AL ITTIHAD FOOTBRIDGE

STEEL ARCH PIPE FOR FOOTBRIDGE PROJECT

Project Name	Footbridge at Al Itihad Road, King Faisal and King Abdul Aziz Street Project
Project Owner	Government of Sharjah Roads & Trans. Authority
Consultant	CH2M
General Contractor	Waagner Biro Gulf LLC
Project Location	Sharjah, United Arab Emirates
Total Tonnage	254 MT
Delivery Date	April 2017

INTRODUCTION

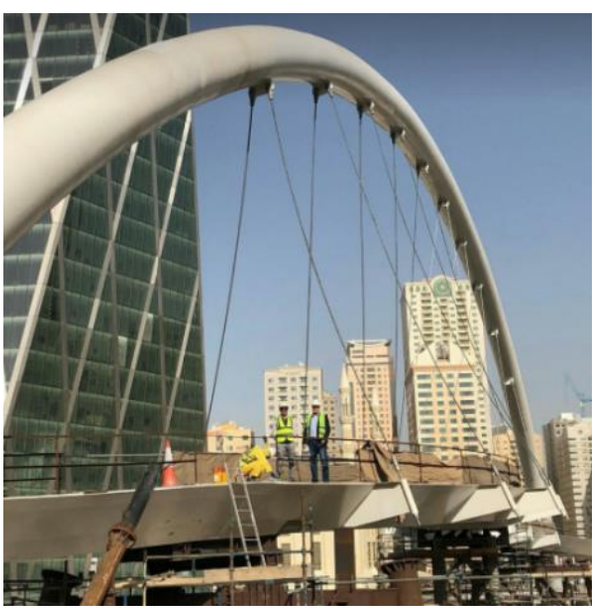
ESC Group was contracted by Waagner Biro Gulf Middle East Bridge Division for the specialty heavy steel fabrication of the heavy pipe arch for a new foot bridge over Al Ittihad Road, one of the busiest highways in Sharjah, United Arab Emirates.

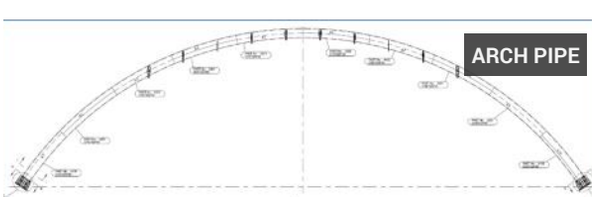
Prior to this project, pedestrian crossing of the Al Ittihad Road, which connects Dubai to Sharjah, was a serious hazard to the public. The Sharjah Urban Planning Council approved the unique footbridge design, which consists of a single arch that spanned over 92 metres length and 25 metres height. The arch was broken down into single 10 metre length pieces to accommodate less complex transport and easier handling. The arch would be constructed in situ and splice welded on site, where they would eventually meet in the centre section.

ESC Group during the tender phase submitted detailed documentation, showing full workflow, timescales, previous similar case studies and the necessary certification for CE marking of both raw materials and end product to BS EN 1090-1 and BS EN 1090-2 Execution Class 3.

ESC's engineers effectively communicated with all the technical queries submitted both by the main contractor and the consultant in Europe. ESC had the advantage by having both offices and skilled personnel in the United Arab Emirates – the project country and China - where the steel raw material was procured and the product was fabricated .

Prior to production, ESC completed a comprehensive Inspection & Test Plan (ITP) with a breakdown of all the processes which included: welder qualification review, raw material inspection, component dimensional inspection, weld inspection and coating inspection. Strategic review, witness and certify hold points were incorporated for each of the stages. A 3rd party inspector was selected for the project as well by ESC and accepted by the client. After several iterations working with both the project client and consultant, the ITP was agreed and approved well before production started.





