Port Equipment Manufacturers Association

RECOMMENDATIONS FOR CRANE RAIL SYSTEMS

A PEMA INFORMATION PAPER

This information paper provides guidance on the selection of rail systems for port cranes and the design of rail support infrastructure. It aims to help reduce problems and costs with rail systems in terms of installation, operation, and performance.

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PORT EQUIPMENT MANUFACTURERS ASSOCIATION

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INTRODUCTION

DOCUMENT PURPOSE

This paper is intended to provide specifiers and purchasers of crane rail systems guidance and recommendations for the selection of state-of-the-art crane rail systems for large cranes.

The goal of the paper is to improve the quality of rail installations and the resulting operation of rail mounted cranes.

Over time, PEMA will further develop this guidance based on industry feedback.

For further information about this paper or to provide feedback, please contact the PEMA Secretariat at info@pema.org.

ABOUT THIS DOCUMENT

This document is one of a series of Information Papers developed by the Equipment Design and Infrastructure Committee (EDI) of the Port Equipment Manufacturers Association (PEMA).

The series is designed to provide those involved in port and terminal operations with advice on standards and their application to the design of port equipment, together with guidance on issues related to equipment design and equipment interfaces with port infrastructure.

This document does not constitute professional advice, nor is it an exhaustive summary of the information available on the subject matter to which it refers.

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1. EXECUTIVE SUMMARY

A rail system consists of rail, clips, rail pad, bearing plates, bearing plate bolts, and grout. Other important considerations include rail welding procedures, expansion joint design, and installation tolerances.

A soft mounting system, consisting of a flexible reinforced pad and rubber nosed rail clips, is of special importance in crane rail applications.

The design of crane rail systems is not well covered by International standards and should be undertaken by a crane rail system specialist (CRSS), who should be a rail system supplier, a qualified specialist contractor, or a qualified consulting engineer.

To ensure compatibility between all elements, it is recommended that the whole crane rail system be purchased from a single reputable CRSS.

Crane rail installation requires specialist knowledge, skills, and equipment. It is recommended that this work is undertaken by, or, as a minimum measure with CRSS oversight.

Image 1: RMG rail installation

2. BACKGROUND

A professionally designed rail system is critical to the reliable long-term performance of large cranes and high-speed cranes. Such installations depend on many pieces fitting together and performing properly, and many things can go wrong.

Problems in design, selection, or installation can result in premature wear of rail and wheels and problems with crane operation. An owner could find that rails or wheels must be replaced well before the design life, with the cost and interruptions this involves. In extreme circumstances, some owners have had to replace crane wheels annually due to rail alignment problems.

This paper does not address the design of structures, piles, gravel beds, or soils that support rail installations, except to note typical differences between supporting structures for quay and yard cranes.

This paper provides general guidance to help avoid problems with rail systems.

Image 2: RMG yard rail installation

3. MAIN DIFFERENCES BETWEEN QUAY AND YARD CRANE RAIL INSTALLATIONS

There are several fundamental differences between gantry rails for quay cranes and yard cranes. These differences relate to how the cranes operate, and the typical detail of the rail support structure.

3.1 OPERATIONAL DIFFERENCES

Typically, quay cranes, whether for handling containers, bulk materials, or miscellaneous cargo, move slowly and utilize the gantry system to position themselves along the quay for a series of operations. Yard cranes, on the other hand, typically move along rails with every operation. The distance travelled by a yard crane or the trolley on any crane is typically far greater than by a quay crane. Thus, operating speeds, accelerations, and travel distances of yard cranes are generally far greater than those for quay cranes. Typical gantry speed of a quay crane is approx. 45m/minute, while the typical gantry speed of an ARMG may be up to 300m/minute.

3.2 DIFFERENCES IN SUPPORT STRUCTURES

Quay cranes are normally installed on continuous reinforced concrete crane beams supported on piles, or by other civil construction methods. Since a port facility normally can only have one quay structure and set of quay crane rails built over water, and without which the facility cannot function, the nature of this construction typically makes it fixed, rigid, and long-lasting.

Typically, crane rails installed on well-engineered beams supported on driven piles provide a long-term fixed foundation for over 20 years. In the case of a caisson construction of quay structures, that include support of the waterside rail, examples of rotation of the structure over time has been observed on some projects, due to eccentric loading of the caisson by the cranes.

On the other hand, in the case of an automated container terminal with many yard crane rails, the supports differ due to the smaller loads and cost considerations. Often, yard crane rails are installed on rail ties on gravel foundations installed over compacted fill.

