

TITLE: CROSS-TIE

Field of the Invention

5 The present invention relates generally to the field of railway tracks, and more specifically to cross-ties that are used with railway tracks.

BACKGROUND OF THE INVENTION

10 Railway vehicles that use linear induction motors (LIM) as their primary source of propulsion are known in the art. In general, linear induction motors (LIM) used by railway vehicles consist of a primary portion that is supported under the railway vehicle, and a reaction rail that is
15 supported on the railway track. As such, railway tracks built for LIM railway vehicles include a pair of running rails for supporting the wheels of the railway vehicle, and a reaction rail for interfacing with the primary portion of the linear induction motor. In addition,
20 railway tracks for LIM railway vehicles include at least one power rail that is generally positioned above, and perpendicularly to the running rails and the reaction rail. It is the one or more power rails that supply power to the railway vehicle as it travels over the railway
25 track.

Traditionally, railway tracks for LIM railway vehicles are formed by fastening each of the running rails, the reaction rail and the one or more power rails to a
30 concrete guideway of the railway track via separate rail fasteners. As such, each of the rails is secured to the concrete guideway of the railway track independently. A deficiency with this manner of building the railway track is that each one of the rails requires a separate rail

fastening arrangement, which makes the railway track time-consuming and expensive to install. A further deficiency with such traditional railway track is that it is difficult to control the relative positioning between the running rails, the reaction rails and the one or more power rails, which is important for the proper operation of the LIM rail vehicle over the track. As such, at the time of installation, the position of each rail must be adjusted such that it is properly positioned in relation to the other rails.

U.S. Patent No. 5,314,115 describes a cross-tie that attempts to overcome at least some of the deficiencies with such traditional railway tracks. The cross-tie described by U.S. Patent No. 5,314,115 supports both the pair of running rails and the reaction rail, and is operative for securing these rails to the concrete guideway of the railway track. A deficiency with this cross-tie is that it does not take into consideration the relative positioning of the power rail in relation to the running rails and the reaction rails. As such, the precise positioning of the power rail in relation to the pair of running rails and the reaction rail needs to be adjusted at the time of installation. In addition, the fact that the running rails and the reaction rails are mounted to the guideway separately from the power rail requires additional fastening studs which results in more work for the person installing the track, and additional parts that can be costly.

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In light of this background, there exists a need in the industry for a more efficient, less cumbersome and less costly manner of building and maintaining a railway track for LIM rail vehicles.

Summary of the Invention

In accordance with a broad aspect, the present invention
5 provides a cross-tie comprising an elongated body. The
elongated body comprises a reaction rail supporting
section, two running rail supporting sections and a power
rail supporting section. The reaction rail supporting
10 section is adapted for supporting a reaction rail and the
two running rail supporting sections are each adapted for
supporting a respective running rail. The power rail
supporting section is adapted for supporting at least one
power rail.

15 In accordance with another broad aspect, the present
invention provides an assembly comprising a cross-tie and
at least one stud assembly. The cross tie includes a
reaction rail supporting section adapted for supporting a
reaction rail, and two running rail supporting sections,
20 each adapted for supporting a respective running rail. The
one or more stud assemblies are adapted for securing the
cross-tie to a guideway of a railway track, and are
operative for electrically insulating the cross-tie from
the guideway.

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In accordance with another broad aspect, the present
invention provides an assembly that comprises a cross-tie
and a wedge member. The cross-tie has an elongated body
that includes a reaction rail supporting section and two
30 running rail supporting sections. The reaction rail
supporting section is adapted for supporting a reaction
rail, and the two running rail supporting sections are
each adapted for supporting a respective running rail.
Each running rail supporting section has a lower surface

adapted for facing a rail guideway and an upper surface adapted for supporting a running rail. The upper surface is substantially parallel to the lower surface. The wedge member is adapted to be positioned on the upper surface of the running rail supporting section between the upper surface and the running rail.

