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MONOBLOCK CROSSINGS

In any configuration and for all types of profiles and layouts

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 l**ength of up to 12 m**, we are the current market leader.
Thanks to this versatility we have **a warehouse with more than 800 patterns** of crossings that can be manufactured quickly to adapt to the client's needs.

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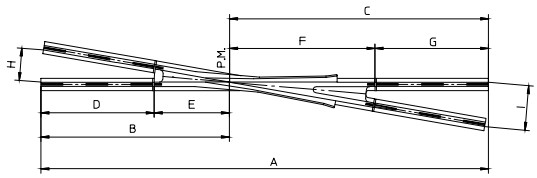
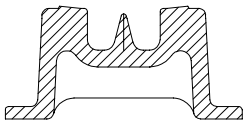
MONOBLOCK CROSSINGS IN HADFIELD STEEEL

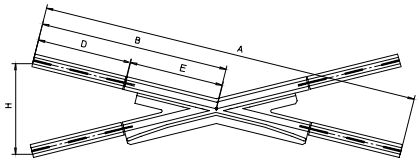
WELDABLE ACUTE CROSSING

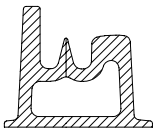




ACUTE CROSSING SECTION

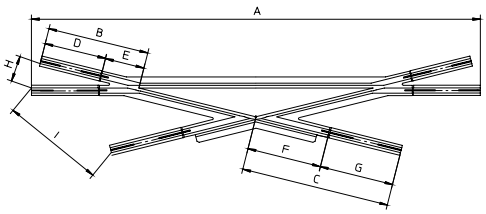
WELDABLE OBTUSE CROSSING

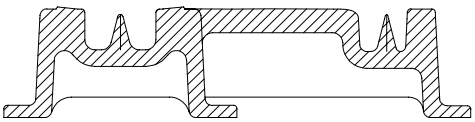




OBTUSE CROSSING SECTION

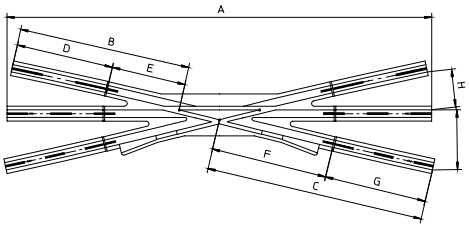
WELDABLE DOUBLE CROSSING

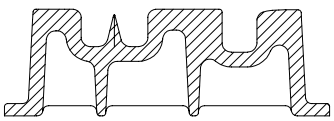




DOUBLE CROSSING SECTION

WELDABLE TRIPLE CROSSING





TRIPLE CROSSING SECTION

A	B	C	D	E	F	G	H	I
TOTAL LENGTH	ENTRANCE BRANCH	EXIT BRANCH	ANTENNA 1	BLOCK ENTRANCE BRANCH	BLOCK EXIT BRANCH	ANTENNA 2	ENTRANCE HEEL SPREAD	EXIT HEEL SPREAD

CHEMICAL COMPOSITION:
C(0.95/1.3); Si (o.65 max); Mn11.5/14); P(0.05 max) Ni(1.75% maX); CR(0.5% MAX); CU (O.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.

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MOVABLE POINT CROSSINGS

High speed, low noise level and passenger comfort

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** welded 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 μ <0.3 to be obtained without the need for lubricants.

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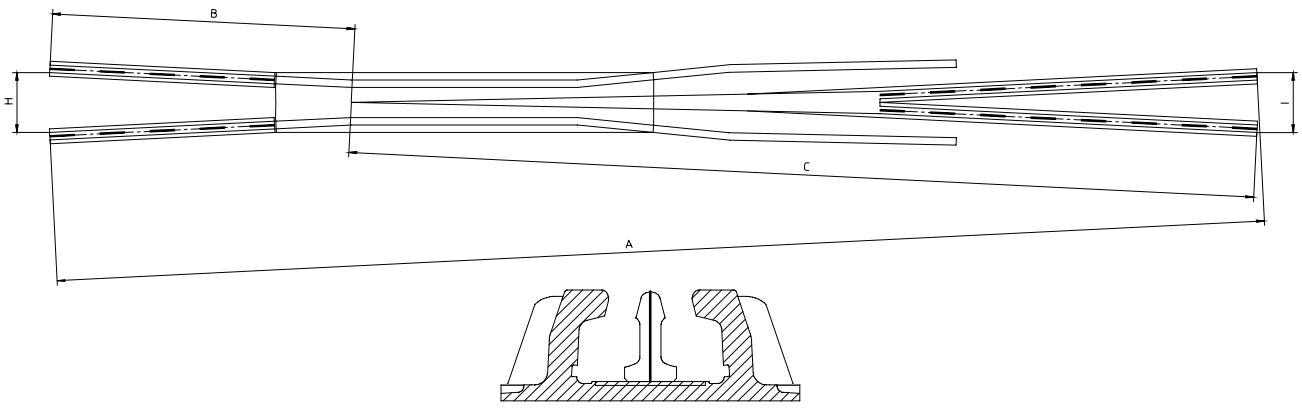
MOVABLE POINT CROSSINGS



