Using CatchmentSIM to assess Aquaplaning Risk in 12d Model

Overview
Aquaplaning (or hydroplaning) can occur when a thin layer of water accumulates on a road surface during a rainfall event. It can result in loss of traction and has been the cause of numerous vehicular accidents and fatalities. Risk factors for aquaplaning include:
- Speed
- Rainfall intensity
- Water depth
- Road surface texture
- Vehicle tyres
- Driver behavior

Most of these factors are outside the realm of the road designer, however, it is prudent for all road surface designs (both new and rehabilitated surfaces) to satisfy some simple design principles including:
- Minimise sag points and ponding locations
- Minimise long shallow grade flow paths

Usually, this design process is relatively straightforward, however, occasionally more complex designs including crowned, projected cross section and staged lane rotation may present road geometry at high risk of aquaplaning.

12d Model Tools
12d Model provides flow arrows, tin shading, contouring and other tools to help the designer identify areas at risk of aquaplaning. However, it is still a manual process that requires detailed examination of large tracts of proposed or rehabilitated road models. This process can be time consuming and there is the potential for high risk areas to be overlooked.

CatchmentSIM
CatchmentSIM offers the ability to highly automate this analysis ensuring that high risk areas are not missed and the assessment is done in a consistent, timely and reproducible manner. The steps involved are:
- Use the 12d-CSIM macro to automatically export an existing or design TIN from 12d and setup a new CatchmentSIM Project. The entire 12d Model project or specific areas of the project can be exported and analysed in CatchmentSIM.
- Identify flow path end points (e.g., edge of pavement, gutter) by importing a *.12da file into the CatchmentSIM project.
- Run a purpose built macro script to calculate flow path lengths, equal area slopes and flow path depths for all roadway areas using the Gallaway equation. Other equations/approximations can be accommodated by modifying the text-based macro script.
- CatchmentSIM will automatically map flow paths that do not meet a user-defined water depth threshold allowing easy visualisation of potential “trouble spots”. Aquaplaning results will also be exported to a separate text file, which can be used for reporting purposes.
- CatchmentSIM will also create a new “Flow Path Depth” layer that allows the maximum flow depth to be extracted at any location across the project area.

Flow path lengths, equal area slopes and flow path depths are automatically calculated for all roadway areas using the Gallaway equation.

Flow paths that do not meet a user-defined depth threshold are automatically mapped and the results are exported to a text file for reporting purposes.

Flow path depths can be visualised and extracted at any location allowing verification of the suitability of the roadway design at all locations.