In accordance with yet another broad aspect, the present invention provides an assembly comprising a cross-tie and a power rail support. The cross-tie includes a reaction rail supporting section, two running rail supporting sections and a power rail supporting section. The reaction rail supporting section is operative for supporting a reaction rail and the two running rail supporting sections are each adapted for supporting a respective running rail. The power rail support is adapted for being removably connected to the power rail supporting section and is adapted for having at least one power rail connected thereto.

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These and other aspects and features of the present invention will now become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying drawings.

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Brief Description of the Drawings

A detailed description of the embodiments of the present invention is provided herein below, by way of example only, with reference to the accompanying drawings, in which:

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Figure 1 is a perspective view of a railway track for an LIM rail vehicle in accordance with a non-limiting example of implementation of the present invention;

5 Figure 2 is a side view of a cross-tie for use with the railway track in accordance with a non-limiting example of implementation of the present invention;

Figure 3 is an expanded view of the portion of Figure 2
10 contained in circle A, in accordance with a non-limiting example of implementation of the present invention;

Figure 4 is an expanded view of the portion of Figure 2
contained in circle B, in accordance with a non-limiting
15 example of implementation of the present invention; and

Figure 5 is an expanded view of the portion of Figure 2
contained in circle C, in accordance with a non-limiting
example of implementation of the present invention; and

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Figure 6 is a cross-sectional view taken along line 5-5
shown in Figure 2, in accordance with specific non-
limiting examples of implementation of the present
invention.

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In the drawings, the embodiments of the invention are
illustrated by way of examples. It is to be expressly
understood that the description and drawings are only for
the purpose of illustration and are an aid for
30 understanding. They are not intended to be a definition of
the limits of the invention.

DETAILED DESCRIPTION

Shown in Figure 1 is a railway track 2 for a rail vehicle
5 (not shown) that uses a linear induction motor (LIM) as
its primary source of propulsion. The railway track 2
includes a guideway 4 that is typically formed of
concrete, and a plurality of cross-ties 10. The cross-ties
10 are operative to support a pair of running rails 6, a
10 reaction rail 8 and at least one power rail 12. In the
non-limiting example of implementation shown in Figure 1,
the cross-tie 10 is operative to support two power rails
12.

15 As shown, the running rails 6 are positioned on the cross-
tie 10 in a parallel, spaced apart relationship, such that
the wheels of the railway vehicle can travel therealong.
The reaction rail 8 is positioned between the two running
rails 6, and is operative to complete a flux path with a
20 primary portion of the linear induction motor located on
the railway vehicle, so as to propel or retard the railway
vehicle along the track. The power rails 12 are positioned
perpendicular to the running rails 6 and the reaction rail
8, and are adapted for supplying power to the LIM railway
25 vehicle. It is to be understood that although the power
rails 12 are generally positioned perpendicularly to the
running rails 6, they could also be positioned parallel to
the running rails 6.

30 Shown in Figure 2, is a more detailed diagram of a cross-
tie 10 in accordance with a non-limiting example of
implementation of the present invention. The cross-tie 10
includes a generally elongated body 14 that defines two

running rail supporting sections 16 and a reaction rail supporting section 18. In the non-limiting embodiment shown, one of the running rail supporting sections 16 is generally U-shaped, in order to be able to support the power rails 12, as will be described further on and the other running rail supporting section 16 is generally L-shaped. The reaction rail supporting section 18 is in the general shape of a rectangular bar, and is positioned between the two running rail supporting sections 16 in an elevated position in relation to the surface of the concrete guideway 4.

In a non-limiting example of implementation of the present invention, the elongated body 14 of the cross-tie 10 is formed of steel. It should be understood, however, that other materials can be used without departing from the spirit of the invention. It should also be understood that the two running rail supporting sections 16 and the reaction rail supporting section 18 can be formed as one integral piece via molding or casting. Or alternatively, the reaction rail supporting section 18 and the running rail supporting sections 16 can be separate pieces that are welded together, or assembled in any other suitable manner, in order to form the single elongated body 14.