SECCIÓN CORAZÓN PUNTA MÓVIL

A	B	C	D	E	F	G	H	I
TOTAL LENGTH	ENTRANCE BRANCH	EXIT BRANCH	ANTENNA 1	BLOCK ENTRANCE BRANCH	BLOCK EXIT BRANCH	ANTENNA 2	ENTRANCE HEEL SPREAD	EXIT HEEL SPREAD

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 counter-point, 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.

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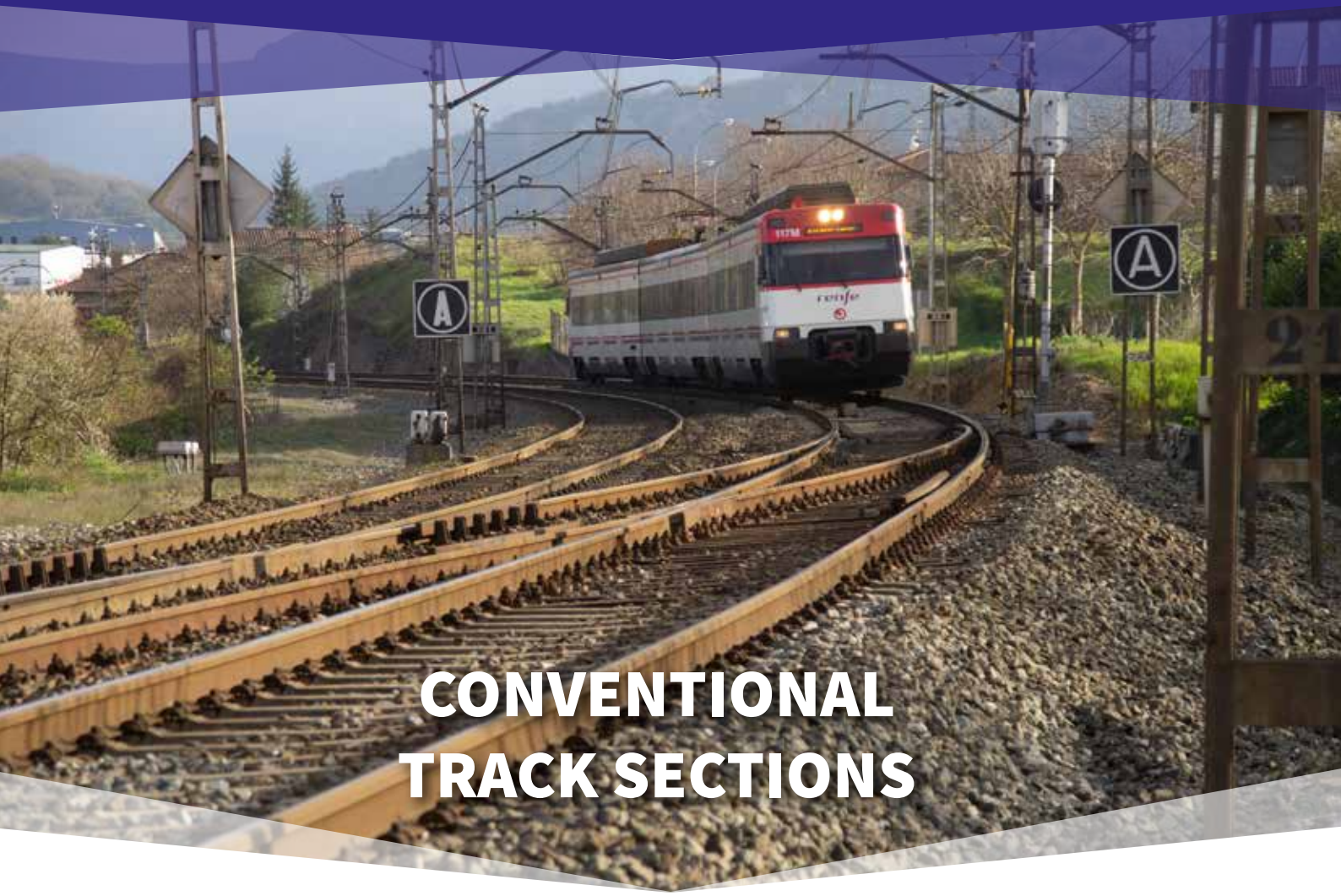

