



GENERAL TECHNICAL CHARACTERISTICS

TV 100 Multi-plate system is compound by a variety of shape structures formed by corrugated steel plates (their widths depends on each project requirements). Structures may be coated or made in black steel; they are longitudinally and peripherally assembled by bolts and nuts, and mounted directly on its final position: an open trench.

Tecnovial counts on a certified Integrated Management System according to ISO 9001:2008 (Quality), ISO 14001:2004 (Environment) and OHSAS 18001:2007 (Safety).

USAGE

Through several decades and hundreds of kilometers of underground works, this solution has been successfully installed in various conditions. TV 100 Multi-plate allows the construction of sewage networks, road and rail crossings, mine entries, as well as utility lines such as gas and electricity.

Through the last decade, TV 100 Multi-plate has become the best solution for complex road crossings and water channels, among others.

ADVANTAGES

In trench installation, makes its mounting process quick and easy, which allows assembling in more than one work front simultaneously and interacting with other support resources. Plate sizes allow their manual handling.

TV 100 corrugation makes this solution the most efficient alternative for structures with diameter between 1.8 and 3.8 meters. Compared to tunnel installations, TV 100 Multi-plate requires a lower height of the soil over the top between the structure keystone and the soil level, which implies that this is an ideal solution for superficial installation. Nevertheless, its structural robustness allows it to be installed in very deep places.

On the other hand, compared to other prefabricated solutions, TV 100 Multi-plate is easy and economical to transport, since its configuration is based on structural plates, allowing its staging on-site to be minimal, and reducing transport costs, therefore, it is ideal for remote or hard to access areas.

DURABILITY

TV 100 Multi-plate provides the lifespan required for each specific project using coating and special solutions for every need, such as:

Galvanization: TV 100 Multi-plate sheets are hot dipped galvanized (according to ASTM A-123 standard) being highly resistant to corrosion and increasing the structure lifespan.

Special Coatings: intended for applications in acid environments, these coatings may contain polymeric elements like: epoxy, polyester or reactive polymers (barrier type coating). Those may be applied by electrostatic deposition or liquid painted and oven dried according to the project requirements.

Concrete Coating: this coating is intended for use in extreme conditions of corrosion or abrasion. The projected concrete may ensure the structures lifespan in a practical and economical way.

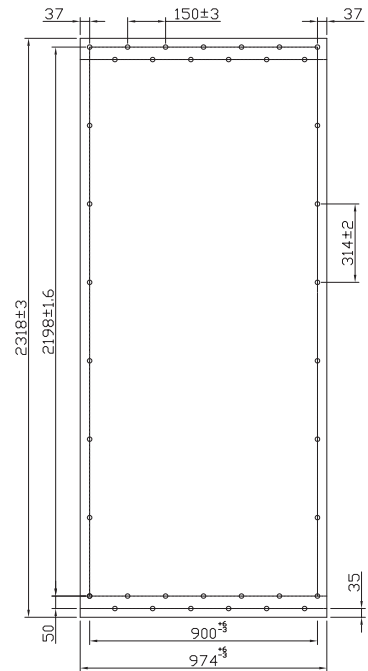
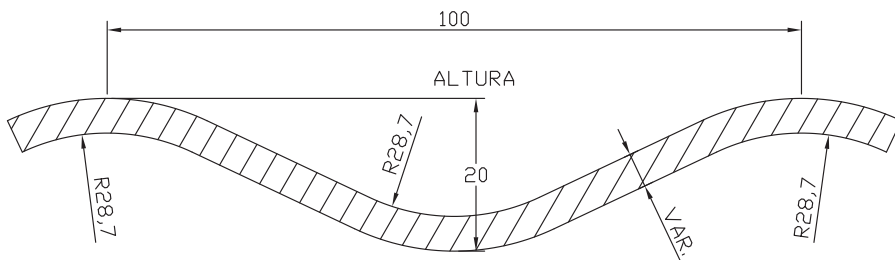


PRODUCT CHARACTERISTICS

Steel Quality: A-36.

Bolts: ASTM A449 quality 5/8" diameter high strength bolts.

Corrugation Characteristics: 20 mm corrugation depth; 100 mm pitch; 900 mm useful length.



