

Track apparatus: High-Speed



Points for a 17,000 radius turnout, speeds 350/220 km/h

At Amurrio, we are pioneers in the design, production and installation of high-speed track apparatus.

Our experience and know-how allow us to undertake, in collaboration with our clients, the most efficient solutions in all kinds of turnouts and single crossovers for high-speed sections.

New geometries, patented and developed completely at Amurrio, improve the safety and comfort of travellers.

These include GEA, which allows the turnout to be designed ergonomically in accordance with the limitations of the 'yerk', over-acceleration and non-compensated acceleration, typical of each administration.

Each of the components of our high-speed apparatus is designed and produced to optimise operating and maintenance costs.

Such as the movable point crossings or swing nose crossings with magnesium steel cradle, cast and machined in our own installations.

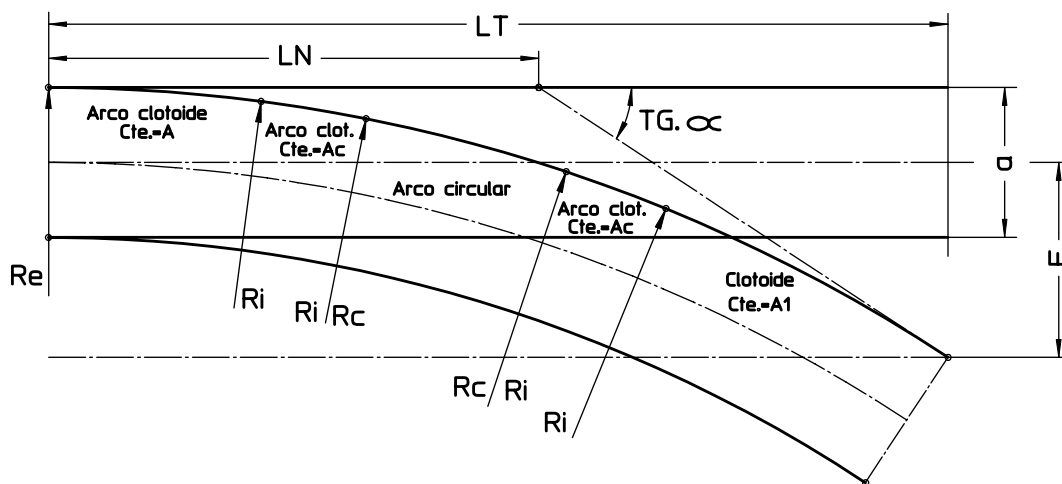
Or our innovating, maximum safety and minimum maintenance CRBM locking devices, also developed completely at Amurrio.



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Track apparatus: High-Speed

GEA - GEOMETRIA ERGONOMICA AMURRIO



Switched speed	Entry Radius (Re) (m.)	Entry Clotoid Arc Cte:(A)	Offset Clotoid Arc Cte: (Ac)	Intermediate Radius (Ri) (m.)	Circular Radius (Rc) (m.)	Exit Clotoid Cte: (A2)	Total Length (LT) (m.)	Knot Length (LN) (m.)	Tg. α	Track width (mm.)	Crossover Track Spacing (m.)
220 km/h	14.680	700	1.883	8.000	7.470	700	200	111,190	1/47,4	1.435	4.700
160 km/h	8.000	300	3.471	4.000	3.950	300	140	73,885	1/31,5	1.435	4.700
100 km/h	1.750	245	887	1.600	1.545	195	87	49,027	1/20,9	1.435	4.700

GEA (Geometría Ergonómica Amurrio) is a patented geometry that allows for an increase in the safety and comfort of passengers and shortens the length of the turnout, with a consequent reduction in costs.

When requested by our clients, at Amurrio we can manufacture track apparatus with traditional Clotoid geometries or any other geometry.