CONVENTIONAL TRACK SECTIONS

Straight
or curved
turnout heel
Scissors
crossovers
Bretelles

Amurrio's catalog covers a **complete range of turnouts** for medium speeds up to 160 km/h on wooden sleepers, and high speed on concrete sleepers up to 250 km/h.

Features:

- Prepared for welding to the **long bar**.
- For **wooden or concrete** track on ballast, concrete sleeper on slab or slab track.
- For **all types of rails** available on the market with different hardness.
- Adaptable to all types of existing **rigid or elastic fastenings** (on request).
- High or low asymmetrical **switch profiles** with forged heel.
- **Manganese steel cores**, with natural hardness or pre-hardened by explosion.
- With **spatter-welded antennae** for weldability on track by aluminothermic welding.

Innovation

Our in-depth knowledge of materials and the functionality of each component of a track system allows us to create **highly innovative solutions** to the problems encountered on any track.

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DESIGNATION OF CONVENIONAL TURNOUTS

Apparatus:
- DS Simple Turnout
- D Mixed Turnout
- ES Simple crossover
- EC Combined crossover
- TSU Crossing
- TUS
- TUD

Sleeper/infrastructure
- H Concrete Sleepers
- HP Concrete without ballast
- P Slab track
- Wood by default

Radius: Espressed in meters

Crossing:
- CC Curved Crossing
- CR Straight Crossing

Inter-axis Expressed in mm.

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

Width:
- I International Iberian by default

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

Rail: 54, 60 ...

Tg.: Expressed in fration or decimals

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

MOST USUAL* TYPES OF CONVENTIONAL TURNOUTS

CHARACTERISTYCS			TYPE A	TYPE B	TYPE C	TYPE P	TIPO G
GENERAL		Maximun 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
SPECIFIC CHARACTERISTICS OF EACH AREA	SWITCH TONGUES	Type of points	Elastic	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	Bajo asimétrico
		Fastening	Coach screws	Coach screw with Grower washer	Elastic indirect	Elastic indirect	Low asymmetrical
		Devoce 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
	CROSSINGS	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
	WING RAILS	profile	UIC-33	UIC-33	UIC-33	UIC-33	UIC-33
		Relation with crossing	Connected to crossing	Steel plate to heel electri-cally insulated	Steel plate to heel electri-cally insulated	None	None
		Fastening of wing rail	Direct to sleeper	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		Adaptation 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.

