



Application of EPS in Civil Engineering
by Ir EG Balakrishnan

Ir. Balakrishnan s/o EttyGauder is currently the committee member of Geotechnical Engineering Technical Division (GETD), IEM. He is a Director at GCU Consultants Sdn Bhd.

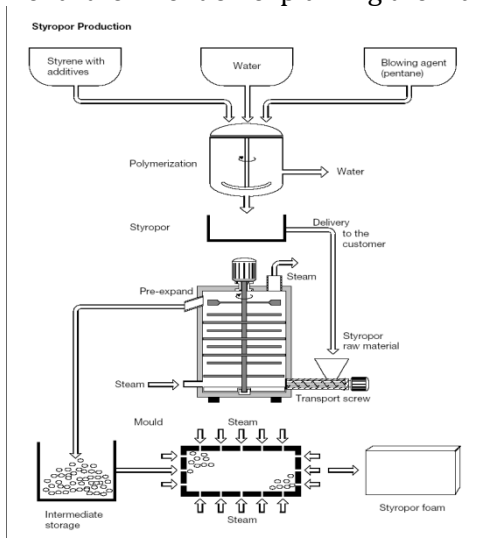
The evening talk on Application of EPS in Civil Engineering was organised by the Geotechnical Engineering Technical Division 28th August 2013 at the Tan Sri Prof. Chin Fung Kee Auditorium. The talk was delivered by Ir. Dr. Hj. Affendi Bin Abdullah. The talk was attended by 68 participants.

Dr.Affendi began by outlining his presentation as follows :

- a. What is EPS (Expanded Polystyrene)
- b. Manufacturing Process of EPS
- c. Features of EPS
- d. Mechanical and Physical Properties
- e. Chemical Resistance
- f. Why Use EPS
- g. Quality Assurance for EPS
- h. Some Construction Aspects
- i. Considerations in EPS Design
- j. Some EPS Applications in Malaysia
- k. Some Application Using EPS
- l. Some Application Using EPS in Road Construction
- m. Most Recent Case Study Using EPS in Road Construction
- n. Monitoring Data
- o. Use of EPS other than Road Project



The speaker introduced that EPS to the participants stating that the EPS is a thermal plastic material, free of CFC, HCFC and Formaldehyde. The material also meets the specification of BS 3837 : Part 1 :1986 and Malaysian Plastic Standard, SIRIM. The material retains its physical properties. He further went on explaining the manufacturing process as shown below:



The salient feature of the Ultra-Lightweight EPS is that it weighs only 1% of the weight of earth fill materials considering the densities of different fill materials:

- Expanded Polystyrene (EPS) 20 kg /m³
- Wood Chip 850 kg /m³
- Leca 1500 kg /m³
- Sand 1700 kg /m³
- Clay 2000 kg /m³

The speaker went on relating the mechanical, physical and chemical properties of EPS as well as the different grades of EPS available.

Comparison between EPS and Other Fill materials is featured as follows:

EPS MATERIAL	OTHER FILL MATERIALS
Low Density	Higher Density
Consistent make up	Variable make up
Engineered to meet expectation	Not Engineered to meet expectation
Few Limitations	Limitations in Handling
Not Weather sensitive	Weather sensitive

The speaker touched on Quality Assurance by relating the frequency for testing material strength and density as shown below:

Volume of EPS Fill	No of Blocks to be Tested
Less than 500 m ³	Minimum 1 Block
500 to 1000 m ³	Minimum 3 Blocks
Greater than 1000m ³	Minimum 3 Blocks per 1000m ³

Block dimensions and evenness should be on one out of every 25 blocks. Evenness and subsoil surface below EPS should be checked in cross-section every 10 meters.

The speaker also touched on the construction aspect related to EPS construction. No construction plant, other than compaction plant, shall be driven or placed upon the polystyrene until a minimum of 250mm of acceptable fill material or capping layer has been placed over the polystyrene. Vibratory compaction plant shall not be used to compact fill material within 500mm vertically and 2m laterally from the polystyrene shall be limited to a maximum weight of 600kg/m width until capping layer or pavement materials is completed to the finished road levels. A minimum 150mm thick reinforced concrete slab shall be cast directly on the Expanded Polystyrene (EPS) blocks. The concrete mix should be designed for strength of Grade 25 or higher, BRC A7 mesh fabric, or A193 mesh fabric to BS 4483. The blocks shall be laid such that the difference in level between adjacent blocks, measured at the joint, shall not exceed 3mm.

The speaker related the stress conditions related to the design of EPS in Civil Engineering works.

The speaker related some examples of using EPS were introduced and went on showing examples of the usage of EPS in Road construction in Malaysia.

The speaker related the most recent application whereby the sub-soil beneath the RE WALL is still undergoing consolidation and would require more time to stabilise at the present fill height. The consolidation time is beyond the allowable construction program. Other solutions were examined but EPS solution could match the required construction time to complete the solution. The fill at that time has reached 6m, 6.8m and 7.7m maximum on Abutments A, B and C respectively. The requirement was the need to control settlement to an acceptable level. Light weight solution provided reduced stress at foundation level managed to control settlement to an acceptable level.

The speaker presented the settlement monitoring for the project which showed acceptable settlement levels. The predicted settlements were larger than the actual measured settlement.

Finally the speaker made a short presentation on the use of EPS in other than road projects.

At the end of the talk the speaker was directed a number of questions from the audience. Lastly a token of appreciation was presented to the speaker. The talk ended with a big round of applause from the audience.