# FIDIC Awards 2015
## Nomination Form

Please enter all information requested below for each entry (signatures by the submitting firm(s) and the client(s)/owner(s) are required). The FIDIC Jury will discard nomination forms missing any required authorisation/signature. Names and information should be typed or printed.

Applications should be accompanied by up to **5 photographs** (JPG format in high resolution) of the project being nominated. Pictures should not be tables or graphics describing the project. Please return this form by email as PDF to the FIDIC Secretariat at fidic@fidic.org or by Fax at +41 22 799 4900 **before 19 June 2015.**

### THE PROJECT

Project Name: Harbin-Dalian passenger-dedicated line (PDL)

(as it is to appear in the award)

Project Location:

Country: The People's Republic of China

City: Harbin-Dalian

Purpose: Harbin-Dalian passenger-dedicated line (PDL) starts from Dalian, the coastal city in the south, stretches to Harbin, the capital of Heilongjiang province via Yingkou, Anshan, Liaoyang, Shenyang and Tieling in Liaoning province as well as Siping and Changchun in Jilin province. The PDL connects the above-mentioned three provinces in northeast China, totaling 903.945km. The PDL, which is the first high speed line with design speed of 350km/h, separates the passenger transport from freight transport, greatly improving the service quality of railway passenger and freight transport besides fully unleashing the capacity of the existing Harbin-Dalian railway. It is of great significance to promote a balanced economic development in northeast China, build an economical society, and to ensure that the goal is fulfilled to build a moderately prosperous society in all respects. What's more, the Harbin-Dalian PDL is an integral part of Eurasia continental bridge in northeast China connecting Democratic People's Republic of Korea (DPRK), Republic of Korea (ROK), and Japan via Dalian port in the south direction, and directly linking Russia and Mongolia through Binzhou, Changbai, and Baa railway lines in the north direction. The building of this PDL will result in a great enhance to the traffic capacity of the corridor, playing an important role in developing international multi-model transport and an export-oriented economy in northeast areas in China.

Year of completion: November 2012 In operation since: December 2012

**Questions to be responded to by the firm submitting the application**

**Why do you think this project should receive an award? How does it demonstrate:**

- innovation, quality, and professional excellence
- the principles of transparency and integrity
- sustainability and respect for the environment

**What services did the member firm provide to the project? Please describe briefly.**

**1. Complicated system design and excellent project quality**

Harbin-Dalian PDL is the first high speed line with design speed of 350km/h located in the extremely cold area in the world. Along the line, the lowest cold reaches -39.9℃ and the snow accumulates 30cm to the maximum. Aiming at the world-class PDL and by means of technology tackling and innovation, the project team designs the six subsystems including civil engineering, traction power supply, communication & signaling, EMU, operation dispatching and passenger service. Therefore, best matching of subsystems are realized.

From the opening in December 2012 to now, the project withstands all kinds of severe natural conditions, all equipment works well and the project quality is fully proven.

**2.Key technological challenges tackling and advanced innovation achievements**

The engineer researches the key technology in extremely cold area and has made many scientific research achievements, which is of high value for technology popularization of passenger-dedicated line construction and related industry in extremely cold area.

(1) Ballastless track technology for extremely cold area

In order to improve the track durability for the project in extremely cold area, the engineer improves the slab track technology of CRTS I for extremely cold area. Through pre-tensioning method and post-tensioning method in prestressing system for track slab trial laying test, it optimizes the dimension of track slab; with thermo-extrusion prestressed steel rob, it improves the anchor pocket structure, betters the construction technology, and reduces the production cost. (See Figure 1)

On the basis of deterioration mechanism analysis for cement-emulsified asphalt mortar, the engineer selects matrix asphalt, adds polymer, selects defoamer to improve the performance of low temperature resistant for cement-emulsified asphalt. Combining the trial laying test results of four kinds of mortar: SL-1; SL-1—40B; SL-2 and PMC, the engineer clarifies the design requirements of technical index for anti-fatigue performance, low temperature anti-cracking performance, ratio of low temperature comprehensive strength and low temperature elasticity modulus.