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TRACK APPARATUS: HIG SPEED

Pioneers in design, production and installation

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**, wich allows the turnout to be **designed ergonomically** in accordance with te 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 managanese 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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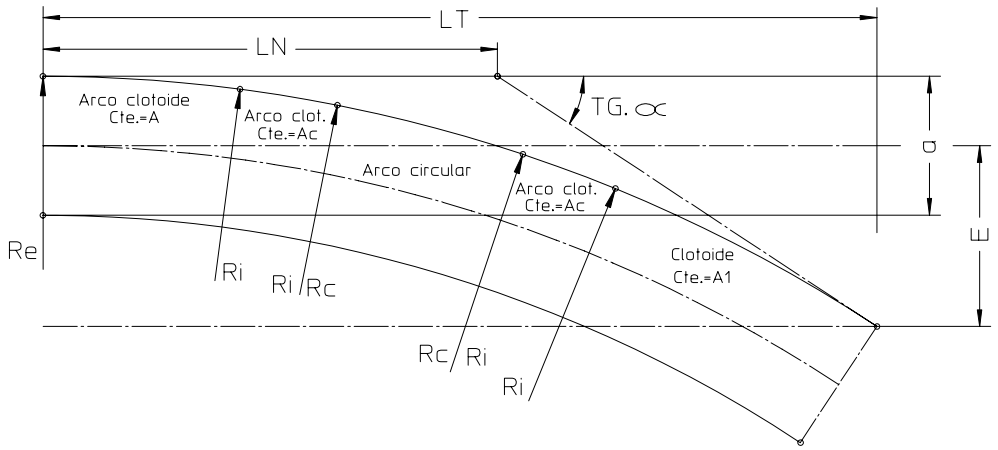
TRACK APPARATUS: HIGH-SPEED

AMURRIO ERGONOMIC GEOMETRY - GEA



Switched speed	Entry Radius (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. a	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 (Ergonomic Geometry Amu rrio) 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.

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

MORE INFORMATION

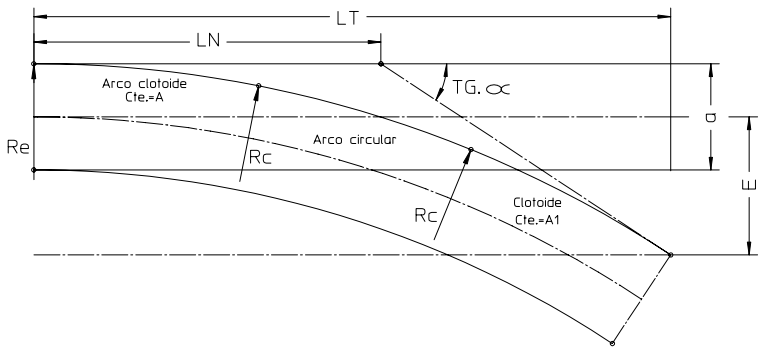
Please e-mail us the following details and we will find the best solution for your section of track:

- Maximum speed on direct and diverted track.
- Axle-load.
- Distance between axles.
- 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 manganese 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



Velocidad desviada	Radio Entrada (m.)	Clotoide entrada A	Radio Circular	Clotoide salida	Longitud total	Longitud nudo	Tg.a	Ancho vía (mm.)	Entrevía escape
220 km/h	17.000 m	900	7.300 m	750 m	207,397	93,673 m	1/48,4	1.435	4.700
160 km/h	10.000 m	500	4.000 m	470 m	151,451	68,003 m	1/35,5	1.435	4.700
100 km/h	3.000 m	285	1.500 m	219 m	92,248	41,594 m	1/21,5	1.435	4.700