MORE INFORMATION

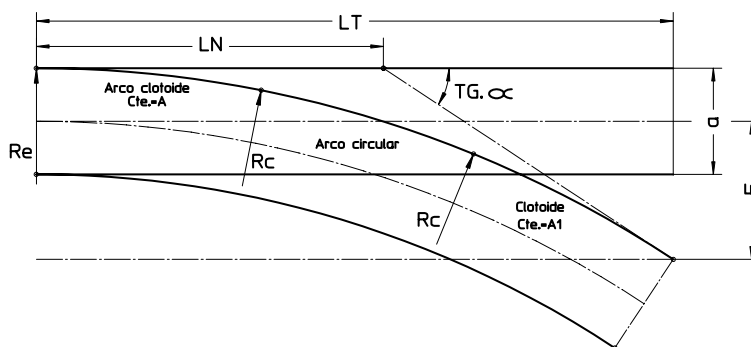
Please e-mail us the following details and we will find the best solution for your section of track:

- Maximum speed on direct and diverted track.
- Axle-load.
- Distance between axes.
- Comfort and safety limitations (yerk, over acceleration and non-compensated acceleration).
- Noise and vibration limitations.
- Type of track structure.
- Requirements of functional regulations.

- The examples show appropriate geometries and structures for speeds of from 250 km/h 250 km/h, with a maximum switch-over speed of 220 km/h.
- Elasticities for greater comfort for travellers: between 17.5 KN/mm and 60 KN/mm.

- Movable point crossings with mangane steel cradles, manufactured in our own foundry.
- Maximum safety in drives and checks with different locking systems. CRBM design developed at Amurrio.

CLOTOIDE DE MESETA



Switched Speed	Entry Radius (Re)	Entry Clotoid Arc Cte:(A)	Circular radius (Rc)	Exit Clotoid Cte: (A1)	Total Length (LT)	Knot Length (LN)	Tg. α	Track width (mm.)	Crossover Track Spacing (m.)
220 km/h	17.000 m	900	7.300 m	750	207,397 m	93,673 m	1/48,4	1.435	4.700
160 km/h	10.000 m	500	4.000 m	470	151,451 m	68,003 m	1/35,5	1.435	4.700
100 km/h	3.000 m	285	1.500 m	219	92,248 m	41,594 m	1/21,5	1.435	4.700

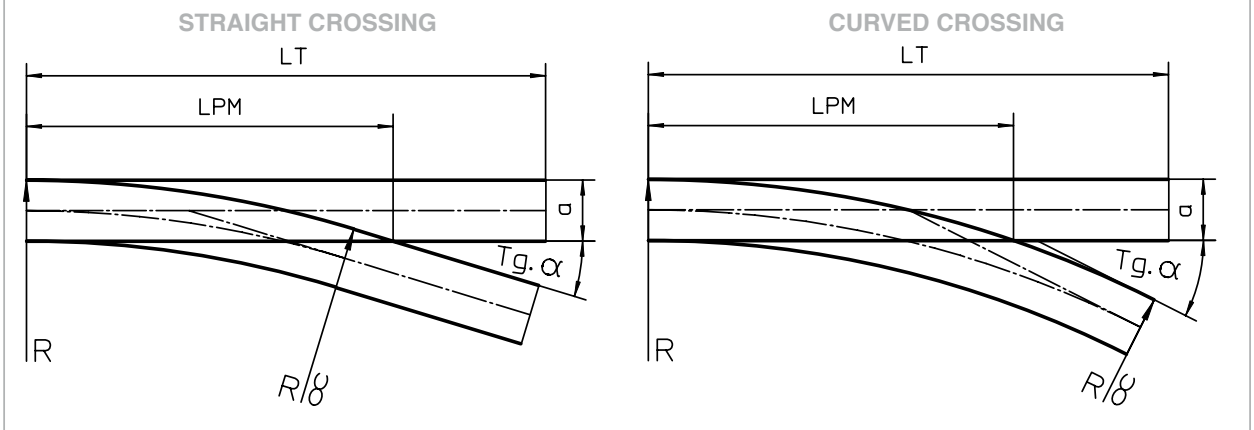
Track Apparatus: Conventional Track Sections



