



**CHỦ ĐỀ - WEARING COAT OF STEEL BRIDGE DECK OF THUAN PHUOC FROM RESEARCH TO REALITY**

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website calling for competent contractors to prepare and submit technical proposal for wearing bridge deck of Thuan Phuoc.

Joint venture MBA including 4 construction consulting companies in Da Nang whose representative Khoa Engineering & Construction Company (BK-ECC) had succeeded with their technical proposal applied above self-sticky rolled membrane in advance Bituthene 5000 SQ as a water proofing membrane. They were chosen as a subcontractor for researching and constructing the wearing coat of steel bridge deck of Thuan Phuoc. This structure was approved by People Committee of Da Nang city under Decision No. 10/UBND dated 10th March 2009 with notices in details about verifications of fitness of materials and contract implementation. MBA suggested investor that a deeper experimental research needed to be carried out to verify and choose the best materials and technology for wearing coat of steel deck of Thuan Phuoc in accordance with practical conditions on temperature, construction progress and limited budget.

**III. RESEARCH AND EXPERIMENTAL PROGRAMMES ON MATERIAL CHOOSING FOR WEARING COAT OF STEEL BRIDGE DECK OF THUAN PHUOC**

The research and experimental programmes include material tests for water proofing layer and different temperature ranges in working condition separately and simultaneously. On the other hand, they also had the job to monitor temperature of the steel deck continuously to define working temperature interval which is not harmful for the steel deck through its whole working. MBA kept collecting material samples, technical documents, contacting with international leading road experts, business traveling abroad to different countries such as Singapore, Thailand, Malaysia, ect... in time to test and choose feasible material and technology. Then, material samples were sent to advanced laboratories abroad to test some criteria which could not be carried out in Vietnam.

Engineers from Da Nang decided to set up an official temperature measurement after box girders had basically been welded together. A temperature monitoring of the steel deck was continuously carried out for one week from 18th to 24th April 2009 under the witness of the Project Consulting and Supervision. The result told that the temperature measured is quite higher than expected (the highest daily temperature is 60°C), especially that on midday of 19th is 84°C. This is a very inconvenient thing for road structure. Some changes about material choosing and construction technology needed to be done to ensure the structure.

With the result, these engineers immediately contacted with foreign experts to exchange available materials in the market which are able to meet with high temperature working condition. They sent more material samples to laboratory abroad for relevant physico-mechanical criteria assessment.

**Materials in experimental programme.****Water proofing/sticky materials:**

1. Self-cold sticky rolled membrane in advance Bituthene 5000, Grace Construction (USA).
2. Warm rolled membrane in advance Poliflex HV 25 AV, Polyglass (USA).
3. Poplytop (for membrane spraying), ATEX (Korea).
4. Bridge Deck Membrane (for membrane spraying), Bridge Preservation (USA).
5. Polymer PMB III mixed with organic cellulose, Shell (USA).
6. Epoxy, Chemco System (USA).

**SMA.**

According to technical standard issued by Transport Engineering Consulting Joint Stock Company, SMA construction technology composed by Joint venture MBA adjusted to Vietnam condition, SMA contains mineral fiber cellulose, high content of asphalt (6.5-7,0%) to increase elasticity, fatigue resistance and aging resistance of wearing course.

**Epoxy.**

Epoxy Asphalt mixture and Epoxy specialized tack coat for steel deck has its main difference. It is used instead of conventional asphalt.

**Assessment of experimental series.**• At normal temperature 30°C, collapses as material is tested in different positions:

- With Bituthene 5000 SQ, collapse occurs between surface of steel slab and rubberized asphalt.
- With Polyurea (Polytop or Bridge Deck Membrane), the collapse occurs at tack coat between membrane and proofing layer.
- With material in advanced asphalt, the collapse occurs among asphalt membrane (the tack coat on steel deck is quite good).
- At over 40°C, with Bituthene 5000 SQ, collapse mainly occurs in Polyester reinforced membrane.
- At high temperature over 60°C, all collapse occurs in tack coat.