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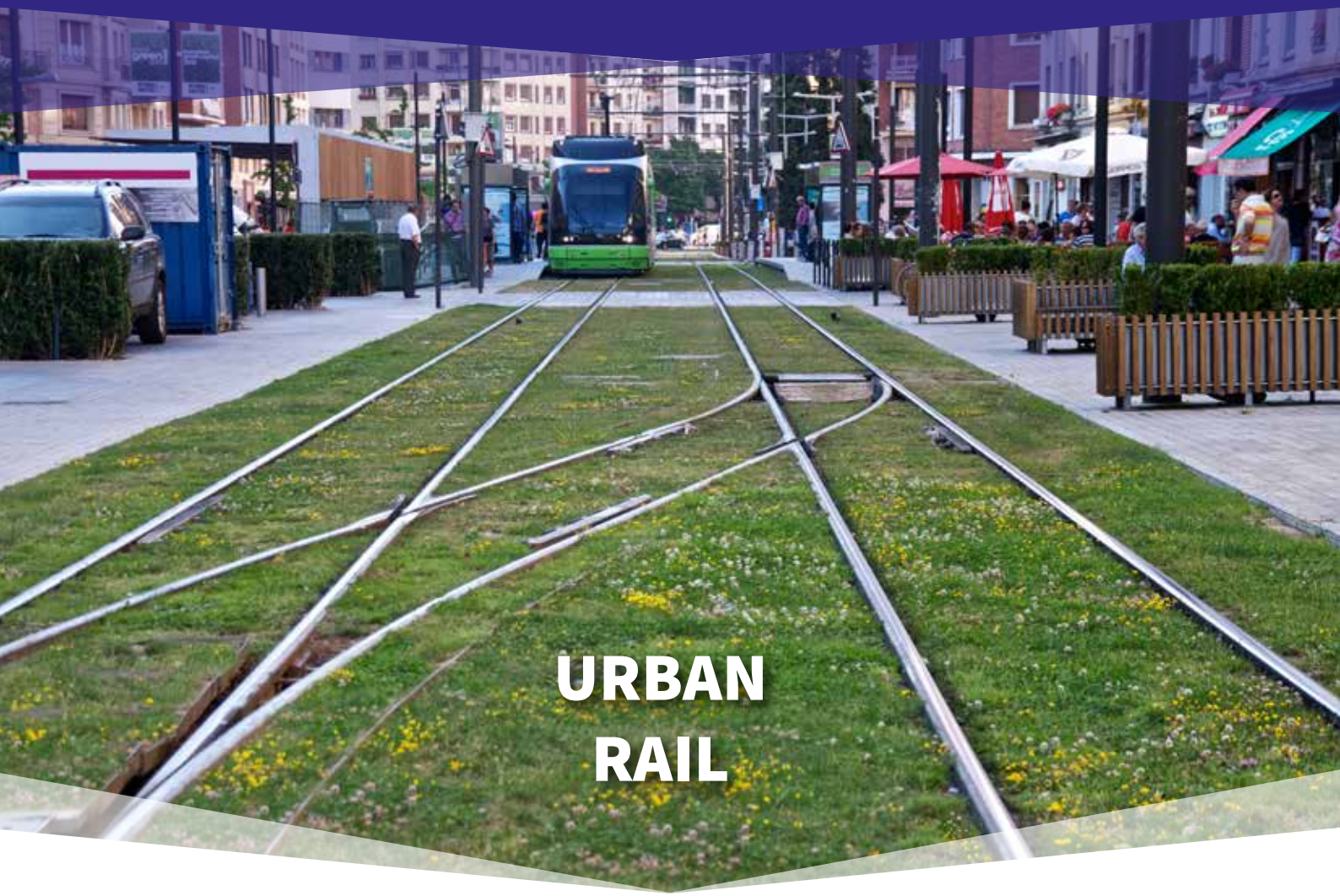

URBAN RAIL

A complete range of track devices for urban layouts

The streetcar is back. And with it other **solutions for urban mobility**, such as the metro or light rail.

At AMURRIO we are proud of our contribution to this change.

For many years we have designed and produced a **complete range of track devices** for urban layouts.

For concrete, grass, asphalt and block **infrastructures**.

And we have installed them in the streets of **cities in our country and around the world**.
From Alexandria to Bremen, from Buenos Aires to Medellin.

We have learned **nearly everything there is to know about urban layouts**, and we have used it to develop new solutions and innovative products.

Like our innovative **Mobile Point crossing for Tramway**, designed to achieve quieter and more efficient urban layouts.

A crossing created to beat in the heart ofa **more livable, more sustainable** city.

A more human city.

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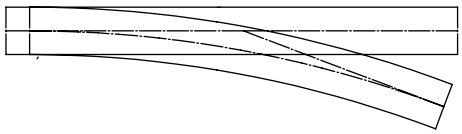
URBAN RAIL

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.

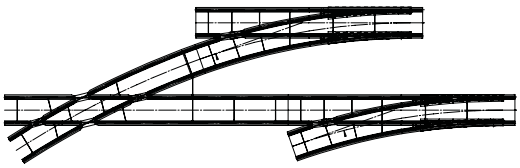
The most usual apparatus in Tram Railways:

TURNOUT

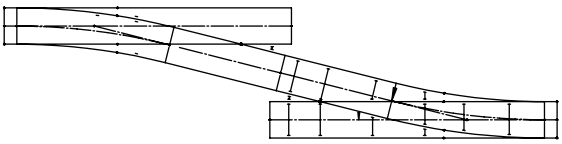


COMB TURNOUTS

CROSSING



CROSSOVERS



CMUR1. A Modular Crossing concept for Urban Rail that allows to replace only the parts that suffer wear in a crossing: the point and the hare's feet. Without having to replace the entire crossing. Without interrupting traffic for more than a few hours. Multiplying the service life of the turnout. And by reducing the maintenance costs.