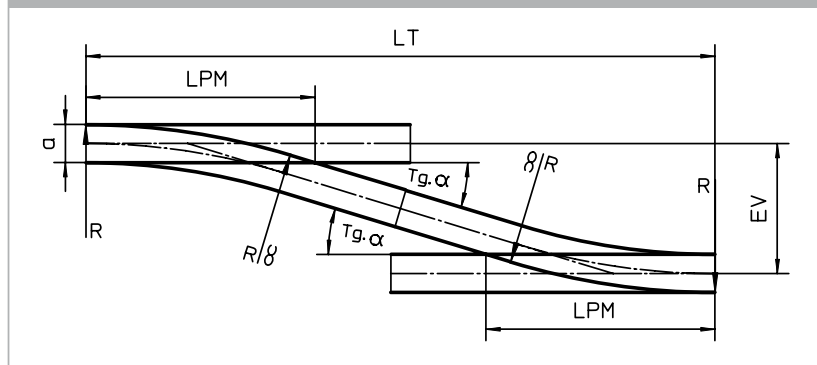
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Straight or curved turnout heel
Scissors crossovers
Single crossovers
Bretelles

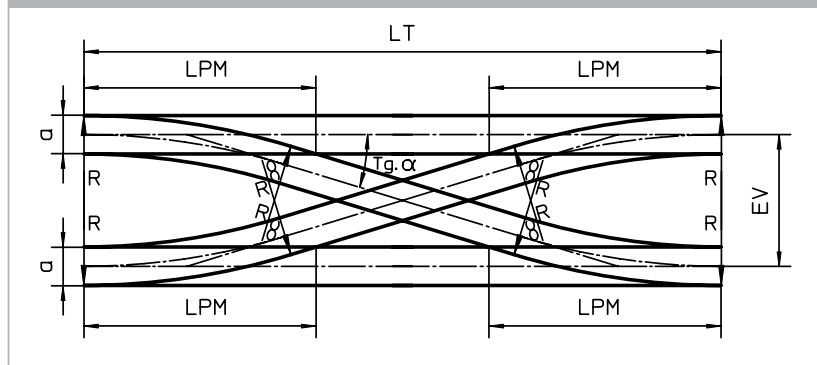
CONVENTIONAL TURNOUTS



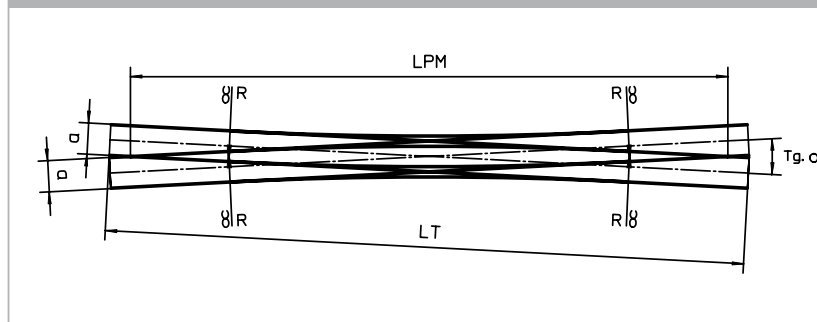
SINGLE CROSSOVER



DOUBLE CROSSOVER



SCISSORS CROSSOVER



Experience

At Amurrio, we have designed, produced and installed track apparatus for all kinds of track sections since 1880. Our experience and know-how allow us to find, in collaboration with our clients, the most efficient solutions.

Versatility

The Amurrio catalogue covers a complete range of turnouts for average speeds of up to 160 km/h on wooden sleepers and high-speed on concrete sleepers of up to 250 km/h, all of them with the following characteristics:

- Ready for long bar welding
- For ballast tracks with wooden sleepers and concrete sleepers, concrete sleepers on slab or slabtrack.
- For all kinds of rails existing on the market with different types of hardness.
- Adaptable to all kinds of rigid or elastic fastenings on demand.
- Asymmetrical high or low point profiles with forged heel
- Manganese steel crossings with natural hardness or pre-hardened by explosion. With flas-butt welded antennas for their on-track weldability by aluminothermic welding.

Innovation

Our in-depth knowledge of materials and the functionality of each component of a piece of track apparatus allow us to find solutions to the problems posed by any section of track, with a high level of innovation.