Experiences from container yard crane installations have shown that deflections of yard crane rails over time, even when installed on compacted soil may be greater than anticipated. Vertical and lateral deflections of crane rails during operation will result in greatly reduced operational life of rails and wheels and may lead to direct problems with crane operation. Therefore, a detailed geotechnical investigation and a conservative approach by experienced geotechnical engineers is recommended for a proper yard crane rail support performance.

Depending on supporting soils, yard crane rails may be supported on either rail ties or other intermittent supports over graded gravel foundations which is at lower end of the cost spectrum, or alternatively supported on fixed crane beams over driven piles at the higher cost end. Selection should always be made by qualified and experienced engineers and based on adequate site soil test data and design loads.

3.3 SPECIFIC CONSIDERATIONS IN ASC RAIL AND SUPPORT SELECTION

Automated stacking crane, (ASC), rails usually have lower wheel loading than quay crane rails, but they experience many more loading cycles, higher wheel speeds, and greater dynamic loads and stresses.

General considerations regarding quay crane rails apply equally to ASC rails: design loads and cycles of operation must be considered, and a soft mounting will improve rail and wheel performance.

Moreover, to cope with the dynamic loads generated by the cranes, specific attention must be given to the rail fastening system design, the rail support, and the grouting.

Typically, and for economic reasons, the rail is intermittently supported by a small steel plate, (usually referred to as a steel chair), and a discontinuous pad designed to prevent its own longitudinal movement.

When the foundation type of the crane track necessitates, the steel chair will be designed to accommodate a settlement of the foundation by incorporating vertical and horizontal adjustment features, within defined limits.

Clips selection and spacing of approx. 600mm generally considered for quay cranes do not apply for ASCs. Specific calculations related to dynamic loads provided by crane manufacturers should be adapted on a case-by-case basis.

Particular attention must be given to grouting works and installation tolerances for ASC rails.

4. RAIL SYSTEM DESIGN AND SELECTION

A rail system consists of rail, clips, rail pad, sole plates, sole plate anchor bolts, and grout. Figure 1 shows a section of a typical quay or ship-to-shore (STS) crane rail system. The following sections discuss the separate elements of the crane rail system.

