



THE SIGNATURE TEAM
MODULAR PLATFORMS SYSTEMS

SYSTRA

OUR EXPERTISE

SYSTRA IS A MULTIDISCIPLINARY SOLUTIONS BUSINESS THAT PROVIDES A FULL RANGE OF SERVICES FROM CONSULTANCY, DESIGN AND ENGINEERING TO MANUFACTURE, INSTALLATION AND ON-SITE PROJECT MANAGEMENT.

We work in partnership with our customers to deliver high quality, innovative and responsive solutions to meet their individual requirements.

We serve many different and demanding market sectors. As a principal railway infrastructure provider, SYSTRA has an influential role in the design and operation of the UK rail network and beyond.

We employ over 700 staff locally across thirteen cities in the UK and Ireland and have access to a global network of expertise. SYSTRA is the signature team for transport and infrastructure in over eighty countries.

Our teams deliver consultancy, design and construction services through the entire project lifecycle from feasibility studies and business cases to design, site and contract management, including participation in design and build partnerships.



TABLE DES MATIÈRES TABLE DES MATIÈRES

WORKING IN THE CONSTRUCTION SECTOR	4
KEY CHALLENGES	6
SCOPE OF SERVICES	8
MODULAR PLATFORM SERVICES	10
INSTALLATION METHODOLOGY	14
KEY AVANTAGES	20
QUALITY AND DURABILITY	22
SUSTAINABILITY ON SITE	23
FOUNDATION LOADINGS	24
HISTORY OF THE SYSTEM	26
INSTALLATION GUIDES	28
INSTALLATION GUIDE – STANDARD SYSTEM	30
INSTALLATION GUIDE – 3 BAY	32
INSTALLATION GUIDE – 6 BAY	34



WORKING IN THE CONSTRUCTION SECTOR

OUR PARTNERSHIP BETWEEN DESIGN ENGINEERING, OFF-SITE MANUFACTURE AND CONSTRUCTION ALLOWS US TO BE AT THE FOREFRONT OF MODULAR AND OFF-SITE CONSTRUCTION.

We design, manufacture and erect modular structures which deliver a wide range of off-site construction benefits such as enhanced speed of construction, greater accuracy and improved site efficiency.

We are an industry leader and can draw upon varied design and operational experience from across our workforce to value manage solutions, providing best value to the client.



KEY CHALLENGES

OUR PRODUCT MITIGATES THE OVERRIDING DIFFICULTY IN CONSTRUCTING PLATFORMS ON THE EXISTING OPERATIONAL INFRASTRUCTURE.

The most challenging obstacle is due to the constraints in access to the worksites being particularly poor both in terms of the availability of possession time and also the physical access.

Other considerations include the high degree of buried and exposed services (including 25kV OHLE on many stations), trains passing at high speed, the proximity of the public, the ground conditions and more.

The key challenges associated with these projects are to deliver speedy, safe and efficient construction in and around the operational infrastructure whilst maintaining operations and sustainability.

Modular construction, and specifically the SYSTRA modular platform system, meets these requirements.

One of the key aspects for many locations is access to the worksite where a lightweight system that can be easily transported will have certain advantages over other forms of construction

Key features of the SYSTRA platform presents the following advantages for your project:

EXPERIENCE

Over 10 years of experience constructing over 100 platforms in a wide variety of difficult access conditions.

ADAPTABILITY

Wide ranging knowledge of the differing requirements for railway projects and adapting the platform system to suit the site and client's requirements.

REDUCED WEIGHT OF CONSTRUCTION

Allowing easier foundations to be constructed, potentially, reducing the need for heavy plant to lift materials.

MINIMISED WET TRADES

Reduced dependence on weather conditions.

FLEXIBILITY AND ADJUSTABILITY

Allows for great construction tolerances and future changes to gauge.

VOIDED CONSTRUCTION AND FLEXIBILITY OF DESIGN

The ability to reduce or remove the need for cable and troughing slews.

DEMOUNTABILITY

Though designed as a permanent structure, the demountability of the modular platform system means that it can be used temporarily and then removed and re-erected in other locations.

SUSTAINABILITY

Off-site construction techniques are inherently sustainable and Steel is arguably the most sustainable construction material available for this type of work due to infinite recyclability of the materials.

