

SYSTEM DESCRIPTION & INSTALLATION PROCEDURE FOR:

**CONSTRUCTING DIRECT FIXATION FASTENER TRACK (DFF)  
IronHorse Gauge Support Fixture (GSF)**





Iron Horse Engineering's "Top Down Construction" rail suspension system was developed in 1987, originally called "IronHorses" our Gauge Support Fixtures (GSF) are fully and easily adjustable for all track geometry parameters. This technique allows for vertical and horizontal control to be accomplished by supporting the rail from above.

The GSF's are fully adjustable for rail seat cant, track gauge, surface/cross-level/superelevation and line. They can be furnished to suit any track gauge and rail base size. They are designed to connect with a simple pinned connection through a Pandrol shoulder to the gauge end of a rail support plate such as the 14.003 Base Support Plate (p/n 12.089) or the 14.005 Head-Grabbing Plate (p/n 12.276). The Support Plates are not embedded in the concrete; they are removed and reused. The plate used to support the rail is determined by the type of track and fastening system on the project. The plates are cantilevered from each end of the GSF, supporting the rails and all the intermediate fasteners attached to them, the two tapered legs, "Surface Adjustment Screws" (SAS), rest on the base slab in the gauge of the track.

## INTRODUCTION

This document describes the “Top Down Construction” method and the recommended procedure for utilizing the Iron Horse Engineering Co. (IHECO) Track Support System in the construction of Direct Fixation DF track. This system allows DF plates or pads and their embedded anchorage inserts to be perfectly set to ensure the accurate line and gauge of final rail placement.

The system description and detailed installation instructions used here to illustrate the IronHorse System is based on the design details and methods most commonly specified in Direct Fixation Track Construction and other spec sections and standards in the industry. The method whereby the rails are supported by IronHorse Gauge Support Fixtures at the correct rail geometry, and the DF pads are fastened to the rail at the specified spacing, providing a “Template” for the quick erection of forms and accurate placement of concrete in the plinth pads at the P.G.L., cross-level, horizontal alignment, and fastener spacing indicated in the plans in a method that is generally known as “Top-Down Construction”.

### Purpose:

The purpose in using the IronHorse method is to provide a fool-proof way to finish the grade line and cross-slope on the plinth concrete and locate the anchorage inserts within the dimensional tolerances specified in a construction sequence that is economical as well as practical. This is achieved by:

1. Using the running rails as a construction template for correctly locating the DF pads, the form plates, and inserts relative to the PROFILE GRADE LINE and geometry parameters.
2. Providing a supporting rail system which locates and holds the rails and fasteners at the design geometry during assembly and the placement of concrete, and which is readily and accurately adjustable for all track geometry parameters.
3. Having a system which allows for visual and instrument inspection of the finished rail-head profile parameters during all phases of the construction, including during the placement and curing of the concrete.
4. Having fixed reference points on the template track to facilitate the fast and accurate placement of perimeter forms, chamfer strips, blockouts, etc.

## SYSTEM DESCRIPTION

### General Description:

The IronHorse System consists of five (5) major component groups which work in concert to provide a positive reference for the accurate placement of concrete by supporting the running rails (or “dummy” rails) at the correct geometry relative to the profile line and grade and supporting the DF pads to the base of those rails, along with the “slobber” plates and threaded inserts. In this way, the proposed grade line of the concrete and the location of the inserts is properly established without the necessity for elaborate forms and survey stationing. The track constructed in this way is the template for the permanent track. This is the “top down method”, if the rails are properly located, then everything attached to them is also properly located. The system has the following important attributes:

### System Components:

The IronHorse System consists of items furnished by IHECO which are combined in specific ways with items furnished by others to make a construction “system” for the purposes previously cited. The five major component groups are described below with their identifying reference numbers used on drawing #12.090.