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As shown in Figure 2, the reaction rail supporting section 18 is adapted to support a reaction rail 8. In the specific example of implementation shown, the reaction rail 8 is connected to the reaction rail supporting section 18 of the cross-tie 10 via a fastening arrangement 20. Shown in Figure 3 is an expanded view of the fastening arrangement 20, as well as the portion of the reaction rail 8, shown in circle A in Figure 2.

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Referring to Figure 3, the reaction rail 8 is formed of two parts, namely a back iron 22 and a top-cap 24. The cross-tie 10 of the present invention enables the back iron 22 and the top-cap 24 to be pre-assembled prior to
5 being mounted to the cross-tie 10. In the non-limiting embodiment shown, the back iron 22 and the top-cap 24 are pre-assembled via bolts 25. The fact that the back iron 22 and the top-cap 24 can be pre-assembled prior to being mounted to the cross-tie 10 means that the reaction rail 8
10 can be mounted to the cross-tie 10 in one step. This avoids having to mount the back iron 22 and the top-cap 24 to the cross-tie 10 separately, which reduces the time required to secure the reaction rail 8 to the cross-tie 10 during installation on site. It is typically more
15 expensive to assemble the components on site than to assemble them in a manufacturing plant. In addition, the fact that the reaction rail 8 can be installed or removed from the cross-tie 10 in one step, reduces the time required to replace or repair the reaction rail 8, should
20 it become damaged.

As shown in Figure 3, the reaction rail 8 is secured to an up-side down U-shaped extension 32 of the reaction rail supporting section 18 via the fastening arrangement 20.
25 The fastening arrangement 20 comprises a screw 26, a nut 28 and a plurality of shims 30. The plurality of shims 30 can be used in order to adjust the height of the reaction rail 8 in relation to the elongated body 14 of the cross-tie 10, and thus in relation to the running rails 6. In a
30 non-limiting example of implementation, the shims can be of 1mm widths, 2mm widths, 5mm widths, and 20mm widths such that by inserting or removing different shims, the appropriate height of the reaction rail 8 can be attained. Once the appropriate combination of shims has been

determined by the person installing the reaction rail 8, the reaction rail 8 is fastened securely to the cross-tie 10 by tightening the nut 28 and screw 26. As shown, the screw 26 extends through the back iron 22 of the reaction
5 rail 8 in order to secure the reaction rail 8 to the U-shaped extension 32 of the reaction rail supporting section 18.

Referring back to Figure 2, each running rail supporting
10 section 16 is adapted to support a respective running rail 6. As shown, each running rail supporting section 16 includes an upper surface 34 and a lower surface 36. As used herein, the lower surface 36 is the surface adapted for facing the concrete guideway 4, and the upper surface
15 34 is the surface adapted for facing a running rail 6 supported thereon.

Traditionally, the running rail supporting sections of prior art cross-ties have angled upper surfaces, such that
20 the running rails secured thereto are positioned at a slight angle in relation to the reaction rail. A deficiency with such prior art cross-ties is that it is difficult to manufacture the angle of the upper surface to the tight tolerances required, which results in a high
25 rate of discarded pieces.

As shown in Figure 2, the upper surface 34 and the lower surface 36 of the cross-tie 10 are substantially parallel to one another, thereby simplifying manufacturing. As
30 such, in order to position the running rails 6 at an angle of inclination in relation to the reaction rail 8, angled wedge members 38 are positioned between the upper surface 34 of the running rail supporting section 16 and each running rail 6. The wedge members 38 can theoretically

form angles of inclination between 0 and 90 degrees, but more practically, this angle is typically between 0 and 3 degrees.