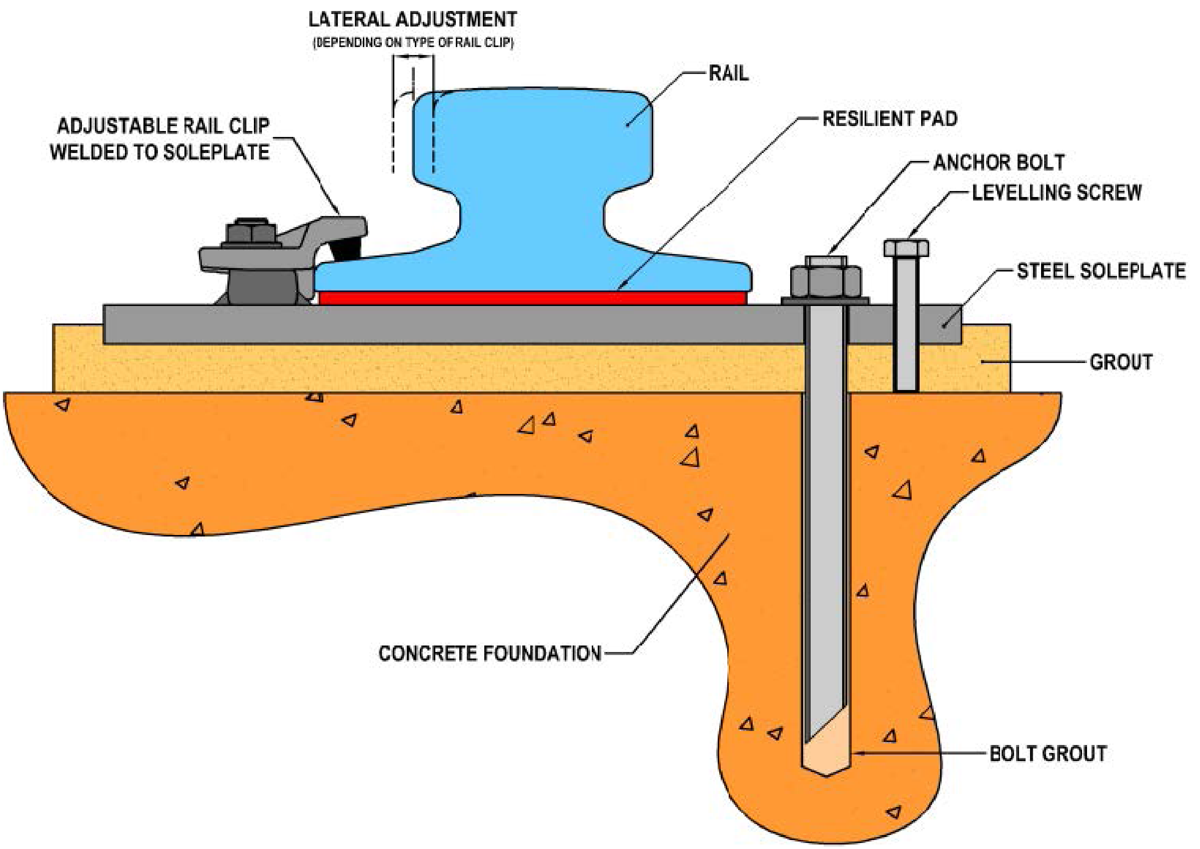

Figure 1: Rail system components

The design of crane rail systems is not comprehensively covered by International standards and should be undertaken by a CRSS, who should be a crane supplier, a qualified specialist contractor, or a qualified consulting engineer. Details of rail system selection should be supported by calculations demonstrating the adequacy of each component and the whole system.

Other significant issues not covered in design standards include rail welding methods and procedures, and expansion joint design.

4.1 CRANE RAILS

Crane rails are selected based on strength, and more significantly the wear and desired service life of the rail and wheels. Wear is related to the contact or bearing stresses between the wheel and rail, the material strength, the wheel speed, and number of loading cycles. Contact stresses are calculated based on the wheel load, wheel diameter, effective contact width of the wheel on the rail head. Other design considerations are the rail and wheel hardness, the speed of travel, and the number of loading cycles.

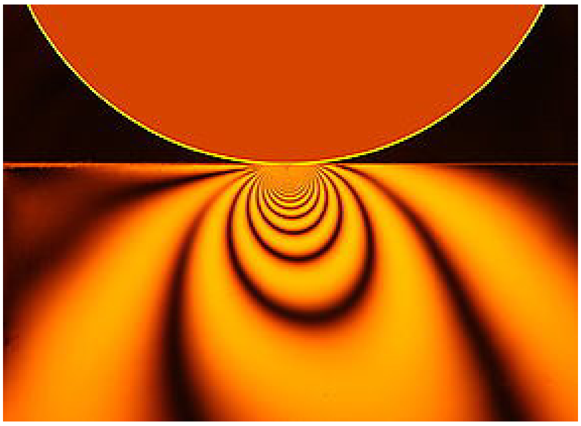

Image 3: Wheel rail contact stress lines. The closer the lines, the greater the stress. Source: Wikipedia "Contact mechanics."

Standard references for rail selection include the following. Different national standards also exist.

DIN 536-1:1991, "Crane rails: Hot rolled, flat bottom crane rails (type A)" is often referred to for dimensions, section parameters and steel grades.

Guidance for wheel selection, based on rail size, is provided in Federation Europeenne de la Manutention (FEM) "Rules for the Design of Hoisting Appliances," 1.001, 3rd Edition, Revised 1998, Section 4.2.4, "Choice of Rail Wheels." This guidance applies equally to rail selection. Note that this information is supplemented and revised in Booklet 9, Section 9.12.

EN 13001-3-3:2014, "Cranes. General design. Limit states and proof of competence of wheel/rail contacts," is the current European standard for selection of rails and wheels for cranes. These standards apply to rails only and do not consider the other components of the rail system.

Today, crane rail head profiles typically have a flat top surface with sides square at 90 degrees to the top surface. This is practical when the rail is installed on a "soft" flexible mounting system allowing the rail to rotate to bear flush with the wheel. In the US, ASCE rails with rounded top surface and sloping sides have performed well in crane rail installations for more than 50 years.

The profile of crane wheel flanges must be suitable for the contour of the rail sides. In many applications side rollers are used that require square sides on the rail head.