(2) Anti-frost heaving subgrade

1) From the out ring of track plate base to cable trough, C25 fibrous concrete is casted on site

to a thickness of 6cm to 10cm. An isolation layer of plastic foil is installed at expansion gap of fibrous concrete and the joints at track plate base or cable trough, which later are poured by hot asphalt mortar.

2) It is proposed in a creative way that the content of graded crushed stone at surface layer of subgrade bed with a grain size of d≤0.075mm shall not exceed 5.0% (of weight ratio), while that figure shall not surpass 7.0% (of weight ratio) after compaction.

The subgrade bed base within the maximum freezing depth chooses of Group A and Group B fillers with a grain size of d≤0.075mm and grain content of 15% or below.

3) Anti-frost heaving berm, whose height and depth surpasses the maximum freezing depth of the season, shall be set at both sides of the embankment slop.

4) Thanks to the three frost-heaving surveillance measures adopted – subgrade track inspection, manual benchmark observation and automatic monitoring, the engineers now have a correct reading on the occurrence and distribution of frost-heaving damage, realizing efficient and scientific maintenance.

(3)Solution to soft foundation

Since there is quite a long section of Harbin-Dalian PDL on soft foundation which is featured with various depth of soft soil layer as foundation base and great difference in physical indexes of different soil layers, targeted measures are taken based on specific conditions. CFG pile is used at the foundation base to consolidate the relevant section, and the pile + cushion course, piling geogrid, or piled raft is used according to the actual layer conditions, width or depth of backfill. It is proved through settlement observation and operation that the subgrade settlement control meets the relevant requirements.

(4) Anti-frost heaving design for box girder bridge, frame bridge, and culvert

The existence of transverse structures such as culvert, frame bridge, and box girder bridge in cold area may affect the surrounding subgrade. In winter, the wind tunnel effects resulting from the aforementioned transverse structures can deteriorate the subgrade congelation, causing worse frost heave, thaw compression, or thaw collapse. The anti-frost heaving design is applied to the subgrade close to transverse structure in this project, and the design structure is composed of heated board that prevents cold energy from spreading and frost protection layer.

(5) Large-span bridge design

1) Comprehensive critical technologies for 56m-span simply-supported box girder

Pre-stressed simply-supported concrete box girder with a span of 56m is used for the bridge of double ballastless track crossing the Pulandian bay, which is the largest span for PDL construction in China to date. (See Figure 2)

With the construction site, construction period, the ensuring of construction quality, and other factors considered, the following methods, such as prefabricated segment, cast-in-situ grouting with movable frame are used to ensure quality.

The design and construction practice of the beam has shown that the pre-stressed simply-supported concrete girder has good vertical, lateral and torsion rigidity, which can cope with the comfort and safety demand for passenger dedicated trains as well as the requirement of ballastless track; theoretical calculation for deformation of the box girder and also stress of the control cross-section and field monitoring result also validated the appropriateness of

boundary conditions and design parameters, providing successful experience for similar bridge design and construction.

2) 138m-span steel bridge stacked tied arch bridge technology

The PDL trunk line crosses over the Fumin street in downtown Changchun city, and applies 1-138m span steel bridge stacked tie arch bridge.

The bridge has upper and lower arches with different rises, which makes the bridge attractive for its vertical view, becoming a distinctive landscape.

The solid round steel rigid boom is first applied on bridges in China, which is featured with a small angle of rotation at the beam end, which helps to reduce the deflection/span ratio, enhance structure rigidity, assure uniform stress condition of the boom and extend service life of the boom.

The 1-138m steel box stacked tied arch bridge which is featured with novel structure, attractive appearance and high technology is first applied in the railway industry. (See Figure 3)

(6) Tunnel with huge cross-section

Based on the construction organization scheme and in order to meet the needs of track laying in some sections, the inner profiles of Bijia Mountain tunnel and Taishan Mountain tunnel are enlarged to meet the requirements of bridge beam and beam transportation vehicle passing through tunnel after the main structure of tunnel is completed. The cross-section, the largest one in the tunnel of high speed double-track railway with an area of 205m2, meets the demand of beam transportation, optimizes the construction organization for the entire line, minimizes the number of construction yards for beam structure, and reduces the investment cost for the project.