5 Depending on the railway track requirements, the running rails 6 may need to be positioned at different angles of inclination in relation to the guideway 4. As such, instead of using a different cross-tie having a different angle of inclination, each time a different angle of
10 inclination is required, the same cross-tie can be used, only with a different wedge member 38. As such, regardless of the desired angle of inclination of the running rails 6, the same cross-tie 10 can be used by simply using a wedge member 38 having the desired angle of inclination.
15 With traditional cross-ties, a different model of cross-tie for each different angle of inclination needed to be manufactured, which is far more costly than simply manufacturing wedge members having different angles of inclination. Also, along a length of the same track, the
20 angle may vary from one track section to another. Therefore, using different wedge members 38 having intermediate angles of inclination provides a smooth transition from a first track section to a second track section.

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In a non-limiting example of implementation, the wedge members 38 are made of an electrically insulating material, such as nylon, therefore providing electric insulation between the running rails 6 and the elongated
30 body 14 of the cross-tie 10.

In the non-limiting embodiment shown in Figure 2, the running rails 6 are secured to their respective running rail supporting sections 16 via a pair of rail clips 40.

It should, however, be understood that the running rails 6 can be secured to the running rail supporting sections 16 via any other securement device known in the art.

5 Shown in Figure 4 is an expanded view of the running rail 6 shown in circle B of Figure 2. Referring now to Figure 4, in the non-limiting embodiment shown, the running rail 6 is secured to the running rail supporting section 16 of the cross-tie 10 via rail clips 40. In addition, the wedge
10 member 38 is secured in place by being sandwiched between the upper surface 34 of the running rail supporting section 16, and the running rail 6.

The rail clips 40 used are standard e-clipsTM from Pandrol.
15 The rail clips 40 secure the running rail 6 to the running rail supporting section 16 of the cross-tie 10. Rail clips 40, such as the ones shown in Figures 2 and 4, are well known in the art, and as such will not be discussed in further detail herein.

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In a non-limiting example of implementation, the rail clips 40 are also electrically insulated. For example, they can be made of an electrically insulating material such as nylon. Therefore, between the electrically
25 insulating wedge members 38, and the electrically insulating rail clips 40, the running rails 6 are completely electrical insulated from the elongated body 14 of the cross-tie 10.

30 Referring back to Figure 2, in the non-limiting embodiment shown, the cross-tie 10 is adapted to be secured to the guideway 4 of the railway track 2 with stud-assemblies 44. It should, however, be understood that the cross-tie 10 can be secured to the guideway 4 of the railway track 2,

via any other fastening assembly known in the art.

In the embodiment shown, the stud assemblies 44 are adapted to extend through holes in the running rail supporting sections 16, such that they can extend into insulating inserts 54 which are cast in the concrete guideway 4. In the non-limiting embodiment shown in Figure 2, the cross-tie 10 is secured to the guideway 4 with one stud assembly 44 connected through each of the two running rail supporting sections 16, for a total of two stud assemblies 44 per cross-tie 10. Shown in Figure 5 is an expanded view of the stud assembly 44 shown in circle C in Figure 2.

Referring now to Figure 5, the stud assembly 44 comprises a stud 46, a lock nut 48, a coil spring 50 and an insulating insert 54. The insulating insert 54 is adapted to have a tight fit with the stud 46 in order to prevent water from infiltrating between the stud 46 and the insulating insert 54 and causing corrosion. In addition, the insulating insert 54 includes self-locking threads 56 that require a larger amount of torque to remove the stud 46, than to insert the stud 46. The insulating insert 54 is able to retain its self-locking properties even after the stud 46 has been removed, such that it can be re-used many times.