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INDUSTRY & PORTS

Designed for installation in complex locations

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 themanufacture of turnouts for two or more different track gauges with a shared rail.

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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	**Cirect 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		

PERFORMANCES	
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
DMRD-B1-54-190-0,11-CR-D	DMRD-H-UIC60-1500-0,042-CR-D

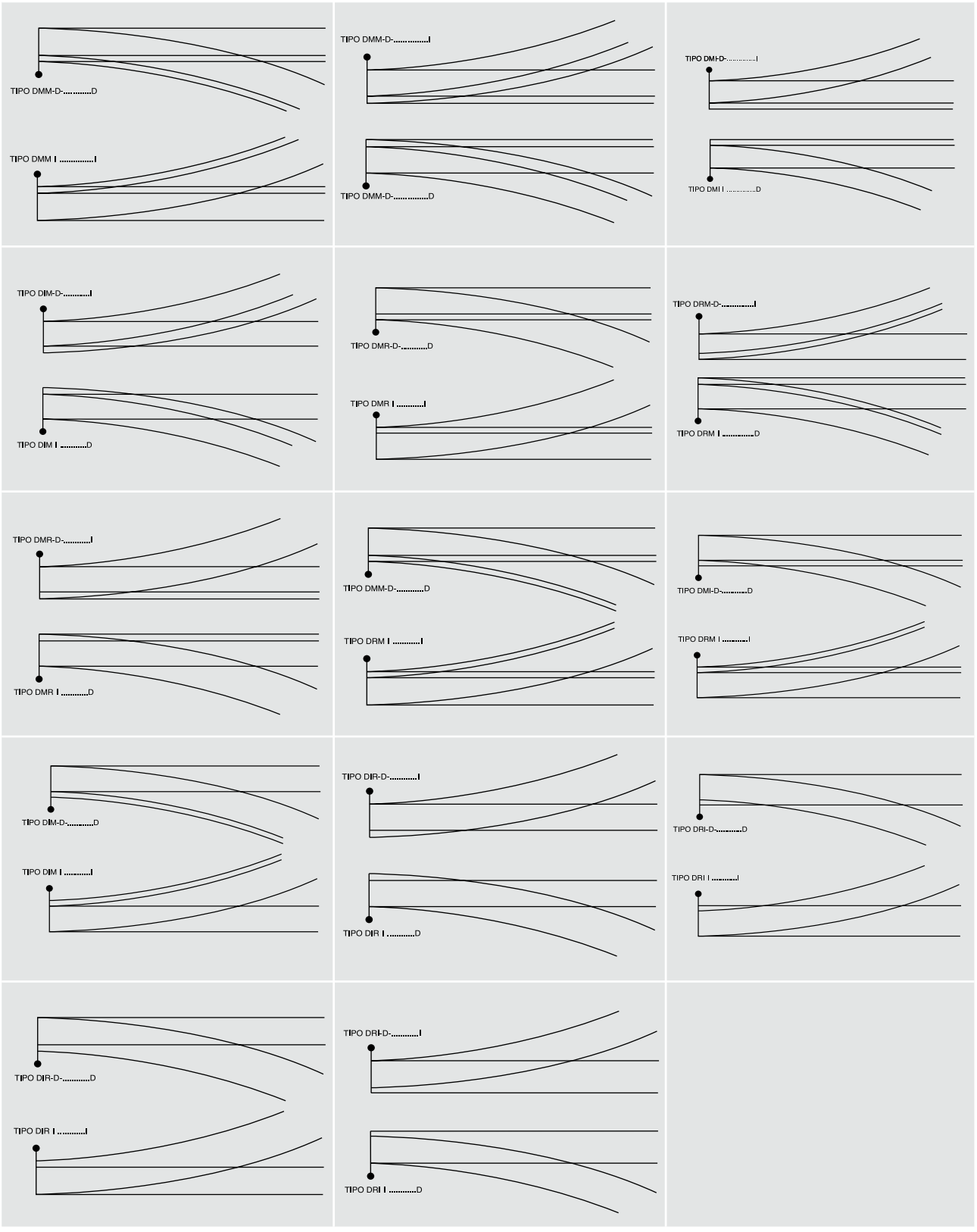
MIXED FOUR-RAIL TURNOUTS

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	**Directed 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		

REALIZATIONS	
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	

MIXED THREE-WIRE TURNOUTS SCHEMES



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EXPANSION JOINTS

In any configuration and for all types of profiles and layouts

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

Tipos	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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RE-RAILER

In any configuration and for all types of profiles and layouts

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.