P/N 12.090 gauge support fixture (GSF), 4'-8 1/2" gauge, which supports the track and provides the adjustments for rail seat cant, gauge, surface, cross-level, and horizontal alignment. The track geometry adjustments are all threaded, turned with a socket wrench.

GSF's are spaced from 9'-0" to 10'-6" on centers.

P/N 12.089 base support plates are attached to the GSF with a quick-pin connection, and actually support the rail from the base. The support plate does **not** embed in the concrete; it is removed after the concrete sets.

P/N 14.015 plate clamp with wing screw are used in pairs to temporarily fasten e-clip style DF fasteners to the base of the rails during the construction and concreting phases. They consist of a ductile casting shape fitted with a wing screw, and fit the pandrol shoulds on the DF pads. The plate clamps are important to use in place of the pandrol e-clips for several reasons:

- 1) They permit quick and easy attachment of the DF pads to the rail without tools and hammers while the rail is hanging in the air. It is much safer than driving the clips on with the DF pads up in the air and unrestrained vertically and longitudinally.

- 2) The clamps can be quickly loosened to adjust the spacing of the DF pads and to provide rebar clearance, etc. and after the placement of concrete to release the rail from the DF pads, allowing any to not affect the fasteners embedment.
- 3) It is generally preferred to apply the pandrol e-clips only once during the track construction, after closure welds are completed and the rail had been distressed. This avoids springing the clips and reducing the installed toe load of the track fasteners.

P/N 12.234 special plate clamp is designed to be used on the gauge side of the restraining rail DF pads during set-up and the placement of concrete with the restraining rail **removed** during these phases.

## INSTALLATION PROCEDURE

This section describes the recommended procedures for constructing the template track and placing concrete. No attempt is made to instruct the contractor in the performance of normal track-building tasks, only those specifically related to the proper usage of the IronHorse System and its components. Suggestions concerning certain activities that may not be part of the contractor's normal experience. In order to do a good job, supervisory personnel should be thoroughly familiar with these instructions.

### General Preparations:

In preparing the site for installation, certain equipment must be furnished and preliminary tasks performed, as follows:

Recommended tools to be furnished on site (in addition to standard tools):

- 1) Wrenches to fit GSF adjustments; 15/16" (ratchet) and 1-1/8" open-end.
- 2) Track jacks and lining (or crow-) bars: 3 or 4, minimum.
- 3) Wood blocking to support the rails temporarily at least 8" above invert.
- 4) Layout tools, including 100-ft. tape, marking crayons (Keel) and track level.

Preliminary operations include:

- 1) Distribute running (or dummy) rails onto temporary support blocking.
- 2) Distribute GSF's and support plates as required by spacing to be used; normal spacing is between 9'-0" and 10'-6"., as required by site conditions.
- 3) Assemble the DF pads, slobber plates and anchors.
- 4) Hand DF Assembly from rails at project spacing and locations.
- 5) Protect or Coat DF pads and form plates with a non-oily form release agent to ensure concrete can be cleaned/ removed from fastener.

#### Construction and Adjustment of Template Track:

The task sequence that follows should be followed **exactly** in the order listed, to avoid backup moves and extra work. It will simplify the track construction to erect the forms **after** all track work is completed, in the following sequence of steps.

- 1) Adjust template rails on blocking to gauge w/in ½" and line w/in 1". It is easier to lower the rail to proper elevation than raise it.
- 2) Mark off locations on rails for DF pads and GSF's, based on the design spacing, making sure the GSF's fall between pads, and preferably in plinth block out locations.
- 3) 3. Install GSF's and support plates. Ensure the fixtures are all oriented the same from the lining rail. Adjust support plates to approximately 1:40 cant before lifting rail off blocking; lift rail and remove blocks.
- 4) Install DF pad/form plate assemblies on base of rail, using the 14.015 plate clamps, tighten securely, making sure the inserts clear the rebar adequately.