DESIGNACIÓN DE DESVÍOS CONVENCIONALES

Apparatus:

DS Simple turnout
 D Mixed turnout
 ES Simple crossover
 E Crossover
 EC Combined crossover
 TSU Crossing
 TUS
 TUD

Sleeper/infraestructure

H Concrete sleepers
 HP Concrete without ballast
 P Slabtrack
 Wood by default

Radius:
 expressed in metres

Crossing:

CC Curved crossing
 CR Straight crossing

ES I HP-B1-54-190-1/7-CC-D-4300

Width:
 I International
 Iberian by default

Type :
 A, B, C, V, P, G,
 GL, AV, V
 (See enclosed
 types chart)

Rail:
 54, 60 ...

Tg.:
 Expressed in
 fraction or
 decimals

Hand (in case of CC):
 D Right
 I Left

MOST USUAL* TYPES OF CONVENTIONAL TURNOUTS

CHARACTERISTICS		TYPE A	TYPE B	TYPE C	TYPE P	TYPE G	
GENERAL	Maximum speed on direct	140 km/h	160 km/h	220 km/h	220 km/h	220 km/h	
	Sleepers	Wood	Wood	Wood or concrete	Concrete	Concrete	
	Arrangement of sleepers	Perpendicular direct track and bisector of crossing	Semi-fan	Semi-fan	Semi-fan	Semi-fan	
	Type of fastening	Rigid	Rigid and elastic indirect	Elastic indirect	Elastic indirect	Elastic indirect	
	Relation with adjacent tracks	Flanged joints	Weldable	Weldable	Weldable	Weldable	
	Requires protection from expansions	Yes	No	No	No	No	
SPE- CIFIC CHA- RACTE- RISTICS OF EACH AREA	SWITCH TONGES	Type of points	Elastic	Elastic	Elastic	Elastic	
		Alignment of point	Non-tangent	Tangent	Tangent	Tangent	Tangent
		Point profile	Special wide web rail	Special wide web rail	Low asymmetrical	Low asymmetrical	Low asymmetrical
		Fastening	Coach screws	Coach screw with Grover washer	Elastic indirect	Elastic indirect	Elastic indirect
		Device to prevent lack of alignment	Check blocks	Check blocks	Peg and fork	Peg and fork	Peg and fork
		Relation of heel point with adjacent tracks	Fish-plated joints	Welded	Welded	Welded	Welded
	CROS- SINGS	Type	Mn steel mono block	Mn steel mono block	Mn steel mono block	Mn steel mono block	Mn steel mono block
		Relation with adjacent tracks	Flanged	Welded	Welded	Welded	Welded
		Fastening	Coach screw	Elastic indirect	Elastic indirect	Elastic indirect	Elastic indirect
	WING RAILS	Profile					
		Relation with crossing	Connected to crossing	Steel plate to heel electrically insulated	Steel plate to heel electrically insulated	None	None
		Fastening of wing rail	Direct to	With single rail-wing rail support	With single rail-wing rail support	With single rail-wing rail support	With single rail-wing rail support
Fastening of rail		Coach screw	Elastic clip	Elastic clip	Elastic clip	Elastic clip	
OTHERS	Adaption to track width	No	No	No	Renfe/UIC transformable width	No	
	Box sleeper	No	No	No	Yes	Yes	
	Side friction block	No	No	No	No	Yes	

* When requested by our clients, we can design, manufacture and install any kind of track apparatus.



ASK US NO OBLIGATION

- *At Amurrio we can help you defining the needs of your railway project. The knowledge we have gained has taught us to anticipate all the possible complications, and provide solutions with high innovation value.*



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Track apparatus: Mono block crossings



At Amurrio, we seek excellence in our production of Hadfield steel mono block heels (Mn 12/14%).

For this purpose we select high-quality scrap and ferroalloys and we cast these in our own electric arc furnaces. We control temperatures constantly and perform spectrometries of test specimens. After moulding, the crossings are subjected to heat treatment in gas furnaces and are cooled in agitated water.

The mechanical impact, penetrating liquids and radiographic tests certify the quality of each one on the crossings delivered to our clients.