DURABILITY

Steel based pre-fabricated platform components, in accordance with Network Rail standards NR/L3/CIV/030, NR/L3/CIV/040 and NR/L2/CIV/003, must have a minimum design life of 100 years. This compares favourably to Fibre Reinforced Polymer (FRP) versions with a maximum design life of 40 years



The SYSTRA Modular Platform Systems are a long established and trusted technique for the construction of new railway platforms, platform extensions, platform widening, walkways and ramps, with the emphasis on delivering projects in the most challenging of environments.

SCOPE OF SERVICES

SYSTRA IS ABLE TO OFFER A FULL MULTIDISCIPLINARY INSTALLATION SERVICE TO SUIT THE CLIENTS' REQUIREMENTS.

SYSTRA has acted as principal contractor on several platform schemes and therefore has the ability to offer the platforms as a package including groundworks, installation, surfacing, drainage, signage, platform lighting and telecommunications and other complimentary services.

DESIGN

SYSTRA has in-house design resource that will carry out the initial and detailed design of the platform structure, to enable Approval to be granted by the relevant railway organisation.

The Standard System is based on a standard design which has full Approval and Certification from Network Rail. The approved design also has a suite of generic details for the platform superstructure which ensure a straight-forward and quick design process.

Full fabrication design of the Modular Platform System is included as part of our process package. The platform is designed to meet and exceed the latest Eurocodes requirements.

We have fabricated and installed nearly 100 modular platforms and other rail structures in the UK.

Pictured right, Castle Bar Park station, shortlisted in the 2015 UK Rail Industry Awards for Small Project of the Year.



MODULAR PLATFORM SYSTEMS

THE SYSTRA MODULAR PLATFORM SYSTEM WAS DEVELOPED IN THE LATE 1990'S BY RAILDECK SYSTEMS.

The platform system is a fully modularised product based upon a range of standard components; integrated through a bespoke design to fit the individual site-specific requirements.

The standard platform is designed to be adjustable in both the horizontal and vertical planes. This provides a measure of system flexibility during platform installation and for future adjustability.



STANDARD SYSTEM

The Standard System is designed such that it can be easily installed by one team of personnel in difficult access conditions. To achieve this all components have been assessed and are able to be installed using manual handling; therefore there is no requirement for mechanical lifting.

Furthermore, the main structure of the system is located behind the Vortok or Line Blockage fencing and so the majority of installation works can continue whilst trains are running. This gives the advantage of quick erection by enabling better working times.

The framework for the standard system is formed predominantly in small section (80/90/100SHS) tubular steel arranged at 1.22m centres along track. The design uses screw jacks on the feet and the leading edge of the platform is adjustable by means of telescopic insert pieces, enabling fine adjustment to be made to horizontal and vertical gauge.

As with all SYSTRA systems, the fence posts, lighting columns etc are mounted on the platform and there is no need for separate foundations. The standard system is extremely lightweight when compared to concrete modular systems and so requires only minimal foundations. The foundations are typically shallow strip footings or raft foundations with minimal reinforcement. In cases where there is poor ground, mini-piled ground beams have been used.

The advantages of shallower foundations is that there is the potential depending on ground conditions and working arrangements, of the excavations for the foundations to be outside of the track support zone which further enables enhanced working times.

6 BAY SYSTEM

The 6 Bay System is a relatively recent development that uses the same basic principle of lightweight, easy-to-build, flexible and adjustable construction from the standard system, but replaces the legs with a spanning ladder beam.

The ladder beam can be of various spans and depths and usually spans between pairs of piles. A convenient span for the system is 7.32m (or 6 x 1.22m "bays") but other spans can be incorporated.

The platform can therefore be brought to site in large prefitted units for speed of installation.

The advantage of this system is that it can be built very quickly when reliant on possessions or blockades for access. Also, if Driven or Low Displacement piles are used, the system can be operated without any need for 'wet works' or spoil removal.

The 6 Bay Platform uses many similar components to the standard system but the ladder beam requires mechanical lifting. However, when platform units are fully prefitted, the weights for a 7.32m x 3.5m unit are still only 2 tonnes (approximately) and can therefore be easily transported and lifted into place using road rail excavators.



3 BAY SYSTEM

The 3 Bay System is the newest development and can also be easily assembled without the use of mechanical lifting. This enables the platform to be built behind a Vortok Fence. Line blockages will only be required to gauge the platform to the X and Y's and to install the front litter screen.