MECHANICAL SECTION PROPERTIES

Width [mm]	Area [cm ² /m]	Moment of Inertia [cm ⁴ /m]	Radius of Gyration [cm]	Longitudinal Juncture Strength [t/m]
2.0	26.1	8.91	0.58	40.6
2.5	31.4	10.73	0.58	53.3
3.0	36.6	12.67	0.59	66.0
3.5	41.8	14.67	0.59	78.7
4.0	47.1	16.73	0.60	91.4

STRUCTURAL CALCULATION

TV 100 Multi-plate excellent structural properties are due to steel strength area and surrounding soil confinement, which prevents the structure from being deformed, and induces a predominantly compressive tensional state; that is why not only the conduct quality is important, but also a good quality, adequate positioning and compacting of the backfill material.

The above mentioned is reached by the material to comply with the granulation established in the ASHTO regulation and a minimum compaction of 90% of modified Proctor (it may be higher depending on each project requirements).

In sum, during the designing stage there must be verified three main points:

- Compressive Strength:** It is determined by the mechanical characteristics of the material, as well as the configuration shapes which rule the plates' bucking.
- Bolted Joint Strength:** It depends on the plates' width only.
- Rigidity to Handling:** It must be verified that the structure rigidity is the appropriated one to ensure a good handling during the assembly.

TECHNICAL ADVISORY

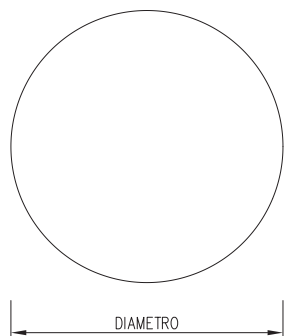
These products design is optimized by our Engineering and Development department according to the requirements of each project and in compliance with the American Association of State Highway and Transportation Officials (AASHTO) and the American Iron and Steel Institute (AISI) standards.

Please note that AASHTO allows dealing with the majority of TV 100 Multi-plate applications; nevertheless, in big major structure loads, short backfill heights, large-scale structures and special conditions of each project, the applicability of this standard is dubious. That is why Tecnovial counts on specialist professionals who are able to address most complex cases utilizing latest generation software.

AVAILABLE SHAPES

Our Engineering and Development may adapt the standard shape to the one that meets the requirement of each project: ellipse, pipe-arch and underpass. Standard shapes are the following.

ROUND PIPE



Model	Diameter [m]	Span [m]	Area [m ²]	Perimeter [m]	Radius [m]	Minimum Height of the Soil over the Top [m]	Minimum Width* [mm]
TV100-C-01	0,60	0,60	0,28	1,88	0,30	0,60	2,00
TV100-C-02	0,70	0,70	0,38	2,20	0,35	0,60	2,00
TV100-C-03	0,80	0,80	0,50	2,51	0,40	0,60	2,00
TV100-C-04	0,90	0,90	0,64	2,83	0,45	0,60	2,00
TV100-C-05	1,00	1,00	0,79	3,14	0,50	0,60	2,00
TV100-C-06	1,10	1,10	0,95	3,46	0,55	0,60	2,00
TV100-C-07	1,20	1,20	1,13	3,77	0,60	0,60	2,00
TV100-C-08	1,30	1,30	1,33	4,08	0,65	0,60	2,00
TV100-C-09	1,40	1,40	1,54	4,40	0,70	0,60	2,00
TV100-C-10	1,50	1,50	1,77	4,71	0,75	0,60	2,00
TV100-C-11	1,60	1,60	2,01	5,03	0,80	0,60	2,00
TV100-C-12	1,70	1,70	2,27	5,34	0,85	0,60	2,00
TV100-C-13	1,80	1,80	2,54	5,65	0,90	0,60	2,00
TV100-C-14	1,90	1,90	2,84	5,97	0,95	0,60	2,00
TV100-C-15	2,00	2,00	3,14	6,28	1,00	0,60	2,00
TV100-C-16	2,10	2,10	3,46	6,60	1,05	0,60	2,00
TV100-C-17	2,20	2,20	3,80	6,91	1,10	0,60	2,00
TV100-C-18	2,30	2,30	4,15	7,23	1,15	0,60	2,50
TV100-C-19	2,40	2,40	4,52	7,54	1,20	0,60	2,50
TV100-C-20	2,50	2,50	4,91	7,85	1,25	0,60	2,50
TV100-C-21	2,60	2,60	5,31	8,17	1,30	0,60	2,50
TV100-C-22	2,70	2,70	5,73	8,48	1,35	0,60	3,00
TV100-C-23	2,80	2,80	6,16	8,80	1,40	0,60	3,00
TV100-C-24	2,90	2,90	6,61	9,11	1,45	0,60	3,50
TV100-C-25	3,00	3,00	7,07	9,42	1,50	0,60	3,50
TV100-C-26	3,10	3,10	7,55	9,74	1,55	0,60	4,00
TV100-C-27	3,20	3,20	8,04	10,05	1,60	0,60	4,00
TV100-C-28	3,30	3,30	8,55	10,37	1,65	0,60	5,00

* Minimum width to comply with installation and handling strength.

