Seminar on Designing Detention and Sediment Basins Using Spreadsheets to Fulfill the Requirements of the Urban Stormwater Management Manual (MSMA) by D.I.D.

By: Ir. Dr Quek Keng Hong

On 15 October 2005, the Water Resources Technical Division (WRTD) of IEM organised a half-day Seminar entitled: "How to Design Detention and Sediment Basins Quickly and Easily using Spreadsheets to Meet the Requirements of the Urban Stormwater Management Manual by D.I.D."

About 120 participants attended the seminar, which was held from 9:00 am to 1:00 pm at Conference Hall A, Bangunan Ingenieur in Petaling Jaya. The fee charged for the seminar was RM50 for members, and RM80 for non-members.

The seminar was conducted by Ir. Dr Quek Keng Hong, former Chairman of WRTD and a practising consulting engineer.

According to Ir. Dr Quek, there are major changes in the design procedures for both detention and sediment basins in the Urban Stormwater Management Manual or Manual Saliran Mesra Alam (MSMA), compared to the old design procedure i.e., the Planning and Design Procedure No. 1 (PDP1).

DESIGN OF DETENTION BASIN

In the design of detention basin based on MSMA, it may be necessary to use hydrograph methods such as the Time-Area Method or Runoff Routing Method for computing the design inflow hydrograph into the basin. This is different from the PDP1 which used the Modified Rational Method of computing the inflow hydrograph.

MSMA uses the Level-Pool Method of routing through the detention basin, compared to the graphical method used in PDP1. As a result, it is possible to route a complete hydrograph through the basin from inlet to outlet using the method in MSMA, but not via the method in PDP1 as it is based on a graphical approach.

Another difference is MSMA states that the post-development peak must not be greater than the pre-development peak for both the major and minor storms, a requirement which is not clearly stated in PDP1.

According to Ir. Dr Quek, the design of detention basin involves basically the following steps:

- Computation of design storm using the polynomial IFD equations in MSMA.
- Computation of the design inflow hydrograph into the basin using a hydrograph method such as the Time-Area Method for a particular design storm.
- Routing of the inflow hydrograph through the reservoir using the Level-Pool Routing Procedure. This involves iterative solution of the Continuity Equation and a stage-storage-discharge function. The output is the outflow hydrograph.
- Checking of the water level associated with the outflow hydrograph using a backwater curve program e.g., the HEC-RAS model.

Ir. Dr Quek said the steps above can best be solved using a spreadsheet. He demonstrated this using a worked example and showed how the following can be solved in a spreadsheet:

- Computation of design storm.
- Time-Area Method computation.
- Reservoir routing procedure.

DESIGN OF SEDIMENT BASIN

In the design of sediment basin, MSMA uses 3 or 6 months A.R.I. (Average Recurrence Interval) for design storm less than or greater than 2 years. It classifies sediment basins into two types i.e., wet or dry sediment basins. The storage volume is related to storm characteristics such as time of concentration and storm depth. In PDP1, however, an empirical approach is used to determine the storage volume of the sediment basin.

According to MSMA, a sediment basin is designed to trap sediment before it leaves the construction site. It is a temporary structure with a life span of 1 to 2 years. Sediment basin is required at the outlet of all disturbed catchment areas greater than 2 hectares, or smaller area if necessary.

Ir. Dr Quek started his presentation of the Half-day Seminar

Participants listened attentively to Ir. Dr Quek's presentation

The sizing criteria for sediment basin are as follows:

- Table 39.4 in MSMA lists three different soil types and the design considerations which apply to sediment basin design and operation for each soil type.
- The design capacity of a sediment basin is the sum of two components:
  - A settling zone, at least 0.6 m deep, to contain runoff and allow suspended sediment to settle.
  - A sediment storage zone, at least 0.3 m deep, to store settled sediment until the basin is cleaned out.
- For dry sediment basins, the embankment or outlet structure must be designed such that the basin will completely empty within 24 hours after a storm event.
- An emergency spillway must be installed to safely convey flows of up to and including 10 years ARI.
- Basin length to settling depth ratio should be less than 200:1.