The 3 Bay System is designed to span 3.66m centres along the track and is predominately used in conjunction with small screw piles, concrete pad or strip foundations.



DECKING SYSTEM

Modular panels are used as platform decking. They are approximately 1200mm x 300mm in size, consisting of folded galvanised steel plate, and provide a continuous steel surface to support the wearing course.

Special deck plates are used where drainage outlets and lighting columns (typically 5m or 6m Abacus raise/lower lighting columns) are required which gives the ability to mount Lighting and certain CCTV columns directly on the platform without need for separate foundations.

INSTALLATION METHODOLOGY

STANDARD (1.22M CENTRES) SYSTEM

If the Standard 1.22m support centres platform is used, the platform is fabricated and delivered to site in predominately shrink wrapped, banded and palletised form. There will be approximately 50m of platform on each articulated lorry delivery.

SYSTRA will largely construct the platform behind the Vortok Fencing. Once the platform is erected it can then be gauged if possessions or non-disruptive line blockages are needed.

There will be two possible construction methods:

1. If line blockages are available these will be used to gauge the platform. All other works will be carried out behind Vortok Fence and the physical barrier created by the gauged platform.
2. If nightly line blockages are not available it may be prudent to work day shifts midweek behind the Vortok Fencing/ possessions to complete the gauging. A similar overall production may be available this way but it is more susceptible to risks from possession irregularities.

6 BAY SYSTEM

If the 6-bay (7,32m) support centres platform is used then the platform components will be fabricated and delivered to site in either in complete units or as discrete components that will then be built-up on-site.

The units can be moved and lifted and relocated either using Road Rail Vehicles and Trailers or Road Vehicles and cranes. The installation works will typically be carried out during midweek night or weekend possessions.

The platform units will be lifted onto prepared Pile Caps which will have been installed by the Main Contractor to the necessary tolerances.

For Health and Safety reasons the number of personnel working on the track whilst units are being lifted in will be limited.

Once units are installed and bolted down the SYSTRA team will carry out fine adjustment in height and gauge and complete the structural steel deck and fencing (if not pre-installed).

All the Modular Platform Systems have flexibility and adaptability engineered into the design to ensure that the system is easy to install and has the potential for future alteration.



3 BAY SYSTEM

The 3 Bay arrives at site fabricated and galvanised. Components are on banded and shrink wrapped pallets which are transferred to the rear of the proposed platform by tele-handler. If this is not possible pallet trucks or hand trolleys are used. Components are assembled behind the Vortok Fence.

The 3 Bay support legs are either placed on top of pile plates and bolted together or placed on concrete footing and secured. Top and bottom chords are bolted to the legs and then bracing bars are secured to the chords. Hubs and transverse beams are secured to the top chords creating a 3 Bay section of 3.66m.

When platform length has been assembled the platform will be gauged. Once possession/line blockage is granted the rigid barrier (Vortok) will be taken down in the area where the platform is to be gauged.



The front inserts are placed into transverse beams to approximately the correct gauge. A calibrated platform gauge is set up on track and set to the correct gauge (making allowance for fascia plate, deck pans and platform coper units).

Once the steel is at the correct fall the front and rear hubs are simultaneously raised or lowered into the correct vertical alignment and the horizontal gauge is checked and adjusted as required.

When the platform is at the correct gauge the inserts are locked into position using pinch bolts and the hubs bolted to the top chords.

Finally, the front fascia is Tee screwed to the insert and the first 4 deck pans laid. Then behind the gauged platform, now acting as a rigid barrier, the remainder of the steelwork is fitted along with rear fence line.

There are many options available to the client when working with our Modular Platform System.

Not only are there multiple forms of construction available but the system can also be configured for:

- New platforms
- Extensions to existing platforms
- Island platforms
- Single sided platforms
- Platform widening
- Platform ramps (DOA compliant or Maintenance Access)
- Walkways and staging

In addition to this the platform has several options for the following:

- Different foundation systems
- Different surfacing options
- Different fencing heights and styles



SURFACING

The Modular Platform will accept any surface finish to suit the practical and aesthetic demands of the station. The options include Dense Bitumen Macadam (DBM), Flag Paving, Blockwork and Anti-slip GRP sheeting. If a traditional type of surfacing is required then SYSTRA can provide a typical section detailing surfacing requirements for the Modular Platform extensions.