INSTALLATION

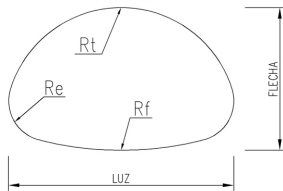
The basic installation sequence for TV 100 Multi-plate is:

- a) Trench excavation.
- b) Sand bed preparation.
- c) Bolted and assembly of the structure.
- d) Backfilling with laterally and superiorly compacted material.

Except for arc shaped ones and after de support basis is ready, the structure assembly commences installing the bottom plates following the exact shape of the structure obtaining an even support. Once all of the bottom plates are disposed, upper plates may be mounted always following a downstream to upstream pattern.

When the whole structure has been assembled, the granular backfill is disposed in 20 cm layers and alternatively compacted with light machinery until it reaches the minimum specified height.

PIPE ARCHES



Model	Span	Rise	Area	Perimeter	Rt	Rf	Re	Fr**	Minimum Width*	Maximum Height
	[m]	[m]	[m ²]	[m]	[m]	[m]	[m]		[m]	[mm]
TV100-B-01	1,58	1,17	1,47	4,40	0,80	2,22	0,41	1,96	0,7	2,00
TV100-B-02	1,58	1,17	1,47	4,40	0,80	2,27	0,40	1,99	0,7	2,00
TV100-B-03	1,60	1,16	1,48	4,40	0,90	1,56	0,48	1,86	0,8	2,00
TV100-B-04	1,71	1,24	1,69	4,71	0,91	2,08	0,50	1,83	0,8	2,00
TV100-B-05	1,83	1,29	1,90	5,02	0,96	4,36	0,50	1,91	0,8	2,00
TV100-B-06	1,85	1,29	1,89	5,02	0,94	2,40	0,41	2,28	0,8	2,00
TV100-B-07	1,93	1,40	2,14	5,34	0,97	2,71	0,45	2,14	0,8	2,00
TV100-B-08	1,89	1,25	1,87	5,02	1,10	1,97	0,48	2,27	0,9	2,00
TV100-B-09	1,99	1,36	2,13	5,34	1,08	2,31	0,51	2,11	0,9	2,00
TV100-B-10	2,06	1,48	2,42	5,65	1,08	2,50	0,55	1,95	0,8	2,00
TV100-B-11	2,33	1,57	2,93	7,54	1,28	4,90	0,62	2,06	0,9	2,50
TV100-B-12	2,49	1,81	3,62	6,91	1,28	5,68	0,70	1,84	0,8	2,50
TV100-B-13	2,72	1,78	3,82	7,22	1,41	3,89	0,56	2,51	0,9	3,00
TV100-B-14	2,82	1,91	4,24	7,54	1,53	2,94	0,70	2,19	0,9	3,00
TV100-B-15	3,01	2,09	4,99	8,16	1,56	4,23	0,73	2,12	0,8	3,50
TV100-B-16	3,20	2,32	5,90	8,79	1,79	3,14	0,97	1,86	0,8	4,00

* Minimum width to comply with installation and handling strength
**Fr = RT/RE.

HYDRAULIC DIMENSIONING

Drain steel corrugated pipes are usually dimensioned as channels and the Manning's Formula is applied.

MANNING'S FORMULA

$$Q = A \cdot \left(\frac{A}{P} \right)^{\frac{2}{3}} \cdot \left(\frac{\sqrt{i}}{n} \right)$$

Q: cross-sectional average velocity [m³/s].

A: cross sectional area of flow [m²].

P: wetted perimeter.

i: slope of the water surface or the linear hydraulic head loss [m/m].

n: Gauckler–Manning coefficient.

Gauckler–Manning coefficient depends on the corrugation profile. Mean values are the following:

Corrugación	n
TV-100	0.021
Concrete Coating	0.015

TECHNICAL STANDARDS

TV 100 structural design is based on AASHTO– American Association of State Highway and Transportation Officials, and AISI – American Iron and Steel Institute standards, as well as Chilean regulation NCh 2462.