(7) Housing structure

With full consideration given to the features of regional culture, we tried to make the newly-built passenger station a landmark structure, thus to improve the image of railway passenger transportation. In terms of cold proofing and thermal preservation, the relatively effective measure by using XPS together with dry hanging stones is taken to ensure that the thermal preservation material is prevented from rain and snow, and the XPS is protected from burning. More stones are used for the external elevation of building to limit the ratio of window to wall and reduce the usage of glass curtain wall. (See Figure 4)

(8) Trouble of moving EMU Detection System (TEDS)

Based on the features of Harbin-Dalian PDL in extremely cold area, the TEDS is established in the north of Shenyang, north of Dalian, west of Changchun, and west of Harbin to counter the potential security threat posed on EMU operation, , and monitor and predict the threats posed by rain, snow, or ice weather on EMU operation. The ice and snow removal shed is established in EMU maintenance depot. Tougher security measures are taken for EMU and the inspection and maintenance levels are increased for EMU operation, accumulating valuable experiences for developing high speed railways in extremely cold area. (See Figure 45)

(9) Turnout snow melting system

The Harbin-Dalian PDL is the first high speed railway in extremely cold area in the world. The turnout snow-melting and gap monitoring system adapting to the extremely cold is proposed for the first time, resulting in great reduction to labour intensity of railway staff, and a better work

place and efficiency.

The turnout snow-melting system as the overcome technical difficulty was awarded as China's top 10 news of progress in science and technology in 2012.

(10) OCS de-icing technology

The OCS icing-proof/de-icing technology fills the technical blank of railway traction and power supply system in China, and is quite instructive to other railway projects. The application of this technology will highly enhance the operation reliability and maintainability of traction and power supply system, and raise the modernization and automation level of the equipment.

(11) Movable OCS technology

The inspection shop of EMU depot uses movable OCS technology that the shop door automatically seals after EMU enters and exits during severe cold season to keep the indoor temperature.

(12) Disaster prevention and safety monitoring system

The disaster prevention and safety monitoring system for Harbin-Dalian Passenger Dedicated Line is built as an one-phase project locating in extremely cold area with the longest extension, the largest number of monitoring points and the most complete monitoring items which include wind speed and direction monitoring, rainfall monitoring, snowfall monitoring, earthquake monitoring and foreign object invasion monitoring.

**3. Promote sustainable development and emphasize environmental protection**

Since the operation starting from December 2012, the Harbin-Dalian PDL has passed tests under all kinds of adverse natural conditions with trains operating smoothly and all the equipments performing well, proving a high quality project.

Harbin-Dalian PDL owns the advantages as less land use, low energy consumption, large capacity, few pollution, all-weather operation and strong adaptability. The journey time of through train on Dalian-Harbin line that originated 14 million passengers in 2014, only lasts 3.5hours, which facilitates passenger travel, cuts down social transport cost and drive local economy development.

Given the requirements on passing main economic points, ensuring safety and meeting technical specifications, for the alignment of the line, attentions are paid to use land intensively. There are 163 bridges totaling 657km on the entire line, accounting for 72.7% of the total length of the line, a high ratio. In addition, energy-saving slope is used in the profile to reduce energy consumption, movable OCS technologies are applied for the gate in EMU servicing workshop to assure inside temperature and save energy via automatic closing and opening.

At the early stage of Harbin-Dalian PDL construction, the demonstration of environmental protection was conducted with special funds invested in environmental protection as well as water and soil conservation, and the special acceptance was passed.

**4. Implement transparency principle and persist in fair and clean principles**

The Harbin-Dalian PDL energetically implements the leading ideas such as FIDIC contract management, risk management, and sustainable development, adopts the bidding way that is transparent, efficient, and competitive for the consulting service of project design. The design unit, based on quality and abiding by professional ethics and integrity principle in work, offers professional, objective, and impartial services and advices to its owners. Project construction

and procurement are tendered publically and transparently. Technology-oriented principle is upheld to offer reasonable advices to owners. Incorruptible principle is implements throughout the construction period, and the corruption risk prevention mechanism is established.

The auditing at all levels in China is conducted after the completion of project, and no violation of moral concepts occurs on a consulting engineer.