Versatility

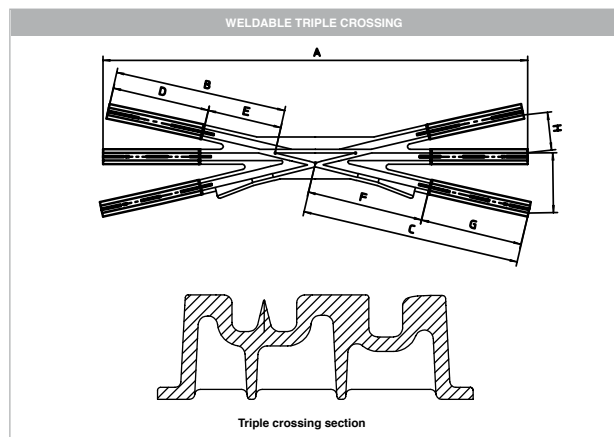
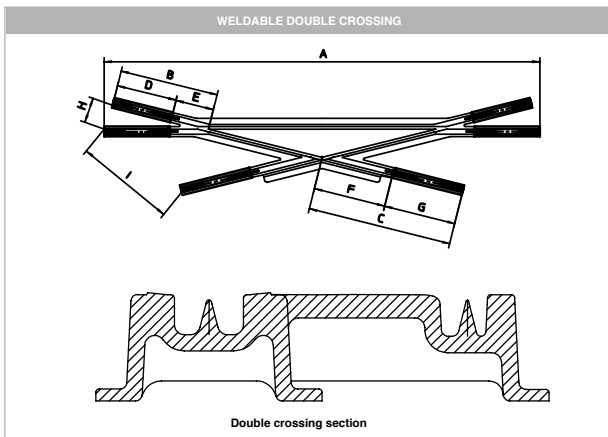
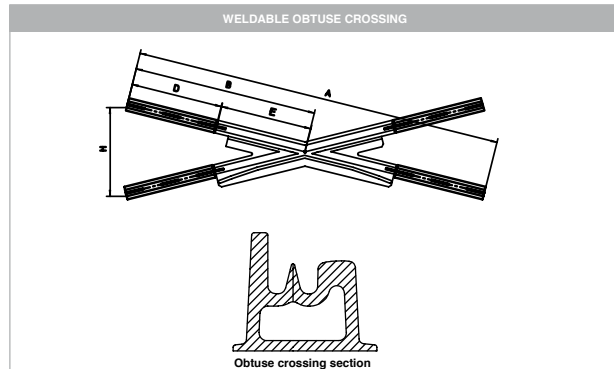
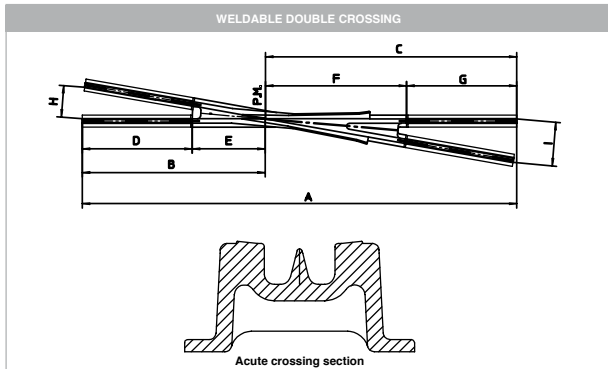
Based on the client's basic geometry and in accordance with the speed and loads per axle requested, our engineering department at Amurrio designs all kinds of crossings: acute, obtuse,

double, triple, cradles for high-speed turnout crossings, and so on. In any kind of profile and with any length of up to 12 m, we are the current market leader.

Thanks to this versatility we have a warehouse with more than 500 patterns of crossings that can be manufactured quickly to adapt to the client's needs.