Where DBM surfacing is specified, the surfacing would be made up of damp proof membrane, 60mm DBM sub-base (20mm aggregate) and 40mm DBM wearing course (6mm aggregate). Note that this surfacing specification is more economical than traditional build platforms, resulting in additional cost savings.

A GRP anti-slip surfacing system which has been used successfully on several projects is also available. There are two GRP Options available:

1. 4mm or 6mm non-structural overlay sheets for general surfacing
2. Load bearing decking suitable for small areas of platform raising

The GRP overlay sheets will be adhered and mechanically fixed to the structural steel deck. The sheets typically consist of a 50mm Angle White 'Coper' edge tongue and are grooved with standard mock tactile paviour sections and black anti-slip.

FENCING

Various fencing types, heights, cladding and litter screens can be specified if a particular appearance is desired, or to suit planning requirements.

LITTER SCREEN

Front and rear litter screens are included to exposed elevations of the platform which typically comprises of galvanised steel mesh panels. These act as a screen to prevent the build up of litter and also restrict access to cables and other services running underneath the platform.

Various other options for the litter screen such as perforated panels, brick cladding panels or powder coated mesh can be offered as an alternative or to meet a specific aesthetic requirement.



SYSTRA DELIVERS HIGH QUALITY, INNOVATIVE SOLUTIONS TAILORED TO MEET CLIENT'S NEEDS.



Barry Heritage Station Platform

Construction showing adaptability of platform design for use on a sensitive site with rear wrought iron girder cladding used as a litter screen



Imperial Wharf Station

Construction showing adaptability of platform design for modern fencing and cladding options

KEY ADVANTAGES

HEALTH AND SAFETY RISKS

Due to the overall reduction in programme. number of possessions required and the reduced emphasis on night-time working the risk to Health and Safety is reduced.

The vast majority of components of the standard Modular Platform System are less than 25kg in weight enabling them to be man-handled as appropriate, mitigating the requirement for on-site plant, thus reducing the risk of accidents and cost.



Stamford Station platform on curve with wire mesh fencing

REDUCED SITE PROGRAMME

Significant savings on time (and associated costs) is available with the use of the SYSTRA Modular Platform.

Since the Modular Platform is based on a suite of generic components. production of detailed design drawings is often significantly quicker than for alternative forms of construction.

Once the platform width is defined. the only component that may vary to suit site conditions is the Leg. Since most of the platform components are standard. fabrication of standard components can be carried out in parallel with the design process.

The quick erection time offers significant savings on site management costs (for the Client and the Principal Contractor) and when integrated into the overall programme can assist in freeing float for critical path activities.

Also. due to reduced dependency on possessions and other reasons stated below. the risk of programme change is reduced.

MINIMAL LINE BLOCKAGES

SYSTRA Modular System has been designed to enable erection of approximately 80% of the structure during normal traffic operation with work carried out behind a safety barrier.

Work that requires track closure is limited to installation of the front inserts and deck plates, setting the platform to the correct clearances, and fitting the front surfacing panels plus anti-litter screen.

ADJUSTABILITY

The Modular Platform System is adjustable both vertically (optional) and horizontally, enabling adjustment to suit site conditions.

On previous projects, this has proved invaluable in accommodating late changes (e.g. during the construction phase) to the X-Y offsets and also changes to the track alignment following tamping.

REDUCED WEATHER DEPENDENCY

Modular Platform requires minimal input from 'wet' trades, thus significantly reducing the risk of delay as a consequence of inclement weather.

TAPERING & CURVED PLATFORMS

The SYSTRA Modular Platform is designed to easily cope with the problems of curved and tapering platforms.

Recent platforms completed where this has been a feature include:

- Pontypridd Platform Works: A curve radius of 450m and several different platform widths and tapering widths.
- Stamford Temporary Platform: A constant radius curve of 500m
- Halte Gelliani: two new 115m long platforms were constructed on a 550m radius curve near Toulouse.

BESPOKE ARRANGEMENTS

SYSTRA has several years of experience of modular platform construction with over 100 installations to date. We have developed numerous bespoke arrangements for particular sites.

These include:

- 2 bay and 3 bay spanning beams to allow the platform to span over obstacles such as culverts, manholes, catchpits and cable routes.
- Mounting of waiting shelters directly on the platform
- Working around existing structures
- Using the inherent adjustability within the

QUALITY AND DURABILITY

CONSISTENT QUALITY

Modular Platform components are factory fabricated offering consistent quality of components. The use of trained, experienced steel erection labour in conjunction with site supervision by experienced personnel ensures

PROTECTIVE COATINGS

All steelwork is hot dip galvanized to meet the specified design life and to take into consideration microclimates. The system complies with NR/L3/CIV/030. Stainless steel fixings are used throughout and are combined with non-conductive washers to isolate the fixings from the galvanized steel.