The steel bridge arch design required a 1524mm circular hollow section at a 60mm thickness at S355J2+N steel grade. Certain sections of the arch called for special steel grade S355+N Z25, where the Z25 required extra testing for thorough thickness ductility, important for special bridge components for both when high loads are transmitted through the thickness and also where large welds are specified on elements that are restrained against shrinkage. Few pipe mills in the world could produce this at such a low diameter to thickness ratio. The pipe section was also formed in a single piece using the JCOE process with a single longitudinal submerged arc weld.

Email: info@escsteel.com
Website: www.escsteel.com

AL ITTIHAD FOOTBRIDGE PROJECT

FOOTBRIDGE PROJECT

To bend the arch into a gradual curve required state of the art heat induction bending. Heat induction bending is used by locally heating the section along the length whilst pivoting it around a preset bend radius. The heat has to be very localized to prevent the previously bent section from plastically deforming producing an uncontrolled distortion. Each pipe was carefully checked using both manual methods and laser positioning equipment to calculate whether the bent product was within the project specific tolerances. The pipe weld was also inspected before and after heat induction bending.

After the heat induction bending, the pipes were slotted to include the hanger plates for the suspension cables. The footbridge deck followed a snake bend trajectory to improve aesthetics. Due to this, the geometry of the hangar plates all followed various planes relative to the plane of the arch which made fitting a complex matter. Using cutting edge laser sensors and highly skilled fitters, precise slotting and fitting was able to be carried out. All plates required full penetration double sided butt welding on a very thick section. This required a well-planned WPS (Weld Procedure Specification) and AWS trained welders working in confined spaces both inside and outside the pipe. Worker health and safety was always the number 1 priority and all appropriate measures were taken to prevent any accidents or health hazards.

ESC completed and packed the pipe arch segments to minimize any chance for damage during shipment. The pipe segments were successfully delivered on time in May 2017 and construction is scheduled to commence in Q3 2017.

ESC SCOPE OF SUPPLY

ARCH PIPE

ARCH BRIDGE OVERVIEW

ESC has been awarded with the contract to supply steel arch pipe for footbridge at Al Ittihad Road located in Dubai, UAE. The arch pipe consists of 10 sections, ESC scope of supply includes the entire 10 sections of arch pipe which consist of OD1524x60mm arch pipe, welding of arch diaphragm plate to arch pipe, fabricated and welded flange plates, stiffener plates, circular plates, and base plates for the first and tenth arch pipe. All the material fabricated in accordance with EN 1090-2 with quality class EXC3.

OD1524mm LSAW STEEL PIPE FORMING

PROCESSES

BEVELLING

LSAW PIPE FORMED

THERMAL INSULATION AND WELDING

All welds tested in accordance with the Manual of Contract Documents for Highway Works Volume 1 Specification for Highways Works – Series 1800 Structural Steelwork category F56.

HEAT INDUCTION BENDING

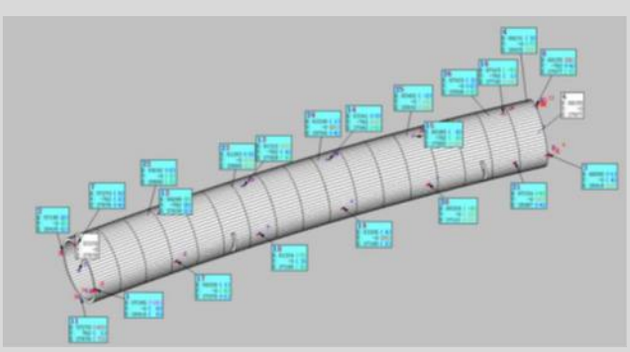
PROCESSES

Heat induction bending is carried out to form the desired bending angle for each pipe section. The heat induction bending temperature is controlled to ensure it is within 900°c to prevent changes in mechanical properties of the arch pipe. A sample from the bent arch pipe is taken to perform a mechanical test to ensure the mechanical properties after heat induction bending remain within the requirements in the specification.


TEMPERATURE CHECK


NDT


DIMENSION INSPECTION USING TOTAL STATION



The above figure shows the results from total station inspection. Total station is used to ensure high precision and accuracy dimensions can be obtained and prevent a mismatch of each section during the field installation process.