AMURRIO FERROCARRIL Y EQUIPOS, S.A.
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amurrio
ferrocarril y equipos, s.a.

CAST STEEL

Specialists in large parts in small series

At Amurrio Ferrocarril y Equipos, S.A. we are specialists in steel casting and machining of large parts (>1m.) in short series.
Our **experience and knowledge** of the characteristics of cast steels, in particular **carbon steel**, low alloy steel and manganese steel, allows us to cast and **machine highly complex parts**, such as electric motor housings, ampoules, dies and other parts for different industrial sectors: mining, iron and steel, capital goods, public works, railroads and others.
Manganese steel is a very suitable steel for the manufacture of parts that require **high impact resistance**, with very good toughness requirements.

In Amurrio Ferrocarril y Equipos we have specialized in the manufacture of r**ailroad crossings,** parts with high requirements in molding and machining.
We cast in molded steel according to the customer's technical specifications.

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MOST COMMON STEELS:

	DESIGNATION	ASTM	DIN	UNE	BSS
NON-ALLOY GENERAL PURPOSE	AM 38	A 27 60-30	GS 38,2	E 20-40 M	
	AM 45	A 27 65-35	GS 45,3	E 23-45 M	BS 3100 A1
	AM 52	A 27 70-36	GS 52,3	E26-52 M	BS 3100 A2
	AM 60	A148 80-40	GS 60,3	E 30-57 M	BS 3100 A3
LOW ALLOY GENERAL PURPOSE	AM 32 Mn 5	A148 80-50	GS 20 Mn 5		BS 3100 A4
	AM 30 Mn 5	A 148 90-60	GS 30 Mn 5	30 M 6-M	BS 3100 A5
	AM 25 CrMo 4	A 148 90-60	GS 25 CrMo 4	25 CD 4-M	
	AM 34 CrMo 4	A 148 105-85	GS 34 CrMo 4	35 CD 4-M	BS 3100 BT1
	AM 42 CrMo 4	A 148 115-95	GS 42 CrMo 4	42 CD 4-M	BS 3100 BT2
	AM 30 NiCrMo 7	A 148 120-95	GS 30 Ni CrMo 7		BS 3100 BT2
FOR LOW TEMPERATURE WORK	AM C 15 K	A 352 LCA/LCB	GS Ck 16	FA-M	BS 3100 AL1
	AM 10 Ni 10	A 352 LC2	GS 14 Ni 10	FC 2-M	BS 3100 BL2
FOR WORK AT ELEVATED TEMPERATURES	AM C 20	A 216 WCA/WCB	GS C 25	A 42 C-M	
	AM 18 Mo 5	A 356 Grado 2	GS 22 Mo 4	20 D 5-M	BS 3100 B1
	AM 18CrMo 05,5	A 356 Grado 6	GS 17 Cr;p 55	18CD 2 05-M	BS 3100 B2
	AM 17 CrMoV 05,11	A 356 Grado 9	GS 17 CrMoV 5 11	15CDV 4 10-M	
ABRASION RESISTANT	AM-X 120 Mn 12	A 128 Grado A	GX 120 Mn 12	Z 120 M 12-M	BS 3100 BW 10
	AM-X 120 MnCr 12,2	A 128 Grado C		Z 120 MC 12 02-M	

CAPACITIES:

- Melting: Electric arc furnaces 8 T
- Heat treatment nominal capacity 7
- No bake molding
- Chemical analysis laboratory
- Mechanical testing laboratory
- NDT equipment (ultrasonic, LP, magnetic particles, RX)
- Programmable 3D control (180x1400x1000)
- CNC machining centers with palletization system
- CNC boring machines (L=12m H=3)
- TCNC automatic lathe (6500mm between points and Diameter 1200 mm)
- Presses, Boilermaking, Oxycutting