SUSTAINABILITY ON SITE

STEEL IS THE MOST SUSTAINABLE CONSTRUCTION MATERIAL SUITABLE FOR THIS TYPE OF CONSTRUCTION.

Environmental benefits:

STEEL

Steel is typically produced from 60% recyclable material and approximately 97% of steel waste is recycled.

REUSED

SYSTRA Modular Platforms can be reused or recycled at the end of their service life (structure is 95% steel which is endlessly recyclable, structure is bolted together allowing rapid disassembly).

REDUCED NOISE AND POLLUTION

There is a reduced need for on-site plant, e.g. cranes, required for installation and works in anti-social hours can be largely reduced.

LESS WASTE

The modular design and off-site manufacture process means there is minimal construction waste.

LIGHTWEIGHT STRUCTURE

Allows for minimal carbon footprint from transport to site (approximately 50m of platform superstructure can be transported on one low loader).

ENVIRONMENTAL CONTROL

The environmental impact of our modular products and processes is being reduced through the successful implementation of an environmental management system that is certified to ISO 14001:2004.

Using off-site construction techniques, which minimises waste and transport, the Modular Platform System is a sustainable form of construction with excellent 'green' credentials.

FOUNDATIONS LOADINGS

LOADING

Typical loadings per leg for the standard system (based on 5kN/m² loading) are shown in the table. For the Long Span system these loadings can be multiplied by the number of bays in each span (e.g. 6-bays = 7.32m span). There is minimal uplift and shear and zero moment.

The typical offset from running edge to centre-line of the front foundations is 1.750mm therefore, according to UK practices, this work could be completed outside of a possession on level ground. Further review of the topographical survey and ground conditions is required to confirm this.

The foundations loadings are approximately 40% less than an equivalent concrete systems.

3 BAY SYSTEM

The 3 Bay System is mainly used on screw piles where the platform legs are bolted to the pile heads.

Concrete strip footings, raft slabs and pad foundations can also be used.

6 BAY SYSTEM

The 6 Bay System could be used with Mass Concrete footings cast at the required centres however it is most appropriate where piling is required and so makes it most suitable on embankments etc. Due to the low shear and moment requirements, the type of piling required can vary but typically small diameter Low Displacement Helical Piles or Driven Steel Piles are most suitable for the Long Span system as the platform can be simply bolted to the Pile Head.

Continuous Flight Auger (CFA) piles may be used with an appropriate Pile Head.

STANDARD (1.22M CENTRES) SYSTEM

The Standard Platform System has frequent but lightly loaded legs and therefore it is generally most suitable for shallow footings such as strip footings or raft foundations with minimal reinforcement. The depth of the foundation would need to be established by ground investigations.

However, there have been several other foundation systems used for this type of platform, such as piled ground beams, generally using mini-piling (such as Grundematt or other small diameter driven piles) techniques with an in-situ concrete ground beam cast on top.



QUAI MODULAIRE TYPIQUE ULS JAMBE CHARGEMENTS (I.L. 5KPA)

Platform Width (M)	Leg Spacing (M)	FRONT LEG (KN)		REAR LEG (KN)	
		MAX	MIN	MAX	MIN
2.5	1.2	34.85	-4.09	26.58	-5.02
3	1.7	32.82	-0.54	26.55	-0.46
3.5	2.2	32.29	1.63	27.11	2.605
4	2.7	34.57	3.29	27.94	5.003

+ve denotes down force -ve denotes uplift

Notes:

- 1) The provided loadings are for preliminary information only and shall at no time be used for detailed design purpose.
- 2) The above loadings have limited correlations with the platform width or the imposed load intensity because the critical load case is not identical across the board.

HISTORY OF THE SYSTEM

SYSTRA'S MODULAR PLATFORM SYSTEM PROVIDES A SWIFT AND COST-EFFECTIVE SOLUTION - EVEN IN THE MOST CHALLENGING OF SITE CONDITIONS.