The insulating inserts 54 for mounting the cross-tie 10 to the guideway 4 of the railway track 2, enable the cross-tie 10 to be electrically insulated from the guideway 4. This prevents stray current from being transmitted into the concrete guideway 4. In addition, the insulating inserts 54 prevent galvanic corrosion of the studs 46. Furthermore, the inserts 54 placed in the concrete

guideway 4 do not constitute a safety hazard, as they are flush with the guideway 4 surface. In prior art cross-ties, studs similar to studs 46 would be cast directly in the concrete of guideway 4. Hence, during construction of the guideway 4 and before any cross-tie was installed, a field of studs 46 would stick out of the guideway 4, such that they would often get bent or damaged. In addition, construction workers could trip on the studs, or even worse, fall on them, and get seriously hurt. In accordance with the present design, the studs 46 are only inserted into the insulating inserts 54 at the same time that the cross-ties 10 are installed. As such, there is not a field of studs sticking out of the guideway 4 prior to installation of the cross-ties 10.

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Referring back to Figure 2, in the non-limiting embodiment shown, positioned between the lower surface 36 of the running rail supporting sections 16, and the guideway 4 of the railway track are elastomeric pads 58. These elastomeric pads 58 help reduce the amount of vibration transferred from the railway vehicle to the rail guideway 4, thereby increasing the travelers' comfort and reducing the amount of noise generated. In addition, in combination with the electrically insulated stud assemblies 44, the elastomeric pads 58 help to electrically insulate the cross-tie 10 from the concrete guideway 4.

The cross-tie 10 is biased toward the elastomeric pads 58 via the coil springs 50 of the stud assemblies 44. As the nut 48 is threaded onto the stud 46 the coil spring 50 compresses, thereby providing the required bias of the cross-tie 10 against the elastomeric pads 58.

As further shown in Figure 2, the cross-tie 10 in

accordance with a non-limiting embodiment of the present invention is further operative to support at least one power rail 12, at least one derailment guard rail 60 and an ATC (Automatic Train Control) cable support 62. Each of
5 these will be discussed in more detail below.

As shown in Figure 2, the cross-tie 10 in accordance with the present invention includes a power rail supporting section 64 which enables a power rail support 66 to be
10 connected to the cross-tie 10. As shown, the power rail support 66 is connected to the power rail supporting section 64 via two bolts 70. It should be understood that more or less bolts could be used without departing from the spirit of the invention. In addition, any other means
15 of securing the power rail support 66 to the power rail supporting section 64 could be used without departing from the spirit of the invention.

The power rail support 66 is operative for carrying the
20 power rails 12, such that the power rails 12 can be connected to the cross-tie 10. As shown, the power rails 12 are connected to the power rail support 66 via bolts 68. Although the power rails 12 are each supported to the power rail support 66 via a single bolt 68, it should be
25 understood that more or less bolts could be used without departing from the spirit of the invention. In addition, any other means of securing the power rails 12 to the power rail support 66 could be used without departing from the spirit of the invention.

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In the specific embodiment shown in the Figures, the power rail supporting section 64 is located on the left hand side of the cross-tie 10, and is substantially perpendicular to the ground. It should be understood,

however, that many other configurations for the power rail supporting section 64 can be used without departing from the spirit of the invention.

5 In addition, although Figure 2 shows the cross-tie 10 and the power rail support 66 as being separate parts, it should be understood that in an alternative example of implementation, the cross-tie 10 and the power rail support 66 can be integrally formed as one continuous
10 piece. In such an embodiment, the power rail support 66 is the power rail supporting section 64.

As mentioned in the background of the invention, the power rails of traditional railway tracks for LIM rail vehicles
15 are connected directly to the concrete guideway of the track. As such, the power rails and the cross-ties are not connected in any way. A deficiency with such railway tracks is that if there is any movement, or deformation of the cross-ties, or of the structure supporting the power
20 rails, then the positioning of the power rails in relation to the running rails and the reaction rail will change. This could negatively impact a railway vehicle's ability to travel over the railway track 2. A further deficiency with such prior art railway tracks is that when the power
25 rail is bolted directly on the guideway 4, stray current could flow in the guideway, prematurely deteriorating it. In addition, the loss of current is expensive for the companies operating the railway track.