Mono block crossings



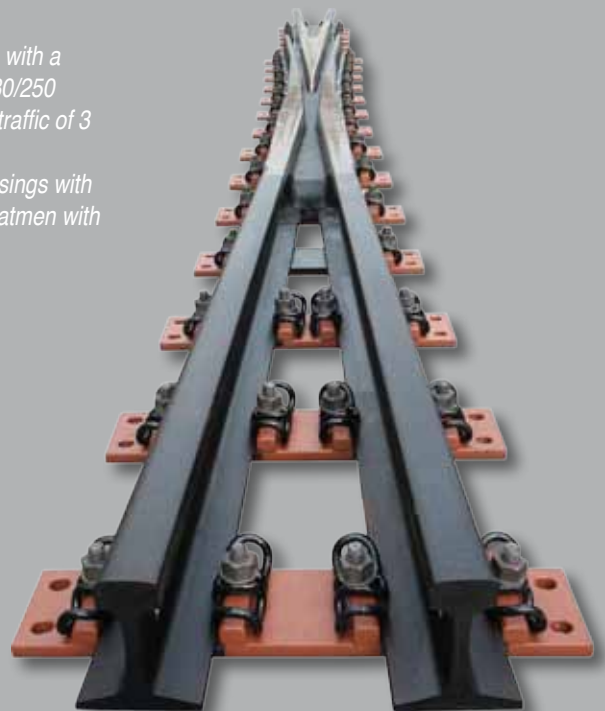
Total length	Entrance branch	Exit branch	Antenna 1	Block entrance branch	Block exit branch	Antenna 2	Entrance heel spread	Exit heel spread
A	B	C	D	E	F	G	H	I

Chemical composition

C (0.95/1.3); Si (0.65 max); Mn(11.5/14);
P(0.05 max); S(0.03 max) Ni(1.75% max);
Cr(0.5% max); Cu (0.3% max) ;
Al (0.045% max).

Structure:

Austenitic, totally carbide free, with a hardness after machining of 230/250 HB. Hardnesses reached with traffic of 3 million tonnes: 400 HB
By request we can supply crossings with pre-hardening by explosion treatment with hardnesses of 360/400 HB.



Track apparatus: Movable Point Crossings



The movable point crossings designed and produced at Amurrio have been conceived especially for installation in two kinds of tracks:

- Sections of track on which trains travel at speeds of over 220 km/h on direct track 100 km/h on diverted track.
- Sections of track on which low noise levels and high passenger comfort are required.

The crossing consists of a mono block cradle of moulded manganese steel wel-

ded by flash-butt process on the point side and on the heel side to the special wing rail, by means of a weld placed outside the rail/wheel contact areas.

The movable point moves laterally on the sliding table formed by the bottom of the cradle.

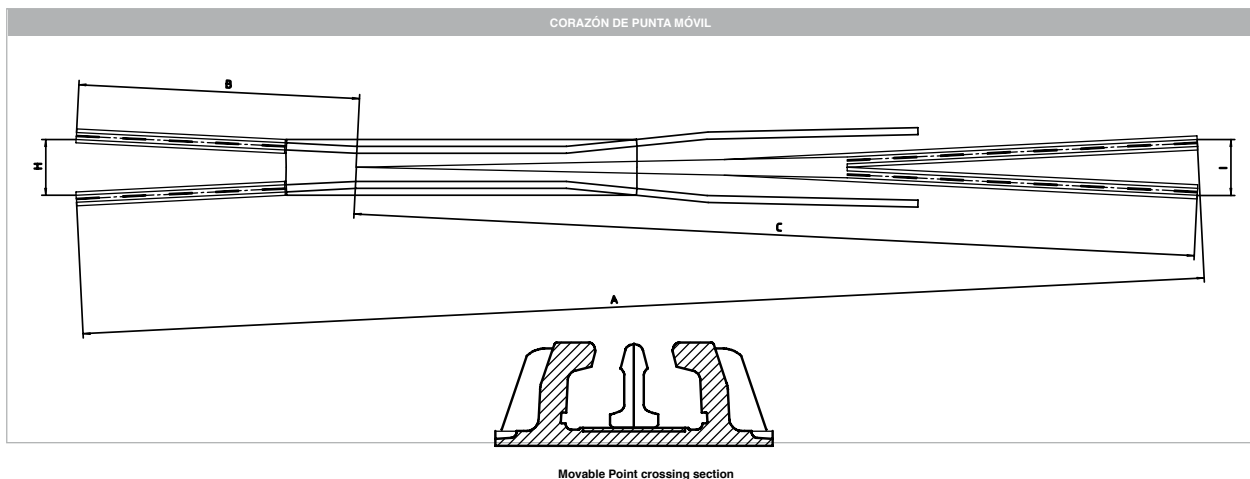
The cradle is adapted so as to ensure that the blocking systems and the electrical control of the point are fastened. Moreover, it is provided with the necessary notches to ensure that the heating devices are placed correctly.