SYSTRA Modular Platform System is proven technology. It has been installed at the following locations:

- Aberdare Branch (5 platform extensions)
- Barry Waterfront (1 new platform)
- Bathgate Branch (3 platform extensions)
- Blackfriars Temporary Platforms and Canopy (2 temporary platform/ canopy extensions)
- Bletchley Station (2 platform extensions)
- Castle Bar Park Station (1 platform extension)
- Chesterfield (1 new platform)
- Chilterns Line (2 platform extensions)
- Deighton Station (2 platform extensions)
- Energlyn & Churchill Park New Station (2 new platforms)
- Feniton Station (1 platform extension)
- Gainsborough (1 new platform)
- Gare de Mitry Claye, Paris (1 platform extension)
- Halte de Montraudran, Toulouse (1 new platform)
- Halte Gelliani, Toulouse (2 new platforms)
- Harrow & Wealdstone (5 platform extensions)
- Hayes & Harlington - Crossrail (1 platform extension)



- High Wycombe (1 platform extension)
- High Wycombe (1 platform reconstruction)
- Hubberts Bridge - 1 platform
- Imperial Wharf (2 new platforms)
- Langley Station - Crossrail (1 platform extension)
- Levenshulme (1 new platform)
- Lichfield (1 platform extension)
- Lichfield (2 temporary platforms)
- Littleport and Waterbeach (3 platform extensions)
- Livingston North platform (widening of existing platform)
- Llanharan (2 new platforms)
- Lochgelly (2 platform extensions)
- Mill Hill Broadway (4 platform extensions)
- Northallerton Station (1 platform extension)
- Peterborough Station (various Platform extensions/ widening to 4 platforms)
- Pontypridd (1 platform widening/extension)
- Rhymney to Penarth route (15 platform extensions)
- Royston Down Platform Extension (1 platform extension)
- St Pancras (1 temporary platform)
- Stamford Temporary platform (1 temporary platform)
- Stevenage Station (2 island extensions)
- Templecombe Station (1 new platform) West Drayton Station - Crossrail (1 platform extension)
- Theale Station (1 new platform)
- Uphall (re-gauging of existing platform)
- West Coast Main Line (17 platform extensions)
- Wolverhampton (1 platform extension)
- Wolverhampton (1 platform extension)
- Woodlesford (1 platform extension)
- Yarm Station (2 platform extensions)



Levenshulme (1 nouveau quai)



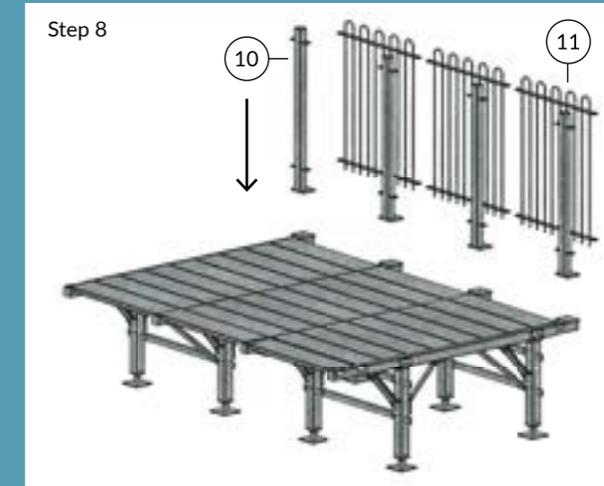
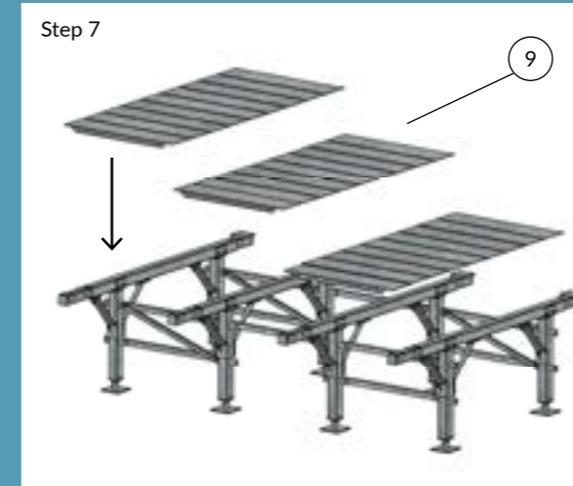
Templecombe Station (1 nouveau quai)