30 A benefit of having the power rails 12 supported by the cross-ties 10 is that the position of the power rails 12 in relation to the running rails 6 and the reaction rail 8 is more easily controlled than if the power rails 12 were connected directly to the concrete guideway 4. As such,

the cross-tie 10 in accordance with the present invention is exposed to less variation in the relative position between the power rails 12 and the running rails 6 and reaction rail 8.

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In a specific, non-limiting example of implementation, the position of power rails 12 should not vary by more than 0.25 inch (6.4 mm) both laterally and vertically with respect to the running rails 6. When the power rails 12
10 are directly installed on the guideway 2, meeting this tight tolerance requires much adjustment. However, with the power rails 12 connected directly to the cross-tie 10, the 0.25 inch tolerance can be more easily and more accurately achieved, by appropriately dimensioning parts
15 and by appropriately manufacturing the same parts.

In the non-limiting embodiment shown, the vertical position and the lateral position of the power rails 12 can be adjusted independently with respect to the cross-
20 tie 10. For example, the vertical position can be adjusted via vertical slots in the portion of the power rail support 66 that mates with the power rail supporting section 64. Alternatively, the vertical slots could be in the power rail supporting section 64. The lateral
25 adjustment of the power rails 12 in relation to the cross-tie 10 may be made through the use of shims (not shown) that can be positioned in between the power rail supporting section 64 and the power rail support 66, or alternatively by adequately positioning power rail 12
30 using the nuts on bolts 68. However, if manufacturing tolerances are met, it is well possible that no adjustment be required.

The fact that the cross-tie 10 supports the power rails 12

provides an advantage in that fewer fasteners are required to connect the cross-tie 10 and the power rails 12 to the guideway 4. This results in a shorter assembly time and lower installation costs. Another advantage is that the
5 insulated insert 54 of the stud assemblies 44 provides an electrically insulated system for the power rails 12.

Although the railway track 2 shown in the Figures shows two power rails 12, it should be understood that the
10 railway track 2 could have included only a single power rail 12. In the field of railway tracks 2 for LIM rail vehicles, there are two types of power rail arrangements that can be used. The first type of power rail arrangement includes only one power rail, called the "third rail", and
15 the second type of power rail arrangement includes two power rails, called a "fourth rail".

The second type of power rail arrangement (i.e. the one with two power rails 12) has one positive rail and one
20 negative rail, while the first type of power rail arrangement (i.e. the one with only one power rail 12), uses the power rail 12 as the positive rail, and uses one of the running rails 6 as the negative return path. The first type of power rail arrangement is the most commonly
25 used, due to the fact that it saves the expense of adding a second power rail 12. However, in order to use the running rail 6 as the negative return path, the running rail 6 must be well insulated from the concrete guideway 4, in order to avoid the loss of current.

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In general, cross-ties in accordance with the prior art are not electrically insulated from the concrete guideway 4, and as such, should they be operative to support a power rail 12, they would be restricted to being used in

the cases where the railway track 2 uses a power rail arrangement with two power rails.

As such, an advantage of the cross-tie 10 of the present invention is that due to the fact that the elongated body 14 is electrically insulated from the guideway 4, via the insulating insert 54 and the elastomeric pad 58, the cross tie 10 is operative to support power rail arrangements having either one power rail, or two power rails. In addition, the power rails 12 benefit from the fact that the running rails 6 are electrically insulated from the cross-tie via the insulating rail clips 40 and the insulating wedge members 38.

As described above, the cross-tie 10 of the present invention includes an ATC (Automatic Train Control) cable support 62. The ATC cable support 62 is positioned on the reaction rail supporting section 18 of the cross-tie 10, and includes a clamp for preventing the ATC cable from moving around. The ATC cable support 30 can include any type of clamp or securing device known in the art that is suitable for preventing the ATC cable from moving around. Typically, the ATC cable should be located approximately 1 inch below the top of the running rails 6. A sensor on the train then receives a signal from the ATC cable as it travels along the track. In prior art railway tracks, the ATC cable is fixed to the top of an L-shaped bracket, about 4 inches high to bring the cable to approximately 1 inch below the top of the running rails. These brackets are screwed directly to the guideway. In accordance with the present invention, the ATC cable sits at approximately 2 inches below the top of the running rails 6, which is lower than the conventional 1 inch, but still enables the sensor on the train to receive a strong signal from the

ATC cable. The fact that the ATC cable is supported directly on the cross-tie 10 avoids having to use an additional bracket, which saves costs, materials, and installation time.