#### Adjusting the template track:

The following adjustments should always be made by starting at one end of the spread, working toward the other. It is often necessary to go over the set-up spread several times. It is not possible to make big adjustment changes in one pass because the rails are too stiff.

- 1) Adjust the cant of the rails to 1:40, using a straightedge level under the DF pads to make sure the bottoms are flat; it is necessary to adjust at least eight (8) GSF's before the rail cant will start to change, because the rail is so stiff.

- 2) When the rails are properly canted, start adjusting gauge; loosen the jam nuts and adjust to **approximate** gauge (+/1/4"), then starting at the beginning again, adjust to exact gauge, making sure that the last adjustment move pulls the rails **in** to final gauge (this takes the slack out); lock the jam nuts.
- 3) Adjust the track to within 1/8" of final surface; remember, when one GSF is more than 1/8" above the next, it will lift the next one off the invert.
- 4) Adjust the horizontal alignment per project requirements, using the lateral adjustment.
- 5) Adjust the track to final grade and cross-level, being sure to adjust the design profile grade line to allow for the difference in thickness between the HDPE permanent shim pan and the form plates; for instance, if the shim pad is 1/8" thick and the form plates 1/4", the profile grade line of the template track **must be set 1/8" high**
- 6) Re-check the line and gauge after completing the surface/x-level.
- 7) This completes the adjustment procedure; however, it is necessary to check the geometry periodically, **especially while placing concrete**, as temperature changes will affect the profile, requiring re-adjustment.
- 8) In sharp curves, it may be necessary to provide "kickers" to help hold the track in correct alignment; these can usually be made from lumber.

#### Forming, Placement and Finishing of Concrete:

The forming, placement and finishing of plinth pad concrete should be done as follows:

- 1) Erect the forms: the type and design of the forms are optional. The intent is to have the perimeter forms placed close against the form plates, after the template track is adjusted.
- 2) It is the further intention to have the chamfer strips placed tight to the underside of the form plates, automatically setting the strike line elevation and cross-slope in proper relationship to the DF pads, track and P.G.L.

- 3) It is better to have forms that are not too high, making the finishing easier.
- 4) Temperature considerations: the top-down construction method recommended here depends on the rails and template track **not moving** significantly during the curing of the concrete. This requires that the lock-in curing take place during a time of day when the rail temperature changes no more than 10-15 degrees during this critical 5 – 6 hour period. A log of rail temperatures, taken on an hourly basis on prior days, will indicate when this window is available; usually it is late morning or at night.
- 5) Prior to placement of concrete, double-check the template track geometry.
- 6) When placing concrete, always feed in one direction under the DF pads, so the concrete doesn't run together and trap air under the form plates.

While placing concrete, be sure to cover/protect the DF pads close to the point of concrete delivery, especially when it is pumped; this will keep the pads free of mortar and reduce the cleanup required.

- 1) Make sure the concrete fills the forms slightly above the strike line so that the top surface is in contact with the bottom of the form plate; otherwise, there is the possibility that there may be a low spot and the proper grade line, cross slope, and flatness for subsequent mounting of the DF pad will not be maintained.
- 2) Finish the concrete between the form plates, using the top edge of the chamfer strips as a strike line; this will put the float-finished concrete at the same grade as the concrete surface being "formed" by the bottom of the form plates.
- 3) After the concrete has been in place approximately four (4) hours, and will meet the thumbnail test for cure strength, the following **must be done timely**:
- 4) Loosen all the plate clamps 3-4 full turns of the screw.
- 5) Raise the surface adjusting screws one (1) full turn (approx. 1/8").

- 6) The reason for doing this is to prevent the shrinkage (or growth) of the rail from disturbing the location of the inserts in the curing concrete; if they move, it will tear the concrete and require epoxy or other expensive repair method to correct the problem—it is costly and wasteful. Loosening the clamps and raising the rail with the GSF's allows the rail to move without disturbing the DF pads or inserts.