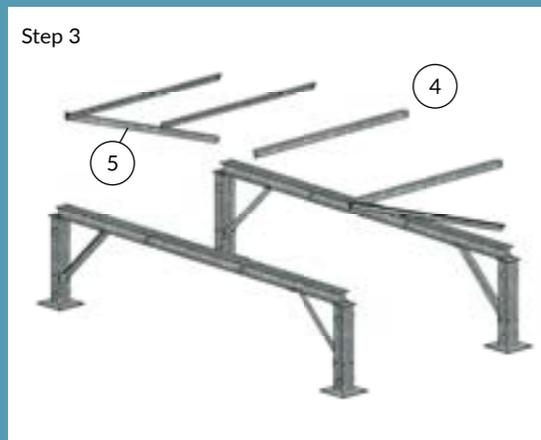
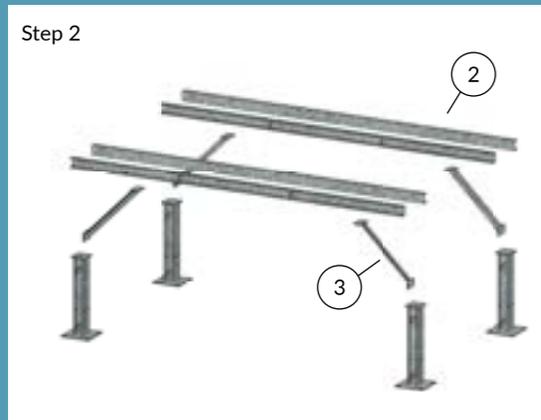


ITEM NO. MODULE	COMPONENT	WEIGHT KG
1	Adjustable Foot Assembly	7
2	Standard leg	11
3	Longitudinal Brace	4
4	Tie Brace	5
5	Transverse Beam	24
6	Knee Brace	2
7	Front Insert	14
8	Back Insert	12
9	Deck Pan	15
10	Fence Post	19
11	Fence Panel	30

All components galvanized to suit the desired design life and client's requirements.

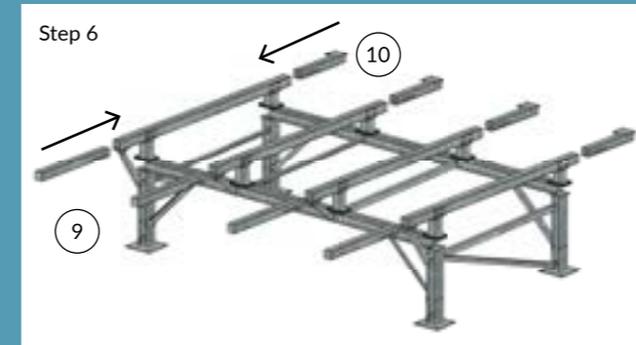


Step 9
All components are fixed together using either A2 or A4 stainless steel bolts with neoprene washers and spring washers.



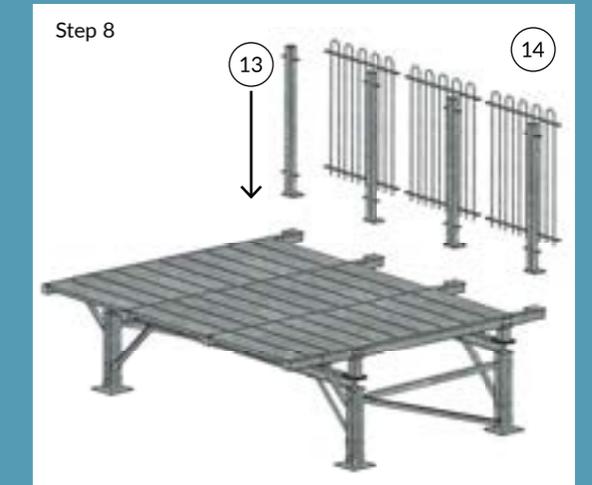
ITEM NO. MODULE	COMPONENT	WEIGHT KG
1	3-Bay Legs	20
2	Top Chord	33
3	Diagonal Chord	10
4	Horizontal Brace	11
5	Diagonal Brace	13
6	Packers	1
7	Hubs	3
8	Transverse Beam	24
9	Front Insert	14
10	Rear Insert	12
11	Knee Brace	2
12	Deck Pan	15
13	Fence Post	19
14	Fence Panel	30