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- Polyurea mothered material (Polytop or Bridge Deck Membrane) has stable tacking and skid on steel slab when temperature changes (Direct tensile experiment). However, as above show experiment is done, collapses (pulling, skid) all occurring in tack coat between this membrane (Collapse in tack coat) has small force value.
- When temperature reaches up to 70°C, all available tack asphalts in market do not maintain that causes layer separation easily among SMA, except Epoxy. This is really dangerous for dur wearing coat because layers of SMA do not work at the same time while steel deck is suffering repeated deformation under vehicle load.
- With working temperature over 60°C, during long daily time, for SMA, though Polymer advan 3 with high melted temperature (over 80°C) is used, there are quite low phisico-mechanical cr it is hard to ensure expected long life of wearing coat due to risks of vertical cracks, tread rutt After laboratory and site researching period, engineers from Da Nang proposed to use Epoxy A coating the bridge at its part for motorized means due to its prominent working productivity di experimental programme on single and combined tack criteria at high temperature that other do. BK-ECC carried out sending local material aggregate samples to laboratories abroad to ass fatigue and rutting resistance, compared to researching SMA.

For sidewalk, SMA Dmax 9.5 with equivalent thickness to Epoxy Asphalt in its part for motoriz suggested to use to reduce expenditure in accordance with project budget. Tack coat and rust layer on bridge deck use with Epoxy Bond coat. It is sprayed in membranes by specialized equ coat spraying specialized equipment). To ensure feasibility of this proposal, engineers from Da contacted with Chemco System (USA) an Epoxy exclusive supplier for bridge deck. They passe requirements to be approved as a product application user. On the other hand, they continuou Thailand for Epoxy construction equipments checking, discussing equipment renting and collec exchanging necessary information for producing and constructing Epoxy Asphalt. It is necessa it costs 2 years of preparation with many strict ability tests, experiments, assessments and te transferring trainings for a contractor who used Epoxy to perform asphalt to 13 flyover bridges get approval from Chemso as an Epoxy application user under its global quality control policy. After getting policy agreement on structure adjustment from Department of Traffic and Transp engineers immediately composed construction technology procedure in details for wearing coa to submit it to Project Consulting and Supervising Unit and relevant parties before deployment so much time and requires high educated staffs due to translated information and documents foreign expert and short site checking during preparation period.

**IV. THE LASTEST PROPOSED MATERIALS AND TECHNOLOGY.****4.1 SMA for sidewalk.****4.1.1 Characteristics.**

- \* Interrupted aggregate, hard frame.
- \* Use Polymer advanced asphalt with high elasticity.
- \* High content of asphalt, use mineral fiber cellulose to stabilize and against asphalt melting.
- \* High elasticity and ability of aging resistance than conventional asphalt.

**4.1.2 SMA construction.**

Distributor Dynapac F140 C, Cienco6 is used to distribute SMA sidewalk on Thuan Phuoc Bridg is equipped with automatic sensing system. Its laser is used for ensuring smooth and thicknes order to perform job through bolts which are firmly welded with bridge deck before paving, en have manufactured a special iron placing for the former. It has simple compaction function like it helps distributor can go on top of bolts.

The first difference between SMA construction and asphalt concrete is compaction procedure. Engineers used cooking oil to grease surface of all rollers and compactors to avoid material sti off phenomena on rolling wheel because asphalt is contained much in SMA and on its surface. ensure density of SMA at edge of paving track, SMA is excessively paved 15cm compared to r designed edge. Then, it is cut backward to ensure for density of SMA and smooth at vertical jc

**4.2 Epoxy Asphalt.****4.2.1 Epoxy Asphalt production.**

Components of Epoxy Asphalt Binder are exported from Oaklan port, USA to Cat Lai port, Ho C continuously transported by truck to Batch Plant of Cienco 6 in 200 l tanks.