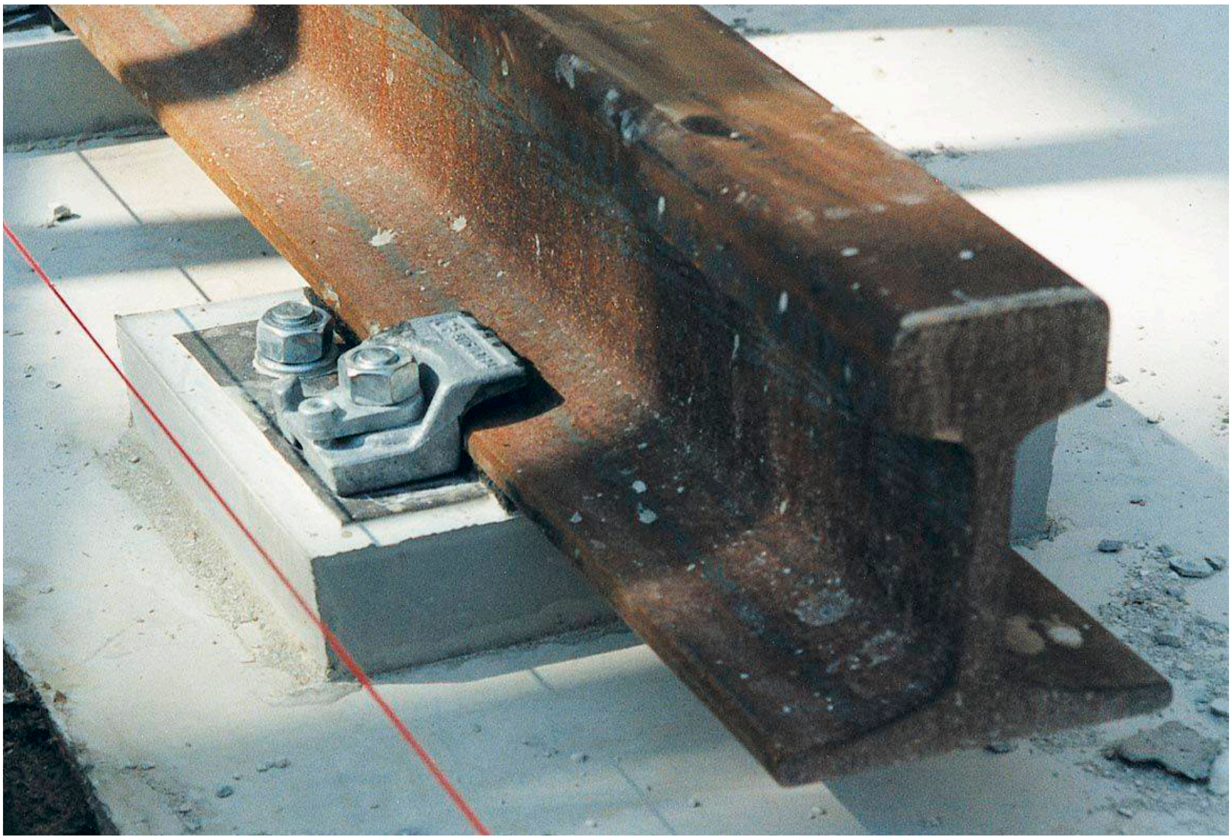

Image 4: Installation of a flat headed crane rail

Crane rail selection must take into consideration how the crane will operate. Fast-running and continuously gantrying RMG cranes in a rail yard, or ASC cranes in a container yard, require wider bearing areas than for cranes with similar wheel loads that move at lower speeds and fewer cycles. Quay cranes with larger wheel loads but with lower operating speeds and fewer hours of gantry operation may require similar rail sizes as the lower wheel load RMG or ASC cranes. For today's large STS cranes, and for high-speed wide-span cantilever RMG cranes, a rail head effective bearing width, of 100mm or more is common.

Rail selection must consider both vertical and side loading of the rail. Vertical loads include those from gravity, reactions from overturning moments from lateral loads including inertia and wind, and warping of the structure due to rails supports not being in the same plane, i.e., one corner support being lower than the others. Side loads include not only wind loads, inertia, lifted load and sway loads, but also skew loads. Skew loads have decreased over time as drive control systems have evolved.

The final crane rail design should be confirmed by a CRSS.