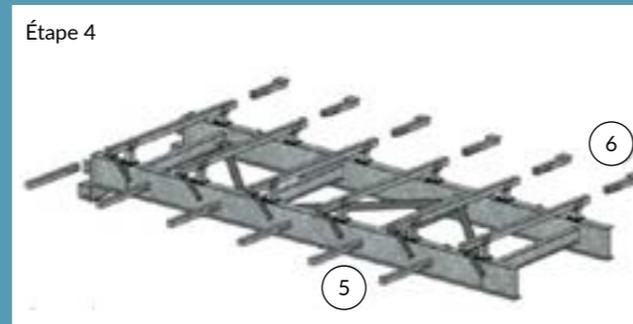
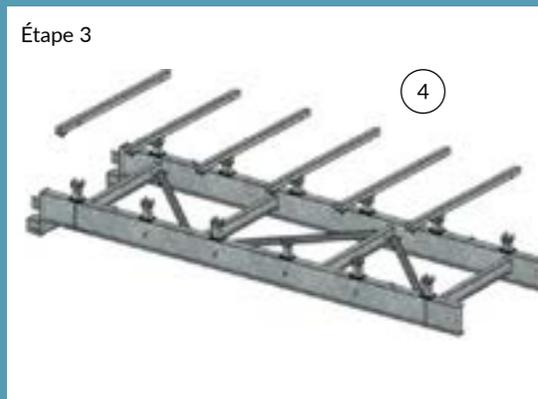
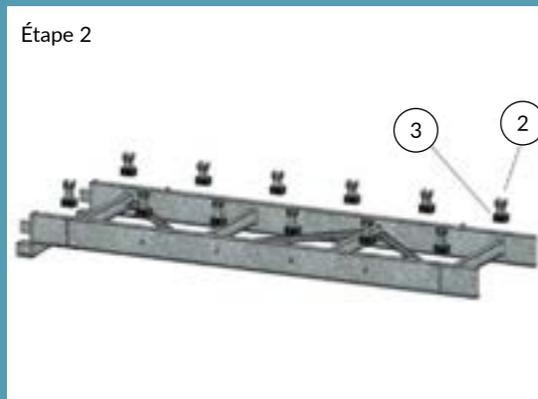
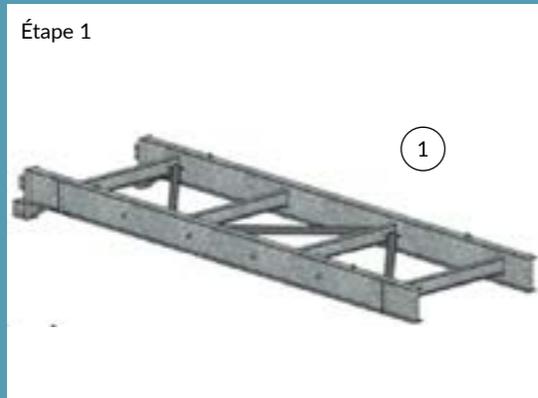
All components galvanized to suit the desired design life and client's requirements.



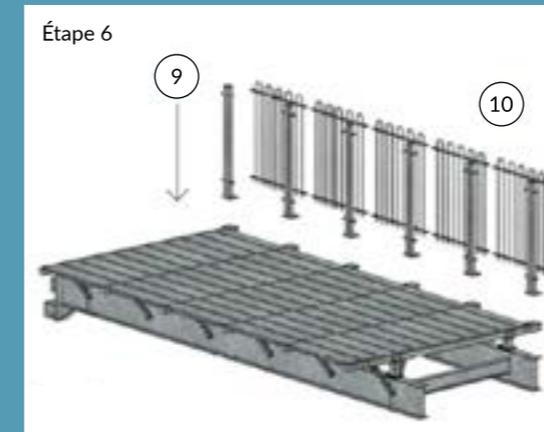
All components galvanized to suit the desired design life and client's requirements.

All components are fixed together using either A2 or A4 stainless steel bolts with neoprene washers and spring washers.





ITEM NO. MODULE	COMPONENT	WEIGHT KG
1	6 Bay Frame	1000
2	Packers	1
3	Hubs	3
4	Transverse Beam	24
5	Front Insert	14
6	Rear Insert	12
7	Knee Brace	2
8	Deck Pan	15
9	Fence Post	19
10	Fence Panel	30



All components galvanized to suit the desired design life and client's requirements.

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THE SIGNATURE TEAM

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