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Special mixer "Meter/Mix" produced by Chemco System was transported from Thailand and in: Batch Plant to make Epoxy. This specialized equipment has automatic meter to measure dose in Epoxy Asphalt, mix and spray them at temperature over from 110 o C to 121 o C into mixer (Installation at Batch Plant).

The matter of controlling temperature is an important factor to success of Epoxy Asphalt paving. Epoxy batch is discharged from batch plant to funnel by subcontractor, its temperature is checked by thermometer. Approved batch is discharged on 15 ton truck to transfer to the bridge with distance estimated time of 30 minutes.

Technically, Epoxy requires strict control on transport time to site because components of Epoxy will react and increase consistence of mixture. Long keeping on truck can make mixture hard to get through spreading screw of distributor and to be tightly compacted.

**4.2.2 Epoxy Asphalt construction.**

The first task needed to be done on site is to clean surface of steel deck. The deck is sand blasted and painted before installing. Because movement done by workers and other tasks on surface, it is dusty on deck by common equipments. A specialized high pressure water sprayer is mobilized. Leaning must be done before spraying tack coat at least 6 hours to ensure that deck surface is clean. Before Epoxy paving, contractor carried out spraying a tack coat Epoxy Asphalt Id on zinc blast. Epoxy Asphalt Id is a version that has consistence better than Epoxy Asphalt. After isolating, it is used as a membrane as a tack coat that is harder than Epoxy Asphalt.

Zinc paint, tack coat Epoxy Asphalt Id and Epoxy Asphalt layer are tightly compacted as long as possible. They form an effective rusting resistance system for bridge deck.

A tack coat mixing and spraying truck manufactured by Chemco System is also mobilized to site. This equipment will heat up components of tack coat layer, dose, mix automatically and spray on deck at temperature about 150 ° C through a sprayer system.

Contractor paved Epoxy Asphalt with paving thickness of 41 mm plus warp compensation layer. Temperature of Epoxy Asphalt on each truck on site, tasks of paving would be done like conventional paving with some small adjustments.

Project technical criteria require that primary compaction should be completed before temperature of mixture decreases less than 82 ° C. And compaction must be completely finished before temperature drops to 65 o C. Temperature limits is regulated to ensure that the mixture will be received necessary compaction before chemical reaction among components happens and significantly increases consistence of mixture.

A large quantity of rollers are arranged on bridge including two 20 ton rubber-tired-rollers, one vibrating roller equipped with cutting net and one 12 ton 3 wheel roller. Practical paving shows that 20 ton rollers are enough to use. The last is not necessary.

**4.2.3 Order and speed of construction.**

Due to process of construction is urgent, method of construction is set up in the way that Epoxy part for motorized means is maximally protected. Therefore, SMA on two sidewalks is firstly paved for other means still operating during paving time. Moreover, SMA constructing equipments are used on surface of Epoxy Asphalt that is reinforcing.

The paving of two sidewalks was initially finished with 2 days. Next day, contractor focused on paving of bridge deck (the deck had been cleaned, but sticky with some Epoxy Asphalt tracks caused by constructing equipments) and spraying Epoxy tack coat as regulated. Epoxy Bond coat B1d was paved on bridge downstream. Upstream is used for truck transportation. At back turn for trucks, a thin layer of Epoxy Asphalt was paved on tack coat layer to avoid Bond coat layer damage by truck.

Downstream part for motorized means was paved next with two paving tracks. Each track is 3 meters wide. After finishing this part, to improve overlaying speed as well as avoid making joint between 2 tracks, contractor decided to install long connector of distributor iron to overlay the rest with only one track for the whole bridge. This decision was proved to be successful due to smooth track and obviously improved paving progress.

The paving of Epoxy Asphalt finished in the morning of 26th, June 2009. At moment, construction of tiles for two girder edges protection where SMA could not do because of handrails still remains

Đã khó

Thực hiện

Chọn chuyên mục

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