4.2 RAIL PAD, SOFT MOUNTING SYSTEM (BEARING PAD)

For more than 40 years, rails have typically been “soft” mounted on a flexible bearing pad. The ‘system’ consists of a steel reinforced elastomeric bearing pad beneath the rail and rubber nosed rail clips bearing down on the rail foot or flanges. These components are considered a ‘system’ as both allow the rail to ‘float’ and be independent of the steel sole plate while keeping the rail locked in position laterally. By releasing the rail from the supporting structure rather than locking it in place with rigid type fastenings that clamp the rail, the steel support and rail remain separate elements. The bearing pad provides several significant benefits:

- Separates the rail and steel support which prevents fretting corrosion and wear
- Distributes the wheel load over a larger rail length reducing the bearing stresses on the grout below the sole plate
- Allows the rail to rotate small amounts to centre the wheel load, allowing for more even bearing stresses and wear, reducing stresses on wheel axles and bearings, and reducing bending in the rail web that could result in fatigue cracking in the same
- Dampens vibrations and reduces noise

The soft mounting system is widely accepted as the best means of mounting crane rails to ensure a long service life with minimal maintenance and is currently the most common support method adopted.

The pad is manufactured from material resistant to wear, shear and crushing, oil, grease, sea water and, where exposed, ozone and ultraviolet light.

4.3 RAIL CLIPS

Rail clips are available in different sizes and capacities to suit a wide variety of rails and wheel loads. They should therefore be chosen to ensure they fit the designated rail and accommodate the maximum horizontal wheel loads generated by the crane.

Clips should have sufficient adjustment to allow rails to be installed to the accurate tolerances required by the cranes. In some support conditions it is worthwhile to have some additional allowance for adjustment for future realignment should the support structure move.

For quay and yard RMG crane rail systems, two-part fastenings are recommended where the lower section is welded to the sole plate and the upper section is bolted to the lower part. This ensures that upper sections and bolts can easily be replaced without disturbing the underlying support should this be necessary.

Image 5: Rail, clips, baseplate, and anchor bolts during installation

Rail clips should not rigidly clamp the rail. They fix the rail laterally to keep it aligned but allow longitudinal movement resulting from thermal expansion to occur. They incorporate an integral rubber nose to accommodate small vertical rail movements that occur due to the deflection of the rail pad and the ‘bow-wave’ effect as the crane wheel travels along the track without applying large vertical forces on the clip system. This flexible element reduces the probability of bolt failures which are common with rigid rail clips. The rubber nose also applies a downward force on the rail which helps limit, but does not eliminate, longitudinal rail movement from thermal expansion and crane acceleration forces. Since rail clips do not fix the rail in the longitudinal direction, restraints may be provided at rail ends to prevent migration.

Rail clips should incorporate a self-locking mechanism so that they tighten under horizontal load to ensure that the upper portion does not move relative to the lower base, to keep rails accurately aligned.

Rail clips should be positioned in pairs, typically located opposite each other.

As a rule of thumb, the minimum lateral design load for clips is 15 per cent of the maximum operating wheel load. The storm wind loading on the crane must also be considered in the design. If the rail trench is filled, e.g., with asphaltic concrete, the strength of the fill material can be considered in the design.

Clips should be spaced along the rail at a spacing determined by the CRSS and justified by calculations that consider the effect on the overall rail stress. For quay crane applications, this spacing is generally in the order of 600mm but varies based on loads and the rail strength.

Clips should be manufactured by a reputable CRSS and supplied as part of the whole engineered solution.

Rail clips should not require annual maintenance other than visual inspection.

4.4 RAIL SUPPORT SYSTEM

This section is written for sole plates installed onto civil infrastructure such as a concrete rail girder. If the rail is supported on gravel, soil or on sleepers, other considerations may apply.

The rail and pad should typically be continuously supported by a steel plate, (sole plate, base plate), providing the load path from the rail, pad, and clips, to the crane beam or other civil infrastructure.

The sole plate must be sized for fitting the rail and clips. Thickness selection must consider its temporary support strength before its grout support is poured as well as minimizing distortion during welding of the rail clips.

The sole plate design considers the civil layout, handling issues on site, source of manufacture, rail and clip width, crane wheel loads, and grout strength. Standard unit lengths will generally be three or six metres, but non-standard sole plates will be needed to suit the rail length.

Sole plates are typically manufactured with clip lower parts “shop-welded” for quality and to help limit distortion and maintain plate flatness. Sole plates will include holes to suit anchor fixings and levelling method, (i.e. temporary support), typically levelling screws. Sole plate flatness should be verified after clip welding and during temporary support before grouting.

As shown in Image 4 above, sometimes, with lighter cranes and strong rails, it is practical and more economical to use intermittent rail supports. In this case, smaller, suitable non-continuous sole plates and bearing pads are provided.

Pad stops should be installed at the ends of rails or at expansion joints to prevent longitudinal pad movement.