None of the components requires greasing and these have sliding surfaces that do not need lubrication. This is especially the case of seating and movable point sliding plates, which will be surfaced with a metalized molybdenum coating that allows a stable friction coefficient $\mu < 0.3$ to be obtained without the need for lubricants.



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Movable Point Crossings



Total length	Entrance branch	Exit branch	Antenna 1	Block entrance branch	Block exit branch	Antenna 2	Entrance heel spread	Exit heel spread
A	B	C	D	E	F	G	H	I

Major features:

The cradle and wing rail assembly houses the special UIC60 D profile flexible movable point head which is inclined 1/20. This inclination is obtained during the rolling process without the need for machining the rolling surface and corresponding heat treatment.

The point is formed by two parts (point and counterpoint) joined together by means of mechanical-welded heel check blocks and, in turn, the assembly is mounted to the wing rails by check blocks, special bolts and elastic pins.



Both the point and counterpoint have forged heels to adapt the UIC60 D profile to the UIC60 profile.

The point slides along the base of the cradle, which is treated with molybdenum and has an anti-lifting device.

The control and safety device consists of CRBM type locking devices or similar.

Track apparatus: Special turnouts



At Amurrio, we are specialists in the design, manufacture and installation of special turnouts for complex points. A good example of these is the coexistence of several track gauges in the same place, such as sea-ports.

The experience and know-how of Amurrio's design office has allowed us to undertake the manufacture of turnouts for two or more different track gauges with a shared rail.



Track apparatus: Special Turnouts

MIXED THREE-WIRE TURNOUTS

Appropriate for operating on 2 widths with a shared rail. The combination of one or two rails in direct track with one or two rails in diverted track and the relative position to the right or left in the direction of travel of the third rail in addition to the switch, gives rise to 28 different types. In the design of the section of track, those types that give rise to obtuse turnout heels should be avoided as these limit the speed along direct tracks.

DENOMINATION								
X	Y		Z		V		W	
Turnout	Direct track		Diverted track		Position 3rd rail		Turnout hand	
D	M	Mixed	M	Mixed	D	Right	D	right
	R	Renfe	R	Renfe	I	Left	I	Left
	I	International	I	International				

PERFORMANCE	
Wooden sleepers for speeds of up to 160 km/h	Concrete sleepers for speeds of up to 220 km/h
DMRD-54-320/194-0,11-CR-D	DMRD-H-UIC60-250-0,11-D
DMRD-54-190-0,11-CR-D	DMID-H-UIC60-250-0,11-CC-I
DMMI-B1-54-190-0,11-CR-D	DMII-H-UIC60-250-0,11-CC-D
DMRI-B1-54-190-0,11-CR-D	DMRI-H-UIC60-250-0,11-CR-I
DMRI-B1-54-190-0,11-CR-D	DMRD-H-UIC60-1500-0,042-CR-D

MIXED FOUR-RAIL TURNOUTS

Appropriate for operating on 3 gauges with a common rail. The combination of one, two or three gauges in direct track with one, two or three gauges in diverted track and the relative position to the right or left in the direction of travel of the third rail in addition to the switch, gives rise to 74 different types. In the design of the section of track, those types that give rise to obtuse turnout crossings should be avoided as these limit the speed along direct tracks.

DENOMINATION								
X	Y		Z		V		W	
Turnout	Direct track		Diverted track		Position 3rd rail		Turnout hand	
D	MF	Mixed triple	MF	Mixed triple	D	Right	D	right
	RI	Renfe/Int.	RI	Renfe/Int.	I	Left	I	Left
	IF	Int./Metric	IF	Int./Metric				
	RF	Renfe/Metric	RF	Renfe/Metric				
	R	Renfe	R	Renfe				
	I	International	I	International				
	F	Metric	F	Metric				

REALIZACIONES	
Wooden sleeper	Concrete sleepers
D (MF) (MF) D-B1-54-190-0,11-CR-D	D (RI) (MF) D-B1-HP-54-190-0,11-CR-D
D (MF) (MF) I-B1-54-190-0,11-CR-I	D (MF) (RI) D-B1-HP.-54-190-0,11-CR-D
D (MF) (RI) D-B1-54-190-0,11-CR-D	



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Track apparatus: Expansion joints



The expansion joints manufactured at Amurrio are designed to protect excessive tensions from the long bar track to a short bar track or to a track apparatus (turnout, crossing, etc.) not welded to the long bar, to metal bridges without ballast or to hyperstatic bridges with ballast.