Email: info@escsteel.com
Website: www.escsteel.com

FABRICATION OF ACCESSORIES

ACTIVITIES


FLANGE PLATE


BASE PLATE


STIFFENER PLATE


DIAPHRAGM PLATE

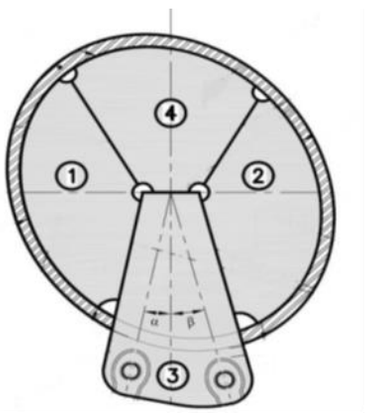
All steel surfaces that are to be welded are grinded to minimize the risk of defective welds.

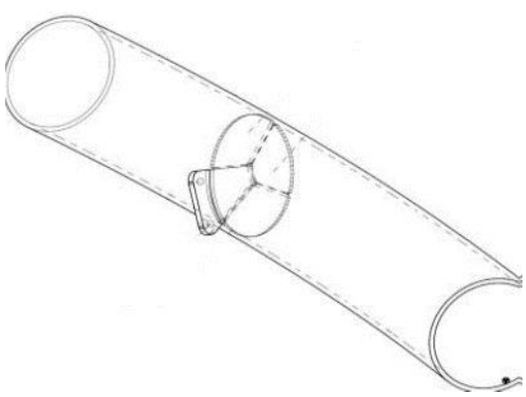
All external longitudinal welds are ground flush for aesthetic purpose.

ACCESSORIES

WELDING & ASSEMBLY

Since the diaphragm plate is designed to be at an angle to the arch pipe, in order to maintain the accuracy of the angle, special precaution is required when welding and installing the diaphragm plate.





Step 1 – Fin plate hole on pipe is measured and cut for the installation of fin plate .

Step 2 – Assembly of the diaphragm plate using the sequence .

Step 3 – Spot weld each assembled diaphragm plate.

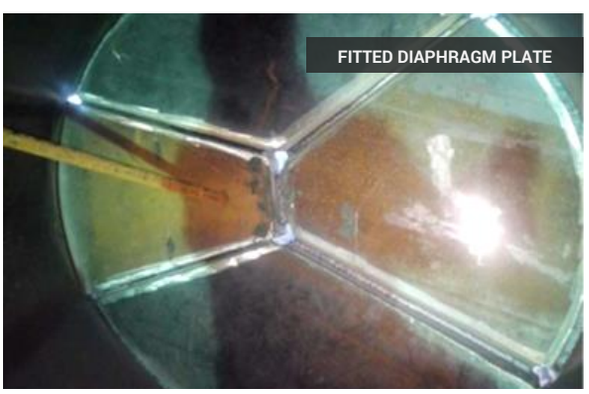
Step 4 – Remove fin plate to prevent the welding stress affect the position and angle of the fin plate.

Step 5 – Fully weld plate , , and .

Step 6 – Finally install and fully weld fin plate .


SLOT FOR FIN PLATE


WELDED FIN PLATE


FITTED DIAPHRAGM PLATE


WELDED BASE SUPPORT

Email: info@escsteel.com
Website: www.escsteel.com

INTERNAL SURFACE

PAINTING

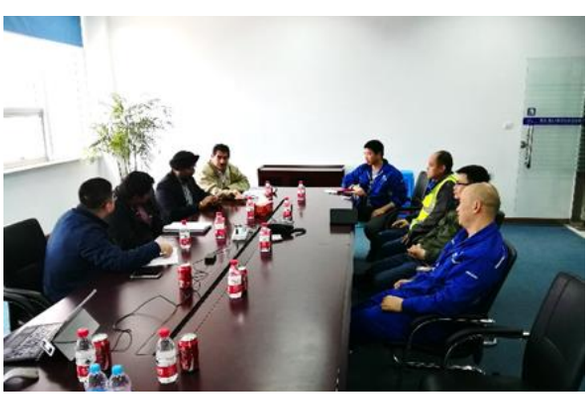
Internal surface that is inaccessible at the field (after the installation of diaphragm plate in the factory) will be painted with one layer of SigmaPrime 200 (manufactured by PPG) with a total DFT of 100 microns.