4.5 INTERFACE WITH CIVIL WORKS

The crane rail system provides the interface between civil structure and the crane. It must, therefore, accommodate relatively large civil tolerances while providing for smaller mechanical tolerances required for the rail. This is achieved by allowing the rail position to be adjusted both vertically and laterally during installation to achieve the fine tolerances required by cranes. Once the final rail level has been set, the steel support is grouted into position.

4.6 ANCHOR BOLTS

Anchor bolts secure the soleplates and therefore the crane rail system into the concrete foundation. In conjunction with grout, anchor bolts also transfer lateral loads to the foundation.

The number, diameter, length, embedment depth and material grade should be determined by the CRSS.

The type of anchor bolts used depends on whether the crane beam is new or of an existing construction.

Pre-formed voids or bolt pockets are sometimes preferred for new builds as they can be cast into the new structure, avoiding post drilling of concrete and the possibility of damaging the steel reinforcement. Bolt pockets also offer reasonable amounts of tolerance to position the steel soleplates.
Drilled holes are most common for existing concrete foundations. Locating existing reinforcing and co-ordinating bolt holes in the sole plate to avoid reinforcing can be time consuming. In this case, the contractor can work with the CRSS to determine the allowable variation tolerances in the installation.

Pre-cast bolts are possible but not preferred for new installations as final anchor bolt positions are set before the arrival of the steel soleplates which can give rise to fitting issues. To be successful, this approach requires highly accurate templates for bolt installation, and oversize holes in soleplates to allow a small amount of misalignment.

In all cases, and where possible, the position of anchor bolts and steel reinforcement should be such that potential interference is avoided.

Anchor bolt diameter and mechanical properties are selected based on design loads.
It can be advantageous to select the same grout for anchors as for sole plate grouting.

4.7 GROUT

Providing a perfect bearing between the sole plate and the concrete below, grout provides permanent and uniform support for the steel sole plate. Grout is typically poured to above the bottom face of the sole plate and thereby provides lateral bearing support to the sole plate. Grout is adhesive, and therefore also provides some lateral load support even if poured only to the bottom face of sole plate.

Crane rail system grouts can either be cement- or epoxy resin-based. Grout strength should be suitable for calculated compressive loads and be appropriate for the required thickness.

Chemically resistant and not affected by water, oils and greases, grout should not shrink when curing, and should be free flowing in the local environmental conditions where it will be poured.

The choice of grout can vary depending on local practices, availability, time-to-operation, service-life, and cost.

Epoxy grout is recommended for all applications due to its excellent performance under dynamic loading and its greater reliability during installation, e.g., less prone to mixing problems.

Prior to installation of a crane rail system, the concrete surface to be grouted should be suitably prepared to ensure acceptable bonding with the grout. The method used should ensure that all loose and weak concrete is removed along with all laitance, greases, oils, and other contaminants.

Grout suppliers should certify that grout is suitable for specific applications and loading requirements. If there are concerns related to the grouting installation process, it is common to engage a grout expert to provide oversight and certify that the installation is acceptable.

4.8 RAIL TRENCH INFILL

Rail trench infill can provide some support, e.g., wheels driving over rails, assist with keeping out water and refuse from the rail trench, and provide rail lateral support. Asphaltic concrete is often used because it has key features required such as: ease of installation and removal, flexibility to accommodate rail movements, and to some extent to keep out water to protect the rail and other hardware. Manufacturers offer alternatives to trench infill based on specific design requirements. Today, depending on local conditions and to allow for rail inspection, it is common not to provide any infill or to provide an easily removable aggregate material.

Image 6: Asphalt trench infill around a lightweight rail for an older, slow moving RMG crane.

4.9 CRANE INTERFACE

Rail systems should be constructed to achieve the mechanical tolerances specified by crane manufacturers. Installation tolerances, therefore, often refer to standards such as ISO 12488, FEM, and VDI 3576.

VDI 3576 “Rails for crane systems – Rail connections, rail beddings, rail fastenings, tolerances for crane tracks” provides particularly useful guidance.

Due to extreme loads, crane stops at the ends of rails are typically not mounted on the rails but are secured into the wharf foundation. Design recommendations for crane stops are not covered in this paper.

Crane rail clamps and storm anchors, wheel flanges, and any other parts of the crane gantry system must be clear of the rail clips and anchor bolts.

For large quay cranes, systems for tie-down during storms and general parking of cranes, should be designed to suit the foundation support. The amount of deformation in crane tie-down systems and cranes themselves should be considered when designing rail systems in the crane stowage area, as well as when selecting the wheel flange geometry, i.e., consider the wheel tread to rail head gap. Issues to consider for severe storm load conditions include ensuring that wheels do not lift excessively, e.g., flanges remain in contact with the rail head, and that the rail does not rotate excessively causing rail clips to break.