In collaboration with ADIF, at Amurrio we have designed the Type A Expansion Joint (points-counterpoints) to replace the old Martinet Joint.

In its version on wooden sleepers, these joints have movable tongues and variable gauge for conventional track. In the version on concrete sleepers, they have mobile counterpoints and fixed gauge. (Renfe gauge convertible to international gauge), of medium elasticity (100 KN/m m), designed for high-speed lines of up to 220 Km/h.

Amurrio is the regular supplier of Expansion Joints for high-speed lines of up to 350 km/h with low elasticity of 27.5 KN/mm

Types	Carrera
ADAM-200	200
ADAM-340	340
ADHFP60-300	500
ADHFP60-500	500
ADIH-AV-60-300	300
ADIH-AV-60-600	600
ADIH-AV-60-1200	1200
ADMIH-60-500	500



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Track apparatus: Re-railer



Track apparatus designed to re-rail an axle that may be derailed when it reaches a bridge and avoid damage to the latter. The design principle of the re-railer consists of a number of inclined planes in a longitudinal ramp placed next to the rail and a number of guide rails that move closer and closer to the rails. The derailed axle moves up the inclined planes and at the same time, the guide rails move the wheels towards the rails until these are placed on them with the aid of a number of re-railing blocks.

The length of the re-railer is dimensioned in accordance with the speed of the line. At Amurrio, we manufacture a number of different types of wooden and concrete sleepers. The most frequent kind is the short, 9 m long re-railer for conventional track and the long, 18 metre re-railer for high-speed lines.



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Track apparatus: Tram



Trazado de la Avenida Diagonal, Barcelona

At Amurrio, we are proud of having collaborated since the beginning of the resurgence of the tram in Spain. We have participated in all the major projects undertaken in recent decades: Valencia, Alicante, Barcelona, La Coruña, Vélez-Málaga, Madrid, Tenerife, Seville, Murcia and Vitoria.

We have developed all kinds of geometries and used the different profiles, grooved and Phoenix, existing on the market, as well as all kinds of infrastructures (concrete, green track, asphalt, blocks) and different rail support jacking to satisfy the requests of our clients.

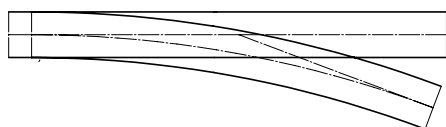


Track apparatus: Tram

Our range of products for trams includes turnouts, crossovers, crossings, double crossovers, comb turnouts and expansion joints, manufactured with assembled points, starting with the profile itself and rolled steel, manganese steel tongues with profiled heel (no gap) in order to weld to the intermediate track by means of aluminio-thermic welding and manganese steel block crossings with welded antennas in fixed-point or movable-points execution.

The most usual apparatus in Tram Railways:

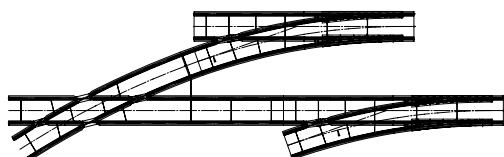
TURNOUT



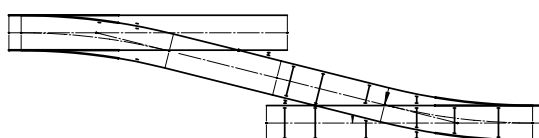
COMB TURNOUTS



CROSSING



CROSSOVERS



Movable point crossing for tramway crossing, completely designed and produced at Amurrio. The use of the Mobile point technology for trams is an innovation that ensures that urban railways are more silent and efficient.



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