When the concrete has reached the strength (usually 2000 psi) to permit stripping forms, do the following:

- 1) Remove: perimeter forms, chamfer strips, blockouts, and construction bolts.
- 2) Snug the plate clamps again on the rail base
- 3) Raise the track 1/2"-3/4" with the GSF's, or track jacks placed under the center of each third fixture; do not raise more than 100-ft. at a time with track jacks, as the track is not stable supported only in the center.
- 4) Loosen the plate clamps and slide the DF pads 9"-10" along the rail.
- 5) Remove the form plates from the surface of the green concrete, being very careful not to damage the surface or drop mortar into the open inserts.
- 6) Inspect concrete surface under the pads, if required, repair any voids exceeding spec with an approved material. Be sure to protect the insert threads from repair slurry.
- 7) Slide the DF pads back into position over the inserts, install the HDPE permanent shim pad, and lower the track and DF pads onto the shim pads; inspect to see if additional shims (or thicker main shim) are required and install at this time.
- 8) Install the permanent bolts and lock washers; **Important!:** Do not tighten to the specified installation torque until the concrete reaches the required strength.
- 9) Remove the GSF's, plate clamps, construction bolts and form plates (and the dummy rail, if used) from the site and deliver to the cleanup location.
- 10) Fill the voids left in the plinth pads by the removal of the surface adjusting screws with an approved grout, or at the engineer's direction.

Perform any other tasks/functions required by the specs.

### Completion of Track and Cleanup:

After the completion of the plinth concrete, there are a number of tasks which must be performed to finish the track installation:

If dummy rail was used during construction, unload welded running rails and lay in the DF pads per spec; make closure welds (if not already done).

When the concrete reaches required strength: torque mounting bolts, de-stress the rails, and apply Pandrol clips per manufacturer's instructions.

Install restraining rail per plan.

Perform any other track work required by the plans (Note: these instructions are not intended to supplant the contract specs; the listing of track-related tasks is simply to indicate where those particular tasks fit in the construction sequence).

Cleanup of the DFF pads: after the track is complete and the plinth concrete well cured, the DFF pads should be cleaned as follows:

Remove large, loose laitance by hand or with a soft-faced hammer.

Using a high-pressure water washer, remove all mortar that is present on the rubber or metallic surfaces, and on the adjacent rails.

Do not use: wire brushes, either power or hand, or sharp-edge tools which may damage the surface of the rubber, or any other method that is not approved by the engineer.

Cleanup of tools and equipment: as in any concrete work, it will go much better if the tools and equipment are cleaned up immediately after the work is completed each day, when possible. We strongly suggest that a cleanup/assembly site be established with suitable cleaning and handling equipment, such as a pressure washer, solvent(s), chippers and scalers, release agent spray, etc. This will permit the orderly and thorough cleaning of the form plates, construction bolts, and laitance covers, with only a modest labor requirement. If the site is fitted with power wrenches, it will also serve as the assembly site for the DFF pads/form plates, and will not require moving of those components prior to assembly.

This completes the installation procedure instructions, except for the following reminders:

- 1) Compensation for the P.G.L. change required by the difference in thickness of the form plates from the HDPE permanent shims **must be made** when setting the top of rail (T.O.R.) elevation of the template track. Whatever the difference is, it must be added to the T.O.R. elevation. For instance, if the HDPE permanent shim is 1/16" thick, and the form plate is 1/4", then the 3/16" difference **must be added** to the T.O.R. elevation for every station, uniformly throughout the job; otherwise, confusion will lead to errors, resulting in additional shimming or possibly requiring grinding.
- 2) It is very important to follow the instruction regarding choosing the best time of day to place concrete, as any gross movement in the template rails will cause damage to the freshly placed PCC. The rule of thumb is: the rail temperature **must not vary by more than 15 degrees F.** during the first 4-5 hours that the concrete is in place. This allows the embeds to "freeze" before the clamps are loosened and the rail raised on the GSF'