Wheel geometry design should account for rail head geometry and proper wheel alignment tolerances selected to avoid accelerated rail head wear.

4.10 PROTECTIVE TREATMENT

The majority of ports are located in marine environments, and therefore, with the exception of the crane rail and elastomer-based components, the entire rail system – including sole plates, holding-down bolts, rail fastenings, bolts, washers, and nuts – should be protected from corrosion. A typical requirement is hot dip galvanization after fabrication or the application of an equivalent protective coating.

Image 7: The harsh environment in which crane rails must perform

As an alternative, exposed areas of base plates, rail fastening assemblies, and holding down bolts should be painted with a suitable protective system, such as a zinc-rich primer with epoxy top coat. The crane rail, with the exception of top surfaces in contact with wheels, may also be painted. Painting processes should conform to manufacturers' recommendations.

Care should be taken to ensure that coatings do not affect clip rubber noses or rail pads.

5.0 RAIL INSTALLATION

To ensure compatibility between all components and to define responsibility, it is recommended that the entire crane rail system be purchased from a single reputable CRSS.

Installation of crane rail systems requires specialist knowledge, skills, and equipment. It is recommended that the installation is also undertaken, or, at a minimum, supervised by the CRSS.

Grouting and rail welding should be given particular attention as they are the most common causes of failure.

Installation tolerances must be agreed upon between the customer and the installer.
Installation tolerances generally refer to ISO 12488 standard or VDI3576 guidelines.

Installers should provide an installation method statement or procedure prior to starting work for the owner to review.

Installers must ensure that site preparation, installation method, and workmanship accuracy deliver a durable crane track adapted to specific customer needs. An independently certified as-built survey should be provided prior to hand-over of the rail system.

5.1 RAIL WELDING

Joining rail sections into a continuous rail is problematic, particularly with certain welding methods. The most reliable and economic methods are typically:

- Aluminothermic welding
- Flash-butt welding
- Enclosed arc welding

Image 8: Rail thermite welding

Civil design may include expansion joints, in which case rail joints should be located away from the expansion joint. See Section 5.2 for more on expansion joints.

Crane rail joints should be vertical and square to the longitudinal axis of the rail.

All welds should be ground flush at the rail head and rail foot (flange) to avoid stress concentrations. Welds at the rail web should be ground where they join with the rail. Welds should be tested for external and internal defects using suitable methods, e.g., ultrasonic inspection (UT).

5.2 RAIL EXPANSION JOINTS

Quay crane wharves and long yard crane beams typically have expansion joints that must be spanned by the rail.

A CRSS can provide a special design for expansion joints, typically involving a tapered rail transition and special base plates and rail clips. These designs will allow smooth traversing and help limit rail wear at such locations.

5.3 RAIL ALIGNMENT

Rails that are out of tolerance in the horizontal plane, either locally or that have a variation of gauge over their full length, will result in premature wear of rails and wheels. The amount of wear will depend on the nature of the misalignment and relative material strengths. With correct design and rail installation there should be little or no discernible wear of rail or wheel other than initial flaking from large contact stresses as the wheels and rails “wear in”.

Rails improperly vertically aligned will result in warping of the crane structure. If significant, this can lead to premature fatigue failures in the crane structure. For quay cranes, warping will affect the alignment of the crane boom with the containers on the vessel.

ISO 12488-1 is a practical guide for rail installation tolerances. This standard provides tolerances for three grades of installation accuracy, correlated with the expected travel distance of the crane during its life and can be used for both rail installation and the design and manufacture of the crane gantry systems. The standard also includes requirements for the vertical angle of rail and straightness of rail end stops.

Image 9: Base plates in position prior to pad, rail, and clip installation, and grouting

6. OTHER TYPES OF CRANE RAIL INSTALLATIONS

The considerations presented in this paper generally apply to the straight gantry crane rails for quay and yard cranes. The following section presents some additional considerations regarding trolley rails on cranes and curved quay rails.

Image 10: Trolley rail and clips on dual trolley STS crane

Image 11: Trolley rail transition joint

6.1 TROLLEY RAILS

Trolley rails are subject to less loading than gantry rails, but typically experience many more loading cycles and higher wheel speeds. Generally, considerations regarding gantry rails apply equally to trolley rails in that design loads and cycles of operation must be considered, and a soft mounting will improve rail and wheel performance. Some crane manufacturers integrate the trolley rails into the structure by welding rails to the girder and boom structure. This is a specialized manufacturing process which requires special considerations in the design and execution of proper bearing, alignment and rail welding to accommodate large local fatigue stresses caused by shear reversal.