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As further described above, the cross-tie 10 in accordance with the present invention is operative to support at least one derailment guard rail 60. In the specific embodiment shown in Figure 2, the cross-tie 10 has two
10 derailment guard rails 60 attached thereto, namely one on each side of the reaction rail supporting section 18. As shown, each derailment guard rail 60 is connected to cross-tie 10 via a bolt 72 that extends through the derailment guard rail 60 and secures it to the respective
15 upper portion of each running rail supporting section 16. Derailment guard rails 60 are known in the art and as such will not be described in more detail herein.

In order to create a railway track 2 for an LIM rail
20 vehicle, such as the one shown in Figure 1, a plurality of cross-ties 10 in accordance with the present invention are positioned across the concrete guideway 4. In a non-limiting embodiment, the cross-ties 10 are mounted to the concrete guideway 4, such that there is one cross-tie 10
25 approximately every 1 meter.

As shown in Figure 1, although each cross-tie 10 includes a power rail supporting section 64, only one out of every three cross-ties 10 has a power rail support 66 connected
30 thereto. It should, however, be understood that a power rail support 66 can be connected to every cross-tie 10, or more frequently or less frequently than every third cross-tie 10.

Once the cross-ties 10 are mounted to the concrete guideway 4, the running rails 6, reaction rail 8 and power rails 12 are mounted thereto. In general, the reaction rail 8 is formed in sections that are between 3m and 10m
5 long. As shown in Figure 6, the sections of reaction rail 8 are attached to the reaction rail supporting sections 18 such that there is a gap 75 between subsequent portions of the reaction rail 8.

10 As described above, the cross-tie 10 of the present invention is operative to support the running rails 6, the reaction rail 8 and one or more power rails 12, as an integrated assembly. Cross-ties 10 in accordance with the present invention, enable a relatively high stiffness of
15 the assembly to maintain the tight tolerance required in the height of the air-gap between the reaction rail 8 and the vehicle mounted LIM, and enable a relatively low stiffness in the cross-tie 10/guideway 4 interface to ensure an acceptable ride quality, wheel/rail interaction
20 and vibration isolation. Since the running rails 6 and the reaction rail 8 are both supported by the cross-tie the relative deflection between them under operating conditions will be limited, and will be independent of deflection of the cross-tie which is mounted on
25 elastomeric pads to the guideway.

Although various embodiments have been illustrated, this was for the purpose of describing, but not limiting, the invention. Various modifications will become apparent to
30 those skilled in the art and are within the scope of this invention, which is defined more particularly by the attached claims.

CLAIMS:

1. A cross-tie comprising an elongated body, said elongated body comprising:
 - 5 - a reaction rail supporting section adapted for supporting a reaction rail;
 - two running rail supporting sections, each running rail supporting section adapted for supporting a respective running rail; and
 - 10 - a power rail supporting section adapted for supporting at least one power rail.
2. A cross-tie as defined in claim 1, wherein said power rail supporting section is adapted for supporting a power rail support, which in turn is adapted for supporting the at least one power rail.
3. A cross-tie as defined in claim 1 or 2, wherein the at least one power rail can be adjusted at least one of vertically and laterally in relation to said elongated body.
4. A cross-tie as defined in claim 1, 2 or 3, wherein said power rail supporting section is operative for supporting one power rail, wherein the power rail and at least one running rail are electrically insulated from one another.
5. A cross-tie as defined in claim 4, wherein the at least one running rail acts as a negative return path for the power rail.