A question and answer session at the end of the Seminar

View of over 100 participants attending the Seminar

Ir. Dr Quek demonstrates the use of spreadsheet for drainage computation

- Basin length to width ratio should be greater than 2:1.
- Side slopes should not be steeper than 2(H): 1 (V). to prevent sloughing.

According to Ir. Dr Quek, a spreadsheet can also be used to design a sediment basin in MSMA. He demonstrated this in a worked example by programming all the criteria above into the spreadsheet, and showed how it can provide answer "automatically" with minimal user input.

In conclusion, Ir. Dr Quek said a spreadsheet is a powerful tool for solving problems in MSMA because of the following reasons:

(i) it is free
(ii) it saves time and can be re-used between jobs
iii) spreadsheet computation is "automatic" and can handle repetitive tasks quickly,
iv) it is very accurate and is less prone to computational errors
(v) it can produce graphs and tables for reporting purposes easily

Ir. Dr Quek presented a lively seminar to a packed conference hall. His presentation lasted more than four hours, followed by a Q&A session. The seminar ended at about 1:30 pm.

Participants were told to download the spreadsheets and notes for the seminar from the URL http://www.msmam.com. Those who missed out on the seminar may obtain the notes and spreadsheets by subscribing to the 9-day eCourse at the above website. ■

REFERENCES:

Drainage and Irrigation Department (2000) "Urban Stormwater Management Manual for Malaysia" Ministry of Agriculture, Malaysia.

Civil and Structural Engineering Technical Division

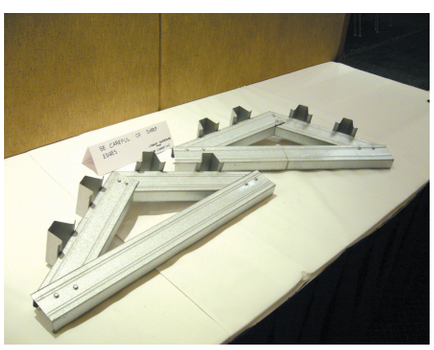
One-Day Seminar on Lightweight Steel Truss

By: Gary Wong

Lightweight (LW) steel truss projects were introduced as an alternative to timber roof truses in 2001 in all JKR projects. While proving to be a worthy replacement, recent high-profile LW steel truss failures have prompted the Civil and Structural Engineering Technical Division to hold a joint seminar with Bluescope Steel (M) Sdn. Bhd., to highlight the causes of LW steel truss failures.

The seminar was held at Armada Hotel, Petaling Jaya and the invited speakers were Ir. N. Selvanayagam, Director of the Specialist and Civil Engineering Branch of the PWD, and from Bluescope Steel, Mr. Campbell Seccombe and Mr. David Humphrey. Together, they gave an enlightening presentation to more than 100 participants.

Ir. P. N. Selvanayagam touched upon the causes of steel truss failures, which are identified as drawing non-conformance (deviations from minimum edge distance and joint splicing) and insufficient or ineffective bracing for the trusses. He stressed the importance of conforming to the JKR Specification by Accredited System Providers.



Samples of steel truss joints at the seminar

Next, Bluescope Steel's Mr. Campbell Seccombe gave an overview of standards (AS4600 vs. BS5950) in LW high-tensile steel and high tensile steel development , highlighting the advances of Bluescope Steel's Smartruss technology, while Mr. David Humphrey ended the seminar on design considerations, detailing issues, application and construction details of LW steel truss.

Mr. Campbell Seccombe and Mr. David Humphrey of Bluescope Steel, fielding questions from the floor

All in all, all three speakers provided valuable insights into the nature of steel truss failures and the importance of having highly-durable, computer-designed steel truss solutions. ■