOI for final design check)			
LC40	0.6m OF Permanent Loads	-26.1	587.4	-34.9	728.7
LC41	0.6m OF + Single Axle C	-23.4	609.7	-30.2	766.7
LC42	0.6m OF + Single Axle Ecc	-23.0	619.0	-29.5	782.5
LC43	0.6m OF + Tandem C	-22.1	617.7	-28.0	780.2
LC44	0.6m OF + Tandem Ecc	-21.1	636.9	-26.3	813.0
LC50	1.0m OF Permanent Loads	-22.2	656.2	-30.0	814.7
LC51	1.0m OF + Single Axle C	-19.8	677.7	-25.8	851.3
LC52	1.0m OF + Single Axle Ecc	-19.2	689.4	-24.8	871.2
LC53	1.0m OF + Tandem C	-18.4	689.4	-23.4	871.2
LC54	1.0m OF + Tandem Ecc	-17.4	708.6	-21.7	903.8
LC60	2.0m OF Permanent Loads	-10.3	863.1	-15.1	1073.4
LC61	2.0m OF + Single Axle C	-8.4	880.6	-11.9	1103.0
LC62	2.0m OF + Single Axle Ecc	-8.0	888.2	-11.2	1116.0
LC63	2.0m OF + Tandem C	-7.4	889.2	-10.2	1117.7
LC64	2.0m OF + Tandem Ecc	-6.8	902.1	-9.0	1139.6
LC70	3.0m OF Permanent Loads	1.7	1072.1	0.0	1334.6
LC71	3.0m OF + Single Axle C	3.3	1087.1	2.7	1360.1
LC72	3.0m OF + Single Axle Ecc	3.4	1091.1	2.9	1366.9
LC73	3.0m OF + Tandem C	4.0	1093.5	3.9	1371.0
LC74	3.0m OF + Tandem Ecc	4.4	1101.4	4.4	1384.3
LC80	4.0m OF Permanent Loads	13.9	1282.6	15.2	1597.7
LC81	4.0m OF + Single Axle C	15.2	1295.3	17.3	1619.3
LC82	4.0m OF + Single Axle Ecc	15.1	1297.3	17.3	1622.6
LC83	4.0m OF + Tandem C	15.7	1300.3	18.3	1627.7
LC84	4.0m OF + Tandem Ecc	15.8	1305.1	18.5	1636.0
LC90	5.0m OF Permanent Loads	26.1	1494.7	30.4	1862.8
LC91	5.0m OF + Single Axle C	27.1	1505.4	32.2	1881.0
LC92	5.0m OF + Single Axle Ecc	27.1	1506.3	32.1	1882.5
LC93	5.0m OF + Tandem C	27.6	1509.4	32.9	1887.8
LC94	5.0m OF + Tandem Ecc	27.6	1512.4	33.0	1892.9

(*): Load Factors Acc. CAN CSA S6-06: $\gamma_{Dead\ Load}$ = 1.10 $\gamma_{Live\ Load}$ = 1.70

$\gamma_{Back\text{-}and\ Overfill}$ = 1.25

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