6. A cross-tie as defined in any one of the preceding claims, wherein a wedge member is adapted for being positioned between said running rail supporting section and a respective running rail.
- 5
7. A cross-tie as defined in claim 6, wherein said wedge member includes a first surface adapted for contacting said running rail supporting section, and a second surface adapted for contacting a respective
- 10 running rail, wherein said first surface and said second surface are positioned at an angle of between 0 and 90 degrees with respect to one another.
8. A cross-tie as defined in claim 6 or 7, wherein said
- 15 wedge member is made from an electrically insulating material.
9. A cross-tie as defined in claim 8, wherein said insulating material includes nylon.
- 20
10. A cross-tie as defined in any one of the preceding claims, wherein said elongated body is adapted for supporting at least one derailment guard rail.
- 25 11. A cross-tie as defined in any one of the preceding claims, wherein said elongated body comprises at least one ATC cable support.
- 30 12. A cross-tie as defined in any one of the preceding claims, wherein said elongated body is adapted for being secured to a guideway via at least one stud-assembly.

13. A cross-tie as defined in claim 12, wherein said elongated body is adapted for being electrically insulated from the guideway.
- 5 14. A cross-tie as defined in claim 12 or 13, wherein said elongated body is adapted for being electrically insulated from the guideway via an elastomeric pad.
- 10 15. A cross-tie as defined in claim 12, 13 or 14, wherein said at least one stud-assembly is electrically insulated from the guideway.
- 15 16. A cross-tie as defined in any one of claims 12 to 15, wherein said at least one stud-assembly includes an insulating insert for electrically insulating said at least one stud assembly from the guideway.
- 20 17. A cross-tie as defined in any one of claims 12 to 16, wherein said elongated body is electrically insulated from said at least one stud assembly.
- 25 18. A cross-tie as defined in any one of claims 12 to 17, wherein said elongated body is electrically insulated from said at least one stud assembly via a shouldered insulating ring.
- 30 19. A cross-tie as defined in any one of claims 12 to 18, wherein the at least one power rail is electrically insulated from the rail guideway.
20. A cross-tie as defined in any one of claims 12 to 19, wherein the at least one power rail is electrically insulated from the rail guideway via at least one of an

elastomeric pad, an insulating insert, a shouldered insulating ring, and an insulating wedge member.

21. A railway track including a rail guideway, said
5 railway track comprising a plurality of cross-ties,
as defined in claim 1, extending across the rail
guideway.
22. An assembly, comprising:
- 10 - a cross-tie having:
- a) a reaction rail supporting section adapted for
supporting a reaction rail;
- b) two running rail supporting sections, each
running rail supporting section adapted for
15 supporting a respective running rail; and
- at least one stud assembly adapted for securing
said cross-tie to a guideway of a railway track,
said at least one stud assembly being operative
for electrically insulating said cross-tie from
20 the guideway.
23. An assembly as defined in claim 22, wherein said at
least one stud assembly includes an insulating insert
for electrically insulating said cross-tie from the
25 guideway.
24. An assembly comprising:
- a cross-tie having an elongated body including:
- a) a reaction rail supporting section adapted for
30 supporting a reaction rail;
- b) two running rail supporting sections, each
running rail supporting section having a lower
surface adapted for facing a rail guideway and
an upper surface adapted for supporting a

running rail, the upper surface being substantially parallel to the lower surface;

- a wedge member adapted to be positioned on said upper surface of said running rail supporting section between said upper surface and the running rail.

25. An assembly, comprising:

- a cross-tie having:
 - 10 a) a reaction rail supporting section adapted for supporting a reaction rail;
 - b) two running rail supporting sections, each running rail supporting section adapted for supporting a respective running rail; and
 - 15 c) a power rail supporting section;
- a power rail support adapted for having at least one power rail connected thereto, said power rail support adapted for being removably connected to said cross-tie at said power rail supporting
- 20 section.