6.2 BOOM TO GIRDER JOINT: TROLLEY RAIL

Trolley rails on quay cranes have discontinuous joints at the boom hinge to allow the boom to be rotated and raised to clear ships superstructure.

The situation here is similar to a wharf expansion joint, except that due to the large number of cycles, the wear by the trolley wheel is a far greater issue than for the gantry rail expansion joint. These rail joints generally require frequent maintenance, in particular on cranes with heavy trolleys. Crane manufacturers, rail system suppliers, and CRSS can provide special designs that address this complex design issue.

6.3 CURVED RAILS

Image 12: Main: Curved rail system with switches, Right photos: Switch and “Frogs”

Some locations require cranes to work on non-linear wharves, follow a curved train rail or operate on wharves located at 90 degrees. In such cases, a curved crane rail system may be required. Typically, the curvature of the rail requires that the connections between crane equalizer beams and bogeys are articulated to allow rotation around a vertical axis. Experienced rail design engineers can optimize the curvature of rails for specific crane configurations and layouts to allow cranes to travel as smoothly as possible and avoid expensive side-shift mechanisms in gantry components. Crane gantry drive control systems are adapted to compensate for the relative speed difference between crane sides when traversing the curved track. Some curved rail systems also incorporate switches to permit crane operation on straight rails after a curve section. Specialized “frog” systems are needed that may also require adjacent crane wheels to be independent rather than coupled due to differential wheel rotation when traversing the frog.

7 CONCLUSION

Specific considerations and recommendations regarding selection and installation of rails systems have been presented in this paper as guidance.

The design of crane rail systems is not well covered by International standards and should be undertaken by a crane rail system specialist (CRSS), who should be a rail system supplier, a qualified specialist contractor, or a qualified consulting engineer.

To ensure compatibility between all components, it is recommended that the whole crane rail system be purchased from a single reputable CRSS.

Crane rail installation requires specialist knowledge, skills, and equipment. It is recommended that this is also undertaken, or, at a minimum, supervised, by a CRSS.

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Images provided by Gantrex, Liftech, Gantrail, KLN Rail Maintenance, and Wikipedia.

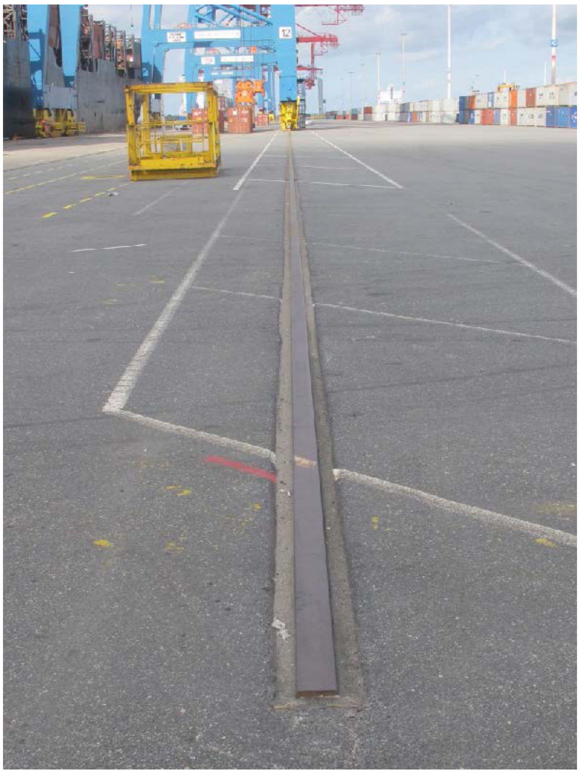

Image 13: STS crane rail installation

ABOUT PEMA

Founded in 2004, PEMA provides a forum and public voice for the global port equipment and technology sectors. The Association has seen strong growth in recent years, and now has more than 100 member companies representing all facets of the industry, including crane, equipment and component manufacturers; automation, software and technology providers; consultants and other experts.

Chief among the aims of the Association is to provide a forum for the exchange of views on trends in the design, manufacture and operation of port equipment and technology worldwide.

PEMA also aims to promote and support the global role of the equipment and technology industries, by raising awareness with the media, customers and other stakeholders; forging relations with other port industry associations and bodies; and contributing to best practice initiatives.

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