The steel surface quality is prepared to achieve Grade P3 as per ISO 8501-3 prior to blasting process. The surface is blasted to a cleanliness level of class Sa2.5 as per ISO 8501-1.


SLOT FOR FIN PLATE


FITTED DIAPHRAGM PLATE

CLIENT VISIT



FINISHED PRODUCT

Email: info@escsteel.com
Website: www.escsteel.com

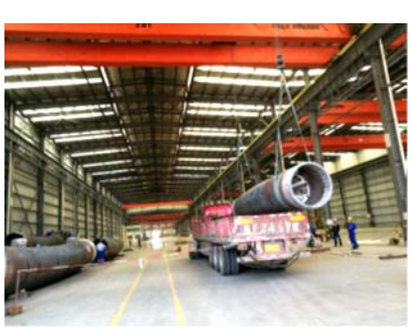
PACKING & EX-MILL

EDGE BEVEL PROTECTION

Since field weld connecting each arch pipe section is required, a bevelled edge is prepared on each section of arch pipe. Special protection is made on each pipe end to prevent damage to the bevelled edge during handling and shipping process.

PACKING & TRUCK LOADING

Due to the shape and components of the first and last arch pipe (two arch pipes with flanges), a foundation is designed for the packing and delivery purpose. The foundation serves to secure the arch pipe to prevent damages during the stacking and shipping process. Each section of arch pipe will be secured with 3 foundations.

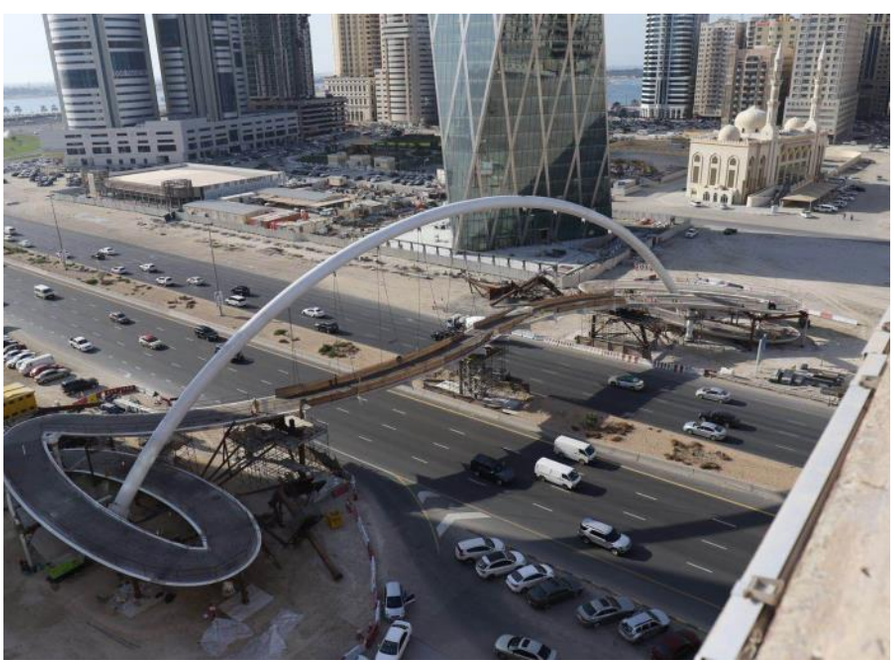


SHIP LOADING

The ship loading process carried out in Luojing Wharf of Shanghai on 16th April 2017. ESC sent two representatives to witness the entire ship loading process (One logistic controller and one QC personnel).

Email: info@escsteel.com
Website: www.escsteel.com

ARCH PIPE AT CLIENT SITE



COMPLETED PROJECT